

Frequenzumrichter Typ

ER321

Synchronmotorsteuerung

Sprache: englisch



BLEMO® Frequenzumrichter

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Permanent Magnet Motor Control Law ([PM Control] (P))

Drive may be set to control synchronous motor. When [PM control] is activated, motor parameters are set to new default value. You can access to additional settings to optimize the motor control.

Motor parameters setting.

These motor parameters below are needed to set:

1 - Set (PE) [Mot cont. mode sel.] to [PM Control] (B) see page 82.

2 - Set [Motor rated freq.] (UL), see page 74:

Note: Motor rated freq.] (UL) = [Motor rated speed] (F417) / (60 / np)

[Motor rated speed] (F417), see page 74, indicated on the motor nameplate or follow the procedure step 4 above.

np = Number of pole pairs, indicated on the motor nameplate.

3 - Set the Motor rated power (unit is kW) by [Motor rated cap.] (F405), see page 82

Note: $P = C \times \omega$

P = Power in W

C = N.m, indicated on the motor nameplate.

$\omega = \text{rad s}^{-1}$

$\omega = 2\pi \times (\text{FRS}/\text{np})$

FRS = [Motor rated freq.] (UL) see page 74, indicated on the motor nameplate.

np = Number of pole pairs, indicated on the motor nameplate.

4 - Motor rated current (unit is A) is set by [Motor rated current] (F415), see page 74.

5 - Set [Motor rated speed] (F417), see page 74, without information:

Set the motor rated speed by $\text{FRS} \times (60 / \text{np})$

FRS = [Motor rated freq.] (UL) see page 74, indicated on the motor nameplate.

np = Number of pole pairs, indicated on the motor nameplate.

6 - Configure [Auto-tuning drive] (F400) to [Tun Static 2] (5), see page 83. Make the TUN (Run order is needed to start the TUN.)

- Motor's rated voltage is set by [Motor Rated Voltage] (ULU)^a, see page 82.

- Stator resistance is set by [Auto Torque Boost] (F402)^a, see page 84.

- Axis "q" stator inductance in mH is set by [Autotune L q-axis] (F912)^a, see page 85.

- Axis "d" stator inductance in mH is set by [Autotune L d-axis] (F913)^a, see page 85.

7 - Check the value of [Saliency Level] (F936), see page 84.

8 - Set [PM mode selection] (F915) according to the [Saliency Level] (F936) value (see page 84).

9 - If (F936) is ≥ 0.2 , increase [Init. Pos. Current] (F921) see page 85.

Configure [Auto-tuning drive] (F400) to [Tun Static 2] (5), see page 83. Make the TUN (Run order is needed to start the TUN.)

10 - Start the motor,

- if there is current limitation on starting, increase the [PM Align cur. Level] (F916) value (See page 85).

- if its behavior is not optimal, reduce by 20% [Motor Rated Voltage] (ULU) value (see page 82).

- After this procedure, if you need further assistance, contact your BLEMO Product Support.

(a) Auto Torque Boost] (F402), [Autotune L q-axis] (F912), [Autotune L d-axis] (F913), and [Motor Rated Voltage] (ULU) may be defined automatically after activation of [Auto-tuning drive] (F400) = [Tun Dyn. 2] (3) or [Tun Static 2] (5)

Code	Name / Description	Adjustment range	Factory setting
Pt	[Mot cont. mode sel.] Motor control mode selection If [Driving Scroll] (F324) page 160 is set to [yes] (1) the setting is replaced by [SVC] (3)	-	1
0	[Constant V/Hz]: Constant V/Hz		
1	[Variable Torque]: Variable torque		
2	[Cst V/Hz+Boost]: Constant V/Hz with automatic torque boost		
3	[SVC]: Sensorless vector control		
4	[Economy]: Energy saving		
5	[Do not use]: Reserved		
6	[PM Control]: Permanent Magnet Motor Control Law		
⚠ ⚠ DANGER			
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH If [Mot cont. mode sel.] (Pt) is set to (6) (Permanent Magnet Motor Control Law), output phase loss monitoring, while the motor is running, is disabled. Phase loss and, by implication, accidental disconnection of cables, are not detected. Verify that this behavior does not result in unsafe conditions and implement alternative monitoring function if required. Failure to follow these instructions will result in death or serious injury.			
uLv	[Motor Rated Voltage] Set parameter uLv (vLv) to the motor's rated voltage as indicated on the motor nameplate. ER321.../3...: 50...330 V. ER321.../4...: 50...660 V. Note: Drive output voltage cannot be set to exceed the input line voltage level. uLv (vLv) may be defined automatically after activation of F400 = [Tun Dyn. 2] (3) or [Tun Static. 2] (5) if [Mot cont. mode sel.] (Pt) = (5)	According to drive rating (1)	According to drive rating (1)
uL	[Motor rated freq.] Set parameter uL (vL) to the motor's rated frequency as indicated on the motor nameplate. Note: It is possible to set the drive's various motor control frequencies to 50 Hz by setting [Parameter reset] (L 9P) to 1, the 50 Hz reset. For more information, see page 66.	25.0 to 400 Hz	50.0 Hz
F405	[Motor rated cap.] Motor rated capacity Set parameter F405 to the motor rated capacity in kilowatt. It permits to calculate automatically [Motor Rated Voltage] (uLv) after TUN F400 [Auto-tuning drive]	0.01 to 75 kW	According to drive rating (1)
F415	[Motor rated current] Set parameter F415 to the motor rated current in amperes as indicated on the motor's nameplate.	0.1 to 200.0 A	According to drive rating (1)
F417	[Motor rated speed] Motor rated speed Set parameter F417 to the motor rated speed in rpm as indicated on the motor's nameplate.	100.0 to 15000 rpm	According to drive rating (1)

