Chapter 5

· Basic Operation ·

This section explains the basic settings required to operate and stop the Inverter.
The settings of parameters described here will be sufficient for simple Inverter operations.
First make these basic settings and then skip to the explanations of those special functions, even when your application requires special functions, such as energy-saving control, PID control, stall prevention, carrier frequency setting, overtorque detection, torque compensation, slip compensation. Refer to *Chapter 6 Advanced Operation*.

5-1 Initial Settings

• The following initial settings are required.

Parameter Write-prohibit Selection/Parameter Initialization (n001): Set n001 to 4 so that n001 through n179 can be set or displayed.

Control Mode Selection (n002): Set to V/f or vector control mode according to the application.

5-1-1 Setting the Parameter Write-prohibit Selection/Parameter Initialization (n001)

• Set n001 to 4 so that n001 through n179 can be set or displayed.

n001	Parameter Write-prohibit Selection/Parameter Initialization	Register	0101 Hex	Changes during operation	No
Setting range	0 to 11	**Unit of setting**	1	**Default setting**	1

Note This parameter makes it possible to write-prohibit parameters, change the parameter set or displayed range, or initialize all parameters to default values.

Set Values

Value	Description
0	Displays and sets n001. Parameters from n002 to n179 can be displayed only.
1	Sets or monitors parameters n001 through n049 (i.e., function group 1 settings).
2	Sets or monitors parameters n001 through n079 (i.e., function groups 1 and 2 settings).
3	Sets or monitors parameters n001 through n119 (i.e., function groups 1 through 3 settings).
4	Sets or monitors parameters n001 through n179 (i.e., function groups 1 through 4 settings).
6	Clears the error log.
8	Initializes parameters to default settings in 2-wire sequence. (See note.)
9	Initializes parameters in 3-wire sequence. (See note.)
10	For the USA, initializes parameter in 2-wire sequence (See note.)
11	For the USA, initializes parameter in 3-wire sequence (See note.)

Note The set value in n002 is not initialized with n001 set to 8, 9, 10, or 11.
Each of the following parameters is initialized according to the preset control mode. The default value varies with the control mode. For details, refer to page 5-3.
n014 (middle output frequency), n015 (middle output frequency voltage), n016 (minimum output frequency), n017 (minimum output frequency voltage), n104 (torque compensation primary-

delay time constant), n111 (slip compensation gain), n112 (slip compensation primary-delay time constant)

5-1-2 Setting the Control Mode (n002)

- The 3G3MV Inverter operates in vector or V/f control mode to be selected according to the application.

- These two modes have the following characteristics.

Vector Control Mode

The Inverter in vector control mode calculates the vector of the operating condition of the motor. Then the 150% rated output torque of the motor is provided at an output frequency of 1 Hz. Vector control provides more powerful motor control than V/f control and makes it possible to suppress speed fluctuation regardless of changes in loads. Normally set the Inverter to this mode.

V/f Control Mode

This mode, which is used by conventional general-purpose inverters, is convenient when replacing a conventional model with the 3G3MV Inverter because the Inverter in this mode can be operated without considering the constants of the motor. Furthermore, set the Inverter to this mode if the Inverter is connected to more than one motor or special motors such as high-speed motors.

$n002$	Control Mode Selection	Register	0102 Hex	Changes during operation	No
Setting range	0, 1	Unit of setting	1	Default setting	0

Note This parameter is used for selecting the control mode of the Inverter.

Set Values

Value	Description
0	V/f control mode
1	Vector control mode (open loop)

Note 1. This parameter is not initialized by setting n001 (parameter write-prohibit selection/parameter initialization) to 8, 9, 10, or 11 for parameter initialization. Be sure to change the parameter n002 before changing the control mode.

Note 2. Each of the following parameters is initialized according to the control mode set in this parameter. The default value varies with the control mode. Therefore, be sure to set the following parameters after setting the control mode in n002.

Parameter	Name	Default value	
		V/f control (Set value: 0)	**Vector control (Set value: 1)**
n014	Middle output frequency	1.5 Hz	3.0 Hz
n015	Middle output frequency voltage	12.0 V (24.0 V) (See note 2.)	11.0 V (22.0 V)
n016	Minimum output frequency	1.5 Hz	1.0 Hz
n017	Minimum output frequency voltage	12.0 V (24.0 V) (See note 2.)	4.3 V (8.6 V)
n104	Torque compensation primary-delay time constant	0.3 s	0.2 s
n111	Slip compensation gain	0.0	1.0
n112	Slip compensation primary-delay time constant	2.0 s	0.2 s

Note   1. Values in parentheses are for 400-V models.

Note   2. For 5.5- and 7.5-kW Inverters, this value is set to 10.0 V for 200-V-class models and to 20.0 V for 400-V-class models.

5-2   Operation in Vector Control

The Inverter in vector control mode calculates the vector of the operating condition of the motor. Then the 150% rated output torque of the motor is provided at an output frequency of 1 Hz. Vector control provides more powerful motor control than V/f control and makes it possible to suppress speed fluctuation with changes in loads.

To operate the Inverter in vector control mode, be sure to set the following parameters. n036 (rated motor current), n106 (rated motor slip), n107 (motor wire-to-wire resistance), n110 (motor no-load current)

■ Setting the Rated Motor Current (n036)

• Check the motor nameplate and set this parameter to the rated current.

• This parameter is used as a vector control constant. Be sure to set the parameter correctly. This set value is also used for determining the electronic thermal characteristics to protect the motor from overheating. The correct set value protects the motor from burning that may result from overloading.

n036	**Rated Motor Current**	**Register**	0124 Hex	**Changes during operation**	No
Setting range	0.0% to 150% (A) of rated output current of the Inverter	**Unit of setting**	0.1 A	**Default setting**	See note.

Note The default setting for this parameter is the standard rated current of the maximum applicable motor.

■ Setting the Rated Motor Slip (n106)

• Set the rated motor slip in n106.

• This parameter is used as a vector control constant. Be sure to set the parameter correctly. This set value is used for slip compensation as well.

• Calculate the rated motor slip value from the rated frequency (Hz) and rpm on the motor nameplate by using the following formula.

   Rated slit value (Hz) = Rated frequency (Hz) – Rated rpm x Number of poles/120

n106	**Rated Motor Slip**	**Register**	016A Hex	**Changes during operation**	Yes
Setting range	0.0 to 20.0 (Hz)	**Unit of setting**	0.1 Hz	**Default setting**	See note.

Note The default setting for this parameter is the standard motor slip of the maximum applicable motor.

■ Setting the Motor Phase-to-neutral Resistance (n107)

• Set this parameter to 1/2 of the phase-to-phase resistance or phase-to-neutral resistance of the motor.

• Contact the manufacturer of the motor for the above resistance.

• This parameter is used as a vector control constant. Be sure to set the parameter correctly.

n107	**Motor Phase-to-neutral Resistance**	**Register**	016B Hex	**Changes during operation**	No
Setting range	0.000 to 65.50 (Ω)	**Unit of setting**	See note 1.	**Default setting**	See note 2.

Note 1. The value will be set in 0.001-Ω increments if the resistance is less than 10 Ω and 0.01-Ω increments if the resistance is 10 Ω or over.

Note 2. The default setting for this parameter is the standard phase-to-neutral resistance of the maximum applicable motor.

■ Setting the Motor No-load Current (n110)

• Set the motor no-load current in percentage based on the rated current of the Inverter as 100%.

• Contact the manufacturer of the motor for the motor no-load current.

• This parameter is used as a vector control constant. Be sure to set the parameter correctly. This set value is used for slip compensation as well.

n110	**Motor No-load Current**		**Register**	016E Hex	**Changes during operation**	No
Setting range	0 to 99 (%)		**Unit of setting**	1%	**Default setting**	See note.

Note The default setting for this parameter is the standard no-load current of the maximum applicable motor.

5-3 Operation in V/f Control

This mode, which is used by conventional general-purpose inverters, is convenient when replacing a conventional model with the 3G3MV Inverter because the Inverter in this mode can be operated without considering the constants of the motor. Furthermore, set the Inverter to this mode if the Inverter is connected to two or more motors or special motors, such as high-speed motors.

To operate the Inverter in V/f control mode, be sure to set n036 for the rated motor current and n011 through n017 for the V/f pattern.

5-3-1 Setting the Rated Motor Current (n036)

- Check the motor nameplate and set this parameter to the rated current.

