

1 Overview

The principle of a slip-ring motor is that external rotor resistance provides the necessary motor torque during acceleration to full speed. Once the motor is close to full speed, the external rotor resistance is shorted out and the motor operates as a standard three phase induction motor.

Old slip-ring motor systems typically consist of either a liquid resistance tank with a mechanically operated electrode, or else a series of cast-iron or wire wound resistor banks with a mechanically operated changeover switch. These systems can become mechanically unreliable and require regular maintenance. They also require mechanical intervention for motor starting.

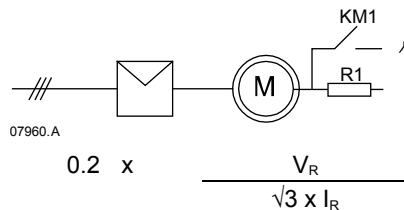
Digistart D3 soft starters include functions specifically to simplify slip-ring motor control. These functions are not suitable for applications where the slip-ring motor is being used for speed control or to develop excess start torque (ie more than 100% motor full load torque to break-away).

You must have some rotor resistance for motor starting. This rotor resistance (R1) is shorted out using an AC2 rated contactor (KM1) when the motor is close to full speed.

The Digistart D3 Dual Ramp function provides a voltage ramp with constant current control while the rotor resistance is in the circuit. This is followed by a smooth transition when shorting out the rotor resistance. A second voltage ramp with constant current control is provided for acceleration to full running speed.

2 Guidelines for Sizing Rotor Resistance

You must have some external rotor resistance when using the Digistart D3 for slip-ring motor control. If the existing system has a series of cast-iron or wire wound resistor banks, then the final stage resistance bank can be used for R1. If you intend to install a new resistance bank, use the following guideline for sizing:



R (per phase) =

$$0.2 \times \frac{V_R}{\sqrt{3} \times I_R}$$

Where V_R = open circuit rotor voltage

I_R = full load rotor current

Power (per phase) =

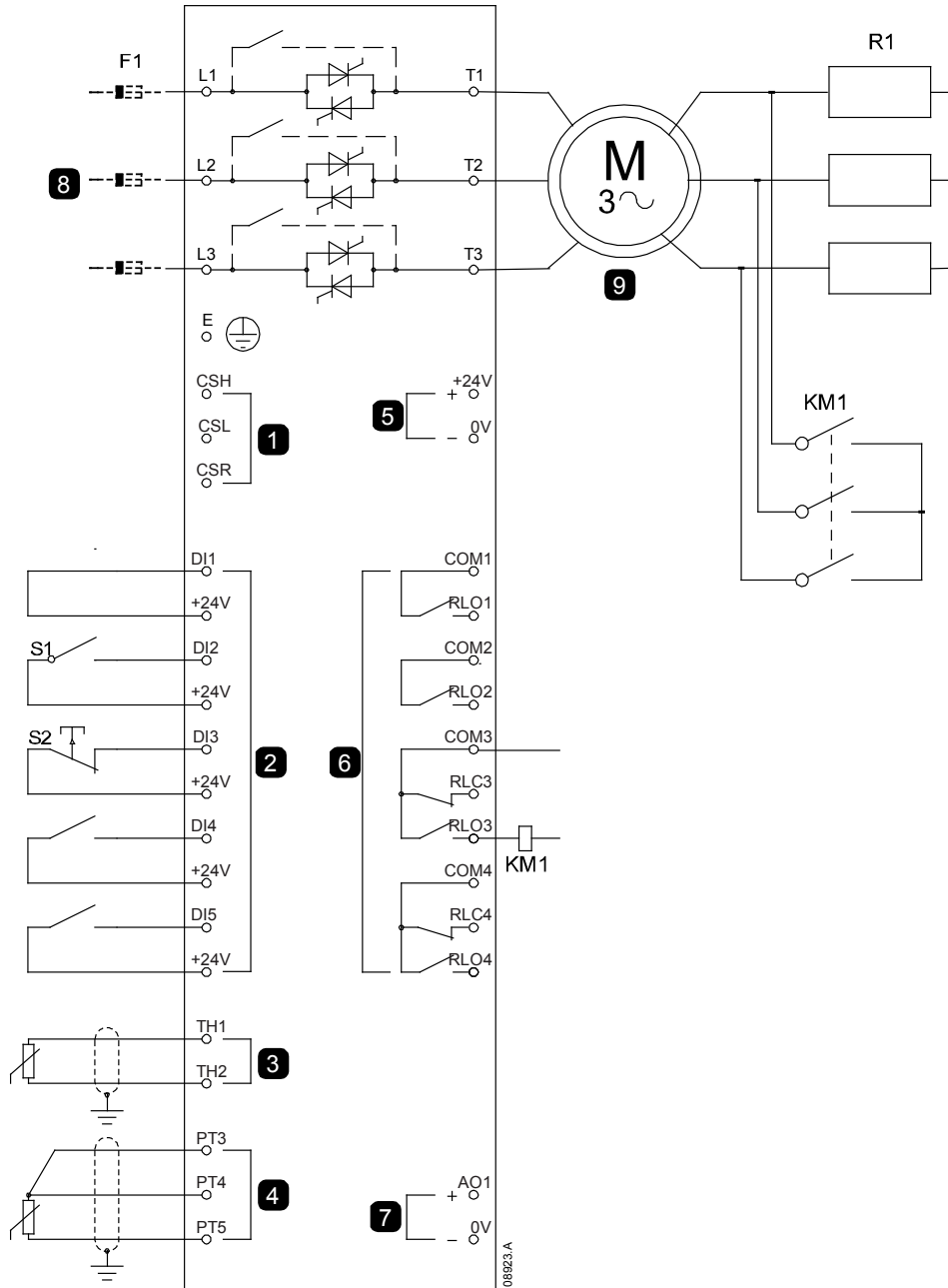
$$\frac{20\% \times \text{motor kW}}{3}$$



This information is for guidance only. You should consult your resistor supplier for technical advice on rotor resistance sizing.

