

Chapter 4 RUNNING THE MOTOR

4.1 Running the Motor for a Test

4.1.1 Inspection and preparation prior to powering on

Check the following prior to starting powering on.

- (1) Check if connection is correct.

Especially check if the power wires are connected to the inverter input terminals L1/R, L2/S and L3/T, and output terminals U, V and W respectively and that the grounding wires are connected to the ground electrodes correctly. Note that FRENIC-Eco series inverter is designed for three phase input and driving three phase motors.

⚠ WARNING

- Do not connect power supply wires to the inverter output terminals U, V, and W. Otherwise, the inverter may be broken if you turn the power ON.
- Be sure to connect the grounding wires of the inverter and the motor to the ground electrodes.

Otherwise, electric shock may occur.

- (2) Check for short circuits between terminals and exposed live parts and ground faults.
- (3) Check for loose terminals, connectors and screws.
- (4) Check if the motor is separated from mechanical equipment.
- (5) Turn the switches OFF so that the inverter does not start or operate erroneously at power-on.
- (6) Check if safety measures are taken against runaway of the system, e.g., a defense to protect people from unexpectedly approaching your power system.

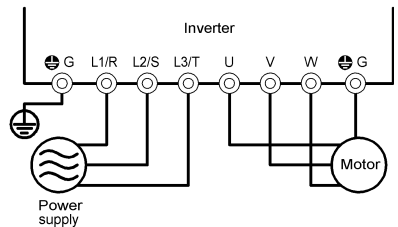


Figure 4.1 Connection of Main Circuit Terminals

4.1.2 Turning ON power and checking

⚠ WARNING

- Be sure to install the covers for both the main circuit terminal block, control circuit terminal block and the front cover if any before turning the power ON. Do not remove any cover while powering on.
- Do not operate switches with wet hands.

Otherwise electric shock could occur.

Turn the power ON and check the following points. This is a case when no function code data is changed from the factory setting.

- (1) Check if the LED monitor displays 0.00 (means that the frequency command is 0 Hz) that is blinking. (See Figure 4.2.)
If the LED monitor displays numbers except 0.00 then press \triangle / ∇ keys to set 0.00 as the frequency command.
- (2) Check if a built-in cooling fan rotates.
(When only the auxiliary power is fed while the main power is turned OFF, the cooling fan does not rotate. For the inverter of 1HP for 208V, 2HP for 460V or below no cooling fan is mounted.)



Figure 4.2 Display of the LED Monitor after Power-on

4.1.3 Preparation before running the motor for a test--Setting function code data

Before starting running the motor, set function code data specified in Table 4.1 to the motor ratings and your system design values. For the motor, check the rated values printed on the nameplate of the motor. For your system design values, ask system designers about them.


-  For details about how to change function code data, refer to Chapter 3, Section 3.4.2 "Setting up function codes quickly using Quick setup." Refer to the function code H03 in Chapter 5 "FUNCTION CODES" for the factory default setting of motor parameters. If any of them is different from the default setting, change the function code data.

Table 4.1 Settings of Function Code Data before Driving the Motor for a Test

Function code	Name	Function code data	Factory setting
F 04	Base frequency	Motor ratings (printed on the nameplate of the motor)	60.0 (Hz)
F 05	Rated voltage (at base frequency)		230 (V) ----- 460 (V)
P 02	Motor parameter (Rated capacity)		Applicable motor rated capacity
P 03	Motor parameter (Rated current)		Rated current of applicable motor
P 99	Motor Selection		0: Characteristic of motor, 0 (Fuji standard 8-series motors)
F 03	Maximum frequency	System design values * For a test-driving of the motor, increase values so that they are longer than your system design values. If the set time is short, the inverter may not start running the motor.	60.0 (Hz)
F 07	Acceleration time 1*		20.0 (s)
F 08	Deceleration time 1*		20.0 (s)

Tip In any of the following cases, the default settings may not produce the best results for auto torque boost, torque calculation monitoring, or auto energy saving, since the standard settings of motor parameters for Fuji motors are not applicable. Tune the motor parameters according to the procedure set forth below.

- The motor to be driven is not a Fuji product or is a non-standard product.
- The cabling between the motor and the inverter is long.
- A reactor is inserted between the motor and the inverter.

<Tuning procedure>

1) Preparation

Referring to the rating plate on the motor, set the following function codes to their nominal ratings:

- F04: Base frequency
- F05: Rated voltage (at Base frequency)
- P02: Rated capacity
- P03: Rated current

2) Selection of Tuning Process

Check the situation of the machine system and choose between "Tuning while the motor is stopped (P04 = 1)" and "Tuning while the motor is running (P04 = 2)." In the case of "Tuning while the motor is running (P04 = 2)," also adjust the acceleration and deceleration times (F07 and F08) and set the rotation direction properly so that it matches the actual rotation direction of the machine system.


