SINAMICS DCC Winder
Introduction

The standard application SINAMICS DCC winder realizes a winder or unwinder, e.g. for film lines, printing machines, coating lines, spoolers or textile machines.

The winder application can be used on:

SINAMICS S120, S150, G130, G150

SINAMICS DCM

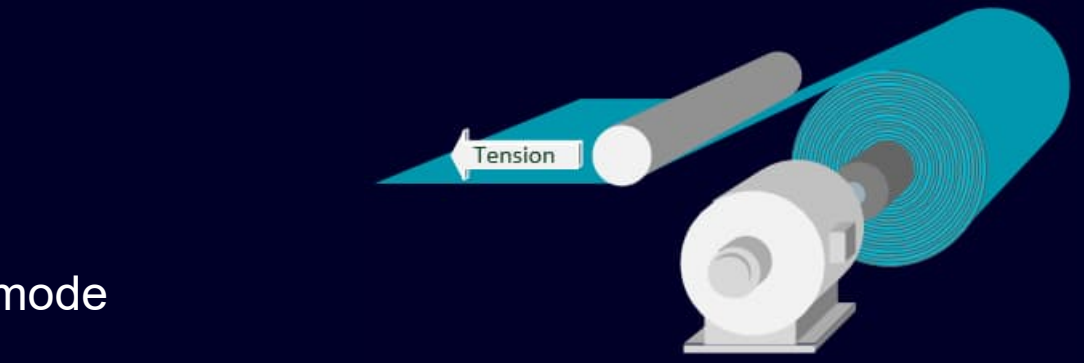
SINAMICS Integrated in SIMOTION D4xx-2

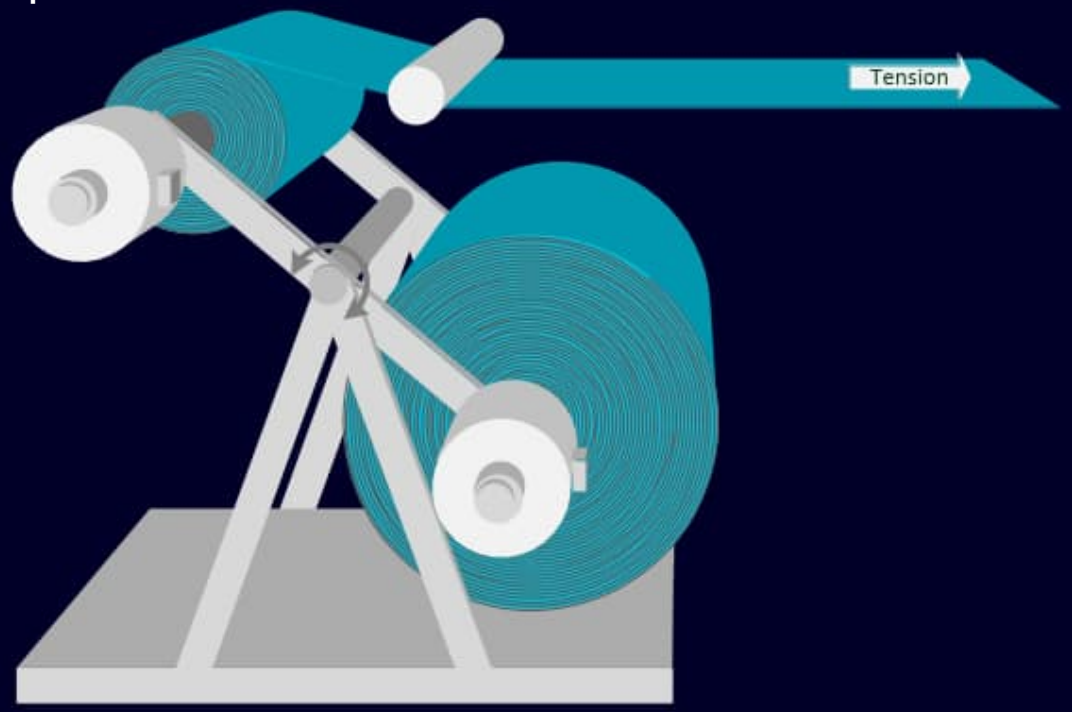
The variant with splice control or support of the DCB traversing application can be used with SINAMICS S120 and S150 and additionally uses DCB Extension.

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

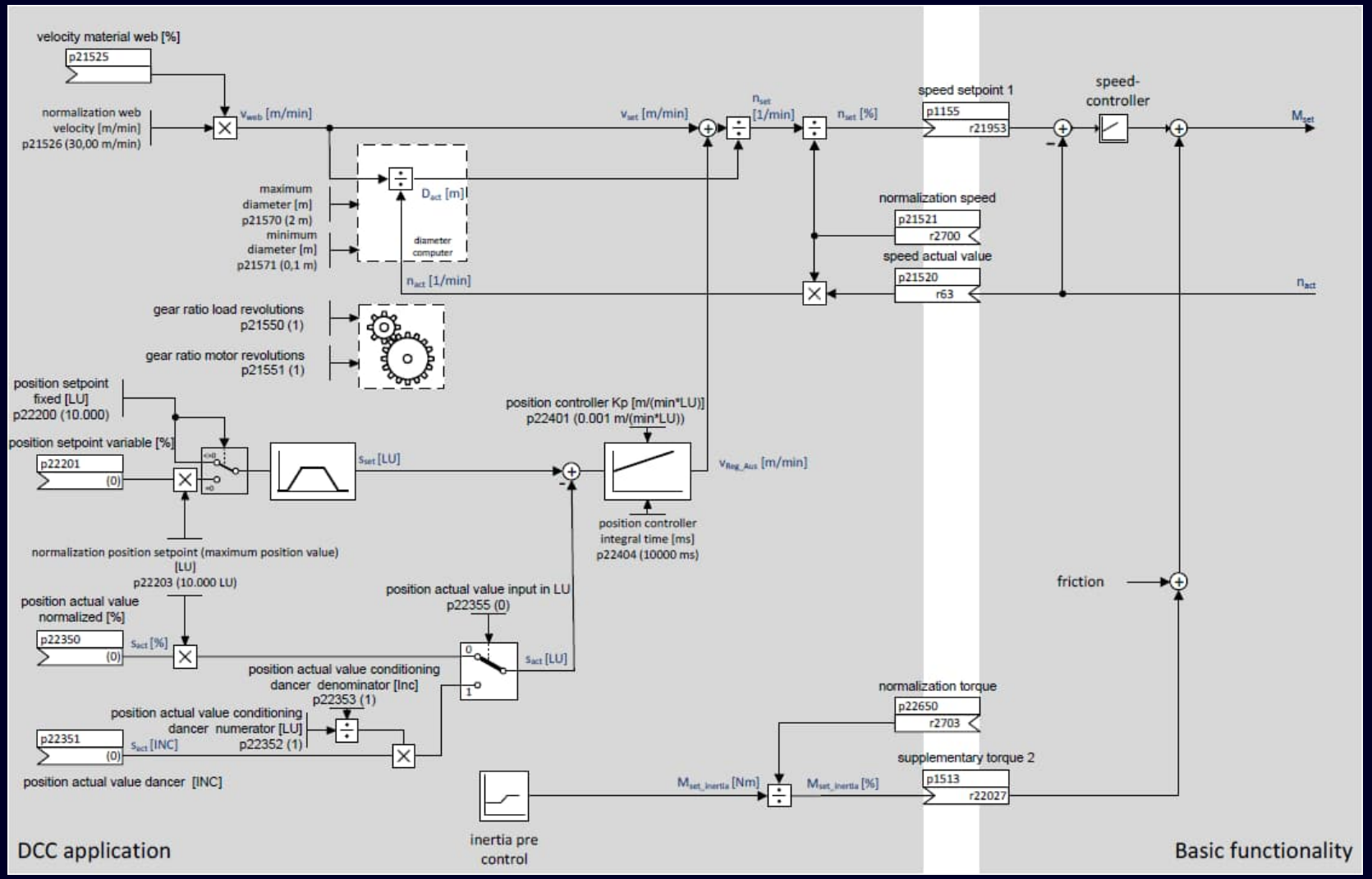




Turret winder

- two or more centerwinds on a rotating axis
- Roll change on the fly
- Output of control cams for gluing roller and knife(only for extended winder with DCB extension)

SINAMICS DCC Winder
Scope of Functionality using the example of dancer position control



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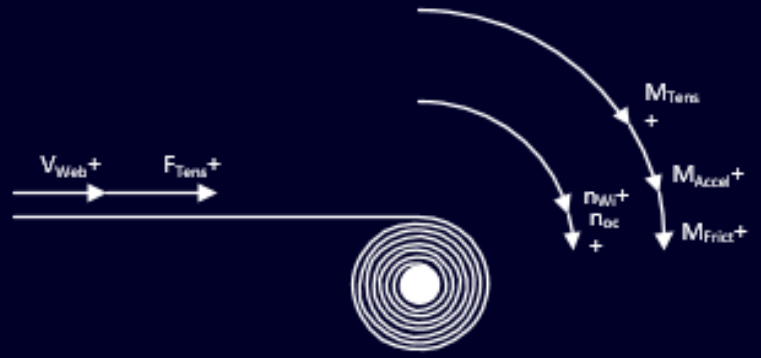
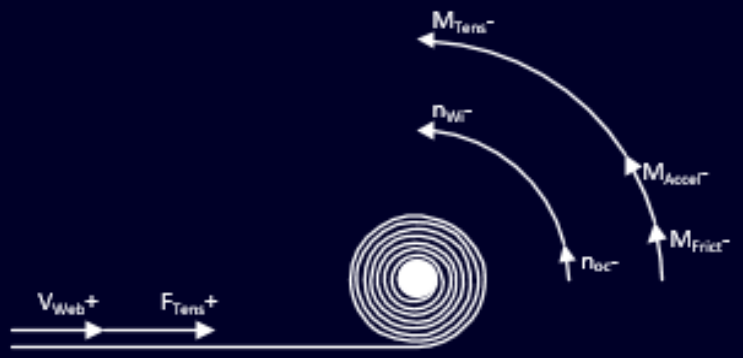
SINAMICS DCC Winder
Scope of Functionality

