YASKAWA

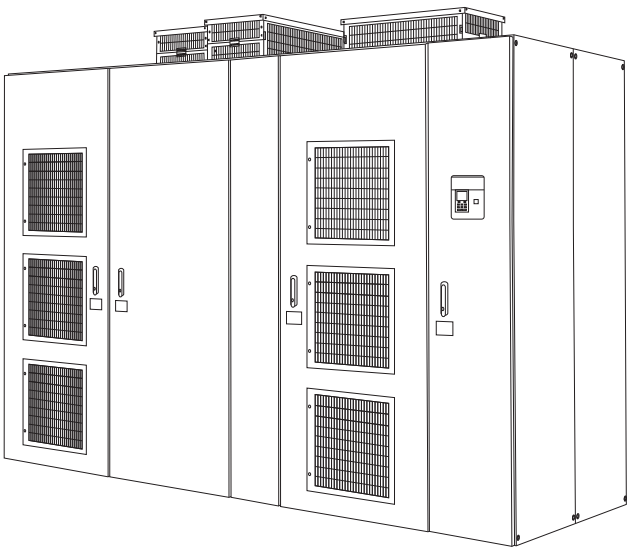
Super Energy-Saving Medium-Voltage AC Drive

# FSDrive-MV1000

# Parameter Guide

2.4 kV Class, 3 kV Class, 4.16 kV Class, 6 kV Class, 11 kV Class

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



MANUAL NO. EZZ010930

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# i

# Preface and General Safety

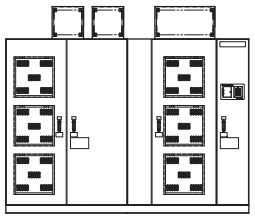
This section provides safety messages pertinent to this product that, if not heeded, may result in fatality, personal injury, or equipment damage. Yaskawa is not responsible for the consequences of ignoring these instructions.

# i.1 Before Using the Product

This manual is designed to ensure correct and suitable application of FSDrive-MV1000-Series Drives. Read this manual before attempting to install, wire, operate, maintain, or inspect a drive and keep it in a safe, convenient location for future reference. Also be sure that you understand all the precautions and safety information before attempting to use the product.

## ◆ Applicable Documentation

The following manuals are available for MV1000 series drives. Refer to the manual appropriate for your purpose.



| |
|---|
| **Super Energy-Saving Medium-Voltage AC Drive FSDrive-MV1000 Parameter Guide (this book)<br>Manual No.: EZZ010930** |
| This manual contains detailed information on parameter settings.<br>Use this manual to expand drive functionality and to take advantage of higher performance features. |
| **Super Energy-Saving Medium-Voltage AC Drive FSDrive-MV1000 Instruction Manual<br>Manual No.: EZZ010926** |
| This manual contains basic information required to install and wire the drive, in addition to an overview of operating procedures, fault diagnostics, and maintenance and inspection.<br>It covers the basic operation and trial running of this product. |

## ◆ Symbols

The symbols used in this manual are explained below.

**Note:** Indicates important advice that must be followed. Also indicate low-level cautions that cause an alarm but do not involve a risk of equipment damage, and supplementary notes.

TERMS Indicates a term or definition used in this manual.

## ◆ Terms and Abbreviations

TERMS

- **Drive, MV1000:** Yaskawa FSDrive-MV1000 Series MV1000
- **V/f:** V/f Control
- **OLV:** Open Loop Vector Control
- **CLV:** Closed Loop Vector Control
- **PM motor:** Permanent Magnet Synchronous motor

## ◆ Trademarks

The companies and product names mentioned in this manual are trademarks or registered trademarks of those companies.

# i.2 General Safety

## ◆ Supplemental Safety Information

| General Precautions |
|---|
| • The diagrams in this manual may be indicated without covers or safety shields to show details. Restore covers or shields before operating the drive and run the drive according to the instructions described in this manual.<br>• Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.<br>• The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.<br>• When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.<br>• If nameplate becomes worn or damaged, order a replacement from your Yaskawa representative or the nearest Yaskawa sales office.<br>• Read and understand this manual before installing, operating or servicing this drive. The drive must be installed according to this manual and local codes.<br>The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems. |

| ⚠ DANGER |
|---|
| Indicates a hazardous situation, which, if not avoided, will result in death or serious injury. |

⚠ **DANGER!** *will also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

| ⚠ WARNING |
|---|
| Indicates a hazardous situation, which, if not avoided, could result in death or serious injury. |

⚠ **WARNING!** *will also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

| ⚠ CAUTION |
|---|
| Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury. |

⚠ **CAUTION!** *will also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

| NOTICE |
|---|
| Indicates a property damage message. |

**NOTICE:** *will also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

## ◆ Safety Messages

**⚠ DANGER**

Heed all of the safety-related information in this manual.

Failure to comply could result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

### Electrical Shock Hazard

Do not connect or disconnect wiring while the power for the main circuit and controls is on.

Failure to comply could result in death or serious injury.

Even when the power supply of the medium-voltage main circuit to the drive is shut off, it takes some time for the internal capacitors to discharge. Wait until the CHARGE LED goes off before starting inspection. While an residual electric charge remains in the capacitor, the surface and inside of the Power Cell will carry a high voltage, so there will be a risk of death or serious injury. The heatsink of the Power Cell can become quite hot during operation, and proper precautions should be taken to prevent burns. When replacing the cooling fan, shut off the main circuit's power and then wait at least 15 minutes. Then, shut off the control circuit's power and make sure that the cooling fan has fully stopped before starting the work.

**⚠ WARNING**

### Sudden Movement Hazard

Do not forget to include an emergency stop circuit in the application.

Failure to comply could result in death or serious injury. A communication error between the digital operator keypad and the drive’s internal control board may make it impossible to stop the drive with the digital operator.

After an emergency stop circuit has been wired, check to make sure it is operating properly.

Failure to comply could result in death or serious injury. The emergency stop circuit may fail to operate if left unchecked. The user is fully responsible for properly wiring the emergency circuit.

Some systems may start moving in response to the supply of power alone, resulting in death or serious injury.

Make sure that there are no personnel around the drive, motor and machine before turning the power on. Also check that couplings with motors, shaft keys and machinery are properly protected.

### Electrical Shock Hazard

Never modify the drive.

Failure to comply could result in death or serious injury.

Yaskawa is not responsible for the consequences of any modification of the product by the user or any client of the user.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

The drive should be installed, wired, repaired, inspected, and have its parts replaced, by someone with a thorough knowledge of drive installation, adjustment and repair.

### Fire Hazard

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Failure to comply could result in death or serious injury by fire.

**NOTICE**

## Equipment Hazard

Observe proper electrostatic discharge procedures (ESD) when handling the drive.

Failure to comply may result in ESD damage to the drive circuitry.

Do not operate damaged equipment.

Failure to comply could result in further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Also check the cable wiring and selection of peripheral devices to identify the cause. Contact your supplier before restarting the drive or the peripheral devices if the cause cannot be identified.

Install adequate branch circuit short circuit protection in accordance with the standards in the country of use.

Failure to comply could result in damage to the drive.

This drive is suitable for circuits carrying a maximum current when shorted of 5 kVA, with a maximum voltage of 2640 Vac (2.4 kV class), 3630 Vac (3 kV class), 4576 Vac (4.16 kV class), 6600 Vac (6 kV class), and 12100 Vac (11 kV class).

If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.

Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.

If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogens, which includes chlorine, fluorine, bromine and iodine can contribute to the erosion of the capacitors, and DOP gas (phthalate esters) can cause cracking of resins.

# i.3 Notes on Using Drives

## ◆ Selection

### ■ Power Supply Capacity

Select a main circuit power supply with a capacity larger than that of the drive to be connected, considering the power factor and efficiency. When connecting multiple drives to a single power supply, select a power supply with a capacity larger than the sum of the power required by all the drives to be connected. Even when the power supply has sufficient capacity, the power supply voltage may drop when the power is turned on, causing malfunction of connected devices if the power supply has a large power impedance.

### ■ Drive Capacity

When running multiple induction motors in parallel using a single drive, the capacity of the drive should be larger than 1.1 times the total motor rated current.

### ■ Emergency Stop

When the drive faults out, a protective function is activated and drive output is shut off. This, however, does not stop the motor immediately. Some type of mechanical brake may be needed if it is necessary to halt the motor faster than the Fast Stop function is able to.

## ◆ Installation

### ■ Ambient Environment

Keep the drive in a clean environment that is free from airborne oil mist, corrosive gas, flammable gas, lint and dust. Install the fan cover at the top of the panel before starting operation. Any modification to the outside of the panel cooling fan, such as connecting air exhaust duct, may reduce air flow for cooling and cause overheating and faults. Do not use air exhaust duct.

### ■ Operating Environment

When the power to the drive is turned back on after it has been stopped for a long time, for example for periodical inspection, electrical components inside dry-type transformers and Power Cell may be subject to condensation depending on the temperature and humidity of the switch room. This condensation will reduce insulation and cause unanticipated accidents (e.g. accidents due to short circuits). You are recommended to install a dehumidifier in the switch room.

### ■ Drive Storage

When storing the drive as is in a storage facility or in the installed state, observe the following points to maintain its reliability.

- Short term storage of the drive
  Short term storage refers to cases where the drive is stored for up to one month after unpacking or up to three months after shipping. Secure a storage environment that satisfies the conditions cited for the drive's environmental specification. Note that an ambient temperature of up to 60°C is acceptable.
- Long term storage of the drive
  Long term storage refers to cases where the drive is stored for more than one month after unpacking or more than three months after shipping. Contact Yaskawa if long term storage is required. Note that an ambient temperature of up to 50°C is acceptable.
- Store the spare parts without unpacking them. For details, refer to the storage method described in the instruction manual.

### ■ Compliance with Local Laws

Please comply with the law of the relevant country when you install the drive panel. For details, contact your Yaskawa representative.

### ■ Effects of Distortion in Power Supply

When the power supply voltage is originally distorted, or when multiple devices and the drive are connected to the same power supply, drive harmonics from the power supply system flow into the drive, resulting in high relative harmonic content.

## ◆ Settings

### ■ Driving Multiple Induction Motors

Use V/f control when running multiple induction motors using a single drive.

### ■ Upper Limits

The drive can be operated at high speeds of up to 120 Hz, and making incorrect settings is dangerous. Set an upper limit by using the upper limit frequency setting function.
The default setting for the maximum output frequency when operating with external input signals is 60 Hz.

### ■ Acceleration/Deceleration Time

Acceleration and deceleration times are determined by the torque that the motor generates, the load torque and the inertia moment ($GD^2$). Set a longer accel/decel time when the stall prevention function is activated during accel/decel. When the stall prevention function is activated, the accel/decel time is extended to cover the time that the function operates. To achieve even faster acceleration and deceleration, select motors, and a drive, with greater capacity.

## ◆ General Handling

### ■ Wiring Check

Never short the output terminals of the drive or apply voltage from the power supply to the output terminals (U, V, W). This will damage the drive.
Carry out wiring that conforms to the wire gauges and tightening torques described in this manual. Conduct a thorough check of wiring and sequences before turning the power on.

### ■ Breaker or Magnetic Contactor Selection and Installation

Select a breaker with sufficient capacity for the main circuit power supply side of the drive, taking the inrush current from the transformer into account.
Avoid using the breaker or magnetic contactor for frequent starting or stopping. This may damage the drive. Do not switch the breaker or magnetic contactor ON/OFF more than twice a day. If it is operated more frequently, install an optional inrush current suppression circuit between the power supply and the drive. Use a low-surge type Vacuum Circuit Breaker for drive primary side breaker.

### ■ Inspection and Maintenance

Even when the power supply of the medium-voltage main circuit to the drive is shut off, it takes some time for the internal capacitors to discharge. Wait until the CHARGE LED goes off before starting inspection. While an residual electric charge remains in the capacitor, the surface and inside of the Power Cell will carry a high voltage, so there will be a risk of death or serious injury. The heatsink of the Power Cell can become quite hot during operation, and proper precautions should be taken to prevent burns.
When replacing the cooling fan, shut off the main circuit's power and then wait at least 15 minutes. Then, shut off the control circuit's power and make sure that the cooling fan has fully stopped before starting the work.

### ■ Wiring

When wiring UL/cUL-compliant drives, refer to the notes on complying with the UL and cUL standards given in the instruction manuals. For details, contact your Yaskawa representative.

### ■ Transportation and Installation

Never steam clean the drive. During transportation and installation, the drive must never be exposed to an atmosphere containing a halogen gas such as fluorine, chlorine, bromine, or iodine.

## ■ Hoisting

With some large capacity drives, the transformer, rather than the transformer panel itself, must be hoisted directly. The drive may deform or fall down if the drive panel frame is hoisted. For details, refer to the installation method described in the instruction manual.

## ■ Radio Frequency Interference

Inputs and outputs of the drive (main circuit) contain harmonic components that may adversely affect communication devices, such as AM radios, used in the vicinity. Use high-voltage cables and ground any shielded cables. Separate cables for control from high-current circuits (main circuit and relay sequence circuits) to avoid induction from peripheral devices. (It is advisable to separate them by a distance of 30 cm or more.)

## ■ Leakage Current

Harmonic leakage current passes through stray capacitance between the drive power lines, ground and the motor lines. Consider taking measures against this leakage current.

# i.4 Notes on Motor Operation

## ◆ Application to Existing Standard Motors

### ■ Insulation Voltage

Consider voltage tolerance levels and insulation in applications with high input voltage or particularly long wiring distances. Contact Yaskawa for consultation.

### ■ High Speed Operation

Running a motor beyond its rated speed may lead to problems imposed by vibration or the durability of motor bearings. Contact the manufacturer of the motor for details.

### ■ Torque Characteristics

When driven by a drive, the torque characteristics of the motor differ from when it is driven with a commercial power supply. Therefore, the load torque characteristics that the motor drives need to be confirmed.

### ■ Vibration and Shock

The PWM control with multiple outputs connected in the drive reduces motor oscillation to the same level as in operation by commercial power supply. However, the motor oscillation is slightly larger due to the following factors.

- Resonance with the natural frequency of the mechanical system
  Take particular caution when using a variable speed drive for an application that is conventionally run by commercial power at a constant speed. Installing shock absorbing rubber under the base of the motor and using Frequency Jump function can be effective measures.
- Residual unbalance of the rotating motor
  Particular care is required when running the motor beyond its rated speed.
- Subsynchronous Resonance
  Subsynchronous resonance may occur in fans, blowers, turbines, and other applications with high load inertia, as well as in motors with a relatively long shaft. Yaskawa recommends using the closed loop vector control for such applications.

# i.5 Warranty Information

## ◆ Warranty Period

This product is warranted for twelve months after being delivered to the end user or eighteen months from the date of shipment from Yaskawa's factory, whichever comes first.

## ◆ Scope of Warranty

### ■ Repairs

If a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, Yaskawa will bear the cost of repairing the unit. However, if the Yaskawa Authorized Service Center determines that the problem with a Yaskawa product is not due to defects in Yaskawa's workmanship or materials, then the end user will be responsible for the cost of any necessary repairs. Some problems that are outside the scope of this warranty are:

- Problems due to improper maintenance or handling, carelessness, or other reasons where the customer is determined to be responsible.
- Problems due to additions or modifications made to the Yaskawa product by the customer without Yaskawa's understanding.
- Problems due to the use of the Yaskawa product under conditions that do not meet the recommended specifications.
- Problems caused by unavoidable occurrences such as natural disaster or fire.
- Or other problems not due to defects in Yaskawa workmanship or materials.

Warranty service is only applicable within the country where the product was purchased. However, after-sales service is available for customers outside of the country where the product was purchased for a reasonable fee.

### ■ Exceptions

Any inconvenience to the customers or damage to non-Yaskawa products due to Yaskawa's defective products whether within or outside the warranty period are NOT covered by this warranty.

## ◆ Restrictions

- This product is not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.
- End users who intend to use this product for devices or systems relating to transportation, health care, space aviation, atomic or electric power, or underwater use must contact their Yaskawa representatives or the nearest Yaskawa sales office beforehand.
- This product has been manufactured under strict quality-control guidelines. However, if this product is to be installed in any location where failure of this product could involve or result in a life-and-death situation or loss of human life, or in a facility where failure may cause a serious accident or physical injury, safety devices must be installed to minimize the likelihood of any accident.

# 1

# Parameter List

This appendix contains a full listing of all parameters and settings available in the drive.

# 1.1 Understanding the Parameter Table

## ◆ Control Modes, Symbols, and Terms

The table below lists terms and symbols used in this section to indicate which parameters are available in which control modes.

**Note:** For a detailed explanation of each control mode, refer to the FSDrive-MV1000 Instructions (Manual No. EZZ010926).

**Table 1.1 Symbols and Icons Used in the Parameter Table**

| Symbol | Description |
|---|---|
| All Modes | Indicates the parameter is accessible in all control modes. |
| V/f | Parameter is available when operating the drive with V/f Control. |
| OLV | Parameter is available when operating the drive with Open Loop Vector. |
| CLV | Parameter is available when operating the drive with Closed Loop Vector. |
| RUN | Indicates this parameter can be changed during run. |
| Motor 2 | Refers to a second motor when the drive is operating two motors. Switch between these motors using the contact input terminals. |

**Note:** If a parameter is not available in a certain control mode, the symbol for that control mode is grayed out.

# 1.2 Parameter Groups

The types of parameters are indicated below.

| Parameter Group | Name | page | Parameter Group | Name | page |
|---|---|---|---|---|---|
| A1 | Initialization Parameters | 20 | F5 | Contact Output Card (DO-A3) | 43 |
| A2 | User Parameters | 21 | F6 | Communication Option Card | 43 |
| A3 | Trace Data | 21 | H1 | Contact Input | 46 |
| b1 | Operation Mode Selection | 22 | H2 | Contact Output | 51 |
| b2 | DC Injection Braking | 23 | H3 | Analog Input | 54 |
| b3 | Speed Search | 23 | H4 | Analog Output | 56 |
| b4 | Timer Function | 24 | H5 | MEMOBUS/Modbus communications | 58 |
| b5 | PID Control | 25 | L1 | Motor Protection | 59 |
| b6 | Dwell Function | 27 | L2 | Momentary Power Loss Ride-Thru | 59 |
| b7 | Droop Control | 27 | L3 | Stall Prevention | 60 |
| C1 | Acceleration and Deceleration Times | 28 | L4 | Speed Detection | 60 |
| C2 | S-Curve Characteristics | 29 | L5 | Fault Restart | 61 |
| C3 | Slip Compensation | 29 | L6 | Torque Detection | 61 |
| C4 | Torque Compensation | 30 | L7 | Torque Limit | 63 |
| C5 | Automatic Speed Regulator (ASR) | 30 | L8 | Drive Protection | 63 |
| d1 | Frequency Reference | 32 | n1 | Hunting Prevention | 65 |
| d2 | Frequency Upper/Lower Limits | 33 | n2 | Speed Feedback Detection Control (AFR) Tuning | 65 |
| d3 | Jump Frequency | 33 | n9 | I/O Voltage Detection | 66 |
| d4 | Frequency Reference Hold and Up/Down 2 Function | 33 | o1 | Digital Operator Display Selection | 66 |
| d5 | Torque Control | 34 | o2 | Digital Operator Keypad Functions | 67 |
| d6 | Field Weakening and Field Forcing | 35 | o3 | Copy Function | 67 |
| d7 | Offset Frequency | 35 | o4 | Maintenance Period | 68 |
| E1 | V/f Pattern for Motor 1 | 36 | T1 | Auto-Tuning for Induction Motors | 68 |
| E2 | Motor 1 Parameters | 36 | U1 | Operation Status Monitors | 70 |
| E3 | V/f Pattern for Motor 2 | 37 | U2 | Fault Trace | 73 |
| E4 | Motor 2 Parameters | 38 | U3 | Fault History | 74 |
| F1 | PG Speed Control Card (PG-B3/PG-X3) | 40 | U4 | Maintenance Monitors | 75 |
| F2 | Analog Input Card (AI-A3) | 41 | U5 | PID Monitors | 76 |
| F3 | Contact Input Card (DI-A3) | 41 | U6 | Control Monitors | 77 |
| F4 | Analog Monitor Card (AO-A3) | 42 | U9 | Power Cell Monitor | 77 |

# 1.3 Parameter Table

## ◆ A: Initialization Parameters

The A parameter group creates the operating environment for the drive. This includes the parameter Access Level, Motor Control Method, Password, User Parameters and more.

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **A1: Initialization Parameters** | | | | |
| A1-00 (100H) RUN <3> | Language Selection | All Modes<br>0: English<br>1: Japanese | Default: 1<br>Min: 0<br>Max: 1 | 88 |
| A1-01 (101H) RUN | Access Level Selection | All Modes<br>0: View and set A1-00, A1-01, and A1-04. U□-□□ parameters can also be viewed.<br>1: Setup Mode Parameters (access to a set of parameters selected by the user, A2-01 to A2-32)<br>2: Advanced Access (access to view and set all parameters) | Default: 2<br>Min: 0<br>Max: 2 | 88 |
| A1-02 (102H) <3> | Control Method Selection | All Modes<br>0: V/f Control<br>2: Open Loop Vector Control<br>3: Closed Loop Vector Control | Default: 2<br>Min: 0<br>Max: 3 | 89 |
| A1-03 (103H) | Initialize Parameters | All Modes<br>0: No initialization<br>1110: User Initialize (parameter values must be stored using parameter o2-03)<br>2220: 2-wire initialization (Resets all parameters to default values.) | Default: 0<br>Min: 0<br>Max: 2220 | 89 |
| A1-04 (104H) | Password | All Modes<br>When the value set in A1-04 does not match the value set in A1-05, parameters A1-01 through A1-03, A1-06, and A2-01 through A2-32 cannot be changed. | Default: 0<br>Min: 0<br>Max: 9999 | 90 |
| A1-05 (105H) | Password Setting | | | |
| A1-06 (127H) | Application Preset | All Modes<br>0: Disabled<br>Note: This function is not available. Always set this parameter to the default value of 0 (disabled). | Default: 0 | 92 |
| A1-90 (3000H) | Year Setting | All Modes<br>Sets the year for the calendar. The setting is used for recording event log data and trace data.<br>Note: Some error arises, so periodic adjustment is advisable. | Default: 2011<br>Min: 2000<br>Max: 2099 | 92 |
| A1-91 (3001H) | Month and Date Setting | All Modes<br>Sets the month and day for the calendar. The setting is used for recording event log data and trace data.<br>Note: Some error arises, so periodic adjustment is advisable. | Default: 1.01<br>Min: 1.01<br>Max: 12.31 | 92 |
| A1-92 (3002H) | Hour and Minute Setting | All Modes<br>Sets the hour and minute for the calendar. The setting is used for recording event log data and trace data.<br>Note: Some error arises, so periodic adjustment is advisable. | Default: 0.00<br>Min: 0.00<br>Max: 23.59 | 92 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **A2: User Parameters** | | | | |
| A2-01 to A2-32 (106 to 125H) | User Parameters 1 to 32 | All Modes<br>Parameters that were recently edited are listed here. The user can also select parameters to appear here for quick access. | Default: 0<br>Min: b1-01<br>Max: o4-☐☐ | 93 |
| A2-33 (126H) | User Parameter Automatic Selection | All Modes<br>0: Parameters A2-01 through A2-32 are reserved for the user to create a list of User Parameters.<br>1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quick access. | Default: 0<br>Min: 0<br>Max: 1 | 93 |
| **A3: Trace Data** | | | | |
| A3-01 to A3-32 (3010H to 302FH) | Trace Data 01 to 32 Selection | All Modes<br>Sets the numbers of the monitor contents to be registered as the trace data. A maximum of 32 contents can be set.<br>Note: 1. Set the desired monitor parameter in the digits available in U☐-☐☐. For example, enter "103" for U1-03 (output current).<br>2. Set 000 if the parameter is not to be used.<br>3. When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00 or oFC00 fault occurs, no fault trace is performed. | Default: <10><br>Min: 0<br>Max: 899 | 94 |
| A3-33 (3030H) | High-Speed Trace Sampling Time | All Modes<br>Sets the sampling time for high-speed tracing in 0.001 s units. Note, however, that if 0.000 s is set, the setting made will actually be 0.00025 s (250 µs).<br>Note: 1. The maximum number of samplings for high-speed tracing is 4000 per content.<br>2. When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00 or oFC00 fault occurs, no fault trace is performed. | Default: 0.000 s<br>Min: 0.000 s<br>Max: 10.000 s | 94 |
| A3-34 (3031H) | Low-Speed Trace Sampling Time | All Modes<br>Sets the sampling time for low-speed tracing in 0.01s units.<br>Note: 1. The maximum number of samplings for low-speed tracing is 500 per content.<br>2. When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00 or oFC00 fault occurs, no fault trace is performed. | Default: 0.05 s<br>Min: 0.01 s<br>Max: 60.00 s | 94 |
| A3-35 (3032H) | Number of Data after High-Speed-Trace Fault Detection | All Modes<br>Sets the number of samplings of the data to be registered after a fault is detected in high-speed tracing.<br>Note: 1. Available only when a fault has been detected and the drive automatically stopped.<br>2. When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00 or oFC00 fault occurs, no fault trace is performed. | Default: 200<br>Min: 0<br>Max: 250 | 94 |
| A3-36 (3033H) | Number of Data after Low-Speed-Trace Fault Detection | All Modes<br>Sets the number of samplings of the data to be registered after a fault is detected in low-speed tracing.<br>Note: 1. Available only when a fault has been detected and the drive automatically stopped.<br>2. When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00 or oFC00 fault occurs, no fault trace is performed. | Default: 50<br>Min: 0<br>Max: 250 | 94 |
| A3-37 (3034H) | Trace Stop Selection | All Modes<br>Selects the stop conditions for tracing.<br>0: Fault always detected<br>1: Fault detected during run<br>Note: When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00 or oFC00 fault occurs, no fault trace is performed. | Default: 0<br>Min: 0<br>Max: 1 | 94 |

<3> Parameter setting value is not reset to the default value when the drive is initialized (A1-03 = 1110/2220).
<10> Default setting is determined by the control mode (A1-02).

## ◆ b: Application

Application parameters configure the source of the Run command, DC Injection Braking, Speed Search, timer functions, PID control, the Dwell function, and a variety of other application-related settings.

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **b1: Operation Mode Selection** | | | | |
| b1-01 (180H) | Frequency Reference Selection 1 | All Modes<br>0: Digital operator<br>1: Analog input terminals<br>2: MEMOBUS/Modbus communications<br>3: Option board | Default: 1<br>Min: 0<br>Max: 3 | 95 |
| b1-02 (181H) | Run Command Selection 1 | All Modes<br>0: Digital operator<br>1: Control circuit terminal (contact input)<br>2: MEMOBUS/Modbus communications<br>3: Option board | Default: 1<br>Min: 0<br>Max: 3 | 96 |
| b1-03 (182H) | Stopping Method Selection | All Modes<br>0: Ramp to stop<br>1: Coast to stop<br>2: DC Injection Braking to stop<br>3: Coast with timer | Default: 1<br>Min: 0<br>Max: 3 <11> | 97 |
| b1-04 (183H) | Reverse Operation Selection | All Modes<br>0: Reverse enabled.<br>1: Reverse disabled. | Default: 1<br>Min: 0<br>Max: 1 | 99 |
| b1-05 (184H) | Action Selection below Minimum Output Frequency (E-09) | V/f OLV CLV<br>0: Operates according to frequency reference (E1-09 is disabled).<br>1: Output shuts off (coast to stop if less than E1-09).<br>2: Operates according to E1-09 (frequency reference set to E1-09).<br>3: Zero speed (frequency reference becomes zero when less than E1-09). | Default: 0<br>Min: 0<br>Max: 3 | 99 |
| b1-06 (185H) | Contact Input Reading | All Modes<br>0: Input status is read once every millisecond and processed immediately (for quick response)<br>1: Input status is read twice every millisecond and processed only if the status is the same in both readings (robust against noisy signals) | Default: 1<br>Min: 0<br>Max: 1 | 100 |
| b1-07 (186H) | LOCAL/REMOTE Run Selection | All Modes<br>0: An external Run command has to be re-input at the new source to be activated.<br>1: An external Run command at new source is accepted immediately. | Default: 0<br>Min: 0<br>Max: 1 | 100 |
| b1-08 (187H) | Run Command Selection while in Programming Mode | All Modes<br>0: Run command not accepted while in the Programming Mode.<br>1: Run command accepted while in the Programming Mode.<br>2: Prohibit entering Programming Mode during run. | Default: 0<br>Min: 0<br>Max: 2 | 101 |
| b1-15 (1C4H) | Frequency Reference Selection 2 | All Modes<br>Enabled when an input terminal set for “External reference” (H1-□□ = 2) closes.<br>0: Digital Operator<br>1: Analog input terminals<br>2: MEMOBUS/Modbus communications<br>3: Option board | Default: 0<br>Min: 0<br>Max: 3 | 101 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| b1-16 (1C5H) | Run Command Selection 2 | All Modes<br>Enabled when a terminal set for "External reference" (H1-☐☐ = 2) closes.<br>0: Digital Operator<br>1: Control circuit terminal (contact input)<br>2: MEMOBUS/Modbus communications<br>3: Option board | Default: 0<br>Min: 0<br>Max: 3 | 101 |
| b1-17 (1C6H) | Run Command at Power Up | All Modes<br>0: Disregarded. A new Run command needs to be issued after power up.<br>1: Allowed. Motor will start immediately after power up if a Run command is already enabled. | Default: 0<br>Min: 0<br>Max: 1 | 102 |
| **b2: DC Injection Braking** | | | | |
| b2-01 (189H) | Zero Speed Level (DC Injection Braking Start Frequency) | All Modes<br>Sets the frequency to start DC injection braking. This parameter is active when "Ramp to stop" is selected as the stopping method (b1-03 = 0). | Default: <10> <36><br>Min: 0.0 Hz<br>Max: 10.0 Hz | 102 |
| b2-02 (18AH) | DC Injection Braking Current | V/f OLV CLV<br>Sets the DC Injection Braking current as a percentage of the drive rated current. | Default: 50%<br>Min: 0%<br>Max: 100% | 103 |
| b2-03 (18BH) | DC Injection Braking Time at Start | All Modes<br>Sets the time for DC Injection Braking Time at Start (Zero Speed Control when in CLV). | Default: 0.00 s<br>Min: 0.00 s<br>Max: 10.00 s | 103 |
| b2-04 (18CH) | DC Injection Braking Time at Stop | All Modes<br>Sets the time for DC Injection Braking Time at Stop (Zero Speed Control when in CLV). | Default: <10><br>Min: 0.00 s<br>Max: 10.00 s | 103 |
| b2-08 (190H) | Magnetic Flux Compensation Value | V/f OLV CLV<br>Sets the magnetic flux compensation as a percentage of the no-load current value (E2-03). | Default: 0%<br>Min: 0%<br>Max: 1000% | 103 |
| **b3: Speed Search** | | | | |
| b3-01 (191H) | Speed Search Selection at Start | V/f OLV CLV<br>0: Disabled<br>1: Enabled | Default: <10><br>Min: 0<br>Max: 1 | 105 |
| b3-02 (192H) | Speed Search Deactivation Current | V/f OLV CLV<br>Sets the current level at which the speed is assumed to be detected and Speed Search is ended. Set as a percentage of the drive rated current. | Default: <10><br>Min: 0%<br>Max: 200% | 106 |
| b3-03 (193H) | Speed Search Deceleration Time | V/f OLV CLV<br>Sets the output frequency reduction time during Speed Search. | Default: 5.0 s<br>Min: 0.1 s<br>Max: 10.0 s | 106 |
| b3-04 (194H) | V/f Gain during Speed Search | V/f OLV CLV<br>Determines how much to lower the V/f ratio during Speed Search. Output voltage during Speed Search equals the V/f setting multiplied by b3-04. | Default: <6><br>Min: 10%<br>Max: 100% | 106 |
| b3-05 (195H) | Speed Search Wait Time (Speed Estimation) | All Modes<br>When using an external contactor on the output side, b3-05 delays executing Speed Search after a momentary power loss to allow time for the contactor to close. | Default: 0.2 s<br>Min: 0.0 s<br>Max: 100.0 s | 106 |
| b3-06 (196H) | Output Current 1 during Speed Search (Speed Estimation) | V/f OLV CLV<br>Sets the size of the output current during Speed Search as a coefficient with respect to the motor's rated current. | Default: <6><br>Min: 0.0<br>Max: 2.0 | 106 |
| b3-07 (197H) | Output Current 2 during Speed Search (Speed Estimation) | V/f OLV CLV<br>Sets the size of the output current during Speed Search as a coefficient with respect to the motor's rated current. | Default: 2.0<br>Min: 0.0<br>Max: 3.0 | 107 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| b3-10 (19AH) | Speed Search Detection Compensation Gain (Speed Estimation) | V/f OLV CLV<br>Sets the gain which is applied to the speed detected by Speed Estimation Speed Search before the motor is reaccelerated. Increase this setting if ov occurs when performing Speed Search after a relatively long period of baseblock. | Default: 1.05<br>Min: 1.00<br>Max: 1.20 | 107 |
| b3-11 (19BH) | Speed Search Method Switching Level (Speed Estimation) | All Modes<br>Sets the switching level when the search method is automatically switched in accordance with the size of the motor's residual voltage. | Default: <6><br>Min: 0.5<br>Max: 100.0 | 107 |
| b3-17 (1F0H) | Speed Search Restart Current Level | V/f OLV CLV<br>Sets the Speed Search restart current level as a percentage of the drive rated current. | Default: 120%<br>Min: 0%<br>Max: 200% | 107 |
| b3-18 (1F1H) | Speed Search Restart Detection Time (Speed Estimation) | V/f OLV CLV<br>Sets the time to detect Speed Search restart. | Default: 0.10 s<br>Min: 0.00 s<br>Max: 1.00 s | 107 |
| b3-19 (1F2H) | Number of Speed Search Restarts | V/f OLV CLV<br>Sets the number of times the drive can attempt to restart when performing Speed Search. | Default: 3<br>Min: 0<br>Max: 10 | 107 |
| b3-25 (1C8H) | Speed Search Wait Time | V/f OLV CLV<br>Sets the time the must wait between each Speed Search restart attempt. | Default: 0.5 s<br>Min: 0.0 s<br>Max: 30.0 s | 107 |
| b3-30 (30B0H) | Torque Compensation Time Constant during Speed Search | V/f OLV CLV<br>Sets the primary delay time of the torque compensation function during Speed Search, in ms units. | Default: 10 ms<br>Min: 0 ms<br>Max: 10000 ms | 108 |
| b3-31 (30B1H) | Current Suppression Start Level during Voltage Recovery | V/f OLV CLV<br>Sets the level at which to start the operation to extend the voltage recovery time in order to suppress the current when the voltage is recovered during Speed Search. The setting is made by taking the motor's no-load current to be 1.0. | Default: 1.5<br>Min: 0.0<br>Max: 5.0 | 108 |
| b3-32 (30B2H) | Current Suppression Time Constant during Voltage Recovery | V/f OLV CLV<br>Sets the time constant to filter the level for extending the voltage recovery time in order to suppress the current when the voltage is recovered during Speed Search. | Default: 5 ms<br>Min: 0 ms<br>Max: 100 ms | 108 |
| b3-33 (30B3H) | Recovery Waiting Time after Speed Search Completion | V/f OLV CLV<br>Sets the waiting time between the end of Speed Search and the switch to normal control. The frequency reference is maintained during this time. | Default: 0.01 s<br>Min: 0.00 s<br>Max: 5.00 s | 108 |
| b3-34 (30B4H) | Software CLA Current Limit Value 1 during Speed Search | V/f OLV CLV<br>Sets the software's current limit value during Speed Search. Set as a percentage of the motor's rated current. | Default: 95.0%<br>Min: 0.0%<br>Max: 300.0% | 108 |
| b3-35 (30B5H) | Software CLA Current Limit Value 2 during Speed Search | V/f OLV CLV<br>Sets the current limit value for the software when the frequency reference value is 0 Hz during Speed Search. Set as a percentage of the motor rating. | Default: 90.0%<br>Min: 0.0%<br>Max: 300.0% | 108 |
| **b4: Timer Function** | | | | |
| b4-01 (1A3H) | Timer Function On-Delay Time | All Modes<br>Sets the on-delay and off-delay times (dead-band width) of the timer function output at the contact output (H2-☐☐=12) in relation to the time function input at the contact input (H1-☐☐=18). | Default: 0.0 s<br>Min: 0.0 s<br>Max: 3000.0 s | 109 |
| b4-02 (1A4H) | Timer Function Off-Delay Time | | Default: 0.0 s<br>Min: 0.0 s<br>Max: 3000.0 s | 109 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **b5: PID Control** | | | | |
| b5-01 (1A5H) | PID Function Setting | All Modes<br>0: Disabled<br>1: Enabled (PID output becomes output frequency reference, deviation D controlled)<br>2: Enabled (PID output becomes output frequency reference, feedback D controlled)<br>3: Enabled (PID output added to frequency reference, deviation D controlled)<br>4: Enabled (PID output added to frequency reference, feedback D controlled) | Default: 0<br>Min: 0<br>Max: 4 | 113 |
| b5-02 (1A6H) RUN | Proportional Gain Setting (P) | All Modes<br>Sets the proportional gain of the PID controller. | Default: 1.00<br>Min: 0.00<br>Max: 25.00 | 113 |
| b5-03 (1A7H) RUN | Integral Time Setting (I) | All Modes<br>Sets the integral time for the PID controller. | Default: 1.0 s<br>Min: 0.0 s<br>Max: 360.0 s | 113 |
| b5-04 (1A8H) RUN | Integral Limit Setting | All Modes<br>Sets the maximum output possible from the integrator as a percentage of the maximum output frequency. | Default: 100.0%<br>Min: 0.0%<br>Max: 100.0% | 113 |
| b5-05 (1A9H) RUN | Derivative Time (D) | All Modes<br>Sets D control derivative time. | Default: 0.00 s<br>Min: 0.00 s<br>Max: 10.00 s | 113 |
| b5-06 (1AAH) RUN | PID Output Limit | All Modes<br>Sets the maximum output possible from the entire PID controller as a percentage of the maximum output frequency. | Default: 100.0%<br>Min: 0.0%<br>Max: 100.0% | 114 |
| b5-07 (1ABH) RUN | PID Offset Adjustment | All Modes<br>Applies an offset to the PID controller output. Set as a percentage of the maximum output frequency. | Default: 0.0%<br>Min: -100.0%<br>Max: 100.0% | 114 |
| b5-08 (1ACH) RUN | PID Primary Delay Time Constant | All Modes<br>Sets a low pass filter time constant on the output of the PID controller. | Default: 0.00 s<br>Min: 0.00 s<br>Max: 10.00 s | 114 |
| b5-09 (1ADH) | PID Output Level Selection | All Modes<br>0: Normal output (direct acting)<br>1: Reverse output (reverse acting) | Default: 0<br>Min: 0<br>Max: 1 | 114 |
| b5-10 (1AEH) | PID Output Gain Setting | All Modes<br>Sets the gain applied to the PID output. | Default: 1.00<br>Min: 0.00<br>Max: 25.00 | 114 |
| b5-11 (1AFH) | PID Output Reverse Selection | All Modes<br>0: Negative PID output triggers zero limit.<br>1: Rotation direction reverses with negative PID output.<br>When using setting 1, make sure reverse operation is permitted by parameter b1-04. | Default: 0<br>Min: 0<br>Max: 1 | 115 |
| b5-12 (1B0H) | PID Feedback Loss Detection Selection | All Modes<br>0: No fault. Contact output only.<br>1: Fault detection. Alarm output, drive continues operation.<br>2: Fault detection. Fault output, drive output is shut off.<br>3: No fault. Contact output only. No fault detection when PID control is disabled.<br>4: Fault detection. Alarm is triggered and drive continues to run. Fault detection even when PID is disabled.<br>5: Fault detection. Drive output shuts off. No fault detection when PID control is disabled. | Default: 0<br>Min: 0<br>Max: 5 | 116 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| b5-13 (1B1H) | PID Feedback Loss Detection Level | All Modes<br>Sets the PID feedback loss detection level as a percentage of the maximum output frequency. | Default: 0%<br>Min: 0%<br>Max: 100% | 116 |
| b5-14 (1B2H) | PID Feedback Loss Detection Time | All Modes<br>Sets a delay time for PID feedback loss. | Default: 1.0 s<br>Min: 0.0 s<br>Max: 25.5 s | 117 |
| b5-15 (1B3H) | PID Sleep Function Start Level | All Modes<br>Sets the frequency level that triggers the sleep function. | Default: <10><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 117 |
| b5-16 (1B4H) | PID Sleep Delay Time | All Modes<br>Sets a delay time before the sleep function is triggered. | Default: 0.0 s<br>Min: 0.0 s<br>Max: 25.5 s | 118 |
| b5-17 (1B5H) | PID Accel/Decel Time | All Modes<br>Sets the acceleration and deceleration time to PID setpoint. | Default: 0.0 s<br>Min: 0.0 s<br>Max: 6000.0 s | 118 |
| b5-18 (1DCH) | PID Setpoint Selection | All Modes<br>0: Disabled<br>1: Enabled | Default: 0<br>Min: 0<br>Max: 1 | 118 |
| b5-19 (1DDH) | PID Setpoint Value | All Modes<br>Sets the PID target value when b5-18 = 1. Set as a percentage of the maximum output frequency. | Default: 0.00%<br>Min: 0.00%<br>Max: 100.00% | 118 |
| b5-20 (1E2H) | PID Setpoint Scaling | All Modes<br>0: 0.01Hz units<br>1: 0.01% units (100% = max output frequency)<br>2: r/min (number of motor poles must entered)<br>3: User-set (set scaling to b5-38 and b5-39) | Default: 1<br>Min: 0<br>Max: 3 | 118 |
| b5-34 (19FH) RUN | PID Output Lower Limit | All Modes<br>Sets the minimum output possible from the PID controller as a percentage of the maximum output frequency. | Default: 0.00%<br>Min: -100.0%<br>Max: 100.0% | 119 |
| b5-35 (1A0H) RUN | PID Input Limit | All Modes<br>Limits the PID control input (deviation signal) as a percentage of the maximum output frequency. Acts as a bipolar limit. | Default: 1000.0%<br>Min: 0%<br>Max: 1000.0% | 119 |
| b5-36 (1A1H) | PID Feedback High Detection Level | All Modes<br>Sets the PID feedback high detection level as a percentage of the maximum output frequency. | Default: 100%<br>Min: 0%<br>Max: 100% | 117 |
| b5-37 (1A2H) | PID Feedback High Detection Time | All Modes<br>Sets the PID feedback high level detection delay time. | Default: 1.0 s<br>Min: 0.0 s<br>Max: 25.5 s | 117 |
| b5-38 (1FEH) | PID Setpoint User Display | All Modes<br>Sets the display value of U5-01 and U5-04 when the maximum frequency is output. | Default: <5><br>Min: 1<br>Max: 60000 | 119 |
| b5-39 (1FFH) | PID Setpoint Display Digits | All Modes<br>0: No decimal places<br>1: One decimal place<br>2: Two decimal places<br>3: Three decimal places | Default: <5><br>Min: 0<br>Max: 3 | 119 |
| b5-40 (17FH) | Frequency Reference Monitor Content during PID | All Modes<br>0: Display the frequency reference (U1-01) after PID compensation has been added.<br>1: Display the frequency reference (U1-01) before PID compensation has been added. | Default: 0<br>Min: 0<br>Max: 1 | 119 |

| No. (Addr.) | Name | Description | Setting | page |
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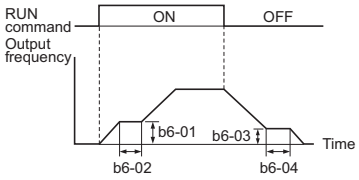
| **b6: Dwell Function** | | | | |
| b6-01 (1B6H) | Dwell Reference at Start | All Modes<br>Parameters b6-01 and b6-02 set the frequency to hold and the time to maintain that frequency at start.<br>Parameters b6-03 and b6-04 set the frequency to hold and the time to maintain that frequency at stop.<br>  | Default: <10><br>Min: 0.0 Hz<br>Max: 120.0 Hz<br><20> | 121 |
| b6-02 (1B7H) | Dwell Time at Start | | Default: 0.0 s<br>Min: 0.0 s<br>Max: 10.0 s | 121 |
| b6-03 (1B8H) | Dwell Reference at Stop | | Default: <10><br>Min: 0.0 Hz<br>Max: 120.0 Hz<br><20> | 121 |
| b6-04 (1B9H) | Dwell Time at Stop | | Default: 0.0 s<br>Min: 0.0 s<br>Max: 10.0 s | 121 |
| **b7: Droop Control** | | | | |
| b7-01 (1CAH) RUN | Droop Control Gain | V/f OLV CLV<br>Sets the speed reduction gain applied at a torque reference of 100%. Set as a percentage of motor base speed. | Default: 0.0%<br>Min: 0.0%<br>Max: 100.0% | 122 |
| b7-02 (1CBH) RUN | Droop Control Delay Time | V/f OLV CLV<br>Used to adjust the responsiveness of Droop Control. | Default: 0.05 s<br>Min: 0.03 s<br>Max: 2.00 s | 122 |
| b7-03 (17EH) | Droop Control Limit Selection | V/f OLV CLV<br>0: Disabled<br>1: Enabled | Default: 1<br>Min: 0<br>Max: 1 | 122 |

<5> Default setting is dependent on PID setpoint scaling (b5-20).
<6> Default setting value varies by the drive model (o2-04).
<8> Parameter value changes automatically if E2-11 is manually changed or changed by Auto-Tuning.
<10> Default setting is determined by the control mode (A1-02).
<11> Setting 2 and 3 are not available when using CLV.
<20> Range upper limit is determined by the maximum output frequency (E1-04) and the upper limit of the frequency reference (d2-01).
<36> Default setting value is determined by the digital operator display selection (o1-03).

## ◆ C: Tuning

C parameters are used to adjust the acceleration and deceleration times, S-curve characteristics, slip compensation, and torque compensation.

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **C1: Acceleration and Deceleration Times** | | | | |
| C1-01 (200H) RUN | Acceleration Time 1 | All Modes<br>Sets the time to accelerate from 0 to maximum frequency. | Default: 60.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 123 |
| C1-02 (201H) RUN | Deceleration Time 1 | All Modes<br>Sets the time to decelerate from maximum frequency to 0. | Default: 120.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 123 |
| C1-03 (202H) RUN | Acceleration Time 2 | All Modes<br>Sets the time to accelerate from 0 to maximum frequency. | Default: 60.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 123 |
| C1-04 (203H) RUN | Deceleration Time 2 | All Modes<br>Sets the time to decelerate from maximum frequency to 0. | Default: 120.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 123 |
| C1-05 (204H) RUN | Acceleration Time 3 (Motor 2 Accel Time 1) | All Modes<br>Sets the time to accelerate from 0 to maximum frequency. | Default: 60.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 123 |
| C1-06 (205H) RUN | Deceleration Time 3 (Motor 2 Decel Time 1) | All Modes<br>Sets the time to decelerate from maximum frequency to 0. | Default: 120.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 123 |
| C1-07 (206H) RUN | Acceleration Time 4 (Motor 2 Accel Time 2) | All Modes<br>Sets the time to accelerate from 0 to maximum frequency. | Default: 60.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 123 |
| C1-08 (207H) RUN | Deceleration Time 4 (Motor 2 Decel Time 2) | All Modes<br>Sets the time to decelerate from maximum frequency to 0. | Default: 120.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 123 |
| C1-09 (208H) | Fast Stop Time | All Modes<br>Sets the time for the Fast Stop function. | Default: 120.0 s<br>Min: 0.0 s<br>Max: 6000.0 s<br><12> | 125 |
| C1-10 (209H) | Accel/Decel Time Setting Units | All Modes<br>0: 0.01 s (0.00 to 600.00 s)<br>1: 0.1 s (0.0 to 6000.0 s) | Default: 1<br>Min: 0<br>Max: 1 | 125 |
| C1-11 (20AH) | Accel/Decel Time Switching Frequency | All Modes<br>Sets the frequency to switch between accel/decel time settings. | Default: <10><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 124 |

| No. (Addr.) | Name | Description | Setting | page |
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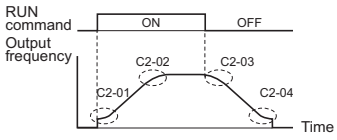
| **C2: S-curve Characteristic** | | | | |
| C2-01 (20BH) | S-Curve Characteristic at Accel Start | All Modes<br>The S-curve can be controlled at the four points shown below.<br>  <br> | Default: <10><br>Min: 0.00 s<br>Max: 10.00 s | 125 |
| C2-02 (20CH) | S-Curve Characteristic at Accel End | | Default: 0.20 s<br>Min: 0.00 s<br>Max: 10.00 s | 125 |
| C2-03 (20DH) | S-Curve Characteristic at Decel Start | | Default: 0.20 s<br>Min: 0.00 s<br>Max: 10.00 s | 125 |
| C2-04 (20EH) | S-Curve Characteristic at Decel End | | Default: 0.00 s<br>Min: 0.00 s<br>Max: 10.00 s | 125 |
| **C3: Slip Compensation** | | | | |
| C3-01 (20FH) RUN | Slip Compensation Gain | All Modes<br>Sets the gain for the motor slip compensation function used for motor 1. | Default: <10><br>Min: 0.0<br>Max: 2.5 | 126 |
| C3-02 (210H) RUN | Slip Compensation Primary Delay Time | V/f OLV CLV<br>Adjusts the slip compensation function delay time used for motor 1. | Default: <10><br>Min: 0 ms<br>Max: 10000 ms | 126 |
| C3-03 (211H) | Slip Compensation Limit | V/f OLV CLV<br>Sets an upper limit for the slip compensation function as a percentage of motor rated slip for motor 1 (E2-02). | Default: 200%<br>Min: 0%<br>Max: 250% | 126 |
| C3-04 (212H) | Slip Compensation Selection during Regeneration | V/f OLV CLV<br>0: Disabled<br>1: Enabled above 6 Hz.<br>2: Enabled whenever slip compensation is possible. | Default: 0<br>Min: 0<br>Max: 2 | 127 |
| C3-05 (213H) | Output Voltage Limit Operation Selection | V/f OLV CLV<br>0: Disabled<br>1: Enabled. Automatically decreases motor flux when output voltage saturation is reached. | Default: <10><br>Min: 0<br>Max: 1 | 127 |
| C3-16 (261H) | Output Voltage Limit Operation Start Level (Percentage Modulation) | V/f OLV CLV<br>Sets the output voltage limit operation start level (percentage modulation) when C3-05 is enabled. | Default: 85.0%<br>Min: 70.0%<br>Max. 90.0% | 127 |
| C3-17 (262H) | Maximum Output Voltage Limit Level | V/f OLV CLV<br>Sets the output voltage limit operation determined by C3-18 (percentage modulation) when C3-05 is enabled. | Default: 90.0%<br>Min: 85.0%<br>Max: 100.0% | 128 |
| C3-18 (263H) | Output Voltage Limit Level | V/f OLV CLV<br>Sets the maximum percentage of output voltage reduction when parameter C3-05 is enabled. | Default: 90.0%<br>Min: 30.0%<br>Max: 100.0% | 128 |
| C3-21 (33EH) RUN | Motor 2 Slip Compensation Gain | All Modes<br>Sets the slip compensation gain used for motor 2. | Default: <15><br>Min: 0.0<br>Max: 2.5 | 128 |
| C3-22 (241H) RUN | Motor 2 Slip Compensation Primary Delay Time | V/f OLV CLV<br>Sets the slip compensation delay time used for motor 2. | Default: 3000 ms<br>Min: 0 ms<br>Max: 10000 ms | 128 |
| C3-23 (242H) | Motor 2 Slip Compensation Limit | V/f OLV CLV<br>Sets the upper limit for the slip compensation function for motor 2. Set as a percentage of the motor rated slip (E4-02). | Default: 200%<br>Min: 0%<br>Max: 250% | 128 |
| C3-24 (243H) | Motor 2 Slip Compensation Selection During Regeneration | V/f OLV CLV<br>0: Disabled<br>1: Enabled above 6 Hz.<br>2: Enabled whenever slip compensation is possible. | Default: 0<br>Min: 0<br>Max: 2 | 129 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **C4: Torque Compensation** | | | | |
| C4-01 (215H) RUN | Torque Compensation Gain | V/f OLV CLV<br>Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque. Used for motor 1. | Default: <10><br>Min: 0.00<br>Max: 2.50 | 129 |
| C4-02 (216H) RUN | Torque Compensation Primary Delay Time 1 | V/f OLV CLV<br>Sets the torque compensation filter time. | Default: <16><br>Min: 0 ms<br>Max: 60000 ms | 130 |
| C4-03 (217H) | Torque Compensation at Forward Start | V/f OLV CLV<br>Sets torque compensation at forward start as a percentage of motor torque. | Default: 0.0%<br>Min: 0.0%<br>Max: 200.0% | 130 |
| C4-04 (218H) | Torque Compensation at Reverse Start | V/f OLV CLV<br>Sets torque compensation at reverse start as a percentage of motor torque. | Default: 0.0%<br>Min: -200.0%<br>Max: 0.0% | 130 |
| C4-05 (219H) | Torque Compensation Time Constant | V/f OLV CLV<br>Sets the time constant for torque compensation at forward start and reverse start (C4-03 and C4-04). | Default: 10 ms<br>Min: 0 ms<br>Max: 200 ms | 130 |
| C4-06 (21AH) | Torque Compensation Primary Delay Time 2 | V/f OLV CLV<br>Sets the torque compensation time 2. | Default: 150 ms<br>Min: 0 ms<br>Max: 10000 ms | 130 |
| C4-07 (341H) RUN | Motor 2 Torque Compensation Gain | V/f OLV CLV<br>Sets the torque compensation gain used for motor 2. | Default: 1.00<br>Min: 0.00<br>Max: 2.50 | 130 |
| **C5: Automatic Speed Regulator (ASR)** | | | | |
| C5-01 (21BH) RUN | ASR Proportional Gain 1 | V/f OLV CLV<br>Sets the proportional gain of the speed control loop (ASR). | Default: <10><br>Min: 0.00<br>Max: 300.00 <17> | 132 |
| C5-02 (21CH) RUN | ASR Integral Time 1 | V/f OLV CLV<br>Sets the integral time of the speed control loop (ASR). | Default: <10><br>Min: 0.000 s<br>Max: 10.000 s | 132 |
| C5-03 (21DH) RUN | ASR Proportional Gain 2 | V/f OLV CLV<br>Sets the speed control gain 2 of the speed control loop (ASR). | Default: <10><br>Min: 0.00<br>Max: 300.00 <17> | 132 |
| C5-04 (21EH) RUN | ASR Integral Time 2 | V/f OLV CLV<br>Sets the integral time 2 of the speed control loop (ASR). | Default: <10><br>Min: 0.000 s<br>Max: 10.000 s | 132 |
| C5-06 (220H) | ASR Primary Delay Time Constant | V/f OLV CLV<br>Sets the filter time constant for the time from the speed loop to the torque command output. | Default: <10><br>Min: 0.000 s<br>Max: 0.500 s | 133 |
| C5-07 (221H) | ASR Gain Switching Frequency | V/f OLV CLV<br>Sets the frequency for switching between proportional gain 1, 2 and integral time 1, 2. | Default: <10><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 133 |
| C5-08 (222H) | ASR Integral Limit | V/f OLV CLV<br>Sets the ASR integral upper limit as a percentage of rated load torque. | Default: 200%<br>Min: 0%<br>Max: 400% | 133 |
| C5-21 (356H) RUN | Motor 2 ASR Proportional Gain 1 | V/f OLV CLV<br>Sets the proportional gain of the speed control loop (ASR) for motor 2. | Default: <15><br>Min: 0.00<br>Max: 300.00 <17> | 134 |
| C5-22 (357H) RUN | Motor 2 ASR Integral Time 1 | V/f OLV CLV<br>Sets the integral time of the speed control loop (ASR) for motor 2. | Default: <15><br>Min: 0.000 s<br>Max: 10.000 s | 134 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| C5-23 (358H) RUN | Motor 2 ASR Proportional Gain 2 | V/f OLV **CLV**<br>Sets the speed control gain 2 of the speed control loop (ASR) for motor 2. | Default: <15><br>Min: 0.00<br>Max: 300.00 <17> | 134 |
| C5-24 (359H) RUN | Motor 2 ASR Integral Time 2 | V/f OLV **CLV**<br>Sets the integral time 2 of the speed control loop (ASR) for motor 2. | Default: <15><br>Min: 0.000 s<br>Max: 10.000 s | 134 |
| C5-26 (35BH) | Motor 2 ASR Primary Delay Time Constant | V/f OLV **CLV**<br>Sets the filter time constant for the time from the speed loop to the torque command output used for motor 2. | Default: <15><br>Min: 0.000 s<br>Max: 0.500 s | 134 |
| C5-27 (35CH) | Motor 2 ASR Gain Switching Frequency | V/f OLV **CLV**<br>Sets the frequency for switching between proportional gain 1, 2 and integral time 1, 2. | Default: 0.0 Hz<br>Min: 0.0 Hz<br>Max: 120.0 Hz | 134 |
| C5-28 (35DH) | Motor 2 ASR Integral Limit | V/f OLV **CLV**<br>Sets the ASR integral upper limit for motor 2 as a percentage of rated load torque. | Default: 200%<br>Min: 0%<br>Max: 400% | 134 |

<10> Default setting is determined by the control mode (A1-02).
<12> The setting range for the acceleration and deceleration times is determined by the accel/decel time setting units in C1-10. For example, if the accel/decel time setting units are set to 0.01 s (C1-10 = 0), the setting range becomes 0.00 to 600.00 s.
<15> The default setting is determined according to the control mode for motor 2 (E3-01).
<16> Default setting is determined by the control mode (A1-02) and the drive model (o2-04).
<17> The setting range is 1.00 to 300.0 in CLV.

## ◆ d: References

Reference parameters are used to set the various frequency reference values during operation.

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **d1: Frequency Reference** | | | | |
| d1-01 (280H) RUN | Frequency Reference 1 | All Modes<br>Sets the frequency reference for the drive. Setting units are determined by parameter o1-03. | Default: 0.00 Hz<br>Min: 0.00 Hz<br>Max: 120.00 Hz<br><20> | 135 |
| d1-02 (281H) RUN | Frequency Reference 2 | | | 135 |
| d1-03 (282H) RUN | Frequency Reference 3 | | | 135 |
| d1-04 (283H) RUN | Frequency Reference 4 | | | 135 |
| d1-05 (284H) RUN | Frequency Reference 5 | | | 135 |
| d1-06 (285H) RUN | Frequency Reference 6 | | | 135 |
| d1-07 (286H) RUN | Frequency Reference 7 | | | 135 |
| d1-08 (287H) RUN | Frequency Reference 8 | | | 135 |
| d1-09 (288H) RUN | Frequency Reference 9 | | | 135 |
| d1-10 (28BH) RUN | Frequency Reference 10 | | | 135 |
| d1-11 (28CH) RUN | Frequency Reference 11 | | | 135 |
| d1-12 (28DH) RUN | Frequency Reference 12 | | | 135 |
| d1-13 (28EH) RUN | Frequency Reference 13 | | | 135 |
| d1-14 (28FH) RUN | Frequency Reference 14 | | | 135 |
| d1-15 (290H) RUN | Frequency Reference 15 | | | 135 |

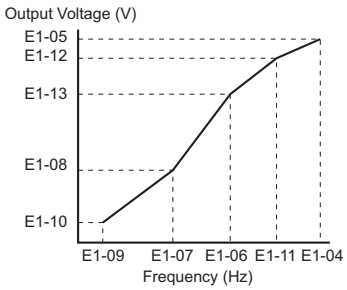
| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| d1-16 (291H) RUN | Frequency Reference 16 | All Modes<br>Sets the frequency reference for the drive. Setting units are determined according to the frequency reference selection/display unit setting (o1-03). | Default: 0.00 Hz<br>Min: 0.00 Hz<br>Max: 120.00 Hz<br><20> | 135 |
| d1-17 (292H) RUN | Jog Frequency Reference | All Modes<br>Sets the jog frequency reference. Setting units are determined by parameter o1-03. | Default: 6.00 Hz<br>Min: 0.00 Hz<br>Max: 120.00 Hz<br><20> | 135 |
| **d2: Frequency Upper/Lower Limits** | | | | |
| d2-01 (289H) | Frequency Reference Upper Limit | All Modes<br>Sets the frequency reference upper limit as a percentage of the maximum output frequency. | Default: 100.0%<br>Min: 0.0%<br>Max: 110.0% | 137 |
| d2-02 (28AH) | Frequency Reference Lower Limit | All Modes<br>Sets the frequency reference lower limit as a percentage of the maximum output frequency. | Default: 0.0%<br>Min: 0.0%<br>Max: 110.0% | 137 |
| d2-03 (293H) | Master Speed Reference Lower Limit | All Modes<br>Sets the lower limit for frequency references from analog inputs as a percentage of the maximum output frequency. | Default: 0.0%<br>Min: 0.0<br>Max: 110.0% | 137 |
| **d3: Jump Frequency** | | | | |
| d3-01 (294H) | Jump Frequency 1 | All Modes<br>Eliminates problems with resonant vibration of the motor/machine by avoiding continuous operation in predefined frequency ranges. The drive accelerates and decelerates the motor through the prohibited frequency ranges.<br>The drive accelerates and decelerates the motor through the prohibited frequency ranges.<br>Setting 0.0 disables this function.<br>Parameters must be set so that d3-01 ≥ d3-02 ≥ d3-03. | Default: 0.0 Hz<br>Min: 0.0 Hz<br>Max: 120.0 Hz<br><20> | 138 |
| d3-02 (295H) | Jump Frequency 2 | | | 138 |
| d3-03 (296H) | Jump Frequency 3 | | | 138 |
| d3-04 (297H) | Jump Frequency Width | All Modes<br>Sets the dead-band width around each selected prohibited frequency reference point. | Default: 1.0 Hz<br>Min: 0.0 Hz<br>Max: 20.0 Hz | 138 |
| **d4: Frequency Reference Hold and Up/Down 2 Function** | | | | |
| d4-01 (298H) | Frequency Reference Hold Function Selection | All Modes<br>0: Disabled. Drive starts from zero when the power is switched on.<br>1: Enabled. At power up, the drive starts the motor at the Hold frequency that was saved. | Default: 0<br>Min: 0<br>Max: 1 | 139 |
| d4-03 (2AAH) RUN | Frequency Reference Bias Step (Up/Down 2) | All Modes<br>Sets the bias added to the frequency reference when the Up 2 and Down 2 contact inputs are enabled (H1-□□ = 75, 76). | Default: 0.00 Hz<br>Min: 0.00 Hz<br>Max: 99.99 Hz | 141 |
| d4-04 (2ABH) RUN | Frequency Reference Bias Accel/Decel (Up/ Down 2) | All Modes<br>0: Use selected accel/decel time.<br>1: Use accel/decel time 4 (C1-07 and C1-08). | Default: 0<br>Min: 0<br>Max: 1 | 141 |
| d4-05 (2ACH) RUN | Frequency Reference Bias Operation Mode Selection (Up/ Down 2) | All Modes<br>0: Bias value is held if no input Up 2 or Down 2 is active.<br>1: When the Up 2 reference and Down 2 reference are both on or both off, the applied bias becomes 0. The specified accel/decel times are used for acceleration or deceleration. | Default: 0<br>Min: 0<br>Max: 1 | 142 |
| d4-06 (2ADH) | Frequency Reference Bias (Up/ Down 2) | All Modes<br>The Up/Down 2 bias value is saved in d4-06 when the frequency reference is not input by the digital operator. Set as a percentage of the maximum output frequency. | Default: 0.0%<br>Min: -99.9%<br>Max: 100.0% | 142 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| d4-07 (2AEH) RUN | Analog Frequency Reference Fluctuation Limit (Up/Down 2) | All Modes<br>Limits how much the frequency reference is allowed to change while an input terminal set for Up 2 or Down 2 is enabled. If the frequency reference changes for more than the set value, then the bias value is held and the drive accelerates or decelerates to the frequency reference. Set as a percentage of the maximum output frequency. | Default: 1.0%<br>Min: 0.1%<br>Max: 100.0% | 142 |
| d4-08 (2AFH) RUN | Frequency Reference Bias Upper Limit (Up/Down 2) | All Modes<br>Sets the upper limit for the bias and the value that can be saved in d4-06. Set as a percentage of the maximum output frequency. | Default: 100.0%<br>Min: 0.0%<br>Max: 100.0% | 143 |
| d4-09 (2B0H) RUN | Frequency Reference Bias Lower Limit (Up/Down 2) | All Modes<br>Sets the lower limit for the bias and the value that can be saved in d4-06. Set as a percentage of the maximum output frequency. | Default: 0.0%<br>Min: -99.9%<br>Max: 0.0% | 143 |
| d4-10 (2B6H) | Up/Down Frequency Reference Limit Selection | All Modes<br>0: The lower limit is determined by d2-02 or an analog input.<br>1: The lower limit is determined by d2-02. | Default: 0<br>Min: 0<br>Max: 1 | 143 |
| **d5: Torque Control** | | | | |
| d5-01 (29AH) | Torque Control Selection | V/f OLV CLV<br>0: Speed Control (Control with the settings of C5-01 to C5-04 and C5-06 to C5-08)<br>1: Torque Control<br>Set to 0 when using a contact input to switch between Speed and Torque Control (H1-□□ = 71). | Default: 0<br>Min: 0<br>Max: 1 | 147 |
| d5-02 (29BH) | Torque Reference Delay Time | V/f OLV CLV<br>Sets a delay time for the torque reference signal.<br>Used to suppress effects by noisy or fluctuating torque reference signals. | Default: <10><br>Min: 0 ms<br>Max: 1000 ms | 147 |
| d5-03 (29CH) | Speed Limit Selection | V/f OLV CLV<br>Sets how the speed limit for the torque control is set.<br>1: Limit set by the frequency reference in b1-01.<br>2: Limit set by d5-04. | Default: 1<br>Min: 1<br>Max: 2 | 148 |
| d5-04 (29DH) | Speed Limit | V/f OLV CLV<br>Sets the speed limit during Torque Control as a percentage of the maximum output frequency. Enabled when d5-03 = 2. A negative setting sets a limit in the opposite direction of the Run command. | Default: 0%<br>Min: -120%<br>Max: 120% | 148 |
| d5-05 (29EH) | Speed Limit Bias | V/f OLV CLV<br>Sets the speed limit bias as a percentage of the maximum output frequency.<br>The bias is applied to the specified speed limit and can adjust the margin for the speed limit. | Default: 10%<br>Min: 0%<br>Max: 120% | 148 |
| d5-06 (29FH) | Speed/Torque Control Switchover Time | V/f OLV CLV<br>Sets the delay time for switching between Speed and Torque Control using an input terminal (H1-□□ = 71). Reference values are held during this switch delay time.<br>This function is enabled when H1-□□ = 71. Within the time set for the speed/torque control switching timer, analog inputs (torque reference, speed limit values) are held at their value at the moment of the “speed/torque control switching” change. Complete the preparations for switching externally during this period. | Default: 0 ms<br>Min: 0 ms<br>Max: 1000 ms | 148 |
| d5-08 (2B5H) | Unidirectional Speed Limit Bias | V/f OLV CLV<br>0: Disabled<br>1: Enabled | Default: 1<br>Min: 0<br>Max: 1 | 148 |

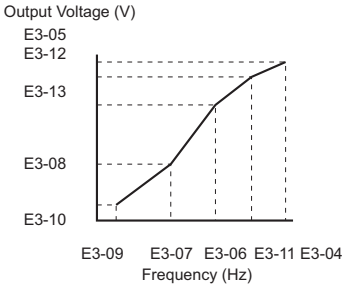
| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **d6: Field Weakening and Field Forcing** | | | | |
| d6-01 (2A0H) | Field Weakening Level | V/f OLV CLV<br>Sets the drive output voltage for the Field Weakening function as a percentage of the maximum output voltage.<br>Enabled when a contact input is set for Field Weakening (H1-☐☐ = 63). | Default: 80%<br>Min: 0%<br>Max: 100% | 149 |
| d6-02 (2A1H) | Field Weakening Frequency Limit | V/f OLV CLV<br>Sets the lower limit of the frequency range where Field Weakening control is valid.<br>The Field Weakening command is valid only at frequencies above this setting and only when the output frequency matches the frequency reference (speed agree). | Default: 0.0 Hz<br>Min: 0.0 Hz<br>Max: 120.0 Hz | 149 |
| d6-03 (2A2H) | Field Forcing Selection | V/f OLV CLV<br>0: Disabled<br>1: Enabled | Default: 0<br>Min: 0<br>Max: 1 | 149 |
| d6-06 (2A5H) | Field Forcing Limit | V/f OLV CLV<br>Sets the upper limit of the excitation current command during magnetic field forcing. A setting of 100% is equal to motor no-load current.<br>Disabled only during DC Injection Braking. | Default: 200%<br>Min: 100%<br>Max: 400% | 149 |
| **d7: Offset Frequency** | | | | |
| d7-01 (2B2H) RUN | Offset Frequency 1 | All Modes<br>Added to the frequency reference when the contact input "Offset Frequency 1" (H1-☐☐ = 44) is switched on. Set as a percentage of the maximum output frequency. | Default: 0.0%<br>Min: -100.0%<br>Max: 100.0% | 150 |
| d7-02 (2B3H) RUN | Offset Frequency 2 | All Modes<br>Added to the frequency reference when the contact input "Offset Frequency 2" (H1-☐☐ = 45) is switched on. Set as a percentage of the maximum output frequency. | Default: 0.0%<br>Min: -100.0%<br>Max: 100.0% | 150 |
| d7-03 (2B4H) RUN | Offset Frequency 3 | All Modes<br>Added to the frequency reference when the contact input "Offset Frequency 3" (H1-☐☐ = 46) is switched on. Set as a percentage of the maximum output frequency. | Default: 0.0%<br>Min: -100.0%<br>Max: 100% | 150 |

<10> Default setting is determined by the control mode (A1-02).
<20> Range upper limit is determined by the maximum output frequency (E1-04) and the upper limit of the frequency reference (d2-01).

