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Lenze

Manual

Global Drive

Software Package - Winder

Template DancerControl

This Manual applies to **Template DancerControl** as of version 1.0.

The **Template DancerControl** can be used for the following Lenze PLCs:

	Type	From hardware version	From software version
9300 Servo PLC	EVS93XX-xT	6A	6.2

Important note :

The software is supplied to the user as described in this document. Any risks resulting from its quality or use remain the responsibility of the user. The user must provide all safety measures protecting against possible maloperation.

We do not take any liability for direct or indirect damage, e.g. profit loss, order loss or any loss regarding business.

Version 1.1 03/2003 TD11

Template DancerControl

Contents

1 Preface and general information

1.1 About this Manual

This Manual contains information about the **Template DancerControl** for the **Drive PLC Developer Studio**.

- You can use the **Template DancerControl** to implement winder-specific functions in a Lenze PLC (e.g. 9300 Servo PLC).
- In addition to the basic winder functions, the **Template DancerControl** includes many “predesigned” solutions, which can help to save precious time.
- The template is part of the **Software Package - Winder**.

1.1.1 Conventions in this Manual

This Manual uses the following conventions to distinguish between different types of information:

Variable identifiers

are written in italics in the explanation:

- “Use *bReset* ...”

Tip!

Information about the conventions used for the variable identifiers of Lenze system blocks, function blocks and functions can be found in the appendix of the DDS online documentation “Introduction into IEC 61131-3 programming”. The conventions ensure universal and uniform labelling and make reading the PLC program easier.

Lenze functions/function blocks

can be recognized by their names. They always begin with an “L_”:

- “The FB **L_WndCalcDiameter**...”

Program listings

are written in “Courier”, keywords are printed in bold:

- “ `IF (ReturnValue < 0) THEN`...”

1.1.2 Pictographs in this Manual

	Use of pictographs	Signal words	
Warning of material damage	STOP	Stop!	Warns of **potential damage to material**. Possible consequences if disregarded: Damage to the controller/drive system or its environment.
Other notes		Tip! Note!	Indicates a tip or note.

1.1.3 Terminology used

Term	In the following text used for
DDS	Drive PLC Developer Studio
FB	Function block
GDC	Global Drive Control (Lenze parameterization program)
Parameter codes	Codes for setting the functionality of a function block
SB	System block
[unit]	Wildcard for the physical unit of the external measuring system used (e. g. " µm", "mm", "cm")

1.2 Version info about the template

The version of the template can be found under the global constant `C_wLenzeTemplateWndVersion` of the **Template DancerControl**.

- The value of this constant is hex-coded. E.g. “16#0130” means “version 1.3”.

1.3 Supported functions

The **Template DancerControl** supports the following functions:

- Speed pre-control with 1/D-evaluated line speed
- Higher-level PID controller for dancer control
- "Teach-in" of the dancer setting range
- Diameter calculator
- Compensation of the dancer movement
- Calculation of the material thickness
- Stop controller
- Control characteristic for tension characteristics
- Automatic identification of the current mass moment of inertia
- Pre-control of the acceleration torque
- Operation and diagnostics of template functions via a visualization
- Visualization of template states and signal flows

2 Winding basics

The following sections describe the winding basics.

- The functions supported by the template are described in chapter 1.3. (📖 1-2)

2.1 General

In a great variety of technology processes, winding drives are an integral part of the entire system.

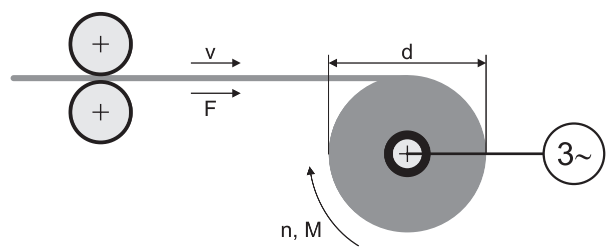
The individual materials processed have specific requirements. This is why different winder concepts and models are used, for instance, surface winders, center winders, multiplex reverse winders for feeding the web ”on the fly” or plate or bell-type winders for wire-shaped materials.

Center winders are most widely spread. With center winders, the reel is driven via the reel shaft. Although center winders are more difficult to control than other winders, they often offer the decisive advantage that the surface of the material is not damaged.

The integrated drive must provide a high speed and torque setting range. The right physical dimensioning and an appropriate load transmission (gearbox, toothed belt) are essential prerequisites for obtaining optimum winding results.

2.2 Motor selection

When using a center winder, the motor torque must be proportional to the reel diameter to ensure a constant tension and the motor speed must be proportional to the reciprocal of the reel diameter to ensure a constant web speed:



$$n \sim v \cdot \frac{1}{d} \qquad M \sim F \cdot d$$

Fig. 2-1 Center winder

The diameter setting range therefore has to be taken into account during the motor configuration.

- The maximum required motor torque results from the maximum required tension with the maximum diameter:

$$M_{max} = F_{max} \cdot \frac{d_{max}}{2}$$

Fig. 2-2 Formula for calculating the maximum motor torque

- The maximum speed results from the maximum material speed with the minimum diameter:

$$n_{max} = v_{max} \cdot \frac{1}{d_{min} \cdot \pi}$$

Fig. 2-3 Formula for calculating the maximum speed

- Accordingly, the reference power of the motor is calculated as follows:

$$P_{Ref} = F_{max} \cdot v_{max} \cdot q$$

Fig. 2-4 Formula for calculating the reference power of the motor
q Diameter ratio (d_{max}/d_{min})

Since the maximum motor torque is usually only reached at low speed and the maximum speed is only reached at a low motor torque, the field weakening range can also be used with asynchronous motors:

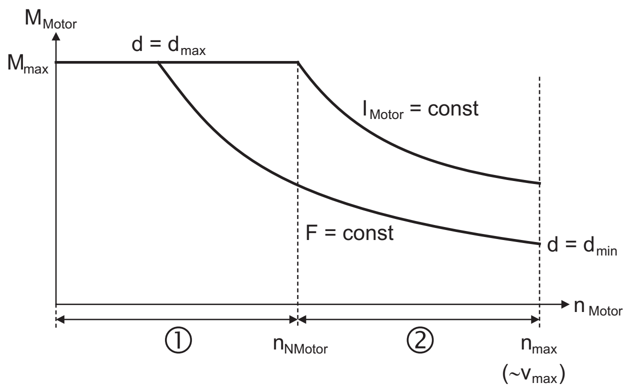


Fig. 2-5 Torque/speed characteristic
① Basic speed range
② Field weakening range

- The required rated motor power is reduced by the maximum field weakening factor:

$$q_F = \frac{n_{max}}{n_{rated\ motor}}$$

Fig. 2-6 Formula for calculating the field weakening factor

- If the efficiency of the gearbox is taken into account, the rated motor power is calculated as follows:

$$P_{rated\ motor} = \frac{P_{Ref}}{q_F \cdot \eta_{Gearbox}}$$

Fig. 2-7 Formula for calculating the rated motor power
P_{Ref} = Reference power of the motor
q_F = Field weakening factor

2.3 Gearbox selection

The total ratio of a winder results from:

$$i_{total} = \frac{n_{max}}{\left(\frac{v_{max}}{d_{min} \cdot \pi}\right)}$$

Fig. 2-8 Formula for calculating the total transmission ratio

We recommend to use only gearboxes with a high level of efficiency for tension-controlled winders.

Since the gearbox efficiency decreases when the gearbox ratio increases, we recommend to use a combination of gearbox and toothed belt ratio when high gearbox ratios are required. In very critical applications, gearboxes should be done without and toothed belt ratios should be used instead.

With dancer-controlled winders, the gearbox efficiency is hardly of importance. Here, a high transmission ratio is of advantage for the stability of the dancer control.

2.4 Winding characteristic

To ensure a constant tension up to the maximum diameter range, the motor torque must increase linearly with the diameter.

With large diameters there is, however, the risk that the static friction between the layers is exceeded and the reel core breaks out. With diameters and materials involving the risk of a break out of the reel core, the tension is therefore continuously reduced from a certain diameter on.

Select a linear tension characteristic or a tension characteristic decreasing with 1/d:

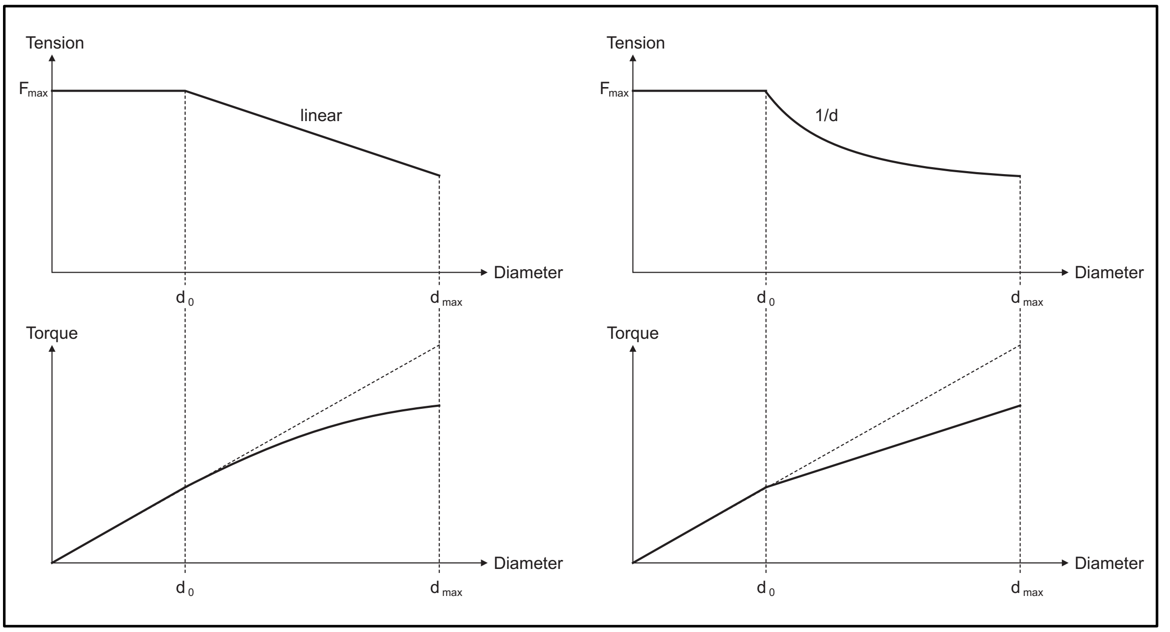


Fig. 2-9 Linear tension characteristic (left), tension characteristic decreasing with 1/d (right)

- If the tension decreases with 1/d, the torque characteristic is linear in the tension reduction range.

Tip!

For materials that require individual tension characteristics, you may alternatively use a table function with 65 coordinates.

2.5 Speed and torque setting range

The speed and the torque setting range are used as characteristics for assessing the motor control requirements.

- The required speed setting range results from the ratio of the maximum and minimum speed multiplied by the diameter ratio:

$$n = \frac{v_{max}}{v_{min}} \cdot q$$

Fig. 2-10 Formula for calculating the speed setting range

v_{max} = maximum speed
v_{min} = minimum speed
q = Diameter ratio

- Accordingly, the torque setting range results from:

$$m = \frac{F_{max}}{F_{min}} \cdot q$$

Fig. 2-11 Formula for calculating the torque setting range

F_{max} = maximum tension with maximum diameter
F_{min} = minimum tension with minimum diameter
q = Diameter ratio

2.6 Interferences

If the tension of the winder is to be controlled via the motor torque, two quantities may have a considerable influence on the desired result. These are, on the one hand, the mechanical losses through bearing and gearbox friction and, on the other hand, torque losses during acceleration. Appropriate correction signals have to be added to the motor torque to ensure that these interference quantities do not have any serious effects.

