SIMOREG DC-MASTER
6RA70 Series

Microprocessor-Based Converters from 6kW to 2500kW for Variable-Speed DC Drives
NOTE

This application does not purport to handle or take into account all of the equipment details or versions or to cover every conceivable operating situation or application. If you require more detailed information, or if special problems occur, which are not handled in enough detail in this document, please contact your local Siemens office.

The contents of this application are not part of an earlier or existing agreement or legal contract and neither do they change it. The actual purchase contract represents the complete liability of the A&D Variable-Speed Drives Group of Siemens AG. The warranty conditions, specified in the contract between the two parties, is the only warranty which will be accepted by the A&D Variable-Speed Drives Group. The warranty conditions specified in the contract are neither expanded nor changed by the information provided in the installation instructions.

WARNING

These converters contain hazardous voltages and control rotating mechanical components (drives). Death, serious bodily injury or substantial property damage may occur if the instructions in the relevant operating manuals are not observed.

Only qualified personnel who are thoroughly familiar with all safety notices contained in the operating instructions as well as erection, installation, operating and maintenance instructions should be allowed to work on these devices.

The successful and safe operation of this equipment is dependent on careful transportation, proper storage and installation as well as correct operation and maintenance.
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1 Overview

1.1 General

Center winders are drives on which a web is either wound or unwound at a defined tension via the driven winding shaft. Center winders are used in various industrial branches such as, for example, in foil mills, printing presses, coating plants, paper processing machines (rotary cutters, glazing rollers), spoolers on wire drawing and cable machines, textile machines and sheet-metal reels.

This application guide shows how to implement a center winder using the freely assignable function blocks available through the option S00. In this case, binary control commands and setpoints are input via Profibus.

NOTES

Owing to the number and type of function blocks required, it is absolutely essential to use software version V2.0 or higher!

Since the winder can operate in the "Drive" and "Brake" modes, the DC-MASTER 6RA70 must be configured for 4Q operation!

1.2 Application guidelines

In principle, this application is suitable for use in all the examples listed in para. 1.1. The user has the advantage that he can individually tailor the existing, highly universal application to suit his plant using BICO technology and without the need for any additional tools.

Restrictions to its use may be encountered in the form of resolution problems in "maneuvering" (low speed) on fast-running machines with large winding ratios, or when the permissible limit frequency of the pulse encoder input is exceeded at $V_{\text{max}}$ (high speed). Please refer to the feasibility calculation in Section 11.8 "Definition of pulse encoder, speed sensing with pulse encoder" of the basic unit operating guide. If the resolution is not high enough, the center winder must be implemented by means of a T400 technology board and associated standard configuration "Center winder SPW420".

1.3 Application conditions

The full range of functions described in this application document will be available for use only if the SIMOREG DC-MASTER is controlled via a higher-level control system (e.g. SIMATIC S7) in combination with an optional interface board (CBP2) and the Profibus.

If you wish to implement hardware-based converter control, you must provide (depending on requirements) CUD2 terminal expansions or supplementary board EB1 and/or EB2. In this case, you will also need to change the connections for the binary input commands and/or setpoints.

Please see the relevant data sheets for the supplementary board specifications. For instructions on mounting the boards, please see Section 5.3 "Mounting options" in the operating guide.
1.4 Operating modes and functions

The winder described can operate in several different modes using a variety of functions. Global settings such as

♦ control method
♦ direction of winding
♦ winder or unwinder
♦ gear box stage
♦ winding characteristic

are selected via the top level control system. Depending on the selection, the requisite parameter settings are automatically made in the SIMOREG device. In the case of machines used to manufacture broad-web products and therefore requiring a variety of control methods, it is possible to choose between several different control modes simply by switching over control bits. There is no need to change any connector or binector links. All you need to do is select the required settings for characteristics, controllers, parameters or optimization runs.

If a hardware control is implemented, the required changes can be made using OR function blocks (for details contact schematic 19).

The following modes of operation are implemented:

♦ direct tension control with tensile force sensor
♦ indirect tension control without tensile force sensor using torque control
♦ dancer roll / compensating roll position control
♦ v-constant control

The following functions are available in these modes:

♦ inching, maneuvering (to lead the web)
♦ stop tension
♦ slip core control
♦ setting of a variable web width
♦ setting a variable material density
♦ calculator for diameter with monotone or not monotone change of diameter
♦ 2 gear box stages
♦ speed controller adaptation
♦ tension controller adaptation
♦ web break recognition
## 2 Closed-loop control of a winder

### 2.1 Criteria for selecting the control method

The following table lists selection criteria based on empirical values. The maximum possible web velocity is dependent to a large degree on its relation to the web-lead or maneuvering velocity (see also para. 1.2 Application guidelines).

<table>
<thead>
<tr>
<th>Control method</th>
<th>Torque limiting control</th>
<th>Speed compensation control</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Indirect tension control</td>
<td>Direct tension control</td>
</tr>
<tr>
<td>Diameter sensing</td>
<td>Calculated from web velocity setpoint and winder speed</td>
<td>Calculated from web velocity setpoint and winder speed</td>
</tr>
<tr>
<td>Diameter ratio $D_{\text{max}}/D_{\text{core}}$</td>
<td>Up to approx. 10:1 Good compensation of acceleration torque and friction required</td>
<td>Up to approx. 15:1 Good compensation of acceleration torque and friction required</td>
</tr>
<tr>
<td>Actual tension sensing</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Tension ratio $F_{\text{max}}/F_{\text{min}}$</td>
<td>Up to approx. 6:1 Good compensation of acceleration torque and friction required</td>
<td>Up to approx. 20:1 Good compensation of acceleration torque and friction required</td>
</tr>
<tr>
<td>Torque ratio $M_{\text{max}}/M_{\text{min}}$</td>
<td>Up to approx. 30:1</td>
<td>Up to approx. 40:1 Dependent on quality of actual tension signal</td>
</tr>
<tr>
<td>Web velocity</td>
<td>Up to 300m/min with good compensation</td>
<td>Up to 1000m/min with good compensation</td>
</tr>
<tr>
<td>Clamping point</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Web tacho</td>
<td>Not required</td>
<td>Not required</td>
</tr>
<tr>
<td>Use preferably for</td>
<td>Sheet metal, textiles, paper, cabling</td>
<td>Paper, thin foils</td>
</tr>
</tbody>
</table>
2.2 Torque limiting control

The basis for this operating principle is the addition (winder) or subtraction (unwinder) of a fixed value = override setpoint (5-10%) to/from the speed setpoint of the speed controller with active tension control and web inserted. Through its connection to the web, the winder reaches one of its torque limits (pos. limit with winder, negative limit with unwinder). The torque limit is obtained from a feedforward control value derived from the tension setpoint, taking into account diameter, friction, moment of inertia and acceleration.

