



## Technical Note

### C2000/C2000 Plus/CH2000

### Master-Follower Configuration

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## History

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# 1 Introduction

## 1.1 Description

This Technical Note will show one possible way to set up two C2000/CH2000 drives in a Master-Follower configuration. This will work as shown in the video below:

[Delta Industrial Automation EMEA - VFD C2000 in position synchronization](#)

For this example both C2000 drives have a PG card connected to their Slot 2.

Both drives are running the motors in FOCPG mode but depending on the application if the Follower drive only needs to follow the Masters speed then it is not mandatory to configure it in FOCPG mode.

## 1.2 Requirements

- Two C2000/C2000 Plus/CH2000 Variable Frequency drives;
- Induction or Permanent Magnet motors with encoders mounted on both motors axis
- Encoder cards (EMC-PG0xx) compatible with the motors encoder

When configuring the VFD in positioning mode the firmware version should be:

Drive	Firmware Version
C2000	V2.06 or newer
C2000 Plus	V3.06 or newer
CH2000	V2.06 or newer

Before starting any tests with positioning it is important to make sure that the drive is running properly in FOCPG mode (pr00-11=3 or 4).

Note:

1. This Technical Note will not explain how to configure the drive in FOCPG mode. Please consult the user manual and/or corresponding Technical Notes for that.
2. One quick way to check if the drive is properly configured in FOCPG mode is to set pr00-04=21 (to display the motor position on the keypad) and then run the drive in velocity mode (pr00-10=0). Check the behavior of the motor at very low speeds and also at zero speed. In FOCPG the motor should be able to develop full torque even at 0Hz.

## 2 Configuration

### 2.1 Wiring

For this Master-Follower configuration the PG OUT terminals of the Master are wired directly to the PG2 terminals on the Follower as shown below:

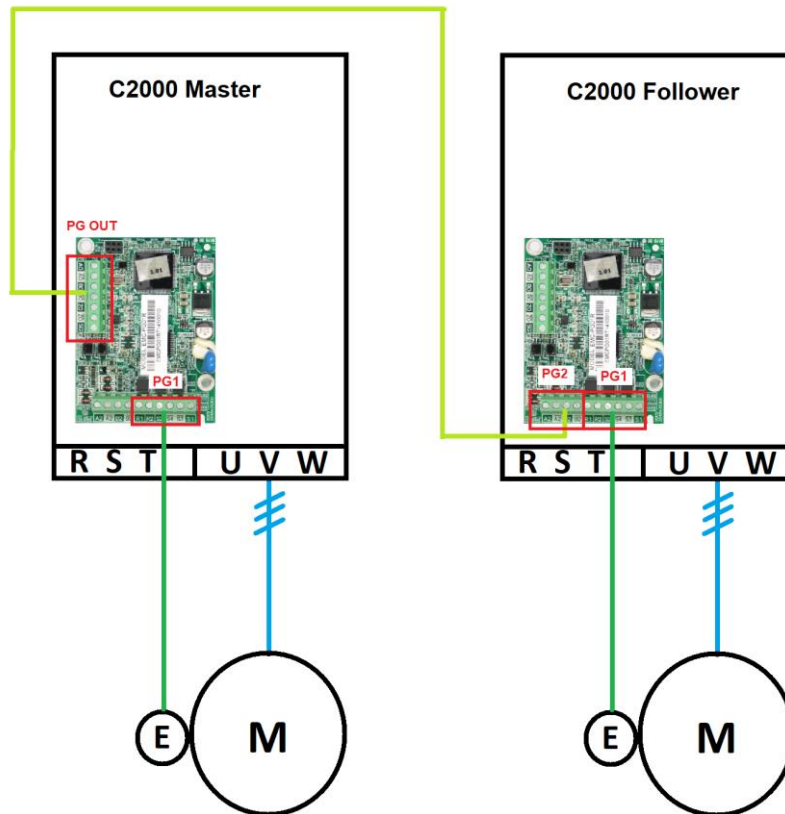


Figure 1.1 Wiring

PG encoder cards will come with the following terminals:

1. PG1 – These are input terminals for getting the encoder signal from the motor so that you can control it in FOCPG mode (closed-loop vector)
2. PG2 – These are input terminals for getting encoder pulses from external devices into the drive. The drive can use those pulses as a frequency command or as a position command. Or, if the onboard PLC is used, it can also be used internally for other purposes.
3. PG\_OUT – These are output terminals. The drive takes the pulses that it receives through the PG1 terminals and outputs them on the PG\_OUT terminals so that they can be sent to other devices. The output signal type will depend on the PG card model that you select. Most PG cards will have a Line Driver output: EMC-PG0xL, EMC-PG0xU, EMC-PG01R and EMC-PG01H. For an Open Collector output you can use the EMC-PG0xO card.