2.7 Friction compensation

The friction torque is becoming increasingly important the lower the motor torque for the lowest tension value. With a 50 % torque setting range, the lowest torque setpoint is already 2 %. Even with a 98% gearbox efficiency, the motor torque would be completely used up by the gearbox friction.

The friction torque consists of a static and a speed-dependent component. In addition to the speed, the gearbox temperature may also influence the friction behaviour:

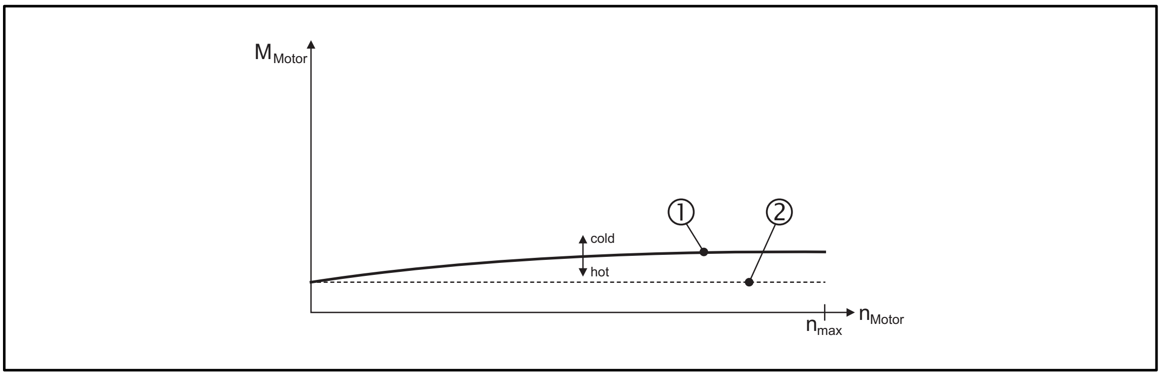


Fig. 2-12 Friction behaviour
① Speed-dependent friction component
② Static friction component

Tip!

The friction characteristics can be identified through an automatic identification run.

After the measurement results have been evaluated and freak values have been corrected, if necessary, the identified values can be used as a table function for pre-controlling the friction torque.

2.8 Acceleration compensation

The acceleration torque is also increasingly important the lower the tension values.

- It results from the current mass moment of inertia and the change of the motor speed:

$$M_{acc} = J \cdot 2 \cdot \pi \cdot \frac{dn}{dt}$$

Fig. 2-13 Formula for calculating the acceleration torque
J = Current mass moment of inertia in [kg cm^2]

The current mass moment of inertia consists of a machine-dependent component and the mass moment of inertia of the reel.

The machine-dependent component results mainly from the constant mass moment of inertia of the motor. Other drive elements such as the gearbox or the reel shaft can usually be neglected.

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Basics

The mass moment of inertia of the reel can, however, be subject to considerable variations and depends on several parameters.

- In general, the below formula applies:

$$J_{reel} = \frac{\pi}{32 \cdot 10^8} \cdot B \cdot \rho \cdot \frac{d^4 - d_{min}^{\ 4}}{i^2}$$

Fig. 2-14 General formula for calculating the material-dependent mass moment of inertia (referred to the motor end)

J_{reel} = Mass moment of inertia of the reel in [kg cm^2]
B = Material width in [mm]
ρ = Material density in [kg/dm^3]
d = Current diameter in [mm]
d_{min} = Sleeve diameter in [mm]
i = Gearbox factor

- If the change of the motor speed is replaced by the change of the line speed and the diameter, the below formula applies:

$$M_{acc} = (J_{machine} + J_{reel}) \cdot \frac{1}{3} \cdot \frac{J_{max} \cdot v_{max} \cdot i}{M_{max} \cdot d_{min}} \cdot \left(\frac{dv_{line}}{dt} - \frac{v_{line}}{d} \cdot \frac{dd}{dt} \right) \cdot \frac{1}{d}$$

Fig. 2-15 Formula for calculating the acceleration torque

The below diagram shows different acceleration torque characteristics as a function of the reel diameter in relation to the setpoint torque characteristics for the minimum and maximum tension:

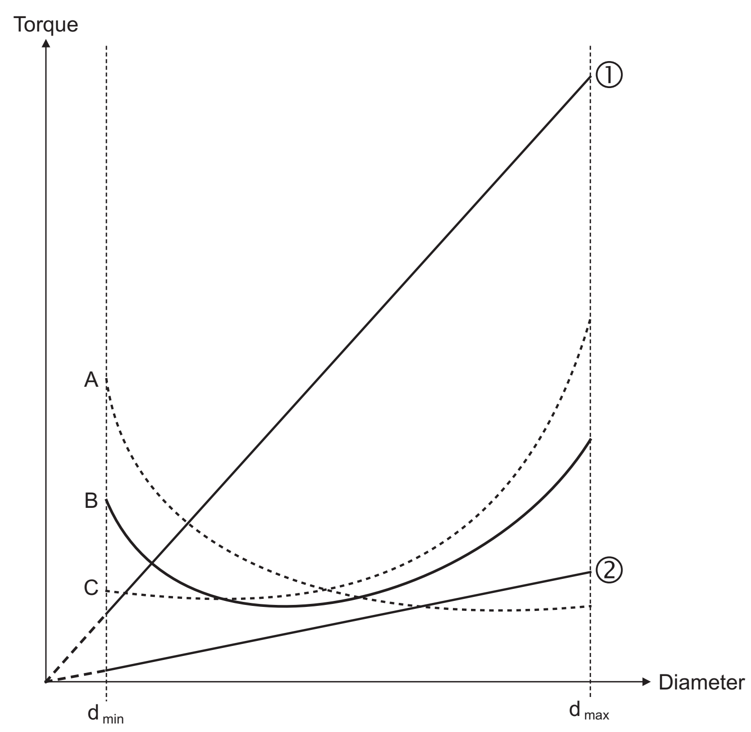

Fig. 2-16 Acceleration torque as a function of the reel diameter
① Setpoint torque characteristics for maximum tension
② Setpoint torque characteristics for minimum tension
A, B, C Typical acceleration torque characteristics with different gearbox factors (see next page)

In general, the constant component of the mass moment of inertia predominates with small diameters so that the acceleration torque is falling with 1/d. With big diameters, the material-dependent component is predominant.

- **Curve B** shows a curve with which the acceleration torque increasingly follows the function d^3.
- **Curve A** shows a typical curve for a winder with a high gearbox ratio. The constant mass moment of inertia dominates throughout the whole diameter setting range.
- **Curve C** shows a typical curve for a winder with a very low gearbox ratio. Here, the acceleration torque starts very soon to rise exponentially.

Tip!

For acceleration torque pre-control, the minimum (constant) mass moment of inertia and the maximum mass moment of inertia have to be entered via codes. The physical values can be identified through an automatic identification run.

2.9 Possible control and regulation methods

There are mainly 3 control methods used for center winders:

- Tension control
- Tension regulation (📖 2-9)
- Dancer control (📖 2-10)

The ”speed-determining center winder” is another variant which is always required if there is no other master available to determine the material speed. (📖 2-11)

2.9.1 Tension control

The tension control is mainly used in applications in which the requirements on the torque setting range are not particularly high and the material hardly reacts to tension deviations. In this case, additional mechanical components such as a dancer system or tension measuring device are not required.

Reference points for possible areas of application

Material:	Sheet metal, textiles, paper
Line speed:	up to 600 m/min
Max. diameter ratio	1 : 10
Max. tension setting range:	1 : 6
Max. torque setting range:	1 : 40

Basic principle

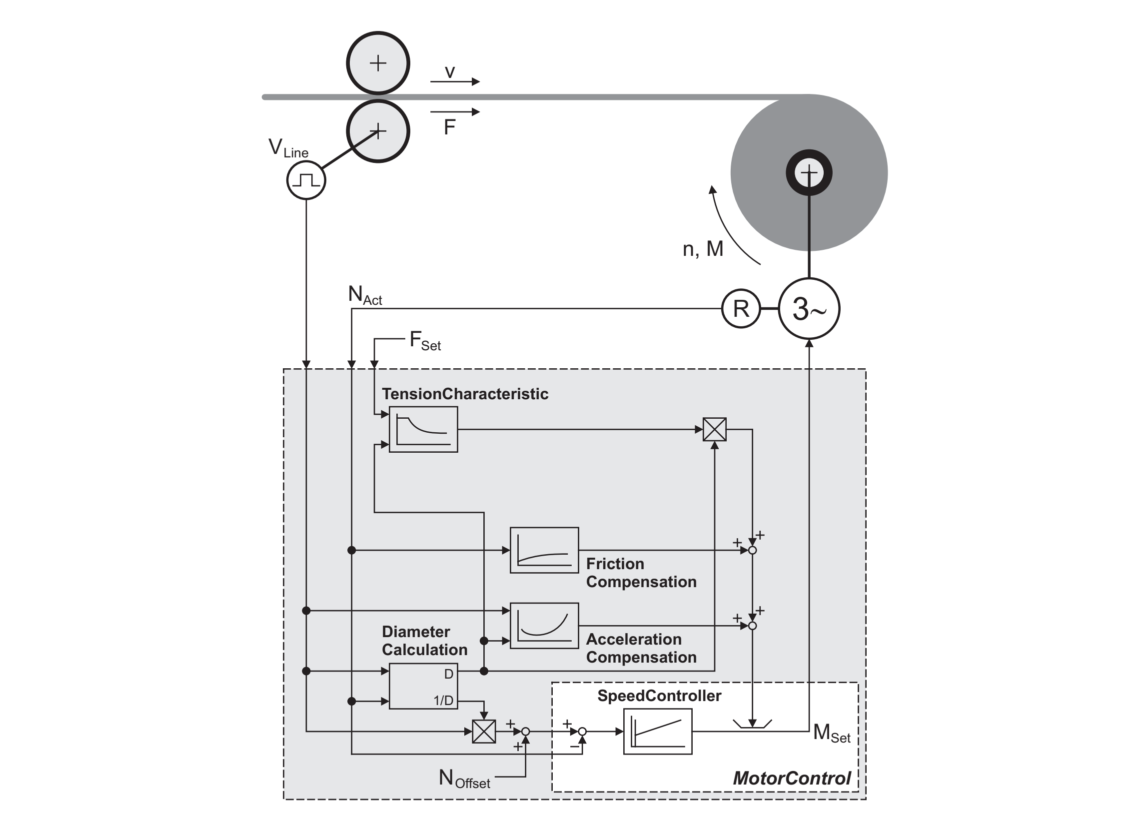

Fig. 2-17 Basic principle: Tension control

For torque control, the speed controller always receives a setpoint that is higher than the actual value. The speed controller is therefore permanently at its upper limitation.
By controlling the torque limitation it is ensured that the motor control generates the required motor torque.

The limitation value consists of the tension setpoint multiplied by the current diameter, the correction signal for compensating the mechanical friction and the correction signal for compensating the acceleration torque.
Precise diameter calculation is essential for speed pre-control and the calculation of the limitation value.

Pre-controlling the speed controller with a setpoint that is slightly too high has the advantage that the drive only accelerates up to this speed after a web break. With an unwinder, the speed controller is only controlled with the offset value. In this way, the drive can without any obstacles brake until coming to a standstill.

