YASKAWA

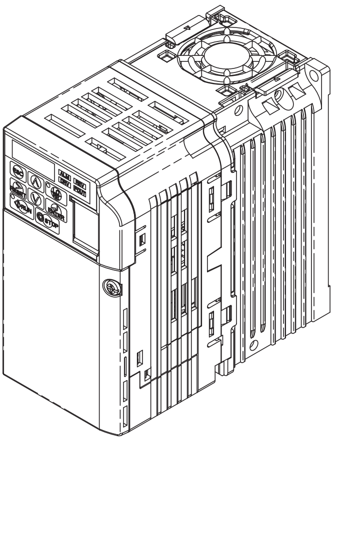
YASKAWA AC Drive - V1000 Option

1000 Hz High Frequency Custom Software

Supplement

Software No. VSV91005X

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



MANUAL NO. TM.V1000SW.134A

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Refer to the V1000 Technical Manual for content not described in this document.

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1 Preface and Safety

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. NO OTHER WARRANTY, EXPRESSED OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

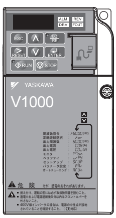
◆ Applicable Documentation

The following manuals are available for the V1000 1000 Hz Drive:

Option Supplement

	**Yaskawa AC Drive -V1000 1000 Hz High Frequency Custom Software Supplement** **Manual No: TM.V1000SW.134A (This document)**
	Read this manual first.This supplement is an addendum to V1000 Quick Start Guide and Technical Manual. It lists the effect of this custom software on the parameters in the drive and function descriptions in the manual. To obtain the supplement access this site: U.S.: http://www.yaskawa.com
	Yaskawa AC Drive -V1000 1167 Hz High Frequency Custom Software Supplement **Manual No: TM.V1000SW.134B (Consult factory if needed for your application)**

Yaskawa Drive

	**Yaskawa AC Drive-V1000** **Quick Start Guide**	To obtain instruction manuals for Yaskawa products access these sites: U.S.: http://www.yaskawa.com For questions, contact the local Yaskawa sales office or the nearest Yaskawa representative.
	Yaskawa AC Drive-V1000 **Technical Manual**	

◆ Supplemental Safety Information

Read and understand this manual and the V1000 Quick Start Guide before installing, operating, or servicing this option unit. The drive must be installed according to the V1000 Quick Start Guide and local codes. Observe all cautions and warnings in this document and the standard drive technical manuals.

Refer to the V1000 Quick Start Guide and the V1000 Technical Manual for safety information and installation and start-up instructions.

This document is a supplement to the standard drive technical manual. It describes the effects on the drive parameters and functions with the software installed.

- Custom software is provided to add functionality to a standard AC drive to enhance or enable use in a specific application.
- The software is loaded to the flash ROM area of the control board, and replaces the standard drive software.

◆ Obtaining Support

When seeking support for a drive with custom software, it is imperative to provide the unique part number shown on the drive nameplate. The software is flashed to the control board memory and the operation of parameters, functions, and monitors are different than the standard drive software, as described herein.

Refer to Yaskawa office locations listed on the back cover of this supplement.

2 Product Overview

◆ About This Product

This custom software is designed for high frequency motor applications. The drive's maximum output frequency can be set up to 1000 Hz. Non-applicable drive functions are deleted in order to optimize CPU processing time for this software.

◆ Applicable Models

The 1000 Hz Option is available in these drive models in *Table 1*.

Table 1 Applicable Models

Drive	Software Version <1>
VU□B□□□□AA□-134	= 005□
VU□B□□□□BA□-134	= 005□
VU□B□□□□FA□-134	= 005□

<1> See "PRG" on the drive nameplate for the software version number.