- This set value is used for determining the electronic thermal characteristics to protect the motor from overheating. The correct set value protects the motor from burning that may result from overloading.

n036	Rated Motor Current	Register	0124 Hex	Changes during operation	No
Setting range	0.0% to 150% (A) of rated output current of the Inverter	Unit of setting	0.1 A	Default setting	See note 1.

Note 1. The default setting for this parameter is the standard rated current of the maximum applicable motor.

Note 2. Motor overload detection (OL1) is disabled by setting the parameter to 0.0.

5-3-2 Setting the V/f Patterns (n011 to n017)

- Set the V/f pattern so that the motor output torque is adjusted to the required load torque.

- The 3G3MV incorporates an automatic torque boost function. Therefore, a maximum of 150% torque can be output at 3 Hz without changing the default settings. Check the system in trial operation and leave the default settings as they are if no torque characteristic changes are required.

n011	Maximum Frequency (FMAX)	Register	010B Hex	Changes during operation	No
Setting range	50.0 to 400.0 (Hz)	Unit of setting	0.1 Hz	Default setting	60.0

n012	Maximum Voltage (VMAX)	Register	010C Hex	Changes during operation	No
Setting range	0.1 to 255.0 [0.1 to 510.0] (V)	Unit of setting	0.1 V	Default setting	200.0 [400.0]

n013	Maximum Voltage Frequency (FA)	Register	010D Hex	Changes during operation	No
Setting range	0.2 to 400.0 (Hz)	Unit of setting	0.1 Hz	Default setting	60.0

n014	Middle Output Frequency (FB)	Register	010E Hex	Changes during operation	No
Setting range	0.1 to 399.9 (Hz)	Unit of setting	0.1 Hz	Default setting	1.5

n015	**Middle Output Frequency Voltage (VC)**	**Register**	010F Hex	**Changes during operation**	No
Setting range	0.1 to 255.0 [0.1 to 510.0] (V)	**Unit of setting**	0.1 V	**Default setting**	12.0 [24.0] (See note 2.)

n016	**Minimum Output Frequency (FMIN)**	**Register**	0110 Hex	**Changes during operation**	No
Setting range	0.1 to 10.0 (Hz)	**Unit of setting**	0.1 Hz	**Default setting**	1.5

n017	**Minimum Output Frequency Voltage (VMIN)**	**Register**	0111 Hex	**Changes during operation**	No
Setting range	0.1 to 50.0 [0.1 to 100.0] (V)	**Unit of setting**	0.1 V	**Default setting**	12.0 [24.0] (See note 2.)

Note 1. [ ] values indicate those for 400-V-class Inverters.

Note 2. For 5.5- and 7.5-kW Inverters, this value is set to 10.0 V for 200-V-class models and to 20.0 V for 400-V-class models.
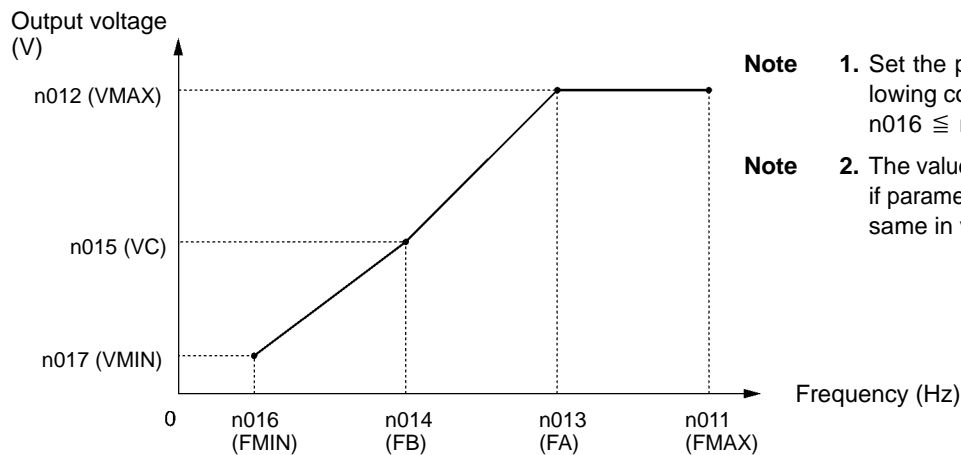
Note 1. Set the parameters so that the following condition will be satisfied.
n016 ≦ n014 < n013 ≦ n011

Note 2. The value set in n015 will be ignored if parameters n016 and n014 are the same in value.

• Set the rated motor frequency as the maximum voltage frequency, and set the rated motor voltage as the maximum voltage.

• The vertical-axis load or the load with high viscous friction may require high torque at low speed. If the torque is insufficient at low speed, increase the voltage in the low-speed range by 1 V, provided that no overload (OL1 or OL2) is detected. If an overload is detected, decrease the set values or consider the use of an Inverter model with a higher capacity.

• The required torque of fan or pump control increases in proportion to the square of the speed. By setting a quadratic V/f pattern to increase the voltage in the low-speed range, the power consumption of the system will increase.

5-4   Setting the Local/Remote Mode

The 3G3MV operates in local or remote mode. The following description provides information on these modes and how to select them.

■ Basic Concept

Operation mode	Basic concept	Description

Remote	The Inverter in a system operates according to the control signal of the host controller.	Operation Command
		
		  Selectable from four types and set in n003.
		
		Frequency Reference
		
		  Selectable from ten types and set in n004.

Local	The Inverter in a system operates independently in this mode so that the Inverter can be checked independently.	Operation Command
		
		  Starts with the RUN Key of the Digital Operator and stops with the STOP/RESET Key.
		
		Frequency Reference
		
		  Set with the Digital Operator or the FREQ adjuster.
		
		  Set with frequency reference selection in local mode in n07.

■ Local/Remote Selection Methods

• The following two selection methods are available to set the Inverter to local or remote mode. However, it is not possible to switch between local and remote modes during operation command input.

    • Select the mode with the LO/RE Key of the Digital Operator.

    • Set any one of multi-function inputs 1 through 7 (n050 through n056) to 17 to set the Inverter to local mode with control input turned ON.

Note If the above setting is made, mode selection will be possible only with multi-function input, and not with the Digital Operator.

• The Inverter always goes into remote mode when the power is turned ON. To operate immediately after powerup, preset the RUN command and frequency reference settings in remote mode.

5-5 Selecting the Operation Command

The following description provides information on how to input operation commands to start or stop the Inverter or change the direction of rotation of the Inverter.
Two types of command input methods are available. Select either one of them according to the application.

■ Selecting the Operation Mode (n003)

- Select the method of operation mode input to start or stop the Inverter.

- The following method is enabled in remote mode only. The command can be input through key sequences on the Digital Operator.

n003	**Operation Command Selection**	**Register**	0103 Hex	**Changes during operation**	No
Setting range	0 to 3	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	The RUN and STOP/RESET Keys of the Digital Operator are enabled.
1	Multi-function input in 2- or 3-wire sequence through the control circuit terminals is enabled.
2	RS-422/485 communications are enabled.
3	Input from option (CompoBus/D Communications Unit) is enabled.

■ Selecting the STOP/RESET Key Function (n007)

- When parameter n003 is not set to 0, set whether or not to use the STOP/RESET Key of the Digital Operator to stop the Inverter in remote mode. The STOP/RESET Key is always enabled in local mode regardless of the setting in n007.

n007	**STOP Key Function Selection**	**Register**	0107 Hex	**Changes during operation**	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	The STOP/RESET Key of the Digital Operator is enabled.
1	The STOP/RESET Key of the Digital Operator is disabled.

5-6 Setting the Frequency Reference

5-6-1 Selecting the Frequency Reference

The following description provides information on how to set the frequency reference in the Inverter. Select the method according to the operation mode.
Remote mode: Select and set one out of ten frequency references in n004.
Local mode: Select and set one out of two frequency references in n008.

■ Selecting the Frequency Reference (n004) in Remote Mode

- Select the input method of frequency references in remote mode.

- Five frequency references are available in remote mode. Select one of them according to the application.

n004	Frequency Reference Selection	Register	0104 Hex	Changes during operation	No
Setting range	0 to 9	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	The settings of the FREQUENCY adjuster in the Digital Operator are enabled. (See note 1.)
1	Frequency reference 1 (n024) is enabled.
2	The frequency reference control terminal (for 0- to 10-V input) is enabled. (See note 2.)
3	The frequency reference control terminal (for 4- to 20-mA current input) is enabled. (See note 3.)
4	The frequency reference control terminal (for 0- to 20-mA current input) is enabled. (See note 3.)
5	The pulse train command control input is enabled.
6	Frequency reference (0002 Hex) through RS-422/485 communications is enabled.
7	Multi-function analog voltage input (0 to 10 V) is enabled. This setting is not required unless two analog inputs are required in PID control.
8	Multi-function analog current input (4 to 20 mA) is enabled. This setting is not required unless two analog inputs are required in PID control.
9	Frequency reference input from option (CompoBus/D Communications Unit) is enabled.