Data for P04	Motor parameters subject to Tuning:	Action	Choose the process when:
1	Primary resistance (%R1) Leakage reactance (%X)	Measure %R1 and %X while the motor is stopped.	The motor cannot be rotated, or more than 50% of the rated load would be applied on the motor if rotated.
2	Primary resistance (%R1) Leakage reactance (%X) No-load current	Measure %R1 and %X while the motor is stopped, and later no-load current while the motor is running. (At 50% of the Base frequency).	Even if the motor is rotated, it is safe and the load applied on the motor would be no more than 50% of the rating. (If you do the tuning with no load, you will get the highest precision.)

Upon completion of the tuning, the primary resistance %R1 will be automatically saved into P07, the leakage reactance %X into P08, and the no-load current into P06.

3) Preparation of Machine System

Perform appropriate preparations on the motor and its load, such as disengaging the coupling and deactivating the safety device.

4) Perform tuning

- ① Set function code P04 to "1" or "2" and press the  key. (The blinking of f or ω^2 on the LED monitor will slow down.)
- ② Enter a Run command for the rotation direction you have chosen. To switch to reverse rotation, change the setting of function code F02.
- ③ The display of f or ω^2 stays lit, and tuning takes place while the motor is stopped. (Maximum tuning time: approximately 40 (s).)
- ④ If the function code P04 = 2, the motor is accelerated to approximately 50% of the base frequency and then tuning takes place. Upon completion of measurements, the motor will coast-to-stop. (Estimated tuning time: Acceleration time + 10 (s) + Deceleration time)
- ⑤ If the terminal signal (FWD) or (REV) is selected as the Run command (F02 = 1), $E-7$ will appear upon completion of the measurements.
- ⑥ The Run command is turned OFF and the tuning completes, with the next function code $P05$ displayed on the keypad (the Run command given through the keypad or the communications link is automatically turned OFF).


■ Errors during tuning

Improper tuning would negatively affect the operation performance and, in the worst case, could even cause hunting or deteriorate precision. Therefore, if the inverter finds any abnormality in the results of the tuning or any error in the process of the tuning, it will display $E-7$ and discard the tuning data.

Listed below are the abnormal or error conditions that can be recognized during tuning.

Abnormal/error condition	Description
Abnormal result of tuning	An inter-phase imbalance has been detected; Tuning has resulted in an abnormally high or low value of a parameter.
Abnormal output current	An abnormally high current has been caused during tuning.
Sequence error	During tuning, the Run command has been turned OFF, or forced STOP, coast-to-stop command (BX), dew condensation protection (DWP), or a similar abnormal command has been received.
Limitation exceeded	During tuning, a certain limitation has been reached or exceeded; The maximum output frequency or the peak limiter for output frequency has been reached or exceeded.
Other alarm condition	An undervoltage or an alarm has been occurred.

If any of these conditions has occurred, either eliminate the abnormal or error factor(s) and perform tuning again, or contact your Fuji Electric representative.

 **Note** If a filter other than Fuji optional output filter (OFL-□□□-4A) is connected to the inverter's output (secondary) circuit, the result of tuning can be unpredictable. When you replace an inverter, take note of the old inverter's settings for the primary resistance %R1, the leakage reactance %X, and the no-load current, and set those values to the new inverter's function codes.

4.1.4 Test run

WARNING






If the user set the function codes wrongly or without completely understanding this Instruction Manual and the FRENIC-Eco User's Manual, the motor may rotate with a torque or at a speed not permitted for the machine.
Accident or injury may result.

Follow the descriptions of the previous Section 4.1.1, "Inspection and preparation prior to powering on" to Section 4.1.3, "Preparation before running the motor for a test," and begin test-driving of the motor.

CAUTION




If any abnormality is found to the inverter or motor, immediately stop operation and determine the cause referring to Chapter 6, "TROUBLESHOOTING."

----- Procedure for Test Run -----

- (1) Turn the power ON and check that the LED monitor blinks while indicating the  Hz frequency.
- (2) Set the frequency to a low frequency such as 5 Hz, using  /  keys. (Check that frequency command blinks on the LED monitor.)
- (3) Press the  key to start running the motor in the forward direction. (Check that the frequency command is displayed on the LED monitor correctly.)
- (4) To stop the motor, press the  key.


<Check the following points>

- Check if the direction of rotation is forward.
- Check for smooth rotation without motor humming or excessive vibration.
- Check for smooth acceleration and deceleration.

When no abnormality is found, press the  key again to start driving the motor, and increase the frequency command using  /  keys. Check the above points for the test-driving of the motor.

4.2 Operation

After confirming ordinary operation by performing a test run, make mechanical connections (connections of the machine system) and electrical connections (wiring and cabling), and set the necessary parameters properly before starting a production run.

 Depending on the conditions of the production run, further adjustments can be required, such as adjustments of torque boost (F09), acceleration time (F07), and deceleration time (F08). Make sure to set relevant function codes properly.