Allen-Bradley

1336 IMPACT™ AC Drive

Speed/Torque Mode Select

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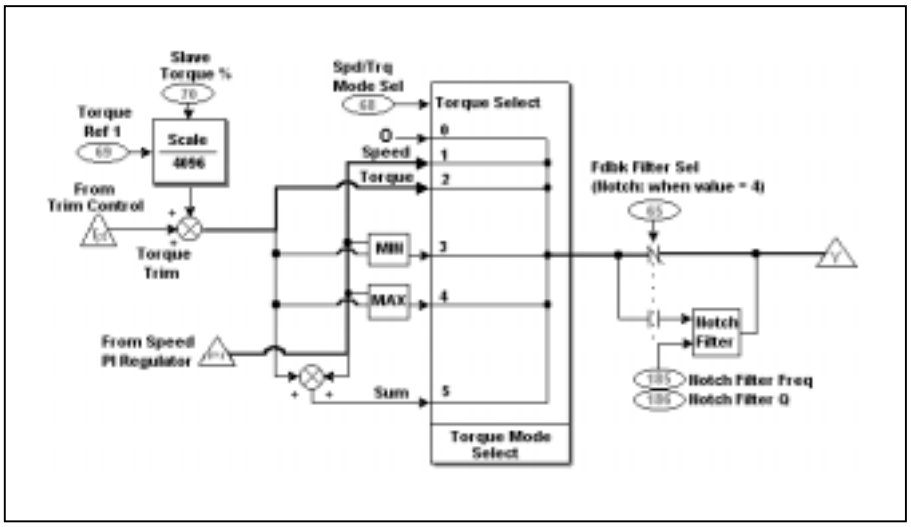
Speed/Torque Mode

Mode of Operation

- *Velocity Regulator*
- *Torque Regulator*
- *Combination of Velocity and Torque Regulators*

Speed/Torque Mode Select Parameter

The Speed/Torque Mode Select parameter is used to choose the operating mode for the drive. The drive can be programmed to operate as a velocity regulator, a torque regulator, or a combination of the two. Refer to the firmware flowchart shown below.



As shown above, parameter 68 [Spd/Trq Mode Sel], is used to select the mode of operation. Zero torque current is allowed when set to (0).

Set to a value of 1, the drive/motor are operated in speed mode. The torque command changes as needed to maintain the desired speed.

Set [Spd/Trq Mode Sel] to a value of 2 for torque mode. In torque regulation mode, the drive controls the desired motor torque. The motor speed will be a result of the torque command and load present at the motor shaft.

Min and Max modes are selected by values 3 and 4 respectively. These two modes offer a combination of speed and torque operation. The algebraic minimum or maximum of speed/torque will be the operating point for the Min and Max modes. The drive automatically switches from speed to torque mode (or from torque to speed) based on the dynamics of the motor/load.

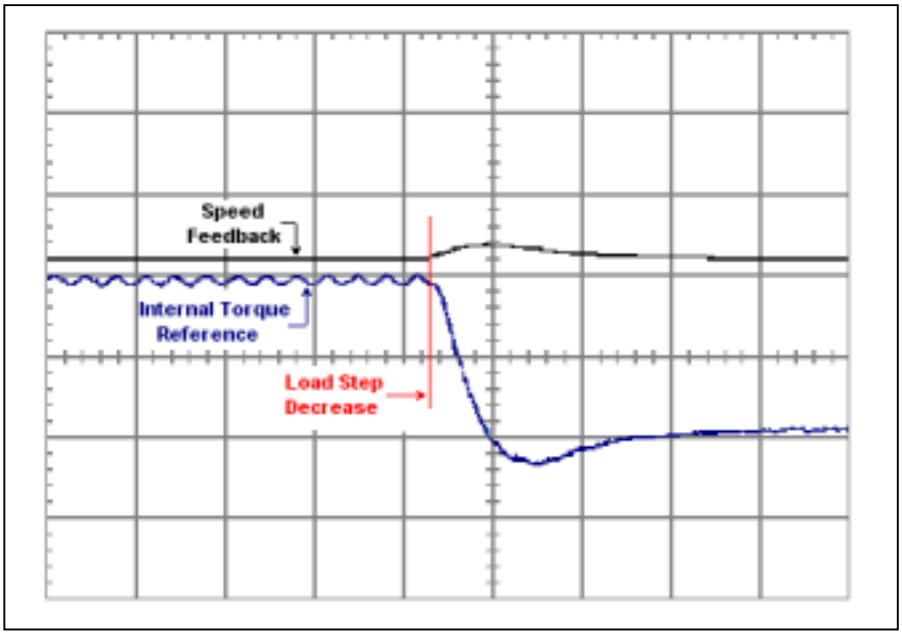
The Min mode is typically used with positive torque and forward speed operation, the minimum of the two is being closest to zero. The Max mode is opposite, typically used with reverse speed and negative torque, the maximum being the least negative (closest to zero).

