Application Note AN-ODP-18

Torque control using the Optidrive Plus

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- ***General :***

Optidrive Plus can operate in torque control mode (P4-01=1) in which the reference input will directly control the output torque of the motor rather than the speed of the motor.

This document describes how to configure the drive for torque control application.
Torque control is not possible in V/F mode. It is therefore important that Auto-tune has been completed correctly. (see AN-ODP-33 for more information regarding the auto-tune function).

- ***Key torque control parameters:***

P4-06 Torque reference select

This parameter is used to set the motor output torque reference value. The available choices are:

0: Fixed Preset	Torque reference is preset by P4-07. If this option is used, the motor output torque reference value will be fixed by the percentage value of motor rated torque set in parameter P4-07. The motor rated torque is determined automatically by the auto-tune.
1: Bipolar analog input	If a variable torque reference is required, the analog input can be used as the torque reference. In this case, the reference value could be changed in real time in proportion to the analog input signal. The correct analog input signal format should be set in parameter P2-30. The input signal format must be unipolar. The option "–10V…+10V" is not supported in torque mode.
2: 2nd Analog input	The second analog input will be used as the motor output torque reference. The correct analog input signal format should be set in parameter P2-33.
3: Modbus torque reference	This option is only available for 3GV-M drives. When this option is selected, the motor torque limit is given by the Modbus master. The value can range from 0% to 200%. For more information about the Modbus control function and the Modbus register map, please refer to AN-ODP-38.

P4-08 Minimum torque reference/limit

This parameter will limit the minimum torque reference input value. This parameter is usually used to prevent the rotor from locking when operating with low torque reference values. The default setting for this parameter is zero. The user usually needs to adjust this parameter in order to get better control performance at low speed (torque) area.

If the analog input is used to vary the torque reference, the torque will be scaled linearly in proportion to the analog input from P4-08 to maximum torque limit in P4-07.

For all torque control applications, the maximum speed of the motor can never exceed the speed limit set in P1-01.

- ***Torque control with variable speed limits:***

Torque control mode is selected using P4-01 = 1 (vector torque control). The torque reference source is selected using P4-06. Set P4-06 = 2 and P2-01 = 4 to use the 2nd analog input signal as torque control reference.

In this configuration, the bipolar analog input will be selected as the speed limit. Digital input 2 will control the motor spin direction.

Alternatively, setting P2-01=19 and opening digital input 2 results in the 2nd analog input being used as a variable torque reference and the bipolar analog input as a variable speed limit.
If digital input 2 is closed in torque control mode (P4-01=1), then the drive speed will be limited to P1-01 (maximum speed limit)

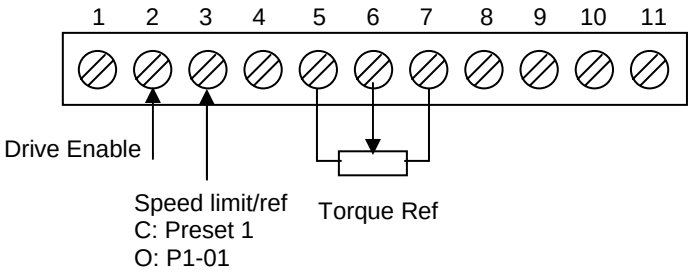
When operating in torque control mode (P4-01=1), the user should avoid to select the same analog input signal for both speed limit and torque limit, In such condition, maximum speed value in P1-01 will be used as speed limit.

Increasing P1-03 may also help to reduce the speed overshoot on start up for certain applications.

Example 1 : Variable torque reference, fixed speed limit

P1-12 = 0 (terminal mode)
P2-01 = 0 (digital input function select)
P4-01 = 1 (torque mode)
P4-06 = 1 (bipolar analog input used for torque reference)

The drive operates in terminal control mode with the torque reference provided by the bipolar analog input. If digital input 2 is open, the speed is limited by P1-01 (max speed limit). If digital input 2 is closed, the speed is limited to speed preset 1. See drive terminal strip connection diagram below:



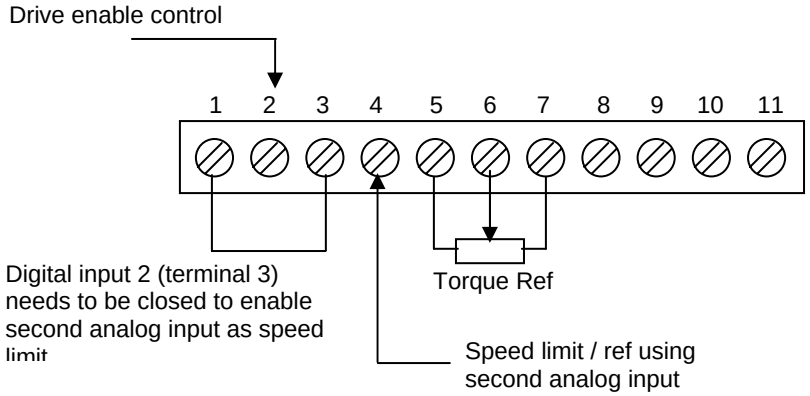
Different settings for P2-01 will give different options, including the connection of an external trip input, selection of different max speed limits via the preset speed parameters etc.

In torque control mode, the maximum output speed is limited by the speed reference value. In keypad control mode the speed reference is set by digital pot, in terminal mode it is set by the status of the digital inputs and function of the digital inputs set in P2-01.

Example *2 : Variable torque reference, variable speed limit*

P1-12 = 0 (terminal mode)
P2-01 = 19 (analog input 1 / analog input 2 select)
P4-01 = 1 (torque mode)
P4-06 = 1 (bipolar analog input used for torque reference)

In this case, the max speed limit is set dynamically by the analog input. The second digital input must be closed so that the second analog input is selected as the speed limit. The bipolar analog input now acts as torque reference and the second analog input as variable maximum speed limit. See drive terminal strip connection diagram below:



Note that if the speed reference and torque reference share the same input source (this would be the case if the second digital input is open), then the output speed will be limited by the maximum speed limit (P1-01).

It may also be required to limit the speed to one of the digital preset speeds. This is equally possible, depending only on the setting of P2-01.

When running in torque control mode, the estimated rotor speed rather than the requested speed will be shown on the drive display.

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