3 Modifications from Standard Software

Changed Item	High Frequency Software	Standard Software
Applicable Drive Models	All	All
Maximum Output Frequency	1000 Hz (1167) *<1>*	400 Hz
Carrier Frequency	Max: 7 kHz C6-02: 2, B, C, F	Max: 15 kHz C6-02: 1 ~ A, F
Drive Current Rating	Fixed at Heavy Duty (HD) ratings	Depends on C6-01
Drive Overload Rating	Fixed at 150%/1 min. (C6-01 fixed)	Depends on C6-01
Control Mode	Fixed at V/f (A1-02 fixed)	V/f, OLV, OLV for PM
DriveWorksEZ (DWEZ)	No	Available
Communication Option Kits	No	Available
Frequency Setting Resolution	Fixed at 0.1 Hz	0.01 Hz (less than 100 Hz) 0.1 Hz (above 10 Hz)
Frequency reference and output frequency display units. *<2>* *<3>*	o1-03 parameter (same as b5-20) 0: 0.1 Hz 1: 0.01 (Max frequency 100%) 2: Deleted 3: User Defined (o1-10 and o1-11)	o1-03 parameter (same as b5-20) 0: 0.1 Hz 1: 0.01 (Max frequency 100%) 2: RPM 3: User Defined (o1-10 and o1-11)
Torque Compensation	Enabled only at low speeds. ***Refer to New and Modified Software Functions on page 14***.	Constant throughout the entire frequency range.
On-Delay Compensation	Enabled only at low speeds. Addition of On-Delay Compensation Selection parameter S1-01 ***Refer to New and Modified Software Functions on page 14***.	Enabled throughout the entire frequency range.
Stall Prevention Level During Acceleration (L3-02)	Maximum setting: 170%	Maximum setting: 150%
Deleted Functions	• All OLV and OLV for PM specific parameters • All OLV and OLV for PM specific monitors • Estimation type Speed Search • High Slip Braking (HSB) • Auto-Tuning • KEB • Overexcitation Deceleration ***Refer to Modified Parameters on page 10***.	-

<1> In order to set the frequency reference above 1000 Hz, consult the Yaskawa Application Engineering group at (800-927-5292) for application review and procedures.
<2> MEMOBUS/Modbus frequency reference can be set by 0.1 Hz. For 1000 Hz reference, 10000 (2710Hex) must be set to 0002Hex MEMOBUS/Modbus register.
<3> Also applies to register data via MEMOBUS/Modbus RTU communication.

4 Modified Parameters

Table 2 Deleted Parameters from Standard Software

Parameter	Name
A1-06	Application Preset
b3-06	Output Current 1 during Speed Search (Estimation Type)
b3-10	Speed Search Detection Compensation Gain (Estimation Type)
b3-24	Speed Search Method Selection
b8-01 ~ b8-19	Energy Saving Control Parameters
C6-01	Normal/Heavy Duty Selection
E3-01	Motor 2 Control Method Selection
L2-06 ~ L2-11	KEB Parameters
L3-11	ov Suppression Function Selection
n3-01 ~ n3-23	High Slip Braking/Overexcitation Deceleration Parameters
T1-01 ~ T1-08	Motor Tuning Parameters

Table 3 Deleted Multi-function Digital Inputs (H1 Group)

Setting	Function
65	KEB Ride-thru 1 (N.C.)
66	KEB Ride-thru 1 (N.O.)
68	HSB (High Slip Braking)
7A	KEB Ride-thru 2 (N.C.)
7B	KEB Ride-thru 2 (N.O.)

Table 4 Deleted Multi-function Digital Outputs (H2 Group)

Setting	Function
4A	KEB Operation

Table 5 Modified Parameter Setting Ranges

Parameter	Name	Setting Range
A1-02	Control Method Selection	0
b4-01	Timer Function On-Delay Time	0.0 ~ 3000.0 s
b4-02	Timer Function Off-Delay Time	0.0 ~ 3000.0 s
b5-20	PID Setpoint Scaling	0, 1, 3
H6-01	Pulse Train Input Terminal RP Function Selection	0, 1, 2
L3-02	Stall Prevention Level during Acceleration	0 ~ 170%
L3-04	Stall Prevention Selection during Deceleration	0 ~ 3
o1-03	Digital Operator Display Selection	0, 1, 3

Table 6 Parameters with Modified Defaults

Parameter	Name	Setting Range	Default	Note
b2-04	DC Injection Braking Time at Stop	0.0 ~ 10.0	0.0 s	Previous default: 0.5
n1-01	Hunting Prevention Selection	0, 1	0 (off)	Previous default: 1 (on)

Table 7 New Parameter

Parameter	Name	Setting Range	Default	Note
S1-01	On-Delay Compensation Selection	0, 1	1	0: Disabled, 1: Enabled