The ramp generator for the speed setpoint merely serves to produce the dv/dt signal (ramp-up and ramp-down time should be set to 0).

2.2.1 Indirect tension control
Description of mode of operation:

Input of current diameter using "Set diameter". This can be done only when the drive is switched off.
The maneuvering setpoint stretches the web between the winder and main drive (clamping point). Applying
the "Tension control ON external" signal allows activation of the tension control (a minimum torque must also
be reached) and the override setpoint is switched in. At the same time, the speed controller input is switched
from maneuvering over to operating setpoint (winder), or to 0 (unwinder). The drive torque is adjusted to the
torque limit specified by the tension control (derived from tension setpoint). A winding hardness
characteristic (tension decreases in proportion to increase in diameter) can be activated as the tension
setpoint for the winder.
The machine can now be started.
With every change in velocity, the product of moment of inertia x acceleration is added to the tension feedforward control.
The current diameter is calculated continuously from the quotient of web velocity/winder speed. The tension feedforward control value is multiplied by the varying diameter, thus ensuring that the web tension remains constant.
A reduced tension (=stop tension) can be injected at standstill. This is calculated as a percentage of the
current operating setpoint tension.
If the web breaks, the winder accelerates initially by its override setpoint, the unwinder decelerates to its
override setpoint (this is negative so the unwinder rotates in the opposite direction). The web break is
sensed, on the one hand, by the delayed evaluation of a minimum torque and, on the other, by a comparison
of the torque setpoint and actual values. These are identical if the tension control is active because the drive
is operating at its torque limit. When the web breaks, the actual torque decreases when the override speed is
reached and this setpoint/actual value difference is evaluated after a delay (to allow for temporary deviations) by a limit monitor. The web velocity setpoint is canceled by the speed controller, both the winder and unwinder rotate at their override setpoint in the winding direction. OFF3 is applied after a
parameterizable time period.
The "Web break" signal can also be specified from an external source (e.g. via light barriers).
To ensure that the specified torque produces a material tension as close as possible to the desired value,
the acceleration and friction torques must be compensated accurately!
2.2.2 Direct tension control

Main drive
(injection of web velocity)

Tensile force sensor

Winder

Web velocity setpoint

Tension feedback value

Converter

I-controller

Torque limitation

kp-Adaption

6RA70

Direct tension control
Description of mode of operation:

Input of current diameter using "Set diameter". This can be done only when the drive is switched off. The maneuvering setpoint stretches the web between the winder and main drive (clamping point). If the tension exceeds a minimum value within a prespecified period, the tension control is automatically activated, the override setpoint switched in and the tension controller enabled along a ramp (if "Tension controller ON external" signal is applied). At the same time, the speed controller input is switched from maneuvering over to operating setpoint. The drive torque is adjusted to the torque limit specified by the tension control (derived from tension setpoint). A winding hardness characteristic (tension decreases in proportion to increase in diameter) can be activated as the tension setpoint for the winder.

The tension controller compares the actual tension with the tension setpoint and adds a corresponding compensation signal to the tension feedforward control value.

The machine can now be started.

With every change in velocity, the product of moment of inertia x acceleration is added to the tension feedforward control value.

The current diameter is calculated continuously from the quotient of web speed/winder speed. The sum of tension feedforward control value + tension controller output is multiplied by the varying diameter, thus ensuring that the web tension remains constant.

A reduced tension (=stop tension) can be injected at standstill. This is calculated as a percentage of the current operating setpoint tension.

If the web breaks, the winder accelerates by its override setpoint, the unwinder decelerates to its override setpoint (this is negative so the unwinder rotates in the opposite direction). The web break is sensed, on the one hand, by the delayed evaluation of a minimum tension and, on the other, by a comparison of the torque setpoint and actual values. When the web breaks, the actual torque decreases when the override speed is reached and this setpoint/actual value difference is evaluated after a delay (to allow for temporary deviations) by a limit monitor. The web velocity setpoint is canceled by the speed controller, both the winder and unwinder rotate at their override setpoint in the winding direction. OFF3 is applied after a parameterizable time period.

The "Web break" signal can also be specified from an external source (e.g. via light barriers).
2.3 Speed compensation control

2.3.1 Dancer control

In this case, a compensation value (magnitude of override 2-10%) is added to the speed controller setpoint. The drive torque limits are always open.

Every time the velocity changes, the product of moment of inertia x acceleration is added as a supplementary torque setpoint to the speed controller output.

The ramp generator for the speed setpoint merely serves to produce the dv/dt signal (ramp-up and ramp-down time should be set to 0).
Description of mode of operation:

Input of current diameter using "Set diameter". This can be done only when the drive is switched off. The maneuvering setpoint stretches the web between the winder and main drive (clamping point), thereby moving the dancer out of its end position. This activates the position control and enables the position controller along a ramp (if "Tension controller ON external" signal is applied); the position controller output forms the supplementary speed setpoint. The dancer moves to its center position (when position setpoint = 0). At the same time, the speed controller input is switched from the maneuvering over to the operating setpoint.

The machine can now be started.

The current diameter is calculated continuously from the quotient of web velocity/winder speed. The tension in the web is determined solely by the dancer weight. If a tension control function is required, the dancer must be provided with a control device (e.g. pressure cylinder). The tension setpoint is converted to a pressure setpoint in the 6RA70 and made available at an analog output. A winding hardness characteristic (tension decreases in proportion to increase in diameter) can be activated as the tension setpoint for the winder.

A reduced tension (=stop tension) can be injected at standstill. This is calculated as a percentage of the current operating setpoint tension.

If the web breaks, the dancer moves to its end positions. The dancer position control is disabled and the OFF3 process initiated. It is useful to delay OFF3 on the winder to allow any loose winding material to be reeled up.

NOTE

It may be necessary to activate the D-action component in the actual-value channel for the position controller. This helps to dampen the dancer roller and prevents build-up of oscillation between the dancer and winder.
2.3.2 \(v\)-constant control (winder)

The three control methods described above each require a clamping point on the machine, e.g. in the form of a pair of contacting rollers through which the web is fed and from which the winder receives the web velocity setpoint. If there is no clamping point on the machine, the winder must be regulated to a constant peripheral speed. This necessitates sensing the web velocity using a web tacho so that the diameter can be calculated from \(v/n\).