For achieving good winding results, the friction and acceleration torque should not exceed the lowest load torque. If the quality of the reel is not good enough, the motor torque can be controlled by means of a tension measuring device.

2.9.2 Tension regulation

Tension regulation is always required when high torque setting ranges have to be reached or the material is very sensitive to tension deviations.

Reference points for possible areas of application

Material:	Plastic film, paper
Line speed:	up to 2000 m/min
Max. diameter ratio	1 : 15
Max. tension setting range:	1 : 20
Max. torque setting range:	1 : 100

Basic principle

Based on the basic tension control principle, the web tension is measured by using an additional measuring device and compared with the tension setpoint. In case of a deviation, the tension controller corrects the pre-control signal:

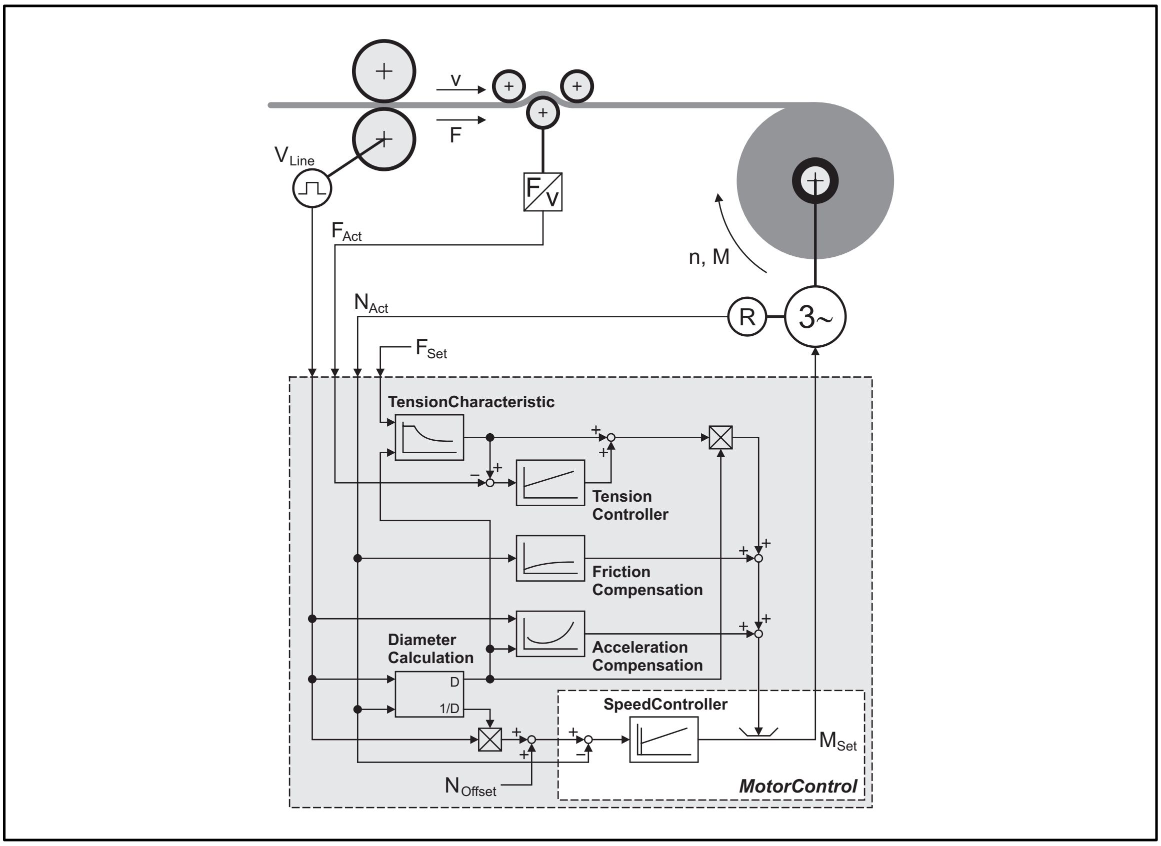

Fig. 2-18 Basic principle: Tension regulation

In general, the tension controller has for stability reasons only a very small dynamic performance. This is why the acceleration compensation is of particular importance.

If interferences, for instance, occurring during acceleration or in the event of eccentricity cannot be satisfactorily compensated, a dancer control should be used instead.

2.9.3 Dancer control

With the dancer control, the web tension is solely produced by the dancer system connected to the winder. The strength of the dancer control is the comparably problem-free behaviour in case of dynamic interferences. It is mainly used in applications requiring a high absolute tension precision.

Reference points for possible areas of application

Material:	Cable, wire, textiles, plastic film, paper
Line speed:	up to 1000 m/min
Max. diameter ratio	1 : 15
Max. tension setting range:	Is determined by the dancer type.
Max. torque setting range:	Is determined by the dancer type.

Basic principle

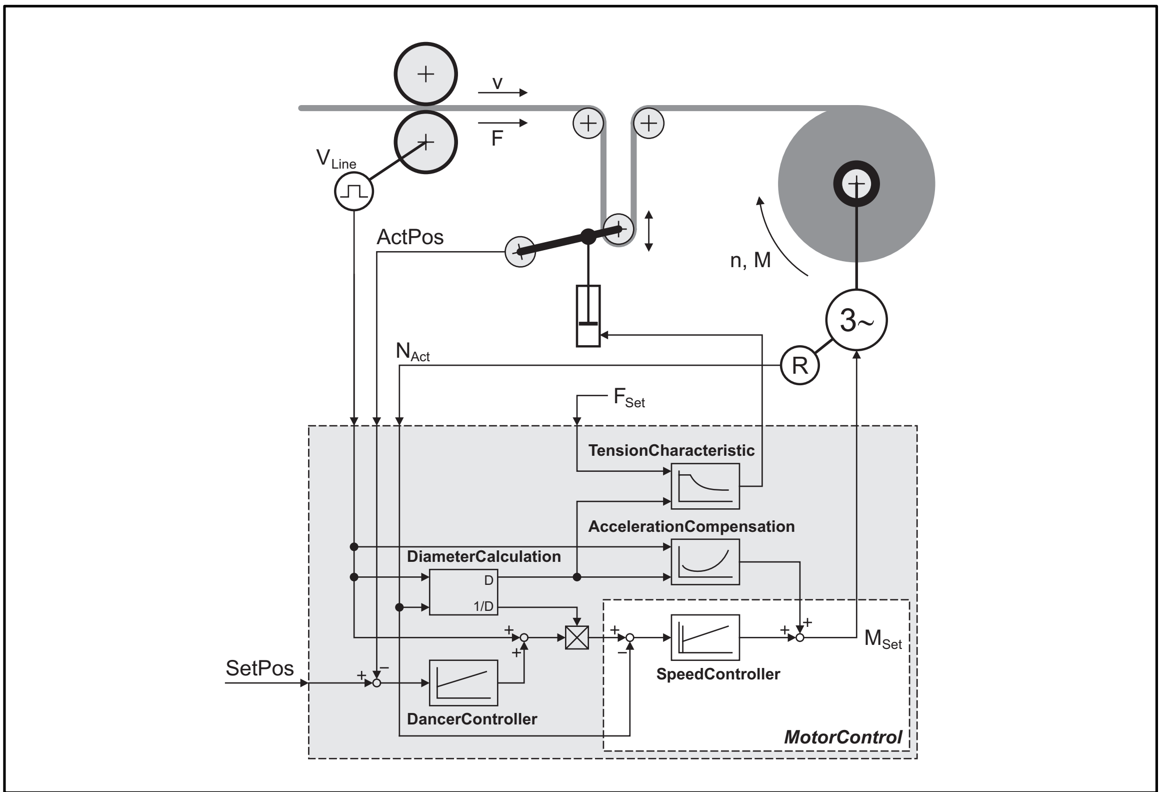

Fig. 2-19 Basic principle: Dancer control

With the dancer control, the winding motor is speed-controlled. For pre-control, the line speed signal is multiplied by the reciprocal of the current diameter. The dancer position is identified and compared with the set setpoint position. In case of a deviation, the dancer controller corrects the pre-control signal.

To ensure that there does not occur a serious control difference in the dancer circuit when the acceleration torque is built-up or reduced, the speed controller output is pre-controlled to compensate the acceleration torque. Just as with the tension control, the tension characteristic can be used to control the dancer system.

Since the dancer system is at the same time a material storage device, short-term fluctuations in the circumferential speed have an effect on the instantaneous dancer position, but hardly any effect on the tension, provided that the limit positions of the dancer are not reached and the mass moment of inertia of the dancer roller is not too high.

To be in a position to react quickly to deviations, a low mass moment of inertia is of advantage, i.e. a high gearbox factor is advantageous when using a dancer controller.

2.9.4 Speed-determining winder

In applications, in which the web speed is not determined by a line drive, the winder has to take over the speed control. Especially with rewinders where only two winders are used for rewinding, one of the drives has to determine the web speed while the other drive takes care of the web tension.

Reference points for possible areas of application

The areas of application are mainly determined by the tension-determining drive.

Basic principle

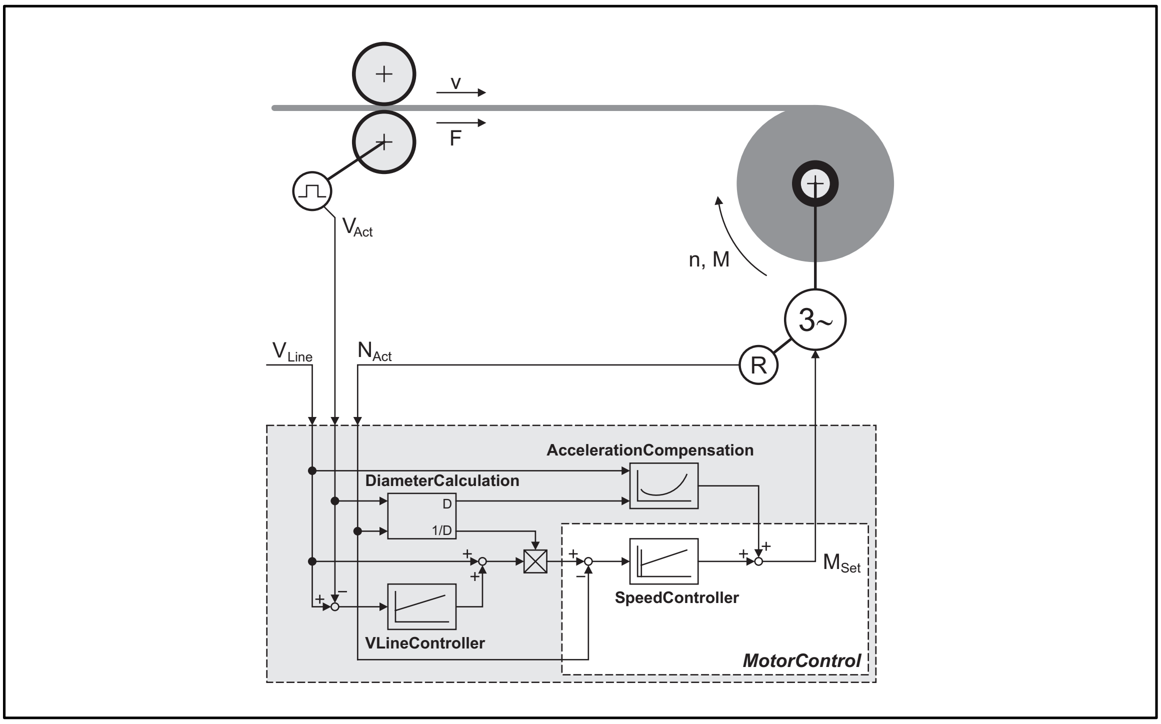

Fig. 2-20 Basic principle: Speed-determining winder

The basic principle of the speed-determining winder is similar to that of the dancer control. In general, there is, however, no controller required for pre-control signal correction.