Table 8 Parameters with Modified Upper Limits

Parameter	Name	Setting Range	Default
b5-19	PID Setpoint Value	0.0 ~ 1000.0	0.0 Hz
C1-11	Accel/Decel Time Switching Frequency	0.0 ~ 1000.0	0.0 Hz
d1-01	Frequency Reference 1	0.0 ~ 1000.0	0.0 Hz
d1-02	Frequency Reference 2	0.0 ~ 1000.0	0.0 Hz
d1-03	Frequency Reference 3	0.0 ~ 1000.0	0.0 Hz
d1-04	Frequency Reference 4	0.0 ~ 1000.0	0.0 Hz
d1-05	Frequency Reference 5	0.0 ~ 1000.0	0.0 Hz
d1-06	Frequency Reference 6	0.0 ~ 1000.0	0.0 Hz
d1-07	Frequency Reference 7	0.0 ~ 1000.0	0.0 Hz
d1-08	Frequency Reference 8	0.0 ~ 1000.0	0.0 Hz
d1-09	Frequency Reference 9	0.0 ~ 1000.0	0.0 Hz
d1-10	Frequency Reference 10	0.0 ~ 1000.0	0.0 Hz
d1-11	Frequency Reference 11	0.0 ~ 1000.0	0.0 Hz
d1-12	Frequency Reference 12	0.0 ~ 1000.0	0.0 Hz
d1-13	Frequency Reference 13	0.0 ~ 1000.0	0.0 Hz
d1-14	Frequency Reference 14	0.0 ~ 1000.0	0.0 Hz
d1-15	Frequency Reference 15	0.0 ~ 1000.0	0.0 Hz
d1-16	Frequency Reference 16	0.0 ~ 1000.0	0.0 Hz
d1-17	Jog Frequency Reference	0.0 ~ 1000.0	0.0 Hz
d3-01	Jump Frequency 1	0.0 ~ 1000.0	0.0 Hz
d3-02	Jump Frequency 2	0.0 ~ 1000.0	0.0 Hz
d3-03	Jump Frequency 3	0.0 ~ 1000.0	0.0 Hz
E1-04	Maximum Output Frequency	0.0 ~ 1000.0	60.0 Hz
E1-06	Base Frequency	0.0 ~ 1000.0	60.0 Hz
E1-07	Mid Output Frequency	0.0 ~ 1000.0	3.0 Hz
E1-09	Minimum Output Frequency	0.0 ~ 1000.0	1.5 Hz
E1-11	Mid Output Frequency 2	0.0 ~ 1000.0	0.0 Hz
E3-04	Motor 2 Maximum Output Frequency	0.0 ~ 1000.0	60.0 Hz
E3-06	Motor 2 Base Frequency	0.0 ~ 1000.0	60.0 Hz
E3-07	Motor 2 Mid Output Frequency	0.0 ~ 1000.0	3.0 Hz
E3-09	Motor 2 Minimum Output Frequency	0.0 ~ 1000.0	1.5 Hz
E3-11	Motor 2 Mid Output Frequency 2	0.0 ~ 1000.0	0.0 Hz
L4-01	Speed Agreement Detection Level	0.0 ~ 1000.0	0.0 Hz
L4-03	Speed Agreement Detection Level (+/-)	-999.9 ~ 999.9	0.0 Hz

Table 9 Modified Monitors

Parameter	Name	Setting Range
U1-01	Frequency Reference	0.0 ~ 1000.0 Hz
U1-02	Output Frequency	0.0 ~ 1000.0 Hz
U1-16	Output Frequency after Soft Start	0.0 ~ 1000.0 Hz
U2-03	Frequency Reference at Previous Fault	0.0 ~ 1000.0 Hz
U2-04	Output Frequency at Previous Fault	0.0 ~ 1000.0 Hz
U4-14	Peak Hold Output Frequency	0.0 ~ 1000.0 Hz

Table 10 Deleted Monitors

Parameter	Name
U1-05	Motor Speed
U1-09	Torque Reference

Table 11 MEMOBUS/Modbus Communication Data

Register	Name	Data
2H	Frequency Reference	Setting upper limit 40000 to FFFFH
3EH	Output Frequency RPM	Deleted

5 New and Modified Software Functions

◆ Carrier Frequency

- The carrier frequency upper limit changed from 15.0 kHz to 7.0 kHz and two new patterns were added. See *Figure 1*.
- The carrier frequency selection parameter (C6-02) has been modified according to *Table 12*.
- *Refer to Application Notes on page 16* for more information.

