

Application Note

AN-ODP-19

## ***Using variable torque limits in speed control mode***

**Author: Ning Xu, Invertek Drives Ltd**

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- **General:**

When operating in vector speed control mode (P4-01=0), the maximum output torque of the motor can be adjusted through the parameter settings.

By default, the output torque limit is set to the 200% of the motor rated output torque. If required, the internal torque limit can also be reduced either to a fixed value or to a variable value. This document describes how to change the output torque limit in vector speed control mode.

- **Parameters:**

### **P4-06 Torque reference / limit select**

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

- |                                 |   |
|---------------------------------|---|
| 0: Fixed Preset                 | Torque reference is pre-set by P4-07. This setting is used by default with the limit for P4-07 set to 200%.<br>The percentage value set in P4-07 represents the proportion of maximum torque that will be available from the motor  |
| 1: Bipolar analog input         | If a variable torque limit is required, the analog input can be used to vary the torque limit in real time. 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: 2 <sup>nd</sup> Analog input | If this option is selected then the second analog input will be used as the motor output torque limit. 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.   |

- **Special notes:**

- When using analog input as variable torque limit in vector speed control mode, the analog input signal scales the torque limit between the minimum torque limit in parameter P4-08 and maximum limit P4-07.

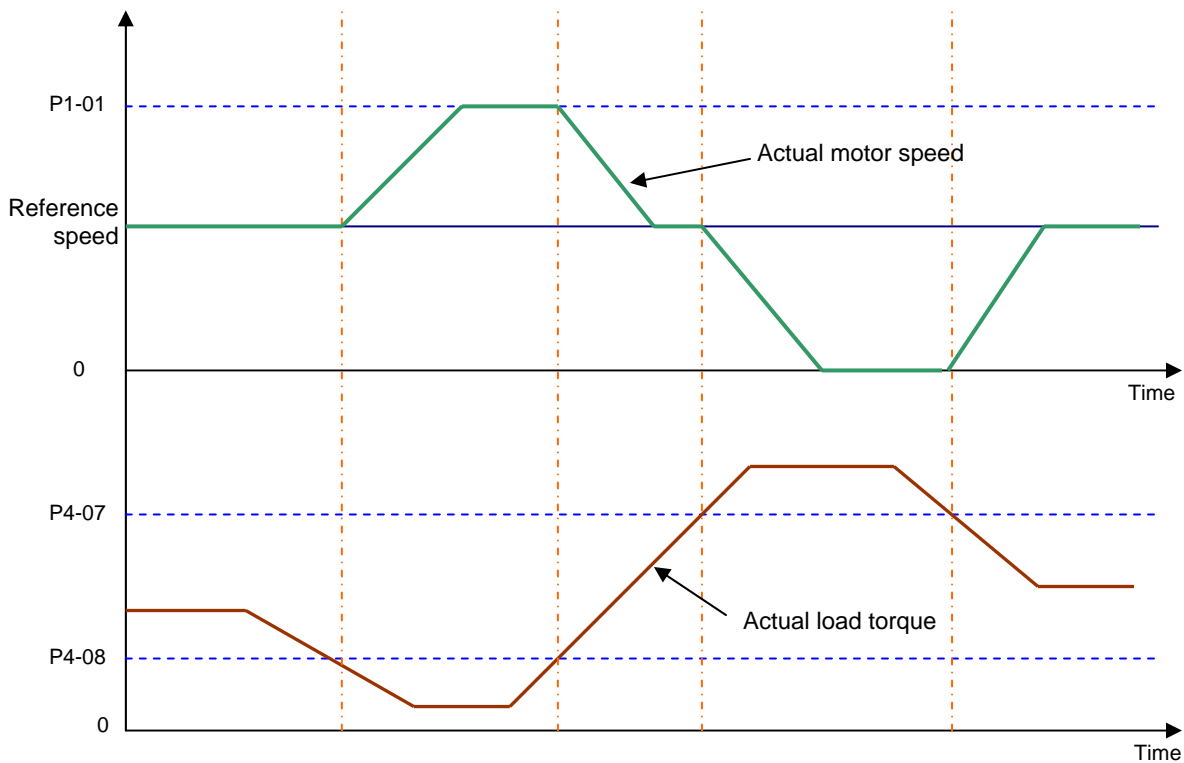
For example if P4-08 = 10%, P4-07 = 100% and P4-06 = 1 with a 0..10V bipolar analog input signal, then 0V will give 10% torque limit in the drive and 10V will give 100% torque limit.