## ◆ E: Motor Parameters

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **E1: V/f Pattern for Motor 1** | | | | |
| E1-04 (303H) | Maximum Output Frequency | All Modes<br>To set linear V/f characteristics, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Ensure that the four frequencies are set according to these rules:<br>E1-09 ≤ E1-07 ≤ E1-06 ≤ E1-11 ≤ E1-04<br>Note that if E1-11 = 0, then both E1-11 and E1-12 are disabled, and the above conditions do not apply.<br>  <br><br>Note: E1-07, E1-08 and E1-10 are available only in the following control modes: V/f Control, Open Loop Vector. | Default: <10><br>Min: 40.0 Hz<br>Max: 120.0 Hz | 151 |
| E1-05 (304H) | Maximum Voltage | | Default: <10> <16><br>Min: 0 V<br>Max: 13000 V | 151 |
| E1-06 (305H) | Base Frequency | | Default: <10> <16><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 151 |
| E1-07 (306H) | Middle Output Frequency | | Default: <10> <16><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 151 |
| E1-08 (307H) | Middle Output Frequency Voltage | | Default: <10> <16><br>Min: 0 V<br>Max: 13000 V | 151 |
| E1-09 (308H) | Minimum Output Frequency | | Default: <10> <16><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 151 |
| E1-10 (309H) | Minimum Output Frequency Voltage | | Default: <10> <16><br>Min: 0 V<br>Max: 13000 V | 151 |
| E1-11 (30AH) <21> | Middle Output Frequency 2 | | Default: 0.0 Hz<br>Min: 0.0 Hz<br>Max: 120.0 Hz | 151 |
| E1-12 (30BH) <21> | Middle Output Frequency Voltage 2 | | Default: 0 V<br>Min: 0 V<br>Max: 13000 V | 151 |
| E1-13 (30CH) | Base Voltage | | Default: 0 V <27><br>Max: 0 V<br>Max: 13000 V | 151 |
| **E2: Motor 1 Parameters** | | | | |
| E2-01 (30EH) | Motor Rated Current | All Modes<br>Sets the motor nameplate full load current in Amps. Automatically set during Auto-Tuning. | Default: <6><br>Min: 10% of drive rated current<br>Max: 200% of drive rated current | 152 |
| E2-02 (30FH) | Motor Rated Slip | All Modes<br>Sets the motor rated slip. Automatically set during Auto-Tuning. | Default: <6><br>Min: 0.00 Hz<br>Max: 20.00 Hz | 152 |
| E2-03 (310H) | Motor No-Load Current | All Modes<br>Sets the no-load current for the motor. Automatically set during Auto-Tuning. | Default: <6><br>Min: 0 A<br>Max: E2-01 | 152 |
| E2-04 (311H) | Number of Motor Poles | All Modes<br>Sets the number of motor poles. Automatically set during Auto-Tuning. | Default: 4<br>Min: 2<br>Max: 48 | 152 |
| E2-05 (312H) | Motor Line-to-Line Resistance | All Modes<br>Sets the phase-to-phase motor resistance. Automatically set during Auto-Tuning. | Default: <6><br>Min: 0.000 Ω<br>Max: 65.000 Ω | 153 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| E2-06 (313H) | Motor Leakage Inductance | All Modes<br>Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. | Default: <6><br>Min: 0.0%<br>Max: 40.0% | 153 |
| E2-07 (314H) | Motor Iron-Core Saturation Coefficient 1 | V/f OLV CLV<br>Sets the motor iron saturation coefficient at 50% of magnetic flux. Automatically set during Auto-Tuning. | Default: 0.50<br>Min: 0.00<br>Max: 0.50 | 153 |
| E2-08 (315H) | Motor Iron-Core Saturation Coefficient 2 | V/f OLV CLV<br>Sets the motor iron saturation coefficient at 75% of magnetic flux. Automatically set during Auto-Tuning. | Default: 0.75<br>Min: E2-07<br>Max: 0.75 | 153 |
| E2-09 (316H) | Motor Mechanical Loss | V/f OLV CLV<br>Sets the motor mechanical loss as a percentage of motor rated power (W). Adjust the setting in the following circumstances:<br>• When there is a large amount of torque loss due to motor bearing friction<br>• When there is a large amount of torque loss in a fan or pump application | Default: 0.0%<br>Min: 0.0%<br>Max: 10.0% | 153 |
| E2-10 (317H) | Motor Iron Loss for Torque Compensation | V/f OLV CLV<br>Sets the motor iron loss. | Default: <6><br>Min: 0 W<br>Max: 65535 W | 153 |
| E2-11 (318H) | Motor Rated Power | All Modes<br>Sets the motor rated capacity in kW. Automatically set during Auto-Tuning. | Default: <6><br>Min: 0 kW<br>Max: 65000 kW | 154 |
| **E3: V/f Pattern for Motor 2** | | | | |
| E3-01 (319H) | Motor 2 Control Mode Selection | All Modes<br>0: V/f Control<br>2: Open Loop Vector Control<br>3: Closed Loop Vector Control | Default: 2<br>Min: 0<br>Max: 3 | 155 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| E3-04 (31AH) | Motor 2 Maximum Output Frequency | All Modes<br>To set linear V/f characteristics, set the same values for E3-07 and E3-09. In this case, the setting for E3-08 will be disregarded. Ensure that the four frequencies are set according to these rules or an oPE10 fault will occur: E3-04 ≥ E3-06 > E3-07 ≥ E3-09<br>  <br><br>Note: E3-07 and E3-08 are only available in the following control modes: V/f Control, Open Loop Vector. | Default: <25><br>Min: 40.0 Hz<br>Max: 120.0 Hz | 155 |
| E3-05 (31BH) | Motor 2 Maximum Voltage | | Default: <25><br>Min: 0.0 V<br>Max: 13000 V | 155 |
| E3-06 (31CH) | Motor 2 Base Frequency | | Default: <25><br>Min: 0 Hz<br>Max: 120 Hz | 155 |
| E3-07 (31DH) | Motor 2 Mid Output Frequency | | Default: <25><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 155 |
| E3-08 (31EH) | Motor 2 Mid Output Frequency Voltage | | Default: <25><br>Min: 0 V<br>Max: 13000 V | 155 |
| E3-09 (31FH) | Motor 2 Minimum Output Frequency | | Default: <25><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 155 |
| E3-10 (320H) | Motor 2 Minimum Output Voltage | | Default: <25><br>Min: 0 V<br>Max: 13000 V | 155 |
| E3-11 (345H) | Motor 2 Mid Output Frequency 2 | | Default: 0.0 <24><br>Min: 0.0 Hz<br>Max: 120.0 Hz | 155 |
| E3-12 (346H) <24> | Motor 2 Mid Output Frequency Voltage 2 | | Default: 0 V <67><br>Max: 0 V<br>Max: 13000 V | 155 |
| E3-13 (347H) | Motor 2 Base Voltage | | Default: 0 V <67><br>Max: 0 V<br>Max: 13000 V | 155 |
| **E4: Motor 2 Parameters** | | | | |
| E4-01 (321H) | Motor 2 Rated Current | All Modes<br>Sets the full load current for motor 2. Automatically set during Auto-Tuning. | Default: <6><br>Min: 10% of drive rated current<br>Max: 200% of drive rated current | 156 |
| E4-02 (322H) | Motor 2 Rated Slip | All Modes<br>Sets the rated slip for motor 2. Automatically set during Auto-Tuning. | Default: <6><br>Min: 0.00 Hz<br>Max: 20.00 Hz | 156 |
| E4-03 (323H) | Motor 2 Rated No-Load Current | All Modes<br>Sets the no-load current for motor 2. Automatically set during Auto-Tuning. | Default: <6><br>Min: 0 A<br>Max: E4-01 | 156 |
| E4-04 (324H) | Motor 2 Motor Poles | All Modes<br>Sets the number of poles of motor 2. Automatically set during Auto-Tuning. | Default: 4<br>Min: 2<br>Max: 48 | 156 |
| E4-05 (325H) | Motor 2 Line-to-Line Resistance | All Modes<br>Sets the phase-to-phase resistance for motor 2. Automatically set during Auto-Tuning. | Default: <6><br>Min: 0.000 Ω<br>Max: 65.000 Ω | 156 |
| E4-06 (326H) | Motor 2 Leakage Inductance | All Modes<br>Sets the voltage drop for motor 2 due to motor leakage inductance as a percentage of rated voltage. | Default: <6><br>Min: 0.0%<br>Max: 40.0% | 157 |
| E4-07 (343H) | Motor 2 Motor Iron-Core Saturation Coefficient 1 | V/f OLV CLV<br>Set to the motor iron saturation coefficient at 50% of magnetic flux for motor 2. Automatically set during Auto-Tuning. | Default: 0.50<br>Min: 0.00<br>Max: 0.50 | 157 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| E4-08 (344H) | Motor 2 Motor Iron-Core Saturation Coefficient 2 | V/f OLV CLV<br>Set to the motor iron saturation coefficient at 75% of magnetic flux for motor 2. This value is automatically set during Auto-Tuning. | Default: 0.75<br>Min: E4-07<br>Max: 0.75 | 157 |
| E4-09 (33FH) | Motor 2 Mechanical Loss | V/f OLV CLV<br>Sets the motor mechanical loss for motor 2 as a percentage of motor rated power (kW).<br>Adjust the setting in the following circumstances:<br>• When there is a large amount of torque loss due to motor bearing friction<br>• When there is a large amount of torque loss in a fan or pump application | Default: 0.0%<br>Min: 0.0%<br>Max: 10.0% | 157 |
| E4-10 (340H) | Motor 2 Iron Loss | V/f OLV CLV<br>Sets the motor iron loss. | Default: <6><br>Min: 0 W<br>Max: 65535 W | 157 |
| E4-11 (327H) | Motor 2 Rated Power | All Modes<br>Sets the motor rated capacity in kW. Automatically set during Auto-Tuning. | Default: <6><br>Min: 0 kW<br>Max: 65000 kW | 157 |

<3> Parameter setting value is not reset to the default value when the drive is initialized (A1-03 = 1110/2220).
<6> Default setting value varies by the drive model (o2-04).
<10> Default setting is determined by the control mode (A1-02).
<16> Default setting is determined by the control mode (A1-02) and the drive model (o2-04).
<21> Parameter ignored when E1-11 (Motor 1 Mid Output Frequency 2) and E1-12 (Motor 1 Mid Output Frequency Voltage 2) are set to 0.0.
<24> Parameter ignored when E3-11 (Motor 2 Mid Output Frequency 2) and E3-12 (Motor 2 Mid Output Frequency Voltage 2) are set to 0.0.
<25> The default setting depends on the control mode for motor 2 set in parameter E3-01. The value shown here is for V/f Control.
<27> When Auto-Tuning is performed, E1-13 and E1-05 will be set to the same value.
<67> The drive changes these settings when Auto-Tuning is performed (Rotational Auto-Tuning, Stationary Auto-Tuning).

## ◆ F: Option Parameters

F parameters are used to program the drive for PG feedback from the motor and to function with option cards.

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **F1: PG Speed Control Card (PG-B3 / PG-X3)**<br>Parameters F1-01 and F1-20 are used to set up a PG option card plugged into option connector CN5-C of the drive. They include “PG 1” in the parameter name.<br>Parameters F1-31, F1-32, F1-35, and F1-36 are used to set up a PG option card plugged into option connector CN5-B of the drive. They include “PG 2” in the parameter name.<br>Other parameters in the F1 group are used to set operation for PG options plugged into connector CN5-C and CN5-B. | | | | |
| F1-01<br>(380H) | PG 1 Pulses Per Revolution | V/f OLV **CLV**<br>Sets the number of PG (pulse generator or encoder) pulses.<br>Sets the number of pulses per motor revolution. | Default: <10><br>Min: 0 ppr<br>Max: 60000 ppr | 158 |
| F1-02<br>(381H) | Operation Selection at PG Open Circuit (PGo) | V/f OLV **CLV**<br>0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02.<br>1: Coast to stop.<br>2: Fast Stop. Decelerate to stop using the deceleration time in C1-09.<br>3: Alarm only (Do not select this setting normally, to prevent damage to the motor and machinery.)<br>4: No alarm display (Do not select this setting normally.)<br>Note: Due to potential damage to motor and machinery, the "Alarm only" and "No alarm display" setting should be used only under special circumstances. | Default: 1<br>Min: 0<br>Max: 4 | 158 |
| F1-03<br>(382H) | Operation Selection at Overspeed (oS) | V/f OLV **CLV**<br>0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02.<br>1: Coast to stop<br>2: Fast Stop. Decelerate to stop using the deceleration time in C1-09.<br>3: Alarm only | Default: 1<br>Min: 0<br>Max: 3 | 158 |
| F1-04<br>(383H) | Operation Selection at Deviation | V/f OLV **CLV**<br>0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02.<br>1: Coast to stop<br>2: Fast Stop. Decelerate to stop using the deceleration time in C1-09.<br>3: Alarm only | Default: 3<br>Min: 0<br>Max: 3 | 159 |
| F1-05<br>(384H) | PG 1 Rotation Selection | V/f OLV **CLV**<br>0: Pulse A leads with Forward run command<br>1: Pulse B leads with Forward run command | Default: <10><br>Min: 0<br>Max: 1 | 159 |
| F1-06<br>(385H) | PG 1 Division Ratio for PG Pulse Monitor | V/f OLV **CLV**<br>Sets the division ratio for the pulse monitor used for the PG option card installed to connector CN5-C. By setting “xyz”, the division ratio becomes = [(1 + x) / yz]. If only using the A pulse for one track input, then the input ratio will be 1:1, regardless of what F1-06 is set to.<br>Setting range 1 to 132 (1 to 1/32) | Default: 1<br>Min: 1<br>Max: 132 | 159 |
| F1-08<br>(387H) | Overspeed (oS) Detection Level | V/f OLV **CLV**<br>Sets the overspeed detection level as a percentage of the maximum output frequency. | Default: 115%<br>Min: 0%<br>Max: 120% | 158 |
| F1-09<br>(388H) | Overspeed (oS) Detection Delay Time | V/f OLV **CLV**<br>Sets the time in seconds for an overspeed situation to trigger a fault (oS). | Default: <10><br>Min: 0.0 s<br>Max: 2.0 s | 158 |
| F1-10<br>(389H) | Excessive Speed Deviation (dEv) Detection Level | V/f OLV **CLV**<br>Sets the excessive speed deviation (dEv) detection level as a percentage of the maximum output frequency. | Default: 10%<br>Min: 0%<br>Max: 50% | 159 |
| F1-11<br>(38AH) | Excessive Speed Deviation (dEv) Detection Delay Time | V/f OLV **CLV**<br>Sets the time in seconds for a speed deviation situation to trigger a fault (dEv). | Default: 0.5 s<br>Min: 0.0 s<br>Max: 10.0 s | 159 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| F1-14 (38DH) | PG Open-Circuit Detection Time | V/f OLV CLV<br>Sets the time required to trigger a PG Open fault (PGo). | Default: 2.0 s<br>Min: 0.0 s<br>Max: 10.0 s | 158 |
| F1-20 (3B4H) | PG Option Card Disconnect Detection 1 | V/f OLV CLV<br>0: Disabled<br>1: Enabled | Default: 1<br>Min: 0<br>Max: 1 | 160 |
| F1-30 (3AAH) | PG Card Option Port for Motor 2 Selection | V/f OLV CLV<br>Sets the port for the PG option card used by motor 2.<br>0: CN5-C<br>1: CN5-B | Default: 1<br>Min: 0<br>Max: 1 | 160 |
| F1-31 (3B0H) | PG 2 Pulses Per Revolution | V/f OLV CLV<br>Sets the number of pulses for a PG option card connected to port CN5-B. | Default: 600 ppr<br>Min: 0 ppr<br>Max: 60000 ppr | 158 |
| F1-32 (3B1H) | PG 2 Rotation Selection | V/f OLV CLV<br>0: Pulse A leads with Forward run command<br>1: Pulse B leads with Forward run command | Default: 0<br>Min: 0<br>Max: 1 | 159 |
| F1-35 (3BEH) | PG 2 Division Ratio for Pulse Monitor | V/f OLV CLV<br>Sets the division ratio for the pulse monitor used for the PG option card 2 installed to connector CN5-B. By setting “xyz”, the division ratio becomes = [(1 + x) / yz].<br>Setting range: 1 to 132 (1/32 to 1) | Default: 1<br>Min: 1<br>Max: 132 | 159 |
| F1-36 (3B5H) | PG Option Card Disconnect Detection 2 | V/f OLV CLV<br>0: Disabled<br>1: Enabled | Default: 1<br>Min: 0<br>Max: 1 | 160 |
| **F2: Analog Input Card (AI-A3)** | | | | |
| F2-01 (38FH) | Analog Input Option Card Operation Selection | All Modes<br>0: Option card input terminals V1 and V2 replace drive analog input 1, 2, and 3 terminals.<br>1: Input signals to terminals V1 and V2 are added together to create the frequency reference. | Default: 0<br>Min: 0<br>Max: 1 | 160 |
| F2-02 (368H) RUN | Analog Input Option Card Gain | All Modes<br>Sets the gain for the input signal to the analog card. | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 160 |
| F2-03 (369H) RUN | Analog Input Option Card Bias | All Modes<br>Sets the bias for the input signal to the analog card. | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 160 |
| **F3: Contact Input Card (DI-A3)** | | | | |
| F3-01 (390H) | Contact Input Option Card Input Selection | All Modes<br>0: BCD, 1% units<br>1: BCD, 0.1% units<br>2: BCD, 0.01% units<br>3: BCD, 1 Hz units<br>4: BCD, 0.1 Hz units<br>5: BCD, 0.01 Hz units<br>6: BCD customized setting (5-digit), 0.02 Hz units<br>7: Binary input<br>When the digital operator units are set to be displayed in Hertz or user-set units (o1-03 = 2 or 3), the units for F3-01 are determined by parameter o1-03. | Default: 0<br>Min: 0<br>Max: 7 | 161 |
| F3-03 (3B9H) | Contact Input Option DI-A3 Data Length Selection | All Modes<br>0: 8 bits<br>1: 12 bits<br>2: 16 bits | Default: 2<br>Min: 0<br>Max: 2 | 161 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| F4: Analog Monitor Card (AO-A3) | | | | |
| F4-01 (391H) | Analog Output 5 (Terminal V1) Monitor Selection | All Modes<br>Sets the monitor signal for output from analog output 5 (terminal V1). Set this parameter to the last three digits (☐-☐☐) of the desired U☐-☐☐ parameter. Some U parameters are available only in certain control modes. | Default: 102<br>Min: 000<br>Max: 999 | 161 |
| F4-02 (392H) RUN | Analog Output 5 (Terminal V1) Gain | All Modes<br>Sets the gain for voltage output via analog output 5 (terminal V1). | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 161 |
| F4-03 (3080H) RUN | Analog Output 5 (terminal V1) Bias | All Modes<br>Sets the amount of bias added to the voltage output via analog output 5 (terminal V1). | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 161 |
| F4-04 (3081H) RUN | Analog Output 5 (Terminal V1) Cell Selection | All Modes<br>Sets the number of the power cell to be output from analog output 5 (terminal V1). This setting is effective when 9☐☐ (power cell) has been set for F4-01 (Analog Output 5 (terminal V1) Monitor Selection). | Default: 1<br>Min: 1<br>Max: 15 | 161 |
| F4-05 (3082H) | Analog Output 5 (Terminal V1) Signal Level Selection | All Modes<br>Sets the signal level for analog output 5 (terminal V1).<br>0: 0 to 10 V<br>1: -10 to 10 V | Default: 1<br>Min: 0<br>Max: 1 | 162 |
| F4-11 (3083H) | Analog Output 6 (Terminal V2) Monitor Selection | All Modes<br>Sets the monitor signal for output from analog output 6 (terminal V2). Set this parameter to the last three digits (☐-☐☐) of the desired U☐-☐☐ parameter. Some U parameters are available only in certain control modes. | Default: 103<br>Min: 000<br>Max: 999 | 162 |
| F4-12 (3084H) RUN | Analog Output 6 (Terminal V2) Gain | All Modes<br>Sets the gain for voltage output via analog output 6 (terminal V2). | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 162 |
| F4-13 (3085H) RUN | Analog Output 6 (terminal V2) Bias | All Modes<br>Sets the amount of bias added to the voltage output via analog output 6 (terminal V2). | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 162 |
| F4-14 (3086H) RUN | Analog Output 6 (Terminal V2) Cell Selection | All Modes<br>Sets the number of the power cell to be output from analog output 6 (terminal V2). This setting is effective when 9☐☐ (power cell) has been set for F4-11 (Analog Output 6 (Terminal V2) Monitor Selection). | Default: 1<br>Min: 1<br>Max: 15 | 162 |
| F4-15 (3087H) | Analog Output 6 (Terminal V2) Signal Level Selection | All Modes<br>Sets the signal level for analog output 6 (terminal V2).<br>0: 0 to 10 V<br>1: -10 to 10 V | Default: 1<br>Min: 0<br>Max: 1 | 163 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **F5: Contact Output Card (DO-A3)** | | | | |
| F5-01 (399H) | Contact Output 1 (Terminal P1-PC) Output Selection | All Modes<br>Sets the function for contact outputs 1 to 8 (terminals P1-PC to P6-PC, M1-M2, and M3-M4). | Default: 0<br>Min: 0<br>Max: 1FF | 163 |
| F5-02 (39AH) | Contact Output 2 (Terminal P2-PC) Output Selection | | Default: 1<br>Min: 0<br>Max: 1FF | 163 |
| F5-03 (39BH) | Contact Output 3 (Terminal P3-PC) Output Selection | | Default: 2<br>Min: 0<br>Max: 1FF | 163 |
| F5-04 (39CH) | Contact Output 4 (Terminal P4-PC) Output Selection | | Default: 4<br>Min: 0<br>Max: 1FF | 163 |
| F5-05 (39DH) | Contact Output 5 (Terminal P5-PC) Output Selection | | Default: 6<br>Min: 0<br>Max: 1FF | 163 |
| F5-06 (39EH) | Contact Output 6 (Terminal P6-PC) Output Selection | | Default: 37<br>Min: 0<br>Max: 1FF | 163 |
| F5-07 (39FH) | Contact Output 7 (Terminal M1-M2) Output Selection | | Default: F<br>Min: 0<br>Max: 1FF | 163 |
| F5-08 (3A0H) | Contact Output 8 (Terminal M3-M4) Output Selection | | Default: F<br>Min: 0<br>Max: 1FF | 163 |
| F5-09 (3A1H) | DO-A3 Output Mode Selection | All Modes<br>0: Output terminals are each assigned separate output functions.<br>1: Binary code output<br>2: Use output terminal functions selected by parameters F5-01 through F5-08. | Default: 0<br>Min: 0<br>Max: 2 | 164 |
| **F6: Communication Option Cards**<br>• F6-01 to F6-03 and F6-06 to F6-08 are parameters used in common in DeviceNet and PROFIBUS-DP.<br>• The other parameters are exclusive to each communications system.<br>• For details, refer to the technical manual of each communication option card. | | | | |
| F6-01 (3A2H) | Communications Error Operation Selection | All Modes<br>0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02.<br>1: Coast to stop<br>2: Fast Stop. Decelerate to stop using the deceleration time in C1-09.<br>3: Alarm only | Default: 1<br>Min: 0<br>Max: 3 | 164 |
| F6-02 (3A3H) | External Fault from Comm. Option Detection Selection | All Modes<br>0: Always detected<br>1: Detection during run only | Default: 0<br>Min: 0<br>Max: 1 | 164 |
| F6-03 (3A4H) | External Fault from Comm. Option Operation Selection | All Modes<br>0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02.<br>1: Coast to stop<br>2: Fast Stop. Decelerate to stop using the deceleration time in C1-09.<br>3: Alarm only | Default: 1<br>Min: 0<br>Max: 3 | 164 |
| F6-04 (3A5H) | bUS Error Detection Time | All Modes<br>Sets the delay time for error detection if a bus error (Option Communication Error) occurs. | Default: 2.0 s<br>Min: 0.0 s<br>Max: 5.0 s | – |
| F6-06 (3A7H) | Torque Reference/ Torque Limit Selection from Comm. Option | V/f OLV CLV<br>0: Disabled. Torque reference/limit from the host controller disabled.<br>1: Enabled. Torque reference/limit from the host controller enabled. | Default: 0<br>Min: 0<br>Max: 1 | 165 |
| F6-07 (3A8H) | NetRef/ComRef Function Selection | All Modes<br>0: Multi-step reference disabled<br>1: Multi-step reference enabled | Default: 0<br>Min: 0<br>Max: 1 | 165 |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| F6-08 (36AH) <3> | Reset Communication Parameters | All Modes<br>0: Host controller-related parameters (F6-☐☐) are not reset when the drive is initialized using A1-03.<br>1: Reset all host controller-related parameters (F6-☐☐) when the drive is initialized using A1-03. | Default: 0<br>Min: 0<br>Max: 1 | 165 |
| F6-30 (3CBH) | PROFIBUS-DP Node Address | All Modes<br>Sets the node address. | Default: 0<br>Min: 0<br>Max: 125 | – |
| F6-31 (3CCH) | PROFIBUS-DP Clear Mode Selection | All Modes<br>0: Value cleared to 0 on reception of Clear Mode command<br>1: Previous value held on reception of Clear Mode command | Default: 0<br>Min: 0<br>Max: 1 | – |
| F6-32 (3CDH) | PROFIBUS-DP Data Format Selection | All Modes<br>0: PPO Type<br>1: Mode for compatibility with previous products | Default: 0<br>Min: 0<br>Max: 1 | – |
| F6-50 (3C1H) | DeviceNet MAC Address | All Modes<br>Sets the MAC address. | Default: 0<br>Min: 0<br>Max: 64 | – |
| F6-51 (3C2H) | DeviceNet Communications Speed | All Modes<br>0: 125 kbps<br>1: 250 kbps<br>2: 500 kbps<br>3: Adjustable from network<br>4: Detect automatically | Default: 0<br>Min: 0<br>Max: 4 | – |
| F6-52 (3C3H) | DeviceNet PCA Setting | All Modes<br>Sets the format of the data set from the DeviceNet master to the drive. | Default: 21<br>Min: 0<br>Max: 255 | – |
| F6-53 (3C4H) | DeviceNet PPA Setting | All Modes<br>Sets the format of the data set from the drive to the DeviceNet master. | Default: 71<br>Min: 0<br>Max: 255 | – |
| F6-54 (3C5H) | DeviceNet Idle Mode Fault Detection | All Modes<br>0: Enabled<br>1: Disabled, no fault detection | Default: 0<br>Min: 0<br>Max: 1 | – |
| F6-55 (3C6H) | DeviceNet Baud Rate Monitor | All Modes<br>Used to verify the baud rate running on the network.<br>0: 125 kbps<br>1: 250 kbps<br>2: 500 kbps | Default: 0<br>Min: 0<br>Max: 2 | – |
| F6-56 (3D7H) | DeviceNet Speed Scaling | All Modes<br>Sets the scaling factor for the speed monitor in DeviceNet. | Default: 0<br>Min: -15<br>Max: 15 | – |
| F6-57 (3D8H) | DeviceNet Current Scaling | All Modes<br>Sets the scaling factor for the output current monitor in DeviceNet. | Default: 0<br>Min: -15<br>Max: 15 | – |
| F6-58 (3D9H) | DeviceNet Torque Scaling | All Modes<br>Sets the scaling factor for the torque monitor in DeviceNet. | Default: 0<br>Min: -15<br>Max: 15 | – |
| F6-59 (3DAH) | DeviceNet Power Scaling | All Modes<br>Sets the scaling factor for the power monitor in DeviceNet. | Default: 0<br>Min: -15<br>Max: 15 | – |
| F6-60 (3DBH) | DeviceNet Voltage Scaling | All Modes<br>Sets the scaling factor for the voltage monitor in DeviceNet. | Default: 0<br>Min: -15<br>Max: 15 | – |
| F6-61 (3DCH) | DeviceNet Time Scaling | All Modes<br>Sets the scaling factor for the time monitor in DeviceNet. | Default: 0<br>Min: -15<br>Max: 15 | – |
| F6-62 (3DDH) | DeviceNet Heartbeat Interval | All Modes<br>Sets the heartbeat interval for DeviceNet communications. | Default: 0<br>Min: 0<br>Max: 10 | – |

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| F6-63 (3DEH) | DeviceNet Network MAC ID | All Modes<br>Saves and monitors the settings 0 to 63 of F6-50 (DeviceNet MAC Address). | Default: 0<br>Min: 0<br>Max: 63 | – |
| F6-64 to F6-71 (3DFH to 3C8H) | Reserved | All Modes<br>Reserved for Dynamic I/O Assembly Parameters. | – | – |

<3> Parameter setting value is not reset to the default value when the drive is initialized (A1-03 = 1110/2220).
<10> Default setting is determined by the control mode (A1-02).

## ◆ H: Terminal Functions

H parameters assign functions to the input and output terminals.

| No. (Addr.) | Name | Description | Setting | page |
|---|---|---|---|---|
| **H1: Contact Inputs** | | | | |
| H1-02 (439H) | Contact Input 2 Function Selection | All Modes<br>Assigns a function to the contact inputs.<br>Refer to *H1 Contact Input Selections on page 47* for a description of setting values.<br>Note: Unused terminals should be set to F. | Default: 40<br>Min: 1<br>Max: 9F | 166 |
| H1-03 (400H) | Contact Input 3 Function Selection | | Default: 6A<br>Min: 0<br>Max: 9F | 166 |
| H1-04 (401H) | Contact Input 4 Function Selection | | Default: 70<br>Min: 0<br>Max: 9F | 166 |
| H1-05 (402H) | Contact Input 5 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-06 (403H) | Contact Input 6 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-07 (404H) | Contact Input 7 Function Selection | | Default: 14<br>Min: 0<br>Max: 9F | 166 |
| H1-08 (405H) | Contact Input 8 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-09 (406H) | Contact Input 9 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-10 (407H) | Contact Input 10 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-11 (408H) | Contact Input 11 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-12 (409H) | Contact Input 12 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-13 (303FH) | Contact Input 13 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-14 (3040H) | Contact Input 14 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-15 (3041H) | Contact Input 15 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |
| H1-16 (3042H) | Contact Input 16 Function Selection | | Default: F<br>Min: 0<br>Max: 9F | 166 |

| H1 Contact Input Selections | | | |
|---|---|---|---|
| **H1-☐☐ Setting** | **Function** | **Description** | **Reference page** |
| 1 | LOCAL/REMOTE Selection | All Modes<br>Open: REMOTE (parameter settings determine the source of the frequency Reference 1 or 2 (b1-01, b1-02 or b1-15, b1-16))<br>Closed: LOCAL, digital operator is run and reference source | 167 |
| 2 | External Reference 1/2 Selection | All Modes<br>Open: Run command and frequency reference source 1 (determined by b1-01 and b1-02)<br>Closed: Frequency Reference Selection 2 (b1-15), Run Command Selection 2 (b1-16) | 167 |
| 3 | Multi-Step Speed Reference 1 | All Modes<br>When contact input terminals are set to Multi-Step Speed References 1 through 3, switching combinations of those terminals will create a multi-step speed sequence using the frequency references set in d1-01 through d1-08. | 167 |
| 4 | Multi-Step Speed Reference 2 | | |
| 5 | Multi-Step Speed Reference 3 | | |
| 6 | Jog Reference Selection | All Modes<br>Closed: Jog frequency reference (d1-17) selected. Jog has priority over all other reference sources. | 167 |
| 7 | Accel/Decel Time Selection 1 | All Modes<br>Used to switch between accel/decel time 1 (set in C1-01, C1-02) and accel/decel time 2 (set in C1-03, C1-04).<br>The combination with H1-☐☐=1A (Accel/Decel Time Selection) allows the drive to switch between accel/decel time 3 and accel/decel time 4. | 167 |
| 8 | Baseblock Command (N.O.) | All Modes<br>Closed: No drive output | 167 |
| 9 | Baseblock Command (N.C.) | All Modes<br>Open: No drive output | 167 |
| A | Accel/Decel Ramp Hold | All Modes<br>Open: Accel/decel is not held<br>Closed: The drive pauses during acceleration or deceleration and maintains the output frequency. | 168 |
| B | Drive Overheat Alarm (oH2) | All Modes<br>Closed: Closes when an oH2 alarm occurs | 168 |
| C | Analog Terminal Input Selection | All Modes<br>Open: Function assigned by H3-14 is disabled.<br>Closed: Function assigned by H3-14 is enabled. | 168 |
| E | ASR Integral Reset | V/f OLV CLV<br>Open: PI control<br>Closed: Integral reset | 168 |
| F | Through Mode | All Modes<br>Select this setting when using the terminal in a pass-through mode.<br>The terminal does not trigger a drive function but can be used as contact input for the controller the drive is connected to. | 168 |
| 10 | Up Command | All Modes<br>The drive accelerates when the Up command terminal closes, and decelerates when the Down command closes. When both terminals are closed or both are open, the drive holds the frequency reference. The Up and Down commands must always be used in conjunction with one another. | 168 |
| 11 | Down Command | | |
| 12 | Forward Jog | All Modes<br>Closed: Runs forward at the Jog frequency d1-17. | 170 |
| 13 | Reverse Jog | All Modes<br>Closed: Runs reverse at the Jog frequency d1-17. | 170 |

| H1 Contact Input Selections | | | |
|---|---|---|---|
| **H1-☐☐ Setting** | **Function** | **Description** | **Reference page** |
| 14 | Fault Reset | All Modes<br>Closed: Resets faults if the cause is cleared and the Run command is removed. | 170 |
| 15 | Fast Stop (N.O.) | All Modes<br>Closed: Decelerates at the Fast Stop time set to C1-09. | 170 |
| 16 | Motor 2 Selection | All Modes<br>Open: Motor 1<br>Closed: Motor 2 | 171 |
| 17 | Fast Stop (N.C.) | All Modes<br>Open: Decelerates to stop at the Fast Stop time set to C1-09. | 170 |
| 18 | Timer Function Input | All Modes<br>Triggers the timer set up by parameters b4-01 and b4-02. Must be set in conjunction with the timer function output (H2-☐☐ = 12). | 171 |
| 19 | PID Disable | All Modes<br>Open: PID control enabled<br>Closed: PID control disabled | 171 |
| 1A | Accel/Decel Time Selection 2 | All Modes<br>Used in conjunction with an input terminal set for “Accel/decel time selection 1” (H1-☐☐ = 7), and allows the drive to switch between accel/decel times 3 and 4. | 171 |
| 1B | Program Lockout | All Modes<br>Open: Parameters cannot be edited (except for U1-01 if the reference source is assigned to the digital operator).<br>Closed: Parameters can be edited and saved. | 171 |
| 1E | Reference Sample Hold | All Modes<br>Closed: Samples the analog frequency reference and operates the drive at that speed. | 172 |
| 20 to 2F | External Fault | All Modes<br>20: N.O., Always detected, ramp to stop<br>21: N.C., Always detected, ramp to stop<br>22: N.O., During run, ramp to stop<br>23: N.C., During run, ramp to stop<br>24: N.O., Always detected, coast to stop<br>25: N.C., Always detected, coast to stop<br>26: N.O., During run, coast to stop<br>27: N.C., During run, coast to stop<br>28: N.O., Always detected, Fast Stop<br>29: N.C., Always detected, Fast Stop<br>2A: N.O., During run, Fast Stop<br>2B: N.C., During run, Fast Stop<br>2C: N.O., Always detected, alarm only (continue running)<br>2D: N.C., Always detected, alarm only (continue running)<br>2E: N.O., During run, alarm only (continue running)<br>2F: N.C., During run, alarm only (continue running) | 172 |
| 30 | PID Integral Reset | All Modes<br>Closed: Resets the PID control integral value. | 173 |
| 31 | PID Integral Hold | All Modes<br>Open: Performs integral operation.<br>Closed: Maintains the current PID control integral value. | 173 |
| 32 | Multi-Step Speed Reference 4 | All Modes<br>The values set in d1-01 to d1-16 (frequency references) can be selected according to the combination of the four terminals set for Multi-Step Speed References 1 to 4. | 173 |
| 33 | Thermostatic Switch (N.C.) | All Modes<br>Closed: Closes when thermostatic switches are OFF, and then a TME2 (Transformer Temperature DI Fault) fault occurs. | 173 |

| H1 Contact Input Selections | | | |
|---|---|---|---|
| **H1-☐☐ Setting** | **Function** | **Description** | **Reference page** |
| 34 | PID Soft Starter Cancel | All Modes<br>Open: PID soft starter is enabled.<br>Closed: Disables the PID soft starter b5-17. | 173 |
| 35 | PID Input Level Selection | All Modes<br>Closed: Inverts the PID input signal (1 to -1 or -1 to 1) | 173 |
| 40 | Forward Run Command (2-wire Sequence) | All Modes<br>Open: Stop<br>Closed: Forward run<br>Note: Cannot be set together with settings 42 or 43. | 173 |
| 41 | Reverse Run Command (2-wire Sequence) | All Modes<br>Open: Stop<br>Closed: Reverse run<br>Note: Cannot be set together with settings 42 or 43. | 173 |
| 42 | Run Command (2-wire Sequence 2) | All Modes<br>Open: Stop<br>Closed: Run<br>Note: Cannot be set together with settings 40 or 41. | 173 |
| 43 | FWD/REV Command (2-wire Sequence 2) | All Modes<br>Open: Reverse<br>Closed: Forward<br>Note: Determines motor direction, but does not issue a Run command. Cannot be set together with settings 40 or 41. | 173 |
| 44 | Add Offset Frequency 1 | All Modes<br>Closed: Adds d7-01 to the frequency reference. | 173 |
| 45 | Add Offset Frequency 2 | All Modes<br>Closed: Adds d7-02 to the frequency reference. | 173 |
| 46 | Add Offset Frequency 3 | All Modes<br>Closed: Adds Offset Frequency 3 (d7-03) to the frequency reference. | 173 |
| 60 | DC Injection Braking Command | All Modes<br>Closed: Triggers DC Injection Braking. | 173 |
| 61 | External Speed Search Command 1 | V/f OLV CLV<br>Closed: Activates Current Detection Speed Search from the maximum output frequency (E1-04). | 174 |
| 62 | External Speed Search Command 2 | V/f OLV CLV<br>Closed: Activates Current Detection Speed Search from the frequency reference. | 174 |
| 63 | Field Weakening | V/f OLV CLV<br>Closed: The drive performs Field Weakening control as set for d6-01 and d6-02. | 174 |
| 67 | Communications Test Mode | All Modes<br>Tests the RS-485 interface. Displays “PASS” if the communications test completes successfully. | 174 |
| 6A | Drive Enable | All Modes<br>Open: Drive disabled. If this input is opened during run, then the drive will stop as specified by b1-03.<br>Closed: Ready for operation. | 174 |
| 70 | Drive Enable 2 | All Modes<br>Open: Drive disabled. If this input is opened during run, then the drive will stop as specified by b1-03.<br>Closed: Ready for operation. | 174 |

| H1 Contact Input Selections | | | |
|---|---|---|---|
| **H1-□□ Setting** | **Function** | **Description** | **Reference page** |
| 71 | Speed/Torque Control Switch | V/f OLV CLV<br>Open: Speed Control<br>Closed: Torque Control | 174 |
| 75 | Up 2 Command | All Modes<br>Used to control the bias added to the frequency reference by the Up/Down 2 function.<br>The Up 2 and Down 2 commands must always be used in conjunction with one another. | 175 |
| 76 | Down 2 Command | | |
| 77 | ASR Gain Switch | V/f OLV CLV<br>Open: ASR proportional gain 1 (C5-01)<br>Closed: ASR proportional gain 2 (C5-03) | 176 |
| 78 | External Torque Reference Polarity Inversion | V/f OLV CLV<br>Open: Forward torque reference<br>Closed: Reverse polarity | 176 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| **H2: Contact Outputs** | | | | |
| H2-01 (40BH) | Contact Output 1 Function Selection (open collector) | All Modes<br>Refer to *H2 Contact Output Settings on page 52* for a description of setting values. | Default: 3A<br>Min: 0<br>Max: 1FF | 176 |
| H2-02 (40CH) | Contact Output 2 Function Selection (open collector) | | Default: E<br>Min: 0<br>Max: 1FF | 176 |
| H2-03 (40DH) | Contact Output 3 Function Selection (open collector) | | Default: 0<br>Min: 0<br>Max: 1FF | 176 |
| H2-04 (40EH) | Contact Output 4 Function Selection (open collector) | | Default: 6<br>Min: 0<br>Max: 1FF | 176 |
| H2-05 (40FH) | Contact Output 5 Function Selection (open collector) | | Default: 10<br>Min: 0<br>Max: 1FF | 176 |
| H2-06 (3044H) | Contact Output 6 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-07 (3045H) | Contact Output 7 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-08 (3046H) | Contact Output 8 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-09 (3047H) | Contact Output 9 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-10 (3048H) | Contact Output 10 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-11 (3049H) | Contact Output 11 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-12 (304AH) | Contact Output 12 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-13 (304BH) | Contact Output 13 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-14 (304CH) | Contact Output 14 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-15 (304DH) | Contact Output 15 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-16 (304EH) | Contact Output 16 Function Selection (open collector) | | Default: F<br>Min: 0<br>Max: 1FF | 176 |
| H2-17 (304FH) | Watt Hour Output Unit Selection | All Modes<br>Outputs a 200 ms pulse signal when the watt-hour counter increases by the units selected.<br>0: 0.1 kWh units<br>1: 1 kWh units<br>2: 10 kWh units<br>3: 100 kWh units<br>4: 1000 kWh units | Default: 3<br>Min: 0<br>Max: 4 | 187 |

| H2 Contact Output Settings | | | |
|---|---|---|---|
| H2-□□ Setting | Function | Description | Reference page |
| 0 | During Run | All Modes<br>Closed: A Run command is active or voltage is output. | 177 |
| 1 | Zero Speed | All Modes<br>Open: Output frequency is above the minimum output frequency set in E1-09.<br>Closed: Output frequency is below the minimum output frequency set in E1-09. | 178 |
| 2 | Speed Agree 1 | All Modes<br>Closed: Output frequency equals the speed reference (plus or minus the hysteresis set to L4-02). | 178 |
| 3 | User-set Speed Agree 1 | All Modes<br>Closed: Output frequency and speed reference equal L4-01 (plus or minus the hysteresis set to L4-02). | 178 |
| 4 | Frequency detection 1 | All Modes<br>Closed: Output frequency is less than or equal to the value in L4-01 with hysteresis determined by L4-02. | 180 |
| 5 | Frequency detection 2 | All Modes<br>Closed: Output frequency is greater than or equal to the value in L4-01 with hysteresis determined by L4-02. | 180 |
| 6 | Drive Ready | All Modes<br>Closed: Power up is complete and the drive is ready to accept a Run command. | 180 |
| 7 | DC Bus Undervoltage | All Modes<br>Closed: DC bus voltage is below the Uv trip level set in L2-05. | 181 |
| 8 | During Baseblock (N.O.) | All Modes<br>Closed: Drive has entered the baseblock state (no output voltage). | 181 |
| 9 | Frequency Reference Source | All Modes<br>Open: External Reference 1 or 2 supplies the frequency reference (set in b1-01 or b1-15).<br>Closed: Digital operator supplies the frequency reference. | 181 |
| A | Run Command Source | All Modes<br>Open: External Reference 1 or 2 supplies the Run command (set in b1-02 or b1-16).<br>Closed: Digital operator supplies the Run command. | 181 |
| B | Torque Detection 1 (N.O.) | All Modes<br>Closed: An overtorque or undertorque situation has been detected. | 181 |
| C | Frequency Reference Loss | All Modes<br>Closed: Analog frequency reference has been lost. | 181 |
| E | Fault | All Modes<br>Closed: Fault occurred. | 181 |
| F | Through Mode | All Modes<br>Set this value when using the terminal in the pass-through mode. | 182 |
| 10 | Minor Fault | All Modes<br>Closed: An alarm has been triggered, or the IGBTs have reached 90% of their expected life span. | 182 |
| 11 | Fault Reset Command Active | All Modes<br>Closed: A command has been entered to clear a fault via the contact input terminals or from the serial network. | 182 |
| 12 | Timer Output | All Modes<br>Closed: Timer output. | 182 |

| H2 Contact Output Settings | | | |
|---|---|---|---|
| H2-☐☐ Setting | Function | Description | Reference page |
| 13 | Speed Agree 2 | All Modes<br>Closed: When drive output frequency equals the frequency reference ±L4-04. | 182 |
| 14 | User-set Speed Agree 2 | All Modes<br>Closed: When the drive output frequency is equal to the value in L4-03 ±L4-04. | 183 |
| 15 | Frequency Detection 3 | All Modes<br>Closed: When the drive output frequency is less than or equal to the value in L4-03 ±L4-04. | 183 |
| 16 | Frequency detection 4 | All Modes<br>Closed: When the output frequency is greater than or equal to the value in L4-03 ±L4-04. | 184 |
| 17 | Torque Detection 1 (N.C.) | All Modes<br>Open: Overtorque or undertorque has been detected. | 181 |
| 18 | Torque Detection 2 (N.O.) | All Modes<br>Closed: Overtorque or undertorque has been detected. | 181 |
| 19 | Torque Detection 2 (N.C.) | All Modes<br>Open: Overtorque or undertorque has been detected. | 181 |
| 1A | During Reverse | All Modes<br>Closed: Drive is running in the reverse direction. | 184 |
| 1B | During baseblock (N.C.) | All Modes<br>Open: Drive has entered the baseblock state (no output voltage). | 184 |
| 1C | Motor 2 Selection | All Modes<br>Closed: Motor 2 is selected by a contact input (H1-☐☐ = 16). | 185 |
| 1D | During Regeneration | V/f OLV CLV<br>Closed: Motor is regenerating energy into the drive. | 185 |
| 1E | Restart Enabled | All Modes<br>Closed: An automatic restart is performed | 185 |
| 1F | Motor Overload Alarm (oL1) | All Modes<br>Closed: oL1 is at 90% of its trip point or greater. An oH3 situation also triggers this alarm. | 185 |
| 20 | Drive overheat pre-alarm (oH) | All Modes<br>Closed: Thermistor temperature exceeds the parameter L8-02 value. | 185 |
| 22 | Mechanical Weakening detection (N.O.) | All Modes<br>Closed: Mechanical weakening detected. | 185 |
| 2F | Maintenance Period | All Modes<br>Closed: Cooling fan, electrolytic capacitors, IGBTs, or the soft charge bypass relay may require maintenance. | 185 |
| 30 | During Torque Limit | V/f OLV CLV<br>Closed: When the torque limit has been reached. | 185 |
| 31 | During Speed Limit | V/f OLV CLV<br>Closed: Speed limit has been reached. | 185 |
| 32 | During Speed Limit in Torque Control | V/f OLV CLV<br>Closed: Speed limit has been reached while using Torque Control. | 185 |
| 37 | During Frequency Output | All Modes<br>Open: Either the drive has stopped or baseblock, DC Injection Braking, or Initial Excitation is being performed.<br>Closed: Drive is running the motor (not in a baseblock state and DC Injection is not being performed). | 186 |

| H2 Contact Output Settings | | | |
|---|---|---|---|
| **H2-☐☐ Setting** | **Function** | **Description** | **Reference page** |
| 38 | Drive Enabled | All Modes<br>Closed: Contact input set for “Drive enable” is closed (H1-☐☐ = 6A) | 186 |
| 39 | Watt Hour Pulse Output | All Modes<br>Output units are determined by H2-06. Outputs a pulse every 200 ms to indicate the kWh count. | 186 |
| 3A | Cooling Fan, Transformer Abnormal Temperature Rise | All Modes<br>Closed: No abnormal temperature rise in the cooling fans or transformers has occurred. | 186 |
| 3C | LOCAL/REMOTE Status | All Modes<br>Open: REMOTE<br>Closed: LOCAL | 186 |
| 3D | During Speed Search | All Modes<br>Closed: Speed Search is being executed. | 186 |
| 3E | PID Feedback Low | All Modes<br>Closed: PID feedback level is too low. | 186 |
| 3F | PID Feedback High | All Modes<br>Closed: The PID feedback level is too high. | 186 |
| 4C | During Fast Stop | All Modes<br>Closed: A Fast Stop command has been entered from the operator or input terminals. | 186 |
| 4D | oH Pre-alarm Time Limit | All Modes<br>Closed: oH pre-alarm time limit has passed. | 186 |
| 60 | Internal Cooling Fan Alarm | All Modes<br>Closed: Internal cooling fan alarm | 186 |
| 100 to 160 | Function 0 to 60 with Inverse Output | All Modes<br>Inverts the output switching of the contact output functions.<br>Set the last two digits of 1☐☐ to reverse the output signal of that specific function.<br>Example: 108: Reverses the output of 8 (During Baseblock)<br>14C: Reverses the output of 4C (During Fast Stop) | 187 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| **H3: Analog Inputs** | | | | |
| H3-01 (410H) | Analog Input 1 Signal Level Selection | All Modes<br>0: 0 to 10 V<br>1: -10 to 10 V | Default: 0<br>Min: 0<br>Max: 1 | 187 |
| H3-02 (434H) | Analog Input 1 Function Selection | All Modes<br>Sets the function of analog input 1. | Default: 0<br>Min: 0<br>Max: FF | 188 |
| H3-03 (411H) RUN | Analog Input 1 Gain | All Modes<br>Sets the level of the input value selected in H3-02 when 10 V is input at analog input 1. | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 188 |
| H3-04 (412H) RUN | Analog Input 1 Bias | All Modes<br>Sets the level of the input value selected in H3-02 when 0 V is input at analog input 1. | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 188 |
| H3-09 (417H) | Analog Input 2 Signal Level Selection | All Modes<br>0: 0 to 10 V<br>1: -10 to 10 V | Default: 1<br>Min: 0<br>Max: 1 | 189 |
| H3-10 (418H) | Analog Input 2 Function Selection | All Modes<br>Sets the function of analog input 2. | Default: 0<br>Min: 0<br>Max: 32 | 189 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| H3-11 (419H) RUN | Analog Input 2 Gain | All Modes<br>Sets the reference value for the function assigned for analog input 2 in % units when 10 V is input. | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 189 |
| H3-12 (41AH) RUN | Analog Input 2 Bias | All Modes<br>Sets the amount of bias for the function assigned for analog input 2 in % units when 0 V is input. | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 189 |
| H3-13 (41BH) | Analog Input Filter Time Constant | All Modes<br>Sets a primary delay filter time constant for analog inputs 1 and 2. Used for noise filtering. | Default: 0.03 s<br>Min: 0.00 s<br>Max: 2.00 s | 189 |
| H3-14 (41CH) | Analog Input Terminal Enable Selection | All Modes<br>Sets of the analog input terminals to be enabled when the analog input is set for “PID target value” (H3-☐☐ = C).<br>1: Analog input 1 only<br>2: Analog input 2 only<br>3: Analog inputs 1 and 2 only | Default: 3<br>Min: 1<br>Max: 3 | 189 |
| H3-16 (2F0H) | Analog input 1 offset | All Modes<br>Adds an offset when the analog signal to analog input 1 is at 0 V. | Default: 0<br>Min: -500<br>Max: 500 | 190 |
| H3-17 (2F1H) | Analog input 2 offset | All Modes<br>Adds an offset when the analog signal to analog input 2 is at 0 V. | Default: 0<br>Min: -500<br>Max: 500 | 190 |

| H3 Analog Input Settings | | | |
|---|---|---|---|
| H3-☐☐ Setting | Function | Description | Reference page |
| 0 | Frequency Bias | All Modes<br>10 V = E1-04 (maximum output frequency) | 190 |
| 1 | Frequency Gain | All Modes<br>0 to 10 V signal allows a setting of 0 to 100%. -10 to 0 V signal allows a setting of -100 to 0%. | 190 |
| 2 | Auxiliary Frequency Reference (used as a Multi-Step Speed 2) | All Modes<br>10 V = E1-04 (maximum output frequency) | 190 |
| 3 | Auxiliary Frequency Reference (3rd step analog) | All Modes<br>10 V = E1-04 (maximum output frequency) | 190 |
| 4 | Output Voltage Bias | V/f OLV CLV<br>10 V = E1-05 (motor rated voltage) | 190 |
| 5 | Accel/decel time gain | All Modes<br>10 V = 100% | 191 |
| 6 | DC Injection Braking Current | V/f OLV CLV<br>10 V = Drive rated current | 191 |
| 7 | Overtorque/Undertorque Detection Level | All Modes<br>10 V = Drive rated current (V/f)<br>10 V = Motor rated torque (OLV, CLV) | 191 |
| 8 | Stall Prevention Level During Run | V/f OLV CLV<br>10 V = Drive rated current | 191 |
| 9 | Output Frequency Lower Limit Level | All Modes<br>10 V = E1-04 (maximum output frequency) | 191 |
| B | PID Feedback | All Modes<br>10 V = 100% | 191 |

| H3 Analog Input Settings | | | |
|---|---|---|---|
| H3-☐☐ Setting | Function | Description | Reference page |
| C | PID Setpoint Value | All Modes<br>10 V = 100% | 192 |
| D | Frequency Bias | All Modes<br>10 V = E1-04 (maximum output frequency) | 192 |
| F | Through Mode | All Modes<br>Set this value when using the terminal in the pass-through mode. | 192 |
| 10 | Forward Torque Limit | V/f OLV CLV<br>10 V = Motor rated torque | 192 |
| 11 | Reverse Torque Limit | V/f OLV CLV<br>10 V = Motor rated torque | 192 |
| 12 | Regenerative Torque Limit | V/f OLV CLV<br>10 V = Motor rated torque | 192 |
| 13 | Torque Reference/Torque Limit | V/f OLV CLV<br>10 V = Motor rated torque | 192 |
| 14 | Torque Compensation | V/f OLV CLV<br>10 V = Motor rated torque | 192 |
| 15 | General Torque Limit | V/f OLV CLV<br>10 V = Motor rated torque | 192 |
| 16 | Differential PID Feedback | All Modes<br>10 V = 100% | 192 |
| 1F | Through Mode | All Modes<br>Set this value when using the terminal in the pass-through mode. | 192 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| H4: Analog Outputs | | | | |
| H4-01 (3050H) | Analog Output 1 Monitor Selection | All Modes<br>Sets the monitor signal from analog output 1.<br>Set the desired monitor parameter to the digits available in U☐-☐☐. For example, enter “103” for U1-03. | Default: 102<br>Min: 000<br>Max: 999 | 193 |
| H4-02 (3051H) RUN | Analog Output 1 Gain | All Modes<br>Sets the signal level at analog output 1 that is equal to 100% of the selected monitor value. | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 193 |
| H4-03 (3052H) RUN | Analog Output 1 Bias | All Modes<br>Sets the bias value added to analog output 1 signal. | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 193 |
| H4-04 (3053H) RUN | Analog Output 1 Cell Selection | All Modes<br>Sets the number of the power cell to be output from analog output 1. This setting is effective when 9☐☐ (power cell) has been set for H4-01 (Analog Output 1 Monitor Selection). | Default: 1<br>Min: 1<br>Max: 15 | 193 |
| H4-05 (3054H) | Analog Output 1 Signal Level Selection | All Modes<br>Sets the signal level output 1.<br>0: 0 to 10 V<br>1: -10 to 10 V | Default: 1<br>Min: 0<br>Max: 1 | 195 |
| H4-11 (305AH) | Analog Output 2 Monitor Selection | All Modes<br>Sets the monitor signal from analog output 2. Set this parameter to the last three digits (☐-☐☐) of the desired U☐-☐☐ parameter. Some U parameters are available only in certain control modes. | Default: 103<br>Min: 000<br>Max: 999 | 193 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| H4-12 (305BH) RUN | Analog Output 2 Gain | All Modes<br>Sets the gain for voltage output via analog output 2. | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 193 |
| H4-13 (305CH) RUN | Analog Output 2 Bias | All Modes<br>Sets the amount of bias added to the voltage output via analog output 2. | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 193 |
| H4-14 (305DH) RUN | Analog Output 2 Cell Selection | All Modes<br>Sets the number of the power cell to be output from analog output 2. This setting is effective when 9□□ (power cell) has been set for H4-11 (Analog Output 2 Monitor Selection). | Default: 1<br>Min: 0<br>Max: 15 | 193 |
| H4-15 (305EH) | Analog Output 2 Signal Level Selection | All Modes<br>Sets the signal level for analog output 2.<br>0: 0 to 10 V<br>1: -10 to 10 V | Default: 1<br>Min: 0<br>Max: 1 | 195 |
| H4-21 (3064H) | Analog Output 3 Monitor Selection | All Modes<br>Sets the monitor signal for output from analog output 3. Set this parameter to the last three digits (□-□□) of the desired U□-□□ parameter. Some U parameters are available only in certain control modes. | Default: 000<br>Min: 000<br>Max: 999 | 193 |
| H4-22 (3065H) RUN | Analog Output 3 Gain | All Modes<br>Sets the gain for voltage output via analog output 3. | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 193 |
| H4-23 (3066H) RUN | Analog Output 3 Bias | All Modes<br>Sets the amount of bias added to the voltage output via analog output 3. | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 193 |
| H4-24 (3067H) RUN | Analog Output 3 Cell Selection | All Modes<br>Sets the number of the power cell to be output from analog output 3. This setting is effective when 9□□ (power cell) has been set for H4-21 (Analog Output 3 Monitor Selection). | Default: 1<br>Min: 0<br>Max: 15 | 193 |
| H4-25 (3068H) | Analog Output 3 Signal Level Selection | All Modes<br>Sets the signal level for analog output 3.<br>0: 0 to 10 V<br>1: -10 to 10 V | Default: 1<br>Min: 0<br>Max: 1 | 195 |
| H4-31 (306EH) | Analog Output 4 Monitor Selection | All Modes<br>Sets the monitor signal for output from analog output 4. Set this parameter to the last three digits (□-□□) of the desired U□-□□ parameter. Some U parameters are available only in certain control modes. | Default: 000<br>Min: 000<br>Max: 999 | 193 |
| H4-32 (306FH) RUN | Analog Output 4 Gain | All Modes<br>Sets the gain for voltage output via analog output 4. | Default: 100.0%<br>Min: -999.9%<br>Max: 999.9% | 193 |
| H4-33 (3070H) RUN | Analog Output 4 Bias | All Modes<br>Sets the amount of bias added to the voltage output via analog output 4. | Default: 0.0%<br>Min: -999.9%<br>Max: 999.9% | 193 |
| H4-34 (3071H) RUN | Analog Output 4 Cell Selection | All Modes<br>Sets the number of the power cell to be output from analog output 4. This setting is effective when 9□□ (power cell) has been set for H4-31 (Analog Output 4 Monitor Selection). | Default: 1<br>Min: 0<br>Max: 15 | 193 |
| H4-35 (3072H) | Analog Output 4 Signal Level Selection | All Modes<br>Sets the signal level for analog output 4.<br>0: 0 to 10 V<br>1: -10 to 10 V | Default: 1<br>Min: 0<br>Max: 1 | 195 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| **H5: MEMOBUS/Modbus Serial Communication** | | | | |
| H5-01 (425H) <32> | Drive Node Address | All Modes<br>Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect. | Default: 1F<br>Min: 0<br>Max: FFH | <38> |
| H5-02 (426H) | Communication Speed Selection | All Modes<br>0: 1200 bps<br>1: 2400 bps<br>2: 4800 bps<br>3: 9600 bps<br>4: 19200 bps<br>5: 38400 bps<br>6: 57600 bps<br>7: 76800 bps<br>8: 115200 bps | Default: 3<br>Min: 0<br>Max: 8 | <38> |
| H5-03 (427H) | Communication Parity Selection | All Modes<br>0: No parity<br>1: Even parity<br>2: Odd parity | Default: 0<br>Min: 0<br>Max: 2 | <38> |
| H5-04 (428H) | Stopping Method After Communication Error (CE) | All Modes<br>0: Ramp to stop<br>1: Coast to stop<br>2: Fast Stop<br>3: Alarm only | Default: 3<br>Min: 0<br>Max: 3 | <38> |
| H5-05 (429H) | Communication Fault Detection Selection | All Modes<br>0: Disabled<br>1: Enabled. If communication is lost for more than the time set in H5-09, a CE fault will occur. | Default: 1<br>Min: 0<br>Max: 1 | <38> |
| H5-06 (42AH) | Drive Transmit Wait Time | All Modes<br>Set the wait time between receiving and sending data. | Default: 5 ms<br>Min: 5 ms<br>Max: 65 ms | <38> |
| H5-07 (42BH) | RTS Control Selection | All Modes<br>0: Disabled. RTS is always on.<br>1: Enabled. RTS turns on only when sending. | Default: 1<br>Min: 0<br>Max: 1 | <38> |
| H5-09 (435H) | CE Detection Time | All Modes<br>Sets the time required to detect a communications error.<br>Adjustment may be needed when networking several drives. | Default: 2.0 s<br>Min: 0.0 s<br>Max: 10.0 s | <38> |
| H5-11 (43CH) | Communications ENTER Function Selection | All Modes<br>0: Drive requires an Enter command before accepting any changes to parameter settings.<br>1: Parameter changes are activated immediately without the Enter command. | Default: 0<br>Min: 0<br>Max: 1 | <38> |
| H5-12 (43DH) | Run Command Method Selection | All Modes<br>0: FWD/Stop, REV/Stop<br>1: Run/Stop, FWD/REV | Default: 0<br>Min: 0<br>Max: 1 | <38> |

<32> If this parameter is set to 0, the drive will be unable to respond to MEMOBUS/Modbus commands.
<38> For details, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

**Note:** The settings for MEMOBUS/Modbus communications only become available once the power has been turned OFF and back ON again.

## ◆ L: Protection Function

L parameters provide protection to the drive and motor, such as: control during momentary power loss, Stall Prevention, frequency detection, fault restarts, overtorque detection, torque limits, and other types of hardware protection.

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| **L1: Motor Protection** | | | | |
| L1-01 (480H) | Motor Overload Protection Selection | All Modes<br>0: Disabled<br>1: Enabled<br>The drive may not be able to provide protection when multiple motors are used, even if overload protection is enabled in L1-01. Set L1-01 to 0 and implement overload protection measures for each motor. | Default: <10><br>Min: 0<br>Max: 1 | 196 |
| L1-02 (481H) | Motor Overload Protection Time | All Modes<br>Sets the motor thermal overload protection (oL1) time. | Default: 60.0 s<br>Min: 1.0 s<br>Max: 300.0 s | 197 |
| L1-06 (3120H) | Motor Overload Detection Start Level | All Modes<br>Sets the start level for motor overload detection as a percentage of the motor rated current. Set a value that is lower than that set for L1-07. | Default: 110%<br>Min: 20%<br>Max: 300% | 197 |
| L1-07 (3121H) | Motor Overload Detection Level | All Modes<br>Sets the level at which motor overload is detected as a percentage of the motor rated current. Set a value that is higher than that set for L1-06. | Default: 150%<br>Min: 30%<br>Max: 300% | 197 |
| L1-13 (46DH) | Continuous Electrothermal Operation Selection | All Modes<br>0: Disabled<br>1: Enabled | Default: 1<br>Min: 0<br>Max: 1 | 197 |
| **L2: Momentary Power Loss Ride-Thru** | | | | |
| L2-01 (485H) | Momentary Power Loss Operation Selection | All Modes<br>0: Disabled. Drive trips on (Uv1) fault when power is lost.<br>1: Recover within the time set in L2-02. Uv1 will be detected if power loss is longer than L2-02.<br>2: Recover as long as CPU has power. Uv1 is not detected. | Default: 0<br>Min: 0<br>Max: 2 | 198 |
| L2-02 (486H) | Momentary Power Loss Ride-Thru Time | All Modes<br>Sets the Power Loss Ride-Thru time. Enabled only when L2-01 = 1. | Default: <6><br>Min: 0.0 s<br>Max: 25.5 s | 199 |
| L2-03 (487H) | Momentary Power Loss Minimum Baseblock Time | All Modes<br>Sets the minimum wait time for residual motor voltage decay before the drive output reenergizes after performing Power Loss Ride-Thru. Increasing the time set to L2-03 may help if overcurrent or overvoltage occur during Speed Search or during DC Injection Braking. | Default: <6><br>Min: 0.1 s<br>Max: 20.0 s | 199 |
| L2-04 (488H) | Momentary Power Loss Voltage Recovery Time | All Modes<br>Sets the time for the output voltage to return to the preset V/f pattern after Speed Search. | Default: <6><br>Min: 0.0 s<br>Max: 5.0 s | 199 |
| L2-05 (489H) | Undervoltage Detection Level (Uv) | All Modes<br>Sets the DC bus undervoltage trip level. | Default: <6><br>Min: 0 V<br>Max: 1700 V | 199 |
| L2-40 (3126H) | Power Supply Overvoltage Operation Selection | All Modes<br>Sets the operation when an overvoltage at the power supply side is detected.<br>0: Ramp to stop (uses the deceleration time set for C1-02)<br>1: Coast to stop<br>2: Fast Stop (uses the Fast Stop time set for C1-09)<br>3: Alarm only | Default: 3<br>Min: 0<br>Max: 3 | 200 |
| L2-41 (3127H) | Power Supply Overvoltage Detection Level | All Modes<br>Sets the level at which overvoltage at the power supply side is detected as a percentage of o2-11, in 0.1% units. | Default: 120.0%<br>Min: 0.0%<br>Max: 200.0% | 200 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| L2-42 (3128H) | Power Supply Overvoltage Detection Time | All Modes<br>Sets the time before iov (overvoltage at the power supply side) is detected, in 0.01 s units.<br>If the state in which the output voltage exceeds the value set for L2-41 continues for the time set for L2-42 or longer, iov (overvoltage at the power supply side) is detected. | Default: 0.05 s<br>Min: 0.00 s<br>Max: 2.00 s | 200 |
| **L3: Stall Prevention** | | | | |
| L3-01 (48FH) | Stall Prevention Selection during Acceleration | V/f OLV CLV<br>0: Disabled. Drive runs at a set frequency. A heavy load may cause speed loss.<br>1: General purpose. Acceleration is paused as long as the current is above the L3-02 setting.<br>2: Intelligent. Accelerate in the shortest possible time without exceeding the L3-02 level. | Default: 1<br>Min: 0<br>Max: 2 | 200 |
| L3-02 (490H) | Stall Prevention Level during Acceleration | V/f OLV CLV<br>Used when L3-01 = 1 or 2. 100% is equal to the drive rated current. | Default: 120%<br>Min: 0%<br>Max: 150% | 201 |
| L3-03 (491H) | Stall Prevention Limit during Acceleration | V/f OLV CLV<br>Sets Stall Prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of the drive's rated current. | Default: 50%<br>Min: 0%<br>Max: 100% | 201 |
| L3-04 (492H) | Stall Prevention Selection during Deceleration | All Modes<br>0: Disabled. Deceleration at the active deceleration rate. An ov fault may occur.<br>1: General purpose. Deceleration is paused when the DC bus voltage exceeds the Stall Prevention level. | Default: 1<br>Min: 0<br>Max: 1 | 202 |
| L3-05 (493H) | Stall Prevention Selection during Run | V/f OLV CLV<br>0: Disabled. Drive runs at a set frequency. A heavy load may cause speed loss.<br>1: Decel time 1. Uses the deceleration time set to C1-02 while Stall Prevention is performed.<br>2: Decel time 2. Uses the deceleration time set to C1-04 while Stall Prevention is performed. | Default: 1<br>Min: 0<br>Max: 2 | 202 |
| L3-06 (494H) | Stall Prevention Level during Run | V/f OLV CLV<br>Enabled when L3-05 is set to 1 or 2. 100% is equal to the drive rated current. | Default: 120%<br>Min: 30%<br>Max: 150% | 203 |
| L3-11 (4C7H) | Overvoltage Suppression Function Selection | V/f OLV CLV<br>Enables or disables the ov suppression function, which allows the drive to change the output frequency as the load changes to prevent an ov fault.<br>0: Disabled<br>1: Enabled | Default: 0<br>Min: 0<br>Max: 1 | 203 |
| L3-23 (4FDH) | Automatic Reduction Selection for Stall Prevention during Run | V/f OLV CLV<br>0: Sets the Stall Prevention level set in L3-06 that is used throughout the entire frequency range.<br>1: Automatic Stall Prevention level reduction in the constant output range. The lower limit value is 40% of L3-06. | Default: 0<br>Min: 0<br>Max: 1 | 203 |
| L3-27 (456H) | Stall Prevention Detection Time | V/f OLV CLV<br>Sets the time the current must exceed the Stall Prevention level to activate Stall Prevention. | Default: 50 ms<br>Min: 0 ms<br>Max: 5000 ms | 203 |
| **L4: Speed Detection** | | | | |
| L4-01 (499H) | Speed Agreement Detection Level | All Modes<br>L4-01 sets the frequency detection level for contact output functions H2-□□ = 2, 3, 4, 5.<br>L4-02 sets the hysteresis or allowable margin for speed detection. | Default: 0.0<br>Min: 0.0 Hz<br>Max: 120.0 Hz <20> | 204 |
| L4-02 (49AH) | Speed Agreement Detection Width | | Default: <10><br>Min: 0.0 Hz<br>Max: 20.0 Hz | 204 |

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|---|---|---|---|---|
| L4-03 (49BH) | Speed Agreement Detection Level (+/-) | All Modes<br>L4-03 sets the frequency detection level for contact output functions H2-□□ = 13, 14, 15, 16.<br>L4-04 sets the hysteresis or allowable margin for speed detection. | Default: 0.0<br>Min: -120.0 Hz<br>Max: 120.0 Hz<br><20> | 204 |
| L4-04 (49CH) | Speed Agreement Detection Width (+/-) | | Default: <10><br>Min: 0.0 Hz<br>Max: 20.0 Hz | 204 |
| L4-05 (49DH) | Frequency Reference Loss Detection Selection | All Modes<br>0: Stop. Drive stops when the frequency reference is lost.<br>1: Run. Drive runs at a reduced speed when the frequency reference is lost. If the frequency reference decreases to 10% of the frequency reference of 0.4 s before, the drive runs at "frequency reference of 0.4 s before × value set in L4-06".<br>Note: This parameter is valid only when Frequency Reference Selection 1 is set to analog input terminals (b1-01 = 1). | Default: 0<br>Min: 0<br>Max: 1 | 204 |
| L4-06 (4C2H) | Frequency Reference at Reference Loss | All Modes<br>Sets the percentage of the frequency reference that the drive should run with when the frequency reference is lost. | Default: 80%<br>Min: 0.0%<br>Max: 100.0% | 205 |
| L4-07 (470H) | Speed Agreement Detection Selection | All Modes<br>0: No detection during baseblock.<br>1: Detection always enabled. | Default: 0<br>Min: 0<br>Max: 1 | 205 |
| **L5: Fault Restart** | | | | |
| L5-01 (49EH) | Number of Auto Restart Attempts | All Modes<br>Sets the number of times the drive may attempt to restart after faults occur. | Default: 0<br>Min: 0<br>Max: 10 | 206 |
| L5-02 (49FH) | Auto Restart Fault Output Operation Selection | All Modes<br>0: Fault output not active.<br>1: Fault output active during restart attempt. | Default: 0<br>Min: 0<br>Max: 1 | 206 |
| L5-04 (46CH) | Fault Reset Interval Time | All Modes<br>Sets the amount of time to wait between performing fault restarts. | Default: 10.0 s<br>Min: 0.5 s<br>Max: 600.0 s | 206 |
| L5-05 (467H) | Fault Reset Operation Selection | All Modes<br>0: Continuously attempt to restart while incrementing restart counter only at a successful restarts.<br>1: Attempt to restart with the interval time set in L5-04 and increment the restart counter with each attempt. | Default: 0<br>Min: 0<br>Max: 1 | 206 |
| **L6: Torque Detection** | | | | |
| L6-01 (4A1H) | Torque Detection Selection 1 | All Modes<br>0: Disabled<br>1: oL3 detection only active during speed agree, operation continues after detection<br>2: oL3 detection always active during run, operation continues after detection<br>3: oL3 detection only active during speed agree, output shuts down on an oL3 fault<br>4: oL3 detection always active during run, output shuts down on an oL3 fault<br>5: UL3 detection only active during speed agree, operation continues after detection<br>6: UL3 detection always active during run, operation continues after detection<br>7: UL3 detection only active during speed agree, output shuts down on an oL3 fault<br>8: UL3 detection always active during run, output shuts down on an oL3 fault | Default: 0<br>Min: 0<br>Max: 8 | 207 |

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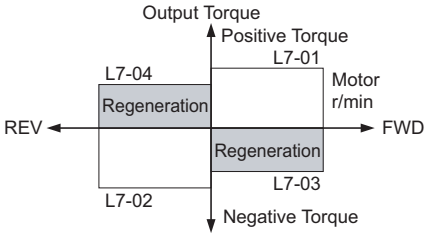
|---|---|---|---|---|
| L6-02 (4A2H) | Torque Detection Level 1 | All Modes<br>For V/f control, set the level as a percentage of the drive rated output current.<br>For Vector control, set the level as a percentage of the motor rated torque. | Default: 150%<br>Min: 0%<br>Max: 300% | 208 |
| L6-03 (4A3H) | Torque Detection Time 1 | All Modes<br>Sets the time an overtorque or undertorque condition must exist to trigger torque detection 1. | Default: 0.1 s<br>Min: 0.0 s<br>Max: 10.0 s | 208 |
| L6-04 (4A4H) | Torque Detection Selection 2 | All Modes<br>0: Disabled<br>1: oL4 detection only active during speed agree, operation continues after detection<br>2: oL4 detection always active during run, operation continues after detection<br>3: oL4 detection only active during speed agree, output shuts down on an oL4 fault<br>4: oL4 detection always active during run, output shuts down on an oL4 fault<br>5: UL4 detection only active during speed agree, operation continues after detection<br>6: UL4 detection always active during run, operation continues after detection<br>7: UL4 detection only active during speed agree, output shuts down on an oL4 fault<br>8: UL4 detection always active during run, output shuts down on an oL4 fault | Default: 0<br>Min: 0<br>Max: 8 | 207 |
| L6-05 (4A5H) | Torque Detection Level 2 | All Modes<br>Sets the overtorque and undertorque detection level. | Default: 150%<br>Min: 0%<br>Max: 300% | 208 |
| L6-06 (4A6H) | Torque Detection Time 2 | All Modes<br>Sets the time an overtorque or undertorque condition must exist to trigger torque detection 2. | Default: 0.1 s<br>Min: 0.0 s<br>Max: 10.0 s | 208 |
| L6-08 (468H) | Mechanical Weakening Detection Operation | All Modes<br>This function can detect an overtorque or undertorque in a certain speed range as a result of machine fatigue. It is triggered by a specified operation time and uses the oL1 detection settings (L6-01 and L6-03)<br>0: Mechanical Weakening Detection disabled.<br>1: Continue running (alarm only). Detected when the speed (signed) is greater than L6-09.<br>2: Continue running (alarm only). Detected when the speed (not signed) is greater than L6-09.<br>3: Interrupt drive output (fault). Detected when the speed (signed) is greater than L6-09.<br>4: Interrupt drive output (fault). Detected when the speed (not signed) is greater than L6-09.<br>5: Continue running (alarm only). Detected when the speed (signed) is less than L6-09.<br>6: Continue running (alarm only). Detected when the speed (not signed) is less than L6-09.<br>7: Interrupt drive output (fault). Detected when the speed (signed) is less than L6-09.<br>8: Interrupt drive output (fault). Detected when the speed (not signed) is less than L6-09. | Default: 0<br>Min: 0<br>Max: 8 | 209 |
| L6-09 (469H) | Mechanical Weakening Detection Speed Level | All Modes<br>Sets the speed that triggers Mechanical Weakening Detection. When L6-08 is set for an unsigned value, the absolute value is used if the setting is negative. | Default: 110.0%<br>Min: -110.0%<br>Max: 110.0% | 209 |
| L6-10 (46AH) | Mechanical Weakening Detection Time | All Modes<br>Sets the time mechanical weakening has to be detected before an alarm or fault is triggered. | Default: 0.1 s<br>Min: 0.0 s<br>Max: 10.0 s | 209 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| L6-11 (46BH) | Mechanical Weakening Detection Start Time | All Modes<br>Sets the operation time (U1-04) required before Mechanical Weakening Detection is active. | Default: 0 h<br>Min: 0 h<br>Max: 65535 h | 210 |
| **L7: Torque Limit** | | | | |
| L7-01 (4A7H) | Forward Torque Limit | V/f OLV CLV<br>Sets the torque limit value as a percentage of the motor rated torque. Four individual quadrants can be set.<br>  | Default: 100%<br>Min: 0%<br>Max: 300% | 210 |
| L7-02 (4A8H) | Reverse Torque Limit | | Default: 100%<br>Min: 0%<br>Max: 300% | 210 |
| L7-03 (4A9H) | Forward Regenerative Torque Limit | | Default: 1%<br>Min: 0%<br>Max: 300% | 210 |
| L7-04 (4AAH) | Reverse Regenerative Torque Limit | | Default: 1%<br>Min: 0%<br>Max: 300% | 210 |
| L7-06 (4ACH) | Torque Limit Integral Time Constant | V/f OLV CLV<br>Sets the integral time constant for the torque limit. Increase the setting for faster torque limit response. | Default: 200 ms<br>Min: 5 ms<br>Max: 10000 ms | 211 |
| L7-07 (4C9H) | Torque Limit Control Method Selection during Accel/Decel | V/f OLV CLV<br>0: Proportional control (changes to integral control at constant speed). Use this setting when acceleration to the desired speed should take precedence over the torque limit.<br>1: Integral control.<br>Set L7-07 to 1 if the torque limit should take precedence. | Default: 0<br>Min: 0<br>Max: 1 | 211 |
| L7-16 (44DH) | Torque Limit Process at Start | V/f OLV CLV<br>0: A delay time is disabled<br>1: A delay time is enabled | Default: 1<br>Min: 0<br>Max: 1 | 211 |
| L7-30 (1FDH) | Regenerative Torque Limit Mode Selection | V/f OLV CLV<br>Sets the mode for the regenerative torque limit.<br>0: Standard mode (torque limits entered from all analog inputs and through communications effective)<br>1: Independent mode (only the torque limits set with L7-03, L7-04, and regenerative torque limit effective (H3-☐☐ = 12) | Default: 0<br>Min: 0<br>Max: 1 | 211 |
| **L8: Drive Protection** | | | | |
| L8-02 (4AEH) | Overheat Alarm Level | All Modes<br>An overheat pre-alarm will occur if the thermistor temperature exceeds the level set in L8-02. | Default: <6><br>Min: 50°C<br>Max: 150°C | 212 |
| L8-03 (4AFH) | Overheat Pre-Alarm Operation Selection | All Modes<br>0: Ramp to stop. A fault is triggered.<br>1: Coast to stop<br>2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. A fault is triggered.<br>3: Continue operation. An alarm is triggered.<br>4: Continue operation at reduced speed as set in L8-19.<br>Note: 0 to 2 are recognized as faults, and 3 and 4 as alarms. | Default: 3<br>Min: 0<br>Max: 4 | 212 |
| L8-07 (4B3H) | Output Phase Loss Protection Selection | All Modes<br>0: Disabled<br>1: Enabled (triggered by a single phase loss)<br>2: Enabled (triggered when two phases are lost)<br>Triggered when the output current falls below 5% of the drive rated current.<br>Output phase loss detection can mistakenly be triggered if the motor rate current is very small comparing with the drive capacity. Disable this parameter in such case. | Default: 2<br>Min: 0<br>Max: 2 | 213 |

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| L8-09 (4B5H) | Output Ground Fault Detection Selection | All Modes<br>0: Disabled<br>1: Enabled | Default: 1<br>Min: 0<br>Max: 1 | 214 |
| L8-10 (4B6H) | Heatsink Cooling Fan Operation Selection | All Modes<br>0: During run only. Fan operates only during run and for L8-11 seconds after stop.<br>1: Cooling fan operates when Uv (DC bus undervoltage) is cleared.<br>2: Fan always on. Cooling fan operates whenever the drive is control powered up. | Default: 1<br>Min: 0<br>Max: 2 | 214 |
| L8-11 (4B7H) | Heatsink Cooling Fan Off Delay Time | All Modes<br>Sets a delay time to shut off the cooling fan after the Run command is removed when L8-10 = 0. | Default: 600 s<br>Min: 0 s<br>Max: 1800 s | 214 |
| L8-15 (4BBH) | oL2 Characteristics Selection at Low Speeds | All Modes<br>0: No oL2 level reduction below 6 Hz.<br>1: oL2 level is reduced linearly below 6 Hz. It is halved at 0 Hz. | Default: 1<br>Min: 0<br>Max: 1 | 214 |
| L8-18 (4BEH) | Software CLA Selection | All Modes<br>Enables or disables the software current limits.<br>0: Disabled<br>1: Enabled | Default: 1<br>Min: 0<br>Max: 1 | 215 |
| L8-19 (4BFH) | Frequency Reduction Rate during Overheat Pre-Alarm | All Modes<br>Specifies the frequency reference reduction gain at overheat pre-alarm when L8-03 = 4. | Default: 0.8<br>Min: 0.1<br>Max: 0.9 | 213 |
| L8-32 (3104H) | Backup Fan Use Selection | All Modes<br>Sets whether the backup fan is used or not.<br>0: Backup fan used<br>1: No backup fan used | Default: 1<br>Min: 0<br>Max: 1 | 215 |
| L8-33 (3105H) | Fan Board Use Selection | All Modes<br>Sets the number of fan control boards (FFB boards) used.<br>0: No fan boards used<br>1: One fan board used<br>2: Two fan boards used | Default: <6><br>Min: 0<br>Max: 2 | 215 |
| L8-63 (3112H) | Output Overvoltage Detection Level | All Modes<br>Sets the level at which overvoltage is detected on the output side. Set as a percentage of the motor's maximum voltage in 0.1% units. | Default: 120.0%<br>Min: 0.0%<br>Max: 200.0% | 215 |
| L8-64 (3113H) | Output Overvoltage Detection Time | All Modes<br>Sets the time before oov (overvoltage at the output side) is detected in 0.01 s units. If the state in which the output voltage exceeds the value set to L8-63 continues for the time set to L8-64 or longer, oov (overvoltage at the output side) is detected. | Default: 0.01 s<br>Min: 0.00 s<br>Max: 2.00 s | 215 |
| L8-65 (3114H) | Output Voltage Imbalance Detection Operation Selection | All Modes<br>Sets the operation when an output voltage imbalance is detected.<br>0: Ramp to stop over the time set for C1-02 (Deceleration Time)<br>1: Coast to stop<br>2: Fast Stop over the time set for C1-09 (Fast Stop Time)<br>3: Alarm only | Default: 3<br>Min: 0<br>Max: 3 | 216 |
| L8-66 (3115H) | Output Voltage Imbalance Detection Level | All Modes<br>Sets the level at which imbalance of the output voltage is detected in 0.1% units (100%: 2400 V for the 2.4 kV class, 3300 V for the 3 kV class, 4160 V for the 4.16 kV class, 6600 V for the 6 kV class, and 11000 V for the 11 kV class). | Default: 10.0%<br>Min: 0.0%<br>Max: 100.0% | 216 |

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| L8-67 (3116H) | Output Voltage Imbalance Detection Time | All Modes<br>Sets the time before output voltage imbalance is detected in 0.001 s units. If the state in which the zero-phase voltage detection value exceeds the level set to L8-66 continues for the time set to L8-67 or longer, VUB (output voltage imbalance) is detected. | Default: 0.200 s<br>Min: 0.001 s<br>Max: 2.000 s | 216 |
| L8-86 (3100H) | Transformer Overheat Alarm (TMA) Operation Selection | All Modes<br>Sets the operation when a TMA (Transformer Overheat Alarm) is detected.<br>0: Ramp to stop over the time set for C1-02 (Deceleration Time)<br>1: Coast to stop<br>2: Fast Stop over the time set for C1-09 (Fast Stop Time)<br>3: Continue operation. TMA alarm is triggered. | Default: 3<br>Min: 0<br>Max: 3 | 216 |
| L8-87 (3101H) | Transformer Overheat Alarm (TMA) Level | All Modes<br>Sets the detection temperature for TMA alarm function in °C units.<br>Note: An alarm is detected when the detected transformer temperature reaches the value set here. | Default: <6><br>Min: 50°C<br>Max: 160°C | 216 |
| L8-88 (3102H) | Transformer Overheat Fault (TME) Level | All Modes<br>Sets the detection temperature for TME fault function in °C units. | Default: <6><br>Min: 50°C<br>Max: 160°C | 217 |

<3> Parameter setting value is not reset to the default value when the drive is initialized (A1-03 = 1110/2220).
<6> Default setting value varies by the drive model (o2-04).
<8> The setting range changes if the value of the motor rated capacity (E2-11) is changed by Auto-Tuning or manual setting.
<10> Default setting is determined by the control mode (A1-02).
<12> The setting range for the acceleration and deceleration times is determined by the accel/decel time setting units in C1-10. For example, if the accel/decel time setting units are set to 0.01 s (C1-10 = 0), the setting range becomes 0.00 to 600.00 s.
<16> Default setting is determined by the control mode (A1-02) and the drive model (o2-04).
<20> The range upper limit is determined according to the maximum output frequency (E1-04) and the upper limit of the frequency reference (d2-01).