Winders using a speed feedback system for diameter calculation can only be safely operated as winding-up units. With unwinders there is the risk of a direct feedback or an uncontrolled acceleration if a loop occurs in front of the web tacho-generator. This is why the speed measurement should be implemented as near as possible to the winder and the web speed should be transmitted without slip.

If the material is to be rewound several times, the diameter calculation has to be replaced by an external diameter sensor or a dancer system has to be used that definitely prevents the formation of loops.

3 Introduction

3.1 What is a template?

Templates are program patterns that are used to create an IEC 61131 project by means of the Drive PLC Developer Studio (DDS). The templates already include pre-defined function modules and program parts that can be used as a basis for solving the individual automation tasks.

Lenze offers templates for a variety of technology functions. The functions of the individual templates have been specially designed for the individual tasks.

- Thanks to this functional demarcation, the user project only contains program parts that have been tailored and optimised for the automation task in question.
- The use of uniform user interfaces and program structures makes program handling and maintenance easier.
- The templates are based on the application know how and technical expertise of Lenze.

3.1.1 Areas of application

We recommend to use templates if:

- A substantial part of the automation task can be solved with the basic template functionalities.
- The user cannot or does not want to program the comprehensive core functions of the technology system used (positioner, cam, winder, ...) himself.
- The user wants to save time by using pre-fabricated function modules.
- The project requires a uniform, protected physical external interface.
- The user would like to take advantage of Lenze know-how.

We do not recommend to use templates if:

- A task is very complex and the user has to have detailed know-how to implement the core functions.
- A task is so easy that the use of a template definitely exceeds the scope of functions required.
- The user does not want to use any pre-fabricated functions from Lenze.

3.2 Software architecture

The templates are part of a multi-layer software architecture:

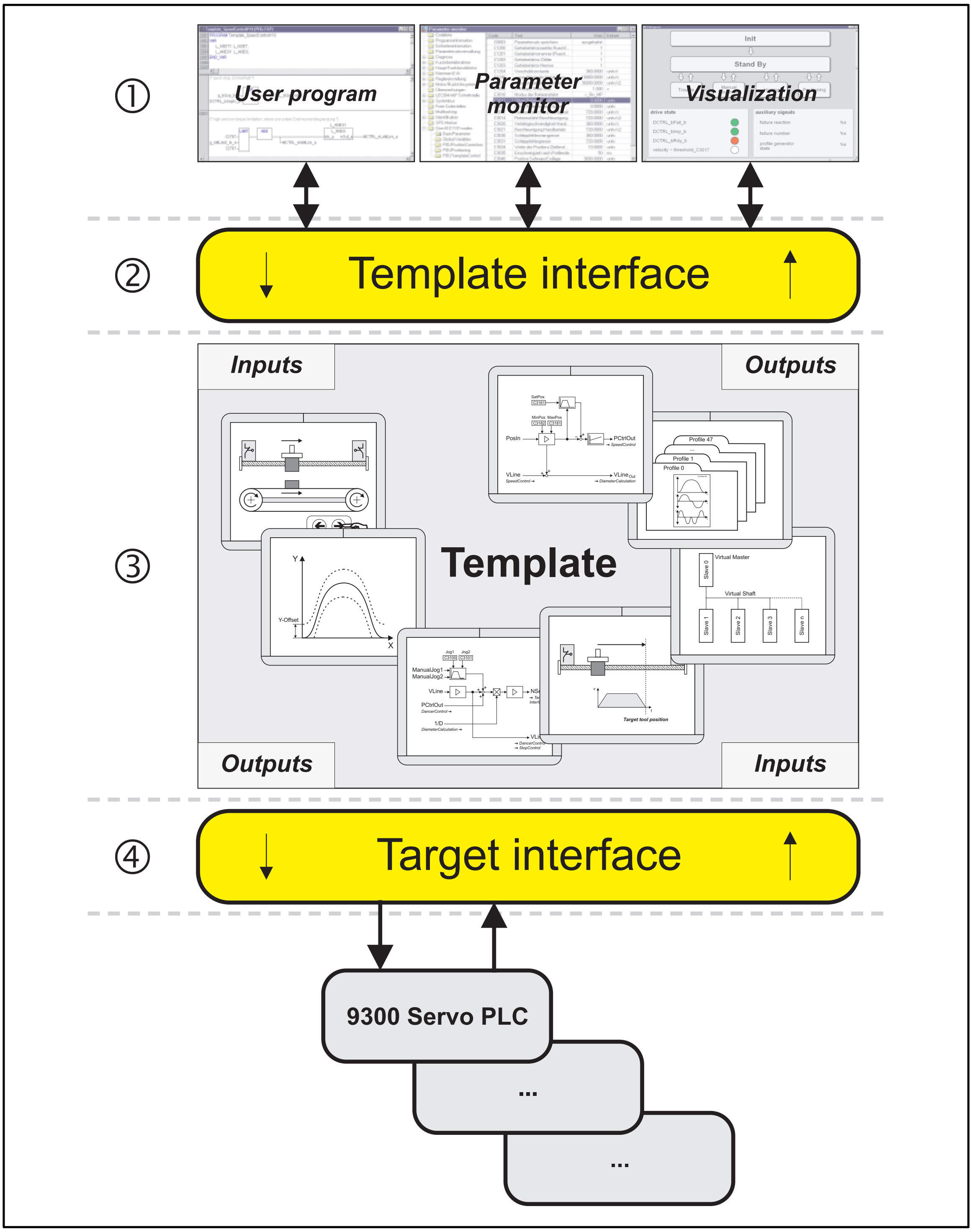

Fig. 3-1 Software architecture

① Application layer
② Defined interface between application layer and template
③ Template with pre-fabricated technology functions
④ Defined interface between template and target system

3.2.1 Basic concept

Basic concept of the template:

- The template provides all core functions of the technology used and cannot be modified by the user.
- The user operates the core functions of the template from his user program via the defined interface of the template.
- All functional extensions or adaptations implemented by the user are implemented in a separate project area, the so-called application layer.

3.2.2 Application layer

The application layer is the project area from which the user controls and monitors the template, defines user-specific parameters, and creates his own template-based IEC 61131 programs to solve individual tasks.

Possible tasks:

- Processing of operator setpoint selections
- Interfacing of host systems or Human Machine Interfaces (HMIs)
- Monitoring of user-specific processes
- Control of peripheral components (terminals, additional drive systems)

The application layer also includes:

- The **Parameter monitor** which can be used for ”online” parameter assignment of codes
- The **Visualizations** which make operation and handling of the template easier.

Tips!

Program Organisation Units (POUs)

The template already includes a variety of POUs which can be adapted and extended by the user. The name of these POUs always begins with the word ”user”.

Project organisation

Take advantage of the opportunity to create your own folders and sub-folders in the *Object Organizer* to organise your individual extensions in a logical project structure.
This makes the subsequent transfer to other templates and template updates easier.

Objects which cannot be changed

Some objects in the *Object Organizer* which are part of the template functionality can be displayed in the editor area for program documentation, but cannot be changed by the user.

3.2.3 Template interface

With its permanently defined inputs and outputs, the *template interface* forms the interface between the application layer and the template itself. It allows to:

- access setpoint and actual template values
- control the template (e.g. start/stop of a drive function)
- control the status of the template (e.g. query of error messages)
- configure and set the parameters of the template

Within the template, this interface is represented by the global variables in the **Template Interface** folder and the codes included in the template.

Note!

Codes 3000 to 3999 are designed for the template configuration.

We therefore recommend not to use any codes from this range for your own extensions to make sure that numbers do not collide during a subsequent update of the template.

3.2.4 Target interface

Since the template has been designed for different platforms it can be used for different target systems (e.g. 9300 Servo PLC or Drive PLC).

The template and the selected target system communicate via a permanently defined interface, the so-called *target interface* . The *target interface* connects internal signals with the target system and re-normalizes them.

- The *target interface* is implemented in a platform-specific function library (LenzeTIxxxx.lib).

3.2.5 Template

The template is the functional core of the project. It provides precisely defined functions for specific tasks which are called and activated from the application layer (the user program).

- Via its "upper" inputs, the template cyclically reads all information from the *template interface.* and then executes the individual functions.
- Via its "upper" outputs, the template cyclically returns status information to the *template interface.* This information can then be evaluated and processed by permanently defined global variables in the user program.

Information between the "lower" inputs and outputs of the template and the *target interface* is exchanged accordingly:

- Via its "lower" outputs, the template cyclically transmits the control information to the *target interface*. The target interface preprocesses this information for the relevant target system and forwards data to it.
- Via its "lower" inputs, the template cyclically reads back the status information through the *target interface* from the target system.

4 Template commissioning

This chapter describes step by step how to commission the template. Please execute the following 10 sections in the given order:

Note!

Please observe the system requirements described on the following pages during commissioning!

4.1 System requirements

System requirements for template commissioning:

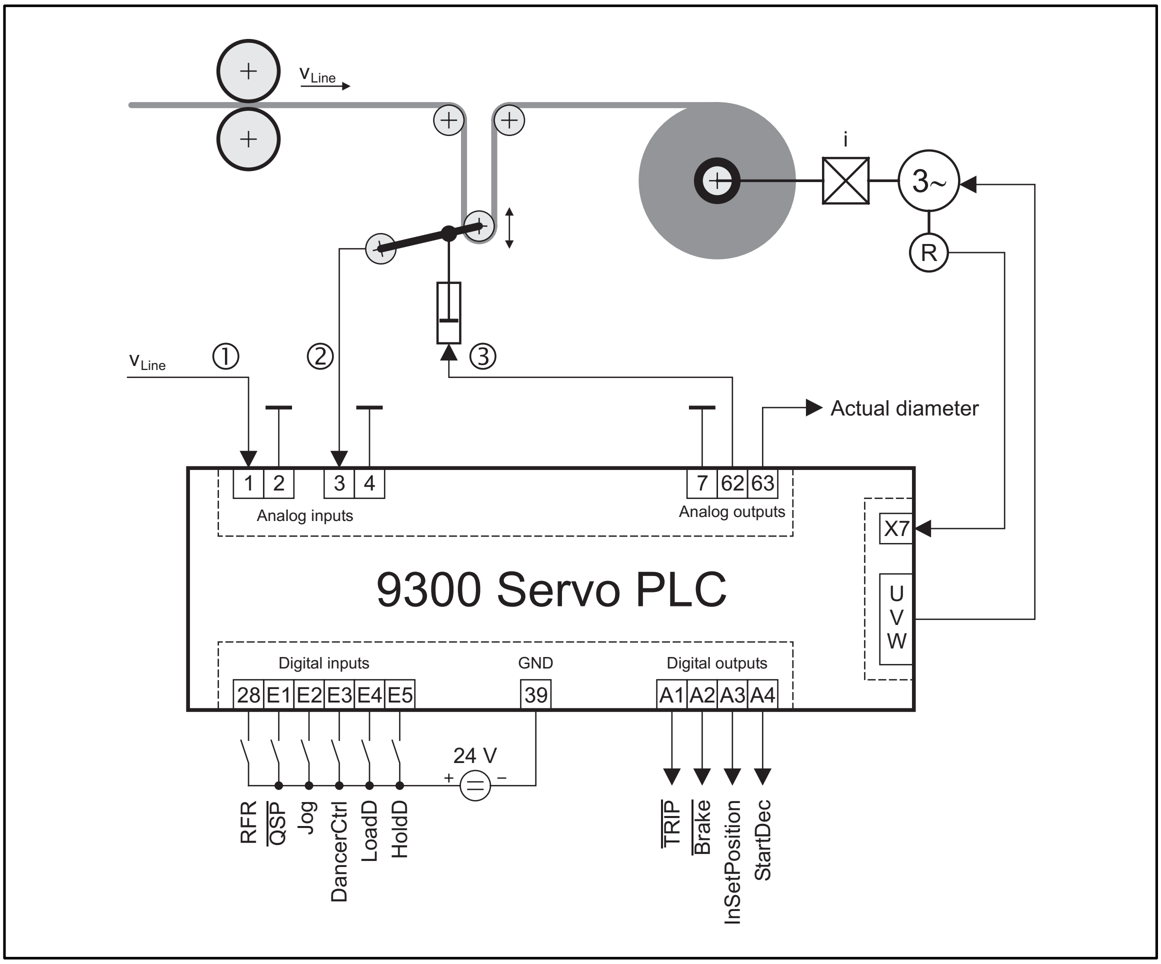

Fig. 4-1 System structure

① Analog input signal proportional to the line speed
② Analog input signal for identifying the dancer position
③ Analog output signal for controlling the dancer tension

Stop!