- The maximum output torque of the motor is also limited by the drive power rating. The maximum output current will never exceed 150% of the drive rated current if operating in vector speed control mode.
- Avoid using the same input reference for both speed reference and torque limit unless specifically required.

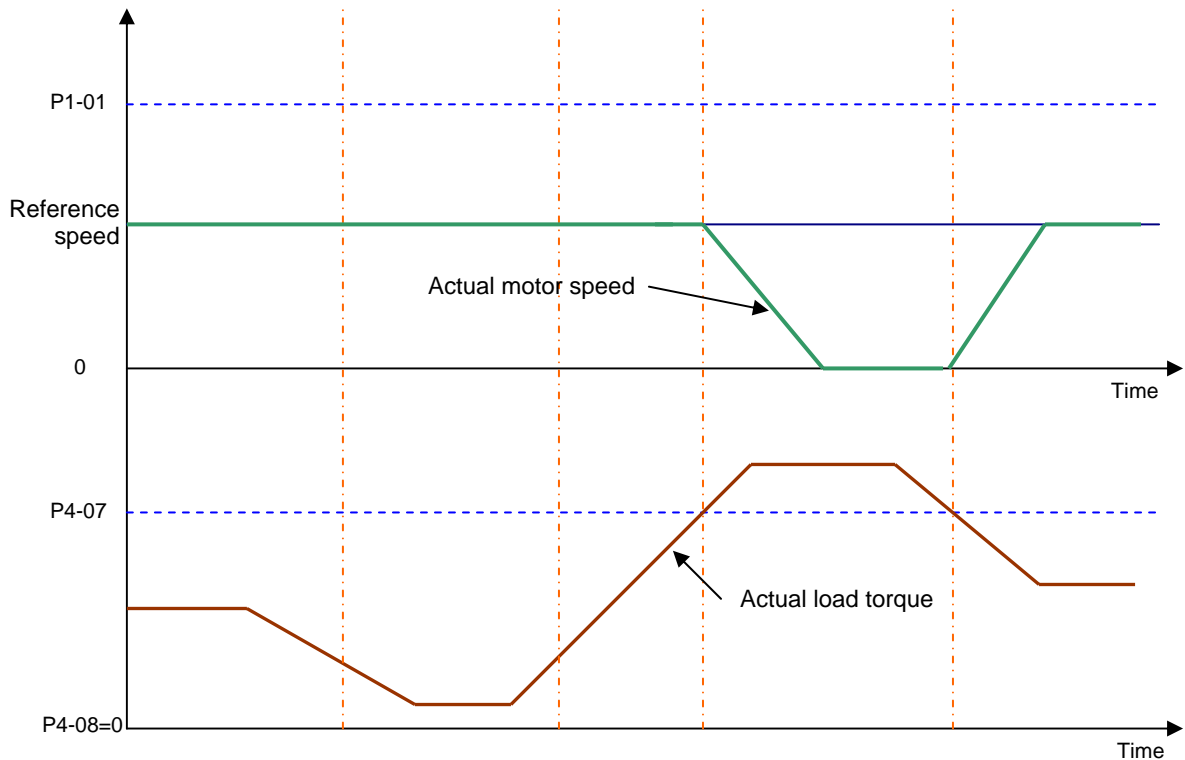
• **Speed performance:**

If the load torque is larger than the maximum output torque limit of the motor, the motor speed will automatically be reduced until the load torque equals the torque limit. Once the load torque is less than the torque limit of the motor, the motor speed will automatically increase to the reference value. The ramp rate will be limited by the maximum torque limit available for acceleration.

If the user sets a minimum torque limit in P4-08 which is greater than the actual load torque, the motor speed will automatically increase until the load torque reaches the minimum limit. The actual motor speed under such a condition depends on the motor load and the maximum output speed will be limited by P1-01. See the diagrams below for more information.



Speed vs Torque (P4-08 large than zero)



Speed vs Torque (P4-08 = 0)

- **Example - Speed control with variable torque limits**

Speed control mode is selected using P4-01 = 0 (vector speed control). The speed reference may come from the digital / analog inputs (terminal mode, P1-12 = 0) or from the keypad when in keypad mode (P1-12 = 1 or 2).

The max torque limit may be selected using P4-06. For a fixed torque limit, set P4-06 = 0 and set P4-07 = the required limit value.

For a variable maximum torque limit, set P4-06 = 2 and P2-01 = 4. In this case, the torque limit is varied using the second analog input between the minimum torque limit set in P4-08 and maximum torque limit in P4-07.

When using this control mode for winding applications, parameter P1-03 may have to be increased to avoid over tension on start up.

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