



# Product Solutions Announcement

Delta Industrial Automation Global Solution Center



Product	AMD	Type	VFD-C2000	Security Level	<input checked="" type="checkbox"/> General <input type="checkbox"/> High <input type="checkbox"/> Top
				No.	N/A
Issued by	SC	Author	Leo Yang	Release Date	30 <sup>th</sup> May, 2012

## C2000 driving IM with TQC+PG

### Devices and tools:

Inverter: VFD007C43A, 1PCS (Firmware V1.01 D12055)

Induction motor: TECO/3phase/380V/0.75kw

PG: EMC-PG01L 1PCS

### Operation Steps:

1. Set Pr00-02=9(50Hz) or 10(60Hz) to go back factory setting.

2. Set the following parameters based on IM motor you are using:

Parameters	Definition	Value
01-00	Induction motor max frequency (Hz)	50.00
01-01	Induction motor rated frequency (Hz)	50.00
01-02	Induction motor rated voltage (V)	380.0
05-01	Induction motor rated current (A)	2.0
05-02	Induction motor rated power (kW)	0.75
05-03	Induction motor rated speed (rpm)	1410
05-04	Induction motor pole numbers	4

3. Set Pr05-00=1 and press **【run】** to begin auto-tuning in rolling test.

Make sure the motor has no-load before executing auto-tuning and the shaft is not connected to any belt or gear motor. It is recommended to set to 2 if the motor can't separate from the load.

If Pr.05-00 is set to 2 (static test), user needs to input the no-load current value of motor into Pr.05-05 for motor 1/Pr.05-17 for motor 2. The figure is about 40% of the rated current

4. Check the following parameters after IM rotary auto-tuning.

When auto-tuning is completed, please check if the measured values are written into motor

1(Pr.05-05 ~05-09) and motor 2 (Pr.05-17 ~05-21) automatically.

5. Set parameters about encoder.

Pr 10-00	Encoder Type	1
Pr 10-01	Encoder pulse	1024
Pr 10-02	Encoder Input Type	1

6. Set Pr00-11=3 for IM FOC+PG control mode.

Keep Pr00-10=0 which means velocity mode, and set Pr00-11 to 3 for IM FOC+PG mode. Set a low speed for the inverter, for example 10 Hz and press “Run” to make sure the inverter is working properly. If not, check the wiring or change Pr10-02 to 2, and then please try again.

7. Set Pr11-00=2 for inertia auto-tuning:

- ✧ Set speed command=2/3\*rated speed of motor (05-03).
- ✧ Set acceleration and deceleration time is 1s or 1.5s.
- ✧ Forward and reverse in turn until 11-01 is stable.

8. Set ASR parameters based on the practical situations:

- ✧ Please set 11-03 11-04 11-05 if we set Pr11-00=1 and finish the inertia auto-tuning.
- ✧ Please set 11-06 to 11-11 if we set 11-00=0 which doesn't need the inertia auto-tuning.

9. Set Pr00-10=2 for torque mode and Pr00-13=0 for TQCPG mode.

TQCPG mode is based on FOCPG mode, so if you want to use this mode, you have to finished the FOCPG mode settings first, then, change Pr00-10 to 2 for torque mode.

10. Set Pr11-27=100: maximum torque command according to your real situation.

This parameter is used to set the upper limit of torque command, and the factory setting is 100%.

11. Set Pr11-33=0 to choose the source of torque command.

Parameter	Value	Definition
11-33	0	Digital Keypad (Pr11-34)
	1	RS485 serial communication
	2	Analog signal (Pr03-00)
	3	CANopen
	4	Reserved
	5	Communication Card

In this case, set Pr11-33=0, which means the torque command source comes from the digital

keypad, and the value can be set in Pr11-34. For example, if you need 50% torque, you can just key in 50 in Pr 11-34. The interval of Pr11-34 is changeable according to Pr11-27.

