YASKAWA

Release Guide

AC Drive GA700

High Frequency Custom Software

Catalog Code:
GA70Cxxxxxxx-9895

2000 Hz | 200 V class: 0.55 to 30 kW; 400 V class: 0.55 to 45 kW
1000 Hz | 200 V class: 0.55 to 110 kW; 400 V class: 0.55 to 200 kW

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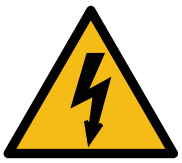
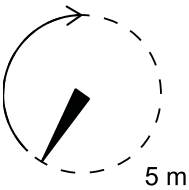
EN **General Warning** | **DE** Allgemeine Warnung |
FR Avertissement général | **IT** Avvertenza generale |
ES Advertencia general | **CS** Obecné varování |
PL Ostrzeżenie ogólne | **TR** Genel Uyarı |
RU Общее предупреждение | **JA** 一般的な警告 |
KO 일반 경고 | **ZH-CN** 一般警告 | **ZH-TW** 一般警告 |



EN **Electricity Hazard** | **DE** Gefahr durch Elektrizität |
FR Risque d'électricité | **IT** Pericolo di elettricità |
ES Peligro por electricidad | **CS** Nebezpečí úrazu elektrickým proudem |
PL Niebezpieczeństwo związane z elektrycznością | **TR** Elektrik Tehlikesi |
RU Опасность поражения электричеством | **JA** 電気的危険 |
KO 감전 위험 | **ZH-CN** 电力危险 | **ZH-TW** 電力危險 |

EN **Hot Surface** | **DE** Heiße Oberfläche |
FR Surface chaude | **IT** Superficie calda |
ES Superficie caliente | **CS** Horký povrch |
PL Gorąca powierzchnia | **TR** Sıcak yüzey |
RU Горячая поверхность | **JA** 熱い表面 |
KO 뜨거운 표면 | **ZH-CN** 热表面 | **ZH-TW** 熱表面 |

EN **Refer to Instruction Manual** | **DE** Siehe Gebrauchsanweisung |
FR Consulter le manuel d'instructions | **IT** Fare riferimento alle istruzioni per l'uso |
ES Consulte el manual de instrucciones | **CS** Viz návod k použití |
PL Zapoznaj się z instrukcją obsługi | **TR** Kullanım Kılavuzuna bakın |
RU Обратитесь к руководству по эксплуатации | **JA** 取扱説明書参照 |
KO 사용 설명서 참조 | **ZH-CN** 请参阅使用说明书 | **ZH-TW** 請參閱使用說明書 |



EN **Wait for 5 Minutes Before Proceeding** | **DE** Warten Sie 5 Minuten, bevor Sie fortfahren |
FR Attendez 5 minutes avant de procéder | **IT** Attendere 5 minuti prima di procedere |
ES Espere 5 minutos antes de proceder | **CS** Před pokračováním vyčkejte 5 minut |
PL Przed przystąpieniem do pracy odczekaj 5 minut | **TR** Devam etmeden önce 5 dakika bekleyin |
RU Подождите 5 минут, прежде чем приступать к работе | **JA** 5 分間待ってから行う |
KO 계속하기 전에 5분 동안 기다리십시오. | **ZH-CN** 等待 5 分钟再继续 | **ZH-TW** 等待 5 分鐘再繼續 |

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1

Introduction

This release guide should be read to ensure proper usage of GA700 High Frequency Custom Software function. Read this guide together with the GA700 Technical Manual (SIEP C710617 05).

Always observe the safety messages and precautions to ensure correct application of the product.

Applicable Software Version

This release guide applies to GA700 software versions PRG: 7040 or later.

The software version is indicated on the nameplate affixed to the side of the product, and also can be viewed by using monitor parameter *U1-25*.

Target Model

The Maximum frequency supported will vary depending on the model due to carrier frequency restrictions.

Model	GA70C2004 - GA70C2138	GA70C2169 - GA70C2415	GA70C4002 - GA70C4103	GA70C4140 - GA70C4389
Maximum Frequency	2000 Hz	1000 Hz	2000 Hz	1000 Hz

Note:

GA70C4477 or higher models are not supported.

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Modifications From The Standard Software

The following modifications from the standard software apply:

