SINAMICS DCC Winder
Introduction

The application SINAMICS DCC Winder was developed with the objective to address many of the known winder applications using one application software.

If required, the application can be configured and/or also changed.

Using the application SINAMICS DCC Winder allows winders and un-winders to be implemented in a wide range of applications, e.g. foil making machines, printing machines, coating machines...

The winder application can be used on the following devices:
SINAMICS S120, S150, G130, G150
SINAMICS DCM
SINAMICS Integrated in SIMOTION D4xx-2
The variant with splice control and that is compatible with DCB Traversing Drive can be used on SINAMICS S120 and S150.
SINAMICS DCC Winder
Benefits when using the Application

- Shorter engineering and service times
- Industry standards are used
- Supported by the various Application Centers
- Continuously updated in the Intranet
- Essentially open source code so that you can adapt the functions to your requirements
- User Manuals in English and German
- Free of Charge
SINAMICS DCC Winder
Contents of the Application

- PowerPoint presentation (English / German)
- Programming in CFC
- User Manuals (English / German)
- Project assistant
- Control block LMCSINA_WinderFB for SIMATIC S7-1500 and S7-1200
**SINAMICS DCC Winder**

**Scope of Functionality**

**Center Winder or tandem center winder**
- winds material around a core or mandrel
- the coil is driven by a motor
- the motor can be operated in torque or speed controlled mode
- dancers or load cells for tension control are optional
- Roll hardness controlled by web tension and optional by nip pressure

**Turret winder**
- two or more centerwinds on a rotating axis
- Roll change on the fly
- A flying knife will slice the material and automatically hold it while it starts to wrap a new coil
SINAMICS DCC Winder
Scope of Functionality using the example of dancer position control
SINAMICS DCC Winder
Scope of Functionality

Winder from above

Unwinder from below

Winder from below

Unwinder from above

Mf: Friction Torque
MP: Torque Precontrol
MT: Tension
n: winder speed
no: speed override
The Winder Function Block covers the common control modes and is an open function for adjustments or build in your own Know-how!

Control modes:
- indirect tension control
- dancer roll control with speed correction
- tension control with torque limiting
- constant v-control
- tension control with speed correction for special applications
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Scope of Functionality – Indirect Tension Control

- No tension feedback required
- Web speed is set via nip
- Tension Torque pre-controlled via torque setpoint
- Good Inertia and friction torque compensation required
- Diameter ratio app. 10:1
- Tension ratio app. 6:1
- Winder torque ratio app. 40:1
- Web speed up to app. 600 m/min
- Material: foil, textile, paper
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Scope of Functionality - Tension control with torque limiting

- Tension measuring device required
- Web speed is set via nip
- Tension Torque pre-controlled via torque set point
- Nip required, tension capsule is very damageable
- Good Inertia and friction torque compensation required
- Diameter ratio app. 15:1
- Tension ratio app. 20:1
- Winder torque app. 100:1
- Web velocity up to app. 2000 m/min
- Tension control via torque limitation
- Material: paper, thin film
SINAMICS DCC Winder
Scope of Functionality - Dancer position control with speed setpoint-correction

- Dancer position measuring device required (e.g. potentiometer, encoder)
- Web speed is set via nip
- Web tension is controlled via additional speed setpoint
- Nip required, dancer influences the web path
- Diameter ratio up to app. 15:1
- Tension ration controlled via dancer
- Winder torque ratio up to app. 40:1, depending on the dancer system
- Web speed up to app. 2000 m/min
- Material: rubber, cable, textile, film and paper
SINAMICS DCC Winder
Scope of Functionality – constant v-control

- Web velocity input via web tachometer
- Web speed isn't set via nip
- Tension can't be affected by winder
- No nip required
- Diameter ratio up to app. 15:1
- Web velocity is depending on the mechanical construction
- Especially for sorter
SINAMICS DCC Winder
Scope of Functionality – Diameter calculation

