ECOSS
Electronic compact starter for wound rotor drives
Controlled and safe start-up of wound rotor drives

Electronic compact starters are used when slip-ring motors have to be started up as smoothly as possible in a controlled or regulated manner.

Gear systems and couplings are subjected to high mechanical loads during start-up. This results in considerable wear and high maintenance costs in many cases.

Conveyor belts often require a starting torque which is very close to or slightly above the rated torque of the motor. A constant load torque depending on the belt loading and the lifting work is typical.

The ECOSS electronic starter enables a controlled start-up. Simple principles can be applied such as start-up through constant resistance reduction with a variable ramping time and an adjustable maximum torque. Regulation to a constant torque (stator current) and speed control can also be implemented.

The ECOSS power-electronic starter operates according to the well-known principle of rectification and subsequent pulsing of the rotor current. The current state of development of power semiconductors, particularly with regard to current carrying capacity and clock rate, also makes it possible for this switching principle to be used for larger power ranges.

Typical application areas
ECOSS can be used for any applications, in which slip-ring motors function as drive movers. In particular, this concerns:

- Conveyor belts
- Fans
- Crushers and mills
- Mixers
- Agitators

Power range
Drives with slip-ring motors in a power range up to approx. 1500 kW.

The advantages for the user at a glance
- Infinitely variable, controlled start-up
- Less wear and mechanical loading
- Reduced maintenance costs
- Longer lifetime of the drives and motors
- No stepping of the starting resistor, therefore constructed from the same elements
- Shockless change in resistance also possible with DC injection braking
- Integration of the starter in modern control networks through coupling via PROFIBUS
- Integration of the starter in the diagnostic and parameterization system DriveWindow of ABB
Belt conveyor application
ECOSS – Design and method of operation

Power electronics module
The heart of the system is the power electronics module which consists of the assembly groups rectifier, IGBT switch, snubber module and the drivers with several internal monitoring controls.

The power electronics module receives the specification of the pulse-width modulated switching cycle from the control module. Both logic and closed-loop controls for the starting procedure are executed in the control module as well as monitoring and control functions for the fans and the short-circuit contactor.

Control unit
The control module can communicate with the plant control system via PROFIBUS or parallel signal coupling. The RDCU board familiar from the ABB converter technology is the basis of the hardware. The DriveWindow diagnostic functions are also available if a DDC bus is installed.

Installation in the cabinet – custom-designed solution
The power electronics, control unit and the short-circuit contactor are installed in a cabinet. The placement and dimensioning of the resistors depends on the requirements of the plant to a great extent.
Example of design:
ECOSS cabinet and four cabinets for the installation of the resistors. Up to five cabinets can be added depending on the application case.

ECOSS versions with two, three and five cabinets for the installation of the resistors.

1) This version would be valid for the example data "Motor 900 kW," on page 6.
Power data
Max. rotor starting current over 60 s  800 A
Max. rotor standstill voltage  1700 V
Basic frequency of the pulsing  1 kHz
Minimum pulse width  2%

Cabinet design
W x H x D  1200 x 2200 x 600 mm
Two-door design
Electronics side  800 mm
Control and ventilation side  400 mm

Installation of switch cabinet
Degree of protection IP43 indoor, switchgear house or container
Degree of protection IP54 outdoor installation

Installation of resistors
In ventilated areas of switchgear houses or containers
In ECOSS modules as shown in figures on page 5

Environmental conditions
Ambient temperature range  -20 °C…+40 °C

Certificates
ISO 9001, DIN VDE 0100

Functions
Ramp time for start
Current limitation
Constant current
Speed control
Fixed pulse specification for test purposes

Monitoring
Overtemperatures of the resistors
Overtemperatures of the IGBTs
Interior temperature of control cabinet
Maximum current rise
Minimum pulse width

System integration
Coupling of the control signals  Parallel or PROFIBUS
ODCS diagnosis bus

Data required for designing ECOSS
The following data for the drive and motor is required at the very least for the precise design of the compact starter, such as dimensioning of the resistors and selection of the power electronics module:

Example of requisite drive data
Drive characteristic of belt drive horizontal 500 m
Two motors at a pulley in the head
Starting time 20 s
Requisite starting torque 1.3 M_k
Maximum starting torque 1.6 M_k for clearance of chute blockages
Maximum braking torque 0.7 M_k at rated motor speed
Action time of the DC injection brake 10 s
Starting and braking cycles 3x in succession (15 s pause), 6x per hour

Example of requisite motor data
Rated motor power  900 kW
Number of pole pairs  3
Rated speed  990 rpm
Rated motor voltage 6000 V
Rated motor current  110 A
No-load voltage of rotor  1180 V
Rated current of rotor  465 A
Breakdown torque  2.4 M_k*

Start-up control
Linear resistance reduction with stop function if maximum current exceeded

Brake control*
Linear resistance reduction to 50% during the braking time

* Only applicable if DC injection brake is to be implemented