Application Note AN-ODP-44

Speed dependent variable torque limits

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- ***General:***

Some applications require the maximum torque that can be developed by a motor to be changed as a function of speed. A typical such application may require high starting torque but a lower running torque at nominal speed.

This application note describes the parameter settings to provide a speed-dependent variable torque limit.
Note that this application note applies to firmware release V2.20 or later and applies only to 3GV / 3GV-M drives operating in 3GV vector speed control mode (P4-01=0).

- ***Parameters:***

P2-11 Analog output function select

This parameter should be set to 7. The analog output will then be proportion to the motor speed and scaled linearly from P1-02 to P1-01.

P2-36 Analog output signal format

If the application requires the torque limit to increase with speed, set this parameter to 0..10V.

If the application requires the torque limit to reduces as speed increases, set this parameter to 10..0V.

P4-06 Torque reference select

This parameter should be set to 1, whereby the bipolar analog input is then used as torque reference input. The second analog input cannot be used for this kind of application as in general an offset must be defined. Only the bipolar analog input has an offset parameter.

P4-07 Maximum torque limit

Set the maximum torque limit value into this parameter, for example 150%.

P2-30 Bipolar analog input format

This parameter should be set to 0…10V format.
P2-31 Bipolar analog input scaling and P2-32 Bipolar analog input offset

These two parameters should be set up according the torque control requirement. See the following example for more details :

- ***Example:***

Motor speed varies from 0Hz (P1-02) to 50Hz (P1-01). Required torque limit profile is 150% torque limit at 0Hz and 90% torque limit at 50Hz.

Required terminal connection:

In order to implement this control function, the drive analog output signal must be used as a torque limit / reference input signal, where the analog output signal is proportion to the motor speed.
In this case, connect the analog output (terminal 8) to the bipolar analog input (terminal 6).

Parameter setup:

Set P2-11=7,
P2-36= 10…0V,
P4-06=1,
P4-07=150%.

Since 150% torque equates to the full analog input voltage (10V), 90% torque reference equates to 60% of the analog input (ie 6V).

Noting that the analog input is linear from 100% (10V @ 0Hz) to 0% (0V @ 50Hz), the bipolar analog input offset and scaling parameters must be set up as follows to give the required result :

$$\begin{cases}(1-X)\times Y = 100\% \\ (0-X)\times Y = 60\%\end{cases}$$

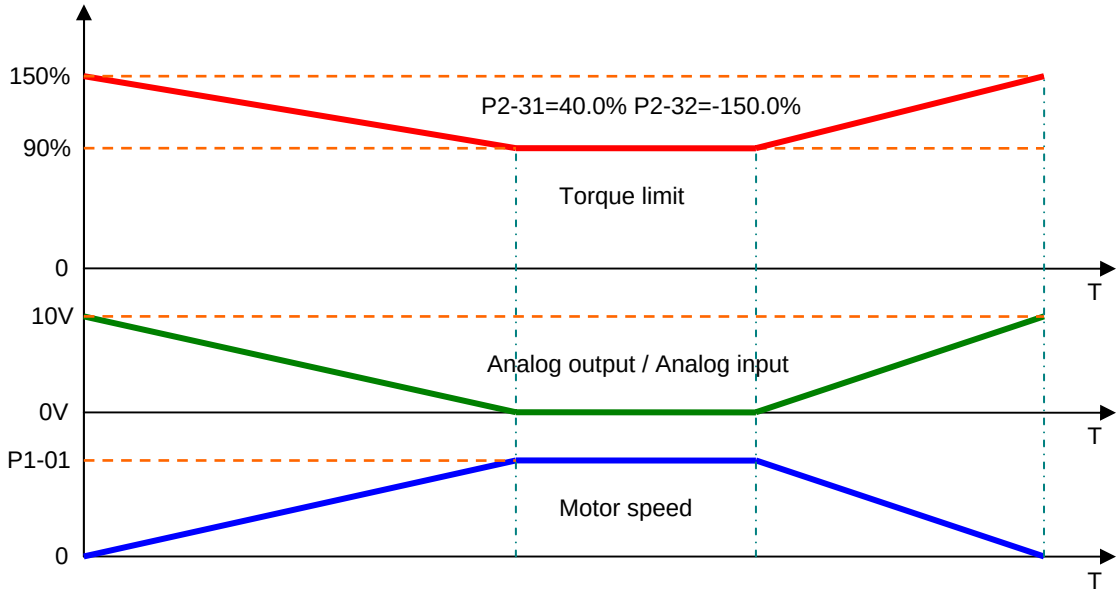
where X = value in P2-32 and Y represents the value in P2-31

