SIEMENS

SIMOREG DC-MASTER

Application
Center Winder

6RA70 Series

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

Edition 06

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.

We have checked that the contents of this publication agree with the hardware and software described herein. Nonetheless, differences might exist and therefore we cannot guarantee that they are completely identical. The information given in this publication is reviewed at regular intervals and any corrections that might be necessary are made in the subsequent printings. Suggestions for improvement are welcome at all times.

0 Contents

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_{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

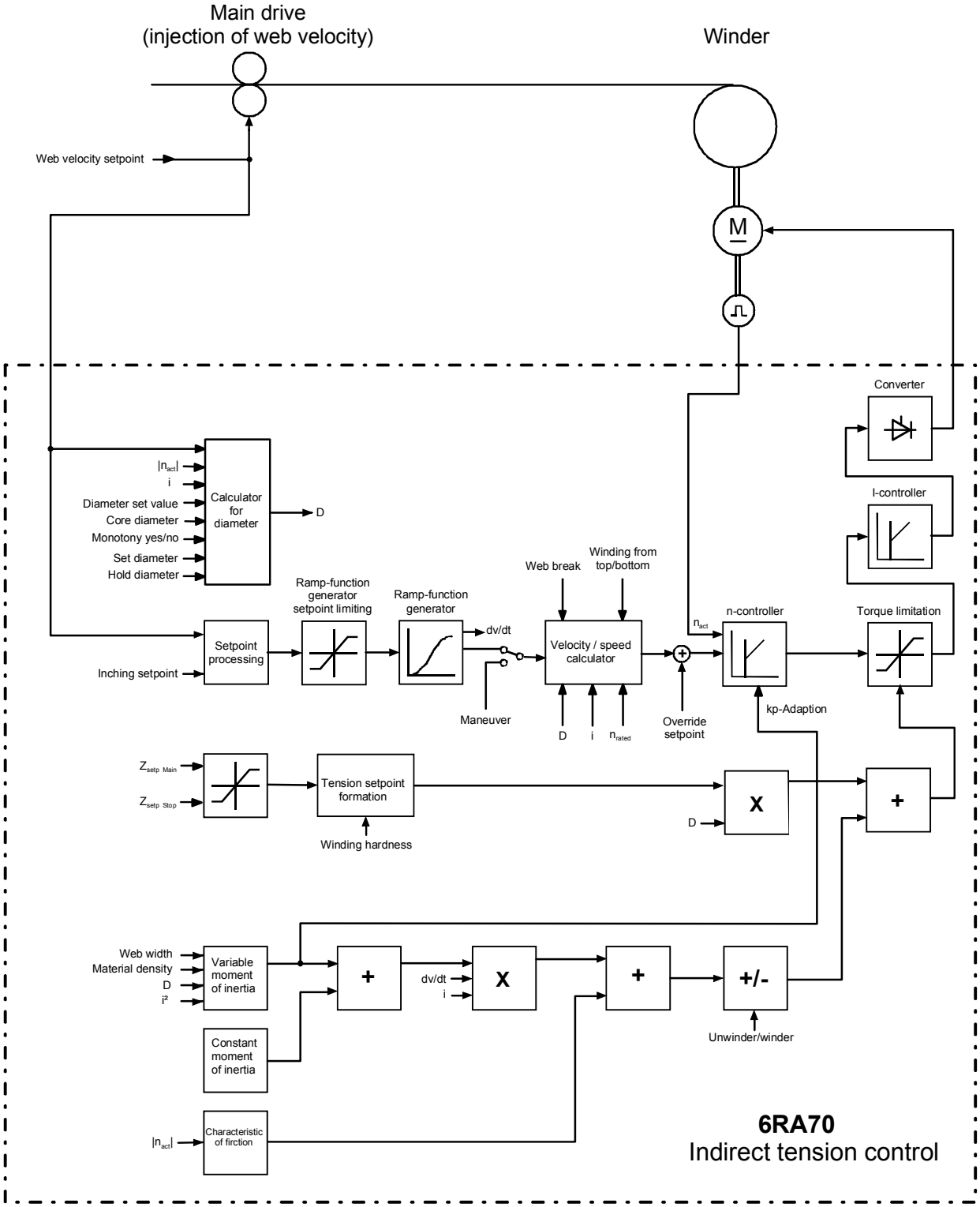
The following table lists selection criteria based on empirical values.
The maximum possible web velocity is dependent to a large degree on its relation to the web-lead or maneuvering velocity (see also para. 1.2 Application guidelines).

Control method	Torque limiting control		Speed compensation control	
	Indirect tension control	**Direct tension control**	**Dancer control**	**v-constant control**
Diameter sensing	Calculated from web velocity setpoint and winder speed	Calculated from web velocity setpoint and winder speed	Calculated from web velocity setpoint and winder speed	Calculated from actual web velocity and winder speed
Diameter ratio D_{max}/D_{core}	Up to approx. 10:1 Good compensation of acceleration torque and friction required	Up to approx.15:1 Good compensation of acceleration torque and friction required	Up to approx. 15:1 Good compensation of acceleration torque and friction required	Up to approx. 15:1
Actual tension sensing	No	Yes	No	No
Tension ratio F_{max}/F_{min}	Up to approx. 6:1 Good compensation of acceleration torque and friction required	Up to approx. 20:1 Good compensation of acceleration torque and friction required	Variable only with variable dancer weight	
Torque ratio M_{max}/M_{min}	Up to approx. 30:1	Up to approx. 40:1 Dependent on quality of actual tension signal		
Web velocity	Up to 300m/min with good compensation	Up to 1000m/min with good compensation	Up to 1000m/min with good compensation	Up to 1000m/min
Clamping point	Required	Required	Required	Not required
Web tacho	Not required	Not required	Not required	Required
Use preferably for	***Sheet metal, textiles, paper, cabling***	***Paper, thin foils***	***Rubber, cabling, wire, foil, textiles (generally for extensible materials)***	***Sorting roller***

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).

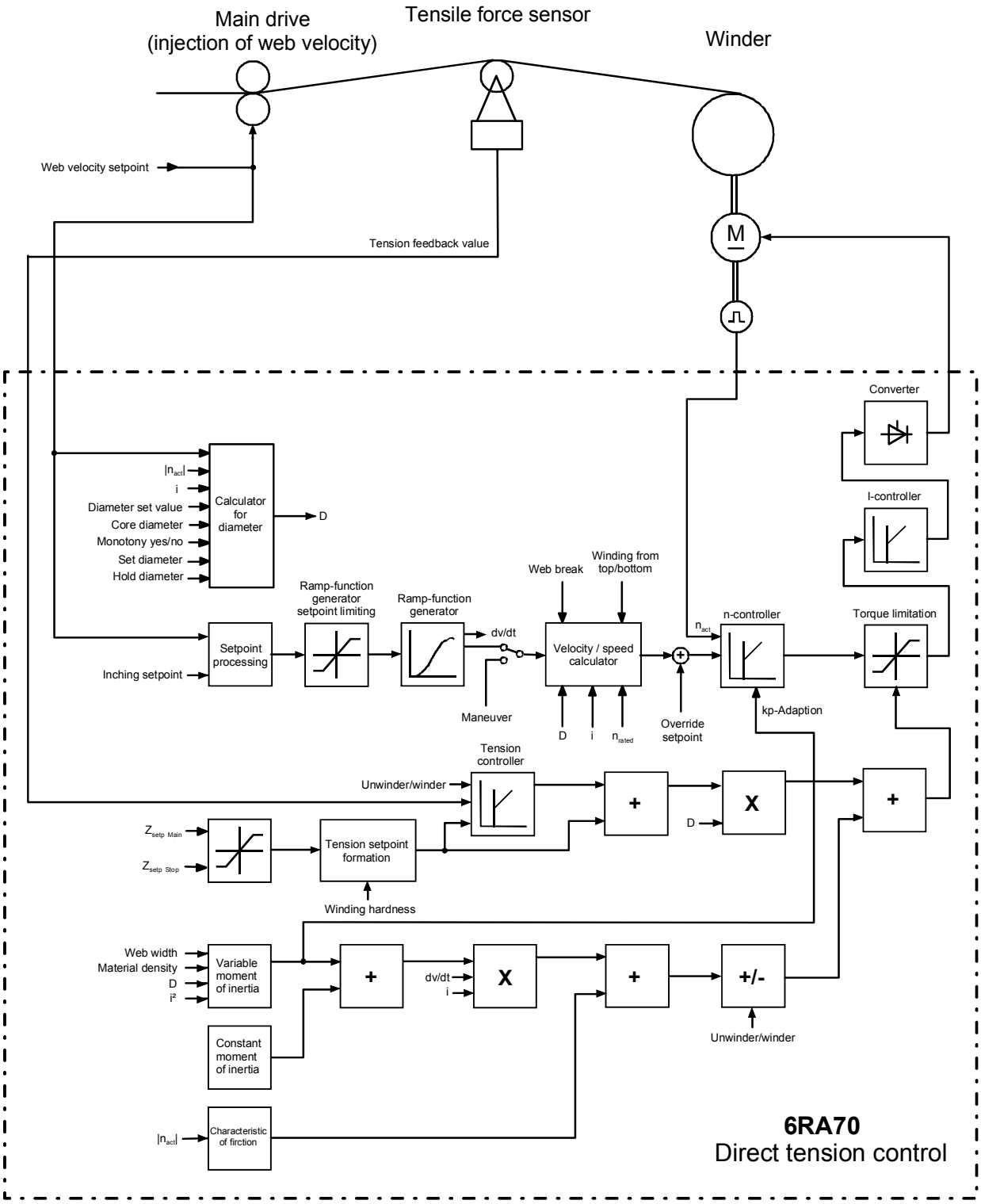
2.2.1 Indirect tension control



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



Description of mode of operation:

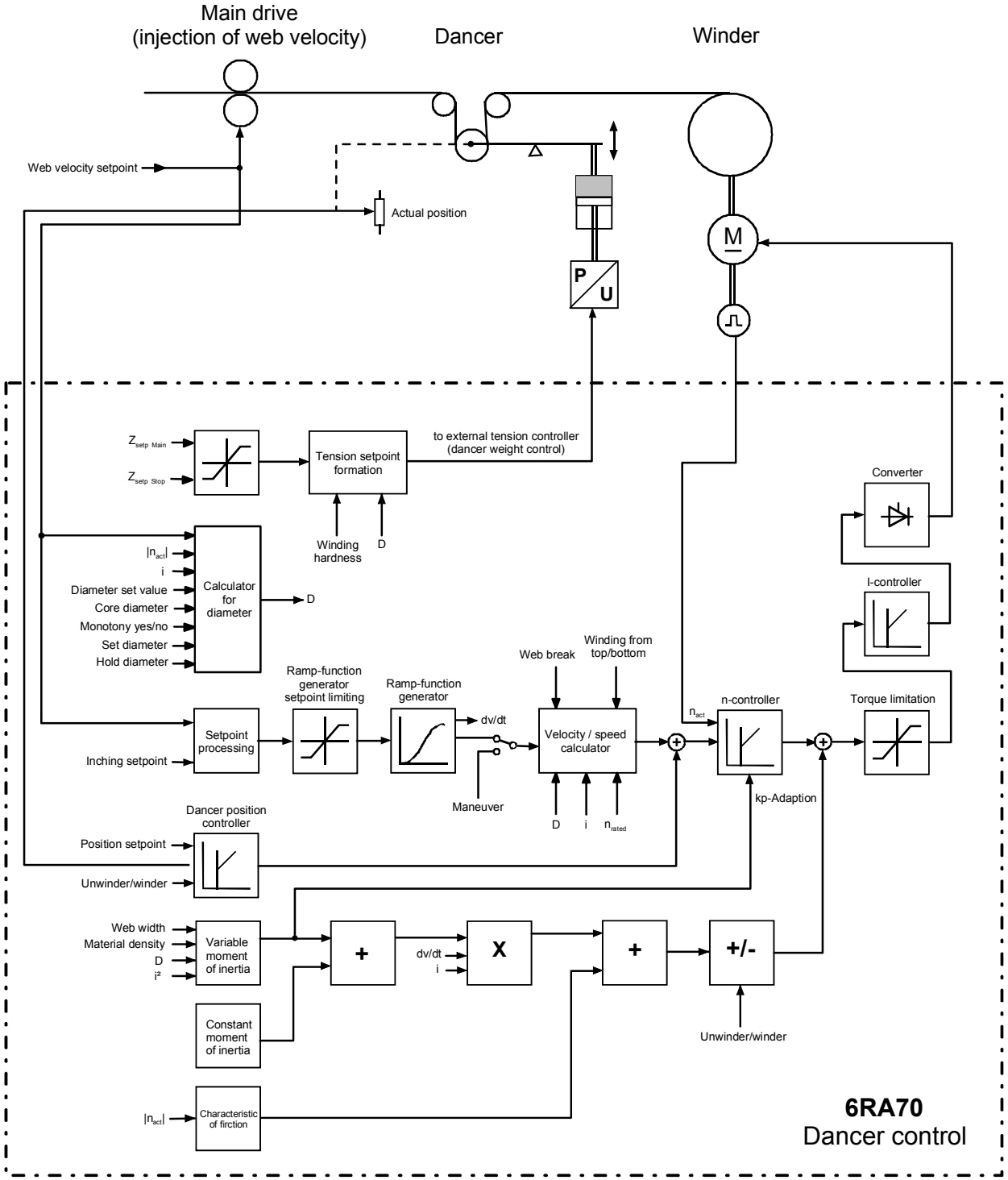
Input of current diameter using "Set diameter". This can be done only when the drive is switched off.
The maneuvering setpoint stretches the web between the winder and main drive (clamping point). If the tension exceeds a minimum value within a prespecified period, the tension control is automatically 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 velocity/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.

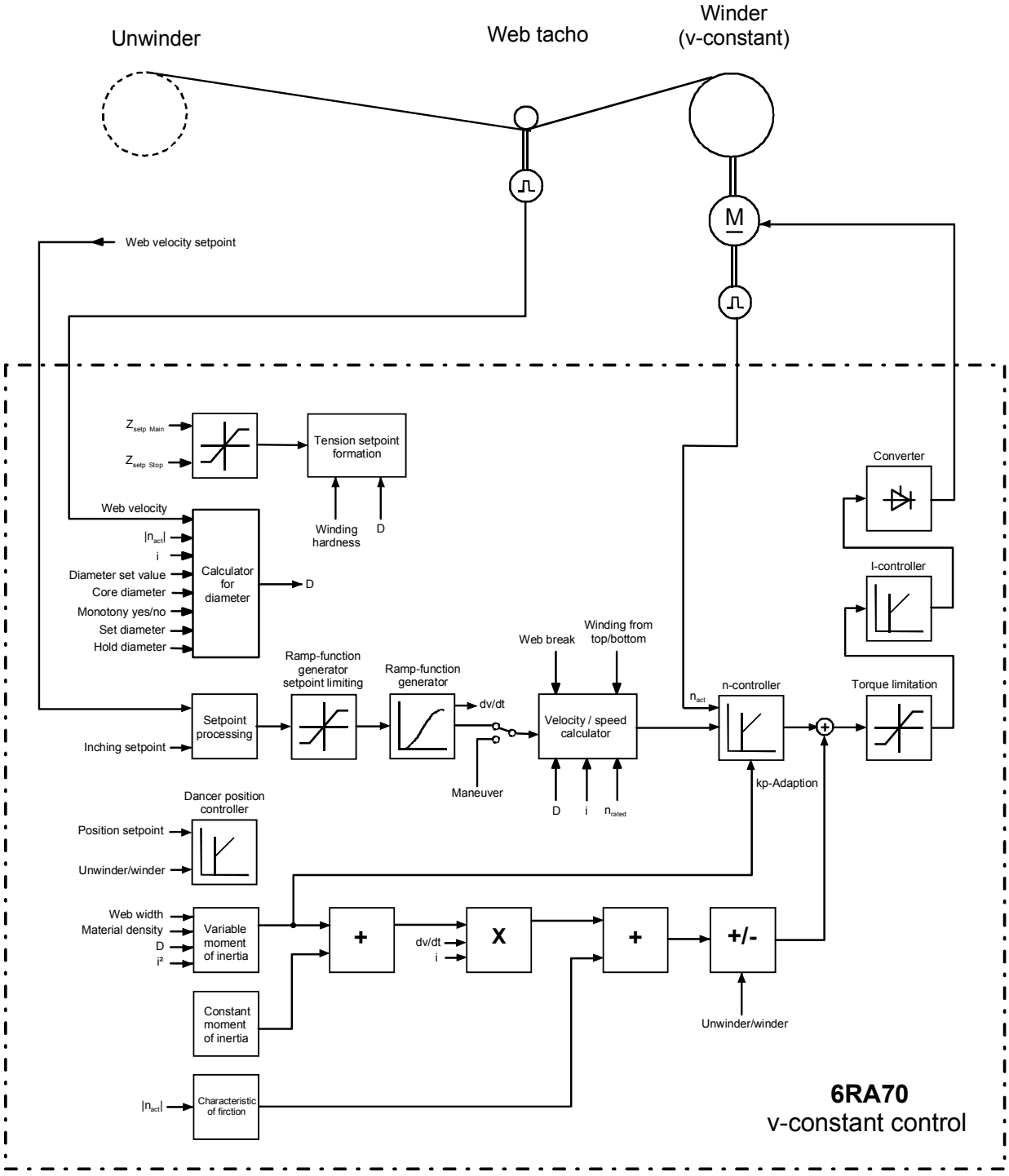
If the web breaks, the dancer moves to its end positions. The dancer position control is disabled and the OFF3 process initiated. It is useful to delay OFF3 on the winder to allow any loose winding material to be reeled up.

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.