(1) See table page 199.

F 400	[Auto-tuning drive]	-	0
⚠ ⚠ DANGER			
<p>HAZARD OF ELECTRIC SHOCK OR ARC FLASH</p> <ul style="list-style-type: none"> • During auto-tuning, the motor operates at rated current. • Do not service the motor during auto-tuning. <p>Failure to follow these instructions will result in death or serious injury.</p>			
⚠ WARNING			
<p>LOSS OF CONTROL</p> <ul style="list-style-type: none"> • It is essential that the following parameters uL₀, uL, F 415 and F 417 are correctly configured before starting auto-tuning. • When one or more of these parameters have been changed after auto-tuning has been performed, F 400 will return 0 and the procedure will have to be repeated. <p>Failure to follow these instructions can result in death or serious injury.</p>			
NOTICE			
<p>RISK OF DAMAGE TO THE MOTOR</p> <ul style="list-style-type: none"> • 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. <p>Failure to follow these instructions can result in equipment damage.</p>			
0	Auto tuning enable [Disabled]		
1	<p>[Initialize constant]: Factory setting of [Auto Torque Boost] (F 402) for asynchronous motor. Factory setting of [Auto Torque Boost] (F 402), [Autotune L q-axis] (F 9 12), and [Autotune L d-axis] (F 9 13), and [Motor Rated Voltage] (vlv) for synchronous motor.</p>		
2	<p>[Tun Dyn. 1]: Tune Dynamic, with driving run after the tuning. Application settings of [Auto Torque Boost] (F 402) for asynchronous motor. Application settings of [Auto Torque Boost] (F 402), [Autotune L q-axis] (F 9 12), and [Autotune L d-axis] (F 9 13) for synchronous motor.</p>		
3	<p>[Tun Dyn. 2]: Complete tune Dynamic, with driving run after the tuning. Application settings of [Auto Torque Boost] (F 402), [Autotune L q-axis] (F 9 12), [Autotune L d-axis] (F 9 13), and [Motor Rated Voltage] (vlv) for synchronous motor.</p>		
4	<p>[Tun Static 1]: Tune Static, without driving run after the tuning. Application settings of [Auto Torque Boost] (F 402) for asynchronous motor. Application settings of [Auto Torque Boost] (F 402), [Autotune L q-axis] (F 9 12), and [Autotune L d-axis] (F 9 13) for synchronous motor.</p>		
5	<p>[Tun Static 2]: Complete tune Static, without driving run after the tuning. Application settings of [Auto Torque Boost] (F 402), [Autotune L q-axis] (F 9 12), and [Autotune L d-axis] (F 9 13), and [Motor Rated Voltage] (vlv) for synchronous motor.</p>		
Parameter F 400 is reset to "0" after the auto tuning is performed.			
F 458	[Current loop gain]	Current loop gain	0...100 Hz 0 Hz
<p>Parameter F 458 is set to the response gain of current loop. If [Mot cont. mode sel.] (Pt) page 82 is set to [PM control] (6) the setting is replaced by 25 Hz.</p>			
<p>Note: Contact BLEMO product support to confirm the modification of this parameter.</p>			

(1) See table page **199**.