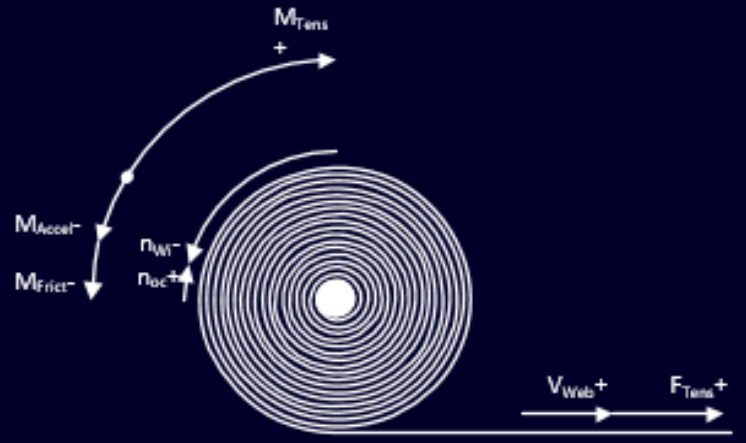
Winding from the top



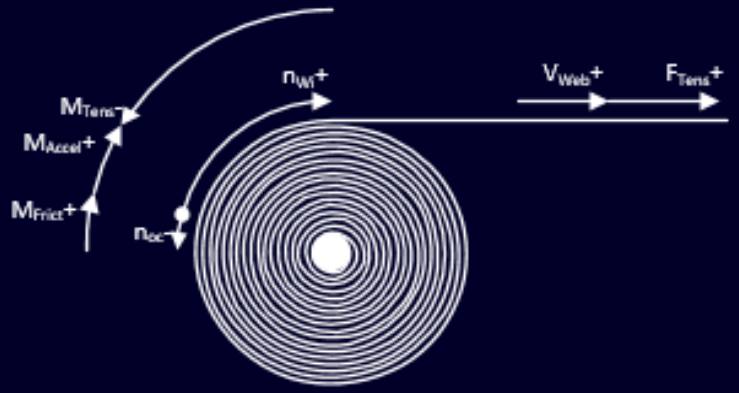
Winding from the bottom



Unwinding from below



Unwinding from the top



V_{Web}	-	Web Velocity
F_{Tens}	-	Material Tension
M_{Tens}	-	Tension Torque
M_{Accel}	-	Accelerating Torque
M_{Frict}	-	Friction Torque
n_{Wi}	-	Winder Speed
n_{oc}	-	Speed overcontrol

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SINAMICS DCC Winder
Scope of Functionality

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:

- Torque Control (Indirect Tension Control)
- Dancer Position Control with Speed Correction
- Tension Control with Torque Limitation
- Constant V control
- Tension Control with Speed Correction for Special Applications

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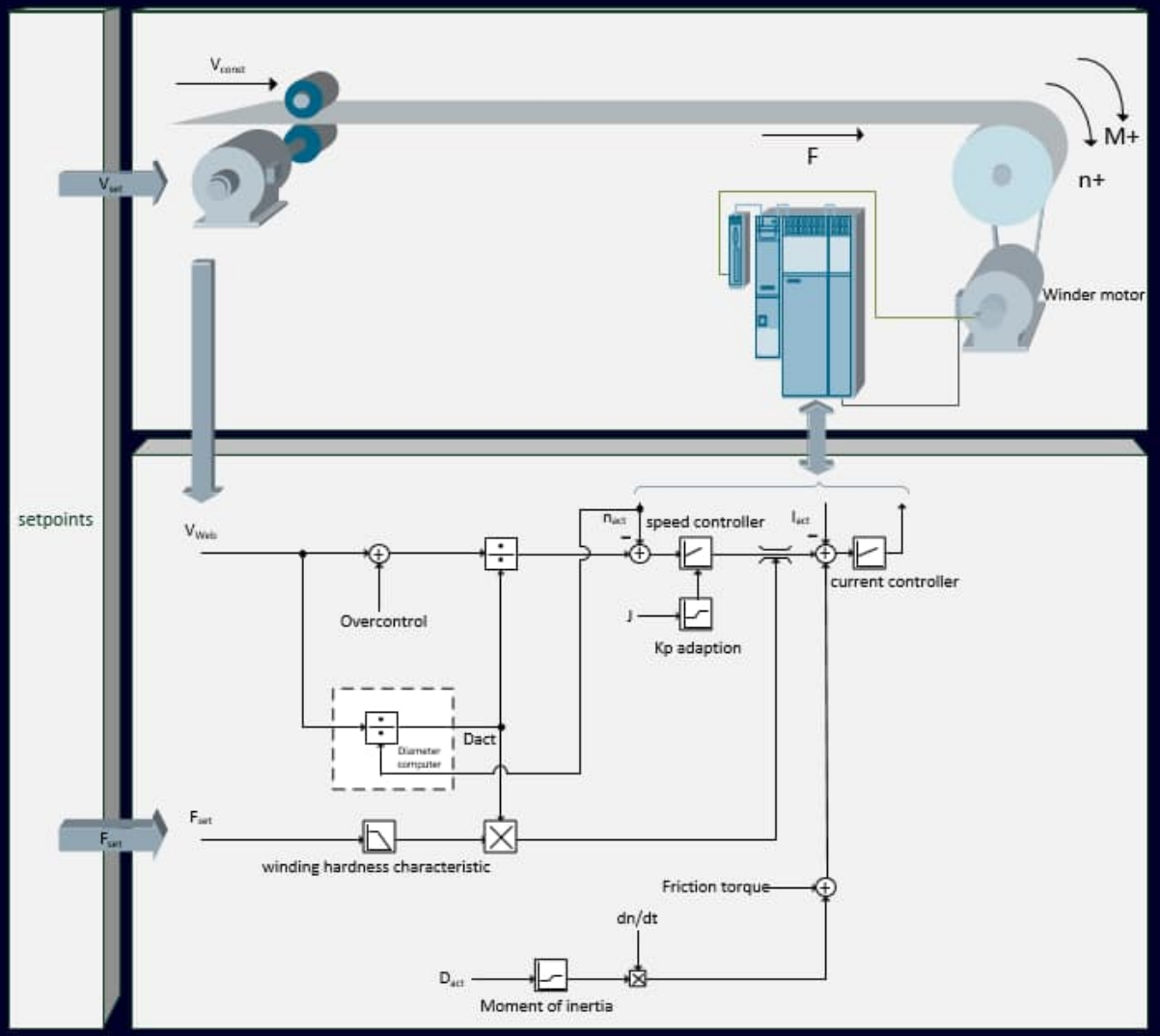
SINAMICS DCC Winder
Scope of Functionality – Indirect Tension Control

- No measured tension value feedback
- Web velocity is specified by nip
- Tension is set in an open loop via the torque setpoint
- Good compensation of acceleration and friction torque required
- Diameter range up to approx. 10:1
- Tension range up to approx. 6:1
- Winding torque range up to approx. 40:1
- Web velocity up to approx. 600 m/min
- Preferably for sheet metal, textile and paper



