

ABB machinery drives

Supplement

Winder control program for ACSM1 drives



Related manuals

Drive manuals

	Code (EN)	
<i>ACSM1-04 (0.75 to 45 kW) Drive Modules Hardware Manual*</i>	3AFE68797543	2)
<i>ACSM1-04 (55 to 110 kW) Drive Modules Hardware Manual*</i>	3AFE68912130	2)
<i>ACSM1-04LC (55 to 132 kW) Liquid-Cooled Drive Modules Hardware Manual*</i>	3AUA0000022083	2)
<i>ACSM1 Motion Control Program Firmware Manual</i>	3AFE68848270	2)
<i>ACSM1 Speed and Torque Control Program Firmware Manual</i>	3AFE68848261	2)

Drive PC tool manuals

<i>DriveStudio User Manual</i>	3AFE68749026
<i>DriveSPC User Manual</i>	3AFE68836590

Option manuals and guides

<i>ACSM1 Control Panel User's Guide</i>	3AUA0000020131	2)
<i>FCAN-01 CANopen Adapter Module User's Manual</i>	3AFE68615500	1)
<i>FDNA-01 DeviceNet Adapter Module User's Manual</i>	3AFE68573360	1)
<i>FECA-01 EtherCAT® Adapter Module User's Manual</i>	3AUA0000068940	1)
<i>FEN-01 TTL Encoder Interface User's Manual*</i>	3AFE68784603	2)
<i>FEN-11 Absolute Encoder Interface User's Manual*</i>	3AFE68784841	2)
<i>FEN-21 Resolver Interface User's Manual*</i>	3AFE68784859	2)
<i>FEN-31 HTL Encoder Interface User's Manual*</i>	3AUA0000031044	2)
<i>FENA-01 Ethernet Adapter Module Hardware Manual</i>	3AUA0000022986	1)
<i>FENA-01 Ethernet Adapter Module Ethernet/IP Protocol Manual</i>	3AUA0000033371	1)
<i>FENA-01 Ethernet Adapter Module Modbus/TCP Protocol Manual</i>	3AUA0000022989	1)
<i>FIO-01 Digital I/O Extension User's Manual*</i>	3AFE68784921	2)
<i>FIO-11 Analog I/O Extension User's Manual*</i>	3AFE68784930	2)
<i>FIO-21 Analog I/O Extension User's Manual*</i>	3AUA0000031061	2)
<i>FMBA-01 Modbus adapter module User's manual</i>	3AFE68586704	1)
<i>FPBA-01 PROFIBUS DP Adapter Module User's Manual</i>	3AFE68573271	1)

¹⁾ Delivered as a printed copy with the option.

²⁾ Delivered by the Marketing Material Order Service on request (<https://order.hansaprint.fi/abb/>).

*A multilingual quick installation guide is included with the delivery.

All manuals are available in PDF format on the Internet. See section [Document library on the Internet](#) on page 10.

Winder control program for ACSM1 drives

Supplement

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Introduction to this supplement

This document is a supplement to *ACSM1 Speed and Torque Control Program Firmware Manual* (3AFE68848261 [English]). The supplement covers actual signals, parameters, technology function blocks, custom circuits as well as fault and alarm messages related to the winder control program. For other information, refer to the *Firmware Manual*.

What this chapter contains

The chapter includes a description of the contents of the supplement. In addition, it contains information about the compatibility, safety and intended audience.

Compatibility

The supplement is compatible with the winder control program for ACSM1 drives (Version UAWI1100 and above).

Safety instructions

Follow all safety instructions delivered with the drive.

- Read the **complete safety instructions** before you install, commission, or use the drive. The complete safety instructions are given at the beginning of the drive *Hardware Manual* (see the list of related manuals on the inside of the front cover, page 2).
- Read the **winder control program specific warnings and notes** before changing the default settings of the parameters and functions. For each parameter, the warnings and notes are given in chapter [Actual signals and parameters](#).
- Read the **firmware function block specific warnings and notes** before changing the default settings of the function. For each firmware function block, the warnings and notes are given in the drive *Firmware Manual* in the section describing the related user-adjustable parameters.

Intended audience

The reader of the supplement is expected to:

- know the standard electrical wiring practices, electronic components and electrical schematic symbols
- have a firm understanding of winding and unwinding principles.

Contents

The supplement consists of the following chapters:

- [Introduction to this supplement](#) describes the contents of this manual.
- [Application overview](#) gives a brief overview of the winder application and related terms.
- [Start-up](#) gives instructions for commissioning the winder application.
- [Default control connections](#) shows the default control connections of the JCU Control Unit.
- [Actual signals and parameters](#) describes the actual signals and parameters of the winder application.
- [Technology function blocks and custom circuits](#) describes the technology function blocks and custom circuits and lists the associated input and output parameters and signals.
- [Fault tracing](#) lists the alarms and fault messages with the possible causes and remedies.
- [Control block diagrams](#) presents the application program pages containing the winder control program technology blocks and custom circuits.
- [Appendix A: Motor rotor inertia, IEC](#) gives an example of common inverter duty AC motor rotor inertia.

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Sales, Support and Service Network*.

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet. Go to www.abb.com/drives and select *Document Library*. You can browse the library or enter selection criteria, for example a document code, in the search field.

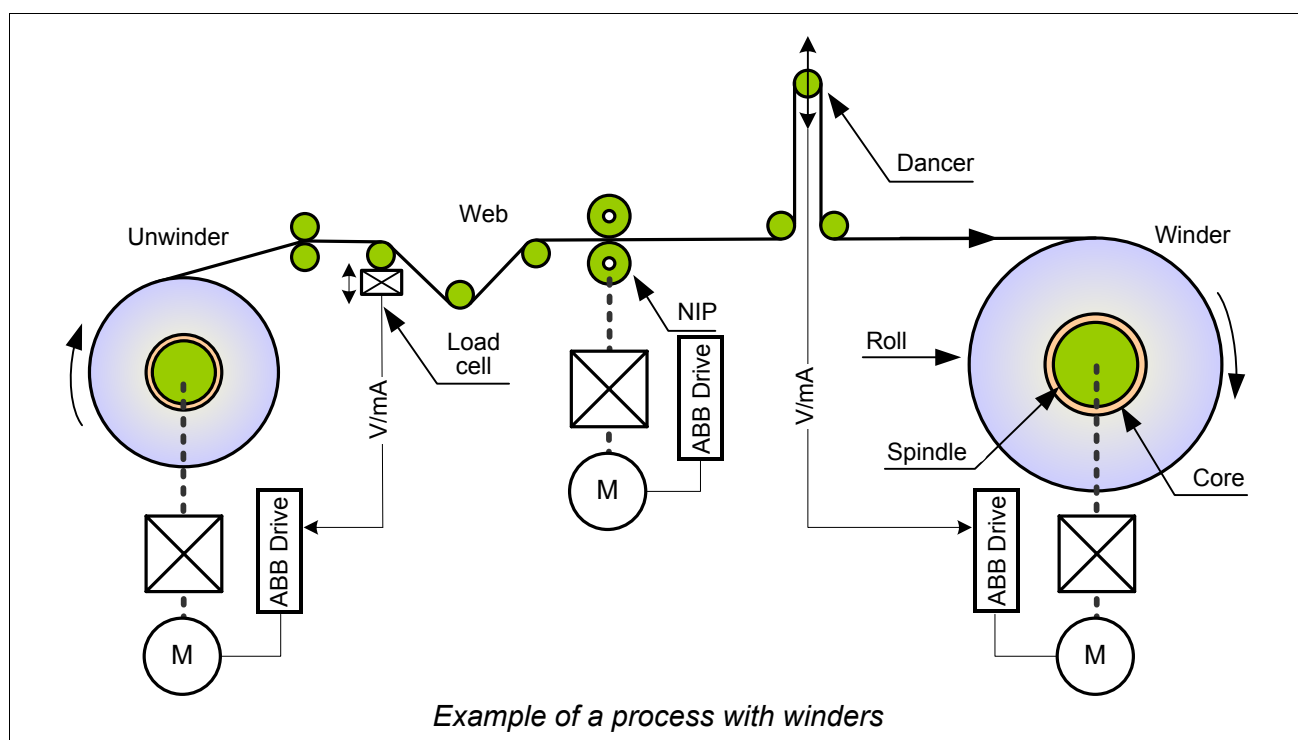
Application overview

What this chapter contains

The chapter includes a brief overview of the winder application and related terms.

Winder control

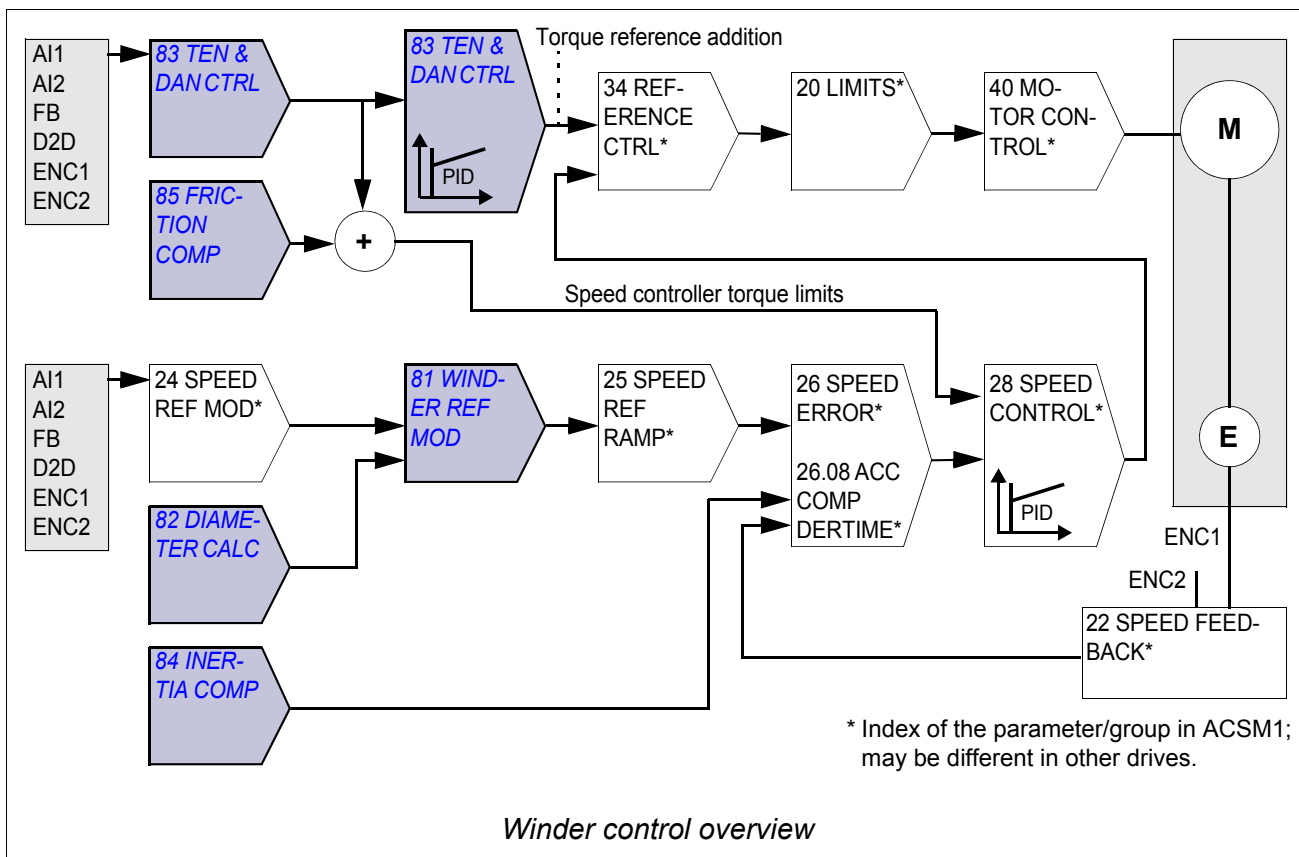
An example of a process with winders is shown in the figure below.



Winder/Unwinder

A winder is used to wind material (web) around the core or from the roll, depending on the wanted direction. Material is taken out of the roll with an unwinder and wound to the core with a winder.

The winder control program is used to calculate the diameter of the roll, control the web tension and line speed according to the user given references. An overview of the winder control is shown in the figure on page 12. Each tension control mode is explained more thoroughly later with the help of control diagrams.



Infeeder

Infeeder (eg, NIP or pinch roll) is a process control section used to help transport material in the process line. For an infeeder, the roll diameter is fixed and the diameter calculation can be disabled. An infeeder can be tension controlled or purely speed controlled. The winder control program can also be used in infeeder applications.

Line speed

Line speed is the operational speed of the controlled process, given in meters per second. Because for winders and unwinders the roll radius is changing, the speed reference to the motor has to be modified according to the actual radius of the driven roll.

Related parameter groups:

- **80 WINDER CONTROL**
- **81 WINDER REF MOD.**

Roll diameter

The winder control program uses the line speed reference and actual roll rpm to calculate the roll diameter. To stabilize the calculation, the actual diameter is ramped according to the web thickness. The roll diameter calculation is based upon internal calculations where no external device is needed; however, the use of an external diameter sensor is available. This aids in stopping and restarting partial rolls with minimal tension disturbances.

For an NIP or pinch roll (infeeders), the diameter of the driven roll does not change, so that the diameter calculation can be disabled.

Related parameter group:

- [82 DIAMETER CALC.](#)

Tension control

The objective of the tension control is to maintain the tension of the web, ie, the force applied to the web. The motor speed and torque must change as a function of the web speed and roll diameter.

$$\text{Motor torque} = \text{Tension reference} \times \text{Roll radius}$$

The following tension control modes are available:

OPEN LOOP

Feedback from the web is not required in this mode. The tension of the web is controlled by calculating the torque reference of the motor, which is the product of the user-given tension reference and the actual roll radius. The tension control PID is disabled. Inertia and friction compensation can be used to improve the tension control accuracy.

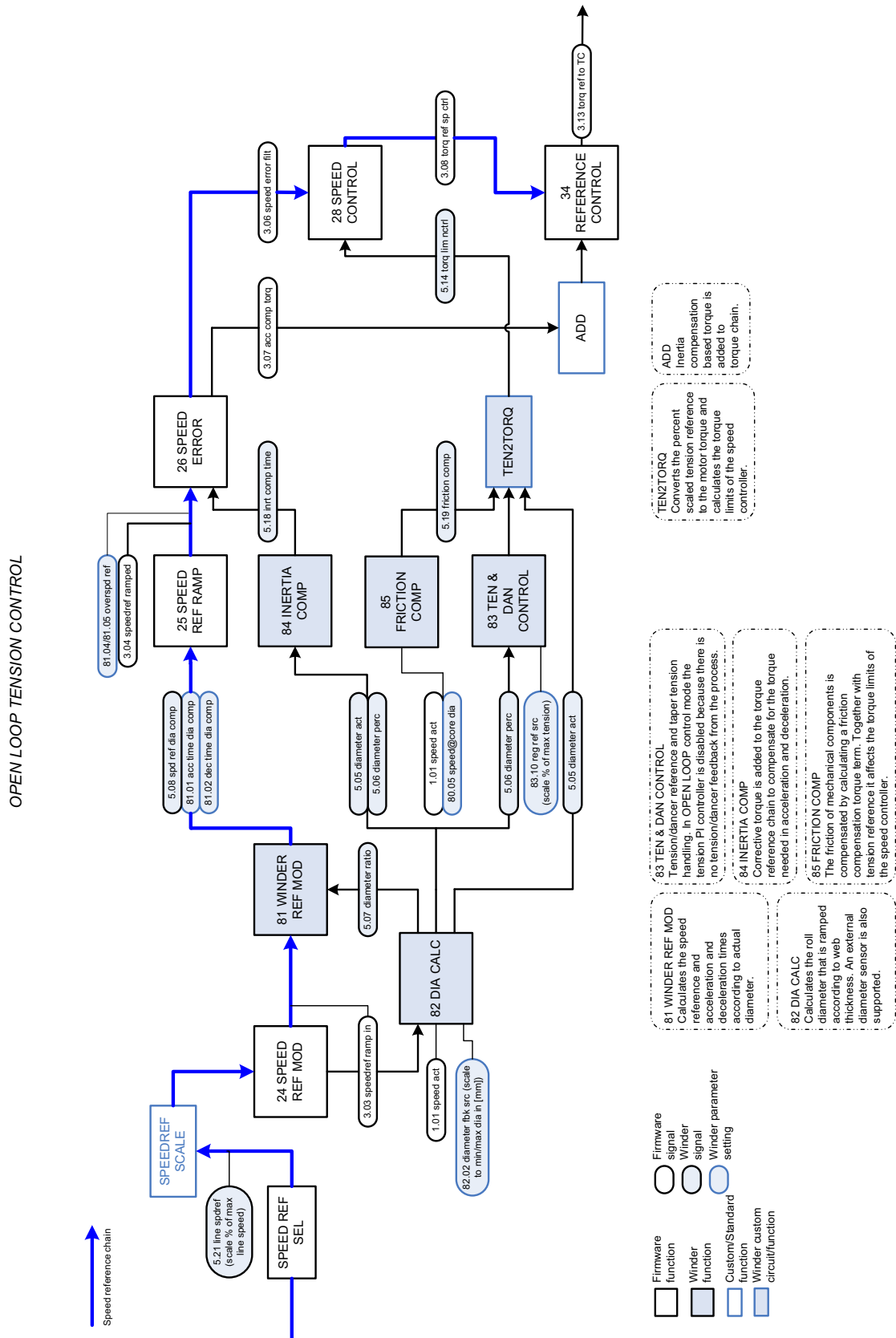
The drive is running as speed controlled; the torque limits of the speed controller are controlled by the tension control. To ensure that the drive is always running against the calculated speed controller torque limits, the application adds an overspeed reference to the final speed reference. The amount of overspeed reference is adaptable with parameters.

Since tension feedback from the web is not available, accurate web data is a prerequisite for successful tension control. Therefore, the friction and inertia compensation should be set up carefully when the OPEN LOOP tension control is used.

The OPEN LOOP tension control is suitable especially for non-stretchy materials which do not set extremely high requirements for the tension.

See [OPEN LOOP TENSION control diagram](#) on page 14.

OPEN LOOP TENSION control diagram



TENSION TORQUE TRIM

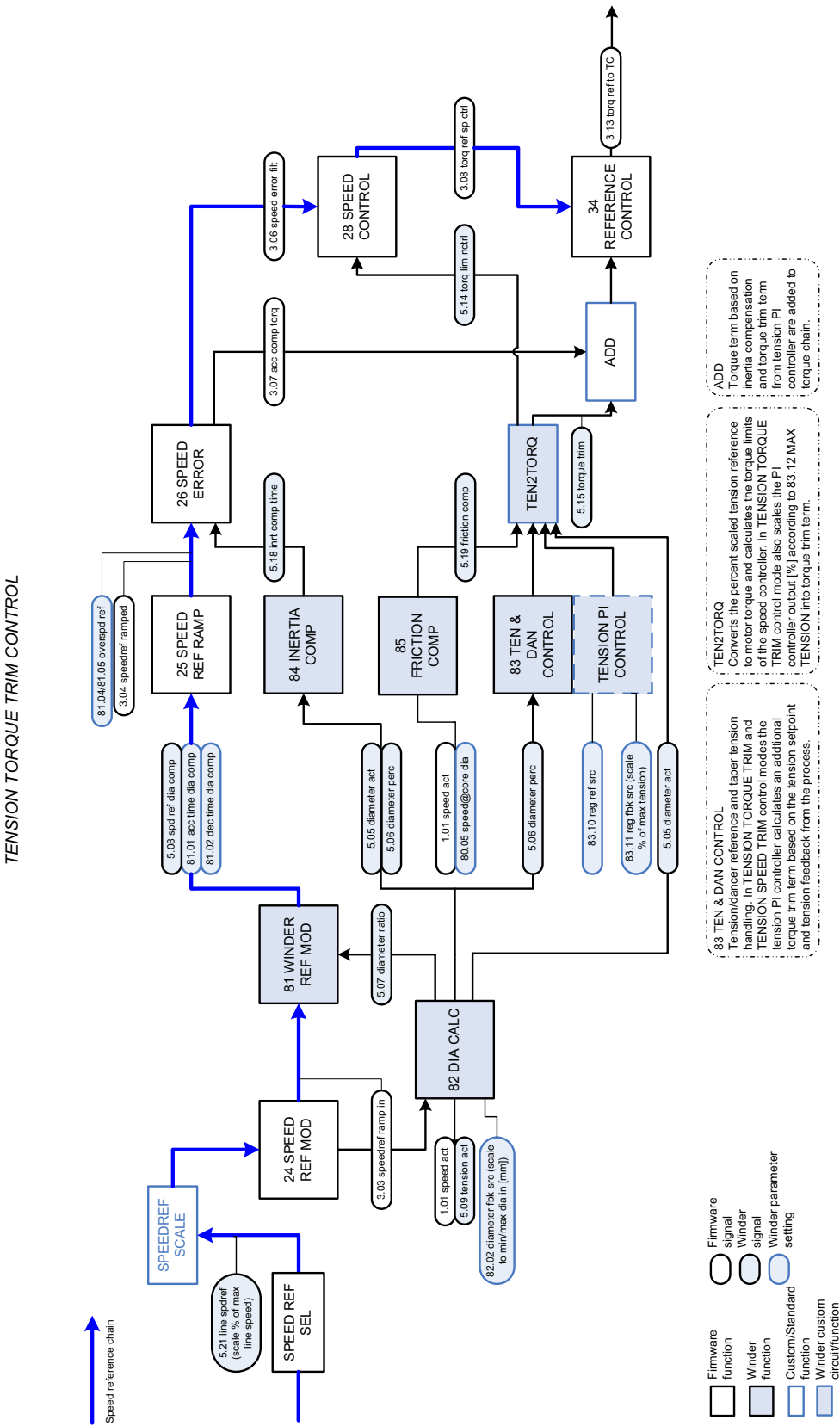
Load cell feedback is required. Tension of the web is controlled by calculating the torque reference of the motor, which is the product of the user-given tension reference and the actual roll radius. In addition, the tension control PID modifies the final motor **torque** reference based on the tension feedback from the load cell. Inertia and friction compensation can be used to improve the tension control accuracy.

The drive is running as speed controlled; the torque limits of the speed controller are controlled by the tension control. To ensure that the drive is always running against the calculated speed controller torque limits, the application adds an overspeed reference to the final speed reference. The amount of overspeed reference is adaptable with parameters. Accurate web material information is required.

The TENSION TORQUE TRIM tension control may result in a stable steady-state performance, but on the other hand it is less adaptable to a wide variety of web materials than the TENSION SPEED TRIM tension control. The TENSION TORQUE TRIM tension control is suitable especially for non-stretchy materials and when high dynamic accuracy is needed.

See [*TENSION TORQUE TRIM control diagram*](#) on page 16.

TENSION TORQUE TRIM control diagram



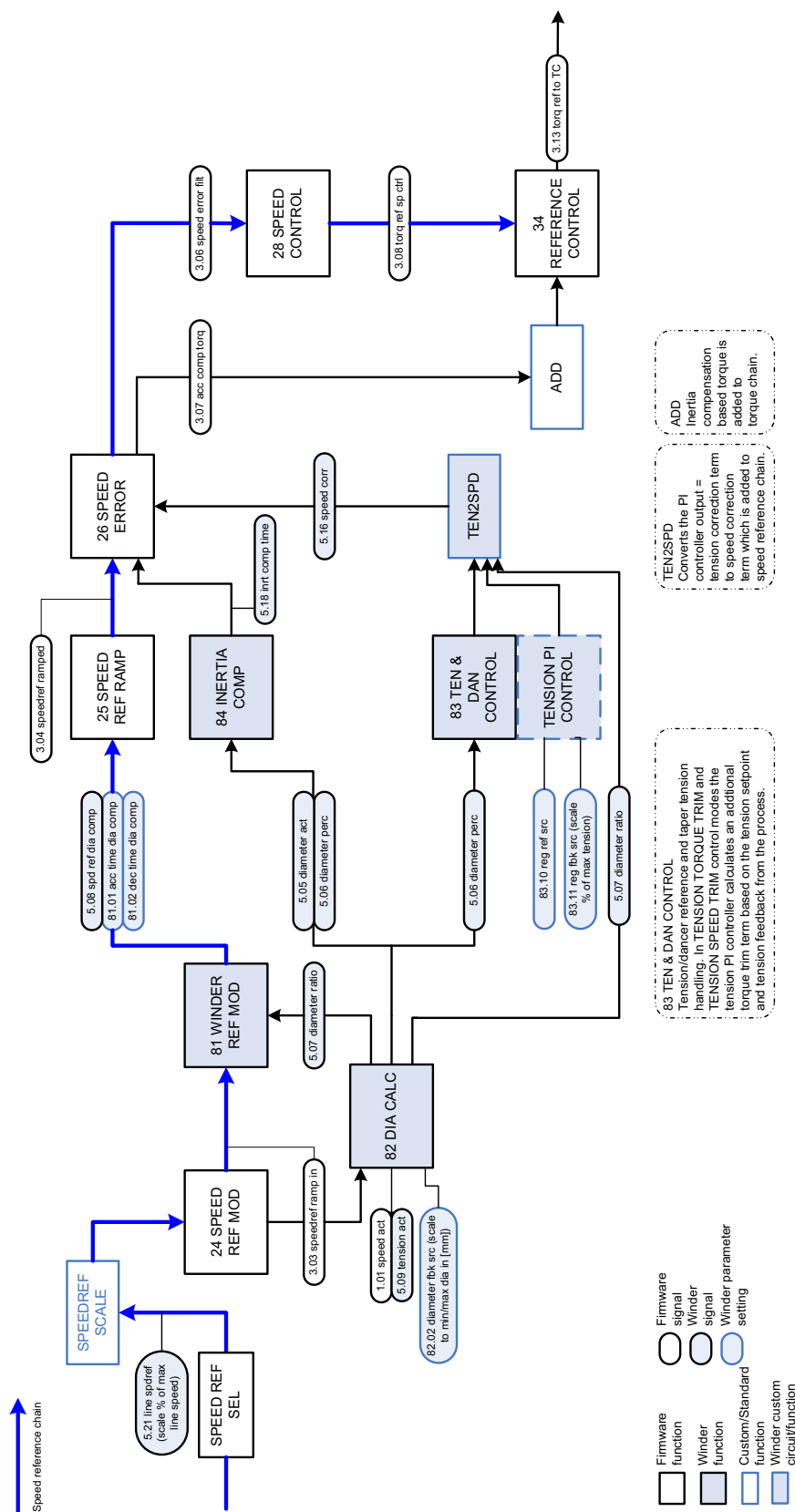
TENSION SPEED TRIM

Load cell feedback is required. Tension of the web is controlled by calculating the torque reference of the motor, which is the product of the user-given tension reference and the actual roll radius. In addition, the tension control PID modifies the final motor **speed** reference based on the tension feedback from the load cell. Inertia compensation can be used to improve the tension control accuracy. The drive is running as speed controlled.

When running in the TENSION SPEED TRIM control mode, the tension controller is very adaptable to a large variety of web material characteristics. The TENSION SPEED TRIM tension control is suitable especially for stretchy materials demanding smooth control of the tension.

