SIEMENS

FAQ about 6RA70 DC-MASTER and SIMOREG CM

Question: How do I operate a series-wound or a compound-wound motor on the 6RA70?

Answer:

What is different about a series-wound motor?

There are several important things to note about operating a series-wound motor on the 6RA70. A key feature of this type of motor is that the armature and field windings are connected in series and therefore carry the same current.

This means that the flux phi changes as function of the load (armature current).

When the motor operates on a closed-loop control without actual speed sensor (closed-loop EMF control), its speed is heavily dependent on the load (countertorque). Under no-load conditions (motor idling), the motor operates with very weak field due to the low current, a condition which can result in very high speeds and irreparable damage to the machine. For this reason, a speed control system with speed actual-value sensor must always be provided for drive applications where the motor might be taken off load.

A closed-loop EMF control is an option where the countertorque increases in proportion to speed (e.g. for pump or fan drives). However, this type of control cannot be expected to meet exacting standards of speed accuracy.

Since the armature and field circuits are connected in series, both windings always carry current in the same direction and a change in the current direction (4Q operation) cannot be used to brake or reverse the rotation direction. In other words, the motor can drive only in forward direction and brake only in the reverse direction. To make the motor brake in the forward direction or change its direction of rotation, the polarity of the armature winding or series winding must be reversed, but current reversal in the converter itself is not possible.
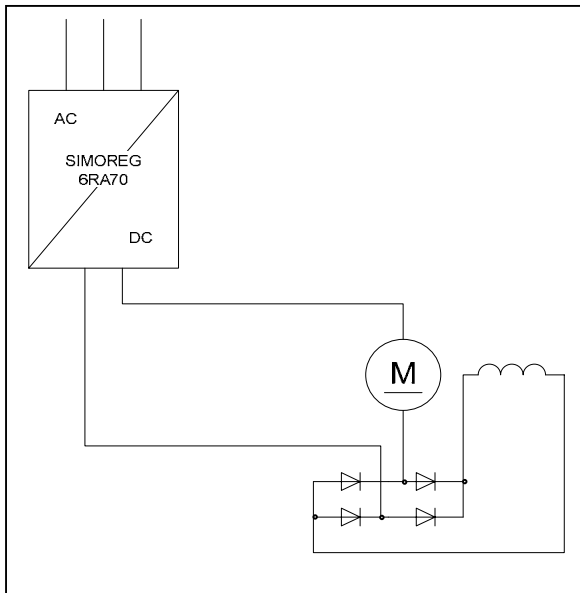
By using a rectifier bridge for the series winding, the current in the motor armature circuit can be reversed by a 4Q converter to allow the machine to operate in 4Q mode.

Note
The current ripple caused by operating a series wound motor on a converter can impair commutation performance and thus lead to brush sparking and increased brush wear. To counteract this problem, a resistor should be connected in parallel to the field winding to limit the AC component in this winding. Information about the size of parallel resistor required must be obtained from the motor manufacturer.

Converter selection
A 1Q device in a B6C connection is used as the converter: **6RA70..-..S22-.**

Parameter settings and what you need to know about commissioning.
The drive is commissioned as described in Chapter 7 of Operating Instructions
P082 = 0, internal field supply device is not used

Options for optimizing the current controller:
a) Manual optimization, sufficiant for this application in most cases
P110: Set the total resistance for the armature and field windings
P111: Set the total inductance for the armature and field windings
P155: Current controller P gain, factory setting is normal suitable
P156: Current controller integration time, factory setting is normal suitable
P153 = 2 Precontrol partially active
If only a low response is required (fan drive): P153 = 0 precontrol disabled.
P110 and P111 need not than to be set.
b) Automatic optimization
As the armature and field are connected in series, the full motor torque is generated during the current controller optimization run and the motor rotor must therefore be locked. If this is not possible for motors with high outputs, proceed as follows:
1) First connect only the armature winding of the motor to the SIMOREG output and start the current controller optimization run. Note down the values calculated for P110 and P111.
2) Then connect only the series winding of the motor to the SIMOREG output and start the current controller optimization run. Note down the values calculated for P110 and P111
3) Enter the sum of the values calculated under 1) and 2) in P110 and P111
The values calculated under 2) for P155, P156 are normally suitable (as the inductance of the series winding is normally higher than that of the armature winding by a factor of about 10)
Set P153 = 2

Optimizing the speed controller
Before this controller is optimized, the armature and series windings of the motor must be connected in series so that the motor is operational again.
P225: P gain, factory setting is normally suitable
P226: integration time, factory setting is normally suitable
If necessary, run the speed controller optimization routine (set the dynamic response factor in P236 to low values during run) or fine tune manually

What do I need to note with respect to compound-wound motors?

A key characteristic of the compound-wound motor is that the motor magnetizing field is produced by a shunt winding and an additional stabilizing series winding. This so-called "compound winding" boosts the motor's magnetic flux as a function of the armature current. Its influence on the motor flux amounts to up to 15% of rated flux at rated armature current. The information above relating to series windings also applies in principle to the stabilizing series winding, but since the latter need produce only a minor proportion of the motor working flux, its inductance is significantly lower than that of a pure series winding. As a result, it is generally sufficient to perform the current controller optimization run in the normal manner.

Set parameter P153 = 2; Precontrol partially active.

With regards to 4-quadrant operation, it is important to note that the stabilizing series winding causes the field to strengthen in one current direction, but to weaken in the other. It is therefore advisable to apply the field strengthening effect in the driving direction and the field weakening effect in the braking direction, because a lower torque in generally required in the braking direction.

As an alternative, it is possible to implement the rectifier bridge connection described under series-wound motor above for the stabilizing series winding in order to obtain a field strengthening effect that is independent of current direction.

If the compound winding is required only to boost the motor torque during acceleration rather than for continuous motor operation, then the necessary torque increase can be achieved by raising the armature current. In such cases, the compound winding can be disconnected, i.e. the armature circuit can be modified to exclude the compound winding.