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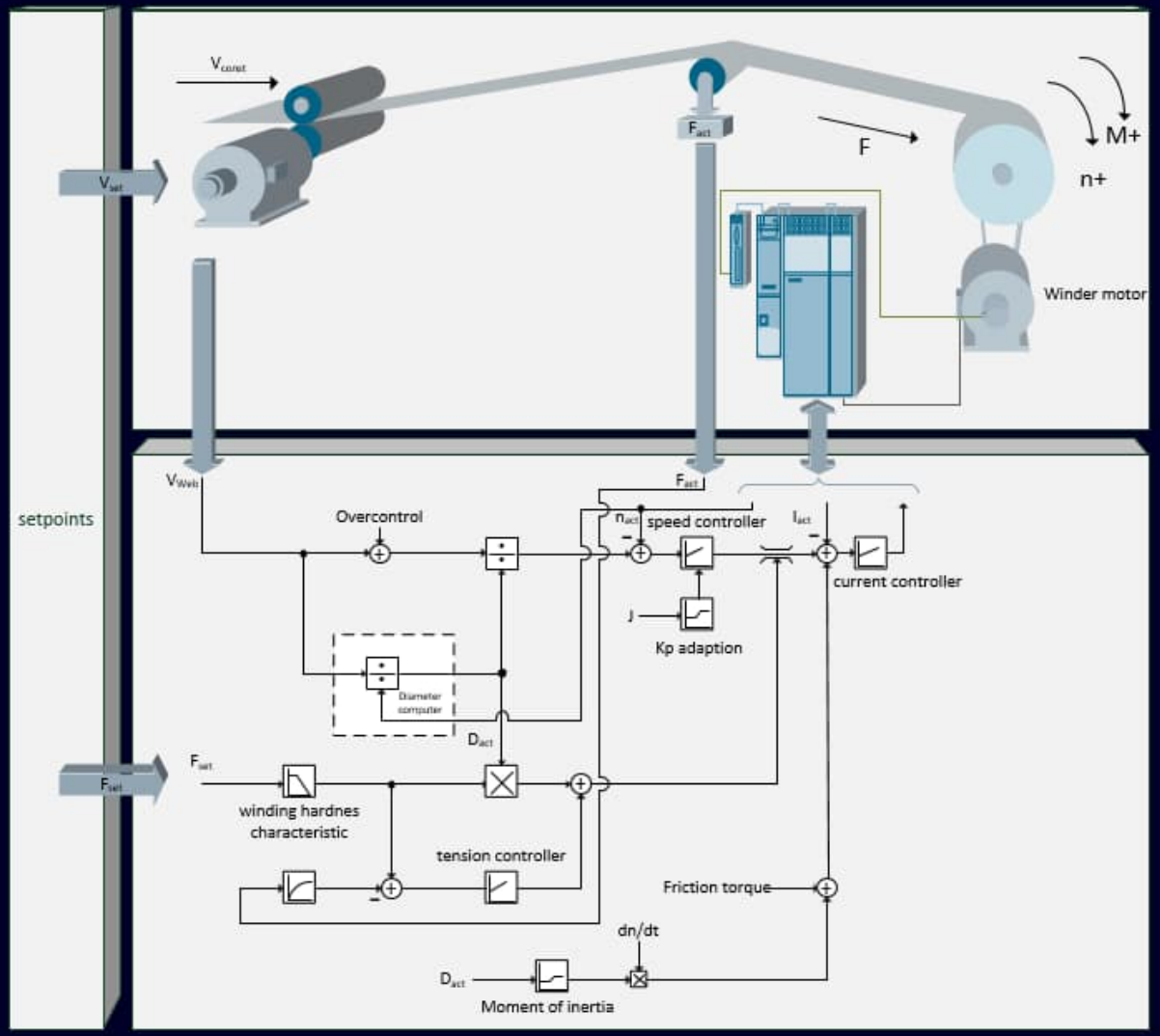
SINAMICS DCC Winder
Scope of Functionality - Tension control with torque limiting

- Measured variable (tension measured value) is fed back via closed loop controller
- Web velocity is set by the nip
- Tension is set directly via the torque
- Nip required, load cell is sensitive to overload
- good compensation of acceleration torque required
- Diameter range up to approx. 15:1
- Tension range up to approx. 20:1
- winding torque range up to approx. 100:1
- web velocity up to approx. 2000 m/min
- Adjustment of the torque limitation
- Preferably for paper and thin foils



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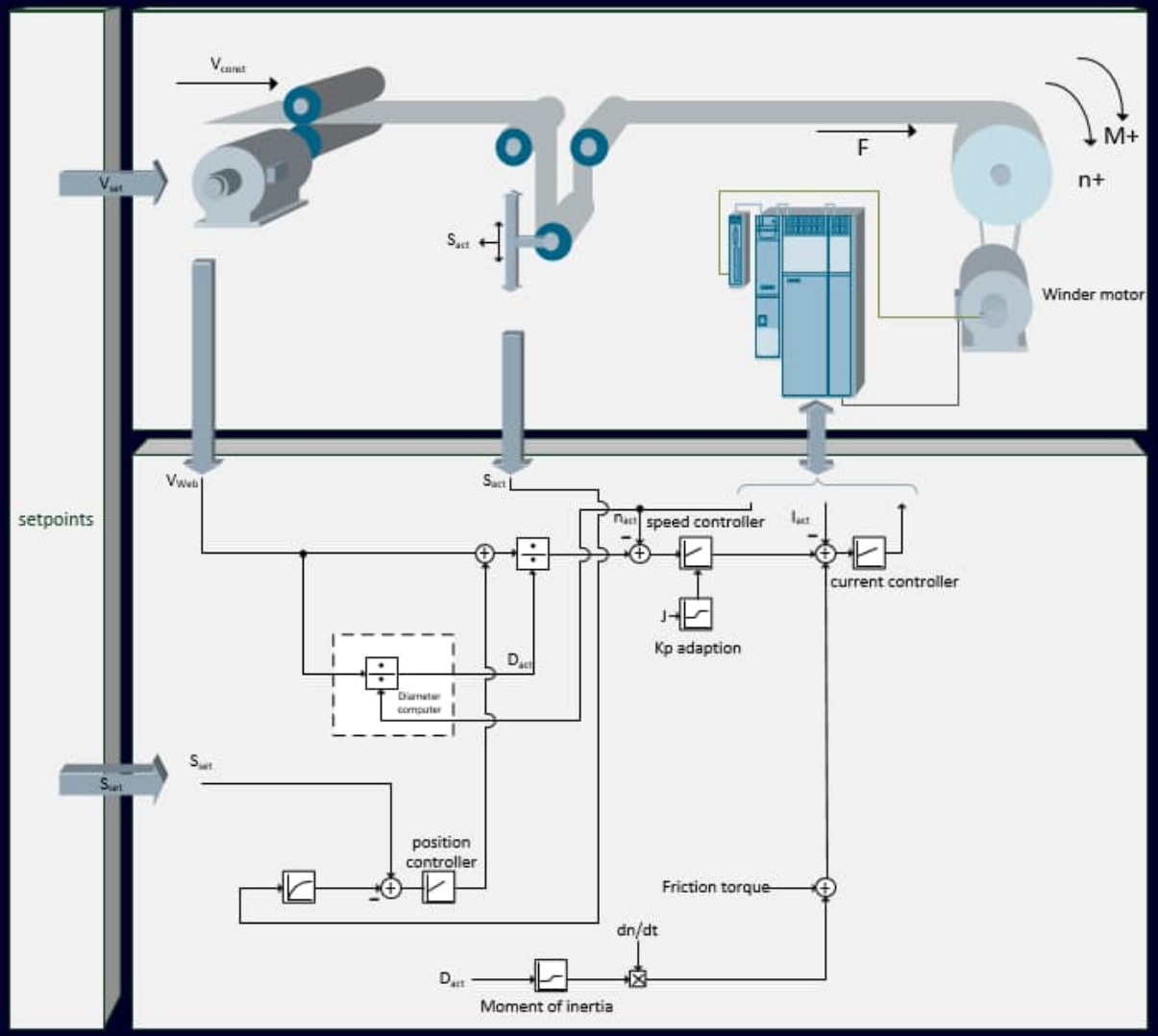
SINAMICS DCC Winder
Scope of Functionality - Dancer position control with speed setpoint correction

- Measured process variable (position measured value) is fed back via a closed loop controller
- Web velocity is preset by nip
- Tension torque is adjusted by an additional speed set point
- nip required, dancer roller intervenes in the web path
- Diameter range up to approx. 15:1
- Tension range can only be changed with adjustable dancer support
- Winding torque range up to approx. 40:1, depending on the dancer support design
- Web velocity up to approx. 2000 m/min
- Preferably for rubber, cable, textile, foil and paper



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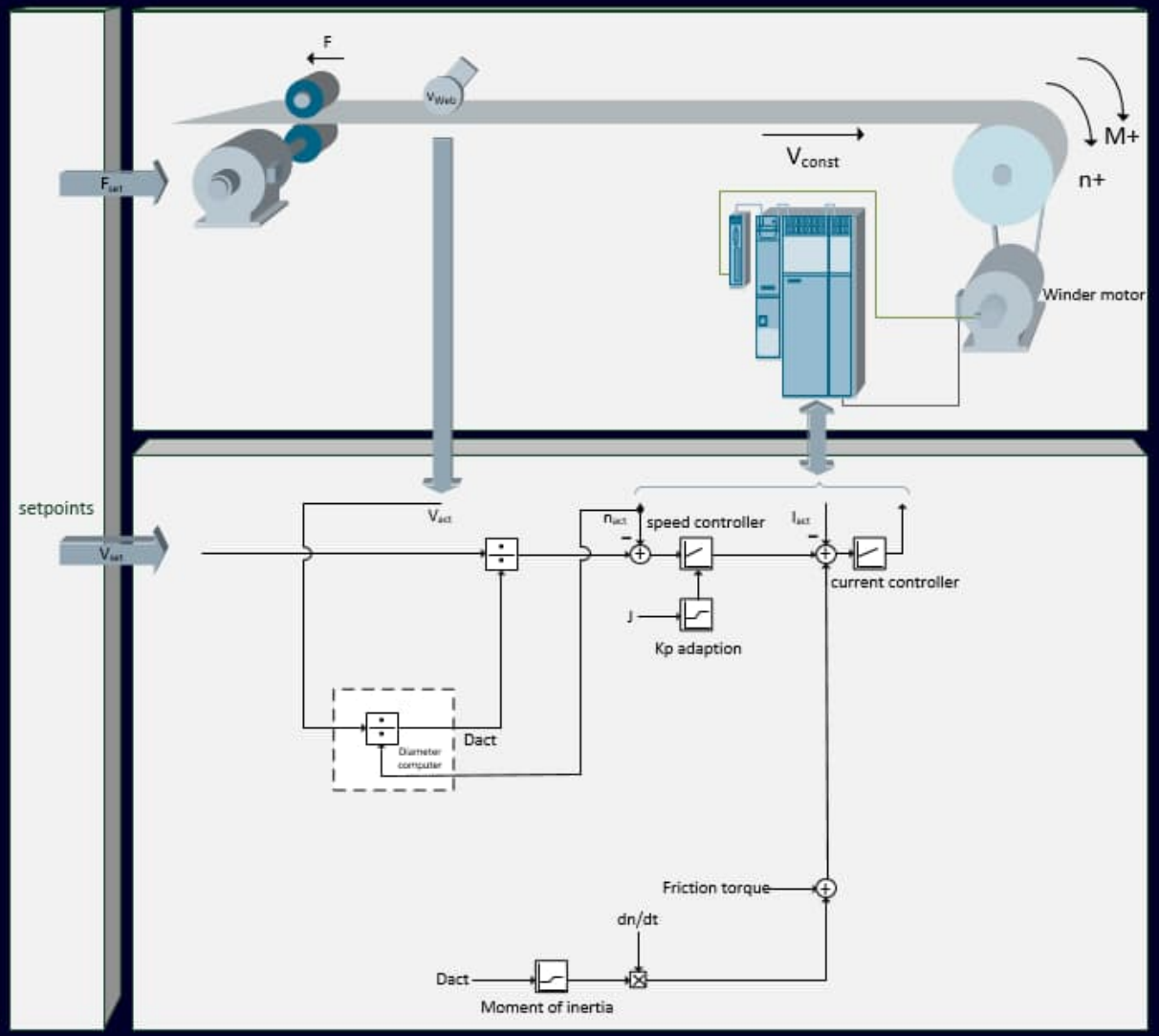
SINAMICS DCC Winder
Scope of Functionality – constant v-control