Sum mode is selected when {Spd/Trq Mode Sel] is set to a value of 5. This mode allows an external torque command to be added to the speed regulator output when desired.

Speed Regulation Mode

Operating as a speed regulator is the most common and therefore simplest mode to set up. Examples of speed regulated applications are blowers, conveyors, feeders, pumps, saws, and tools.

To configure the drive as a speed regulator, set [Spd/Trq Mode Sel] to 1. Select a speed-reference source and program the appropriate link. The factory default link is [SP An In1 Value] 134 29 [Speed Ref 1]. If left at default, the drive will follow the speed reference of the SCANport 1 input. Typically this reference will be the potentiometer on the drive mounted Human Interface Module (HIM). The chart below shows the drive operating in speed regulation mode with a step decrease in load. The response of the drive/motor to a change in load is dependent on the tuning of the drive (bandwidth setting), and system inertia.



Note that under steady state conditions the speed feedback is steady while the torque reference is a constantly adjusting signal. This is required to maintain the desired speed. At transient state, the torque reference will change dramatically to compensate for a speed change. A short duration change in speed is the result of increasing or decreasing the load very rapidly.

Torque Regulation Mode

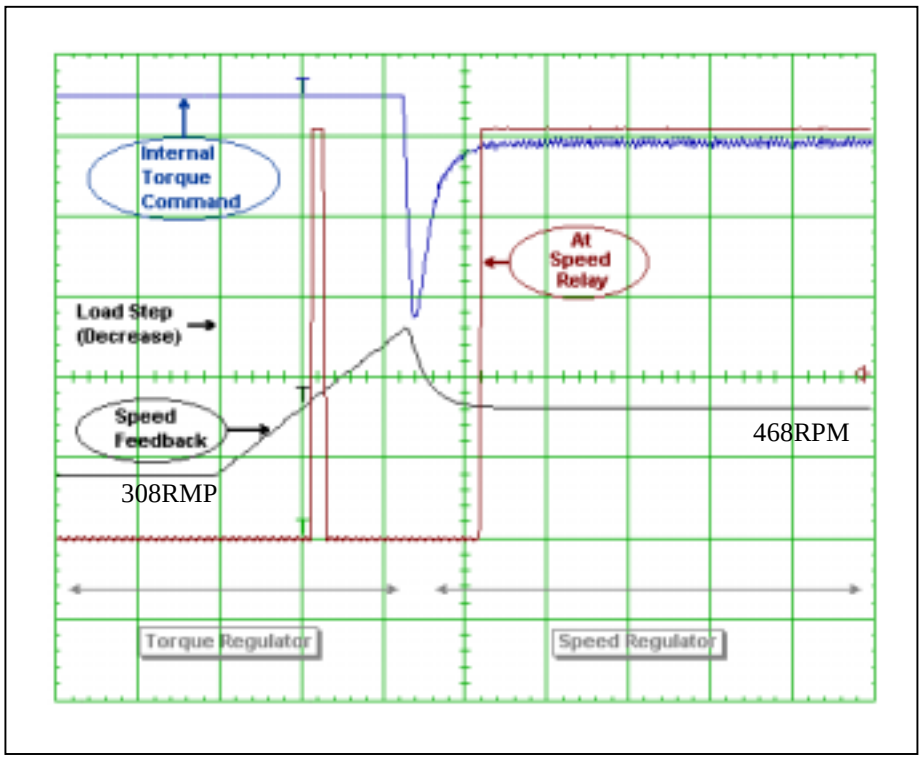
A torque-regulated application can be described as any process that requires some tension control. An example of this is a winder or unwinder where material is being "drawn" or "pulled" with a specific tension required. The process requires another element setting the speed. Configuring the drive for torque regulation requires [Spd/Trq Mode Sel] to be set to 2. In addition to that a reference signal must be linked to the Torque Reference. If an analog signal is used for the reference, link [An In1 Value] 96 69 [Torque Ref 1].

When operating in a torque mode, the motor current will be adjusted to achieve the desired torque. If the material being wound/unwound breaks, the load will decrease dramatically and the motor can potentially go into a "runaway" condition.

MIN Mode/MAX Mode

This operating mode compares the speed and torque commands. The algebraically minimum value is used. This mode can be thought of as a Speed Limited Adjustable Torque operation. Instead of operating the drive as a pure torque regulator, the "runaway" condition can be avoided by limiting the speed. A winder is a good example for the application of the Min Spd/Trq operating mode. Max mode would be used if both speed and torque were negative.