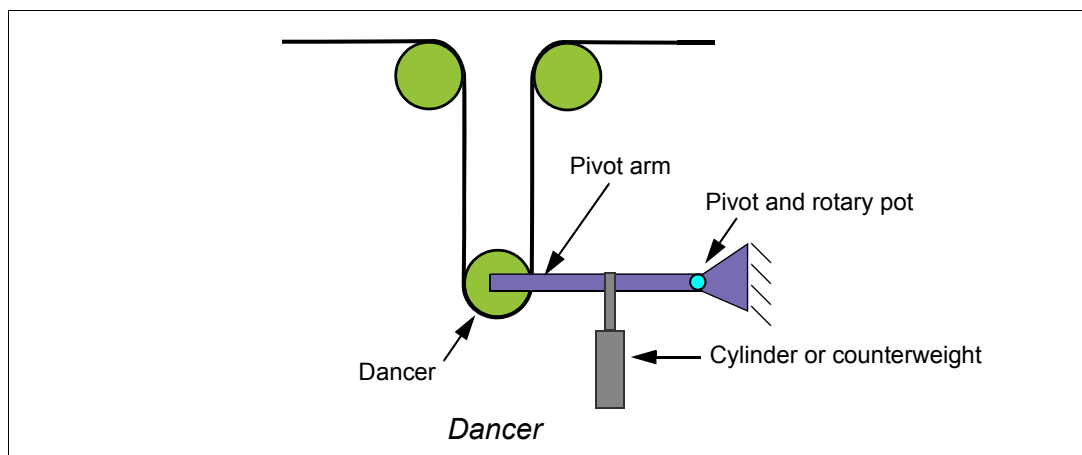
See [*TENSION SPEED TRIM control diagram*](#) on page 18.

TENSION SPEED TRIM CONTROL



DANCER SPEED TRIM

Dancer feedback signal is required. The purpose of the dancer regulation is to control the web tension by regulating the dancer (mechanical roll/wheel) position. The dancer is loaded from either an external source controlled by the user or by the output of the dancer PI controller of the drive. The dancer absorbs the changes of the web tension, which cause the dancer position to change. The dancer PI controller corrects the position error of the dancer by means of speed trimming. Inertia compensation can be used to improve the tension control accuracy. The drive is running as speed controlled.



An advantage of a dancer is the web storage, which acts like an accumulator to absorb and isolate tension disturbances.

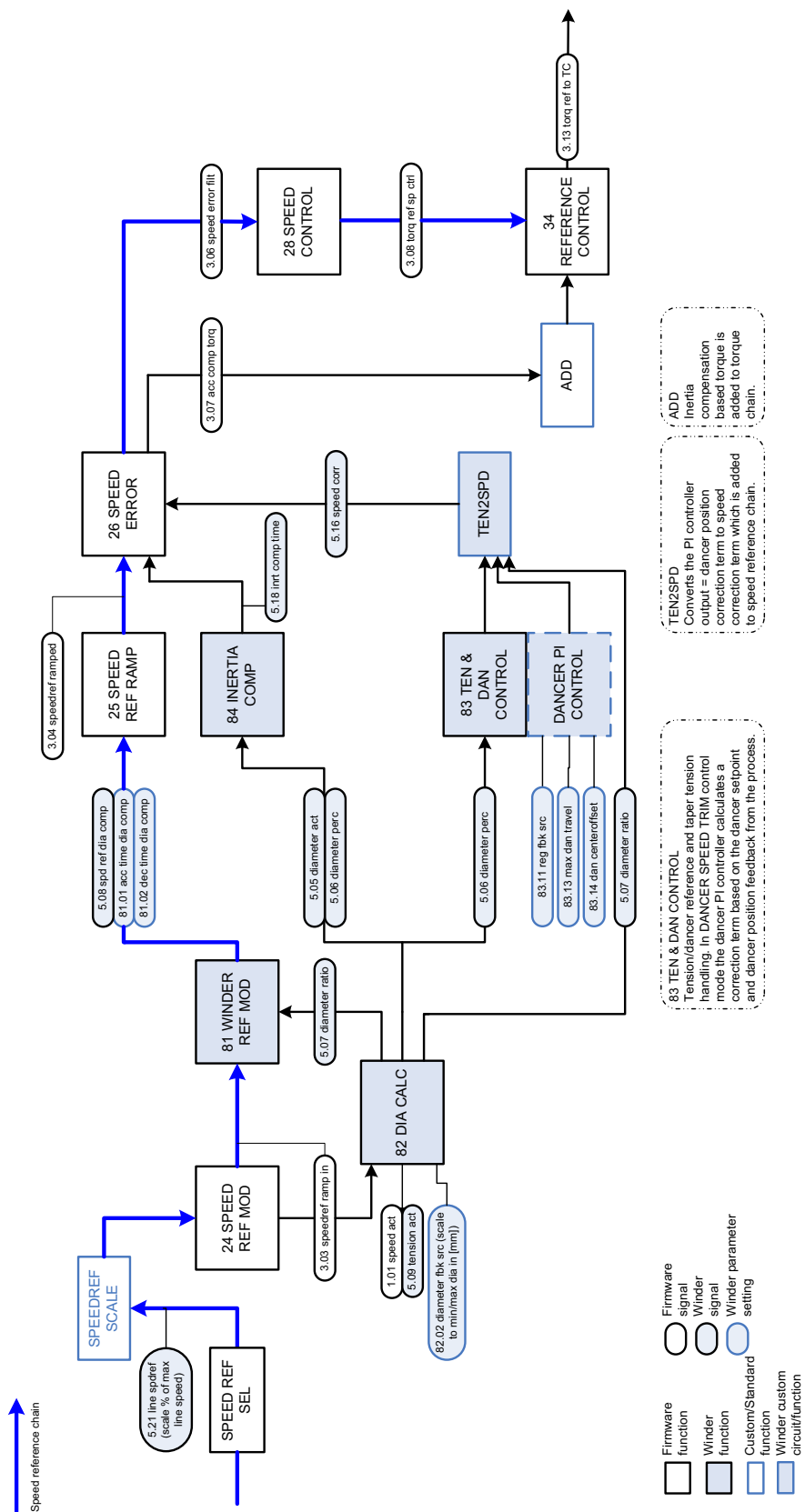
The DANCER SPEED TRIM tension control is suitable especially for stretchy materials demanding smooth control of the tension.

Related parameter groups:

- [83 TEN & DAN CTRL](#)
- [84 INERTIA COMP](#)
- [85 FRICTION COMP.](#)

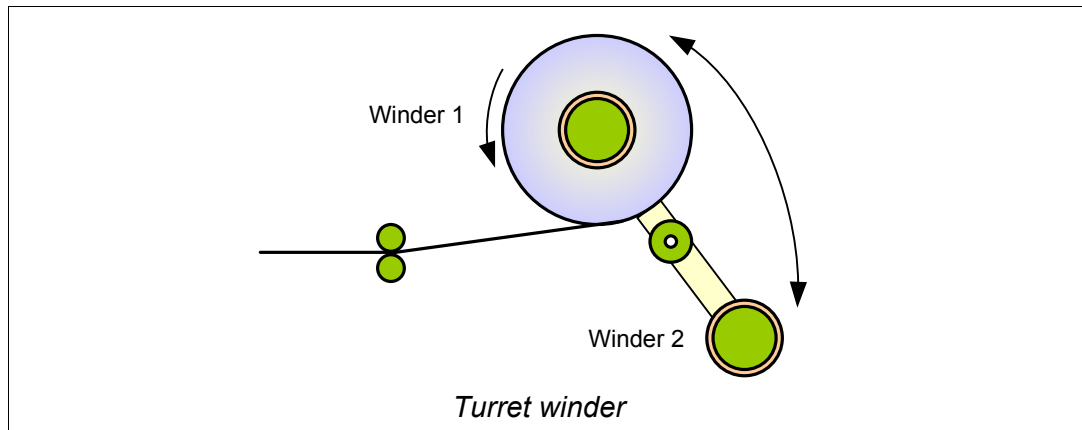
See [DANCER SPEED TRIM control diagram](#) on page 20.

DANCER SPEED TRIM CONTROL



Automatic roll change

Turret winders are used to perform an automatic roll change. In the turret winder two center winders are located on a rotating axis, whose position is changed so that a new roll can be started on the fly.



During the roll change, the web material is cut with a flying knife. To facilitate slicing of the material, parameterizable torque boost can be applied to temporarily increase the tension of the web. When the material is cut, the load cell or dancer is disconnected from the web and cannot therefore be used for the tension control. To finish the roll after cutting, the torque memorized before cutting can be used as the torque reference for the motor.

The pivot control of the automatic roll change machine is not part of the winder control program but has to be controlled by the user.

Related parameter group:

- [86 TORQ MEM CTRL](#).

Expandability and adaptivity

The application features introduced above are implemented with the DriveSPC (Solution Programming Composer) tool. With DriveSPC, the user can modify and adapt the winder control program to customer needs whenever needed.

In addition, for example the control of the extension I/O modules is realized with SPC programming. Default I/O can be extended with the following options (refer to the drive *Firmware Manual* for further information on I/O extensions):

- FIO-01: 4 DIO + 2 RO
- FIO-11: 3 AI + 1 AO + 2 DIO.

Start-up

What this chapter contains

This chapter describes the basic commissioning procedure of the application.

How to commission the application

If an alarm or a fault is generated during the commissioning, see chapter [Fault tracing](#) (alarms and faults generated by the winder control program) or chapter [Fault tracing](#) in the drive *Firmware Manual* (other alarms and faults) for the possible causes and remedies.

DRIVE COMMISSIONING		
☐	Commission the drive according to the start-up instructions in the drive <i>Firmware Manual</i> . Ensure that the following parameters have appropriate values:	
☐	Firmware limits: • 20.01 MAXIMUM SPEED • 20.02 MINIMUM SPEED • 20.06 MAXIMUM TORQUE • 20.07 MINIMUM TORQUE	<i>Firmware Manual</i>
☐	Firmware parameter groups for the drive control: • 10 DRIVE LOGIC (Start function and start/stop source) • 24 SPEED REF SEL	<i>Firmware Manual</i>
APPLICATION COMMISSIONING		
Entering core data		
☐	Set the core diameter.	82.04 CORE DIAMETER
☐	Reset the actual roll diameter to the core diameter.	82.09 DIA RESET ENA
Entering basic application control data		
☐	Set the winding mode.	80.01 WINDING MODE
☐	Set the winding direction.	80.02 WINDING DIR
☐	Set the process stop activation/deactivation.	80.03 PROCESS STOP
☐	Set the maximum rotational speed in rpm for the winder at the core (= minimum diameter).	80.05 SPEED@CORE DIA

☐	Set the ratio of the motor rpm to the spindle rpm when the spindle rpm is scaled as 1. Example: Set parameter value to 2 if the motor rotates two rounds as the spindle rotates one round (2:1).	80.06 GEAR RATIO
☐	Set the acceleration time from zero to the speed defined by parameter 25.02 SPEED SCALING (see the drive <i>Firmware Manual</i>).	81.01 ACC TIME
☐	Set the deceleration time from the speed defined by parameter 25.02 SPEED SCALING to zero (see the drive <i>Firmware Manual</i>).	81.02 DEC TIME
☐	Set the time within which the drive is stopped from the speed defined by parameter 25.02 SPEED SCALING if process stop is activated by parameter 80.03 PROCESS STOP .	81.03 PROCESS STP TIME
Entering inertia and friction compensation data		
☐	Check that the tension controller is disabled, ie, parameter 83.01 REG CTRL ENA = C.False.	83.01 REG CTRL ENA
☐	Set the inertia and friction data using parameters in group 84 INERTIA COMP and 85 FRICTION COMP . For more information, see pages 40 and 42, respectively.	84 INERTIA COMP 84 INERTIA COMP , 85 FRICTION COMP 85 FRICTION COMP
Verifying set data		
☐	Start the drive to rotate the spindle and core without the web to verify that the line speed matches the line speed reference. Confirm the setting of parameter 80.05 SPEED@CORE DIA if there is a mismatch between the line speed and the roll speed.	80.05 SPEED@CORE DIA
☐	Check that the winding/unwinding directions are according to the winding mode and winding direction parameters.	80.01 WINDING MODE , 80.02 WINDING DIR
☐	Rotate the core and spindle to verify the inertia and friction compensation data set above.	84 INERTIA COMP 84 INERTIA COMP , 85 FRICTION COMP 85 FRICTION COMP
Entering winder data		
☐	<u>For winder applications only. For infeeder applications, go directly to step Entering infeeder data on page 25.</u> Set the web and roll data using parameters in group 82 DIAMETER CALC .	82 DIAMETER CALC 82 DIAMETER CALC
☐	Select the tension control mode.	83.02 TENSION CTRLMODE
☐	Enable the tension control by setting 83.01 REG CTRL ENA to ENABLED. Go to step Winder and infeeder, continued on page 25.	83.01 REG CTRL ENA

Entering infeeder data		
	For infeeder applications only. For winder applications, go directly to step Winder and infeeder, continued on page 25.	
☐	Select the tension control mode.	83.02 TENSION CTRLMODE
☐	Enable the tension control by setting 83.01 REG CTRL ENA to C.True.	83.01 REG CTRL ENA
☐	Disable diameter calculation by setting parameters 82.07 COUNT UP ENA and 82.08 COUNT DOWN ENA to C.False.	82.07 COUNT UP ENA , 82.08 COUNT DOWN ENA
Winder and infeeder, continued		
☐	Set the rest of the tension/dancer control parameters in group 83 TEN & DAN CTRL (see page 38).	83 TEN & DAN CTRL 83 TEN & DAN CTRL
☐	If possible, run the section first without the tension controller by setting 83.04 OPEN LOOP FORCE = C.True to verify feedback signals, etc.	83.04 OPEN LOOP FORCE
☐	Start the section with the web and verify functionality of the tension control.	
☐	Set process specific parameters, for example group 86 TORQ MEM CTRL (see page 43) parameters for the automatic roll change.	86 TORQ MEM CTRL 86 TORQ MEM CTRL
☐	Check the operation of the speed controller. In the OPEN LOOP and TENSION TORQUE TRIM tension control modes, the speed controller torque must be continuously limited by the tension controller. For successful operation, check that the speed controller keeps the speed stable below the final speed reference so that the torque limit is active. Overspeed referencing has to be sufficient as well; typically the default value is appropriate. Note that when the torque limitation is active, speed controller tuning has no effect. In the TENSION SPEED TRIM and DANCER SPEED TRIM tension control modes, tune the speed controller as advised by the drive <i>Firmware Manual</i>. Relevant parameters: • 6.03 SPEED CTRL STAT • 81.04 OVERSPD REF MUL • 81.05 OVERSPD REF ADD • 28.02 PROPORT GAIN • 28.03 INTEGRATION TIME.	<i>Firmware Manual</i> 81.04 OVERSPD REF MUL 81.05 OVERSPD REF ADD

Default control connections

What this chapter contains

This chapter shows the default control connections of the JCU Control Unit.

More information on the connectivity of the JCU is given in the *Hardware Manual* of the drive.

The figure below shows the default external control connections for the winder control.

Notes:

*Total maximum current: 200 mA

1) Selected by parameter 12.01 DIO1 CONF.

2) Selected by parameter 12.02 DIO2 CONF.

3) Selected by parameter 12.03 DIO3 CONF.

4) Selected by jumper J1.

5) Selected by jumper J2.

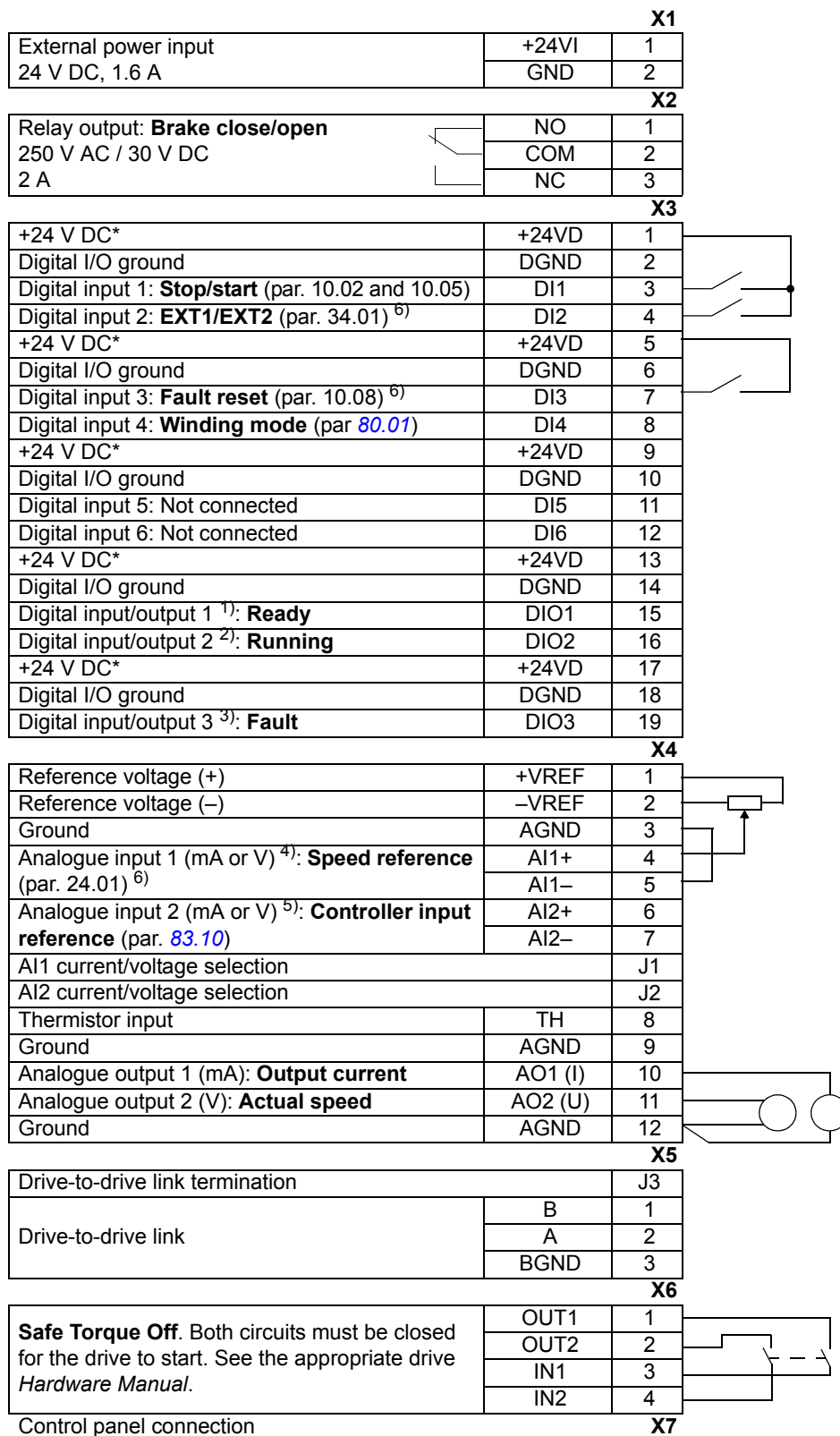
6) See the drive *Firmware Manual*.

Current:

J1/2  ○ ○

Voltage:

J1/2 ○ ○ 



Actual signals and parameters

What this chapter contains

The chapter describes the actual signals and parameters related to the winder control program. For other actual signals and parameters, refer to the drive *Firmware Manual*.

The range and default value, when applicable, as well as a page number for more detailed information are given for each signal and parameter. The page number refers to the related technology function block or custom circuit in chapter [Technology function blocks and custom circuits](#).

Note: The total range of winder-related actual signals in group 5 is -32768...32768. The range which the application uses is mentioned in this manual.

Terms and abbreviations

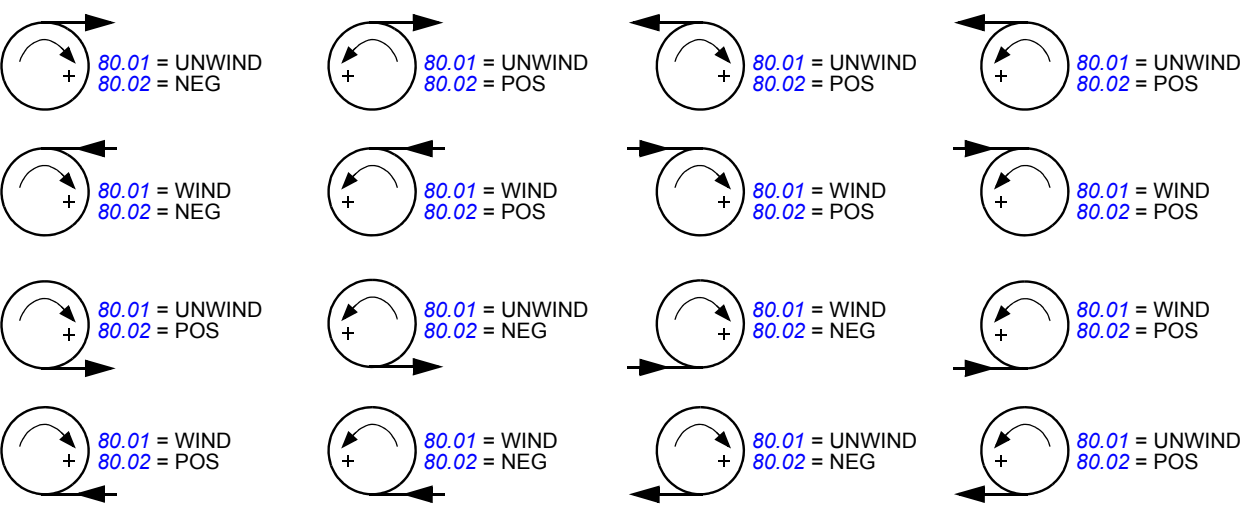
The table defines the terms and abbreviations used in the parameter and actual signal tables.

Term	Definition
Actual signal	Signal measured or calculated by the drive. Can be monitored by the user. No user setting possible.
Parameter	A user-adjustable operation instruction of the drive.
Val./Def.	On a parameter row: Parameter default value. On rows under the parameter row: Parameter alternative values (for parameters with value names).
Page	Page in chapter Technology function blocks and custom circuits where the signal or parameter is listed as an input or output to a technology function block or custom circuit. More information on the signal or parameter, for example type, unit and fieldbus equivalent are shown there.
C.False, C.True	When adjusting a bit pointer parameter on the control panel, value 0 (FALSE) is displayed as "C.FALSE" and value 1 (TRUE) as "C.TRUE". See also Bit ptr on page 50.
P.xx.yy	A value pointer points to the value of another parameter/signal. The source parameter is given in format P.xx.yy , where xx = parameter group, yy = parameter index. See also Val ptr on page 50.

Index	Name/Value	Description	Val./Def.	Page																																																										
05 WINDER ACT SIGNALS		Signals for monitoring the winder (read-only)																																																												
5.01	WINDER SW1	Winder status word 1	-	56, 67, 69, 71, 73, 75, 76, 76, 78, 80																																																										
		<table><tr><th>Bit</th><th>Name</th><th>Val.</th><th>Description</th></tr><tr><td rowspan="2">0</td><td rowspan="2">FULL ROLL</td><td>0</td><td>Partial roll</td></tr><tr><td>1</td><td>Roll diameter equals full roll</td></tr><tr><td rowspan="2">1</td><td rowspan="2">REV REG OUT</td><td>0</td><td>Controller output is not reversed</td></tr><tr><td>1</td><td>Controller output is reversed</td></tr><tr><td rowspan="2">2</td><td rowspan="2">REV REF</td><td>0</td><td>Speed reference is not reversed</td></tr><tr><td>1</td><td>Speed reference is reversed</td></tr><tr><td rowspan="2">3</td><td rowspan="2">WEB LOSS</td><td>0</td><td>No web loss detected</td></tr><tr><td>1</td><td>Web loss detected</td></tr><tr><td rowspan="2">4</td><td rowspan="2">TORQ MEM ON</td><td>0</td><td>Torque memory not active</td></tr><tr><td>1</td><td>Torque memory activated</td></tr><tr><td rowspan="2">5</td><td rowspan="2">STALL ACTIVE</td><td>0</td><td>No stall tension active</td></tr><tr><td>1</td><td>Stall tension activated</td></tr><tr><td rowspan="2">6</td><td rowspan="2">DIAMETER HOLD</td><td>0</td><td>Diameter hold not active</td></tr><tr><td>1</td><td>Diameter hold active</td></tr><tr><td>7</td><td>Not used</td><td></td><td></td></tr><tr><td>...</td><td></td><td></td><td></td></tr><tr><td>15</td><td></td><td></td><td></td></tr></table>	Bit	Name	Val.	Description	0	FULL ROLL	0	Partial roll	1	Roll diameter equals full roll	1	REV REG OUT	0	Controller output is not reversed	1	Controller output is reversed	2	REV REF	0	Speed reference is not reversed	1	Speed reference is reversed	3	WEB LOSS	0	No web loss detected	1	Web loss detected	4	TORQ MEM ON	0	Torque memory not active	1	Torque memory activated	5	STALL ACTIVE	0	No stall tension active	1	Stall tension activated	6	DIAMETER HOLD	0	Diameter hold not active	1	Diameter hold active	7	Not used			...				15					
Bit	Name	Val.	Description																																																											
0	FULL ROLL	0	Partial roll																																																											
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7	Not used																																																													
...																																																														
15																																																														
5.03	TEN CTRLMODE ACK	Tension control mode acknowledgement	-	65, 67, 69, 71, 73, 75																																																										
	STOPPED	Tension/dancer control not active	0																																																											
	OPEN LOOP	Open loop tension control active	1																																																											
	TEN TORQ TRIM	Tension control with torque trim active	2																																																											
	TEN SPD TRIM	Tension control with speed trim active	3																																																											
	DAN SPD TRIM	Dancer control with speed trim active	4																																																											
5.04	FB TENDAN REF	Tension reference from the fieldbus (fieldbus reference 2) as a percentage of parameter • 83.12 MAX TENSION, if 83.02 TENSION CTRLMODE setting = TEN TORQ TRIM or TEN SPD TRIM, or • 83.13 MAX DAN TRAVEL, if 83.02 TENSION CTRLMODE setting = DAN SPD TRIM.	-																																																											
	0...100%	Range																																																												
5.05	DIAMETER ACT	Actual filtered diameter	-	57, 62, 71																																																										
	0...10000 mm	Range																																																												

Index	Name/Value	Description	Val./Def.	Page
5.06	DIAMETER PERC	Actual diameter as a percentage of the full roll	-	57, 62, 65
	0...200%	Range		
5.07	DIAMETER RATIO	Ratio of the actual diameter to the core	-	57, 69, 78
	0...100	Range		
5.08	SPD REF DIA COMP	Diameter scaled speed reference output from the winder reference modification	-	78
	-30000...30000 rpm	Range		
5.09	TENSION ACT	Actual tension from the load cell	-	56, 65
	-1000...1000 N·m	Range		
5.10	DANCER POS	Position of the dancer arm	-	65
	0...3000 mm	Range		
5.11	REG REF TAPERED	Tapered tension or dancer reference as a percentage of parameter • 83.12 MAX TENSION, if 83.02 TENSION CTRLMODE setting = TEN TORQ TRIM or TEN SPD TRIM, or • 83.13 MAX DAN TRAVEL, if 83.02 TENSION CTRLMODE setting = DAN SPD TRIM.	-	65, 71
	-1000...1000%	Range		
5.12	REGULATOR OUT	Output of the tension or dancer control as a percentage of parameter • 83.12 MAX TENSION, if 83.02 TENSION CTRLMODE setting = TEN TORQ TRIM or TEN SPD TRIM, or • 83.13 MAX DAN TRAVEL, if 83.02 TENSION CTRLMODE setting = DAN SPD TRIM.	-	65
	-1000...1000%	Range		
5.13	REG OUT TRIMMED	Trimmed output of the tension or dancer control as a percentage of parameter • 83.12 MAX TENSION, if 83.02 TENSION CTRLMODE setting = TEN TORQ TRIM or TEN SPD TRIM, or • 83.13 MAX DAN TRAVEL, if 83.02 TENSION CTRLMODE setting = DAN SPD TRIM.	-	65, 69, 71
	-1000...1000%	Range		
5.14	TORQUE LIM NCTRL	Torque limit of the speed controller	-	67, 71
	-1000...1000%	Range		
5.15	TORQUE TRIM	Torque trim from the tension control, added to the final torque reference	-	71
	-1000...1000%	Range		
5.16	SPEED CORRECTION	• Speed correction calculated from the tension or dancer controller output, if 83.02 TENSION CTRLMODE setting = TEN SPD TRIM or DAN SPD TRIM, or • Overspeed reference, if 83.02 TENSION CTRLMODE setting = TEN TORQ TRIM or OPEN LOOP	-	69, 75
	-30000...30000 rpm	Range		
5.17	INERTIA EST	Estimated total inertia	-	62
	0...32767 kgm ²	Range		
5.18	INRT COMP TIME	Inertia compensation derivation time from the inertia calculation	-	
	-1000...1000%	Range		