NOTE

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

$$J = \frac{\Pi * \rho * b * D^4}{32} \text{ [kgm²]}$$

Moment of inertia hollow cylinder

$$J = \frac{\Pi * \rho * b * \left(D^4 - D^4_{Core}\right)}{32} \text{ [kgm²]}$$

Calculation of percentage accelerating torque M_{bF} using the fixed moment of inertia J_F and the acceleration time t_b. The equation outputs a moment of inertia corresponding to the rated current in %.
Precondition: $D = D_{core}$, $t_b = t_h$ and J_{core} is ignored

Determining the value for parameter P407

$$M_{bF} = \frac{J_F * n_N * i}{2{,}865 * D_{Core} * P_N} * \frac{\Delta v}{t_b} \text{ [%]}$$

Determining the value for parameter P407

$$P407 = \frac{M_{bF} * t_h}{P542} * 100\%$$

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.

$$J_{v\,max} = \frac{\Pi * \rho_{max} * b_{max} * \left(D_{max}^4 - D_{Core}^4\right)}{32 * i^2} \text{ [kgm²]}$$

Calculation of percentage accelerating torque corresponding to the related current in %
Requirements: $D = D_{max}$, $t_b = t_h$ and $J_F = 0$

$$M_{bV} = \frac{b_{max} * \rho_{max} * \left(D_{max}^4 - D_{Core}^4\right) * n_N}{29{,}18 * i * D_{max} * P_N} * \frac{\Delta v}{t_b} \text{ [%]}$$

Determining the value for Parameter U529:

$$U529 = \frac{M_{bV} * t_h}{P542} * 100\%$$

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]
M_{bF}	maximum accelerating torque corresponding to J_F [% of M_N]
M_{bV}	maximum accelerating torque corresponding to J_{vmax} [% of M_N]
M_N	rated motor torque [Nm]
n_N	rated motor speed [rpm]
P_N	rated motor power [kW]
t_b	time of acceleration [s]
t_h	ramp up time of web velocity; range 0 – V_{max} [s]
Δv	speed difference [m/min]
ρ	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.

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

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.

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

3.1.2 Analog input

Maneuver setpoint: analog input main setpoint X174: 4-5
value range: -10V.....+10V

tension / position feedback value1: 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 in to 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. fe. 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

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

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: i1/i2.
f.e. i1=4, i2=5 ➔ 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:

$$U539.01 = \frac{(D_{max} - Dsleeve) * v_{max} * U537}{D_{max} * d_{min} * 0{,}42} * 0{,}95 \ [s]$$

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

5 Appendix

5.1 List of freely assignable function blocks used

Block type	**Blocknumber**
Binector/connector converter	13
Average value during n cycles	16
Adders/subtractors	20,21,22,23,24,25
Sign inverters	35,36
Switchable sign inverters	40,41
Dividers	42,45,46
Multipliers	50,51,52,53,290.....297
High resolution multipliers/dividers	55,56
Absolute value generators with filter	60,61
limiters	65
Limit-value monitors without filters	73,74
Maximum selection	80
Tracking-/storrage element	82
Analog signal selector switches	90.....99
Integrators	101
Characteristic blocks	106,107,108, 280
Simple ramp-function generator	113
Technology controller	114
Velocity/speed controller	115
Variable moment of inertia	116
Multiplexer	86,87
AND – elements	121.....132
OR – elements	150.....167
Inverters	180.....193
NAND elements	200
RS-flipflop	215
Timers	240.....246
Binary signal selector switch	250.....253
PI-controller	260

5.2 List of settable fixed values used

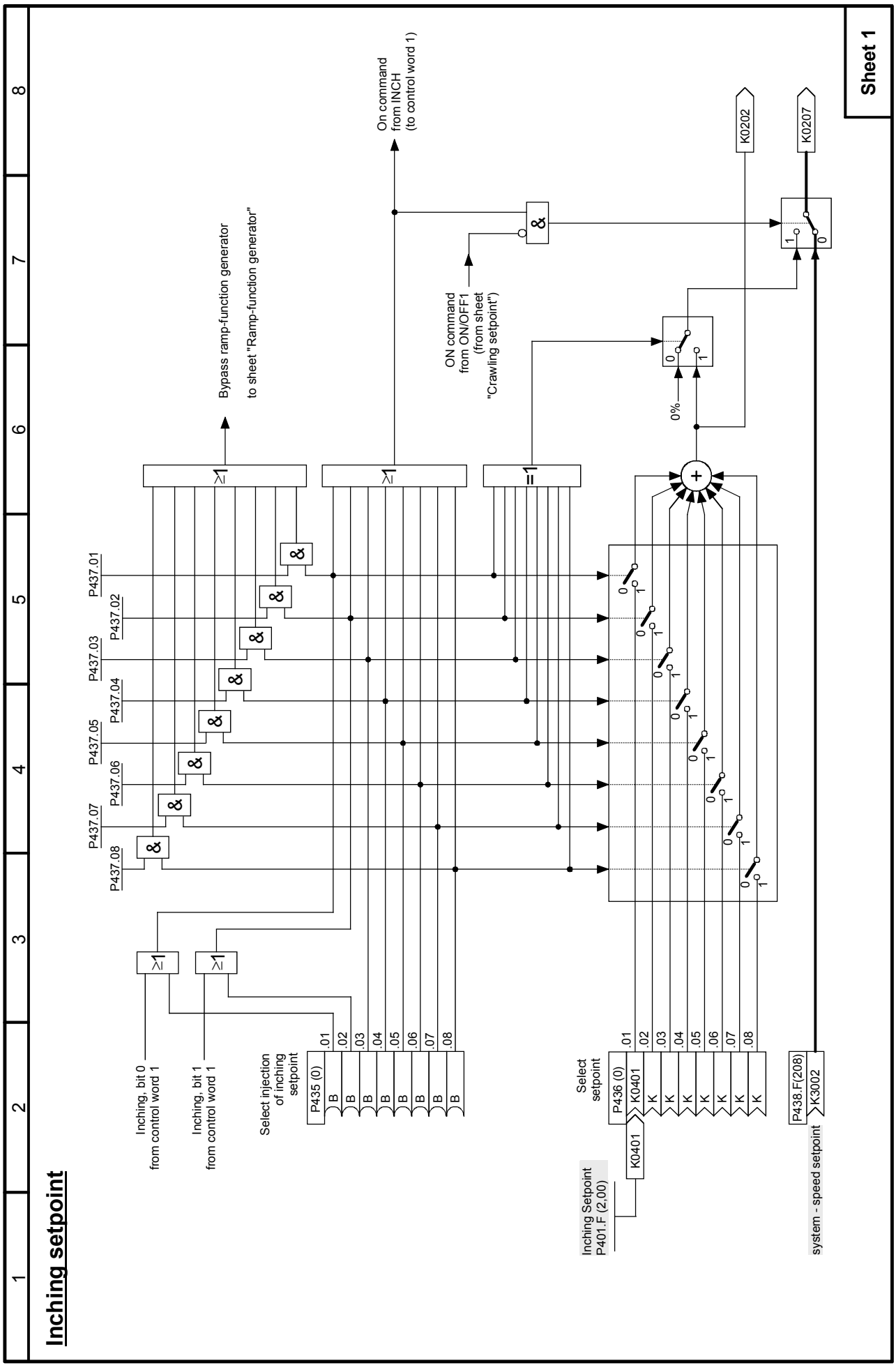
Parameter	Function	Sheet
P401	Inching setpoint	1.1
P402	Adjustment of setpoint – actual value difference of torque for web break recognition	17.1
P403	Fine tuning of web (system) speed	8.4
P404	Diameter of core in % of D_{max}	8.6
P405	Bias for speed controller in conjunction with direct and ind. tension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