Changed Item	High Frequency Software	Standard Software
Maximum output frequency	2000 Hz / 1000 Hz **Note:** The maximum output frequency varies by drive model.	590 Hz
Setting unit for all parameters related to frequency	0.1 Hz	0.01 Hz
Frequency reference and output frequency display units (The MEMOBUS communication contains it.)	o1-03 parameter (same as b5-20) **0 : 0.1 Hz** **1 : 0.01%** Maximum frequency 100% **2 : -** **3 : User-selected units** o1-10: It is possible to set it within the range of 1 to 60000.	o1-03 parameter (same as b5-20) **0 : 0.01 Hz** **1 : 0.01%** Maximum frequency 100% **2 : min^{-1}** Calculated automatically based on the maximum output frequency and number of motor poles **3 : User-selected units** o1-10: It is possible to set it within the range of 1 to 60000.
Control method (A1-02)	**0 : V/f Control** **1 : -** **2 : -** **3 : Closed Loop Vector** Control mode online switching **4 : -** **5 : PM Open Loop Vector** **6 : -** **7 : -** **8 : -**	**0 : V/f Control** **1 : V/f Control w/ PG** **2 : Open Loop Vector** **3 : Closed Loop Vector** **4 : Advanced Open Loop Vector** **5 : PM Open Loop Vector** **6 : PM Advanced Open Loop Vector** **7 : PM Closed Loop Vector** **8 : EZ Vector Control**
Torque boost	Enabled only at low speeds.	Constant throughout the entire frequency range.
Carrier frequency	C6-04, C6-05 parameter The parameter is available when operating the drive with V /f Control and PM Open Loop Vector.	C6-04, C6-05 parameter The parameter is available when operating the drive with V /f Control.
PM motor parameter settings	Number of digits past the decimal point are as follows: • E5-05 (PM Motor Resistance (ohms/phase)): 4 digits • E5-06 (PM d-axis Inductance (mH/phase)): 3 digits • E5-07 (PM q-axis Inductance (mH/phase)): 3 digits • E5-09 (PM Back-EMF Vpeak (mV/ (rad/s))): 2 digits • E5-24 (PM Back-EMF L-L Vrms (mV/rpm)): 2 digits	Number of digits past the decimal point are as follows: • E5-05 (PM Motor Resistance (ohms/phase)): 3 digits • E5-06 (PM d-axis Inductance (mH/phase)): 2 digits • E5-07 (PM q-axis Inductance (mH/phase)): 2 digits • E5-09 (PM Back-EMF Vpeak (mV/ (rad/s))): 1 digit • E5-24 (PM Back-EMF L-L Vrms (mV/rpm)): 1 digit
Torque detection	L6-02, L6-05 parameter Even in the case of closed-loop vector control, it is detected by the value of the current.	L6-02, L6-05 parameter In the case of closed-loop vector control , it is detected by the value of torque.

Changed Item	High Frequency Software	Standard Software
Special adjustment: Added functions	• S1-02: Polarity Level Disable • S1-04: Adjustment Gain for Current Monitor • S1-05: Filter Time Constant for Output Power Monitor • S1-07: Current Detection Timing Adjustment • S1-08: Voltage Output Timing Adjustment • S1-10: Carrier Synchronization Method Selection	-
	Only for Closed vector control mode • S2-01: Control Mode Switch Frequency • S2-02: Control Mode Switch Hysteresis Width • S2-05: Slip Compensation Gain at Hi-Speed • S2-06: Slip Compensation Primary Delay Time at Hi-Speed • S2-07: Slip Compensation Limit at Hi-Speed • S2-08: Slip Compensation Selection during Regeneration at Hi-Speed • S2-11: Control Mode Switch Frequency 2 • S2-12: Control Mode Switch Hysteresis Width 2 • S2-15: Motor 2 Slip Compensation Gain at Hi-Speed • S2-16: Motor 2 Slip Compensation Primary Delay Time at Hi-Speed • S2-17: Motor 2 Slip Compensation Limit at Hi-Speed • S2-18: Motor 2 Slip Compensation Selection during Regeneration at Hi-Speed	
Parameters now available for closed vector control (Online Control Mode Switch Function)	C4-xx: Torque Compensation E1-xx: V/f Pattern for Motor1 E3-xx: V/f Pattern for Motor2 N1-xx: Hunting Prevention	Not available with closed vector control
Deleted functions	• A1-06: Application Preset • b3-xx: Speed Search • b7-xx: Droop Control • b8-xx: Energy Saving Control • d5-xx: Torque Control • d6-xx: Field Forcing • E5-01: PM Motor Code Selection • L2-xx: KEB, Power Loss Ride Through (deleted only for closed vector control) • L3-xx: Overvoltage Suppression Current Limit Acceleration Suppression • L5-xx: Fault restart • n3-xx: Overexcitation Braking, High Slip Braking • n5-xx: Feed Forward Control • o1-04: V/f Pattern Display Unit • T0-00 =1: Control tuning • T1-01 = 0, T2-01 = 4： Rotational Auto-Tuning	-

3

Precautions

- Select the appropriate drive capacity for the motor capacity used.
- Use only devices designed specifically for operation with a PWM drive.
- For operation in PM Open Loop Vector Control for motors, contact Yaskawa.
- Foreign Exchange and Foreign Trade Regulations apply. Be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