The following chart illustrates how Min mode operates. The drive starts out operating as a torque regulator. The torque reference causes the motor to operate at 308 rpm. The speed reference is 468 rpm, so the minimum is to operate as a torque regulator. While operating in torque regulation, the load decreases and the motor speeds up. Notice the torque command has not changed. When the speed regulator comes out of saturation, it clamps the speed and now the drive operates as a speed regulator. The "at speed relay" then closes.



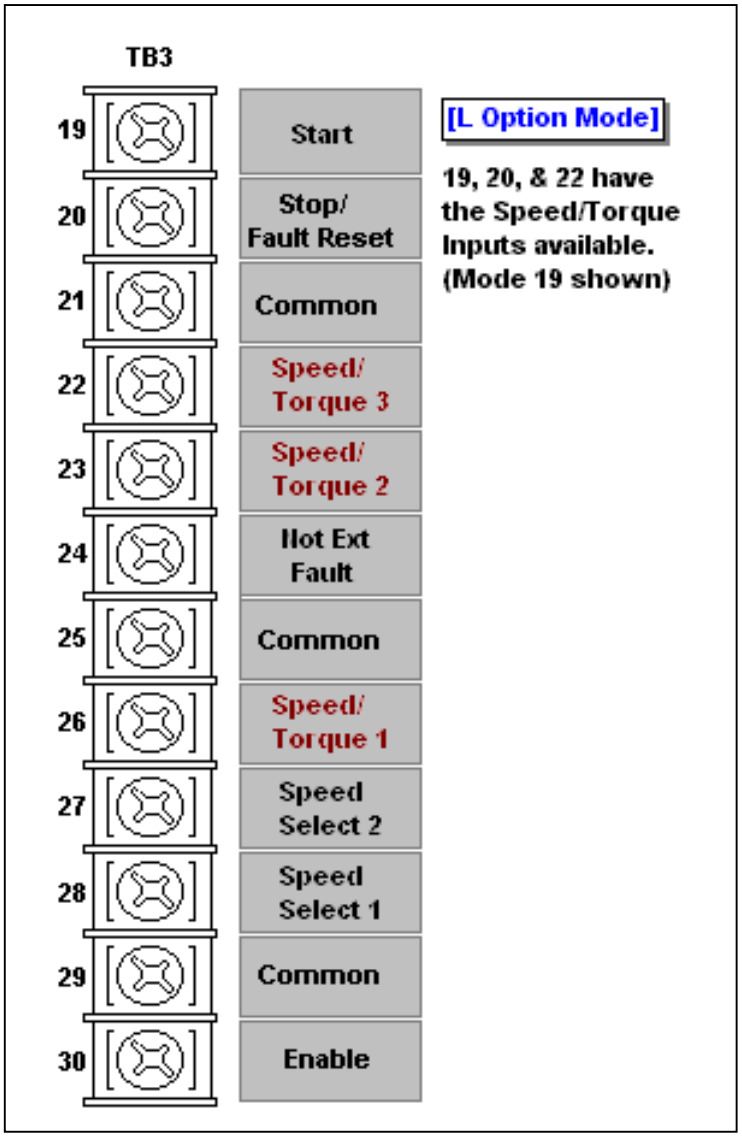
Sum Mode

Configuring the drive in this mode allows an external torque input to be summed with the torque command generated by the speed regulator. The drive requires both a speed reference and a torque reference to be linked. This mode can be used for applications that have precise speed changes with critical time constraints. If the torque requirement and timing is known for a given speed change, then the external torque input can be used to pre-load the integrator. The timing of the speed change and the application of an external torque command change must be coordinated for this mode to be useful. The sum mode will then work as a feed forward to the torque regulator.

Zero Torque Mode

Operation in zero torque mode allows the motor to be fully fluxed and ready to rotate when a speed command or torque command is given. For a cyclical application where through put is a high priority this mode can be used. When the [L Option Mode], parameter 116, is set to a value of 19, 20, or 22, logic inputs may be used to switch between operating modes. Refer to the Speed/Torque Select table.

Speed/Torque Mode



The logic inputs can select zero torque during the “rest” portion of a machine cycle instead of stopping the drive. When the cycle start occurs, instead of issuing a start to the drive, a speed regulate mode can be selected. The drive will then immediately accelerate the motor without the need for “flux up” time.

Speed/Torque Select Table

SPD/TRQ 1	SPD/TRQ 2	SPD/TRQ 3	OPERATING MODE
False	False	False	Zero Torque
True	False	False	Speed Regulate
False	True	False	Torque Regulate
True	True	False	Min Speed/Torque
False	False	True	Max Speed/Torque
True	False	True	Sum Speed/Torque
False	True	True	Zero Torque
True	True	True	Zero Torque

Zero Torque may excessively heat the motor if operated in this mode for extended periods of time. No load or flux current is still present when the drive is operating in zero torque mode. A motor with an extended speed range or separate cooling methods (blower) may be required.

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