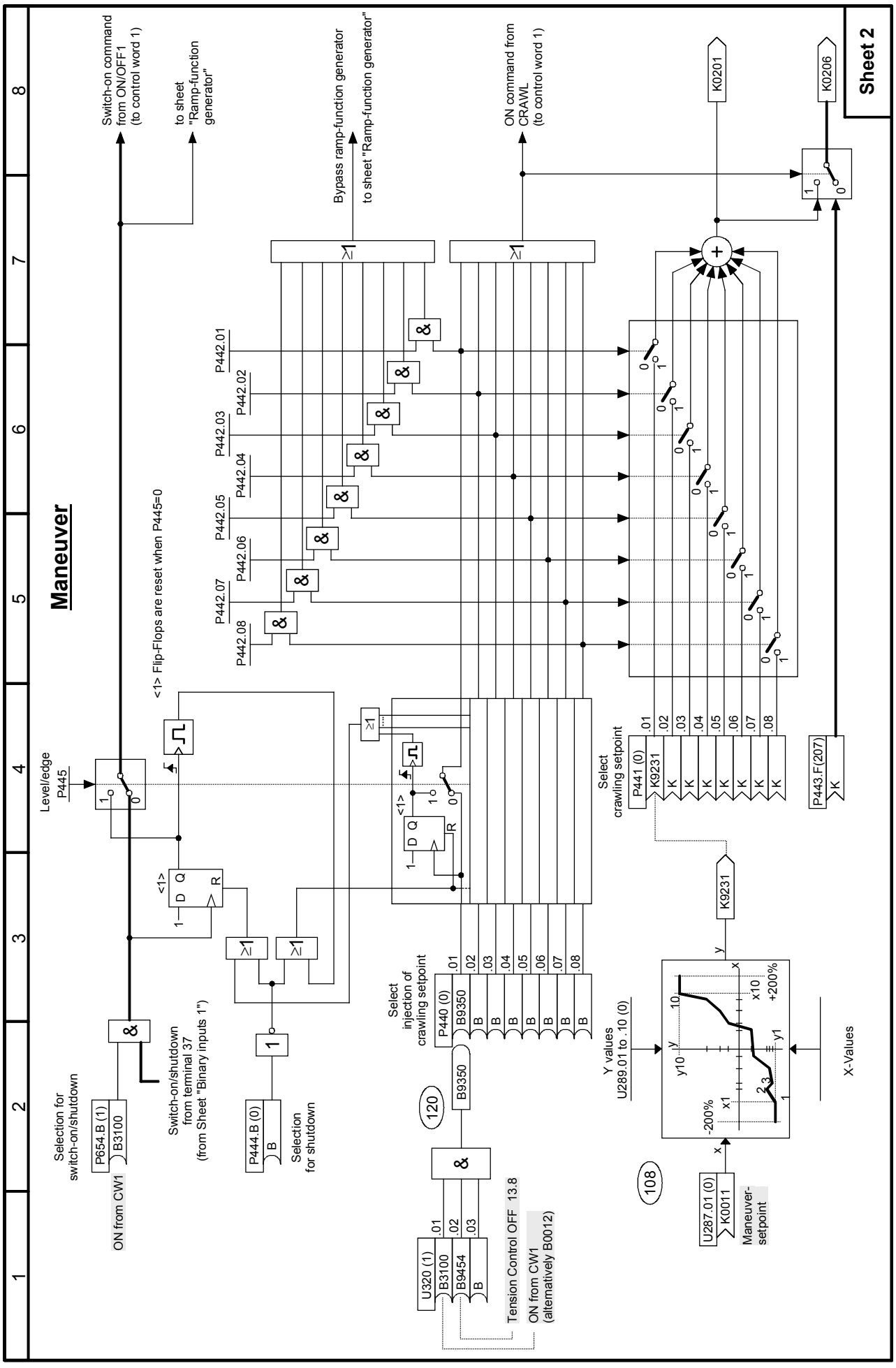
5.3 Detailed schematics

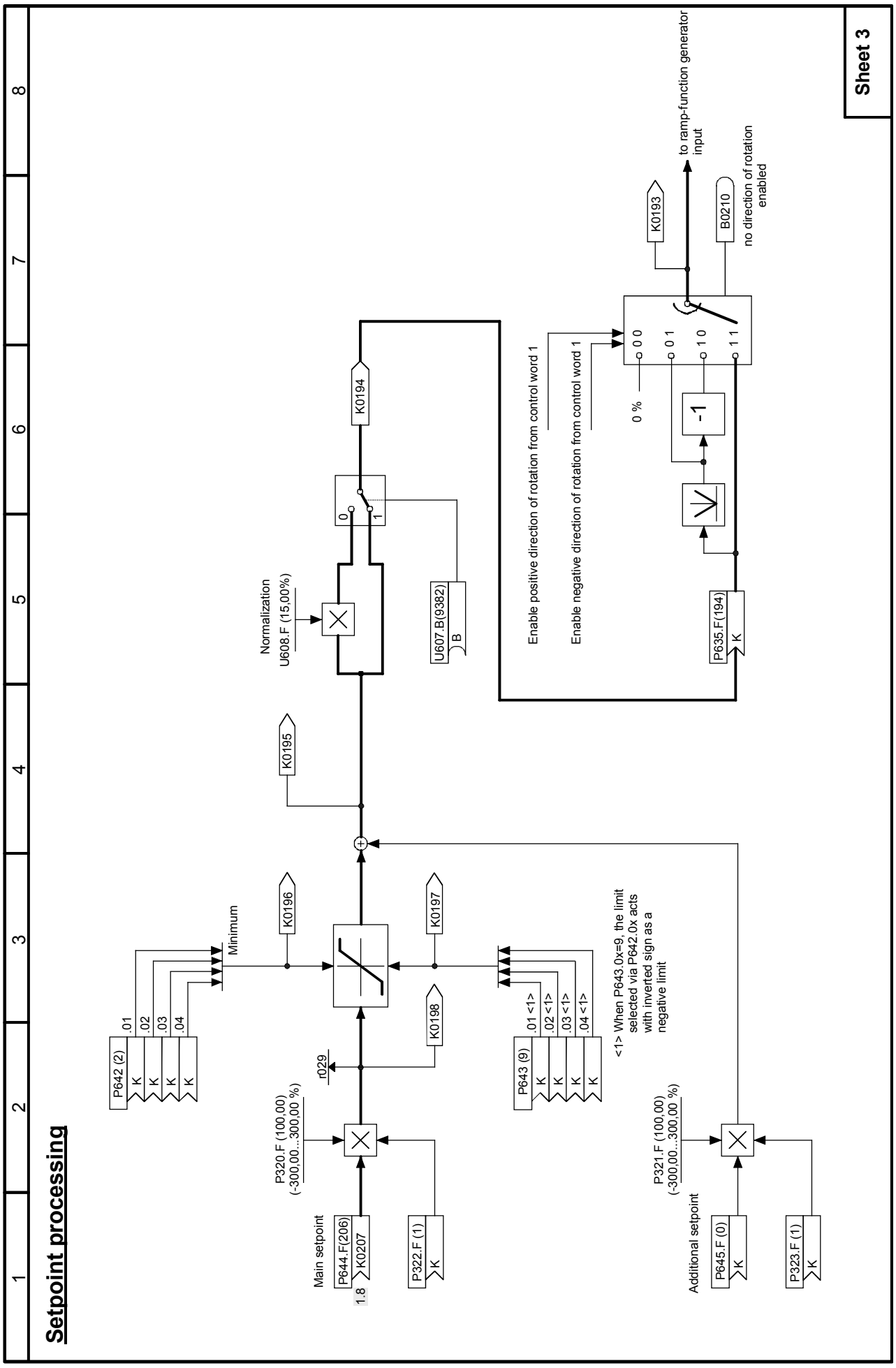
See following sheets 1.....20

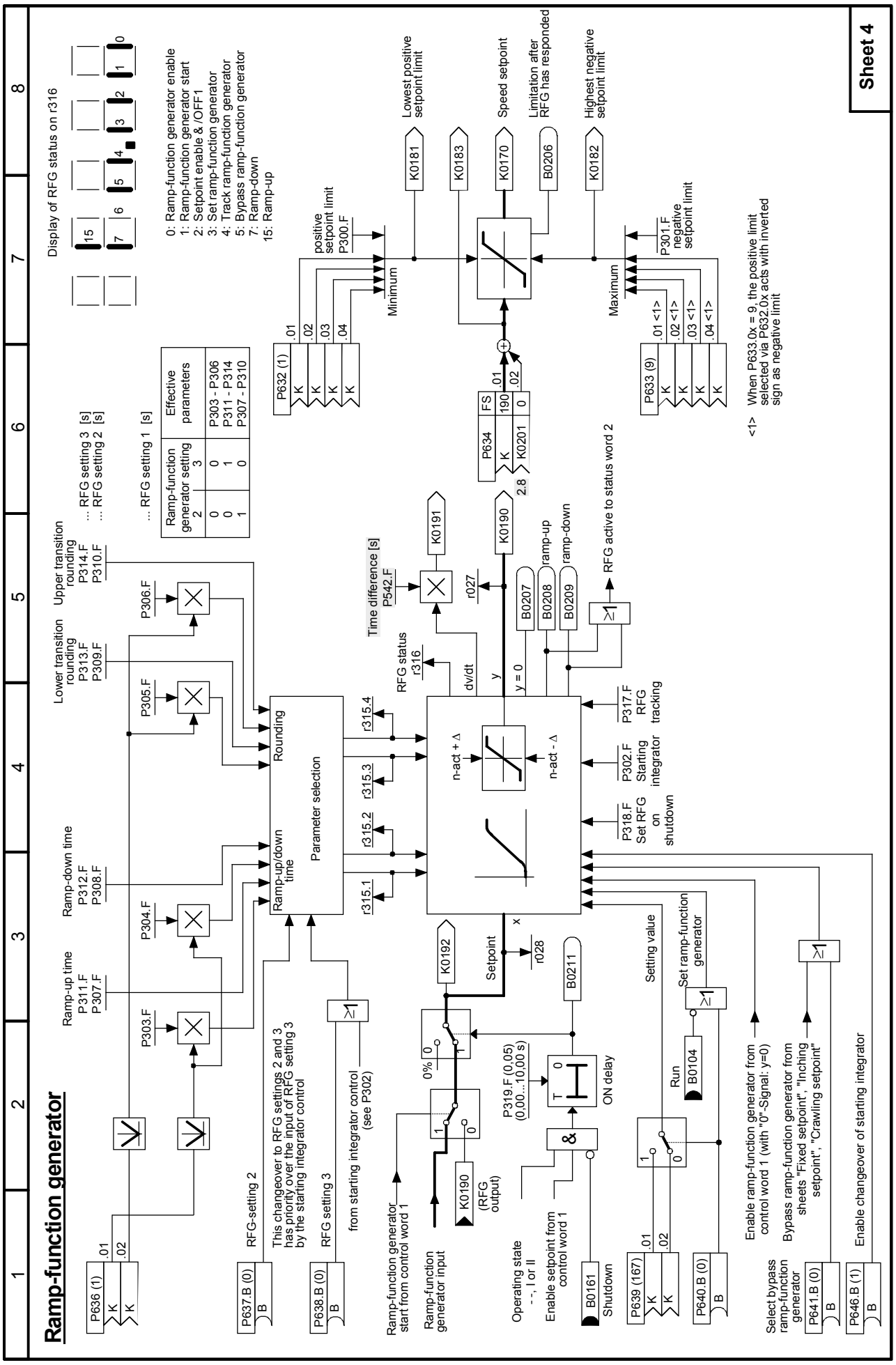
NOTE

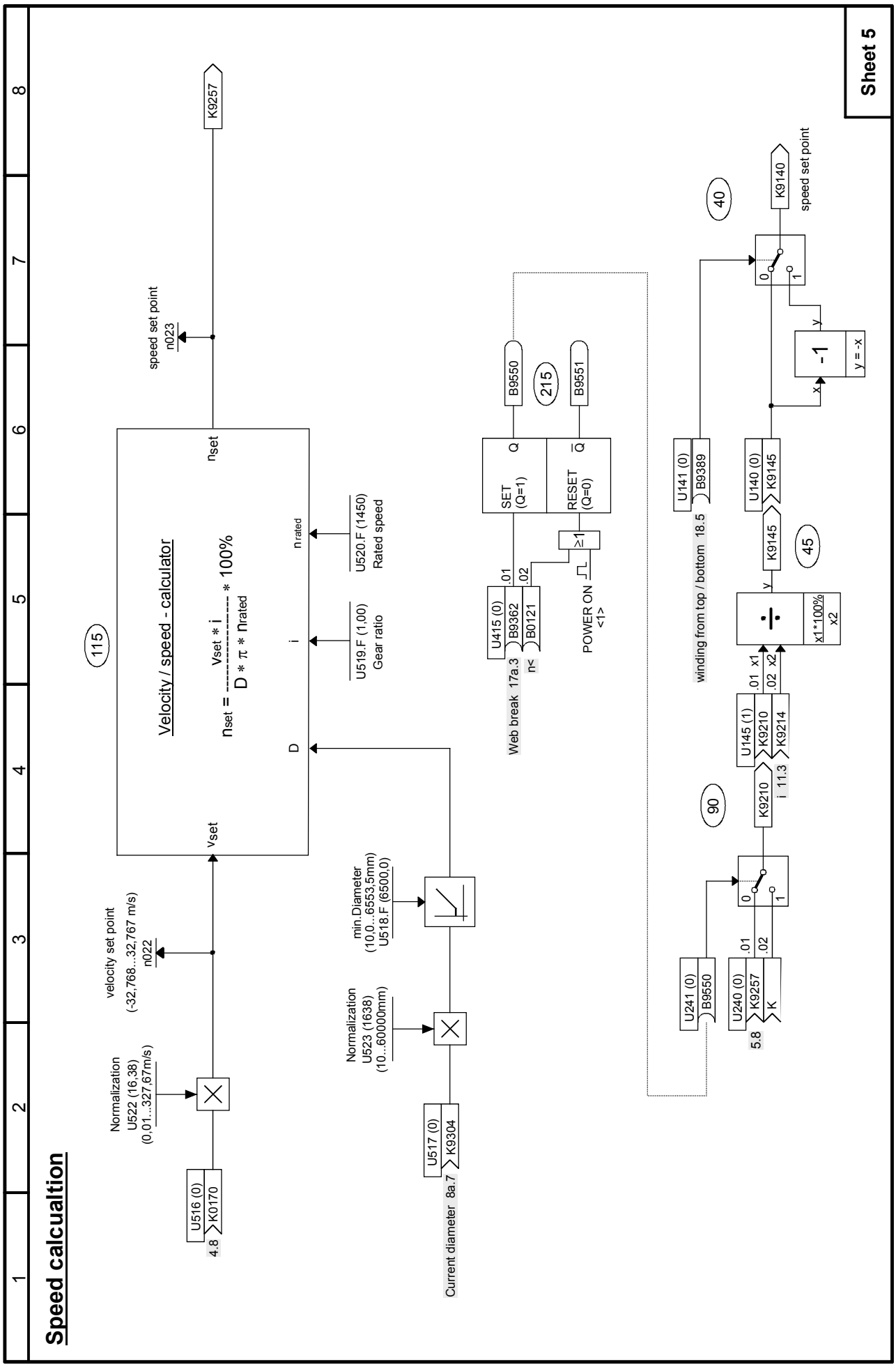
For easier identification, the winder-specific changes to binector and connector links, and parameter changes, are displayed on a light gray background. These values deviate from the factory setting.

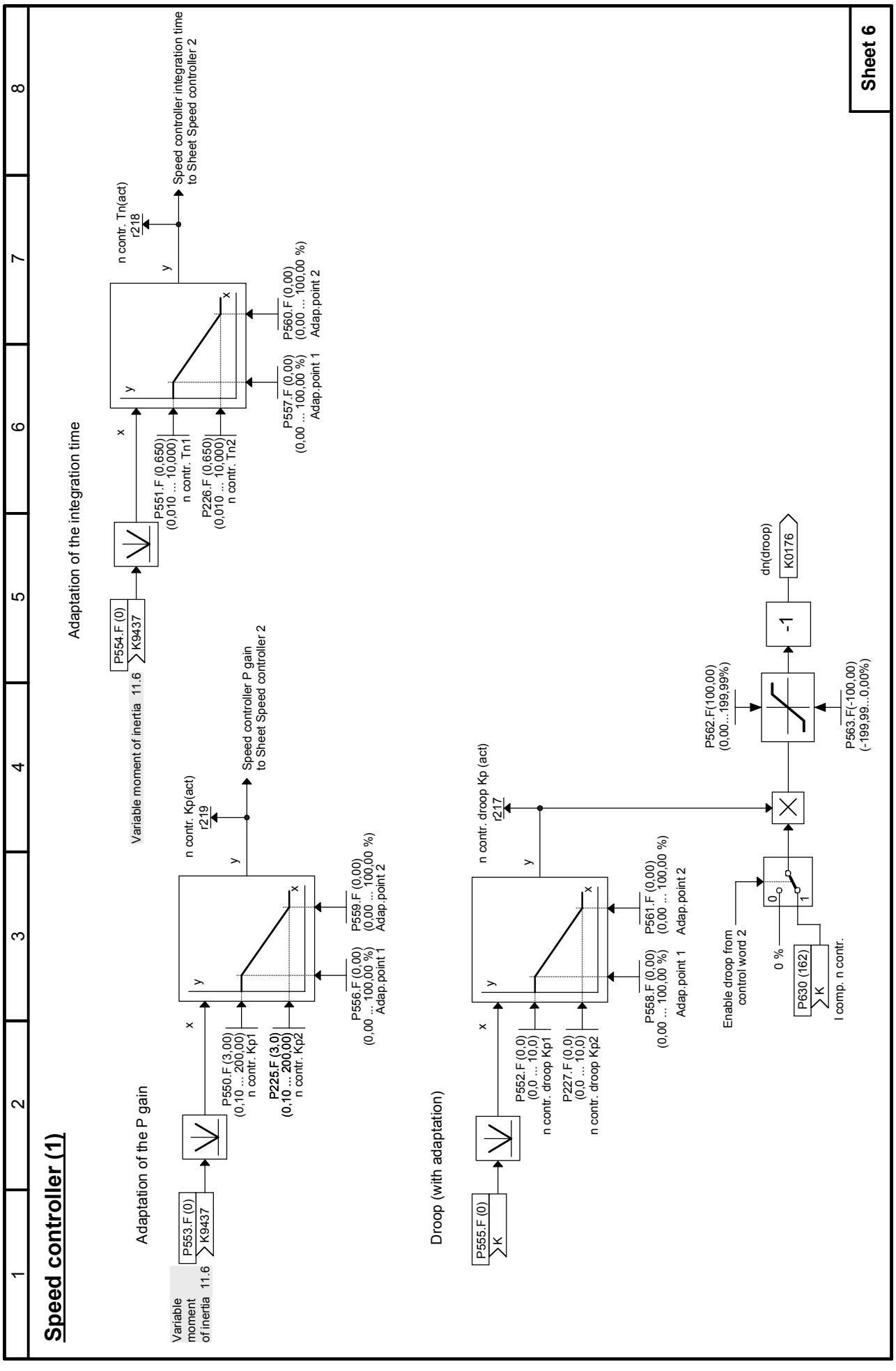

Inching setpoint
Sheet 1
Bypass ramp-function generator
to sheet "Ramp-function generator"
On command
from INCH
(to control word 1)
ON command
from ON/OFF1
(from sheet
"Crawling setpoint")
0%
K0202
K0207
Inching, bit 0
from control word 1
Inching, bit 1
from control word 1
Select injection
of inching
setpoint
P435 (0)
Select
setpoint
P436 (0)
K0401
Inching Setpoint
P401.F (2,00)
P438.F(208)
K3002
system - speed setpoint
P437.01
P437.02
P437.03
P437.04
P437.05
P437.06
P437.07
P437.08

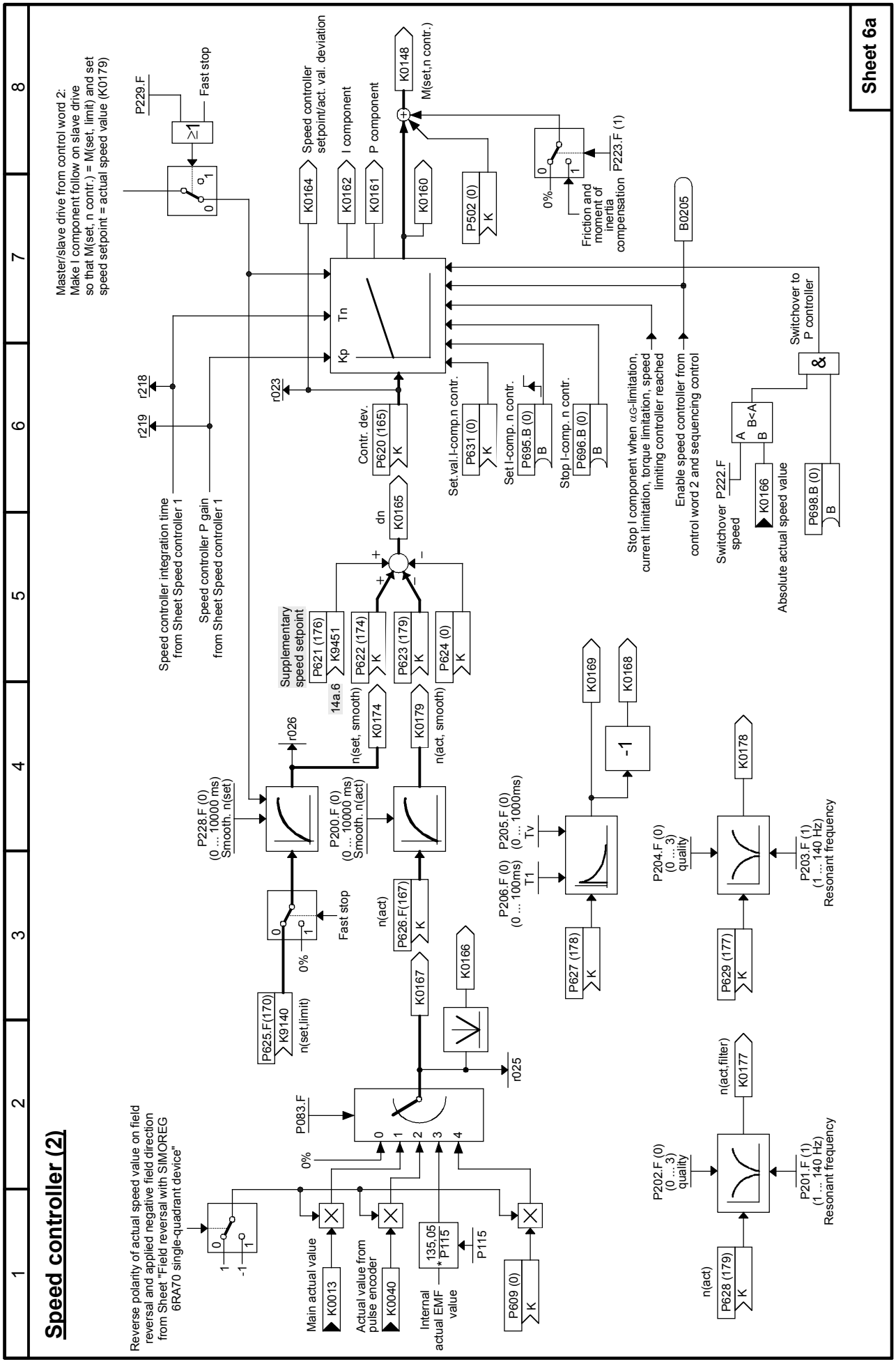

Sheet 2
Maneuver
Switch-on command from ON/OFF1 (to control word 1)
to sheet "Ramp-function generator"
Bypass ramp-function generator
to sheet "Ramp-function generator"
ON command from CRAWL (to control word 1)
K0201
K0206
<1> Flip-Flops are reset when P445=0
Level/edge P445
P442.01
P442.02
P442.03
P442.04
P442.05
P442.06
P442.07
P442.08
Select crawling setpoint
P441 (0) K9231
P443.F(207) K
Selection for switch-on/shutdown
P654.B (1) B3100
ON from CW1
Switch-on/shutdown from terminal 37 (from Sheet "Binary inputs 1")
P444.B (0) B
Selection for shutdown
Select injection of crawling setpoint
P440 (0) B9350
B9350
120
U320 (1) B3100 B9454
Tension Control OFF 13.8
ON from CW1 (alternatively B0012)
Y values U289.01 to .10 (0)
X-Values
-200%
+200%
x10
x1
y10
y1
108
U287.01 (0) K0011
Maneuver-setpoint

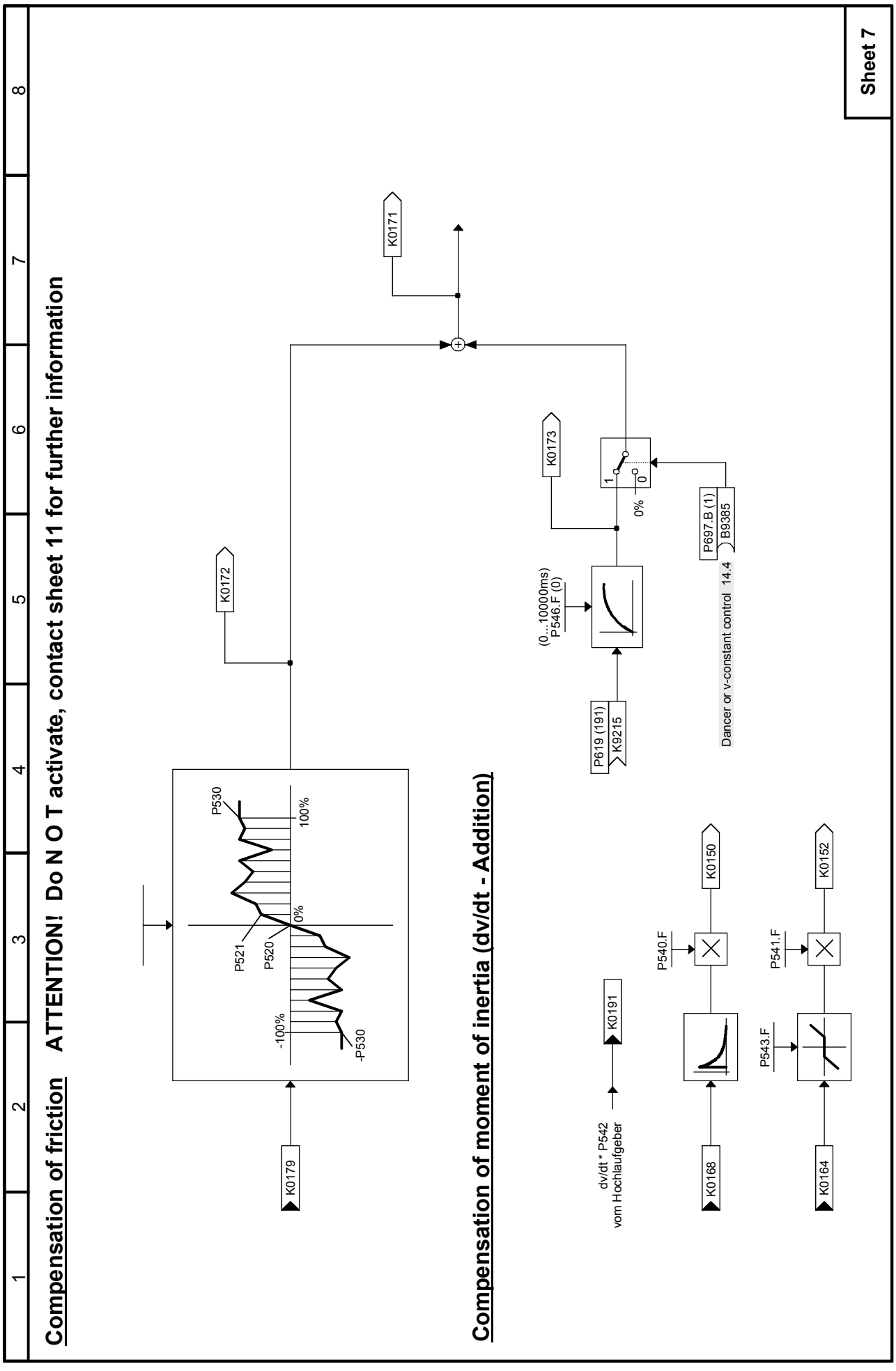

Sheet 3
Setpoint processing
1
2
3
4
5
6
7
8
Main setpoint
P644.F(206)
K0207
1.8
P320.F (100,00)
(-300,00...300,00 %)
P322.F (1)
K
r029
K0198
P642 (2)
.01
.02
.03
.04
Minimum
K0196
K0197
P643 (9)
.01 <1>
.02 <1>
.03 <1>
.04 <1>
<1> When P643.0x=9, the limit selected via P642.0x acts with inverted sign as a negative limit
Additional setpoint
P321.F (100,00)
(-300,00...300,00 %)
P645.F (0)
P323.F (1)
K0195
Normalization
U608.F (15,00%)
K0194
U607.B(9382)
B
Enable positive direction of rotation from control word 1
Enable negative direction of rotation from control word 1
0 %
-1
P635.F(194)
0 0
0 1
1 0
1 1
K0193
B0210
to ramp-function generator input
no direction of rotation enabled