Since the winder is acting quasi as a "main drive" in this instance, the ramp generator must be used to ramp the speed setpoint.
Description of mode of operation:

Input of current diameter using "Set diameter". This can be done only when the drive is switched off.
The machine can be started when the web is tensioned.
Web-break sensing is not operative in v-constant control mode. If the web breaks, the web tacho signal
switches to 0. The calculated diameter would then integrate in direction D_min, resulting in a corresponding
increase in the winder speed. To prevent this from happening, the "monotone" setting of the diameter
calculator must be activated, i.e. the diameter can only increase for the winder and thus remains constant if
the web breaks.

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| When the v-constant control method is used, the web velocity must be measured using a web tacho. This
also necessitates use of supplementary board SBP pulse encoder evaluation (second actual tacho
value). |

2.4 Control function blocks

2.4.1 Stop tension control
The stop tension is injected as a function of the external control and the internal n=0 message. It can be
parameterized as a percentage of the set operating tension. If a constant stop tension is required, parameter
U151.01 must be connected to K0001.

2.4.2 Slip core control
The coil hardness influences, in conjunction with the diameter, the tension setpoint according to an
adjustable characteristic. The setpoints can be taken either from an internal characteristic block or externally
from the bus. Depending on the application, 5 additional characteristics are available. It is meaningful to
work without the slip core control if an unwinder is used. Switching between different characteristics is
implemented via external control.

2.4.3 Variable web width
The selection of different web widths is automatically taken into account for the calculation of the moment of
inertia and therefore also for the resulting feedforward control torque. In this case, the maximum web width
must always be assumed to be 100%. If a fixed web width is required, parameter U150.03 must be
connected to K0001.

2.4.4 Variable material density
The selection of different material densities is automatically taken into account for the calculation of the moment of
inertia and therefore also for the resulting feedforward control torque. In this case, the maximum material density
must always be assumed to be 100%. If a variable material density input is not required, parameter U525.04 must be
connected to K0001.

2.4.5 Calculator for the diameter
The diameter calculator calculates the current diameter from the web velocity setpoint (or actual web velocity
with V-constant control method) and the winder speed. This calculation is only performed if there is a
frictional connection to the continuous material, the tension controller is turned on and the system is in the
run state. Since the diameter can only decrease on an unwinder, and increase on a winder, calculation in the
opposite direction is disabled ("monotone" setting for diameter change).
If the user wishes to alter this behavior, he can enable the diameter calculator to work in both directions by
changing parameter P421 from 1 to 0.

2.4.6 Gearbox stage
The selection of gear stage 2 is automatically taken into account in the calculation of the moment of inertia
and the resulting feedforward control torque. The lower gear ratio must always be assumed to be 100%.
2.4.7 Speed controller adaptation
The proportional gain and reset time of the speed controller can be adapted as a function of moment of inertia. An optimization process is used to determine the values at minimum and maximum winding diameters and linear interpolation performed between them.

2.4.8 Tension controller adaptation
The proportional gain of the tension controller can be adapted as a function of moment of inertia.

2.4.9 Web break recognition
If the tension control is turned on, the web break recognition is enabled.

Direct tension control: Triggering results if selectable torque variance is exceeded and torque drops below minimum tension.
Indirect tension control: Triggering results if selectable torque variance is exceeded and torque drops below selectable minimum.
Compensating roll: Triggering results if instantaneous value exceeds selectable position value.

If web tear recognition is triggered, speed setpoint is set 0 and the calculation for the diameter is disabled. The unwinder turns backwards, the winder forward, both using their bias. If a compensating (dancer) roll control is used, the position controller reaches its limit due to the missing instantaneous value. The bias results from the set intervention. After a selectable time, "Off 3" is triggered.

2.5 Acceleration compensation calculation
In order to ensure a constant tension torque during acceleration and deceleration, the armature current should be pre controlled using the required torque. The moment of inertia is never a constant value due to the steady change of the diameter of the winder.

♦ Fixed inertia \( J_F \) (adjustable using P407)
♦ Variable moment of inertia \( J_V \) (is calculated using building block 116, and is influenced by web width \( K3008 \) and material density \( K3009 \))

Chapter 4 contains instructions on how to calculate the two torques using available system data.

2.5.1 Determination of fixed value inertia
The fixed moment of inertia is the sum of the following moment of inertia

♦ moment of inertia of motors
♦ moment of inertia of gear corresponding to the shaft of the motor
♦ moment of inertia of winder core corresponding to the motor shaft
♦ additional moments of inertia such as couplers

Formula:
\[
J_F = J_{Motor} + J_{Gear} + \frac{J_{Core}}{i^2}
\]

For motor or gear values please refer to the datasheet or type plate. The inertia of the winder core has to be calculated. (Contact formula for the calculation of moment of inertia for solid cylinder or hollow cylinder.) If the winder’s core mass is relatively small, or the gear ratio rather large, the moment of inertia can be considered irrelevant as it is in this application.
If the moment of inertia of the winder core is not negligible, the user can adapt the calculation accordingly (taking into account \( J_{core} \) with \( i^2 \)).
Moment of inertia solid cylinder

\[ J = \frac{\Pi \cdot \rho \cdot b \cdot D^4}{32} \text{ [kgm}^2]\]

Moment of inertia hollow cylinder

\[ J = \frac{\Pi \cdot \rho \cdot b \cdot \left(D^4 - D_{Core}^4\right)}{32} \text{ [kgm}^2]\]

Calculation of percentage accelerating torque \( Mb^F \) using the fixed moment of inertia \( J^F \) and the acceleration time \( tb \). The equation outputs a moment of inertia corresponding to the rated current in %. Precondition: \( D = D_{Core}, tb = th \) and \( J_{Core} \) is ignored

Determining the value for parameter P407

\[ Mb^F = \frac{J^F \cdot n_N \cdot i \cdot \Delta v}{2865 \cdot D_{Core} \cdot P_N} \cdot \frac{\Delta v}{tb} \text{ [%]}\]

Determining the value for parameter P407

\[ P407 = \frac{Mb^F \cdot th}{P542} \times 100\%\]