- Web velocity is read in via web tachometer
- Web velocity is not specified by nip point
- Tension torque cannot be influenced by the winder
- No nip required
- Diameter range up to approx. 15:1
- Web velocity dependent on mechanical design
- Preferably for sorting winders



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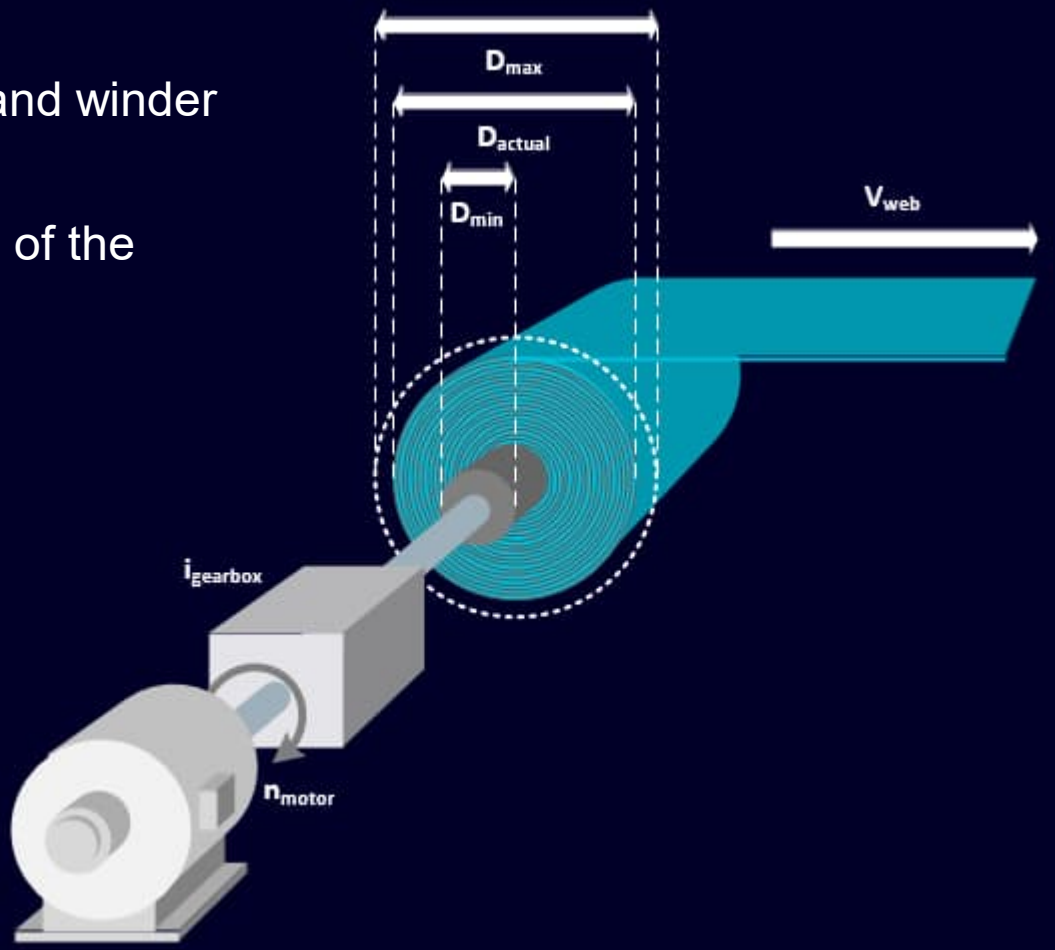
SINAMICS DCC Winder
Scope of Functionality – Diameter calculation

- 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



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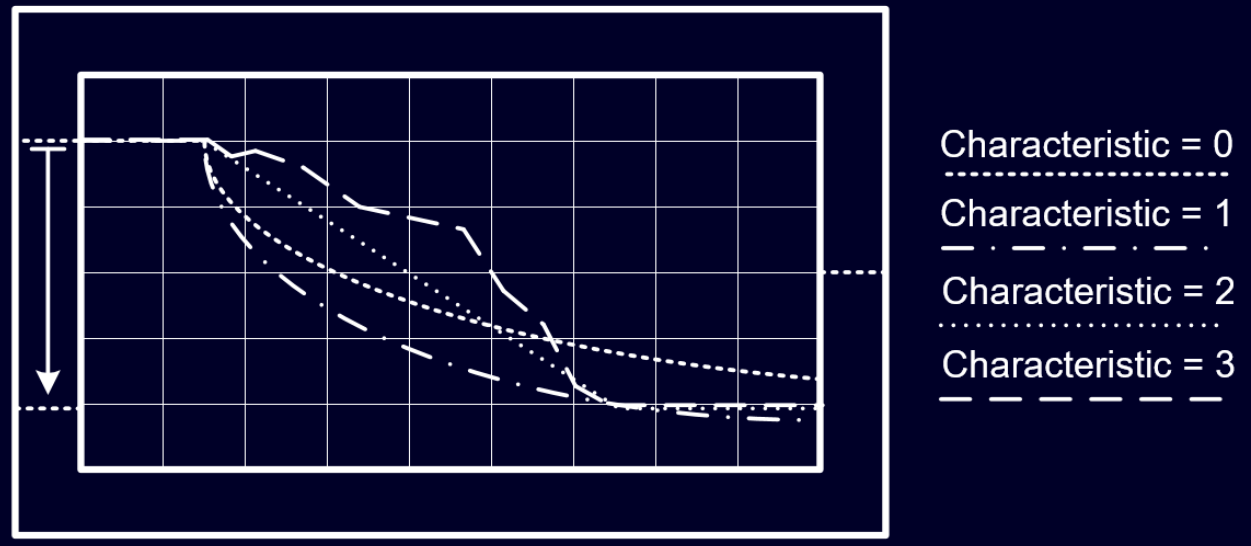
SINAMICS DCC Winder
Scope of Functionality – Taper characteristic

- 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 (0)
    - Max. tension reduction at specified diameter (1)
  - Linear characteristic with tension reduction when maximum diameter is reached (2)
  - Free characteristic using 10 points (3)



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SINAMICS DCC Winder
Scope of Functionality – Controller adaption

- 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

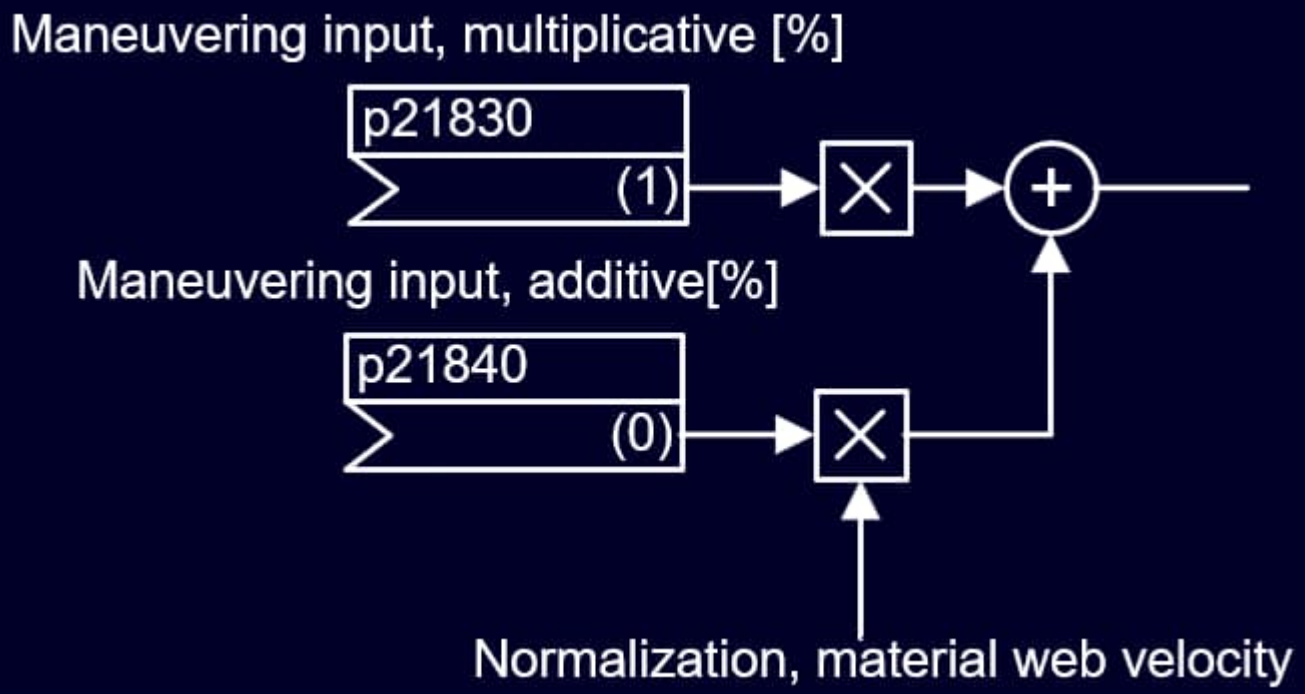
- Optional compensation of the acceleration/ deceleration torque, resulting of the moment of inertia to improve the dynamic reaction of the drive
- Inertia compensation reduces tension fluctuation based on speed changes
- Inertia compensation is required if indirect tension control is used and recommended 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

