

This Application Note applies to the Unidrive M100/M400 Drive Series

Fan and Pump Setup

The default parameter set for the Unidrive M Open-Loop drives is more oriented to run constant torque loads such as conveyor or extruders. In order to run a fan or pump (only those that follow variable speed/torque characteristics) using our drives, one must make the following parameter configurations to best utilize the drives for these applications.

Pr. 00.001: Minimum Speed

This parameter sets the minimum fan or pump speed. For many systems, the fan or pump must always be turning at some low speed.

Pr. 00.002: Maximum Speed

This parameter sets the maximum fan or pump speed. ALWAYS set this to the base frequency of the motor (i.e. 50 or 60 Hz). Fans and most pumps have a load characteristic where by the load increases as the square of the speed of the motor.

Pr. 00.003/00.004: Acceleration Rate 1/Deceleration Rate 1

These should NOT be set to anything less than the time the motor takes to coast from full speed to zero speed. The characteristic of the load is such that it appears to be a heavy frictional load at high speed and a high inertial load at low speed. Quick deceleration times lead to over voltage trips. If quick stop times are necessary, consider using a dynamic braking resistor.

Remember that the default units for these rates are sec/100 Hz. By default, your time inputs mean the time your motor takes to reach 100 Hz. Go to Pr. 02.039 to change this if necessary.

Pr. 00.007: Motor Rated Speed

Set this parameter to zero. Normally, this is used for the drive's slip compensation algorithm (motor speed droop). Setting this to zero disables the function.

Pr. 00.008: Motor Rated Voltage

Set to the proper range for your motor. For example: 480 for a 460 Vac motor, 240 for 230 Vac.

Pr. 00.009: Motor Power Factor

Set this to either the motor nameplate value (indicated as PF, P.F., or $\cos \varphi$) or the value calculated after a successful rotating autotune of the motor, uncoupled. If no information is available, use the default value of 0.85.

Pr. 00.028: Ramp Mode Select

When the motor slows down, power is fed to the DC link of the drive. This parameter defines how the behavior of the drive's DC link controller during deceleration. Change this to Fast if a dynamic braking resistor is being used. Otherwise, change this to Standard Boost (Std.bSt), which allows for slightly better braking than default.



Pr. 00.032: Dynamic V to F Select

When this parameter is set to 1, the drive's V/Hz characteristic becomes variable, as the Motor Rated Frequency is now defined as a function of Percentage Load (Pr. 04.020). This intended for applications where power loss should be kept at a minimum under low load conditions.

- This should only be used on single motor applications where drive is sized for the motor current rating.
- This should not be used on multiple motor applications
- This should not be used when the drive is being used as a soft start to full speed, where drive is not being used as a variable speed control.

Pr. 00.041: Control Mode

By default, this parameter allows for optimal Open Loop vector control by requiring the drive to consider stator resistance compensation, where stator flux is controlled. The drive offers four options of resistance compensation, which only differ in when it measures stator resistance. For fan and pump applications, the drive can simply use a V/Hz characteristic to determine velocity control without the use of stator resistance measurements. In our case, set this parameter to Square (SrE) to provide the square V/Hz relationship appropriate for the application.

Pr. 00.042: Low Frequency Voltage Boost

This parameter provides a voltage offset ("boost") for 0 Hz in the V/Hz characteristic. Fans and pumps have a very low starting torque, so it is recommended that this parameter be set to a value between 0.5 to 1%.

Generally,

For 75-100 HP this value would be close to 0.3%.

For 125-300 HP this value should be close to 0.1%.

Pr. 05.027: Slip Compensation Level

By default, this is set to 100% so the drive can closely follow the speed reference for optimal Open Loop control. For fan/pump applications, this can lead to the motor failing to decelerate properly. Even though we've set the Control Mode (Pr. 00.041) correctly, we would still need to set this parameter to 0.0% to completely disable slip compensation.

Additional Improvements: S-Ramp

The Unidrive M will come with linear acceleration and deceleration ramps by default, meaning that the drive will abruptly change the motor's acceleration from no acceleration to value established by the ramps. These abrupt transitions in acceleration (can also be interpreted as high values of jerk) translate to abrupt demands in current required from the power line/drive. Ultimately, these current surges lead to sudden surges in motor shaft torque, which could lead to unwanted mechanical strain on your system.

To reduce the possibility of current surges during a change of acceleration or deceleration, the drive can be configured to use an S-Ramp, where the drive smoothly transitions into the defined acceleration/deceleration ramp to change to the new speed reference.



S-Ramp Basic Configuration

Set Pr. 02.006 = ON to enable S-Ramp functionality. Then, set Pr. 02.007 to 60-100 for accel/decel ramps of 33 secs/100 Hz. For higher ramp values, you would want to also increase Pr. 02.007 to around 300. In general, increasing Pr. 02.007 increases curvature at the ends of the ramp.

Overvolts “OU” Trip

The Overvolts (OU) trip indicates that the DC link bus is receiving regenerative voltage typically during a deceleration phase. For this application, disabling slip compensation (Pr. 05.027 = 0, 00.007 = 0) and enabling an S-ramp should make sure this trip doesn't appear during operation. For any required fast deceleration, use a dynamic braking resistor.

If the trip keeps occurring after following the all of the above recommended settings, a few more things to try would be to change current loop gains and small change to the ramp:

- Increase Current Loop Proportional Gain Pr. 04.013 to around 40-90.
- If speed tends to rise upon a stop command, change Pr. 04.013 to around 40-50 range.
- Decrease Current Loop Integral Gain Pr. to around 5-10.
- Decrease Ramp Voltage Pr. 02.008 to about 20-30 volts.
- If “OU” trip occurs around 15-40 Hz, consider enabling Dynamic V/Hz (Pr. 00.032 = 1).

NOTE: The Overvolts (OU) trip appears as “OV” in M100-M300 user guides.

Resources: can be found on our website: www.controltechniques.com

For help contact techsupport.cta@mail.nidec.com, or call Technical Support at 952-995-8000, 24/7/365