Index	Name/Value	Description	Val./Def.	Page
5.19	FRICTION COMP	Frictional compensation term (static + dynamic)	-	59, 71
	-2000...2000 N·m	Range		
5.20	TORQUE MEM	Memorized torque. Torque boost included.	-	67, 73
	-1000...1000%	Range		
5.21	LINE SPDREF	Line speed reference as a percentage of the maximum line speed	-	
	0...100%	Range		
5.22	REG ERROR	Control error of the tension/dancer controller. Error = reference - feedback.	-	
	-1000...1000%	Range		
40 FLUX CONTROL		Flux control variables. Improves the stability of a system by decreasing the amount of electrical motor flux when low torque requirements are present.		
40.70	FLUX REF/MAX	Maximum flux reference. Used if 40.71 ACTIVE FLUX CTRL is NO or if the required motor torque is > 30%.	100%	82
	0.0...100.0%	Range		
40.71	ACTIVE FLUX CTRL	Activates/deactivates the active flux control.	NO	82
	NO	Motor flux percentage equals 40.70 FLUX REF/MAX .	0	
	YES	Motor flux percentage comes from the active program control.	1	
40.72	FLUX REF 2	Motor flux percentage active while no run signal is present or when the required motor torque is > 10% and < 30%.	60%	82
	30.0...100.0%	Range		
40.73	FLUX MIN	Motor flux percentage active while the required motor torque is < 10%.	25%	82
	0.0...100.0%	Range		
40.74	FLUX RAMP RATE	The time it takes for the flux to ramp from 40.73 FLUX MIN to 40.70 FLUX REF/MAX when 40.71 ACTIVE FLUX CTRL is set to YES.	3 s	82
	0.0...100.0 s	Range		
80 WINDER CONTROL		Winder control and setup		
80.01	WINDING MODE	Selects whether the driven machine acts as a winder or unwinder. See the figure below.	WIND	56, 71, 76
	WIND	Material is wound to the core.	0	
	UNWIND	Material is unwound from the roll.	1	
80.02	WINDING DIR	Direction of rotation of the motor when material is wound to the core (roll diameter is increasing). See the figure below.	POS	76
	POS	• Positive direction of the motor: Material is wound to the core. • Negative direction of the motor: Material is unwound from the roll.	0	
	NEG	• Negative direction of the motor: Material is wound to the core. • Positive direction of the motor: Material is unwound from the roll.	1	

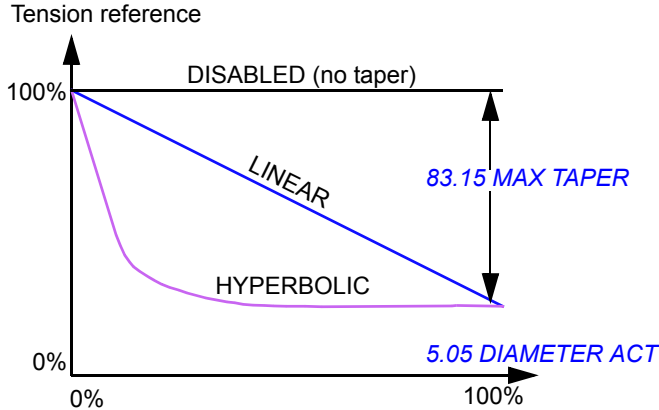
Index	Name/Value	Description	Val./Def.	Page
 <i>Direction of the driven machine</i>				
80.03	PROCESS STOP	Activates/deactivates process stop. The parameter is used to stop the process within the time defined by parameter 81.03 PROCESS STP TIME irrespective of the actual diameter.	C.True	78
	C.False	Process stop activated	0	
	C.True	Process stop not activated	1	

Index	Name/Value	Description	Val./Def.	Page																																																																												
80.04	WINDER CW1	Winder control word 1	-																																																																													
		<table><tr><th>Bit</th><th>Name</th><th>Val.</th><th>Description</th></tr><tr><td rowspan="2">0</td><td rowspan="2">UNWIND</td><td>0</td><td>Command to wind</td></tr><tr><td>1</td><td>Command to unwind</td></tr><tr><td rowspan="2">1</td><td rowspan="2">PROCESS STOP</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Activate process stop</td></tr><tr><td rowspan="2">2</td><td rowspan="2">OPEN LOOP CTRL</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Force open loop control</td></tr><tr><td rowspan="2">3</td><td rowspan="2">INRTCOMP DISABLE</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Disable inertia compensation</td></tr><tr><td rowspan="2">4</td><td rowspan="2">DIA RESET</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Reset diameter</td></tr><tr><td rowspan="2">5</td><td rowspan="2">DIA PRESET</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Preset diameter</td></tr><tr><td rowspan="2">6</td><td rowspan="2">DIA HOLD</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Frozen diameter calculation</td></tr><tr><td rowspan="2">7</td><td rowspan="2">TORQ MEM SAMPLE</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Enable torque memory sampling</td></tr><tr><td rowspan="2">8</td><td rowspan="2">TORQ MEM ENA</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Use memorized torque as torque reference</td></tr><tr><td rowspan="2">9</td><td rowspan="2">REG CTRL DISABLE</td><td>0</td><td>Normal operation</td></tr><tr><td>1</td><td>Disable regulator control (forces pure speed control)</td></tr><tr><td>10</td><td>Not used</td><td></td><td></td></tr><tr><td>...</td><td></td><td></td><td></td></tr><tr><td>15</td><td></td><td></td><td></td></tr></table>	Bit	Name	Val.	Description	0	UNWIND	0	Command to wind	1	Command to unwind	1	PROCESS STOP	0	Normal operation	1	Activate process stop	2	OPEN LOOP CTRL	0	Normal operation	1	Force open loop control	3	INRTCOMP DISABLE	0	Normal operation	1	Disable inertia compensation	4	DIA RESET	0	Normal operation	1	Reset diameter	5	DIA PRESET	0	Normal operation	1	Preset diameter	6	DIA HOLD	0	Normal operation	1	Frozen diameter calculation	7	TORQ MEM SAMPLE	0	Normal operation	1	Enable torque memory sampling	8	TORQ MEM ENA	0	Normal operation	1	Use memorized torque as torque reference	9	REG CTRL DISABLE	0	Normal operation	1	Disable regulator control (forces pure speed control)	10	Not used			...				15					
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15																																																																																
80.05	SPEED@CORE DIA	Maximum rotational speed in rpm for the winder at the core (minimum diameter). The value is calculated as follows: $\text{SPEED@CORE DIA} = \frac{L_{\text{max}} \cdot \text{Gear ratio}}{D_{\text{core}} \cdot \text{Pi}} = \frac{L_{\text{max}} \cdot \text{Par } 80.06}{\text{Par } 82.04 \cdot \text{Pi}}$ where L_{max} = maximum line speed in m/min It is strongly advised to confirm the calculated value during the start-up. Check the surface speed of the sections with a tachometer (hand tach). Then, without changing speeds, check the surface speed of the roll. Adjust 80.05 SPEED@CORE DIA to match the roll surface speed to the line speed if needed.	1500 rpm	59, 69, 80																																																																												
	0...30000 rpm	Range																																																																														
80.06	GEAR RATIO	Ratio of the motor rpm to the spindle rpm when the spindle rpm is scaled as 1. Example: Set parameter value to 2 if the motor rotates two rounds as the spindle rotates one round (2:1).	1	56, 62, 71																																																																												
	0.1...1000	Range																																																																														

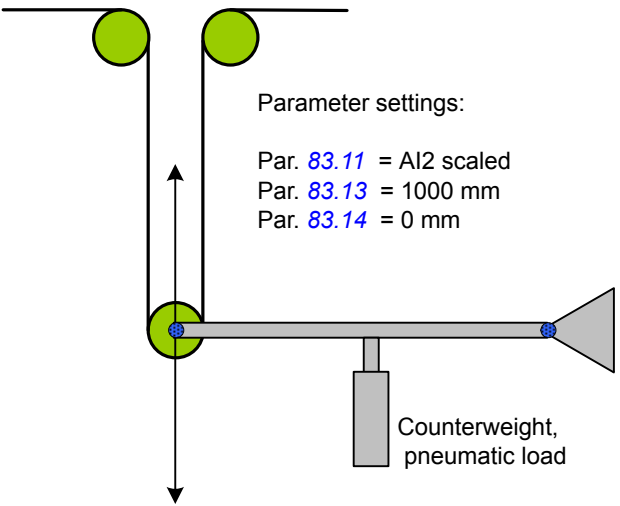
Index	Name/Value	Description	Val./Def.	Page
80.07	WEB LOSS	Enables/disables the web loss detection and selects how the drive reacts when a web loss is detected.	DISABLED	75
	DISABLED	Web loss detection disabled.	0	
	ALARM	Web loss detection enabled. An alarm is generated when a web loss is detected.	1	
	FAULT	Web loss detection enabled. A fault is generated when a web loss is detected.	2	
80.08	WEB LOSS FBK SRC	Source of the web loss feedback. Feedback is given as a percentage (0...100%) of parameter • 83.12 MAX TENSION, if 83.02 TENSION CTRLMODE setting = TEN TORQ TRIM or TEN SPD TRIM, or • 83.13 MAX DAN TRAVEL, if 83.02 TENSION CTRLMODE setting = DAN SPD TRIM. See the functionality description of the WEBLOSS custom circuit on page 74 .	P.05.09	75
80.09	WEB LOSS LEVEL	Percentage level interpreted as a web loss	2%	75
	0...100%	Range		
80.10	WEB LOSS DELAY	Time delay before the web loss fault is set	1 s	75
	0...100 s	Range		
81 WINDER REF MOD		Ramping time adjustments and winder-related speed reference adaptation setup		
81.01	ACC TIME	Acceleration time from zero to the speed defined by parameter 25.02 SPEED SCALING (see the drive <i>Firmware Manual</i>)	5 s	78
	0...1800 s	Range		
81.02	DEC TIME	Deceleration time from the speed defined by parameter 25.02 SPEED SCALING (see the drive <i>Firmware Manual</i>) to zero	5 s	78
	0...1800 s	Range		
81.03	PROCESS STP TIME	Time within which the drive is stopped from the speed defined by parameter 25.02 SPEED SCALING (see the drive <i>Firmware Manual</i>) if process stop is activated by parameter 80.03 PROCESS STOP	5 s	78
	0...1800 s	Range		
81.04	OVERSPD REF MUL	Multiplier of the ramped speed reference for the overspeed reference	10%	69
	0...100%	Range		
81.05	OVERSPD REF ADD	Value of the parameter is added to the speed reference. Value is given as a percentage of parameter 80.05 SPEED@CORE DIA .	1%	69
	0...1000%	Range		
81.06	SPD TRIM MUL SRC	Defines the source for tension to speed conversion. PI controller output is multiplied by the value of this source.	P.80.05	69
	SPEED REF ACT	Final speed reference is used as a multiplier.	P.03.04	
	SPEED REF MAX	Parameter 80.05 SPEED@CORE DIA is used as a multiplier.	P.80.05	
81.07	MIN REF TO REG	Minimum reference to be used when parameter 81.06 SPD TRIM MUL SRC is set to SPEED REF ACT. By using this value, a zero speed reference can be avoided.	100 rpm	69
	0...1000 rpm	Range		

Index	Name/Value	Description	Val./Def.	Page
82 DIAMETER CALC		Diameter calculation control and setup. In winder/unwinder applications, set group parameters to define the conditions and slope of the diameter calculation. In infeed applications, set the roll diameter to parameter 82.04 CORE DIAMETER and disable diameter calculation by setting parameters 82.07 COUNT UP ENA and 82.08 COUNT DOWN ENA to C.False. The rest of the group parameters can be left at their default values.		
82.01	DIA CALC MODE	Mode for calculating the actual diameter of the roll	INTERNAL	56
	INTERNAL	Diameter is calculated internally as the ratio of the actual speed and the line speed reference. The rate of change of the actual diameter is limited according to the web thickness.	0	
	EXT FBK	External feedback sensor value is used as the source of the actual diameter. The rate of change of the actual diameter is limited according to the web thickness.	1	
	EXT FBK@STOP	External feedback sensor value is used as the source of the actual diameter when the internal diameter calculation is frozen. Otherwise the internal calculator is used. The rate of change of the actual diameter is limited according to the web thickness. The internal calculator is frozen • at the zero speed • according to parameter 82.12 MIN SPD DIA CALC • according to parameter 82.13 MIN TEN DIA CALC • when 82.09 DIA RESET ENA or 82.10 DIA PRESET ENA is activated • when jogging speed is activated • when a web loss occurs (= web loss bit in the winder SW1 is set to 1).	2	
82.02	DIAMETER FBK SRC	Source of the actual diameter feedback Note: The feedback source has to be scaled according to min/max diameter in [mm]. Example: Let us assume that • AI1 scaled is the diameter feedback source • 82.04 CORE DIAMETER = 100 mm • 82.05 FULL ROLL DIA = 1000 mm. AI1 has to be scaled accordingly, ie, AI1 MIN SCALE = 100 and AI1 MAX SCALE = 1000.	P.02.05	56
82.03	DIA ACT FTIME	Filter time diameter (1st order low pass filter)	0 s	56
	0...1 s	Range		
82.04	CORE DIAMETER	Diameter of the core (minimum diameter)	1 mm	56 , 62
	0...4000 mm	Range		
82.05	FULL ROLL DIA	Diameter of the full roll (maximum diameter)	1 mm	56
	0...10000 mm	Range		

Index	Name/Value	Description	Val./Def.	Page
82.06	WEB THICKNESS	Material thickness in millimeters. Set to a value larger than the thickest material that will be run through the machine. If the value entered is too small, the calculator cannot keep up with the actual rate of change of the machine. For a wire winding application, enter a value equivalent to the wire diameter divided by the number of turns needed to complete one full width of the spool.	0.01 mm	56
	0...500 mm	Range		
82.07	COUNT UP ENA	Activates/deactivates the diameter up-count. In infeed applications, disable the count by setting the parameter to C.False.	C.True	56
	C.False	Diameter up-count not activated	0	
	C.True	Diameter up-count activated	1	
82.08	COUNT DOWN ENA	Activates/deactivates the diameter down-count. In infeed applications, disable the count by setting the parameter to C.False.	C.True	56
	C.False	Diameter down-count not activated	0	
	C.True	Diameter down-count activated	1	
82.09	DIA RESET ENA	Activates/deactivates the diameter reset. If parameter 80.01 WINDING MODE is set to WIND, the diameter value is reset to the core diameter. If parameter 80.01 WINDING MODE is set to UNWIND, the diameter value is reset to the full roll diameter.	C.False	56
	C.False	Diameter reset not activated	0	
	C.True	Diameter reset activated	1	
82.10	DIA PRESET ENA	Activates/deactivates the diameter preset to the value defined by parameter 82.11 DIAMETER PRESET	C.False	56
	C.False	Diameter preset not activated	0	
	C.True	Diameter preset activated	1	
82.11	DIAMETER PRESET	Value to which the diameter is preset	0 mm	56
	0...10000 mm	Range		
82.12	MIN SPD DIA CALC	Speed below which the diameter calculation is frozen. Given as a percentage of 80.05 SPEED@CORE DIA.	0%	56
	0...100%	Range		
82.13	MIN TEN DIA CALC	Tension or dancer position below which the diameter calculation is frozen. Given as percentage of parameter • 83.12 MAX TENSION, if 83.02 TENSION CTRLMODE setting = TEN TORQ TRIM or TEN SPD TRIM, or • 83.13 MAX DAN TRAVEL, if 83.02 TENSION CTRLMODE setting = DAN SPD TRIM.	0%	56
	0...100%	Range		
82.14	THICK START MUL	Multiplier for widening the range of the allowed change rate of the actual diameter at start. Setting parameter to 2 doubles the allowed rate of the actual diameter change. Widening can be used at start with partial rolls to correct the possible error between the actual and estimated diameter of the roll. Might cause oscillation in torque.	1	56
	0.01...10	Range		
82.15	THICK START TIME	Delay after which the multiplication defined by parameter 82.14 THICK START MUL is no longer effective. The delay counter is started by the rising edge of the diameter update enable.	3 s	56
	0...60 s	Range		

Index	Name/Value	Description	Val./Def.	Page
83 TEN & DAN CTRL		Tension and dancer control and setup		
83.01	REG CTRL ENA	Activates/deactivates the tension/dancer controller	C.True	65
	C.False	Tension/dancer controller not activated	0	
	C.True	Tension/dancer controller activated	1	
83.02	TENSION CTRLMODE	Selects the used tension control mode	OPEN LOOP	65
	OPEN LOOP	Selects the open loop tension control	0	
	TEN TORQ TRIM	Selects the tension control with torque trim	1	
	TEN SPD TRIM	Selects the tension control with speed trim. See section Tension control on page 13.	2	
	DAN SPD TRIM	Selects the dancer control with speed trim	3	
83.03	TAPER MODE	Selects the used taper mode. The taper function allows to reduce or increase the tension of the web as the material builds (diameter increases). Can be used to control roll hardness and to prevent the roll starring or crushing of the core. 	DISABLED	65
	DISABLED	Taper function is disabled.	0	
	LINEAR	If parameter 83.15 MAX TAPER is positive, the tension reference is decreased linearly as the roll diameter increases. If parameter 83.15 MAX TAPER is negative, the tension reference is increased linearly as the roll diameter increases.	1	
	HYPERBOLIC	If parameter 83.15 MAX TAPER is positive, the tension reference is decreased hyperbolically as the roll diameter increases. If parameter 83.15 MAX TAPER is negative, the tension reference is increased hyperbolically as the roll diameter increases.	2	
83.04	OPEN LOOP FORCE	Forces open loop (disables 5.09 TENSION ACT and 5.10 DANCER POS). If activated, the tension mode is OPEN LOOP. (Tension/dancer control PID controller is disabled.)	C.False	65
	C.False	Open loop not activated	0	
	C.True	Open loop activated	1	
83.05	TRIM RANGE	Amount of allowed correction to the torque/speed reference by the PI controller output	5%	65
	0...100%	Range		

Index	Name/Value	Description	Val./Def.	Page
83.06	STALL ENA	Activates/deactivates the stall function	C.False	80
	C.False	Stall function not activated	0	
	C.True	Stall function activated	1	
83.07	CORE GAIN	Tension controller gain used for the core (minimum diameter)	10	65, 80
	0...1000	Range		
83.08	FULL ROLL GAIN	Tension controller gain used for the full roll	10	65, 80
	0...1000	Range		
83.09	INTEGRATION TIME	Integration time of the tension control	1 s	65, 80
	0...100 s	Range		
83.10	REG REF SRC	Source of the controller input reference (%). In the dancer control (83.02 TENSION CTRLMODE setting = DAN SPD TRIM), the parameter is in use only if the drive is used for controlling the dancer loading. In the tension control modes, the parameter selects the source of the tension reference.	P.02.07	65, 80
83.11	REG FBK SRC	Source of the controller feedback (%) In the TENSION TORQUE TRIM and TENSION SPEED TRIM tension control modes, the controller feedback source is scaled according to the value of parameter 83.12 MAX TENSION . 100% corresponds to the set maximum tension value (N). In the DANCER SPEED TRIM tension control mode, the scaling is done according to the value of parameter 83.13 MAX DAN TRAVEL . 100% corresponds to the set maximum dancer travel (mm).	P.02.07	65
83.12	MAX TENSION	Scales the reference given as a percentage (83.10 REG REF SRC) to N	10 N	65, 71
	0...30000 N	Range		
83.13	MAX DAN TRAVEL	Scales the reference given as a percentage (83.10 REG REF SRC) to mm. The parameter is used only if parameter 83.02 TENSION CTRLMODE setting = DAN SPD TRIM.	1000 mm	65
	0...3000 mm	Range		

Index	Name/Value	Description	Val./Def.	Page
83.14	DAN CENTEROFFSET	Offset of the dancer. The parameter is used only if parameter 83.02 TENSION CTRLMODE setting = DAN SPD TRIM. The default setting 0 mm corresponds to 50% of the value of parameter 83.13 MAX DAN TRAVEL . The figure below presents one possible dancer configuration.	0 mm	65
Par. 5.10 and 83.13 1000 mm ----- 500 mm ----- 0 mm ----- Par. 83.11 100% ----- 50% ----- 0 % ----- Par. 83.14 500 mm ----- 0 mm ----- -500 mm -----  Parameter settings: Par. 83.11 = AI2 scaled Par. 83.13 = 1000 mm Par. 83.14 = 0 mm Counterweight, pneumatic load				
	-1500...1500 mm	Range		
83.15	MAX TAPER	Maximum allowed taper increased/decreased from the tension reference	2%	65
	-100...100%	Range		
83.16	REG STALL REF	Tension reference as a percentage of the maximum tension in the stall mode	0%	80
	0...100%	Range		
83.17	STALL SPEED	Stall speed level as a percentage of the maximum speed 80.05 SPEED@CORE DIA	0%	80
	0...100%	Range		
83.18	STALL REG GAIN	Tension controller gain in the stall mode	10	80
	0...1000	Range		
83.19	STALL INT TIME	Tension controller integration time in the stall mode	1 s	80
	0...100 s	Range		
84 INERTIA COMP		Inertia compensation control and setup		
84.01	INERTIA COMP ENA	Enables/disables the inertia compensation	C.False	62
	C.False	Inertia compensation disabled	0	
	C.True	Inertia compensation enabled	1	

Index	Name/Value	Description	Val./Def.	Page																
84.02	ROLL WEIGHT SEL	Selects whether the calculated or user given roll weight is used for the inertia calculation	CALCULATED	62																
	CALCULATED	Roll weight is calculated using parameters 84.05 WEB DENSITY and 84.06 WEB WIDTH .	0																	
	PAR 84.04	Value of parameter 84.04 FULL ROLL WEIGHT is used as the roll weight.	1																	
84.03	FIXED INERTIA	Fixed inertia, includes the inertia of the motor, shaft and gearing. Inertia of the shaft and gearbox must be reflected on the motor side. Fixed inertia = Motor inertia + $\frac{\text{Gear inertia} + \text{Shaft inertia}}{\text{Gear ratio}^2}$	0 kgm2	62																
	0...30000 kgm2	Range																		
84.04	FULL ROLL WEIGHT	Weight of the full roll	0 kg	62																
	0...30000 kg	Range																		
84.05	WEB DENSITY	Density of the web material. The parameter is not used if parameter 84.02 ROLL WEIGHT SEL = PAR 84.04. The table below gives examples of the densities for some materials. In a wire winding application, density values smaller than the actual density of the material can be used since the material is not necessarily wound evenly to the spool and the inertia will therefore be smaller. <table border="1"><thead><tr><th>Material</th><th>Density (kg/m³)</th></tr></thead><tbody><tr><td>Steel</td><td>7800</td></tr><tr><td>Aluminium</td><td>2700</td></tr><tr><td>Copper</td><td>8960</td></tr><tr><td>Paper</td><td>700...1200</td></tr><tr><td>Rubber (soft)</td><td>900...1100</td></tr><tr><td>Nylon</td><td>1100</td></tr><tr><td>Wool</td><td>1300</td></tr></tbody></table>	Material	Density (kg/m ³)	Steel	7800	Aluminium	2700	Copper	8960	Paper	700...1200	Rubber (soft)	900...1100	Nylon	1100	Wool	1300	0 kg/m3	62
Material	Density (kg/m ³)																			
Steel	7800																			
Aluminium	2700																			
Copper	8960																			
Paper	700...1200																			
Rubber (soft)	900...1100																			
Nylon	1100																			
Wool	1300																			
	10...15000 kg/m3	Range																		
84.06	WEB WIDTH	Width of the web material. The parameter is not used if parameter 84.02 ROLL WEIGHT SEL = PAR 84.04.	0 mm	62																
	0...10000 mm	Range																		

Index	Name/Value	Description	Val./Def.	Page
85 FRICTION COMP		Friction compensation control and setup. Static friction is the static mechanical friction of the section. Dynamic (linear) friction is an additional friction loss component as a function of the roll speed. Proper friction compensation is essential especially in the open loop tension control to improve accuracy of the tension control. For proper adjustment of the friction compensation, you can use the following procedure: 1. Place an empty core into the section. 2. Deactivate the tension control by setting 83.01 REG CTRL ENA = C.False. 3. Deactivate the inertia compensation by setting 84.01 INERTIA COMP ENA = C.False. Check that all parameter values in group 85 FRICTION COMP are set to zero. 4. Change to local control (eg, from the panel) and set the speed reference to 10% of the maximum ($0.1 \cdot 80.05 \text{ SPEED@CORE DIA}$). Start the drive. 5. Multiply the average of 1.06 TORQUE by 99.12 MOT NOM TORQUE and enter the product to 85.01 STATIC FRICTION. 6. Increase the speed to 20% of 80.05 SPEED@CORE DIA. 7. Multiply the average of 1.06 TORQUE by 99.12 MOT NOM TORQUE and subtract 85.01 STATIC FRICTION from the result. Multiply the product by 0.8 and enter the product to 85.02 DYN FRICTION@20. 8. Increase the speed to 40% of 80.05 SPEED@CORE DIA. 9. Multiply the average of 1.06 TORQUE by 99.12 MOT NOM TORQUE and subtract 85.01 STATIC FRICTION from the result. Multiply the product by 0.8 and enter the product to 85.03 DYN FRICTION@40. 10. Increase the speed to 60% of 80.05 SPEED@CORE DIA. 11. Multiply the average of 1.06 TORQUE by 99.12 MOT NOM TORQUE and subtract 85.01 STATIC FRICTION from the result. Multiply the product by 0.8 and enter the product to 85.04 DYN FRICTION@60. 12. Increase the speed to 80% of 80.05 SPEED@CORE DIA. 13. Multiply the average of 1.06 TORQUE by 99.12 MOT NOM TORQUE and subtract 85.01 STATIC FRICTION from the result. Multiply the product by 0.8 and enter the product to 85.05 DYN FRICTION@80. 14. Increase the speed to 80.05 SPEED@CORE DIA. 15. Multiply the average of 1.06 TORQUE by 99.12 MOT NOM TORQUE and subtract 85.01 STATIC FRICTION from the result. Multiply the product by 0.8 and enter the product to 85.06 DYN FRICTION@100.		
85.01	STATIC FRICTION	Mechanical friction of the section	0 N·m	59
	-1000...1000 N·m	Range		
85.02	DYN FRICTION@20	Dynamic friction component at 20% of the maximum speed 80.05 SPEED@CORE DIA	0 N·m	59
	-1000...1000 N·m	Range		
85.03	DYN FRICTION@40	Dynamic friction component at 40% of the maximum speed 80.05 SPEED@CORE DIA	0 N·m	59
	-1000...1000 N·m	Range		

Index	Name/Value	Description	Val./Def.	Page
85.04	DYN FRICTION@60	Dynamic friction component at 60% of the maximum speed 80.05 SPEED@CORE DIA	0 N·m	59
	-1000...1000 N·m	Range		
85.05	DYN FRICTION@80	Dynamic friction component at 80% of the maximum speed 80.05 SPEED@CORE DIA	0 N·m	59
	-1000...1000 N·m	Range		
85.06	DYN FRICTION@100	Dynamic friction component at the maximum speed 80.05 SPEED@CORE DIA	0 N·m	59
	-1000...1000 N·m	Range		
86 TORQ MEM CTRL		Torque memory control and setup		
86.01	TORQ MEM SAMPLE	Activates/deactivates the torque memory sampling	C.False	73
	C.False	Torque memory sampling not activated	0	
	C.True	Torque memory sampling activated	1	
86.02	TORQ MEM ENA	Activates/deactivates the torque memory usage (torque memory used as the torque reference)	C.False	73
	C.False	Torque memory usage not activated	0	
	C.True	Torque memory usage activated	1	
86.03	TORQ BOOST	Boost as a percentage of the memorized torque	0%	73
	-300...300%	Range		
86.04	BOOST ON DELAY	Delay time from the enable signal 86.02 TORQ MEM ENA to the activation of the torque boost	5 s	73
	0...1000 s	Range		

Fieldbus control

What this chapter contains

This chapter describes how the winder control program communicates with the external devices through the serial communication interfaces.