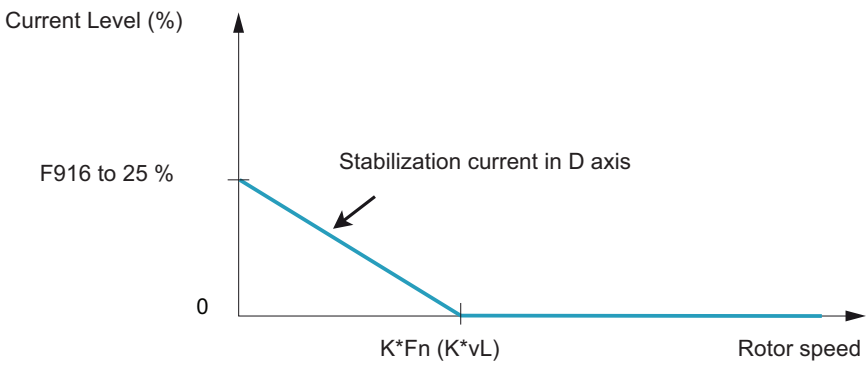
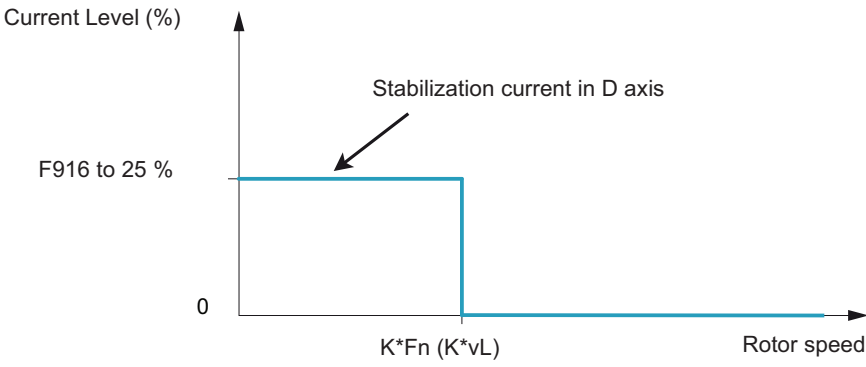
F 4 1 8	[Frequency loop gain]		1 to 150	40
<p>Parameters F 4 1 8 and [Freq. loop stability] (F 4 1 9) reduce the speed of the drive's response to a change in speed command. The factory setting of these two parameters assumes that the inertia of the load is three times as large as that of the motor shaft. Adjust these two parameters if the factory setting is not appropriate for the application.</p> <p>Note: It is possible for the drive's output frequency to exceed its upper limit (parameter [Max frequency] (F H)) if the acceleration parameter (A C C or F 5 0 7) is set to its minimum value.</p> <p>Increasing the setting of parameter F 4 1 8 reduces the drive's response time to changes in the speed reference.</p>				
F 4 1 9	[Freq. loop stability]	Frequency loop stability	1 to 100	20
<p>Increasing the setting of parameter F 4 1 9 further reduces the drive's response to changes in the speed reference.</p>				
F 4 9 5	[Motor voltage coef.]	Maximum voltage adjustment coefficient	90 to 120%	104%
<p>Use parameter F 4 9 5 to limit the drive's maximum output voltage. Increasing this setting increases torque when the motor is operated above its rated frequency, but may also cause motor vibration. Do not increase the value of F 4 9 5 if motor vibrations occur.</p>				
F 9 3 6	[Saliency Level]	Saliency coefficient for PM motor	0 to 2.55	0
<p>PM type [PM mode selection] (F 9 1 5) is selected by the saliency level [Saliency Level] (F 9 3 6)</p> <p>F 9 3 6 ≥ 0.2 = high saliency F 9 3 6 < 0.2 = low saliency.</p> <p>Note: This parameter is automatically computed with the setting of [Autotune L q-axis] (F912) and [Autotune L d-axis] (F913)</p>				
F 9 1 5	[PM mode selection]	PM control mode selection	-	3
0	[Basic Ctrl]: basic control			
1	[Ctrl Type1]: control type 1 (for IPM, interior-buried Permanent Magnet motor)			
2	[Ctrl Type2]: control type 2 (for IPM, interior-buried Permanent Magnet motor)			
3	[Ctrl Type3]: control type 3 (for IPM / SPM, interior-buried Permanent Magnet motor / Surface-mounted Permanent Magnet motor)			
4	[Ctrl Type4]: control type 4 (for IPM / SPM, interior-buried Permanent Magnet motor / Surface-mounted Permanent Magnet motor)			

Refer to the following tables to select the setting of the parameter **F 9 1 5**, **F 9 1 5** is selected by the saliency level **F 9 3 6**

	- big starting torque is needed. - for constant torque application.(1)	- big starting torque is not needed. - for variable torque application (2)	- big starting torque is not needed - for variable torque application - motor electrical magnetic noise is forbidden (3)
The saliency level is high (F 9 3 6 ≥ 0.2)	F915 = 4 or 2	F915 =1 or 3	F915 =0
The saliency level is low (F 9 3 6 < 0.2)	F915 =3		

- (1) There is some motor electrical magnetic noise at start and low speed area.
- (2) There is some motor electrical magnetic noise at start. It can not be started in case of high start-up torque.
- (3) It goes opposite direction at start sometimes. It cannot be started in case rotor saliency is high.