## ◆ n: Special Adjustment

The n parameters are used to adjust more advanced performance characteristics such as Hunting Prevention and Speed Feedback Detection Control.

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| **n1: Hunting Prevention** | | | | |
| n1-01 (580H) | Hunting Prevention Selection | V/f OLV CLV<br>0: Disabled<br>1: Enabled | Default: 1<br>Min: 0<br>Max: 1 | 218 |
| n1-02 (581H) | Hunting Prevention Gain Setting | V/f OLV CLV<br>If the motor vibrates while lightly loaded, increase the gain by 0.1 until vibration ceases. If the motor stalls, decrease the gain by 0.1 until the stalling ceases. | Default: 1.00<br>Min: 0.00<br>Max: 2.50 | 218 |
| n1-03 (582H) | Hunting Prevention Time Constant | V/f OLV CLV<br>Sets the time constant used for Hunting Prevention. | Default: <6><br>Min: 0 ms<br>Max: 500 ms | 218 |
| n1-05 (530H) | Hunting Prevention Gain while in Reverse | V/f ベクトル PG・ベクトル<br>Sets the gain used for Hunting Prevention. If set to 0, the gain set to n1-02 is used for operation in reverse. | Default: 0.00<br>Min: 0.00<br>Max: 2.50 | 218 |
| **n2: Speed Feedback Detection Control** | | | | |
| n2-01 (584H) | Speed Feedback Detection Control (AFR) Gain | V/f OLV CLV<br>Sets the internal speed feedback detection control gain in the automatic frequency regulator (AFR).<br>If hunting occurs, increase the set value. If response is low, decrease the set value. | Default: 2.00<br>Min: 0.00<br>Max: 10.00 | 219 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| n2-02 (585H) | Speed Feedback Detection Control (AFR) Time Constant 1 | V/f OLV CLV<br>Sets the time constant used for speed feedback detection control (AFR). | Default: 250 ms<br>Min: 0 ms<br>Max: 2000 ms | 219 |
| n2-03 (586H) | Speed Feedback Detection Control (AFR) Time Constant 2 | V/f OLV CLV<br>Sets the AFR time constant to be used during Speed Search and during regeneration. Increase the setting if overvoltage occurs at the end of acceleration or with sudden load changes. | Default: 750 ms<br>Min: 0 ms<br>Max: 2000 ms | 219 |
| n2-06 (30A0H) | Speed Feedback Detection Control (AFR) Gain Switch Start Gain | V/f OLV CLV<br>Sets the switching start gain for speed feedback detection control (AFR) gain. | Default: 1.00<br>Min: 0.00<br>Max: 2.00 | 219 |
| **n9: I/O Voltage Detection** | | | | |
| n9-02 (31C0H) | Output Current Detection Gain | All Modes<br>Sets the gain for adjusting the output current detection value in 0.0001 units. | Default: <6><br>Min: 0.0001<br>Max: 2.0000 | 219 |
| n9-70 (657H) | Output Voltage Detection Gain | All Modes<br>Sets the gain for adjusting the output voltage detection value in 0.0001 units. | Default: 1.0000<br>Min: 0.0000<br>Max: 2.0000 | 220 |
| n9-71 (31D1H) | Input Current Conversion Coefficient | All Modes<br>Sets the input current conversion coefficient in 0.0001 units. | Default: <6><br>Min: 0.0000<br>Max: 6.5535 | 220 |
| n9-72 (659H) | Input Voltage Detection Gain | All Modes<br>Sets the gain for adjusting the input voltage detection value in 0.0001 units. | Default: 1.0000<br>Min: 0.0000<br>Max: 2.0000 | 220 |

<6> Default setting value varies by the drive model (o2-04).

## ◆ o: Operator Related Settings

The o parameters are used to set up the digital operator displays.

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| **o1: Digital Operator Display Selection** | | | | |
| o1-01 (500H) RUN | Drive Mode Unit Monitor Selection | All Modes<br>Selects the content of the last monitor that is shown when scrolling through Drive Mode display. Enter the last three digits of the monitor parameter number to be displayed: U□-□□. | Default: 106 (Monitor U1-06)<br>Min: 104<br>Max: 699 | 221 |
| o1-02 (501H) RUN | User Monitor Selection after Power Up | All Modes<br>1: Frequency reference (U1-01)<br>2: Direction<br>3: Output frequency (U1-02)<br>4: Output current (U1-03)<br>5: User-selected monitor (set by o1-01) | Default: 1<br>Min: 1<br>Max: 5 | 221 |
| o1-03 (502H) | Frequency Reference Setting/ Display Unit | All Modes<br>0: 0.01 Hz<br>1: 0.01% (100% = E1-04)<br>2: $min^{-1}$(calculated using the number of motor poles setting in E2-04, E4-04, or E5-04)<br>3: User-selected units (set by o1-10 and o1-11) | Default: <10><br>Min: 0<br>Max: 3 | 221 |
| o1-04 (503H) | V/f Pattern Frequency Parameter Setting Unit | V/f OLV CLV<br>0: Hz<br>1: r/min | Default: <10><br>Min: 0<br>Max: 1 | 222 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| o1-10 (520H) | User-Set Display Units Maximum Value | All Modes<br>These settings define the display values when o1-03 is set to 3.<br>o1-10 sets the display value that is equal to the maximum output frequency.<br>o1-11 sets the position of the decimal position. | Default: <36><br>Min: 1<br>Max: 60000 | 222 |
| o1-11 (521H) | User-set Display Units Decimal Display | | Default: <36><br>Min: 0<br>Max: 3 | 222 |
| **o2: Digital Operator Keypad Functions** | | | | |
| o2-01 (505H) | LO/RE Key Function Selection | All Modes<br>0: Disabled<br>1: Enabled. LO/RE key switches between LOCAL and REMOTE operation. | Default: 1<br>Min: 0<br>Max: 1 | 222 |
| o2-02 (506H) | STOP Key Function Selection | All Modes<br>0: Disabled. STOP key is disabled in REMOTE operation.<br>1: Enabled. STOP key is always enabled. | Default: 1<br>Min: 0<br>Max: 1 | 223 |
| o2-03 (507H) | User Parameter Default Value | All Modes<br>0: No change.<br>1: Set defaults. Saves parameter settings as default values for a User Initialization.<br>2: Clear all. Clears the default settings that have been saved for a User Initialization. | Default: 0<br>Min: 0<br>Max: 2 | 223 |
| o2-04 (508H) | Drive Model Selection | All Modes<br>Enter the drive model. Setting required only if installing a new control board. | Default: Determined by drive capacity<br>Min: –<br>Max: – | 224 |
| o2-05 (509H) | Frequency Reference Setting Method Selection | All Modes<br>0: ENTER key must be pressed to enter a frequency reference.<br>1: ENTER key is not required. The frequency reference can be adjusted using the up and down arrow keys only. | Default: 0<br>Min: 0<br>Max: 1 | 224 |
| o2-06 (50AH) | Operation Selection when Digital Operator is Disconnected | All Modes<br>0: The drive continues operating if the digital operator is disconnected.<br>1: A fault is triggered (oPr) and the motor coasts to stop. | Default: 0<br>Min: 0<br>Max: 1 | 224 |
| o2-07 (527H) | Motor Direction at Power Up when Using Operator | All Modes<br>0: Forward<br>1: Reverse<br>This parameter requires that drive operation be assigned to the digital operator. | Default: 0<br>Min: 0<br>Max: 1 | 224 |
| o2-09 (50DH) | Initialization Specification Selection | – | Do not change this setting.<br>Min: –<br>Max: – | – |
| o2-11 (50FH) | Reference Voltage for Input Voltage Detection | All Modes<br>Sets the primary rated voltage of the transformer. | Default: <6><br>Min: 0 V<br>Max: 20000 V | 225 |
| **o3: Copy Function** | | | | |
| o3-01 (515H) | Copy Function Selection | All Modes<br>0: No action<br>1: Read parameters from the drive, saving them onto the digital operator.<br>2: Copy parameters from the digital operator, writing them to the drive.<br>3: Verify parameter settings on the drive to check if they match the data saved on the operator. | Default: 0<br>Min: 0<br>Max: 3 | 225 |
| o3-02 (516H) | Copy Allowed Selection | All Modes<br>0: Read operation prohibited<br>1: Read operation allowed | Default: 0<br>Min: 0<br>Max: 1 | 225 |

| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| **o4: Maintenance Monitor Settings** | | | | |
| o4-01 (50BH) | Cumulative Operation Time Setting | All Modes<br>Sets the value for the cumulative operation time of the drive in units of 10 h. | Default: 0<br>Min: 0<br>Max: 9999 | 225 |
| o4-02 (50CH) | Cumulative Operation Time Selection | All Modes<br>0: Logs power-on time<br>1: Logs operation time when the drive output is active (output operation time). | Default: 0<br>Min: 0<br>Max: 1 | 226 |
| o4-11 (510H) | U2, U3 Initialization | All Modes<br>0: U2-□□ and U3-□□ monitor data is not reset when the drive is initialized (A1-03).<br>1: U2-□□ and U3-□□ monitor data is reset when the drive is initialized (A1-03). | Default: 0<br>Min: 0<br>Max: 1 | 226 |
| o4-12 (512H) | kWh Monitor Initialization | All Modes<br>0: U4-10 and U4-11 monitor data is not reset when the drive is initialized (A1-03).<br>1: U4-10 and U4-11 monitor data is reset when the drive is initialized (A1-03). | Default: 0<br>Min: 0<br>Max: 1 | 226 |
| o4-13 (528H) | Number of Run Commands Counter Initialization | All Modes<br>0: Number of Run commands counter is not reset when the drive is initialized (A1-03).<br>1: Number of Run commands counter is reset when the drive is initialized (A1-03). | Default: 0<br>Min: 0<br>Max: 1 | 226 |
| o4-20 (3090H) | Event Log Initialization | All Modes<br>0: Event log data is not reset when the drive is initialized (A1-03).<br>1: Event log data is reset when the drive is initialized (A1-03). | Default: 0<br>Min: 0<br>Max: 1 | 227 |
| o4-21 (3091H) | Trace Initialization | All Modes<br>0: Trace data is not reset when the drive is initialized (A1-03).<br>1: Trace data is reset when the drive is initialized (A1-03). | Default: 0<br>Min: 0<br>Max: 1 | 227 |

<6> Default setting value varies by the drive model (o2-04).
<10> Default setting is determined by the control mode (A1-02).
<36> The default setting value is determined according to the frequency reference selection/display unit setting (o1-03).

## ◆ T: Motor Tuning

Enter data into the following parameters to tune the motor and drive for optimal performance

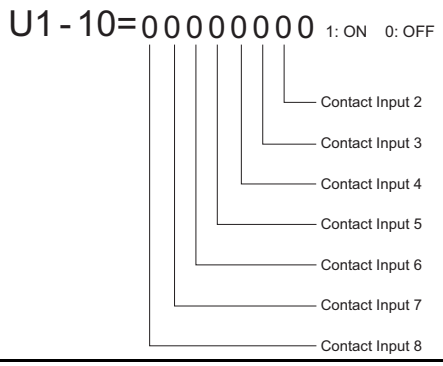
| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| **T1: Induction Motor Auto-Tuning** | | | | |
| T1-00 (700H) | Motor 1/Motor 2 Selection | All Modes<br>1: Motor 1 (sets E1-□□, E2-□□)<br>2: Motor 2 (sets E3-□□, E4-□□) | Default: 1<br>Min: 1<br>Max: 2 | <38> |
| T1-01 (701H) <37> | Auto-Tuning Mode Selection | All Modes<br>0: Rotational Auto-Tuning<br>2: Stationary Auto-Tuning for Line-to-Line Resistance | Default: <10><br>Min: 0<br>Max: 2 | <38> |
| T1-02 (702H) | Motor Rated Power | All Modes<br>Sets the motor rated power as specified on the motor nameplate. | Default: <6><br>Min: 0 kW<br>Max: 65000 kW | <38> |
| T1-03 (703H) | Motor Rated Voltage | All Modes<br>Sets the motor rated voltage as specified on the motor nameplate. | Default: <16><br>Min: 0 V<br>Max: 13000 V | <38> |
| T1-04 (704H) | Motor Rated Current | All Modes<br>Sets the motor rated current as specified on the motor nameplate. | Default: <6><br>Min: 10% of drive rated current<br>Max: 200% of drive rated current | <38> |

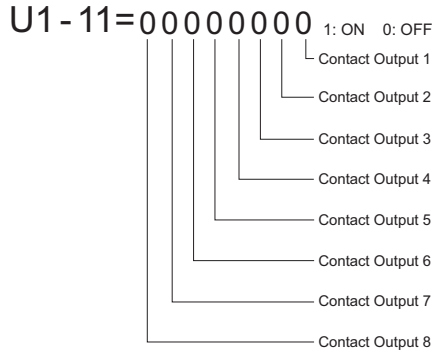
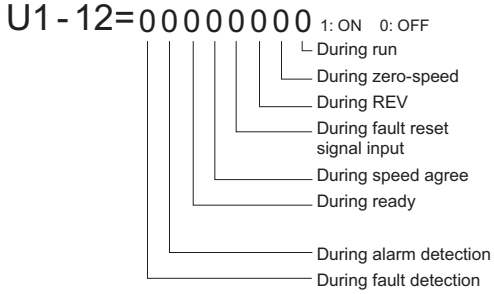
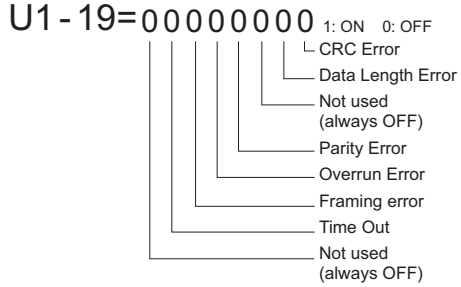
| No. (Addr.) | Name | Description | Setting | Page |
|---|---|---|---|---|
| T1-05 (705H) | Motor Base Frequency | All Modes<br>Sets the rated frequency of the motor as specified on the motor nameplate. | Default: 60.0 Hz<br>Min: 0.0 Hz<br>Max: 120.0 Hz | <38> |
| T1-06 (706H) | Number of Motor Poles | All Modes<br>Sets the number of motor poles as specified on the motor nameplate. | Default: 4<br>Min: 2<br>Max: 48 | <38> |
| T1-07 (707H) | Motor Base Speed | All Modes<br>Sets the rated speed of the motor as specified on the motor nameplate. | Default: 1750 $min^{-1}$<br>Min: 0 $min^{-1}$<br>Max: 24000 $min^{-1}$ | <38> |
| T1-08 (708H) | PG Number of Pulses Per Revolution | V/f OLV CLV<br>Set the number of pulses per revolution for the PG being used (pulse generator or encoder). | Default: 600 ppr<br>Min: 0 ppr<br>Max: 60000 ppr | <38> |
| T1-11 (70BH) | Motor Iron Loss for Torque Compensation | V/f OLV CLV<br>Sets the iron loss for determining the Energy Saving coefficient. The value is set to E2-10 (motor iron loss) set when the power is re-input. If T1-02 is changed, a default value appropriate for the motor capacity that was entered will appear. | Default: 14 W<br>Min: 0 W<br>Max:: 65535 W | <38> |

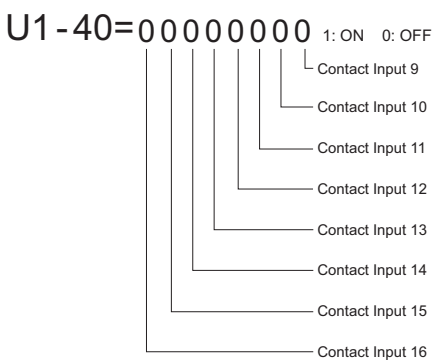
<6> Default setting value varies by the drive model (o2-04).
<10> Default setting is determined by the control mode (A1-02).
<16> Default setting is determined by the control mode (A1-02) and the drive model (o2-04).
<37> The availability of certain Auto-Tuning methods depends on the control mode selected for the drive.
<38> For details, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

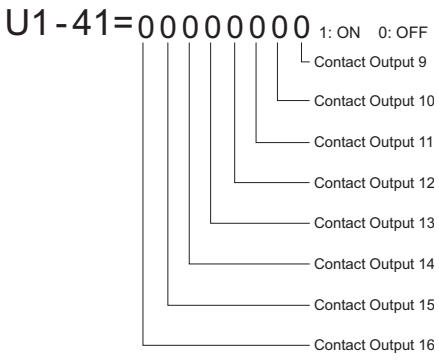
## ◆ U: Monitors

Monitor parameters allow the user to view drive status, fault information, and other data concerning drive operation.

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| **U1: Operation Status Monitors** | | | | | |
| U1-01 (40H) | Frequency Reference | All Modes<br>Monitors the frequency reference. Display units are determined by o1-03. | 10 V: Max frequency | 0.01 Hz | – |
| U1-02 (41H) | Output Frequency | All Modes<br>Displays the output frequency. Display units are determined by o1-03. | 10 V: Max frequency | 0.01 Hz | – |
| U1-03 (42H) | Output Current | All Modes<br>Displays the output current. | 10 V: Drive rated current | 0.1 A | – |
| U1-04 (43H) | Control Method | All Modes<br>0: V/f Control<br>2: Open Loop Vector Control<br>3: Closed Loop Vector Control | No signal output available | – | – |
| U1-05 (44H) | Motor Speed | V/f OLV CLV<br>Displays the motor speed feedback.<br>Display units are determined by o1-03. | 10 V: Max frequency | 0.01 Hz | – |
| U1-06 (45H) | Output Voltage Reference | All Modes<br>Displays the output voltage. | 10 V: Drive rated voltage | 1 V | – |
| U1-07 (46H) | DC Bus Voltage | All Modes<br>Displays the average DC bus voltage of each power cell. | 10 V: 2000 V | 1 V | – |
| U1-08 (47H) | Output Power | All Modes<br>Displays the output power (this value is calculated internally). | 10 V: Drive capacity (motor rated capacity) kW <60> | 1 kW | – |
| U1-09 (48H) | Torque Reference | V/f OLV CLV<br>Monitors the internal torque reference. | 10 V: Motor rated torque | 0.1% | – |
| U1-10 (49H) | Input Terminal Status | All Modes<br>Displays the input terminal status.<br>  | No signal output available | – | – |

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| U1-11 (4AH) | Output Terminal Status | All Modes<br>Displays the output terminal status<br>  | No signal output available | – | – |
| U1-12 (4BH) | Drive Status | All Modes<br>Verifies the drive operation status.<br>  | No signal output available | – | – |
| U1-13 (4EH) | Analog Input 1 Input Voltage | All Modes<br>Displays the voltage of analog input 1. | 10 V: 100% | 0.1% | – |
| U1-14 (4FH) | Analog Input 2 Input Voltage | All Modes<br>Displays the input voltage of analog input 2. | 10 V: 100% | 0.1% | – |
| U1-16 (53H) | Output Frequency after Soft Starter | All Modes<br>Displays output frequency with ramp time and S-curves. Units determined by o1-03. | 10 V: Max frequency | 0.01 Hz | – |
| U1-17 (58H) | DI-A3 Input Status | All Modes<br>Displays the reference value input from the DI-A3 option card.<br>Display will appear in hexadecimal as determined by the digital card input selection in F3-01.<br>3FFFF: Set (1 bit) + sign (1 bit) + 16 bits | No signal output available | – | – |
| U1-18 (61H) | oPE Fault Parameter | All Modes<br>Displays the parameter number that caused the oPE□□ or Err (EEPROM write error) error. | No signal output available | – | – |
| U1-19 (66H) | MEMOBUS/ Modbus Error Code | All Modes<br>Displays the contents of a MEMOBUS/Modbus error.<br>  | No signal output available | – | – |

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| U1-21 (77H) | AI-A3 Terminal V1 Input Voltage Monitor | All Modes<br>Displays the input voltage to terminal V1 on analog input card AI-A3. | 10 V: 100% | 0.1% | – |
| U1-22 (72AH) | AI-A3 Terminal V2 Input Voltage Monitor | All Modes<br>Displays the input voltage to terminal V2 on analog input card AI-A3. | 10 V: 100% | 0.1% | – |
| U1-23 (72BH) | AI-A3 Terminal V3 Input Voltage Monitor | All Modes<br>Displays the input voltage to terminal V3 on analog input card AI-A3. | 10 V: 100% | 0.1% | – |
| U1-25 (4DH) | Software Number (Flash) | All Modes<br>Displays FLASH ID. | No signal output available | – | – |
| U1-26 (5BH) | Software No. (ROM) | All Modes<br>Displays ROM ID. | No signal output available | – | – |
| U1-27 (7A8H) | Message ID (OPR) | All Modes<br>Displays OPR ID. | No signal output available | – | – |
| U1-28 (7A9H) | Message ID (INV) | All Modes<br>Displays INV ID. | No signal output available | – | – |
| U1-29 (7AAH) | Control Board FPGA No. | All Modes<br>Displays FPGA ID. | No signal output available | – | – |
| U1-30 (7ABH) | Analog Output 1 Output Value | All Modes<br>Displays the output value of analog output 1. | No signal output available | – | – |
| U1-31 (7ACH) | Analog Output 2 Output Value | All Modes<br>Displays the output value of analog output 2. | No signal output available | – | – |
| U1-32 (7ADH) | Analog Output 3 Output Value | All Modes<br>Displays the output value of analog output 3. | No signal output available | – | – |
| U1-33 (7AEH) | Analog Output 4 Output Value | All Modes<br>Displays the output value of analog output 4. | No signal output available | – | – |
| U1-34 (7AFH) | Analog Output 5 Output Value | All Modes<br>Displays the output value of analog output 5.<br>(Analog output option card AO-A3) | No signal output available | – | – |
| U1-35 (7BAH) | Analog Output 6 Output Value | All Modes<br>Displays the output value of analog output 6.<br>(Analog output option card AO-A3) | No signal output available | – | – |
| U1-36 (30BFH) | Malfunctioned Cell | All Modes<br>Displays the power cell at which a fault has occurred in hexadecimal. | No signal output available | – | – |
| U1-40 (9DH) | Input Terminal Status 2 | All Modes<br>Displays the input terminal status.<br>  | No signal output available | – | – |

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| U1-41 (9EH) | Output Terminal Status 2 | All Modes<br>Displays the output terminal status.<br>  | No signal output available | – | – |
| U1-49 (30C0H) | Output Zero-phase Voltage | All Modes<br>Displays the detected zero-phase voltage at the output side. | 10 V: Drive rated voltage | 1 V | – |
| U1-52 (1081H) | Output Voltage | All Modes<br>Displays the detected output voltage value. | 10 V: Drive rated voltage | 1 V | – |
| U1-54 (1083H) | Input Voltage | All Modes<br>Displays the detected input voltage value (compatible with option cards). | 10 V: Input reference voltage (o2-11) | 1 V | – |
| U1-55 (1084H) | Input Current | All Modes<br>Displays the detected input current value (compatible with option cards). | 10 V: Input reference current (o2-11) | 0.1 A | – |
| **U2: Fault Trace** | | | | | |
| U2-01 (80H) | Current Fault | All Modes<br>Displays the current fault. | No signal output available | – | – |
| U2-02 (81H) | Previous Fault | All Modes<br>Displays the previous fault. | No signal output available | – | – |
| U2-03 (82H) | Frequency Reference at Previous Fault | All Modes<br>Displays the frequency reference at the previous fault. | No signal output available | 0.01 Hz | – |
| U2-04 (83H) | Output Frequency at Previous Fault | All Modes<br>Displays the output frequency at the previous fault. | No signal output available | 0.01 Hz | – |
| U2-05 (84H) | Output Current at Previous Fault | All Modes<br>Displays the output current at the previous fault. | No signal output available | 0.1 A | – |
| U2-06 (85H) | Motor Speed at Previous Fault | V/f OLV CLV<br>Displays the motor speed at the previous fault. | No signal output available | 0.01 Hz | – |
| U2-07 (86H) | Output Voltage at Previous Fault | All Modes<br>Displays the output voltage at the previous fault. | No signal output available | 1 V | – |
| U2-08 (87H) | DC Bus Voltage at Previous Fault | All Modes<br>Displays the DC bus voltage at the previous fault. | No signal output available | 1 V | – |
| U2-09 (88H) | Output Power at Previous Fault | All Modes<br>Displays the output power at the previous fault. | No signal output available | 1 kW | – |
| U2-10 (89H) | Torque Reference at Previous Fault | V/f OLV CLV<br>Displays the torque reference at the previous fault. | No signal output available | 0.1% | – |
| U2-11 (8AH) | Input Terminal Status at Previous Fault | All Modes<br>Displays the input terminal status at the previous fault. Displays the same status displayed as in U1-10. | No signal output available | – | – |

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| U2-12 (8BH) | Output Terminal Status at Previous Fault | All Modes<br>Displays the output status at the previous fault. Displays the same status displayed as in U1-11. | No signal output available | – | – |
| U2-13 (8CH) | Drive Operation Status at Previous Fault | All Modes<br>Displays the operation status of the drive at the previous fault. Displays the same status displayed in U1-12. | No signal output available | – | – |
| U2-14 (8DH) | Cumulative Operation Time at Previous Fault | All Modes<br>Displays the cumulative operation time at the previous fault. | No signal output available | 1 h | – |
| U2-15 (7E0H) | Soft Starter Speed Reference at Previous Fault | All Modes<br>Displays the speed reference for the soft starter at the previous fault. | No signal output available | 0.01 Hz | – |
| U2-16 (7E1H) | Motor q-Axis Current at Previous Fault | All Modes<br>Displays the q-axis current for the motor at the previous fault. | No signal output available | 0.1% | – |
| U2-17 (7E2H) | Motor d-Axis Current at Previous Fault | V/f OLV CLV<br>Displays the d-axis current for the motor at the previous fault. | No signal output available | 0.1% | – |
| U2-18 (7E3H) | ASR Output at Previous Fault | All Modes<br>Displays the ASR output at the previous fault. | No signal output available | 0.01% | – |
| U2-20 (8EH) | IGBT Temperature at Previous Fault | All Modes<br>Displays the temperature of the IGBTs at the previous fault. | No signal output available | 1°C | – |
| U2-28 (7FCH) | Malfunctioned Cell | All Modes<br>Displays the power cell at which a fault has occurred in hexadecimal. | No signal output available | – | – |
| U2-29 (30E0H) | Output Zero-phase Voltage at Previous Fault | All Modes<br>Displays the detected zero-phase voltage at the output side at the previous fault. | 10 V: Drive rated voltage | 1 V | – |
| U2-30 (30E1H) | Output Voltage at Previous Fault | All Modes<br>Displays the detected output voltage value at the previous fault. | 10 V: Drive rated voltage | 1 V | – |
| U2-31 (30E2H) | Input Voltage at Previous Fault | All Modes<br>Displays the detected input voltage value at the previous fault. | 10 V : Input reference voltage | 1 V | – |
| **U3: Fault History** | | | | | |
| U3-01 to U3-49 (3140H to 3170H) | First to 49th Most Recent Fault | All Modes<br>Displays the 1st to the 49th most recent faults.<br>After 49 faults have occurred in the drive, the data for the oldest fault is deleted. The most recent fault appears in U3-01, with the next most recent fault appearing in U3-02. The data is moved to the next monitor parameter every time a fault occurs. | No signal output available | – | – |
| U3-51 to U3-99 (3172H to 31A2H) | Cumulative Operation Time at 1st to 49th Most Recent Fault | All Modes<br>Displays the cumulative operation time when the 1st to the 49th most recent faults occurred. | No signal output available | 1 h | – |

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| **U4: Maintenance Monitors** | | | | | |
| U4-01 (4CH) | Cumulative Operation Time | All Modes<br>Displays the cumulative operation time of the drive. The value for the cumulative operation time counter can be reset in parameter o4-01.<br>Use parameter o4-02 to determine if the operation time should start as soon as the power is switched on or only while the Run command is ON.<br>The maximum number displayed is 99999, after which the value is reset to 0. | No signal output available | 1 h | – |
| U4-02 (75H) | Number of Run Commands | All Modes<br>Displays the number of times the Run command is entered. Reset the number of Run commands using parameter o4-13. This value will reset to 0 and start counting again after reaching 65535. | No signal output available | 1 Time | – |
| U4-08 (68H) | IGBT Temperature | All Modes<br>Displays the power cell with the highest IGBTs temperature. | 10 V: 100°C | 1°C | – |
| U4-10 (5CH) | kWh, Lower 4 Digits | All Modes<br>Monitors the drive output power. The value is shown as a 9-digit number displayed across two monitor parameters, U4-10 and U4-11.<br>Example:<br>12345678.9 kWh is displayed as:<br>U4-10: 678.9kWh<br>U4-11: 12345MWh | No signal output available | 0.1 kWh | – |
| U4-11 (5DH) | kWh, Upper 5 Digits | | No signal output available | 1 MWh | – |
| U4-13 (7CFH) | Peak Hold Current | All Modes<br>Displays the highest current value that occurred during run. | No signal output available | 0.1 A | – |
| U4-14 (7D0H) | Peak Hold Output Frequency | All Modes<br>Displays the output frequency when the current value shown in U4-13 occurred. | No signal output available | 0.01 Hz | – |
| U4-16 (7D8H) | Motor Overload Estimate (oL1) | All Modes<br>Shows the value of the motor overload detection accumulator. 100% is equal to the oL1 detection level. | 10 V: 100% | 0.1% | – |
| U4-18 (7DAH) | Frequency Reference Source Selection | All Modes<br>Displays the source for the frequency reference as XY-nn.<br>X: indicates which reference is used:<br>1 = Reference 1 (b1-01)<br>2 = Reference 2 (b1-15)<br>Y-nn: indicates the reference source<br>0-01 = Digital operator<br>1-01 = Analog (contact input 1)<br>1-02 = Analog (contact input 2)<br>2-02 to 17 = Multi-step speed (d1-02 to 17)<br>3-01 = MEMOBUS/Modbus communications<br>4-01 = Communication option card | No signal output available | – | – |
| U4-19 (7DBH) | Frequency Reference from MEMOBUS/ Modbus Comm. | All Modes<br>Displays the frequency reference provided by MEMOBUS/Modbus (decimal). | No signal output available | 0.01% | – |
| U4-20 (7DCH) | Option Frequency Reference | All Modes<br>Displays the frequency reference input by an option card (decimal). | No signal output available | – | – |

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| U4-21 (7DDH) | Run Command Source Selection | All Modes<br>Displays the source for the Run command as XY-nn.<br>X: Indicates which Run source is used:<br>1 = Reference 1 (b1-02)<br>2 = Reference 2 (b1-16)<br>Y: Input power supply data<br>0 = Digital operator<br>1 = External terminals<br>3 = MEMOBUS/Modbus communications<br>4 = Communication option card<br>nn: Run command limit status data<br>00: No limit status.<br>01: Run command was left on when stopped in the PRG mode<br>02: Run command was left on when switching from LOCAL to REMOTE operation<br>03: Waiting for soft charge bypass contactor after power up (Uv or Uv1 flashes after 10 s)<br>04: Waiting for “Run command prohibited” time period to end<br>05: Fast Stop (contact input, digital operator)<br>06: b1-17 (Run command given at power-up)<br>07: During baseblock while coast to stop with timer<br>08: Frequency reference is below minimal reference during baseblock<br>09: Waiting for Enter command<br>10: Run command on during COPY operation | No signal output available | – | – |
| U4-22 (7DEH) | MEMOBUS/ Modbus Communications Reference | All Modes<br>Displays the drive control data set by MEMOBUS/Modbus communications register no. 0001H as a four-digit hexadecimal number. | No signal output available | – | – |
| U4-23 (7DFH) | Communication Option Card Reference | All Modes<br>Displays drive control data set by an option card as a four-digit hexadecimal number. | No signal output available | – | – |
| U4-33 (1040H) | Transformer Temperature | All Modes<br>Displays the detected transformer temperature value. | 10 V: 200.0°C | 0.1°C | – |
| U4-90 (30D0H) | Calendar Year | All Modes<br>Displays the calendar year. | No signal output available | 1 | – |
| U4-91 (30D1H) | Calendar Month and Day | All Modes<br>Displays the calendar month and day. | No signal output available | 01.01 | – |
| U4-92 (30D2H) | Calendar Hour and Minute | All Modes<br>Displays the calendar hour and minute. | No signal output available | 01.01 | – |
| U4-93 (30D3H) | Calendar Minute and Second | All Modes<br>Displays the calendar minute and second. | No signal output available | 01.01 | – |
| **U5: PID Monitors** | | | | | |
| U5-01 (57H) | PID Feedback | All Modes<br>Displays the PID feedback value. | 10 V: Max frequency | 0.01% | – |
| U5-02 (63H) | PID Input | All Modes<br>Displays the amount of PID input (deviation between PID setpoint and feedback). | 10 V: Max frequency | 0.01% | – |
| U5-03 (64H) | PID Output | All Modes<br>Displays PID control output. | 10 V: Max frequency | 0.01% | – |
| U5-04 (65H) | PID Setpoint Value | All Modes<br>Displays the PID setpoint. | 10 V: Max frequency | 0.01% | – |
| U5-05 (7D2H) | Differential PID Feedback | All Modes<br>Displays the 2nd PID feedback value if differential feedback is used (H3-□□ = 16). | 10 V: Max frequency | 0.01% | – |

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| U5-06 (7D3H) | PID Adjusted Feedback | All Modes<br>Displays the difference of both feedback values if differential feedback is used (U5-01 - U5-05).<br>If differential feedback is not used, then U5-01 and U5-06 will be the same. | 10 V: Max frequency | 0.01% | – |
| **U6: Control Monitors** | | | | | |
| U6-01 (51H) | Motor Secondary Current (Iq) | All Modes<br>Displays the value of the motor secondary current (Iq). Motor rated secondary current is 100%. | 10 V: Motor secondary rated current | 0.1% | – |
| U6-02 (52H) | Motor Excitation Current (Id) | V/f OLV CLV<br>Displays the value calculated for the motor excitation current (Id). Motor rated secondary current is 100%. | 10 V: Motor secondary rated current | 0.1% | – |
| U6-03 (54H) | ASR Input | V/f OLV CLV<br>Displays the input and output values when using ASR control. | 10 V: Max. output frequency | 0.01% | – |
| U6-04 (55H) | ASR Output | | 10 V: Motor secondary rated current | | |
| U6-05 (59H) | Output Voltage Reference (Vq) | V/f OLV CLV<br>Output voltage reference (Vq) for the q-axis. | 10 V: Drive rated voltage | 1 V | – |
| U6-06 (5AH) | Output Voltage Reference (Vd) | V/f OLV CLV<br>Output voltage reference (Vd) for the d-axis. | 10 V: Drive rated voltage | 1 V | – |
| U6-07 (5FH) | q-Axis ACR Output | V/f OLV CLV<br>Displays the output value for current control relative to motor secondary current (q-axis). | 10 V: Drive rated voltage | 0.1% | – |
| U6-08 (60H) | d-Axis ACR Output | V/f OLV CLV<br>Displays the output value for current control relative to motor secondary current (d-axis). | 10 V: Drive rated voltage | 0.1% | – |
| U6-18 (7CDH) | Speed Detection PG1 Counter | All Modes<br>Monitors the number of pulses for speed detection (PG1). | 10 V: 65536 | 1 pulse | |
| U6-19 (7E5H) | Speed Detection PG2 Counter | All Modes<br>Monitors the number of pulses for speed detection (PG2). | 10 V: 65536 | 1 pulse | |
| U6-20 (7D4H) | Frequency Reference Bias (Up/Down 2) | All Modes<br>Displays the bias value used to adjust the frequency reference. | 10 V: Max frequency | 0.1% | – |
| U6-21 (7D5H) | Offset Frequency | All Modes<br>Displays the frequency added to the main frequency reference. | – | 0.1% | – |
| U6-80 to U6-99 (7B0 to 7B9, 7F0 to 7F9H) | Option Monitor 1 to 20 | All Modes<br>Displays a monitor value of option cards. | No signal output available | – | – |
| **U9: Power Cell Monitors** | | | | | |
| U9-01 (3400H) | Power Cell Status 1 | All Modes<br>Displays the status 1 of each of the power cells in hexadecimal.<br>Bit 0 to F: ASIC status | No signal output available | – | – |
| U9-02 (3410H) | Power Cell Status 2 | All Modes<br>Displays the status 2 of each of the power cells in hexadecimal.<br>Bit 0 to F: Fault information 1 | No signal output available | – | – |
| U9-03 (3420H) | Power Cell Status 3 | All Modes<br>Displays the status 3 of each of the power cells in hexadecimal.<br>Bit 0 to F: Fault information 2 | No signal output available | – | – |

| No. (Addr.) | Name | Description | Analog Output Level | Unit | Page |
|---|---|---|---|---|---|
| U9-04 (3430H) | Power Cell Status 4 | All Modes<br>Displays the status 4 of each of the power cells in hexadecimal.<br>Higher two digits (8 bits): Switching<br>Lower two digits (8 bits): Number of communication errors | No signal output available | – | – |
| U9-05 (3440H) | Power Cell DC Bus Voltage 1 | All Modes<br>Displays the DC bus voltage 1 (Vpc) of each power cell. | 10 V: 2000 V | 1 V | – |
| U9-06 (3450H) | Power Cell DC Bus Voltage 2 | All Modes<br>Displays the DC bus voltage 2 (Vcn) of each power cell. | 10 V: 2000 V | 1 V | – |
| U9-07 (3460H) | Power Cell Temperature | All Modes<br>Displays the temperature of each power cell. | 10 V: 200°C | 0.01°C | – |
| U9-08 (3470H) | Power Cell Output Current | All Modes<br>Displays the output current of each power cell. | 10 V: Drive rated current | 0.1 A | – |
| U9-09 (3480H) | Power Cell Software No. (CPU) | All Modes<br>Displays the CPU ID of each power cell. | No signal output available | – | – |
| U9-10 (3490H) | Power Cell Software No. (FPGA) | All Modes<br>Displays the FPGA ID of each power cell. | No signal output available | – | – |

<60> V/f Control: 10 V: drive rated power (kW), OLV and CLV: 10 V: motor capacity (E2-11)

# 1.4 Control Mode Dependent Parameter Default Values

The tables below list the parameters that depend on the control mode selection (A1-02 for motor 1, E3-01 for motor 2). These parameters are initialized to the shown values if the control mode is changed.

## ◆ A1-02 (Motor 1 Control Mode) Dependent Parameters

**Table 1.2 A1-02 (Motor 1 Control Mode) Dependent Parameters and Default Values**

| No. | Name | Setting Range | Resolution | Control Modes (A1-02) | | |
|---|---|---|---|---|---|---|
| | | | | V/f (0) | OLV (2) | CLV (3) |
| A3-01 | Trace Data 01 | 0 to 899 | – | 101 | 101 | 101 |
| A3-02 | Trace Data 02 | 0 to 899 | – | 102 | 102 | 102 |
| A3-03 | Trace Data 03 | 0 to 899 | – | 103 | 103 | 103 |
| A3-04 | Trace Data 04 | 0 to 899 | – | 106 | 105 | 105 |
| A3-05 | Trace Data 05 | 0 to 899 | – | 107 | 106 | 106 |
| A3-06 | Trace Data 06 | 0 to 899 | – | 110 | 107 | 107 |
| A3-07 | Trace Data 07 | 0 to 899 | – | 111 | 109 | 109 |
| A3-08 | Trace Data 08 | 0 to 899 | – | 112 | 110 | 110 |
| A3-09 | Trace Data 09 | 0 to 899 | – | 113 | 111 | 111 |
| A3-10 | Trace Data 10 | 0 to 899 | – | 116 | 112 | 112 |
| A3-11 | Trace Data 11 | 0 to 899 | – | 149 | 113 | 113 |
| A3-12 | Trace Data 12 | 0 to 899 | – | 152 | 116 | 116 |
| A3-13 | Trace Data 13 | 0 to 899 | – | 154 | 149 | 149 |
| A3-14 | Trace Data 14 | 0 to 899 | – | 408 | 152 | 152 |
| A3-15 | Trace Data 15 | 0 to 899 | – | 416 | 154 | 154 |
| A3-16 | Trace Data 16 | 0 to 899 | – | 418 | 408 | 408 |
| A3-17 | Trace Data 17 | 0 to 899 | – | 419 | 416 | 416 |
| A3-18 | Trace Data 18 | 0 to 899 | – | 421 | 418 | 418 |
| A3-19 | Trace Data 19 | 0 to 899 | – | 601 | 419 | 419 |
| A3-20 | Trace Data 20 | 0 to 899 | – | 618 | 421 | 421 |
| A3-21 | Trace Data 21 | 0 to 899 | – | 000 | 601 | 601 |
| A3-22 | Trace Data 22 | 0 to 899 | – | 000 | 602 | 602 |
| A3-23 | Trace Data 23 | 0 to 899 | – | 000 | 605 | 603 |
| A3-24 | Trace Data 24 | 0 to 899 | – | 000 | 606 | 604 |
| A3-25 | Trace Data 25 | 0 to 899 | – | 000 | 607 | 605 |
| A3-26 | Trace Data 26 | 0 to 899 | – | 000 | 608 | 606 |
| A3-27 | Trace Data 27 | 0 to 899 | – | 000 | 618 | 607 |
| A3-28 | Trace Data 28 | 0 to 899 | – | 000 | 000 | 608 |
| A3-29 | Trace Data 29 | 0 to 899 | – | 000 | 000 | 618 |
| A3-30 | Trace Data 30 | 0 to 899 | – | 000 | 000 | 000 |
| A3-31 | Trace Data 31 | 0 to 899 | – | 000 | 000 | 000 |
| A3-32 | Trace Data 32 | 0 to 899 | – | 000 | 000 | 000 |
| b2-01 | Zero Speed Level (DC Injection Braking Start Frequency) <36> | 0.0 to 10.0 | 0.1 | 0.5 Hz | 0.5 Hz | 0.5 Hz |
| b2-04 | DC Injection Braking Time at Stop | 0.00 to 10.00 | 0.01 s | 0.50 | 0.50 | 0.50 |
| b3-01 | Speed Search Selection at Start | 0 to 1 | – | 0 | 0 | – |
| b3-02 | Speed Search Deactivation Current | 0 to 200 | 1% | 30 | 30 | – |
| b5-15 | PID Sleep Function Start Level | 0.0 to 120.0 <20> | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| b6-01 | Dwell Reference at Start | 0.0 to 120.0 | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| b6-03 | Dwell Reference at Stop | 0.0 to 120.0 <20> | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| C1-11 | Accel/Decel Time Switching Frequency | 0.0 to 120.0 | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| C2-01 | S-Curve Characteristic at Accel Start | 0.00 to 10.00 | 0.01 s | 0.20 | 0.20 | 0.20 |
| C3-01 | Slip Compensation Gain | 0.0 to 2.5 | 0.1 | 0.0 | 1.0 | 1.0 |
| C3-02 | Slip Compensation Primary Delay Time | 0 to 10000 | 1 ms | 3000 | 3000 | – |
| C3-05 | Output Voltage Limit Operation Selection | 0 to 1 | – | – | 0 | 1 |
| C4-01 | Torque Compensation Gain | 0.00 to 2.50 | 0.01 | 1.00 | 1.00 | – |

## 1.4 Control Mode Dependent Parameter Default Values

| No. | Name | Setting Range | Resolution | Control Modes (A1-02) | | |
|---|---|---|---|---|---|---|
| | | | | V/f (0) | OLV (2) | CLV (3) |
| C4-02 | Torque Compensation Primary Delay Time | 0 to 10000 | 1 ms | 200 | 50 | – |
| C5-01 | ASR Proportional Gain 1 | 0.00 to 300.00 | 0.01 | – | – | 5.00 |
| C5-02 | ASR Integral Time 1 | 0.000 to 10.000 | 0.001 s | – | – | 5.000 |
| C5-03 | ASR Proportional Gain 2 | 0.00 to 300.00 | 0.01 | – | – | 5.00 |
| C5-04 | ASR Integral Time 2 | 0.000 to 10.000 | 0.001 s | – | – | 5.000 |
| C5-06 | ASR Primary Delay Time Constant | 0.000 to 0.500 | 0.001 s | – | – | 0.012 |
| C5-07 | ASR Gain Switching Frequency | 0.0 to 120.0 | 0.1 | – | – | 0.0 Hz |
| d3-01 | Jump Frequency 1 | 0.0 to 120.0 | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| d3-02 | Jump Frequency 2 | 0.0 to 120.0 | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| d3-03 | Jump Frequency 3 | 0.0 to 120.0 | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| d3-04 | Jump Frequency Width | 0.0 to 20.0 | 0.1 | 1.0 Hz | 1.0 Hz | 1.0 Hz |
| d5-02 | Torque Reference Delay Time | 0 to 1000 | 1 ms | – | – | 0 |
| E1-04 | Maximum Output Frequency | 40.0 to 120.0 | 0.1 Hz | 60.0 | 60.0 | 60.0 |
| E1-05 | Maximum Voltage | 0 to 13000 | 1 V | 2000 | 2000 | 2000 |
| E1-06 | Base Frequency | 0.0 to 120.0 | 0.1 Hz | 60.0 | 60.0 | 60.0 |
| E1-07 | Middle Output Frequency | 0.0 to 120.0 | 0.1 Hz | 3.0 | 3.0 | 0.0 |
| E1-08 | Middle Output Frequency Voltage | 0 to 13000 | 1 V | 150 | 110 | 0 |
| E1-09 | Minimum Output Frequency | 0.0 to 120.0 | 0.1 Hz | 1.5 | 0.5 | 0.0 |
| E1-10 | Minimum Output Frequency Voltage | 0 to 13000 | 1 V | 90 | 20 | 0 |
| F1-01 | PG 1 Pulses Per Revolution | 0 to 60000 | 1 ppr | – | – | 600 |
| F1-05 | PG 1 Rotation Selection | 0 to 1 | – | – | – | 1 |
| F1-09 | Overspeed Detection Delay Time | 0.0 to 2.0 | 0.1 s | – | – | 0.0 |
| L1-01 | Motor Overload Protection Selection | 0 to 1 | – | 1 | 1 | 1 |
| L4-01 | Speed Agreement Detection Level | 0.0 to 120.0 | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| L4-02 | Speed Agreement Detection Width | 0.0 to 20.0 | 0.1 | 2.0 Hz | 2.0 Hz | 2.0 Hz |
| L4-03 | Frequency Detection Level (+/–) | –120.0 to 120.0 | 0.1 | 0.0 Hz | 0.0 Hz | 0.0 Hz |
| L4-04 | Speed Agreement Detection Width (+/–) | 0.0 to 20.0 | 0.1 | 2.0 Hz | 2.0 Hz | 2.0 Hz |
| o1-03 | Digital Operator Display Selection | 0 to 3 | – | 0 | 0 | 0 |
| o1-04 | V/f Pattern Display Unit | 0 to 1 | – | – | – | 0 |

<20> Range upper limit is determined by the maximum output frequency (E1-04) and the upper limit of the frequency reference (d2-01).
<36> Default setting value is determined by the digital operator display selection (o1-03).

## ◆ E3-01 (Motor 2 Control Mode) Dependent Parameters

**Table 1.3 E3-01 (Motor 2 Control Mode) Dependent Parameters and Default Values**

| No. | Name | Setting Range | Resolution | Control Modes (E3-01) | | |
|---|---|---|---|---|---|---|
| | | | | V/f (0) | OLV (2) | CLV (3) |
| C3-21 | Motor 2 Slip Compensation Gain | 0.0 to 2.5 | 0.1 | 0.0 | 1.0 | 1.0 |
| C5-21 | Motor 2 ASR Proportional Gain 1 | 0.00 to 300.00 | 0.01 | – | – | 5.00 |
| C5-22 | Motor 2 ASR Integral Time 1 | 0.000 to 10.000 | 0.001 s | – | – | 5.000 |
| C5-23 | Motor 2 ASR Proportional Gain 2 | 0.00 to 300.00 | 0.01 | – | – | 5.00 |
| C5-24 | Motor 2 ASR Integral Time 2 | 0.000 to 10.000 | 0.001 s | – | – | 5.000 |
| C5-26 | Motor 2 ASR Primary Delay Time Constant | 0.0 to 0.500 | 0.001 s | – | – | 0.004 |
| E3-04 | Motor 2 Maximum Output Frequency | 40.0 to 120.0 | 0.1 Hz | 60.0 | 60.0 | 60.0 |
| E3-05 | Motor 2 Maximum Voltage | 0 to 13000 | 1 V | 2000 | 2000 | 2000 |
| E3-06 | Motor 2 Base Frequency | 0.0 to 120.0 | 0.1 Hz | 60.0 | 60.0 | 60.0 |
| E3-07 | Motor 2 Mid Output Frequency | 0.0 to 120.0 | 0.1 Hz | 3.0 | 3.0 | 0.0 |
| E3-08 | Motor 2 Mid Output Frequency Voltage | 0 to 13000 | 1 V | 150 | 110 | 0 |
| E3-09 | Motor 2 Minimum Output Frequency | 0.0 to 120.0 | 0.1 Hz | 1.5 | 0.5 | 0.0 |
| E3-10 | Motor 2 Minimum Output Frequency Voltage | 0 to 13000 | 1 V | 90 | 20 | 0 |

# 1.5 Defaults by Drive Model Selection (o2-04)

The following tables show parameters and default settings that change with the drive model selection (o2-04). Parameter numbers shown in parenthesis are valid for motor 2.

**Table 1.4 2.4 kV Class Drives Default Settings by Drive Model Selection**

| No. <61> | Name | Unit | Default Settings | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| – | Model CIMR-MV2□□□□ | – | 052 | 058 | 077 | 093 | 102 | 115 | 135 | 160 | 180 | 205 | 220 | 330 | 390 | 440 | 505 | 550 | 600 |
| o2-04 | Drive Model Selection | – | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0C | 0D | 0E | 0F | 10 | 11 |
| E2-11(E4-11) | Motor Rated Power | kW | 170 | 190 | 260 | 310 | 340 | 380 | 450 | 530 | 600 | 680 | 730 | 1100 | 1300 | 1460 | 1680 | 1830 | 2000 |
| b3-04 | V/f Gain during Speed Search | % | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| b3-06 | Output Current 1 during Speed Search | – | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| b3-11 | Speed Search Method Switching Level (Speed Estimate Speed Search) | % | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| E2-01(E4-01) | Motor Rated Current | A | 40.0 | 50.0 | 70.0 | 80.0 | 90.0 | 100.0 | 110.0 | 140.0 | 150.0 | 170.0 | 190.0 | 280.0 | 330.0 | 370.0 | 430.0 | 470.0 | 510.0 |
| E2-02(E4-02) | Motor Rated Slip | Hz | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| E2-03(E4-03) | Motor No-Load Current | A | 10.0 | 13.0 | 18.0 | 20.0 | 23.0 | 25.0 | 28.0 | 35.0 | 38.0 | 43.0 | 48.0 | 70.0 | 83.0 | 93.0 | 108.0 | 118.0 | 128.0 |
| E2-05(E4-05) | Motor Line-to-Line Resistance | W | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 |
| E2-06(E4-06) | Motor Leakage Inductance | % | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 |
| E2-10(E4-10) | Motor Iron Loss for Torque Compensation | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| L2-02 | Momentary Power Loss Ride-Thru Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-03 | Momentary Power Loss Minimum Baseblock Time | sec | 10.0 | 13.0 | 18.0 | 20.0 | 23.0 | 25.0 | 28.0 | 35.0 | 38.0 | 43.0 | 48.0 | 70.0 | 83.0 | 93.0 | 108.0 | 118.0 | 128.0 |
| L2-04 | Momentary Power Loss Voltage Recovery Time | sec | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| L2-05 | Undervoltage Detection Level (Uv) | V | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 | 693 |
| L8-02 <62> | Overheat Alarm Level | – | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 95 | 105 | 105 | 105 | 105 | 105 | 105 |
| L8-09 | Output Ground Fault Detection Selection | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| L8-33 | FAN Board Use Selection | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| L8-87 | Transformer Overheat Alarm (TMA) Level | °C | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| L8-88 | Transformer Overheat Fault (TME) Level | °C | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| n1-03 | Hunting Prevention Time Constant | ms | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| n9-02 | Output Current Detection Gain | – | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| n9-71 | Input Current Conversion Coefficient | – | 0.0235 | 0.0235 | 0.0150 | 0.0150 | 0.0150 | 0.0094 | 0.0094 | 0.0060 | 0.0060 | 0.0060 | 0.0060 | 0.0044 | 0.0030 | 0.0020 | 0.0020 | 0.0020 | 0.0020 |
| o2-11 | Reference Voltage for Input Voltage Detection | V | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 |

<61> Parameter numbers shown in parenthesis are valid for motor 2.
<62> The alarm detection level differs for each drive model because of the different thermistor position on each drive.

**Table 1.5 3 kV Class Drives Default Settings by Drive Model Selection**

| No. <61> | Name | Unit | Default Settings | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| – | Model CIMR-MV2□□□□ | – | 035 | 050 | 070 | 100 | 140 | 200 | 260 | 330 | 400 | 520 | 650 |
| o2-04 | Drive Model Selection | – | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 2A |
| E2-11(E4-11) | Motor Rated Power | kW | 160 | 230 | 320 | 460 | 640 | 910 | 1190 | 1510 | 1830 | 2380 | 2970 |
| b3-04 | V/f Gain during Speed Search | % | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| b3-06 | Output Current 1 during Speed Search | – | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| b3-11 | Speed Search Method Switching Level (Speed Estimate Speed Search) | % | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| E2-01(E4-01) | Motor Rated Current | A | 30.0 | 45.0 | 60.0 | 85.0 | 120.0 | 170.0 | 220.0 | 280.0 | 340.0 | 440.0 | 550.0 |
| E2-02(E4-02) | Motor Rated Slip | Hz | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| E2-03(E4-03) | Motor No-Load Current | A | 8.0 | 11.0 | 15.0 | 21.0 | 30.0 | 43.0 | 55.0 | 70.0 | 85.0 | 110.0 | 138.0 |
| E2-05(E4-05) | Motor Line-to-Line Resistance | W | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 |
| E2-06(E4-06) | Motor Leakage Inductance | % | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 |
| E2-10(E4-10) | Motor Iron Loss for Torque Compensation | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| L2-02 | Momentary Power Loss Ride-Thru Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-03 | Momentary Power Loss Minimum Baseblock Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-04 | Momentary Power Loss Voltage Recovery Time | sec | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| L2-05 | Undervoltage Detection Level (Uv) | V | 940 | 940 | 940 | 940 | 940 | 940 | 940 | 940 | 940 | 940 | 940 |
| L8-02 <62> | Overheat Alarm Level | – | 105 | 105 | 105 | 105 | 105 | 105 | 95 | 105 | 105 | 105 | 105 |
| L8-09 | Output Ground Fault Detection Selection | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| L8-33 | FAN Board Use Selection | – | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| L8-87 | Transformer Overheat Alarm (TMA) Level | °C | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| L8-88 | Transformer Overheat Fault (TME) Level | °C | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| n1-03 | Hunting Prevention Time Constant | ms | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| n9-02 | Output Current Detection Gain | – | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| n9-71 | Input Current Conversion Coefficient | – | 0.0340 | 0.0340 | 0.0235 | 0.0150 | 0.0094 | 0.0060 | 0.0060 | 0.0044 | 0.0030 | 0.0020 | 0.0020 |
| o2-11 | Reference Voltage for Input Voltage Detection | V | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 |

<61> Parameter numbers shown in parenthesis are valid for motor 2.
<62> The alarm detection level differs for each drive model because of the different thermistor position on each drive.

### Table 1.6 4.16 kV Class Drives Default Settings by Drive Model Selection

| No. <61> | Name | Unit | Default Settings | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| – | Model CIMR-MV2□□□□ | – | 052 | 058 | 064 | 077 | 093 | 102 | 115 | 125 | 155 | 190 | 220 | 285 | 315 | 340 | 375 | 440 | 505 | 575 | 625 |
| o2-04 | Drive Model Selection | – | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4C | 4D | 4E | 4F | 50 | 51 | 52 | 53 |
| E2-11(E4-11) | Motor Rated Power | kW | 300 | 330 | 370 | 440 | 540 | 590 | 660 | 720 | 890 | 1100 | 1270 | 1640 | 1820 | 1960 | 2160 | 2540 | 2910 | 3310 | 3600 |
| b3-04 | V/f Gain during Speed Search | % | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| b3-06 | Output Current 1 during Speed Search | – | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| b3-11 | Speed Search Method Switching Level (Speed Estimate Speed Search) | % | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| E2-01(E4-01) | Motor Rated Current | A | 40.0 | 50.0 | 50.0 | 70.0 | 80.0 | 90.0 | 100.0 | 110.0 | 130.0 | 160.0 | 190.0 | 240.0 | 270.0 | 290.0 | 320.0 | 370.0 | 430.0 | 490.0 | 530.0 |
| E2-02(E4-02) | Motor Rated Slip | Hz | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| E2-03(E4-03) | Motor No-Load Current | A | 10.0 | 13.0 | 13.0 | 18.0 | 20.0 | 23.0 | 25.0 | 28.0 | 33.0 | 40.0 | 48.0 | 60.0 | 68.0 | 73.0 | 80.0 | 93.0 | 108.0 | 123.0 | 133.0 |
| E2-05(E4-05) | Motor Line-to-Line Resistance | W | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 |
| E2-06(E4-06) | Motor Leakage Inductance | % | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 |
| E2-10(E4-10) | Motor Iron Loss for Torque Compensation | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| L2-02 | Momentary Power Loss Ride-Thru Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-03 | Momentary Power Loss Minimum Baseblock Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-04 | Momentary Power Loss Voltage Recovery Time | sec | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| L2-05 | Undervoltage Detection Level (Uv) | V | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 |
| L8-02 <62> | Overheat Alarm Level | – | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 95 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| L8-09 | Output Ground Fault Detection Selection | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| L8-33 | FAN Board Use Selection | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| L8-87 | Transformer Overheat Alarm (TMA) Level | °C | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| L8-88 | Transformer Overheat Fault (TME) Level | °C | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| n1-03 | Hunting Prevention Time Constant | ms | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| n9-02 | Output Current Detection Gain | – | 100 | 100 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| n9-71 | Input Current Conversion Coefficient | – | 0.0235 | 0.0235 | 0.0235 | 0.0150 | 0.0150 | 0.0150 | 0.0094 | 0.0094 | 0.0060 | 0.0060 | 0.0060 | 0.0044 | 0.0044 | 0.0030 | 0.0030 | 0.0020 | 0.0020 | 0.0020 | 0.0020 |
| o2-11 | Reference Voltage for Input Voltage Detection | V | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 | 4160 |

<61> Parameter numbers shown in parenthesis are valid for motor 2.
<62> The alarm detection level differs for each drive model because of the different thermistor position on each drive.

**Table 1.7 6 kV Class Drives Default Settings by Drive Model Selection**

| No. <61> | Name | Unit | Default Settings | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| – | Model CIMR-MV2□□□□ | – | 035 | 050 | 070 | 100 | 140 | 200 | 260 | 330 | 400 | 520 | 650 |
| o2-04 | Drive Model Selection | – | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 6A |
| E2-11(E4-11) | Motor Rated Power | kW | 320 | 460 | 640 | 910 | 1280 | 1830 | 2380 | 3020 | 3660 | 4760 | 5940 |
| b3-04 | V/f Gain during Speed Search | % | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| b3-06 | Output Current 1 during Speed Search | – | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| b3-11 | Speed Search Method Switching Level (Speed Estimate Speed Search) | % | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| E2-01(E4-01) | Motor Rated Current | A | 30.0 | 45.0 | 60.0 | 85.0 | 120.0 | 170.0 | 220.0 | 280.0 | 340.0 | 440.0 | 550.0 |
| E2-02(E4-02) | Motor Rated Slip | Hz | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| E2-03(E4-03) | Motor No-Load Current | A | 8.0 | 11.0 | 15.0 | 21.0 | 30.0 | 43.0 | 55.0 | 70.0 | 85.0 | 110.0 | 138.0 |
| E2-05(E4-05) | Motor Line-to-Line Resistance | W | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 |
| E2-06(E4-06) | Motor Leakage Inductance | % | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 |
| E2-10(E4-10) | Motor Iron Loss for Torque Compensation | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| L2-02 | Momentary Power Loss Ride-Thru Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-03 | Momentary Power Loss Minimum Baseblock Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-04 | Momentary Power Loss Voltage Recovery Time | sec | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| L2-05 | Undervoltage Detection Level (Uv) | V | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 |
| L8-02 <62> | Overheat Alarm Level | – | 105 | 105 | 105 | 105 | 105 | 105 | 95 | 105 | 105 | 105 | 105 |
| L8-09 | Output Ground Fault Detection Selection | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| L8-33 | FAN Board Use Selection | – | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| L8-87 | Transformer Overheat Alarm (TMA) Level | °C | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| L8-88 | Transformer Overheat Fault (TME) Level | °C | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| n1-03 | Hunting Prevention Time Constant | ms | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| n9-02 | Output Current Detection Gain | – | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| n9-71 | Input Current Conversion Coefficient | – | 0.0340 | 0.0340 | 0.0235 | 0.0150 | 0.0094 | 0.0060 | 0.0060 | 0.0044 | 0.0030 | 0.0020 | 0.0020 |
| o2-11 | Reference Voltage for Input Voltage Detection | V | 6600 | 6600 | 6600 | 6600 | 6600 | 6600 | 6600 | 6600 | 6600 | 6600 | 6600 |

<61> Parameter numbers shown in parenthesis are valid for motor 2.
<62> The alarm detection level differs for each drive model because of the different thermistor position on each drive.

**Table 1.8 11 kV Class Drives Default Settings by Drive Model Selection**

| No. <61> | Name | Unit | Default Settings | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| – | Model CIMR-MV2□□□□ | – | 035 | 050 | 070 | 100 | 140 | 200 | 260 | 330 | 400 | 520 | 650 |
| o2-04 | Drive Model Selection | – | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 8A |
| E2-11(E4-11) | Motor Rated Power | kW | 530 | 760 | 1070 | 1520 | 2130 | 3050 | 3960 | 5030 | 6100 | 7930 | 9910 |
| b3-04 | V/f Gain during Speed Search | % | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| b3-06 | Output Current 1 during Speed Search | – | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| b3-11 | Speed Search Method Switching Level (Speed Estimate Speed Search) | % | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| E2-01(E4-01) | Motor Rated Current | A | 30.0 | 45.0 | 60.0 | 85.0 | 120.0 | 170.0 | 220.0 | 280.0 | 340.0 | 440.0 | 550.0 |
| E2-02(E4-02) | Motor Rated Slip | Hz | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| E2-03(E4-03) | Motor No-Load Current | A | 8.0 | 11.0 | 15.0 | 21.0 | 30.0 | 43.0 | 55.0 | 70.0 | 85.0 | 110.0 | 138.0 |
| E2-05(E4-05) | Motor Line-to-Line Resistance | W | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 |
| E2-06(E4-06) | Motor Leakage Inductance | % | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 |
| E2-10(E4-10) | Motor Iron Loss for Torque Compensation | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| L2-02 | Momentary Power Loss Ride-Thru Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-03 | Momentary Power Loss Minimum Baseblock Time | sec | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| L2-04 | Momentary Power Loss Voltage Recovery Time | sec | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| L2-05 | Undervoltage Detection Level (Uv) | V | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 | 1188 |
| L8-02 <62> | Overheat Alarm Level | – | 105 | 105 | 105 | 105 | 105 | 105 | 95 | 105 | 105 | 105 | 95 |
| L8-09 | Output Ground Fault Detection Selection | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| L8-33 | FAN Board Use Selection | – | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| L8-87 | Transformer Overheat Alarm (TMA) Level | °C | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| L8-88 | Transformer Overheat Fault (TME) Level | °C | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| n1-03 | Hunting Prevention Time Constant | ms | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| n9-02 | Output Current Detection Gain | – | 100 | 100 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| n9-71 | Input Current Conversion Coefficient | – | 0.0340 | 0.0340 | 0.0235 | 0.0150 | 0.0094 | 0.0060 | 0.0060 | 0.0044 | 0.0030 | 0.0020 | 0.0020 |
| o2-11 | Reference Voltage for Input Voltage Detection | V | 11000 | 11000 | 11000 | 11000 | 11000 | 11000 | 11000 | 11000 | 11000 | 11000 | 11000 |

<61> Parameter numbers shown in parenthesis are valid for motor 2.
<62> The alarm detection level differs for each drive model because of the different thermistor position on each drive.

# 2

# Parameter Details

# 2.1 A: Initialization

The initialization group contains parameters associated with initial setup of the drive. Parameters involving the access levels, initialization, and password are located in this group.

## ◆ A1: Initialization

### ■ A1-00: Language Selection

Selects the display language for the digital operator.

**Note:** This parameter is not reset when the drive is initialized using parameter A1-03.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A1-00 | Language Selection | 0 or 1 | 1 |

**Setting 0: English**
**Setting 1: Japanese**

### ■ A1-01: Access Level Selection

Allows or restricts access to drive parameters.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A1-01 | Access Level Selection | 0 to 2 | 2 |

**Setting 0: Operation only**

Access is restricted to parameters A1-00, A1-01, A1-04 and all U☐-☐☐ monitor parameters.

**Setting 1: User Parameters**

Access to only a specific list of parameters set in A2-01 through A2-32. These User Parameters can be accessed using the Setup Mode of the digital operator.

**Setting 2: Advanced Access Level (A) and Setup Access Level (S)**

All parameters can be viewed and edited.

**Notes on Parameter Access**

- If the drive parameters are password protected by A1-04 and A1-05, parameters A1-01 through A1-03, A1-06, and all A2 parameters cannot be modified.
- If a contact input terminal programmed for “Program lockout” (H1-☐☐ = 1B) is enabled, parameter values cannot be modified, even if A1-01 is set to 1 or 2.
- If parameters are changed via serial communication, then it will not be possible to edit or change parameters settings with the drive’s digital operator until an Enter command is issued to the drive from the serial communication.

## ■ A1-02: Control Method Selection

Selects the Control Method (also referred to as the “control mode”) the drive uses to operate the motor. If the drive is set up to run two motors, then A1-02 determines the control mode for motor 1.

**Note:** When changing control modes, all parameter settings depending upon the setting of A1-02 will be reset to the default.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A1-02 | Control Mode Selection | 0, 2, 3 | 2 |

### Control Modes for Induction Motors (IM)

#### Setting 0: V/f Control

V/f Control is for simple speed control and multiple motor applications with low demands to dynamic response or speed accuracy. This control mode should be used when the motor parameters are unknown and Auto-Tuning cannot be performed.

#### Setting 2: Open Loop Vector Control

For general, variable-speed applications that require precise speed control, quick torque response, and high torque at low speed without using a speed feedback signal from the motor.