Supported fieldbus profiles

The winder control program supports fieldbus profiles (parameter 51.05 PROFILE) PROFIdrive and ABB Drives Profile. Transparent 16, transparent 32 and PROFIdrive motion profiles are not supported for referencing. To set up the bus configuration, refer to the corresponding fieldbus adapter manual (includes also the contents of the main status and control words).

FBA reference 1 / FBA actual signal 1

FBA reference 1 (parameter 2.14 FBA MAIN REF1) is always considered as the line speed reference. 16-bit references must be used. **The line speed reference is always handled as an absolute value.** Whenever needed, the direction (wind/unwind) can be changed with parameter [80.01 WINDING MODE](#) or with bit 0 of parameter [80.04 WINDER CW1](#).

FBA actual signal 1 is always considered as the actual line speed. 16-bit actual values must be used. The direction is indicated by the sign of the value.

PROFIdrive scaling

0...0x4000 (0...16384) corresponds to 0...100% of the maximum line speed (parameter [80.05 SPEED@CORE DIA](#)) in the reference and actual values.

ABB Drives scaling

0...0x4E20 (0...20000) corresponds to 0...100% of the maximum line speed (parameter [80.05 SPEED@CORE DIA](#)) in the reference and actual values.

FBA reference 2 / FBA actual signal 2

FBA reference 2 (parameter 2.15 FBA MAIN REF2) is always considered as the tension reference or dancer load setpoint, depending on the selected tension control mode (parameter [83.02 TENSION CTRLMODE](#)). 16-bit references must be used.

FBA actual signal 2 is always considered as the actual tension or dancer position, depending on the selected tension control mode. Actual tension is not available in the OPEN LOOP tension control mode. 16-bit actual values must be used.

PROFIdrive and ABB Drives scaling

0...0x2710 (0...10000) corresponds to 0...100% of the maximum tension or maximum dancer travel (parameters [83.12 MAX TENSION](#) and [83.13 MAX DAN TRAVEL](#)) in the reference and actual values.

Control and status

The main control word of the drive is used for the common drive controls, such as start/stop. The winder control word ([80.04 WINDER CW1](#)) includes winder specific controls, such as diameter hold and wind/unwind selection.

Similarly, the main status words of the drive (6.01 STATUS WORD 1 and 6.02 STATUS WORD 2) show common drive status signals, such as running or fault active. The winder status word ([5.01 WINDER SW1](#)) includes winder specific status signal, such as web loss, etc.

Example of settings for the PROFIBUS

Typical settings for the winder control program with FBA control are shown in the table below. After the settings are completed, they must be activated by setting parameter 51.27 FBA PAR REFRESH to value REFRESH. Its value will automatically revert to DONE. For parameter descriptions, see the drive *Firmware Manual*.

Index	Signal/Parameter	Value	Note
50.01*	FBA ENABLE	ENABLE	
50.04*	FBA REF1 MODESEL	SPEED	Locked
50.05*	FBA REF2 MODESEL	RAW DATA	Locked
10.01*	EXT1 START FUNC	FBA	
24.01*	SPEED REF1 SEL	FBA REF 1	
34.03*	EXT1 CTRL MODE	SPEED	
51.02*	NODE ADDRESS	According to the bus configuration	
51.04*	TELEGRAM TYPE	According to the bus configuration	
51.05*	PROFILE	0 = PROFIdrive 1 = ABB Drives	
52.01*	FBA DATA IN1	4	Status word 1
52.02*	FBA DATA IN2	5	Actual value 1 (Line speed)
52.03*	FBA DATA IN3	6	Actual value 2 (Tension)
52.04*	FBA DATA IN4	501	5.01 WINDER SW1
52.05*	FBA DATA IN5	505	5.05 DIAMETER ACT (32 bits)
53.01*	FBA DATA OUT1	1	Control word 1
53.02*	FBA DATA OUT2	2	Reference 1 (Line speed)
53.03*	FBA DATA OUT3	3	Reference 2 (Tension)
53.03*	FBA DATA OUT3	8004	80.04 WINDER CW1 (16 bits)

* Index of the parameter in ACSM1; may be different in other drives.

Technology function blocks and custom circuits

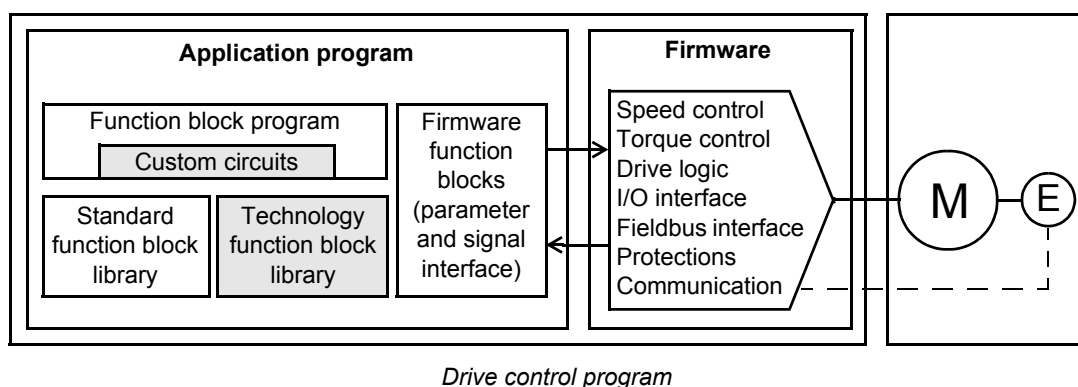
What this chapter contains

This chapter describes the winder-specific technology function blocks and custom circuits and lists the associated input and output signals and parameters.

General

The drive control program is divided into two parts:

- firmware program
- application program.



The firmware program performs the main control functions, including speed and torque control, drive logic (start/stop), I/O, feedback, communication and protection functions. Firmware functions are configured and programmed with parameters. The functions of the firmware program can be extended with the DriveSPC tool. Application programs are built out of function blocks: Firmware, standard and technology function blocks.

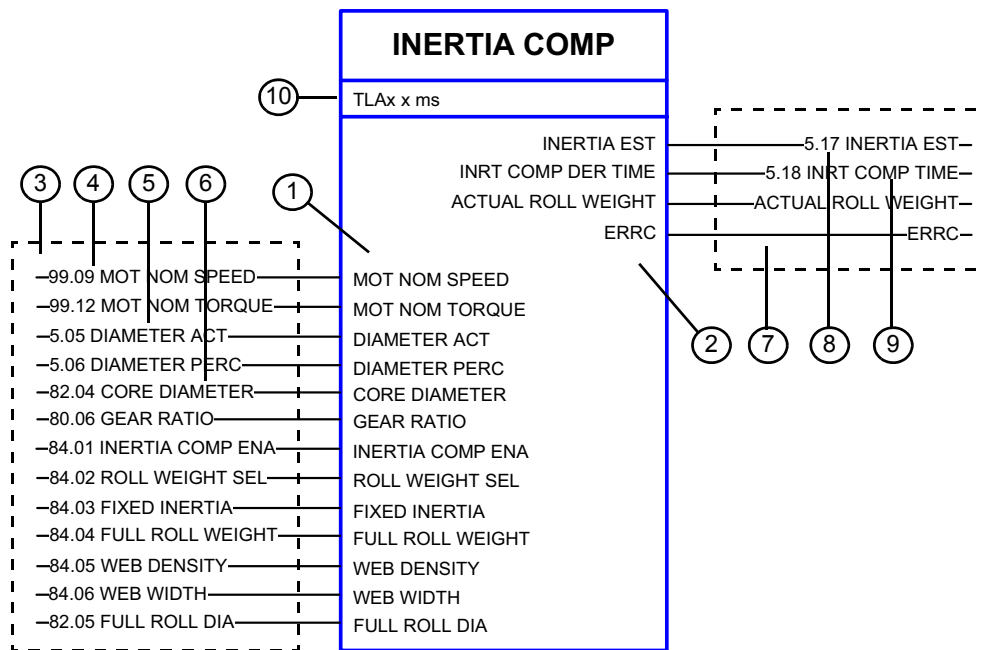
Technology function blocks are application-specific blocks. Custom circuits are application-specific blocks built with standard blocks. Technology function blocks are fixed while custom circuits can be modified by the user.

Firmware function blocks and standard function blocks are described in the drive *Firmware Manual*. Technology function blocks and custom circuits related to the winder control program are described in this supplement.

The drive supports two different programming methods:

- parameter programming
- programming with the DriveSPC tool based on the IEC-61131 standard.

Technology block and custom circuit layout



1	Input parameters of the technology block (custom circuit)
2	Output parameters of the technology block (custom circuit)
3	Inputs from drive general or winder-specific actual signals or parameters, or winder-internal parameters. See section <i>Inputs</i> for the appropriate technology block or custom circuit.
4	Block input parameter MOT NOM SPEED is set to the value of the drive-general parameter 99.09 MOT NOM SPEED.
5	Block input parameter DIAMETER ACT is set to the value of the winder-specific actual signal 5.05 DIAMETER ACT . These actual signals belong to group 5.
6	Block input parameter CORE DIAMETER is set to the value of the winder-specific parameter 82.04 CORE DIAMETER . These parameters belong to groups 80...86.
7	Outputs to drive general or winder-specific actual signals or parameters, or winder-internal parameters. See section <i>Outputs</i> for the appropriate technology block or custom circuit.
8	Winder-specific actual signal 5.17 INERTIA EST is set to the value of the block output parameter INERTIA EST.
9	Winder-specific parameter 5.18 INRT COMP TIME is set to the value of the block output parameter INRT COMP DER TIME.
10	ID of the time level (TLx) and time level (x ms). Time level, ie, update cycle, is application specific.

Actual signals

Actual signals are signals measured or calculated by the drive. They are normally used for monitoring and diagnostics, and cannot be adjusted by the user. Winder-specific actual signals are in group 5.

For additional signal data, eg, description, see chapter [Actual signals and parameters](#).

Parameters

Parameters are user-adjustable operation instructions of the drive. Winder-specific parameters are in groups 40 and 80...86.

For additional parameter data, eg, description and possible value selection list, see chapter [Actual signals and parameters](#).

Terms in the parameter/signal tables

Term	Definition
Actual signal	Signal measured or calculated by the drive. Can be monitored by the user. No user setting is possible.
Data len.	Length of data for fieldbus. May be different from the actual data length in the drive software.
Def	Default value
Enum	Enumerated list, ie, selection list
FbEq	Fieldbus equivalent: The scaling between the value shown on the panel and the integer used in serial communication
INT32	32-bit integer value (31 bits + sign)
Bit ptr	Bit pointer. A bit pointer parameter points to the value of a bit in another signal, or can be fixed to 0 (FALSE) or 1 (TRUE). In addition, bit pointer parameters may have a set of pre-selected choices. When adjusting a bit pointer parameter on the optional control panel, CONST is selected in order to fix the value to 0 (displayed as "C.FALSE") or 1 ("C.TRUE"). POINTER is selected to define a source from another signal. A pointer value is given in format P.xx.yy.zz, where xx = parameter group, yy = parameter index, zz = bit number. Example: Digital input DI5 status, 2.01 DI STATUS bit 4, is used for diameter resetting by setting parameter 82.09 DIA RESET ENA to value P.02.01.04.
Val ptr	Value pointer. A value pointer points to the value of another parameter/signal. The source parameter is given in format P.xx.yy, where xx = parameter group, yy = parameter index. In addition, value pointer parameters may have a set of pre-selected choices. Example: Tension signal, 5.09 TENSION ACT, is connected to analogue output AO1 by setting parameter 15.01 AO1 PTR to value P.05.09.
P.	Page in chapter Actual signals and parameters where the description and possible value selection list for the signal or parameter are shown
Parameter	A user-adjustable operation instruction of the drive
Pb	Packed boolean
PT	Parameter protection type. See WP and WPD.
REAL	$\underbrace{\hspace{1cm}}_{16\text{-bit value}} \underbrace{\hspace{1cm}}_{16\text{-bit value}} (31 \text{ bits} + \text{sign})$ = integer value = fractional value
REAL24	$\underbrace{\hspace{1cm}}_{8\text{-bit value}} \underbrace{\hspace{1cm}}_{24\text{-bit value}} (31 \text{ bits} + \text{sign})$ = integer value = fractional value
Signal	See Actual signal.
Type	Data type. See Enum, INT32, Bit ptr, Val ptr, Pb, REAL, REAL24, UINT32.
UINT32	32-bit unsigned integer value
WP	Write protected parameter (ie, read only)
WPD	Write protected parameter while the drive is running

Fieldbus equivalent

Serial communication data between a fieldbus adapter and drive is transferred in integer format. Thus, the drive actual and reference signal values must be scaled to 16/32-bit integer values. Fieldbus equivalent defines the scaling between the signal value and the integer used in serial communication.

All the read and sent values are limited to 16/32 bits.

Example: If [82.04 CORE DIAMETER](#) is set from an external control system, an integer value of 100 corresponds to 1 mm.

Fieldbus addresses

For FPBA-01 Profibus Adapter, FDNA-01 DeviceNet Adapter and FCAN-01 CANopen Adapter, see the *User's Manual* of the fieldbus adapter module.

Pointer parameter format in fieldbus communication

Value and bit pointer parameters are transferred between the fieldbus adapter and drive as 32-bit integer values.

32-bit integer value pointers

When a value pointer parameter is connected to the value of another parameter or signal, the format is as follows:

	Bit			
	30...31	16...29	8...15	0...7
Name	Source type	Not in use	Group	Index
Value	1	-	1...255	1...255
Description	Value pointer is connected to parameter/signal.	-	Group of source parameter	Index of source parameter

When a value pointer parameter is connected to an application program, the format is as follows:

	Bit		
	30...31	24...29	0...23
Name	Source type	Not in use	Address
Value	2	-	0...2 ²³
Description	Value pointer is connected to application program.	-	Relative address of application program variable

Note: Value pointer parameters connected to an application program cannot be set through the fieldbus (ie, read access only).

32-bit integer bit pointers

When a bit pointer parameter is connected to value 0 or 1, the format is as follows:

	Bit		
	30...31	16...29	0
Name	Source type	Not in use	Value
Value	0	-	0...1
Description	Bit pointer is connected to 0/1.	-	0 = False, 1 = True

When a bit pointer parameter is connected to a bit value of another signal, the format is as follows:

	Bit				
	30...31	24...29	16...23	8...15	0...7
Name	Source type	Not in use	Bit sel	Group	Index
Value	1	-	0...31	2...255	1...255
Description	Bit pointer is connected to signal bit value.	-	Bit selection	Group of source parameter	Index of source parameter

When a bit pointer parameter is connected to an application program, the format is as follows:

	Bit		
	30...31	24...29	0...23
Name	Source type	Bit sel	Address
Value	2	0...31	0...2 ²³
Description	Bit pointer is connected to application program.	Bit selection	Relative address of application program variable

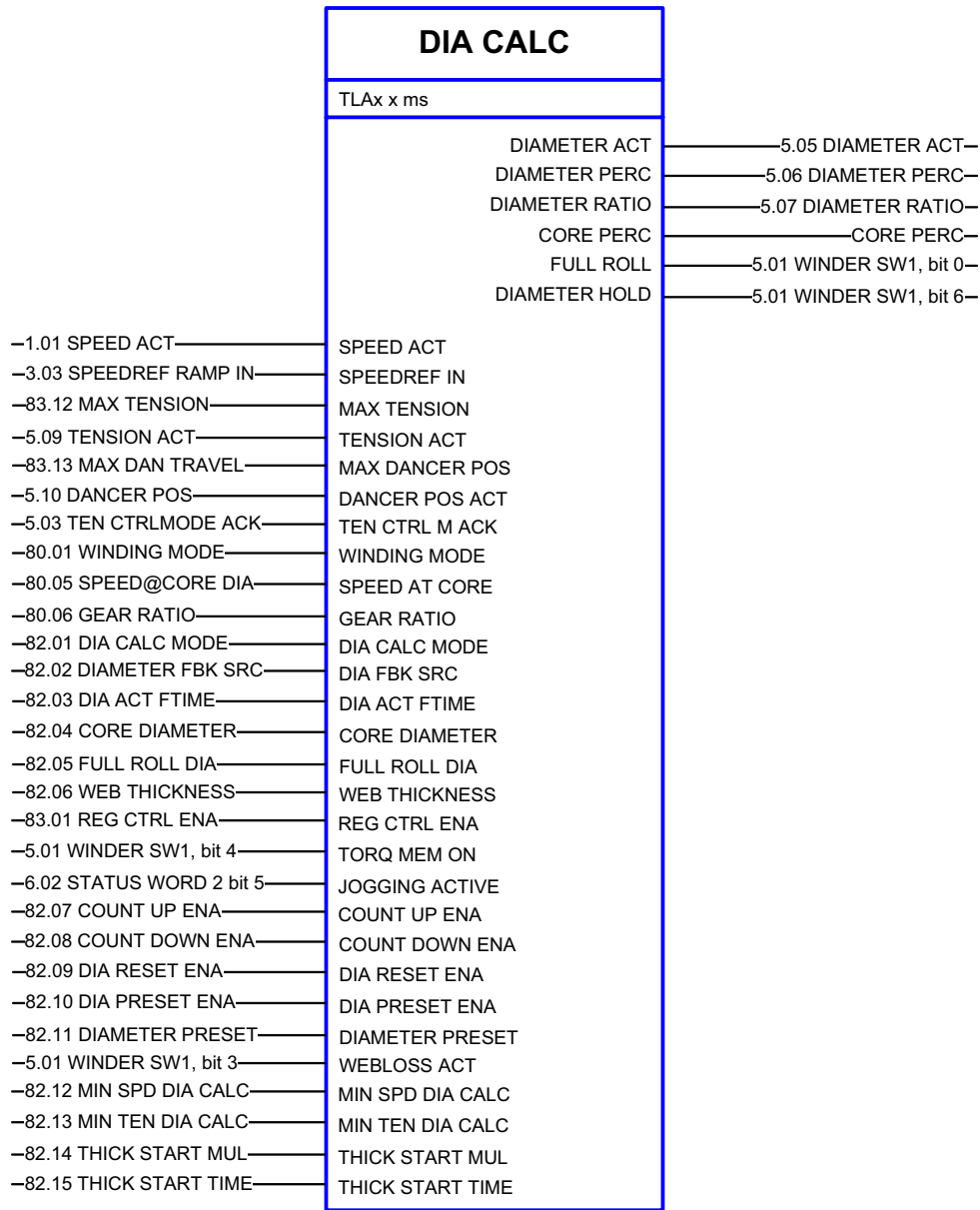
Note: Bit pointer parameters connected to an application program cannot be set through the fieldbus (ie, read access only).

List of technology function blocks and custom circuits

Name	Type	Description	Page
DIA CALC	Technology block	Calculates the roll diameter.	54
FRICTION COMP	Technology block	Calculates the linear friction compensation term.	58
INERTIA COMP	Technology block	Calculates the inertia and inertia compensation derivation time.	60
TEN&DAN CTRL	Technology block	Controls the tension (PI controller) or dancer (output for the pivot arm control).	63
NCTRLTORQLIMSEL	Custom circuit	Selects the torque limit for the speed controller depending on the actual tension control mode.	66
TEN2SPD	Custom circuit	Converts the tension reference to the speed reference with a multiplier term (speed trim control modes). Calculates the overspeed reference (torque trim and open loop modes).	68
TEN2TORQ	Custom circuit	Converts the percent scaled tension reference to the motor torque. Calculates the torque limit for the speed controller.	70
TORQMEM	Custom circuit	Stores the used torque.	72
WEBLOSS	Custom circuit	Detects a web loss.	74
WINDERCTRL	Custom circuit	Interprets winder set-up parameters to the controller output and negated speed reference signals.	76
WINDERREFMOD	Custom circuit	Modifies the speed reference and acceleration and deceleration times according to the roll diameter.	77
WINDERSTALL	Custom circuit	Selects the speed reference and controller parameters according to the stall activation request.	79
FLUX CTRL	Custom circuit	Improves torque control performance in low torque areas.	81

DIA CALC

Technology block

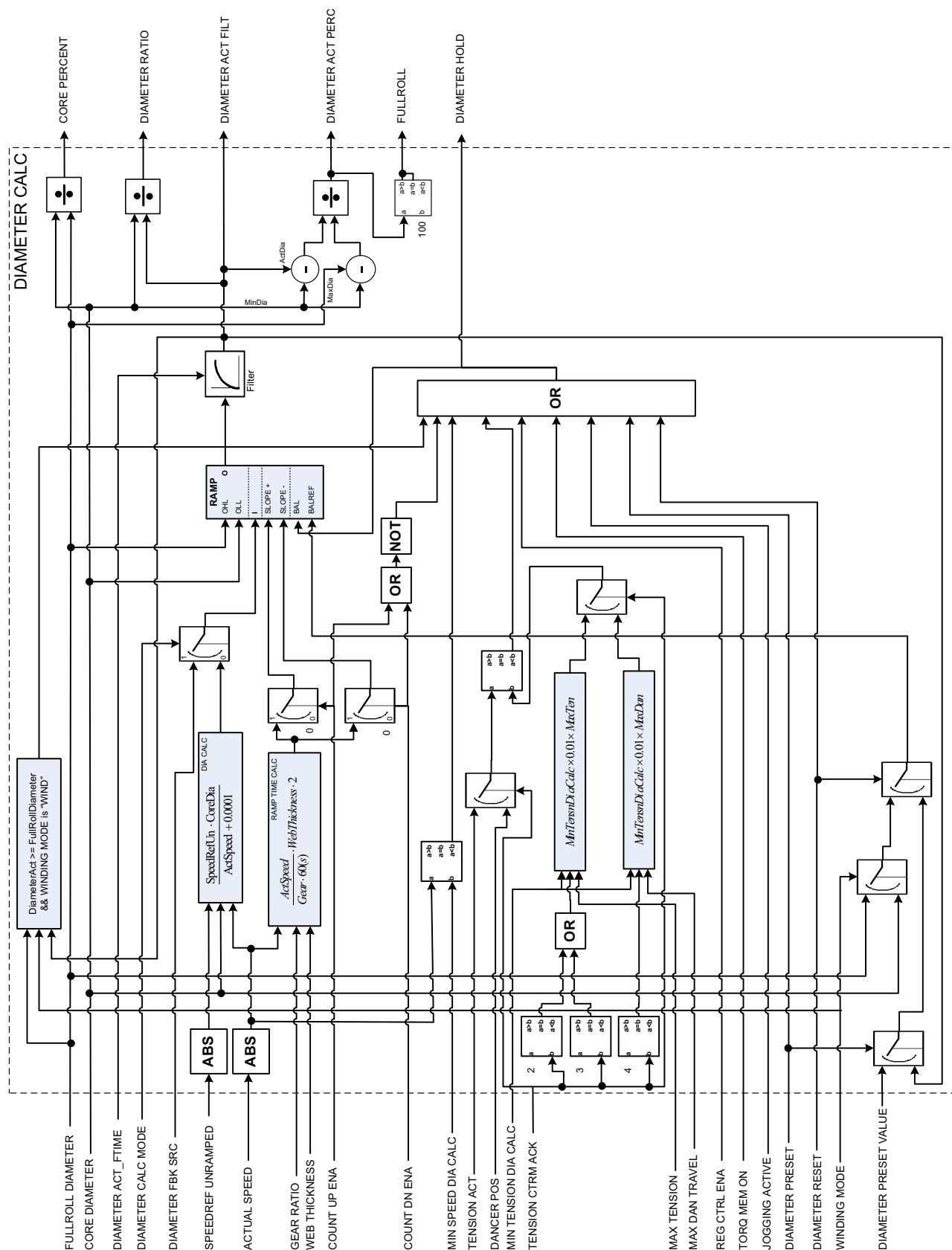


Block diagram

See page 55.

Description

DIA CALC calculates the roll diameter. The diameter is ramped according to the web thickness. Calculation can be disabled if the speed or tension is below the limit. The diameter can be reset to the core diameter or the full roll diameter (depending if the winding mode is wind or unwind) and preset to a user-defined value. An external diameter sensor is supported.



Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
1.01*	SPEED ACT	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
3.03*	SPEEDREF RAMP IN	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
5.01	WINDER SW1, bit 1 (REV REG OUT)	Boolean	0...1	-	-	30	-	-	WP	
5.01	WINDER SW1, bit 3 (WEB LOSS)	Boolean	0...1	-	-	30	-	-	WP	
5.01	WINDER SW1, bit 4 (TORQ MEM ON)	Boolean	0...1	-	-	30	-	-	WP	
5.03	TEN CTRLMODE ACK	Enum	0...4	-	1 = 1	30	32	-	WP	
5.09	TENSION ACT	REAL	-1000...1000	N·m	1 = 10	31	16	-	WP	
5.10	DANCER POS	REAL	0...3000	mm	1 = 10	31	16	-	WP	
6.02*	STATUS WORD 2, bit 5 (JOGGING)	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
80.01	WINDING MODE	Bit ptr	-	-	-	32	32	WIND	-	
80.05	SPEED@CORE DIA	REAL	0...30000	rpm	1 = 10	34	32	1500 rpm	-	
80.06	GEAR RATIO	REAL	0.1...1000	-	1 = 1000	34	32	1	-	
82.01	DIA CALC MODE	Enum	0...2	-	1 = 1	36	32	INTERNAL	-	
82.02	DIAMETER FBK SRC	Val ptr	-	-	-	36	32	P.02.05	-	
82.03	DIA ACT FTIME	REAL	0...1	s	1 = 100	36	32	0 s	-	
82.04	CORE DIAMETER	REAL	0...1000	mm	1 = 100	36	32	1 mm	-	
82.05	FULL ROLL DIA	REAL	1...4000	mm	1 = 100	36	32	1 mm	-	
82.06	WEB THICKNESS	REAL	0...10	mm	1 = 1000	37	16	0 mm	-	
82.07	COUNT UP ENA	Bit ptr	-	-	-	37	32	C.True	-	
82.08	COUNT DOWN ENA	Bit ptr	-	-	-	37	32	C.True	-	
82.09	DIA RESET ENA	Bit ptr	-	-	-	37	32	C.False	-	
82.10	DIA PRESET ENA	Bit ptr	-	-	-	37	32	C.False	-	
82.11	DIAMETER PRESET	REAL	0...4000	mm	1 = 100	37	32	0 mm	-	
82.12	MIN SPD DIA CALC	REAL	0...100	%	1 = 10	37	16	0%	-	
82.13	MIN TEN DIA CALC	REAL	0...100	%	1 = 10	37	16	0%	-	
82.14	THICK START MUL	REAL	0.01...10	-	1 = 100	37	16	1	-	
82.15	THICK START TIME	REAL	0...60	s	1 = 10	37	16	3 s	-	
83.01	REG CTRL ENA	Bit ptr	-	-	-	38	32	C.True	-	
83.12	MAX TENSION	REAL	0...30000	N	1 = 100	39	32	10 N	-	
83.13	MAX DAN TRAVEL	REAL	0...3000	mm	1 = 100	39	32	1000 mm	-	

* Index of the parameter in ACSM1; may be different in other drives.