Note 1. The maximum frequency (FMAX) is set when the FREQ adjuster is set to MAX.

Note 2. The maximum frequency (FMAX) is set with 10 V input.

Note 3. The maximum frequency (FMAX) is set with 20 mA input, provided that SW2 on the control PCB is switched from V to I.

Note 4. Set n149 for the pulse train input scale to the pulse train frequency that is equivalent to the maximum frequency (FMAX).

- The frequency reference set in n004 functions as frequency reference 1 when the Inverter is in multi-step speed operation. The set values in n025 through n031 and n120 through n127 for frequency references 2 through 16 are enabled.

■ Selecting the Frequency Reference (n008) in Local Mode

- Select the input method of frequency references in local mode.

- Two frequency references are available in local mode. Select one of them according to the application.

n008	Frequency Reference Selection in Local Mode	Register	0108 Hex	Changes during operation	No
Setting range	0, 1	Unit of setting	1	Default setting	0

Set Values

Value	Description
0	The settings of the FREQ adjuster in the Digital Operator are enabled. (See note 1.)
1	Key sequences on the Digital Operator are enabled. (See note 2.)

Note 1. The maximum frequency (FMAX) is set when the FREQ adjuster is set to MAX.

Note 2. The frequency reference can be set with key sequences while the FREF indicator is lit or with the set value in n024 for frequency reference 1. In either case, the value is set in n024.

5-6-2 Upper and Lower Frequency Reference Limits

Regardless of the methods of operation mode and frequency reference input, the upper and lower frequency reference limits can be set.

■ Setting the Upper and Lower Frequency Reference Limits (n033 and n034)

- Set the upper and lower frequency reference limits as percentage based on the maximum frequency as 100%.

n033	Upper Frequency Reference Limit	Register	0121 Hex	Changes during operation	No
Setting range	0% to 110% (Max. frequency = 100%)	Unit of setting	1%	Default setting	100

n034	Lower Frequency Reference Limit	Register	0122 Hex	Changes during operation	No
Setting range	0% to 110% (Max. frequency = 100%)	Unit of setting	1%	Default setting	0

Note If n034 is set to a value less than the minimum output frequency (FMIN), the Inverter will have no output when a frequency reference less than the minimum output frequency input is ON.

5-6-3 Frequency Referencing by Analog Input

This section explains the methods for referencing frequencies by analog input, adjusting input characteristics, and detecting input command errors. Either the frequency reference control terminal (voltage/current) or multi-function analog voltage/current input can be used for analog inputs. The gain, bias, and filter time parameters can be used for adjustments, or, alternatively, the adjustments can be made by external analog voltage (current), using the multi-function analog inputs.

■ Setting Frequency References by Analog Input

• Analog inputs can be set only in remote mode. Set parameter n004 (frequency reference selection) to any of the following: 2 to 4 (frequency reference control terminal), 7 (multi-function analog voltage input), or 8 (multi-function analog current input).

Note If the frequency reference control terminal is to be used for current inputs, the SW2 setting must be changed from V to I.

■ FR Terminal Adjustments for Frequency Reference Input

● Gain and Bias Settings (n060 and n061)

• Set the input characteristics of analog frequency references in n060 (for the frequency reference gain) and n061 (for the frequency reference bias).

• Set the frequency of maximum analog input (10 V or 20 mA) in n060 as percentage based on the maximum frequency as 100%.

   Example: In order to obtain the maximum frequency at 5 V, set the value to 200% because 10-V input is 200% maximum frequency.

• Set the frequency of minimum analog input (0 V, 0 mA, or 4 mA) in n061 as percentage based on the maximum frequency as 100%.

   Example: In order to obtain 50% maximum frequency output with 0 V input, set the value to 50%.

n060	Frequency Reference Gain	Register	013C Hex	Changes during operation	Yes
Setting range	0% to 255% (Max. frequency = 100%)	Unit of setting	1%	Default setting	100

n061	Frequency Reference Bias	Register	013D Hex	Changes during operation	Yes
Setting range	–99% to 99% (Max. frequency = 100%)	Unit of setting	1%	Default setting	0

● Filter Time Constant Settings (n062)

• A primary-delay digital filter can be set for analog frequency references to be input.

• This setting is ideal if the analog input signal changes rapidly or the signal is subject to noise interference.

• The larger the set value is, the slower the response speed will be.

n062	Analog Frequency Reference Filter Time Constant	Register	013E Hex	Changes during operation	No
Setting range	0.00 to 2.00 (s)	Unit of setting	0.01 s	Default setting	0.10

∎ Multi-function Analog Input

Various auxiliary analog inputs can be set for the Digital Operator's multi-function analog voltage/current input. Select from the following functions.

n077	Multi-function Analog Input Terminal Function Selection	Register	014D Hex	Changes during operation	No
Setting range	0 to 4	Unit of setting	1	Default setting	0

n078	Multi-function Analog Input Terminal Selection	Register	014E Hex	Changes during operation	No
Setting range	0, 1	Unit of setting	1	Default setting	0

n079	Multi-function Analog Input Frequency Bias	Register	014F Hex	Changes during operation	No
Setting range	0 to 50	Unit of setting	1 %	Default setting	10

• For n077, select from the following five functions allocated to the multi-function analog input terminal.

n077 Set Values

Value	Name	Description
0	Multi-function Analog Input Function Disable	Disables multi-function analog inputs.
		Set "0" when setting multi-function inputs with n004 (Frequency Reference Selection) or n164 (PID Feedback Input Block Selection). If this function is allocated for both, an error (err or oP6) will be generated.
1	Auxiliary Frequency Reference	Sets the terminal to be used as a second analog frequence reference terminal. The analog input from the multi-function analog input becomes the frequency reference in place of Frequency Reference 2. Toggle the two analog inputs with the multi-function input's multi-step speed references.
		When this function is set, Frequency Reference 2 (n025) is ignored.
2	Frequency Gain (See note 1.)	Adjusts the gain for frequency references that are input to the frequency reference input (analog) terminal.
		0 to 10 V (4 mA, or 0 mA to 20 mA): 0x to 2x (See note 2.)
3	Frequency Bias (See note 1.)	Adjusts the bias for frequency references that are input to the frequency reference input (analog) terminal.
		0 to 10 V (4 mA, or 0 mA to 20 mA): –n079 SV to +n079 SV (See note 2.)
4	Output Voltage Bias	Adjusts the Inverter's output voltage bias. The bias value that is input is added to the output voltage value for the normal V/f setting.
		0 to 10 V (4 mA, or 0 mA to 20 mA): 0 V to +100 V (See note 2.)

Note 1. The frequency reference gain (n060) and frequency reference bias (n061) parameter settings are enabled. If "frequency gain" is set for the multi-function analog input, it is multiplied by n060; if "frequency bias" is set, it is added to n061.

Note 2. The relationship between the multi-function analog input's input voltage and control variable is shown for when the frequency reference and multi-function analog input gain are 100%, and when the bias setting is 0%.

• For n078, select whether select whether voltage inputs or current inputs are to be used.

Value	Description
0	Enable multi-function analog voltage inputs. (Disable current inputs.)
1	Enable multi-function analog current inputs. (Disable voltage inputs.)

• When setting "3" (frequency bias) for the multi-function analog input terminal function selection (n077), set the standard value for the bias in n079. Make the setting as a percentage, with the maximum frequency (n011) as 100%.

■ Adjusting Multi-function Analog Input

● Setting the Gain and Bias of Multi-function Analog Voltage/Current Input (n068 to n072)

• Set the multi-function analog voltage input characteristics in n068 (multi-function analog voltage input gain) and n069 (multi-function analog voltage input bias). Set the multi-function analog current input characteristics in n071 (multi-function analog current input gain) and n072 (multi-function analog current input bias).

• For the gain, set the maximum analog input (10 V or 20 mA) frequency as a percentage with the maximum frequency as 100%.