4

Content of Changed Parameters

4.1 List of Newly Added Parameters and Monitors from Standard Drive

Parameter (Hex.)	Name	Range	Default Value
S1-02 (681H)	Polarity Level Disable	0, 1	1
S1-04 (683H)	Adjustment Gain for Current Monitor	0.00 ... 2.00	1.00
S1-05 (684H)	Filter Time Constant for Output Power Monitor	0.00 ... 5.00 s	0.00 s
S1-07 (686H)	Current Detection Timing Adjustment	-2.00 ... 2.00	0.00
S1-08 (687H)	Voltage Output Timing Adjustment	-2.00 ... 2.00	0.00
S1-10 (689H)	Carrier Synchronization Method Selection	0, 1	0
S2-01 (691H)	Control Mode Switch Frequency	0 ... 400 Hz	0 Hz
S2-02 (692H)	Control Mode Switch Hysteresis Width	2 ... 100 Hz	20 Hz
S2-05 (695H)	Slip Compensation Gain at Hi-Speed	0.0 ... 2.5	0.0
S2-06 (696H)	Slip Compensation Primary Delay Time at Hi-Speed	0 ... 10000 ms	2000 ms
S2-07 (697H)	Slip Compensation Limit at Hi-Speed	0 ... 250%	200%
S2-08 (698H)	Slip Compensation Selection during Regeneration at Hi Speed	0 ... 2	0
S2-11 (699H)	Motor2 Control Mode Switch Frequency	0 ... 400 Hz	0 Hz
S2-12 (69AH)	Motor2 Control Mode Switch Hysteresis Width	2 ... 100 Hz	20 Hz
S2-15 (69DH)	Motor2 Slip Compensation Gain at Hi-Speed	0.0 ... 2.5	0.0
S2-16 (69EH)	Motor2 Slip Compensation Primary Delay Time	0 ... 10000 ms	2000 ms
S2-17 (69FH)	Motor2 Slip Compensation Limit at Hi-Speed	0 ... 250%	200%
S2-18 (6A0H)	Motor2 Slip Compensation Selection during Regeneration at Hi Speed	0 ... 2	0

4.2 Setting Ranges That Differ from Standard Software

Parameter	Name	Range
A1-02	Control Method Selection	0, 3, 5
b5-20	PID Unit Selection	0, 1, 3
C6-02	Carrier Frequency Selection	F
E3-01	Motor 2 Control Mode Selection	3
E5-01	PM Motor Code Selection	FFFF
E5-05	PM Motor Resistance (ohms/phase)	0.0000 ... 6.5000
E5-06	PM d-axis Inductance (mH/phase)	0.000 ... 65.000
E5-07	PM q-axis Inductance (mH/phase)	0.000 ... 65.000
E5-09	PM Back-EMF Vpeak (mV/ (rad/s))	0.00 ... 650.00
E5-24	PM Back-EMF L-L Vrms (mV/rpm)	0.00 ... 650.00
L2-01	Momentary Power Loss Ope Select	0, 1, 2

Parameter	Name	Range
L3-01	Stall Prevent Select during Accel	0, 1
L3-02	Stall Prevent Level during Accel	0 ... 170
L3-04	Stall Prevention during Decel	0, 1, 3
o1-03	Frequency Display Unit Selection	0, 1, 3
T0-00	Tuning Mode Selection	0
T1-01	Auto-Tuning Mode Selection	2
T1-05	Motor Base Frequency	00. ... 1000.0
T1-07	Motor Base Speed	0 ... 60000
T2-01	PM Auto-Tuning Selection	0, 1, 2
T2-02	PM Motor Code Selection	FFFF
T2-07	PM Motor Base Frequency	0.0 ... 1000.0
T2-09	PM Motor Base Speed	0 ... 60000
T2-10	PM Motor Stator Resistance	0.0000 ... 6.5000
T2-11	PM Motor d-Axis Inductance	0.000 ... 65.000
T2-12	PM Motor q-Axis Inductance	0.000 ... 65.000
T2-14	Back-EMF Voltage Constant (Ke)	0.00 ... 650.00

4.3 Parameters That Default Values are Changed

Parameter	Name	Range	Default Value
A1-02	Control Method Selection	0, 3, 5	0
C6-02	Carrier Frequency Selection	F	F
C6-03	Carrier Frequency Upper Limit	1.0 ... 15 kHz	10.0 kHz
C6-04	Carrier Frequency Lower Limit	1.0 ... 15 kHz	1.1 kHz
C6-05	Carrier Freq Proportional Gain	0 ... 99	12
E3-04	Motor 2 Maximum Output Frequency	3	3
E5-01	PM Motor Code Selection	FFFF	FFFF
T1-05	Motor Base Frequency	0.0 ... 2000.0 Hz	50.0 Hz

4.4 Upper Limits That Have been Changed for 2000.0 Hz Software

Parameter	Name	Range	Default Value
b5-15	PID Sleep Function Start Level	0.0 ... 2000.0 Hz	0.0 Hz
b6-01	Dwell Reference at Start	0.0 ... 2000.0 Hz	0.0 Hz
b6-03	Dwell Reference at Stop	0.0 ... 2000.0 Hz	0.0 Hz
C1-11	Accel/Decel Time Switchover Freq	0.0 ... 2000.0 Hz	0.0 Hz
C5-07	ASR Gain Switchover Frequency	0.0 ... 2000.0 Hz	0.0 Hz
d1-01	Reference 1	0.0 ... 2000.0 Hz	0.0 Hz
d1-02	Reference 2	0.0 ... 2000.0 Hz	0.0 Hz
d1-03	Reference 3	0.0 ... 2000.0 Hz	0.0 Hz
d1-04	Reference 4	0.0 ... 2000.0 Hz	0.0 Hz
d1-05	Reference 5	0.0 ... 2000.0 Hz	0.0 Hz
d1-06	Reference 6	0.0 ... 2000.0 Hz	0.0 Hz
d1-07	Reference 7	0.0 ... 2000.0 Hz	0.0 Hz
d1-08	Reference 8	0.0 ... 2000.0 Hz	0.0 Hz