#### Setting 3: Closed Loop Vector Control

For general, variable-speed applications that requiring precise speed control down to zero speed, fast torque response, or precise torque control. A speed feedback signal from the motor is required.

## ■ A1-03: Initialize Parameters

Resets parameters back to the original default values. After initialization, the setting for A1-03 automatically returns to 0.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A1-03 | Initialize Parameters | 0, 1110, 2220 | 0 |

#### Setting 1110: User Initialize

Drive parameters are reset to values selected by the user as User Settings. User Settings are stored when parameter o2-03 is set to “1: Set defaults”.

**Note:** A “user-initialization” resets all parameters to a user-defined set of default values that were previously saved to the drive. To clear the user-defined default values, set parameter o2-03 to 2.

#### Setting 2220: 2-Wire Initialization

Resets all parameters back to their original default settings with contact inputs S1 and S2 configured as Forward run and Reverse run, respectively.

### Notes on Parameter Initialization

The parameters shown in *Table 2.1* will not be reset when the drive is initialized by setting A1-03 = 2220.

**Table 2.1 Parameters not Changed by Drive Initialization**

| No. | Name |
|---|---|
| A1-00 | Language Selection |
| A1-02 | Control Method Selection |
| F6-08 | Comm. Parameter Reset |
| o2-04 | Drive Model Selection |

## ■ A1-04, A1-05: Password and Password Setting

A1-04 is for entering the password when the drive is locked. A1-05 is a hidden parameter used to set the password.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A1-04 | Password | 0000 to 9999 | 0000 |
| A1-05 | Password Setting | | |

### How to use the Password

The user can set a password for the drive to restrict access. The password is set to A1-05 and must be entered in A1-04 to unlock parameter access. Until the correct password is entered, the following parameters cannot be viewed or edited: A1-01 through A1-03, A1-06, A2-01 through A2-32.

The instructions below demonstrate how to set a new password. Here, the password set is “1234”. An explanation follows on how to enter the password to unlock the parameters.

**Table 2.2 Setting the Password for Parameter Lock**

| Step | | | Display/Result |
|---|---|---|---|
| 1 | Turn on the power to the drive. The initial display appears. | → | - MODE - DRV Rdy<br>FREF (OPR)<br>U1-01= 0.00Hz<br>U1-02= 0.00Hz LSEQ<br>U1-03= 0.00A LREF<br>JOG FWD FWD/REV |
| 2 | Scroll to the Parameter Setup display and press ∨. | → | - MODE - PRG<br>Programming<br>HELP FWD DATA |
| 3 | Scroll to the right by pressing ENTER. | → | -PRMSET- PRG<br>Initialization<br>A1-00= 0<br>Select Language<br>← FWD → |
| 4 | Select the flashing digits by pressing RESET. | → | -PRMSET- PRG<br>Select Language<br>A1-00= 0 *0*<br>English<br>← FWD → |
| 5 | Select A1-04 by pressing ∧. | → | -PRMSET- PRG<br>Enter Password<br>A1-04 = 0<br>(0~9999)<br>“0”<br>← FWD → |
| 6 | Press the STOP key while holding down ∧ at the same time. A1-05 will appear.<br>Note: Because A1-05 is hidden, it will not be displayed by simply pressing the ∧ key. | → | -PRMSET- PRG<br>Select Password<br>A1-05 = 0<br>(0~9999)<br>“0”<br>← FWD →<br>“05” flashes |
| 7 | Press the ENTER key. | → | -PRMSET- PRG<br>Select Password<br>A1-05 = 0000<br>(0~9999)<br>“0”<br>← FWD → |
| 8 | Use RESET, ∨ and ∧ to enter the password. | → | -PRMSET- PRG<br>Select Password<br>A1-05= 1234<br>(0~9999)<br>“0”<br>← FWD → |
| 9 | Press ENTER to save what was entered. | → | Entry Accepted |

| Step | | | Display/Result |
|---|---|---|---|
| 10 | The display automatically returns to the display shown in step 6. | → | -PRMSET- PRG<br>Select Password<br>A1-05 = 1234<br>(0~9999)<br>"0"<br>← FWD → |

**Table 2.3 Check to see if A1-02 is locked (continuing from step 10 above)**

| Step | | | Display/Result |
|---|---|---|---|
| 1 | Press V to display A1-02. | → | -PRMSET- PRG<br>Control Method<br>A1-02= 2 *2*<br>Open Loop Vector<br>← FWD →<br>"02" flashes |
| 2 | Press ENTER to make sure that the settings cannot be changed. | | |
| 3 | Press ESC to return to the first display. | → | - MODE - PRG<br>Programming<br>HELP FWD DATA |

**Table 2.4 Enter the Password to Unlock Parameters (continuing from step 2 above)**

| Step | | | Display/Result |
|---|---|---|---|
| 1 | Scroll to the right by pressing ENTER. | → | -PRMSET- PRG<br>Initialization<br>A1-00= 0<br>Select Language<br>← FWD → |
| 2 | Select the flashing digits by pressing RESET. | → | -PRMSET- PRG<br>Select Language<br>A1-00= 0 *0*<br>English<br>← FWD →<br>"00" flashes |
| 3 | Press ^ to display A1-04, then press ENTER. | → | -PRMSET- PRG<br>Enter Password<br>A1-04 = 0<br>(0~9999)<br>"0"<br>← FWD → |
| 4 | Press RESET or ^ to enter the password. | → | -PRMSET- PRG<br>Enter Password<br>A1- 04 = 1234<br>(0~9999)<br>"0"<br>← FWD → |
| 5 | Press ENTER to save what was entered. | → | Entry Accepted |
| 6 | The drive returns to the parameter display. | → | -PRMSET- PRG<br>Enter Password<br>A1-04 = 0<br>(0~9999)<br>"0"<br>← FWD → |
| 7 | Press V to display A1-02. | → | -PRMSET- PRG<br>Control Method<br>A1-02= 2 *2*<br>Open Loop Vector<br>← FWD → |
| 8 | Press ENTER to display the value set in A1-02. If the first "0" blinks, the parameter settings are unlocked. | → | -PRMSET- PRG<br>Control Method<br>A1-02= 2 *2*<br>Open Loop Vector<br>← FWD → |

| Step | | | Display/Result |
|---|---|---|---|
| 9 | Press RESET or ∧ to make sure that the settings can be changed. | → | -PRMSET- PRG<br>Control Method<br>A1-02= 0 *2*<br>V/F Control<br>"2"<br>← FWD → |
| 10 | Press ESC to cancel the changed settings. | | |
| 11 | The drive returns to the parameter display. | → | -PRMSET- PRG<br>Control Method<br>A1-02= 2 *2*<br>Open Loop Vector<br>← FWD → |

**Note:** Parameter settings can be edited after entering the correct password. Performing a 2-wire initialization resets the password to "0000". Reenter the password in parameter A1-05 after drive initialization.

## ■ A1-06: Application Preset

**Note:** This function is not available. Always set this parameter to its default setting "0 (disabled)".

## ■ A1-90: Calendar Year

Sets the year for the calendar. The setting is used for recording event log data and trace data.

**Note:** Some error arises, so periodic adjustment is recommended.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A1-90 | Calendar Year | 2000 to 2099 | 2011 |

## ■ A1-91: Calendar Month and Day

Sets the month and day for the calendar. The setting is used for recording event log data and trace data.

**Note:** Some error arises, so periodic adjustment is recommended.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A1-91 | Calendar Month and Day | 1.01 to 12.31 | 1.01 |

## ■ A1-92: Calendar Hour and Minute

Sets the hour and minute for the calendar. The setting is used for recording event log data and trace data.

**Note:** Some error arises, so periodic adjustment is recommended.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A1-92 | Calendar Hour and Minute | 0.00 to 23.59 | 0.00 |

## ◆ A2: User Parameters

### ■ A2-01 to A2-32: User Parameters 1 to 32

The user can select 32 parameters and assign them to A2-01 through A2-32. This saves time later scrolling through the parameter menu. The list of User Parameters can also track the most recently edited settings and save those parameters to this list.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A2-01 to A2-32 | User Parameters 1 to 32 | b1-01 to o4-□□ | 0 |

<1> This drive allows parameters that are adjusted frequently to be saved as user parameters A2-01 to A2-22 so that they can be set and referred to easily.

**Table 2.5 Parameter Registered as User Parameters (A2-01 to A2-22)**

| No. | Name | No. | Name |
|---|---|---|---|
| A1-02 | Control Method Selection | E1-06 | Base Frequency |
| b1-01 | Frequency Reference Selection 1 | E1-09 | Minimum Output Frequency |
| b1-02 | Run Command Selection 1 | E1-13 | Base Voltage |
| b1-03 | Stopping Method Selection | E2-01 | Motor Rated Current |
| C1-01 | Acceleration Time 1 | E2-04 | Number of Motor Poles |
| C1-02 | Deceleration Time 1 | E2-11 | Motor Rated Power |
| d1-01 | Frequency Reference 1 | H4-02 | Analog Output 1 Gain |
| d1-02 | Frequency Reference 2 | H4-12 | Analog Output 2 Gain |
| d1-03 | Frequency Reference 3 | H4-22 | Analog Output 3 Gain |
| d1-04 | Frequency Reference 4 | H4-32 | Analog Output 4 Gain |
| d1-17 | Jog Frequency Reference | L1-01 | Motor Overload Protection Selection |
| E1-04 | Maximum Output Frequency | L3-04 | Stall Prevention during Deceleration |
| E1-05 | Maximum Voltage | – | – |

#### Saving User Parameters

To save specific parameters to A2-01 to A2-32, first set the access level to allow access to all parameters (A1-01 = 2). Next assign the parameter number to the User Parameters list by entering it into one of the A2-□□ parameters. If A1-01 is then set to 1, the access level can be restricted so that users can only set and refer to the specific parameters saved as User Parameters.

### ■ A2-33: User Parameter Automatic Selection

A2-33 determines whether or not parameters that have been edited are saved to the User Parameters (A2-17 to A2-32) for quick, easy access.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A2-33 | User Parameter Automatic Selection | 0 or 1 | 0 |

#### Setting 0: Do not save list of recently viewed parameters.

To manually select the parameters listed in the User Parameter group, set A2-33 to 0.

#### Setting 1: Save history of recently viewed parameters.

By setting A2-33 to 1, all parameters that were recently edited will be automatically saved to A2-17 through A2-32. A total of 16 parameters are saved with the most recently edited parameter set to A2-17, the second most recently to A2-18, and so on. User Parameters can be accessed using the Setup Mode of the digital operator.

## ◆ A3: Trace Data

### ■ A3-01 to A3-32: Trace Data 01 to 32

Sets the numbers of the monitor items to be registered as the trace data. A maximum of 32 items can be set.

**Note:** **1.** Set this parameter to the last three digits □-□□ of the desired U□-□□ parameter. For example, enter "103" for U1-03 (output current).
**2.** Set 000 if the parameter is not used.
**3.** When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00, or oFC00 fault occurs, no fault trace is performed.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A3-01 to A3-32 | Trace Data 01 to 32 | 0 to 899 | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### ■ A3-33: High-Speed Trace Sampling Time

Sets the sampling time for high-speed tracing in 0.001 s units. Note, however, that if 0.000 s is set the setting made will actually be 0.00025 s (250 µs).

**Note:** **1.** The maximum number of sampling points for high-speed tracing is 4000 per item.
**2.** When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00, or oFC00 fault occurs, no fault trace is performed.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A3-33 | High-Speed Trace Sampling Time | 0.000 to 10.000 s | 0.000 s |

### ■ A3-34: Low-Speed Trace Sampling Time

Sets the sampling time for low-speed tracing in 0.01s units.

**Note:** **1.** The maximum number of sampling points for low-speed tracing is 500 per item.
**2.** When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00, or oFC00 fault occurs, no fault trace is performed.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A3-34 | Low-Speed Trace Sampling Time | 0.01 to 60.00 s | 0.05 s |

### ■ A3-35: Number of Data after High-Speed-Trace Fault Detection

Sets the number of samplings of the data to be registered after a fault is detected in high-speed tracing.

**Note:** **1.** Only effective when a fault has been detected and operation automatically stopped.
**2.** When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00, or oFC00 fault occurs, no fault trace is performed.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A3-35 | Number of Data after High-Speed-Trace Fault Detection | 0 to 250 | 200 |

### ■ A3-36: Number of Data after Low-Speed-Trace Fault Detection

Sets the number of samplings of the data to be registered after a fault is detected in low-speed tracing.

**Note:** **1.** Only effective when a fault has been detected and operation automatically stopped.
**2.** When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00, or oFC00 fault occurs, no fault trace is performed.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A3-36 | Number of Data after Low-Speed-Trace Fault Detection | 0 to 250 | 50 |

### ■ A3-37: Trace Stop Selection

Sets the condition to stop tracing.

**Note:** When a CPF00, CPF01, CPF06, Uv1, oFA00, oFb00, or oFC00 fault occurs, no fault trace is performed.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| A3-37 | Trace Stop Selection | 0 or 1 | 0 |

**Setting 0: Error always detected and drive stopped**
**Setting 1: Error detected and drive stopped during run only**

# 2.2 b: Application

## ◆ b1: Operation Mode Selection

### ■ b1-01: Frequency Reference Selection 1

Parameter b1-01 determines the frequency reference source in the REMOTE mode.

**Note:** **1.** If a Run command is input to the drive but the frequency reference entered is 0 or below the minimum frequency, the RUN indicator LED on the digital operator will flash.
**2.** Press the LO/RE key to set the drive to LOCAL and use the operator keypad to enter the frequency reference.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-01 | Frequency Reference Selection 1 | 0 to 3 | 1 |

**Setting 0: Operator keypad**

Using this setting, the frequency reference can be input by:

- switching between the multi-speed references in the d1-☐☐ parameters.
- entering the frequency reference on the operator keypad.

For details on how to change the setting value for the frequency reference, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

**Setting 1: Terminals (analog input terminals)**

Using this setting, analog frequency references can be input as a voltage signal from analog input 1 or 2.

For details on the setting, refer to *Table 2.6*.

**Table 2.6 Analog Input Settings for Frequency Reference Using Voltage Signals**

| Terminal | Signal Level | Parameter Settings | | | | Notes |
|---|---|---|---|---|---|---|
| | | Signal Level Selection | Function Selection | Gain | Bias | |
| Analog input 1 | 0 to 10 Vdc | H3-01 = 0 | H3-02 = 0 (Master Speed Frequency Reference) | H3-03 | H3-04 | – |
| | -10 to +10 Vdc | H3-01 = 1 | | | | |
| Analog input 2 | 0 to 10 Vdc | H3-09 = 0 | H3-10 = 0 (Master Speed Frequency Reference) | H3-11 | H3-12 | – |
| | -10 to +10 Vdc | H3-09 = 1 | | | | |

#### Switching between Main/Auxiliary Frequency References

The frequency reference input can be switched between analog input 1 and 2 using multi-speed inputs.

Refer to *Table 2.15 Multi-step Speed Reference and Contact Input Combinations on page 136* for details on using this function.

#### Setting 2: MEMOBUS/Modbus Communications

This setting requires entering the frequency reference via the RS-485 serial communications port (control terminals R+, R-, S+, and S-). Refer to MEMOBUS/Modbus Communications on page 513 for instructions. For details, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

#### Setting 3: Option card

This setting requires entering the frequency reference via an option board plugged into connector CN5-A on the drive control board. Consult the option board manual for instructions on integrating the drive with the communication system.

**Note:** If the frequency reference source is set for an option board (b1-01 = 3), but an option board is not installed, an OPE05 Operator Programming Error will be displayed on the digital operator and the drive will not run.

## ■ b1-02: Run Command Selection 1

Parameter b1-02 determines the Run command source 1 in the REMOTE mode.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-02 | Run Command Selection 1 | 0 to 3 | 1 |

#### Setting 0: Operator keypad

This setting requires entering the Run command via the digital operator RUN key and also illuminates the LO/RE indicator on the digital operator.

#### Setting 1: Control Circuit Terminal

This setting requires that the Run and Stop commands are entered from the contact input terminals. The following sequences can be used:

- 2-wire sequence 1:
  Two inputs (FWD/Stop-REV/Stop). Initializing the drive by setting A1-03 = 2220, assigns the Forward Run Command (2-wire Sequence) function (H1-☐☐ = 40) to contact input 2. At this time, the Reverse Run Command (2-wire Sequence) function (H1-☐☐ = 41) is not assigned and it needs to be set separately. This is the default setting of the drive. Also refer to *Setting 40, 41: Forward run, Reverse run command for 2-wire sequence on page 173*.
- 2-wire sequence 2:
  Two inputs (Start/Stop-FWD/REV). Also refer to *Setting 42, 43: Run and direction command 2 for 2-wire sequence 2 on page 173*.

#### Setting 2: MEMOBUS/Modbus Communications

To issue a Run command via serial communications, set b1-02 to 2 and connect the RS-485 serial communication cable to control terminals R+, R-, S+, and S- on the removable terminal block. For instructions, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

#### Setting 3: Option card

To issue the Run command via the communication option board, set b1-02 to 3 and plug a communication option board into the CN5-A port on the control PCB. Refer to the manual supplied with the option board for instructions on integrating the drive into the communication system.

**Note:** If b1-02 is set to 3, but an option board is not installed in CN5-A, an oPE05 operator programming error will be displayed on the digital operator and the drive will not run.

## ■ b1-03: Stopping Method Selection

Select how the drive stops the motor when the Run command is removed or when a Stop command is entered.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-03 | Stopping Method Selection | 0 to 3 <1> | 1 |

<1> Note: Setting 2 is not available in CLV.

### Setting 0: Ramp to stop

When the Run command is removed, the drive will decelerate the motor to stop. The deceleration rate is determined by the active deceleration time. The default deceleration time is set to parameter C1-02.

When the output frequency falls below the level set in parameter b2-01, the drive will start DC injection braking or Zero Speed Control. Refer to *b2: DC Injection Braking on page 102* for details.

### Setting 1: Coast to stop

When the Run command is removed, the drive will shut off its output and the motor will coast (uncontrolled deceleration) to stop. The stopping time is determined by the inertia and the friction in the driven system.

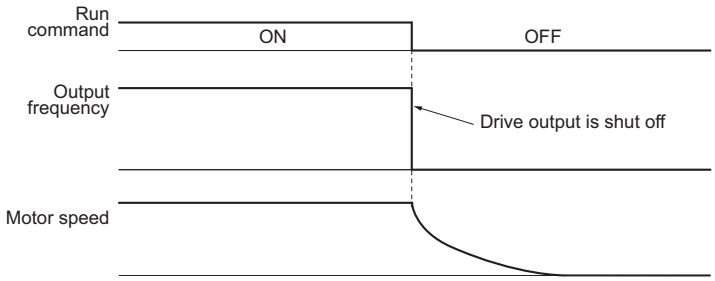



**Figure 2.1 Coast to Stop.**

**Note:** After a stop is initiated, any subsequent Run command entered will be ignored until the minimum baseblock time (L2-03) has expired. Do not enter a Run command until it has come to a complete stop. To start the motor back up before it has stopped completely, use DC Injection at start (refer to *b2-03: DC Injection Braking Time at Start on page 103*) or Speed Search (refer to *b3: Speed Search on page 103*).

### Setting 2: DC Injection Braking to stop

When the Run command is removed, the drive will enter baseblock (turn off its output) for the minimum baseblock time (L2-03). Once the minimum baseblock time has expired, the drive will brake the motor by injecting DC current into the motor windings. The stopping time is significantly faster than when compared with simply coasting to stop. The level of current used for DC Injection Braking is set by parameter b2-02 (default = 50%).

**Note:** This function is not available in CLV (A1-02 = 3).

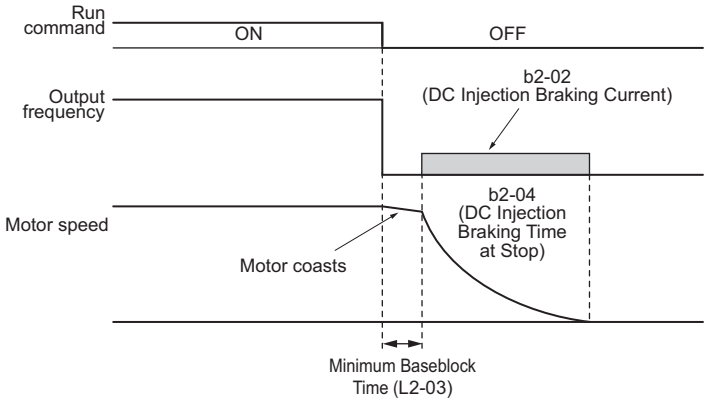



**Figure 2.2 DC Injection Braking to stop**

The time for DC Injection Braking is determined by the value set in b2-04 and by the output frequency at the time the Stop command is input or the Run command is turned OFF. It can be calculated by:

$$\text{DC Injection brake time} = \frac{(\text{b2-04}) \times 10 \times \text{Output frequency}}{\text{Max. output frequency (E1-04)}}$$

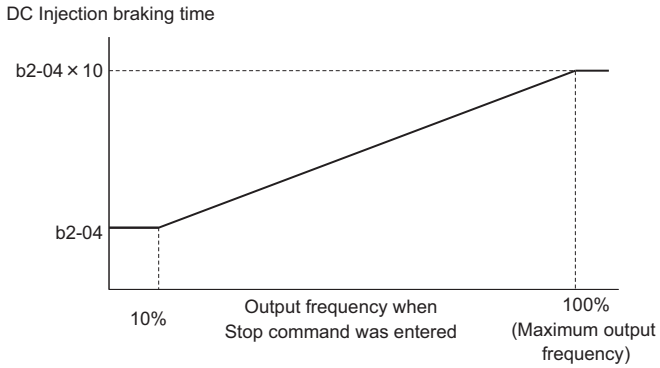



**Figure 2.3 DC Injection Braking Time Depending on Output Frequency**

**Note:** If an overcurrent (oC) fault occurs during DC Injection Braking to a stop, lengthen the minimum baseblock time (L2-03) until the fault no longer occurs.

### Setting 3: Coast to Stop with Timer

When a Stop command is input or the Run command is turned OFF, the drive will turn off its output and the motor will coast to a stop. If a Run command is input before the time t has elapsed, the drive will not start.

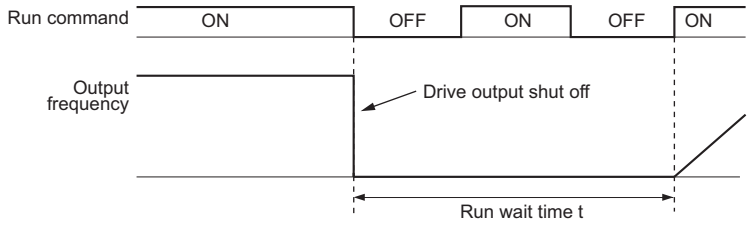



**Figure 2.4 Coast to Stop with Timer**

The wait time t is determined by the output frequency when the Stop command is input and by the active deceleration time.

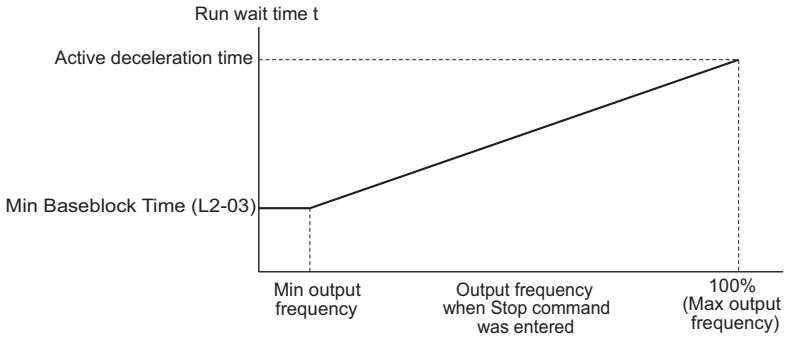



**Figure 2.5 Run Wait Time Depending on Output Frequency**

## ■ b1-04: Reverse Operation Selection

For some applications, reverse motor rotation is not appropriate and may cause problems (e.g., air handling units, pumps, etc.). Setting parameter b1-04 to 1 instructs the drive to ignore any Reverse run commands.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-04 | Reverse Operation Selection | 0 or 1 | 1 |

**Setting 0: Reverse operation enabled**

Possible to operate the motor in both forward and reverse directions.

**Setting 1: Reverse operation disabled**

The drive disregards a Reverse run command or a negative frequency reference.

## ■ b1-05: Action Selection below Minimum Output Frequency (CLV)

Parameter b1-05 sets the operation when the frequency reference is lower than the minimum output frequency set in parameter E1-09.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-05 | Action Selection below Minimum Output Frequency (E-09) | 0 to 3 | 0 |

**Setting 0: Follow the Frequency Reference (E1-09 is disabled)**

The drive adjusts the motor speed following the speed reference, even if the frequency reference is below the setting of parameter E1-09. When a Stop command is input and the motor speed is smaller than the setting of b2-01, Zero Speed Control (not position lock) is performed for the time set in parameter b2-04 before the drive output shuts off.

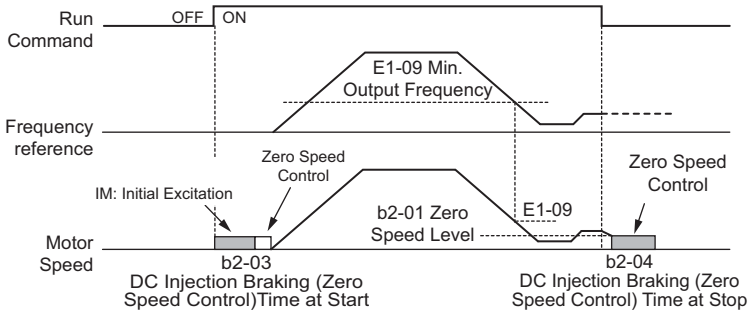



**Figure 2.6 Run at the Frequency Reference**

**Setting 1: Coast to stop**

The motor is started first when the frequency reference exceeds the setting of parameter E1-09. Once the motor is running and the frequency reference falls below E1-09 the drive output is shut off and the motor coasts. When the motor speed falls below the zero speed level set in parameter b2-01, Zero Speed Control is activated for the time set in b2-04.

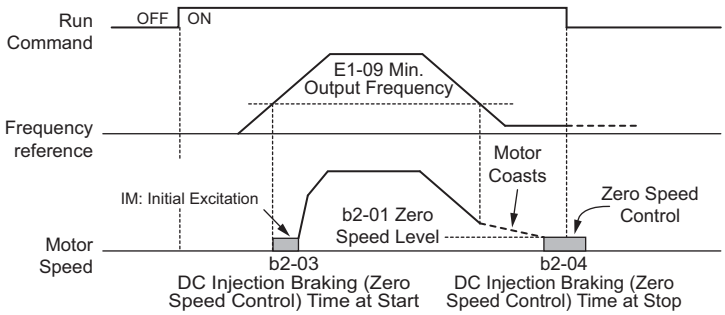



**Figure 2.7 Coast to Stop.**

### Setting 2: Run at the minimum frequency

Whenever a Run command is active and the frequency reference is smaller than the value of parameter E1-09, the drive runs the motor at the speed set in E1-09. When the Run command is turned OFF, the drive decelerates the motor. As soon as the motor speed reaches the zero speed level set in b2-01, Zero Speed Control is activated for the time set in b2-04.

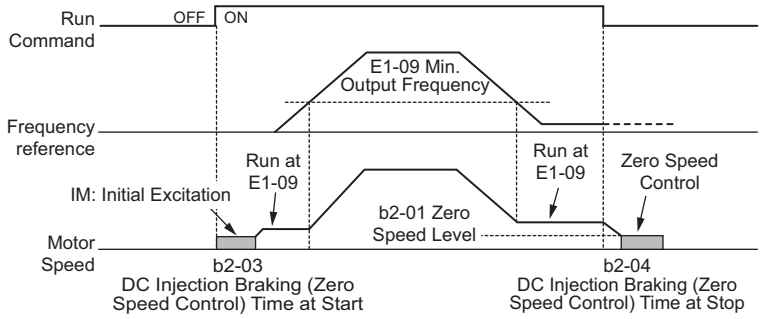



**Figure 2.8 Run at the Minimum Frequency**

### Setting 3: Zero Speed Control

The drive applies Zero Speed Control whenever the frequency reference setting is below the value of parameter E1-09. When the Run command is turned OFF, Zero Speed Control is activated for the time set in b2-04, even if it was already active before.

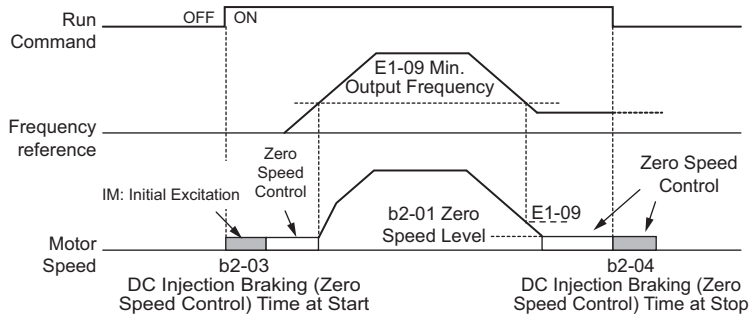



**Figure 2.9 Zero Speed Control**

## ■ b1-06: Contact Input Reading

This parameter defines how the contact inputs are read. The inputs are acted upon every 1 ms or 2 ms depending upon the setting.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-06 | Contact Input Reading | 0 or 1 | 1 |

### Setting 0: Read once (1 ms scan)

The state of a contact input is read once. If the state has changed, the input command is immediately processed. With this setting the drive responds more quickly to contact inputs, but a noisy signal could cause erroneous operation.

### Setting 1: Read twice (2 ms scan)

The state of a contact input is read twice. Only if the state does not change during the double reading, the input command is processed. This reading process is slower but more resistant against noisy signals.

## ■ b1-07: LOCAL/REMOTE Run Selection

The drive has three separate control sources that can be switched using contact inputs (H1-☐☐ = 1 (LOCAL/REMOTE Selection) or 2 (External reference 1/2)) or the LO/RE key on the digital operator. Refer to *Setting 1: LOCAL/REMOTE selection on page 167*, *Setting 2: External reference 1/2 selection on page 167* and *o2-01: LO/RE (LOCAL/REMOTE) Key Function Selection on page 222* for details.

- LOCAL: Digital operator. The digital operator is used to set the frequency reference and Run command.
- REMOTE: External reference 1. The frequency reference and Run command source are set by b1-01 and b1-02.
- REMOTE: External reference 2. The frequency reference and Run command source are set by b1-15 and b1-16.

When switching from LOCAL to REMOTE, or between External reference 1 and External reference 2, the Run command may already be present at the location the source was switched to. Parameter b1-07 can be used to determine how the Run command is treated in this case.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-07 | LOCAL/REMOTE Run Selection | 0 or 1 | 0 |

**Setting 0: Run command must be cycled**

When the Run command source is different in the old and new source (e.g., the old source was the terminals and the new source is serial communication), and the Run command is active at the new source as the switch over occurs, the drive will not start or will stop operation if it was running before. The Run command has to be re-input at the new source in order to start the drive again.

**Setting 1: Accept Run command at the new source**

When the Run command is active at the new source, the drive starts or continues operation if it was running before.

⚠ **WARNING!** *The drive may start unexpectedly if switching control sources when b1-07 = 1. Clear all personnel away from rotating machinery and electrical connections prior to switching control sources. Failure to comply may cause death or serious injury.*

## ■ b1-08: Run command selection while in Programming Mode

As a safety precaution, the drive will not normally respond to a Run command input when the digital operator is being used to adjust parameters in the Programming Mode (Verify Menu, Setup Mode, Parameter Settings Mode, and Auto-Tuning Mode).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-08 | Run Command Selection while in Programming Mode | 0 to 2 | 0 |

**Setting 0: Disabled**

A Run command is not accepted while the digital operator is in the Programming Mode.

**Setting 1: Enabled**

A Run command is accepted in any digital operator mode.

**Setting 2: Prohibit programming during run**

It is not possible to enter the Programming Mode as long as the drive output is active. The Programming Mode cannot be displayed during Run.

## ■ b1-15: Frequency Reference Selection 2

Refer to ***b1-01: Frequency Reference Selection 1 on page 95***.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-15 | Frequency Reference Selection 2 | 0 to 3 | 0 |

## ■ b1-16: Run Command Selection 2

Refer to ***b1-02: Run Command Selection 1 on page 96***.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-16 | Run Command Selection 2 | 0 to 3 | 0 |

### ■ b1-17: Run Command at Power Up

This parameter is used to determine whether an external Run command that is active during power up will start the drive or not.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b1-17 | Run Command at Power Up | 0 or 1 | 0 |

**Setting 0: Run command at power up is not issued**

The Run command has to be re-input to start the drive.

**Note:** For safety reasons, the drive is initially programmed not to accept a Run command at power up (b1-17 = 0). If a Run command is issued at power up, the RUN indicator LED will flash quickly.

**Setting 1: Run command at power up is issued**

The Run command has to be re-input to start the drive.

⚠ **WARNING!** *Sudden Movement Hazard. If b1-17 is set to 1 and an external Run command is active during power up, the motor will begin rotating as soon as the power is switched on. Proper precautions must be taken to ensure that the area around the motor is safe prior to powering up the drive. Failure to comply may cause serious injury.*

## ◆ b2: DC Injection Braking

These parameters determine how the DC Injection Braking and Zero Speed Control operate.

### ■ b2-01: Zero Speed Level (DC Injection Braking Start Frequency)

Parameter b2-01 is active when "Ramp to stop" is selected as the stopping method (b1-03 = 0).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b2-01 | Zero Speed Level (DC Injection Braking Start Frequency) | 0.0 to 10.0 Hz | Determined by A1-02 and o1-03 |

The function triggered by parameter b2-01 depends on the control mode that has been selected.

**V/f and OLV (A1-02 = 0, 2)**

For these control modes, parameter b2-01 sets the starting frequency for DC Injection Braking at stop. Once the output frequency falls below the setting of b2-01, DC Injection Braking is enabled for the time set in parameter b2-04.

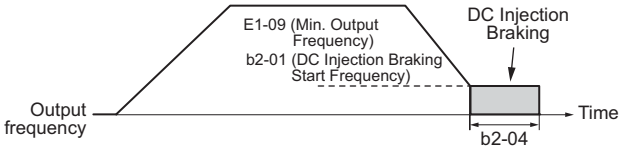



**Figure 2.10 DC Injection Braking at Stop for V/f and OLV**

**Note:** If b2-01 is set to a smaller value than parameter E1-09 (minimum frequency), then DC Injection Braking will begin as soon as the frequency falls to the value set to E1-09.

**CLV (A1-02 = 3)**

For these control modes, parameter b2-01 sets the starting frequency for Zero Speed Control (not position lock) at stop.

Once the output frequency falls below the setting of b2-01, Zero Speed Control is enabled for the time set in parameter b2-04.

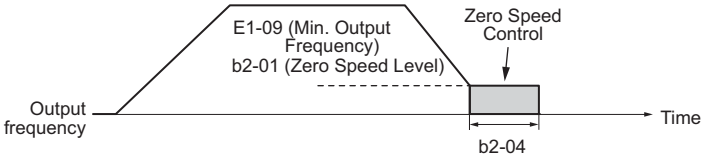



**Figure 2.11 Zero Speed Control at Stop in CLV**

**Note:** If b2-01 is set to lower than the minimum frequency (E1-09), then Zero Speed Control begins at the frequency set to E1-09.

### ■ b2-02: DC Injection Braking Current

Sets the DC Injection Braking current as a percentage of the drive rated current. If set larger than 50%, the carrier frequency is automatically reduced to 1 kHz.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b2-02 | DC Injection Braking Current | 0 to 100% | 50% |

The level of DC Injection Braking current affects the strength of the magnetic field attempting to lock the motor shaft. Increasing the current level will increase the amount of heat generated by the motor windings. This parameter should only be increased to the level necessary to hold the motor shaft.

### ■ b2-03: DC Injection Braking Time at Start

Sets the time of DC Injection Braking (Zero Speed Control when in CLV) at start. Used to stop a coasting motor before restarting it or to apply braking torque at start. Disabled when set to 0.00 s.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b2-03 | DC Injection Braking Time at Start | 0.00 to 10.00 s | 0.00 s |

**Note:** Before starting an uncontrolled rotating motor (e.g., a fan motor driven by windmill effect), DC Injection or Speed Search should be used to either stop the motor or detect its speed before starting it. Otherwise motor stalling and other faults can occur.

### ■ b2-04: DC Injection Braking Time at Stop

Sets the time of DC Injection Braking (Zero Speed Control when in CLV) at stop. Used to completely stop a motor with high inertia load after ramp down. Increase the value if the motor still coasts due to inertia after it should have stopped. Disabled when set to 0.00 s.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b2-04 | DC Injection Braking Time at Stop | 0.00 to 10.00 s | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### ■ b2-08: Magnetic Flux Compensation Value

Parameter b2-08 sets the magnetic flux compensation at start as a percentage of the no-load current value (E2-03). This function allows more flux to develop, making it easier to start machines that require high starting torque or motors with a large rotor time constant.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b2-08 | Magnetic Flux Compensation Value | 0 to 1000% | 0% |

When a Run command is issued, the DC current level injected into the motor changes linearly from the level set in b2-08 to E2-03 within the time set to b2-03.

Note that the level of the DC current injected to the motor is limited to 80% of the drive rated current or to the motor rated current, whichever value is smaller.

**Note:**
1. If b2-08 is set below 100%, it can take a relatively long time for flux to develop.
2. If b2-08 is set to 0%, the DC current level will be the DC Injection current set in b2-02.
3. As DC Injection can generate a fair amount of noise, b2-08 may need to be adjusted to keep noise levels acceptable.

## ◆ b3: Speed Search

The Speed Search function allows the drive to detect the speed of a rotating motor shaft that is driven by external forces (e.g., a fan rotating by windmill effect or a motor driven by load inertia). Motor operation can be started directly from the speed detected without needing to stop the machine before.

Example: When a momentary loss of power occurs, the drive output shuts off. This results in a coasting motor. When power returns, the drive can find the speed of the coasting motor and restart it directly.

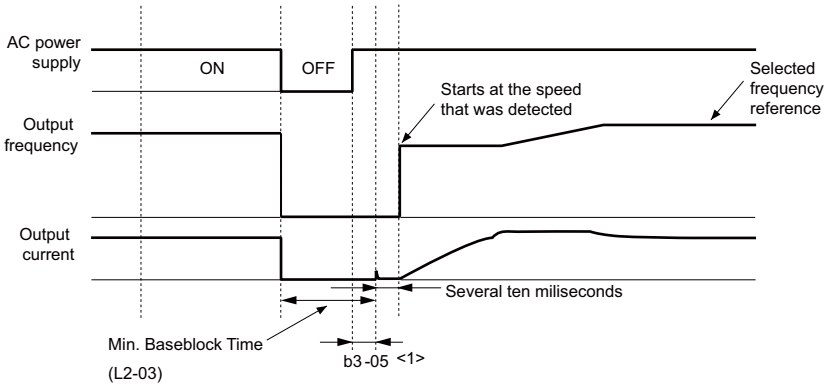
## ■ Speed Estimate Speed Search

This method can be used for a single induction motor connected to a drive. It should not be used if the motor is one or more frame sizes smaller than the drive, at motor speeds above 120 Hz, or when using a single drive to operate more than one motor.

Speed Estimation is executed in two steps as described below.

### Step 1: Back EMF Voltage Estimation

This method is used by Speed Search after short baseblock (e.g., a power loss where the drive's CPU kept running and the Run command was kept active). Here, the drive estimates the motor speed and rotation direction by analyzing the Back EMF voltage. It outputs the estimated rotation direction, frequency, and voltage, and then recovers the voltage using the deceleration rate set in L2-04 to correspond to the V/f pattern selected. After that, the motor is accelerated or decelerated in accordance with the output frequency reference selected. If there is not enough residual voltage in the motor, then the drive will automatically proceed to step 2.




<1> Once AC power is restored, the drive will wait for at least the time set to b3-05. If the power interruption is longer than the minimum baseblock time set to L2-03, the drive will wait until the time set to b3-05 has passed after power is restored before starting Speed Search.

**Figure 2.12 Speed Search after Baseblock**

### Step 2: Current Injection

Current Injection is performed when there is not enough residual voltage remaining in the motor. This might occur after after longer power losses, when Speed Search is applied with the Run command (b3-01 = 1), or if an External search command is used. It injects the DC current set in b3-06 to the motor and detects the speed by measuring the current feedback. The drive recovers the voltage according to the Momentary Power Loss Voltage Recovery Ramp Time set in L2-04 using the estimated output frequency. As long as the drive output current is higher than the level set in b3-02, the output frequency is lowered using the deceleration time set in b3-03. If the current falls below b3-02, the drive assumes that the output frequency and motor speed are synchronized and accelerates or decelerates to the frequency reference.

**Note:** Be aware that sudden acceleration may occur when using this method of Speed Search with relatively light loads.

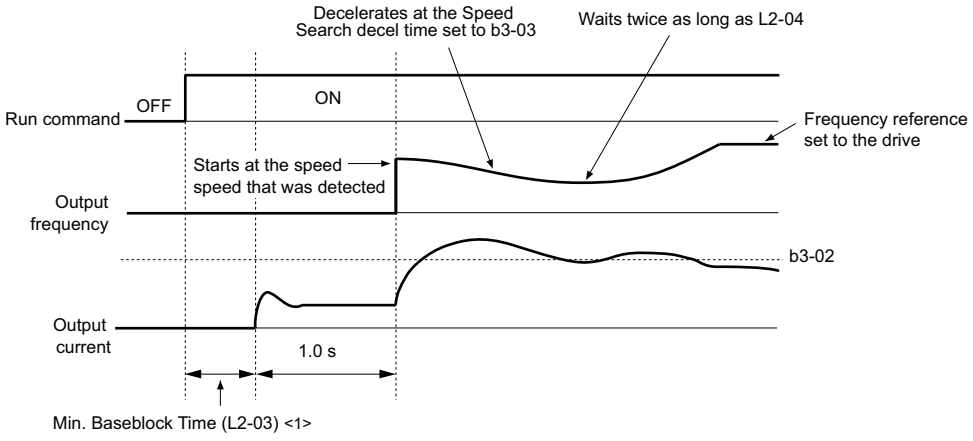



**Figure 2.13 Speed Search at Start**

The wait time for Speed Search (b3-05) determines the lower limit.

### Notes on Using Speed Estimation Speed Search

- Stationary Auto-Tuning for Line-to-Line Resistance (T1-01 = 2) needs to be performed first if you plan to use Speed Estimation in V/f Control. Perform Stationary Auto-Tuning for Line-to-Line Resistance (T1-01 = 2) again if there is a change in the cable length between the drive and motor.
- Use Current Detection Speed Search if a high-speed motor of 120 Hz or greater is used, if the application is running multiple motors from the same drive, or if the motor capacity is considerably smaller than the capacity of the drive.
- Speed Estimation may have trouble finding the actual speed if the motor cable is very long.
- With small-capacity motors of up to 1.5 kW, estimation of motor speed and direction of rotation may not be possible, and the motor may stop during Speed Estimation.

## ■ Activating of Speed Search

Speed Search can be activated as described below.

1. **Automatically activate Speed Search with every Run command.**
   **Here, external Speed Search commands are ignored.**

2. **Activate Speed Search using a contact input (External Search Command).**
   **The following input functions for H1-☐☐ can be used.**

**Table 2.7 Speed Search Activation by Contact Inputs**

| Setting | Name | Function |
|---|---|---|
| 61 | External Search Command 1 | Activate Speed Estimation Speed Search |
| 62 | External Search Command 2 | |

To activate Speed Search by a contact input, the input must always be set together with the Run command, or the Run command must be input after the Speed Search command is given.

3. **After automatic fault restart**
   **When the number of maximum fault restarts in parameter L5-01 is set higher than 0, the drive will automatically perform Speed Search following a fault.**

4. **After momentary power loss**
   This mode requires that the Power Loss Ride-Thru function be enabled always or at least enabled during CPU operation (L2-01 = 1 or 2). For details, refer to *L2-01: Momentary Power Loss Operation Selection on page 198*.

5. **After external baseblock is released**
   **The drive will resume the operation starting with Speed Search if the Run command is ON and the output frequency is above the minimum frequency when the Baseblock command is released.**

## ■ b3-01: Speed Search Selection at Start

Determines if Speed Search is automatically performed when a Run command is issued or not.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-01 | Speed Search Selection at Start | 0 or 1 | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### Setting 0: Disabled

When the Run command is input, the drive starts operating at the minimum output frequency. If external Speed Search 1 or 2 is already enabled by a contact input, the drive will start operating with Speed Search.

### Setting 1: Enabled

Speed Search is performed whenever the Run command is input. The drive begins running the motor once Speed Search is complete.

## ■ b3-02: Speed Search Deactivation Current

Sets the operating current for Speed Search as a percentage of the drive rated current. Normally there is no need to change this setting. If the drive has trouble restarting, try lowering this value.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-02 | Speed Search Deactivation Current | 0 to 200% | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

## ■ b3-03: Speed Search Deceleration Time

Parameter b3-03 sets the output frequency reduction ramp. The time entered into b3-03 will be the time to decelerate from maximum frequency (E1-04) to minimum frequency (E1-09).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-03 | Speed Search Deceleration Time | 0.1 to 10.0 s | 5.0 s |

## ■ b3-04: V/f Gain during Speed Search

During Speed Search, the output voltage calculated from the V/f pattern is multiplied by the value set in parameter b3-04. Changing this setting can be useful in order to reduce the output current during Speed Search.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-04 | V/f Gain during Speed Search | 10 to 100% | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ b3-05 Speed Search Delay Time (Speed Estimation)

In cases where an output contactor is used between the drive and the motor, the contactor must be closed before Speed Search can be performed. This parameter can be used to delay the Speed Search operation, giving the contactor enough time to close completely.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-05 | Speed Search Delay Time (Speed Estimation) | 0.0 to 100.0 s | 0.2 s |

## ■ b3-06: Output Current 1 during Speed Search (Speed Estimation)

Sets the current injected to the motor at the beginning of Speed Estimation Speed Search as a factor of the motor rated current set in E2-01 (E4-01 for motor 2). If the motor speed is relatively slow when the drive starts to perform Speed Search after a long period of baseblock, it may be helpful to increase the setting value. The output current during Speed Search is automatically limited by the drive rated current.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-06 | Output Current 1 during Speed Search (Speed Estimation) | 0.0 to 2.0 | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

**Note:** If Speed Estimation is not working correctly even after adjusting b3-06, try using the Current Injection step in Speed Estimation Speed Search instead. For details, refer to *Step 2: Current Injection on page 104*.

## ■ b3-07: Output Current 2 during Speed Search (Speed Estimation)

Sets the current injected to the motor at the beginning of Speed Estimation Speed Search as a factor of the motor rated current set in E2-01 (E4-01 for motor 2).
If, when a Speed Estimation search is performed, the estimation result is the minimum output frequency, increase the set value in increments of 0.1.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-07 | Output Current 2 during Speed Search (Speed Estimation) | 0.0 to 3.0 | 2.0 |

## ■ b3-10: Speed Search Detection Compensation Gain (Speed Estimation)

This parameter sets the gain for the detected motor speed of the Speed Estimation Speed Search. The setting should be increased only if an overvoltage fault occurs when the drive restarts the motor.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-10 | Speed Search Detection Compensation Gain (Speed Estimation) | 1.00 to 1.20 | 1.05 |

## ■ b3-11: Speed Search Method Switching Level (Speed Estimation)

This parameter sets the switching level when the search method is automatically selected in accordance with the size of the motor's residual voltage.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-11 | Speed Search Method Switching Level (Speed Estimation) | 0.5 to 100.0 | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ b3-17: Speed Search Restart Current Level

A large current can flow into the drive if there is a fairly large difference between the estimated frequency and the actual motor speed when performing Speed Estimation. This parameter sets the current level at which Speed Estimation is restarted, thus avoiding overcurrent and overvoltage problems. Set as a percentage of the drive rated current.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-17 | Speed Search Restart Current Level | 0 to 200% | 120% |

## ■ b3-18: Speed Search Restart Detection Time

Sets the time that the current must be greater than the level set in b3-17 before Speed Search can be restarted.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-18 | Speed Search Restart Detection Time | 0.00 to 1.00 s | 0.10 s |

## ■ b3-19: Number of Speed Search Restarts

Sets the number of times the drive should attempt to find the speed and restart the motor. If the number of restart attempts exceeds the value set to b3-19, the SEr fault will occur and the drive will stop.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-19 | Number of Speed Search Restarts | 0 to 10 | 3 |

## ■ b3-25: Speed Search Wait Time

Sets the wait time between Speed Search restarts. Increase the wait time if problems occur with overcurrent, overvoltage, or if the SEr fault occurs.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-25 | Speed Search Wait Time | 0.0 to 30.0 s | 0.5 s |

## ■ b3-30: Torque Compensation Time Constant during Speed Search

This parameter sets the primary delay time of the torque compensation function during Speed Search, in ms units.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-30 | Torque Compensation Time Constant during Speed Search | 0 to 10000 ms | 10 ms |

## ■ b3-31: Current Suppression Start Level during Voltage Recovery

This parameter sets the level at which to start the operation to extend the voltage recovery time in order to suppress the current when the voltage is recovered during Speed Search. The setting is made by taking the motor's no-load current to be 1.0.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-31 | Current Suppression Start Level during Voltage Recovery | 0.0 to 5.0 | 1.5 |

## ■ b3-32: Current Suppression Time Constant during Voltage Recovery

This parameter sets the time constant for filtering of the level for extending the voltage recovery time in order to suppress the current when the voltage is recovered during Speed Search.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-32 | Current Suppression Time Constant during Voltage Recovery | 0 to 100 ms | 5 ms |

## ■ b3-33: Recovery Waiting Time after Speed Search Completion

This parameter sets the waiting time between the end of Speed Search and the switch to normal control. The frequency reference is maintained during this time.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-33 | Recovery Waiting Time after Speed Search Completion | 0.00 to 5.00 s | 95.0 |

## ■ b3-34: Software CLA Current Limit Value 1 during Speed Search

This parameter sets the software's current limit value during Speed Search as a percentage of the motor's rated current.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-34 | Software CLA Current Limit Value 1 during Speed Search | 0.0 to 300.0% | 100.0% |

## ■ b3-35: Software CLA Current Limit Value 2 during Speed Search

This parameter sets the current limit value for the software when the frequency reference is 0 Hz during Speed Search as a percentage of the motor rating.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b3-35 | Software CLA Current Limit Value 2 during Speed Search | 0.0 to 300.0% | 90.0% |

## ◆ b4: Delay Timers

The timer function is independent of drive operation and can be used to delay the switching of a contact output triggered by a contact input signal. An on-delay and off-delay can be separately set. The delay timer can help to get rid of chattering switch noise from sensors.

To enable the timer function, a contact input must be set to “Timer input” (H1-□□=18) and a contact output must be set to “Timer output” (H2-□□=12). One timer can be used only.

### ■ b4-01, b4-02: Timer Function On-Delay, Off-Delay Time

Parameter b4-01 sets the on-delay time for switching the timer output. Parameter b4-02 sets the off-delay time for switching the timer output.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b4-01 | Timer Function On-Delay Time | 0.0 to 3000.0 s | 0.0 s |
| b4-02 | Timer Function Off-Delay Time | 0.0 to 3000.0 s | 0.0 s |

### ■ Timer Function Operation

When the timer function input closes for longer than the value set in b4-01, the timer output switches on. When the timer function input is open for longer than the value set in b4-02, the timer output function switches off. The following diagram demonstrates the timer function operation.

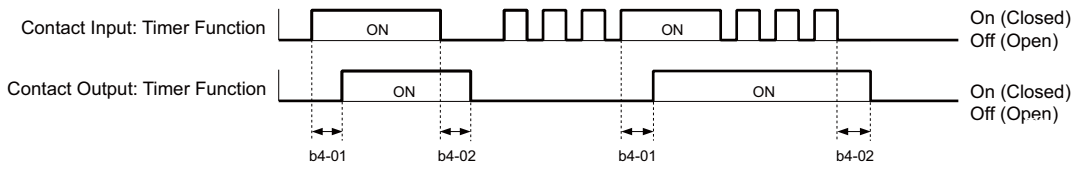



**Figure 2.14 Timer Operation**

## ◆ b5: PID Control

The PID controller matches the feedback value (detected value) to the target value. Proportional (P), Integral (I), and D (Derivative) combination control is also available for machinery applications in which a loss time occurs.

### ■ P Control

The output of P control is the product of the deviation and the P gain so that it follows the deviation directly and linearly. With P control, only an offset between the target and feedback remains.

### ■ I Control

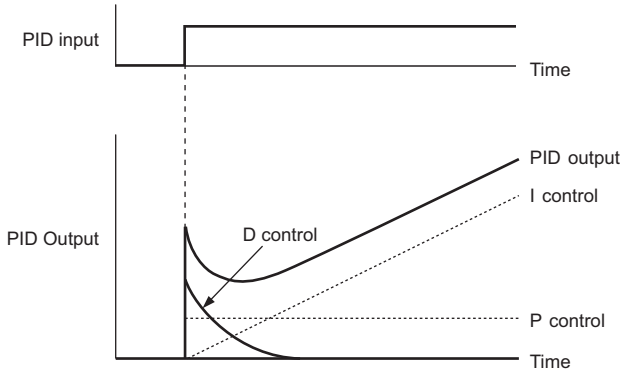
The output of I control is the integral of the deviation. It matches the feedback value to the target value. When the target value changes rapidly, this control is lost.

### ■ D Control

D control predicts the deviation signal by multiplying its derivative (slope of the deviation) by a time constant, then adds this value to the PID input. This way the D portion of a PID controller provides a braking action on the controller response and can reduce the tendency to oscillate and overshoot.
Be aware that D control tends to amplify noise on the deviation signal, which can result in control instability. D control should therefore only be used when necessary.

### ■ PID Operation

To better demonstrate how PID works, the diagram below shows how the PID output changes when the PID input (deviation) jumps from 0 to a constant level.




### ■ Using PID Control

Applications for PID control are listed in the table below.

| Application | Description | Sensors Used |
|---|---|---|
| Speed Control | Machinery speed is fed back and adjusted to meet the target value.<br>Synchronous control is performed using speed data from other machinery as the target value | Tachometer |
| Pressure | Maintains constant pressure using pressure feedback. | Pressure sensor |
| Fluid Control | Keeps flow at a constant level by feeding back flow data. | Flow rate sensor |
| Temperature Control | Maintains a constant temperature by controlling a fan with a thermostat. | Thermocoupler, Thermistor |

## ■ PID Setpoint Input Methods

The PID setpoint input depends on the PID function setting in parameter b5-01.
If parameter b5-01 is set to 1 or 2, the frequency reference in b1-01 (or b1-15) or one of the inputs listed in *Table 2.8* becomes the PID setpoint.
If b5-01 is set to 3 or 4, then the PID setpoint can be input from one of the sources listed in *Table 2.8*.

**Table 2.8 PID Setpoint Sources**

| PID Setpoint Sources | Setting |
|---|---|
| Analog input 1 | Set H3-02 = C |
| Analog input 2 | Set H3-10 = C |
| MEMOBUS/Modbus Register 0006H | Set bit 1 in register 000FH to 1 and input the setpoint to register 0006H |
| Parameter b5-19 | Set parameter b5-18 = 1 and input the PID setpoint to b5-19 |

**Note:** A duplicate allocation of the PID setpoint input will result in an oPE alarm.

## ■ PID Feedback Input Methods

Either one feedback signal can be input for normal PID control, or two feedback signals can be input to control a differential process value.

### Normal PID Feedback

The PID feedback signal can be input from one of the sources listed below.

**Table 2.9 PID Feedback Source**

| PID Feedback Source | Setting |
|---|---|
| Analog input 1 | Set H3-02 = B |
| Analog input 2 | Set H3-10 = B |

**Note:** A duplicate allocation of the PID feedback input will result in an oPE alarm.

### Differential Feedback

The second PID feedback signal for differential feedback can come from the sources listed below. The differential feedback function is automatically enabled when a differential feedback input is assigned.

**Table 2.10 PID Differential Feedback Sources**

| PID Differential Feedback Source | Setting |
|---|---|
| Analog input 1 | Set H3-02 = 16 |
| Analog input 2 | Set H3-10 = 16 |

**Note:** A duplicate allocation of the PID differential feedback input will result in an oPE alarm.

## ■ PID Block Diagram

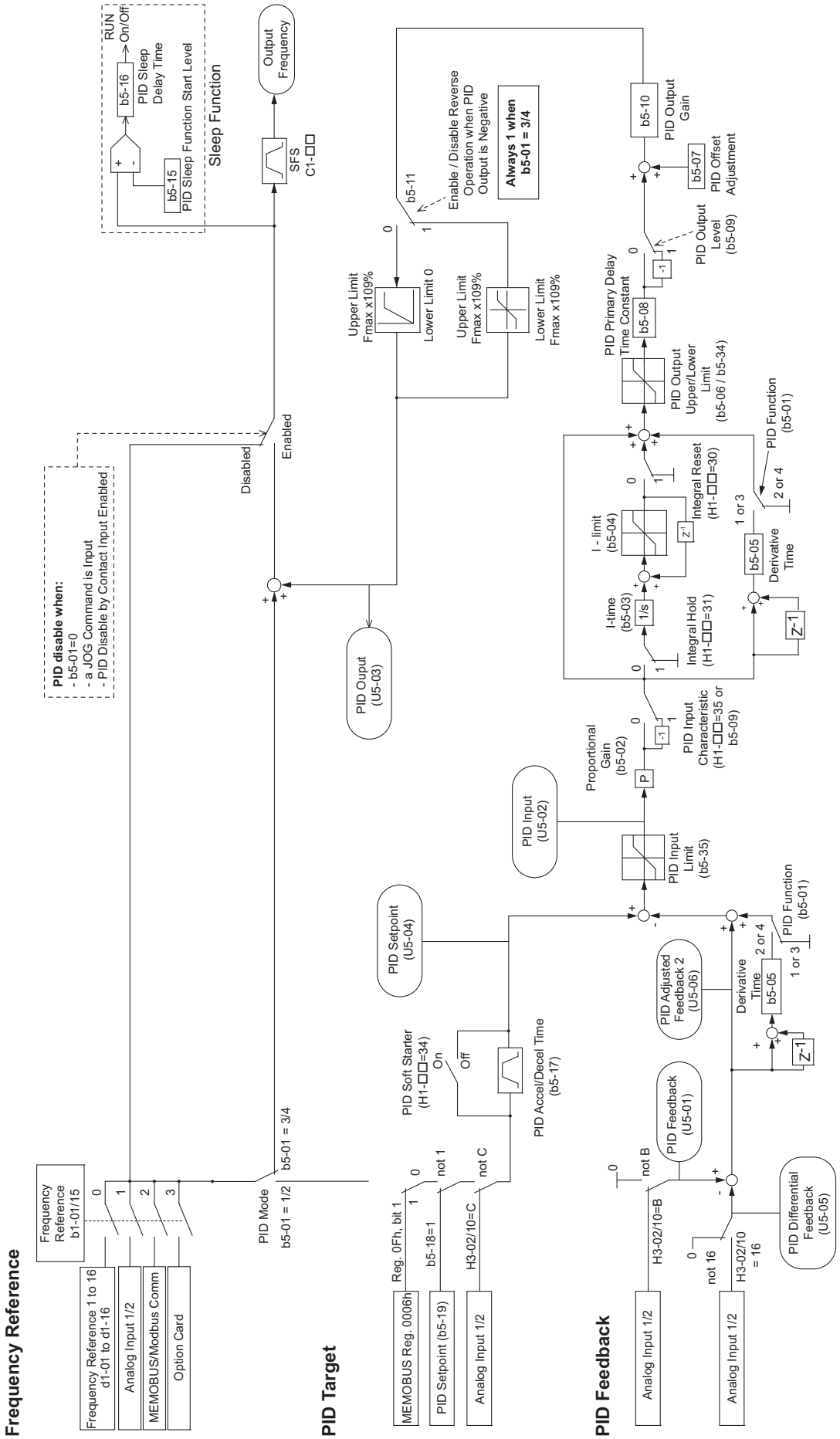



**Figure 2.15 PID Block Diagram**

## ■ b5-01: PID Function Setting

Enables or disables PID operation and selects the PID operation mode.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-01 | PID Function Setting | 0 to 4 | 0 |

**Setting 0: PID disabled**

**Setting 1: Output frequency = PID output 1**

The PID controller is enabled and the PID output builds the frequency reference. The PID input is D controlled.

**Setting 2: Output frequency = PID output 2**

The PID controller is enabled and the PID output builds the frequency reference. The PID feedback is D controlled.

**Setting 3: Output frequency = frequency reference + PID output 1**

The PID controller is enabled and the PID output is added to the frequency reference. The PID input is D controlled.

**Setting 4: Output frequency = frequency reference + PID output 2**

The PID controller is enabled and the PID output is added to the frequency reference. The PID feedback is D controlled.

## ■ b5-02: Proportional Gain Setting (P)

Sets the P gain that is applied to the PID input. A large value will tend to reduce the error, but may cause instability (oscillations) if set too high. A low value may allow too much offset between the setpoint and feedback.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-02 | Proportional Gain Setting (P) | 0.00 to 25.00 | 1.00 |

## ■ b5-03: Integral Time Setting (I)

Sets the time constant that is used to calculate the integral of the PID input. The smaller the integral time set in b5-03, the faster the offset will be eliminated. If set too short, it can cause overshoot or oscillation. To turn off the integral time, set b5-03 = 0.00.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-03 | Integral Time Setting (I) | 0.0 to 360.0 s | 1.0 s |

## ■ b5-04: Integral Limit Setting

Sets the maximum output possible from the integral block. Set as a percentage of the maximum frequency (E1-04).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-04 | Integral Limit Setting | 0.0 to 100.0% | 100.0% |

**Note:** On some applications, especially those with rapidly varying loads, the output of the PID function may show a fair amount of oscillation. To suppress this oscillation, a limit can be applied to the integral output by programming b5-04.

## ■ b5-05: Derivative Time (D)

Sets the time the drive predict the PID input/PID feedback signal based on the derivative of the PID input/PID feedback. Longer time settings will improve the response but can cause vibrations. Shorter settings will reduce the overshoot but also reduce the controller responsiveness. D control is disabled by setting b5-05 to zero seconds.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-05 | Derivative Time (D) | 0.00 to 10.00 s | 0.00 s |

## ■ b5-06: PID Output Limit

Sets the maximum output possible from the entire PID controller. Set as a percentage of the maximum frequency (E1-04).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-06 | PID Output Limit | 0.0 to 100.0% | 100.0% |

## ■ b5-07: PID Offset Adjustment

Sets the offset added to the PID controller output. Set as a percentage of the maximum frequency.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-07 | PID Offset Adjustment | -100.0 to 100.0% | 0.0% |

## ■ b5-08: PID Primary Delay Time Constant

Sets the time constant for the filter applied to the output of the PID controller. Normally, change is not required.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-08 | PID Primary Delay Time Constant | 0.00 to 10.00 s | 0.00 s |

**Note:** Useful when there is a fair amount of oscillation or when rigidity is low. Set to a value larger than the cycle of the resonant frequency. Increasing this time constant may reduce the responsiveness of the drive.

## ■ b5-09: PID Output Level Selection

Normally a positive PID input (feedback smaller than setpoint) leads to positive PID output. Parameter b5-09 can be used to reverse the sign of the PID controller output signal.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-09 | PID Output Level Selection | 0 or 1 | 0 |

**Setting 0: Normal Output**

A negative PID input causes an increase in the PID output (direct action).

**Setting 1: Reverse Output**

A positive PID input causes a decrease in the PID output (reverse action).

## ■ b5-10: PID Output Gain Setting

Applies a gain to the PID output and can be helpful when the PID function is used to trim the frequency reference (b5-01 = 3 or 4).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-10 | PID Output Gain Setting | 0.00 to 25.00 | 1.00 |

## ■ b5-11: PID Output Reverse Selection

Determines whether a negative PID output reverses the direction of drive operation or not. When the PID function is used to trim the frequency reference (b5-01 = 3 or 4), this parameter has no effect and the PID output will not be limited (same as b5-11 = 1).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-11 | PID Output Reverse Selection | 0 or 1 | 0 |

**Setting 0: Reverse Disabled**

Negative PID output will be limited to 0 and the drive output will be stopped.

**Setting 1: Reverse Enabled**

Negative PID output will cause the drive to run in the opposite direction.

## ■ PID Feedback Loss Detection

The PID feedback loss detection function can detect broken sensors or broken sensor wiring. It should be used whenever PID control is enabled to prevent critical machine conditions (e.g., acceleration to max. frequency) caused by a feedback loss.

Feedback loss can be detected in two ways:

- Feedback Low Detection
  Detected when the feedback falls below a certain level for longer than the specified time. This function is set up using parameters b5-12 to b5-14.
- Feedback High Detection
  Detected when the feedback rises beyond a certain level for longer than the specified time. This function is set up using parameters b5-12, b5-36, and b5-37.

The following figure explains the working principle of feedback loss detection when the feedback signal is too low. Feedback high detection works in the same way.

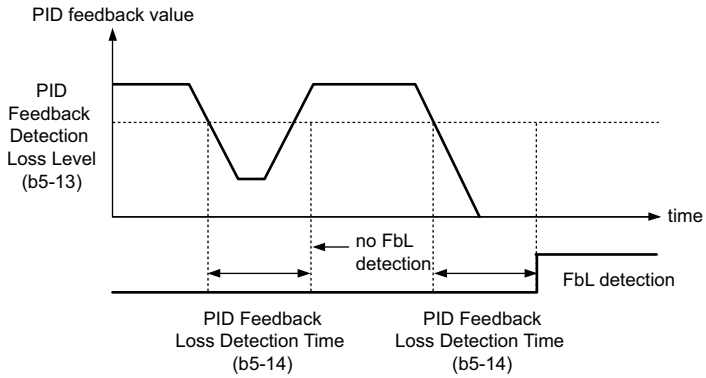



**Figure 2.16 PID Feedback Loss Detection**

Set parameters b5-12 to b5-14 to perform feedback loss detection and parameters b5-12, b5-36 and b5-37 to perform feedback high detection.

## ■ b5-12: 1PID Feedback Loss Detection Selection

Enables or disables the feedback loss detection and sets the operation when a feedback loss is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-12 | PID Feedback Loss Detection Selection | 0 to 5 | 0 |

**Setting 0: Contact output only**

A contact output set for "PID feedback low" (H2-☐☐ = 3E) will be triggered if the PID feedback value is below the detection level set to b5-13 for the time set to b5-14 or longer. A contact output set for "PID feedback high" (H2-☐☐ = 3F) will be triggered if the PID feedback value is beyond the detection level set to b5-36 for longer than the times set to b5-37. Neither a fault nor an alarm is displayed on the digital operator. The drive will continue operation. When the feedback value leaves the loss detection range, the output is reset.

**Setting 1: Feedback Loss Alarm**

If the PID feedback value falls below the level set to b5-13 for longer than the time set to b5-14, a "FBL - Feedback Low" alarm will be displayed and a contact output set for "PID feedback low" (H2-☐☐ = 3E) will be triggered. If the PID feedback value exceeds the level set to b5-36 for longer than the time set to b5-37, a "FBH - Feedback High" alarm will be displayed and a contact output set for "PID feedback high" (H2-☐☐ = 3F) will be triggered. Both events trigger an alarm output (H1-☐☐ = 10). The drive will continue operation. When the feedback value leaves the loss detection range, the alarm and outputs are reset.

**Setting 2: Feedback Loss Fault**

If the PID feedback value falls below the level set to b5-13 for longer than the time set in b5-14, a "FbL - Feedback Low" fault will be displayed.

If the PID feedback value exceeds the level set to b5-36 for longer than the time set in b5-37, a "FbH - Feedback High" fault will be displayed.

Both events trigger a fault output (H2-☐☐ = E) and cause the drive to stop the motor.

**Setting 3: Contact output only, even if PID is disabled by contact input**

Same as b5-12 = 0. Detection is still active even if PID is disabled by a contact input (H1-☐☐ = 19).

**Setting 4: Feedback loss alarm, even if PID is disabled by contact input**

Same as b5-12 = 1. Detection is still active even if PID is disabled by a contact input (H1-☐☐ = 19).

**Setting 5: Feedback loss fault, even if PID is disabled by contact input**

Same as b5-12 = 2. Detection is still active even if PID is disabled by a contact input (H1-☐☐ = 19).

## ■ b5-13: PID Feedback Low Detection Level

Sets the feedback level used for PID feedback low detection. The PID feedback has to fall below this level for longer than the time b5-14 before feedback loss is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-13 | PID Feedback Loss Detection Level | 0 to 100% | 0% |

## ■ b5-14: PID Feedback Low Detection Time

Sets the time that the PID feedback has to fall below b5-13 before feedback loss is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-14 | PID Feedback Loss Detection Time | 0.0 to 25.5 s | 1.0 s |

## ■ b5-36: PID Feedback High Detection Level

Sets the feedback level used for PID feedback high detection. The PID feedback has to exceed this level for longer than the time b5-37 before feedback loss is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-36 | PID Feedback High Detection Level | 0 to 100% | 100% |

## ■ b5-37: PID Feedback High Detection Time

Sets the time for that the PID feedback has to exceed b5-36 before feedback loss is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-37 | PID Feedback High Detection Time | 0.0 to 25.5 s | 1.0 s |

## ■ PID Sleep

The PID Sleep function stops the drive when the PID output or the frequency reference falls below the PID Sleep operation level for a certain time. The drive will resume operating once the PID output or frequency reference rises above the PID Sleep operation level for the specified time.

An example of PID Sleep operation appears in the figure below.

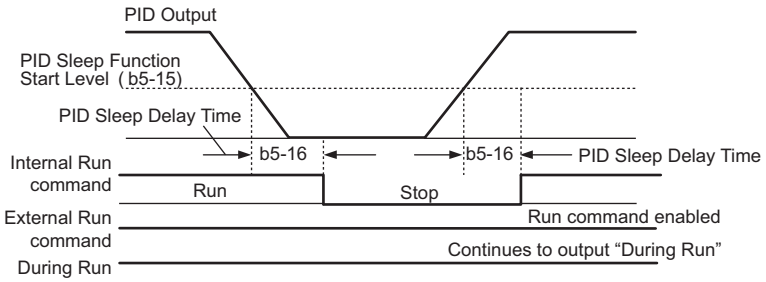



**Figure 2.17 PID Sleep Operation**

**Notes on using the PID Sleep function**

- The PID Sleep function is always active, even if PID control is disabled.
- The PID Sleep function stops the motor according to the stopping method in b1-03.

The parameters necessary that control the PID Sleep function are explained below.

## ■ b5-15: PID Sleep Function Start Level

Sets the level that triggers PID Sleep.

The drive goes into Sleep mode if the PID output or frequency reference is smaller than b5-15 for longer than the time set in b5-16. It resumes operation when the PID output or frequency reference is above b5-15 for longer than the time set in b5-16.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-15 | PID Sleep Function Start Level | 0.0 to 120.0 Hz | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

## ■ b5-16: PID Sleep Delay Time

Sets the delay time for activation or deactivation of the PID Sleep function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-16 | PID Sleep Delay Time | 0.0 to 25.5 s | 0.0 s |

## ■ b5-17: PID Accel/Decel Time

The PID acceleration/deceleration time is applied on the PID setpoint value.

As the normal acceleration times C1-☐☐ are applied after the PID output, they reduce the responsiveness of the system and can cause hunting or overshoot and undershoot when the setpoint changes quickly. Using the PID acceleration/deceleration time instead helps to avoid such problems.

The PID acceleration/deceleration time can be canceled using a contact input programmed for “PID SFS cancel” (H1-☐☐ = 34).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-17 | PID Accel/Decel Time | 0.0 to 6000.0 s | 0.0 s |

## ■ b5-18: PID Setpoint Selection

Enables or disables parameter b5-19 for the PID setpoint.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-18 | PID Setpoint Selection | 0 or 1 | 0 |

**Setting 0: Disabled**

Parameter b5-19 is not used as the PID setpoint.

**Setting1: Enabled**

Parameter b5-19 is used as the PID setpoint.

## ■ b5-19: PID Setpoint Value

Used as the PID setpoint if parameter b5-18 = 1.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-19 | PID Setpoint Value | 0.00 to 100.00% | 0.00% |

## ■ b5-20: PID Setpoint Scaling

Determines the units that the PID setpoint (b5-19) is set in and displayed. Also determines the units for monitors U5-01 and U5-04.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-20 | PID Setpoint Scaling | 0 to 3 | 1 |

**Setting 0: 0.01 Hz units**

The setpoint and PID monitors are displayed in Hz with a resolution of 0.01 Hz.

**Setting 1: 0.01% units (100% = max. output frequency)**

The setpoint and PID monitors are displayed as a percentage with a resolution of 0.01%.

**Setting 2: r/min**

The setpoint and PID monitors are displayed in r/min with a resolution of 1 r/min.

**Setting 3: User Defined**

Parameters b5-38 and b5-39 determine the units and resolution used to display the values the setpoint in b5-19, and PID monitors U1-01 and U1-04.

## ■ b5-34: PID Output Lower Limit

Sets the minimum possible PID controller output as a percentage of the maximum output frequency (E1-04). The lower limit is disabled when set to 0.00%

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-34 | PID Output Lower Limit | -100.0 to 100.0% | 0.0% |

## ■ b5-35: PID Input Limit

Sets the maximum allowed PID input as a percentage of the maximum output frequency (E1-04). Parameter b5-35 acts as a bipolar limit.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-35 | PID Input Limit | 0 to 1000.0% | 1000.0% |

## ■ b5-38, b5-39: PID Setpoint User Display, PID Setpoint Display Digits

When parameter b5-20 is set to 3, the parameters b5-38 and b5-39 can be used to set a user-defined display of the PID setpoint values and units for PID feedback monitors (U5-01, U5-04).

