

## 6.14 Setting motor constants

- F400**: Auto-tuning
- F401**: Slip frequency gain
- F402**: Automatic torque boost value
- F405**: Motor rated capacity
- F415**: Motor rated current
- F416**: Motor no-load current
- F417**: Motor rated speed
- F459**: Load moment of inertia ratio

To use vector control, automatic torque boost and automatic energy saving, motor constant setting (motor tuning) is required. The following three methods are available to set motor constants.

- 1) Using the torque boost setting macro function (**RU2**) for setting the V/F control mode selection (**Pt**) and auto-tuning (**F400**) at the same time
- 2) Setting V/F control mode selection (**Pt**) and auto-tuning (**F400**) independently
- 3) Combining the V/F control mode selection (**Pt**) and manual tuning

**Caution:**

If the settings for V/F control mode selections **Pt** are **2**: automatic torque boost control, **3**: vector control, **4**: energy saving.

Look at the motor's name plate and set the following parameters.

- uL**: Base frequency 1 (rated frequency)
- uLv**: Base frequency voltage 1 (rated voltage)
- F405**: Motor rated capacity
- F415**: Motor rated current
- F417**: Motor rated speed

Set the other motor constants as necessary.

[Selection 1: Setting by parameter setting macro torque boost]

This is the easiest of the available methods. It conducts vector control and auto-tuning at the same time. Be sure to set the motor for  $\omega L$ ,  $\omega L \omega$ ,  $F405$ ,  $F415$ ,  $F417$ .

Set  $AV2$  to 1  
(Automatic torque boost + auto-tuning)

Set  $AV2$  to 2  
(Vector control + auto-tuning).

Set  $AV2$  to 3  
(Energy-saving + auto-tuning)

See Section 5.4 for details of the setting method.

[Selection 2: Setting vector control and auto-tuning independently]

Set vector control, automatic torque boost, and energy saving and auto-tuning individually. After setting  $P4$  (V/F control mode selection), auto-tuning occurs.

Set the auto-tuning parameter  $F400$  to 2  
(Auto-tuning enabled)

[Parameter setting]

Title	Function	Adjustment range	Default setting
$F400$	Auto-tuning	0: Auto-tuning disabled (use of internal parameters) 1: Initialization of $F402$ (reset to 0) 2: Auto-tuning executed (after execution: 0)	0

Set  $F400$  to 2 to before the start of operation. Tuning is performed at the start of the motor.

☆ Precautions on auto-tuning

- (1) Conduct auto-tuning only after the motor has been connected and operation completely stopped. If auto-tuning is conducted immediately after operation stops, the presence of a residual voltage may result in abnormal tuning.
- (2) Voltage is applied to the motor during tuning even though it barely rotates. During tuning, "E t n !" is displayed on the operation panel.
- (3) Tuning is performed when the motor starts for the first time after  $F400$  is set to 2. Tuning is usually completed within three seconds. If it is aborted, the motor will trip with the display of  $E t n !$  and no constants will be set for that motor.
- (4) High-speed motors, high-slip motors or other special motors cannot be auto-tuned. For these motors, perform manual tuning using Selection 3 described below.
- (5) Provide cranes and hoists with sufficient circuit protection such as mechanical braking. Without sufficient circuit protection, the resulting insufficient motor torque during tuning could create a risk of machine stalling/falling.
- (6) If auto-tuning is impossible or an "E t n !" auto-tuning error is displayed, perform manual tuning with Selection 3.

[Selection 3: Setting vector control and manual tuning independently]

If an "E L n I" tuning error is displayed during auto-tuning or when vector control characteristics are to be improved, set independent motor constants.

Title	Function	Adjustment range	Default setting
<i>F401</i>	Slip frequency gain	0-150 (%)	50
<i>F402</i>	Automatic torque boost value	0.0-30.0 (%)	Depends on the capacity (See 11.4)
<i>F405</i>	Motor's rated capacity	0.01-5.50 (kW)	
<i>F415</i>	Motor rated current	0.1-30.0 (A)	
<i>F416</i>	Motor no-load current	10-90 (%)	
<i>F417</i>	Motor rated rotational speed	100-32000 (min <sup>-1</sup> )	*1
<i>F459</i>	Load moment of inertia ratio	0.1-100.0 (times)	1.0
<i>ELnI</i>	Motor electronic thermal protection level 1	10-100 (%) / (A)	100

\*1: Depends upon the setup menu settings.

Setting procedure Adjust the following parameters:

- F401*: Set the compensation gain for the slipping of the motor. A higher slip frequency reduces motor slipping correspondingly. After setting *F417*, set *F401* to adjust in detail. Be careful as inputting a value larger than necessary causes hunting and other unstable operation.
- F402*: Adjust the primary resistive component of the motor. Decreases in torque due to a possible voltage drop during low-speed operation can be suppressed by setting a large value in this parameter. Be careful as setting a value larger than necessary may lead to an increased current causing a trip at low speeds. (Perform adjustments according to the actual operation.)
- F405*: Set the the motor's rated capacity according to the motor's name plate or test report.
- F415*: Set the rated current of the motor. For the rated current, see the motor's nameplate or test report.
- F416*: Set the ratio of the no-load current of the motor to the rated current. Enter the value in % that is obtained by dividing the no-load current specified in the motor's test report by the rated current. Increasing this value increases the excitation current.
- F417*: Set the rated rotational speed of the motor. For the rated current, see the motor's nameplate or test report.

★ Adjustment method for the moment of inertia of the load

- F459*: Adjusts the excess response speed. A larger value gives a smaller overshoot at the acceleration/deceleration completion point. In the default settings, the moment of inertia of the load (including the motor shaft) value is optimally set considering a motor shaft of 1x. When the moment of inertia of the load is not 1x, set a value that matches that actual moment of inertia of the load.
- tHr* : If the rated capacity of the motor is one size smaller than that of the inverter, lower the thermal protective level according to the rated current of the motor.
- \* Sensorless vector control may not operate properly if the motor capacity differs from the applicable rated capacity of the inverter by more than two grades.

Caution:

If a combination of the inverter rating and the motor capacity is different for more than 2 items, vector control may not operate correctly.

Note 1: *F412*, *F458*, *F460*, *F461*, *F462*, *F467*, *F480*, *F485*, and *F495* (Motor specific coefficient 1-9) are parameters for manufacturer settings. Do not change the parameters.