2.5.2 Determination of the variable moment of inertia

The following equation outputs a value for the maximum variable moment of inertia using the maximum diameter, density and maximum width.

\[ J_{V_{max}} = \frac{\Pi \cdot \rho_{max} \cdot b_{max} \cdot \left(D_{max}^4 - D_{Core}^4\right)}{32 \cdot i^2} \text{ [kgm}^2]\]

Calculation of percentage accelerating torque corresponding to the related current in %

Requirements: \( D = D_{max}, tb = th \) and \( J^F = 0 \)

\[ Mb^V = \frac{b_{max} \cdot \rho_{max} \cdot \left(D_{max}^4 - D_{Core}^4\right) \cdot n_N \cdot \Delta v}{29.18 \cdot i \cdot D_{max} \cdot P_N} \cdot \frac{\Delta v}{tb} \text{ [%]}\]

Determining the value for Parameter U529:

\[ U529 = \frac{Mb^V \cdot th}{P542} \times 100\%\]

2.5.3 Formulas and dimensions

- \( b \) web width [m]
- \( D \) diameter [m]
- \( D_{max} \) maximum diameter [m]
- \( D_{Core} \) diameter of winder - core [m]
- \( i \) gear ratio
- \( J^F \) constant moment of inertia (motor, Gear, winder - core) corresponding to shaft of motor [kgm²]
- \( J^V \) variable moment of inertia result of windup material corresponding to shaft of motor [kgm²]
- \( Mb^F \) maximum accelerating torque corresponding to \( J^F \) [% of \( MN \)]
- \( Mb^V \) maximum accelerating torque corresponding to \( J_{V_{max}} \) [% of \( MN \)]
- \( MN \) rated motor torque [Nm]
- \( n_N \) rated motor speed [rpm]
- \( P_N \) rated motor power [kW]
- \( tb \) time of acceleration [s]
- \( th \) ramp up time of web velocity; range \( 0 - V_{max} \) [s]
- \( \Delta v \) speed difference [m/min]
- \( \rho \) specific weight (density) [kg/dm³]
3 Interfaces

3.1 Received data from top level control

Data are exchanged via the communication board 1 (CBP2), PPO type 5. The functionality implemented in this application can be guaranteed only if the interface settings are made exactly as described in the table below.

<table>
<thead>
<tr>
<th>Word</th>
<th>Connector</th>
<th>Binector</th>
<th>Label</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K3001</td>
<td>Control word 1</td>
<td>Control Word 1 according to user manual</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>K3002</td>
<td>system speed setpoint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>K3003</td>
<td>Tension setpoint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>K3004</td>
<td>Control word 2</td>
<td>Control Word 2 according to user manual</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>K3005</td>
<td>Control word 3</td>
<td>Control word 3 for coilers / winders</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3500</td>
<td>Set diameter</td>
<td>1.....Set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3501</td>
<td>Stop diameter</td>
<td>1.....Stop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3502</td>
<td>Wind/Coil from top/bottom</td>
<td>0.....top / 1.....bottom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3503</td>
<td>Winder/Unwinder</td>
<td>0.....Winder / 1.....Unwinder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3504</td>
<td>v-constant control</td>
<td>If 1, the state of B3506 is not relevant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3505</td>
<td>Dancer roll control</td>
<td>If 1, the state of B3506 is not relevant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3506</td>
<td>Dir./Indir. Tension Control</td>
<td>0.....direct / 1.....indirect</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3507</td>
<td>Gear box stage 1/2</td>
<td>0.....Stage1 / 1.....Stage2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3508</td>
<td>Switch characteristic for coil hardness</td>
<td>The selected characteristic is the result of the combination of these three binectors (see truth table of the multiplexer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3509</td>
<td>Switch characteristic for coil hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3510</td>
<td>Switch characteristic for coil hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3511</td>
<td>Stop tension control</td>
<td>1.....On</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3512</td>
<td>Tension control ON ext.</td>
<td>1.....On</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3513</td>
<td>web break ext.</td>
<td>1.....On</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3514</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3515</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>K3006</td>
<td>Diameter set value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>K3007</td>
<td>Ext. characteristic coil hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>K3008</td>
<td>Web width</td>
<td>If different materials are produced</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>K3009</td>
<td>Density</td>
<td>If different materials are produced</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>K3010</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE

It is not permissible to enable B3504 (v-constant control) and B3505 (dancer roll control) at the same time. If they are enabled simultaneously, OFF3 will be triggered immediately!
3.1.1 Transmit data to top level control

Data exchange is done via the communication board 1 (CBP2), PPO-Type 5.

<table>
<thead>
<tr>
<th>Word</th>
<th>Parameter</th>
<th>Bit</th>
<th>Label</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U734.01</td>
<td>status word 1</td>
<td>Status word 1 according to user manual.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>U734.02</td>
<td>Actual speed value</td>
<td>K0179</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>U734.03</td>
<td>Instantaneous tension value</td>
<td>K9240</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>U734.04</td>
<td>status word 2</td>
<td>Status word 2 according to user manual.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>U734.05</td>
<td>status word 3</td>
<td>Status word for winder/coiler status K9113</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>Tension control is ON</td>
<td>1....ON</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Tension control limit reached</td>
<td>1....limit reached</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Web break</td>
<td>1....Web break</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Speed limit succeeded</td>
<td>1....n&gt;&gt;</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Operating mode ambiguous</td>
<td>1....ambiguous</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>U734.06</td>
<td>Current diameter</td>
<td>K9304</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>U734.07</td>
<td>Actual torque value (motor-related)</td>
<td>K0149</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>U734.08</td>
<td>Actual current value (motor-related)</td>
<td>K0107</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>U734.09</td>
<td>Output of tension control</td>
<td>K9249</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>U734.10</td>
<td>Web velocity</td>
<td>(when an optional SBP board is used for v-constant control) K0039</td>
<td></td>
</tr>
</tbody>
</table>

3.1.2 Analog input

Maneuver setpoint: analog input main setpoint X174: 4-5
value range: -10V.....+10V
tension / position feedback value: analog input 1 X174: 6-7
value range: tension feedback value: 0........+10V
position feedback value: -10V.....+10V
(both end positions can be sensed with a +/- supply)

3.1.3 Analog output

Tension setpoint for compensating weight if compensating roll control is enabled: analog output 1 X175: 14-15

3.1.4 Pulse generator input

Input for digital pulse - generator corresponding to „User Manual“.
4 Commissioning notes

4.1 Speed feedback adjustment

The following parameters have to be set:

U518 minimum diameter of winder shaft in mm

U519 gear ratio
   If two gear box stages are used, the gear box with the smaller gear ratio has to be used
   for example: i1=4, i2=5.... → U519=4
   \[ i = \frac{n_{Motor}}{n_{winder}} \]

U520 rated speed
   The motor speed in r.p.m. which occurs for the core diameter, maximum web speed setpoint and
   for the gear transmission ratio set at U519 must be set.