Please read the Safety and Application Instructions for Lenze current converters in the Mounting Instructions for the 9300 Servo PLC!

Terminal	Signal	Info		
Analog inputs				
1, 2	VLine	Signal ① proportional to the line speed (web speed).		
3, 4	Dancer position	Signal ② for detecting the dancer position (e.g. via a magnetoresistive potentiometer).		
Digital inputs				
28	RFR	Controller enable		
			LOW	Controller inhibited.
			HIGH	Controller enabled.
E1	QSP	Quickstop (QSP)		
			LOW	Activates the quick stop. • The brake is activated (A2 = LOW). • After reaching the standstill, a pulse inhibit can be automatically set after a variable delay time (option). This function is configured under C3254 and C3255.
			HIGH	Deactivates the quick stop. • The brake is released (A2 = HIGH).
E2	Jog	Jog control • The jog speed can be set under C3100. • The acceleration can be set under C3102, the deceleration can be set under C3103.		
			HIGH	Jog control activated. • If *g_bManualOperation* = TRUE.
E3	DancerCtrl	Dancer control		
			HIGH	Dancer control activated.
E4	LoadD	Loading the diameter value		
			HIGH	The value set in C3006 is loaded into the diameter calculator. The calculation of the material thickness is reset.
E5	HoldD	Holding diameter and material thickness values		
			HIGH	The calculated diameter and material thickness values are maintained (remain unchanged).
Analog outputs				
62	TensionOut	Signal ③ for controlling the dancer tension		
63	DAct	Current diameter • Referred to d_{max} (C3005)		
Digital outputs				
A1	$\overline{\text{TRIP}}$	Status signal ”Error”		
			LOW	An internal error has occurred.
			HIGH	No error.
A2	$\overline{\text{Brake}}$	Brake control		
			LOW	Activates the brake
			HIGH	Releases the brake
A3	InSetPosition	Status signal ”Setpoint position reached”		
			LOW	Dancer deviates from the setpoint position.
			HIGH	Dancer has reached its setpoint position.
A4	StartDec	Status signal ”Start braking” • The direction of winding can be selected under *g_bUnwindOperation*. • The reference diameter for wind up operation can be selected under C3142. • The reference diameter for unwind operation can be selected under C3143.		
			LOW	Pre-stop point not yet reached.
			HIGH	Pre-stop point reached.

4.2 Commissioning

The following sub-sections lead you step by step through the template commissioning. They are based on the system requirements described in chapter 4.1.

Tip!

The dancer control can only be optimised during the commissioning of the winder. Detailed information about this can be found in chapter 5.3, "Function DancerControl". (5-7)

4.2.1 Resetting the PLC

1. Load the factory setting with C0002 = 2 (e. g. via keypad).
2. Permanently save the factory setting with C0003 = 1.
3. Set all PLC inputs to LOW level.

4.2.2 Creating a new project in DDS

1. Select **File →Open** to open an existing project in the Drive PLC Developer Studio.
2. Go to the dialog box *Open*, select the file **ExampleDancerControl.pro** in the DDS sub-directory **Projects/Winder** and confirm with **Open**.

The dialog box *Password for working group* will be indicated.

3. Select **Step 1**, do not enter anything under **Password** and confirm the entry with **OK**.

Tip!

- The project will be displayed with visualisation.
- Use the command **Project →Project Information** to add information such as author, version and history to the project.

4. Select **File →Save as** to save the project under a new name.

4.2.3 Setting the machine parameters

In DDS, the constant machine parameters are set under the **Code initialization values** that can be found in the *Object Organizer* in the **Resources** register.

1. Open the **Code initialization values** and enter the machine parameters:

Global parameters				
Code / **Subcode**	**Data type**	**Access**	**Info** / **Possible settings**	**Presetting**
C3000		R / W	Maximum line speed (v_{max})	
			0.0 {0.1 m/min} 3000.0	0.0 m/min
		R / W	Gearbox factors • The gearbox factor is binary coded. It is selected via the inputs *g_bGear1* and *g_bGear2*. If both inputs are not assigned or set to FALSE, the basic gearbox factor will be used.	
C3002			Basic gearbox factor (numerator)	
			-32767 {1} 32767	1
C3003			Basic gearbox factor (denominator)	
			1 {1} 32767	1
C3012*			Gearbox factor 1 (numerator)	
			-32767 {1} 32767	1
C3013*			Gearbox factor 1 (denominator)	
			1 {1} 32767	1
C3022*			Gearbox factor 2 (numerator)	
			-32767 {1} 32767	1
C3023*			Gearbox factor 2 (denominator)	
			1 {1} 32767	1
C3032*			Gearbox factor 3 (numerator)	
			-32767 {1} 32767	1
C3033*			Gearbox factor 3 (denominator)	
			1 {1} 32767	1
* These codes can be created in the **Code initialization values** , if required.				

Parameters for the function "SpeedControl"				
Code / **Subcode**	**Data type**	**Access**	**Info** / **Possible settings**	**Presetting**
C3100		R / W	Jog speed 1 • Referred to v_{max} • Use positive values for jogging in winding up direction, negative values for jogging in unwinding direction. • For jog control set *g_bManualOperation* to TRUE.	
			-199.99 {0.01 %} 199.99	0.00 %
		R / W	Gain factor for line speed • For adapting the pre-control signal *g_nVLine* to the internal normalisation. $\frac{C3105}{C3106} = \frac{10V}{\text{Input voltage for } v_{max}\ [V]}$	
C3105			Numerator	
			-32767 {1} 32767	1
C3106			Denominator	
			1 {1} 32767	1

Parameters for the function "DiameterCalculation"							
Code	Subcode	Data type	Access	Info			
				Possible settings			Presetting
C3004			R / W	Minimum diameter (d_{min})			
				1	{1 mm}	10000	1 mm
C3005			R / W	Maximum diameter (d_{max})			
				1	{1 mm}	10000	1 mm
C3006			R / W	Selection of an initial diameter value • Set *g_bLoadD* to TRUE to load value. • Value can be alternatively selected under *g_nSetD_a*. For this, set *g_bSetDExtern* to TRUE.			
				1	{1 mm}	10000	1 mm

Parameters for the function "ThicknessCalculation"							
Code	Subcode	Data type	Access	Info			
				Possible settings			Presetting
C3007			R / W	Minimum material thickness			
				1	{1 µm}	30000	1 µ m
C3008			R / W	Maximum material thickness			
				1	{1 µm}	30000	1 µ m
C3009			R / W	Selection of an initial material thickness • Set *g_bLoadS* to TRUE to load value. • Value can be alternatively selected under *g_nSetD_wSetS*. For this, set *g_bSetSExtern* to TRUE.			
				1	{1 µm}	30000	1 µ m

Parameters for the function "StopControl"							
Code	Subcode	Data type	Access	Info			
				Possible settings			Presetting
C3140			R / W	Nominal deceleration time for braking			
				0.000	{0.001 sec}	10000.000	0 s
C3141			R / W	Residual length after the stop			
				0.000	{0.001 m}	10000.000	0 m
C3142			R / W	Reference diameter for pre-stop and stop signal during wind up operation			
				0	{1 µm}	10000000	0 µ m
C3143			R / W	Reference diameter for pre-stop and stop signal during unwind operation • For unwind operation set *g_bUnwindOperation* to TRUE.			
				0	{1 µm}	10000000	0 µ m

2. Select **Project →Compile all** to compile the project.
3. Select **File →Save** to save the project and the changes made.

Tip!

If an error occurred during compiling, carry out an error analysis:

- Press the function key **<F4>** or select **Edit →Next fault** .
- Remove the fault and re-compile the project.

Repeat these two steps until the project has been compiled correctly.

4.2.4 Setting the system parameters

The system parameters are set in online mode via the **Parameter monitor** (*Object Organizer* in the **Resources** register).

1. Select **Online ➞Log in** to change to the online mode and log in.
2. Confirm the question "Do you want to load the new program?" with **Yes**.
3. Open the **Parameter monitor** and enter the machine parameters:

Category	Settings	Notes
Motor data		
	Folder **Motor/feedback system** ➞ folder **Motor settings** : • Select the motor type under C0086.	If you use a motor not listed under C0086, select a similar Lenze motor and adapt the motor data manually in accordance with the nameplate.
Feedback system		
	Folder **Motor/feedback system** ➞ folder **Feedback systems** : • Select the feedback system under C0025.	
Speed setting range		
	Folder **Main function blocks** ➞ folder **MCTRL: Motor control** : • Select the maximum speed under C0011: $\text{Setting C0011} \geq \frac{v_{max}[m/min] \cdot \text{Gear factor}}{d_{min}[m] \cdot \pi}$ • Select the maximum field weakening under C0575. $\text{Setting C0575} = \frac{\text{C0011 (Maximum speed)}}{\text{C0087 (Rated motor speed)}}$	For dancer control, select the speed setting range reserve high enough to ensure that the speed setpoint cannot be > 100 % with maximum pre-control signal and maximum correcting variable of the controller.
Deceleration time for quick stop of the drive system (QSP)		
	Folder **Main function blocks** ➞ folder **MCTRL: Motor control**: • Select the deceleration time to be used to decelerate the motor with quick stop (QSP) to standstill under C0105.	

4. Permanently save the parameter set with C0003 = 1.

4.2.5 Optimising the speed control circuit

Tip!
A high gain in the speed control circuit is of advantage for the higher-level dancer control.

1. Proceed as follows:
   – Insert the reel shaft with an empty sleeve.
   – Start the PLC program (**Online ➞Start** or **<F5>**).
2. Set terminal 28 to HIGH level to deactivate controller inhibit in the PLC.
3. Optimise the gain of the speed controller under C0070:
   (**Parameter monitor** : Folder **Controller settings** ➞ folder **Speed**)
   – Increase the settings in C0070 step by step until resonances occur in the speed control circuit. These can be, for instance, motor noises.
   – Reduce the settings in C0070 until there are no more resonances.
4. Reset terminal 28 to LOW level to re-activate controller inhibit in the PLC.