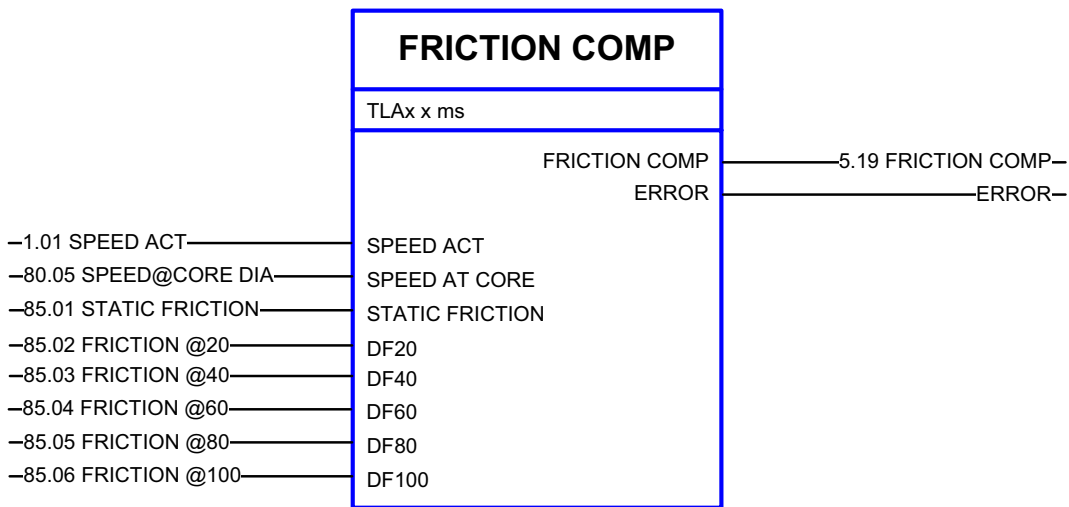
Outputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.01	WINDER SW1, bit 0 (FULL ROLL)	Boolean	0...1	-	-	30	-	-	WP	
5.01	WINDER SW1, bit 6 (DIAMETER HOLD)	Boolean	0...1	-	-	30	-	-	WP	

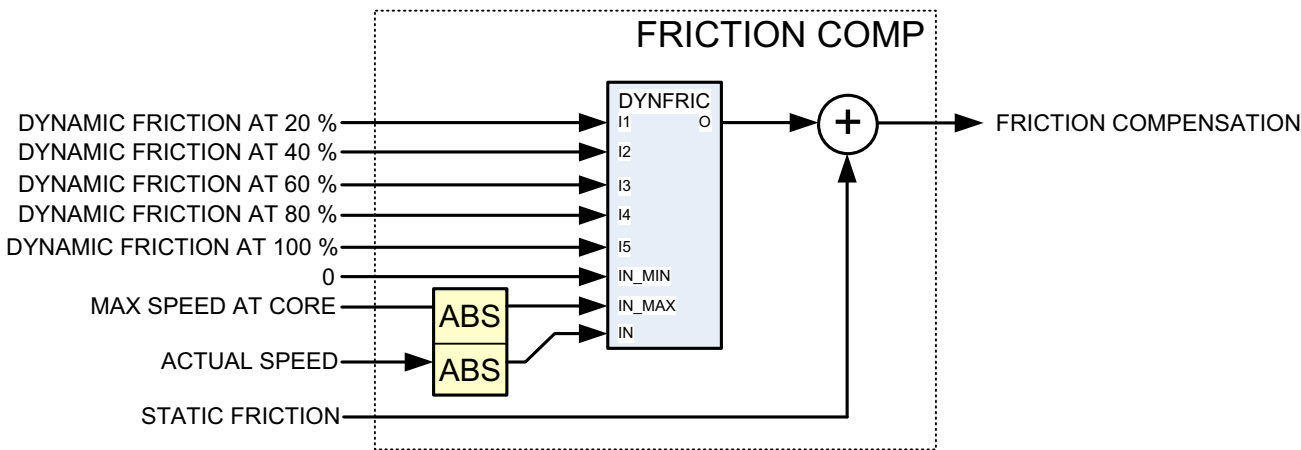
5.05	DIAMETER ACT	REAL	0...4000	mm	1 = 100	30	32	-	WP	
5.06	DIAMETER PERC	REAL	0...200	%	1 = 10	31	16	-	WP	
5.07	DIAMETER RATIO	REAL	0...100	-	1 = 10	31	16	-	WP	
	CORE PERC	REAL	0...100	%	-	-	-	-	-	

FRICION COMP

Technology block



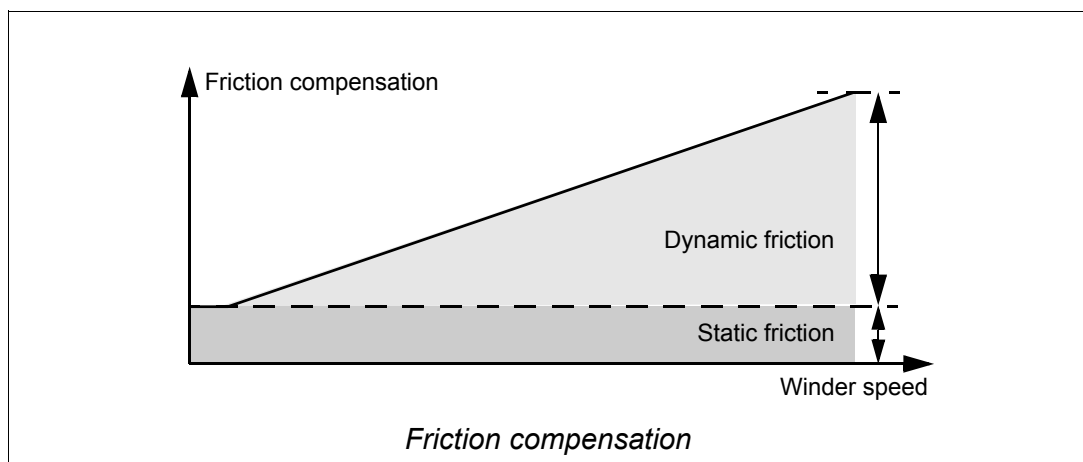
Block diagram



Description

FRICION COMP calculates the linear friction compensation term based on a predefined friction curve (see the figure on page 59). The curve is defined by dynamic friction values at 20%, 40%, 60%, 80% and 100% of the maximum speed (maximum speed for the winder with an empty roll). The term at a specific speed is the sum of the dynamic friction at this speed and the static friction.

Friction compensation is essential in the OPEN LOOP tension control.



Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
1.01*	SPEED ACT	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
80.05	SPEED@CORE DIA	REAL	0...30000	rpm	1 = 10	34	32	1500 rpm	-	
85.01	STATIC FRICTION	REAL	-1000...1000	N·m	1 = 100	42	16	0 N·m	-	
85.02	DYN FRICTION@20	REAL	-1000...1000	N·m	1 = 100	42	16	0 N·m	-	
85.03	DYN FRICTION@40	REAL	-1000...1000	N·m	1 = 100	42	16	0 N·m	-	
85.04	DYN FRICTION@60	REAL	-1000...1000	N·m	1 = 100	43	16	0 N·m	-	
85.05	DYN FRICTION@80	REAL	-1000...1000	N·m	1 = 100	43	16	0 N·m	-	
85.06	DYN FRICTION@100	REAL	-1000...1000	N·m	1 = 100	43	16	0 N·m	-	

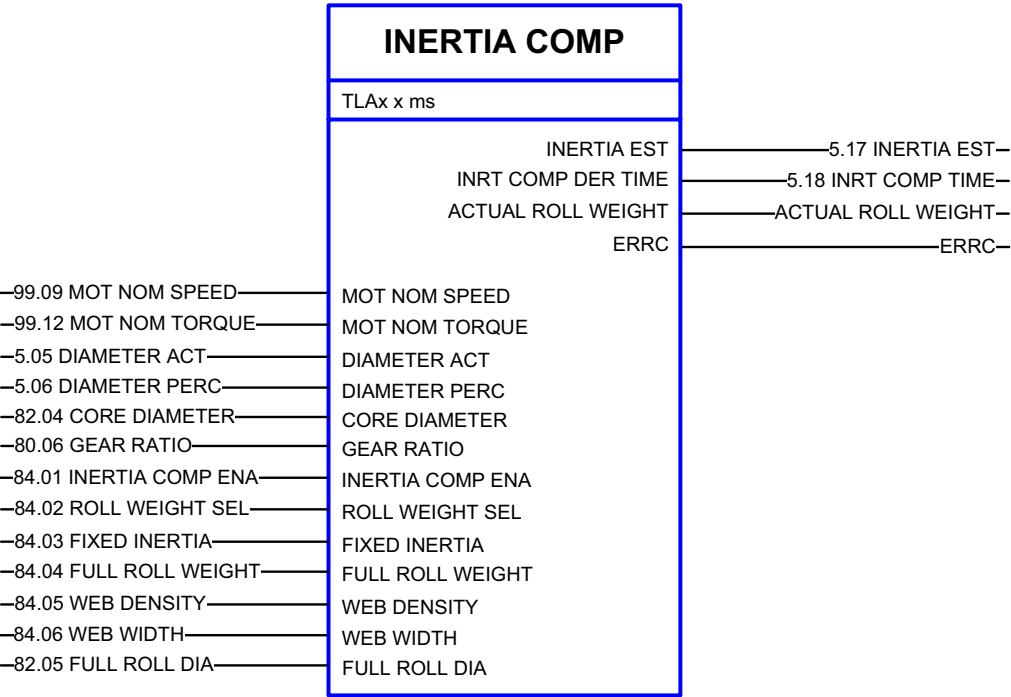
* Index of the parameter in ACSM1; may be different in other drives.

Outputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.19	FRICTION COMP	REAL	-2000...2000	N·m	1 = 100	32	16	-	WP	

INERTIA COMP

Technology block

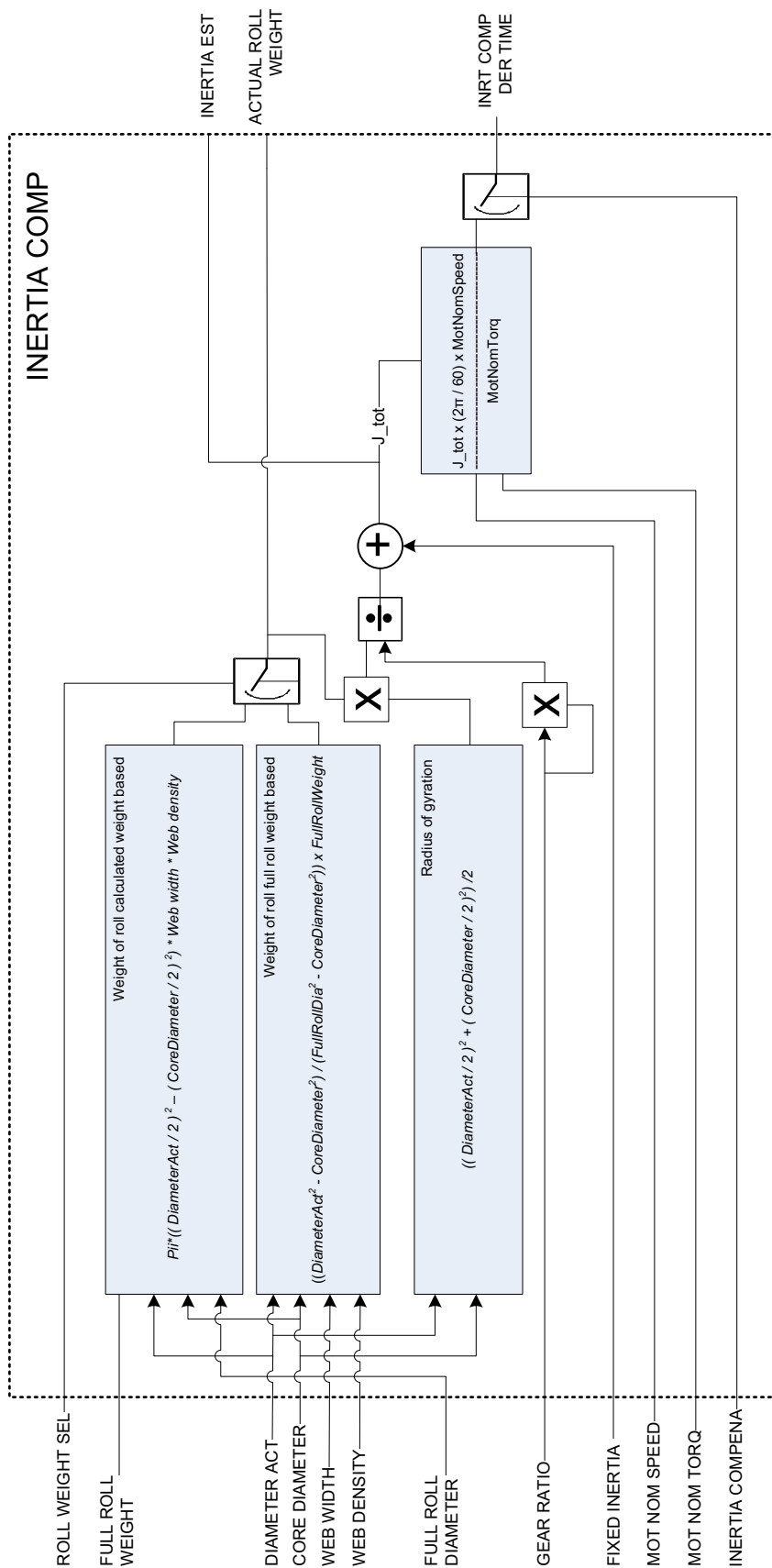


Block diagram

See page [61](#).

Description

INERTIA COMP calculates the inertia based on the roll diameter and material data. Alternatively, the weight of the full roll or web data is given as the input data. The block also calculates the inertia compensation derivation time from the calculated inertia and known motor nominal torque and speed.



Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
99.09*	MOT NOM SPEED	See the description of the parameter in the drive <i>Firmware Manual</i> .								
99.12*	MOT NOM TORQUE	See the description of the parameter in the drive <i>Firmware Manual</i> .								
5.05	DIAMETER ACT	REAL	0...4000	mm	1 = 100	30	32	-	WP	
5.06	DIAMETER PERC	REAL	0...200	%	1 = 10	31	16	-	WP	
80.06	GEAR RATIO	REAL	0.1...1000	-	1 = 1000	34	32	1	-	
82.04	CORE DIAMETER	REAL	0...1000	mm	1 = 100	36	32	1 mm	-	
82.05	FULL ROLL DIA	REAL	1...4000	mm	1 = 100	36	32	1 mm	-	
84.01	INERTIA COMP ENA	Bit ptr	-	-	-	40	32	C.False	-	
84.02	ROLL WEIGHT SEL	Enum	0...1	-	1 = 1	41	32	CALCULATED	-	
84.03	FIXED INERTIA	REAL	0...30000	kgm2	1 = 100	41	32	0 kgm2	-	
84.04	FULL ROLL WEIGHT	REAL	0...30000	kg	1 = 10	41	32	0 kg	-	
84.05	WEB DENSITY	REAL	10...15000	kg/m3	1 = 1	41	16	0 kg/m3	-	
84.06	WEB WIDTH	REAL	0...10000	mm	1 = 1	41	16	0 mm	-	

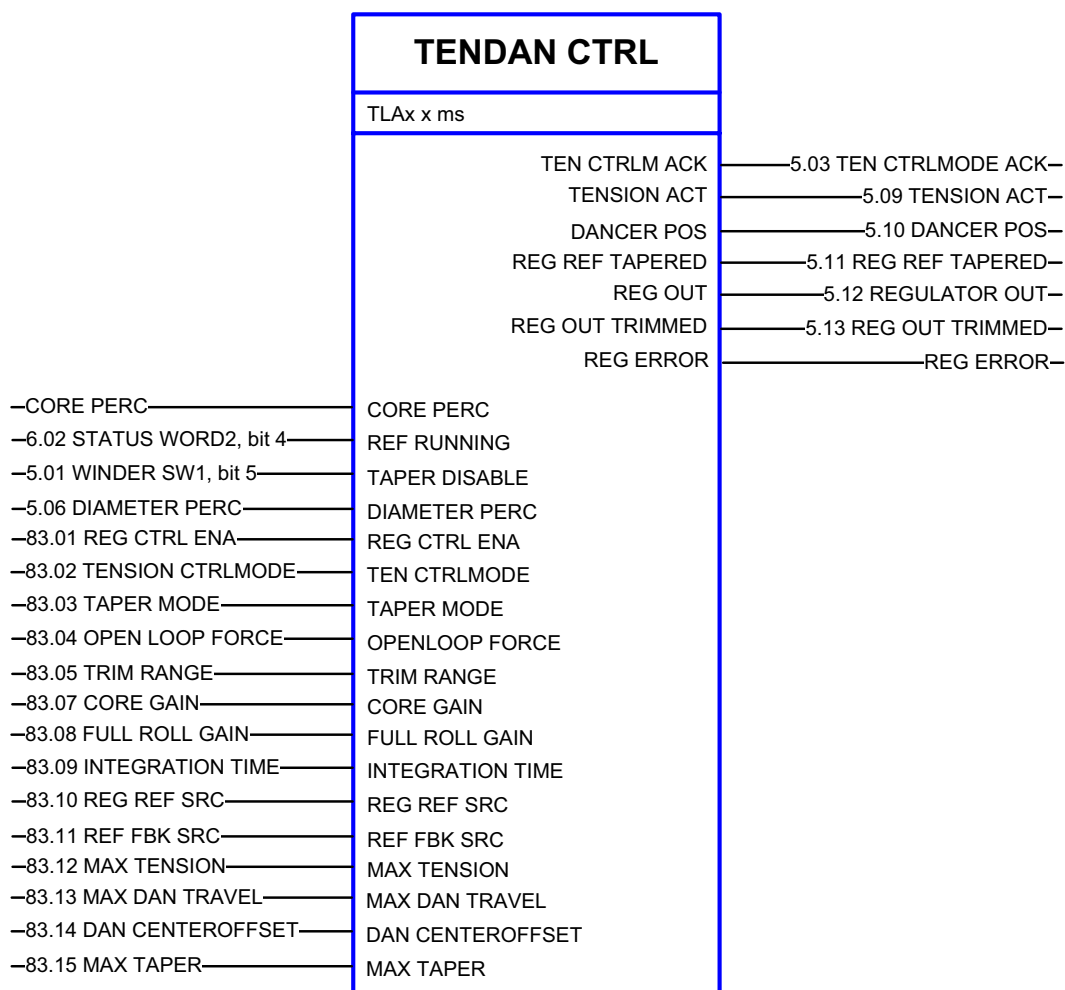
* Index of the parameter in ACSM1; may be different in other drives.

Outputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.17	INERTIA EST	REAL	0...32767	kgm2	1 = 10	31	32	-	WP	
5.18	INRT COMP TIME	REAL	-1000...1000	s	1 = 100	31	32	-	WP	

TEN&DAN CTRL

Technology block



Block diagram

See page [64](#).

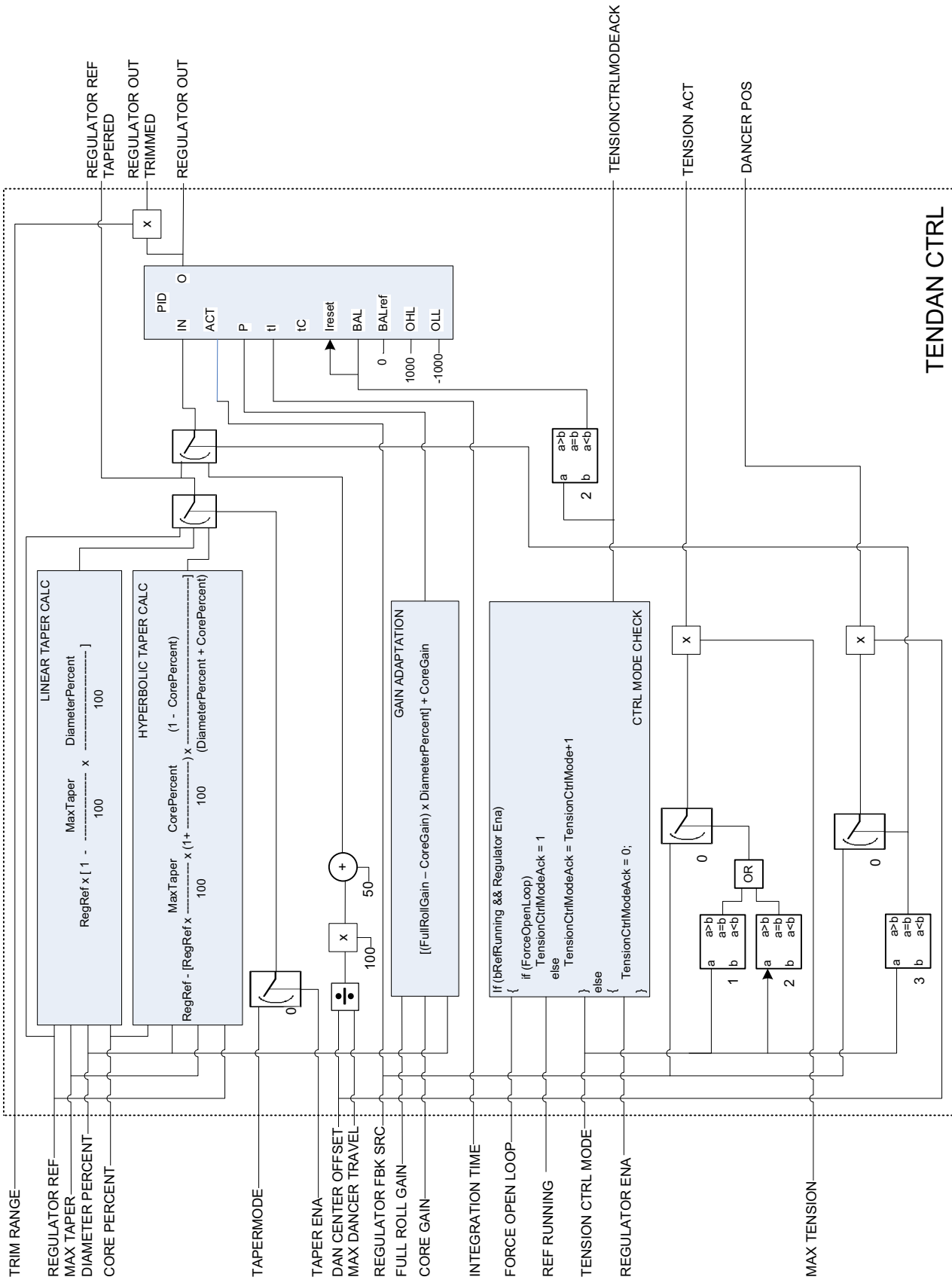
Description

TEN&DAN CTRL handles the tension control (PI controller for tension) and dancer control (output for the pivot arm control).

For the PI controller, feedback is needed from the dancer or load cell. In the OPEN LOOP tension control, the PI controller is bypassed.

The block can calculate a linear and hyperbolic tapered reference. The taper can be disabled, for example, during a stall tension request.

The reference and output of the controller is given as a percentage of the maximum tension or maximum dancer travel.



Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
	CORE PERC	REAL	0...100	%	-	-	-	-	-	
6.02*	STATUS WORD 2, bit 4 (REF RUNNING)	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
5.01	WINDER SW1	Boolean	0...1	-	-	30	-	-	WP	
5.06	DIAMETER PERC	REAL	0...200	%	1 = 10	31	16	-	WP	
83.01	REG CTRL ENA	Bit ptr	-	-	-	38	32	C.True	-	
83.02	TENSION CTRLMODE	Enum	0...3	-	1 = 1	38	32	OPEN LOOP	-	
83.03	TAPER MODE	Enum	0...2	-	1 = 1	38	32	DISABLED	-	
83.04	OPEN LOOP FORCE	Bit ptr	-	-	-	38	32	C.False	-	
83.05	TRIM RANGE	REAL	0...100	%	1 = 100	38	16	5%	-	
83.07	CORE GAIN	REAL	0...1000	-	1 = 100	39	32	10	-	
83.08	FULL ROLL GAIN	REAL	0...1000	-	1 = 100	39	32	10	-	
83.09	INTEGRATION TIME	REAL	0...100	s	1 = 100	39	16	1 s	-	
83.10	REG REF SRC	Val ptr	-	-	-	39	32	P.02.07	-	
83.11	REG FBK SRC	Val ptr	-	-	-	39	32	P.02.07	-	
83.12	MAX TENSION	REAL	0...30000	N	1 = 100	39	32	10 N	-	
83.13	MAX DAN TRAVEL	REAL	0...3000	mm	1 = 100	39	32	1000 mm	-	
83.14	DAN CENTEROFFSET	REAL	-1500...1500	mm	1 = 100	40	32	0 mm	-	
83.15	MAX TAPER	REAL	-100...100	%	1 = 10	40	16	2%	-	

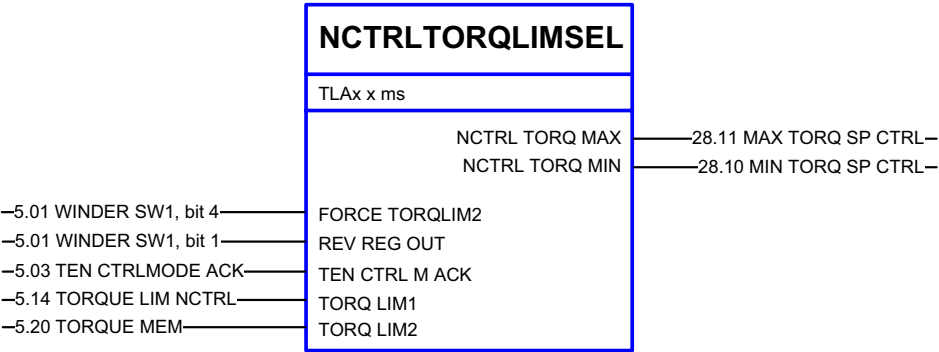
* Index of the parameter in ACSM1; may be different in other drives.

Outputs

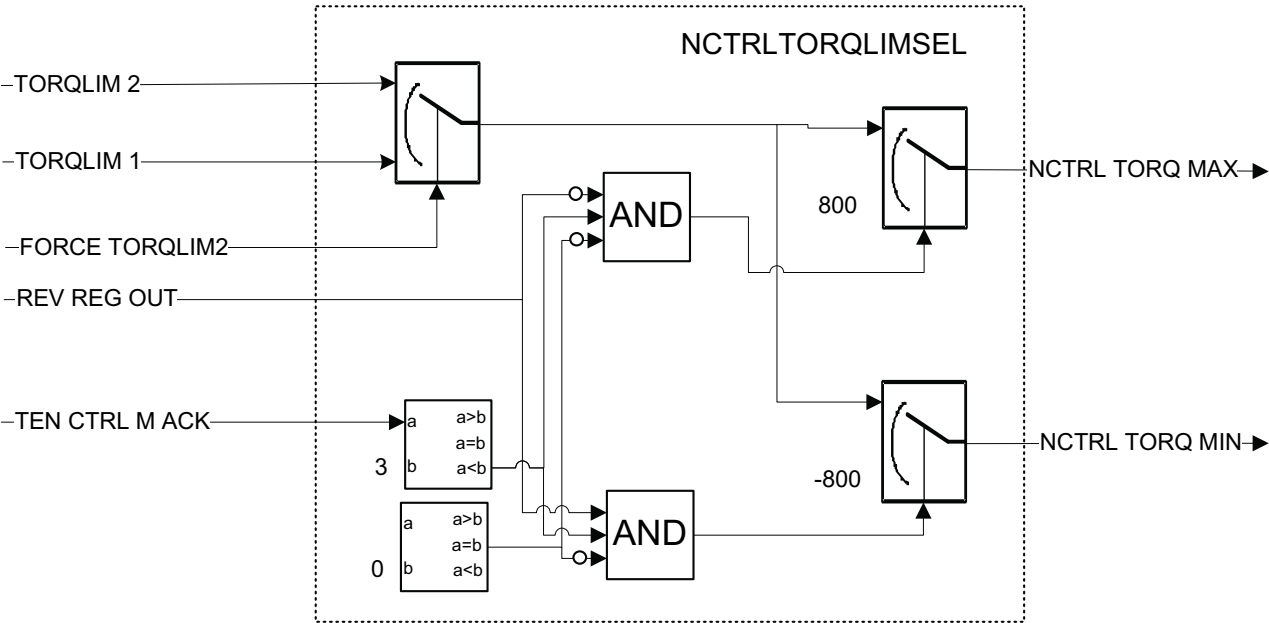
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.03	TEN CTRLMODE ACK	Enum	0...4	-	1 = 1	30	32	-	WP	
5.09	TENSION ACT	REAL	-1000...1000	N	1 = 10	31	16	-	WP	
5.10	DANCER POS	REAL	0...3000	mm	1 = 10	31	16	-	WP	
5.11	REG REF TAPERED	REAL	-1000...1000	%	1 = 10	31	16	-	WP	
5.12	REGULATOR OUT	REAL	-1000...1000	%	1 = 10	31	16	-	WP	
5.13	REG OUT TRIMMED	REAL	-1000...1000	%	1 = 10	31	16	-	WP	

NCTRLTORQLIMSEL

Custom circuit



Block diagram



Description

NCTRLTORQLIMSEL selects the torque limit for the speed controller. The actual torque limit is selected according to the tension control mode and direction of rotation. By forcing input, torque limit 2 can be applied regardless of the control mode (used, for example, for the torque memory).

Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.01	WINDER SW1 , bit 1 (REV REG OUT)	Boolean	0...1	-	-	30	-	-	WP	
5.01	WINDER SW1 , bit 4 (TORQ MEM ON)	Boolean	0...1	-	-	30	-	-	WP	
5.03	TEN CTRLMODE ACK	Enum	0...4	-	1 = 1	30	32	-	WP	
5.14	TORQUE LIM NCTRL	REAL	-1000...1000	%	1 = 10	31	16	-	WP	
5.20	TORQUE MEM	REAL	-1000...1000	%	1 = 10	32	16	-	WP	

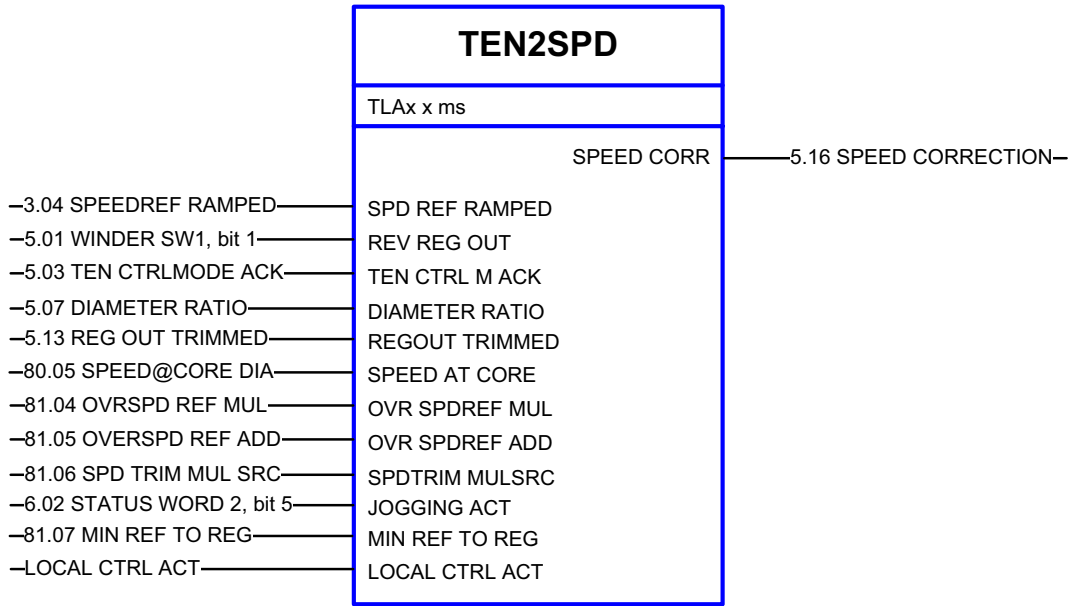
Outputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
28.10*	MIN TORQ SP CTRL	See the description of the parameter in the drive <i>Firmware Manual</i> .								
28.11*	MAX TORQ SP CTRL	See the description of the parameter in the drive <i>Firmware Manual</i> .								

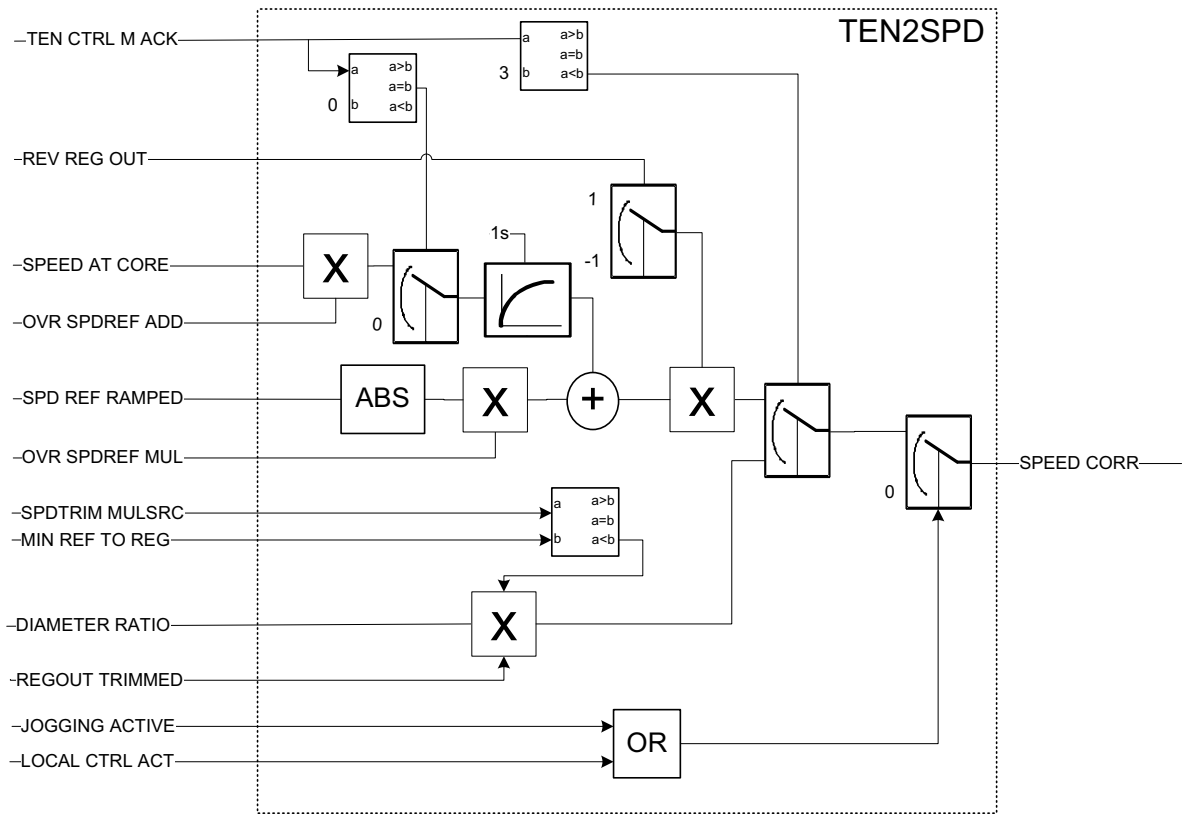
* Index of the parameter in ACSM1; may be different in other drives.

TEN2SPD

Custom circuit



Block diagram

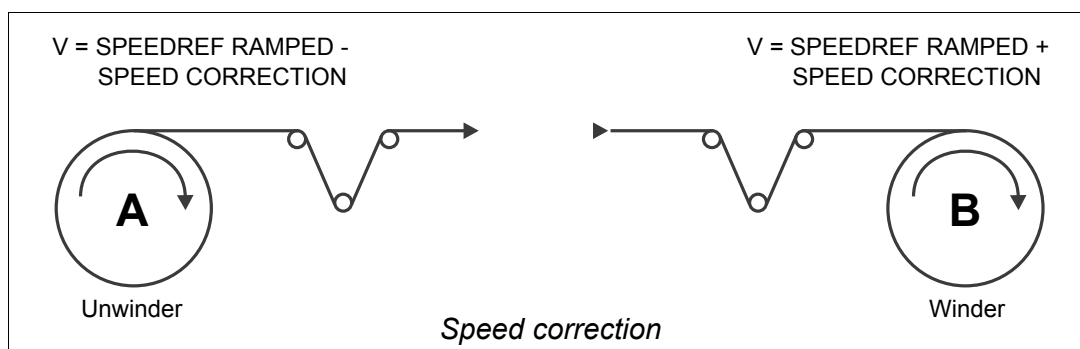


Description

In the speed trim control modes, TEN2SPD converts the tension reference to the speed with a multiplier term.

In the torque trim and open loop modes, it calculates the overspeed reference.

The calculated speed correction value is added to the ramped speed reference of the winder and subtracted from the speed reference of the unwinder to maintain a tension that will not let the web to loosen.



Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
3.04*	SPEEDREF RAMPED	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
5.01	WINDER SW1 bit 1, (REV REG OUT)	Boolean	0...1	-	-	30	-	-	WP	
5.03	TEN CTRLMODE ACK	Enum	0...4	-	1 = 1	30	32	-	WP	
5.07	DIAMETER RATIO	REAL	0...100	-	1 = 10	31	16	-	WP	
5.13	REG OUT TRIMMED	REAL	-1000...1000	%	1 = 10	31	16	-	WP	
6.02*	STATUS WORD 2, bit 5 (JOGGING)	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
80.05	SPEED@CORE DIA	REAL	0...30000	rpm	1 = 10	34	32	1500 rpm	-	
81.04	OVERSPD REF MUL	REAL	0...100	%	1 = 10	35	16	10%	-	
81.05	OVERSPD REF ADD	REAL	0...1000	%	1 = 10	35	16	1%	-	
81.06	SPD TRIM MUL SRC	Val ptr	-	-	-	35	32	P.80.05	-	
81.07	MIN REF TO REG	REAL	0...1000	rpm	1 = 10	35	16	100 rpm	-	

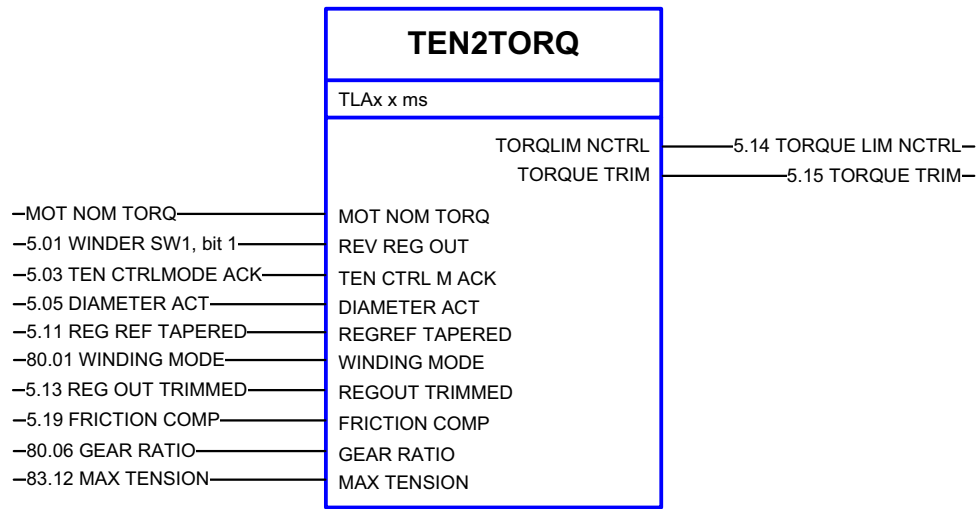
* Index of the parameter in ACSM1; may be different in other drives.

Outputs

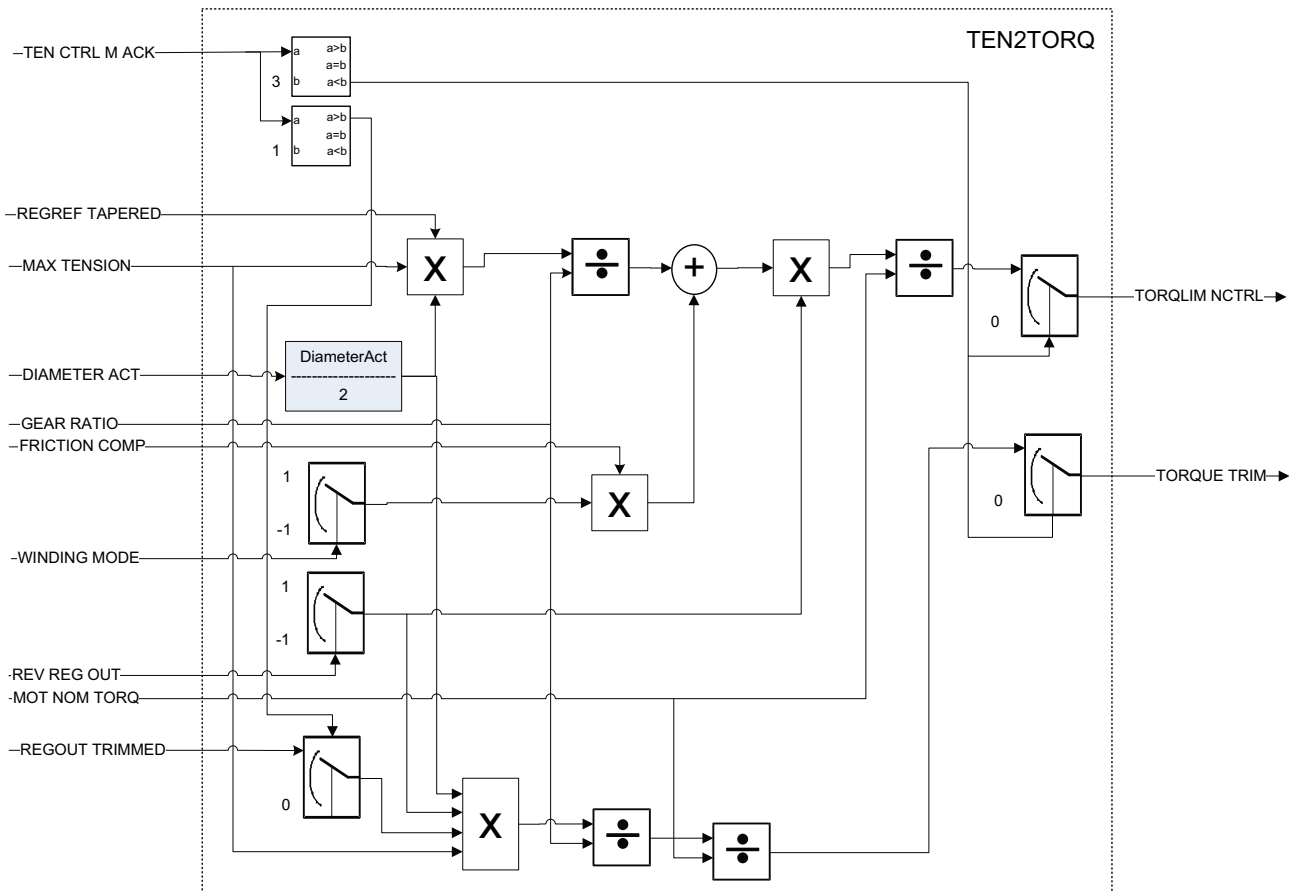
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.16	SPEED CORRECTION	REAL	-30000...30000	rpm	1 = 1000	31	32	-	WP	

TEN2TORQ

Custom circuit



Block diagram



Description

TEN2TORQ converts the percent scaled tension reference to the motor torque.

It also calculates the torque limit of the speed controller (tension reference + friction compensation term).

Inputs

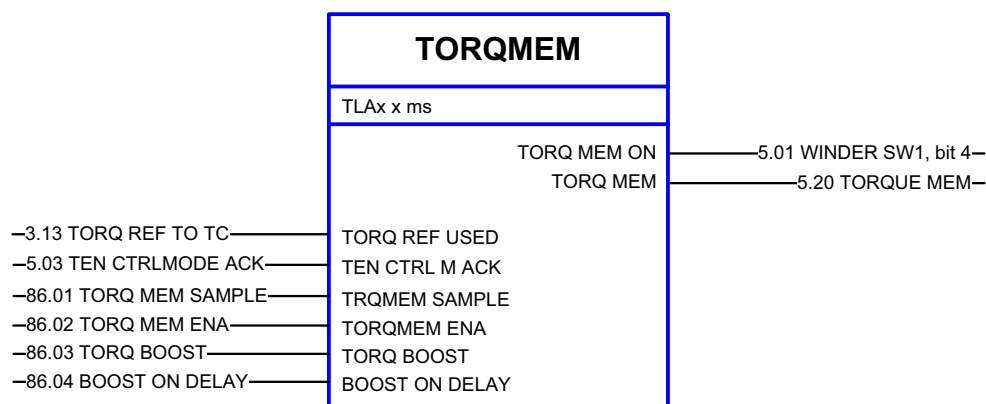
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.01	WINDER SW1 , bit 1 (REV REG OUT)	Boolean	0...1	-	-	30	-	-	WP	
5.03	TEN CTRLMODE ACK	Enum	0...4	-	1 = 1	30	32	-	WP	
5.05	DIAMETER ACT	REAL	0...4000	mm	1 = 100	30	32	-	WP	
5.11	REG REF TAPERED	REAL	-1000...1000	%	1 = 10	31	16	-	WP	
5.13	REG OUT TRIMMED	REAL	-1000...1000	%	1 = 10	31	16	-	WP	
5.19	FRICTION COMP	REAL	-2000...2000	N·m	1 = 100	32	16	-	WP	
80.01	WINDING MODE	Bit ptr	-	-	-	32	32	WIND	-	
80.06	GEAR RATIO	REAL	0.1...1000	-	1 = 1000	34	32	1	-	
83.12	MAX TENSION	REAL	0...30000	N	1 = 100	39	32	10 N	-	

Outputs

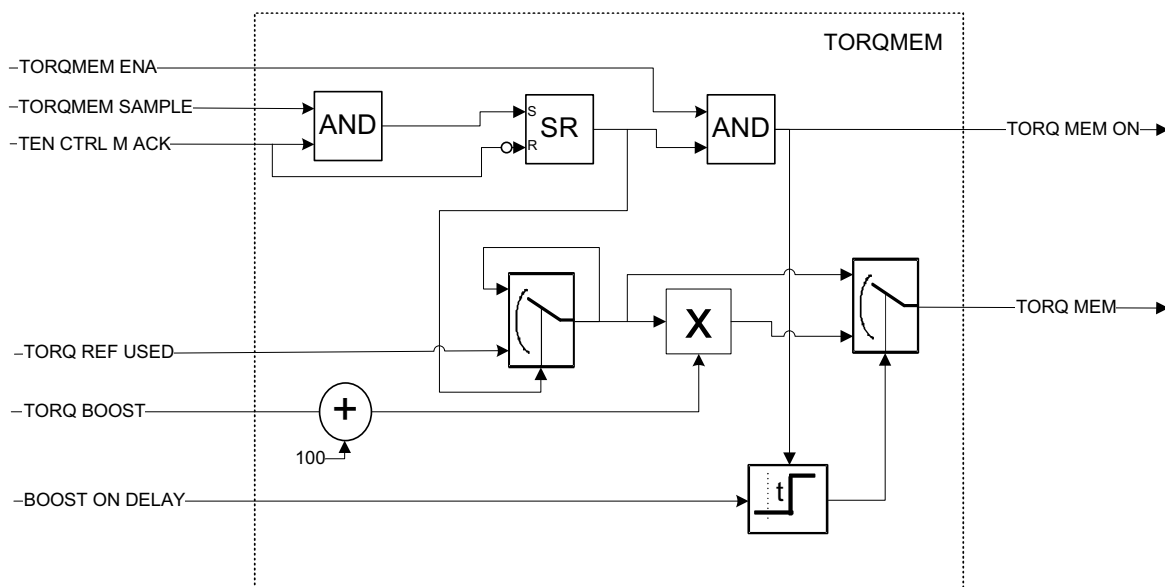
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.14	TORQUE LIM NCTRL	REAL	-1000...1000	%	1 = 10	31	16	-	WP	
5.15	TORQUE TRIM	REAL	-1000...1000	%	1 = 10	31	16	-	WP	

TORQMEM

Custom circuit



Block diagram



Description

TORQMEM stores the used torque at the moment of a request and calculates the boosted torque from the stored torque.

TORQMEM is used in continuous process lines with the automated winder roll change. The torque is memorized before the finished roll is removed from the winding position. When the finishing roll is isolated from the tension feedback, the torque memory is enabled to maintain the tension in the finishing roll section. See also section [Automatic roll change](#) on page 21.

Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
3.13*	TORQ REF TO TC	See the description of the parameter in the drive <i>Firmware Manual</i> .								
5.03	TEN CTRLMODE ACK	Enum	0...4	-	1 = 1	30	32	-	WP	
86.01	TORQ MEM SAMPLE	Bit ptr	-	-	-	43	32	C.False	-	
86.02	TORQ MEM ENA	Bit ptr	-	-	-	43	32	C.False	-	
86.03	TORQ BOOST	REAL	-300...300	%	1 = 10	43	16	0%	-	
86.04	BOOST ON DELAY	REAL	0...1000	s	1 = 10	43	16	5 s	-	

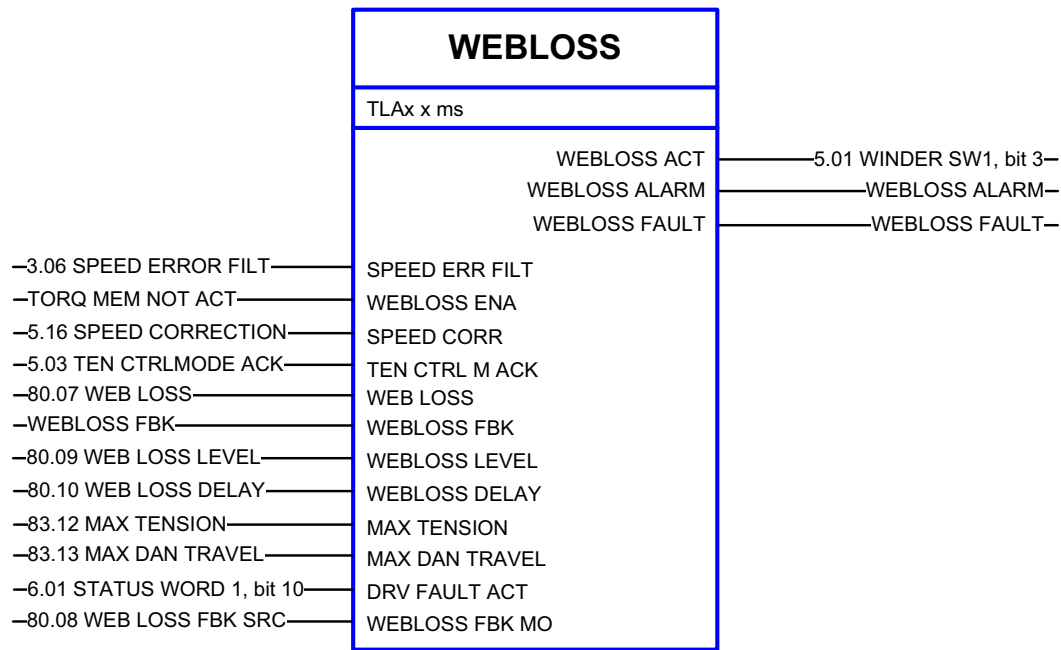
* Index of the parameter in ACSM1; may be different in other drives.

Outputs

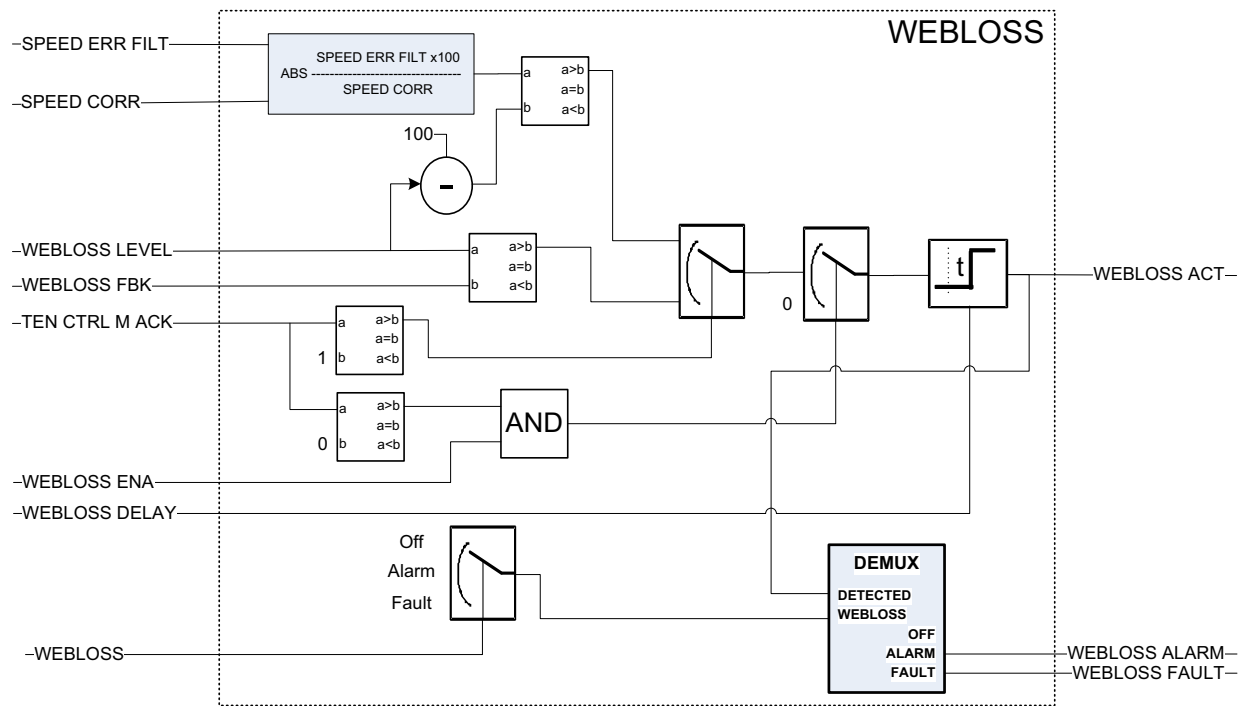
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.01	WINDER SW1 , bit 4 (TORQ MEM ON)	Boolean	0...1	-	-	30	-	-	WP	
5.20	TORQUE MEM	REAL	-1000...1000	%	1 = 10	32	16	-	WP	

WEBLOSS

Custom circuit



Block diagram



Description

WEBLOSS detects a web loss (web break, wire break or cable breakdown) in the tension control modes from the following conditions:

In the OPEN LOOP tension control, a web loss is detected when the difference between the actual line speed and final speed reference + overspeed reference becomes zero. This is because in case of a web loss, the motor speed will rush from the line speed to the overspeed reference and the speed difference will decrease to zero.

In the other tension control modes, a web loss is detected when the tension feedback from the web (tension or dancer position) is less than the web loss limit set by the user.

The user can define a time delay from the web loss detection to the activation of the web loss signal.

Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
3.06*	SPEED ERROR FILT	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
5.03	TEN CTRLMODE ACK	Enum	0...4	-	1 = 1	30	32	-	WP	
5.16	SPEED CORRECTION	REAL	-30000...30000	rpm	1 = 1000	31	32	-	WP	
6.01*	STATUS WORD 1, bit 10 (FAULT)	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
80.07	WEB LOSS	Enum	0...2	-	1 = 1	35	32	DISABLED	-	
80.08	WEB LOSS FBK SRC	Val ptr	-	-	-	35	32	P.02.07	-	
80.09	WEB LOSS LEVEL	REAL	0...100	%	1 = 10	35	16	2%	-	
80.10	WEB LOSS DELAY	REAL	0...100	s	1 = 10	35	16	1 s	-	
83.12	MAX TENSION	REAL	0...30000	N	1 = 100	39	32	10 N	-	
83.13	MAX DAN TRAVEL	REAL	0...3000	mm	1 = 100	39	32	1000 mm	-	

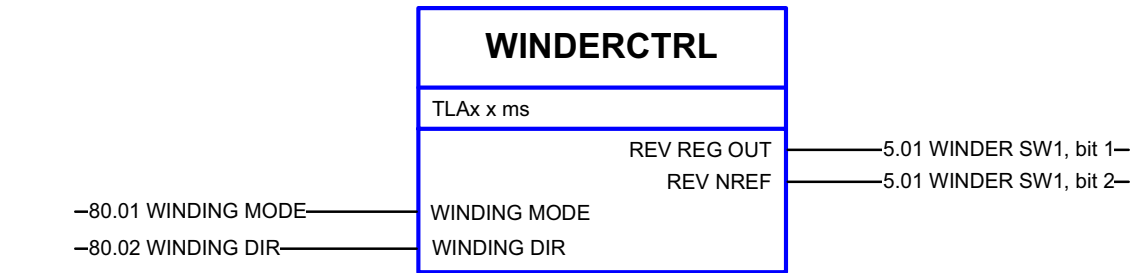
* Index of the parameter in ACSM1; may be different in other drives.

Outputs

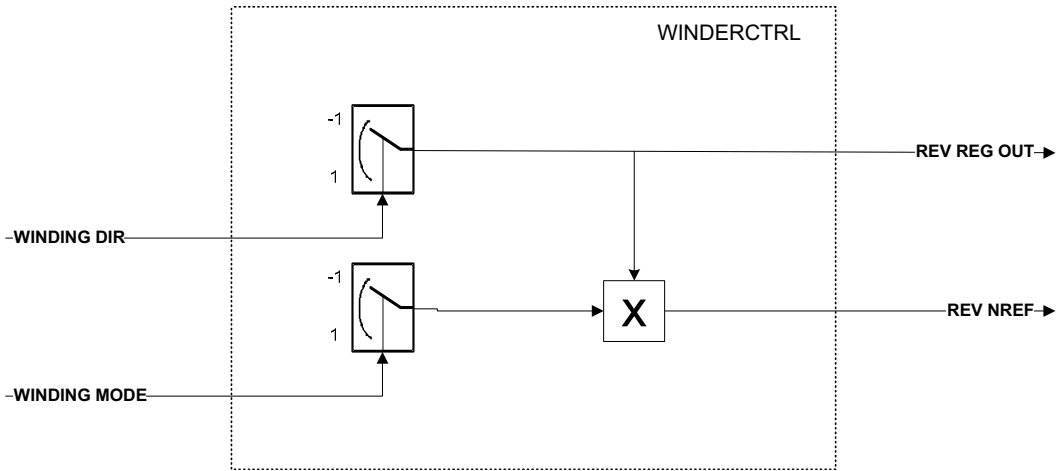
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.01	WINDER SW1, bit 3 (WEB LOSS)	Boolean	0...1	-	-	30	-	-	WP	

WINDERCTRL

Custom circuit



Block diagram



Description

WINDERCTRL sets the controller output and inverted speed reference signals according to the winder set-up parameters.

Inputs

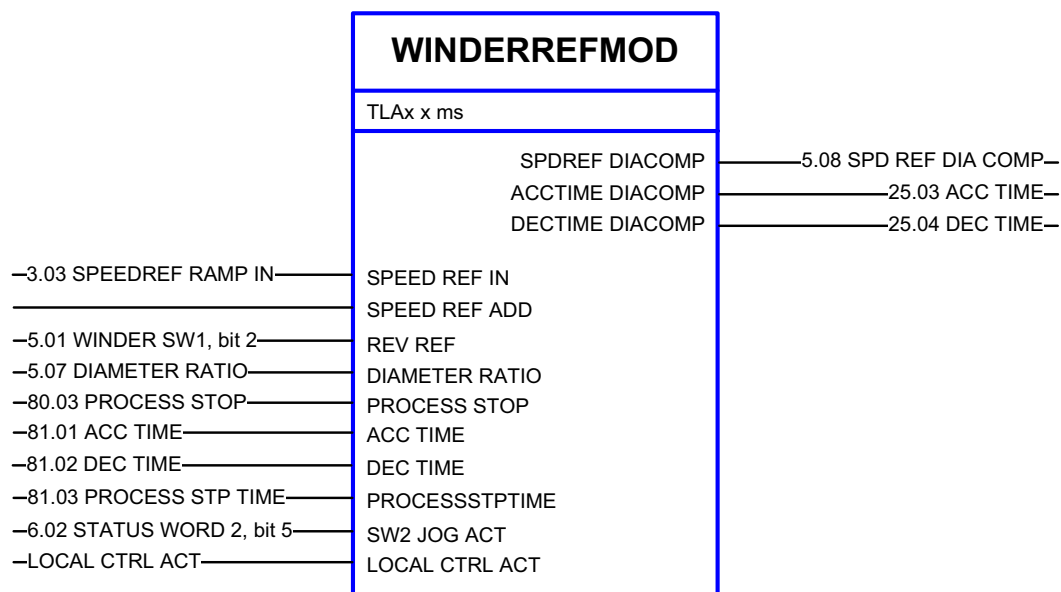
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
80.01	WINDING MODE	Bit ptr	-	-	-	32	32	WIND	-	
80.02	WINDING DIR	Bit ptr	-	-	-	32	32	POS	-	

Outputs

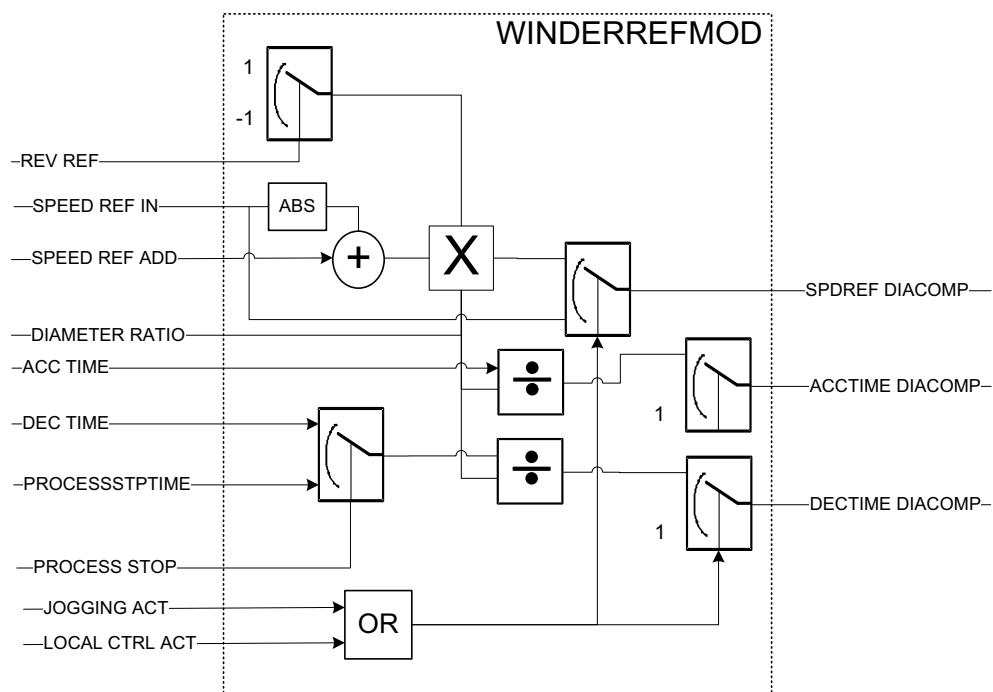
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.01	WINDER SW1, bit 1 (REV REG OUT)	Boolean	0...1	-	-	30	-	-	WP	
5.01	WINDER SW1, bit 2 (REV REF)	Boolean	0...1	-	-	30	-	-	WP	

WINDERREFMOD

Custom circuit



Block diagram



Description

WINDERREFMOD calculates the speed reference and acceleration and deceleration times according to the actual roll diameter.

Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
3.03*	SPEEDREF RAMP IN	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
6.02*	STATUS WORD 2, bit 5 (JOGGING)	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
5.01	WINDER SW1, bit 2 (REV REF)	Boolean	0...1	-	-	30	-	-	WP	
5.07	DIAMETER RATIO	REAL	0...100	-	1 = 10	31	16	-	WP	
80.03	PROCESS STOP	Bit ptr	-	-	-	33	32	C.True	-	
81.01	ACC TIME	REAL	0...1800	s	1 = 100	35	32	5 s	-	
81.02	DEC TIME	REAL	0...1800	s	1 = 100	35	32	5 s	-	
81.03	PROCESS STP TIME	REAL	0...1800	s	1 = 100	35	32	5 s	-	

* Index of the parameter in ACSM1; may be different in other drives.

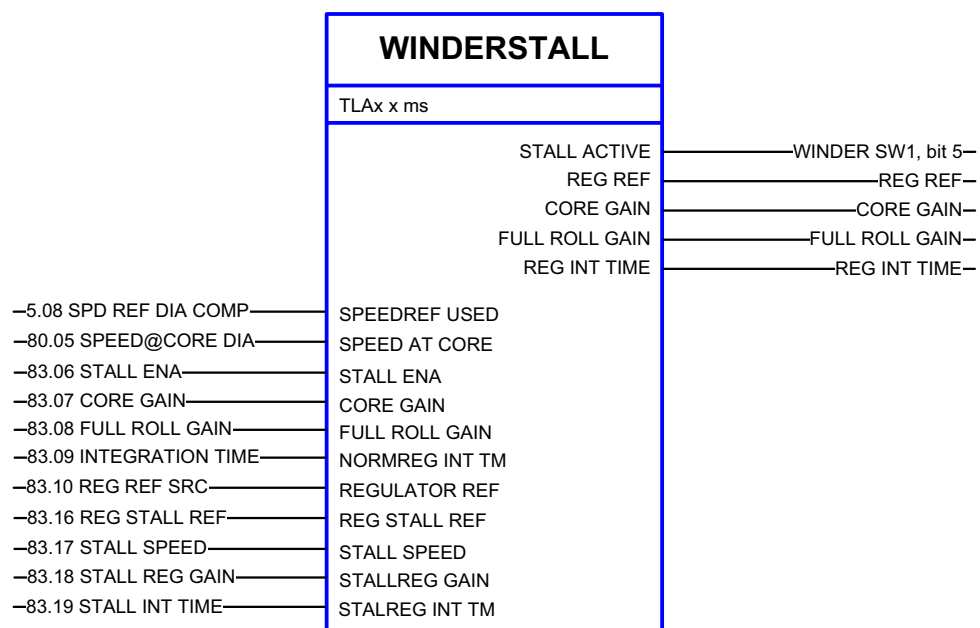
Outputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.08	SPD REF DIA COMP	REAL	-30000...30000	rpm	1 = 1000	31	32	-	WP	
25.03*	ACC TIME	See the description of the parameter in the drive <i>Firmware Manual</i> .								
25.04*	DEC TIME	See the description of the parameter in the drive <i>Firmware Manual</i> .								

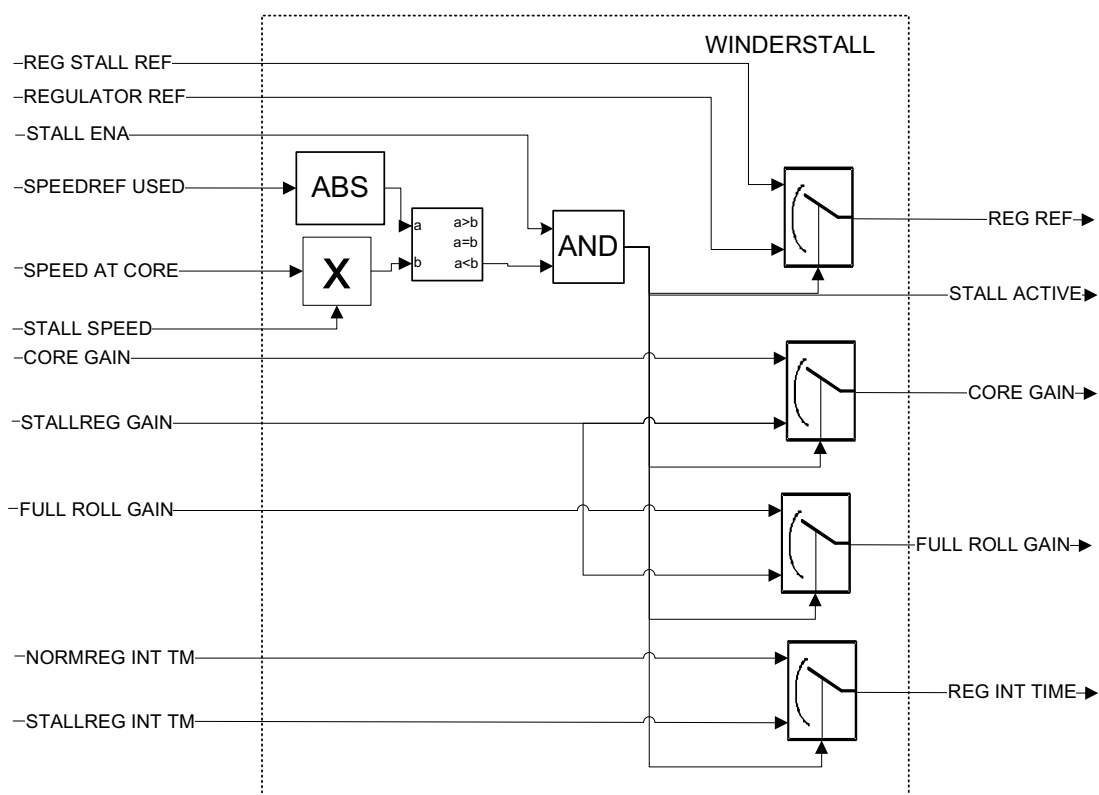
* Index of the parameter in ACSM1; may be different in other drives.

WINDERSTALL

Custom circuit



Block diagram



Description

WINDERSTALL selects the speed reference and the controller parameters according to the stall activation request. Stall values are used instead of the normal ones when stall enable is activated.

Stall is used, for example, when threading web material through a machine (low speed and tension reference) and for a machinery standstill.

Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.08	SPD REF DIA COMP	REAL	-30000...30000	rpm	1 = 1000	31	32	-	WP	
80.05	SPEED@CORE DIA	REAL	0...30000	rpm	1 = 10	34	32	1500 rpm	-	
83.06	STALL ENA	Bit ptr	-	-	-	39	32	C.False	-	
83.07	CORE GAIN	REAL	0...1000	-	1 = 100	39	32	10	-	
83.08	FULL ROLL GAIN	REAL	0...1000	-	1 = 100	39	32	10	-	
83.09	INTEGRATION TIME	REAL	0...100	s	1 = 100	39	16	1 s	-	
83.10	REG REF SRC	Val ptr	-	-	-	39	32	P.02.07	-	
83.16	REG STALL REF	REAL	0...100	%	1 = 10	40	16	0%	-	
83.17	STALL SPEED	REAL	0...100	%	1 = 10	40	16	0%	-	
83.18	STALL REG GAIN	REAL	0...1000	-	1 = 100	40	32	10	-	
83.19	STALL INT TIME	REAL	0...100	s	1 = 100	40	16	1 s	-	

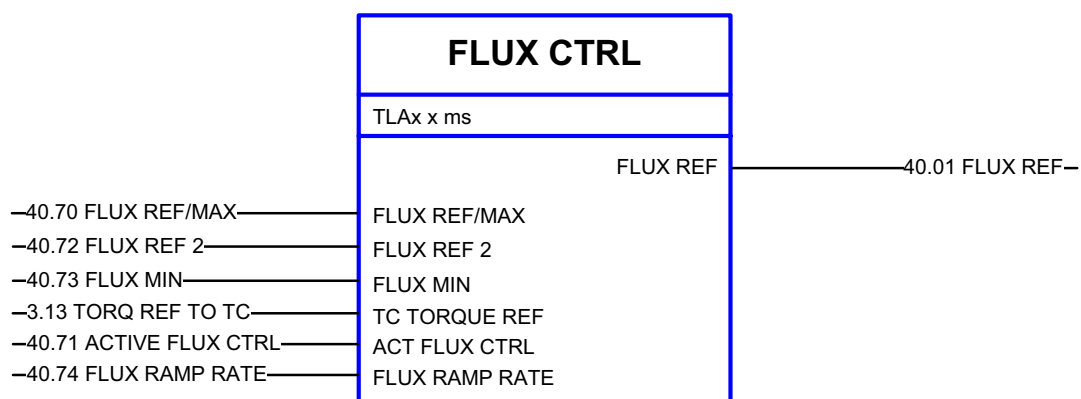
* Index of the parameter in ACSM1; may be different in other drives.

Outputs

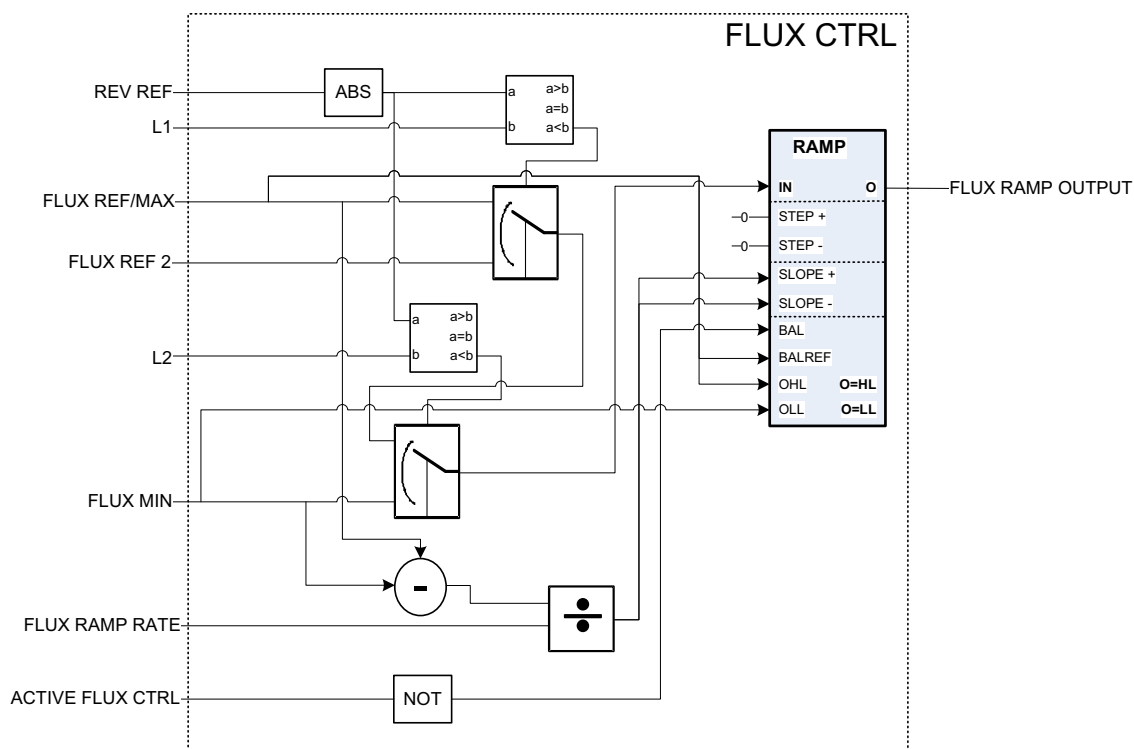
Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
5.01	WINDER SW1 , bit 5 (STALL ACTIVE)	Boolean	0...1	-	-	30	-	-	WP	
	REG REF	REAL	0...100	%	-	-	-	-	-	
	CORE GAIN	REAL	0...1000	-	-	-	-	-	-	
	FULL ROLL GAIN	REAL	0...1000	-	-	-	-	-	-	
	REG INT TIME	REAL	0...100	s	-	-	-	-	-	

FLUX CTRL

Custom circuit



Block diagram



Description

FLUX CTRL improves torque control performance in low torque areas.

Inputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
3.13*	TORQ REF TO TC	See the description of the actual signal in the drive <i>Firmware Manual</i> .								
40.70	FLUX REF/MAX	REAL	0...100	%	1 = 10	32	16	100%	-	
40.71	ACTIVE FLUX CTRL	Bit ptr	-	-	-	32	32	NO	-	
40.72	FLUX REF 2	REAL	30...100	%	1 = 10	32	16	60%	-	
40.73	FLUX REF MIN	REAL	0...100	%	1 = 10	32	16	25%	-	
40.74	FLUX RAMP RATE	REAL	0...100	s	1 = 10	32	16	3 s	-	

* Index of the parameter in ACSM1; may be different in other drives.

Outputs

Index	Signal/Parameter	Type	Range	Unit	FbEq	P.	Data len.	Def	PT	
40.01*	FLUX REF	See the description of the parameter in the drive <i>Firmware Manual</i> .								

* Index of the parameter in ACSM1; may be different in other drives.

Fault tracing

What this chapter contains

The chapter lists the alarm and fault messages generated by the winder control program only. The messages are listed with the possible cause and corrective actions. For the listing of other alarm and fault messages, see the drive *Firmware Manual*.

Safety



WARNING! Only qualified electricians are allowed to maintain the drive. Read the *Safety Instructions* on the first pages of the drive *Firmware Manual* before you start working with the drive.

Alarm and fault indications

An alarm or a fault message indicates an abnormal drive status. You can identify and correct most alarm and fault causes using this information. If not, contact an ABB representative.

The four-digit code number in brackets after the message is for the fieldbus communication.

The alarm/fault code is displayed on the 7-segment display of the drive. The following table describes the indications given by the 7-segment display.

Display	Meaning
"E-" followed by error code	System error. See the drive <i>Hardware Manual</i> .
"A-" followed by error code	Alarm. See section Alarm messages on page 85 and the drive <i>Firmware Manual</i> .
"F-" followed by error code	Fault. See section Fault messages on page 85 and the drive <i>Firmware Manual</i> .

How to reset

The drive can be reset either by pressing the reset key on the PC tool () or control panel (**RESET**) or switching the supply voltage off for a while. When the fault has been removed, the motor can be restarted.

A fault can also be reset from an external source by parameter 10.08 FAULT RESET SEL.

Fault history

When a fault is detected, it is stored in the fault logger with a time stamp. The fault history stores information on the 16 latest faults of the drive. Three of the latest faults are stored at the beginning of a power switch off.

Signals 8.01 ACTIVE FAULT and 8.02 LAST FAULT store the fault codes of the most recent faults.

Alarms can be monitored with alarm words 8.05...8.07 ALARM WORD 1...3. Alarm information is lost at power switch off or fault reset.

Alarm messages

Code	Alarm (fieldbus code)	Cause	What to do
2401	WEB LOSS (0x6F81)	The processed material (web, wire or cable) may be broken. In the OPEN LOOP tension control, a web loss is detected when the difference between the actual line speed and final speed reference + overspeed reference becomes zero. In the other tension control modes, a web loss is detected when the feedback from the web (tension or dancer position) has been below the detection limit defined with parameter 80.09 WEB LOSS LEVEL.	If there is a real web break, wire break or cable breakdown, detection has acted in the correct way. If there is no real cause for the web loss detection to be activated, check the settings of the web loss detection. For example, if the delay time for detection is too short or the level for detection is too small, unnecessary detections may occur.

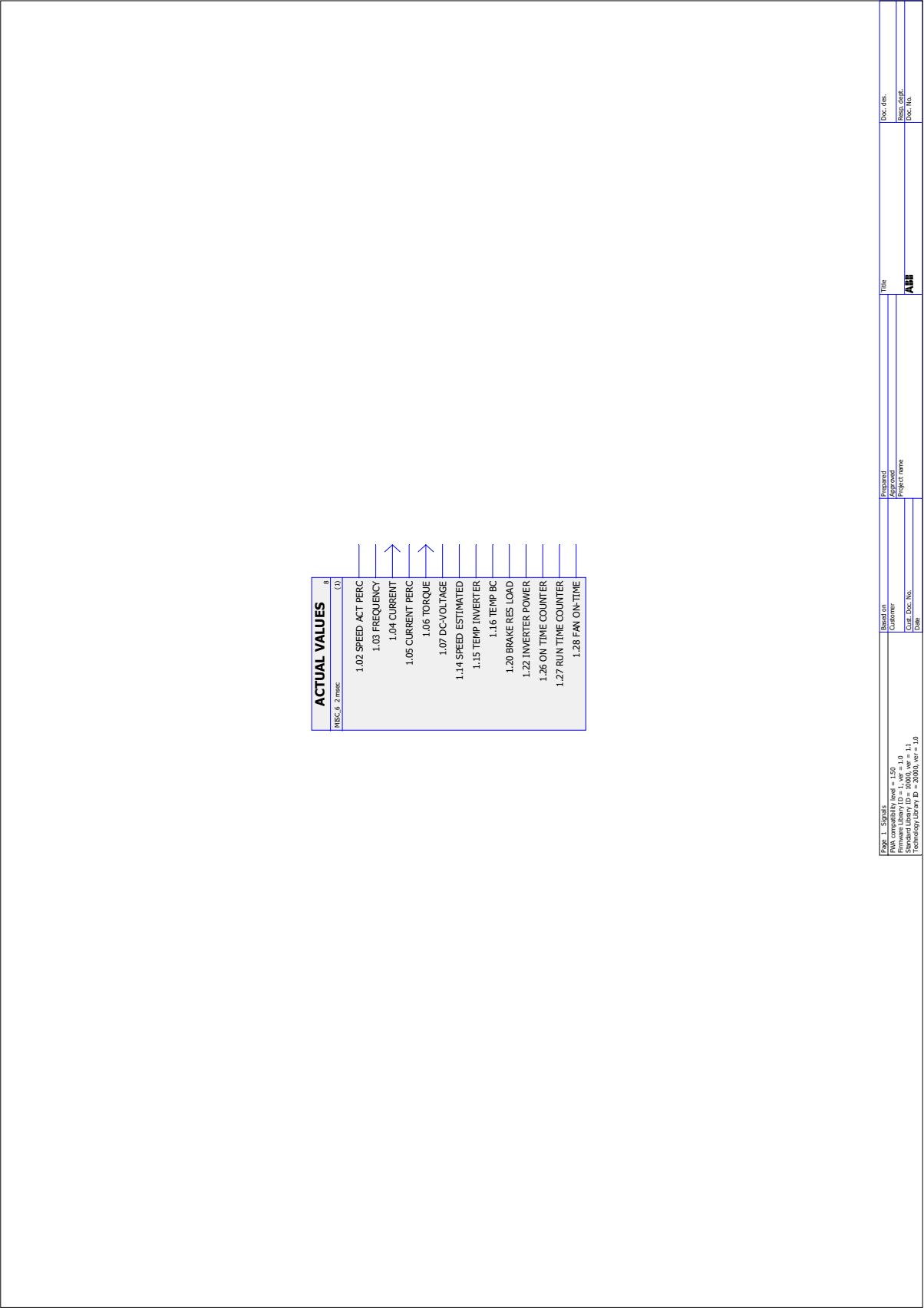
Fault messages

Code	Extension code	Fault (fieldbus code)	Cause	What to do
0317	xxxx	SOLUTION FAULT (0x6200)	Application fault generated by function block SOLUTION_FAULT. The user can create this fault with the DriveSPC tool.	Check the extension code in the fault logger and locate the corresponding SOLUTION_FAULT block in the DriveSPC tool.
601	-	WEB LOSS (0x6E81)	The processed material (web, wire or cable) may be broken. In the OPEN LOOP tension control, a web loss is detected when the difference between the actual line speed and final speed reference + overspeed reference becomes zero. In the other tension control modes, a web loss is detected when the feedback from the web (tension or dancer position) has been below the detection limit defined with parameter 80.09 WEB LOSS LEVEL.	If there is a real web break, wire break or cable breakdown, detection has acted in the correct way. If there is no real cause for the web loss detection to be activated, check the settings of the web loss detection. For example, if the delay time for detection is too short or the level for detection is too small, unnecessary detections may occur.