• For the bias, set the minimum analog input (0 V or 20 mA) frequency as a percentage with the maximum frequency as 100%.

n068	Multi-function Analog Voltage Input Gain	Register	0144 Hex	Changes during operation	Yes
Setting range	−255(%) to 255(%) (Max. frequency: 100%)	Unit of setting	1%	Default setting	100

n069	Multi-function Analog Voltage Input Bias	Register	0145 Hex	Changes during operation	Yes
Setting range	−100(%) to 100(%) (Max. frequency: 100%)	Unit of setting	1%	Default setting	0

n071	Multi-function Analog Current Input Gain	Register	0147 Hex	Changes during operation	Yes
Setting range	−255(%) to 255(%) (Max. frequency: 100%)	Unit of setting	1%	Default setting	100

n072	Multi-function Analog Current Input Bias	Register	0148 Hex	Changes during operation	Yes
Setting range	−100(%) to 100(%) (Max. frequency: 100%)	Unit of setting	1%	Default setting	0

● **Setting the Filter Time Constant for Multi-function Analog Voltage/Current Input (n070 and n073)**

• These parameters can be used to set a primary-delay digital filter for multi-function analog voltage input. For voltage inputs, set the multi-function analog voltage input filter time constant (n070). For current inputs, set the multi-function analog current input filter time constant (n073).

• These parameter settings are effective for smooth operation of the Inverter if the analog input signal changes too rapidly or the signal is interfered with by noise.

• The larger the set value is, the lower the response will be.

n070	Multi-function Analog Voltage Input Filter Time Constant	Register	0146 Hex	Changes during operation	Yes
Setting range	0.00 to 2.00 (s)	Unit of setting	0.01 s	Default setting	0.10

n073	Multi-function Analog Current Input Filter Time Constant	Register	0149 Hex	Changes during operation	Yes
Setting range	0.00 to 2.00 (s)	Unit of setting	0.01 s	Default setting	0.10

■ Frequency Reference Loss Detection (n064)

This function is provided for 5.5- and 7.5-kW Inverters only. If the frequency reference from the control circuit drops by more than 90% within 400 ms, this function detects it and determines that the reference has been lost (e.g., from some cause such as disconnected wiring).

• When operating in remote mode, the setting for the frequency reference loss detection function is enabled when either an analog reference or a pulse train reference is selected for n004 (frequency reference selection).

Note 1. If "frequence reference agree" (set value: 2) is preset for multi-function outputs 1 to 3 (n057 to n059), the frequency reference loss status can be checked. When using this output, implement external error processing.

Note 2. When the frequency reference loss detection is enabled and a loss is detected, operation will continue at 80% of the frequency reference prior to the loss.

Note 3. If the frequency reference is restored during a frequency reference loss, and the frequency returned to at least the level of the continuing operation, the frequency reference loss detection will be cleared and the Inverter will return to normal operation.

Note 4. Frequency reference loss detection does not operate for multi-function analog inputs.

n064	Frequency Reference Loss Detection	Register	0140 Hex	Changes during operation	No
Setting range	0, 1	Unit of setting	1	Default setting	0

Value	Description
0	Loss detection disabled. (Operation according to frequency reference; frequency reference loss detection disabled.)
1	Loss detection enabled. (After loss detection, operation continues at 80% of the frequency reference prior to the loss; frequency reference loss detection enabled.)

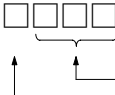## 5-6-4 Setting Frequency References through Key Sequences

The following description provides information on parameters related to frequency reference settings through key sequences on the Digital Operator

■ Frequency Reference Setting/Display Unit Selection (n035)

• Set the unit of frequency reference and frequency-related values to be set or monitored in n035 through the Digital Operator.

• The frequency reference value will be set in 0.01-Hz increments if the frequency is less than 100 Hz and 0.1-Hz increments if the frequency is 100 Hz or over.

n035	Frequency Reference Setting/Display Unit Selection	Register	0123 Hex	Changes during operation	No
Setting range	0 to 3,999	Unit of setting	1	Default setting	0

Set Values

Value	Description
0	Less than 100 Hz: 0.01-Hz increments 100 Hz or over: 0.1-Hz increments
1	0.1% increments (Max. frequency: 100%)
2 to 39	1-rpm increments (number of motor poles)
40 to 3,999	Unit setting The value to be set or monitored at max. frequency ⬚⬚⬚⬚ ├── Three digits └── Decimal place **Note** To display 50.0 for example, set the value to 1500. (See note.)

Note The unit of setting of each parameter and monitor item below varies with the decimal place.

Parameters

n024 to n032: Frequency references 1 through 8 and inching frequency command
n120 through n127: Frequency references 9 through 16

Monitor Items

U-01: Frequency reference monitor
U-02: Output frequency monitor

■ Setting Frequency References 1 through 16 and the Inching Frequency Command (n024 through n031, n120 through n127)

Frequency references 1 through 16 and an inching frequency command can be set together in the Inverter (using registers n024 through n31, n120 through n127).

● Setting Frequency References 1 through 16 (n024 through n31, n120 through n127)

n024	**Frequency Reference 1**	**Register**	0118 Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	6.0

n025	**Frequency Reference 2**	**Register**	0119 Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n026	**Frequency Reference 3**	**Register**	011A Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n027	**Frequency Reference 4**	**Register**	011B Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n028	**Frequency Reference 5**	**Register**	011C Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n029	**Frequency Reference 6**	**Register**	011D Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n030	**Frequency Reference 7**	**Register**	011E Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n031	**Frequency Reference 8**	**Register**	011F Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n 120	**Frequency Reference 9**	**Register**	0178 Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n 121	**Frequency Reference 10**	**Register**	0179 Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n 122	**Frequency Reference 11**	**Register**	017A Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n 123	**Frequency Reference 12**	**Register**	017B Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n 124	**Frequency Reference 13**	**Register**	017C Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n 125	**Frequency Reference 14**	**Register**	017D Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n 126	**Frequency Reference 15**	**Register**	017E Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

n 127	**Frequency Reference 16**	**Register**	017F Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	0.00

Note 1. The setting unit of frequency references 1 through 16 is changed with the set value in n035 for frequency reference setting and decimal place selection. Values will be set in 0.01-Hz increments if the frequency is less than 100 Hz and 0.1-Hz increments if the frequency is 100 Hz or over.

Note 2. Frequency reference 1 is enabled with n004 for frequency reference selection set to 1.

Note 3. Frequency references 2 through 16 are enabled by setting multi-step speed references 1 through 4 in n050 through n056 for multi-function input. Refer to the following table for the

relationship between multi-step speed references 1 through 4 and frequency references 1 through 16.

Frequency reference	Multi-step speed reference 1 (Set value: 6)	Multi-step speed reference 2 (Set value: 7)	Multi-step speed reference 3 (Set value: 8)	Multi-step speed reference 4 (Set value: 9)
Frequency reference 1	OFF	OFF	OFF	OFF
Frequency reference 2	ON	OFF	OFF	OFF
Frequency reference 3	OFF	ON	OFF	OFF
Frequency reference 4	ON	ON	OFF	OFF
Frequency reference 5	OFF	OFF	ON	OFF
Frequency reference 6	ON	OFF	ON	OFF
Frequency reference 7	OFF	ON	ON	OFF
Frequency reference 8	ON	ON	ON	OFF
Frequency reference 9	OFF	OFF	OFF	ON
Frequency reference 10	ON	OFF	OFF	ON
Frequency reference 11	OFF	ON	OFF	ON
Frequency reference 12	ON	ON	OFF	ON
Frequency reference 13	OFF	OFF	ON	ON
Frequency reference 14	ON	OFF	ON	ON
Frequency reference 15	OFF	ON	ON	ON
Frequency reference 16	ON	ON	ON	ON

To change the frequency of frequency reference 2, for example, turn ON only the multi-function input terminal where multi-step speed reference 2 is set, and turn OFF any other multi-function input terminal.

For example, no settings for multi-step speed reference 3 or 4 will be required if only frequency references 1 through 4 are used. Any multi-step speed reference not set is regarded as turned-OFF input.

● Setting the Inching Frequency Command (n032)

● The inching frequency command must be set as multi-function input in order to use the inching frequency command.

n032	**Inching Frequency Command**	**Register**	0120 Hex	**Changes during operation**	Yes
Setting range	0.00 to max. frequency	**Unit of setting**	0.01 Hz (See note 1.)	**Default setting**	6.0

Note 1. The setting unit of the inching frequency command is changed with the set value in n035 for frequency reference setting and decimal place selection. The value will be set in 0.01-Hz increments if the frequency is less than 100 Hz and 0.1-Hz increments if the frequency is 100 Hz or over.

