



0.75KW~300KW 220V/440V Class

**Flux Vector Control Inverter**

# **ERIC-9001** Series

**CONSTANTS  
MANUAL**



**RICH**  
ELECTRIC

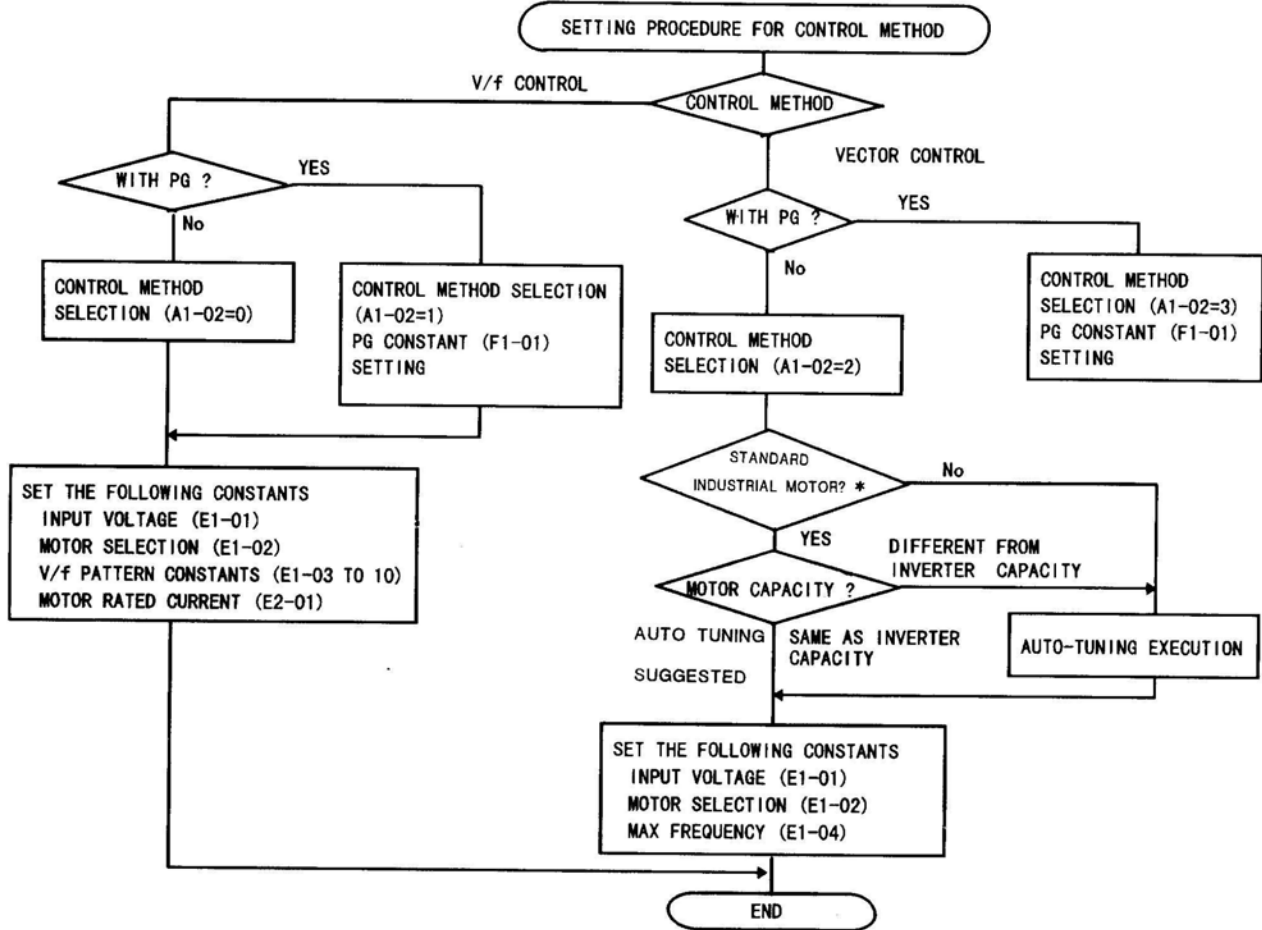
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# 1. CONTROL METHOD SELECTION

## 1.1 INTRODUCTION

The EI-9001 is provided with four control modes : open loop vector, flux vector, V/f control with PG feedback, and V/f control. The control method can be selected easily by using the operator according to the users' applications. The method is set to open loop vector prior to shipment. Set the control method and motor-related constants according to the following procedures before using the EI-9001.



