

FAQ for SINAMICS DCM

Question: Which points need to be remembered when motors are connected in parallel or in series on a common SINAMICS DCM?

Answer:

In the case of new applications, we recommend a separate incoming supply to each motor via a separate SINAMICS DCM in master-slave mode if the motors are installed on a common shaft, or alternatively load sharing control if the motors are coupled by means of the web, rope, gear or gear rack.

In the case of retrofit applications, the existing parallel or series arrangement of the motors can be retained. It is usually sufficient to replace the existing converters with a SINAMICS DCM. The flexibility of the SINAMICS DCM allows the control concept to be tailored to any requirements.

In the case of old motors with old converters, the existing smoothing reactor should normally be retained. If the system is upgraded from Ward Leonard kits to converters, it may be necessary to retrofit a smoothing reactor in order to reduce the additional losses and ensure good commutation. If in doubt, please consult the motor manufacturer. Siemens advisory services can help with sizing the inductance of the smoothing reactor.

A) Operation of parallel motors on one SINAMICS DCM

If several motors are operated in parallel on one SINAMICS DCM, they are supplied with a common armature voltage. This kind of application used to be standard practice, for instance when motors were installed on a common shaft or with roller conveyor motors. The load is distributed roughly evenly between the motors, assuming an identical motor characteristic and a falling load characteristic.

A series resistor is recommended in the motor armature circuits to support the uniform current distribution between the motors (it results in a falling load characteristic).

The following rule of thumb is useful for sizing: a drop of approximately 5% in the rated armature voltage should occur across the series resistor at the motor rated current.

Example: $U_{dn} = 400V$; $I_{dn} = 100A$; $R_v = 400 * 0.05 / 100 = 0.2 \text{ ohm}$.

All the motors should be of the same type and have the same motor flux in order for the same EMF to be induced in each of them at the same speed (precondition of a uniform current distribution). When field windings are connected in parallel to a field supply, this is normally achieved by trimming the motor fields with series resistors. The aim of trimming is to obtain a uniform current distribution between the motors under load. Since the resistance of a field winding is highly temperature sensitive, a separately controlled field current supply is recommended for each motor – especially if the motors need to be switched off as required during operations.

The field windings can also be connected in series, in which case there is automatically a uniform field current distribution between the motors.

The motors must be individually monitored for overload, for instance by evaluating the motor temperature with PTC thermistors, separate armature fuses or overload relays. Electronic evaluation is also possible by measuring the armature current of each motor using separate shunts and isolating amplifiers with downstream evaluation of the maximum value in the SINAMICS DCM.

B) Operation of series motors on one SINAMICS DCM

If several motors are operated in series on one SINAMICS DCM, the same current flows through each of them (same moment at the same motor flux). This kind of application used to be standard practice for motors coupled by means of the web, for instance in order to apply a uniform moment to the material at bridles. A uniform voltage distribution between the motors is guaranteed assuming the same motor speed and the same motor field. The motor insulation in these applications must be rated for the summation voltage.

The motor fields must be supplied as described above, and the field windings are usually also operated in a series connection.

Measurement using isolating amplifiers with downstream evaluation of the maximum value in the SINAMICS DCM is recommended for monitoring the maximum permissible motor armature voltage.

C) Optimization of the control

The control (current controller, speed controller, possibly field weakening controller) is optimized on the SINAMICS DCM simultaneously for all motors. If some motors are switched off during operations, the control is adapted to the new plant configuration (standardization, optimization of the controlled system) by switching the data set (DDS, four sets provided in the SINAMICS DCM).

A) Two motors connected in parallel, R_v : armature series resistors

The fields in this example are connected in parallel with trimming resistors R_1 , R_2

B) Two motors connected in series;

The fields in this example are connected in series