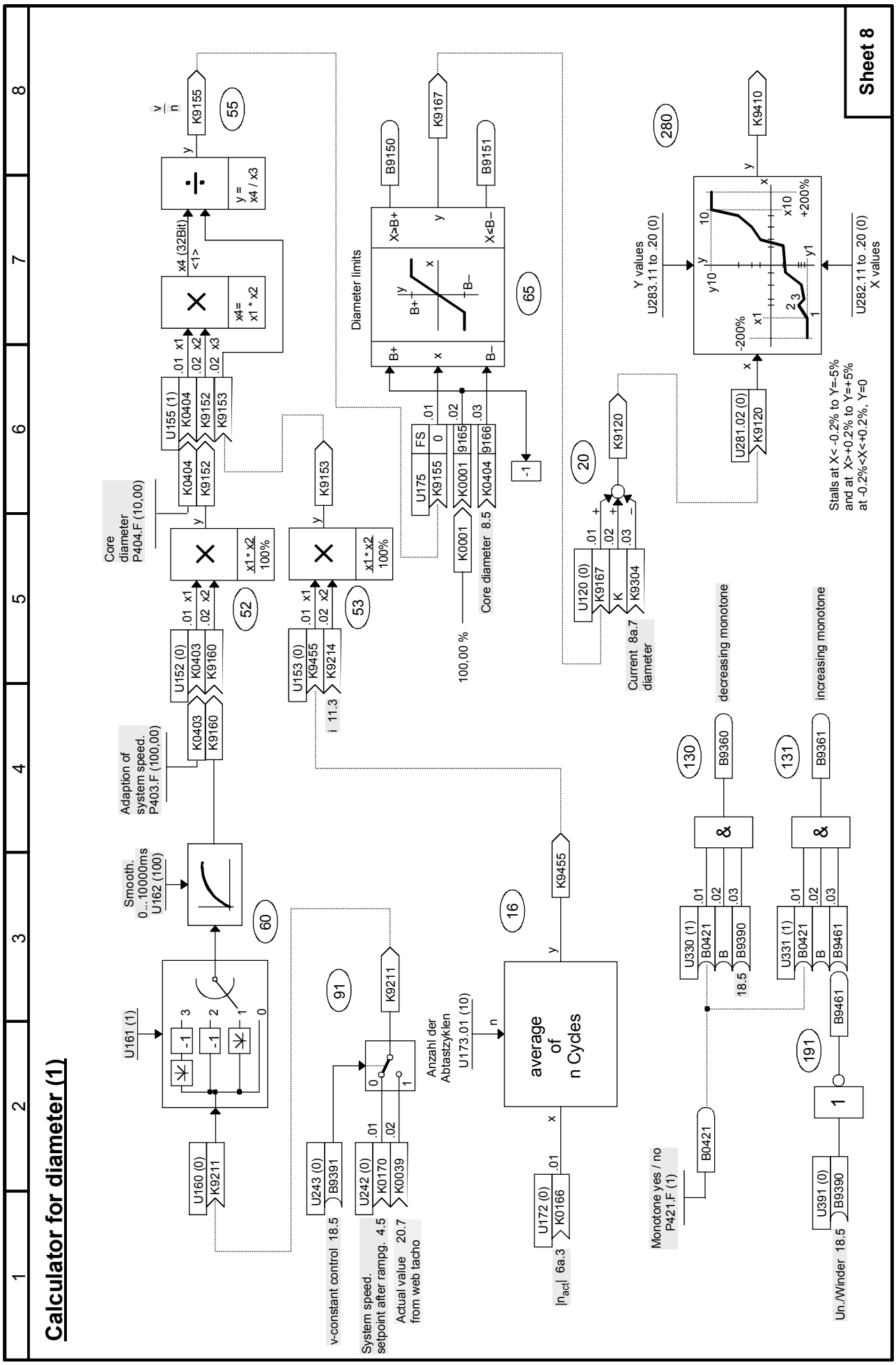

Ramp-function generator
Sheet 4
Display of RFG status on r316
0: Ramp-function generator enable
1: Ramp-function generator start
2: Setpoint enable & /OFF1
3: Set ramp-function generator
4: Track ramp-function generator
5: Bypass ramp-function generator
7: Ramp-down
15: Ramp-up
... RFG setting 1 [s]
... RFG setting 2 [s]
... RFG setting 3 [s]
Ramp-function generator setting 2 3
0 0
0 1
1 0
Effective parameters
P303 - P306
P311 - P314
P307 - P310
P636 (1)
P637.B (0)
P638.B (0)
P639 (167)
P640.B (0)
P641.B (0)
P646.B (1)
Ramp-up time P311.F P307.F
Ramp-down time P312.F P308.F
Upper transition rounding P314.F P310.F
Lower transition rounding P313.F P309.F
P303.F
P304.F
P305.F
P306.F
Rounding
Ramp-up/down time
Parameter selection
RFG-setting 2
This changeover to RFG settings 2 and 3 has priority over the input of RFG setting 3 by the starting integrator control
RFG setting 3
from starting integrator control (see P302)
Ramp-function generator start from control word 1
Ramp-function generator input
K0190 (RFG output)
K0192
Setpoint
r028
0%
P319.F (0,05) (0,00...10,00 s)
ON delay
B0211
Operating state - -, I or II
Enable setpoint from control word 1
B0161 Shutdown
Setting value
Run
B0104
Set ramp-function generator
Enable ramp-function generator from control word 1 (with "0"-Signal: y=0)
Bypass ramp-function generator from sheets "Fixed setpoint", "Inching setpoint", "Crawling setpoint"
Select bypass ramp-function generator
Enable changeover of starting integrator
RFG status r316
dv/dt
y
y = 0
Time difference [s] P542.F
r027
K0191
K0190
2.8
B0207
B0208 ramp-up
B0209 ramp-down
RFG active to status word 2
P317.F RFG tracking
P302.F Starting integrator
P318.F Set RFG on shutdown
n-act + Δ
n-act - Δ
r315.1
r315.2
r315.3
r315.4
P632 (1)
positive setpoint limit P300.F
Minimum
K0181
Lowest positive setpoint limit
K0183
P634 FS 190 0
K0201
K0170
Speed setpoint
B0206
Limitation after RFG has responded
Maximum
K0182
Highest negative setpoint limit
P633 (9)
P301.F negative setpoint limit
<1> When P633.0x = 9, the positive limit selected via P632.0x acts with inverted sign as negative limit


Speed calcualtion
Sheet 5
1
2
3
4
5
6
7
8
115
Velocity / speed - calculator
nset = Vset * i / D * π * nrated * 100%
Vset
D
i
nrated
nset
K9257
speed set point
n023
velocity set point
(-32,768...32,767 m/s)
n022
Normalization
U522 (16,38)
(0,01...327,67m/s)
U516 (0)
K0170
4.8
Normalization
U523 (1638)
(10...60000mm)
min.Diameter
(10,0...6553,5mm)
U518.F (6500,0)
U517 (0)
K9304
Current diameter 8a.7
U519.F (1,00)
Gear ratio
U520.F (1450)
Rated speed
U415 (0)
B9362
B0121
Web break 17a.3
n<
.01
.02
SET
(Q=1)
RESET
(Q=0)
Q
B9550
215
B9551
≥1
POWER ON
<1>
90
U241 (0)
B9550
U240 (0)
K9257
K
5.8
.01
.02
0
1
K9210
i 11.3
U145 (1)
K9210
K9214
.01 x1
.02 x2
÷
x1*100%
x2
y
K9145
45
U140 (0)
K9145
U141 (0)
B9389
winding from top / bottom 18.5
40
0
1
-1
y = -x
x
y
K9140
speed set point

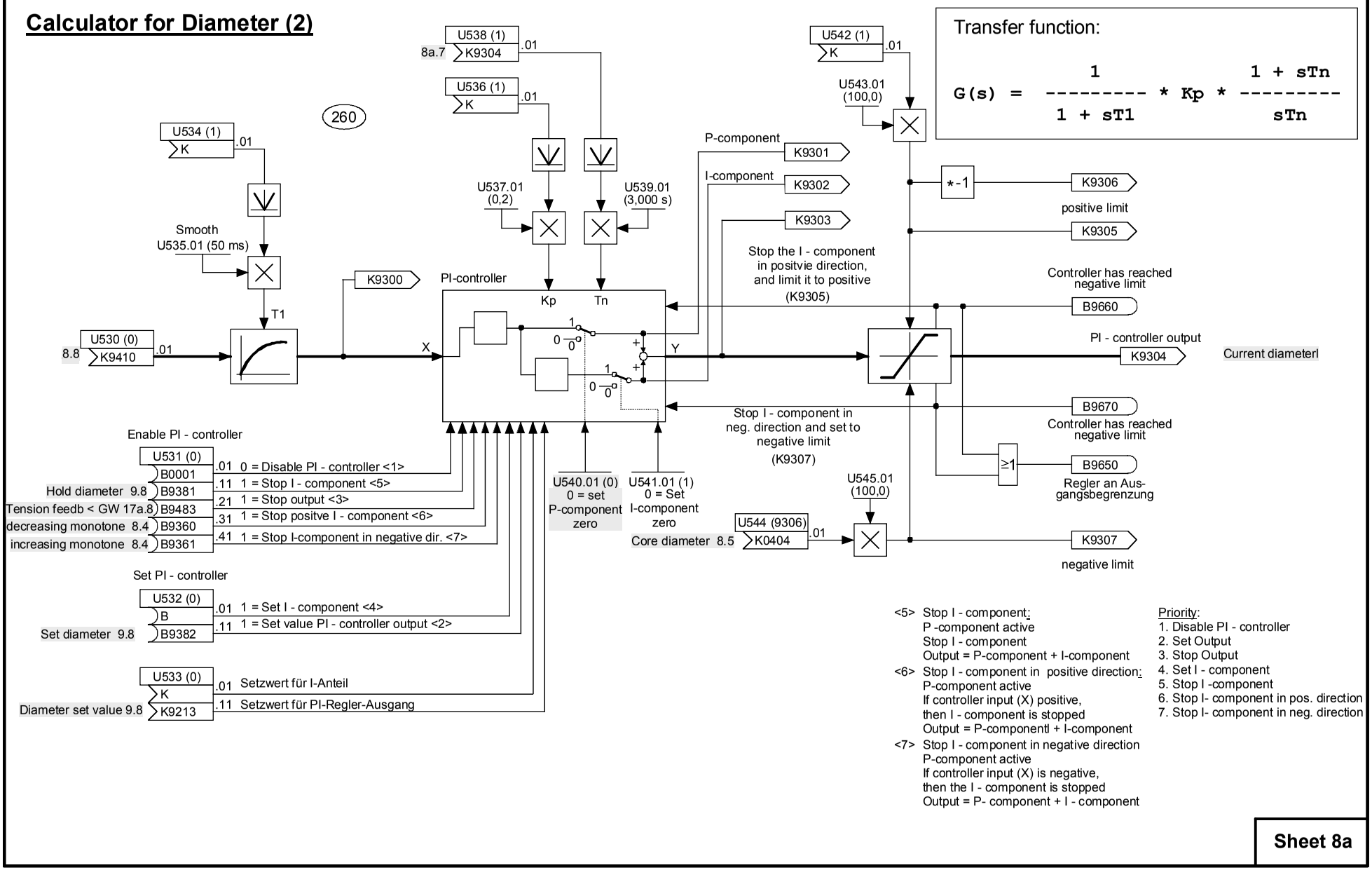

Speed controller (1)
Sheet 6
Adaptation of the integration time
Variable moment of inertia 11.6
P554.F (0)
K9437
P551.F (0,650)
(0,010 ... 10,000)
n contr. Tn1
P226.F (0,650)
(0,010 ... 10,000)
n contr. Tn2
P557.F (0,00)
(0,00 ... 100,00 %)
Adap.point 1
P560.F (0,00)
(0,00 ... 100,00 %)
Adap.point 2
n contr. Tn(act)
r218
Speed controller integration time
to Sheet Speed controller 2
Adaptation of the P gain
Variable moment of inertia 11.6
P553.F (0)
K9437
P550.F (3,00)
(0,10 ... 200,00)
n contr. Kp1
P225.F (3.0)
(0,10 ... 200,00)
n contr. Kp2
P556.F (0,00)
(0,00 ... 100,00 %)
Adap.point 1
P559.F (0,00)
(0,00 ... 100,00 %)
Adap.point 2
n contr. Kp(act)
r219
Speed controller P gain
to Sheet Speed controller 2
Droop (with adaptation)
P555.F (0)
K
P552.F (0,0)
(0,0 ... 10,0)
n contr. droop Kp1
P227.F (0,0)
(0,0 ... 10,0)
n contr. droop Kp2
P558.F (0,00)
(0,00 ... 100,00 %)
Adap.point 1
P561.F (0,00)
(0,00 ... 100,00 %)
Adap.point 2
n contr. droop Kp (act)
r217
P562.F(100,00)
(0,00...199,99%)
P563.F(-100,00)
(-199,99...0,00%)
-1
dn(droop)
K0176
Enable droop from control word 2
0 %
P630 (162)
K
I comp. n contr.


Sheet 6a
Speed controller (2)
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
K0013
Actual value from pulse encoder
K0040
Internal actual EMF value
135.05
P115
P609 (0)
P083.F
0%
n(set,limit)
P625.F(170)
K9140
Fast stop
P228.F (0)
(0 ... 10000 ms)
Smooth. n(set)
P200.F (0)
(0 ... 10000 ms)
Smooth. n(act)
n(act)
P626.F(167)
K0167
K0166
r025
r026
n(set, smooth)
K0174
n(act, smooth)
K0179
Supplementary speed setpoint
P621 (176)
K9451
14a.6
P622 (174)
P623 (179)
P624 (0)
Speed controller integration time from Sheet Speed controller 1
Speed controller P gain from Sheet Speed controller 1
r218
r219
r023
Kp
Tn
Contr. dev.
P620 (165)
dn
K0165
Master/slave drive from control word 2: Make I component follow on slave drive so that M(set, n contr.) = M(set, limit) and set speed setpoint = actual speed value (K0179)
P229.F
≥1
Fast stop
K0164
Speed controller setpoint/act. val. deviation
K0162
I component
K0161
P component
K0160
K0148
M(set,n contr.)
P502 (0)
0%
Friction and moment of inertia compensation
P223.F (1)
Set.val.I-comp.n contr.
P631 (0)
Set I-comp. n contr.
P695.B (0)
Stop I-comp. n contr.
P696.B (0)
Stop I component when αG-limitation, current limitation, torque limitation, speed limiting controller reached
Enable speed controller from control word 2 and sequencing control
B0205
Switchover P222.F
Switchover speed
A B<A B
K0166
Absolute actual speed value
Switchover to P controller
&
P698.B (0)
P206.F (0)
(0 ... 100ms)
T1
P205.F (0)
(0 ... 1000ms)
Tv
P627 (178)
K0169
K0168
-1
P204.F (0)
(0 ... 3)
quality
P629 (177)
K0178
P203.F (1)
(1 ... 140 Hz)
Resonant frequency
P202.F (0)
(0 ... 3)
quality
n(act,filter)
K0177
P201.F (1)
(1 ... 140 Hz)
Resonant frequency
P628 (179)
n(act)


Sheet 7
Compensation of friction ATTENTION! Do N O T activate, contact sheet 11 for further information
K0179
K0172
K0171
P530
100%
0%
-100%
-P530
P521
P520
Compensation of moment of inertia (dv/dt - Addition)
K0191
dv/dt * P542
vom Hochlaufgeber
P540.F
K0150
K0168
P543.F
P541.F
K0152
K0164
K0173
1
0
0%
(0...10000ms)
P546.F (0)
P619 (191)
K9215
P697.B (1)
B9385
Dancer or v-constant control 14.4


Calculator for diameter (1)
Sheet 8
1
2
3
4
5
6
7
8
U161 (1)
U160 (0)
K9211
Smooth.
0...10000ms
U162 (100)
60
Adaption of
system speed.
P403.F (100,00)
K0403
K9160
U152 (0)
K0403
K9160
Core
diameter
P404.F (10,00)
52
U153 (0)
K9455
K9214
53
i 11.3
K9153
x1*x2
100%
U155 (1)
K0404
K9152
K9153
x4=
x1 * x2
x4 (32Bit)
<1>
y =
x4 / x3
K9155
55
100,00 %
K0001
Core diameter 8.5
U175
FS
0
K9155
K0001
9165
K0404
9166
-1
Diameter limits
B+
B–
X>B+
X<B–
B9150
B9151
K9167
65
20
U120 (0)
K9167
K
K9304
K9120
Current 8a.7
diameter
280
Y values
U283.11 to .20 (0)
U282.11 to .20 (0)
X values
U281.02 (0)
K9120
K9410
-200%
+200%
y10
10
x10
y1
2,3
Stalls at X< -0.2% to Y=-5%
and at X>+0.2% to Y=+5%
at -0.2%<X<+0.2%, Y=0
91
U243 (0)
B9391
v-constant control 18.5
U242 (0)
K0170
K0039
K9211
System speed.
setpoint after ramppg. 4.5
Actual value 20.7
from web tacho
Anzahl der
Abtastzyklen
U173.01 (10)
16
average
of
n Cycles
K9455
U172 (0)
K0166
|nact| 6a.3
130
131
U330 (1)
B0421
B
B9390
18.5
U331 (1)
B0421
B
B9461
B9360
B9361
decreasing monotone
increasing monotone
&
Monotone yes / no
P421.F (1)
B0421
191
1
B9461
U391 (0)
B9390
Un./Winder 18.5

Calculator for Diameter (2)



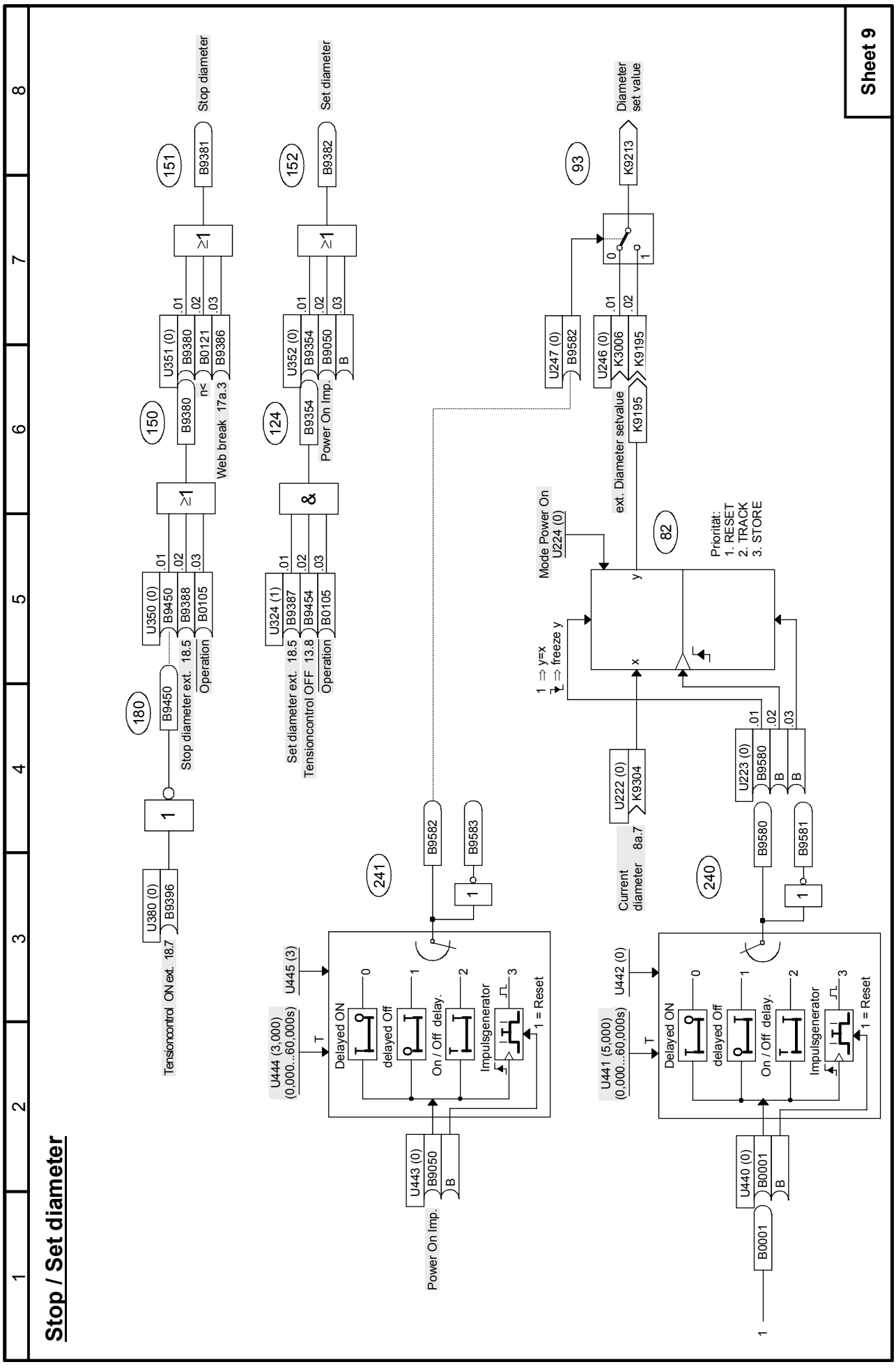
<5> Stop I - component:
P -component active
Stop I - component
Output = P-component + I-component