## 1.2 FEATURES OF FOUR CONTROL METHODS

Control Method	V/f Control	V/f with PG feedback	Open Loop Vector	Flux Vector
Basic control	Voltage/frequency control (open loop)	Voltage/frequency control with speed compensation	Current vector control without PG	Current vector control
Speed detector	Not needed	Needed (pulse generator)	Not needed	Needed (pulse generator)
Speed detection option	Not needed	PG-A2, PG-D2	Not needed	PG-B2, PG-X2
Speed control range	1:40	1:40	1:100	1:1000
Starting torque	150%/3Hz	150%/3Hz	150%/1Hz	150%/0r/min
Speed control accuracy	±2~±3%	±0.03%	±0.2%	±0.02%
Torque limit	Not possible	Not possible	Possible	Possible
Torque control	Not possible	Not possible	Not possible	Possible
Noise reduction	Standard *	Standard *	Standard *	Standard *
Application	Multiple motor drives Replacement of existing motors whose motor constants are not known When auto-tuning is disabled	Application where pulse generator is provided to machine side	All range of variable speed applications	Simplified servo drives High-accuracy speed control Torque control

\* Some capacity models cannot be applied for noise reduction.

### 1.3 CHANGING CONTROL METHOD

(Example) The control method is changed from open loop vector to V/f control.

Description	Key Sequence	Digital Operator Display	Remarks
• Displaying frequency reference.		Frequency Ref U1-01=60.00Hz	
• Displays Operation.	MENU	**Main Menu** Operation	
• Displays Initialize.	↓ ↑	**Main Menu** Initialize	
• Select Initialize.	DATA/ENTER	Select Language English	When selecting Initialize, Select Language is displayed.
• Change the constant name. (Displays Control Method.)	↓ ↑	Control Method Open Loop Vector	
• By depressing DATA/ENTER key, Constant No. and set value are displayed.	DATA/ENTER	A1-02=02 Open Loop Vector	
• Change the control method. (Displays V/f Control.)	↓ ↑	A1-02=00 V/F Control	After displaying Entry Accepted for 0.5 second, returns to the control method display.
• Select V/f Control.	DATA/ENTER	Entry Accepted	
• Return to Operation.	MENU	**Main Menu** Operation	
• Select Operation to display frequency reference.	DATA/ENTER	Frequency Ref U1-01=60.00Hz	

### 1.4 SETTING PROCEDURE AT V/f CONTROL (A1-02=0, 1)

Set the motor related constants in the following procedure.

Order	Contents	Description
1	Input voltage setting	Set the inverter input voltage in constant E1-01 in units of 0.1V.
2	Motor selection	Set 00 (standard motor) or 01 (inverter motor) in constant E2-01.
3	V/f pattern selection	<p>Select V/f pattern.</p> <ul style="list-style-type: none"> <li>• At E1-03=0 to 0E, 15 preset V/f patterns can be selected. For each V/f pattern, refer to Par. 2.7, "V/f PATTERN".</li> <li>• At E1-03=0F, custom V/f patterns can be set in constants E1-04 to E1-10. The following shows the relation of E1-04 to E1-10.</li> </ul>
4	Motor rated current setting	<p>Set motor rated current in constant E2-01.</p> <p>Motor rated current setting unit is 0.01A for models of 7.5kW or below and 0.1A for models of 11kW or above.</p>

## 1.5 AUTO-TUNING PROCEDURE

Perform auto-tuning, referring to the following description.

### PRECAUTIONS

- ① Since the motor rotates automatically during auto-tuning, disconnect the motor from the machine system for safe operation.
- ② All control circuit terminal input signals are disregarded in the auto-tuning mode.
- ③ Since carrier frequency is changed to 2kHz during auto-tuning, motor noise may be increased.
- ④ Verify that the motor is stopped before starting tuning.

