

# ACS800 in high end speed and torque control applications



## High end speed control applications

Speed control requirements vary from one process to another. The ACS800 offers numerous possibilities for high end speed control and for access to those functions via a standard analog interface, numerous fieldbuses or through industrial PC interfaces.

Typical high end speed control applications:

- Test benches where speed and torque control is essential
- Printing lines
- Converting lines
- Rolling Mills
- Master-follower configurations
- General System Integration

## Torque control features

The performance of the speed controller is highly dependent on torque control performance. For the ACS800 with Direct Torque Control:

Torque control cycle time: 25 $\mu$ s

Torque rise time: 1-2 ms measured from current rise, dependent on motor characteristics

## Speed control features

PID speed control loop at 1 ms for adjusting speed when speed reference is changed

- Separated speed reference ramping for acceleration and deceleration and shape function for smooth change of speed
- Set point weighting of gain - enables high gain and fast response without overshoot
- Adaption of gain and integration time in speed function and in load - a useful function when compensating for nonlinearity in load characteristics

Speed regulator control features

Impact drop for nominal load step:

0.3 - 0.4% without encoder feedback

0.1 - 0.2% with encoder feedback

Impact drop describes the maximum speed change in respect to time when a stepwise nominal load step is given. Impact drop is dependent on speed control tuning.

Static speed accuracy

10% of motor slip without encoder feedback e.g. typically < 0.1 Hz electrical speed

0.01% of nominal speed with encoder feedback

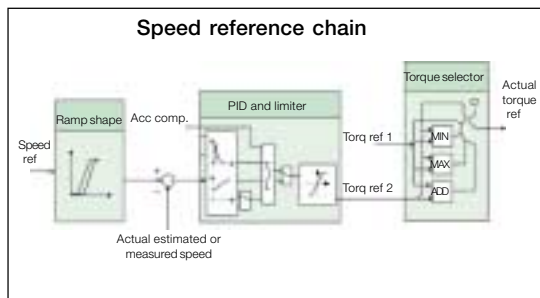


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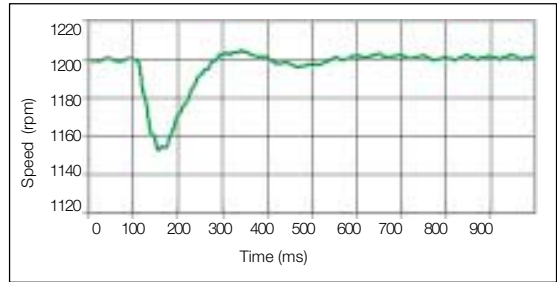
## Advanced speed and torque control features

There are over 60 parameters for achieving the desired coordination of speed and torque. These functions include:

- Basic PID controller
- User-parameterised overspeed protection
- User-parameterised torque limitation
- Bumpless transfer from speed reference to torque reference control and vice versa
- Speed limitation in torque control mode
- Window control: drive follows torque reference when shaft speed is within given limits. If limits are exceeded the speed controller activates and takes over control
- Mechanical oscillation damping algorithm to prevent undesired mechanical oscillation proceeding through speed controller
- Feed-forward
- Inertia compensation
- Ramp hold function
- Two memorised inching speed references e.g. for enabling the operator to use digital inputs for slow machine operation



Speed reference chain including torque selector for user-given torque reference. Principal block diagram.

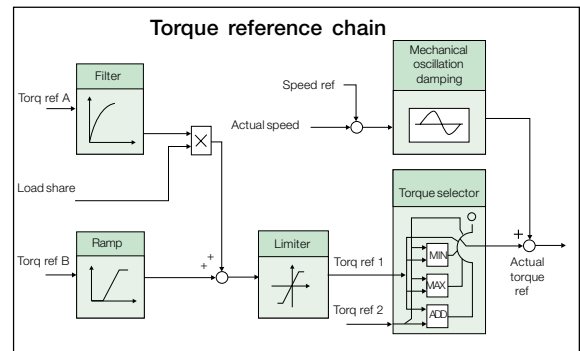


Example of impact drop measurement. In this case the impact drop is about 0.32%. A nominal load step was applied to a 4-pole AC motor shaft.

## Torque selector

The torque selector enables online pick up of desired torque reference and bumpless transfer from one reference source to another:

- Output of speed controller: torque reference
- User-given torque reference
- Sum of speed controller's torque reference and user-given torque reference. Used in follower drive in combination with speed window function allowing free torque reference control within specified speed window
- Min/Max selection. Drive selects and switches in bumpless manner between speed controller's torque reference and user-given torque reference according to the given speed reference, and the signs (plus or minus) of the torque requested.



Torque reference chain including optional filter for mechanical oscillation damping. Principal block diagram.



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