U522 standardization of system speed in m/s at maximum setpoint

U523 standardization of diameter in mm. 100% = maximum diameter

4.2 Compensation of friction torque

In general, the friction depends on the speed of the winder. Gear warming can result in negative influence.
After a few hours of operation there is the possibility a post optimization has to be performed.

Procedure:
♦ Operate winder only with speed control, binector B3512 (tension control ON ext.) has to be 0
♦ Disable acceleration compensation f.e. by preventing the dv/dt Signal (set P542 to 0,01).
♦ Take measurements at minimum diameter of winder; set minimal diameter; there may be no connection
to material web.
♦ Start drive via internal ramp function generator, and increase the speed in steps (f.e 10% steps)
♦ Read the actual torque on connector K0142 at every step and enter in U283.01 to .10 (characteristic
   block no. 106).
♦ Stop drive
♦ Select "Dancer control" and set binector B3501 (retain diameter) to 1.
♦ Start drive for winder and increase speed in 10 % steps. After each increase check connector K0160
   (output of speed controller). The value should be in the range of +/-3%.

NOTICE

Setting the friction compensation too high can cause the winder to break away and produce backlash in
the web while it is unwinding under indirect tension control.
4.3 Compensation of acceleration torque

Unless the acceleration torque is negligible in relation to the remaining torque, acceleration compensation should be set on the winder with indirect and direct tension control. Acceleration compensation is not generally required in dancer control mode, and is not generally activated in v-constant mode.

General procedure:
♦ No connection to material web, gear box stage 1 selected (changeover to gear box stage 2 is automatically taken into account.
♦ Set ramp up time and ramp down time according to the application
♦ P542 (dv/dt evaluation) is preset to 30s, i.e. the dv/dt value is 100% with a ramp-up or ramp-down time of 30s. P542 should always be set to the same value as the actual ramp-up and ramp-down time so that the dv/dt signal (K0191) always corresponds to max. 100%. P542 can, if necessary, be set to another value for the purpose of finely adjusting the acceleration compensation function.
♦ Select operating state "indirect tension control" and set the bias P405 to 0 % and binector B3501 (hold diameter value) to 1.

4.3.1 Constant moment of inertia
♦ Take measurements at minimum coil diameter; set minimal diameter
♦ Prohibit influence of variable moment of inertia. e.g. by setting the web width to 0% using K3008.
♦ Vary the speed of the winder between 10% and 90% and observe K0160 (output of speed controller) during acceleration and deceleration. The deviation from the final value then equals the acceleration or deceleration torque.
♦ Set evaluation of the const. moment of inertia in P407 to the value calculated in the paragraph above. The output of the tension/dancer controller (K9249) can be monitored in direct tension control or dancer control mode to check the setting. This should remain within a range of +/-3%.

4.3.2 Variable moment of inertia
♦ Set the following parameters:
    U526 = U528 = Maximum possible diameter in mm
    P404 = Core diameter as % of maximum diameter
    U527 = Core diameter in mm
♦ If possible insert a rather fully loaded coil with a large material width and density.
♦ Set values of actual diameter, density of material and web width
♦ Vary the speed of the winder between approx. 10% and a speed at which the maximum peripheral speed of the winder roller is not exceeded and monitor connector K0160 (speed controller output) while the drive is accelerating and decelerating. The deviation from the final value then equals the acceleration or deceleration torque.
♦ Set evaluation of the var. moment of inertia in U529 such that the value calculated in the paragraph above is output at K9121 (sum of const. and var. moments of inertia). The output of the tension/dancer controller (K9249) can again be monitored in direct tension control or dancer control mode to check the setting. This should remain within a range of +/-3%.

NOTE
If the web width and / or the density is always constant, Parameter U150.03 and / or U525.04 (density) have to be set to K0001 (100%)
4.4 **Optimization of speed controller**

Raise torque limits, for example by setting the signal “Compensating roll position control ON”. (P605 is set to 150%)

Set the adaptation of kp 2 using P559 and Tn 2 using P560. The value can be calculated using the following formula

\[ P559 = P560 = \frac{D_{\text{max}}^4 - D_{\text{Core}}^4}{D_{\text{max}}^4} \times U529 \times 100\% \]

Requirement: Density and width of material have to be 100%, U529 calculated according to 4.3.2

The thresholds 1 (P556, P557) must always equal to 0.

4.4.1 **Optimization at minimal diameter**

- Run system with fully loaded winder
- Perform optimization for speed controller according to the user manual (P051=26).
- Use value of P225 (kp) and P226 (Tn) to set P550 / P551 (equals lower values of kp and Tn adaptation)

4.4.2 **Optimization at maximum diameter**

- Run system with empty winder
- Perform optimization for speed controller according to the user manual (P051=26).
- The set values in P225 and P226 equal the upper values of kp and Tn – adaptation

4.5 **Hints for setting parameters**

**P406:** Gear stage 2.

The value is calculated as follows: \(i_1/i_2\).

f.e. \(i_1=4, i_2=5\) \(\Rightarrow P406 = 4/5 = 80\%\)

**U198:** Tension control: Value for required tension or torque for web break observation 5%.

Position control: Set observation value for compensating roll, f.e. 90%90%.

**U282.01-.10:** Characteristic of friction.

**U283.01-.10:** Only positive values allowed.

**U285.01-.10:** Characteristic for slip coil control

**U286.01-.10:** Only positive values allowed.

**U288.01-.10:** Characteristic (Building block 108).

**U289.01-.10:** Using this block, you can delinearize the influence of the potentiometer for maneuvering
(a characteristic is set which equals approximately \(y=f(x^2)\))

**U450:** Delay web break recognition.

Is used to disable false triggering on short, sudden tension or torque drops.