### [ Operation Procedure ]

Procedure	Description																
1 Verify safety	<ul style="list-style-type: none"> <li>▪ Is the motor disconnected from the machine system ?</li> <li>▪ Is the motor shaft key removed ?</li> <li>▪ Is there any person or object around the motor shaft ?</li> <li>▪ Is the brake released ? ( In case of motor with brake )</li> <li>▪ Are inspections or settings described in Pars. 4.2 and 4.3 of the instruction manual performed ?</li> </ul>																
2 Turn ON inverter power supply	<ul style="list-style-type: none"> <li>▪ Verify that no fault has occurred.</li> <li>▪ Verify the PG rotating direction ( when PG is provided ).</li> </ul>																
3 Select tuning mode	<ul style="list-style-type: none"> <li>▪ Depress MENU key and select „Main Menu„ / Operation. Then depress ▽ or △ key to display „Main Menu„ / Auto-Tuning.</li> </ul>																
4 Input tuning data	<ul style="list-style-type: none"> <li>▪ After depressing DATA / ENTER key, input the motor nameplate data.</li> </ul> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Data Name</th> <th style="width: 50%;">Input Value</th> </tr> </thead> <tbody> <tr> <td>Rated Voltage</td> <td>Set motor rated voltage [VAC]</td> </tr> <tr> <td>Rated Current</td> <td>Set motor rated current [A]</td> </tr> <tr> <td>Rated Frequency</td> <td>Set motor rated frequency [Hz]</td> </tr> <tr> <td>Rated Speed</td> <td>Set rated rotating speed [r/min] (with constant torque motor). Set base rotating speed [r/min] (with constant output motor).</td> </tr> <tr> <td>Number of Poles</td> <td>Set the number of motor poles.</td> </tr> <tr> <td>Select Motor 1/2</td> <td>1 : For driving the connected motor as the 1st motor 2 : For driving the connected motor as the 2nd motor.</td> </tr> <tr> <td>PG Pulses/Rev (Displayed only when control with PG is selected.)</td> <td>Set the number of pulse generator pulses [PPR]. Set 0 when tuning without PG.</td> </tr> </tbody> </table> <ol style="list-style-type: none"> <li>① Depress DATA/ENTER key to display Rated Voltage.</li> <li>② Change the set value by depressing ▽, △ or &gt; /Reset keys, and then depress DATA/ENTER key.</li> <li>③ Depress △ key to display Rated Current.</li> <li>④ To change the data, perform the same procedure as step ②.</li> <li>⑤ Input the data in Rated Frequency, Rated Speed, Number of Poles, Select Motor 1/2, PG Pulses/Rev, respectively.</li> </ol> <p style="text-align: center;">Note : PG pulse/Rev is not displayed when control without PG is selected.</p> <ol style="list-style-type: none"> <li>⑥ Depress △ key to display Tuning Ready ? / Press RUN Key. ( “Press RUN Key” is blinking. )</li> </ol>	Data Name	Input Value	Rated Voltage	Set motor rated voltage [VAC]	Rated Current	Set motor rated current [A]	Rated Frequency	Set motor rated frequency [Hz]	Rated Speed	Set rated rotating speed [r/min] (with constant torque motor). Set base rotating speed [r/min] (with constant output motor).	Number of Poles	Set the number of motor poles.	Select Motor 1/2	1 : For driving the connected motor as the 1st motor 2 : For driving the connected motor as the 2nd motor.	PG Pulses/Rev (Displayed only when control with PG is selected.)	Set the number of pulse generator pulses [PPR]. Set 0 when tuning without PG.
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5	Execute tuning	<ul style="list-style-type: none"> <li>• Verify the motor rotating direction by LED and change it by FWD/REV key when necessary. Depress RUN key to execute tuning. During tuning, "Tune Proceeding" (blinking) is displayed. After completing tuning, "Tune Successful" (blinking) is displayed. After the motor stops, "Tune Successful" is displayed.</li> </ul> <p>Note : By depressing STOP key during tuning, auto-tuning is interrupted and the motor coasts to stop. The data under tuning are returned to the data obtained before tuning.</p>
6	After Completion of Tuning	<ul style="list-style-type: none"> <li>• After completion or interruption of tuning, depress MENU key to return to the drive mode.</li> <li>• To perform tuning again, start from step 1.</li> </ul>

**[ FAULT DISPLAYS AND CORRECTIVE ACTIONS AT AUTO-TUNING ]**

The following are fault displays and corrective actions at auto-tuning. If any of the following faults are found, the digital operator displays the fault contents ; the motor coasts to stop if it is under operation. Fault contact output or minor fault contact output does not operate.