Parameter b5-38 determines the display value when the maximum frequency is output. Parameter b5-39 determines the number of digits. The setting value is equal to the number of decimal places.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-38 | PID Setpoint User Display | 1 to 60000 | Determined by b5-20 |
| b5-39 | PID Setpoint Display Digits | 0 to 3 | Determined by b5-20 |

## ■ b5-40: Frequency Reference Monitor Content During PID

Sets the content of the frequency reference monitor display (U1-01) when PID control is active.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b5-40 | Frequency Reference Monitor Content during PID | 0 or 1 | 0 |

**Setting 0: Frequency Reference after PID**

Monitor U1-01 displays the frequency reference increased or reduced for the PID output.

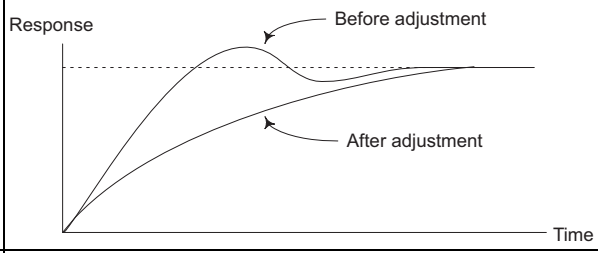
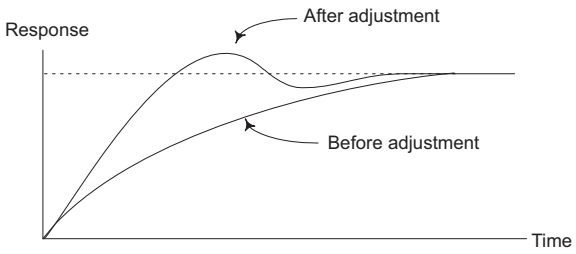
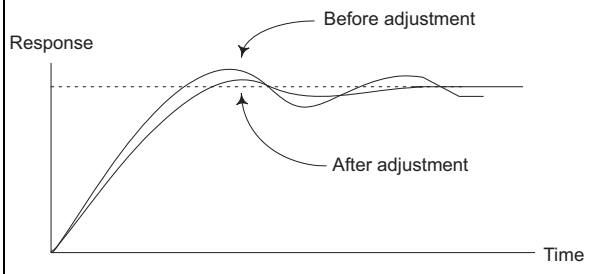
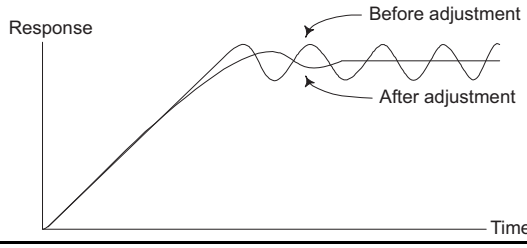
**Setting 1: Frequency Reference**

Monitor U1-01 displays the frequency reference value.

## ■ Fine-Tuning PID

Once PID control parameters have been set, fine-tuning may be required. Follow the directions below.

**Table 2.11 PID Fine Tuning**

| Goal | Tuning Procedure | Result |
|---|---|---|
| Overshoot must be suppressed | • Reduce the derivative time (b5-05)<br>• increase the integral time (b5-03) |  |
| Quickly achieve stability, and some overshoot is permissible | • Decrease the integral time (b5-03)<br>• Increase the derivative time (b5-05) |  |
| Suppress long cycle oscillations (longer than the integral time setting) | • Increase the integral time (b5-03) |  |
| Suppress short cycle oscillations | • If oscillation cycle time is close to the derivative time, the derivative part is likely having too much influence. Reduce the derivative time (b5-05).<br>• If the derivative time is set to 0.00 s and oscillations are still a problem, try reducing the proportional gain (b5-02) or try increasing the PID primary delay time (b5-08) |  |

## ◆ b6: Dwell Function

The Dwell function is used to temporarily hold the frequency reference at a predefined value for a set time, then continue accelerating or decelerating.
The Dwell function can help prevent speed loss when starting and stopping a heavy load.
The figure below shows how the Dwell function works.

**Note:** Using the Dwell function requires that the stopping method for the drive be set to “Ramp to stop” (b1-03 = 0).

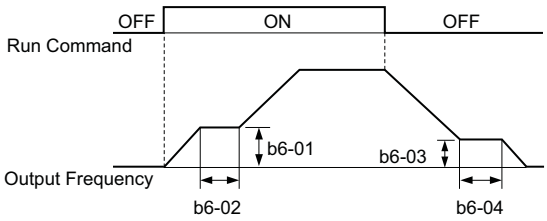



**Figure 2.18 Dwell Function at Start and Stop**

### ■ b6-01, b6-02: Dwell Reference, Dwell Time at Start

Parameter b6-01 determines the frequency that is held for the time set in b6-02 during acceleration.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b6-01 | Dwell Reference at Start | 0.0 to 120.0 Hz <1> | Determined by A1-02 <2> |
| b6-02 | Dwell Time at Start | 0.0 to 10.0 s | 0.0 s |

<1> The upper limit is determined by the maximum output frequency (E1-04) and upper limit for the frequency reference (d2-01).
<2> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### ■ b6-03, b6-04: Dwell Reference, Dwell Time at Stop

Parameter b6-03 determines the frequency that is held for the time set in b6-04 during deceleration.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b6-03 | Dwell Reference at Stop | 0.0 to 120.0 Hz <1> | Determined by A1-02 <2> |
| b6-04 | Dwell Time at Stop | 0.0 to 10.0 s | 0.0 s |

<1> Range upper limit is determined by the maximum output frequency (E1-04) and the upper limit of the frequency reference (d2-01).
<2> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

## ◆ b7: Droop Control (CLV)

Droop control can automatically balance the load level between two motors that drive the same load, such as in a traverse cranes applications. It must be activated in one of the two drives that control these motors. The drive in which Droop control is activated will automatically reduce the speed if the torque reference rises, and increase the speed if the torque reference falls again, thereby shifting the load from one motor to the other.

**Note:** Disable Feed Forward (n5-01 = 0) whenever using Droop control.

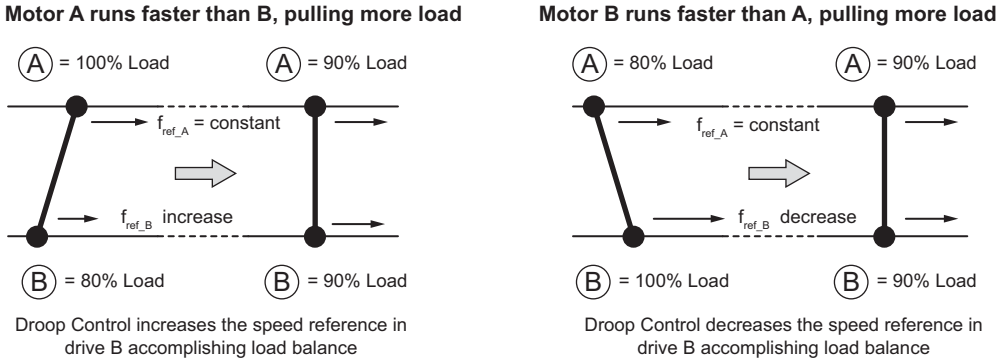



**Figure 2.19 Droop Control in a Traverse Application**

### ■ b7-01: Droop Control Gain

Sets the amount of speed reduction when the torque reference is 100%. The gain is set as a percentage of the maximum output frequency. A setting of 0.0% disables the Droop control function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b7-01 | Droop Control Gain | 0.0 to 100.0% | 0.0% |

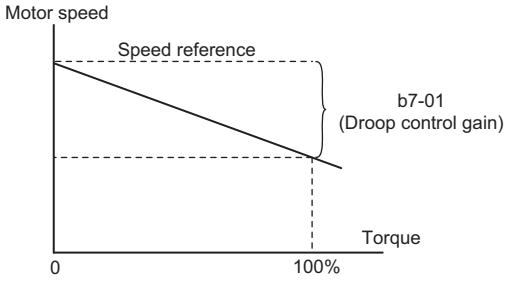



**Figure 2.20 Droop Control Gain**

### ■ b7-02: Droop Control Delay Time

The setting in b7-02 adjusts the responsiveness of Droop control. Reduce the setting if the reaction time is too long, and increase it if hunting occurs.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b7-02 | Droop Control Delay Time | 0.03 to 2.00 s | 0.05 s |

### ■ b7-03: Droop Control Limit Selection

Enables or disables the droop control limit.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| b7-03 | Droop Control Limit Selection | 0 or 1 | 1 |

**Setting 0: Disabled**
**Setting 1: Enabled**

# 2.3 C: Tuning

C parameters are used to set the acceleration and deceleration characteristics, as well as S-curves. Other parameters in this group cover settings for slip compensation and torque compensation.

## ◆ C1: Acceleration and Deceleration Times

### ■ C1-01 to C1-08: Accel, Decel Times 1 to 4

Four different sets of acceleration and deceleration times can be set in the drive. They can be selected by contact inputs, by the motor selection, or can be switched automatically. Acceleration time parameters always set the time to accelerate from 0 Hz to the maximum output frequency (E1-04). Deceleration time parameters always set the time to decelerate from maximum output frequency to 0 Hz. C1-01 and C1-02 are the default active accel/decel settings.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C1-01 | Acceleration Time 1 | 0.0 to 6000.0 s <1> | 60.0 s |
| C1-02 | Deceleration Time 1 | | 120.0 s |
| C1-03 | Acceleration Time 2 | | 60.0 s |
| C1-04 | Deceleration Time 2 | | 120.0 s |
| C1-05 | Acceleration Time 3 (Motor 2 Accel Time 1) | | 60.0 s |
| C1-06 | Deceleration Time 3 (Motor 2 Decel Time 1) | | 120.0 s |
| C1-07 | Acceleration Time 4 (Motor 2 Accel Time 2) | | 60.0 s |
| C1-08 | Deceleration Time 4 (Motor 2 Decel Time 2) | | 120.0 s |

<1> The setting range for the acceleration and deceleration times is determined by the acceleration/deceleration time setting units in C1-10. For example, if the time is set in units of 0.01 s (C1-10 = 0), the setting range becomes 0.00 to 600.00 s.

#### Switching Acceleration Times by Contact Input

Accel/decel times 1 are active by default if no input is set. The accel/decel times 2, 3, and 4 can be activated by contact inputs (H1-□□ = 7 and 1A) as explained in ***Table 2.12***.

**Table 2.12 Accel/Decel Time Selection by Contact Input**

| Accel/Decel Time Sel. 1 H1-□□ = 7 | Accel/Decel Time Sel. 2 H1-□□ = 1A | Active Times | |
|---|---|---|---|
| | | Acceleration | Deceleration |
| 0 | 0 | C1-01 | C1-02 |
| 1 | 0 | C1-03 | C1-04 |
| 0 | 1 | C1-05 | C1-06 |
| 1 | 1 | C1-07 | C1-08 |

***Figure 2.21*** shows an operation example for changing accel/decel. times. The example below requires that the stopping method be set for “Ramp to stop” (b1-03 = 0).

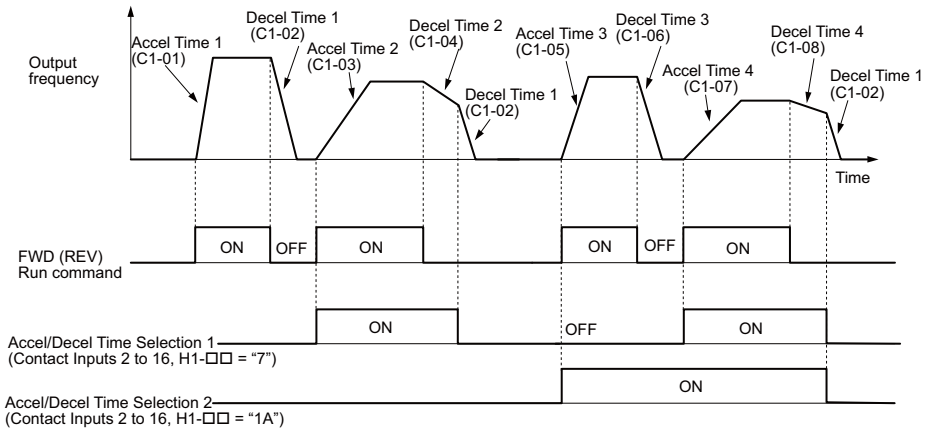



**Figure 2.21 Timing Diagram of Accel/Decel Time Change**

### Switching Acceleration and Deceleration Times by Motor Selection

When switching between motor 1 and 2 using a contact input (H1-☐☐= 16), parameters C1-01 to C1-04 become accel/decel time 1 and 2 for motor 1, while C1-05 to C1-08 become accel/decel time 1 and 2 for motor 2. Accel/decel times 1 and 2 can be switched for each motor using a contact inputs set to H1-☐☐ = 7 like shown in *Table 2.13*.

**Note:** **1.** The motor 2 selection function cannot be used when PM motor is used.
**2.** The contact input setting "Accel/Decel time 2 selection" (H1-☐☐ = 1A) cannot be used together with motor 1/2 switching. Trying to do so triggers an oPE03 error, indicating a contradictory multifunction input settings.

**Table 2.13 Motor Switching and Accel/Decel Time Combinations**

| Accel/Decel Time 1 (H1-☐☐ = 7) | Motor 1 Selected (Terminal set to H1-☐☐=16 OFF) | | Motor 2 Selected (Terminal set to H1-☐☐=16 ON) | |
|---|---|---|---|---|
| | Accel | Decel | Accel | Decel |
| Open | C1-01 | C1-02 | C1-05 | C1-06 |
| Closed | C1-03 | C1-04 | C1-07 | C1-08 |

### Switching Accel/Decel Times by a Frequency Level

The drive can switch between different acceleration and deceleration times automatically. The drive will switch from accel/decel time 4 in C1-07 and C1-08 to the default accel/decel time in C1-01 and C1-02 (C1-05 and C1-06 for motor 2) when the output frequency exceeds the frequency level set in parameter C1-11. When it falls below this level, the accel/decel times are switched back. *Figure 2.22* shows an operation example.

**Note:** Acceleration and deceleration times selected by contact inputs have priority over the automatic switching by the frequency level set to C1-11. For example, if accel/decel time 2 is selected, the drive will use this time only and not switch from accel/decel time 4 to the selected one.

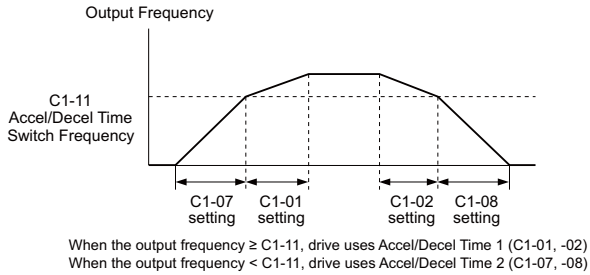



**Figure 2.22 Accel/Decel Time Switching Frequency**

## ■ C1-11: Accel/Decel Time Switching Frequency

Sets the frequency at which the drive switches between accel/decel time settings. Refer to *Switching Accel/Decel Times by a Frequency Level on page 124*.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C1-11 | Accel/Decel Time Switching Frequency | 0.0 to 120.0 Hz | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

**Note:** Setting C1-11 to 0.0 Hz (0.0%) disables this function.

### ■ C1-09: Fast Stop Time

Parameter C1-09 sets a special deceleration that is used when certain faults occur or that can be operated by closing a contact input configured as H1-☐☐ = 15 (N.O. input) or 17 (N.C. input). The input does not have to be closed continuously, even a momentary closure will trigger the Fast Stop operation. Unlike standard deceleration, once the Fast Stop operation is initiated, the drive cannot be restarted until the deceleration is complete, the Fast Stop input is cleared, and the Run command is re-input.
A contact output programmed for "During Fast Stop" (H2-☐☐ = 4C) will be closed as long as Fast Stop is active.

A Fast Stop can be selected as the action the drive should take when certain faults occur, such as L8-03 (Overheat Pre-Alarm Operation Selection).

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| C1-09 | Fast Stop Time | 0.0 to 6000.0 s <1> | 120.0 s |

<1> The setting range for the acceleration and deceleration times is determined by the acceleration/deceleration time setting units in C1-10. For example, if the time is set in units of 0.01 s (C1-10 = 0), the setting range becomes 0.00 to 600.00 s.

**Note:** Rapid deceleration can trigger an overvoltage fault. When a fault occurs, the drive output shuts off, and the motor coasts. To avoid this uncontrolled motor state and to ensure that the motor stops quickly and safely, set an appropriate Fast Stop time to C1-09.

### ■ C1-10 Accel/Decel Time Setting Units

Determines the units for the acceleration and deceleration times set to C1-01 through C1-09 using parameter C1-10.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C1-10 | Accel/Decel Time Setting Units | 0, 1 | 1 |

**Setting 0: 0.01 s units**

The accel/decel times are set in 0.01 s units. The setting range will be 0.00 to 600.00 s. If any of the parameters C1-01 to C1-09 is set to 600.1 seconds or more, then C1-10 cannot be set to 0.

**Setting 1: 0.1 s units**

The accel/decel times are set in 0.1 s units. The setting range will be 0.0 to 6000.0 s.

## ◆ C2: S-Curve Characteristics

Use S-curve characteristics to smooth acceleration and deceleration and to minimize abrupt shock to the load. Set S-curve characteristic time during acceleration/deceleration at start and acceleration/deceleration at stop. If the STo fault (Hunting Detection) occurs when starting a PM motor, try increasing the value set to C2-01.

### ■ C2-01 to C2-04: S-Curve Characteristics

C2-01 through C2-04 set separate S-curves for each section of the acceleration or deceleration.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| C2-01 | S-Curve Characteristic at Accel Start | 0.00 to 10.00 s | Determined by A1-02 <1> |
| C2-02 | S-Curve Characteristic at Accel End | | 0.20 s |
| C2-03 | S-Curve Characteristic at Decel Start | | 0.20 s |
| C2-04 | S-Curve Characteristic at Decel End | | 0.00 s |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

*Figure 2.23* explains how S-curves are applied.

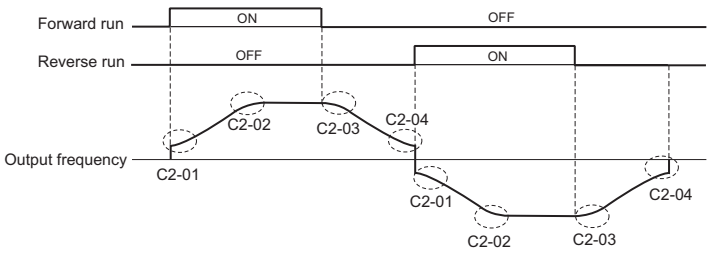



**Figure 2.23 S-Curve Timing Diagram - FWD/REV Operation**

Setting the S-curve will increase the acceleration and deceleration times.

Actual accel time = accel time setting + (C2-01 + C2-02) / 2

Actual decel time = decel time setting + (C2-03 + C2-04) / 2

## ◆ C3: Slip Compensation

The Slip Compensation function improves the speed accuracy of an induction motor. By adjusting the output frequency in accordance with the motor load, it compensates for the slip and makes the motor speed equal to the frequency reference.

**Note:** Make sure that the motor rated current (E2-01), the motor rated slip (E2-02), and the motor no-load current (E2-03) have all been set properly before making any adjustments to slip compensation parameters. When using Closed Loop Vector control, the motor rated slip can be set by Auto-Tuning.

### ■ C3-01: Slip Compensation Gain

This parameter sets the gain for the motor slip compensation function. Although this parameter rarely needs to be changed, adjustments might be needed under the following circumstances:

- If the motor at constant speed is slower than the frequency reference, increase C3-01.
- If the motor at constant speed is faster than the frequency reference, decrease C3-01.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-01 | Slip Compensation Gain | 0.0 to 2.5 | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### ■ C3-02: Slip Compensation Primary Delay Time

Adjusts the filter on the output side of the slip compensation function. Although this parameter rarely needs to be changed, adjustment may help in the following situations:

- Decrease the setting when the slip compensation response is too slow.
- Increase this setting when the speed is unstable.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-02 | Slip Compensation Primary Delay Time | 0 to 10000 ms | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### ■ C3-03: Slip Compensation Limit

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

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-03 | Slip Compensation Limit | 0 to 250% | 200% |

The slip compensation limit is constant throughout the constant torque range (frequency reference ≤ E1-06). In the constant power range (frequency reference ≥ E1-06), it is increased based on C3-03 and the output frequency as shown in the following diagram.

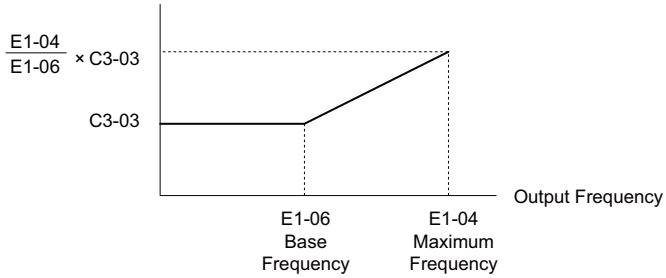



**Figure 2.24 Slip Compensation Limit**

## ■ C3-04: Slip Compensation Selection during Regeneration

Enables or disables slip compensation during regenerative operation.

Even if enabled, this function does not operate when the output frequency is too low.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-04 | Slip Compensation Selection during Regeneration | 0 to 2 | 0 |

**Setting 0: Disabled**

Slip compensation is not provided. Depending on the load and mode of operation, the actual motor speed will be lower or higher than the frequency reference.

**Setting 1: Enabled (6 Hz and above)**

Slip compensation is enabled during regenerative operation. It will not be active at output frequencies below 6 Hz.

**Setting 2: Enabled (compensation provided wherever possible)**

Slip compensation is enabled during regenerative operation, and at frequencies as low as 2 Hz. The drive uses the motor rated slip set in E2-02 to automatically calculate the frequency range where compensation will be disabled.

## ■ C3-05: Output Voltage Limit Operation Selection

Determines if the motor flux reference is automatically reduced when the output voltage reaches the saturation range.

If the input power supply voltage is low or the motor has a high voltage rating, this function can help improve the speed precision when moving heavy loads at high speeds. When this function is enabled, the reduction in flux causes a slightly higher current to compensate the torque. Keep this in mind when selecting the drive.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-05 | Output Voltage Limit Operation Selection | 0 or 1 | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

**Setting 0: Disabled**
**Setting 1: Enabled**

## ■ C3-16: Output Voltage Limit Operation Start Level (Percentage Modulation)

Sets the output voltage limit operation start level (percentage modulation) when C3-05 is enabled.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-16 | Output Voltage Limit Operation Start Level (Percentage Modulation) | 70.0 to 90.0% | 85.0% |

## ■ C3-17: Maximum Output Voltage Limit Level (Percentage Modulation)

Sets the output voltage limit operation determined by C3-18 (percentage modulation) when C3-05 is enabled.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-17 | Maximum Output Voltage Limit Level (Percentage Modulation) | 85.0 to 100.0% | 90.0% |

## ■ C3-18: Output Voltage Limit Level

Sets the maximum percentage of output voltage reduction when C3-05 is enabled.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-18 | Output Voltage Limit Level | 30.0 to 100.0% | 90.0% |

## ■ C3-21: Motor 2 Slip Compensation Gain

Used to improve speed accuracy for motor 2. Functions in the same way that C3-01 functions for motor 1.

Adjust this parameter only after the motor rated current (E4-01), motor rated slip (E4-02), and the motor no-load current (E4-03) have all been set.

Adjustments might be needed in the following circumstances:

- Increase C3-21 if the motor at constant speed is slower than the frequency reference.
- Decrease C3-21 if the motor at constant speed is faster than the frequency reference.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-21 | Motor 2 Slip Compensation Gain | 0.0 to 2.5 | Determined by E3-01 <1> |

<1> For details on the default settings, refer to *E3-01 (Motor 2 Control Mode) Dependent Parameters on page 81*.

## ■ C3-22: Motor 2 Slip Compensation Primary Delay Time

Functions for motor 2 in the same way that C3-02 functions for motor 1.

Refer to *C3-02: Slip Compensation Primary Delay Time on page 126* for instructions on how to adjust this parameter.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-22 | Motor 2 Slip Compensation Primary Delay Time Constant | 0 to 10000 ms | 3000 ms |

## ■ C3-23: Motor 2 Slip Compensation Limit

Sets the upper limit for the slip compensation function as a percentage of the motor rated slip (E4-02).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-23 | Motor 2 Slip Compensation Limit | 0 to 250% | 200% |

The slip compensation limit is constant throughout the constant torque range (frequency reference ≤ E3-06). In the constant power range (frequency reference > E3-06), it is increased based on C3-23 and the output frequency as shown in *Figure 2.25*.

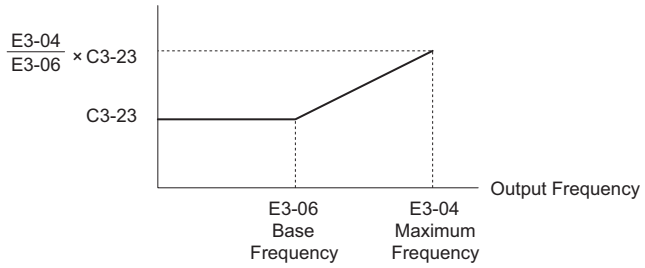



**Figure 2.25 Slip Compensation Limit**

### ■ C3-24: Motor 2 Slip Compensation Selection during Regeneration

Functions for motor 2 in the same way that C3-04 functions for motor 1.

Parameter C3-24 enables/disables slip compensation during regeneration.

Even if enabled, this function does not operate when the output frequency is too low.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C3-24 | Motor 2 Slip Compensation Selection During Regeneration | 0 to 2 | 0 |

**Setting 0: Disabled**
**Setting 1: Enabled (6 Hz and above)**
**Setting 2: Enabled (compensation provided wherever possible)**

## ◆ C4: Torque Compensation

The torque compensation function compensates for insufficient torque production at start-up or when a load is applied.

**Note:** Make sure the motor parameters and V/f pattern are set properly before setting torque compensation parameters.

### ■ C4-01: Torque Compensation Gain

Sets the gain for the torque compensation function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C4-01 | Torque Compensation Gain | 0.00 to 2.50 | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

#### Torque Compensation in V/f:

The drive calculates the motor primary voltage loss using the output current and the termination resistor value (E2-05) and then adjusts the output voltage to compensate insufficient torque at start or when load is applied. The effects of this voltage compensation can be increased or decreased using parameter C4-01.

#### Torque Compensation in OLV:

The drive controls the motor excitation current (d-axis current) and torque producing current (q-axis current) separately. Torque compensation affects the torque producing current only. C4-01 works as a factor of the torque reference value that builds the torque producing current reference.

#### Adjustment

Although this parameter rarely needs to be adjusted, changing the torque compensation gain in small steps of 0.05 may help in the following situations:

- Increase this setting when using a long motor cable.
- Decrease this setting when motor oscillation occurs.

Adjust C4-01 so that the output current does not exceed the drive rated current.

**Note:** Refrain from adjusting torque compensation in Open Loop Vector Control, as it can have a negative effect on torque accuracy.

## ■ C4-02: Torque Compensation Primary Delay Time

Sets the delay time used for applying torque compensation.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C4-02 | Torque Compensation Primary Delay Time | 0 to 60000 ms | Determined by A1-02 and o2-04 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### Adjustment

Although C4-02 rarely needs to be changed, adjustments may help in the following situations:

- If the motor vibrates, increase C4-02.
- If the motor responds too slowly to changes in the load, decrease C4-02.

## ■ C4-03: Torque Compensation at Forward Start (OLV)

Sets the amount of torque at start in the forward direction in order to improve motor performance during start with a heavy load. Compensation is applied using the time constant set in parameter C4-05. Enable this function when the load pulls the motor in reverse when starting with a Forward run command. Setting of 0.0% disables this feature.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C4-03 | Torque Compensation at Forward Start | 0.0 to 200.0% | 0.0% |

## ■ C4-04: Torque Compensation at Reverse Start (OLV)

Sets the amount of torque reference at start in the reverse direction in order to improve motor performance during start with heavy load. Compensation is applied using the Torque Compensation Time set in parameter C4-05. Enable this function if the load pulls the motor in the forward direction when starting with a Reverse run command. Setting 0.0% disables this feature.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C4-04 | Torque Compensation at Reverse Start | -200.0 to 0.0% | 0.0% |

## ■ C4-05: Torque Compensation Time Constant (OLV)

This parameter is the time constant for applying the torque compensation at start that is set in C4-03 and C4-04.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C4-05 | Torque Compensation Time Constant | 0 to 200 ms | 10 ms |

## ■ C4-06: Torque Compensation Primary Delay Time 2 (OLV)

This time constant is used during Speed Search or during regenerative operation. Increase the value if an overvoltage fault occurs with sudden changes in the load or at the end of acceleration with high inertia load.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C4-06 | Torque Compensation Primary Delay Time 2 | 0 to 10000 ms | 150 ms |

**Note:** If C4-06 is set to a relatively large value, be sure to also increase the setting in n2-03 (AFR Time Constant 2) proportionally.

## ■ C4-07: Motor 2 Torque Compensation Gain

Functions for motor 2 in the same way that C4-01 functions for motor 1.

Sets the gain for the torque compensation function of the motor 2.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C4-07 | Motor 2 Torque Compensation Gain | 0.00 to 2.50 | 1.00 |

## ◆ C5: Automatic Speed Regulator (ASR)

The ASR is used for controlling the motor speed in CLV control mode. It adjusts the torque reference (CLV) in order to minimize the differencebetween frequency reference and actual motor speed.*Figure 2.26* illustrates how ASR works.

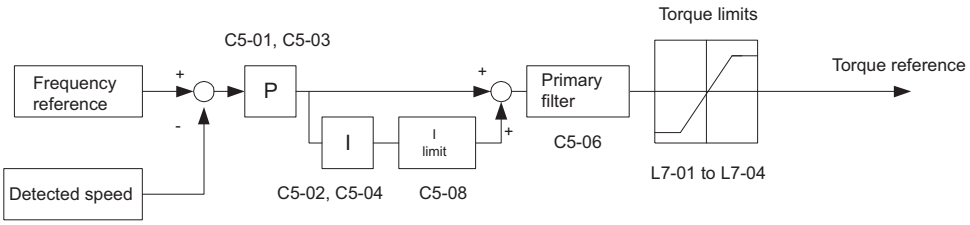



**Figure 2.26 Speed Control Block Diagram for CLV**

### ■ Adjusting the ASR Parameters

Before adjusting ASR parameters make sure all motor data have been set up correctly or Auto-Tuning has been performed.

Analog output signals should be used to monitor the frequency reference after softstarter (U1-16) and the motor speed (U1-05) when adjusting the ASR. Refer to *H4: Analog Outputs on page 193* for details on setting up analog output functions.

Generally when tuning the ASR, first optimize the ASR gain, then adjust the integral time settings. Always make adjustments with the load connected to the motor.

#### Adjusting the ASR Parameters in CLV

In CLV, the drive is pre-set to use ASR settings C5-01/02 over the whole speed range. If required by the application, a second set of ASR parameters (C5-03/04) can be automatically activated depending on the motor speed or by using a contact input. Also refer to *C5-01, C5-03 / C5-02, C5-04: ASR Proportional Gain 1, 2 / ASR Integral Time 1, 2 on page 132*.

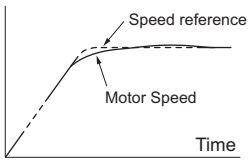
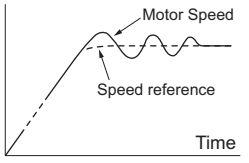
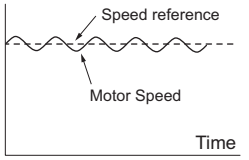
Perform the following steps for adjusting ASR parameters:

1. Run the motor at zero speed and increase the ASR gain (C5-01) as much as possible without oscillation.
2. Run the motor at zero speed and decrease the ASR integral time (C5-02) as much as possible without oscillation.
3. Run at the normal operating speed. Check for over/undershoot when changing speed and for any oscillation.
4. Should problems occur in step 3, increase the integral time and reduce the gain.
   Alternatively, use different ASR settings for high and low speed. Set the values from step 1 and 2 to parameters C5-03 and C5-04, then set an ASR switching frequency in parameter C5-07. Run the motor at a speed higher than C5-07 and repeat step 3 while adjusting C5-01 and C5-02.

### Solving Problems During ASR Setup

Use *Table 2.14* when making adjustments to ASR. Though the parameters listed below are for motor 1, the same changes can be made to the corresponding motor 2 parameters when running a second motor.

**Table 2.14 ASR Setup Problems and Corrective Actions**

| Problem | | Possible Solutions |
|---|---|---|
| Slow response to speed changes or speed deviation lasts for too long |  | • Increase the ASR gain.<br>• Decrease the integral time. |
| Overshoot or undershoot at the end of acceleration or deceleration |  | • Decrease the ASR gain.<br>• Increase the integral time. |
| Vibration and oscillation occur at constant speed |  | • Decrease the ASR gain.<br>• Increase the integral time.<br>• Increase the ASR delay time (C5-06). |
| Oscillation at low speed and response is too slow at high speed (or vice versa) | - | • V/f control: Use C5-01/02 and C5-03/04 to set up different ASR settings at minimum and maximum speed.<br>• CLV: Use C5-01, C5-02 and C5-03, C5-04 to define optimal ASR settings for high and low speed. Use C5-07 to define a switching frequency. |

## ■ C5-01, C5-03 / C5-02, C5-04: ASR Proportional Gain 1, 2 / ASR Integral Time 1, 2

These parameters can be used to adjust the responsiveness of the ASR.

**Note:** C5-01 is automatically set when ASR Tuning is performed (T1-01 = 9 or T2-01 = 9).

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| C5-01 | ASR Proportional Gain 1 | 0.00 to 300.00 | Determined by A1-02 <1> |
| C5-02 | ASR Integral Time 1 | 0.000 to 10.000 s | Determined by A1-02 <1> |
| C5-03 | ASR Proportional Gain 2 | 0.00 to 300.00 | Determined by A1-02 <1> |
| C5-04 | ASR Integral Time 2 | 0.000 to 10.000 s | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

These parameter settings will function differently depending on the control mode.

### CLV

In these control modes, parameters C5-03 and C5-04 define the ASR gain an integral time at zero speed. The settings in C5-01 and C5-02 are used at speeds above the setting in C5-07. C5-07 is set to 0 as the default so that C5-01 and C5-02 are used over the entire speed range. Also refer to *C5-07: ASR Gain Switching Frequency on page 133*.

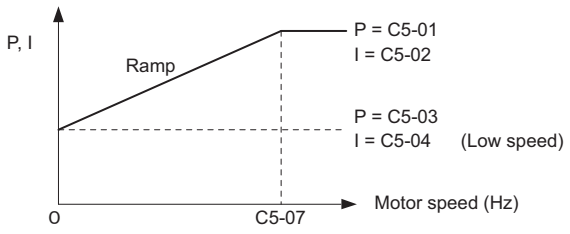



**Figure 2.27 Low-speed and High-speed Gain Settings**

The gain set in C5-03 can also be activated with a contact input programmed to “ASR gain switch” (H1-□□ = 77). When the terminal is open, the drive uses the ASR gain level set by the pattern in the figure above. When the terminal closes, C5-03 is used. The integral time set to C5-02 is used to change linearly between these settings.

The ASR gain switch command from a multi-function input terminal overrides the switching frequency set to C5-07.

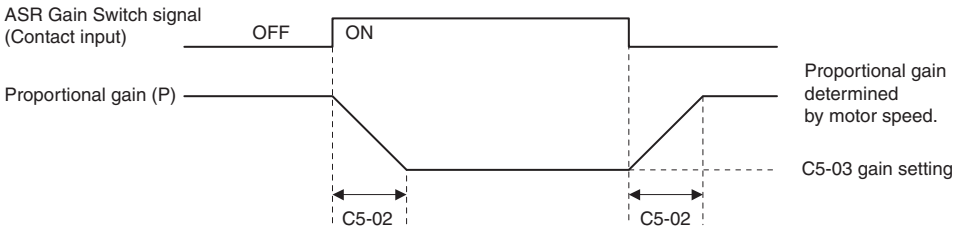



**Figure 2.28 ASR Proportional Gain Switch**

### ASR Gain Tuning (C5-01, C5-03)

The higher this setting, the faster is the speed response. Too high of a setting can lead to oscillation. In general, this setting should be increased with larger loads in order to minimize the speed deviation.

### ASR Integral Time Tuning (C5-02, C5-04)

Determines how fast a continuous speed deviation problem is eliminated. Too long of an integral time makes the speed control less responsive, while a too short of an integral time can cause oscillation.

## ■ C5-06: ASR Primary Delay Time Constant

This parameter sets the filter time constant for the time from the speed loop to the torque command output.

Increase this setting gradually in increments of 0.01 for loads with low rigidity, or when oscillation is a problem.

**Note:** This parameter rarely requires adjustment.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C5-06 | ASR Primary Delay Time Constant | 0.000 to 0.500 s | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

## ■ C5-07: ASR Gain Switching Frequency

Sets the frequency where the drive should switch between ASR proportional gain 1 and 2 (C5-01, C5-03) as well as between integral time 1 and 2 (C5-02, C5-04).
Switching the proportional gain and integral time in the low or high speed range can help stabilize operation and avoid resonance problems. A good switching point is about 80% of the frequency where oscillation occurs, or at 80% of the target speed.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C5-07 | ASR Gain Switching Frequency | 0.0 to 120.0 Hz | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

**Note:** A contact input set for the ASR gain switch (H1-□□ = 77) takes priority over the ASR gain switching frequency.

## ■ C5-08: ASR Integral Limit

Sets the upper limit for ASR as a percentage of the rated load.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C5-08 | ASR Integral Limit | 0 to 400% | 200% |

## ■ C5-21, C5-23 / C5-22, C5-24: Motor 2 ASR Proportional Gain 1, 2 / Integral Time 1, 2

These parameters function for motor 2 in the same way that C5-01 through C5-04 function for motor 1. For more details, see *C5-01, C5-03 / C5-02, C5-04: ASR Proportional Gain 1, 2 / ASR Integral Time 1, 2 on page 132*.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| C5-21 | Motor 2 ASR Proportional Gain 1 | 0.00 to 300.00 | Determined by E3-01 <1> |
| C5-22 | Motor 2 ASR Integral Time 1 | 0.000 to 10.000 s | Determined by E3-01 <1> |
| C5-23 | Motor 2 ASR Proportional Gain 2 | 0.00 to 300.00 | Determined by E3-01 <1> |
| C5-24 | Motor 2 ASR Integral Time 2 | 0.000 to 10.000 s | Determined by E3-01 <1> |

<1> For details on the default settings, refer to *E3-01 (Motor 2 Control Mode) Dependent Parameters on page 81*.

## ■ C5-26: Motor 2 ASR Primary Delay Time Constant

Functions for motor 2 in the same way that C5-06 functions for motor 1.

Sets the filter time constant for the time from the speed loop to the torque command output. For more details, see *C5-06: ASR Primary Delay Time Constant on page 133*.

**Note:** This parameter rarely requires adjustment.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| C5-26 | Motor 2 ASR Primary Delay Time Constant | 0.000 to 0.500 s | Determined by E3-01 <1> |

<1> For details on the default settings, refer to *E3-01 (Motor 2 Control Mode) Dependent Parameters on page 81*.

## ■ C5-27: Motor 2 ASR Gain Switching Frequency

Functions for motor 2 in the same way that C5-07 functions for motor 1.

Sets the frequency for motor 2 to change ASR proportional gain 1 and 2 (C5-21, C5-23) as well as the integral time 1 and 2 (C5-22, C5-24). For more details, see *C5-01, C5-03 / C5-02, C5-04: ASR Proportional Gain 1, 2 / ASR Integral Time 1, 2 on page 132*.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| C5-27 | Motor 2 ASR Gain Switching Frequency | 0.0 to 400.0 Hz | 0.0 Hz |

**Note:** A contact input set for the ASR gain switch (H1-□□ = 77) takes priority over the ASR gain switching frequency.

## ■ C5-28: Motor 2 ASR Integral Limit

Functions for motor 2 in the same way that C5-08 functions for motor 1.

Parameter C5-08 sets the ASR integral upper limit as a percentage of the rated load.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| C5-28 | Motor 2 ASR Integral Limit | 0 to 400% | 200% |

# 2.4 d: Reference Settings

The figure below gives an overview of the reference input, selections, and priorities.

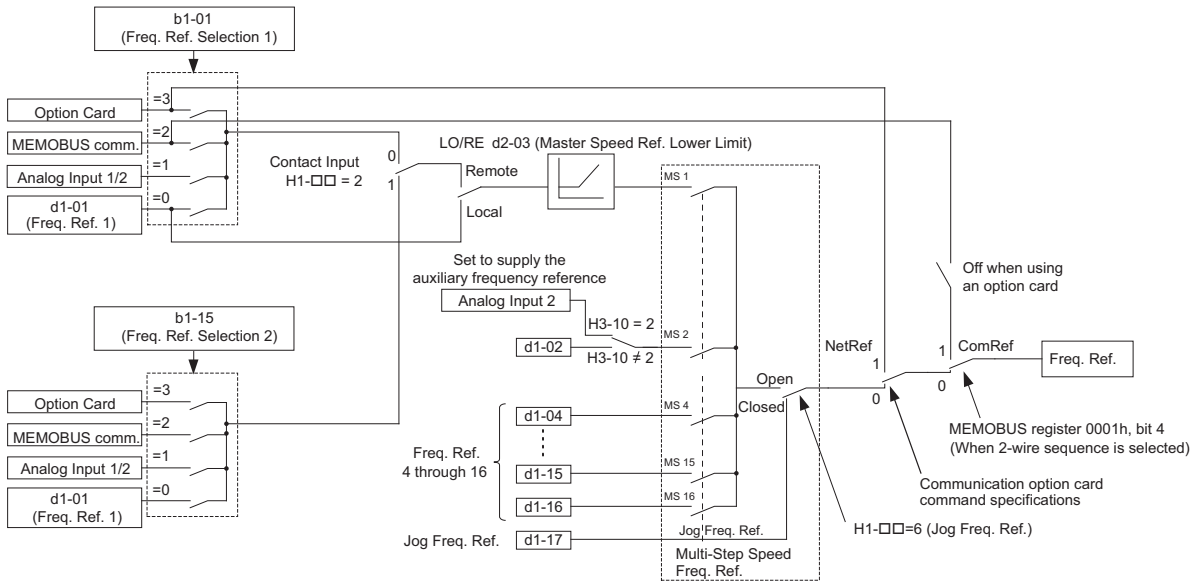



**Figure 2.29 Frequency Reference Setting Hierarchy**

## ◆ d1: Frequency Reference

### ■ d1-01 to d1-17: Frequency Reference 1 to 16 and Jog Frequency Reference

Up to 17 preset frequency references (including the Jog reference) can be programmed in the drive. The drive lets the user switch between these frequency references during run by using contact inputs. The drive uses the acceleration and deceleration times that have been selected when switching between frequency references.

The Jog frequency must be selected by a separate contact input and overrides all other frequency references.

The multi-step speed references 1, 2, and 3 can be input from analog inputs 1 and 2.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d1-01 to d1-16 | Frequency Reference 1 to 16 | 0.00 to 120.00 Hz <1> | 0.00 Hz |
| d1-17 | Jog Frequency Reference | 0.00 to 120.00 Hz <1> | 6.00 Hz |

<1> The upper limit is determined by the maximum output frequency (E1-04) and upper limit for the frequency reference (d2-01).

#### Multi-Step Speed Selection

To use several speed references for a multi-step speed sequence, set the H1-□□ parameters to 3, 4, 5, and 32 (Multi-Step Speed Reference 1, 2, 3, and 4). To assign the Jog reference to a contact input, set H1-□□ to 6.

Notes on using analog inputs as Frequency Reference 1, 2, and 3:

- Multi-Step Speed 1
  When setting analog input 1 to Multi-Step Speed 1, set b1-01 to 1, and when setting d1-01 (Frequency Reference 1) to Multi-Step Speed 1, set b1-01 to 0.
- Multi-Step Speed 2
  When setting analog input 2 to Multi-Step Speed 3, set H3-10 (Analog Input 2 Function Selection) to 3 (Auxiliary frequency reference 2). When setting d1-03(Frequency Reference 3) to Multi-Step Speed 3, set H3-10 to 1F (Through mode).
  When inputting 0 to 10 V to analog input 2, set H3-09 to 0.

The different speed references can be selected as shown in ***Table 2.15***. ***Figure 2.30*** illustrates the multi-step speed selection.

**Table 2.15 Multi-step Speed Reference and Contact Input Combinations**

| Reference | Multi-step Speed Reference 1 H1-□□ = 3 | Multi-step Speed Reference 2 H1-□□ = 4 | Multi-step Speed Reference 3 H1-□□ = 5 | Multi-step Speed Reference 4 H1-□□ = 32 | Jog Reference H1-□□ = 6 |
|---|---|---|---|---|---|
| Frequency Reference 1 (set in b1-01) | OFF | OFF | OFF | OFF | OFF |
| Frequency Reference 2 (d1-02 or analog input 1, 2) | ON | OFF | OFF | OFF | OFF |
| Frequency Reference 3 (d1-03 or analog input 1, 2) | OFF | ON | OFF | OFF | OFF |
| Frequency Reference 4 (d1-04) | ON | ON | OFF | OFF | OFF |
| Frequency Reference 5 (d1-05) | OFF | OFF | ON | OFF | OFF |
| Frequency Reference 6 (d1-06) | ON | OFF | ON | OFF | OFF |
| Frequency Reference 7 (d1-07) | OFF | ON | ON | OFF | OFF |
| Frequency Reference 8 (d1-08) | ON | ON | ON | OFF | OFF |
| Frequency Reference 9 (d1-09) | OFF | OFF | OFF | ON | OFF |
| Frequency Reference 10 (d1-10) | ON | OFF | OFF | ON | OFF |
| Frequency Reference 11 (d1-11) | OFF | ON | OFF | ON | OFF |
| Frequency Reference 12 (d1-12) | ON | ON | OFF | ON | OFF |
| Frequency Reference 13 (d1-13) | OFF | OFF | ON | ON | OFF |
| Frequency Reference 14 (d1-14) | ON | OFF | ON | ON | OFF |
| Frequency Reference 15 (d1-15) | OFF | ON | ON | ON | OFF |
| Frequency Reference 16 (d1-16) | ON | ON | ON | ON | OFF |
| Jog Frequency Reference (d1-17) <1> | – | – | – | – | ON |

<1> The Jog frequency overrides all other frequency references.

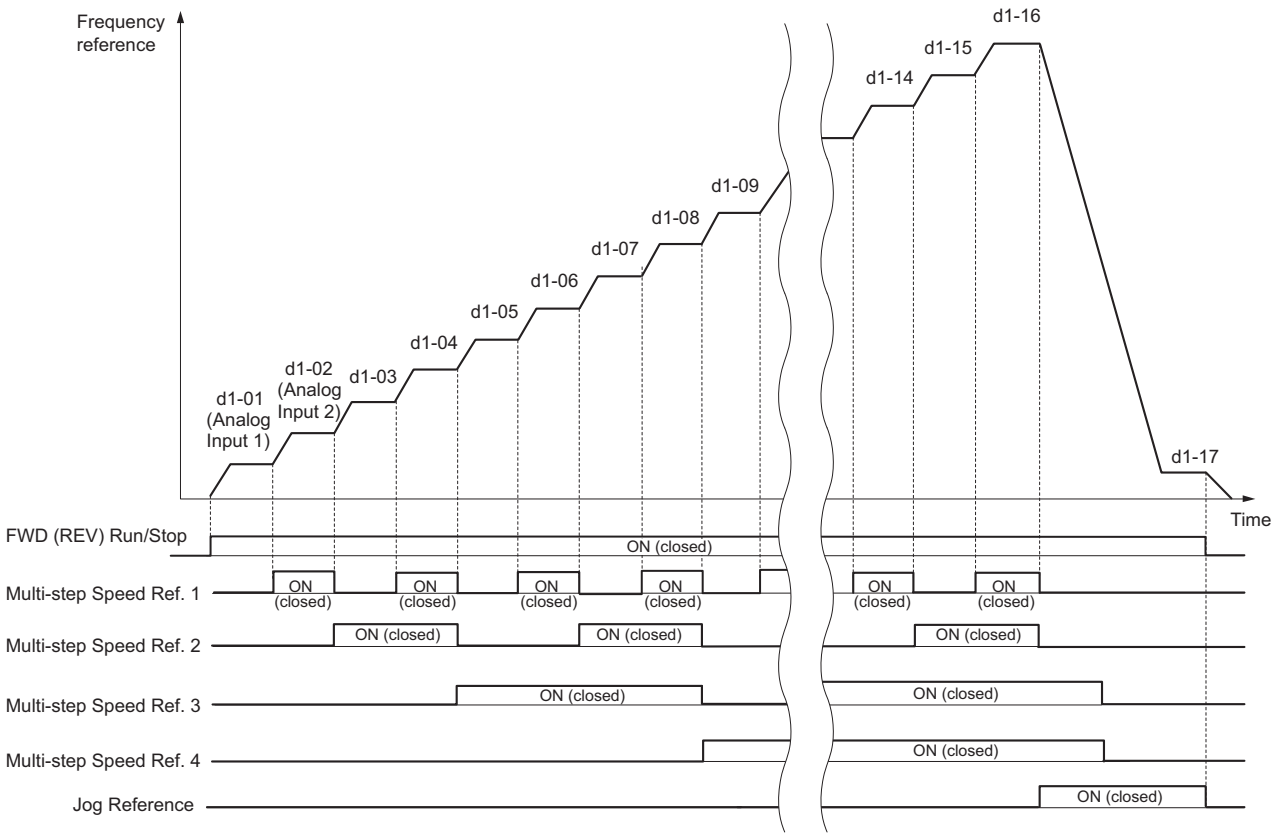



**Figure 2.30 Preset Reference Timing Diagram**

## ◆ d2: Frequency Upper/Lower Limits

By entering upper or lower frequency limits, the user can keep motor speed from going above or below levels that may cause resonance or equipment damage.

### ■ d2-01: Frequency Reference Upper Limit

Sets the maximum frequency reference as a percentage of the maximum output frequency (E1-04). This limit applies to all frequency references.
Even if the frequency reference is set to a higher value, the drive internal frequency reference will not exceed this value.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d2-01 | Frequency Reference Upper Limit | 0.0 to 110.0% | 100.0% |

### ■ d2-02: Frequency Reference Lower Limit

Sets the minimum frequency reference as a percentage of the maximum output frequency (E1-04). This limit applies to all frequency references.
If a lower reference than this value is entered, the drive will run at the limit set in d2-02. If the drive is started with a lower reference than d2-02, it will accelerate up to d2-02.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d2-02 | Frequency Reference Lower Limit | 0.0 to 110.0% | 0.0% |

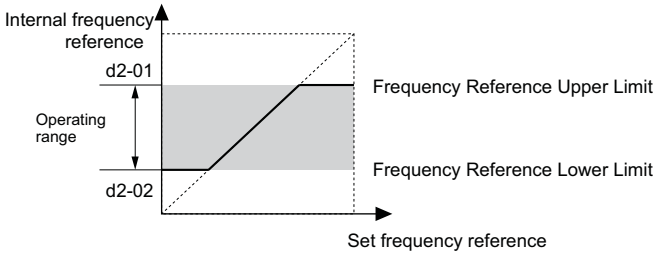



**Figure 2.31 Frequency Reference: Upper and Lower Limits**

### ■ d2-03: Master Speed Reference Lower Limit

Unlike frequency reference lower limit (d2-02) that affects the all frequency references wherever they are sourced from (i.e., analog input, preset speed, Jog speed, etc.), the master speed lower limit (d2-03) sets a lower limit that will only affect a frequency reference entered from the analog input terminals (analog input 1, analog input 2).

Set as a percentage of the maximum output frequency (E1-04).

**Note:** When lower limits are set in both parameters d2-02 and d2-03, the drive uses the greater of those two values as the lower limit.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d2-03 | Master Speed Reference Lower Limit | 0.0 to 110.0% | 0.0% |

## ◆ d3: Jump Frequency

### ■ d3-01 to d3-04: Jump Frequencies 1, 2, 3 and Jump Frequency Width

To avoid operating at a speed that causes resonance in driven machinery, the drive can be programmed with three separate Jump frequencies. The Jump frequencies are frequency ranges that the drive will not operate at. If the speed reference falls within a Jump frequency dead band, the drive will clamp the frequency reference just below the dead band and only accelerate past it when the frequency reference rises above the upper end of the dead band.

Setting parameters d3-01 through d3-03 to 0.0 Hz disables the Jump frequency function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d3-01 | Jump Frequency 1 | 0.0 to 120.0 Hz <1> | 0.0 Hz |
| d3-02 | Jump Frequency 2 | | |
| d3-03 | Jump Frequency 3 | | |
| d3-04 | Jump Frequency Width | 0.0 to 20.0 Hz | 1.0 Hz |

<1> The upper limit is determined by the maximum output frequency (E1-04) and upper limit for the frequency reference (d2-01).

*Figure 2.32* shows the relationship between the Jump frequency and the output frequency.

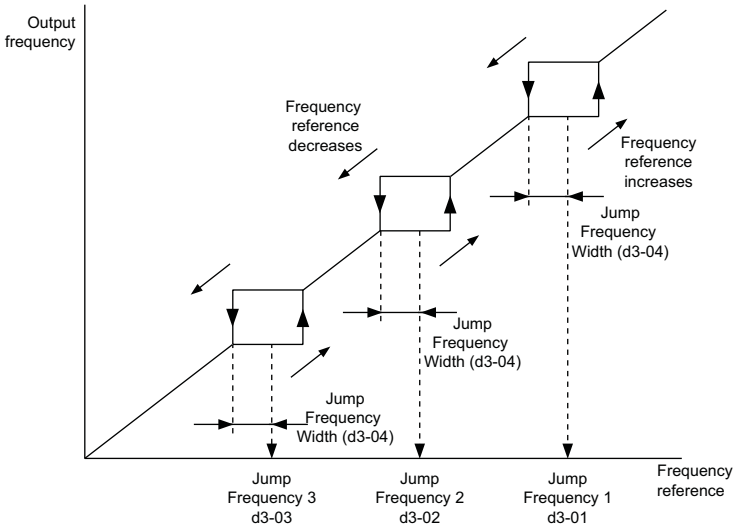



**Figure 2.32 Jump Frequency Operation**

**Note:** **1.** The drive will use the active accel/decel time (C1-01 and -02) to pass through the specified dead band range, but will not allow continuous operation in that range.

**2.** When setting more than one Jump frequency, make sure that the parameters do not overlap.

## ◆ d4: Frequency Reference Hold and Up/Down 2 Function

### ■ d4-01: Frequency Reference Hold Function Selection

This parameter is effective when either of the contact input functions listed below is used.

- Accel/decel ramp hold function (H1-□□ = A)
- Up/Down function (H1-□□ = 10 and 11)
- Up/Down 2 function (H1-□□ = 75 and 76)

Parameter d4-01 determines whether the frequency reference or the frequency bias (Up/Down 2) value is saved when the Stop command is entered or the power supply is shut down.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-01 | Frequency Reference Hold Function Selection | 0 or 1 | 0 |

The operation depends on the function used with parameter d4-01.

**Setting 0: Disabled**

- Acceleration hold
  The hold value will be reset to 0 Hz when the Stop command is entered or the drive power is switched off. The active frequency reference will be the value the drive uses when it restarts.
- Up/Down
  The frequency reference value will be reset to 0 Hz when the Stop command is entered or the drive power is switched off. The drive will start from 0 Hz when it is turned back on again.
- Up/Down 2
  The frequency bias is not saved when the Stop command is entered, or longer than 5 s after the Up/Down 2 command has been released. The Up/Down 2 function will start with a bias of 0% when the drive is restarted.

**Setting 1: Enabled**

- Acceleration hold
  The last hold value will be saved when the Run command or the drive power is switched off. The drive will use the value that was saved as the frequency reference when it restarts. The input terminal set for Accel/decel ramp hold (H1-□□ = A) must be enabled the entire time, or else the hold value will be cleared when the power is switched on.

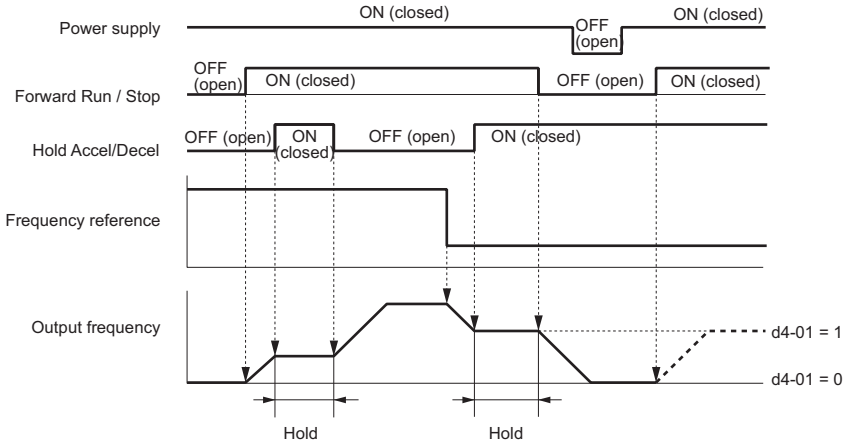



**Figure 2.33 Frequency Reference Hold with Accel/Decel Hold Function**

- Up/Down
  The frequency reference value will be saved when the Run command or the drive power is switched off. The drive will use the frequency reference that was saved when it restarts.
- Up/Down 2 with frequency reference from digital operator
  The frequency reference value will be saved when the drive power is switched off. The drive will use the frequency reference that was saved when it restarts.

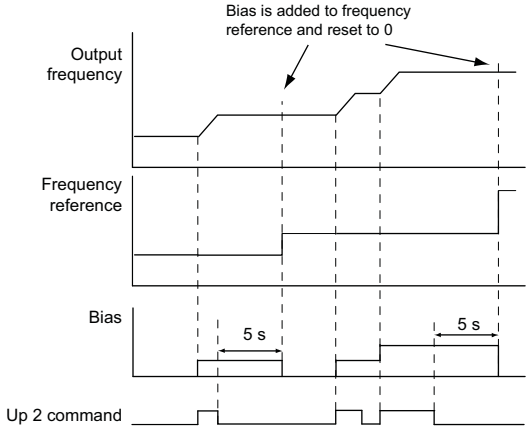



**Figure 2.34 Up/Down 2 Example with Reference from Digital Operator and d4-01 = 1**

- Up/Down 2 with frequency reference from input sources other than the digital operator
  When a Run command is active and the Up/Down 2 command has been disabled for longer than 5 s, the bias value will be saved in parameter d4-06. When restarting after the power is switched off, the drive will add the value saved in d4-06 as a bias to the frequency reference.

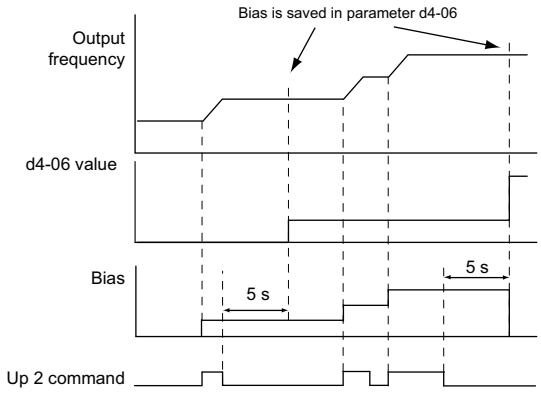



**Figure 2.35 Up/Down 2 Example with Other Reference than Digital Operator and d4-01 = 1**

**Note:** Be sure to set the limits for Up/Down 2 properly when using d4-01 = 1 in combination with the Up/Down 2 function. Refer to *d4-08: Frequency Reference Bias Upper Limit (Up/Down 2) on page 143* and *d4-09: Frequency Reference Bias Lower Limit (Up/Down 2) on page 143* for details on the limit settings.

### Clearing the Value that was Saved

Depending on which function is used, the frequency reference value that was saved can be cleared by:

- Releasing the input programmed for acceleration hold.
- Setting an Up or Down command while no Run command is active.
- Parameter d4-06 is reset to zero. Refer to *d4-06: Frequency Reference Bias (Up/Down 2) on page 142* for details.

## ■ d4-03: Frequency Reference Bias Step (Up/Down 2)

Sets the bias that is added to or subtracted from the frequency reference by the Up/Down 2 function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-03 | Frequency Reference Bias Step (Up/Down 2) | 0.00 to 99.99 Hz | 0.00 Hz |

The operation depends on the set value:

**Setting d4-03 = 0.00 Hz**

While the Up 2 or Down 2 command is enabled, the bias value is increased or decreased using the accel/decel time determined by parameter d4-04. During this period, the accel/decel times C1-01 through C1-08 are disregarded.

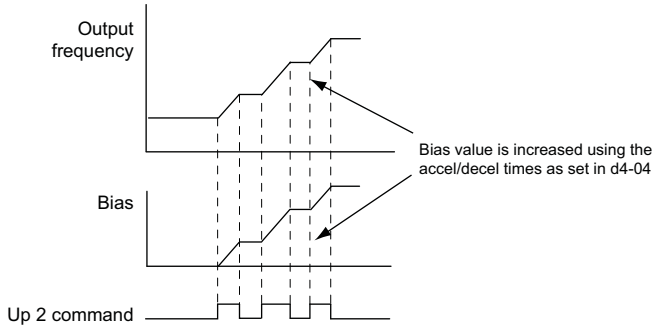



**Figure 2.36 Up/Down 2 Bias when d4-03 = 0.0 Hz**

**Setting d4-03 ≠ 0.00 Hz**

When an Up 2 or Down 2 command is enabled, the bias is increased or decreased in steps corresponding to the value set in d4-03. The frequency reference changes with the accel/decel times determined by parameter d4-04.

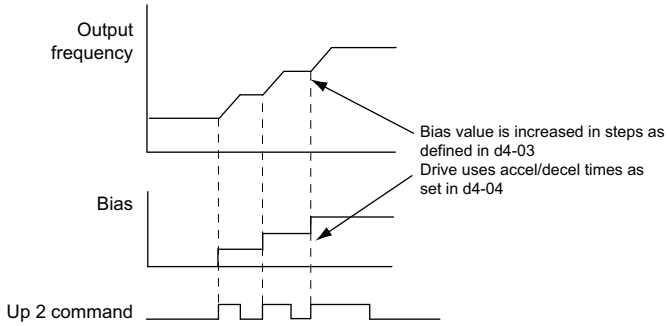



**Figure 2.37 Up/Down 2 Bias when d4-03 > 0.0 Hz**

## ■ d4-04: Frequency Reference Bias Accel/Decel (Up/Down 2)

Parameter d4-04 determines the accel/decel times that are used for increasing/decreasing the frequency reference bias when the Up/Down 2 function is used.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-04 | Frequency Reference Bias Accel/Decel (Up/Down 2) | 0 or 1 | 0 |

**Setting 0: Current Accel/Decel Time**

The drive uses the currently active accel/decel time.

**Setting 1: Accel/Decel Time 4**

The drive uses accel/decel time 4 set in parameters C1-07 and C1-08.

## ■ d4-05: Frequency Reference Bias Operation Mode Selection (Up/Down 2)

Determines if the bias value is held or not when the Up/Down 2 inputs are both disabled or both enabled.

The frequency reference bias mode is enabled when parameter d4-03 is set to 0.00.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-05 | Frequency Reference Bias Operation Mode Selection (Up/Down 2) | 0 or 1 | 0 |

**Setting 0: Hold Bias Value**

The bias value will be held if no input Up 2 or Down 2 is active.

**Setting 1: Reset Bias Value**

The bias is reset to 0% when both inputs Up 2 and Down 2 are either on or off. The drive will use the acceleration/deceleration time as selected in d4-04 to accelerate or decelerate to the frequency reference value.

## ■ d4-06: Frequency Reference Bias (Up/Down 2)

This parameter is used to save the frequency reference bias value set by the Up/Down 2 function. It is set as a percentage of the maximum output frequency. The function of d4-06 depends on how the Up/Down 2 function is configured.

- This parameter is normally not used when the frequency reference is set by the digital operator. The user can set d4-06 to a certain value that will be applied during run, but this value will be reset by the Up/Down 2 command in a certain case.
- When d4-01 = 0 and the frequency reference is set by a source other than the digital operator, the value set in d4-06 is added to or subtracted from the frequency reference.
- When d4-01 = 1 and the frequency reference is set by a source other than the digital operator, the bias value adjusted with the Up/Down 2 inputs is stored in d4-06 once 5 s have elapsed after the Up 2 or Down 2 command is released. The frequency reference will then return to what it was without the Up/Down 2 command.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-06 | Frequency Reference Bias (Up/Down 2) | –99.9 to 100.0% | 0.0% |

**Conditions that Generally Reset or Disable Parameter d4-06**

- When the frequency reference bias function (Up/Down 2 command) has not been assigned to contact inputs
- When the frequency reference source has been changed (including LOCAL/REMOTE or External reference 1/2 switch over by contact inputs)
- If d4-03 = 0 Hz, d4-05 = 1 and the Up/Down 2 commands are both open or both closed
- Any changes to the maximum frequency set in E1-04

## ■ d4-07: Analog Frequency Reference Fluctuation Limit (Up/Down 2)

This parameter is for handling changes in the frequency reference while the terminal set for Up 2 or Down 2 is enabled. If the frequency reference changes for more than the level set to d4-07, then the bias value will be held, and the drive will accelerate or decelerate following the frequency reference. When the frequency reference is reached, the bias hold is released and the bias follows the Up/Down 2 input commands.

Parameter d4-07 is applicable only if the frequency reference is set by an analog input.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-07 | Analog Frequency Reference Fluctuation Limit (Up/Down 2) | 0.1 to 100.0% | 1.0% |

## ■ d4-08: Frequency Reference Bias Upper Limit (Up/Down 2)

Parameter d4-08 sets the upper limit of the Up/Down 2 bias (monitor U6-20) and the value that can be saved in parameter d4-06. Set this parameter to an appropriate value before using the Up/Down 2 function.

**Note:** When the frequency reference is set by the digital operator (b1-01 = 0) and d4-01 = 1, the bias value will be added to the frequency reference if no Up/Down 2 command is received for 5 s, and will be reset to 0 afterwards. From that point, the bias can be increased up to the limit set in d4-08 again.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-08 | Frequency Reference Bias Upper Limit (Up/Down 2) | 0.0 to 100.0% | 100.0% |

## ■ d4-09: Frequency Reference Bias Lower Limit (Up/Down 2)

Parameter d4-09 sets the lower limit of the Up/Down 2 bias (monitor U6-20) and the value that can be saved in parameter d4-06. Set this parameter to an appropriate value before using the Up/Down 2 function.

**Note:** When the frequency reference is set by the digital operator (b1-01 = 0) and d4-01 = 1, the bias value will be added to the frequency reference if no Up/Down 2 command is received for 5 s, and will be reset to 0 afterwards. If the bias is increased using the Up 2 command, it cannot be reduced with a Down 2 command when the limit set in d4-09 is 0. To allow speed reduction in this situation, set a negative lower limit in d4-09.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-09 | Frequency Reference Bias Lower Limit (Up/Down 2) | –99.9 to 0.0% | 0.0% |

## ■ d4-10: Up/Down Frequency Reference Limit Selection

Selects how the lower frequency limit is set when the Up/Down function is used. Refer to *Setting 10, 11: Up, Down command on page 168* for details on the Up/Down function in combination with frequency reference limits.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d4-10 | Up/Down Frequency Reference Limit Selection | 0 or 1 | 0 |

### Setting 0: Lower Limit is Determined by d2-02 or Analog Input

The lower frequency reference limit is determined by the higher value of either parameter d2-02 or an analog input 1, 2 that is programmed for “Frequency bias”.

**Note:** For example, if the command to switch the external reference (H1-☐☐ = 2) is used to switch between the Up/Down function and an analog input as the reference source, then the analog value would become the lower reference limit when the Up/Down command is active. Change d4-10 to 1 to make the Up/Down function independent of the analog input value.

### Setting 1: Lower Limit is Determined by Parameter d2-02

Only parameter d2-02 sets the lower frequency reference limit.

## ◆ d5: Torque Control

Torque Control is available for CLV (A1-02 = 3). It allows to define a setpoint for the torque produced by the motor.

### ■ Torque Control Operation

Torque control can be enabled either by setting parameter d5-01 to 1 or by a contact input (H1-☐☐ = 71). *Figure 2.38* illustrates the working principle.

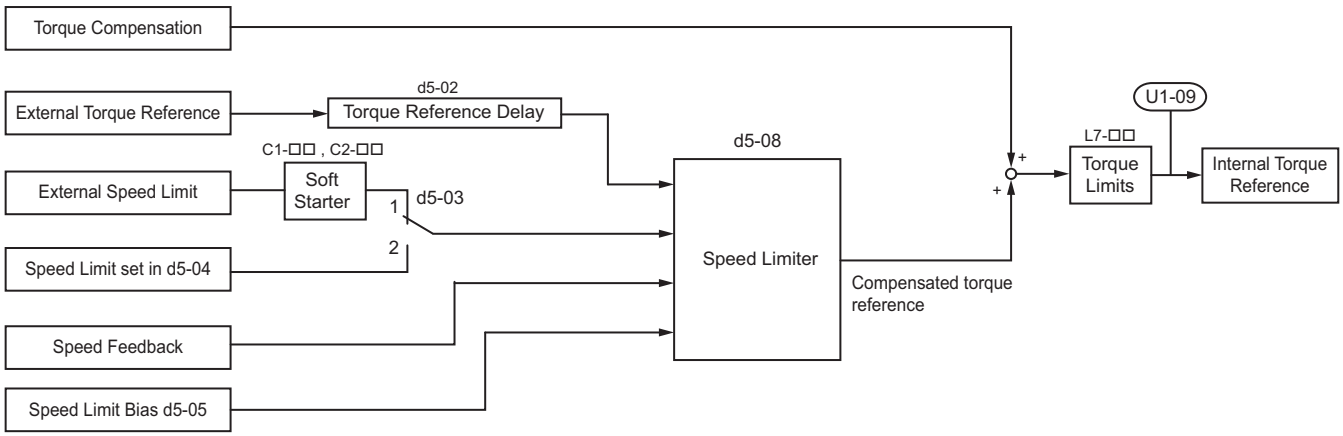



**Figure 2.38 Torque Control Block Diagram**

The externally input torque reference is used as the target value for the motor output torque. If the motor torque reference and the load torque are not in balance when in Torque Control, the motor accelerates or decelerates. Operation beyond the speed limit is prevented by compensating the external torque reference value if the motor speed reaches the limit. The compensation value is calculated using the speed limit, speed feedback, and the speed limit bias.

If an external torque compensation value is input, it is added to the speed limit compensated torque reference value. The value calculated is limited by the L7-☐☐ settings, and is then used as the internal torque reference, which can be monitored in U1-09. The L7-☐☐ settings have highest priority, i.e., the motor cannot be operated with a higher torque than the L7-☐☐ settings, even if the external torque reference value is increased.

## ■ Setting the Torque Reference, Speed Limit, and Torque Compensation Values

### Torque Control Reference Sources

Input values for Torque Control can be set as explained in ***Table 2.16***.

**Table 2.16 Torque Control Input Value Selection**

| Input Value | Signal Source | Parameter Settings | Remarks |
|---|---|---|---|
| Torque Reference | Analog Input 1, 2 | • H3-02/H3-10 = 13 <1> | Make sure the signal level settings for the input terminal selected match the signal used. Refer to ***H3: Analog Inputs on page 187*** for details on adjusting analog input signals. |
| | Analog Option Card AI-A3 | • F2-01 = 0<br>• H3-02/H3-10 = 13 <1> | The H3-☐☐ settings become effective for the option board input terminals. Make sure the signal level settings for the input terminal selected match the signal used. Refer to ***H3: Analog Inputs on page 187*** for details on adjusting analog input signals. |
| | MEMOBUS Register 0004h | • b1-01 = 2<br>• Set Register 000FH, Bit 2 = 1 to enable Torque reference from register 0004H | – |
| | Communication Option Card | • b1-01=3<br>• F6-06 = 1<br>Refer to the option card manual for details about setting the torque reference. | – |
| Speed Limit | Signal selected as frequency reference source | d5-03 = 1<br>The speed limit is taken from the input selected as the frequency reference source in parameter b1-01 or b1-15. <1> | The settings in C1-☐☐ for accel/decel times and in C2-☐☐ for S-curves are applied to the speed limit value. |
| | d5-04 | d5-03 = 2 | – |
| Torque Compensation | Analog Input 1, 2 | H3-02/H3-10 = 14 <1> | Make sure the signal level settings for the input terminal selected match the signal used. Refer to ***H3: Analog Inputs on page 187*** for details on adjusting analog input signals. |
| | Analog Option Card AI-A3 | • F2-01 = 0<br>• H3-02/H3-10 = 14 <1> | The H3-☐☐ settings are effective for the option card input terminals. Make sure the signal level settings for the input terminal selected match the signal used. |
| | MEMOBUS Register 0005H | • b1-01 = 2<br>• Set Register 000FH, bit 3 = 1 to enable torque compensation setting by register 0005H. | – |
| | Communication Option Card | • b1-01=3<br>• Refer to the option card manual for details about setting the torque compensation value. | – |

<1> Set analog input 1 and 2 to supply the speed limit, torque reference, or torque compensation. An oPE07 error (multi-function analog input program error) will occur if two analog inputs are set for the same function.

### Input Value Polarity

The direction of the input values described above depends on the polarity of the Run command and the input value.

- With a Forward run command and a positive torque reference signal the internal torque reference will be positive, i.e., in the forward direction.
- With a Forward run command and a negative torque reference signal the internal torque reference will be negative, i.e., in the reverse direction.