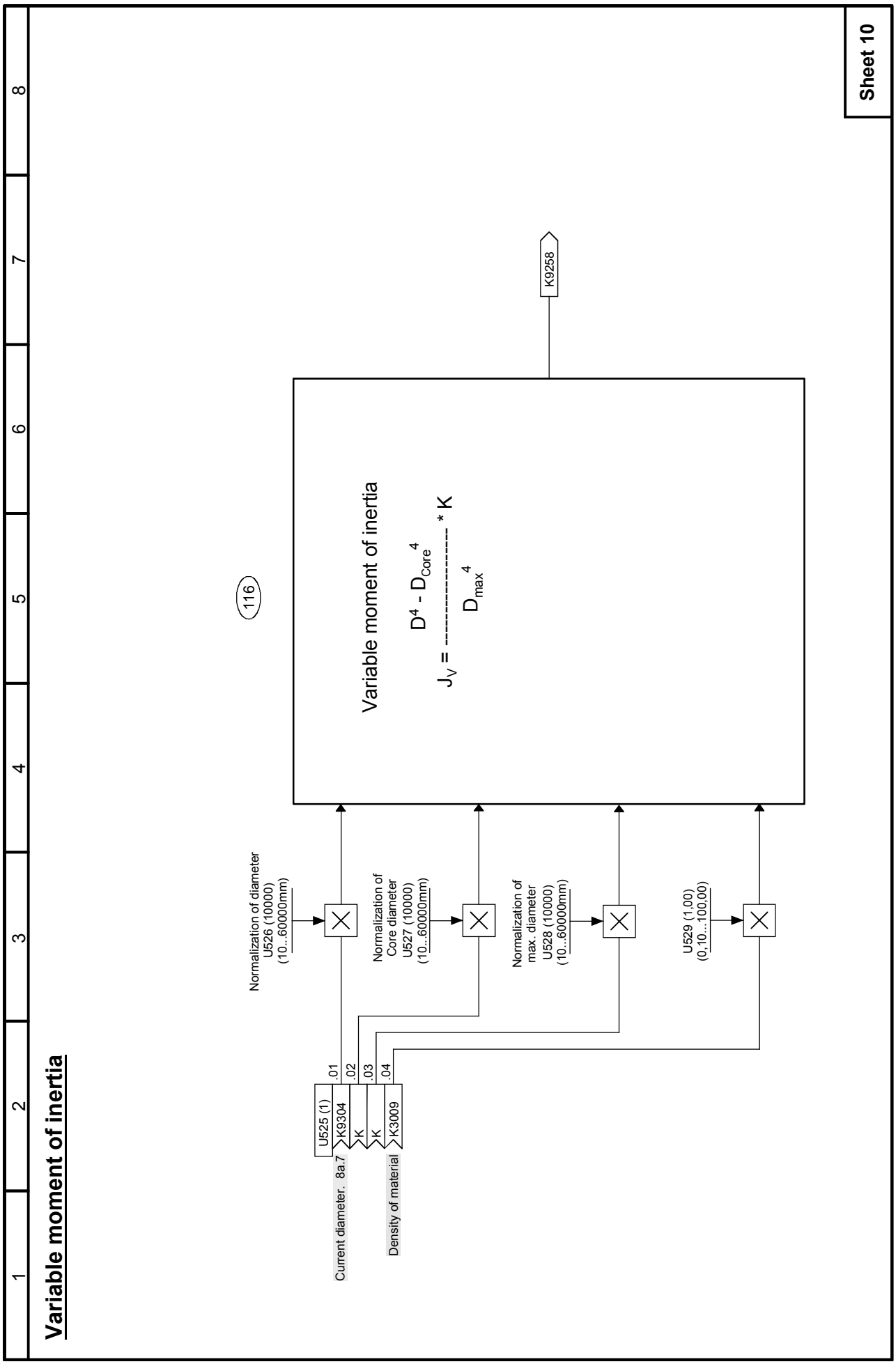
<6> Stop I - component in positive direction:
P-component active
If controller input (X) positive,
then I - component is stopped
Output = P-componentl + I-component

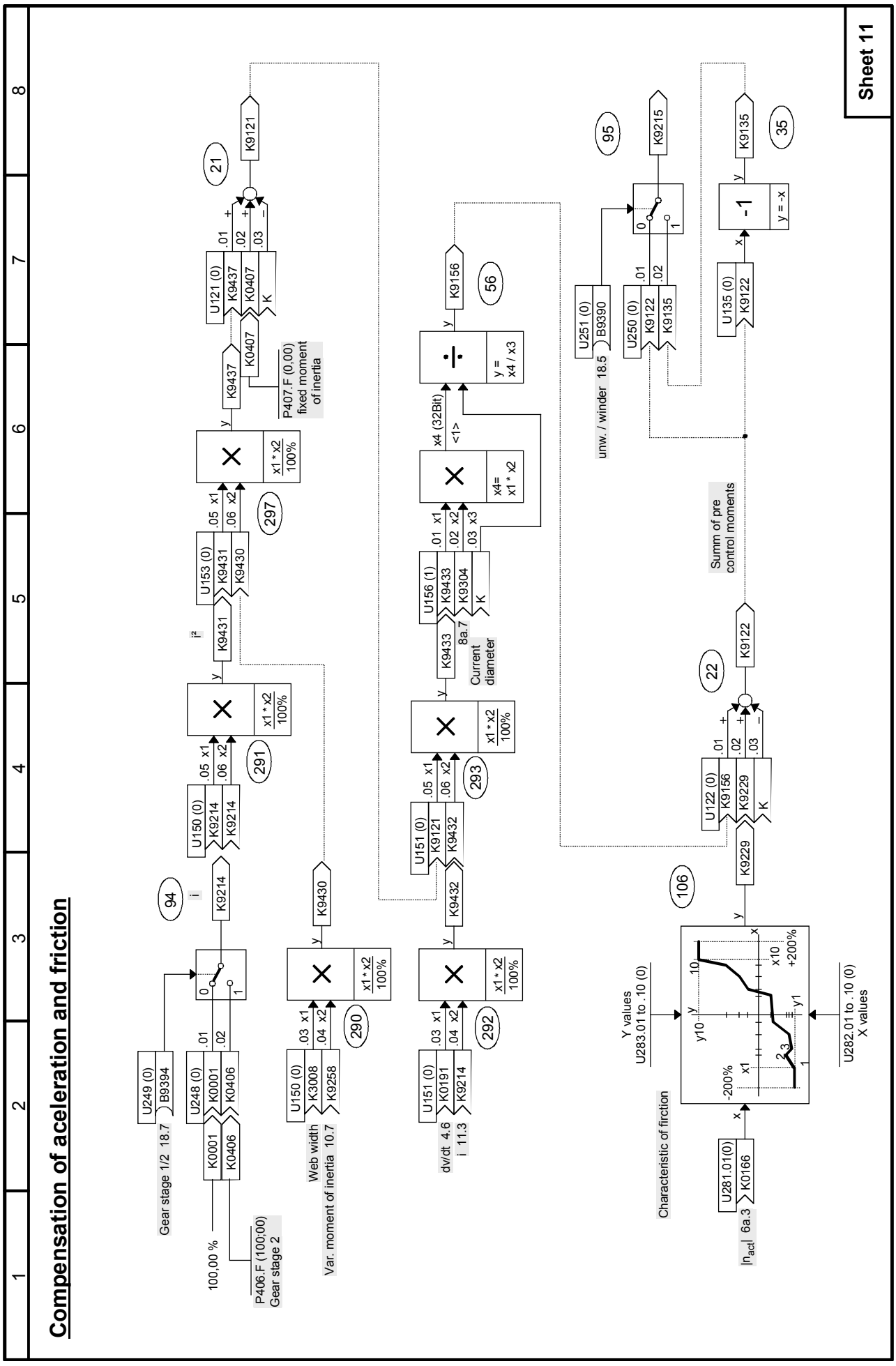
<7> Stop I - component in negative direction
P-component active
If controller input (X) is negative,
then the I - component is stopped
Output = P- component + I - component

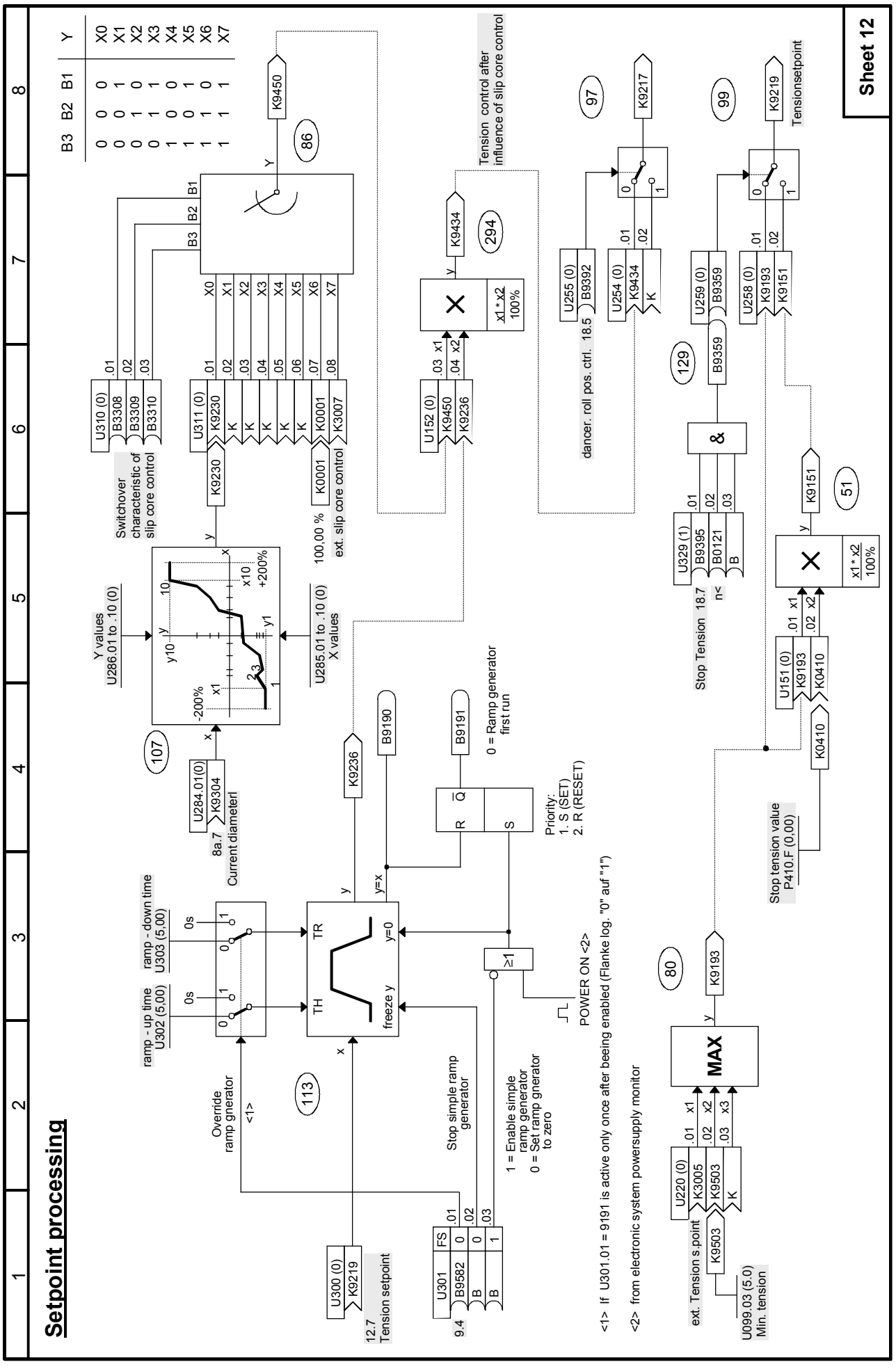
Priority:
1. Disable PI - controller
2. Set Output
3. Stop Output
4. Set I - component
5. Stop I -component
6. Stop I- component in pos. direction
7. Stop I- component in neg. direction