Fault Display	Contents	Description	Corrective Action
Data Invalid	Motor data fault	Motor data input tuning was not proper	<ul style="list-style-type: none"> <li>• Check the input data</li> <li>• Check the inverter and motor capacities</li> </ul>
Resistance	Line-to-line resistance fault	Tuning was not completed within the specified time	<ul style="list-style-type: none"> <li>• Check the input data</li> <li>• Check the motor wiring</li> </ul>
No-load Current	No-load current fault		
Saturation - 1	Iron core saturation coefficient 1 fault		
Saturation - 2	Iron core saturation coefficient 2 fault		
Rated Slip	Rated slip fault		
Accelerate	Acceleration fault	Motor did not accelerate in the specified time	<ul style="list-style-type: none"> <li>• Increase acceleration time (C1-01)</li> <li>• Increase torque limit values (L7-01, 02) if they are small values</li> <li>• When the motor is connected to the machine, separate them from each other</li> </ul>
PG Direction	Motor rotating direction fault	Inverter, PG (phases A and B) and motor (phases U, V and W) were not connected properly	<ul style="list-style-type: none"> <li>• Check the PG wiring</li> <li>• Check the motor wiring</li> </ul>
Motor speed	Motor speed fault	Torque reference became excessive (100%) at tuning	<ul style="list-style-type: none"> <li>• If the motor is connected to the machine, separate them from each other</li> <li>• Increase acceleration time (C1-01)</li> <li>• Check the input data, especially the number of PG pulses</li> </ul>
ALARM : Over Load (Displayed after completion of tuning)	Excessive tuning load	Torque reference exceeded 20% at tuning	<p>(For display at tuning with motor single-unit)</p> <ul style="list-style-type: none"> <li>• Check the input data, especially the number of PG pulses</li> </ul>

## 1.6 INITIALIZE MODE

As described below, the language displayed on the digital operator, the access level to set/read constants or constants or control method (V/f control, vector control) can be selected. Make sure to set this mode before using the EI-9001. The following table shows the main constants for initialize mode.

Constant No.	Digital Operator Display	Name	Description
A1-00	Select Language	Language selection (can be changed during run)	0 : English 1 : Japanese
A1-01	Access Level	Access level (can be changed during run)	0 : Exclusive for monitoring 1 : Constants for user selection (Constants to be set/read can be programmed by digital operator.) 2 : QUICK-START (Constants required for test run are set/read.) 3 : BASIC (Normally-used constants are set/read.) 4 : ADVANCED (All constants are set/read.)
A1-02	Control Method	Control method selection	0 : V/f control                      1 : V/f control with PG feedback 2 : Open loop vector                3 : Flux vector
A1-03	Init Parameters	Reset to factory defaults	1110 : Initialization of user setting 2220 : 2-wire initialization 3330 : 3-wire initialization
A1-04	Enter Password	Password 1	Input password 1
A1-05	Select Password	Password 2	Input password 2
A2-01 ~32	User Param 1 to 32	User select constants	Up to 32 constants required for the user can be selected. When A1-01=01 (user program) is selected, only constants specified by A2-01 to 32 can be selected. Set the constant Nos. you selected.

Note : When password 1 differs from password 2, A1-01 to A1-03 and A2-01 to 32 cannot be set (can be read only) and all constants belonging to the EI-9001 are locked in the status initialized by the user.

If you depress both >/RESET key and MENU key simultaneously, password 2 is displayed and it can be set/read.

### 1.6.1 Constant Access Level

Constants to be set/read by digital operator can be selected by setting constant A1-01 as shown below. A1-01=2 (QUICK-START) is preset at the factory.

A1-01	Name	Description
0	Exclusive for monitoring	Operation mode and initialize mode are enabled. Constants cannot be set/read by digital operator in programming mode or modified constants mode.
1	User selected constants	Up to 32 constants to be set/read by digital operator can be selected. When A1-01=01 is selected, constants specified by A2-01 to 32 can be set/read by digital operator. Set the constant Nos. in A2-01 to 32. When constant Nos. are not set in A2-01 to 32, user selected constants by A1-01 cannot be set/read.
2	QUICK-START	Constants required for quick-start operation are set/read. For details, refer to the access level list in Table 1.
3	BASIC	Basic constants are set/read. For details, refer to the access level list in Table 1.
4	Advanced	Advanced constants are set/read. For details, refer to the access level list in Table 1.