When analog inputs are used, negative input values can be generated by

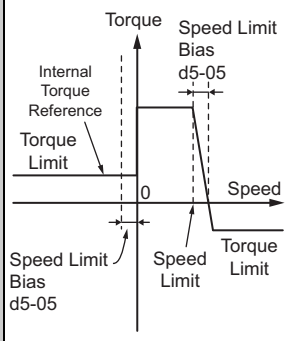
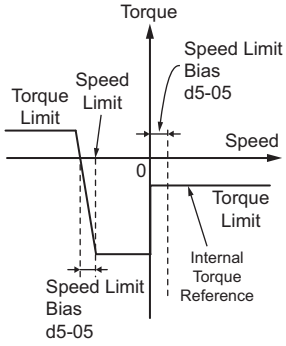
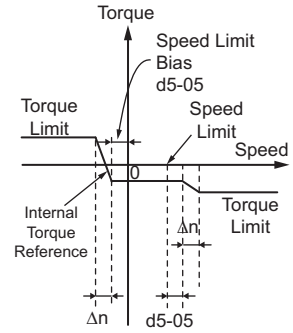
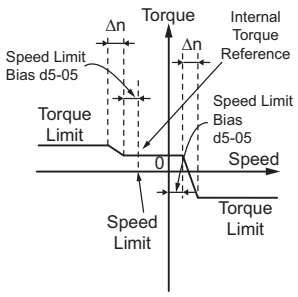
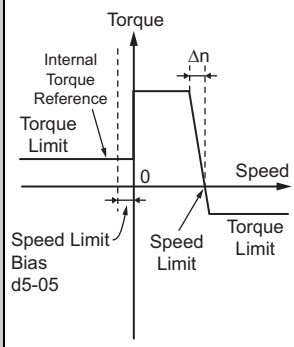
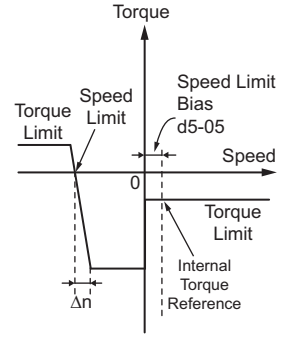
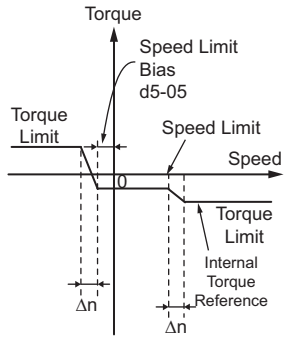
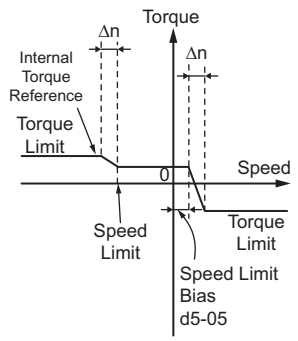
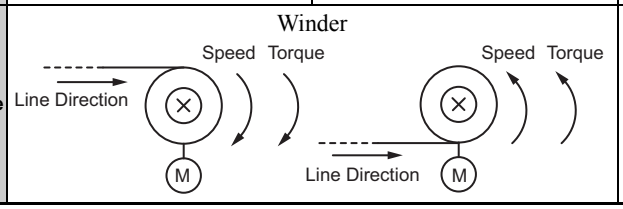
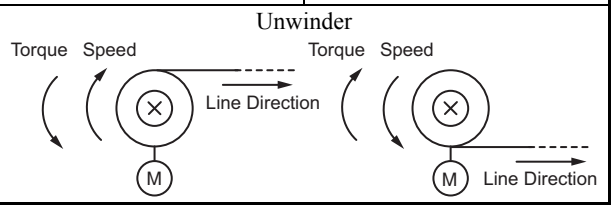
- applying negative voltage input signals.
- using positive analog input signals but setting the analog input bias to negative values so that the input value can be negative.
- applying positive voltage input signals and using a contact input that is programmed for H1-☐☐ = 78.

When MEMOBUS communication or a communication option card is used, only positive input values can be set.

## ■ Speed Limitation and Speed Limit Bias

The speed limit setting is read from the input selected in parameter d5-03. A bias can be added to this speed limit using parameter d5-05 while parameter b5-08 determines how the speed limit bias is applied. *Table 2.17* explains the relation between these settings.

**Table 2.17 Speed Limit, Speed Bias and Speed Limit Polarity Selection**

| | Operating Conditions | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Run Command** | Forward | Reverse | Forward | Reverse | Forward | Reverse | Forward | Reverse |
| **Torque Reference Direction** | Positive (Forward) | Positive (Forward) | Negative (Reverse) | Negative (Reverse) | Negative (Reverse) | Negative (Reverse) | Positive (Forward) | Positive (Forward) |
| **Speed Limit Direction** | Positive (Forward) | Negative (Reverse) | Negative (Reverse) | Positive (Forward) | Positive (Forward) | Negative (Reverse) | Negative (Reverse) | Positive (Forward) |
| **Normal Operation Direction** | Forward | | Reverse | | Forward | | Reverse | |
| **Bidirectional Speed Limit Bias (d5-08 = 0)** <1> |  | |  | |  | |  |
| **Unidirectional Speed Limit Bias (d5-08 = 1)** <1> |  | |  | |  | |  |
| **Application Example** |  | | | |  | | | |

<1> The value of Δn in the drawings depends on the ASR setting in parameters C5-☐☐.

## ■ Indicating Operation at the Speed Limit

A contact output can be programmed to close when the drives is operating at or beyond the speed limit (H2-☐☐ = 32).

Use this output to notify a PLC or some other control device of abnormal operating conditions.

## ■ Switching Between Torque and Speed Control

A contact output can be used to switch Torque Control and Speed Control (H1-□□ = 71). When switching from Speed Control to Torque Control, the torque limit becomes the torque reference and the speed reference becomes the speed limit. This change is reversed when switching back to Speed Control.

If required by the application, a delay time can be set up using parameter d5-06. The reference values (torque reference/speed limit in Torque Control or speed reference/torque limit in Speed Control) are held during this switch delay time. Be sure to change the reference values from the controller within this delay time.

**Note:** **1.** The switching delay time d5-06 is not applied when the Stop command is entered. Here the operation switches immediately to speed control and the drive decelerates to a stop at the torque limit.

**2.** Set d5-01 to 0 when switching between Torque Control and Speed Control. An oPE15 alarm will be triggered if parameter d5-01 is set to 1 while H1-□□ is set to 71 at the same time.

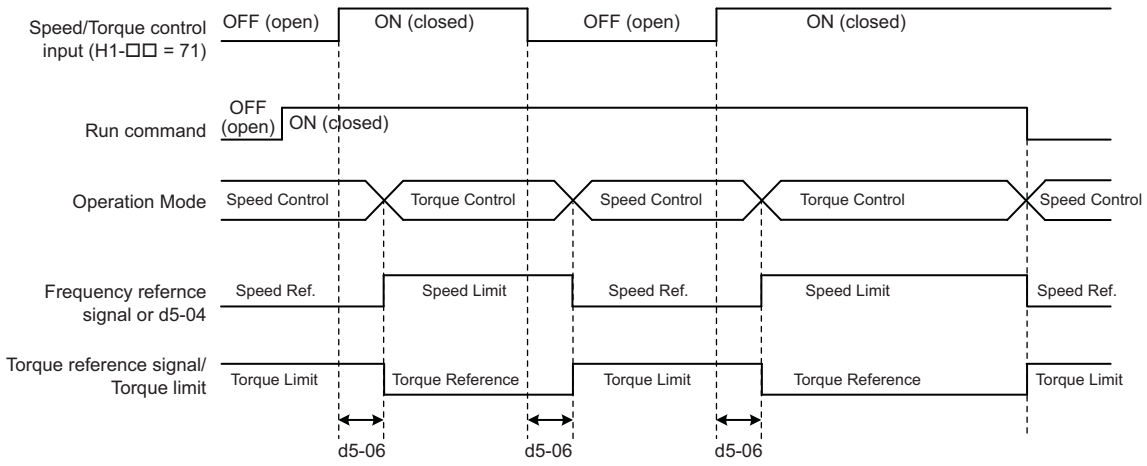



**Figure 2.39 Speed/Torque Control Switching Time**

## ■ d5-01: Torque Control Selection

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d5-01 | Torque Control Selection | 0 or 1 | 0 |

**Setting 0: Disabled**

Speed Control will be active. Also use this setting when H1-□□ = 71 (Speed/Torque Control Switch).

**Setting 1: Enabled**

Torque Control is always enabled.

## ■ d5-02: Torque Reference Delay Time

A filter with the time constant set in parameter d5-02 can be applied to the torque reference signal in order to eliminate oscillation that results from an unstable torque reference signal. A higher filter time will stabilize control, but also reduce the responsiveness.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d5-02 | Torque Reference Delay Time | 0 to 1000 ms | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

## ■ d5-03: Speed Limit Selection

Parameter d5-03 determines how the speed limit is set.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d5-03 | Speed Limit Selection | 1 or 2 | 1 |

**Setting 1: Frequency Reference Input**

The frequency reference value at the active reference source (digital operator, External reference 1 or External reference 2) will be used as speed limit. Note that in this case all settings for accel/decel times (C1-01 to C1-08) and S-curves (C2-01 to C2-04) will apply for the speed limit.

**Setting 2: Parameter d5-04**

The speed limit is set by parameter d5-04.

## ■ d5-04: Speed Limit

Sets the speed limit during torque control if parameter d5-03 is set to 2. Refer to *Speed Limitation and Speed Limit Bias on page 146*.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d5-04 | Speed Limit | -120 to 120% | 0% |

## ■ d5-05: Speed Limit Bias

Using d5-05, a bias can be applied to the speed limit value. The bias is set as a percentage of the maximum output frequency.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d5-05 | Speed Limit Bias | 0 to 120% | 10% |

## ■ d5-06: Speed/Torque Control Switchover Time

Sets the delay time for switching from Speed Control to Torque Control and vice versa.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d5-06 | Speed/Torque Control Switchover Time | 0 to 1000 ms | 0 ms |

## ■ d5-08: Unidirectional Speed Limit Bias

Parameter d5-08 selects how the speed limit bias is applied.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d5-08 | Unidirectional Speed Limit Bias | 0 or 1 | 1 |

**Setting 0: Disabled**

The speed limit bias is applied in both directions, the speed limit direction and the opposite direction.

**Setting 1: Enabled**

The speed limit bias is applied in the opposite direction to the speed limit direction only.

## ◆ d6: Field Weakening and Field Forcing

### Field Weakening

The Field Weakening function reduces the output voltage to a pre-defined level in order to reduce the energy consumption of the motor. It can be activated using a contact input programmed for H1-□□ = 63. Field Weakening should only be used with a known and unchanging light load condition.

### Field Forcing

The Field Forcing function compensates for the delaying influence of the motor time constant when changing the excitation current reference. Field Forcing can improve the motor responsiveness. It is ineffective during DC Injection Braking.

### ■ d6-01: Field Weakening Level

Sets the level to what the output voltage is reduced when Field Weakening is activated. Set as percentage of the drive maximum output voltage.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d6-01 | Field Weakening Level | 0 to 100% | 80% |

### ■ d6-02: Field Weakening Frequency Limit

Sets the minimum output frequency for which field weakening can be activated. For frequencies below d6-02, Field Weakening cannot be activated.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d6-02 | Field Weakening Frequency Limit | 0.0 to 120.0 Hz | 0.0 Hz |

### ■ d6-03: Field Forcing Selection

Enables or disables the Field Forcing function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d6-03 | Field Forcing Selection | 0 or 1 | 0 |

**Setting 0: Disabled**
**Setting 1: Enabled**

### ■ d6-06: Field Forcing Limit

Sets the maximum level to what the Field Forcing function can boost the excitation current reference. The value is set as a percentage of the motor no load current.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d6-06 | Field Forcing Limit | 100 to 400% | 200% |

**Note:** Adjustment is not normally required.

## ◆ d7: Offset Frequency

### ■ d7-01 to d7-03: Offset Frequency 1 to 3

Three different offset values can be added to the frequency reference. They can be selected using contact inputs programmed for Offset frequency 1, 2, and 3 (H1-☐☐ = 44, 45, 46). The selected offset values are added together if multiple inputs are closed at the same time. The value is set as a percentage of the Maximum Output Frequency.

**Note:** This function can be used to replace the "Trim Control" function (H1-☐☐ = 1C, 1D) of earlier Yaskawa drives.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| d7-01 | Offset Frequency 1 | -100.0 to 100.0% | 0.0% |
| d7-02 | Offset Frequency 2 | -100.0 to 100.0% | 0.0% |
| d7-03 | Offset Frequency 3 | -100.0 to 100.0% | 0.0% |

*Figure 2.40* illustrates the Offset frequency function.

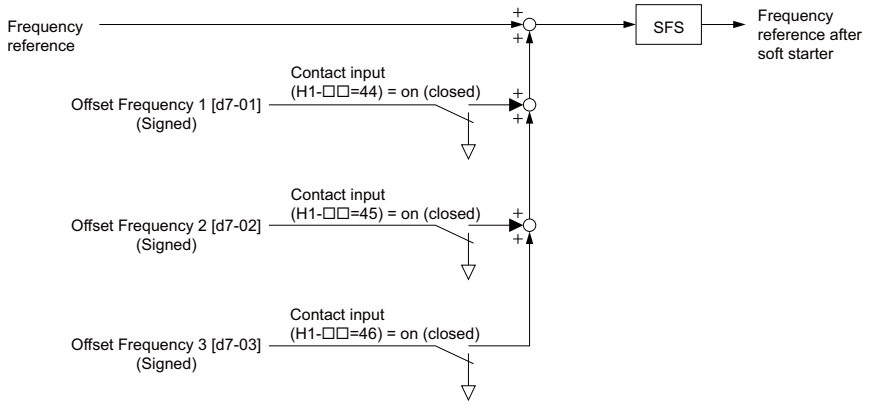



**Figure 2.40 Offset Frequency Operation**

# 2.5 E: Motor Parameters

E parameters cover V/f pattern and motor data settings.

## ◆ E1: 1V/f Pattern for Motor 1

### ■ E1-04 to E1-13

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E1-04 | Maximum Output Frequency | 40.0 to 120.0 Hz | <1> |
| E1-05 | Maximum Voltage | 0 to 13000 V | <1> <5> |
| E1-06 | Base Frequency | 0.0 to120.0 Hz | <1> |
| E1-07 | Middle Output Frequency | 0.0 to 120.0 Hz | <1> |
| E1-08 | Middle Output Frequency Voltage | 0 to 13000 V | <1> |
| E1-09 | Minimum Output Frequency | 0.0 to 120.0 Hz | <1> |
| E1-10 | Minimum Output Frequency Voltage | 0 to 13000 V | <1> |
| E1-11 | Middle Output Frequency 2 | 0.0 to 120.0 Hz | 0.0 Hz <3> |
| E1-12 | Middle Output Frequency Voltage 2 | 0 to 13000 V | 0 V <2> <3> |
| E1-13 | Base Voltage | 0 to 13000 V | 0 V <2> <4> |

<1> Default setting depends on the control mode set in parameter A1-02. The value shown here is for V/f Control.
<2> The drive changes these settings when Auto-Tuning is performed (Rotational Auto-Tuning, Stationary Auto-Tuning).
<3> Parameter ignored when E1-11 and E1-12 are set to 0.0.
<4> When Auto-Tuning is performed, E1-13 and E1-05 will be set to the same value.
<5> When vector control is used, set the no-load voltage value.

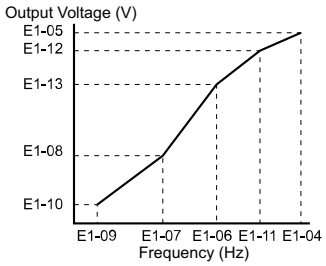



**Figure 2.41 V/f Pattern**

**Note:**
1. The following condition must be true when setting up the V/f pattern: E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04
2. To make the V/f pattern a straight line below E1-06, set E1-09 = E1-07. In this case the E1-08 setting is disregarded.
3. When the parameters are initialized using parameter A1-03, the settings for E1-04 through E1-13 are returned to their default values.
4. Parameters E1-11, E1-12, and E1-13 should only be used to fine-tune the V/f pattern in the constant output range. These parameters rarely need to be changed.

## ◆ E2: Motor 1 Parameters

These parameters contain the motor data needed for motor 1. They are set automatically when Auto-Tuning is performed (this includes Rotational Auto-Tuning, Stationary Auto-Tuning). If Auto-Tuning cannot be performed, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

### ■ E2-01: Motor Rated Current

Set E2-01 to the full load amps (FLA) stamped on the motor nameplate. This value is used for motor protection and to calculate torque limits. If Auto-Tuning completes successfully, the value entered to T1-04 will automatically be saved to E2-01.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-01 | Motor Rated Current | 10% to 200% of the drive rated current. | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

**Note:** If the motor rated current in E2-01 is set lower than the motor no-load current in E2-03, than a parameter setting error will occur (oPE02). E2-03 must be set correctly to prevent this error.

### ■ E2-02: Motor Rated Slip

Sets the motor rated slip in Hz to provide motor control, protect the motor and calculate torque limits. This value is automatically set during Auto-Tuning (Rotational Auto-Tuning, Stationary Auto-Tuning).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-02 | Motor Rated Slip | 0.00 to 20.00 Hz | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

If Auto-Tuning cannot be performed, calculate the motor rated slip using the information written on the motor nameplate and the formula below:

E2-02 = f - (n × p)/120

f: rated frequency (Hz), n: rated motor speed ($min^{-1}$), p: number of motor poles

### ■ E2-03: Motor No-Load Current

Sets the no-load current for the motor in amperes when operating at the rated frequency and the no-load voltage. This value is automatically set during Auto-Tuning (Rotational, Stationary). The motor no-load current listed in the motor test report can also be directly entered manually. Contact the motor manufacturer to receive a copy of the motor test report.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-03 | Motor No-Load Current | 0 to [E2-01] | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

### ■ E2-04: Number of Motor Poles

Set the number of motor poles in E2-04. If Auto-Tuning completes successfully, the value entered to T1-06 will automatically be saved in E2-04.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-04 | Number of Motor Poles | 2 to 48 | 4 |

## ■ E2-05: Motor Line-to-Line Resistance

Sets the line-to-line resistance of the motor stator winding. If Auto-Tuning completes successfully, this value is automatically calculated. Remember that this value must be entered as line-to-line and not for each motor phase.

If Auto-Tuning is not possible, then contact the motor manufacturer to find out the line-to-line resistance or measure it manually. When using the manufacturer motor test report, calculate E2-05.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-05 | Motor Line-to-Line Resistance | 0.000 to 65.000 Ω | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ E2-06: Motor Leakage Inductance

Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-06 | Motor Leakage Inductance | 0.0 to 40.0% | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ E2-07: Motor Iron-Core Saturation Coefficient 1

Sets the motor iron saturation coefficient at 50% of the magnetic flux. If Rotational Auto-Tuning completes successfully, then this value is automatically calculated and set in E2-07. This coefficient is used when operating with constant output.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-07 | Motor Iron-Core Saturation Coefficient 1 | 0.00 to 0.50 | 0.50 |

## ■ E2-08: Motor Iron-Core Saturation Coefficient 2

Sets the motor iron saturation coefficient at 75% of the magnetic flux. If Rotational Auto-Tuning completes successfully, then this value is automatically calculated and set in E2-08. This coefficient is used when operating with constant output.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-08 | Motor Iron-Core Saturation Coefficient 2 | [E2-07] to 0.75 | 0.75 |

## ■ E2-09: Motor Mechanical Loss

This parameter sets to the motor mechanical loss as a percentage of motor rated power (kW) capacity.
Adjust this setting in the following circumstances:

- When there is a large amount of torque loss due to motor bearing friction.
- When there is a large amount of torque loss in a fan or pump application.

The setting for the mechanical loss is added to the torque.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-09 | Motor Mechanical Loss | 0.0 to 10.0% | 0.0% |

## ■ E2-10: Motor Iron Loss for Torque Compensation

This parameter sets the motor iron loss in watts.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-10 | Motor Iron Loss for Torque Compensation | 0 to 65535 W | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ E2-11: Motor Rated Power

This parameter sets the motor rated power in kW. If Auto-Tuning completes successfully, the value entered to T1-02 will automatically be saved to E2-11.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E2-11 | Motor Rated Power | 0 to 65000 kW | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ Setting Motor Parameters Manually

Follow the instructions below when setting motor-related parameters manually instead of using the Auto-Tuning feature. Refer to the motor test report included with the motor to make sure the correct data is entered into the drive.

### Setting the Motor Rated Current

Enter the motor rated current listed on the nameplate of the motor in E2-01.

### Setting the Motor Rated Slip

Use the base speed listed on the motor nameplate to calculate the rated slip. Refer to the formula below, then enter that value in E2-02.

Motor rated slip = rated frequency [Hz] – base speed [$min^{-1}$] × (no. of motor poles) / 120

### Setting the No-Load Current

Enter the no-load current at the rated frequency and rated voltage in E2-03. The no-load current is not usually listed on the nameplate. Contact the motor manufacturer if the data cannot be found.

### Setting the Number of Motor Poles

Only required in Closed Loop Vector Control. Enter the number of motor poles as indicated on motor nameplate.

### Setting the Line-to-Line Resistance

E2-05 is normally set during Auto-Tuning. If Auto-Tuning cannot be performed, contact the manufacturer of the motor to find out what the correct resistance is between motor lines. The motor test report can also be used to calculate this value:

- E-type insulation: Multiply 0.92 times the resistance value (Ω) listed on the test report at 75°C.
- B-type insulation: Multiply 0.92 times the resistance value (Ω) listed on the test report at 75°C.
- F-type insulation: Multiply 0.87 times the resistance value (Ω) listed on the test report at 115°C.

### Setting the Motor Leakage Inductance

The motor leakage inductance set in E2-06 determines the amount of voltage drop relative to the motor rated voltage. This value should be entered particularly for motors with a low degree of inductance, such as high-speed motors. As this information is not listed on the motor nameplate, contact the motor manufacturer to find out the correct value for the motor leakage inductance.

### Setting the Motor Iron-Core Saturation Coefficient 1, 2

E2-07 and E2-08 are set when Rotational Auto-Tuning is performed.

### Motor Mechanical Loss

The drive only requires this information when using Closed Loop Vector Control. The drive compensates for the degree of mechanical loss with torque compensation. Although E2-09 rarely needs to be changed, adjustment may benefit the following circumstances:

- When there is a large amount of torque loss due to motor bearing friction
- When there is a large amount of torque loss in a fan or pump application

### Setting the Motor Iron Loss for Torque Compensation

This value only needs to be set when using V/f Control. Enter this value in watts to E2-10. The drive uses this setting to improve the precision of torque compensation.

## ◆ E3: V/f Pattern for Motor 2

These parameters set the V/f pattern used for motor 2. Refer to *Setting 16: Motor 2 selection on page 171* for details on switching motors.

### ■ E3-01: Motor 2 Control Mode Selection

Selects the control mode for motor 2.

**Note:** **1.** E3-01 dependant parameters are reset to the default settings when E3-01 is changed.
**2.** Protection from motor overload (oL1) is determined by L1-01, just as it is for motor 1.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E3-01 | Motor 2 Control Mode Selection | 0, 2, 3 | 2 |

**Setting 0: V/f Control**
**Setting 2: Open Loop Vector Control**
**Setting 3: Close Loop Vector Control**

### ■ E3-04 to E3-13

Parameters E3-04 through E3-13 set up the V/f pattern used for motor 2 as shown in *Figure 2.42*.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E3-04 | Motor 2 Maximum Output Frequency | 40.0 to 120.0 Hz | <1> |
| E3-05 | Motor 2 Maximum Voltage | 0 to 13000 V | <1> |
| E3-06 | Motor 2 Base Frequency | 0.0 to 120.0 Hz | <1> |
| E3-07 | Motor 2 Mid Output Frequency | 0.0 to 120.0 Hz | <1> |
| E3-08 | Motor 2 Mid Output Frequency Voltage | 0 to 13000 V | <1> |
| E3-09 | Motor 2 Minimum Output Frequency | 0.0 to 120.0 Hz | <1> |
| E3-10 | Motor 2 Minimum Output Voltage | 0 to 13000 V | <1> |
| E3-11 | Motor 2 Mid Output Frequency 2 | 0.0 to120.0 Hz | 0.0 Hz <3> |
| E3-12 | Motor 2 Mid Output Frequency Voltage 2 | 0 to 13000 V | 0 V <2> <3> |
| E3-13 | Motor 2 Base Voltage | 0 to 13000 V | 0 V <2> |

<1> Default setting is determined by the control mode selected for motor 2 (E3-01).
<2> The drive sets this value when Auto-Tuning is performed (Rotational Auto-Tuning and Stationary Auto-Tuning).
<3> Parameter ignored when E3-11 and E3-12 are set to 0.0.

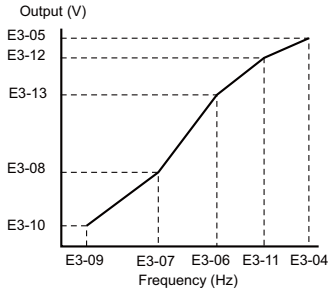



**Figure 2.42 V/f Pattern for Motor 2**

**Note:** **1.** The following conditions must be true when setting up the V/f pattern: E3-09 ≤ E3-07 < E3-06 ≤ E3-11 ≤ E3-04
**2.** To make the V/f pattern a straight line at a frequency lower than E3-06, set E3-09 = E3-07. With this setting, E3-08 is disregarded.
**3.** Parameters E3-04 through E3-13 are reset to their default values when the drive is initialized.
**4.** E3-11, E3-12, and E3-13 rarely need to be changed, and should only be used to fine-tune the V/f pattern in the constant output range.

## ◆ E4: Motor 2 Parameters

E4 parameters contain the motor data for motor 2. These parameters are usually set automatically during the Auto-Tuning process (Rotational Auto-Tuning, Stationary Auto-Tuning). If Auto-Tuning cannot be performed, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

### ■ E4-01: Motor 2 Rated Current

Set E4-01 to the full load amps (FLA) stamped on the nameplate of motor 2. This value is used for motor protection and to calculate torque limits. If Auto-Tuning completes successfully, the value entered in T1-04 will automatically be saved to E4-01.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-01 | Motor 2 Rated Current | 10% to 200% of the drive rated current. | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

**Note:** If the motor rated current in E4-01 is set lower than the motor no-load current in E4-03, then a parameter setting error will occur (oPE02). E4-03 must be set correctly to prevent this error.

### ■ E4-02: Motor 2 Rated Slip

This parameter sets the motor 2 rated slip frequency. Slip compensation is based on this value. The drive calculates this value automatically during Auto-Tuning (Rotational Auto-Tuning and Stationary Auto-Tuning).

For information on calculating the motor rated slip, refer to *E2-02: Motor Rated Slip on page 152*.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-02 | Motor 2 Rated Slip | 0.00 to 20.00 Hz | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

### ■ E4-03: Motor 2 Rated No-Load Current

Set the no-load current for motor 2 in amperes when operating at the rated frequency and the no-load voltage. The drive sets E2-03 during the Auto-Tuning process (Rotational Auto-Tuning and Stationary Auto-Tuning). The motor no-load current listed in the motor test report can also be entered to E2-03 manually. Contact the motor manufacturer to receive a copy of the motor test report.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-03 | Motor 2 Rated No-Load Current | 0 to [E4-01] | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

### ■ E4-04: Motor 2 Motor Poles

Set the pole number of motor 2 to E4-04. If Auto-Tuning completes successfully, the entered value in T1-06 will be automatically saved in E4-04.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-04 | Motor 2 Motor Poles | 2 to 48 | 4 |

### ■ E4-05: Motor 2 Line-to-Line Resistance

Sets the line-to-line resistance for the motor 2 stator winding. If Auto-Tuning completes successfully, this value is automatically calculated. Remember this value must be entered as line-to-line and not for each motor phase. Refer to *E2-05: Motor Line-to-Line Resistance on page 153* to manually enter this parameter setting.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-05 | Motor 2 Line-to-Line Resistance | 0.000 to 65.000 W | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ E4-06: Motor 2 Leakage Inductance

Sets the voltage drop due to motor leakage inductance as a percentage of rated voltage of motor 2.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-06 | Motor 2 Leakage Inductance | 0.0 to 40.0% | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ E4-07: Motor 2 Motor Iron-Core Saturation Coefficient 1

Sets the motor 2 iron saturation coefficient at 50% of magnetic flux. This value is automatically set during Rotational Auto-Tuning. Adjust this parameter when operating in the constant output range.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-07 | Motor 2 Motor Iron-Core Saturation Coefficient 1 | 0.00 to 0.50 | 0.50 |

## ■ E4-08: Motor 2 Motor Iron-Core Saturation Coefficient 2

Sets the motor 2 iron saturation coefficient at 75% of magnetic flux. This value is automatically set during Rotational Auto-Tuning. Adjust this parameter when operating in the constant output range.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-08 | Motor 2 Motor Iron-Core Saturation Coefficient 2 | [E4-07] to 0.75 | 0.75 |

## ■ E4-09: Motor 2 Mechanical Loss

This parameter seldom needs to be changed, but may need to be adjusted in the following circumstances:
The setting for the mechanical loss is added to the torque reference.

- When there is a large amount of torque loss due to motor bearing friction
- When there is a large amount of torque loss in a fan or pump application

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-09 | Motor 2 Mechanical Loss | 0.0 to 10.0% | 0.0% |

## ■ E4-10: Motor 2 Iron Loss

Sets the motor 2 iron loss in watts.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-10 | Motor 2 Iron Loss | 0 to 65535 W | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ E4-11: Motor 2 Rated Power

Sets the motor 2 rated power. If Auto-Tuning completes successfully, the value entered to T1-02 will automatically be saved to E4-11.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| E4-11 | Motor 2 Rated Power | 0 to 65000 kW | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

# 2.6 F: Option Settings

## ◆ F1: PG Speed Control Card Settings

Yaskawa offers a PG-X3 and PG-B3 motor encoder PG option card. Use the CN5-C port when using only one PG option card and use the CN5-C and CN5-B ports when using two PG option cards. When programming one of the contact input to act as a switch between two motors (H1-□□= 16), use the card connected to port CN5-C for motor 1 and use the card connected to CN5-B for motor 2.

*Table 2.18* lists the parameters that must be set for each option card port.

**Table 2.18 Option Card Ports and Corresponding Parameters**

| Port | Parameters |
|---|---|
| CN5-C and CN5-B (common) | F1-02 to F1-04, F1-08 to F1-11, F1-14 |
| CN5-C only | F1-01, F1-05, F1-06, F1-20 |
| CN5-B only | F1-31, F1-32, F1-35, F1-36 |

### ■ F1-01, F1-31: PG 1 and PG 2 Pulses Per Revolution

Sets the number encoder number of pulses per revolution.

| No. | Parameter Name | Option Port | Setting Range | Default |
|---|---|---|---|---|
| F1-01 | PG 1 Pulses Per Revolution | CN5-C | 0 to 60000 ppr | Determined by A1-02 <1> |
| F1-31 | PG 2 Pulses Per Revolution | CN5-B | 0 to 60000 ppr | 600 ppr |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### ■ F1-02, F1-14: PG Open (PGo) Circuit Operation Selection, Detection Time

A PGo fault is triggered if the drive receives no pulse signal for longer than the time set in F1-14. The stopping method when PGo occurs should be set to parameter F1-02.

| No. | Parameter Name | Option Port | Setting Range | Default |
|---|---|---|---|---|
| F1-02 | Operation Selection at PG Open Circuit (PGo) | CN5-B, CN5-C | 0 to 4 | 1 |
| F1-14 | PG Open-Circuit Detection Time | CN5-B, CN5-C | 0.0 to 10.0 s | 2.0 s |

**Parameter F1-02 Settings:**
**Setting 0: Ramp to stop (uses the deceleration time set to C1-02)**
**Setting 1: Coast to stop**
**Setting 2: Fast Stop (uses the Fast Stop time set to C1-09)**
**Setting 3: Alarm only**
**Setting 4: No alarm display**

**Note:** Due to potential damage to motor and machinery, the “Alarm only” and “No alarm display” setting should be used only under special circumstances.

### ■ F1-03, F1-08, F1-09: Overspeed (oS) Operation Selection, Detection Level, Delay Time

An overspeed error (oS) is triggered when the speed feedback exceeds the value set in F1-08 for longer than the time set in F1-09. The stopping method when an overspeed fault occurs can be selected in parameter F1-03.

| No. | Parameter Name | Option Port | Setting Range | Default |
|---|---|---|---|---|
| F1-03 | Operation Selection at Overspeed (oS) | CN5-B, CN5-C | 0 to 3 | 1 |
| F1-08 | Overspeed Detection Level | CN5-B, CN5-C | 0 to 120% | 115% |
| F1-09 | Overspeed Detection Delay Time | CN5-B, CN5-C | 0.0 to 2.0 s | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

**Parameter F1-03 Settings:**
**Setting 0: Ramp to stop (uses the deceleration time set to C1-02)**
**Setting 1: Coast to stop**
**Setting 2: Fast Stop (uses the Fast Stop time set to C1-09)**
**Setting 3: Alarm only**
**Note:** Due to potential damage to motor and machinery, the "Alarm only" setting should be used only under special circumstances.

## ■ F1-04, F1-10, F1-11: Operation at Speed Deviation (dEv), Detection Level, Delay Time

A speed deviation error (dEv) is triggered when the difference between the frequency reference and the speed feedback exceeds the value set in F1-10 for longer than the time set in F1-11. The stopping method when a speed deviation fault occurs can be selected in parameter F1-04.

| No. | Parameter Name | Option Port | Setting Range | Default |
|---|---|---|---|---|
| F1-04 | Operation Selection at Deviation (dEv) | CN5-B, CN5-C | 0 to 3 | 3 |
| F1-10 | Excessive Speed Deviation Detection Level | CN5-B, CN5-C | 0 to 50% | 10% |
| F1-11 | Excessive Speed Deviation Detection Delay Time | CN5-B, CN5-C | 0.0 to 10.0 s | 0.5 s |

**Settings for Parameter F1-04:**
**Setting 0: Ramp to stop (uses the deceleration time set to C1-02)**
**Setting 1: Coast to stop**
**Setting 2: Fast Stop (uses the Fast Stop time set to C1-09)**
**Setting 3: Alarm only (drive continues operating while "dEv" flashes on the screen)**

## ■ F1-05, F1-32: PG 1, PG 2 Rotation Selection

Determines the direction indicated by the pulses from the PG feedback encoder for motor 1 and motor 2.

See PG option card instruction manual for details on how to set the direction for the PG encoder and the motor.

| No. | Parameter Name | Option Port | Setting Range | Default |
|---|---|---|---|---|
| F1-05 | PG 1 Rotation Selection | CN5-C | 0, 1 | Determined by A1-02 <1> |
| F1-32 | PG 2 Rotation Selection | CN5-B | 0, 1 | 0 |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

**Setting 0: A pulse leads with Forward run command.**
**Setting 1: B pulse leads with Forward run command.**

## ■ F1-06, F1-35: PG 1, PG 2 Division Rate for PG Pulse Monitor

Sets the ratio between the pulse input and the pulse output of a PG option card as a three digit number, where the first digit (n) sets the numerator and the second and third digit (m) set the denominator as shown below:

$$f_{Pulse\ Input} = f_{Pulse\ Output} \cdot \frac{(1 + n)}{m}$$

Example: To have a ratio of 1/32 between the PG card pulse input and output, set F1-06 = 32.

| No. | Parameter Name | Option Port | Setting Range | Default |
|---|---|---|---|---|
| F1-06 | PG 1 Division Rate for PG Pulse Monitor | CN5-C | 1 to 132 (1 to $\frac{1}{32}$) | 1 |
| F1-35 | PG 2 Division Rate for PG Pulse Monitor | CN5-B | 1 to 132 (1 to $\frac{1}{32}$) | 1 |

### ■ F1-20, F1-36: PG Option Card Disconnect Detection

Sets whether the drive detects a fault or not when a PG-X3 card is disconnected.

| No. | Parameter Name | Option Port | Setting Range | Default |
|---|---|---|---|---|
| F1-20 | PG Option Card Disconnection Detection 1 | CN5-C | 0, 1 | 1 |
| F1-36 | PG Option Card Disconnection Detection 2 | CN5-B | 0, 1 | 1 |

**Setting 0: Disabled**
**Setting 1: Enabled**

### ■ F1-30: PG Option Card Port for Motor 2 Selection

Specifies the drive port for the PG option card used for motor 2. This parameter should be set when switching between motor 1 and motor 2, where both motors supply a speed feedback signal to the drive. If the same PG card is being used for feedback signals from both motors, then set F1-30 to 0. If each motor has its own PG card connected to the drive, then set F1-30 to 1.

**Note:** The motor 2 selection function cannot be used when PM motor is used.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F1-30 | PG Option Card Port for Motor 2 Selection | 0, 1 | 1 |

**Setting 0: CN5-C**
**Setting 1: CN5-B**

## ◆ F2: Analog Input Card Settings

These parameters are used to setup the drive for operation with the analog input option card AI-A3. This section describes parameters that govern operation with an input option card. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

### ■ F2-01: Analog Input Option Card Operation Selection

Determines how the input terminals on the AI-A3 option card are to be used.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F2-01 | Analog Input Option Card Operation Selection | 0, 1 | 0 |

**Setting 0: Separate functions for each terminal (V1, V2 replace analog inputs 1, 2**

Apply this setting to replace the drive analog input 1 and 2 by the option board terminals V1 and V2. Functions, gain, and bias levels for an analog reference supplied by AI-A3 are set using the H3-☐☐ parameters as described in *H3-03, H3-04: Analog Input 1 Gain and Bias Settings on page 188*.

**Note:** Parameter setting error oPE05 will occur if option card terminals are set for separate input functions (F2-01 = 0) while b1-01 = 3.

**Setting 1: Combine input terminal values to create frequency reference**

With this setting, all three input signals on the AI-A3 option card are added together to create the frequency reference. When the option card is the source of the frequency reference for the drive, parameter b1-01 must be set to 3. Gain and bias settings for the frequency reference supplied from AI-A3 can be set using parameters F2-02 and F2-03.

### ■ F2-02, F2-03: Analog Input Option Card Gain, Bias

Parameter F2-02 sets the gain and parameter F2-03 sets the bias for the AI-A3 input signal when the card is used in the combined input signals mode (F2-01 = 1). Both gain and bias are set as a percentage of the maximum output frequency.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F2-02 | Analog Input Option Card Gain | -999.9 to 999.9% | 100.0% |
| F2-03 | Analog Input Option Card Bias | -999.9 to 999.9% | 0.0% |

**Note:** Enabled only when F2-01 = 1.

## ◆ F3: Contact Input Card Settings

These parameters set up the drive for operation with the option card DI-A3. This section describes parameters that govern operation with a contact input option card. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

### ■ F3-01: Contact Input Option Card Input Selection

Determines the type of input for contact input option card DI-A3 when o1-03 is set to 0 or 1.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F3-01 | Contact Input Option Card Input Selection | 0 to 7 | 0 |

**Setting 0: BCD, 1% units**
**Setting 1: BCD, 0.1% units**
**Setting 2: BCD, 0.01% units**
**Setting 3: BCD, 1 Hz units**
**Setting 4: BCD, 0.1 Hz units**
**Setting 5: BCD, 0.01 Hz units**
**Setting 6: BCD, special setting (5-digit input), 0.02 Hz units**
**Setting 7: Binary**
The units and setting range are determined by the setting for F3-03 as shown below.

F3-03 = 0: 100%/255 (-255 to +255)

F3-03 = 1: 100%/4095 (-4095 to +4095)

F3-03 = 2: 100%/30000 (-33000 to +33000)

**Note:** When o1-03 = 2 or 3, the input is BCD regardless of the setting for F3-01, and the units are determined by parameter o1-03.

### ■ F3-03: Contact Input Option DI-A3 Data Length Selection

Determines the number of bits for the option card input that sets the frequency reference.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F3-03 | Contact Input Option DI-A3 Data Length Selection | 0 to 2 | 2 |

**Setting 0: 8 bit**
**Setting 1: 12 bit**
**Setting 2: 16 bit**

## ◆ F4: Analog Monitor Card Settings

These parameters set up the drive for operation with the analog output option card AO-A3. This section describes parameters that govern operation with an analog output option card. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

### ■ F4-01: Analog Output 5 (Terminal V1) Monitor Selection

Selects the data to output from analog output 5 (terminal V1). Enter the final three digits of U□-□□ to determine which monitor data is output from the option card. Some monitors are only available in certain control modes.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-01 | Analog Output 5 (Terminal V1) Monitor Selection | 000 to 999 | 102 |

### ■ F4-02: Analog Output 5 (Terminal V1) Gain

Parameter F4-02 determines the gain. This parameter is set as a percentage of the output signal from analog output 5 (terminal V1) where 100% equals 10 V output. The terminal output voltage is limited to 10 V.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-02 | Analog Output 5 (Terminal V1) Gain | –999.9 to 999.9% | 100.0% |

## ■ F4-03: Analog Output 5 (Terminal V1) Bias

Parameter F4-03 determines the bias. This parameter is set as a percentage of the output signal from analog output 5 (terminal V1) where 100% equals 10 V output. The terminal output voltage is limited to 10 V.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-03 | Analog Output 5 (Terminal V1) Bias | –999.9 to 999.9% | 0.0% |

## ■ F4-04: Analog Output 5 (Terminal V1) Cell Selection

Parameter F4-04 determines the power cell number to be output from analog output 5 (terminal V1). This parameter is effective when 9☐☐ (power cell) has been set for F4-01 (Analog Output 5 (Terminal V1) Monitor Selection).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-04 | Analog Output 5 (Terminal V1) Cell Selection | 1 to 15 | 1 |

## ■ F4-05: Analog Output 5 (Terminal V1) Signal Level Selection

Sets the signal level for analog output 5 (terminal V1).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-05 | Analog Output 5 (Terminal V1) Signal Level Selection | 0 or 1 | 1 |

**Setting 0: 0 to 10 Vdc**
**Setting 1: -10 to 10 Vdc**

## ■ F4-11: Analog Output 6 (Terminal V2) Monitor Selection

Selects the data to output from analog output 6 (terminal V2). Enter the final three digits of U☐-☐☐ to determine which monitor data is output from the option card. Some monitors are only available in certain control modes.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-11 | Analog Output 6 (Terminal V2) Monitor Selection | 000 to 999 | 103 |

## ■ F4-12: Analog Output 6 (Terminal V2) Gain

Parameter F4-12 determines the gain. This parameter is set as a percentage of the output signal from analog output 6 (terminal V2) where 100% equals 10 V output. The terminal output voltage is limited to 10 V.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-12 | Analog Output 6 (Terminal V2) Gain | –999.9 to 999.9 | 100.0 |

## ■ F4-13: Analog Output 6 (Terminal V2) Bias

Parameter F4-13 determines the bias. This parameter is set as a percentage of the output signal from analog output 6 (terminal V2) where 100% equals 10 V output. The terminal output voltage is limited to 10 V.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-13 | Analog Output 6 (terminal V2) Bias | –999.9 to 999.9 | 0.0 |

## ■ F4-14: Analog Output 6 (Terminal V2) Cell Selection

Parameter F4-14 determines the number of the power cell to be output from analog output 6 (terminal V2). This parameter is effective when 9☐☐ (power cell) has been set for F4-11 (Analog Output 6 (Terminal V2) Monitor Selection).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-14 | Analog Output 6 (Terminal V2) Cell Selection | 1 to 15 | 1 |

### ■ F4-15: Analog Output 6 (Terminal V2) Signal Level Selection

Sets the signal level for analog output 6 (terminal V2).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F4-15 | Analog Output 6 (Terminal V2) Signal Level Selection | 0 or 1 | 1 |

**Setting 0: 0 to 10 Vdc**
**Setting 1: -10 to 10 Vdc**
**Using Gain and Bias to Adjust Output Signal Level**

The output signal is adjustable while the drive is stopped.

**Analog Output 5 (Terminal V1)**
1. View the value set to F4-02 (Analog Output 5 (Terminal V1) Gain) on the digital operator. A voltage equal to 100% of the parameter being set in F4-01 will be output from analog output 5 (terminal V1).
2. Adjust F4-02 viewing the monitor connected to the analog output 5 (terminal V1).
3. View the value set to F4-03 on the digital operator, analog output 5 (terminal V1) will output a voltage equal to 0% of the parameter being set in F4-01.
4. Adjust F4-03 viewing the output signal on the analog output 5 (terminal V1).

**Analog Output 6 (Terminal V2)**
1. View the value set to F4-12 (Analog Output 6 (Terminal V2) Gain) on the digital operator. A voltage equal to 100% of the parameter being viewed in F4-11 will be output from analog output 6 (terminal V2).
2. Adjust F4-12 viewing the monitor connected to the analog output 6 (terminal V2).
3. View the value set to F4-13 on the digital operator, analog output 6 (terminal V2) will output a voltage equal to 0% of the parameter being set in F4-11.
4. Adjust F4-13 viewing the output signal on the analog output 6 (terminal V2).

## ◆ F5: Contact Output Card Settings

These parameters set up the drive for operation with the contact output option card DO-A3. This section describes parameters that govern operation with a contact output option card. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

### ■ F5-01 through F5-08: Contact Output Option Card Terminal Function Selection

When F5-09 = 2, the parameters listed in the table below are used to assign functions to the output terminals on the option card.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| F5-01 | Contact Output 1 (Terminal P1-PC Output Selection) | 0 to 1FF | 0: During run |
| F5-02 | Contact Output 2 (Terminal P2-PC Output Selection) | 0 to 1FF | 1: Zero speed |
| F5-03 | Contact Output 3 (Terminal P3-PC Output Selection) | 0 to 1FF | 2: Frequency (speed) agree |
| F5-04 | Contact Output 4 (Terminal P4-PC Output Selection) | 0 to 1FF | 4: Frequency (FOUT) detection 1 |
| F5-05 | Contact Output 5 (Terminal P5-PC Output Selection) | 0 to 1FF | 6: Drive ready |
| F5-06 | Contact Output 6 (Terminal P6-PC Output Selection) | 0 to 1FF | 37: During frequency output |
| F5-07 | Contact Output 7 (Terminal M1-M2 Output Selection) | 0 to 1FF | F: Not used |
| F5-08 | Contact Output 8 (Terminal M3-M4 Output Selection) | 0 to 1FF | F: Not used |

### ■ F5-09: DO-A3 Output Mode Selection

Determines how the DO-A3 option card is to work with the drive.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F5-09 | DO-A3 Output Mode Selection | 0 to 2 | 0 |

**Note:** Refer to TOBP C730600 41 YASKAWA AC Drive-Option Card DO-A3 Installation Manual for more details on F5-09 settings.

**Setting 0: Separate output functions for each of 8 terminals**
**Setting 1: Binary output**
**Setting 2: Output functions assigned by F5-01 through F5-08**

## ◆ F6: Communication Option Card Settings

These parameters are used to set the communication option card, and to set the fault detection method.

Some parameters apply to all communication option cards, while some parameters are used only for certain network options.

| Parameter | Communication Protocol | |
|---|---|---|
| | PROFIBUS-DP | DeviceNet |
| F6-01 to F6-03, F6-06 to F6-08 | ○ | ○ |
| F6-30 to F6-32 | ○ | – |
| F6-50 to F6-63 | – | ○ |

### ■ F6-01: Communications Error Operation Selection

Determines drive operation if a communication error occurs.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F6-01 | Communications Error Operation Selection | 0 to 3 | 1 |

**Setting 0: Ramp to stop (uses the deceleration time set to C1-02)**
**Setting 1: Coast to stop**
**Setting 2: Fast Stop (uses the Fast Stop time set to C1-09)**
**Setting 3: Alarm only (continue operation)**

### ■ F6-02: External Fault from Comm. Option Detection Selection

Determines the detection method of an external fault initiated by a communication option (EF0).

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F6-02 | External Fault from Comm. Option Detection Selection | 0 or 1 | 0 |

**Setting 0: Always detected**
**Setting 1: Detection during run only**

### ■ F6-03: External Fault from Comm. Option Operation Selection

Determines the operation when an external fault is initiated by a communication option (EF0).

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F6-03 | External Fault from Comm. Option Operation Selection | 0 to 3 | 1 |

**Setting 0: Ramp to stop**
**Setting 1: Coast to stop**
**Setting 2: Fast Stop**
**Setting 3: Alarm only (continue operation)**

### ■ F6-06: Torque Reference / Torque Limit Selection from Comm. Option

Used to select if torque reference and torque limit values are assigned to the drive from the network.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F6-06 | Torque Reference / Torque Limit Selection from Comm. Option | 0, 1 | 0 |

**Setting 0: Enabled**
**Setting 1: Disabled**

### ■ F6-07: Multi-Step Speed Enable/Disable when NetRef/ComRef is Selected

Selects how multi-step speed inputs are treated when the NetRef command is set.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F6-07 | NetRef/ComRef Function Selection | 0, 1 | 0 |

**Setting 0: Multi-step speed operation disabled**

If the NetRef command is selected, multi-step speed input frequency references are disabled.

**Setting 1: Multi-step speed operation enabled**

Even if the NetRef command is selected, multi-step speed inputs are still active and can override the frequency reference from the communications option.

### ■ F6-08: Reset Communication Parameters

Determines whether communication-related parameters (F6-☐☐) are reset when the drive is initialized using parameter A1-03.

| No. | Parameter Name | Setting Range | Default |
|---|---|---|---|
| F6-08 | Reset Communication Parameters | 0, 1 | 0 |

**Setting 0: Do not reset parameters F6-☐☐ when the drive is initialized with A1-03**
**Setting 1: Reset F6-☐☐ when the drive is initialized with A1-03**
**Note:** F6-08 is not reset when the drive is initialized.

## ◆ PROFIBUS-DP Parameters

Parameters F6-30 through F6-32 set up the drive to operate on a PROFIBUS-DP network.

For details on parameter settings, refer to the YASKAWA AC Drive-Option Card PROFIBUS-DP Installation Manual and Technical Manual.

## ◆ DeviceNet Parameters

Parameters F6-50 through F6-63 set up the drive to operate on a DeviceNet network.

For details on parameter settings, refer to the YASKAWA AC Drive-Option Card DeviceNet Installation Manual and Technical Manual.

# 2.7 H: Terminal Functions

H parameters are used to assign functions to the external terminals.

## ◆ H1: Contact Inputs

### ■ H1-02 to H1-16: Functions for Contact Inputs 2 to 16

These parameters assign functions to the contact inputs. The various functions and their settings are listed below in *Table 2.19*.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H1-02 | Contact Input 2 Function Selection | 1 to 9F | 41 (F): Reverse Run Command (2-wire sequence) |
| H1-03 | Contact Input 3 Function Selection | 0 to 9F | 24: External Fault |
| H1-04 | Contact Input 4 Function Selection | 0 to 9F | 14: Fault Reset |
| H1-05 | Contact Input 5 Function Selection | 0 to 9F | F: Through mode |
| H1-06 | Contact Input 6 Function Selection | 0 to 9F | 4 (3): Multi-Step Speed Reference 2 |
| H1-07 | Contact Input 7 Function Selection | 0 to 9F | 6 (4): Jog Reference Selection |
| H1-08 | Contact Input 8 Function Selection | 0 to 9F | 8: External Baseblock Command |
| H1-09 | Contact Input 9 Function Selection | 0 to 9F | F: Through mode |
| H1-10 | Contact Input 10 Function Selection | 0 to 9F | F: Through mode |
| H1-11 | Contact Input 11 Function Selection | 0 to 9F | F: Through mode |
| H1-12 | Contact Input 12 Function Selection | 0 to 9F | F: Through mode |
| H1-13 | Contact Input 13 Function Selection | 0 to 9F | F: Through mode |
| H1-14 | Contact Input 14 Function Selection | 0 to 9F | F: Through mode |
| H1-15 | Contact Input 15 Function Selection | 0 to 9F | F: Through mode |
| H1-16 | Contact Input 16 Function Selection | 0 to 9F | F: Through mode |

**Table 2.19 Contact Input Terminal Settings**

| Setting | Function | Page | Setting | Function | Page |
|---|---|---|---|---|---|
| 1 | LOCAL/REMOTE Selection | 167 | 20 to 2F | External fault | 172 |
| 2 | External Reference 1/2 Selection | 167 | 30 | PID Integral Reset | 173 |
| 3 | Multi-Step Speed Reference 1 | 167 | 31 | PID Integral Hold | 173 |
| 4 | Multi-Step Speed Reference 2 | 167 | 32 | Multi-Step Speed Reference 4 | 173 |
| 5 | Multi-Step Speed Reference 3 | 167 | 33 | Thermostatic Switch (N.C.) | 173 |
| 6 | Jog Reference Selection | 167 | 34 | PID Soft Starter Cancel | 173 |
| 7 | Accel/Decel Time Selection 1 | 167 | 35 | PID input level selection | 173 |
| 8 | Baseblock Command (N.O.) | 167 | 40 | Forward run command (2-wire sequence) | 173 |
| 9 | Baseblock Command (N.C.) | 167 | 41 | Reverse run command (2-wire sequence) | 173 |
| A | Accel/Decel Ramp Hold | 168 | 42 | Run command (2-wire sequence 2) | 173 |
| B | Drive Overheat Alarm (oH2) | 168 | 43 | FWD/REV command 2 (2-wire sequence 2) | 173 |
| C | Analog Terminal Input Selection | 168 | 44 | Add Offset Frequency 1 | 173 |
| E | ASR Integral Reset | 168 | 45 | Add Offset Frequency 2 | 173 |
| F | Through Mode | 168 | 46 | Add Offset Frequency 3 | 173 |
| 10 | Up Command | 168 | 60 | DC Injection Braking Command | 173 |
| 11 | Down Command | 168 | 61 | External Search Command 1: Maximum output frequency | 174 |
| 12 | Forward Jog | 170 | 62 | External Search Command 2: Set frequency reference | 174 |
| 13 | Reverse Jog | 170 | 63 | Field Weakening | 174 |
| 14 | Fault Reset | 170 | 67 | Communications Test Mode | 174 |
| 15 | Fast Stop (N.O.) | 170 | 6A | Drive Enable | 174 |
| 16 | Motor 2 Selection | 171 | 70 | Drive Enable 2 | 174 |
| 17 | Fast Stop (N.C.) | 170 | 71 | Speed/Torque Control Switch | 174 |
| 18 | Timer Function Input | 171 | 75 | Up 2 Command | 175 |
| 19 | PID Disable | 171 | 76 | Down 2 Command | 175 |
| 1A | Accel/Decel Time Selection 2 | 171 | 77 | ASR Gain Switch | 176 |

| Setting | Function | Page | Setting | Function | Page |
|---|---|---|---|---|---|
| 1B | Program Lockout | 171 | 78 | External Torque Reference Polarity Inversion | 176 |
| 1E | Reference Sample Hold | 172 | | | |

### Setting 1: LOCAL/REMOTE selection

This setting allows the input terminal to determine if the drive will run in LOCAL mode or REMOTE mode.

| Status | Description |
|---|---|
| Closed | LOCAL: The frequency reference and Run command are input from the digital operator. |
| Open | REMOTE: The frequency reference and Run command are input from the external reference that has been selected. If a contact input set to H1-☐☐ = 2 is active, they will be read from external reference source 2 (b1-15 and b1-16). Otherwise they will be read from external reference source 1 (b1-01 and b1-02). |

**Note:** **1.** If one of the contact input terminals is set to LOCAL/REMOTE, then the LO/RE key on the digital operator will be disabled.
**2.** When the drive is set to LOCAL, the LO/RE will light.
**3.** The default setting of the drive is not to allow switching between LOCAL and REMOTE during run. To allow the drive to switch between LOCAL and REMOTE during run, Refer to ***b1-07: LOCAL/REMOTE Run Selection on page 100***.

### Setting 2: External reference 1/2 selection

This function can be used to switch the Run command and frequency reference source between External reference 1 and 2 if the drive is in the REMOTE mode.

| Status | Description |
|---|---|
| Open | External reference 1 is used (defined by parameters b1-01 and b1-02) |
| Closed | External reference 2 is used (defined by parameters b1-15 and b1-16) |

**Note:** With default settings the drive is not to allow switching between External reference 1 and 2 during run. Refer to ***b1-07: LOCAL/REMOTE Run Selection on page 100*** if this feature is required by the application.

### Setting 3 to 5: Multi-Step Speed Reference 1 to 3

Used to switch multi-step speed frequency references d1-01 to d1-08 by contact inputs. Refer to ***d1-01 to d1-17: Frequency Reference 1 to 16 and Jog Frequency Reference on page 135*** for details.

### Setting 6: Jog reference selection

The Jog frequency set in parameter d1-17 becomes the frequency reference when the input terminal closes. Refer to ***d1: Frequency Reference on page 135*** for details.

### Setting 7: Accel/decel time selection 1

Used to switch between accel/decel times 1 (C1-01 and C1-02) and 2 (C1-03 and C1-04). Refer to ***C1-01 to C1-08: Accel, Decel Times 1 to 4 on page 123*** for details.

### Setting 8, 9: Baseblock command (N.O): Baseblock when closed<br>Baseblock command (N.C.): Baseblock when open

When the drive receives a Baseblock command, the output transistor stops switching and the motor coasts to stop. During this time, the alarm “ bb ” will flash on the digital operator to indicate baseblock. When baseblock ends and a Run command is active, the drive performs Speed Search to get the motor running again.

| Contact Input Function | Drive Operation | |
|---|---|---|
| | Input Open | Input Closed |
| **Setting 8 (N.C.)** | Baseblock (Interrupt output) | Normal operation |
| **Setting 9 (N.O.)** | Normal operation | Baseblock (Interrupt output) |

**NOTICE:** *If using baseblock in hoist applications, make sure the brake closes when the drive output is cut off by a Baseblock command triggered via one of the input terminals. Failure to do so will result in the motor suddenly coasting when the Baseblock command is entered, causing the load to slip.*

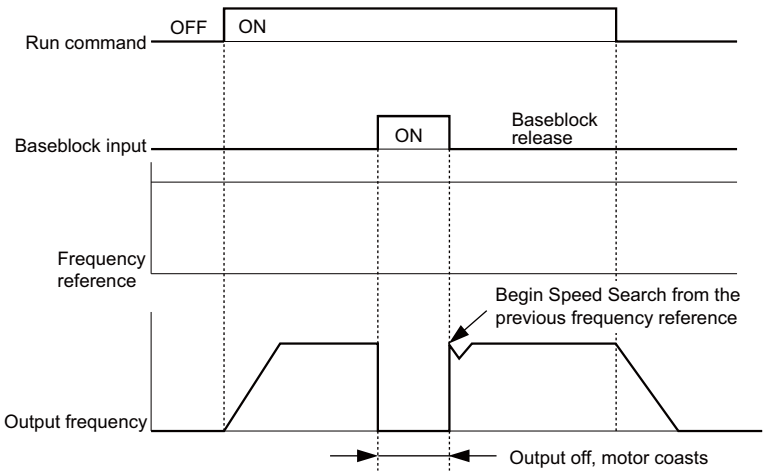



**Figure 2.43 Baseblock Operation during Run**

#### Setting A: Accel/decel ramp hold

When the contact input programmed for the Accel/decel ramp hold function closes, the drive will lock ("hold") the output frequency. Acceleration or deceleration will resume once the input is opened again.

If the Accel/decel ramp hold function is enabled (d4-01 = 1), the drive will save the output frequency to memory whenever the Ramp Hold input is closed. When the drive is restarted after stop or after power supply interruption, the output frequency that was saved will become the frequency reference (provided that the Accel/decel ramp hold input is still closed). Refer to *d4-01: Frequency Reference Hold Function Selection on page 139* for details.

#### Setting B: Drive overheat alarm (oH2)

Triggers an oH2 alarm when the contact closes. Because this is an alarm, drive operation is not affected.

#### Setting C: Analog terminal input selection (analog inputs 1, 2)

When closed, the terminals specified in H3-14 are enabled. When open, the drive disregards the input signal to the analog terminals.

#### Setting E: ASR integral reset

Switches between PI control or simply P control by resetting the integral value. As long as the terminal is closed, integral operation is disabled and the drive uses P control. When the terminal opens, PI control resumes.

#### Setting F: Through mode

Select this setting when using the terminal in a pass-through mode. When set to F, an input does not trigger any function in the drive. Setting F, however, still allows the input status to be read out by a PLC via a communication option or MEMOBUS/Modbus communications.

#### Setting 10, 11: Up, Down command

Using the Up/Down function allows the frequency reference to be set by two push buttons. One contact input must be programmed as the Up input (H1-☐☐ = 10) to increase the frequency reference, and the other one must be programmed as the Down input (H1-☐☐ = 11) to decrease the frequency reference.

The Up/Down function has priority over the frequency references from the digital operator and the analog inputs (b1-01 = 0, 1). If the Up/Down function is used, then references provided by these sources will be disregarded.

The inputs operate as shown in *Table 2.20*.

**Table 2.20 Up, Down command**

| Status | | Drive Operation |
|---|---|---|
| Up (10) | Down (11) | |
| Open | Open | Hold current frequency reference |
| Closed | Open | Increase frequency reference |
| Open | Closed | Decrease frequency reference |
| Closed | Closed | Hold current frequency reference |

**Note:**
1. An oPE03 (Incorrect Contact Input Selection) error will occur when only one of the functions Up/Down is programmed for a contact input.
2. An oPE03 alarm will occur if the Up/Down function is assigned to the terminals while another input is programmed for the Accel/decel ramp hold function. For more information on alarms, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).
3. The Up/Down function can only be used for External reference 1. Consider this when using Up/Down and the external reference switching command (H1-☐☐ = 2).

### Using the Up/Down Function with Frequency Reference Hold (d4-01)

- When the frequency reference hold function is disabled (d4-01 = 0), the Up/Down frequency reference will be reset to 0 when the Run command is cleared or the power is cycled.
- When d4-01 = 1, the drive will save the frequency reference set by the Up/Down function. When the Run command is re-input or the power turned off and back on, the drive will restart with the reference value that was saved. The value that was saved can be reset by closing either the Up or Down input without having a Run command active. Refer to *d4-01: Frequency Reference Hold Function Selection on page 139*.

### Using the Up/Down Function with Frequency Reference Limits

The upper frequency reference limit is determined by parameter d2-01.

The value for the lower frequency reference limit depends on the setting of parameter d4-10, and can be set by an analog input or parameter d2-02. Refer to *d4-10: Up/Down Frequency Reference Limit Selection on page 143* for details. When a Run command is applied, the lower limits work as follows:

- If the lower limit is set by d2-02 only, the drive will accelerate to this limit as soon as a Run command is entered.
- If the lower limit is determined by an analog input only, the drive will accelerate to the limit as long as the Run command and an Up or Down command are active. It will not start running if only the Run command is on.
- If the lower limit is set by both an analog input and d2-02, and the analog limit is higher than the d2-02 value, then the drive will accelerate to the d2-02 value when a Run command is input. Once the d2-02 value is reached, it will continue acceleration to the analog limit only if an Up or Down command is set.

*Figure 2.44* shows an Up/Down function example with a lower frequency reference limit set by d2-02, and the frequency reference hold function both enabled and disabled.

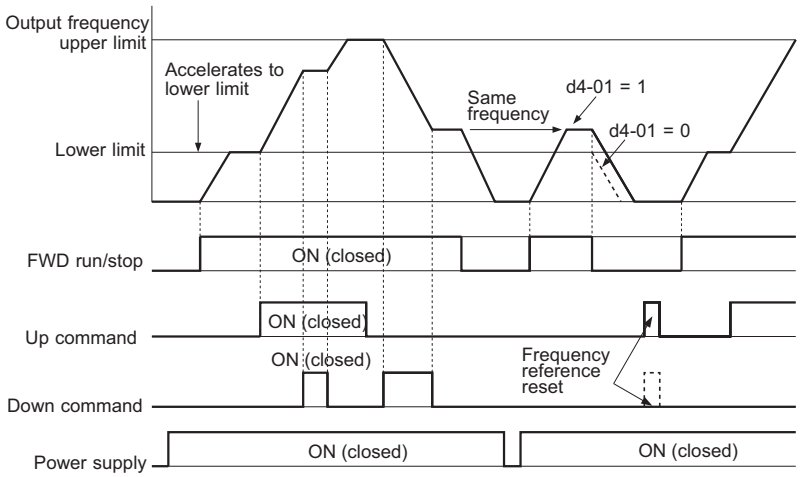



**Figure 2.44 Up/Down Command Operation**

### Setting 12, 13: Forward Jog, Reverse Jog

Contact inputs programmed as Forward Jog (H1-☐☐ = 12) and Reverse Jog (H1-☐☐ = 13) will be Jog inputs that do not require a Run command. Closing the terminal set for Forward Jog input will cause the drive to ramp to the Jog frequency reference (d1-17) in the forward direction. The Reverse Jog will cause the same action in the reverse direction. The Forward Jog and Reverse Jog command can be set independently.

**Note:** The Forward Jog and Reverse Jog commands override all other frequency references. However, if the drive is set to prohibit reverse rotation (b1-04 = 1), then activating Reverse Jog will have no effect. If both the Forward Jog and Reverse Jog are input simultaneously for 500 ms or longer, an alarm will occur and the drive will ramp to stop.

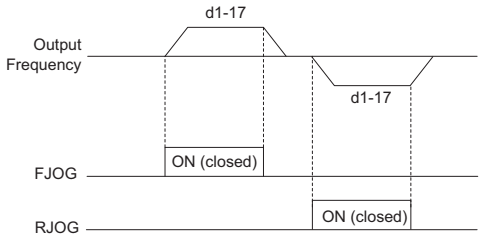



**Figure 2.45 FJOG/RJOG Operation**

### Setting 14: Fault reset

Whenever the drive detects a fault condition, the fault output contact will close and the drive's output will shut off. The motor then coasts to a stop (specific stopping methods can be selected for some faults such as L8-03 for Overheat Pre-Alarm Operation Selection). Once the Run command is turned OFF, the fault can be cleared for restarting the drive either by pressing RESET on the digital operator or by closing a contact input configured as a Fault Reset (H1-☐☐ = 14).

**Note:** Fault Reset commands are ignored as long as the Run command is present. To reset a fault, first turn off the Run command.

### Setting 15, 17: Fast Stop (N.O., N.C.)

The Fast Stop function operates much like an emergency stop input to the drive. If a Fast Stop command is input while the drive is running, the drive will decelerate to a stop within the deceleration time set in C1-09 (*C1-09: Fast Stop Time on page 125*). The drive can only be restarted after it has come to a complete stop, the Fast Stop input is off, and the Run command has been switched off.

- To trigger the Fast Stop function with an N.O. switch, set H1-☐☐ = 15.
- To trigger the Fast Stop function with an N.C. switch, set H1-☐☐ = 17.

*Figure 2.46* shows an operation example for Fast Stop.

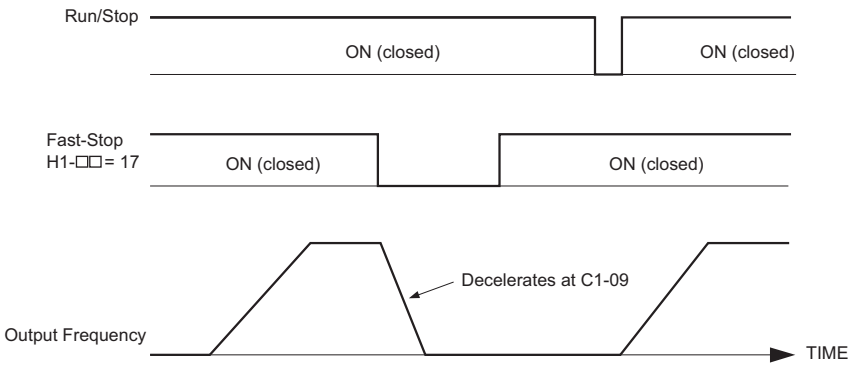



**Figure 2.46 Fast Stop Sequence**

**NOTICE:** *Rapid deceleration can trigger an overvoltage fault. When faulted, the drive output shuts off, and the motor coasts. To avoid this uncontrolled motor state and to ensure that the motor stops quickly and safely, set an appropriate Fast Stop time to C1-09.*

### Setting 16: Motor 2 selection

The drive has the capability to control two induction motors independently. A second motor may be selected using a contact input as shown in *Figure 2.47*.

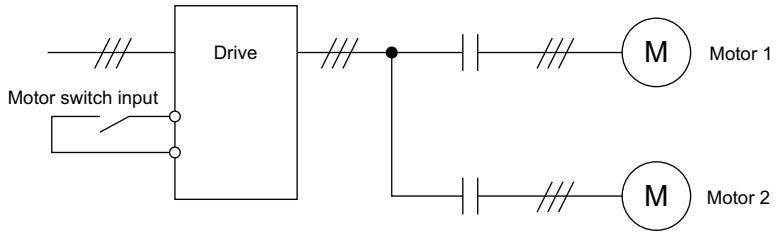



**Figure 2.47 Motor Selection**

When switching between motor 1 and motor 2, the parameters used to control those motors also change. Below, *Table 2.21* lists the parameters that correspond to each motor.

**Table 2.21 Parameters for Switching Between Two Motors**

| No. | Setting 16 Open (Motor 1) | ⇒ | Setting 16 Closed (Motor 2) |
|---|---|---|---|
| C1-□□: Acceleration/ Deceleration Time | C1-01 to C1-04 | ⇒ | C1-05 to C1-08 |
| C3-□□: Motor Slip Compensation | C3-01 to C3-04 | ⇒ | C3-21 to C3-24 |
| C4-□□: Motor Torque Compensation | C4-01 | ⇒ | C4-07 |
| C5-□□: Speed Control (ASR) | C5-01 to C5-08 | ⇒ | C5-21 to C5-24, C5-26 to C5-28 |
| E1-□□, E3□□: V/f Pattern E2-□□, E4□□: Motor Parameters | E1-□□, E2-□□ | ⇒ | E3-□□, E4-□□ |
| F1-□□ (PG Constant) | F1-01 to F1-11, F1-14, F1-20 | ⇒ | F1-02 to F1-04, F1-08 to F1-11, F1-14, F1-31, F1-32, F1-35, F1-36 |

**Note:** **1.** When using 2 motors, the motor overload protection selection (oL1) set to L1-01 applies to both motor 1 and motor 2.
**2.** It is not possible to switch between motor 1 and motor 2 during run. Doing so will trigger the “rUn” alarm.
**3.** There is a 500 ms delay when switching between motors equipped with a PG encoder for feedback.

If a contact output is programmed for “Motor 2 selection” (H1-01, H1-02, or H1-03 = 1C), motor will be selected when the output is closed.

### Setting 18: Timer function input

This setting configures a contact input terminal as the input for the timer function. Use this setting in combination with the timer function output (H2-□□ = 12). Refer to *b4: Delay Timers on page 109* for details.

### Setting 19: PID disable

When the PID function has been enabled by parameter b5-01, it can be indefinitely disabled by closing a contact input. When the input is released, the drive resumes PID operation. Also refer to *PID Block Diagram on page 112*.

### Setting 1A: Accel/decel time selection 2

Used to select accel/decel times 1 to 4 in combination with the Accel/decel time selection 1 command. Refer to *C1-01 to C1-08: Accel, Decel Times 1 to 4 on page 123* for details.

### Setting 1B: Program lockout

When an input is programmed for Program Lockout, parameter values cannot be changed as long as this input is open (it is still possible to view and monitor parameter settings).

### Setting 1E: Reference sample hold

This function allows the user to sample an analog frequency reference signal being input to analog input 1 or analog input 2 and hold the frequency reference at the sampled level. Once the Analog Frequency Reference Sample/Hold function is held for at least 100 ms, the drive reads the analog input and changes the frequency reference to the newly sampled speed as illustrated in *Figure 2.48*.

When the power is shut off and the sampled analog frequency reference is cleared, the frequency reference is reset to 0.

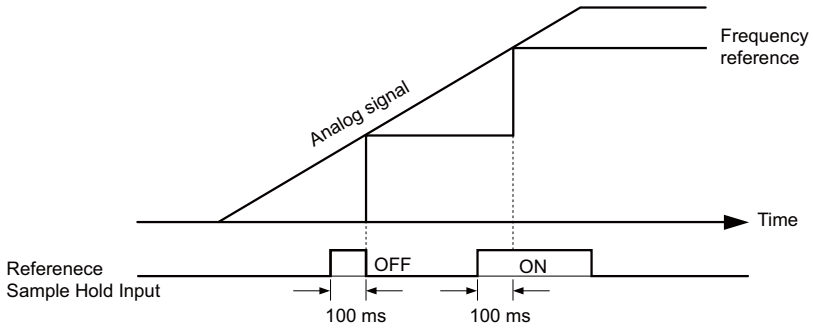



**Figure 2.48 Analog Frequency Reference Sample/Hold**

An oPE03 error will occur when one of the following functions is used simultaneously with the Analog frequency reference sample/hold command.

- Hold accel/decel stop (setting: A)
- Up command, Down command (setting: 10, 11)
- Offset frequency (setting: 44 to 46)
- Up or Down functions (setting: 75, 76)

### Setting 20 to 2F: External fault

By using the External fault command, fault contact outputs can be triggered when problems occur with external devices. To use the External fault command, set one of the contact inputs to any value between 20 to 2F. The digital operator will display EF☐ where ☐ is the number of the terminal to which the external fault signal is assigned.

For example, if an external fault signal is input to contact input 3, “EF3” will be displayed.