Parameter	Name	Range	Default Value
d1-09	Reference 9	0.0 ... 2000.0 Hz	0.0 Hz
d1-10	Reference 10	0.0 ... 2000.0 Hz	0.0 Hz
d1-11	Reference 11	0.0 ... 2000.0 Hz	0.0 Hz
d1-12	Reference 12	0.0 ... 2000.0 Hz	0.0 Hz
d1-13	Reference 13	0.0 ... 2000.0 Hz	0.0 Hz
d1-14	Reference 14	0.0 ... 2000.0 Hz	0.0 Hz
d1-15	Reference 15	0.0 ... 2000.0 Hz	0.0 Hz
d1-16	Reference 16	0.0 ... 2000.0 Hz	0.0 Hz
d1-17	Jog Reference	0.0 ... 2000.0 Hz	6.0 Hz
d3-01	Jump Frequency 1	0.0 ... 2000.0 Hz	0.0 Hz
d3-02	Jump Frequency 2	0.0 ... 2000.0 Hz	0.0 Hz
d3-03	Jump Frequency 3	0.0 ... 2000.0 Hz	0.0 Hz
d3-04	Jump Frequency Width	0.0 ... 2000.0 Hz	1.0 Hz
d6-02	Field Weakening Frequency Limit	0.0 ... 2000.0 Hz	0.0 Hz
E1-04	Maximum Output Frequency	40.0 ... 2000.0 Hz	60.0 Hz
E1-06	Base Frequency	0.0 ... 2000.0 Hz	60.0 Hz
E1-07	Mid Point A Frequency	0.0 ... 2000.0 Hz	3.0 Hz
E1-09	Minimum Output Frequency	0.0 ... 2000.0 Hz	1.5 Hz
E1-11	Mid Point B Frequency	0.0 ... 2000.0 Hz	0.0 Hz
E3-04	Motor2 Maximum Output Frequency	40.0 ... 2000.0 Hz	60.0 Hz
E3-06	Motor2 Base Frequency	0.0 ... 2000.0 Hz	60.0 Hz
E3-07	Motor2 Mid Point A Frequency	0.0 ... 2000.0 Hz	6.0 Hz
E3-09	Motor2 Mid Point B Frequency	0.0 ... 2000.0 Hz	1.5 Hz
E3-11	Motor2 Minimum Output Frequency	0.0 ... 2000.0 Hz	0.0 Hz
L4-01	Speed Agree Detection Level	0.0 ... 2000.0 Hz	0.0 Hz
L4-03	Speed Agree Detection Level (+/-)	-2000 ... 2000 Hz	0 Hz

4.5 List of Deleted MEMOBUS communications data from Standard Software

Register No. (Hex.)	Description	Units
3EH	Output Frequency	min^{-1} or r/min
ACH	U1-05 (Motor Speed)	min^{-1} or r/min

Register No. (Hex.)	Description	Units
B5H	U1-16 (SFS Output Frequency)	min^{-1} or r/min
B7H	Frequency Reference Monitor	min^{-1} or r/min

4.6 List of Deleted Parameters and Monitors from Standard Software

Parameter	Name
A1-06	Application Preset
b3-05	Speed Search Delay Time
b3-06	Speed Estimation Current Level 1
b3-07	Speed Estimation Current Level 2
b3-08	Speed Estimation ACR P Gain
b3-09	Speed Estimation ACR I Time
b3-10	Speed Estimation Detection Gain

Parameter	Name
b3-24	Speed Search Method Selection
b3-25	Speed Search Wait Time
b3-26	Direction Determination Level
b3-35	Low Back EMF Detection Level
b3-36	High Back EMF Detection Level
b7-xx	Droop Control
b8-01	Energy Saving Control Selection

Parameter	Name
b8-02	Energy Saving Gain
b8-03	Energy Saving Filter Time
b8-04	Energy Saving Coefficient Value
b8-05	Power Detection Filter Time
b8-06	Search Operation Voltage Limit
b8-16	PM E-Save Coefficient Ki
b8-17	PM E-Save Coefficient Kt
b8-18	E-Save d-axis Current FilterTime
C3-28	Adaptive Slip Control Mode
D5-xx	Torque Control
D6-xx	Field Forcing
L2-xx	Power Loss Ride Through Select **Note:** Deleted only for closed loop vector control.
L2-06	Kinetic Energy Backup Decel Time
L2-07	Kinetic Energy Backup Accel Time
L2-08	Frequency Gain at KEB Start
L2-09	KEB Minimum Frequency Level
L2-10	Minimum KEB Time
L2-11	KEB DC Bus Voltage Setpoint
L2-29	Kinetic Energy Backup Method
L2-30	KEB Zero Speed Operation
L2-31	KEB Start Voltage Offset Level
L3-11	Overvoltage Suppression Select