Note 2. In order to use the inching frequency command, one of the n050 through n056 parameters for multi-function input must be set to 10 as an inching frequency command. Parameter n032 is selectable by turning ON the multi-function input set with the inching frequency command. The inching frequency command takes precedence over the multi-step speed reference (i.e., when the inching frequency command is ON, all multi-step speed reference input will be ignored).

■ Setting the Frequency Reference with the FREF Indicator Lit

- The frequency reference can be set while the FREF indicator of the Digital Operator is lit in the following cases.

    - Parameter n004 for frequency reference selection is set to 1, which enables frequency reference 1, and the Inverter is in remote mode.

    - Parameter n008 for frequency selection in local mode is set to 1, which enables key sequences on the Digital Operator, and the Inverter is in local mode.

    - Frequency references 2 through 16 are set with multi-step speed reference input.

- The frequency reference can be changed, even during operation.

- When the frequency reference is changed while the FREF indicator is lit, the corresponding parameter is changed simultaneously. For example, if frequency reference 2 has been selected with multi-function input (a multi-step speed reference), the set value in n025 (for frequency reference 2) will be changed simultaneously when the frequency reference is changed while the FREF indicator is lit.

- Take the following default steps, for example, to change the frequency reference with the FREF indicator lit.

FREF 6.00 → FREF 60.00 → FREF 60.00

Key sequence	Indicator	Display example	Explanation
	FREF	6.00	Power On **Note** If the FREF indicator has not been lit, press the Mode Key repeatedly until the FREF indicator is lit.
⌃ ⌄	FREF	60.00	Use the Increment or Decrement Key to set the frequency reference. The data display will flash while the frequency reference is set.
↵	FREF	60.00	Press the Enter Key so that the set value will be entered and the data display will be lit.

● Setting the Operator Frequency Setting Method (n009)

- The Enter Key need not be pressed when changing the setting in n009. In that case, the frequency reference will change when the set value is changed with the Increment or Decrement Key while the data display is continuously lit.

n009	Operator Frequency Setting Method	Register	0109 Hex	Changes during operation	No
Setting range	0, 1	Unit of setting	1	Default setting	0

Set Values

Value	Description
0	Enter Key enabled (The set value is entered with the Enter Key pressed.)
1	Enter Key disabled (The set value set is entered immediately.)

5-6-5   Setting Frequency References by Pulse Train Input

By setting n004 for frequency reference selection to 5 for enabling the pulse train reference control terminal, frequency references can be executed by pulse train input through the PR terminal.
The following description provides information on the n149 parameter (pulse train input scale), which is used to execute frequency references by pulse train input.

■ Setting the Pulse Train Input Scale (n149)

• Set this parameter to the pulse train input scale so that frequency references can be executed by pulse train input.

• Set the maximum pulse train frequency in 10-Hz increments based on 10 Hz as 1. A proportional relationship is applied to frequencies less than the maximum frequency.

n149	Pulse Train Input Scale	Register	0195 Hex	Changes during operation	No
Setting range	100 to 3,300	Unit of setting	1 (10 Hz)	Default setting	2,500

Note   1. For example, to set the maximum frequency reference with pulse train frequency input at 10 kHz, set the parameter to 1,000 from the following formula.
10,000 (Hz)/10 (Hz) = 1,000

Note   2. Input the pulse train into the frequency reference common (FC) and pulse train input (RP) terminals under the following conditions.
High level: 3.5 to 13.2 V
Low level: 0.8 V max.
The response frequency is within a range from 0 to 33 kHz (30% to 70% ED).

■ Setting the Pulse Train Frequency Reference Gain/Bias (n074/n075)

• Set the input characteristics of pulse train input.

• Gain: Set the gain in percentage based on the maximum frequency of the pulse train input scale in n149 as 100%.

• Bias: Set the bias in percentage for frequency reference input at 0-Hz pulse train input based oh the maximum frequency as 100%.

n074	Pulse Train Frequency Reference Gain	Register	014A Hex	Changes during operation	Yes
Setting range	0 to 255	Unit of setting	1%	Default setting	100

$n075$	**Pulse Train Frequency Reference Bias**	**Register**	014B Hex	**Changes during operation**	Yes
Setting range	−100 to 100	**Unit of setting**	1%	**Default setting**	0
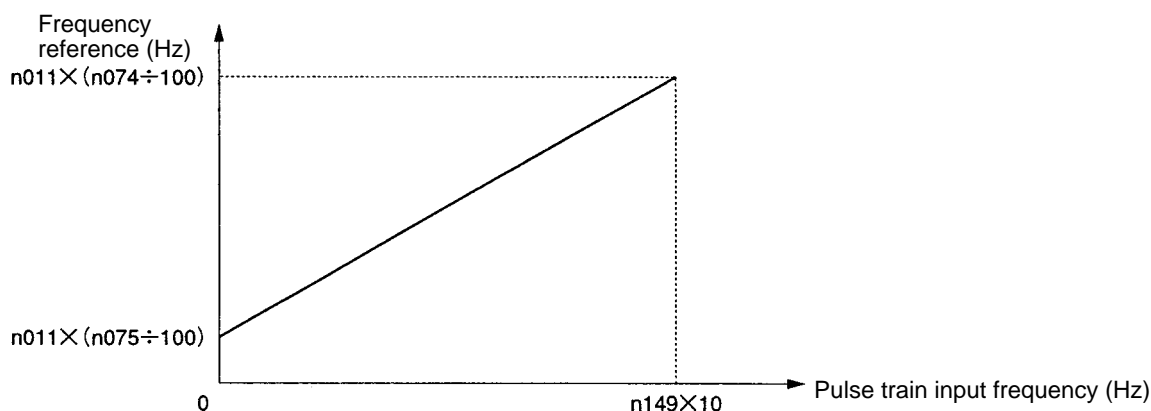
n011: Maximum frequency

■ Pulse Train Frequency Reference Input Filter Constant (n076)

- This parameter can be used to set a primary-delay digital filter for pulse train frequency reference input.

- This parameter setting is effective for smooth operation of the Inverter if the pulse train input signal changes too rapidly or the signal is interfered with by noise.

- The larger the set value is, the lower the response will be.

$n076$	**Pulse Train Frequency Reference Input Filter Constant**	**Register**	014C Hex	**Changes during operation**	No
Setting range	0.00 to 2.00	**Unit of setting**	0.01 s	**Default setting**	0.10

5-7   Setting the Acceleration/Deceleration Time

The following description provides information on parameters related to acceleration and deceleration time settings.

Trapezoidal and S-shape acceleration and deceleration are available. Using the S-shape characteristic function for acceleration and deceleration can reduce shock to the machinery when stopping or starting.

■ Acceleration/Deceleration Time Unit (n018)

• The acceleration and deceleration time of the Inverter can be set within a range from 0.0 to 6,000 s without changing the default setting. If a more precise unit of setting is required, this parameter can be set for 0.01-s increments. In this case, the setting range will be from 0.00 to 600.0 s.

n018	Acceleration/Deceleration Time Setting Unit	Register	0112 Hex	Changes during operation	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Less than 1,000 s: 0.1-s increments 1,000 s or over: 1-s increments
1	Less than 100 s: 0.01-s increments 100 s or over: 0.1-s increments

■ Setting the Acceleration/Deceleration Time (n019 through n022)

• Two acceleration times and two deceleration times can be set.

• The acceleration time is the time required to go from 0% to 100% of the maximum frequency and the deceleration time is the time required to go from 100% to 0% of the maximum frequency. The actual acceleration or deceleration time is obtained from the following formula.

Acceleration/Deceleration time = (Acceleration/Deceleration time set value)
$\times$ (Frequency reference value) $\div$ (Max. frequency)

Acceleration time 2 and deceleration time 2 are enabled by setting 11 for acceleration/deceleration time selection in any of the n050 through n056 parameters for multi-function input.