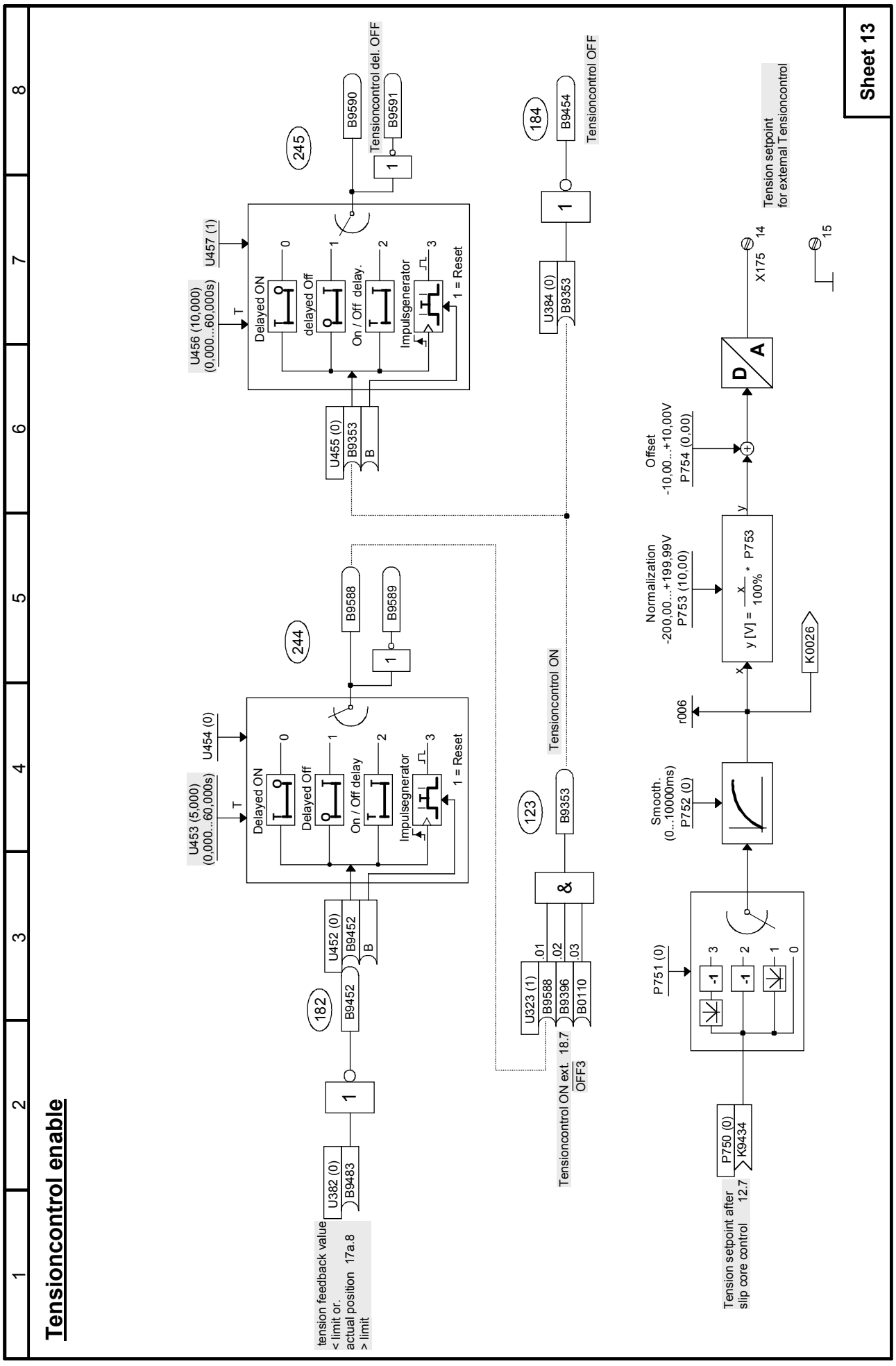
Sheet 8a

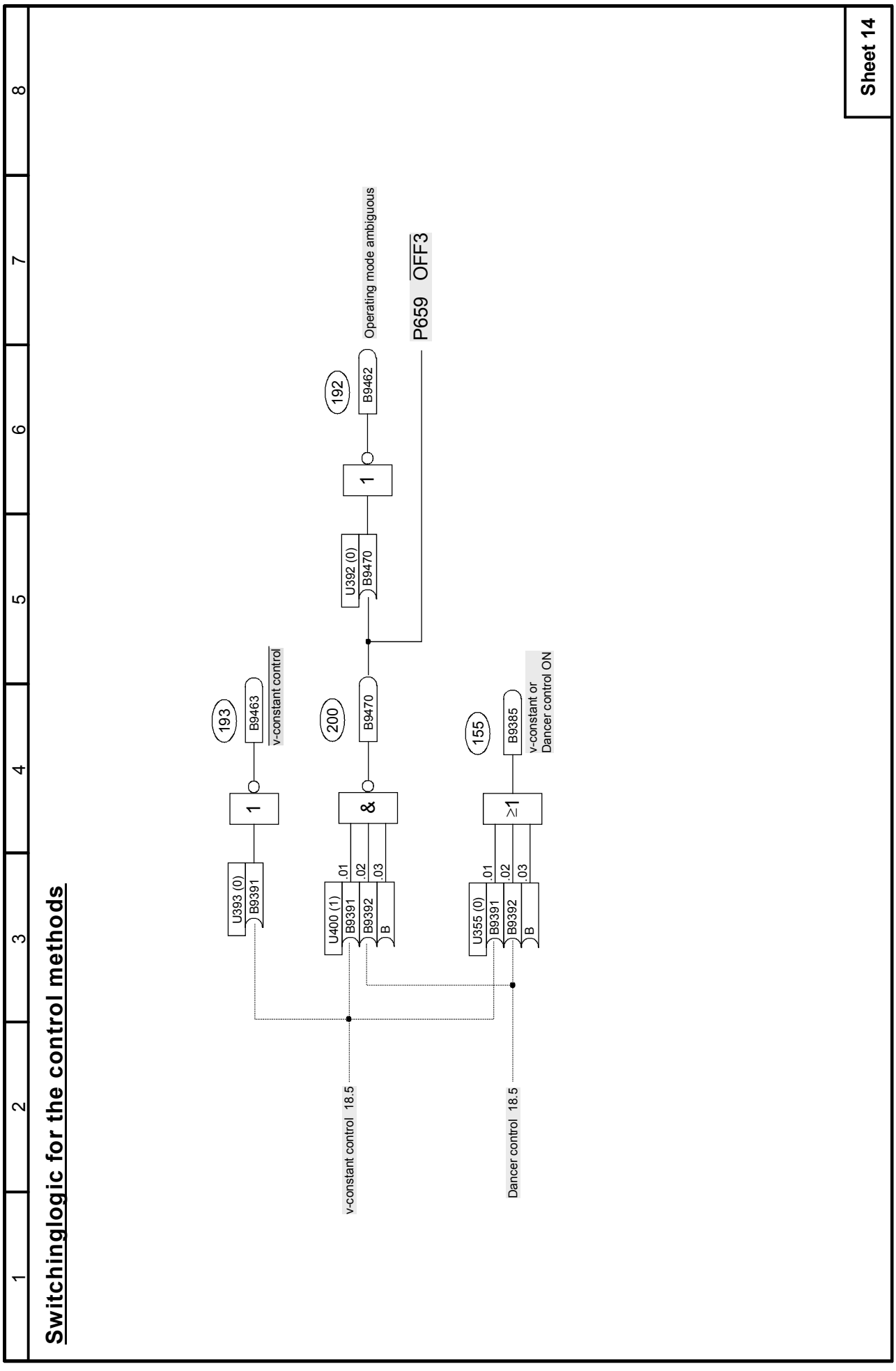

Stop / Set diameter
Sheet 9
1
2
3
4
5
6
7
8
Tensioncontrol ON ext. 18.7
U380 (0) B9396
1
180
B9450
Stop diameter ext. 18.5
Operation
U350 (0) B9450 B9388 B0105
.01 .02 .03
≥1
150
B9380
Web break 17a.3
U351 (0) B9380 B0121 B9386
.01 .02 .03
≥1
151
B9381
Stop diameter
Set diameter ext. 18.5
Tensioncontrol OFF 13.8
Operation
U324 (1) B9387 B9454 B0105
.01 .02 .03
&
124
B9354
Power On Imp.
U352 (0) B9354 B9050 B
.01 .02 .03
≥1
152
B9382
Set diameter
U247 (0) B9582
93
0 1
U246 (0) K3006 K9195
.01 .02
K9195
ext. Diameter setvalue
K9213
Diameter set value
Mode Power On U224 (0)
1 ⇒ y=x
0 ⇒ freeze y
x y
82
Priorität:
1. RESET
2. TRACK
3. STORE
U222 (0) K9304
Current diameter 8a.7
U223 (0) B9580 B B
.01 .02 .03
U443 (0) B9050 B
Power On Imp.
U444 (3,000) (0,000...60,000s)
T
U445 (3)
Delayed ON
delayed Off
On / Off delay.
Impulsgenerator
1 = Reset
0 1 2 3
241
B9582
B9583
1
U441 (5,000) (0,000...60,000s)
T
U442 (0)
Delayed ON
delayed Off
On / Off delay.
Impulsgenerator
1 = Reset
0 1 2 3
240
B9580
B9581
1
U440 (0) B0001 B
B0001
1

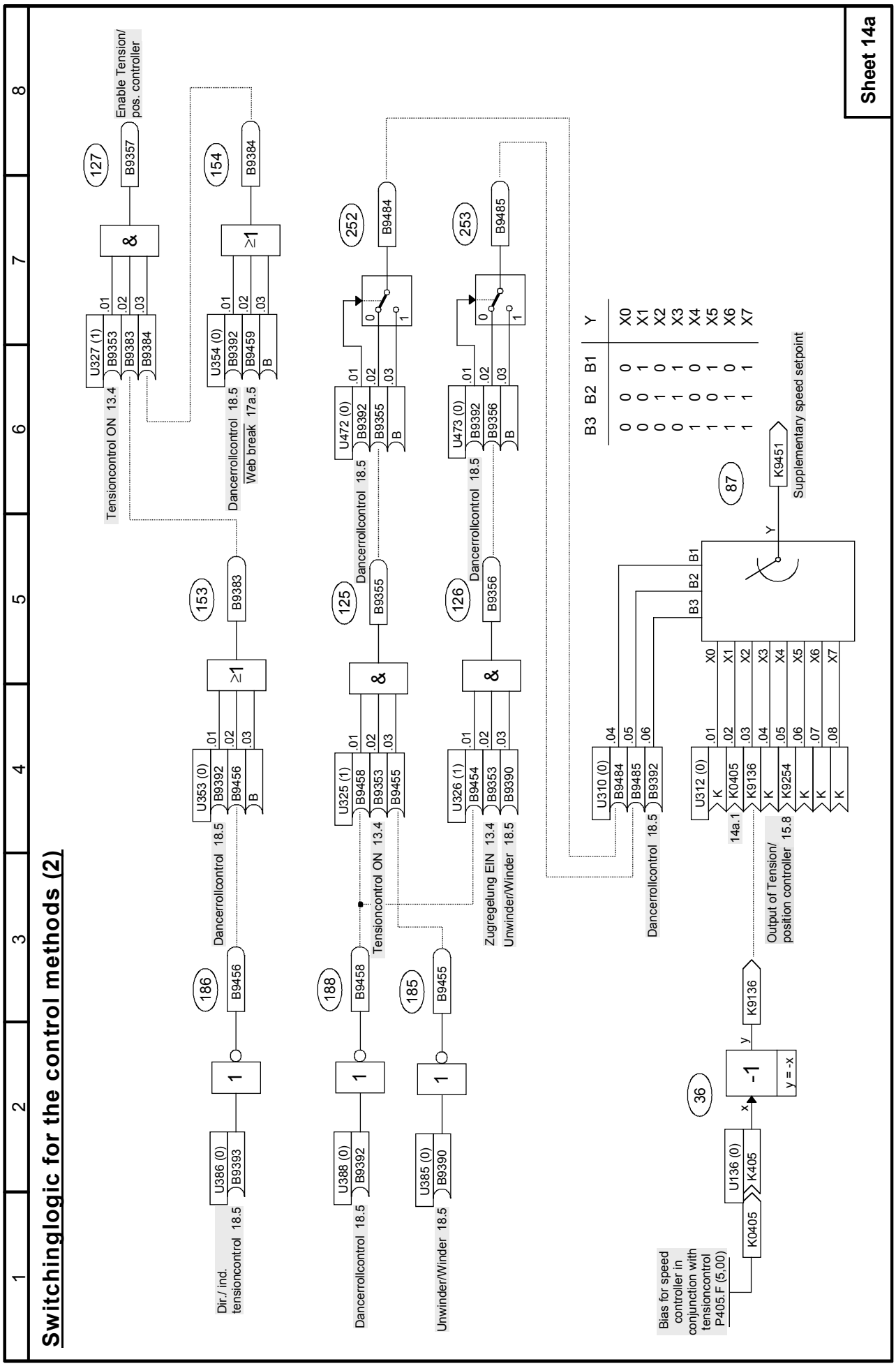

Variable moment of inertia
Sheet 10
1
2
3
4
5
6
7
8
116
Variable moment of inertia
$J_V = \frac{D^4 - D_{Core}^4}{D_{max}^4} * K$
K9258
Normalization of diameter
U526 (10000)
(10...60000mm)
Normalization of
Core diameter
U527 (10000)
(10...60000mm)
Normalization of
max. diameter
U528 (10000)
(10...60000mm)
U529 (1,00)
(0,10...100,00)
U525 (1)
.01
.02
.03
.04
K9304
K
K
K3009
Current diameter: 8a.7
Density of material

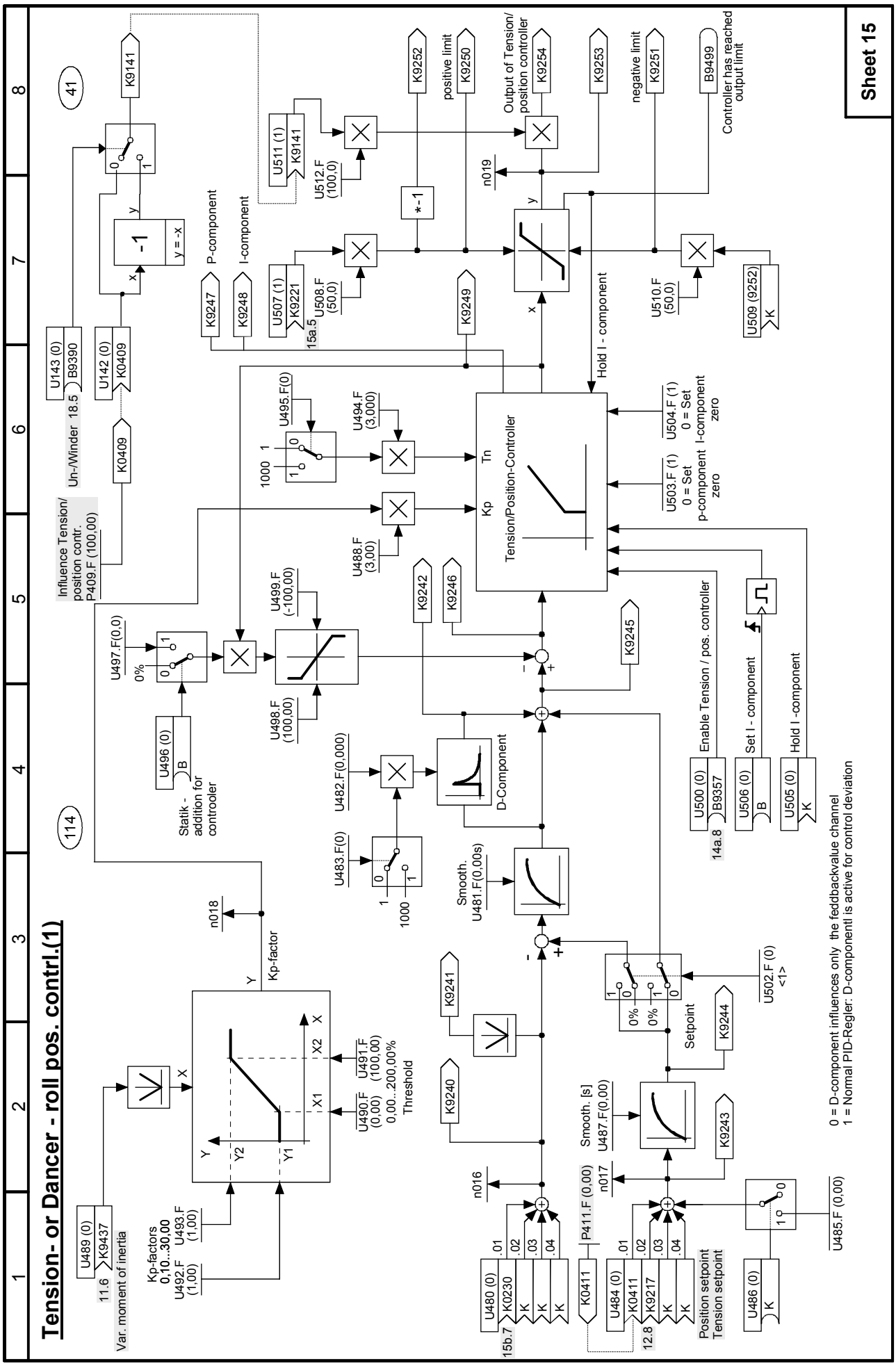

Compensation of aceleration and friction
Sheet 11
1
2
3
4
5
6
7
8
Gear stage 1/2 18.7
U249 (0)
B9394
100,00 %
P406.F (100,00)
Gear stage 2
U248 (0)
K0001
K0406
94
i
K9214
U150 (0)
K9214
K9214
291
i²
K9431
U153 (0)
K9431
K9430
297
K9437
K0407
P407.F (0,00)
fixed moment
of inertia
U121 (0)
K9437
K0407
K
21
K9121
Web width 10.7
U150 (0)
K3008
K9258
290
K9430
dv/dt 4.6
i 11.3
U151 (0)
K0191
K9214
292
K9432
U151 (0)
K9121
K9432
293
K9432
Current
diameter
K9433
8a.7
U156 (1)
K9433
K9304
K
x4 (32Bit)
<1>
x4=
x1 * x2
56
K9156
y =
x4 / x3
unw. / winder 18.5
U251 (0)
B9390
95
K9215
U250 (0)
K9122
K9135
U135 (0)
K9122
-1
y = -x
35
Summ of pre
control moments
22
K9122
U122 (0)
K9156
K9229
K
K9229
106
Characteristic of firction
Y values
U283.01 to .10 (0)
U282.01 to .10 (0)
X values
U281.01(0)
K0166
|nact| 6a.3
-200%
+200%
x1
x10
y10
y1
10
1
2
3

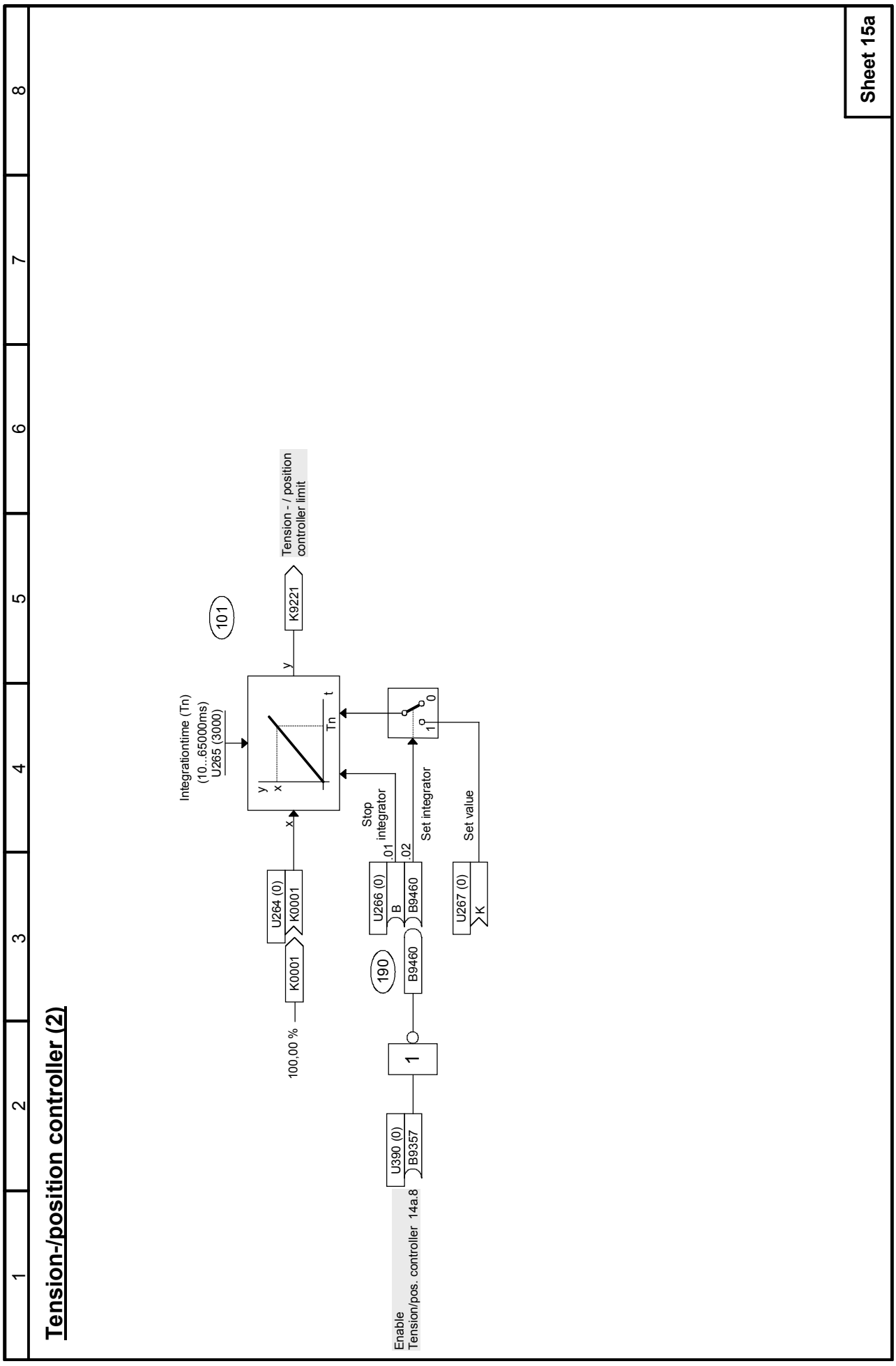

Sheet 12
Setpoint processing
B3 B2 B1 Y
0 0 0 X0
0 0 1 X1
0 1 0 X2
0 1 1 X3
1 0 0 X4
1 0 1 X5
1 1 0 X6
1 1 1 X7
Switchover characteristic of slip core control
U310 (0) B3308 B3309 B3310
U311 (0) K9230
K0001 K3007
100,00 % ext. slip core control
Tension control after influence of slip core control
U152 (0) K9450 K9236
K9434
x1 * x2 100%
dancer. roll pos. ctrl. 18.5
U255 (0) B9392
U254 (0) K9434
K9217
U259 (0) B9359
U258 (0) K9193 K9151
K9219
Tensionsetpoint
Y values U286.01 to .10 (0)
U285.01 to .10 (0) X values
-200% +200%
U284.01(0) K9304
8a.7 Current diameter
K9236
B9190
B9191
0 = Ramp generator first run
Priority: 1. S (SET) 2. R (RESET)
POWER ON <2>
ramp - up time U302 (5,00)
ramp - down time U303 (5,00)
Override ramp generator <1>
Stop simple ramp generator
1 = Enable simple ramp generator
0 = Set ramp generator to zero
U300 (0) K9219
12.7 Tension setpoint
U301 FS B9582
9.4
Stop Tension 18.7
U329 (1) B9395 B0121
n<
U151 (0) K9193 K0410
K9151
Stop tension value P410.F (0,00)
U220 (0) K3005 K9503
ext. Tension s.point
U099.03 (5.0) Min. tension
MAX
<1> If U301.01 = 9191 is active only once after beeing enabled (Flanke log. "0" auf "1")
<2> from electronic system powersupply monitor