SINAMICS DCC Winder
Scope of Functionality – tension operation

- 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

SINAMICS DCC Winder
Scope of Functionality – Maneuvering input

The maneuvering input can e.g. be connected with an analog input to influence the internal speed setpoint.



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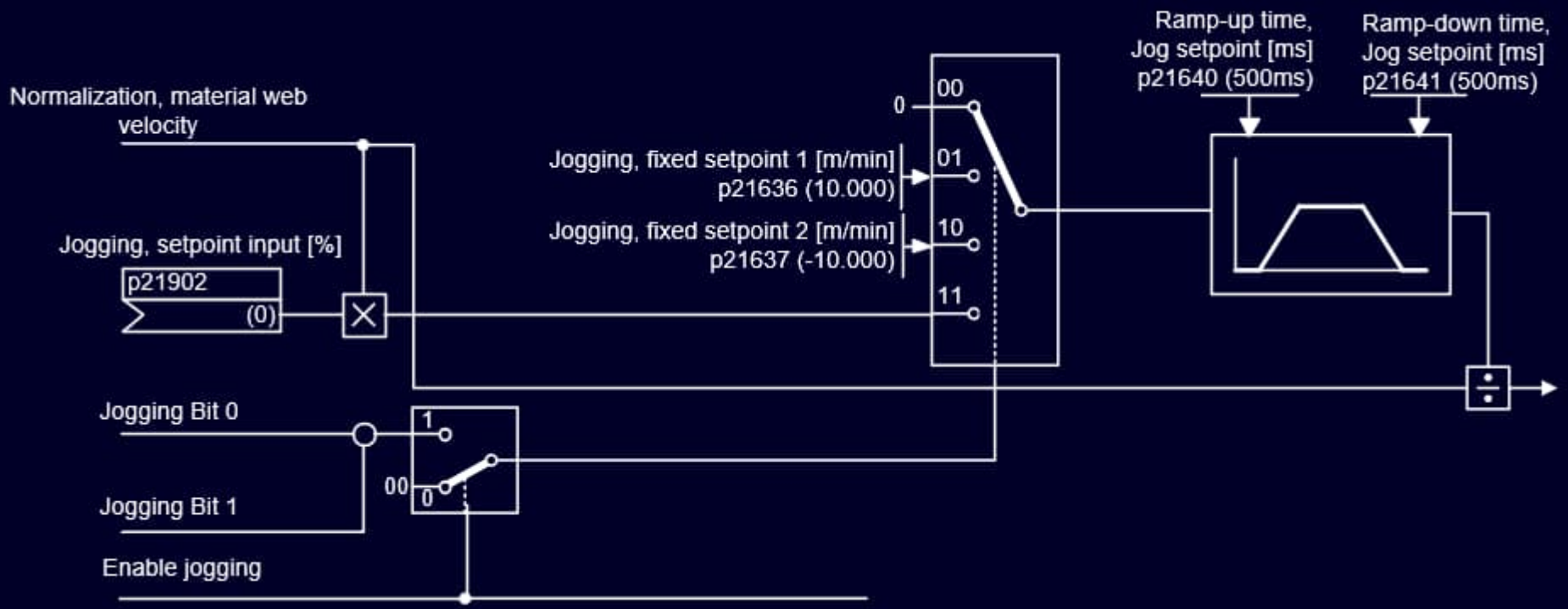
SINAMICS DCC Winder
Scope of Functionality – Jog

- 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



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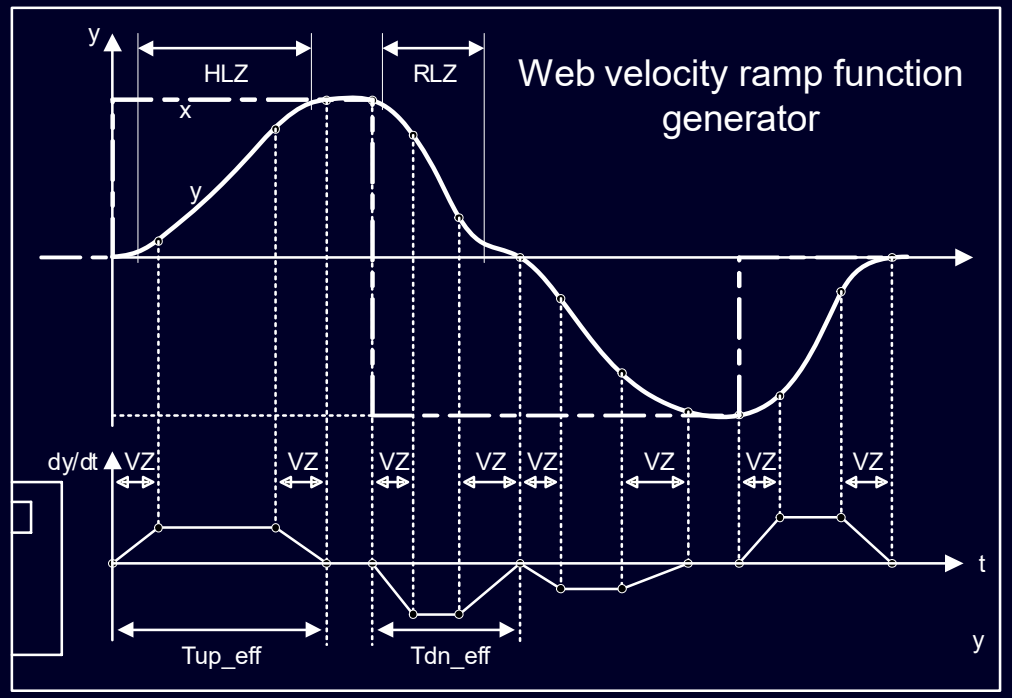
SINAMICS DCC Winder Scope of Functionality – machine ramp function, synchronize and stop web setpoint

- winder can operate as velocity ramp function generator 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



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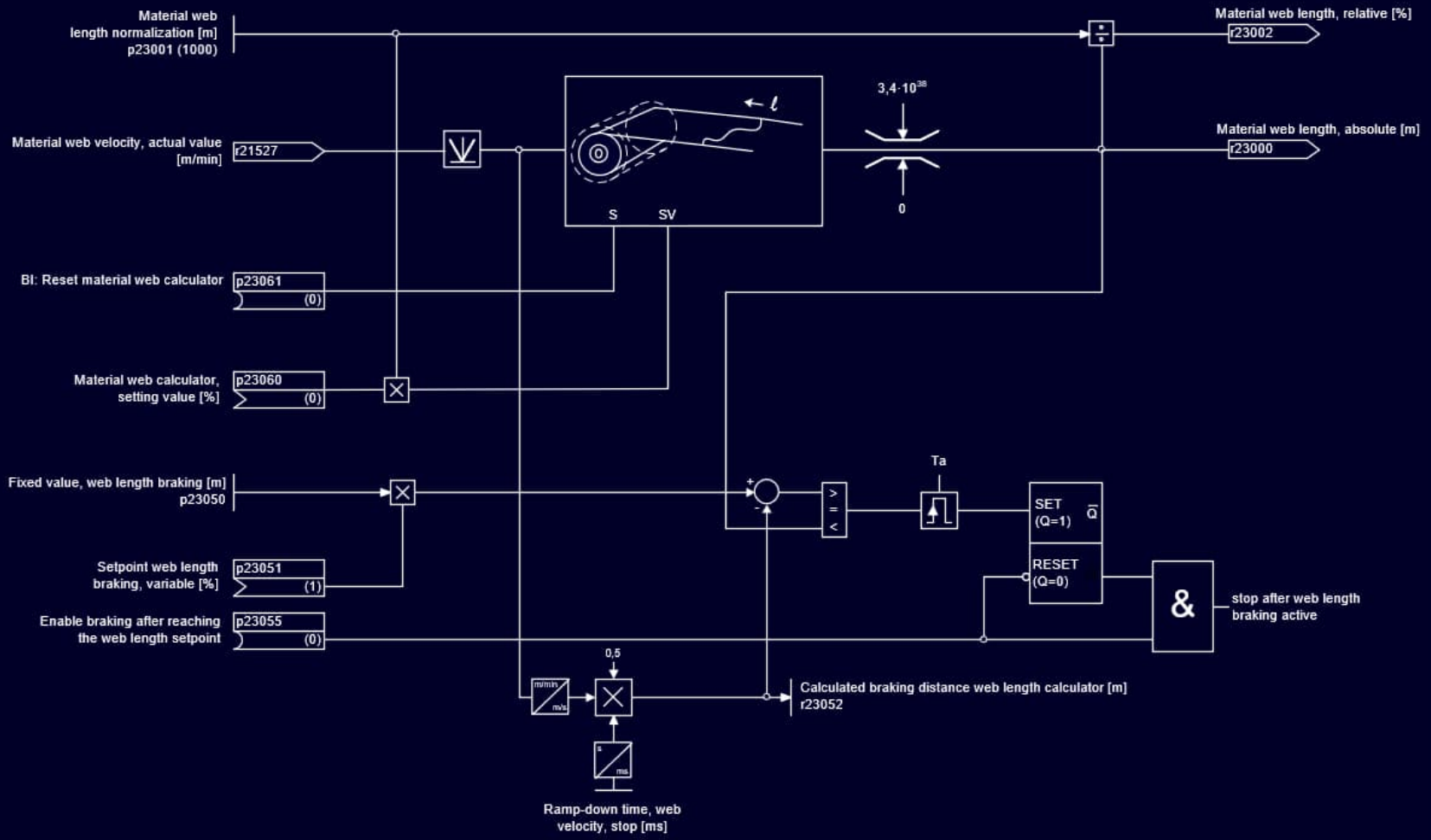
SINAMICS DCC Winder
Scope of Functionality – web length and braking distance