Deceleration time 2 is also enabled by emergency-stop settings 19, 20, 21, and 22 in any of the parameters for parameters n050 through n056 for multi-function input with n005 for interruption mode selection set to 0 (i.e., deceleration stop).

n019	Acceleration Time 1	Register	0113 Hex	Changes during operation	Yes
Setting range	0.0 to 6,000 (s) (See note 1.)	**Unit of setting**	0.1 s (See note 1.)	**Default setting**	10.0

n020	Deceleration Time 1	Register	0114 Hex	Changes during operation	Yes
Setting range	0.0 to 6,000 (s) (See note 1.)	**Unit of setting**	0.1 s (See note 1.)	**Default setting**	10.0

n̄021	**Acceleration Time 2**	**Register**	0115 Hex	**Changes during operation**	Yes
Setting range	0.0 to 6,000 (s) (See note 1.)	**Unit of setting**	0.1 s (See note 1.)	**Default setting**	10.0

n̄022	**Deceleration Time 2**	**Register**	0116 Hex	**Changes during operation**	Yes
Setting range	0.0 to 6,000 (s) (See note 1.)	**Unit of setting**	0.1 s (See note 1.)	**Default setting**	10.0

Note   1. The setting unit of acceleration or deceleration time is determined by the set value in n018 (acceleration/deceleration time unit).
n018 set to 0: Setting range from 0.0 to 6,000 (0.0 through 999.9 s or 1,000 through 6,000 s)
n018 set to 1: Setting range from 0.00 to 600.0 (0.0 through 99.99 s or 100.0 through 600.0 s)

Note   2. When n018 is set to 1, the default value of acceleration or deceleration time will be set to 10.00.

■ S-shape Acceleration/Deceleration Characteristic (n023)

• Trapezoidal and S-shape acceleration and deceleration are available. Using the S-shape characteristic function for acceleration and deceleration can reduce shock to the machinery when stopping or starting.

• Any one of three S-shape acceleration/deceleration times (0.2, 0.5, and 1.0 s) is selectable.

n̄023	**S-shape Acceleration/Deceleration Characteristic**	**Register**	0117 Hex	**Changes during operation**	No
Setting range	0 to 3	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	No S-shape acceleration/deceleration characteristic (Trapezoidal acceleration/deceleration)
1	S-shape acceleration/deceleration characteristic time is 0.2 s
2	S-shape acceleration/deceleration characteristic time is 0.5 s
3	S-shape acceleration/deceleration characteristic time is 1.0 s

Note When the S-shape acceleration/deceleration characteristic time is set, the acceleration and deceleration times will be lengthened according to the S-shape at the beginning and end of acceleration/deceleration.

5-8   Selecting the Reverse Rotation-prohibit

This parameter is used to specify whether to enable or disable the reverse rotation command sent to the Inverter from the control circuit terminals or Digital Operator.
The parameter should be set to "not accept" when the Inverter is applied to systems that prohibit the reverse rotation of the Inverter.

■ Selecting the Reverse Rotation-prohibit (n006)

n006	Reverse Rotation-prohibit Selection	Register	0106 Hex	Changes during operation	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Accept
1	Not accept

5-9   Selecting the Stopping Method

This parameter is used to specify the stopping method when the STOP command is input.

The Inverter either decelerates or coasts to a stop according to the stopping method selection.

■ Selecting the Stopping Method (n005)

n005	Stopping Method Selection	Register	0105 Hex	Changes during operation	No
Setting range	0, 1	Unit of setting	1	Default setting	0

Set Values

Value	Description
0	Frequency deceleration stop (See notes 1 and 2.)
1	Free running (coasts to stop) (See note 3.)

Note 1. The Inverter will decelerate to stop according to the setting in n020 for deceleration time 1 if any of the n050 through n056 parameters for multi-function input is not set to 11 for acceleration/deceleration time selection. If any one of the n050 through n056 multi-function input parameters is set to acceleration/deceleration time selection, the Inverter will decelerate to stop according to the selected setting of deceleration time when the STOP command is input.

Note 2. If the RUN signal is input again during a deceleration stop, deceleration will be stopped at the point of the input and operation will accelerate to the frequency reference.

Note 3. Do not input a RUN signal for a free-running stop if the motor's rotation speed is not sufficient slowed. If a RUN signal is input under these conditions, a main circuit overvoltage (OV) or overcurrent (OC) will be detected. To restart a free running motor, set a speed search command in one of the multi-function inputs 1 to 7 (n50 to n56) and use the speed search to detect the speed of the free running motor, and then accelerate smoothly.

5-10   Multi-function I/O

5-10-1 Multi-function Input

The 3G3MV incorporates seven multi-function input terminals (S1 through S7). Inputs into these terminals have a variety of functions according to the application.

◼ Multi-function Input (n050 through n056)

n050	**Multi-function Input 1 (S1)**	**Register**	0132 Hex	**Changes during operation**	No
Setting range	1 to 25 (For 26, see note.)	**Unit of setting**	1	**Default setting**	1

n051	**Multi-function Input 2 (S2)**	**Register**	0133 Hex	**Changes during operation**	No
Setting range	1 to 25 (For 26, see note.)	**Unit of setting**	1	**Default setting**	2

n052	**Multi-function Input 3 (S3)**	**Register**	0134 Hex	**Changes during operation**	No
Setting range	0 to 25 (For 26, see note.)	**Unit of setting**	1	**Default setting**	3

n053	**Multi-function Input 4 (S4)**	**Register**	0135 Hex	**Changes during operation**	No
Setting range	1 to 25 (For 26, see note.)	**Unit of setting**	1	**Default setting**	5

n054	**Multi-function Input 5 (S5)**	**Register**	0136 Hex	**Changes during operation**	No
Setting range	1 to 25 (For 26, see note.)	**Unit of setting**	1	**Default setting**	6

n055	**Multi-function Input 6 (S6)**	**Register**	0137 Hex	**Changes during operation**	No
Setting range	1 to 25 (For 26, see note.)	**Unit of setting**	1	**Default setting**	7

n056	**Multi-function Input 7 (S7)**	**Register**	0138 Hex	**Changes during operation**	No
Setting range	1 to 25, 34, and 35 (For 26, see note.)	**Unit of setting**	1	**Default setting**	10

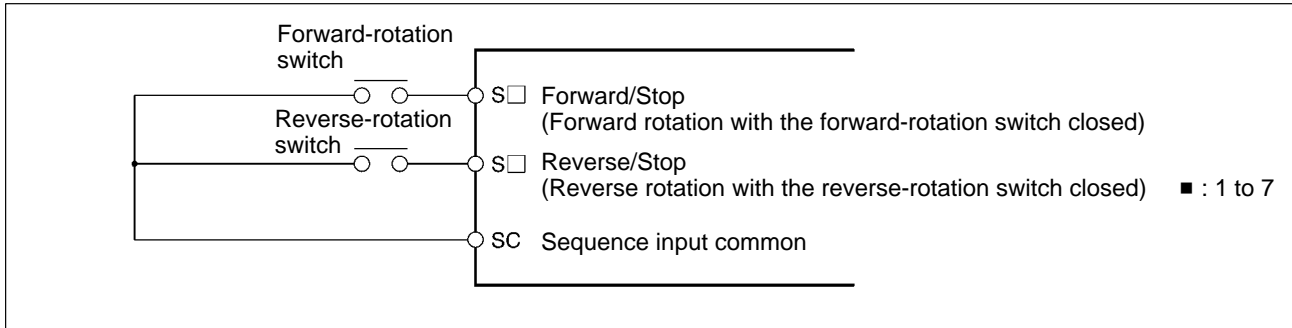**Note** Set value 26 is available for 5.5- and 7.5-kW Inverters only.

Set Values

Value	Function	Description
0	Forward/Reverse rotation command	3-wire sequence (to be set in n052 only)
		By setting n052 to 0, the set values in n050 and n051 are ignored and the following settings are forcibly made.
		S1: RUN input (RUN when ON)
		S2: STOP input (STOP when OFF)
		S3: Forward/Reverse rotation command (OFF: Forward; ON: Reverse)
1	Forward/Stop	Forward rotation command in 2-wire sequence
2	Reverse/Stop	Reverse rotation command (2-wire sequence)
3	External fault (NO)	ON: External fault (EF■ detection: ■ is a terminal number)
4	External fault (NC)	OFF: External fault (EF■ detection: ■ is a terminal number)
5	Fault reset	ON: Fault reset (disabled while RUN command is input)
6	Multi-step speed reference 1	Signals to select frequency references 2 through 16.
7	Multi-step speed reference 2	**Note** Refer to *5-6-4 Setting the Frequency References through Key Sequences* for the relationship between multi-step speed references 1 through 4 and frequency references 1 through 16.
8	Multi-step speed reference 3	**Note** Any multi-step speed reference not set is regarded as turned-OFF input.
9	Multi-step speed reference 4	
10	Inching frequency command	ON: Inching frequency command (taking precedence over the multi-step speed reference)
11	Acceleration/Deceleration time selection	ON: Acceleration time 2 and deceleration time 2 are selected.
12	External base block command (NO)	ON: Output turned OFF (while motor coasting to a stop and "bb" flashing)
13	External base block command (NC)	OFF: Output turned OFF (with motor free running and "bb" flashing)
14	Search command (Searching starts from maximum frequency)	ON: Speed search (Searching starts from n011)
15	Search command (Searching starts from preset frequency)	ON: Speed search
16	Acceleration/Deceleration-prohibit command	ON: Acceleration/Deceleration is on hold (running at parameter frequency)
17	Local or remote selection	ON: Local mode (operated with the Digital Operator)
		Note After this setting is made, mode selection with the Digital Operator is not possible.
18	Communications/Remote selection	ON: RS-422/485 communications input is enabled. Communications RUN command (0001 Hex) is enabled together with frequency reference (0002 Hex).

