

Technical instruction

ACS250 micro drives, 110-600 V

Energy optimization function



Overview

ACS250 has a built in energy optimization function designed to provide the energy savings achievable when the motor and drive are operated at less than the rated load. The energy optimizer works with both constant and variable torque loads to maximize energy efficiency. The energy optimizer operates whenever the drive output current is less than the motor rated current that was set in parameter 9906.

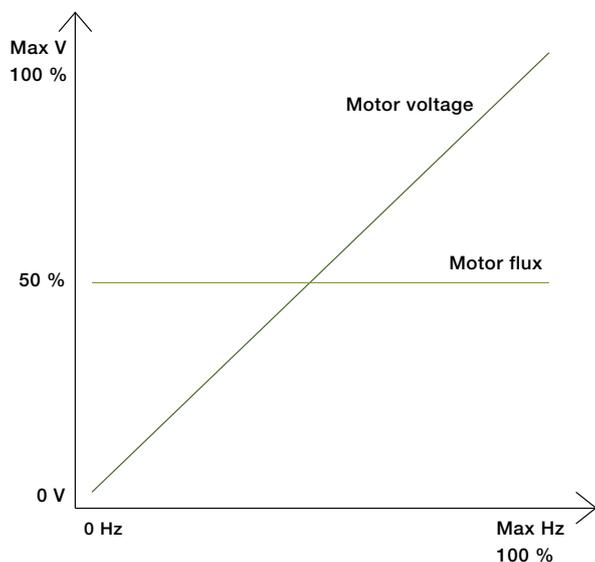
This technical instruction examines the principles and advantages of the energy optimization function, and how it is enabled or disabled within the drive parameter set.

Energy optimization can be activated only in V/Hz mode. It is not available in the sensorless vector control mode found in the 500-600 V drives.

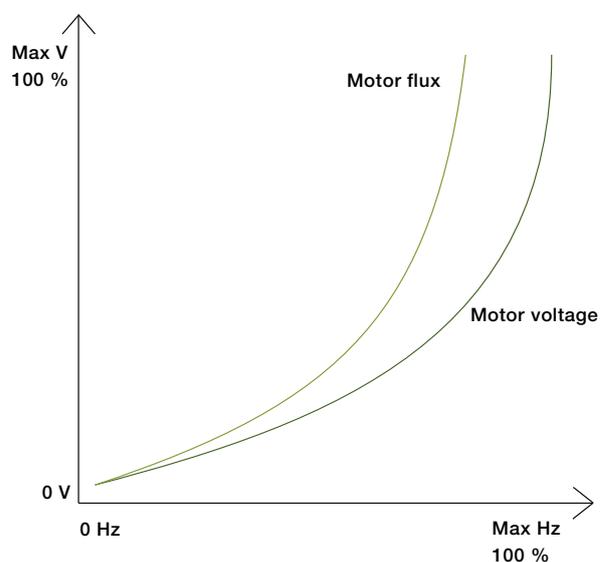
Principles of the energy optimization function

Most drives approximate the relationship between voltage and frequency using predefined voltage profiles programmed into the drive. These profiles are usually split into two categories – constant torque and variable torque. Typical characteristics for these profiles are shown below.

Constant torque profile



Variable torque profile

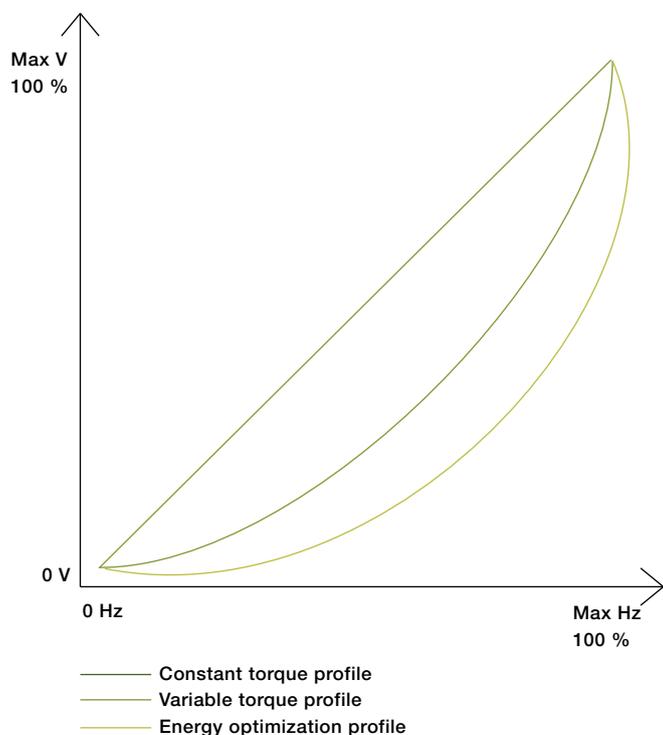


The constant torque profile provides the best results for energy savings because the load is constant and close to the nominal value. However, under no load or lightly loaded conditions the excess magnetizing current will unnecessarily increase the losses in the stator making the motor less efficient.