Select the value to be set in H1-☐☐ from a combination of any of the following three conditions:

- Signal input level from peripheral devices (N.O., N.C.)
- External fault detection method
- Operation after external fault detection

*Table 2.22* shows the relationship between the conditions and the value set for H1-☐☐:

**Table 2.22 Stopping Method for External Fault**

| Setting | Terminal Status <1> | | Detection Conditions <2> | | Stopping Method | | | |
|---|---|---|---|---|---|---|---|---|
| | N.O. | N.C. | Always Detected | Detected during Run only | Ramp to Stop (fault) | Coast to Stop (fault) | Fast Stop (fault) | Alarm Only (continue running) |
| 20 | ○ | | ○ | | ○ | | | |
| 21 | | ○ | ○ | | ○ | | | |
| 22 | ○ | | | ○ | ○ | | | |
| 23 | | ○ | | ○ | ○ | | | |
| 24 | ○ | | ○ | | | ○ | | |
| 25 | | ○ | ○ | | | ○ | | |
| 26 | ○ | | | ○ | | ○ | | |
| 27 | | ○ | | ○ | | ○ | | |
| 28 | ○ | | ○ | | | | ○ | |
| 29 | | ○ | ○ | | | | ○ | |
| 2A | ○ | | | ○ | | | ○ | |
| 2B | | ○ | | ○ | | | ○ | |
| 2C | ○ | | ○ | | | | | ○ |
| 2D | | ○ | ○ | | | | | ○ |

| Setting | Terminal Status <1> | | Detection Conditions <2> | | Stopping Method | | | |
|---|---|---|---|---|---|---|---|---|
| | N.O. | N.C. | Always Detected | Detected during Run only | Ramp to Stop (fault) | Coast to Stop (fault) | Fast Stop (fault) | Alarm Only (continue running) |
| 2E | ○ | | | ○ | | | | ○ |
| 2F | | ○ | | ○ | | | | ○ |

<1> Determine the terminal status for each fault, i.e., whether the terminal is normally open or normally closed.
<2> Determine whether detection for each fault should be enabled only during run or always detected.

### Setting 30: PID integral reset

By configuring one of the contact inputs for PID integral reset (H1-□□ = 30), the value of the integral component in PID control will be reset to 0 whenever the input terminal is closed. Refer to ***PID Block Diagram on page 112*** for more details.

### Setting 31: PID integral hold

By configuring one of the contact inputs for PID integral hold (H1-□□ = 31), the value of the integral component in PID control is held as long as the input terminal is active. The PID controller resumes integral operation from the held value as soon as the input terminal is released. Refer to ***PID Block Diagram on page 112*** for more information on this function.

### Setting 32: Multi-Step Speed Reference 4

Used to select the multi-step speeds d1-09 to d1-16 in combination with the input terminal set for Multi-Step Speed 1, 2 and 3. Refer to ***d1-01 to d1-17: Frequency Reference 1 to 16 and Jog Frequency Reference on page 135***.

### Setting 33: Thermostatic Switch (N.C.)

Triggers a TME2 alarm when the contact closes, and then thermostatic switches are OFF.

### Setting 34: PID soft starter cancel

A contact input configured as a PID soft starter cancel input (H1-□□ = 34) can be used to enable or disable the PID soft starter and thereby canceling the PID accel/decel time (b5-17). Refer to ***PID Block Diagram on page 112***.

### Setting 35: PID input level selection

Allows and input terminal to switch the sign of the PID input. Refer to ***PID Block Diagram on page 112*** for details.

### Setting 40, 41: Forward run, Reverse run command for 2-wire sequence

Configures the drive for a 2-wire sequence.

When an input terminal set to 40 closes, the drive operates in the forward direction. When an input set for 41 closes, the drive will operate in reverse. Closing both inputs at the same time will result in an external fault.

**Note:** This function cannot be used simultaneously with settings 42 and 43.

### Setting 42, 43: Run and direction command 2 for 2-wire sequence 2

When an input terminal programmed for 42 is closed, the drive will operate in the direction selected. When the input opens, the drive will stop. The input programmed for 43 selects the direction. If it is closed, the forward direction is selected. If it is open, the reverse direction is selected.

**Note:** This function cannot be used simultaneously with settings 40 and 41.

### Setting 44, 45, 46: Offset frequency 1, 2, 3

These inputs can be used to add offset frequencies d7-01, d7-02, and d7-03 to the frequency reference. Refer to ***d7-01 to d7-03: Offset Frequency 1 to 3 on page 150*** for details.

### Setting 60: DC Injection Braking command

When a DC Injection Braking command is input while the drive is stopped, DC Injection Braking operation is activated. When a Run command or a Jog command is input, DC Injection Braking is released. Refer to ***b2: DC Injection Braking on page 102*** for details on setting up the DC Injection Braking function.

The diagram below illustrates how the DC Injection Braking function works.

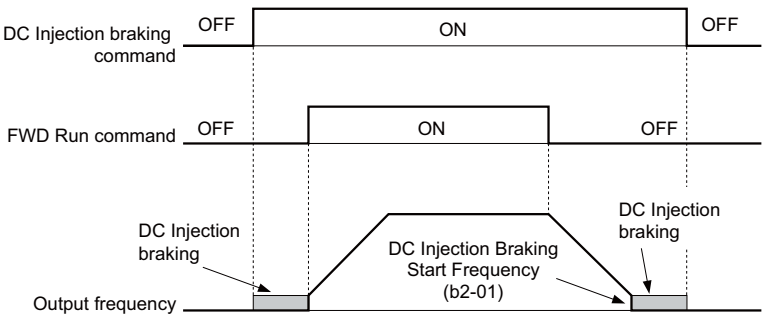



**Figure 2.49 DC Injection Braking Input Timing Diagram**

### Setting 61, 62: External Speed Search command 1, 2

These input functions can be used to enable Speed Search even if parameter b3-01 = 0 (no Speed Search at start).

Refer to ***Activating of Speed Search on page 105*** for details on how to use the input signals. Refer to ***b3: Speed Search on page 103*** for more about Speed Search.

**Note:** Operator error oPE03 will result if both Speed Search 1 and Speed Search 2 are set to the input terminals at the same time.

### Setting 63: Field Weakening

Enabled in V/f Control. When closed, Field Weakening is performed. For details, ***Refer to d6: Field Weakening and Field Forcing on page 149***.

### Setting 67: Communication test mode

The drive has a built-in function for self-diagnosing serial communications operation. The test involves wiring the send and receive terminals of the RS-485 port together. The drive transmits data and then confirms that the communications are received normally. For details on the self-diagnosing function and its operation, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

### Setting 6A: Drive enable

A contact input configured as “Drive enable” (H1-☐☐ = 6A) will prevent the drive from executing a Run command until the input is closed. When the input is open, the digital operator will display “dnE” to indicate that the drive is disabled.

If a Run command is enabled before the terminal set for “Drive enable” closes, then the drive will not run until the Run command is input (i.e., a new Run command is required). If the input is opened while the drive is running, the drive will stop according to the stop method set to b1-03 (***b1-03: Stopping Method Selection on page 97***).

### Setting 70: Drive enable 2

A contact input configured as “Drive enable 2” (H1-☐☐ = 70) will prevent the drive from executing a Run command until the input is closed. When the input is open, the digital operator will display “dnE” to indicate that the drive is disabled.

If a Run command is enabled before the terminal set for “Drive enable 2” closes, then the drive will not run until the Run command is input (i.e., a new Run command is required). If the input is opened while the drive is running, the drive will stop according to the stop method set to b1-03 (***b1-03: Stopping Method Selection on page 97***).

### Setting 71: Speed/Torque Control switch

Switches the drive between Torque Control and Speed Control. Torque Control is enabled when the terminal is closed, and Speed Control is enabled when the terminal is open. Note that parameter d5-01 must be set to 0 when using this function. Refer to ***d5: Torque Control on page 144*** and ***Switching Between Torque and Speed Control on page 147***.

### Preparing a Wait Time When Switching Between Torque and Speed Control

d5-06 can set up a wait time between opening and closing the input terminal using a parameter in units of ms. 3 analog input terminals holds the reference values when speed control/torque control switching signal changes during this wait time. Be sure to switch the signals with external devices within this wait time. Refer to ***Switching Between Torque and Speed Control on page 147***.

### Setting 75, 76: Up 2, Down 2 command

The Up 2 and Down 2 function can be used to add a bias to the frequency reference. The input programmed for 75 (Up 2 function) will increase the bias and the input programmed for 76 (Down 2 function) will decrease it. ***Table 2.23*** explains how the Up/Down 2 function works depending on the frequency reference source and parameters d4-01, d4-03, and d4-05. Refer to ***d4: Frequency Reference Hold and Up/Down 2 Function on page 139*** for detailed explanations of these and other Up/Down 2 related parameters.

**Note:** **1.** The Up 2 and Down 2 functions must be set as a pair.
**2.** When using the Up 2 and Down 2, set appropriate bias limit values to parameters d4-08 and d4-09.

**Table 2.23 Up/Down 2 Operations**

| Condition | Freq. Ref. Source | d4-03 | d4-05 | d4-01 | Operation | Frequency Saved |
|---|---|---|---|---|---|---|
| 1 | Multi-Step Speed Reference | 0 | 0 | 0 | • Accelerates (increases the bias) while the Up 2 terminal is closed.<br>• Decelerates (decreases the bias) while Down 2 is closed.<br>• Holds output frequency (holds the bias) when no Up 2 or Down 2 input or both active.<br>• Resets the bias when the reference changes.<br>• Operates with the frequency reference in all other situations. | Not saved |
| 2 | | | | 1 | | If the bias and frequency reference are constant for 5 s, the bias is added to the active frequency reference and reset afterwards. |
| 3 | | | 1 | -- | • Accelerates (increases the bias) while the Up 2 terminal is closed.<br>• Decelerates (decreases the bias) while Down 2 is closed.<br>• Otherwise operates at the frequency reference. | Not saved |
| 4 | Multi-Step Speed Reference | Value other than 0 | -- | 0 | • When the Up 2 is enabled, drive accelerates up to the frequency reference plus d4-03 (bias is increased for d4-03).<br>• When Down 2 is enabled, drive decelerates down to the frequency reference minus d4-03 (bias is decreased for d4-03).<br>• Holds output frequency (holds the bias) when no Up 2 or Down 2 input or both active.<br>• Resets the bias when the reference changes.<br>• Operates with the frequency reference in all other situations. | Not saved |
| 5 | | | | 1 | | If the bias and frequency reference are constant for 5 s, the bias is added to the active frequency reference and reset afterwards. |
| 6 | Other (analog comm., etc.) | 0 | 0 | 0 | • Accelerates (increases the bias) while the Up 2 terminal is closed.<br>• Decelerates (decreases the bias) while Down 2 is closed.<br>• Holds output frequency (holds the bias) when no Up 2 or Down 2 input or both active.<br>• If the frequency reference changes for more than d4-07 during accel/decel, bias value is held until the output frequency meets the reference (speed agree). | Not saved |
| 7 | | | | 1 | | If the bias is constant for 5 s, it is saved to parameter d4-06. The frequency reference cannot be overwritten, so only the bias is saved. |
| 8 | Other (analog comm, etc.) | 0 | 1 | -- | • Accelerates (increases the bias) while the Up 2 terminal is closed.<br>• Decelerates (decreases the bias) while Down 2 is closed.<br>• Otherwise operates at the frequency reference | Not saved |
| 9 | | Value other than 0 | -- | 0 | • When Up 2 is enabled, drive accelerates up to the frequency reference plus d4-03 (increases the bias for d4-03).<br>• When Down 2 is enabled, drive decelerates down to the frequency reference minus d4-03 (decreases the bias for d4-03).<br>• If the frequency reference changes for more then d4-07 during accel/decel, bias value is held until the output frequency meets the reference (speed agree). | Not saved |
| 10 | | | | 1 | | If the bias is constant for 5 s, it is saved to parameter d4-06. The frequency reference cannot be overwritten, so only the bias is saved. |

#### Setting 77: ASR gain switch

Switches the ASR gain between the values set in C5-01 and C5-03. The gain set to C5-03 is enabled when the terminal is closed, and C5-01 is enabled when the terminal opens again. See *C5: Automatic Speed Regulator (ASR) on page 131* for a more detailed description.

#### Setting 78: External torque reference polarity inversion

Reverses the direction of the torque reference when the terminal closes. Refer to *d5: Torque Control on page 144* and *Setting the Torque Reference, Speed Limit, and Torque Compensation Values on page 145* for details.

## ◆ H2: Contact Outputs

### ■ H2-01 to H2-16: Functions for Contact Outputs 1 to 16

The drive has 16 contact output terminals. *Table 2.24* lists the functions available for theses terminals using H2-01 to H2-16.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H2-01 | Contact output 1 function selection (open collector) | 0 to 192 | 0: During run |
| H2-02 | Contact output 2 function selection (open collector) | 0 to 192 | F: Fault |
| H2-03 | Contact output 3 function selection (open collector) | 0 to 192 | 0: During run |
| H2-04 | Contact output 4 function selection (open collector) | 0 to 1FF | 6: Drive ready |
| H2-05 | Contact output 5 function selection (open collector) | 0 to 1FF | 10: Minor fault |
| H2-06 | Contact output 6 function selection (open collector) | 0 to 1FF | F: Through mode |
| H2-07 | Contact output 7 function selection (open collector) | 0 to 1FF | F: Through mode |
| H2-08 | Contact output 8 function selection (open collector) | 0 to 1FF | F: Through mode |
| H2-09 | Contact output 9 function selection (open collector) | 0 to 1FF | F: Through mode |
| H2-10 | Contact output 10 function selection (open collector) | 0 to 1FF | F: Through mode |
| H2-11 | Contact output 11 function selection (open collector) | 0 to 1FF | F: Through mode |
| H2-12 | Contact output 12 function selection (open collector) | 0 to 1FF | F: Through mode |
| H2-13 | Contact output 13 function selection (open collector) | 0 to 1FF | F: Through mode |
| H2-14 | Contact output 14 function selection (open collector) | 0 to 1FF | Setting F: Through mode |
| H2-15 | Contact output 15 function selection (open collector) | 0 to 1FF | Setting F: Through mode |
| H2-16 | Contact output 16 function selection (open collector) | 0 to 1FF | Setting F: Through mode |

**Table 2.24 Contact output Terminal Settings**

| Setting | Function | Page | Setting | Function | Page |
|---|---|---|---|---|---|
| 0 | During Run | 177 | 1A | During Reverse | 184 |
| 1 | Zero Speed | 178 | 1B | During baseblock (N.C.) | 184 |
| 2 | Speed Agree 1 | 178 | 1C | Motor 2 Selection | 185 |
| 3 | User-set Speed Agree 1 | 178 | 1D | During Regeneration | 185 |
| 4 | Frequency detection 1 | 180 | 1E | Restart Enabled | 185 |
| 5 | Frequency detection 2 | 180 | 1F | Motor Overload Alarm (oL1) | 185 |
| 6 | Drive Ready | 180 | 20 | IGBT overheat pre-alarm (oH) | 185 |
| 7 | DC Bus Undervoltage | 181 | 22 | Mechanical Weakening detection (N.O.) | 185 |
| 8 | During Baseblock (N.O.) | 181 | 2F | Maintenance Period | 185 |
| 9 | Frequency Reference Source | 181 | 30 | During Torque Limit | 185 |
| A | Run Command Source | 181 | 31 | During Speed Limit | 185 |
| B | Torque detection 1 (N.O.) | 181 | 32 | Speed limit circuit operating (for torque control) | 185 |
| C | Frequency Reference Loss | 181 | 37 | During Frequency Output | 186 |
| E | Fault | 181 | 38 | Drive Enabled | 186 |
| F | Through Mode | 182 | 39 | Watt Hour Pulse Output | 186 |
| 10 | Minor Fault | 182 | 3A | Cooling Fan, Transformer Abnormal Temperature Rise | 186 |
| 11 | Fault Reset Command Active | 182 | 3C | LOCAL/REMOTE Status | 186 |
| 12 | Timer Output | 182 | 3D | During Speed Search | 186 |
| 13 | Speed Agree 2 | 182 | 3E | PID Feedback Low | 186 |
| 14 | User-set Speed Agree 2 | 183 | 3F | PID Feedback High | 186 |
| 15 | Frequency detection 3 | 183 | 4C | During Fast Stop | 186 |
| 16 | Frequency detection 4 | 184 | 4D | oH Pre-alarm Time Limit | 186 |
| 17 | Torque detection 1 (N.C.) | 181 | 60 | Drive Cooling Fan Alarm | 186 |
| 18 | Torque detection 2 (N.O.) | 181 | 100 to 160 | Function 0 to 60 with Inverse Output | 187 |
| 19 | Torque detection 2 (N.C.) | 181 | | | |

### Setting 0: During Run

Output closes when the drive is outputting a voltage.

| Status | Description |
|---|---|
| Open | Drive is stopped. |
| Closed | A Run command is input or the drive is during deceleration or during DC injection. |

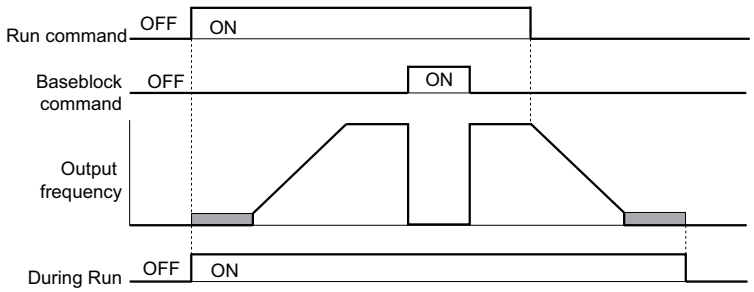



**Figure 2.50 During Run Time Chart**

### Setting 1: Zero speed

Terminal closes whenever the output frequency or motor speed (CLV) falls below the minimum output frequency set in E1-09 or b2-01.

| Status | Description |
|---|---|
| Open | Output frequency is above the minimum output frequency set to E1-09 or b2-01 |
| Closed | Output frequency is less than the minimum output frequency set to E1-09 or b2-01 |

**Note:** When using CLV control modes, the zero speed level is defined by b2-01. In all other control modes, the zero speed level is the minimum output frequency set in E1-09.

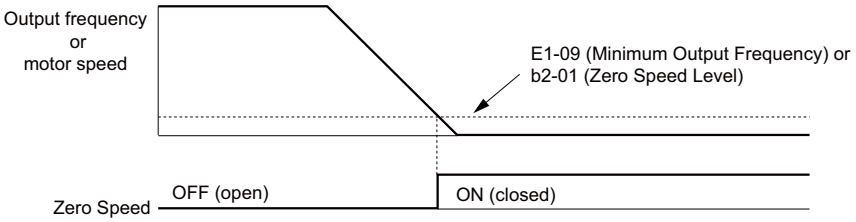



**Figure 2.51 Zero-Speed Time Chart**

### Setting 2: Speed agree 1 ($f_{ref}$ /$f_{out}$ Agree 1)

Closes whenever the actual output frequency or motor speed (CLV) is within the Speed Agree Width (L4-02) of the current frequency reference regardless of the direction.

| Status | Description |
|---|---|
| Open | Output frequency or motor speed does not match the frequency reference while the drive is running. |
| Closed | Output frequency or motor speed is within the range of frequency reference ±L4-02. |

**Note:** **1.** Detection works in both directions, forward and reverse.
**2.** When using the CLV control mode, it is the motor speed ± L4-02 that is considered.

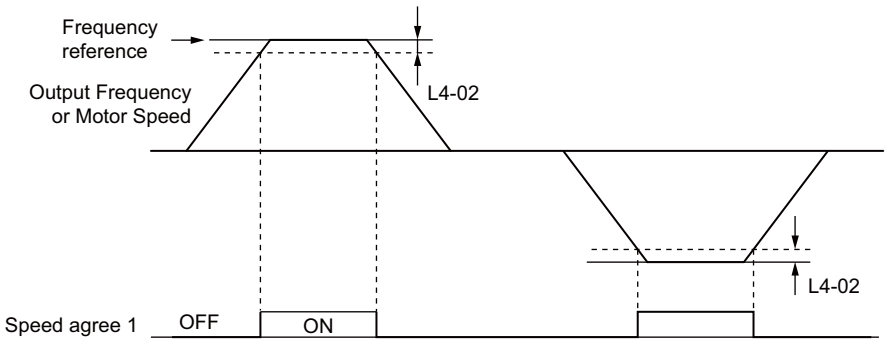



**Figure 2.52 Speed Agree 1 Time Chart**

Refer to *L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 204* for more details.

### Setting 3: User-set speed agree 1 ($f_{ref}$ /$f_{set}$ Agree 1)

Closes whenever the actual output frequency or motor speed (CLV) and the frequency reference are within the speed agree width (L4-02) of the programmed speed agree level (L4-01).

| Status | Description |
|---|---|
| Open | The output frequency is outside the range “L4-01 ± L4-02” or outside the range “frequency reference ±L4-02”. |
| Closed | The output frequency is within the range “L4-01 ± L4-02” and also within the range “frequency reference ±L4-02”. |

**Note:** Frequency detection works in both forward and reverse. The value of L4-01 is used as the detection level for both directions.

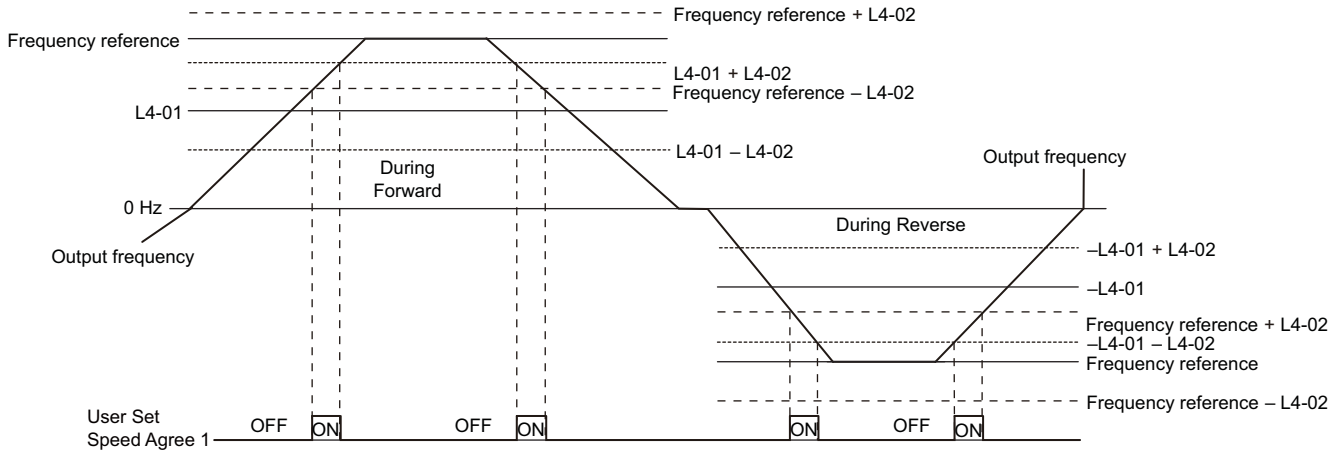



**Figure 2.53 User Set Speed Agree 1 Time Chart**

*Refer to L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 204* for more instructions.

### Setting 4: Frequency Detection 1

Output opens when the output frequency or motor speed (CLV) rises above the detection level set in L4-01 plus the detection width set in L4-02. The terminal remains open until the output frequency or motor speed falls below the level set in L4-01.

| Status | Description |
|---|---|
| Open | Output frequency or motor speed exceeded L4-01 + L4-02. |
| Closed | Output frequency or motor speed is below L4-01 or has not exceeded L4-01 + L4-02. |

**Note:** Frequency detection works in both forward and reverse. The value of L4-01 is used as the detection level for both directions.

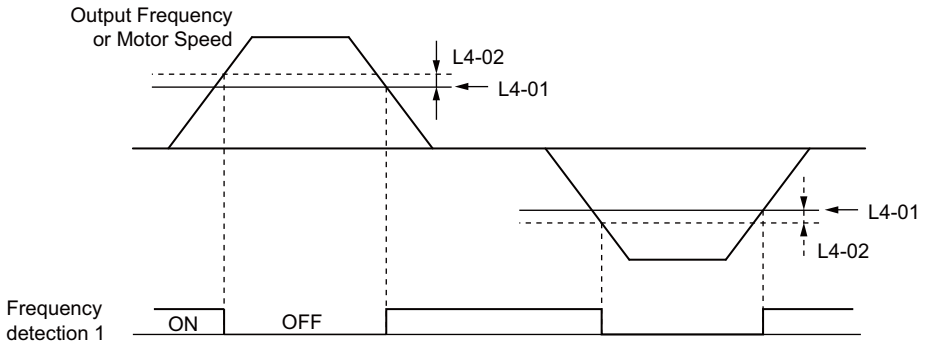



**Figure 2.54 Frequency Detection 1 Time Chart**

Refer to *L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 204* for more details.

### Setting 5: Frequency Detection 2

Output closes whenever the output frequency or motor speed (CLV) is above the detection level set in L4-01. The terminal remains closed until the output frequency or motor speed falls below L4-01 minus the setting of L4-02.

| Status | Description |
|---|---|
| Open | Output frequency or motor speed is below L4-01 minus L4-02 or has not exceeded L4-01. |
| Closed | Output frequency or motor speed exceeded L4-01. |

**Note:** Frequency detection works in both forward and reverse. The value of L4-01 is used as the detection level for both directions.

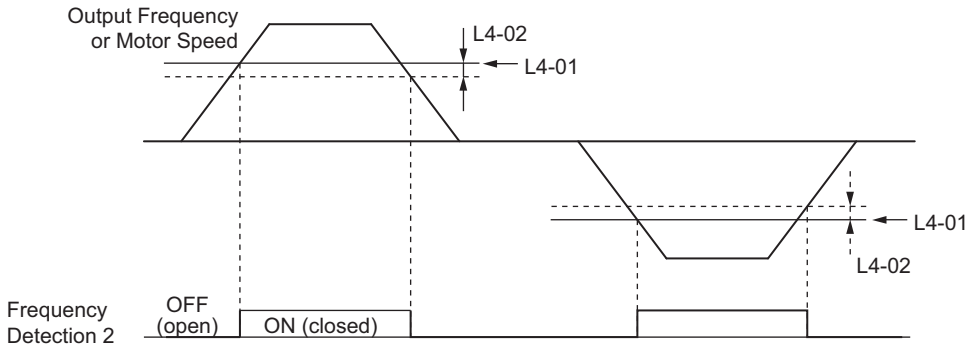



**Figure 2.55 Frequency Detection 2 Time Chart**

Refer to *L4-01, L4-02: Speed Agreement Detection Level and Detection Width on page 204* for more details.

### Setting 6: Drive ready

Output closes whenever the drive is ready to operate the motor. The terminal will not close under the conditions listed below, and any Run commands will be disregarded.

- When the power is shut off
- During a fault
- When the drive's internal power supply has malfunctioned
- When a parameter setting error makes it impossible to run
- Although stopped, an overvoltage or undervoltage situation occurs
- While editing a parameter in the Programming Mode (when b1-08 = 0)

### Setting 7: DC bus undervoltage

Output closes whenever the DC bus voltage or control circuit power supply drops below the trip level set in L2-05. A fault in the DC bus circuit will also cause the terminal to set for “DC bus undervoltage” to close.

| Status | Description |
|---|---|
| Open | DC bus voltage is above the level set in L2-05 |
| Closed | DC bus voltage has fallen below the trip level set in L2-05. |

### Setting 8: During baseblock (N.O.)

Output closes to indicate that the drive is in a baseblock state. While in baseblock, output transistors do not switch and no main circuit voltage is output.

| Status | Description |
|---|---|
| Open | Drive is not in a baseblock state. |
| Closed | Baseblock is being executed. |

### Setting 9: Frequency reference source

A contact output programmed for this function shows the frequency reference source that is currently selected.

| Status | Description |
|---|---|
| Open | Frequency reference is provided from External reference 1 (b1-01) or External reference 2 (b1-15) |
| Closed | Frequency reference is being sourced from the digital operator. |

### Setting A: Run command source

A contact output programmed for this function shows the Run command source that is currently selected.

| Status | Description |
|---|---|
| Open | Run command is provided from External reference 1 (b1-02) or 2 (b1-16). |
| Closed | Run command is being sourced from the digital operator. |

### Setting B, 17, 18, 19: Torque detection 1 (N.O., N.C.), Torque detection 2 (N.O., N.C.)

These contact output functions can be used to signal an overtorque or undertorque situation to an external device.

Set up the torque detection levels and select the output function from the table below. Refer to *L6: Torque Detection on page 207* for details.

| Setting | Status | Description |
|---|---|---|
| B | Closed | Torque detection 1 (N.O.):<br>Output current/torque exceeds (overtorque detection) or is below (undertorque detection) the torque value set in parameter L6-02 for longer than the time specified in parameter L6-03. |
| 17 | Open | Torque detection 1 (N.C.):<br>Output current/torque exceeds (overtorque detection) or is below (undertorque detection) the torque value set in parameter L6-02 for longer than the time specified in parameter L6-03. |
| 18 | Closed | Torque detection 2 (N.O.):<br>Output current/torque exceeds (overtorque detection) or is below (undertorque detection) the torque value set in parameter L6-05 for longer than the time specified in parameter L6-06. |
| 19 | Open | Torque detection 2 (N.C.):<br>Output current/torque exceeds (overtorque detection) or is below (undertorque detection) the torque value set in parameter L6-05 for longer than the time specified in parameter L6-06. |

### Setting C: Frequency reference loss

An output set for this function will be closed if frequency reference loss is detected. Refer to *L4-05: Frequency Reference Loss Detection Selection on page 204* for details.

### Setting E: Fault

The contact output will close whenever the drive experiences a fault (this excludes faults CPF00 and CPF01).

### Setting F: Through mode

Select this setting when using the terminal in a pass-through mode. When set to F, an output does not trigger any function in the drive. Setting F, however, still allows the output status to be read by a PLC via a communication option or MEMOBUS/Modbus communications.

### Setting 10: Minor fault

Output closes when an alarm is active.

### Setting 11: Fault reset command active

Output closes whenever there is an attempt to reset a fault situation from the control circuit terminals, via serial communications, or using a communications option card.

### Setting 12: Timer output

This setting configures a contact output terminal as output for the timer function. Refer to *b4: Delay Timers on page 109* for details.

### Setting 13: Speed agree 2 ($f_{ref}$ /$f_{out}$ agree 2)

Closes whenever the actual output frequency or motor speed (CLV) is within the speed agree width (L4-04) of the current frequency reference, regardless of the direction.

| Status | Description |
|---|---|
| Open | Output frequency or motor speed does not match the frequency reference while the drive is running. |
| Closed | Output frequency or motor speed is within the range of frequency reference ±L4-04. |

**Note:** Detection works in both forward and reverse.

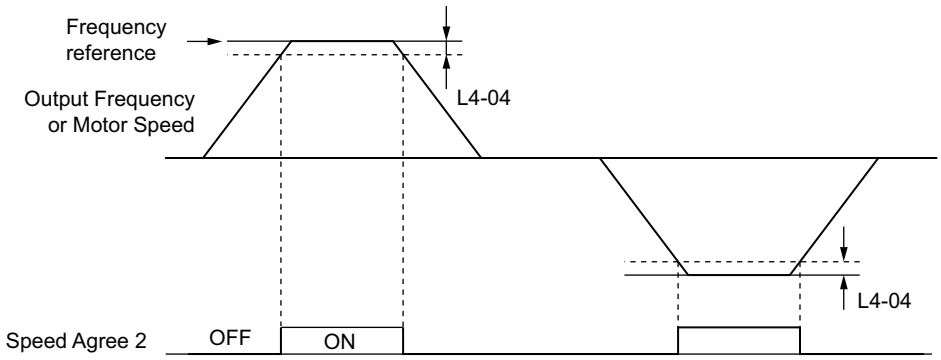



**Figure 2.56 Speed Agree 2 Time Chart**

Refer to *L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 204* for more details.

### Setting 14: User-set speed agree 2 ($f_{ref}$ /$f_{set}$ agree 2)

Closes whenever the actual output frequency or motor speed (CLV) and the frequency reference are within the speed agree width (L4-04) of the programmed speed agree level (L4-03). As the detection level L4-03 is a signed value, detection works in the specified direction only.

| Status | Description |
|---|---|
| Open | Output frequency or motor speed and frequency reference are both outside the range of L4-03 ±L4-04 |
| Closed | Output frequency or motor speed and the frequency reference are both with in the range of L4-03 ±L4-04 |

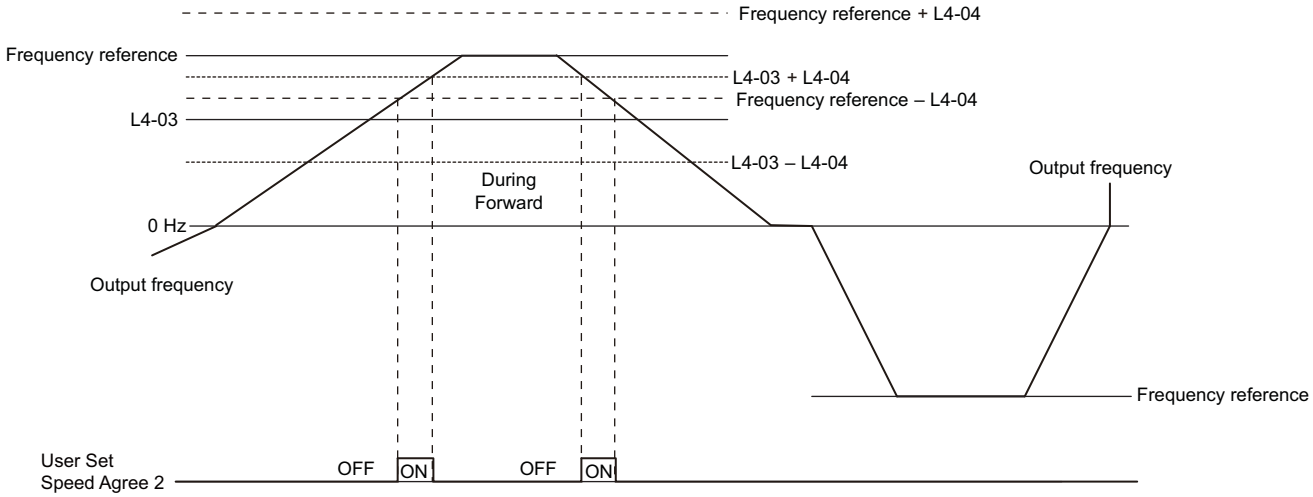



**Figure 2.57 User Set Speed Agree 2 Example with a Positive L3-04 Value**

*Refer to L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 204* for more details.

### Setting 15: Frequency detection 3

Output opens when the output frequency or motor speed (CLV, CLV/PM) rises above the detection level set in L4-03 plus the detection with set in L4-04. The terminal remains open until the output frequency or motor speed falls below the level set in L4-03. As the detection level L4-03 is a signed value, the detection works in the specified direction only.

| Status | Description |
|---|---|
| Open | Output frequency or motor speed exceeded L4-03 plus L4-04. |
| Closed | Output frequency or motor speed is below L4-03 or has not exceeded L4-03 plus L4-04 yet. |

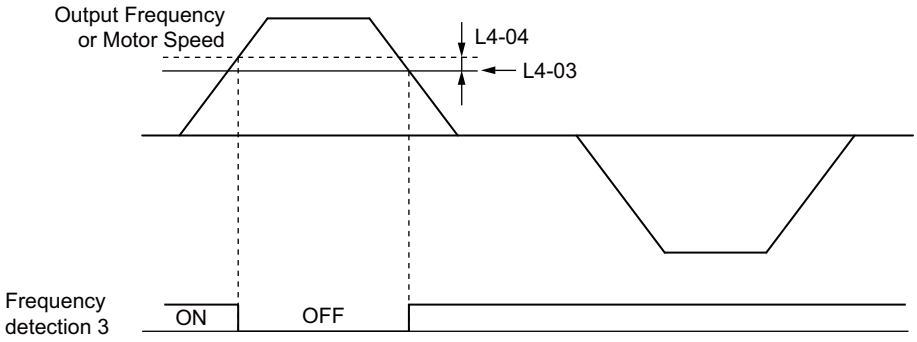



**Figure 2.58 Frequency Detection 3 Example with a Positive L4-03 Value**

Refer to *L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 204* for more details.

### Setting 16: Frequency detection 4

Output closes whenever the output frequency or motor speed (CLV) is above the detection level set in L4-03. The terminal remains closed until the output frequency or motor speed falls below L4-03 minus the setting of L4-04. As the detection level L4-03 is a signed value, frequency detection works in the specified direction only.

| Status | Description |
|---|---|
| Open | Output frequency or motor speed is below L4-03 minus L4-04 or has not exceeded L4-03 yet. |
| Closed | Output frequency or motor speed exceeded L4-03. |

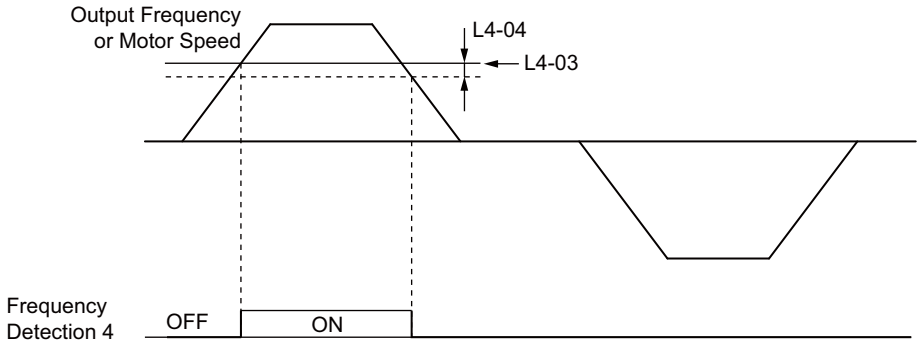



**Figure 2.59 Frequency Detection 4 Example with Positive L4-03 Value**

Refer to *L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-) on page 204* for more details.

### Setting 1A: During reverse

A contact output set for “During reverse” will close whenever the drive is running the motor in the reverse direction.

| Status | Description |
|---|---|
| Open | Motor is being driven in the forward direction or stopped. |
| Closed | Motor is being driven in reverse. |

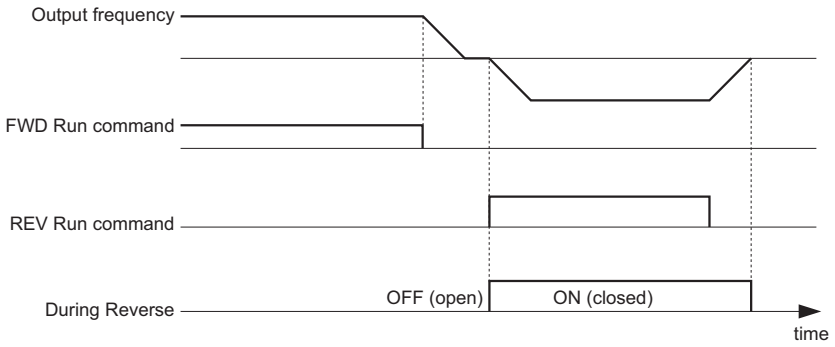



**Figure 2.60 Reverse Direction Output Example Time Chart**

### Setting 1B: During baseblock (N.C.)

Output opens to indicate that the drive is in a baseblock state. While Baseblock is executed, output transistors do not switch and no main circuit voltage is output.

| Status | Description |
|---|---|
| Open | Baseblock is being executed. |
| Closed | Drive is not in a baseblock state. |

### Setting 1C: Motor 2 selection

Indicates which motor is selected when another output terminal is set up to switch drive operation between two motors (H1-☐☐ = 16). Refer to *Setting 16: Motor 2 selection on page 171* for details on switching motors.

| Status | Description |
|---|---|
| Open | Motor 1 is selected. |
| Closed | Motor 2 is selected. |

### Setting 1D: During regeneration

Terminal closes when the motor is driven in the regenerative mode.

### Setting 1E: Restart enabled

An output set for “Restart enabled” closes once the drive begins attempting to restart after a fault has occurred.

The fault restart function allows the drive to automatically clear a fault. The terminal set to 1E will close after the fault is cleared and the drive has begun attempting to restart. If the drive cannot successfully restart within the number of attempts permitted by L5-01, then a fault will be triggered and the terminal set to 1E will open. Refer to *L5: Fault Restart on page 205* for details on automatic restart.

### Setting 1F: Motor overload alarm (oL1)

An output programmed for this function will close when the motor overload level estimated by the oL1 fault detection exceeds 90% of the oL1 detection level. Refer to *L1-01: Motor Overload Protection Selection on page 196*.

### Setting 20: IGBT overheat pre-alarm (oH)

Output closes whenever the drive thermistor temperature reaches the level specified by parameter L8-02. Refer to *L8-02: Overheat Alarm Level on page 212* for details on IGBT overheat detection.

### Setting 22: Mechanical weakening detection (N.O.)

Output closes when a mechanical weakening situation is detected. Refer to *Mechanical Weakening Detection on page 209* for details.

### Setting 2F: Maintenance period

Output closes when the cooling fan, DC bus capacitors, or DC bus pre-charge relay may require maintenance as determined by the estimated performance life span of those components. Components performance life is displayed as a percentage on the digital operator screen. For details, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

### Setting 30: During torque limit

Output closes when the motor is operating at the torque limit specified by the L7-☐☐ parameters or an analog input. This setting can only be used in OLV and CLV control modes. Refer to *L7-01 to L7-04: Torque Limits on page 210* for details.

### Setting 31: During speed limit

Output closes when the speed limit has been reached. This function can be used in CLV and control mode.

| Status | Description |
|---|---|
| Open | The conditions described below are not present. |
| Closed | 1. The frequency reference has reached the upper limit set in d2-01.<br>2. The frequency reference has fallen to the lower limit set in d2-02 or d2-03.<br>3. Parameter b1-05 is set to 1, 2, or 3, and the frequency reference has fallen below the minimum output frequency (E1-09). |

### Setting 32: During speed limit in Torque Control

The motor torque and load torque are not in balance, causing the motor to accelerate. An output terminal set to 32 closes when the motor reaches the speed limit. Refer to *d5: Torque Control on page 144* and *Indicating Operation at the Speed Limit on page 146* for details.

### Setting 37: During frequency output

Output closes when the drive is outputting a frequency.

| Status | Description |
|---|---|
| Open | Drive is stopped or one of the following functions is being executed: baseblock, DC Injection Braking. |
| Closed | Drive is outputting the frequency. |

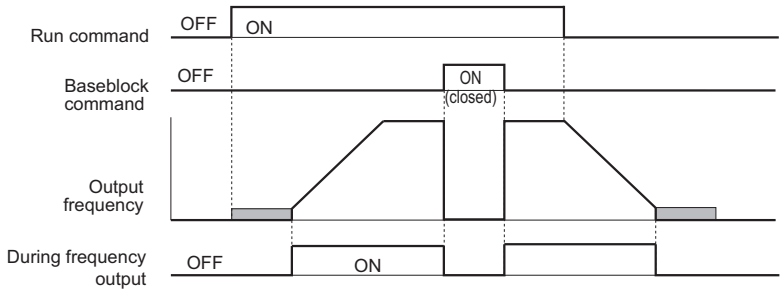



**Figure 2.61 During Frequency Output Time Chart**

### Setting 38: Drive enable

A contact output set for “Drive enable” will reflect the status of a contact input configured as “Drive enable” input (H1-☐☐ = 6A). If that contact input closes, then the contact output set for “Drive enable” will also close.

### Setting 39: Watt hour pulse output

Outputs a pulse to indicate the watt hours. Refer to ***H2-17: Watt Hour Output Unit Selection on page 187*** for details.

### Setting 3A: Cooling Fan, Transformer Abnormal Temperature Rise

Output closes whenever no abnormal temperature rise in the cooling fans or transformers has occurred.

### Setting 3C: LOCAL/REMOTE status

Output terminal closes while the drive is set for LOCAL and opens when in REMOTE.

| Status | Description |
|---|---|
| Open | REMOTE: The external reference that has been selected (either b1-01 and b1-02 or b1-15 and b1-16) is used as the frequency reference and Run command source |
| Closed | LOCAL: The digital operator is used as the frequency reference and Run command source |

### Setting 3D: During Speed Search

Output terminal closes while Speed Search is being performed. Refer to ***b3: Speed Search on page 103*** for details.

### Setting 3E: PID feedback low

The set output terminal closes when a PID feedback loss (FbL) is detected. The feedback is considered to be lost if it falls below the level set in b5-13 for longer than the time set in b5-14. Refer to ***PID Feedback Loss Detection on page 115*** for details.

### Setting 3F: PID feedback high

The set output terminal closes when a PID feedback high (FbH) is detected. The feedback is considered to be high if it exceeds the level set in b5-36 for longer than the time set in b5-37. Refer to ***PID Feedback Loss Detection on page 115*** for details.

### Setting 4C: During Fast Stop

Output terminal closes when a Fast Stop is being executed. Refer to ***Setting 15, 17: Fast Stop (N.O., N.C.) on page 170***.

### Setting 4D: oH pre-alarm time limit

Output terminal closes when the drive is reducing the speed due to a drive overheat alarm (L8-03 = 4) and the overheat alarm has not cleared after ten frequency reduction operation cycles. Refer to ***L8-03: Overheat Pre-Alarm Operation Selection on page 212*** for a more detailed description.

### Setting 60: Drive Cooling Fan Alarm

Output closes when the drive’s cooling fan has failed.

#### Setting 100 to 160: Functions 0 to 60 with inverse output

These settings have the same function as settings 0 to 60 but with inverse output. Set as 1□□, where the "1" indicates inverse output and the last two digits specify the setting number of the function.

Examples: For inverse output of "8 (During Baseblock)", set 108.
For inverse output of "4C (During fast stop)", set 14C.

### ■ H2-17: Watt Hour Output Unit Selection

When one of the terminals is set to output the number of watt hours (H2-01 to H2-16 = 39), parameter H2-17 determines the units for the output signal.
This output function provides a watt hour meter or a PLC input based on a 200 ms pulse signal. H2-06 determines the frequency that pulses are issued to keep track of the kWh for the drive.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H2-17 | Watt Hour Output Unit Selection | 0: 0.1 kWh units<br>1: 1 kWh units<br>2: 10 kWh units<br>3: 100 kWh units<br>4: 1000 kWh units | 3 |

**Note:** **1.** A negative power output (i.e., regeneration) does not subtract from the total watt hours.
**2.** The drive keeps track of the watt hours as long as the control circuit has power. The value is reset when the power supply is shut off.

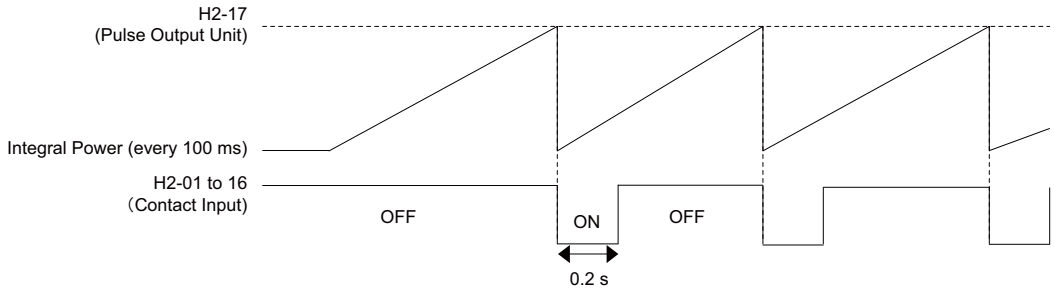



**Figure 2.62 Watt Hour Output Example**

## ◆ H3: Analog Inputs

The drive is equipped with two analog input terminals: analog input 1 and analog input 2. See *Table 2.25* for a listing of the functions that can be set for these terminals.

### ■ H3-01: Analog Input 1 Signal Level Selection

Selects the input signal level for analog input 1.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-01 | Analog Input 1 Signal Level Selection | 0 or 1 | 0 |

#### Setting 0: 0 to 10 Vdc

The input level is 0 to 10 Vdc. The minimum input level is limited to 0%, so that a negative input signal due to gain and bias settings will be simply read as 0%.

#### Setting 1: -10 to 10 Vdc

The input level is -10 to 10 Vdc. If the resulting voltage is negative after being adjusted by gain and bias settings, then the motor will rotate in reverse.

## ■ H3-02: Analog Input 1 Function Selection

Determines the function assigned to analog input 1. Refer to *Analog Input Terminal Settings on page 190* for details.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-02 | Analog Input 1 Function Selection | 0 to FF | 0 |

## ■ H3-03, H3-04: Analog Input 1 Gain and Bias Settings

Parameter H3-03 sets the level of the selected input value that is equal to 10 Vdc input at analog input 1 (gain).

Parameter H3-04 sets the level of the selected input value that is equal to 0 V input at analog input 1 (bias).

Both can be used to adjust the characteristics of the analog input signal to analog input 1.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-03 | Analog Input 1 Gain | -999.9 to 999.9% | 100.0% |
| H3-04 | Analog Input 1 Bias | -999.9 to 999.9% | 0.0% |

**Setting Examples**

- Gain H3-03 = 200%, bias H3-04 = 0, analog input 1 as frequency reference input (H3-02 = 0):
  An input of 10 Vdc will be equivalent to a 200% frequency reference and 5 Vdc will be equivalent to a 100% frequency reference. Since the drive output is limited by the maximum frequency parameter (E1-04), the frequency reference will be equal to E1-04 above 5 Vdc.

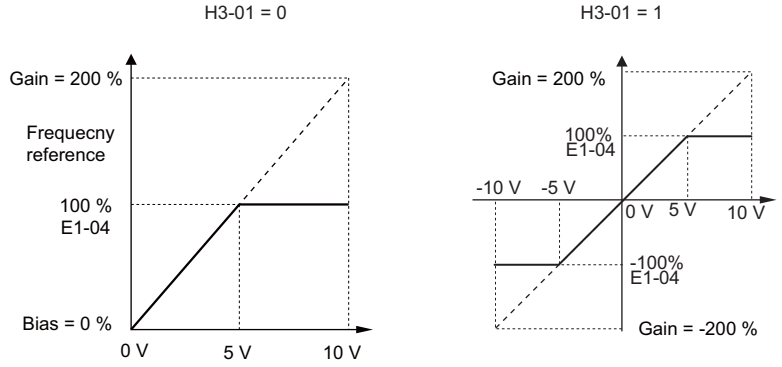



**Figure 2.63 Frequency Reference Setting by Analog Input with Increased Gain**

- Gain H3-03 = 100%, bias H3-04 = -25%, analog input 1 as frequency reference input:
  An input of 0 Vdc will be equivalent to a -25% frequency reference.
  When parameter H3-01 = 0, the frequency reference is 0% between 0 and 2 Vdc input.
  When parameter H3-01 = 1, the motor will rotate in reverse in response to input between -10 and 2 Vdc input.

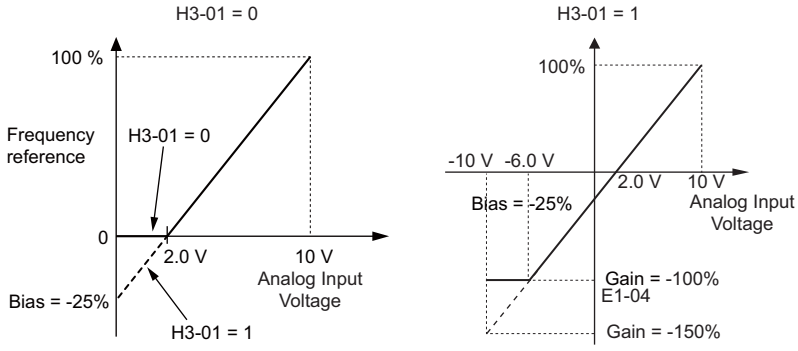



**Figure 2.64 Frequency Reference Setting by Analog Input with Negative Bias**

## ■ H3-09: Analog Input 2 Signal Level Selection

Selects the input signal level for analog input 2.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-09 | Analog Input 2 Signal Level Selection | 0 or 1 | 1 |

**Setting 0: 0 to 10 Vdc**

The input level is 0 to 10 Vdc. Refer to *Setting 0: 0 to 10 Vdc on page 187*.

**Setting 1: -10 to 10 Vdc**

The input level is -10 to 10 Vdc. Refer to *Setting 1: -10 to 10 Vdc on page 187*.

## ■ H3-10: Analog Input 2 Function Selection

Parameter H3-10 sets the function assigned to analog input 2. Refer to *Analog Input Terminal Settings on page 190* for details.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-10 | Analog Input 2 Function Selection | 0 to 32 | 0 |

## ■ H3-11, H3-12: Analog Input 2 Gain and Bias Setting

Parameter H3-11 sets the level of the input value selected that is equal to 10 Vdc input at analog input 2.

Parameter H3-12 sets the level of the input value selected that is equal to 0 V input at analog input 2.

Both can be used to adjust the characteristics of the analog input signal at analog input 2. The setting works in the same way as parameters H3-03 and H3-04 for analog input 1.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-11 | Analog Input 2 Gain | -999.9 to 999.9% | 100.0% |
| H3-12 | Analog Input 2 Bias | -999.9 to 999.9% | 0.0% |

## ■ H3-13: Analog Input Filter Time Constant

Parameter H3-13 sets the time constant for a first order filter that will be applied to the analog inputs 1 and 2.

An analog input filter can be used to prevent erratic drive control when a “noisy” analog reference is used. The drive operation becomes more stable the longer the time programmed, but it becomes less responsive to rapidly changing analog signals.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-13 | Analog Input Filter Time Constant | 0.00 to 2.00 s | 0.03 s |

## ■ H3-14: Analog Input Terminal Enable Selection

When one of the contact input parameters is set for “Analog input enable” (H1-☐☐ = C), the value set for H3-14 determines which analog input terminals are enabled and which terminals are disabled when the input is closed.

All analog input terminals will be enabled all of the time if H1-☐☐ is not set to C.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-14 | Analog Input Terminal Enable Selection | 1 to 3 | 3 |

**Setting 1: All analog input terminals enabled**
**Setting 2: Only analog input 2 enabled**
**Setting 3: Only analog input 1 and 2 enabled**

## ■ H3-16, H3-17: Analog Input 1/2 Offset

Parameters H3-16 and H3-17 set the offset level of the selected input value to analog input 1 or 2 that is equal to 0 Vdc input. These parameters rarely need adjustment.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H3-16 | Analog input 1 offset | -500 to 500 | 0 |
| H3-17 | Analog input 2 offset | -500 to 500 | 0 |

## ■ Analog Input Terminal Settings

See *Table 2.25* for information on how H3-02 and H3-10 determine functions for analog inputs 1 and 2.

**Note:** The scaling of all input functions depends on the gain and bias settings for the analog inputs. Set these to appropriate values when selecting and adjusting analog input functions.

**Table 2.25 Analog Input Terminal Settings**

| Setting | Function | Page | Setting | Function | Page |
|---|---|---|---|---|---|
| 0 | Frequency bias | 190 | C | PID Setpoint Value | 192 |
| 1 | Frequency Gain | 190 | D | Frequency Bias | 192 |
| 2 | Auxiliary frequency reference 1 | 190 | F | Through Mode | 192 |
| 3 | Auxiliary frequency reference 2 | 190 | 10 | Forward Torque Limit | 192 |
| 4 | Output Voltage Bias | 190 | 11 | Reverse Torque Limit | 192 |
| 5 | Accel/decel time gain | 191 | 12 | Regenerative Torque Limit | 192 |
| 6 | DC Injection Braking Current | 191 | 13 | Torque Reference/Torque Limit | 192 |
| 7 | Overtorque/Undertorque Detection Level | 191 | 14 | Torque Compensation | 192 |
| 8 | Stall Prevention Level During Run | 191 | 15 | General Torque Limit | 192 |
| 9 | Output Frequency Lower Limit Level | 191 | 16 | Differential PID Feedback | 192 |
| B | PID Feedback | 191 | 1F | Through Mode | 192 |

### Setting 0: Frequency bias

The input value of an analog input set to this function will be added to the analog frequency reference value. When the frequency reference is supplied by a different source other than the analog inputs, this function will have no effect. Use this setting also when only one of the analog inputs is used to supply the frequency reference.
By default, analog inputs 1 and 2 are set for this function. Using analog inputs 1 and 2 at the same time increases the frequency reference by the total of all inputs.

Example: If the analog frequency reference from analog input 1 is 50% and a bias of 20% is set for analog input 2, the resulting frequency reference will be 70% of the maximum output frequency.

### Setting 1: Frequency gain

The input value of an analog input set to this function will be multiplied by the analog frequency reference value.

Example: If the analog frequency reference from analog input 1 is 80% and a gain of 50% is applied from analog input 2, the resulting frequency reference will be 40% of the maximum output frequency.

### Setting 2: Auxiliary reference 1

Sets the auxiliary frequency reference 1 when multi-step speed operation is selected. Refer to *Multi-Step Speed Selection on page 135* for details.

### Setting 3: Auxiliary reference 2

Sets the auxiliary frequency reference 2 when multi-step speed operation is selected. Refer to *Multi-Step Speed Selection on page 135* for details.

### Setting 4: Output voltage bias

Voltage bias boosts the output voltage of the V/f curve as a percentage of the maximum output voltage (E1-05). Available only when using
V/f Control.

### Setting 5: Accel/decel time gain

Adjusts the gain level for the acceleration and deceleration times set in parameters C1-01 through C1-08.

The acceleration time used by the drive is calculated by multiplying this gain level by C1-☐☐ as follows:

C1-☐☐ × Accel/decel time gain = Drive accel/decel time

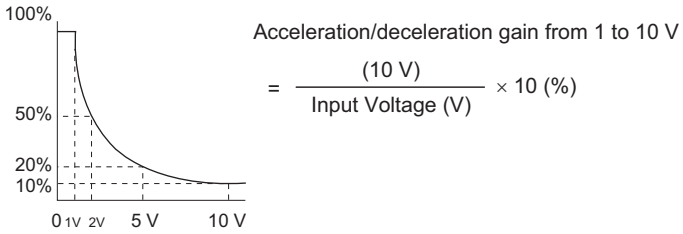



**Figure 2.65 Accel/Decel Time Gain with Analog Input Terminal**

### Setting 6: DC Injection Braking current

The current level used for DC Injection Braking. Set as a percentage of the maximum output current using. When setting the bias by parameter, however, make the setting as a percentage of the motor rated current. Note also that the DC injection braking current is limited by the motor rated current value.

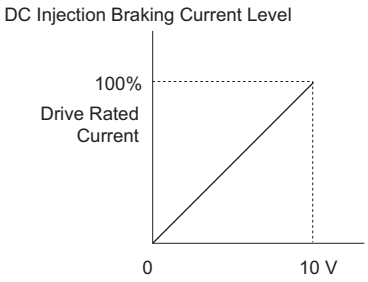



**Figure 2.66 DC Injection Braking Current Using an Analog Input Terminal**

### Setting 7: Torque Detection level

Using this setting, the overtorque/undertorque detection level for Torque Detection Selection 1 (L6-01) can be set by an analog input. The analog input will replace the level set for Torque Detection Level 1 (L6-02). An analog input of 100% (10 V) will set a torque detection level equal to 100% drive rated current / motor rated torque. Adjust the analog input gain if higher detection level settings are required. Refer to ***L6: Torque Detection on page 207*** for details.

### Setting 8: Stall Prevention level

This setting allows an analog input signal to adjust the Stall Prevention level. ***Figure 2.67*** shows the setting characteristics. The drive will use either the Stall Prevention level set in L3-06 or the level coming from the analog input terminal that has been selected, whichever value is lower.

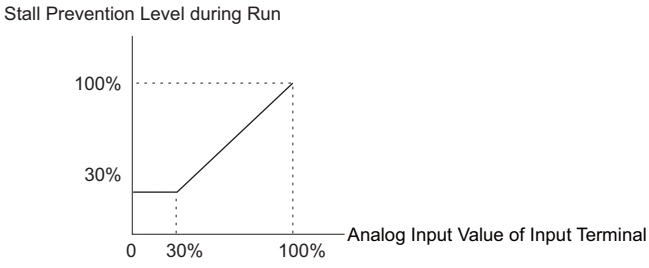



**Figure 2.67 Stall Prevention During Run Using an Analog Input Terminal**

### Setting 9: Output frequency lower limit level

The user can adjust the lower limit of the output frequency using an analog input signal.

### Setting B: PID feedback

An input set for this function supplies the PID feedback value. This setting requires PID operation to be enabled in b5-01. Refer to ***PID Feedback Input Methods on page 111***.

#### Setting C: PID setpoint

An input set for this function supplies the PID setpoint value, and the frequency reference selected in parameter b1-01 is no longer the PID setpoint. PID operation to be enabled in b5-01 to use this setting. Refer to *PID Feedback Input Methods on page 111*.

#### Setting D: Frequency bias

The input value of an analog input set to this function will be added to the frequency reference. This function can be used with any frequency reference source.

#### Setting F, 1F: Through mode

When set to F or 1F, an input does not affect any drive function, but the input level can still be read out by a PLC via a communication option or MEMOBUS/Modbus communications.

#### Setting 10, 11, 12, 15: Forward, Reverse, Regenerative, General torque limit (OLV, CLV)

These functions can be used to set a torque limit using analog inputs for different operating conditions. These functions can be used to set a torque limit using analog inputs for different operating conditions. Refer to *L7: Torque Limit on page 210* for details.

#### Setting 13: Torque Limit Using Torque Reference/Speed Limit

When using Torque Control, an analog input programmed to this function can set the torque reference (when in Torque Control) or the torque limit (when in Speed Control). Refer to *Setting the Torque Reference, Speed Limit, and Torque Compensation Values on page 145* for details.

#### Setting 14: Torque compensation

Used to set a torque compensation value when using Torque Control. Refer to *Setting the Torque Reference, Speed Limit, and Torque Compensation Values on page 145* for details.

#### Setting 16: Differential PID Feedback

If an analog value is set for this function, the PID controller is set for differential feedback. The subtraction of the PID feedback input value and the differential feedback input value builds the feedback value that is used to calculate the PID input. Refer to *PID Feedback Input Methods on page 111*.

## ◆ H4: Analog Outputs

These parameters assign functions to analog outputs 1 to 4 for monitoring a specific aspect of drive performance.

### ■ H4-01, H4-11, H4-21, H4-31: Analog Output 1, 2, 3, 4 Monitor Selections

Sets the desired drive monitor parameter U☐-☐☐ to output as an analog value via analog outputs 1 to 4. Refer to *U: Monitors on page 70* for a list of all monitors. The "Analog Output Level" column indicates if a monitor can be used for analog output.

Example: Enter "103" for U1-03.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H4-01 | Analog Output 1 Monitor Selection | 000 to 999 | 102 |
| H4-11 | Analog Output 2 Monitor Selection | 000 to 999 | 103 |
| H4-21 | Analog Output 3 Monitor Selection | 000 to 999 | 000 |
| H4-31 | Analog Output 4 Monitor Selection | 000 to 999 | 000 |

A setting of 031 or 000 applies no drive monitor to the analog output. With this setting, terminal functions as well as analog output levels can be set by a PLC via a communication option card or MEMOBUS/Modbus (through mode).

### ■ H4-02, H4-03: Analog Output 1 Gain and Bias<br>H4-12, H4-13: Analog Output 2 Gain and Bias<br>H4-22, H4-23: Analog Output 3 Gain and Bias<br>H4-32, H4-33: Analog Output 4 Gain and Bias

Parameter H4-02, H4-12, H4-22, and H4-32 set analog outputs 1 to 4 signal level equal to 100% of the monitor (gain). Parameter H4-03, H3-13, H3-23, H3-33 set the bias added to the monitor output for analog outputs 1 to 4. Both are set as a percentage, where 100% equals 10 Vdc analog output. The output voltage of both terminals is limited to 10 Vdc.
The output signal range can be selected between 0 to +10 Vdc or -10 to +10 Vdc using parameter H4-05, H4-15, H4-25, and H4-35.
*Figure 2.68* illustrates how gain and bias settings work.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H4-02 | Analog Output 1 Gain | -999.9 to 999.9% | 100.0% |
| H4-03 | Analog Output 1 Bias | -999.9 to 999.9% | 0.0% |
| H4-12 | Analog Output 2 Gain | -999.9 to 999.9% | 100.0% |
| H4-13 | Analog Output 2 Bias | -999.9 to 999.9% | 0.0% |
| H4-22 | Analog Output 3 Gain | -999.9 to 999.9% | 100.0% |
| H4-23 | Analog Output 3 Bias | -999.9 to 999.9% | 0.0% |
| H4-32 | Analog Output 4 Gain | -999.9 to 999.9% | 100.0% |
| H4-33 | Analog Output 4 Bias | -999.9 to 999.9% | 0.0% |

## ■ H4-04, H4-14, H4-24, H4-34: Analog Output 1, 2, 3, 4 Cell Selection

Parameters H4-04, H4-14, H4-24, and H4-34 set the power cell numbers to be output from analog outputs 1 to 4. Their settings are effective when 9☐☐ (power cell) has been set for H4-01, H4-11, H4-21 and H4-31 (Analog Output 1 to 4 Monitor Selections).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H4-04 | Analog Output 1 Cell Selection | 1 to 15 | 1 |
| H4-14 | Analog Output 2 Cell Selection | 1 to 15 | 1 |
| H4-24 | Analog Output 3 Cell Selection | 1 to 15 | 1 |
| H4-34 | Analog Output 4 Cell Selection | 1 to 15 | 1 |

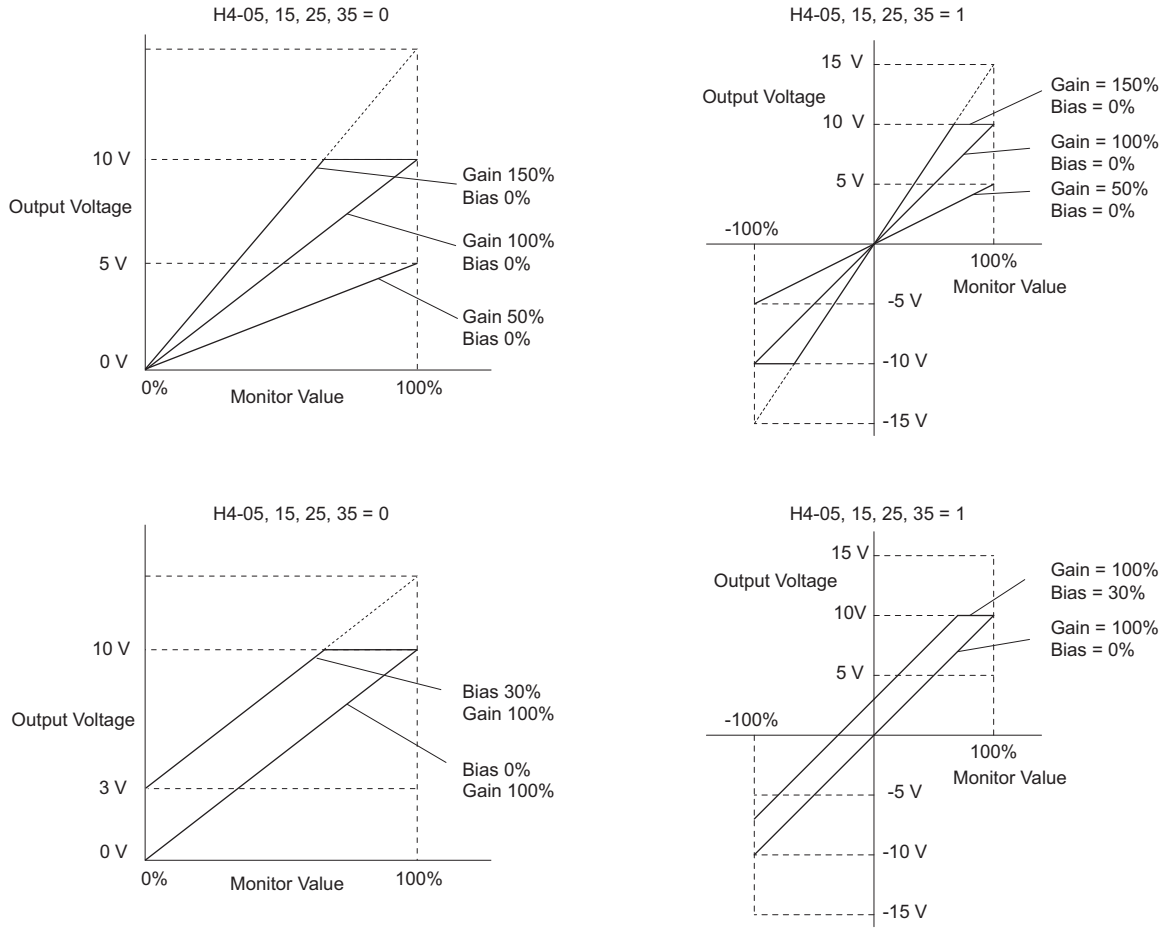



**Figure 2.68 Analog Output Gain and Bias Setting**

### Using Gain and Bias to Adjust Output Signal Level

The meter can be calibrated while the drive is stopped.

The procedure for calibration is as follows.

### Analog Output 1

1. View the value set to H4-02 (Analog Output 1 Gain) on the digital operator. A voltage equal to 100% of the parameter being set in H4-01 will be output from analog output 1.
2. Adjust H4-02 viewing the monitor connected to the analog output 1.
3. View the value set to H4-03 on the digital operator, analog output 1 will output a voltage equal to 0% of the parameter being set in H4-01.
4. Adjust H4-03 viewing the output signal on the analog output 1.

### Analog Output 2

1. View the value set to H4-12 (Analog Output 2 Gain) on the digital operator. A voltage equal to 100% of the parameter being set in H4-11 will be output from analog output 2.
2. Adjust H4-12 viewing the monitor connected to the analog output 2.
3. View the value set to H4-13 on the digital operator, analog output 2 will output a voltage equal to 0% of the parameter being set in H4-11.
4. Adjust H4-13 viewing the output signal on the analog output 2.

### Analog Output 3

1. View the value set to H4-22 (Analog Output 3 Gain) on the digital operator. A voltage equal to 100% of the parameter being set in H4-21 will be output from analog output 3.
2. Adjust H4-22 viewing the monitor connected to the analog output 3.
3. View the value set to H4-23 on the digital operator, analog output 3 will output a voltage equal to 0% of the parameter being set in H4-21.
4. Adjust H4-23 viewing the output signal on the analog output 3.

### Analog Output 4

1. View the value set to H4-32 (Analog Output 4 Gain) on the digital operator. A voltage equal to 100% of the parameter being set in H4-31 will be output from analog output 4.
2. Adjust H4-32 viewing the monitor connected to the analog output 4.
3. View the value set to H4-33 on the digital operator, analog output 4 will output a voltage equal to 0% of the parameter being set in H4-31.
4. Adjust H4-33 viewing the output signal on the analog output 4.

### ■ H4-05, H4-15, H4-25, H4-35: Analog Output 1, 2, 3, 4 Signal Level Selection

Parameters H4-05, H4-15, H4-25, and H4-35 set the voltage output level of U parameter (monitor parameter) data to analog output terminals 1 to 4.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| H4-05 | Analog Output 1 Signal Level Selection | 0 or 1 | 1 |
| H4-15 | Analog Output 2 Signal Level Selection | 0 or 1 | 1 |
| H4-25 | Analog Output 3 Signal Level Selection | 0 or 1 | 1 |
| H4-35 | Analog Output 4 Signal Level Selection | 0 or 1 | 1 |

## ◆ H5: MEMOBUS/Modbus Serial Communication

Through the drives built in RS-485 port (terminals R+, R-, S+, S-), serial communication is possible using programmable logic controllers (PLCs) or similar devices running the MEMOBUS/Modbus protocol.

The H5-□□ parameters are used for the drive settings when using MEMOBUS/Modbus communications. For details, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

# 2.8 L: Protection Functions

## ◆ L1: Motor Protection

### ■ L1-01: Motor Overload Protection Selection

The drive has an electronic overload protection function that estimates the motor overload level based on output current, output frequency, thermal motor characteristics, and time. An oL1 fault will be triggered when motor overload is detected and drive output will be shut off.

L1-01 sets the overload protection function characteristics according to the motor being used.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L1-01 | Motor Overload Protection Selection | 0 or 1 | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

**Note:** **1.** When the motor protection function is enabled (L1-01 ≠ 0), an oL1 alarm can be output through one of the contact outputs by setting H2-01 to 1F. The output will close when the motor overload level reaches 90% of the oL1 detection level.
**2.** Select a method to protect the motor from overheat by setting L1-01 to 1 when running a single motor from the drive. An external thermal relay is not needed.

**Setting 0: Disabled (motor overload protection is not provided)**

This setting should be used if no motor overheat protection is desired or if multiple motors are connected to a single drive. In this case it is recommended that you install a thermal relay for each motor as shown in ***Figure 2.69***.

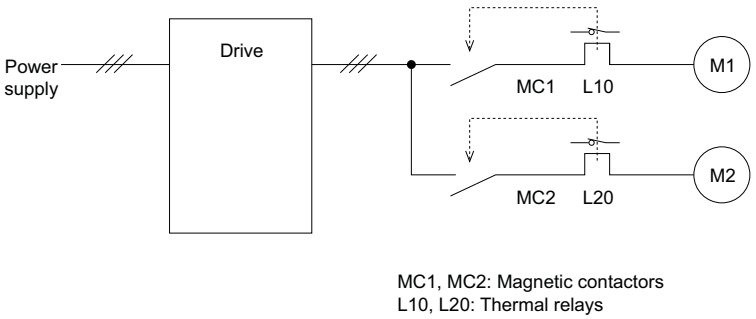



**Figure 2.69 Example of Protection Circuit Design for Multiple Motors**

**NOTICE:** *Thermal protection cannot be provided when running multi-motors simultaneously with the same drive, or when using motors with a current rating that is relatively high when compared with other standard motors. Failure to comply could result in motor damage. Disable the electronic overload protection of the drive (L1-01 = "0: Disabled") and protect each motor with individual motor thermal overloads.*

**NOTICE:** *Close MC1 and MC2 before operating the drive. (MC1 and MC2 cannot be switched off during run.)*

**Setting 1: Enabled (motor overload protection is provided)**

Sets the time it takes the drive to detect motor overheat due to overload. This setting rarely requires adjustment.

## ■ L1-02: Motor Overload Protection Time

Sets the time it takes the drive to detect motor overheat due to overload. This setting rarely requires adjustment, but should correlate with the motor overload tolerance protection time for performing a hot start.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L1-02 | Motor Overload Protection Time | 1.0 to 300.0 s | 60.0 s |

Defaulted to operate with an allowance of 150% overload operation for one minute.
*Figure 2.70* shows an example of the electrothermal protection operation time.