Code	Name / Description	Adjustment range	Factory setting
F 4 0 2	[Auto Torque Boost]	0.0 to 30.0%	According to drive rating
<p>Use parameter F 4 0 2 to adjust the amount of automatic torque boost that is applied.</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; margin-right: 10px;"> F 4 0 2 : Automatically adjusts the amount of torque boost. </div> </div> <p style="text-align: center;">Motor Rated Frequency $\omega L \omega$ Output Frequency (Hz)</p>			

<p>F 9 1 2</p>	<p>[Autotune L q-axis] q-axis self-inductance</p> <p>Axis "q" stator inductance in mH The setting is replaced by the result of the auto-tuning operation, if it has been performed.</p> <p>Measured between the neutral and the phase, its value could be different than the datasheet of the motor. [Autotune L q-axis] (F 9 1 2) is defined automatically after activation of [Auto-tuning drive] (F 4 0 0) = [Tun Dyn. 2] (3)</p>	<p>0.01 to 650 mH</p>	<p>10</p>
<p>F 9 1 3</p>	<p>[Autotune L d-axis] d-axis self-inductance</p> <p>Axis "d" stator inductance in mH The setting is replaced by the result of the auto-tuning operation, if it has been performed.</p> <p>Measured between the neutral and the phase, its value could be different than the datasheet of the motor. [Autotune L q-axis] (F 9 1 3) is defined automatically after activation of [Auto-tuning drive] (F 4 0 0) = [Tun Dyn. 2] (3)</p>	<p>0.01 to 650 mH</p>	<p>10</p>
<p>F 9 1 6</p>	<p>[PM Align cur. Level] Stabilization at the starting and low speed(for PM)</p> <p>It might be able to stabilize the motor rotation behavior by the current in D axis at no load when starting or low-speed</p> <p>If you have a torque jolt, when starting / stopping or low-speed, it is recommended to increase the setting of 9 1 6. If E - 2 0 [Excess torque boost flt] trip occurs at the start, it is recommended to increase the setting of 9 1 6.</p> <p>In the case of F915=0, 1, 2, 3</p>  <p>In the case of F915=4</p>  <p>Starting current F916 is set 25% as the default setting, Limit it to the value of about 75% in the maximum with consideration of copper loss and iron loss of the motor. If the loss of motor at no load is made decreased, please decrease the value of F916 confirming the stability when starting.</p>	<p>0 to 100 %</p>	<p>25 %</p>
<p>F 9 2 1</p>	<p>[Init. Pos. Current] Current for initial position estimation</p> <p>In case of position detection 3, the current level can be set by this parameter, during the auto-tuning for d axis / q axis inductance, the maximum current level can be adjusted by this parameter setting.</p>	<p>10 to 150 %</p>	<p>100 %</p>
<p>F 4 2 0</p>	<p>[Torque Boost Coef] Compensation coefficient of torque boost</p> <p>If synchronous or asynchronous motor is used, F 4 2 0 [Torque Boost Coef] is set to 90%. If you have a torque jolt, when starting / stopping or low-speed, increase the value of F 4 2 0</p> <p>Note: If E - 2 0 [Excess torque boost flt] trip occurs at the start, it is recommended to be decreased the setting of F 4 2 0</p>	<p>0 to 200%</p>	<p>90 %</p>

Parameters described in this page can be accessed by the extended menu

Code	Name / Description	Adjustment range	Factory setting
F914 D I	[N-S direction] Method of detection N-S Method of detection. If F914 = 0, the N-S direction of rotor position is judged by the method of DC offset for position detection. If F914 = 1, the N-S direction of rotor position is judged by the method of AC offset for position detection. Note : N-S method of detection is available if [PM mode selection] (F915) is set to [Ctrl Type1] (1) or [Ctrl Type2] (2)	0 - 1	0
F917 D I	[PM Max torq. Ctrl] Max torque control activation (for IPM) [0] : Deactivation [1] : Activation	0 - 1	1
F918	[Cur. phase adjt] It is possible to aim the higher efficiency in the case of IPM (Interior Permanent Magnet), by activation of [PM Max torq. Ctrl] (F917) which makes required current the minimum, the loss of motor and driver may be reduced and the efficiency may be attained higher level.	- 45.0 to 45.0	0
F920	[Position Adjust] In case of heavy load, the estimated position can be adjusted by setting this parameter. Adjustment for position estimation, available if [PM mode selection] (F915) is set to [Ctrl Type2] (2) or [Ctrl Type4] (4) .	0 - 150 %	0 = Auto