## 12. Set Pr11-36=0 to choose the source of speed limitation.

Parameter	Value	Definition
11-36	0	Set by Pr.11-37 (Forward speed limit) and Pr.11-38 (Reverse speed limit)
	1	Set by Pr.11-37,11-38 and Pr.00-20 (Source of Master Frequency Command)
	2	Set by Pr.00-20 (Source of Master Frequency Command).

You can set Pr11-36 to choose the source of this speed limitation. In this case, set Pr11-36=0 to choose Pr11-37&Pr11-38 as the source of speed limitation. In TQCPG mode, when the motor speed is accelerated to speed limit value (Pr.11-36, 11-37 and 11-38), it will switch to speed control mode to stop acceleration.

## 13. Set forward and reverse speed limit.

Set Pr11-37=10, Pr11-38=10, here 10 means 10% of Pr01-00 max output frequency. For example, if you set Pr01-00=50Hz, forward and reverse speed limit will be 5Hz.

## 14. Set torque offset according to your real situation:

- ✧ Choose the source of torque offset Pr11-28:
  - 0, Disable
  - 1, Analog input (by Pr03-00)
  - 2, Torque offset setting (by Pr11-29)
  - 3, Control by external terminal (by Pr11-30 to Pr11-32)
- ✧ If Pr11-28=1, torque offset comes from analog input, then, set Pr03-00=3.
- ✧ If Pr11-28=2, torque offset comes from Pr11-29, key in the figure you need.
- ✧ If Pr11-28=3, torque offset comes from external terminals, you have to choose three multi-function input terminals, for example, MI1,MI2,MI3, and set Pr02-01=31(low torque offset), Pr02-02=32(middle torque offset), Pr02-03=33(high torque offset). Low/middle/high torque offset will take effect when the particular MI port is on.

## 15. Set ASR control at Torque mode according to your real situation:

ASR control function under torque mode is now contained in firmware V1.01 date12055. If you want to adjust PI value in the ASR of torque mode, please refer to Pr10-24:

Bit#0	0: Use PI as ASR	1: Use P as ASR
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Then, adjust Pr11-06~Pr11-11 if you set Pr11-00=0.

## Attentions:

### 1. How to make auto-tuning when load cannot be taken off from the motor?

There are two auto-tuning functions in C2000, one is Pr05-00=1(dynamic auto-tuning) and the other is Pr05-00=2(static auto-tuning). We can use dynamic auto-tuning when the motor is empty load, but when the motor is on load, this function will not take effect. In that condition, we have to use static auto-tuning instead. The operation steps of these two ways is just the same, the only difference between them is that when you use static auto-tuning, you need to input the no-load current value of motor into Pr.05-05 for motor 1/Pr.05-17 for motor 2. The figure is about 40% of the rated current.

### 2. In TQCPG mode, the output frequency rises immediately or speeds up with a accelerate time?

In standard factory firmware, if you choose Pr11-37&Pr11-38 as your speed limitation, the output frequency will rise immediately without a accelerate/decelerate time; if you choose frequency command as your speed limitation, the output frequency will speed up or decelerate with a accelerate/decelerate time, and you can adjust this time in Pr01-12~Pr01-19.

### 3. In TQCPG mode, is there any output torque or power when output frequency is zero?

If torque command is 0%, the motor will produce excitation current but no torque current. It's mean that there is not any output torque or power there. If you do want to make an output torque there, you can set Pr11-39=1. This parameter defines the torque command mode at 0% of torque output. When Pr.11-39 is set as 1 (the speed mode), if torque command is 0%, the AC motor drive can still produce torque current through speed controller to prevent motor race and the drive will also automatically adjust the speed to 0 when the speed command is not equal to 0.

### 4. What's the difference between P and PI in ASR control?

"P" is used to eliminate the system error. It is usually used to decrease the error and get the faster response speed. But if setting too large value, it may cause the system oscillation and instability. "I" is used to eliminate the error during stable system. The integral control doesn't stop working until error is 0. The integral is acted by the integral time. The smaller integral time is set, the stronger integral action will be. It is helpful to reduce overshoot and oscillation to make a stable system. At this moment, the decreasing error will be slow. The integral control is often used with other two controls to become PI controller or PID controller.