4.2.6 Checking the direction of winding

1. Proceed as follows:
   – Insert the reel shaft with an empty sleeve.
2. Select the diameter of the empty sleeve as initial diameter for the diameter calculation under C3006.
   (**Parameter monitor** : Folder **Individual IEC1131 codes** → folder **BasicParameter**)
3. Set terminal E4 to HIGH level to load the diameter selected in C3006.
4. Set terminal 28 to HIGH level to deactivate controller inhibit in the PLC.
5. Set terminal E2 to HIGH level to activate jog control using the speed selected in C3100.
6. Set terminal E1 to HIGH level to deactivate quick stop in the PLC.
7. Check the direction of rotation of the reel shaft.

If the direction of rotation is wrong:

If the reel shaft revolves opposite the direction expected according to the sign of the jog speed set under C3100, the direction of rotation of the motor has to be inverted:

1. Reset terminal E1 to LOW level to re-activate quick stop in the PLC.
2. Wait until the motor has come to standstill.
3. Invert the sign of the gearbox factor set under C3002 to invert the direction of rotation.
   (**Parameter monitor**: Folder **Individual IEC1131 codes** → folder **BasicParameter**)
4. Deactivate quick stop to check the change of the direction of rotation by setting terminal E1 to HIGH level.

Terminating the check:

If the reel shaft revolves in the expected direction, terminate the check as follows:

1. Reset terminal E1 to LOW level to re-activate quick stop in the PLC.
2. Set terminal E2 to LOW level to de-activate jog control.
3. Reset terminal 28 to LOW level to re-activate controller inhibit in the PLC.

4.2.7 Checking the speed pre-control

1. Proceed as follows:
   – Insert the reel shaft with an empty sleeve.
   – Set the pre-control signal VLine to ”0” by applying 0 V at terminal 1.
2. Select the diameter of the empty sleeve as initial diameter for the diameter calculation under C3006.
   (**Parameter monitor** : Folder **Individual IEC1131 codes** → folder **BasicParameter**)
3. Set terminal E4 to HIGH level to load the diameter selected in C3006.
4. Set terminal 28 to HIGH level to deactivate controller inhibit in the PLC.
5. Set terminal E1 to HIGH level to deactivate quick stop in the PLC.
6. Apply the pre-control signal for the selected line speed at terminal 1 (VLine) (if possible, by using a ramp generator):
   – Positive voltage for wind up operations.
   – Negative voltage for unwind operations.

The reel shaft should now revolve in the corresponding direction at the preset circumferential speed.

- The line speed calculated by the PLC is displayed under C3050.
  (**Parameter monitor** : Folder **Individual IEC1131 codes** → folder **BasicParameter**)

If the speed and/or direction of rotation is wrong:

Check the parameter assignment of the VLine gain in C3105 and C3106.
(**Parameter monitor** : Folder **Individual IEC1131 codes** → folder **PouSpeedControl**)

Note!

- Only change the settings in C3105 and C3106 when the check has been completed and then repeat the check once again.
- Information about the parameter assignment of the VLine gain can be found in chapter 4.2.3 ”Setting the machine parameters”. (📖 4-5)

Terminating the check:

1. Use the pre-control signal to bring the drive to standstill.
2. Reset terminal E1 to LOW level to re-activate quick stop in the PLC.
3. Reset terminal 28 to LOW level to re-activate controller inhibit in the PLC.

4.2.8 Setting the parameters for acceleration compensation

For parameterizing the acceleration compensation, you can automatically identify the moment of inertia. For this, the drive is automatically accelerated and brought to standstill.

1. Proceed as follows:
   – Insert the reel shaft with an empty sleeve.
2. Open the visualisation **VisCompensation**.
   (*Object Organizer* /register **Visualization**)

Status display during the identification run

In the visualisation **VisCompensation** the current status of the identification run is displayed in the display field "state":

Status of the identification run (display field "state")	
Status messages:	
0	The identification run is not active.
20	The identification run was activated, waiting for controller enable. • The display "identification active" lights up in green.
21	Controller enable has been carried out. • The display "identification busy" lights up in green.
22	The drive is accelerated at the set torque until the set limit speed is reached. (Acceleration starts during run-up.)
23	The drive has reached the set limit speed and is decelerated at the inverse torque until it comes to standstill. (Acceleration starts during deceleration.)
24	The mass moment of inertia is calculated.
30	The identification run has been completed. • The displays "identification busy" and "identification active" go out. • The display "identification done" lights up in green. • Now you can start another identification run or set the controller inhibit to return to status "0".
Error messages (waiting for controller inhibit or restart):	
-1	The set values are beyond the permissible limits.
-2	Cancellation via the button "abort identification" in the visualisation.
-3	Cancellation through pulse inhibit.
-4	Cancellation through quick stop.
-7	Speed reached at the end of acceleration too low.
-8	Mass moment of inertia too high (overflow).

Note!

During the identification run, pulse inhibit, quick stop (QSP) or a click on the button **abort identification** lead to an immediate abort.

First identification run (constant moment of inertia)

1. Use the visualisation to define the test conditions under which the constant mass moment of inertia is to be identified:
   – Use the input field **motor speed for identification** to enter the maximum motor speed to which the drive is accelerated.
   Recommendation: 50 %
   – Use the input field **motor torque for identification** to enter the maximum motor torque at which the drive accelerates and brakes.
   Recommendation: 25 %

Tip!

The test conditions ”maximum motor speed” and ”maximum motor torque” can be alternatively defined under the codes C3230 and C3231.

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2. Set terminal E1 to HIGH level to deactivate quick stop in the PLC.
3. Start the identification run by clicking the button **start identification** in the visualisation.
   – The display ”identification active” lights up in green and controller enable is expected.
4. Set terminal 28 to HIGH level to deactivate controller inhibit in the PLC.
   – The display ”identification busy” lights up in green.

Note!

After controller enable, the identification run only starts after expiry of the delay time set in C3232. In this way, the magnetic flux of the motor can be built up before acceleration starts (only required for asynchronous motors).

- For huge machines, the factory setting for C3232 has to be increased or the identification run has to be started once again after the first identification run by a click on the button **start identification.**

   – The drive is automatically accelerated and brought to standstill.
   – The rate of change of the reel shaft speed results from the set acceleration torque and the existing mass moment of inertia.
   – After completion of the identification run, the identified mass moment of inertia is displayed in the field **identified moment of inertia**, the display ”identification busy” goes out and the display ”identification done” lights up in green.
5. Enter the identified value in the input field **const. moment of inertia**.
6. Reset terminal E1 to LOW level to re-activate quick stop in the PLC.
7. Reset terminal 28 to LOW level to re-activate controller inhibit in the PLC.

Second identification run (max. moment of inertia)

1. Feed the winder with the maximum possible reel (max. diameter and max. width).

Note!

If there is only a small reel available, the identification run can nevertheless be carried out. In this case, the value displayed for the identified mass moment of inertia has to be projected accordingly to obtain the max. possible mass moment of inertia:

$$J_{max} = J_{Measuring} \cdot \frac{B_{max}}{B_{Measuring}} \cdot \left(\frac{d_{max}}{d_{Measuring}} \right)^4$$

2. Use the visualisation to define the test conditions for the second identification run:
   – Use the input field **motor speed for identification** to enter the maximum motor speed to which the drive is accelerated.
   Recommendation: 5 %
   Important: If the values are much higher, the maximum permissible circumferential speed might be exceeded!
   – Use the input field **motor torque for identification** to enter the maximum motor torque at which the drive accelerates and brakes.
   Recommendation: 25 %
3. Set terminal E1 to HIGH level to deactivate quick stop in the PLC.
4. Re-start the identification run by clicking the button **start identification** in the visualisation.
   – The display "identification active" lights up in green and controller enable is expected.
5. Set terminal 28 to HIGH level to deactivate controller inhibit in the PLC.
   – The display "identification busy" lights up in green.
   – After expiry of the delay time defined in C3232, the drive is automatically accelerated and brought to standstill.
   – After completion of the identification run, the identified mass moment of inertia is displayed in the field **identified moment of inertia** , the display "identification busy" goes out and the display "identification done" lights up in green.
6. Enter the identified or the projected value in the input field **max. moment of inertia**.
7. Reset terminal E1 to LOW level to re-activate quick stop in the PLC.
8. Reset terminal 28 to LOW level to re-activate controller inhibit in the PLC.

Note!

If there is no reel available, you can also calculate the maximum mass moment of inertia:

$$J_{max} = J_{Motor} + \frac{\pi}{32 \cdot 10^8} \cdot B \cdot \rho \cdot \frac{d_{max}^{\ 4} - d_{min}^{\ 4}}{i^2}$$

$$J_{max} \approx J_{Motor} + \frac{m \cdot d_{max}^{\ 2}}{800 \cdot i^2}$$

J_{max}	= Maximum mass moment of inertia in [kg cm^2]	d_{max}	= Maximum diameter in [mm]
J_{motor}	= Mass moment of inertia of the motor in [kg cm^2]	d_{min}	= Sleeve diameter in [mm]
B	= Material width in [mm]	i	= Gearbox factor
ρ	= Material density in [kg/dm^3]	m	= Mass in [kg]

4.2.9 Setting the dancer setting range

1. Open the visualisation **VisDancerControl**.
   (*Object Organizer* / register **Visualization**)
2. Position the dancer in the upper limit position.
   (Position, in which there is no more material stored in the dancer unit.)
3. Accept the dancer position for the upper limit position by clicking the button **teach** for the upper limit position in the visualisation.
   – The corresponding value is automatically written in C3181.
4. Position the dancer in the lower limit position.
   (Position, in which the max. storage capacity is reached.)
5. Accept the dancer position for the lower limit position by clicking the button **teach** for the lower limit position in the visualisation.
   – The corresponding value is automatically written in C3182.
6. Enter the material length which can be stored in the dancer in the input field **storage length**.
   – The value will be automatically written in C3183.

4.2.10 Permanent saving of parameters

Saving parameters in the PLC

- Permanently save the parameter set with C0003 = 1 in the PLC.

Note!

All codes ≥ C3000 are no system codes and are overwritten by the preset initialisation values when the program is downloaded again.

Saving parameters in the project

If you want to save the code settings in the project, you have to transfer the corresponding parameters to the **Code initialization values** :

1. Select **Online →Log out** to log out and change to the offline mode.
2. Open the **Code initialization values** (*Object Organizer* /register **Resources**).
3. Transfer the following code settings to the **Code initialization values** :

Code	Setting	Parameter monitor
C3002	Basic gearbox factor - numerator	Folder **Individual IEC1131 codes** → folder **BasicParameter**
C3003	Basic gearbox factor - denominator	
C3105	VLine gain - numerator	Folder **Individual IEC1131 codes** → folder **POUSpeedControl**
C3106	VLine gain - denominator	
C3181	Upper limit position of the dancer	Folder **Individual IEC1131 codes** → folder **POUDancerControl**
C3182	Lower limit position of the dancer	
C3183	Storage length of the dancer	
C3200	Min. moment of inertia	Folder **Individual IEC1131 codes** → folder **POUAccelerationCompensation1**
C3201	Max. moment of inertia	

4. Select **File →Save** to save the project and the changes made.

Tip!

The **Code initialization values** can also be used to save the system code settings in the project and to transfer them to other PLCs.

4.3 What's coming next?

In the last chapter, you have entered all settings required to operate the winder in a DC bus connection with the machine.