Table 12 Carrier Frequency Selection Parameter (C6-02) Settings

C6-02 Carrier Frequency Selection	C6-03 Carrier Frequency Upper Limit	C6-04 Carrier Frequency Lower Limit	C6-05 Carrier Frequency Proportional Gain	Note
2	5.0	5.0	0	Same as standard
B	7.0	1.0	12	New setting
C	7.0	1.0	8	New setting
F	2.0	2.0	0	Same as standard

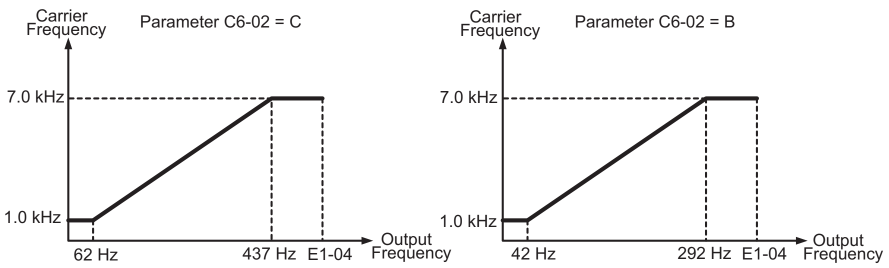


Figure 1 Additional Carrier Frequency Patterns

◆ Torque Compensation

High speed motors typically have very low impedance compared to standard 60/120 Hz motors. These high speed/low impedance motors saturate easily and may cause hunting and oscillation when a high V/f pattern is applied, especially at high frequencies. Therefore, Torque Compensation Gain (C4-01) is modified to limit voltage boost above 120 Hz and eliminate voltage boost above 160 Hz as shown in ***Figure 2***.

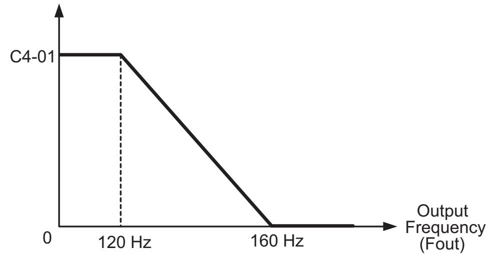


Figure 2 Torque Compensation Gain

◆ On-Delay Compensation

High speed motors typically operate at low V/f ratios compared to standard 60/120 Hz motors, and On-Delay Compensation settings may adversely affect the motor voltage and cause hunting and oscillation. Therefore, On-Delay Compensation Gain is modified to reduce its effectiveness above 120 Hz as shown in ***Figure 3***.

Note: When S1-01 = 0, On-Delay Compensation is disabled at all frequencies.

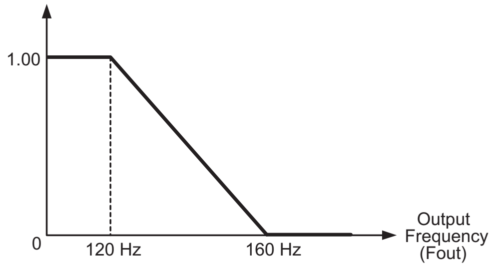


Figure 3 On-Delay Compensation Gain

6 Application Notes

◆ Using an Output Reactor

If drive **oL2** faults occur and a typical drive overload is not suspected, an output reactor or a larger drive may be required to eliminate oL2 faults. High-speed motors typically have very low impedance, which may result in excessive peak motor current, increased motor temperature, low speed cogging, or increased torque ripple.

It may be necessary to use an output reactor to add impedance to the system and reduce the peak ripple current and eliminate nuisance oL2 faults. To confirm that excessive peak current caused by low motor impedance is causing the oL2 fault, measure the output current using an oscilloscope or chart recorder with a clamp-on amp meter.

Generally, the peak of the motor current waveform should not exceed **100% continuous drive HD nameplate x 2.5**. This value may vary slightly by drive model. Refer to ***Figure 4*** for an example of peak current measurement.

When using a reactor to reduce peak current, consult with the reactor manufacturer to select a reactor that will smooth out the current waveform and also prevent a large voltage drop.

Proper reactor selection is critical in high speed applications because the reactor impedance is directly proportional to the output frequency, which is usually given at 60 Hz. Example; a reactor operating at 600 Hz will have 10 times the impedance and result in 10 times the voltage drop when compared to the same reactor operating at 60 Hz.