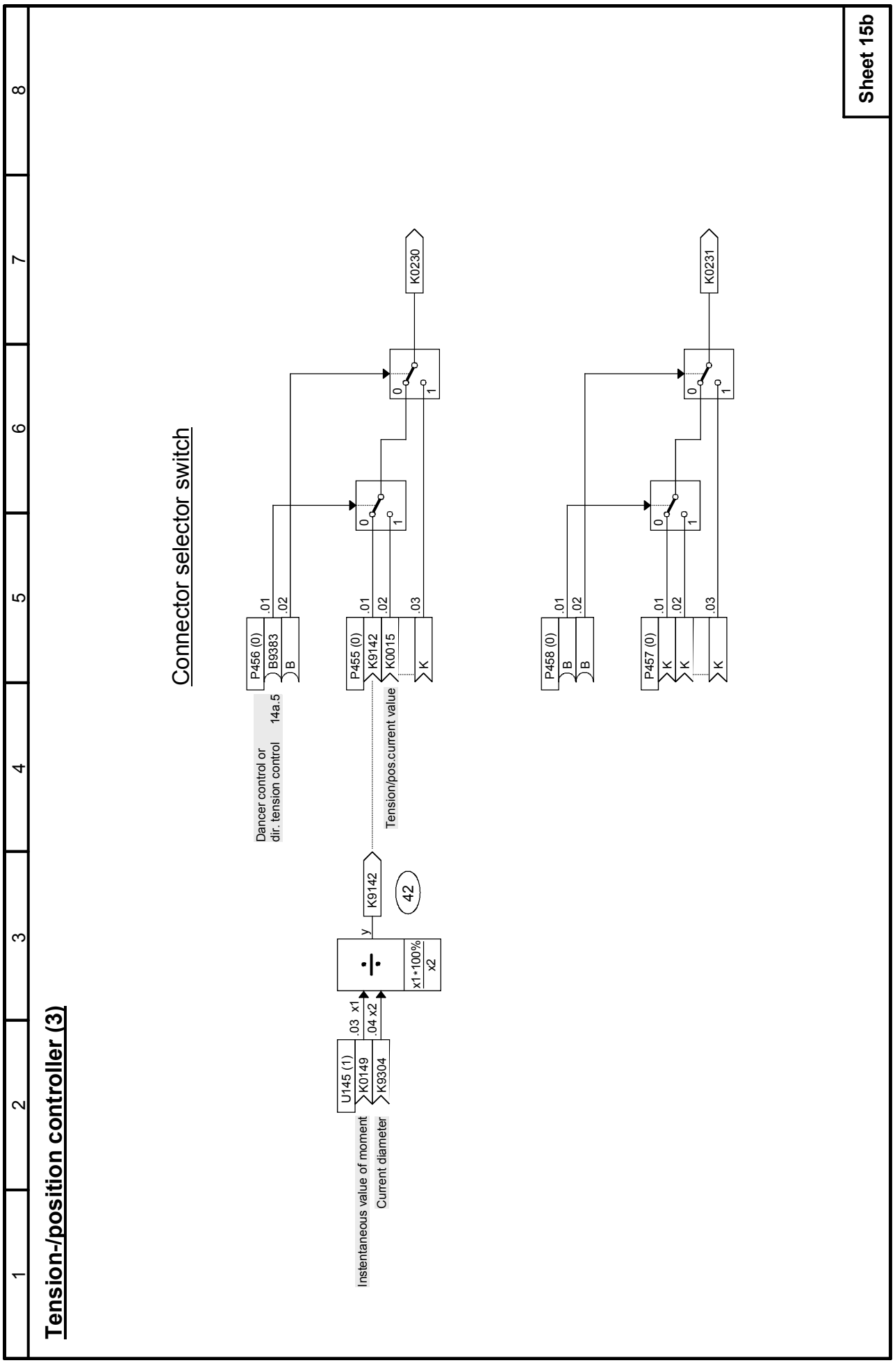

Sheet 13
Tensioncontrol enable
tension feedback value
< limit or.
actual position 17a.8
> limit
U382 (0)
B9483
1
182
B9452
U452 (0)
B9452
B
U453 (5,000)
(0,000...60,000s)
T
U454 (0)
Delayed ON
Delayed Off
On / Off delay
Impulsegenerator
1 = Reset
0
1
2
3
244
B9588
B9589
1
123
B9353
&
U323 (1)
B9588
B9396
B0110
.01
.02
.03
Tensioncontrol ON ext. 18.7
OFF3
Tensioncontrol ON
U455 (0)
B9353
B
U456 (10,000)
(0,000...60,000s)
T
U457 (1)
245
B9590
B9591
1
Tensioncontrol del. OFF
184
B9454
1
U384 (0)
B9353
Tensioncontrol OFF
P751 (0)
-1
-1
3
2
1
0
Smooth.
(0...10000ms)
P752 (0)
r006
Normalization
-200,00...+199,99V
P753 (10,00)
x
y [V] = x / 100% * P753
y
K0026
Offset
-10,00...+10,00V
P754 (0,00)
D/A
X175
14
15
Tension setpoint
for external Tensioncontrol
P750 (0)
K9434
Tension setpoint after
slip core control 12.7

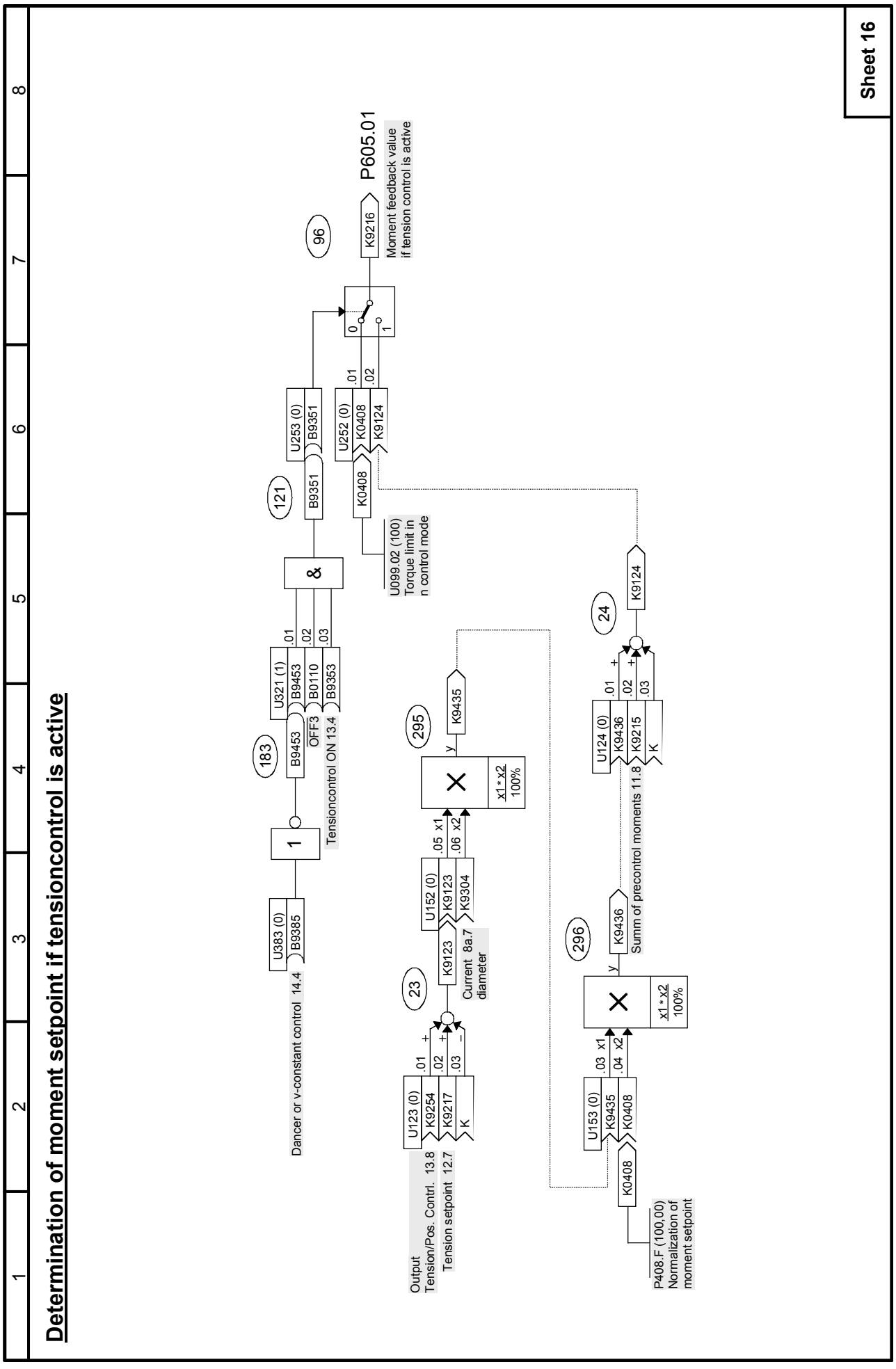

Sheet 14
1
2
3
4
5
6
7
8
Switchinglogic for the control methods
U393 (0)
B9391
1
193
B9463
v-constant control
U400 (1)
B9391
B9392
B
.01
.02
.03
&
200
B9470
U392 (0)
B9470
1
192
B9462
Operating mode ambiguous
P659 OFF3
U355 (0)
B9391
B9392
B
.01
.02
.03
≥1
155
B9385
v-constant or
Dancer control ON
v-constant control 18.5
Dancer control 18.5

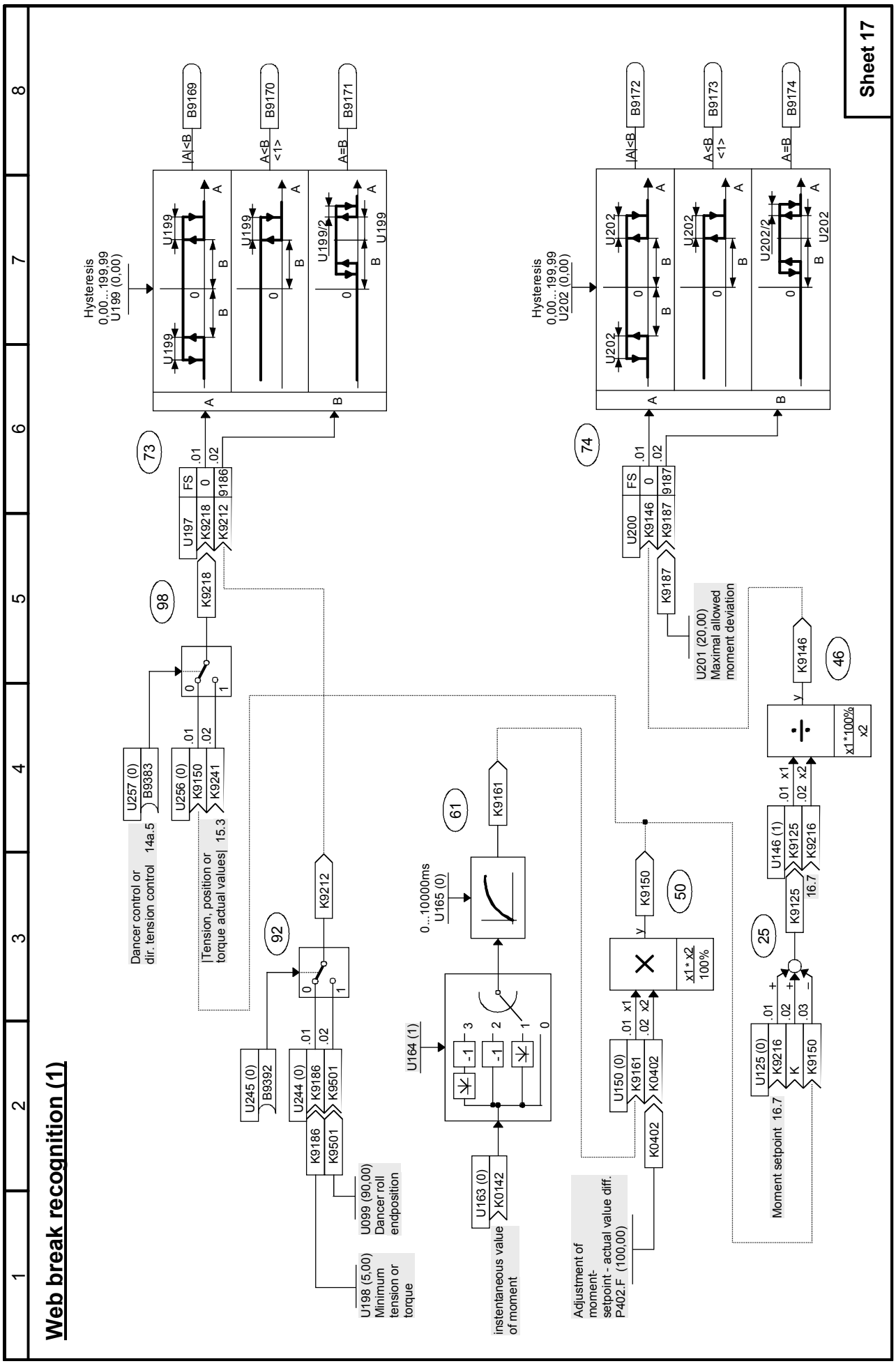

Switchinglogic for the control methods (2)
Sheet 14a
1 2 3 4 5 6 7 8
Enable Tension/ pos. controller
Tensioncontrol ON 13.4
Dancerrollcontrol 18.5
Web break 17a.5
Dancerrollcontrol 18.5
Dancerrollcontrol 18.5
Dancerrollcontrol 18.5
Dir./ ind. tensioncontrol 18.5
Dancerrollcontrol 18.5
Tensioncontrol ON 13.4
Unwinder/Winder 18.5
Zugregelung EIN 13.4
Unwinder/Winder 18.5
Dancerrollcontrol 18.5
14a.1
Output of Tension/ position controller 15.8
Supplementary speed setpoint
Bias for speed controller in conjunction with tensioncontrol P405.F (5.00)
B3 B2 B1 Y
0 0 0 X0
0 0 1 X1
0 1 0 X2
0 1 1 X3
1 0 0 X4
1 0 1 X5
1 1 0 X6
1 1 1 X7

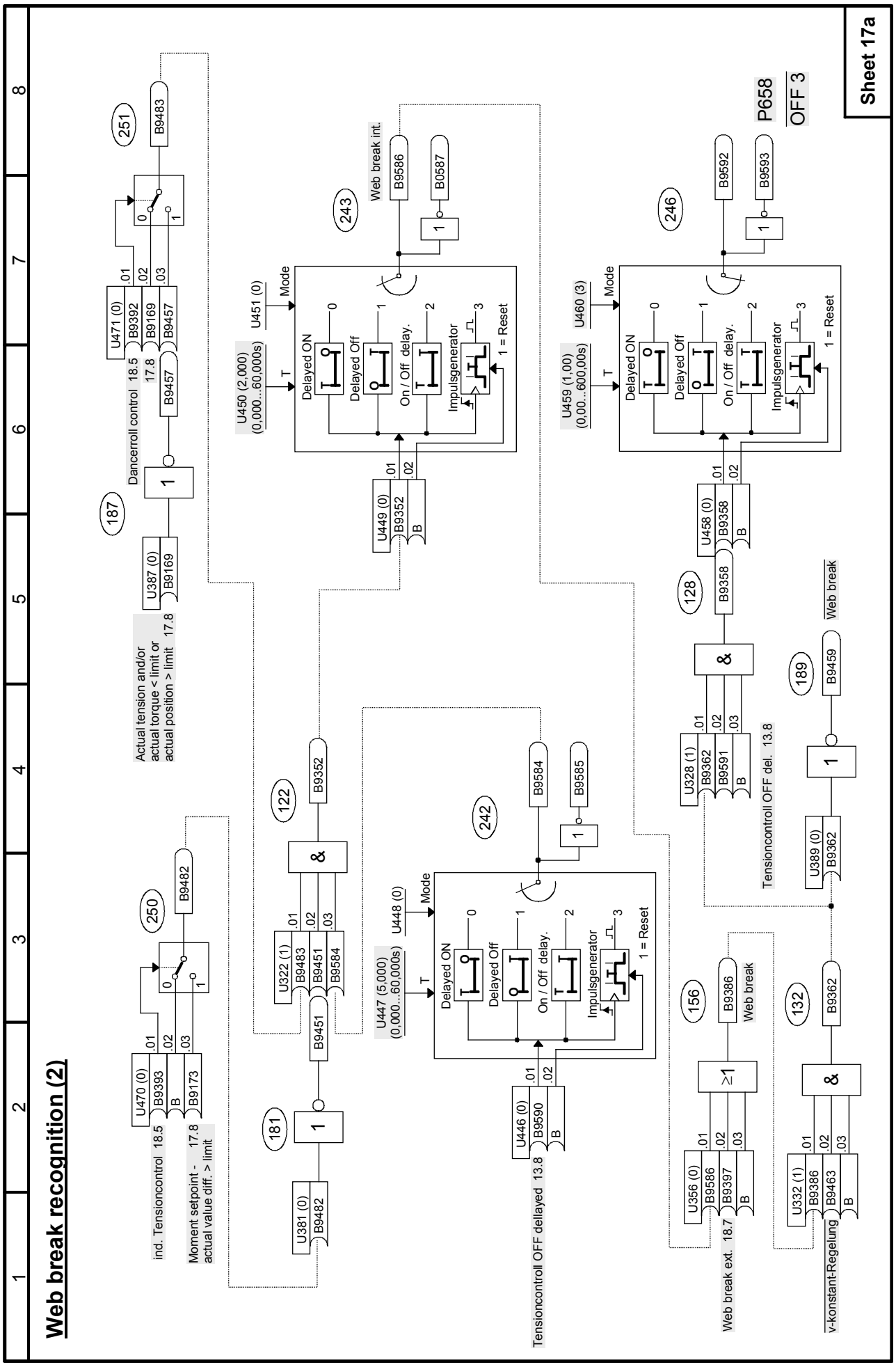

Sheet 15
Tension- or Dancer - roll pos. contrl.(1)
Tension/Position-Controller
Kp
Tn
Hold I - component
P-component
I-component
D-Component
Output of Tension/ position controller
positive limit
negative limit
Controller has reached output limit
Influence Tension/ position contr. P409.F (100,00)
Un-/Winder 18.5
Statik - addition for controoler
Kp-factor
Kp-factors 0,10...30,00
Var. moment of inertia
Threshold
Smooth. U481.F(0,00s)
Smooth. [s] U487.F(0,00)
Setpoint
Position setpoint
Tension setpoint
Enable Tension / pos. controller
Set I - component
Hold I -component
0 = D-component influences only the feddbackvalue channel
1 = Normal PID-Regler: D-componentI is active for control deviation