Value	Function	Description
19	Emergency stop fault (NO)	The Inverter stops according to the setting in n005 for interruption mode selection with the emergency stop input turned ON.
20	Emergency stop warning (NC)	n005 set to 0: Decelerates to stop at deceleration time 2 set in n022. n005 set to 1: Coasts to a stop.
21	Emergency stop fault (NO)	**Note** NO: Emergency stop with the contact closed. NC: Emergency stop with the contact opened. **Note** Fault: Fault output is ON and reset with RESET input. Warning: Warning output is ON and automatically restored when emergency stop input is cleared (no reset required).
22	Emergency stop warning (NC)	**Note** "STP" is displayed (lit with fault input ON and flashes with alarm input ON)
23	PID control cancel	ON: PID control is disabled. PID control set is disabled and the Inverter is in normal operation according to the n003 and n004 settings.
24	PID control integral reset	ON: Integral value is reset (cleared). The integral value as a result of PID operation is cleared when the Inverter is in PID control. The input status of the Inverter continues with the integral function disabled.
25	PID control integral hold	ON: Integral value is kept on hold (fixed). The integral value as a result of PID operation is kept on hold with only the integral operation function disabled when the Inverter is in PID control.
26 (See note.)	Inverter overheating warning oH3	ON: oH3 display (at the Operator); Inverter overheating warning output ON (multi-function output). Operation continues during input. When the input turns OFF, the Operator display and multi-function output are cleared. Use for functions such as displaying the status of external thermal relays.
34	Up or down command	Up or down command (set in n056 only) By setting n056 to 0, the set value in n055 is ignored and the following settings are forcibly made. S6: Up command S7: Down command
35	Self-diagnostic test	ON: RS-422/485 communications self-diagnostic test (set in n056 only) The communications function is tested by connecting the transmission and reception terminals together and checking that the data received is the same as the transmission data.

For value 34:

	Acceleration	Deceleration	Hold	Hold
S6 terminal (Up command)	ON	OFF	OFF	ON
S7 terminal (Down command)	OFF	ON	OFF	ON

Note It is impossible to set the up or down command and multi-step speed references 1 through 4 together.

Note To keep the frequency reference that has been adjusted with the Up or Down command after the Inverter is turned OFF, set n100 (Up/Down frequency memory) to 1.

Note Set value 26 is available for 5.5- and 7.5-kW Inverters only.

■ Operation in 2-wire Sequence (Set Value: 1, 2)

- The Inverter operates in 2-wire sequence by setting a multi-function input selection to 1 (forward/reverse) or 2 (reverse/stop).

- The following diagram shows a wiring example of the terminals in 2-wire sequence.

Forward-rotation switch

S□ Forward/Stop
(Forward rotation with the forward-rotation switch closed)

Reverse-rotation switch

S□ Reverse/Stop
(Reverse rotation with the reverse-rotation switch closed)   ■ : 1 to 7

SC Sequence input common

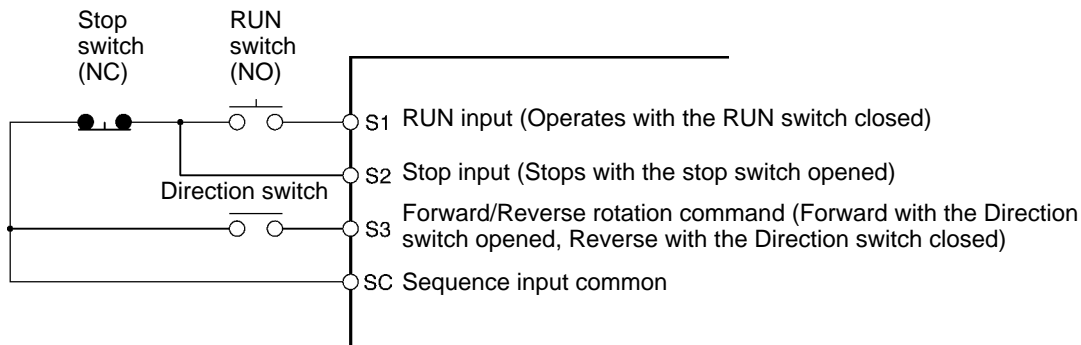## ■ Operation in 3-wire Sequence (n052 = 0)

- The Inverter operates in 3-wire sequence by setting n052 for multi-function input 3 to 0.

- Only n052 can be set to 0 (3-wire sequence). By making this setting, the set values in n050 and n051 are ignored and the following settings are forcibly made.

    S1: RUN input (RUN when ON)

    S2: STOP input (STOP when OFF)

    S3: Forward/Reverse rotation command (OFF: Forward; ON: Reverse)

- The following diagram shows a wiring example of the terminals in 3-wire sequence.

Stop switch (NC)   RUN switch (NO)

S1 RUN input (Operates with the RUN switch closed)

S2 Stop input (Stops with the stop switch opened)

Direction switch

S3 Forward/Reverse rotation command (Forward with the Direction switch opened, Reverse with the Direction switch closed)

SC Sequence input common

■ External Base Block Command (Set Value: 12, 13)

When an SPST-NO (set value: 12) or SPST-NC (set value: 13) input is received, Inverter outputs are shut OFF. Use these inputs in the following cases to stop Inverter outputs.

- For switching the motor to free running status when applying an external brake.

- For stopping Inverter outputs before disconnecting motor wiring when changing the motor from an Inverter to a commercial power supply.

Note The external base block only shuts Off the Inverter's output frequency, and the Inverter's internal frequency continues to be calculated as usual. Therefore, if the external base block is cleared when the frequency is not zero, the frequency calculated at that point will be output. Because of

this, if the baseblock is cleared during deceleration while the motor is free running, a large discrepancy between the motor speed at that moment and the Inverter output frequency may result in a main circuit overvoltage (OV) or overcurrent (OC).

■ Speed Search (Set Value: 14, 15)

- The speed search function is provided for smooth restarting without stopping a free running motor. Use it when switching the motor from a commercial power supply operation to Inverter operation, when starting with the Inverter a motor turned by external force, and so on.

- The speed search function searches for the present motor frequency, from high frequency to low. When the motor's rotation speed is detected, it is accelerated from that frequency to the frequency reference according to the acceleration/deceleration time setting.
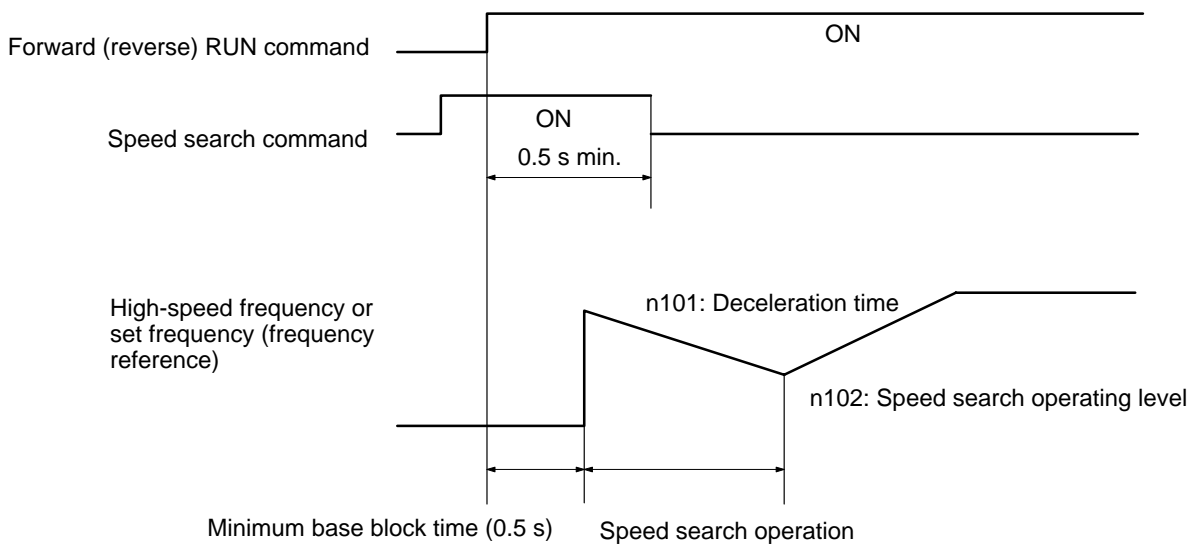
Note For 5.5- and 7.5-kW Inverters only, the speed search function can be adjusted by setting parameters n101 (speed search deceleration time) and n102 (speed search operating level). If the speed search cannot be executed properly using the default setting, lengthen the deceleration time or lower the operating level. To reduce the speed search time, check with the application while either shortening the deceleration time or raising the operating level.