Parameter	Name
L3-17	DC Bus Reg Level
L3-20	DC Bus Voltage Adjustment Gain
L3-21	OVSuppression Accel/Decel P Gain
L3-24	Motor Accel Time@ Rated Torque
L3-25	Load Inertia Ratio
L3-35	Speed Agree Width for Auto Decel
L3-36	VibraSuppression Gain duringAccel
L3-37	Current Limit P Gain @ Accel
L3-38	Current Limit I Time @ Accel
L3-39	CurlimIntegTime Con duringAcc/Dec
L3-40	CurlimMaxScurve Sel duringAcc/Dec
L5-xx	Fault Reset **Note:** Deleted only for closed loop vector control.
n3-xx	High Slip Braking/Overexcitation Deceleration parameter
n5-xx	Feed Forward Control
o1-04	V/f Pattern Display Unit
T1-08	PG Number of PulsesPerRevolution
T1-09	Motor No-Load Current
T1-10	Motor Rated Slip Frequency
T2-16	PGNumOfPulses/Rev forPMMotor Tun
T2-17	Encoder Z-Pulse Offset
T3-xx	Control Loop Tuning parameter

4.7 Deleted Multi-Function Digital Input/Output Setting Values

Setting	Name
H1-xx = 65	KEB Ride-Thru 1 (N.C.)
H1-xx = 66	KEB Ride-Thru 1 (N.O.)
H1-xx = 68, 168	High Slip Braking (HSB)

Setting	Name
H1-xx = 7A	KEB Ride-Thru 2 (N.C.)
H1-xx = 7B	KEB Ride-Thru 2 (N.O.)
H2-xx = 4A, 14A	During KEB Ride-Thru

4.8 Added Multi-Function Digital Output Setting Values

Setting	Name
H2-xx = 50	Control Mode

4.9 Added Parameter Setting Errors

Code	Name
oPE21	Control Mode Switch Frequency Setting Error

5

Explanation of Addition and Change Functions

5.1 Torque Compensation Function

Decrease *C4-01 [Torque Compensation Gain]* according to the output frequency as below:

5.2 Notes for Auto-Tuning in PM Open Loop Vector

For SPM motors with a small difference in d-axis inductance *[E5-06]* and q-axis *[E5-07]* inductance, parameter *S1-02 [Polarity Level Disable]* should be disabled (*S1-02 = 0*, default = *1*) prior to performing Auto-Tuning.

In motors where there is some difference in d-axis inductance *[E5-06]* and q-axis inductance *[E5-07]*, reduce the setting of *n8-84 [Polarity Detection Current]* prior to Auto-Tuning if there is a relatively lower amount of motor armature resistance *[E5-05]*.

Note:

Because the high frequency motor has a unique design, Auto-Tuning may not be enough for the drive to achieve proper performance with the motor. Motor parameters *[E5-xx]* should therefore be set manually accordingly the information on the motor nameplate.

5.3 Adjustment Gain for Current Monitor [S1-04]

Normally there is no need to change *S1-04 [Adjustment Gain for Current Monitor]* from its default setting. The monitor value of *U1-03 [Output Current]* may differ from the measured value of the clamp meter due to high-frequency noise. Use *S1-04* to adjust the monitor value so that it approaches the actual measurement value.

5.4 Filter Time Constant for Output Power Monitor [S1-05]

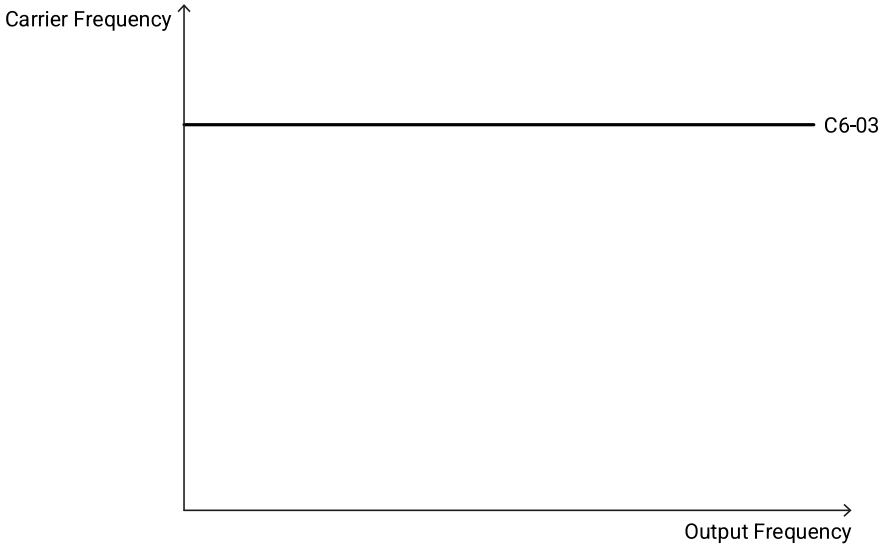
S1-05 filters the output power monitor *U1-08 [Output Power]*. Set this parameter if the *U1-08* monitor fluctuates during high frequency operation.