**U453:** Time, during which the minimum tension (set using U198) has to be surpassed to activate the tension control.

**U456:** Time for reverse winding if web break occurs.
U539.01: Integration time - calculator for diameter
The following formula is used for calculation:

\[
U539.01 = \frac{(D_{\text{max}} - D_{\text{sleeve}}) \cdot v_{\text{max}} \cdot U537 \cdot 0.95}{D_{\text{max}} \cdot d_{\text{min}} \cdot 0.42} \text{ [s]}
\]

- \(D_{\text{max}}\): Maximum roller diameter \([\text{m}]\)
- \(D_{\text{sleeve}}\): Minimum (core) diameter \([\text{m}]\)
- \(v_{\text{max}}\): Maximum system speed \([\text{m/min}]\)
- \(d_{\text{min}}\): Minimum thickness of the material \([\text{mm}]\)
- 0.95: Factor for incorporating 5% safety margin
## 5 Appendix

### 5.1 List of freely assignable function blocks used

<table>
<thead>
<tr>
<th>Block type</th>
<th>Blocknumber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binector/connector converter</td>
<td>13</td>
</tr>
<tr>
<td>Average value during n cycles</td>
<td>16</td>
</tr>
<tr>
<td>Adders/subtractors</td>
<td>20,21,22,23,24,25</td>
</tr>
<tr>
<td>Sign inverters</td>
<td>35,36</td>
</tr>
<tr>
<td>Switchable sign inverters</td>
<td>40,41</td>
</tr>
<tr>
<td>Dividers</td>
<td>42,45,46</td>
</tr>
<tr>
<td>Multipliers</td>
<td>50,51,52,53,290.....297</td>
</tr>
<tr>
<td>High resolution multipliers/dividers</td>
<td>55,56</td>
</tr>
<tr>
<td>Absolute value generators with filter</td>
<td>60,61</td>
</tr>
<tr>
<td>Limiters</td>
<td>65</td>
</tr>
<tr>
<td>Limit-value monitors without filters</td>
<td>73,74</td>
</tr>
<tr>
<td>Maximum selection</td>
<td>80</td>
</tr>
<tr>
<td>Tracking-/storage element</td>
<td>82</td>
</tr>
<tr>
<td>Analog signal selector switches</td>
<td>90.....99</td>
</tr>
<tr>
<td>Integrators</td>
<td>101</td>
</tr>
<tr>
<td>Characteristic blocks</td>
<td>106,107,108, 280</td>
</tr>
<tr>
<td>Simple ramp-function generator</td>
<td>113</td>
</tr>
<tr>
<td>Technology controller</td>
<td>114</td>
</tr>
<tr>
<td>Velocity/speed controller</td>
<td>115</td>
</tr>
<tr>
<td>Variable moment of inertia</td>
<td>116</td>
</tr>
<tr>
<td>Multiplexer</td>
<td>86,87</td>
</tr>
<tr>
<td>AND – elements</td>
<td>121.....132</td>
</tr>
<tr>
<td>OR – elements</td>
<td>150.....167</td>
</tr>
<tr>
<td>Inverters</td>
<td>180.....193</td>
</tr>
<tr>
<td>NAND elements</td>
<td>200</td>
</tr>
<tr>
<td>RS-flipflop</td>
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</tr>
<tr>
<td>Timers</td>
<td>240.....246</td>
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<tr>
<td>Binary signal selector switch</td>
<td>250.....253</td>
</tr>
<tr>
<td>PI-controller</td>
<td>260</td>
</tr>
</tbody>
</table>
5.2 List of settable fixed values used

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>P401</td>
<td>Inching setpoint</td>
<td>1.1</td>
</tr>
<tr>
<td>P402</td>
<td>Adjustment of setpoint – actual value difference of torque for web break recognition</td>
<td>17.1</td>
</tr>
<tr>
<td>P403</td>
<td>Fine tuning of web (system) speed</td>
<td>8.4</td>
</tr>
<tr>
<td>P404</td>
<td>Diameter of core in % of Dmax</td>
<td>8.6</td>
</tr>
<tr>
<td>P405</td>
<td>Bias for speed controller in conjunction with direct and ind. tension cont.</td>
<td>14a.1</td>
</tr>
<tr>
<td>P406</td>
<td>i gear stage 2</td>
<td>11.1</td>
</tr>
<tr>
<td>P407</td>
<td>Constant moment of inertia</td>
<td>11.2</td>
</tr>
<tr>
<td>P408</td>
<td>Scaling of torque setpoint</td>
<td>16.1</td>
</tr>
<tr>
<td>P409</td>
<td>Influence tension-/position controller</td>
<td>15.5</td>
</tr>
<tr>
<td>P410</td>
<td>Stop tension</td>
<td>12.4</td>
</tr>
<tr>
<td>P411</td>
<td>Position setpoint (always 0 except in the case of dancer control!)</td>
<td>15.1</td>
</tr>
<tr>
<td>P421</td>
<td>Change of diameter monotone 0....no 1.....yes</td>
<td>8.2</td>
</tr>
<tr>
<td>U099.01</td>
<td>Dancer end position sensing</td>
<td>17.1</td>
</tr>
<tr>
<td>U099.02</td>
<td>Maximum torque in n control mode</td>
<td>16.5</td>
</tr>
<tr>
<td>U099.03</td>
<td>Minimum tension setpoint</td>
<td>12.1</td>
</tr>
<tr>
<td>U198</td>
<td>Minimum tension or minimum torque</td>
<td>17.1</td>
</tr>
<tr>
<td>U201</td>
<td>Maximum permissible torque deviation for web break detection</td>
<td>17.5</td>
</tr>
</tbody>
</table>

5.3 Detailed schematics

See following sheets 1.....20

NOTE

For easier identification, the winder-specific changes to binector and connector links, and parameter changes, are displayed on a light gray background. These values deviate from the factory setting.
Inching setpoint

- Inching, bit 0 from control word 1
- Inching, bit 1 from control word 1
- Select injection of inching setpoint

- P435 (0)
- B
- B
- B
- B
- B
- B
- B

- P436 (0)
- K0401

- P437.07
- P437.06
- P437.05
- P437.04
- P437.03
- P437.02
- P437.01

- P438.F (208)
- K3002
- K0207

- Bypass ramp-function generator to sheet "Ramp-function generator"

- ON command from INCH (to control word 1)

- ON command from ON/OFF1 (from sheet "Crawling setpoint")

- Incching Setpoint P401.F (2,00)
- Select setpoint

- K0401
- K0401
- K
- K
- K
- K
- K
- K

- system - speed setpoint P438.F (208)
- K0202

- Sheet 1
Selection for switch-on/shutdown

Switch-on/shutdown from terminal 37 (from Sheet "Binary inputs 1")