- calculation of the actual web length by integration of the material web velocity
- stop the winder when reaching a set web length setpoint



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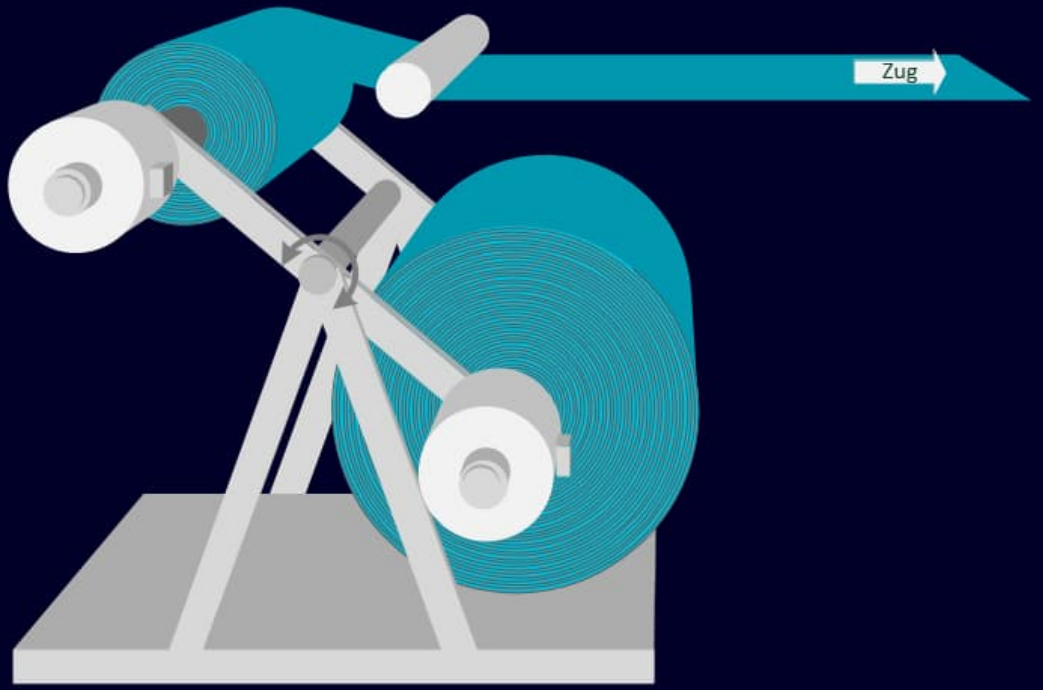
SINAMICS DCB Extended Winder
Scope of Functionality – Splice control

- 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

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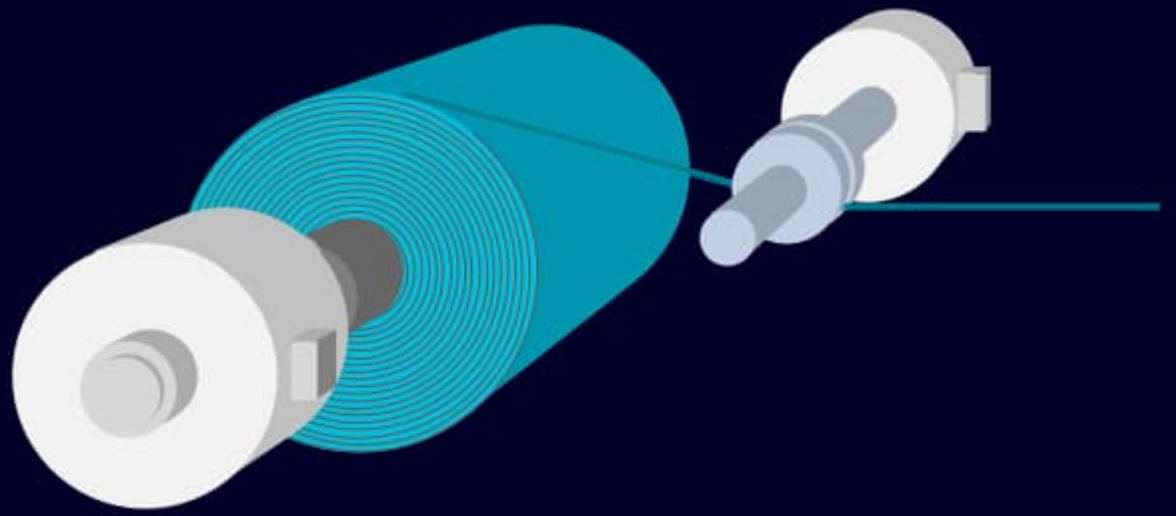
SINAMICS DCB Extended Winder
Scope of Functionality – Master for DCB Traversing Drive

- The Extended Winderapplication* 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

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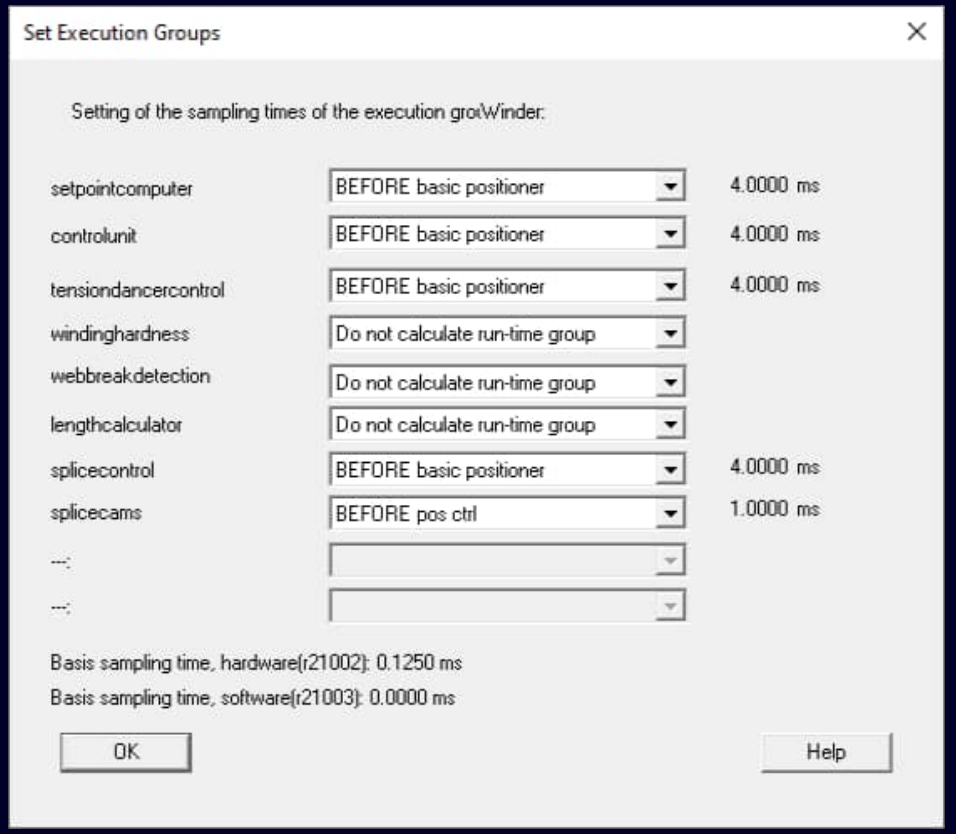
SINAMICS DCC Winder
Scope of Functionality – Execution groups

The required components of the application are enabled via execution groups:

	Name	Type	Clock cycle
1	01_Control_unit	Drive Control Chart	[1002] T= 2 * r21003
2	02_Setpoint_computer	Drive Control Chart	[3005] BEFORE basic positioner
3	03_Tension_dancer_controller	Drive Control Chart	[3005] BEFORE basic positioner
4	04_Winding_hardness_characteristi	Drive Control Chart	[0] Do not calculate runtime group
5	05_Web_break_detection	Drive Control Chart	[0] Do not calculate runtime group
6	06_Web_length_calculator_windin...	Drive Control Chart	[0] Do not calculate runtime group
7	08_Fast_splice_cams	Drive Control Chart	[3004] BEFORE pos ctrl
8	09_Splice_control	Drive Control Chart	[3005] BEFORE basic positioner