3 Installation

3.1 Slip ring motor wiring diagram



1	Control voltage
2	Remote control inputs
3	Thermistor input
4	PT100 RTD input
5	24 VDC output
6	Relay outputs
7	Analog output
8	3-phase supply
9	Slip ring induction motor

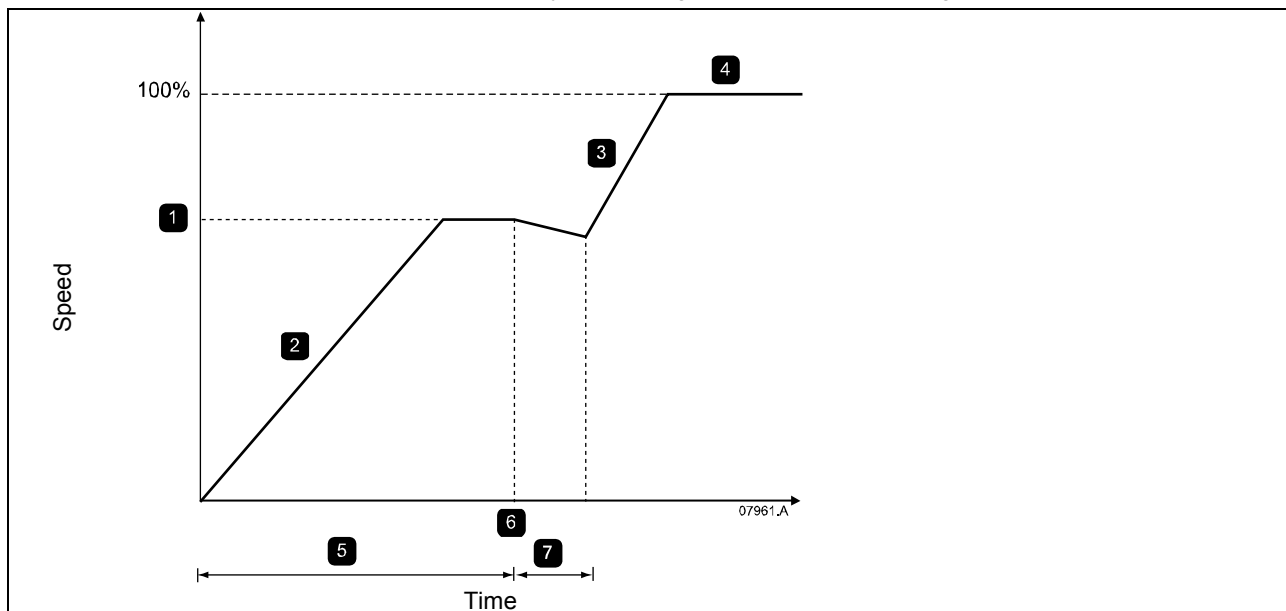
KM1	Changeover contactor
F1	Semiconductor fuses (optional)
S1	Start/stop contact
S2	Reset contact
R1	Rotor resistance (external)

4 Commissioning

1. Configure the Digistart D3 as follows:

Parameter settings:

- Pr **4D** *Relay B Action*
 - Select Changeover Contactor
 - Pr **4E** *Relay B On Delay*
 - Set this to the maximum time (5m:00s).
 - Pr **13A** *Motor Data-1 Ramp*
 - Select Dual Ramp (for Slip-Ring induction motor control)
 - Pr **13C** *Slip-Ring Conduction Retard*
 - Default setting is 50%. Set this parameter to a value which is high enough to cause the motor to instantly accelerate once the rotor resistance (R1) has been bridged out and low enough to avoid a motor current pulse.
 - Pr **13D** *Changeover Time*
 - Default setting is 150 milliseconds. Set this to a value just greater than the changeover contactor (KM1) pole closing time.
2. Start the motor under normal load conditions and record the time it takes to reach a constant speed with external rotor resistance (R1) in the circuit. Stop the motor soon after a constant speed has been reached. Change Pr **4E** to the recorded time value.
3. Start the motor under normal load conditions and monitor the motor speed behaviour and motor current when the changeover contactor (KM1) switches in to short-out the rotor resistance (R1)
If the motor does not start to accelerate immediately after changeover, increase the setting of Pr **13C**.
If there is a pulse in motor current immediately after changeover, reduce the setting of Pr **13C**.



1	R1 Constant Speed
2	First ramp
3	Second ramp
4	Run mode ($I < 120\%$ FLC)

5	Pr 4E
6	KM1 closes
7	Pr 13D



NOTE

For this installation to function correctly, only use the primary motor settings. Only use the constant current start method (Pr **2A** *Start Mode*).