- Diameter calculation based on ratio between web velocity and winder rotational speed
- The diameter is required to e.g. calculate the correct speed of the winder axis from the machine speed

- optional there is:
  - integrating calculation method
  - division method
  - the possibility to interconnect a diameter sensor
  - method with layer counting available

$$\text{Diameter} = \frac{\text{web velocity} \times \text{gear ratio}}{\text{motor speed} \times \pi}$$
• Optional for rewinder, if the tension is reduced with increasing diameter
• Taper characteristic depends on the actual diameter
• Decrease can be absolute (N) or relative (% of tension setpoint)
• four characteristics are implemented:
  • Hyperbolic characteristic with:
    • Max. tension reduction at infinite diameter
    • Max. tension reduction at specified diameter
  • Linear characteristic with tension reduction when maximum diameter is reached
  • Personal characteristic using 10 points along the characteristic
Controller gain of the tension/position controller is adaptable based on the actual diameter
→ higher gain at higher diameter

Controller gain of the speed controller is adaptable based on the moment of inertia of the roll
→ higher controller performance with high load conditions
SINAMICS DCC Winder
Scope of Functionality – Torque pre-control

- Optional compensation of the acceleration/ deceleration torque, resulting of the moment of inertia to improve the dynamic reaction of the drive
- Inertia compensation reduces tension fluctuation based on speed changes
- Inertia compensation is required if indirect tension control is used and recommended in tension control mode via load cell
- Inertia compensation is set up during commissioning
- Inertia compensation is calculated based on the diameter, the web width, the gear ratio und the material density
Tension operation can only be enabled if the control is in operation and web break detection is not signaling an error.

It is recommended to only enable tension operation in machine stand still.

Tension or position setpoint will be enabled using adaptable ramp functions.

If tension operation is not active, the diameter computer and the speed override are disabled.
The maneuvering input can e.g. be connected with an analog input to influence the internal speed setpoint.
• Jog operation is only enabled when tension operation is disabled
• Jog speed setpoint either via fixed setpoint or via connectable input
• During jog operation, the maneuvering mode is disabled
• separate ramp function generator
SINAMICS DCC Winder Scope of Functionality – Velocity master, synchronize and stop web setpoint

- Winder can operate as velocity master for the whole machine
- Stop the winder on continuing web, e.g. after flying roll change
- Synchronize a stopped winder to the web, e.g. before splicing
SINAMICS DCC Winder
Scope of Functionality – web length and braking distance

- calculation of the actual web length by integration of the material web velocity
- stop the winder when reaching a set web length setpoint
SINAMICS DCB Extended Winder
Scope of Functionality – Splice control

- flying roll change with optional application “Extended Winder”*
- cam outputs to control knife and splice roll
- “rewinding after splice” for unwinder

* for splice control the DCB-Extension library “GMC” and a DCB-Extension license 6SL3077-0AA00-0AB0 are required
The Extended Winder application* is operated as master for the separate available DCB Traversing Drive.

Traversing describes the accurate positioning of the material on the coil.

While the winder is responsible for the rotation of the coil, the traversing drive is responsible for the controlled positioning of the material.

For e.g. wire, cables, textil threads, …

* for traversing drive the DCB-Extension library “GMC” and a DCB-Extension license 6SL3077-0AA00-0AB0 are required.
The required components of the application are enabled via execution groups:
The project assistant provides a guided commissioning of the winder and a graphical diagnostic support.
For controlling the DCC Winder with SIMATIC S7-1500 or S7-1200 the SIMATIC library LMCSINA is available:

The winder functionality is part of the application SINAMICS DCC Winder.

The application is implemented in DCC.

The documentation is based on function plans.
Sizing winders the engineering tool Sizer is used:
Thank you for your attention!

Application Center
DF FA PMA APC
Frauenauracher Str. 80
D-91056 Erlangen
E-Mail:
tech.team.motioncontrol@siemens.com

siemens.com/answers