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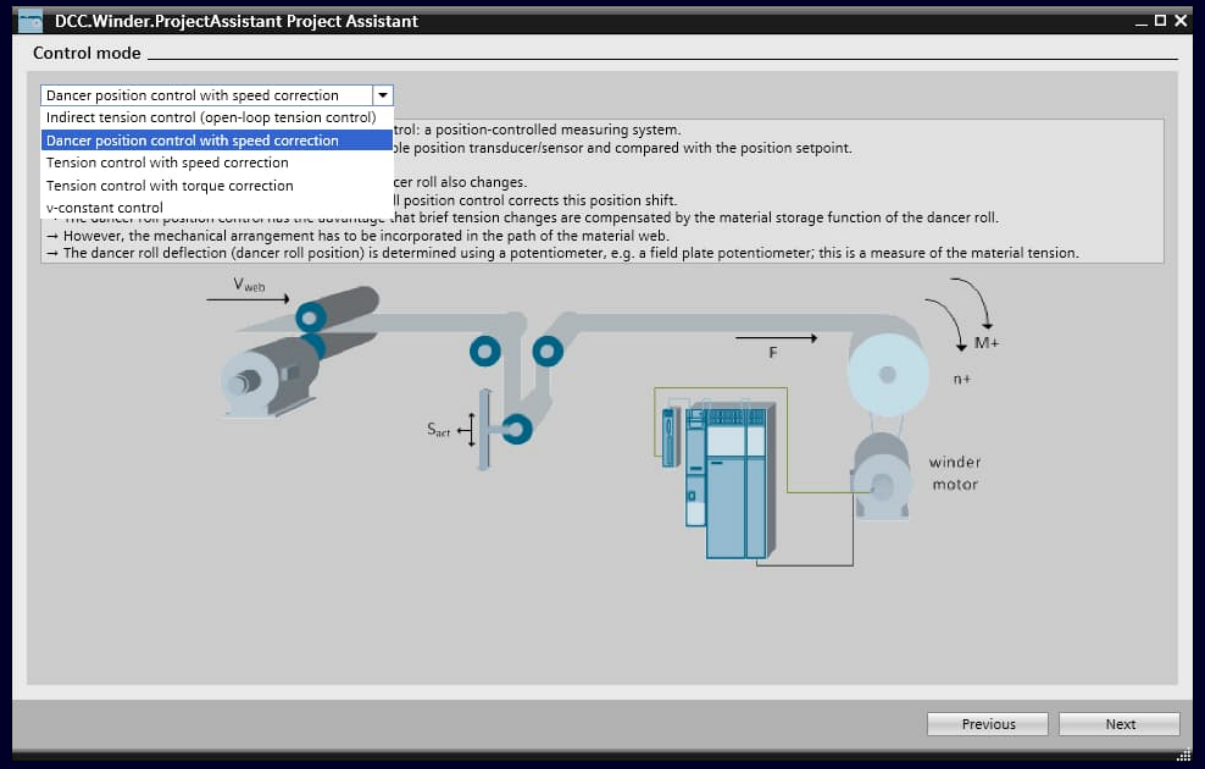
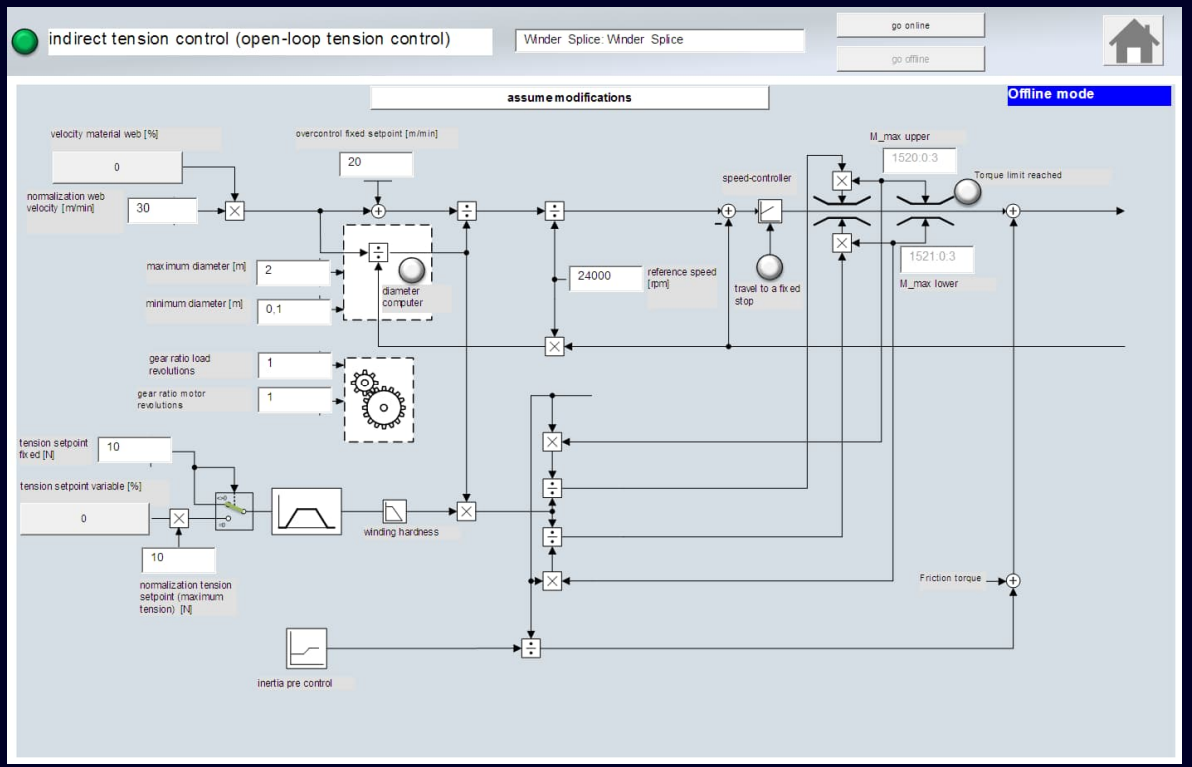
SINAMICS DCC Winder
Scope of Functionality – Project assistant



The project assistant offers a guided commissioning of the winder and is available in a variant for Startdrive as AddIn and for Starter on Excel basis



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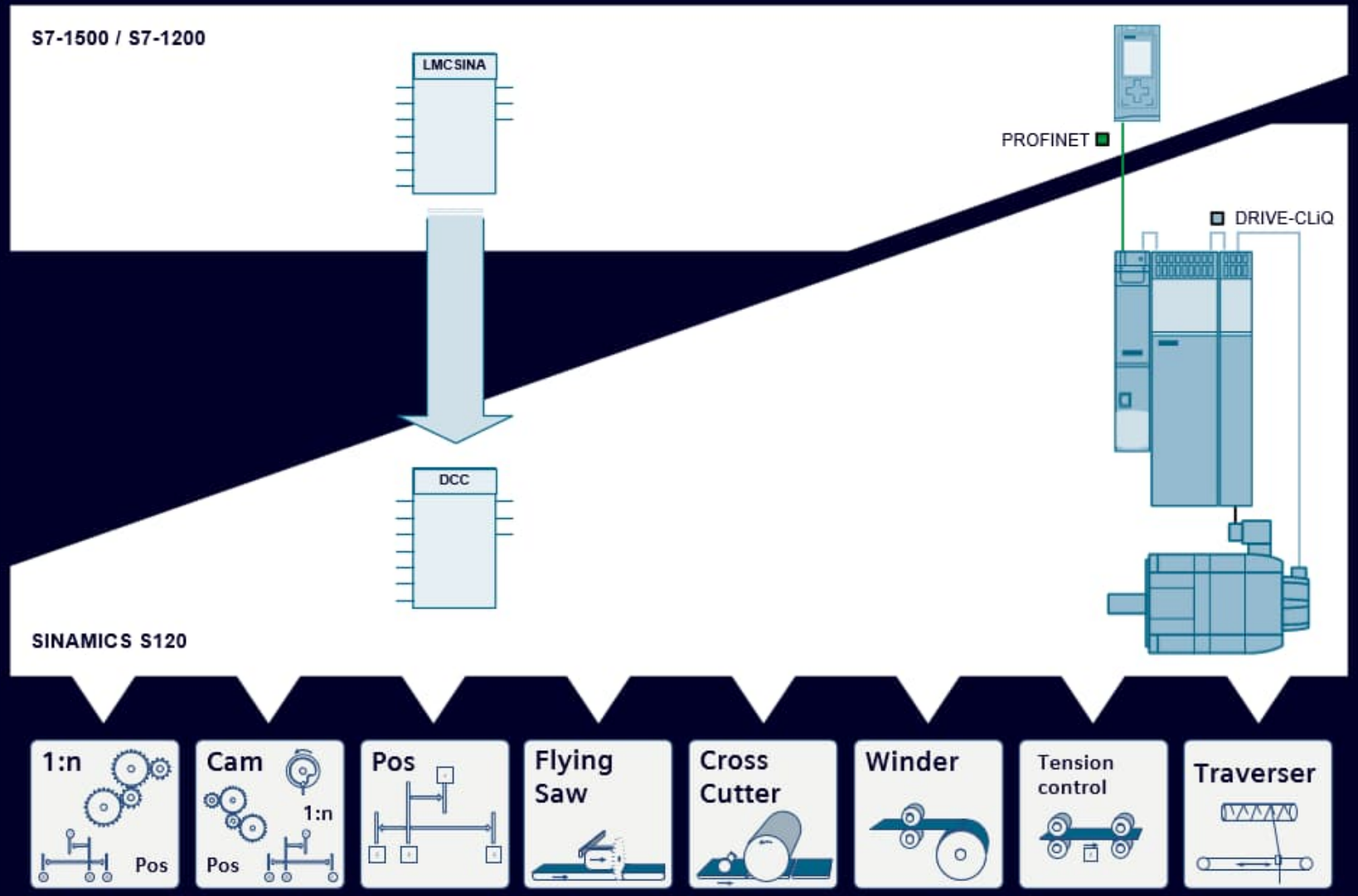
SINAMICS DCC Winder
Scope of Functionality – Control with LMCSINA