5.5 Current Detection Timing Adjustment [S1-07], Voltage Output Timing Adjustment [S1-08]

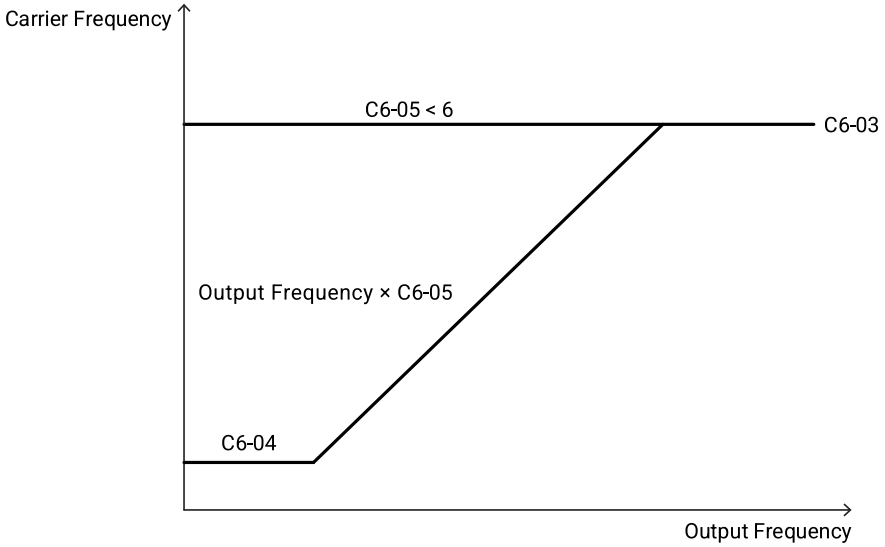
Refer to *Parameter Adjustment for PM Motor on page 21* for PM motor.

5.6 Carrier Synchronization Method Selection [S1-10]

Setting a Variable Carrier Frequency to Agree with the Output Frequency, when *S1-10 = 0 [Carrier Synchronization Method Selection = 0]*.

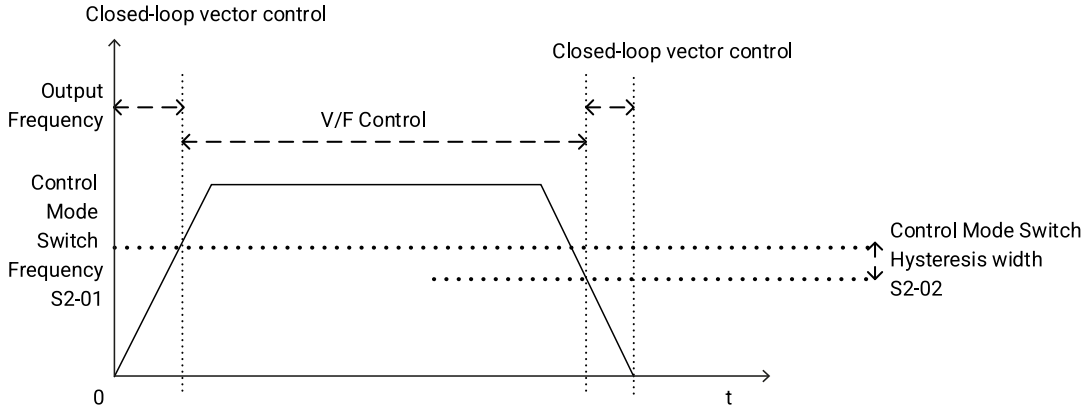


Setting a Variable Carrier Frequency to Agree with the Output Frequency, when *S1-10 = 1 [Carrier Synchronization Method Selection = 1]*.



5.7 Online Control Mode Switch Function

This software can switch between Closed Loop Vector Control and V/f Control during run. At Low-Speed the drive will run as Closed Loop Vector Control and automatically switch to V/f Control when the output is above the frequency which was set.



Added Parrameters

The S2 parameter can only be set when the control mode is closed loop.