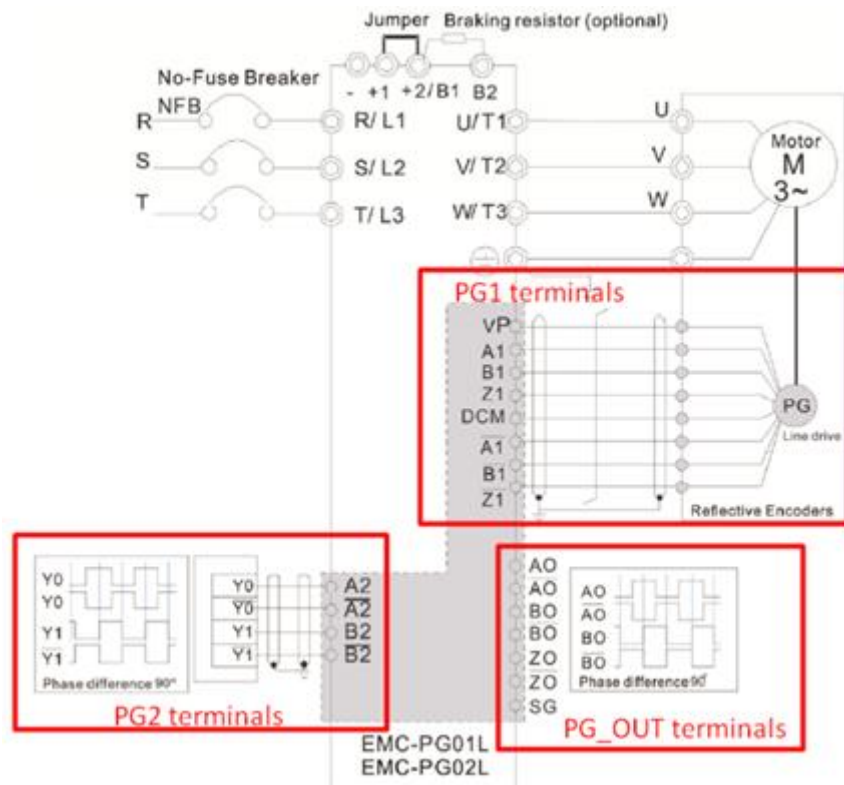


Figure 1.2 PG Terminals of an EMC-PG01L card

## 2.2 Parametrization

The parameters mentioned below are relevant for the synchronization function. The complete description of these parameters can be found in the user manual.

### Master drive

Parameter	Setting	Description
10-03	1	Pulse output denominator. Determines the number of pulses that PG_OUT will output based on the formula: <b><math>PG\_OUT = PG1 / pr10-03</math></b>
10-43	Read Only	Check the PG card type, version and whether or not it is properly recognized by the drive

### Follower drive

Parameter	Setting	Description
00-04	21	Show motor position on keypad
00-06	Read Only	Check the firmware version of the drive. For positioning mode this should be at least V2.06
00-10	1	Positioning Mode
00-11	3 or 4	IMFOCPG or PMFOCPG
00-20	5	Source of frequency is the pulse input
10-16	1 or 2	Pulse input type (on PG2)
10-17	1	These parameters should be adjusted
10-18	1	
10-43	Read Only	Check the PG card type, version and whether or not it is properly recognized by the drive
11-00	1	Drive will use ASR gains
11-40	1	Source of position is the pulse input

Note:

1. If the follower drive is synchronized based on Speed (pr00-10=0) instead of Position, then the following parameters will also have to be lowered: pr01-12, pr01-13, pr01-24 ~ pr01-27 (acceleration/deceleration and S-ramps). This will prevent delays caused by adding the Follower's ramps on top of the Master drives ramps.



## 2.3 Trial RUN

Initial tests should be as simple as possible and without load.

Check if the Follower can accurately match the Masters speed and look for any delays.

After adding load check if the speed is still followed accurately.

In some cases when testing with load it may be necessary to adjust the parameters below in order to obtain a better response:

Parameter	Applicability	Description
11-03	Speed mode	ASR gain for the Low-speed bandwidth
11-04	Speed mode	ASR High-speed bandwidth
11-05	Speed mode	ASR Zero-speed bandwidth
11-24	Positioning mode	Kp gain for the Automatic Position Regulator (APR)
11-25	Positioning mode	APR Feed Forward Gain
11-26	Positioning mode	APR Curve Time

If these parameters are set too high you might start to see the motor vibrate, especially when running with very little or no load. If that happens decrease the corresponding parameter until there is no more vibration.