n101	**Speed Search Deceleration Time**	**Register**	0165 Hex	**Changes during operation**	No
Setting range	0.0 to 10.0	**Unit of setting**	0.1 s	**Default setting**	2.0

n102	**Speed Search Operating Level**	**Register**	0166 Hex	**Changes during operation**	No
Setting range	0 to 200	**Unit of setting**	1 %	**Default setting**	150

- For n101, set the origin search deceleration time to the time required to go from 100% to 0% of the maximum frequency.
- If 0 is set for the origin search deceleration time, operation will be carried out at the default setting of 2.0 seconds.
- For n102, set the operating level as a percentage, with the Inverter's rated input taken as 100%. If the Inverter's output current drops below the level of the Inverter's output current, the speed search will be completed and acceleration will be resumed.

5-10-2 Multi-function Output

The 3G3MV incorporates four multi-function output terminals: two multi-function contact outputs (MA and MB) and two multi-function photocoupler outputs (P1 and P2).
Output from these terminals has a variety of functions according to the application.

■ Selecting the Multi-function Output (n050 through n056)

n057	Multi-function Output 1 (MA/MB and MC)	Register	0139 Hex	Changes during operation	No
Setting range	0 to 7, 10 to 21 (See note.)	**Unit of setting**	1	**Default setting**	0

n058	Multi-function Output 2 (P1 and PC)	Register	013A Hex	Changes during operation	No
Setting range	0 to 7, 10 to 21 (see note.)	**Unit of setting**	1	**Default setting**	1

n059	Multi-function Output 3 (P2 and PC)	Register	013B Hex	Changes during operation	No
Setting range	0 to 7, 10 to 21 (See note.)	**Unit of setting**	1	**Default setting**	2

Note Set values 20 and 21 are available for 5.5- and 7.5-kW Inverters only.

Set Values

Value	Function	Description
0	Fault output	ON: Fault output (with protective function working)
1	Operation in progress	ON: During RUN (with RUN command input or inverter output)
2	Frequency agree	ON: Frequency agree (output frequency agrees with frequency reference)
3	Idling	ON: Zero speed (at less than min. output frequency)
4	Frequency detection 1	ON: Output frequency $\geqq$ frequency detection level (n095)
5	Frequency detection 2	ON: Output frequency $\leqq$ frequency detection level (n095)
6	Overtorque being monitored (NO-contact output)	Output if any of the following parameter conditions is satisfied. • Overtorque detection function selection 1 (n096) • Overtorque detection function selection 2 (n097)
7	Overtorque being monitored (NC-contact output)	• Overtorque detection level (n098) • Overtorque detection time (n099) **Note** NO contact: ON with overtorque being detected; NC contact: OFF with overtorque being detected

Value	Function	Description
8	Not used.	---
9		
10	Warning output	ON: Warning being detected (Nonfatal error being detected)
11	Base block in progress	ON: Base block in progress (in operation with output turned OFF)
12	RUN mode	ON: Local mode (with the Digital Operator)
13	Inverter ready	ON: Inverter ready to operate (with no fault detected)
14	Fault retry	ON: Fault retry (Inverter resetting with fault retry (n082) not set to 0)
15	UV in progress	ON: Undervoltage being monitored (main circuit undervoltage UV1 detected)
16	Rotating in reverse direction	ON: Rotating in reverse direction
17	Speed search in progress	ON: Speed search in progress
18	Communications output	ON: Communications output (turns ON/OFF according to 0009 Hex set from communications. Communications setting = ON)
19	PID feedback loss	ON: PID feedback being lost (set detection method in n136, n137, n138)
20 (See note 2.)	Frequency reference loss	ON: Frequency reference lost. (When the frequency reference loss detection (n064) is enabled, and the frequency reference selection (n004) is set for analog input or pulse train input.)
21 (See note 2.)	Inverter overheating warning oH3	ON: Inverter overheating warning ON while the Inverter overheating warning signal is being input (while oH3 is flashing).

Note 1. Use "during RUN" (set value: 1) or "zero speed" (set value: 3) for the timing for stopping the motor using a brake. To specify a precise stop timing, set "frequency detection 1" (set value: 4) or "frequency detection 2" (set value: 5), and set the frequency detection level (n095).

Note 2. Set values 20 (frequency reference loss) and 21 (Inverter overheating warning oH3) are available for 5.5- and 7.5-kW Inverters only.

5-11 Multi-function Analog Output and Pulse Monitor Output

The 3G3MV Inverter incorporates multi-function analog output terminals (AM and AC). A parameter setting makes it possible to output pulse monitor signals from these terminals. Make the necessary settings in these terminals according to the application.

5-11-1 Setting the Multi-function Analog Output (n065 through n067)

- By setting n065 for multi-function analog output type selection to 0 for analog voltage output, analog monitoring is possible through the multi-function analog output terminals.

- A monitoring item is set in n066 (multi-function analog output selection). Six items including the output frequency and current are available.

- Set the analog output characteristics in n067 (multi-function analog output gain).

n065	Multi-function Analog Output Type Selection	Register	0141 Hex	Changes during operation	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Analog voltage output (with monitoring item set in n066)
1	Pulse train output (according to output frequency set in n150)

n066	Multi-function Analog Output	Register	0142 Hex	Changes during operation	No
Setting range	0 to 5	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Output frequency (Reference: 10-V output at max. frequency)
1	Output current (Reference: 10-V output at rated output current)
2	Main circuit DC voltage (Reference: 10-V output at 400 V DC for 200-V models and 800 V DC for 400-V models)
3	Vector operation torque monitor (Reference: 10-V output at rated motor torque)
4	Output power (Reference: 10-V output at power equivalent to max. applicable motor capacity and 0-V output during regenerative operation).
5	Output voltage (Reference: 10-V output at 200 V AC for 200-V models and 400 V AC for 400-V models)

Note Output power cannot be monitored in vector control mode.

n067	Multi-function Analog Output Gain	Register	0143 Hex	Changes during operation	Yes
Setting range	0.00 to 2.00	**Unit of setting**	0.01	**Default setting**	1.00

Note 1. Refer to the above information on the set values in n066 and set the multiplication rate based on the reference value. For example, if 5-V output is desired at maximum output frequency (with n066 set to 0), set n067 to 0.50.

Note 2. The multi-function analog output terminals (AM and AC) have a maximum output of 10 V.

5-11-2 Setting the Pulse Monitor Output (n065 and n150)

- By setting n065 for multi-function analog output type selection to 1 for pulse train output, monitoring pulse output frequency signals is possible through the multi-function analog output terminals.

- The relationship between the output frequency and pulse train output frequency is set in n150 for multi-function analog output, pulse train frequency selection.

n065	Multi-function Analog Output Type Selection	Register	0141 Hex	Changes during operation	No
Setting range	0, 1	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	Analog voltage output (with monitoring item set in n066)
1	Pulse train output (according to output frequency set in n150)

n150	Multi-function Analog Output, Pulse Train Frequency Selection	Register	0197 Hex	Changes during operation	No
Setting range	0, 1, 6, 12, 24, and 36	**Unit of setting**	1	**Default setting**	0

Set Values

Value	Description
0	1,440 Hz at max. frequency (A proportional relationship is applied to frequencies less than the maximum frequency)
1	1x output frequency
6	6x output frequency
12	12x output frequency
24	24x output frequency
36	36x output frequency

Note The pulse train voltage is 10 V at high level and 0 V at low level at a duty rate of 50%.