Parameter (Hex.)	Name	Description	Range	Default
S2-01 (691H)	Control Mode Switch Frequency mode change fout	Sets the frequency of switching from Closed Loop Vector Control to V/f Control. **Note:** This function will be disabled when 0 or 400 Hz is set, the drive will run as V/f Control when 0 is set and Closed Loop Vector Control when 400 Hz is set. However, OPE21 will occur when the relations among *Control Mode Switch Frequency [S2-01]* and *PG Pulse per Revolution [F1-01]* and *Numbers of Motor Poles [E2-04]* are set higher then the permissible input frequency of PG option.	0 ... 400 Hz	0 Hz
S2-02 (692H)	Control Mode Switch Hysteresis Width mode change Hys	Sets the hysteresis width of Control Mode Switch. Increase if shock occurs during Control Mode switching. Please set the value such that *S2-01* > *S2-02*.	2 ... 100 Hz	20 Hz
S2-05 (695H) RUN	Slip Compensation Gain at Hi-Speed Slip Comp Gain	Sets the gain for the Motor Slip Compensation at Hi-Speed 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 *S2-05*. • If the motor at constant speed is faster than the frequency reference, decrease *S2-05*.	0.0 ... 2.5	0.0
S2-06 (696H) RUN	Slip Compensation Primary Delay Time at Hi-Speed Slip Comp Time	Sets the filter on the output side of the Slip Compensation at Hi-Speed Function. Although this parameter rarely needs to be changed, adjustments might be needed under the following circumstances: • Decrease the setting when the slip compensation response is too slow. • Increase this setting when speed is unstable.	0 ... 1000 ms	2000 ms
S2-07 (697H)	Slip Compensation Limit at Hi- Speed Slip Comp Limit Slip Comp Regen	Sets the upper limit for the Slip Compensation at Hi-Speed Function as a percentage of the *Motor Rated Slip [E2-02]*.	0 ... 250 %	200 %

Parameter (Hex.)	Name	Description	Range	Default
S2-08 (698H)	Slip Compensation Selection during Regeneration at Hi-Speed Slip Comp Regen	**0 : Disable** **1 : Enabled (6Hz and above)** **2 : Enabled (compensation provided wherever possible)** **Note:** When Slip Compensation during Regeneration at Hi-Speed has been activated and a regenerative load is applied, it might be necessary to use a dynamic braking option (braking resistor, braking resistor unit, or braking unit).	0 ... 2	0
S2-11 (699H)	Control Mode Switch Frequency 2 change fout2	Sets the frequency of switching from Closed Loop Vector Control to V/f Control for Motor 2. **Note:** This function will be disabled when 0 or 400Hz is set, the drive will run as V/f Control when 0 is set, and Closed Loop Vector Control when 400Hz is set. However, OPE21 will occur when the relations among *Control Mode Switch Frequency [S2-01]* and *PG Pulse per Revolution [F1-01]* and *Numbers of Motor Poles [E2-04]* are set higher then the permissible input frequency of PG option.	0 ... 400 Hz	0 Hz
S2-12 (69AH)	Control Mode Switch Hysteresis Width 2 change Hys2	Sets the hysteresis width of Control Mode Switch for Motor 2. Increase if shock occurs during Control Mode switching. Please set the value such that *S2-11* > *S2-12*.	2 ... 100 Hz	20 Hz
S1-15 (69DH) RUN	Motor 2 Slip Compensation Gain at Hi-Speed SlpCmp Gain Mtr2	Sets the gain for the Motor Slip Compensation at Hi-Speed Function for Motor 2. 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 *S2-05*. • If the motor at constant speed is faster than the frequency reference, decrease *S2-05*.	0.0 ... 2.5	0.0
S1-16 (69EH) RUN	Motor 2 Slip Compensation Primary Delay Time at Hi-Speed Slip Comp Time 2	Sets the filter on the output side of the Slip Compensation at Hi-Speed Function for Motor 2. Although this parameter rarely needs to be changed, adjustments might be needed under the following circumstances: • Decrease the setting when the slip compensation response is too slow. • Increase this setting when speed is unstable.	0 ... 10000 ms	2000 ms
S1-17 (69FH)	Motor 2 Slip Compensation Limit at Hi-Speed Slip Comp Limit2	Sets the upper limit for the Slip Compensation at Hi-Speed Function for Motor 2 as a percentage of the *Motor Rated Slip [E2-02]*.	0 ... 250%	200%
S1-18 (6A0H)	Motor 2 Slip Compensation Selection during Regeneration at Hi-Speed RegenSlpComp2	**0 : Disable** **1 : Enabled (6Hz and above)** **2 : Enabled (compensation provided wherever possible)** **Note:** When Slip Compensation during Regeneration at Hi-Speed has been activated and a regenerative load is applied, it might be necessary to use a dynamic braking option (braking resistor, braking resistor unit, or braking unit).	0 ... 2	0

5.8 Multi-Function Digital Input

Setting	Name	Description	Control Method	
			V/f	CLV
50	Control Mode Switch ctrl mode change	Control Mode will switch from Closed Loop Vector Control to V/f Control according to *Control Mode Switch Frequency [S2-01]* at "OFF". All area V/f Control at "ON". **Note:** Muti-Function Input is only accepted while the inverter is stopped. The status of Multi-Function Input is dismissed during run.	×	○

5.9 OPE21: Control Mode Switch Frequency Setting Error

In case of Closed Loop Vector Control, if the permissible value of PG option was exceeded, OPE21 Error was added.

Please make sure that the value of *Control Mode Switch Frequency [S2-01 or S2-11]* is satisfied with conditions below.