From this equation, we get :

$$X = -150\% \quad Y = 40\%$$

Hence, setting P2-31= 40.0% and P2-32= -150.0% gives the required result.

The diagram below shows the relationship between motor speed, bipolar analog input and torque limit.



Example 2 : Required Torque limit = 200% at 0Hz and 80% at 50Hz

Set P4-07 = 200%

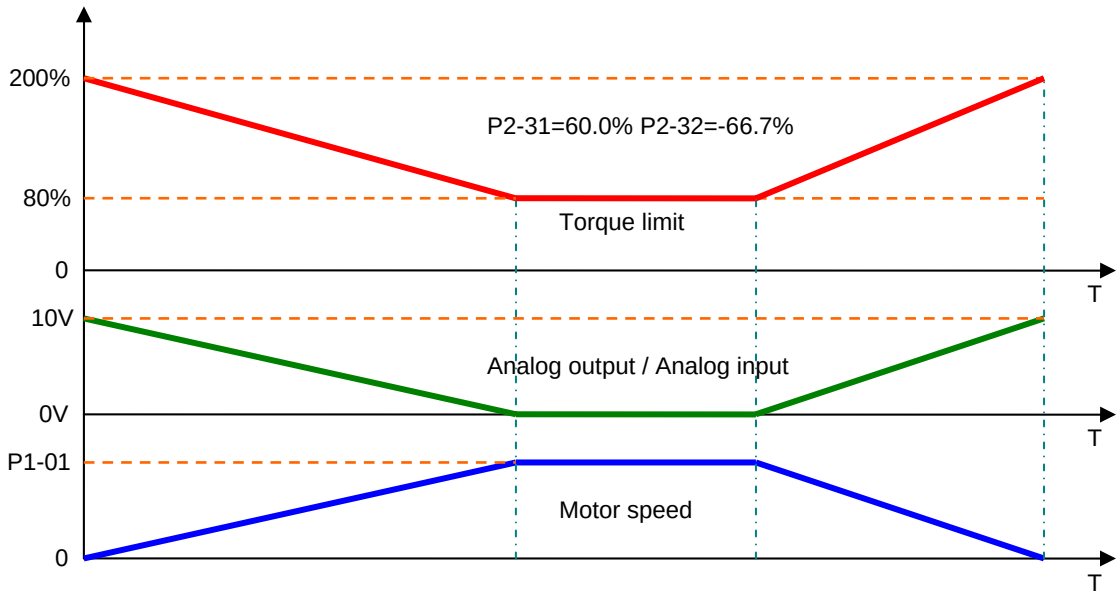
200% torque then equates to 100% on the analog input and 80% torque to 40%.

Putting these two values (100% and 40%) into the equation:

$$\begin{cases}(1-X)\times Y = 100\% \\ (0-X)\times Y = 40\%\end{cases}$$ where X = value in P2-32 and Y represents the value in P2-31

From the equation : $X = -66.7\%$ $Y = 60\%$

Setting P2-31= 60.0% and P2-32= -66.7% gives the desired control function.



Note that in this kind of application, the bipolar analog input cannot be used as a speed reference, as it is used as torque limit input.

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