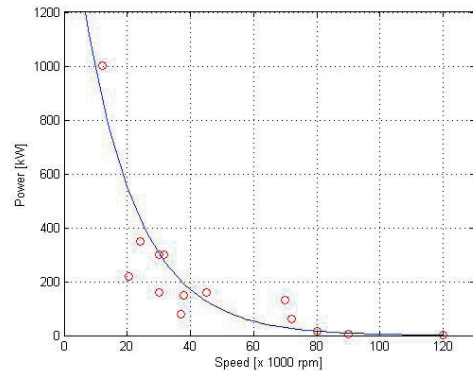


VACON AC DRIVES FOR HIGH SPEED APPLICATIONS

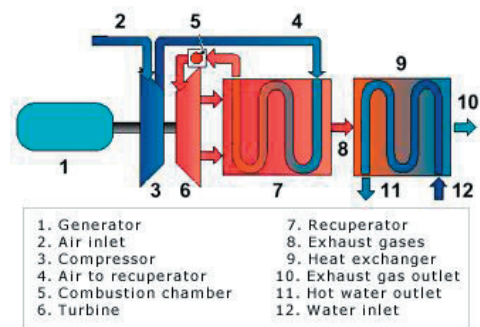
Overview

High speed motors are used in many applications such as turbo blowers, chillers, compressors, micro-turbine gas generators, machine tools, material cutting, down-hole oil-pumps etc. Benefits of high speed motor drives are, for example, the reduced size and the increased efficiency. High speed motors are nowadays mainly permanent magnet synchronous motors or induction motors, which both can be controlled by Vacon frequency converters. Permanent magnet motors are coming more and more popular due to the good power factor and efficiency.

At very high speeds, the use of closed loop control with external speed sensors (encoders) is difficult, for example, due to the rotational speed limits of speed sensors and the reliable mechanical mounting of the encoder to the motor shaft. Due to this, Vacon uses open loop control in most of the high speed applications in order to increase the drive train reliability. Motors can be run up to the thousands of Hz, the main limiting factor being usually the maximum switching frequency which the drive inverter can thermally withstand. The same open loop control can be effectively used also with different type of output filters such as du/dt-filters or sin-filters, if those are required by the motor manufacturer.



Reference cases; motor speed vs. power



High speed microturbine generators

Application

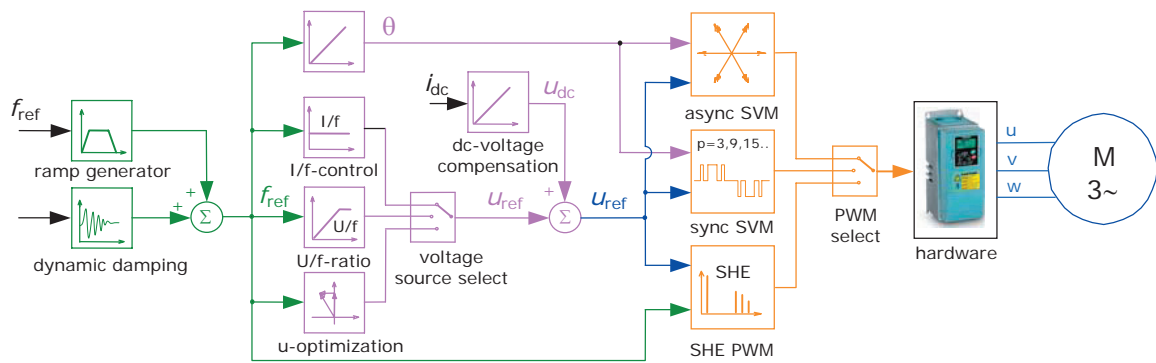
- The Vacon High Speed Application has been designed for processes that require higher speeds than 320 Hz, allowed by general Vacon applications. There are 2 different levels of this application (ASF1FF12). The first level can run up to 1900 Hz and with the second level it is possible to run the motor up to 7200 Hz. These applications are based on the Vacon Standard Application and can be used in both NXS and NXP drives.
- The application has a "high speed" parameter subgroup, where it is possible to fine tune the motor controller for smoother run
- For slow acceleration/deceleration, Long Ramp times (1-30 000s) can be activated by a parameter. Default is 0.1-3000s.
- For the fieldbus, it is possible to program separately the content of Process Data Outputs 1 to 8. This is done in parameter group 10.



High speed blowers



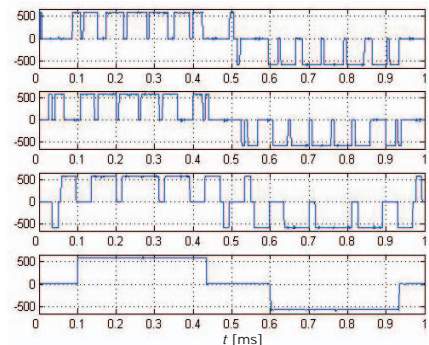
High speed compressors



A simplified control diagram for the speed sensorless control of high speed motors.

Benefits and features

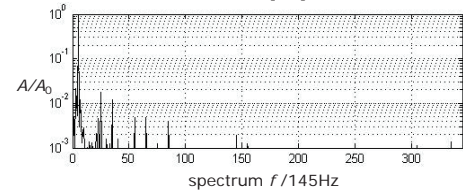
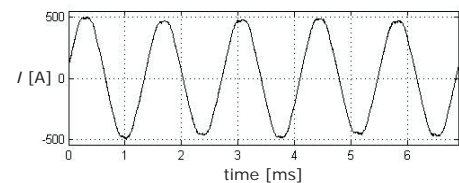
- Efficient control for synchronous permanent magnet motors and asynchronous motors. At high output frequencies open loop control can be used without any speed sensor feedback, which increases the drive train reliability.
- Provides the user with optimal control for reducing motor losses.
- Reduces motor current harmonics and power losses with advanced output voltage synthesis such as synchronous Space Vector Modulation and Selected Harmonic Elimination. Low output voltage pulse number, including the square-wave control with full output voltage can be used to reduce the power losses and increase the efficiency.
- High output frequency up to the 7200 Hz
- Output filters can be used with the same motor control
- Control of insensitive motor and drive system parameter variations.
- Easy commissioning procedures.



Different PWM methods to optimize drive performance



High speed machine tools



Resulting in clean motor current waveforms