Table 1 Access Level List

Group No.	Group	Function No.	Function Name	Digital Operator Display	Access Level		
					Q	B	A
B	Application	B1	Operation mode selection	Sequence	○	○	○
		B2	DC injection braking	DC Braking		○	○
		B3	Speed search	Speed Search			○
		B4	Timer function	Delay Timers			○
		B5	PID control	PID Control			○
		B6	DWELL function	Reference Hold			○
		B7	DROOP function	Droop Control			○
		B8	Energy-saving control	Energy Saving			○
		B9	Zero servo	Zero Servo			○
C	Tuning	C1	Accel/decel time	Accel / Decel	○	○	○
		C2	S-curve characteristics	S-Curve Acc/Dec		○	○
		C3	Slip compensation	Motor-Slip Comp		○	○
		C4	Torque compensation	Torque Comp		○	○
		C5	ASR	ASR Tuning		○	○
		C6	Carrier frequency	Carrier Freq		○	○
		C7	Hunting prevention	Hunting Prev			○
		C8	Factory adjusted constant	Factory Tuning			○
D	Reference	D1	Frequency reference value	Preset Reference	○	○	○
		D2	Upper/lower limits	Reference Limits		○	○
		D3	Setting prohibiting frequency	Jump Frequencies		○	○
		D4	Sequence	Sequence			○
		D5	Torque reference	Torque Control			○
E	Motor	E1	V/f characteristics	V/F Pattern	○	○	○
		E2	Motor constants	Motor Setup	○	○	○
		E3	Motor 2 control method	Motor 2 Ctl Method			○
		E4	V/f characteristics 2	V/F Pattern 2			○
		E5	Motor 2 constants	Motor 2 Setup			○
F	Options	F1	PG speed control card	PG Option Setup	○	○	○
		F2	Analog reference card	A1-14 Setup		○	○
		F3	Digital input card	DI-08, 16 Setup		○	○
		F4	Analog monitor card	A0-08, 12 Setup		○	○
		F5	Digital output card	DO-02 Setup		○	○
		F6	Digital output card	DO-08 Setup		○	○
		F7	Pulse monitor card	PO-36F Setup		○	○
H	Terminal	H1	Sequence input	Digital Inputs		○	○
		H2	Sequence output	Digital Outputs		○	○
		H3	Analog input	Analog Inputs		○	○
		H4	Analog output	Analog Outputs		○	○
		H5	MODBUS communication (RS-485)	Serial Com Setup			○
L	Protection	L1	Motor electronic overload thermal	Motor Overload		○	○
		L2	Momentary power loss ride-through	PwrLoss Ride-thru		○	○
		L3	Stall prevention	Stall Prevention		○	○
		L4	Frequency detection	Ref Detection		○	○
		L5	Fault retry	Fault Restart		○	○
		L6	Overtorque detection	Torque Detection		○	○
		L7	Torque limit	Torque Limit		○	○
		L8	Hardware protection	Hdwe Protection		○	○
O	Operator	O1	Selection of display	Monitor Select		○	○
		O2	Operation (key functions)	Key Selections		○	○

## 1.6.2 Constant Initialization

To return the inverter constants to the factory settings or to replace the control circuit boards, initialize the constants after setting language selection (A1-00), control method selection (A1-02), or kVA selection (O2-04). The contents of initialization differ as shown below, depending on the set values.

A1-03	Name	Description
1110	User Initialize	<ul style="list-style-type: none"> <li>Returns to the initial value of user setting.</li> <li>By setting O2-03=1, constants stored in the inverter are stored as user setting initial values.</li> <li>Up to 50 constants can be stored in the inverter as user setting initial values. When the constants are not stored as user setting initial values, this initialization is not possible.</li> </ul>
2220	2-Wire Initialize	Terminal 1 becomes FWD run command and terminal 2 becomes REV run command.
3330	3-Wire Initialize	Terminal 1 becomes run command, terminal 2 becomes stop command and terminal 3 becomes FWD/REV run selection.

○ The following shows typical operation to initialize to English display and open loop vector control.

Description	Key Sequence	Digital Operator Display	Remarks
• Displaying frequency reference		Frequency Ref U1-01=60.00Hz	
• Displays Main Menu	MENU	**Main Menu** Operation	
• Displays Initialize	↓ ↑	**Main Menu** Initialize	
• Select Initialize	DATA/ENTER	Select Language English	• When selecting Initialize, Select Language is displayed.
• Displays Control Method	↓ ↑	Control Method Open Loop Vector	• To change control method, depress ENTER key and then ↑ key to select control method.
• Displays Initialize Selection	↓ ↑	Initialize No Initialize	
• Depress DATA/ENTER key	DATA/ENTER	A1-03=0 * No Initialize	
• Displays 2-Wire Initialize	↓ ↑	A1-03=2220 * 2-Wire Initial	
• Perform initialization	DATA/ENTER	Entry Accepted	After displaying Entry Accepted for 1.5 seconds, returns to display of Initialize Selection.
• Return to Operation	MENU	**Main Menu** Operation	
• Select Operation to display frequency reference	DATA/ENTER	Frequency Ref U1-01=60.00Hz	

## 2. CONSTANT LIST

### 2.1 CONSTANTS ARRAY OF DIGITAL OPERATOR DISPLAY FUNCTIONS

