Product	AMD	Type	**VFD-C2000**	Security Level	☑General ☐High ☐Top
				No.	N/A
Issued by	Global SC	Author	John Zuo	Release Date	11th Feb. 2014

C2000 Drive IM with FOC+PG

Devices and tools:

Inverter: VFD007C43A, Firmware V1.04(D13305), PG: EMC-PG01L;

IM motor: Teco Motor with 1024 PPR Line driver Encoder

Operation Steps:

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

2. Set correct parameters Pr01-00, Pr01-01 and Pr01-02 based on Motor.

3. Key in the following parameters base on IM you are using.

Pr. no	Definition	Setting value
05-01	Induction motor rated current (A)	Motor Nameplate
05-02	Induction motor rated power (kW)	Motor Nameplate
05-03	Induction motor rated speed (rpm)	Motor Nameplate
05-04	Induction motor pole numbers	Motor Nameplate

4. Set Pr05-00=1 and press the【RUN】key for IM dynamic auto-tuning (empty Load).
   Please kindly have your attention that motor will spin in dynamic auto-tuning method.

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

   05-05 IM No-load current, 05-06 IM Stator resistance, 05-07 IM Rotor resistance,

   05-08 IM Lm, 05-09 IM Lx.

6. Set parameters about encoder:

10-00	Encoder types	1
10-01	Pulse Encoder PPR	1024
10-02	Encoder operation modes	1

7. Set 00-11=3 for IM FOCPG control mode.

Keep 00-10 is 0 namely speed control, and then set 00-11 to 3. Run the inverter and check any error there. If PGF is error there, please check your encoder wiring and change 10-02 to 2.

8. Set Pr11-00=2 for inertia auto-tuning (After tuning over, 11-00 will be 0 automatically):

- Keep empty load first.
- 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. And then press stop, the tuning is over.
- Connect the load, and repeat the inertia auto-tuning procedures again. If the inertia auto-tuning is OK, the loading inertia result is better. If the loading inertia not OK, we must input the 11-01 inertia by hand based on the tuning result in empty load.

9. Enable ASR bandwidth adjustment automatically function.

- If we keep Pr11-00=0, we just disable the ASR bandwidth adjustment automatically. And we only can use Pr11-06 to Pr11-11 and the PI ASR will be invariable during running.
- If we set Pr11-00=1, we enable the ASR bandwidth adjustment automatically, and we can use Pr11-03 to Pr11-05 (no Pr11-06 to Pr11-11 anymore), and Pr11-03 to Pr11-05 can make real ASR PI changed automatically based on practical current situation. This is more flexible for practical commissioning.

FAQ:

1. Is there any other auto-tuning method for IM with PG?

There are two auto-tuning methods for FOC+PG for IM.

- Pr05-00=1 is dynamic auto-tuning. Every motor parameter can be learnt in this mode. The weakness is we must make the motor empty load every time.
- Pr05-00=2 is static auto-tuning. The motor don't need empty load so don't need to be separated from the load. The weakness is the auto-tuning precision is not so good like Pr05-00=1 and Pr05-05 namely IM no load current must be written before the static auto-tuning start, if we can't input the precise no load current of motor, the tuning result is not

so reliable which will cause the current oscillation, unstable speed and etc..

2. Is the inertia auto-tuning mandatory or optional?

It is mandatory for complete vector control. And the best auto-tuning is for loading not empty load. However, practically, when we connect the load for inertia auto-tuning, the mechanic issue will cause the inertia auto-tuning fail (unsymmetrical structure, limited operation distance or height). Hence, we suggest we should first take the inertia auto-tuning in the empty load (we must take motor auto-tuning empty load if we can't have the precise no load motor current), and then we go to take the inertia auto-tuning with load. If we can succeed, that is fantastic. If not, we can input the inertia by hand based on the result from empty load.

E.g., we get Pr11-01 inertia is 100 with empty load. And we go to take the inertia auto-tuning with load but it fail. So we must input inertia ourselves but we generally can confirm it is bigger than 100 since the inertia for motor with load must be bigger than empty load motor shaft. Very less time, we should reduce the inertia less than empty load result for trying if the current is too big (OC or OCA), and this is because loading mechanic is unsymmetrical to cause the inertia variable.

3. Why is there no angle auto-tuning like PM?

The vector control for IM or PM is all based on clark-park transformation so the theta angle, which is the transformation angle in theory, is very important for realizing the vector control. However, PM theta is based on magnet position so we must take the angle auto-tuning for PM to get the magnet position, and if not, PM can't be controlled well.

For IM, the theta can be obtained by current and motor speed feedback, so we don't need to take angle auto-tuning for IM.
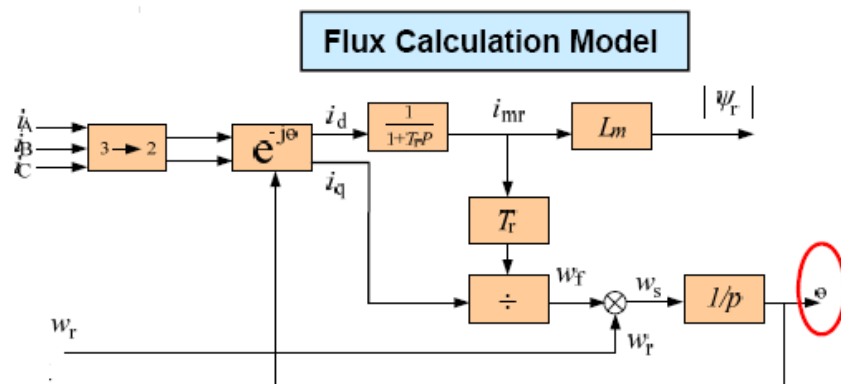
4. Do we must use PG card for motor auto-tuning in FOC+PG for IM?

The motor auto-tuning is nothing to do with PG card, so you don't need to use PG card for auto-tuning. Besides, the practical experience just suggests us PG card circuit will cause the static auto-tuning damage to inverter due to the disturbance to PG. Hence, please kindly remove

PG when you take the any auto-tuning.

5. Can we use EMC-PG01U for receiving the ABZ incremental encoder like EMC-PG01L or PG01O?

This is possible. But we must follow 2 rules,

- The parameter 10-00 must be 4 if we use the PG01U.
- The Switch of PG-01U must be on the right for S. Namely only the S mode can support receive the motor with standard ABZ/UVW or the normal ABZ incremental encoder.
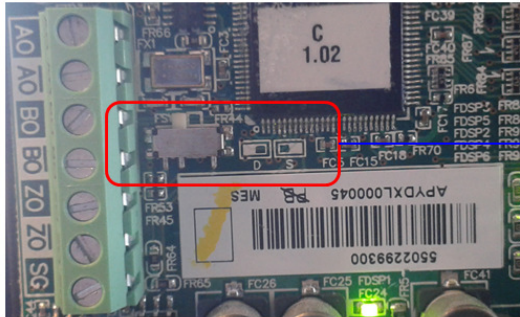
D: For Delta ECMA-C3 motor

S: For the motor with standard ABZ/UVW encoder

6. Why some noises could be there when we go to motor auto-tuning and the tuning can't be successful?

Most time, we take the auto-tuning for FOCPG with PG card there since this is for PG function and we should install PG from the beginning. But we usually neglect one issue that our PG card must connect the encoder shielding cable to one fixed port. Please kindly refer to the red circle below. So if we never connect like this, the auto-tuning will be influenced by interference because of hardware design issue. And if we connect like this, the interference will be removed by shielding and auto-tuning could be fine.