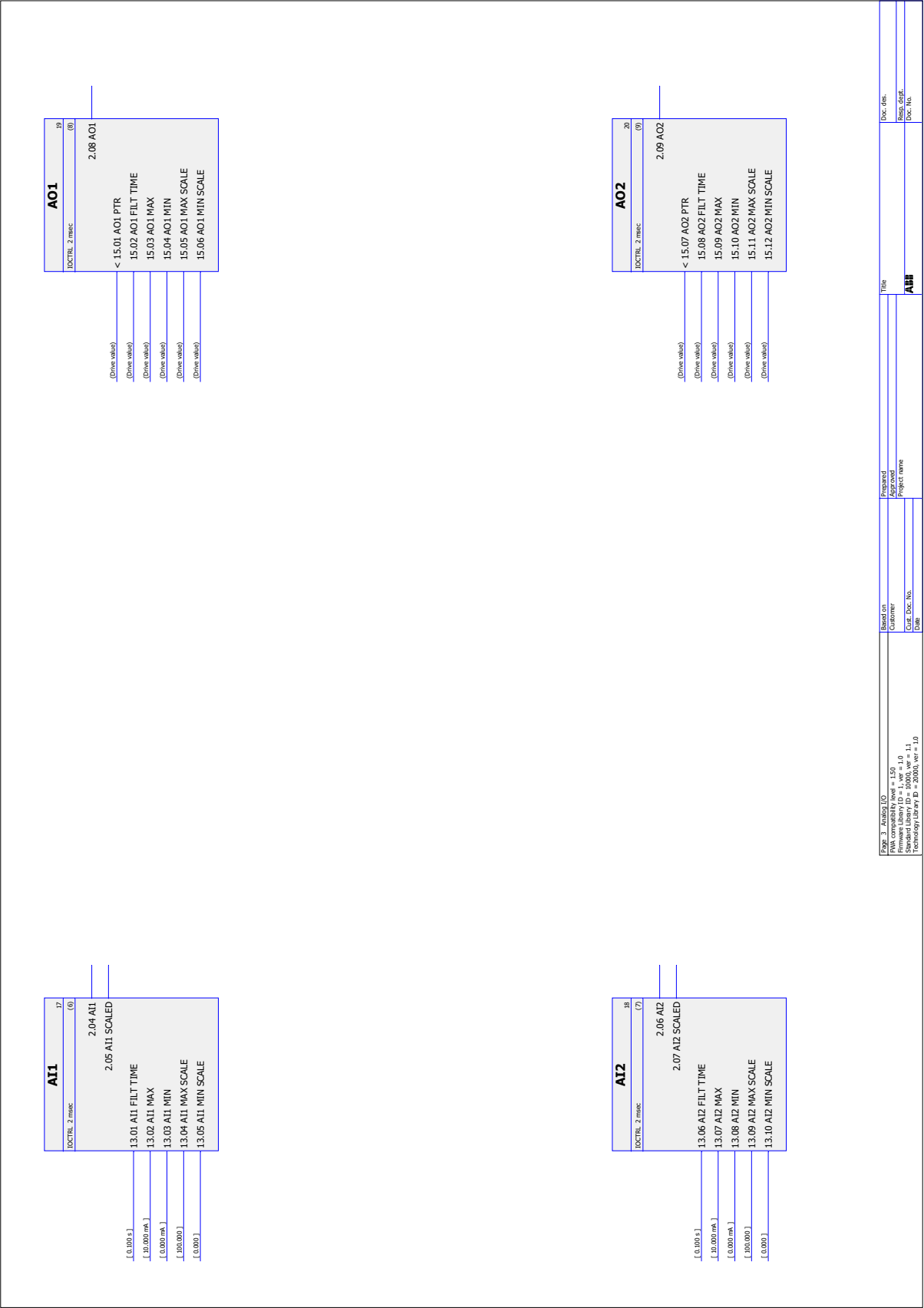
Control block diagrams

What this chapter contains

This chapter presents the application program pages containing the winder control program technology blocks and custom circuits. Winder-specific blocks and circuits are white, while the firmware blocks are shaded in the following diagrams.







Page 3 Analog I/O
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Firmware Library ID = 1, ver = 1.0
Standard Library ID = 10000, ver = 1.1
Technology Library ID = 20000, ver = 1.0

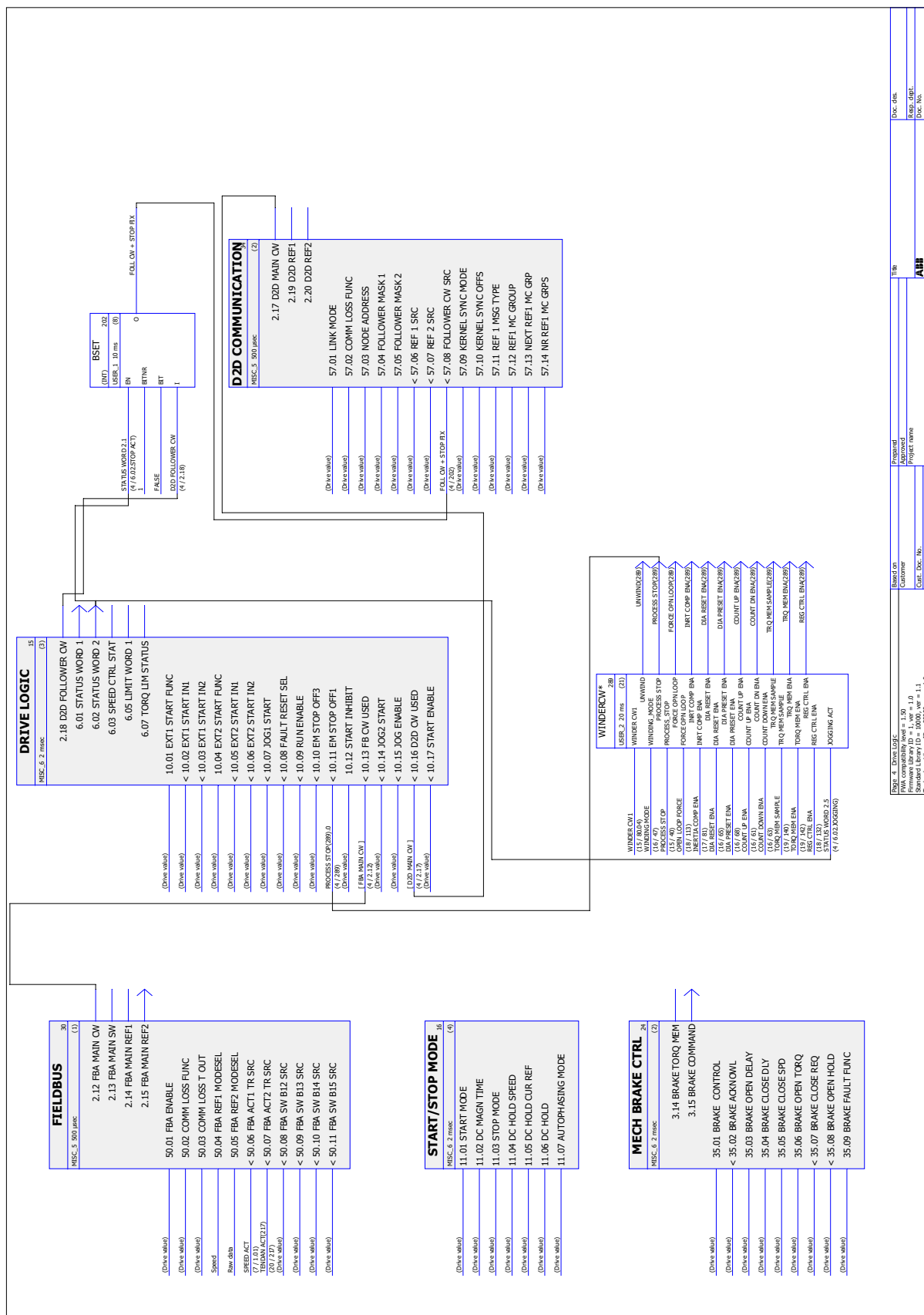
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Date

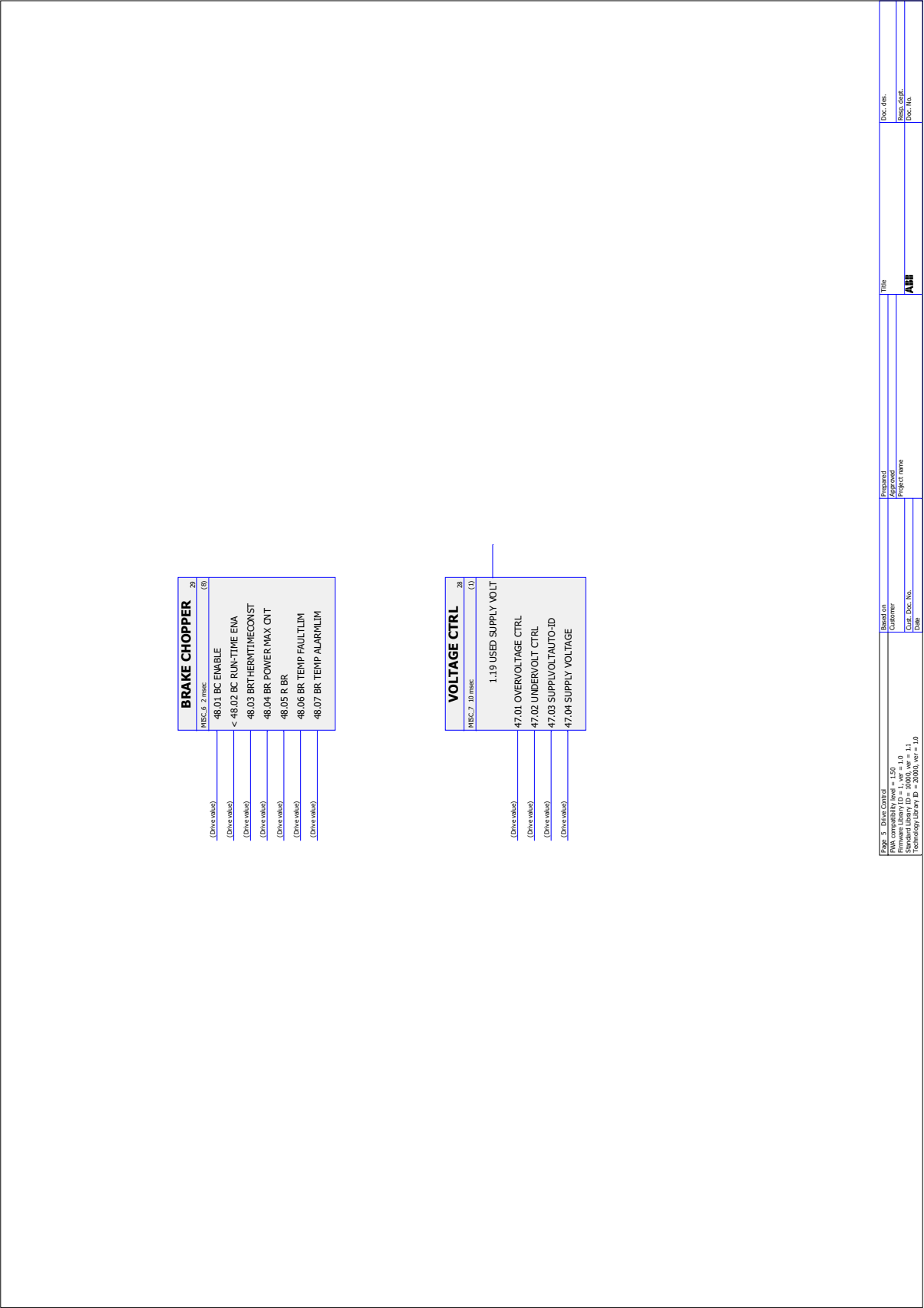
Prepared
by
Project Name

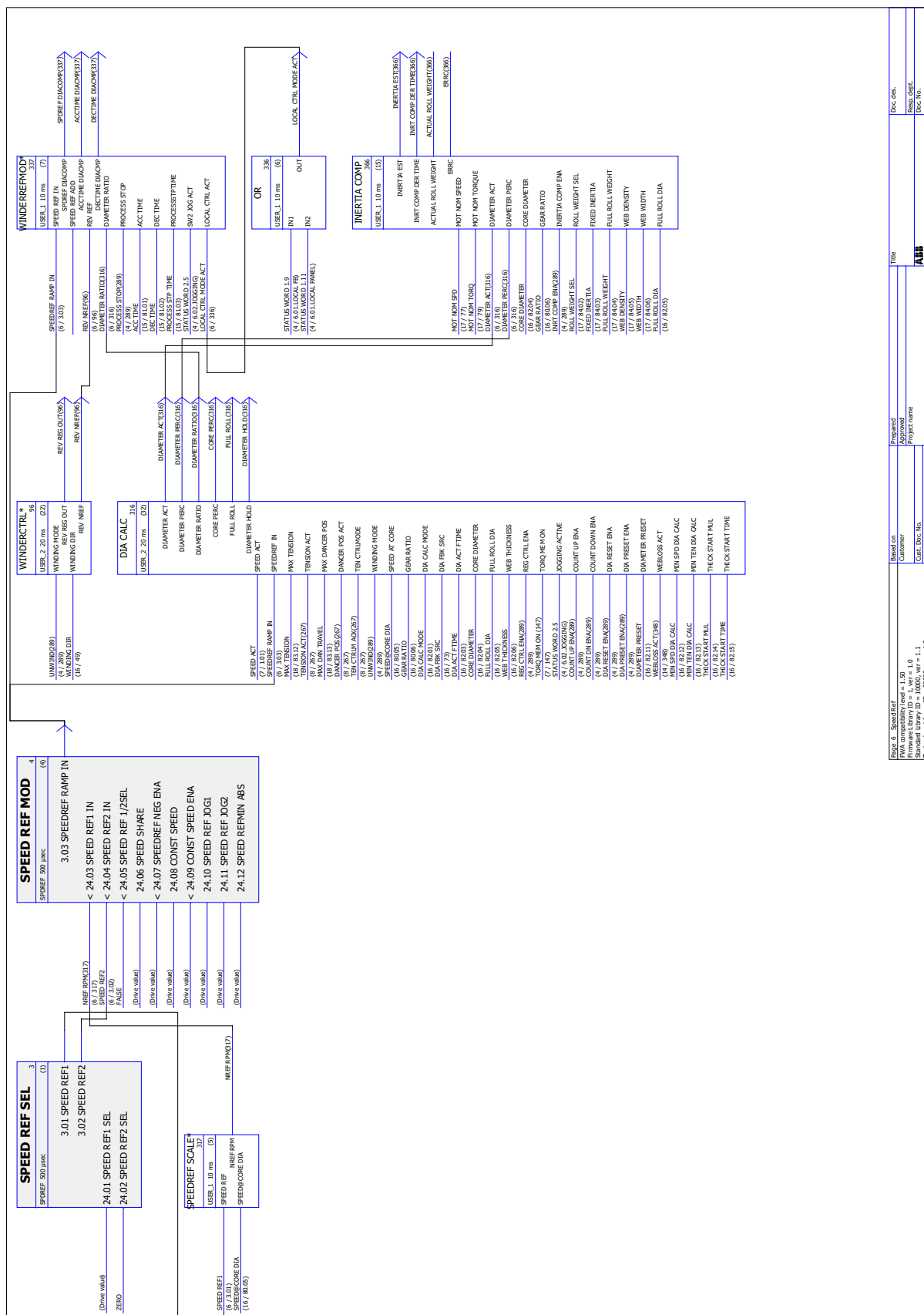
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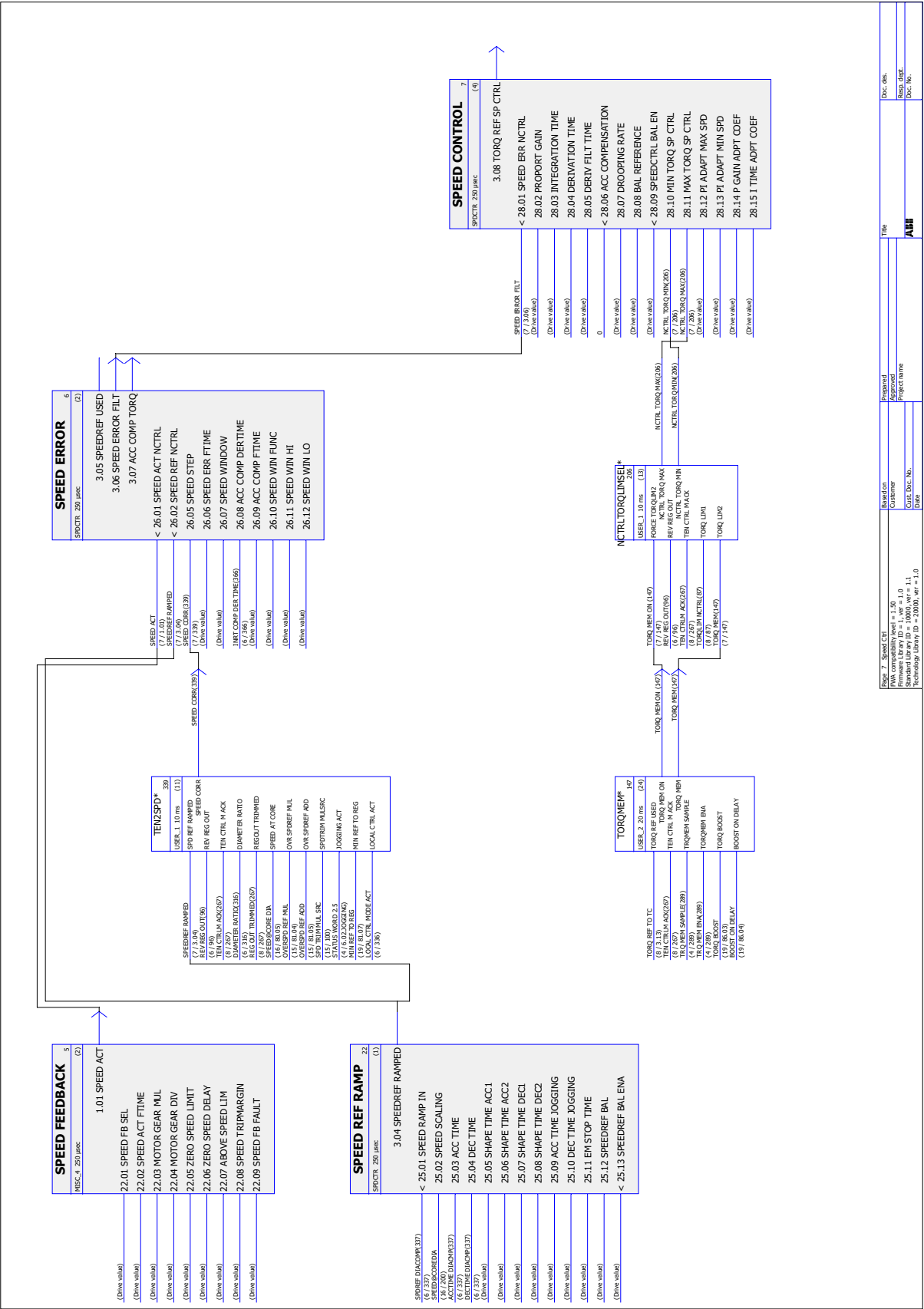
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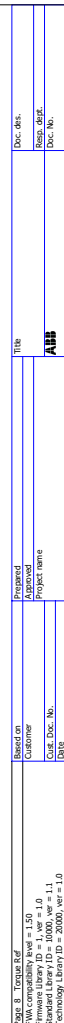
Control block diagrams

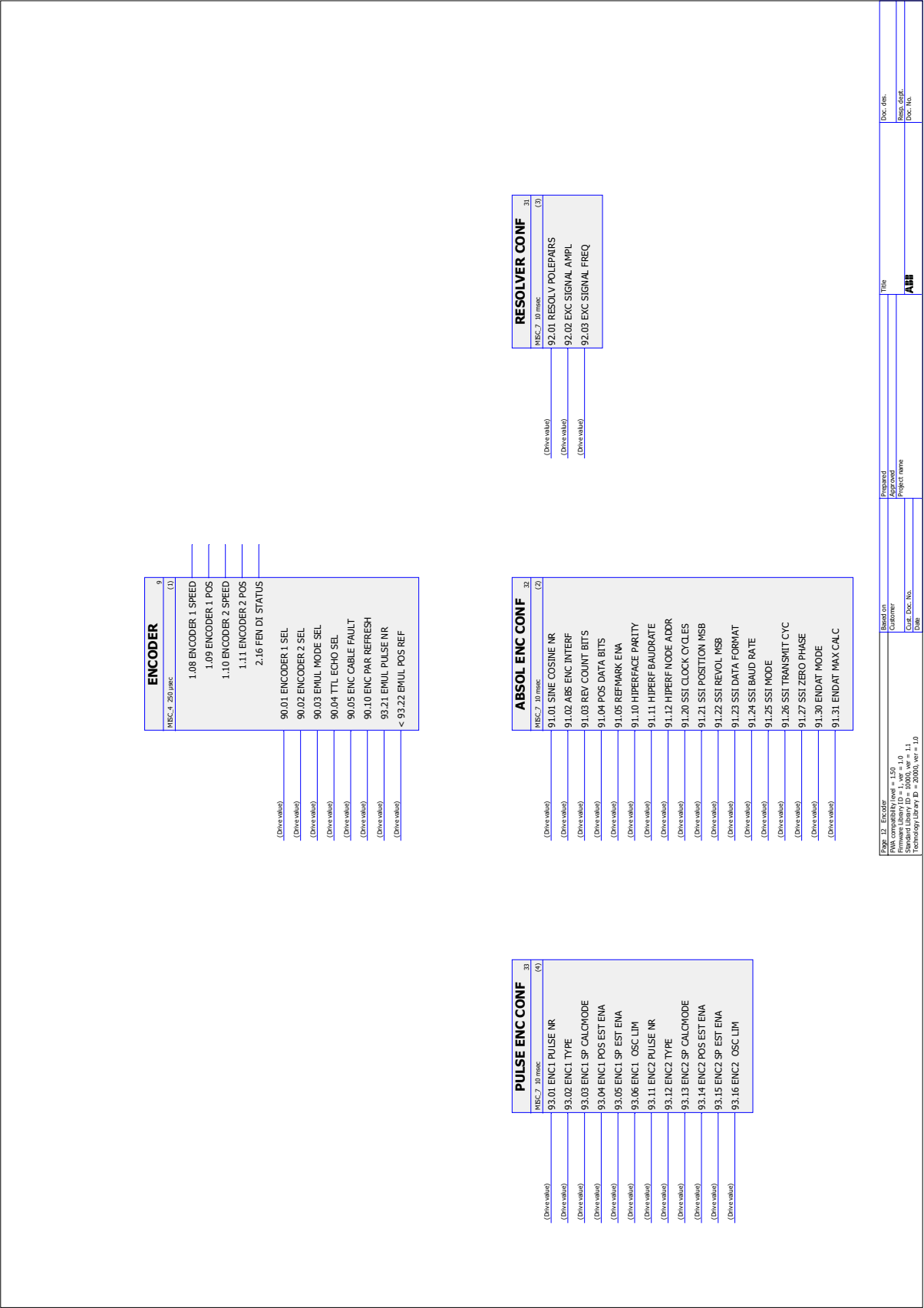


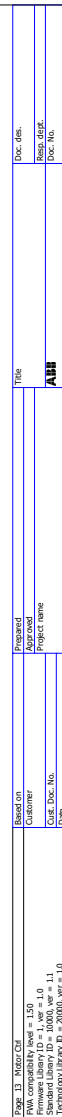


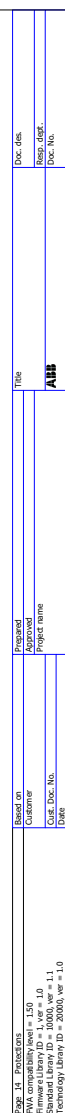












Appendix A: Motor rotor inertia, IEC

The table given below is an example of common inverter duty AC motor rotor inertia. The data is from the ABB cast iron totally enclosed squirrel cage motors catalog. The electrical ratings are based on 400 V AC 50 Hz sinusoidal input.

Power (kW)	Poles	Base rpm	IEC Frame	Nominal current (A)	Nominal torque (Nm)	Inertia (kgm ²)
0.75	6	935	90 S6	2.05	7.65	0.0039
	4	1410	80 M4	1.85	5	0.0021
	2	2830	80 M2	1.6	2.53	0.00097
1.1	6	920	90 L6	2.8	11.5	0.0049
	4	1410	90 S4	2.65	7.45	0.0029
	2	2835	80 M2	2.25	3.7	0.0012
1.5	6	950	100 L6	3.8	15	0.011
	4	1410	90 L4	3.45	10.1	0.0037
	2	2850	90 S2	3.0	5.0	0.0015
2.2	6	950	112 M6	5	22	0.017
	4	1425	100 L4	4.6	14.7	0.0075
	2	2840	90 L2	4.3	7.4	0.002
3	6	955	132 S6	6.5	30	0.038
	4	1415	100 L4	6.1	20.2	0.0098
	2	2870	100 L2	5.8	10	0.0044
4	6	955	132 M6	8.8	40	0.049
	4	1435	112 M4	8	26.6	0.014
	2	2880	112 M2	7.6	13	0.0075
5.5	6	955	132 M6	11.4	55	0.065
	4	1430	132 S4	10.9	36.7	0.031
	2	2900	132 S2	10.4	18	0.013
7.5	6	970	160 M	15.7	74	0.088
	4	1430	132 M4	14.2	50	0.04
	2	2900	132 S2	13.9	24.5	0.016
11	6	970	160 L	23	108	0.106
	4	1455	160 M	21.5	72	0.066
	2	2925	160 MA	19.6	36	0.039

Power (kW)	Poles	Base rpm	IEC Frame	Nominal current (A)	Nominal torque (Nm)	Inertia (kgm ²)
15	6	975	180 L	31	147	0.207
	4	1460	160 L	29	98	0.09
	2	2915	160 M	16.5	49	0.047
18.5	6	980	200 ML	35	180	0.37
	4	1470	180 M	35	120	0.161
	2	2915	160 L	32.5	61	0.054
22	6	980	200 ML	41.5	214	0.43
	4	1470	180 L	41.5	143	0.191
	2	2945	180 M	39.5	72	0.077
30	6	985	225 SM	56	291	0.64
	4	1475	200 ML	56	194	0.29
	2	2950	200 ML	53	97	0.15
37	6	985	250 SM	67	359	1.16
	4	1480	225 SM	68	239	0.37
	2	2950	200 ML	64	120	0.18
45	6	990	280 SM	82	434	1.85
	4	1475	225 SM	81	291	0.42
	2	2970	225 SM	79	145	0.26
55	6	990	280 SM	101	531	2.2
	4	1480	250 SM	98	355	0.72
	2	2975	250 SM	95	177	0.49
75	6	992	315 SM	141	722	3.2
	4	1484	280 SM	135	483	1.25
	2	2977	280 SM	131	241	0.8
90	6	992	315 SM	163	866	4.1
	4	1483	280 SM	158	580	1.5
	2	2975	280 SM	152	289	0.9
110	6	991	315 SM	202	1060	4.9
	4	1487	315 SM	192	706	2.3
	2	2982	315 SM	194	352	1.2

Power (kW)	Poles	Base rpm	IEC Frame	Nominal current (A)	Nominal torque (Nm)	Inertia (kgm²)
132	6	991	315 ML	240	1272	5.8
	4	1487	315 SM	232	848	2.6
	2	2982	315 SM	228	423	1.4
160	6	992	355 S	280	1540	10.4
	4	1486	315 SM	282	1028	2.9
	2	2981	315 SM	269	513	1.7
200	6	992	355 SM	355	1925	12.5
	4	1486	315 ML	351	1285	3.5
	2	2978	315 ML	334	641	2.1
250	6	992	355 SM	450	2407	12.5
	4	1487	355 S	430	1606	6.5
	2	2980	355 S	410	801	3.8



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