If material is applied, the dancer control can be optimised.

Tip!

Information about the optimisation of the dancer control can be found in chapter 5.3 "Function DancerControl". (5-7)

4.3.1 Selection of the direction of winding

When the default template configuration is used, the winder winds up the fed material with a positive line speed signal and unwinds the material with a negative line speed signal.

- If the winder is to be used as an unwinder with a positive line speed signal, simply invert the line speed signal internally by inverting the sign of the value entered in C3105.
- For an unwind operation, set the variable *g_bUnwindOperation* to TRUE. After this, the function **StopControl** changes to unwind operation.
- If the material is to be alternately fed from the top and from the bottom, the direction of rotation of the motor can be changed accordingly with the variable *g_bCCWOperation*.

4.3.2 Different initial diameters

Proceed as follows to reset the diameter calculator to different initial diameters:

1. Select the initial value via the external input *g_nSetD_a* .
2. Set *g_bSetDExtern* to TRUE to select the external input for the selection of the diameter value.
3. Set *g_bLoadD* to TRUE to load the value at the external input as initial value into the diameter calculator.

4.3.3 Different material widths

When the material width is changed, the tension usually has to be adapted accordingly. If the dancer tension is controlled via the template, adapt the tension selection accordingly under *g_nTensionSet_a*.

For simultaneously changing the moment of inertia to ensure an optimum adaptation of the acceleration compensation use *g_nVarMInertiaAdapt_a*.

- The value "16384" at *g_nVarMInertiaAdapt_a* is the maximum material width accepted during the identification of the maximum moment of inertia.

4.3.4 Controlling the diameter calculator

The reel diameter can only be internally calculated from the line speed and the motor speed if the line speed represents the circumferential speed of the reel. If this relation is not or no longer given, e. g. after a web break, the value calculated by the diameter calculator has to be held or an external diameter signal has to be selected.

- Set *g_bHoldD* to TRUE to hold the value calculated by the diameter calculator.
- Use *g_nSetD_a* to select an external diameter signal which will be loaded into the diameter calculator when *g_bSetDExtern* is set to TRUE.

We also recommend to hold the calculated diameter when falling below a certain motor speed during start and stop.

In the example project, you can find a network in the POU **Input** from which you can see how to control the input *g_bHoldD*.
(*Object Organizer* → register **Organization units** → folder **UserExtensions** → folder **User_POUs**)

5 Functions

5.1 Function overview

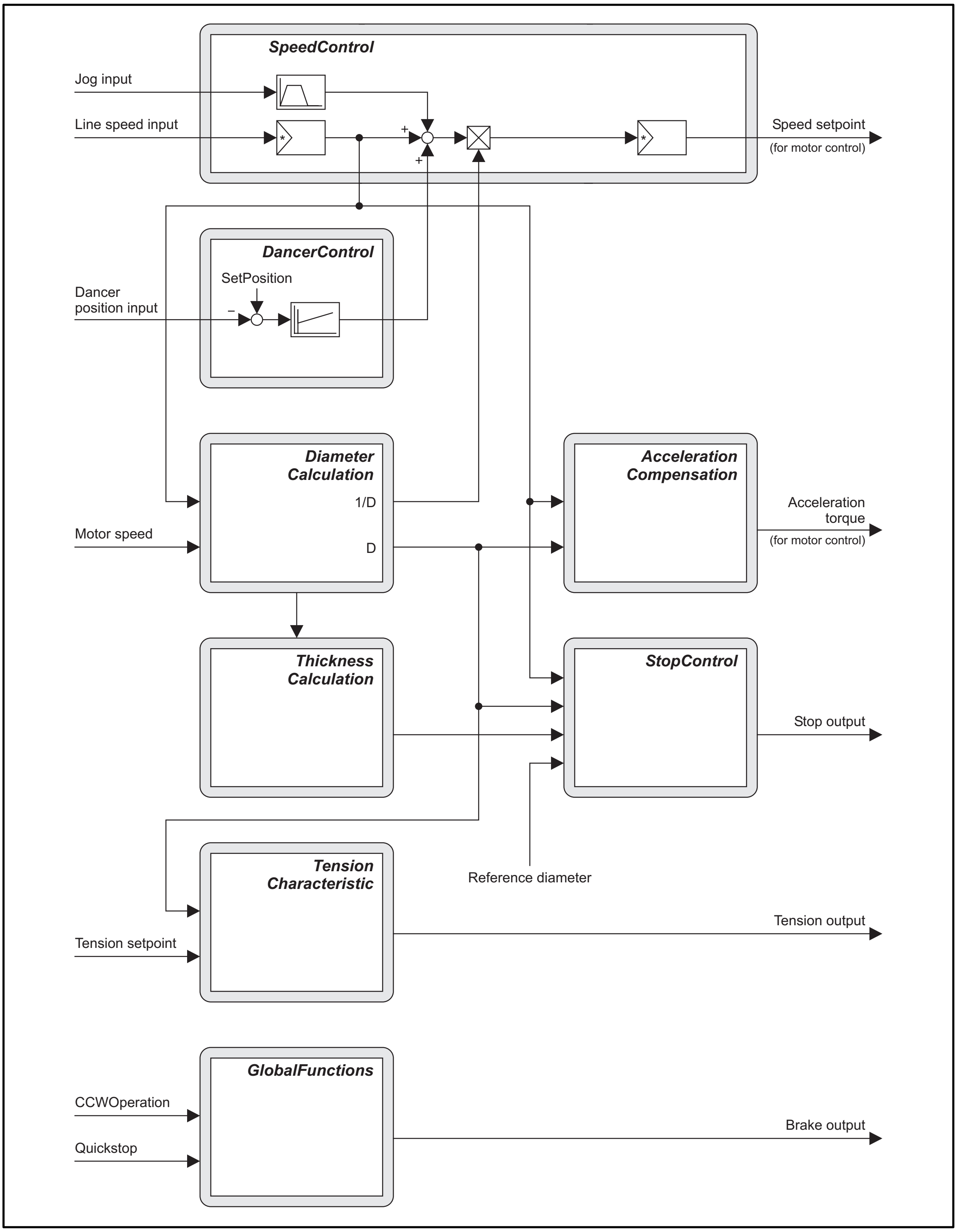
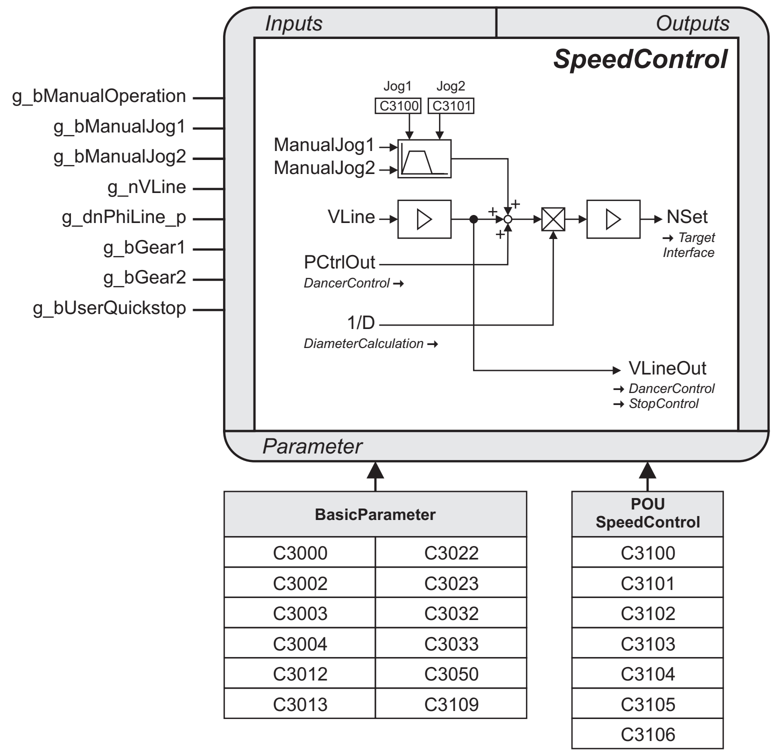


Fig. 5-1 Overview: Template functions

5.2 Function "SpeedControl"

This template function is used to precontrol the speed of the winding motor. The line speed signal is multiplied by the reciprocal of the current diameter and converted by means of the machine data into a normalised setpoint for the motor control.

- Two jog speeds are available for the machine set-up. They are added to the pre-control signal.
- The output signal of the dancer control is also added to the pre-control signal.



➩ **Inputs**				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_bManualOperation	Bool	R / W	Activating manual control	
			TRUE	• The line speed signal is deactivated. • The control inputs *g_bManualJog1* and *g_bManualJog2* are enabled.
g_bManualJog1	Bool	R / W	Activating jog speed 1	
			TRUE	Activates the jog speed set in C3100.
g_bManualJog2	Bool	R / W	Activating jog speed 2	
			TRUE	Activates the jog speed set in C3101.
g_nVLine,	Integer	R / W	Current line speed	
g_dnPhiLine_p	Double integer	R / W	Current angle of rotation of a line drive • For alternative line speed calculation.	

⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_bGear1 g_bGear2	Bool	R / W	Selection of the gearbox factor (binary coded) *g_bGear2* | *g_bGear1* FALSE | FALSE | Basic gearbox factor | (C3002/C3003) FALSE | TRUE | Gearbox factor 1 | (C3012/C3013) TRUE | FALSE | Gearbox factor 2 | (C3022/C3023) TRUE | TRUE | Gearbox factor 3 | (C3032/C3033)
g_bUserQuickstop	Bool	R / W	User quick stop (quick stop of the drive system) • Simultaneously deactivates the jog speeds. TRUE | Carries out quick stop

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**						
Code / **Subcode**	**Data type**	**Access**	**Info** / **Possible settings**			**Presetting**
C3000		R / W	Maximum line speed (v_{max})			
			0.0	{0.1 m/min}	3000.0	0.0 m/min
C3004		R / W	Minimum diameter (d_{min})			
			1	{1 mm}	10000	1 mm
		R / W	Gearbox factors • The gearbox factor is binary coded. It is selected via the inputs *g_bGear1* and *g_bGear2* . If both inputs are not assigned or set to FALSE, the basic gearbox factor will be used.			
C3002			Basic gearbox factor (numerator)			
			-32767	{1}	32767	1
C3003			Basic gearbox factor (denominator)			
			1	{1}	32767	1
C3012			Gearbox factor 1 (numerator)			
			-32767	{1}	32767	1
C3013			Gearbox factor 1 (denominator)			
			1	{1}	32767	1
C3022			Gearbox factor 2 (numerator)			
			-32767	{1}	32767	1
C3023			Gearbox factor 2 (denominator)			
			1	{1}	32767	1
C3032			Gearbox factor 3 (numerator)			
			-32767	{1}	32767	1
C3033			Gearbox factor 3 (denominator)			
			1	{1}	32767	1
C3050		R	Physical line speed			
			-6000.0	{0.1 m/min}	6000.0	Only display
C3109		R	Maximum speed setpoint ($v_{Line} = v_{max}$, $d = d_{min}$) • Referred to n_{max} (C0011)			
			0.00	{0.01 %}	5000.00	Only display

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUSpeedControl**						
Code	**Subcode**	**Data type**	**Access**	**Info**	**Possible settings**	**Presetting**
C3100			R / W	Jog speed 1 • Referred to v_{max} • Use positive values for winding up direction, negative values for unwinding direction. • For jog control set *g_bManualOperation* to TRUE.	-199.99 {0.01 %} 199.99	0.00 %
C3101			R / W	Jog speed 2 • Referred to v_{max} • Use positive values for winding up direction, negative values for unwinding direction. • For jog control set *g_bManualOperation* to TRUE.	-199.99 {0.01 %} 199.99	0.00 %
C3102			R / W	Acceleration time for jog speed 1 & 2	0.000 {0.001 sec} 999.999	5.000 s
C3103			R / W	Deceleration time for jog speed 1 & 2	0.000 {0.001 sec} 999.999	1,000 s
C3104			R / W	Selecting the setting for the line speed	0 Input *g_nVLine*, (proportional signal) 1 Input *g_dnPhiLine_p* (angle of rotation)	0
			R / W	Gain factor for line speed • For adapting the pre-control signal *g_nVLine* to the internal normalisation. $\frac{C3105}{C3106} = \frac{10V}{\text{Input voltage for } U_{max}\ [V]}$		
C3105				Numerator	-32767 {1} 32767	1
C3106				Denominator	1 {1} 32767	1

Activating manual control (jog control)

For the machine set-up you can switch over to manual control (jog control). You can choose between two jog speeds.