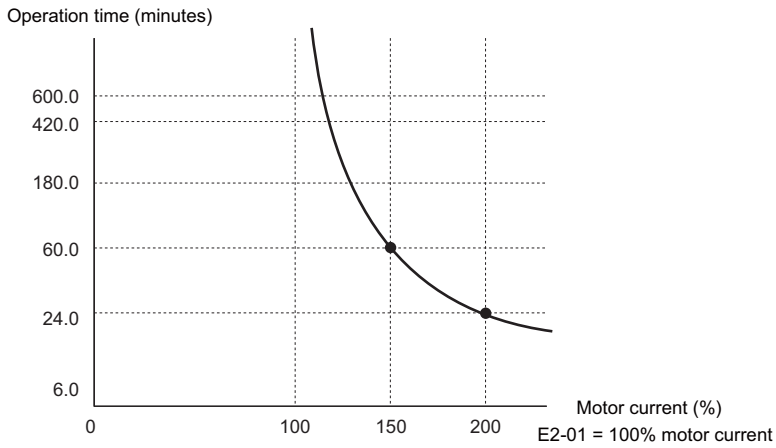



**Figure 2.70 Motor Protection Actuation Time**

## ■ L1-06: Motor Overload Detection Start Level

Sets the start level for motor overload detection as a percentage of the motor's rated current. Set a smaller value than the setting for L1-07.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L1-06 | Motor Overload Detection Start Level | 20 to 300% | 110% |

## ■ L1-07: Motor Overload Detection Level

Sets the current level for motor overload detection as a percentage of the motor's rated current. Set a larger value than the setting for L1-06.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L1-07 | Motor Overload Detection Level | 30 to 300% | 150% |

## ■ L1-13: Continuous Electrothermal Operation Selection

Determines whether or not to hold the current value of the electrothermal motor protection (L1-01) when the power supply is interrupted.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L1-13 | Continuous Electrothermal Operation Selection | 0 or 1 | 1 |

**Setting 0: Disabled**
**Setting 1: Enabled**

## ◆ L2: Momentary Power Loss Ride-Thru

### ■ L2-01: Momentary Power Loss Operation Selection

When a momentary power loss occurs (DC bus voltage falls below the level set in L2-05), the drive can be set to automatically return to the operation it was performing when the power went out based on certain conditions. When using the Momentary Power Loss Ride-Thru function, a Momentary Power Loss Ride-Thru unit (option) is required.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L2-01 | Momentary Power Loss Operation Selection | 0 to 2 | 0 |

**Setting 0: Disabled (default)**

If power is not restored within 15 ms, a Uv1 fault will result and the drive will stop the motor. The motor coasts to stop.

**Setting 1: Enabled**

When a momentary power loss occurs, the drive output will be shut off. Should the power return within the time set to parameter L2-02, the drive will perform Speed Search and attempt to resume operation. If power is not restored within this time (i.e., DC bus voltage level remains below Uv1 detection level L2-05), then a Uv1 fault is triggered and the drive will stop.

**Setting 2: Recover as long as CPU has power**

When a momentary power loss occurs, the drive output will be shut off. Should the power return as long as the drive control circuit has power, the drive will attempt to perform Speed Search and resume the operation. A Uv1 fault is not triggered.

### ■ KEB Ride-Thru Function

When power loss is detected, the Kinetic Energy Backup Ride-Thru function (KEB Ride-Thru) decelerates the motor and uses regenerative energy to keep the main circuit operating. Despite power loss, the drive output is not interrupted.

### ■ KEB Ride-Thru Start

KEB operation is always triggered in the same way, independent of the selected KEB operation mode. When the KEB function is selected as the function to be executed when power loss operation occurs (L2-01 = 3, 4, or 5), then KEB Ride-Thru will be activated if one of the following conditions becomes true:

- The DC bus voltage fell below the level specified in L2-05.

  **Note:** KEB Ride-Thru 1 cannot both be assigned to input terminals at the same time. Attempting this will trigger an oPE3 error.

If a contact input is used for triggering the KEB operation and the device that controls the input acts relatively slow, parameter L2-10 can be used to set a minimum KEB operation time. In the example below, KEB operation is triggered by the DC bus voltage and the Hold command is triggered by a contact input.

### ■ KEB Operation Wiring Example

*Figure 2.71* shows a wiring example for triggering the KEB Ride-Thru at power loss using an undervoltage relay. If power loss occurs, the undervoltage relay triggers KEB Ride-Thru at contact input 9. Note that an additional dynamic braking option is required if System KEB Ride-Thru 1 is used.

**Note:** Make sure the Run command is not switched off during momentary power loss. If the Run command is shut off, the drive will not accelerate back to speed when the power is restored.

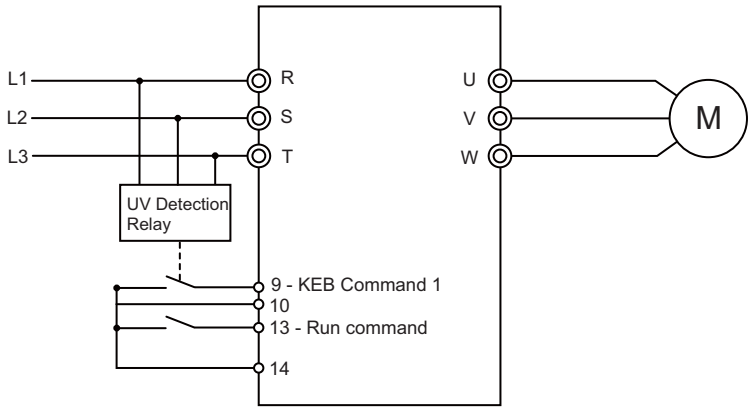



**Figure 2.71 Example Wiring for KEB Ride-Thru Function**

**Note:** When a momentary power loss occurs, check if the Run command remains in effect. If the Run command is turned OFF, the drive will not be able to accelerate to the speed set in the frequency reference when the power is restored.

## ■ L2-02: Momentary Power Loss Ride-Thru Time

Sets the maximum time allowed to ride through a power loss. If power loss operation exceeds this time, the drive will attempt to accelerate back to frequency reference. This parameter is valid if L2-01 = 1.

**Note:** The amount of time the drive is capable of recovering after a power loss is determined by the capacity of the drive. Drive capacity determines the upper limit for L2-02.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L2-02 | Momentary Power Loss Ride-Thru Time | 0.0 to 25.5 s | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

## ■ L2-03: Momentary Power Loss Minimum Baseblock Time

Sets the minimum baseblock time when power is restored following a momentary power loss. This determines the time the drive waits for the residual voltage in the motor to dissipate. Increase this setting if overcurrent or overvoltage occurs at the beginning of Speed Search, after a power loss, or during DC Injection Braking.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L2-03 | Momentary Power Loss Minimum Baseblock Time | 0.1 to 20.0 s | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

## ■ L2-04: Momentary Power Loss Voltage Recovery Ramp Time

Sets the time for the drive to restore the output voltage to the level specified by the V/f pattern after Speed Search. The setting value determines the time for the voltage to go from 0 V to the maximum voltage.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L2-04 | Momentary Power Loss Voltage Recovery Ramp Time | 0.0 to 5.0 s | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

## ■ L2-05: Undervoltage Detection Level (Uv)

Determines the voltage at which a Uv1 fault is triggered or at which the KEB function is activated. This setting rarely needs to be changed.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L2-05 | Undervoltage Detection Level (Uv) | 0 to 1700 V | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

### ■ L2-40: Power Supply Overvoltage Operation Selection

Sets the operation when overvoltage is detected at the power supply side.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L2-40 | Power Supply Overvoltage Operation Selection | 0 to 3 | 3 |

**Setting 0: Ramp to Stop (uses the deceleration time set for C1-02)**
**Setting 1: Coast to stop**
**Setting 2: Fast Stop (uses the Fast Stop time set for C1-09)**
**Setting 3: Alarm only**

### ■ L2-41: Power Supply Overvoltage Detection Level

Sets the level at which overvoltage is detected at the power supply side as a percentage of the value set for o2-11 (Reference Voltage for Input Voltage Detection) in 0.1% units.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L2-41 | Power Supply Overvoltage Detection Level | 0.0 to 200.0% | 120.0% |

### ■ L2-42: Power Supply Overvoltage Detection Time

Sets the time before overvoltage at the power supply side (iov) is detected, in 0.01 s units. If the state in which the output voltage exceeds the value set for L2-41 continues for the time set for L2-42 or longer, overvoltage at the power supply side (iov) is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L2-42 | Power Supply Overvoltage Detection Time | 0.00 to 2.00 s | 0.05 s |

## ◆ L3: Stall Prevention

When the load is too high or acceleration and deceleration times are too short, the motor may be unable to keep up with the frequency reference, resulting in excessive slip. During acceleration, this usually causes an overcurrent fault (oC), drive overload (oL2), or motor overload (oL1). During deceleration, it can cause excessive regenerative power to flow back into the DC bus capacitors, eventually causing the drive to fault out from overvoltage (ov). The drive can prevent the motor from stalling and still reach the desired speed without the user needing to change the acceleration or deceleration time settings. The Stall Prevention function can be set separately for acceleration, operating at constant speeds, and deceleration.

### ■ L3-01: Stall Prevention Selection during Acceleration

Stall Prevention during acceleration (L3-01) prevents tripping with overcurrent (oC), motor overload (oL1), or drive overload (oL2) faults common when accelerating with heavy loads.
L3-01 determines the type of Stall Prevention the drive should used during acceleration.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-01 | Stall Prevention during Acceleration Selection | 0 to 2 | 1 |

**Setting 0: Disabled**

No Stall Prevention is provided. If the acceleration time is too short, the drive may not be able to get the motor up to speed fast enough, thus tripping an overload fault.

**Setting 1: Enabled**

Enables Stall Prevention during acceleration. Operation varies, depending on the control mode.

- V/f Control and Open Loop Vector Control:
  If the output current rises above the Stall Prevention level set in L3-02, then the drive stops accelerating. Acceleration will not resume until the output current falls 15% below the setting in L3-02.
  The Stall Prevention level is automatically reduced in the constant power range. Refer to *L3-03: Stall Prevention Limit during Acceleration on page 201*.

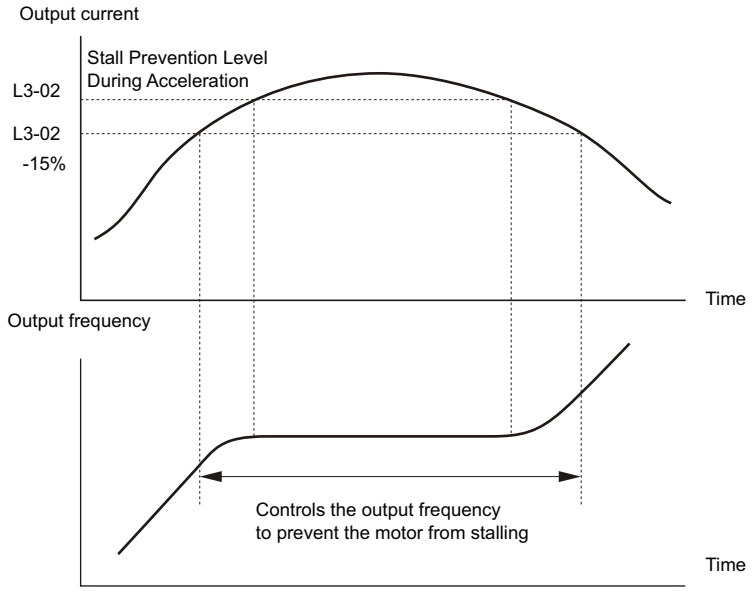



**Figure 2.72 Stall Prevention during Acceleration for Induction Motors**

**Setting 2: Intelligent Stall Prevention**

When L3-02 = 2, the drive will disregard the selected acceleration time and try to accelerate in the minimum time. The acceleration rate is adjusted so that the current does not exceed the value set in parameter L3-02.

## ■ L3-02: Stall Prevention Level during Acceleration

Sets the output current level at which the Stall Prevention during acceleration is activated.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-02 | Stall Prevention Level during Acceleration | 0 to 150% | 120% |

- Stalling may occur when the motor is rated at a smaller capacity than the drive and the Stall Prevention default settings are used. Set L3-02 as appropriate if stalling occurs.
- When operating the motor in the constant power range, also set parameter L3-03.

## ■ L3-03: Stall Prevention Limit during Acceleration

The Stall Prevention level is automatically reduced when the motor is operated in the constant power range.

L3-03 sets the lower limit for this reduction as a percentage of the drive rated current.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-03 | Stall Prevention Limit during Acceleration | 0 to 100% | 50% |

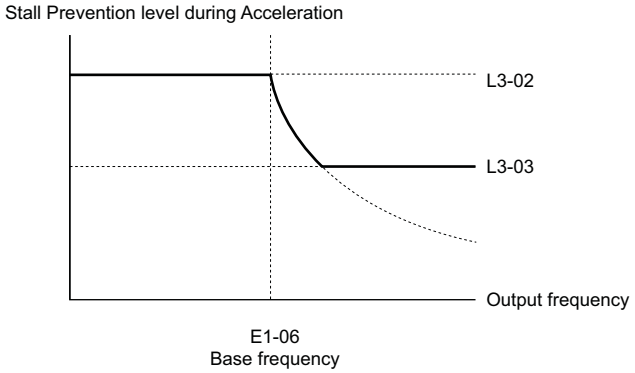



**Figure 2.73 Stall Prevention Level and Limit During Acceleration**

## ■ L3-04: Stall Prevention Selection during Deceleration

Stall Prevention during deceleration can control the deceleration based on the DC bus voltage and prevent an overvoltage fault caused by high inertia or rapid deceleration.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-04 | Stall Prevention Selection during Deceleration | 0 or 1 | 1 |

### Setting 0: Disabled

When this setting is used, the drive decelerates according to the set deceleration time. With high inertia loads or rapid deceleration, an overvoltage (ov) fault may occur. In this case, use dynamic braking options or switch to another L3-04 selection.

### Setting 1: Enabled

With this setting the drive tries to decelerate within the set deceleration time. When the DC bus voltage exceeds the Stall Prevention level, the drive interrupts deceleration and maintains the frequency at that time. Deceleration continues as soon as the DC bus voltage drops below that level. Repeating these operations makes it possible to decelerate the motor to a stop without causing a DC Bus Overvoltage (ov) fault even when a deceleration time is set too short beyond the drive capacity. The DC bus voltage level for Stall Prevention depends on the input voltage setting E1-01.

**Note:** This method may lengthen the total deceleration time compared to the set value. If this is not appropriate for the application consider using a braking option.

*Figure 2.74* illustrates the function of Stall Prevention during deceleration.

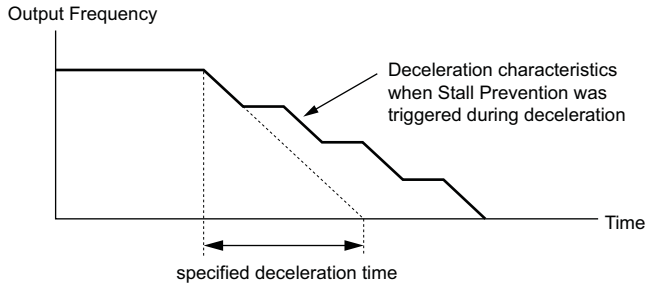



**Figure 2.74 Stall Prevention During Deceleration**

## ■ L3-05: Stall Prevention Selection during Run

Stall Prevention during run can prevent a motor from stalling by automatically reducing the speed when a transient overload occurs while the motor is running at constant speed.
This parameter determines how Stall Prevention works during run.
This parameter determines how Stall Prevention works during run.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-05 | Stall Prevention Selection during Run | 0 to 2 | 1 |

**Note:** **1.** This function is available in V/f Control.
**2.** When output frequency is 6 Hz or less, Stall Prevention during run is disabled regardless of the setting in L3-05 and L3-06.

### Setting 0: Disabled

Drive runs at the set frequency reference. A heavy load may cause the motor to stall and trip the drive with an oC or oL fault.

### Setting 1: Decelerate using C1-02

If the current exceeds the Stall Prevention level set in parameter L3-06, then the drive will decelerate at decel time 1 (C1-02). Once the current level drops below the value of L3-06 minus 2% for 100 ms, the drive accelerates back to the frequency reference at the active acceleration time.

### Setting 2: Decelerate using C1-04

Same as setting 1 except the drive decelerates at decel time 2 (C1-04).

## ■ L3-06: Stall Prevention Level during Run

Sets the current level to trigger Stall Prevention during run. Depending on the setting of parameter L3-23, the level is automatically reduced in the constant power range (speed beyond base speed). A setting of 100% is equal to the drive rated current. The Stall Prevention level can be adjusted using an analog input. Refer to *Analog Input Terminal Settings on page 190* for details.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-06 | Stall Prevention Level During Run | 30 to 150% | 120% |

## ■ L3-23: Automatic Reduction Selection for Stall Prevention during Run

This function reduces the Stall Prevention during run level in the constant power range.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-23 | Automatic Diminution Selection for Stall Prevention Level during Run | 0 or 1 | 0 |

**Setting 0: Disabled**

The level set in L3-06 is used throughout the entire speed range.

**Setting 1: Enabled**

The Stall Prevention level during run is reduced in the constant power range. The lower limit will be 40% of L3-06.

## ■ Overvoltage Suppression Function

This function suppresses overvoltage faults by decreasing the regenerative torque limit and slightly increasing the output frequency when the DC bus voltage rises. It can be used to drive loads with cyclic regenerative operation, such as a punch press or other applications that involve repetitive crank movements.

**Note:**
1. The motor speed will exceed the frequency reference when overvoltage suppression is triggered. Consequently, overvoltage suppression is not appropriate in applications that require a perfect match between the frequency reference and the motor speed.
2. Overvoltage may still occur if there is a sudden increase to a regenerative load.
3. This function is enabled only when operating just below the maximum frequency. Overvoltage suppression does not increase the output frequency beyond the maximum frequency. If this is required by the application, increase the maximum frequency and change the base frequency setting.

## ■ L3-11: Overvoltage Suppression Selection (CLV Control Mode Only)

Enables or disables the overvoltage suppression function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-11 | Overvoltage Suppression Function Selection | 0 or 1 | 0 |

**Setting 0: Disabled**

The regenerative torque limit and the output frequency are not adjusted. A regenerative load may trip the drive with an overvoltage fault.

**Setting 1: Enabled**

When the DC bus voltage rises due to regenerative load, an overvoltage fault is prevented by decreasing the regenerative torque limit and increasing the output frequency.

## ■ L3-27: Stall Prevention Detection Time

Sets a delay time from when the Stall Prevention level is reached and the actual Stall Prevention function is activated.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L3-27 | Stall Prevention Detection Time | 0 to 5000 ms | 50 ms |

## ◆ L4: Speed Detection

These parameters set up the speed agree and speed detection functions which can be assigned to the contact output terminals.

The speed is detected using the motor speed when A1-02 = 3.

### ■ L4-01, L4-02: Speed Agreement Detection Level and Detection Width

Parameter L4-01 sets the detection level for the contact output functions “Speed agree 1,” “User-set speed agree 1,” “Frequency detection 1,” and “Frequency detection 2.”

Parameter L4-02 sets the hysteresis level for these functions.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L4-01 | Speed Agreement Detection Level | 0.0 to 120.0 Hz <<1>> | 0.0 Hz |
| L4-02 | Speed Agreement Detection Width | 0.0 to 20.0 Hz | Determined by A1-02 <2> |

<<1>> Range upper limit is determined by the maximum output frequency (E1-04) and the upper limit of the frequency reference (d2-01).
<2> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

Refer to *H2: Contact Outputs on page 176*.

### ■ L4-03, L4-04: Speed Agreement Detection Level and Detection Width (+/-)

Parameter L4-03 sets the detection level for the contact output functions “Speed agree 2,” “User-set speed agree 2,” “Frequency detection 3,” and “Frequency detection 4.”
Parameter L4-04 sets the hysteresis level for these functions.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L4-03 | Frequency Detection Level (+/-) | -120.0 to 120.0 Hz <1> | 0.0 Hz |
| L4-04 | Speed Agreement Detection Width (+/-) | 0.0 to 20.0 Hz | Determined by A1-02 <2> |

<1> Range upper limit is determined by the maximum output frequency (E1-04) and the upper limit of the frequency reference (d2-01).
<2> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

Refer to *H2-01 to H2-16: Functions for Contact Outputs 1 to 16 on page 176*.

### ■ L4-05: Frequency Reference Loss Detection Selection

The drive can detect a loss of an analog frequency reference from analog input 1 or 2. Frequency reference loss is detected when the frequency reference drops below 10% of the master speed frequency reference before or below 5% of the maximum output frequency within 400 ms.

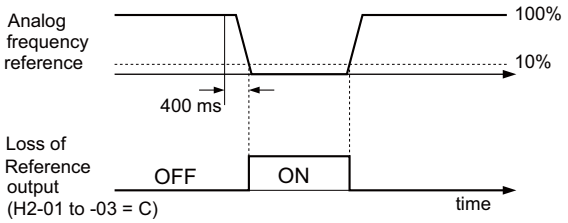



**Figure 2.75 Loss of Reference Function**

To have a contact output trigger when frequency reference loss occurs, set H2-01, H2-02, or H2-03 to C. Refer to *Setting C: Frequency reference loss on page 181* for details on setting the output function.

**Note:** This parameter is effective only when b1-01 (Frequency Reference Selection 1) is set to 1 (Analog input terminals).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L4-05 | Frequency Reference Loss Detection Selection | 0 or 1 | 0 |

**Setting 0: Stop**

Drive follows the frequency reference (which is no longer present) and simply stops the motor.

**Setting 1: Continue operation with reduced frequency reference**

The drive will continue operation at the frequency reference value set in parameter L4-06. When the external frequency reference value is restored, the operation is continued with the frequency reference.

### ■ L4-06: Frequency Reference at Reference Loss

Sets the frequency reference level the drive runs with when L4-05 = 1 and a reference loss was detected. The value is set as a percentage of the frequency reference when the loss was detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L4-06 | Frequency Reference at Reference Loss | 0.0 to 100.0% | 80.0% |

### ■ L4-07: Speed Agreement Detection Selection

Determines when frequency detection is active using parameters L4-01 through L4-04.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L4-07 | Speed Agreement Detection Selection | 0 or 1 | 0 |

**Setting 0: Detection during run (no detection when drive output shut down)**
**Setting 1: Detection always enabled**

## ◆ L5: Fault Restart

After a fault has occurred, this function attempts to automatically restart the motor and continue operation instead of stopping.
The drive can be set up to perform a self-diagnostic check and resume the operation after a fault has occurred. If the self-check is successful and the cause of the fault has disappeared, the drive restarts by first performing Speed Search (Refer to *b3: Speed Search on page 103* for details).

**Note:** **1.** The wiring sequence should remove the Forward/Reverse command when a fault is triggered and output is shut off.
**2.** With the Forward/Reverse command removed, the drive can perform a self-diagnostic check and attempt to reset the fault automatically.

The drive can attempt to restart itself following the faults listed below.

| Fault | Name | Fault | Name |
|---|---|---|---|
| CF | Control Fault | LIN nn | Link Fault Communication Fault |
| CFA nn CoF | Current Offset Fault | oH | IGBT Overheating |
| CFA nn FU | Fuse Blowout | oL1 | Motor Overload |
| CFA nn oC | Overcurrent | oL2 | Drive Overload |
| CFA nn oH1 | IGBT Overheating 1 | oL3 | Overtorque 1 |
| CFA nn ov1 | Overvoltage 1 | oL4 | Overtorque 2 |
| CFA nn ov2 | Overvoltage 2 | Uv1 | DC Bus Undervoltage <1> |
| GF | Ground Fault | VUB | Output Voltage Imbalance |
| LF | Output Open Phase | – | – |

<1> When L2-01 is set to 1 or 2 (continue operation during momentary power loss)

Use parameters L5-01 to L5-05 to set up automatic fault restart.

To output a signal during fault restart, set H2-01, H2-02, or H2-03 to 1E.

## ■ L5-01: Number of Auto Restart Attempts

Sets the number of times that the drive may attempt to restart itself.

The method of incrementing the restart counter is determined by the setting of parameter L5-05. When the counter reaches the number set in L5-01, the operation stops and the fault has to be reset manually after correcting the cause.

The restart counter is incremented at each restart attempt, regardless of whether the attempt was successful. When the counter reaches the number set in L5-01, the operation stops and the fault has to be reset manually after correcting the cause.

The number of fault restarts is reset back to zero when:

- The drive operates normally for ten minutes following a fault restart.
- A fault is cleared after protective functions are triggered.
- The power supply is cycled.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L5-01 | Number of Auto Restart Attempts | 0 to 10 Times | 0 Time |

## ■ L5-02: Auto Restart Fault Output Operation Selection

Parameter L5-02 sets the fault signal operation (H2-□□ = E) when the drive attempts to restart.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L5-02 | Auto Restart Fault Output Operation Selection | 0 or 1 | 0 |

**Setting 0: No fault output**
**Setting 1: Fault output is set**

## ■ L5-04: Fault Reset Interval Time

Parameter L5-04 sets the length of time to wait between restart attempts when parameter L5-05 is set to 1.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L5-04 | Fault Reset Interval Time | 0.5 to 600.0 s | 10.0 s |

## ■ L5-05: Fault Reset Operation Selection

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L5-05 | Fault Reset Operation Selection | 0 or 1 | 0 |

**Setting 0: Count successful restarts**

The drive will continuously attempt to restart. If it restarts successfully, the restart counter is increased. This operation is repeated each time a fault occurs until the counter reaches the value set in L5-01.

**Setting 1: Count restart attempts**

The drive will try to restart using the time interval set in parameter L5-04. A record is kept of the number of attempts to restart the drive, regardless of whether or not those attempts were successful. When the number of attempted restarts exceeds the value set in L5-01, the drive gives up trying to restart.

## ◆ L6: Torque Detection

The drive provides two independent torque detection functions that trigger an alarm or fault signal when the load is too heavy (oL), or suddenly drops (UL). They are set up using the L6-☐☐ parameters. To indicate the underload or overload condition to an external device, contact outputs should be programmed as shown below.

**NOTICE:** *When overtorque occurs in the application, the drive may stop due to overcurrent (oC) or overload (oL1). To prevent this, an overload situation should be indicated to the controller before oC or oL1 occurs in the drive. Use the torque detection for this purpose. Use undertorque detection to discover application problems like a torn belt, a pump shutting off, or other similar trouble.*

| H2-01, H2-02, H2-03 Setting | Name |
|---|---|
| B | Torque detection 1, N.O. (output closes when overload or underload is detected) |
| 17 | Torque detection 1, N.C. (output opens when overload or underload is detected |
| 18 | Torque detection 2, N.O. (output close when overload or underload is detected) |
| 19 | Torque detection 2, N.C. (output opens when overload or underload is detected) |

*Figure 2.76* and *Figure 2.77* show the function of overtorque and undertorque detection.

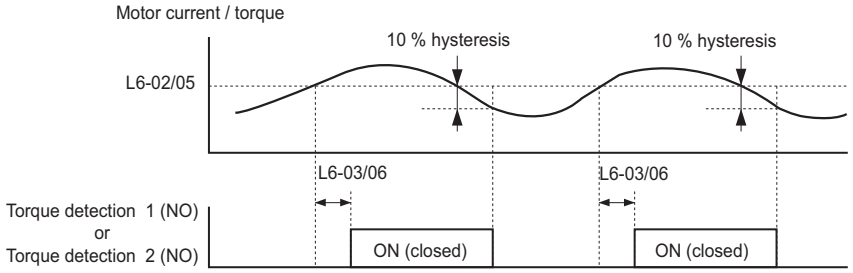



**Figure 2.76 Overtorque Detection Operation**

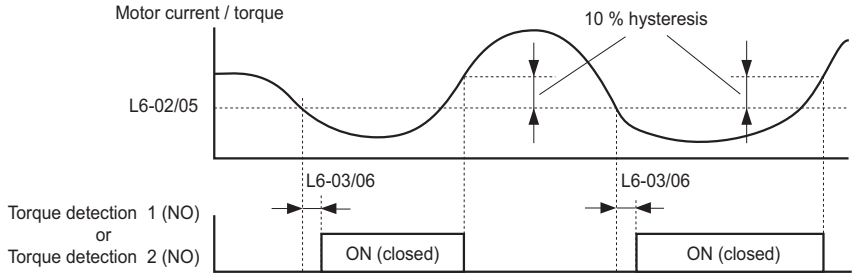



**Figure 2.77 Undertorque Detection Operation**

**Note:** **1.** The torque detection function uses a hysteresis of 10% of the drive rated output current and motor rated torque.
**2.** In V/f, the level is set as a percentage of the drive rated output current. In CLV, it is set as a percentage of the motor rated torque.

## ■ L6-01, L6-04: Torque Detection Selection 1, 2

The torque detection function is triggered when the current or torque exceeds the levels set in L6-02 and L6-05 for longer than the time set in L6-03 and L6-06. L6-01 and L6-04 select the conditions for detection and the operation that follows.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L6-01 | Torque Detection Selection 1 | 0 to 8 | 0 |
| L6-04 | Torque Detection Selection 2 | 0 to 8 | 0 |

**Setting 0: Disabled**
**Setting 1: oL3, oL4 at speed agree (alarm)**

Overtorque detection is active only when the output speed is equal to the frequency reference, i.e., no detection during acceleration and deceleration. The operation continues after detection and an oL3/oL4 alarm is triggered.

**Setting 2: oL3, oL4 at run (alarm)**

Overtorque detection works as long as the Run command is active. The operation continues after detection and an oL3 or oL4 alarm is triggered.

**Setting 3: oL3, oL4 at speed agree (fault)**

Overtorque detection is active only when the output speed is equal to the frequency reference, i.e., no detection during acceleration and deceleration. The operation is stopped and an oL3 or oL4 fault is triggered.

**Setting 4: oL3, oL4 at run - (fault)**

Overtorque detection works as long as a Run command is active. Operation stops and an oL3 or oL4 fault is triggered.

**Setting 5: UL3, UL4 at speed agree (alarm)**

Undertorque detection is active only when the output speed is equal to the frequency reference, i.e., no detection during acceleration and deceleration. The operation continues after detection and a UL3 or UL4 alarm is triggered.

**Setting 6: UL3, UL4 at Run - Alarm**

Undertorque detection works as long as the Run command is active. The operation continues after detection and a UL3 or UL4 alarm is triggered.

**Setting 7: UL3, UL4 at Speed Agree - Fault**

Undertorque detection is active only when the output speed is equal to the frequency reference, i.e., there is no detection during acceleration and deceleration. The operation is stopped and a UL3 or UL4 fault is triggered.

**Setting 8: UL3, UL4 at run - fault**

Undertorque detection works as long as a Run command is active. Operation stops and a UL3 or UL4 fault is triggered.

## ■ L6-02, L6-05: Torque Detection Level 1, 2

These parameters set the overtorque/undertorque detection levels for torque detection function 1 and 2. In the V/f control mode, these levels are set as a percentage of the drive's rated output current, while in the OLV control mode they are set as a percentage of the motor rated torque.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L6-02 | Torque Detection Level 1 | 0 to 300% | 150% |
| L6-05 | Torque Detection Level 2 | 0 to 300% | 150% |

**Note:** The torque detection level 1 (L6-02) can also be supplied by an analog input terminal set to H3-□□ = 7. Here, the analog input value has priority and the setting in L6-02 is disregarded. Torque detection level 2 (L6-05) cannot be set by an analog input.

## ■ L6-03, L6-06: Torque Detection Time 1, 2

These parameters determine the time required to trigger an alarm or fault after exceeding the levels in L6-02 and L6-05.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L6-03 | Torque Detection Time 1 | 0.0 to 10.0 s | 0.1 s |
| L6-06 | Torque Detection Time 2 | 0.0 to 10.0 s | 0.1 s |

## ■ Mechanical Weakening Detection

This function can be used to detect mechanical weakening of a machine that leads to overtorque or undertorque situations after a certain machine operation time has elapsed.

The function is activated in the drive when the cumulative operation counter U4-01 exceeds the time set in parameter L6-11. Mechanical Weakening Detection uses the torque detection 1 settings (L6-01 to L6-03) and triggers an oL5 (Mechanical Weakening Detection 1) or UL5 (Mechanical Weakening Detection 2) fault when overtorque or undertorque occurs in the speed range determined by parameters L6-08 and L6-09. The operation of the drive after detection of oL5 or UL5 is set by parameter L6-08.

To output a signal for Mechanical Weakening Detection, set H2-□□ to 22.

## ■ L6-08: Mechanical Weakening Detection Operation

Sets the speed range to detect mechanical weakening and the action to take when mechanical weakening is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L6-08 | Mechanical Weakening Detection Operation | 0 to 8 | 0 |

**Setting 0: Disabled**

**Setting 1: Continue running if the speed is greater than L6-09 (signed) (alarm)**

Detection when the speed is above L6-09 (signed). Upon detection operation continues, but an oL5 alarm is output.

**Setting 2: Continue running if the speed is greater than L6-09 (alarm)**

Detection when the speed is above L6-09 (unsigned). Upon detection operation continues, but an oL5 alarm is output.

**Setting 3: Stop when motor speed is greater than L6-09 (signed)**

Detection when the speed is above L6-09 (signed). Upon detection operation is stopped and an oL5 fault is output.

**Setting 4: Stop when Motor Speed is Greater than L6-09**

Detection when the speed is above L6-09 (unsigned). Upon detection operation is stopped and an oL5 fault is output.

**Setting 5: Continue running if the speed is less than L6-09 (signed) (alarm)**

Detection when the speed is below L6-09 (signed). Upon detection operation continues, but a UL5 alarm is output.

**Setting 6: Continue running if the speed is less than L6-09 (alarm)**

Detection when the speed is below L6-09 (unsigned). Upon detection operation continues, but a UL5 alarm is output.

**Setting 7: Stop when Motor Speed is less than L6-09 (signed)**

Detection when the speed is below L6-09 (signed). Upon detection operation is stopped and a UL5 fault is output.

**Setting 8: Stop when motor speed is less than L6-09**

Detection when the speed is below L6-09 (unsigned). Upon detection the operation is stopped and a UL5 fault is output.

## ■ L6-09: Mechanical Weakening Detection Speed Level

Sets the speed level for Mechanical Weakening Detection.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L6-09 | Mechanical Weakening Detection Speed Level | -110.0 to 110.0% | 110.0% |

The value is set as a percentage of the maximum frequency. If L6-08 is set for unsigned speed detection (L6-08 = 2, 4, 6, 8) then the absolute value of L6-09 is used (negative settings are treated as positive values).

## ■ L6-10: Mechanical Weakening Detection Time

Sets the time permitted for the situation selected in parameter L6-08 to arise before mechanical weakening is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L6-10 | Mechanical Weakening Detection Time | 0.0 to 10.0 s | 0.1 s |

### ■ L6-11: Mechanical Weakening Detection Start Time

Sets the drive cumulative operation time at which Mechanical Weakening Detection is activated. If U4-01 reaches the L6-11 value, the function is activated.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L6-11 | Mechanical Weakening Detection Start Time | 0 to 65535 h | 0 h |

## ◆ L7: Torque Limit

The torque limit function can be used to limit the torque in each of the four quadrants individually and thereby protect the machinery. It can be used in OLV and CLV control modes. The limit can be either set by parameters or by analog inputs. A contact output programmed for “During torque limit” (H2-01, H2-02, H2-03 = 30) can be switched when the drive is operating at the torque limit.

### ■ Setting Torque Limits

The torque limits are defined by parameters L7-01 to L7-04 for each of the four operation quadrants. Analog inputs can also be used to either define a general limit for all operation conditions (H3-02, H3-06, H3-10 = 15) or for setting separate limits for each operation condition (H3-02, H3-06, H3-10 = 10, 11, or 12). ***Figure 2.78*** shows which of the limit settings is applied in each quadrant.

If two limit values are defined for the same operation conditions, the drive will use the lower value.

**Note:** The maximum output torque is ultimately limited by the drive output current (max. 150% of drive rated current in HD, 120% in ND). Output torque will not exceed the limit set for the drive rated current, even if the torque limits are set to higher values.

Example: If parameter L7-01 = 130%, L7-02 to L7-04 = 200%, and a general torque limit of 150% is set by an analog input (H3-02, H3-06, H3-10 = 15), then the torque limit in quadrant 1 will be 130%, but 150% in all other quadrants.

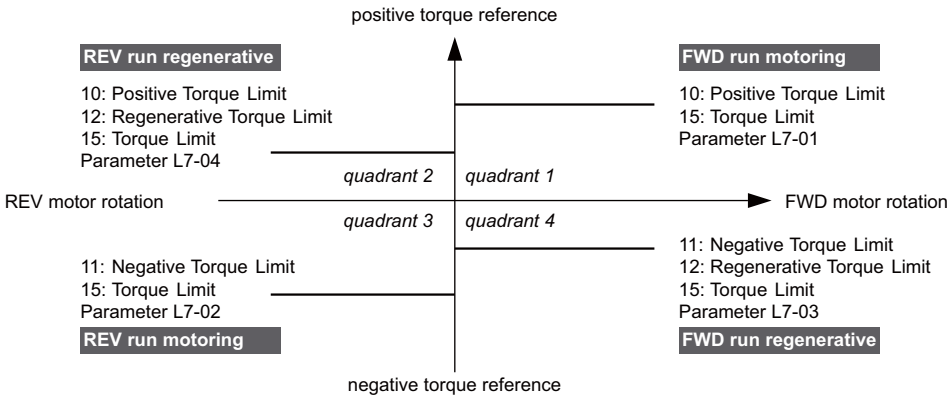



**Figure 2.78 Torque Limit Parameters and Analog Input Settings**

### ■ L7-01 to L7-04: Torque Limits

A setting of 100% is equal to the motor rated torque.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L7-01 | Forward Torque Limit | 0 to 300% | 100% |
| L7-02 | Reverse Torque Limit | 0 to 300% | 100% |
| L7-03 | Forward Regenerative Torque Limit | 0 to 300% | 1% |
| L7-04 | Reverse Regenerative Torque Limit | 0 to 300% | 1% |

**Note:** If the analog input is programmed for “10: Forward torque limit”, “11: Reverse torque limit”, “12: Regenerative torque limit”, or “15: General torque limit”, the drive uses the lower value in L7-01 through L7-04, or analog input torque limit.

## ■ L7-06: Torque Limit Integral Time Constant

Sets the integral time constant for the torque limit function. Decrease this setting to increase frequency fluctuation due to torque limit while applying integral control.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L7-06 | Torque Limit Integral Time Constant | 5 to 10000 ms | 200 ms |

## ■ L7-07: Torque Limit Control Method Selection during Accel/Decel

Selects the function of torque limit during acceleration and deceleration.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L7-07 | Torque Limit Control Method Selection during Accel/Decel | 0 or 1 | 0 |

**Setting 0: Proportional control (changes to integral control at constant speed).**

The torque limit function works with P control during accel and decel, and switches to I control at constant speed. Use this setting when accelerating or decelerating to the desired speed has priority over the torque limit during speed changes.

**Setting 1: Integral control**

The torque limit function always uses I control. Use this setting when a highly accurate torque limit is required, even during speed changes. Using this function may increase the acceleration time, or may prevent the motor speed from reaching the frequency reference if the torque limit is reached first.

## ■ L7-16: Torque Limit Process at Start

Assigns a time filter to allow the torque limit to build at start.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L7-16 | Torque Limit Process at Start | 0 to 1 | 1 |

**Setting 0: Disabled**

Toque limit is created at start without a delay time. Disable L7-16 to maximize response time when the application requires sudden acceleration or deceleration at start.

**Setting 1: Enabled**

A time filter is added to allow the torque limit to build at start.

## ■ L7-30: Regenerative Torque Limit Mode Selection

Parameter L7-30 sets the mode for the regenerative torque limit.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L7-30 | Regenerative Torque Limit Mode Selection | 0 or 1 | 0 |

**Setting 0: Standard mode (torque limits from all analog and communications inputs effective)**
**Setting 1: Independent mode (only L7-03, -04 and H3-□□ (regenerative torque limit) effective)**

## ◆ L8: Drive Protection

### ■ L8-02: Overheat Alarm Level

Sets the overheat alarm (oH) detection level.

The drive will output an alarm when the heatsink temperature exceeds the alarm level set in parameter L8-02. If the operation when this alarm occurs is set for continued operation (L8-03 = 4) and the temperature reaches the overheat fault level, the drive will trigger an oH fault and stop operation.

When an output terminal is set for the oH pre-alarm (H2-☐☐ = 20), the switch will close when the thermistor temperature rises above L8-02.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-02 | Overheat Alarm Level | 50 to 150°C | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

### ■ L8-03: Overheat Pre-Alarm Operation Selection

Sets the operation when an overheat pre-alarm is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-03 | Overheat Pre-Alarm Operation Selection | 0 to 4 | 3 |

**Setting 0: Ramp to stop**

If an overheat alarm occurs, the drive decelerates to a stop using the deceleration time currently selected. If a contact output is programmed for “fault” (H2-☐☐ = E), this output will be triggered.

**Setting 1: Coast to stop**

If heatsink overheat (oH) occurs, the drive switches off the output and the motor coasts to a stop. If a contact output is programmed for “fault” (H2-☐☐ = E), this output will be triggered.

**Setting 2: Fast Stop**

If an overheat alarm occurs, the drive decelerates to a stop using the Fast Stop time (C1-09). If a contact output is programmed for “fault” (H2-☐☐ = E), this output will be triggered.

**Setting 3: Alarm only**

If an overheat alarm occurs, an alarm is output and the drive continues operation.

**Setting 4: Operation with reduced speed**

If an overheat alarm occurs, the operation is continued but the speed is reduced to the level set in parameter L8-19. If after 10 s the oH alarm is still present, the speed is reduced once more. The amount of reduction depends on how often the alarm repeats. If the oH alarm disappears while the drive is operating at a reduced speed, then the drive will switch back to the previous speed it was reduced to before. ***Figure 2.79*** explains the operation with reduced speed during an oH alarm. A contact output programmed for 4D is switched when the oH alarm is still active after ten reduction cycles.

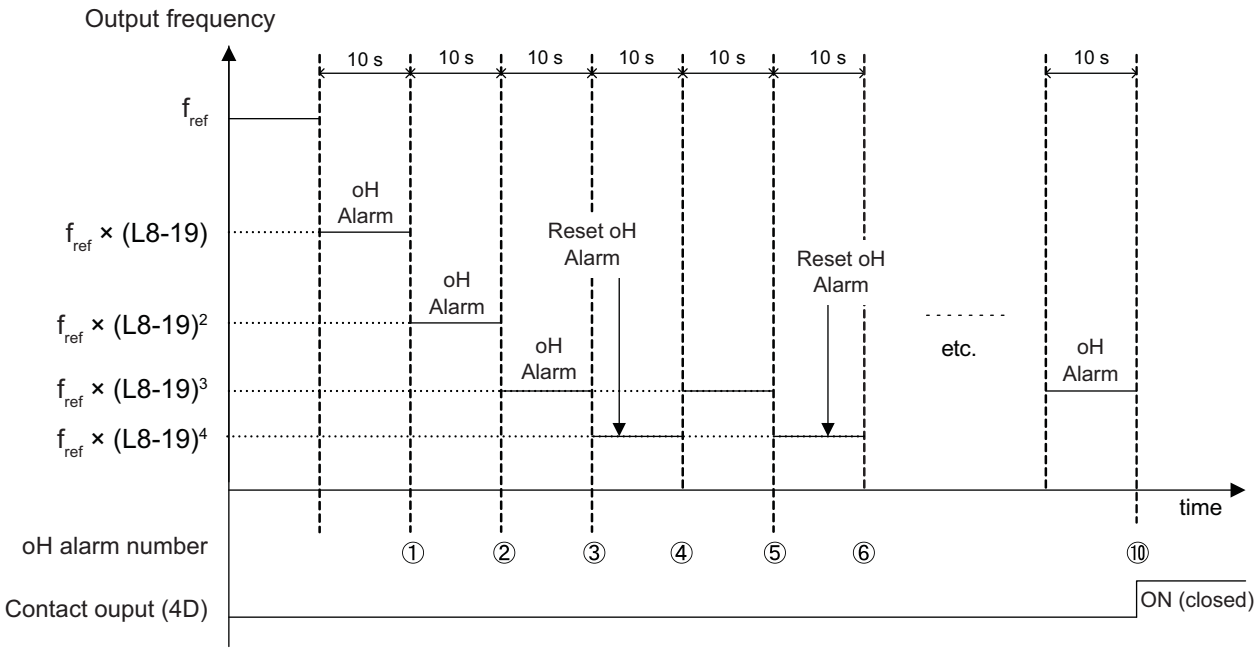



**Figure 2.79 Output Frequency Reduction during IGBT Overheat Pre-Alarm**

## ■ L8-19: Frequency Diminution Rate During Overheat Pre-Alarm

Specifies how much the output frequency is reduced when L8-03 is set to 4 and an overheat pre-alarm is triggered. Set as a factor for the maximum output frequency.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-19 | Frequency Reduction Rate during Overheat Pre-Alarm | 0.1 to 0.9 | 0.8 |

## ■ L8-07: Output Phase Loss Protection Selection

Enables or disables the output phase loss detection, which is triggered when the output current falls below 5% of the drive rated current.

**Note:** Output phase loss detection can mistakenly be triggered if the motor rated current is very small compared to the drive rating. Disable this parameter in such cases.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-07 | Output Phase Loss Protection Selection | 0 to 2 | 2 |

**Setting 0: Disabled**

**Setting 1: Fault when one phase is lost**

An output phase loss fault (LF) is triggered when one output phase is lost. The output shuts off and the motor coasts to a stop.

**Setting 2: Fault when two or more phases are lost**

An output phase loss fault (LF) is triggered when two or more output phases are lost. The output shuts off and the motor coasts to a stop.

## ■ L8-09: Output Ground Fault Detection Selection

Enables or disables the output ground fault detection.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-09 | Output Ground Fault Detection Selection | 0 or 1 | 1 |

**Setting 0: Disabled**

Ground faults are not detected.

**Setting 1: Enabled**

A ground fault (GF) is triggered when high leakage current or a ground short circuit occurs in one or two output phases.

## ■ L8-10: Heatsink Cooling Fan Operation Selection

Selects the heatsink cooling fan operation.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-10 | Heatsink Cooling Fan Operation Selection | 0 to 2 | 1 |

**Setting 0: Run with timer**

The fan is switched on when a Run command is active. It is switched off with the delay set in parameter L8-11 after the Run command has been released. Using this setting extends the fan lifetime.

**Setting 1: Operates when the Uv (DC bus undervoltage) fault has been cleared**

The fan starts operating when the voltage of the DC bus rises above the Undervoltage Detection Level (Uv) set in L2-05.

**Setting 2: Operates whenever the control power supply is ON**

The cooling fan runs all the time while control power is being supplied to the drive.

## ■ L8-11: Heatsink Cooling Fan Off-Delay Time

Sets the cooling fan switch off-delay time if parameter L8-10 is set to 0.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-11 | Heatsink Cooling Fan Off Delay Time | 0 to 1800 s | 600 s |

## ■ L8-15: oL2 Characteristics Selection at Low Speeds

Selects whether the drive overload capability (oL fault detection level) is reduced at low speeds in order to prevent premature output transistor failures.

**Note:** Contact Yaskawa for consultation first before disabling this setting.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-15 | oL2 Characteristics Selection at Low Speeds | 0 or 1 | 1 |

**Setting 0: Protection disabled at low speed**

The overload protection level is not reduced. Frequently operating the drive with high output current at low speed can lead to premature drive faults.

**Setting 1: Protection enabled at low speed**

The overload protection level (oL2 fault detection level) is automatically reduced at speeds below 6 Hz.

## ■ L8-18: Software CLA Selection

The Software Current Limit (CLA) is a drive protection function that prevents main circuit transistor failures caused by high current. Parameter L8-18 enables or disables a drive protection function.

**Note:** This setting should not be changed unless absolutely necessary. For proper drive protection and operation leave the Software CLA function enabled.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-18 | Software CLA Selection | 0 or 1 | 1 |

**Setting 0: Software CLA disabled (gain = 0)**

The drive may trip on an oC fault if the load is too heavy or the acceleration is too short.

**Setting 1: Software CLA enabled**

When the soft CLA current level is reached, the drive reduces the output voltage in order to reduce the current. If the current level drops below the Software CLA level, then normal operation will continue.

## ■ L8-32: Backup Fan Use Selection

Sets whether the backup fan is used or not.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-32 | Backup Fan Use Selection | 0 or 1 | 1 |

**Setting 0: Backup fan provided**
**Setting 1: No backup fan**

## ■ L8-33: Fan Board Use Selection

Sets the number of fan control boards (FFB boards) used.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-33 | Fan Board Use Selection | 0 to 2 | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

**Setting 0: No fan boards used**
**Setting 1: One fan boards used**
**Setting 2: Two fan boards used**

## ■ L8-63: Output Side Overvoltage Detection Level

Parameter L8-63 sets the detection level for overvoltage at the output side. Set as a percentage of the maximum motor voltage in 0.1% units.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-63 | Output Overvoltage Detection Level | 0.0 to 200.0% | 120.0% |

## ■ L8-64: Output Overvoltage Detection Time

Sets the time before an Output Overvoltage (oov) is detected, in 0.01 s units. If the state in which the output voltage exceeds the value set for L8-63 continues for the time set for L8-64 or longer, Output Overvoltage (oov) is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-64 | Output Overvoltage Detection Time | 0.00 to 2.00 s | 0.01 s |

## ■ L8-65: Output Voltage Imbalance Detection Operation Selection

Sets the action the drive should take when an output voltage imbalance is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-65 | Output Voltage Imbalance Detection Operation Selection | 0 to 3 | 3 |

**Setting 0: Ramp to stop using the deceleration time set in C1-02**
**Setting 1: Coast to stop**
**Setting 2: Ramp to stop using the Fast Stop time set in C1-09**
**Setting 3: Alarm only**

## ■ L8-66: Output Voltage Imbalance Detection Level

Sets the level at which imbalance of the output voltage is detected in 0.1% units (100%: 2400 V for the 2 kV class, 3300 V for the 3 kV class, 4160 V for the 4 kV class, 6600 V for the 6 kV class, and 11000 V for the 11 kV class).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-66 | Output Voltage Imbalance Detection Level | 0.0 to 100.0% | 10.0% |

## ■ L8-67: Output Voltage Imbalance Detection Time

Sets the time before output voltage imbalance is detected, in 0.001 s units. If the state in which the zero-phase voltage detection value exceeds the level set for L8-66 continues for the time set for L8-67 or longer, output voltage imbalance (VUB) is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-67 | Output Voltage Imbalance Detection Time | 0.001 to 2.000 s | 0.200 s |

## ■ L8-86: Transformer Overheat Alarm (TMA) Operation Selection

Parameter L8-86 sets the action the drive should take when a transformer overheat pre-alarm (TMA) is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-86 | Transformer Overheat Alarm (TMA) Operation Selection | 0 to 3 | 3 |

**Setting 0: Ramp to stop**

The drive stops the motor using the deceleration time 1 set in parameter C1-02.

**Setting 1: Coast to stop**

The drive output is switched off and the motor coasts to stop.

**Setting 2: Fast Stop**

The drive stops the motor using the Fast Stop time set in parameter C1-09.

**Setting 3: Alarm only**

The operation is continued.

**Note:** TMA is detected as a fault when setting 0 to 2 is selected. It is detected as an alarm when setting 3 or 4 is selected.

## ■ L8-87: Transformer Overheat Alarm (TMA) Level

Sets the trigger temperature for the transformer overheat alarm (TMA) function in °C units.

**Note:** When the detected transformer temperature has reached the setting for this parameter, a transformer overheat alarm (TMA) is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-87 | Transformer Overheat Alarm (TMA) Level | 50 to 160°C | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ L8-88: Transformer Overheat Fault (TME) Level

Sets the trigger temperature for the transformer overheat fault (TME) function in °C units.

**Note:** When the detected transformer temperature has reached the setting for this parameter, a transformer overheat fault (TME) is detected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| L8-88 | Transformer Overheat Fault (TME) Level | 50 to 160°C | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

# 2.9 n: Special Adjustments

These parameters handle a variety of specialized adjustments and functions, including Hunting Prevention and AFR Control functions.

## ◆ n1: Hunting Prevention

Hunting often occurs with an output frequency below 30 Hz.

### ■ n1-01: Hunting Prevention Selection

Enables or disables the Hunting Prevention function.

**Note:** This function is available only when using V/f Control. Hunting Prevention should be disabled when drive response is more important than suppressing motor oscillation. This function can also be disabled without any problems in applications with high inertia loads or relatively heavy loads.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n1-01 | Hunting Prevention Selection | 0 or 1 | 1 |

**Setting 0: Disabled**
**Setting 1: Enabled**

### ■ n1-02: Hunting Prevention Gain Setting

Sets the gain for the Hunting Prevention Function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n1-02 | Hunting Prevention Gain Setting | 0.00 to 2.50 | 1.00 |

Normally, n1-02 does not need to be changed, but adjustment may help under the following conditions:

- If the motor vibrates while lightly loaded and n1-01 = 1, increase the gain by 0.1 until vibration ceases.
- If the motor stalls while n1-01 = 1, decrease the gain by 0.1 until the stalling ceases.

### ■ n1-03: Hunting Prevention Time Constant

Determines how responsive the Hunting Prevention function is (affects the primary delay time for Hunting Prevention).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n1-03 | Hunting Prevention Time Constant | 0 to 500 ms | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

Normally, n1-03 does not need to be changed, but adjustment may help under the following conditions:

- Increase this value for applications with a large load inertia. A higher setting leads to slower response, though, which can result in oscillation at lower frequencies.
- Lower this setting if oscillation occurs at low speed.

### ■ n1-05: Hunting Prevention Gain while in Reverse

This parameter is the same as n1-02, except that it is used when rotating in reverse. See the explanation for n1-02.

**Note:** When set to 0, n1-02 is enabled even when the drive is operating in reverse.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n1-05 | Hunting Prevention Gain while in Reverse | 0.00 to 2.50 | 0.00 |

## ◆ n2: Speed Feedback Detection Control (AFR) Tuning

These parameters are used to achieve speed stability when a load is suddenly applied or removed.

**Note:** Before making changes to the AFR parameters, make sure all motor parameters are set properly or perform Auto-Tuning.

### ■ n2-01: Speed Feedback Detection Control (AFR) Gain

Sets the internal speed feedback detection control gain in the AFR.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n2-01 | Speed Feedback Detection Control (AFR) Gain | 0.00 to 10.00 | 2.00 |

Normally there is no need to adjust n2-01 from the default setting. Make adjustments in the following cases:

- If hunting occurs, increase the setting value in steps of 0.05 while checking the response.
- If response is low, decrease the setting value in steps of 0.05 while checking the response.

### ■ n2-02, n2-03: Speed Feedback Detection Control (AFR) Time Constant 1, 2

Parameter n2-02 sets the time constant normally used by AFR.

Parameter n2-03 sets the time constant during Speed Search or regenerative operation.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n2-02 | Speed Feedback Detection Control (AFR) Time Constant 1 | 0 to 2000 ms | 250 ms |
| n2-03 | Speed Feedback Detection Control (AFR) Time Constant 2 | 0 to 2000 ms | 750 ms |

**Note:** Parameter n2-02 cannot be set higher than n2-03 or an oPE08 error will result.

These parameters rarely need to be changed. Adjust settings only under the following conditions:

- If hunting occurs, increase n2-02. If response is low, decrease it.
- Increase n2-03 if overvoltage occurs with high inertia loads at the end of acceleration or with sudden load changes.
- If setting n2-02 to a higher value, also increase C4-02 (Torque Compensation Delay Time Constant 1) proportionally.
- If setting n2-03 to a higher value, also increase C4-06 (Torque Compensation Delay Time Constant 2) proportionally.

### ■ n2-06: Speed Feedback Detection Control (AFR) Gain Switch Start Gain

Parameter n2-06 sets the gain-switching start gain for speed feedback detection control (AFR).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n2-06 | Speed Feedback Detection Control (AFR) Gain Switch Start Gain | 0.00 to 2.00 | 1.00 |

## ◆ n9: I/O Voltage Detection

### ■ n9-02: Output Current Detection Gain

Sets the gain for adjusting the output current detection value in 0.0001 units.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n9-02 | Output Current Detection Gain | 0.0001 to 2.0000 | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ n9-70: Output Voltage Detection Gain

Sets the gain for adjusting the output voltage detection value in 0.0001 units.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n9-70 | Output Voltage Detection Gain | 0.0000 to 2.0000 | 1.0000 |

## ■ n9-71: Input Current Conversion Coefficient

Sets the input current conversion coefficient in 0.0001 units.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n9-71 | Input Current Conversion Coefficient | 0.0000 to 6.5535 | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ■ n9-72: Input Voltage Detection Gain

Sets the gain for adjusting the input voltage detection value in 0.0001 units.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| n9-72 | Input Voltage Detection Gain | 0.0000 to 2.0000 | 1.0000 |

# 2.10 o: Operator Related Settings

These parameters are for controlling the various functions, features, and display of the digital operator.

## ◆ o1: Digital Operator Display Selection

These parameters determine how data appears on the operator display.

### ■ o1-01: Drive Mode Unit Monitor Selection

When the drive is powered up, the monitor selected in parameter o1-02 appears first on the display. If o1-02 is set to 5, o1-01 can be used to change the content of this monitor.

When using the digital operator, pressing the up arrow key will display the following data: speed reference → rotational direction → output speed → output current → o1-01 selection.

Parameter o1-01 lets the user select the content of the last monitor in this sequence. There is no effect like this on an LCD operator.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o1-01 | Drive Mode Display Item Selection | 104 to 699<br>U1-04 (Control Mode) to U6-99 (Option Monitor 20) <1> | 106 (U1-06) |

<1> U2-□□ and U3-□□ parameters cannot be selected

### ■ o1-02: User Monitor Selection after Power Up

Selects which monitor parameter is displayed upon power up. This is done by entering the 1□□ part of U1-□□. Certain monitors are not available in some control modes. Refer to *U: Monitors on page 70* for a list of monitors.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o1-02 | User Monitor Selection after Power Up | 1 to 5 | 1 |

**Setting 1: Frequency reference (U1-01)**
**Setting 2: Motor direction**
**Setting 3: Output frequency (U1-02)**
**Setting 4: Output current (U1-03)**
**Setting 5: User-selected monitor (set by o1-01)**

### ■ o1-03: Digital Operator Display Selection

Sets the units used to display the frequency reference and monitor values. Set o1-03 to 3 to select user-set units, then set details in parameters o1-10 and o1-11.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o1-03 | Frequency Reference Setting/Display Unit | 0 to 3 | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

**Setting 0: 0.01 Hz units**
**Setting 1: 0.01% units (100% = max. output frequency)**
**Setting 2: r/min units (calculated by the max. output frequency and the no. of motor poles)**
**Setting 3: User-set units (use o1-10, o1-11)**

Set the value use for the maximum frequency reference in o1-10. The placement of the decimal point in this number should be set to o1-11.

For example, to have the maximum output frequency displayed as “100.00”, set o1-10 = 1000 and o1-11 = 2 (i.e., 1000 with 2 decimal points).

**Note:** **1.** Parameter o1-03 allows the programmer to change the units used in the following parameters and monitors:
- U1-01: frequency reference
- U1-02: output frequency
- U1-05: motor speed
- U1-16: output frequency after softstarter (accel/decel ramp generator)
- d1-01 to d1-17: frequency references 1 to 17

**2.** Setting o1-03 to 2 requires that the number of motor poles be entered to E2-04 and E4-04

### ■ o1-04: V/f Pattern Display Unit (CLV)

Determines the units used for the frequency reference when setting parameters that create the V/f pattern: E1-04, E1-06, E1-07, E1-09, and E1-11. For motor 2, this includes parameters E3-04, E3-06, E3-07, E3-09, and E3-11.

Enabled only in the CLV control mode.
When o1-04 = 1, this parameter is set in r/min units with the value in E2-04 as the number of motor poles.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o1-04 | V/f Pattern Display Unit | 0 or 1 | Determined by A1-02 <1> |

<1> For details on the default settings, refer to *Control Mode Dependent Parameter Default Values on page 79*.

**Setting 0: Hz**
**Setting 1: r/min**
**Note:** For motor 2, o1-04 can only be set to 0 for Hertz.

### ■ o1-10: User-Set Display Units Maximum Value

Determines the display value that is equal to the maximum output frequency.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o1-10 | User-Set Display Units Maximum Value | 1 to 60000 | Determined by o1-03 |

### ■ o1-11: User-Set Display Units Decimal Display

Determines how many decimal points should be used to set and display the frequency reference.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o1-11 | User-set Display Units Decimal Display | 0 to 3 | Determined by o1-03 |

**Setting 0: No decimal point**
**Setting 1: One decimal point**
**Setting 2: Two decimal points**
**Setting 3: Three decimal points**

## ◆ o2: Digital Operator Keypad Functions

These parameters determine the functions assigned to the operator keys.

### ■ o2-01: LO/RE (LOCAL/REMOTE) Key Function Selection

Parameter o2-01 determines whether the LO/RE key on the digital operator will be enabled or not for switching between LOCAL and REMOTE.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o2-01 | LO/RE Key Function Selection | 0 or 1 | 1 |

**Setting 0: Disabled**

The LO/RE key is disabled.

**Setting 1: Enabled**

The LO/RE switches between LOCAL and REMOTE operation. Switching is possible during stop only. When LOCAL is selected, the LED indicator on the LO/RE key will light up.

⚠ **WARNING!** *Sudden Movement Hazard. The drive may start unexpectedly if the Run command is already applied when switching from LOCAL mode to REMOTE mode when b1-07 = 1, resulting in death or serious injury. Check all mechanical or electrical connections thoroughly before making any setting changes to o2-01 and b1-07. **Table 2.26** lists the setting combinations for o2-01 and b1-07.*

**Table 2.26 LO/RE Key and b1-07**

| o2-01 | b1-07 | Switch from LOCAL to REMOTE | Switch from REMOTE to LOCAL |
|---|---|---|---|
| 0 | 0 | Not possible | Not possible |
| | 1 | Not possible | Not possible |
| 1 | 0 | Will not run until a new Run command is entered. | Run not possible |
| | 1 | If a Run command is entered, the drive will start running as soon as the LO/RE key is pushed to change from LOCAL to REMOTE. | Run not possible |

## ■ o2-02: STOP Key Function Selection

Determines if the STOP key on the digital operator can still be used to stop drive operation when the drive is being controlled from a remote source (i.e., not from digital operator).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o2-02 | STOP Key Function Selection | 0 or 1 | 1 |

**Setting 0: Disabled**
**Setting 1: Enabled**

The STOP key can be used to terminate drive operation, even if the Run command source is not assigned to the digital operator. If the drive is stopped by pressing the STOP key, the Run command must be re-input to restart the drive.

## ■ o2-03: User Parameter Default Value

Once drive parameters are set up completely, the values set can be saved as user-set default values using parameter o2-03. Once this has been done, the “Initialize Parameters” parameter (A1-03) will offer the choice of “1110: User Initialize”. Choosing A1-03 = “1110: User Initialize” will reset all parameters to the values saved as user-set defaults. Refer to *A1-03: Initialize Parameters on page 89* for details on drive initialization.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o2-03 | User Parameter Default Value | 0 to 2 | 0 |

**Setting 0: No change (awaiting command)**
**Setting 1: Set User Initialize values**

The current parameter settings are saved as user-set default for User Initialize. Once o2-03 is set to 1 and the ENTER key is pressed, the values are saved and the display returns to 0.

**Setting 2: Clear User Initialize Values**

All user-set defaults for “User Initialize” are cleared. Once o2-03 is set to 2 and the ENTER key is pressed, the values are erased and the display returns to 0.

## ■ o2-04: Drive Capacity Selection

This parameter must be set when replacing the controller for any reason. For information on the drive model selection, see *Defaults by Drive Model Selection (o2-04) on page 82*.

**NOTICE:** *Drive performance will suffer if the correct drive capacity is not set for o2-04, and protective functions will fail to operate properly.*

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o2-04 | Drive Capacity Selection | – | Determined by drive capacity |

**Note:** Change settings only when necessary.

## ■ o2-05: Frequency Reference Setting Method Selection

Determines if the ENTER key must be pressed after changing the frequency reference using the digital operator while in the Drive Mode.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o2-05 | Frequency Reference Setting Method Selection | 0 or 1 | 0 |

**Setting 0: ENTER key required**

Every time the frequency reference is changed using the digital operator, the ENTER key must be pressed for the drive to accept the change.

**Setting 1: ENTER key not required**

The output frequency changes immediately when the reference is changed with the up or down arrow keys on the digital operator. The ENTER key does not need to be pressed. The frequency reference (Fref) is saved to memory after remaining unchanged for 5 seconds.

## ■ o2-06: Operation Selection when Digital Operator is Disconnected

Determines if the drive will stop when the digital operator is removed in LOCAL mode or when b1-02 or b1-16 is set to 0. When the operator is reconnected, the display will indicate that it was disconnected.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o2-06 | Operation Selection when Digital Operator is Disconnected | 0 or 1 | 0 |

**Setting 0: Disabled**

The operation is continued.

**Setting 1: Trigger a fault**

The operation is stopped and an “oPr” fault is triggered. The motor coasts to stop.

## ■ o2-07: Motor Direction at Power Up when Using Operator

Determines the direction in which the motor will rotate after the drive is powered up and the Run command is given from the digital operator.

**Note:** This parameter is effective only when the Run command is set to be given from the digital operator (b1-02, b1-16 = 0).

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o2-07 | Motor Direction at Power Up when Using Operator | 0 or 1 | 0 |

**Setting 0: Forward**
**Setting 1: Reverse**

### ■ o2-11: Reference Voltage for Input Voltage Detection

Sets the primary voltage rating of the transformer.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o2-11 | Reference Voltage for Input Voltage Detection | 0 to 20000 V | Determined by o2-04 <1> |

<1> For details on the default settings, refer to *Defaults by Drive Model Selection (o2-04) on page 82*.

## ◆ o3: Copy Function

### ■ o3-01: Copy Function Selection

These parameters control the digital operator's Copy function. The Copy function lets the user store all parameter settings into the memory of the digital operator, and easily transfer those settings to other drives (requires that the other drives be the same model, capacity, and have the same control mode setting). See the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926) for a description of errors and displays.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o3-01 | Copy Function Selection | 0 to 3 | 0 |

**Setting 0: Copy Select (no function)**
**Setting 1: INV --> OP READ**

All parameters are copied from the drive to the digital operator.

**Setting 2: OP --> INV WRITE**

All parameters are copied from the digital operator to the drive.

**Setting 3: OP<-->INV VERIFY**

Parameters in the drive are compared with the parameter settings saved on the digital operator to see if they match.

### ■ o3-02: Copy Allowed Selection

Restricts or allows the use of the Copy function.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o3-02 | Copy Allowed Selection | 0 or 1 | 0 |

**Setting 0: Disabled**
**Setting 1: Enabled**

## ◆ o4: Maintenance Monitor Settings

### ■ o4-01: Cumulative Operation Time Setting

Parameter o4-01 sets the cumulative operation time of the drive. The user can also manually set this parameter to begin keeping track of operation time from some desired value. Total operation time can be viewed in monitor U4-01.

**Note:** The value in o4-01 is set in 10 h units. For example, a setting of 30 will set the cumulative operation time counter to 300 h. 300 h will also be displayed in monitor U4-01.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o4-01 | Cumulative Operation Time Setting | 0 to 9999 | 0 |

## ■ o4-02: Cumulative Operation Time Selection

Selects the conditions for how the drive keeps track of its total operation time. This time log can be viewed in U4-01.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o4-02 | Cumulative Operation Time Selection | 0 or 1 | 0 |

**Setting 0: Power on time**

The drive logs the time it is connected to a power supply, regardless of whether the motor is running or not.

**Setting 1: Run time**

The drive logs the time that the output is active. This includes whenever the Run command is active (even if the motor is not rotating) and when there is voltage output.

## ■ o4-11: U2, U3 Initialization

Resets the fault trace and fault history monitors (U2-☐☐ and U3-☐☐). Initializing the drive using A1-03 does not reset these monitors.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o4-11 | U2, U3 Initialization | 0 or 1 | 0 |

**Setting 0: No action**

The drive keeps the record already saved concerning fault trace and fault history.

**Setting 1: Reset fault data**

Resets the data for the U2-☐☐ (Fault Trace) and U3-☐☐ (Fault History) monitors. Once o4-11 is set to 1 and the ENTER key is pressed, fault data is erased and the setting of the parameter returns to 0.

## ■ o4-12: kWh Monitor Initialization

The kWh monitors U4-10 and U4-11 are not initialized when the power is shut off or the drive is initialized. Use o4-12 to manually reset them.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o4-12 | kWh Monitor Initialization | 0 or 1 | 0 |

**Setting 0: No Action**

The kWh data are kept as they are.

**Setting 1: Reset kWh Data**

Resets the kWh counter. The monitors U4-10 and U4-11 will display “0” after they are initialized. Once o4-12 is set to 1 and the ENTER key is pressed, kWh data is erased and the display returns to 0.

## ■ o4-13: Number of Run Commands Counter Initialization

The Run command counter displayed in U4-02 is not reset when the power is cycled or the drive is initialized. Use o4-13 to reset U4-02.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o4-13 | Number of Run Commands Counter Initialization | 0 or 1 | 0 |

**Setting 0: No Action**

The Run command data are kept as they are.

**Setting 1: Number of Run Commands Counter**

Resets the Run command counter. The monitor U4-02 will show 0. Once o4-13 is set to 1 and the ENTER key is pressed, the counter value is erased and the setting of the parameter returns to 0.

### ■ o4-20: Event Log Initialization

Sets the method for initializing event log data.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o4-20 | Event Log Initialization | 0 or 1 | 0 |

**Setting 0: Event log data is retained.**
**Setting 1: Event log data is initialized (setting returned to 0 after initialization).**

### ■ o4-21: Trace Initialization

Sets the method for initializing trace data.

| No. | Name | Setting Range | Default |
|---|---|---|---|
| o4-21 | Trace Initialization | 0 or 1 | 0 |

**Setting 0: Trace data is retained.**
**Setting 1: Trace data is initialized (setting returned to 0 after initialization).**

## ◆ T: Motor Tuning

Auto-Tuning automatically sets and tunes parameters required for optimal motor performance.

For details, refer to the FSDrive-MV1000 Instruction Manual (Manual No. EZZ010926).

# 2.11 U: Monitor Parameters

Monitor parameters let the user view various aspects of drive performance using the digital operator display. Some monitors can be output from output terminals 1 to 4 by assigning the specific monitor parameter number to H4-01, H4-11, H4-21, and H4-31. Refer to *H4-01, H4-11, H4-21, H4-31: Analog Output 1, 2, 3, 4 Monitor Selections on page 193* for details on assigning functions to an analog output.

Analog output option card AO-A3 also let the user view various aspects of drive performance.

## ◆ U1: Operation Status Monitors

Status monitors display drive status data such as output frequency and output current. Refer to *U1: Operation Status Monitors on page 70* for a complete list of U1-☐☐ monitors and descriptions.

## ◆ U2: Fault Trace

These monitor parameters are used to view various drive statuses when a fault occurs.

This information is helpful for finding out why a fault occurred. Refer to *U2: Fault Trace on page 73* for a complete list of U2-☐☐ monitors and descriptions.

U2-☐☐ monitors are not reset when the drive is initialized. Refer to *o4-11: U2, U3 Initialization on page 226* for instructions on how to reset these monitor values.

**Note:** Fault trace (i.e., the fault history) is not kept when CPF00, CPF01, Uv1, Uv2 occur.

## ◆ U3: Fault History

These parameters display faults that have occurred during operation as well as the drive operation time when those faults occurred. Refer to *U3: Fault History on page 74* for a complete list of U3-☐☐ monitors and descriptions.

U3-☐☐ monitors are not reset when the drive is initialized. Refer to *o4-11: U2, U3 Initialization on page 226* for instructions on how to reset these monitor values.

**Note:** Fault trace (i.e., the fault history) is not kept when CPF00, CPF01, Uv1, Uv2 occur.

## ◆ U4: Maintenance Monitors

Maintenance monitors show:

- kWh data
- Highest peak current that has occurred and output frequency at the time the peak current occurred
- Motor overload status information
- Detailed information about the present Run command and frequency reference source selection

Refer to *U4: Maintenance Monitors on page 75* for a complete list of U4-☐☐ monitors and descriptions.

## ◆ U5: PID Monitors

These monitors display various aspects of PID control. Refer to *PID Block Diagram on page 112* for details on how these monitors display PID data.

*U5: PID Monitors on page 76* has a complete list of U5-☐☐ monitors and descriptions.

## ◆ U6: Control Monitors

Control monitors show:

- Reference data for the output voltage and vector control
- ASR and Feed Forward control monitors
- Pulse data from the PG motor encoder
- ASR and Feed Forward control monitors
- ASR and Feed Forward control monitors Refer to ***Figure 2.26*** on page ***131*** and ***Figure 2.27*** on page ***132*** for details and an illustration showing where monitors are located in the ASR block.
- The offset value added to the frequency reference by the frequency offset function. Refer to ***Setting 44, 45, 46: Offset frequency 1, 2, 3 on page 173***.
- The bias value added to the frequency reference by the Up/Down 2 function (see ***Setting 75, 76: Up 2, Down 2 command on page 175***)

Refer to ***U6: Control Monitors on page 77*** for a complete list of U6-☐☐ monitors and descriptions.

## ◆ U9: Power Cell Monitor

Power cell monitors show:

- Status of each power cell
- DC bus voltage of each power cell
- Temperature of each power cell
- Output current of each power cell
- Software No. of each power cell

Refer to ***U9: Power Cell Monitors on page 77*** for a complete list of U9-☐☐ monitors and descriptions.

# Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.

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