In the same way, variable torque voltage profiles provide the best motor efficiency as long as the load matches the predefined variable torque profile. Any deviation from it will cause excessive losses in the stator circuit (when load is lower than the profile value) or in the rotor circuit (if load is higher than the estimated value).

Energy optimizer provides a solution to the efficiency loss caused by excessive magnetizing currents. It automatically optimizes the voltage/frequency relationship for each application by modeling the load more precisely, instead of applying a standard constant torque profile or variable torque profile for the application. The energy optimizer helps to minimize the energy consumption of the motor by creating a unique V/Hz profile tailored to each application.

Operation of the drive with and without the energy optimization function is illustrated below. The graph assumes operation of a variable torque load such as a fan or pump and illustrates the difference between running that type of load with a constant torque profile, a variable torque profile, and then with the energy optimization function turned on. The curves on the graph are approximations to show principle of operation.



It can be seen that energy savings exist in the area between the different profiles. The energy optimization function adjusts voltage to provide energy savings under all conditions. Even a constant torque drive with energy optimization function can operate the motor more efficiently than a variable torque drive without energy optimization.

In the energy optimizer mode, the drive is continuously monitoring the load requirements of the application and immediately provides additional torque when needed. When the load changes or the motor is required to accelerate or change speed, it will provide current up to its maximum overload value. Once the motor reaches a steady state speed, the drive immediately returns to optimizing the output to the load and the energy savings that results.

Advantages of the energy optimization function

The primary purpose of the energy optimization function is to save energy by reducing losses in the motor. This reduces the operating cost of them equipment being powered by the motor, saving money for the end user. For the drive system, matching the motor and drive with the load requirements eliminates any energy wasted by oversized components. Energy optimization reduces energy wasted by over magnetizing the motor at reduced loads.

In addition, reducing over magnetization in the stator and rotor circuits reduces unnecessary heating that causes thermal stresses on the motor. The result can be improved motor reliability and life span.

Taking a wider look at the control system, energy optimization can also reduce the supply current to the drive. This can result in reduced current being supplied to line reactors and other heat producing components within the control system, again leading to reduced energy losses and improved reliability.

As previously stated the energy optimization function reduces the load current during periods of low load operation and this has the additional positive effect of reducing the audible motor noise. Reduced motor noise can be an attractive feature when the motor is located in noise sensitive applications..

As with all ABB innovations this feature is easy to implement. Activation using a simple enable/disable parameter within the drive allows technicians and commissioning engineers of any skill level to implement the function within their application and realize the benefits of this feature.

Parameter set up of the energy optimization function

The ACS250 provides a constant torque output profile with or without energy optimization active.

The energy optimization function is enabled and disabled through a simple parameter change available in the long parameter group. This parameter is detailed below.

2601 Energy optimization:

- 2601=0: Energy optimization function is disabled.
- 2601=1: Energy optimization function is enabled.

Operation of the drive in energy optimization mode

When this function is enabled, the ACS250 continuously monitors the motor load condition by checking the output current compared to the motor rated current. When the drive operates at constant speed and the motor load is less than full load, the drive will automatically reduce the output voltage applied to the motor, thereby reducing the energy consumption of the motor.

If the load on the motor increases, or the frequency set point changes, the output voltage will immediately increase in order to compensate for the load change.

The energy optimization function is fully dynamic, permitting energy saving to be achieved while maintaining the ability to deliver full rated motor torque whenever required.

The energy optimizer only operates when the drive frequency set point remains constant over a period of time. This can be especially useful, for example, in applications such as conveyors, which are required to operate with any load condition between full or empty belt.

Note! Care should be taken in using the energy optimizer function in applications where the frequency set point to the drive changes continuously, such as PI control applications. As the motor voltage is reduced, the slip of the motor may increase, resulting in a small drop in motor speed, which can make the PI control unstable.



For more information please contact
your local ABB representative or visit:

www.abb.com/drives

© Copyright 2014 ABB. All rights reserved.
Specifications subject to change without notice.