ON from CW1

P4.04.01
B3100

Selection for shutdown

P4.04.00
B

Tension Control OFF 13.8
ON from CW1 (alternatively B0012)

U287.01 (0)
X0211

ON command from CW1 (alternatively B0012)

U289.01 to .10 (0)

Maneuver-setpoint

X-values

Y values

200% +

-200%

X1

X2

X3

X4

X5

X6

X7

X8

X9

X10

Y1

Y2

Y3

Y4

Y5

Y6

Y7

Y8

Y9

Y10

X-Values

Y-values

Maneuver-setpoint

Sheet 2
Setpoint processing

- Main setpoint
  - P644.F(2010)
  - K0207

- Additional setpoint
  - P645.F(0)
  - P623.F(1)

- Limit selection
  - P320.F(100.00)
  - P321.F(100.00)
  - P322.F(1)

- Normalization
  - U008.F(15.00%)

- Enable positive direction of rotation from control word 1
- Enable negative direction of rotation from control word 1

- Ramp function generator input
  - 0 %
  - 10 %
  - 11 %

- Direction of rotation enabled
  - 00
  - 01
  - 10
  - 11

- Limit selection
  - <1> When P643.0x=9, the limit selected via P642.0x acts with inverted sign as a negative limit

Sheet 3
**Speed calculation**

1. **Normalization**
   - U522 = 16.38 (0.01 to 32.767 m/s)

2. **Velocity set point**
   - n022

3. **Velocity / speed calculator**
   - \[ v_{set} = \frac{v_{set} \cdot i}{D \cdot \pi \cdot n_{rated}} \times 100\% \]
   - D: Diameter
   - i: Gear ratio
   - n_{rated}: Rated speed

4. **Web break**
   - n<sub>set</sub> = \( \frac{v_{set} \cdot i}{D \cdot \pi \cdot n_{rated}} \times 100\% \)

5. **Winding from top / bottom**
   - 18.5

6. **Power on**
   - QSET (Q=1)
   - RESET (Q=0)

7. **Speed set point**
   - n023

---

**Sheet 5**

---
Reverse polarity of actual speed value on field reversal and applied negative field direction from Sheet: "Field reversal with SIMOREG 6RA70 single-quadrant device"

Main actual value

Actual value from pulse encoder

Internal actual EMF value

Speed controller (2)

- Speed controller integration time from Sheet Speed controller 1
- Speed controller P gain from Sheet Speed controller 1
- Supplementary speed setpoint

Contr. dev. n(set, smooth) n(act, smooth)

Set.val I-comp n contr.

Contr. dev. n(set, limit) n(act)

Contr. dev. quality resonant frequency

Switchover to P controller

Friction and moment of inertia compensation

Stop I component when limitation reached

Enable speed controller from control word 2 and sequencing control

Switchover speed setpoint

Fast stop

Master/slave drive from control word 2:
Make I component follow on slave drive so that M(set, n contr.) = M(set, limit) and setspeed setpoint = actual speed value (K0179)
Compensation of friction

ATTENTION! Do N O T activate, contact sheet 11 for further information

Compensation of moment of inertia (dv/dt - Addition)

Compensation of friction

Compensation of moment of inertia (dv/dt - Addition)
**Calculator for Diameter (2)**

**Transfer function:**
\[
G(s) = \frac{1}{1 + \frac{s}{T_1}} \cdot \frac{K_p}{1 + \frac{s}{T_n}}
\]

**Sheet 8a**

**Priority:**
1. Disable PI - controller
2. Set Output
3. Stop l-component
4. Stop I-component active
5. Stop l-component
6. Stop l-component in pos. direction
7. Stop l-component in neg. direction

**Set PI - controller:**
- 0 = Disable PI - controller
- 1 = Stop l-component
- 2 = Stop output

**Set diameter 9.8:**
- 0 = Set l-component
- 1 = Set value PI - controller output

**Diameter set value 9.8:**
- 0 = Set l-component
- 1 = Set value PI - controller output

**Tension feed < GW 17:**
- 0 = Disable PI - controller
- 1 = Stop l-component
- 2 = Stop output

**Enable PI - controller:**
- 0 = Disable PI - controller
- 1 = Stop l-component
- 2 = Stop output

**PI-controller Controller has reached negative limit:**

**K9307**

**PI - controller output**

**B9600**

**B9650**

**B9670**

**Regler an Ausgangssignatur**

**Stop l-component in negative direction and set to negative limit (K9307):**

**Stop l-component in positive direction, and limit it to positive:**

**Current diameter:**

**Transfer function:**
\[
G(s) = \frac{1}{1 + \frac{s}{T_1}} \cdot \frac{K_p}{1 + \frac{s}{T_n}}
\]
Variable moment of inertia

\[ J_V = \frac{D^4 - D_{Core}^4}{D_{max}^4} \times K \]

Current diameter: 8a.7

Normalization of diameter
US26 (10000) (10...60000/mm)

US25 (1) 0.01
X
US309 0.02
X
K 0.03
X
K 0.04
X

Normalization of core diameter
US27 (100000) (10000...60000/mm)

US29 (1.00) (0.10...100.00)

Normalization of max. diameter
US28 (100000) (10...60000/mm)

Density of material

Variable moment of inertia

Sheet 10
Compensation of acceleration and friction

Gear stage 1/2, 18.7

Web width
Var. moment of inertia 10.7

X values
U282.01 to .10 (0)

Y values
U283.01 to .10 (0)

Characteristic of friction

Current diameter
x4 = x1 * x2

x1 * x2 100%
x1 * x2 100%

Summ of pre control moments

Unw. / winder 18.5

|n| 6a.3

|dv/dt| 4.6

i 11.3

Var. moment of inertia
10.7

Gear stage 2

P406.F (100.00)

Gear stage 2

100.00 %
Setpoint processing

1. S (SET)
2. R (RESET)

0 = Ramp generator
1 = Enable simple ramp generator
Stop simple ramp generator

<1> If U301.01 = 9191 is active only once after being enabled (Flanke log. "0" auf "1")

<2> from electronic system powersupply monitor

Priority:
1. S (SET)
2. R (RESET)

Stop tension value P410.F (0,00)

Y values U286.01 to .10 (0)