For controlling the DCC Winder with SIMATIC S7-1500 or S7-1200 the SIMATIC library LMCSINA is available:

https://support.industry.siemens.com/cs/ww/en/view/109479491

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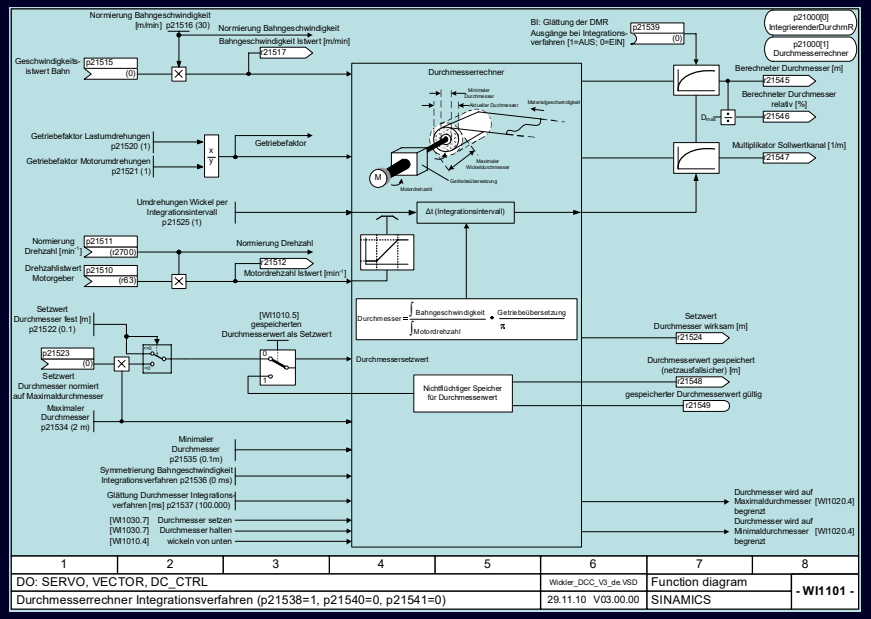
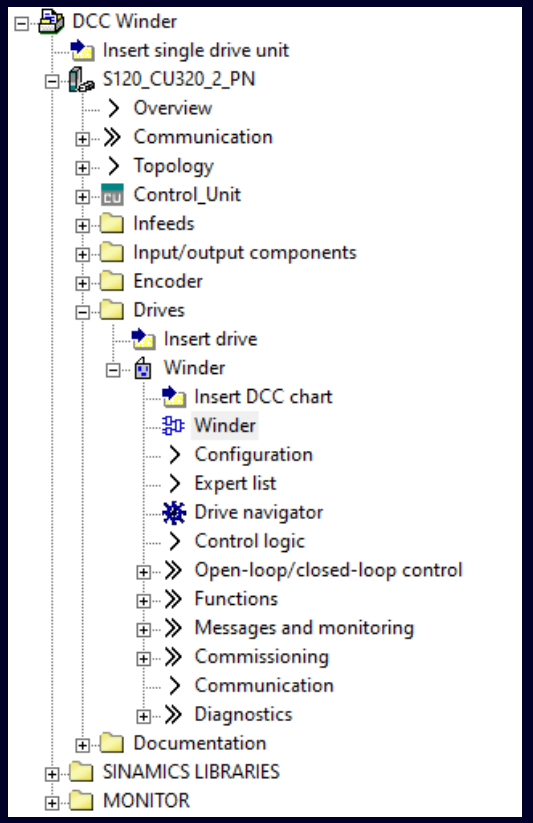
SINAMICS DCC Winder
Function Block Overview

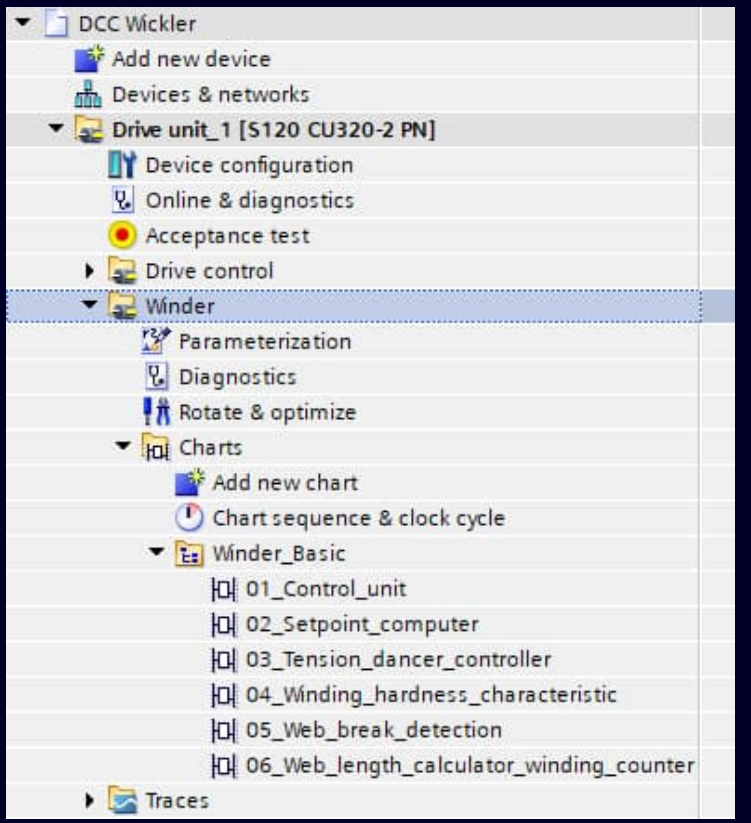
The winder functionality is part of the application SINAMICS DCC Winder.

The application is implemented in DCC.

The documentation is based on function plans.







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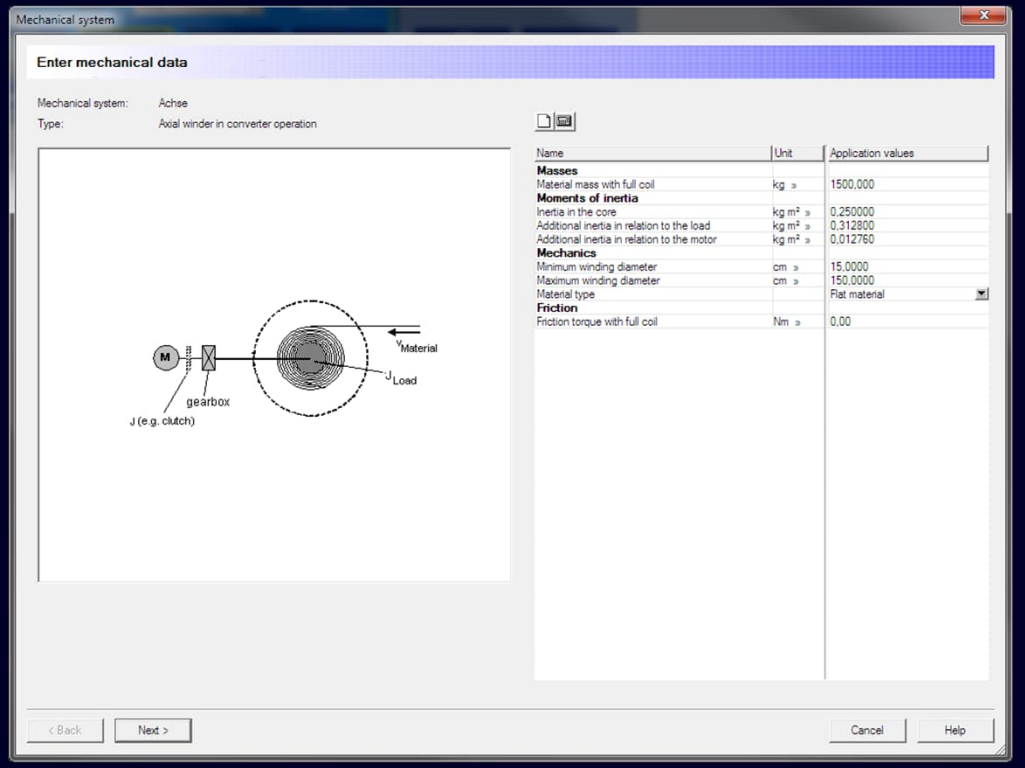
SINAMICS DCC Winder
Tools for sizing

Sizing winders the engineering tool Sizer is used:
https://support.industry.siemens.com/cs/ww/en/view/54992004



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Disclaimer

Subject to changes and errors. The information in this document contains only general descriptions or performance features which do not always apply as described in the specific application or which may change as a result of further development of the products. The desired performance characteristics are only binding if they are expressly agreed upon conclusion of the contract.

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