For Motor1:

- PG-B3: F1-01 × E2-04 / 2 × S2-01 > 50kHz
- PG-X3: F1-01 × E2-04 / 2 × S2-01 > 300kHz

For Motor2:

- PG-B3: F1-31 × E4-04 / 2 × S2-11 > 50kHz
- PG-X3: F1-31 × E4-04 / 2 × S2-11 > 300kHz

Parameter Adjustment for PM Motor

6.1 Parameters

No. (Hex.)	Name	Description	Default Setting (Setting Range)	Control Method	
				V/f	CLV
S1-07 (686H) RUN	Current detection Timing adjustment	UVW->dq conversion of current detection with the following phase θ θ=θ(n-1)+S1-07×Δθ	0.00 (-2.00 ... +2.00)	A	A
S1-08 (687H) RUN	Voltage output timing adjustment	Output voltage command with the following phase θ dq->UVW conversion θ=θ(n)+S1-08×Δθ	0.00 (-2.00 ... +2.00)	A	A

S1-07 [Current Detection Timing Adjustment]

Convert the current detection value to UVW->DQ with the following phase.

θ = θ (n - 1) + S1-07 × Δθ

θ is the estimated motor magnetic pole position and Δθ is output frequency × current control period

The current used for motor control is delayed for a certain time before A/D conversion to avoid the effect of delay in the current detection circuit. This delay does not affect normal speed motor drive, but it does affect high-frequency motor drive, and *S1-07 [Current Detection Timing Adjustment]* adjusts the current detection timing to compensate for the delay.

S1-08 [Voltage Output Timing Adjustment]

Convert the output voltage command to dq→UVW with the following phase.

θ = θ (n) + S1-08 × Δθ

After the magnetic pole position of the motor is estimated, some time elapses (about several tens of μs) for the voltage to actually be output. This effect does not occur in a normal speed motor drive, but it does occur in a high-frequency motor drive, and the voltage output timing is adjusted by *S1-08 [Voltage Output Timing Adjustment]* to compensate for this effect.

6.2 Adjustment Procedure

Please check the following items after reviewing the checklist for test run described in the Technical Manual in advance.

Table 6.1 Checklist for test run

No.	Content	Check
1	Did you set *E1-01* to *E1-09 [Motor Parameters]*? Set the data provided by the motor manufacturer.	☐
2	Did you set *E5-01* to *E5-24 [PM motor parameters]*? Set the data provided by the motor manufacturer. However, it is preferable to input the actual measurement results for the induction voltage values. Also, for the inductance values Ld and Lq, set not nominal values but values that take into account saturation changes due to shaft current, if available from the motor manufacturer.	☐
3	Have you set *C6-03* to *C6-05 [Carrier Frequency Parameters]*? (It is desirable to set the carrier frequency as high as possible relative to the output frequency.)	☐

No.	Content	Check
4	Did you set *L8-27 [Parameters for motor demagnetization current level]*? Check the design value of the motor manufacturer and set it. If not, be sure to set it because the motor magnet may be demagnetized depending on the temperature.	☐
5	Did you set *n8-62 [output voltage limit level]*? Check the input voltage condition and set it. This setting is necessary to prevent step-out when the input voltage drops, although the current value increases at the limit.	☐

6.3 Hints for Adjusting Drives During Test Run

This section describes how to adjust the drive when issues such as turbulence or vibration, which are considered to be caused by controllability, occur during test run.

Issue	Parameter	Countermeasure	Default Setting	Adjusted Value
Normal acceleration is not possible due to the influence of voltage accuracy in the low output voltage range at startup and low speed.	S1-10 (Carrier Synchronization Method Selection)	Set the drive to run at a low carrier at low speeds.	0	1
Can't accelerate.	N8-51 (pull-in current at acceleration)	Set each +10% larger to increase torque during acceleration.	50 %	Adjust by 10% if necessary
Losing impact load at constant speed.	N8-48 (Pull-in current)	Set a larger value by +10% to increase the impact load capacity. **Note:** If the current flows too much at a constant speed, reduce the setting value slightly.	30 %	Adjust by 10% if necessary
Vibration is generated.	N8-55 (control response adjustment)	Basically, it is adjusted according to the ratio between the motor and inertia. **Note:** If a large value is set, vibration may occur.	0	1, 2, 3
Improve efficiency.	N8-56 (high efficiency control selection)	It is recommended to set 2 (both valid Vd and Vq) for vector control to be valid. (If no problems occur with the default values, there is no need to change them.)	1	2
Output voltage drops and current increases during high-speed operation.	S1-07 (Current detection timing adjustment)	Recommended setting value: -0.20～-0.30 If output voltage drops or current increases during high- speed operation, change the value by 0.1.	0.0	-0.25 Adjust ±0.1 increments as needed.
	S1-08 (Output voltage timing adjustment)	When driving at high speed, it is recommended to set a value of +0.5 to compensate for PWM payout timing. If the output voltage drops during driving, increase this value by +0.1 (or -0.1). If output voltage drops or other problems occur during driving, change this value by +0.1 (or - 0.1).	0.0	0.5 Adjust by ±0.1 if necessary.

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AC Drive GA700

Release Guide

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In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Act. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.
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Original instructions.

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