Switchover characteristic of slip core control

Stop tension 18.7

Tension control after influence of slip core control
Tension control enable

- Tension feedback value:
  - < limit or actual position 17a.8
  - > limit

- Tension control ON ext. 18.7:
  - OFF3

- Tension control ON:
  - &

- Tension control OFF:
  - 18.4

- Tension setpoint after slip core control 12.7

- P751 (0)

- P755 (0)

- P756 (0)

- Normalization:
  - -200.00...+199.99V
  - P753 (10.00)

- Offset:
  - -10.00...+10.00V
  - P754 (0.00)

- X175: Tension setpoint for external Tension control
Switching logic for the control methods

- v-constant control
- Dancer control

Switching logic:
- v-constant control 18.5
- Dancer control 18.5

States:
- 1
- U393 (0)
- B9391
- U400 (1)
- B9391
- B9392
- B
- U395 (0)
- B9391
- U9391
- B9392
- B

Other notes:
- Operating mode ambiguous
- P659 OFF3
- Switching logic for the control methods
- v-constant or Dancer control ON
Tension- or Dancer - roll pos. contrl.(1)

- Diagram shows a tension or dancer roll position controller with various input and output signals.
- Key components include:
  - Kp and Tn factors
  - D-component Tension/Position-Controller
  - Threshold
  - Position setpoint
  - Tension setpoint

- Annotations note:
  - 0 = D-component influences only the feedback value channel
  - 1 = Normal PID-Regler: D-component is active for control deviation

- Block diagram includes:
  - U489 (0)
  - U482.F (0.00)
  - U497.F (0.00)
  - U493.F (100.00)
  - U491.F (100.00)
  - U483.F (0.00)
  - U481.F (0.00)
  - U485.F (0.00)

- Variables and settings:
  - Kp-factor
  - X1, X2
  - Y1, Y2
  - Threshold

- Additional notes:
  - Influence Tension/position contrl. P409.F (100.00)
  - Uni./Winder 18.5
  - Sheet 15
Tension-/position controller (2)

Enable
Tension/pos. controller: 14a.8

Integration time (Tn)
(10...65000ms)
U265 (0000)

100,00 %
K0001
K0001

Tension - position controller limit

Enable
Tension/pos. controller: 14a.8

1

Stop integrator

Set integrator

Set value

U264 (0)
B9460

U266 (0)
B9460

U267 (0)
B9357

190

101
Tension-/position controller (3)

Connector selector switch

Instantaneous value of moment
Current diameter

Dancer control or
dir. tension control

Current diameter

Tension/pos.current value

Sheet 15b
Determination of moment setpoint if tension control is active

Output
Tension/Pos. Ctrl.: 13.8
Tension setpoint: 12.7

Moment feedback value if tension control is active

Torque limit in n control mode

Summ of precontrol moments 11.8

Current 8a,7 diameter

Normalization of moment setpoint

Tension control ON 13.4

Dancer or v-constant control 14.4
Web break recognition (1)

Dancer control or dir. tension control  14a.5

<table>
<thead>
<tr>
<th>P02.F</th>
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<tbody>
<tr>
<td>U099</td>
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<td>U244</td>
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Adjustment of moment-setpoint - actual value diff.

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Minimum tension or torque

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Dancer roll endposition

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instantaneous value of moment

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U199 (0,00)

Vertical axis

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Maximum allowed moment deviation

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Moment setpoint

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Hysteresis 0,00...199,99

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U199 (0,00)

Hysteresis 0,00...199,99

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U199 (0,00)

Horizontal axis

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<tbody>
<tr>
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<tr>
<td>(0,00)</td>
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</table>
Web break recognition (2)

- Actual tension and/or actual torque < limit or actual position > limit
- Actual tension and/or actual torque < limit or actual position > limit

- Danceroll control OFF
- Delayed ON
- Delayed OFF
- On / Off delay.
- Impulsgenerator

- Mode
- Mode
- Mode

- Sheet 17a

Page 7

48-55 Siemens AG SIMOREG DC-MASTER Application Center Winder
Statusword 3

- Tension control ON: 13.4
- Tension controller operates in limit: 15.8
- Web break: 17a.3
- Speed limit succeeded: 17.10
- Operating mode ambiguous: 14.6

Sheet 19
**SBP pulse encoder evaluation**

(optional for web tacho, required only in V constant control mode)

---

**Power supply**
- +Vss
- -Vss

**Supply voltage**
- U791 = 0: 5V
- U791 = 1: 15V

**Ground coarse/fine**
- +5/15V

**Coarse pulse 1**
- B7001

**Coarse pulse 2**
- <2>
- B7002
- B7003

**Fine pulse 2**
- <2>

**Encoder type**
- U793=0: A/B track
- U793=1: Forward/reverse tracks

**Voltage level**
- U790.01: A/B, CTRL track
- U790.02: Zero pulse

**Number of lines**
- 100...20000

**Track A**
- + Track A
- - Track A

**Track B**
- + Track B
- - Track B

**Zero pulse**
- + Zero pulse
- - Zero pulse

**CTRL**
- + CTRL
- - CTRL

**Control track**
- + M

---

**Speed measurement**

**Reference speed**
- 50.0...6500.0

**Speed actual value**
- K0039

**Speed actual value in rpm**
- K0038

**Reset position counter**
- U796

**Position acquisition**

**Overflow**
- B0055

**Underflow**
- B0056

**Position value range**
- 8000 0000H to 7FFF FFFFH

---

<1> 0=Enable position counter (K0038)
1=Reset (K0038:=0)

<2> The signals "coarse pulse 2" and "fine pulse 2" are only routed to binectors B7002 and B7003 in the SIMOREG DC Master. They have no other function.
5.4 Parameter list

Download file "achswickler.winder.dnl" is stored in the "Applications_d" folder on the SIMOREG DC-MASTER CD-ROM (Order No.: 6RX1700-0AD64).

The file "achswickler.winder.dnl" has been created with "DriveMonitor" and can only be loaded with this application. This should not be done until the basic commissioning process (motor data settings, optimization runs) is finished. Parameters modified during basic commissioning are not altered by the contents of the download file.

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<td>After &quot;achswickler.winder.dnl&quot; has been downloaded, parameter U969 must be set to 4. This ensures that unconnected function blocks are deselected and any connected function blocks are selected (activated) if they are not selected already.</td>
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<tr>
<td>Deselecting any function blocks that are not needed reduces the load on the processor (see visualization parameter n009).</td>
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