Using a larger capacity drive to allow for the additional peak current may also solve the oL2 overload trip problem. The decision to employ an output reactor or increase drive capacity is made on a case-by-case basis.

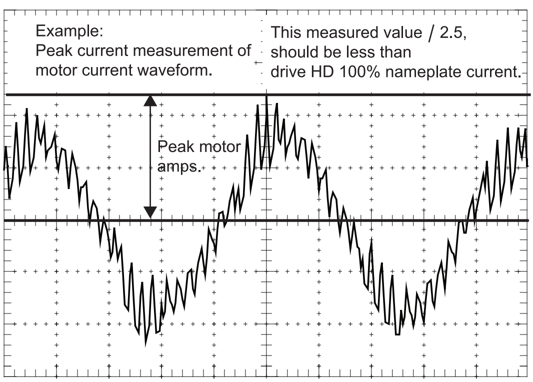


Figure 4 Measuring Peak Current

◆ Fine Tuning the Carrier Frequency

It is important to optimize the carrier frequency to improve the motor current waveform. This will improve motor speed stability and torque performance and also limit hunting and oscillation at higher speeds.

Use one of the following setting recommendations to fine tune the carrier frequency for optimum motor performance:

1. **For a flat 7.0 kHz across the speed range:** Set C6-02 = “F” with C6-03 = “7.0”, C6-04 = “7.0”, and C6-05 = “0”. The 7.0 kHz across the output frequency range keeps the carrier frequency as high as possible.
2. **To create a ramped carrier frequency pattern to keep the output frequency and carrier frequency at a constant ratio:**

- Set C6-02 = “F” to build a custom pattern.
- Set C6-03 = “7.0 kHz” so the motor will run at 7.0 kHz at top speed.
- Set C6-04 = “1.0 kHz” so the carrier frequency will be ramped for the greatest output frequency range.
- Solve the following formula for C6-05:

  C6-05 = [7000 Hz / (2 x E1-04)]

  The C6-05 setting range is 7 ~ 99, however a setting lower than 7 disables the ramp function and C6-03 is used across the output frequency range. For motors with output frequencies greater than 500 Hz, use C6-05 = 7.
- Solve for corner output frequencies A and B

  A Hz = [1000 Hz / (2 x C6-05)]
  B Hz = [7000 Hz / (2 x C6-05)]

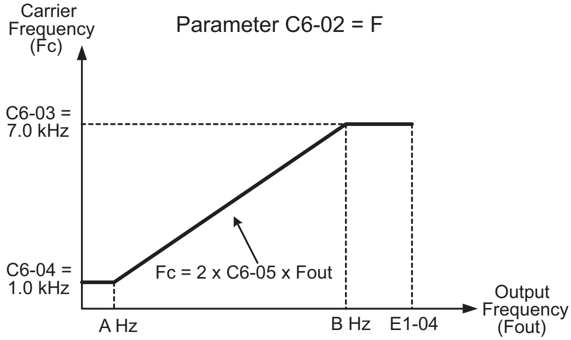


Figure 5 Carrier Frequency

◆ Precautions for High Frequency/Low Impedance Motors

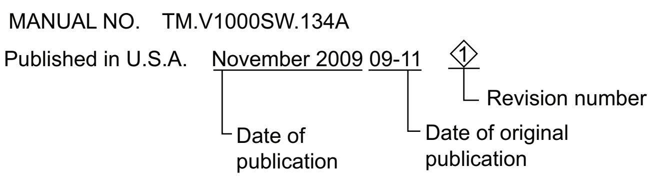
High frequency motors exhibit different characteristics than standard 60/120 Hz maximum frequency motors. The low impedance associated with these high frequency motors often requires manually programming a custom V/f pattern into the E1 parameter group to obtain proper performance and rated power from the drive-motor combination.

The low impedance may also cause excessive motor current. In addition to considering the use of an output reactor, it may be advantageous to oversize the drive to accommodate the high peak current that may result from the low impedance motor. Using a drive that is at least one or two models larger than the motor FLA may also help eliminate the oL2 faults.

Compatibility between the drive, motor, and the reactor is best accomplished via testing and observation of the motor current waveform with an oscilloscope. ***Refer to Using an Output Reactor on page 16***.

◆ Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.



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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 Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

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