Tension-/position controller (2)
Sheet 15a
1
2
3
4
5
6
7
8
Enable
Tension/pos. controller 14a.8
U390 (0)
B9357
1
190
B9460
100,00 %
K0001
U264 (0)
K0001
x
Integrationtime (Tn)
(10...65000ms)
U265 (3000)
y
x
Tn
t
101
y
K9221
Tension - / position
controller limit
Stop
integrator
.01
.02
Set integrator
U266 (0)
B
B9460
1
0
Set value
U267 (0)
K


Tension-/position controller (3)
Sheet 15b
Connector selector switch
P456 (0)
B9383
B
.01
.02
Dancer control or
dir. tension control
14a.5
P455 (0)
K9142
K0015
K
.01
.02
.03
Tension/pos.current value
P458 (0)
B
B
.01
.02
P457 (0)
K
K
K
.01
.02
.03
K0230
K0231
0
1
U145 (1)
K0149
K9304
.03 x1
.04 x2
Instentaneous value of moment
Current diameter
x1*100%
x2
y
K9142
42

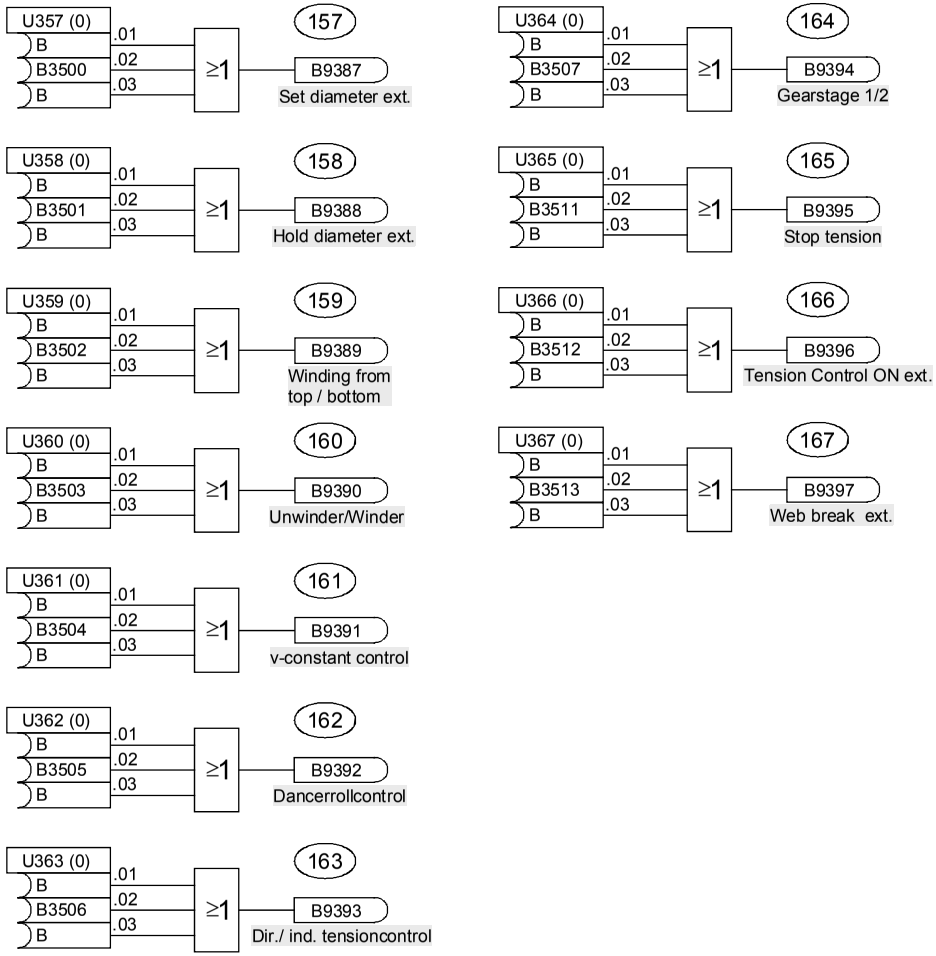

Sheet 16
Determination of moment setpoint if tensioncontrol is active
1
2
3
4
5
6
7
8
U383 (0)
B9385
Dancer or v-constant control 14.4
183
B9453
OFF3
Tensioncontrol ON 13.4
U321 (1)
B9453
B0110
B9353
.01
.02
.03
121
&
B9351
U253 (0)
B9351
96
0
1
U252 (0)
K0408
K9124
.01
.02
K9216
P605.01
Moment feedback value
if tension control is active
K0408
U099.02 (100)
Torque limit in
n control mode
U123 (0)
K9254
K9217
K
.01 +
.02 +
.03 -
23
Output
Tension/Pos. Contrl. 13.8
Tension setpoint 12.7
K9123
Current 8a.7
diameter
U152 (0)
K9123
K9304
.05 x1
.06 x2
295
y
X
x1 * x2
100%
K9435
296
y
X
x1 * x2
100%
K9436
Summ of precontrol moments 11.8
U153 (0)
K9435
K0408
.03 x1
.04 x2
K0408
P408.F (100,00)
Normalization of
moment setpoint
24
U124 (0)
K9436
K9215
K
.01 +
.02 +
.03
K9124


Web break recognition (1)
Sheet 17
1
2
3
4
5
6
7
8
Hysteresis 0,00...199,99 U199 (0,00)
Hysteresis 0,00...199,99 U202 (0,00)
|A|<B
A<B <1>
A=B
B9169
B9170
B9171
B9172
B9173
B9174
U199
U199/2
U202
U202/2
73
74
98
92
61
50
46
25
U197 FS 0 K9218 K9212 9186
U200 K9146 0 K9187 9187
U257 (0) B9383
U256 (0) K9150 K9241
Dancer control or dir. tension control 14a.5
Tension, position or torque actual values 15.3
U245 (0) B9392
U244 (0) K9186 K9501
K9186 K9501
U099 (90,00) Dancer roll endposition
U198 (5,00) Minimum tension or torque
0...10000ms U165 (0)
U164 (1)
U163 (0) K0142
instentaneous value of moment
U150 (0) K9161 K0402
K0402
x1 * x2 100%
Adjustment of moment-setpoint - actual value diff. P402.F (100,00)
U201 (20,00) Maximal allowed moment deviation
U146 (1) K9125 K9216
K9125
16.7
U125 (0) K9216 K K9150
Moment setpoint 16.7
x1*100% x2

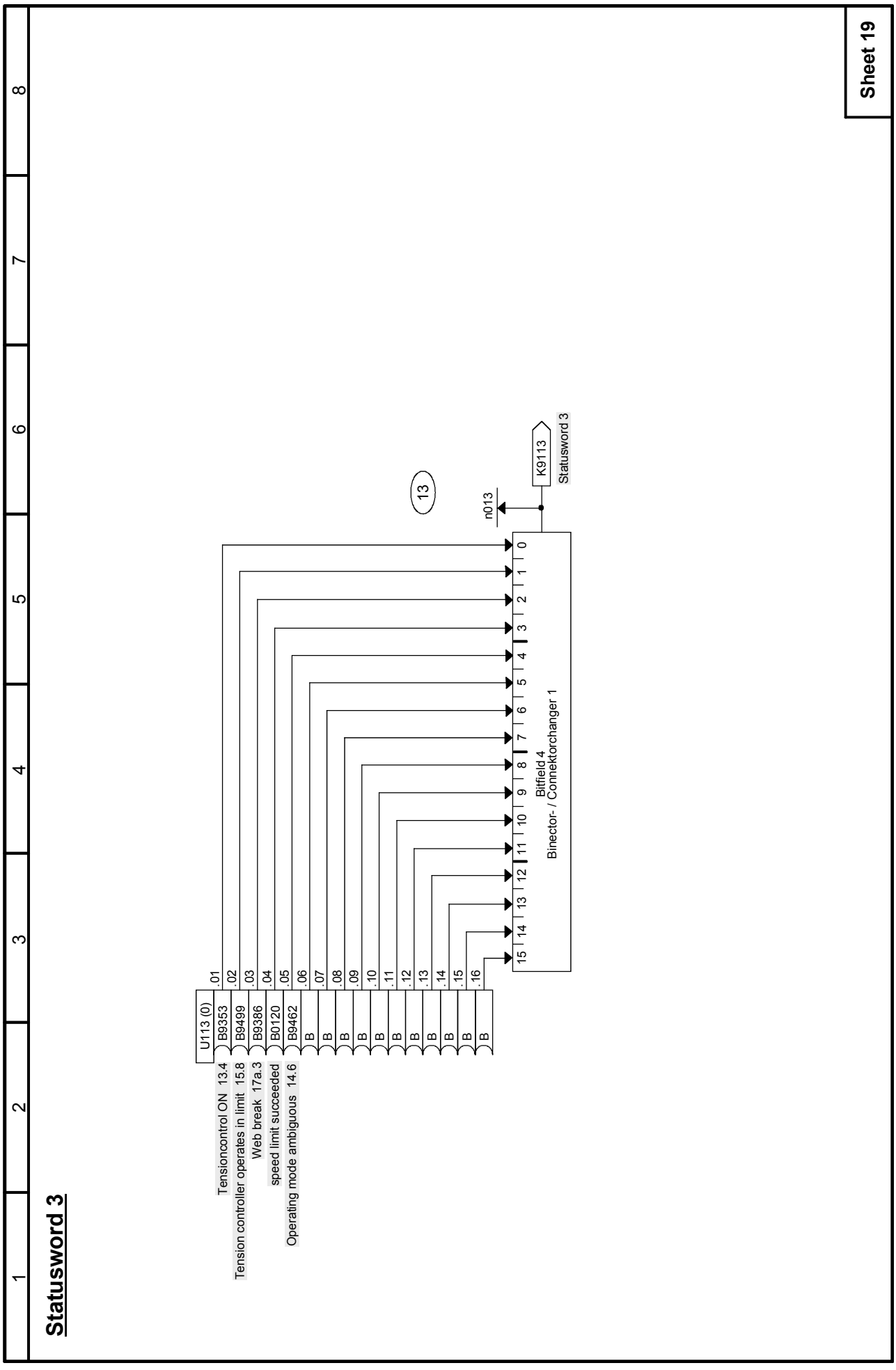

Web break recognition (2)
Sheet 17a
P658
OFF 3
1 2 3 4 5 6 7 8
187
Dancerroll control 18.5
17.8
U471 (0)
B9392
B9169
B9457
251
B9483
B9457
1
U387 (0)
B9169
Actual tension and/or
actual torque < limit or
actual position > limit 17.8
243
Web break int.
B9586
B0587
1
U450 (2,000)
(0,000...60,000s)
U451 (0)
Mode
T
Delayed ON
Delayed Off
On / Off delay.
Impulsgenerator
1 = Reset
U449 (0)
B9352
246
B9592
B9593
1
U460 (3)
U459 (1,00)
(0,00...600,00s)
U458 (0)
B9358
128
B9358
&
U328 (1)
B9362
B9591
Tensioncontroll OFF del. 13.8
189
B9459
Web break
1
U389 (0)
B9362
250
B9482
U470 (0)
B9393
B9173
ind. Tensioncontrol 18.5
Moment setpoint - 17.8
actual value diff. > limit
181
1
U381 (0)
B9482
122
B9352
&
U322 (1)
B9483
B9451
B9584
242
B9584
B9585
1
U447 (5,000)
(0,000...60,000s)
U448 (0)
U446 (0)
B9590
Tensioncontroll OFF dellayed 13.8
156
B9386
Web break
≥1
U356 (0)
B9586
B9397
Web break ext. 18.7
132
B9362
&
U332 (1)
B9386
B9463
v-konstant-Regelung

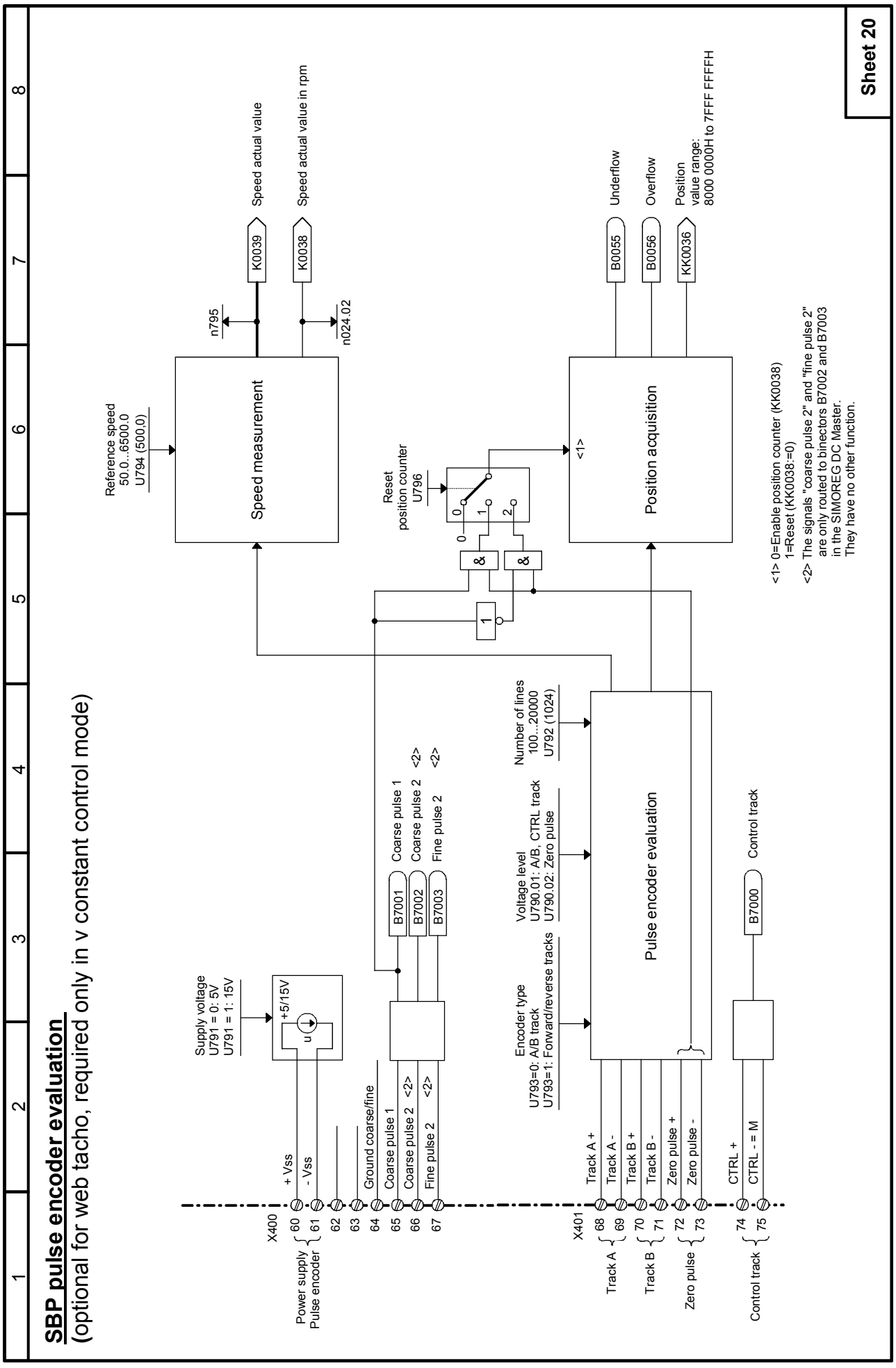
1	2	3	4	5	6	7	8

Setting Controlword 3



Sheet 18


Sheet 19
Statusword 3
U113 (0)
.01
B9353
.02
B9499
.03
B9386
.04
B0120
.05
B9462
.06
B
.07
B
.08
B
.09
B
.10
B
.11
B
.12
B
.13
B
.14
B
.15
B
.16
B
Tensioncontrol ON 13.4
Tension controller operates in limit 15.8
Web break 17a.3
speed limit succeeded
Operating mode ambiguous 14.6
13
n013
K9113
Statusword 3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Bitfield 4
Binector- / Connektorchanger 1


Sheet 20
SBP pulse encoder evaluation
(optional for web tacho, required only in v constant control mode)
Speed measurement
Reference speed
50.0...6500.0
U794 (500.0)
n795
K0039
Speed actual value
K0038
Speed actual value in rpm
n024.02
Position acquisition
B0055
Underflow
B0056
Overflow
KK0036
Position
value range:
8000 0000H to 7FFF FFFFH
Reset
position counter
U796
<1>
Pulse encoder evaluation
Supply voltage
U791 = 0: 5V
U791 = 1: 15V
+5/15V
Number of lines
100...20000
U792 (1024)
Voltage level
U790.01: A/B, CTRL track
U790.02: Zero pulse
Encoder type
U793=0: A/B track
U793=1: Forward/reverse tracks
B7001
B7002
B7003
Coarse pulse 1
Coarse pulse 2
Fine pulse 2
B7000
Control track
X400
X401
+ Vss
- Vss
Ground coarse/fine
Track A +
Track A -
Track B +
Track B -
Zero pulse +
Zero pulse -
CTRL +
CTRL - = M
Power supply
Pulse encoder
Track A
Track B
Zero pulse
Control track
<1> 0=Enable position counter (KK0038)
1=Reset (KK0038:=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.

NOTE

After "achswickler.winder.dnl" 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.

Deselecting any function blocks that are not needed reduces the load on the processor (see visualization parameter n009).

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