- The jog speeds are set under C3100 and C3101.
- The acceleration and deceleration time for the jog speeds is selected under C3102 and C3103.

Set *g_bManualOperation* to TRUE to activate manual control.

- This enables the control inputs *g_bManualJog1* and *g_bManualJog2* and deactivates the line speed signal *g_nVLine*.

Selecting and adapting the line speed signal

Under C3104 you can select if you want to use a signal which is proportional to the line speed or an angle of rotation of a line drive.

Important!

Only use signals coming from a speed measuring device, e.g. from an incremental encoder on a take-up roller or the speed feedback of a line drive.

Reference setpoints may temporarily deviate from the line speed and thus lead to instabilities!

Selecting the line speed via an analog signal

If the line speed is selected via an analog signal, the input signal of the analog input (e.g. *AIN1_nIn_a*) has to be connected with the global variable *g_nVLine*.

- Under C3105 and C3106, you can adapt the analog signal to the internal normalisation (16384≡ V_{max}):

$$\frac{C3105}{C3106} = \frac{10\ V}{\text{Input voltage for } v_{max}\ [V]}$$

Correcting the signal polarity

If the material is to be wound up by a winder, a positive line speed signal is expected during normal operation. For an unwinder, the signal has to be negative.

- If the sign of the input signal has to be inverted, you only have to enter the value in C31055 with a negative sign.

Transmitting the line speed

For transmitting the line speed between two drive controllers of the 9300 series you can either use a digital frequency connection or the system bus (CAN).

Transmitting the line speed via a digital frequency connection

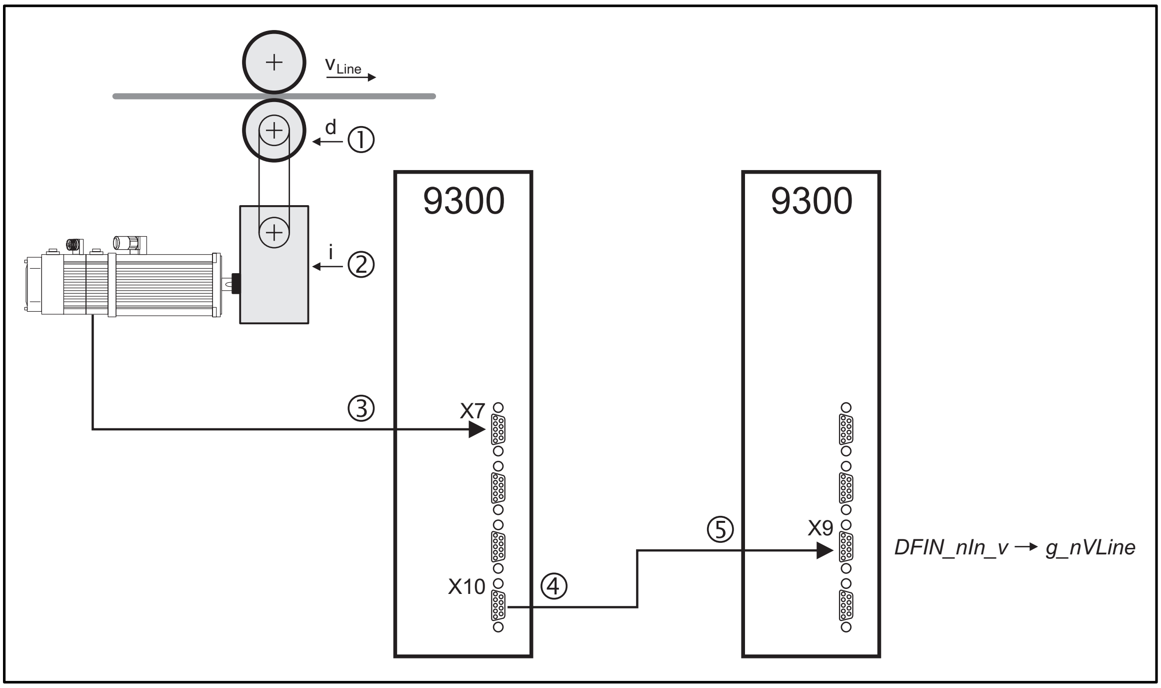


Fig. 5-2 Schematic: Transmitting the line speed between two 9300 drive controllers via a digital frequency connection

① Diameter d_{Roller}
② Gearbox factor i
③ Speed feedback
④ Digital frequency output
⑤ Digital frequency input

- Under C3105 and C3106, you can adapt the digital frequency signal to the internal normalisation:

$$\frac{C3105}{C3106} = \frac{15 \cdot d_{roll}\ [mm] \cdot \pi \cdot \text{LF const input}}{i \cdot v_{max}\ [m/min] \cdot \text{LF const output}}$$

Transmitting the line speed via the system bus (CAN)

Since incremental losses cannot be excluded with a time-discrete speed signal transmission, we recommend to use the motor angle of rotation (*MCTRL_dnPos_p*).

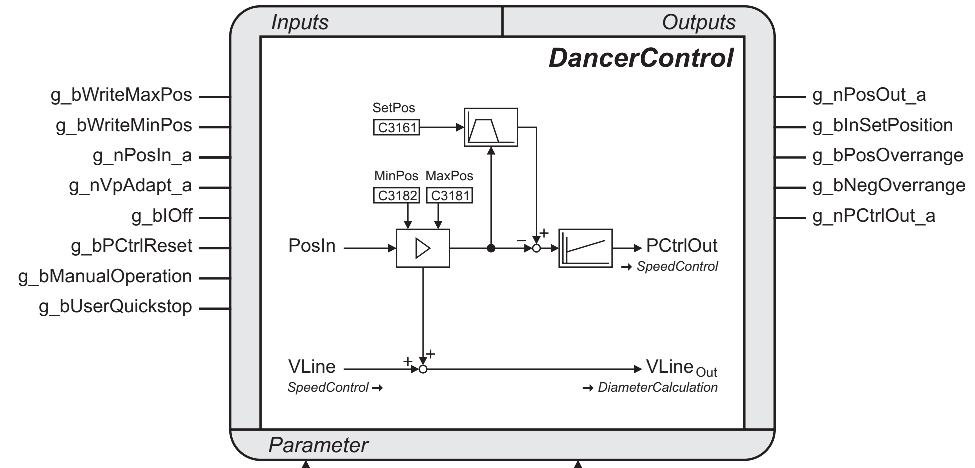
- For this purpose, apply, e.g. the signal *CAN2_dnInD1_p* to input *g_dnPhiLine_p* to transmit the angle of rotation of the motor and set C3104 to ”1” to select this input.
- Under C3105 and C3106, you can adapt the internal speed signal to the internal normalisation:

$$\frac{C3105}{C3106} = \frac{15 \cdot d_{roll}\,[mm] \cdot \pi}{i \cdot v_{max}\,[m/min]}$$

5.3 Function ”DancerControl”

This template function is used to implement the main positioning control functions of the dancer.

- Under consideration of the input signals for the lower and upper limit position of the dancer, the input signal of the actual dancer value is filtered and normalised to the value range ±100 %.
- The difference between the actual and the setpoint dancer value is transmitted to the dancer controller which generates a corresponding output signal from it that is added to the line speed by using the function **SpeedControl**.
- The additional speed of the material which results from the dancer movement is also calculated from the alteration of the actual position value. When added to the line speed, you will obtain the circumferential speed of the reel which is required for the function **DiameterCalculation**.



BasicParameter
C3000

POUDancerControl	
C3160	C3180
C3161	C3181
C3163	C3182
C3164	C3183
C3165	C3184
C3166	C3185
C3167	C3186
C3168	C3187
C3169	C3188
C3170	C3189
C3171	C3190
C3172	

Template DancerControl

Functions

Function "DancerControl"

⇨ Inputs				
Identifier	**Data type**	**Access**	**Info/possible settings**	
g_bWriteMaxPos	Bool	R / W	Accepting the current dancer position as maximum position value	
			TRUE	Accept value
g_bWriteMinPos	Bool	R / W	Accepting the current dancer position as minimum position value	
			TRUE	Accept value
g_nPosIn_a	Integer	R / W	Current dancer position	
g_nVpAdapt_a	Integer	R / W	Dancer controller gain	
g_bIOff	Bool	R / W	Dancer control with/without I-component	
			FALSE	Dancer control with I-component
			TRUE	Dancer control without I-component (I-component = zero)
g_bPCtrlReset	Bool	R / W	Activating/deactivating the dancer controller • Can be alternatively selected under C3160.	
			FALSE	Dancer controller activated
			TRUE	Dancer controller deactivated (dancer controller output = zero)
g_bManualOperation	Bool	R / W	Activating manual control	
			TRUE	• The line speed signal is deactivated. • The dancer controller is deactivated.
g_bUserQuickstop	Bool	R / W	User quick stop (quick stop of the drive system) • Simultaneously deactivates the dancer controller.	
			TRUE	Carries out the quick stop

Outputs ⇨				
Identifier	**Data type**	**Access**	**Value/meaning**	
g_nPosOut_a	Integer	R	Current dancer position • Normalised to the specified setting range.	
g_bInSetPosition	Bool	R	Status signal "Dancer in setpoint position"	
			TRUE	The dancer is in the setpoint position.
g_bPosOverrange	Bool	R	Status signal "Maximum dancer position has been reached"	
			TRUE	The maximum dancer position (C3181) has been reached.
g_bNegOverrange	Bool	R	Status signal "Minimum dancer position has been reached"	
			TRUE	The minimum dancer position (C3182) has been reached.
g_nPCtrlOut_a	Integer	R	Output signal of the dancer controller	

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**				
Code **Subcode**	**Data type**	**Access**	**Info**	
			Possible settings	**Presetting**
C3000		R / W	Maximum line speed (v_{max})	
			0.0 {0.1 m/min} 3000.0	0.0 m/min

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUDancerControl**				
Code **Subcode**	**Data type**	**Access**	**Info**	
			Possible settings	**Presetting**
C3160		R / W	Permanently deactivating the dancer controller • Can be alternatively controlled via *g_bPCtrlReset*.	
			0 Dancer controller activated 1 Dancer controller deactivated (dancer controller output = zero)	0
C3161		R / W	Setpoint dancer position	
			-199.99 {0.01 %} 199.99	0.00 %
C3163		R / W	Influence of the dancer controller • Referred to V_{max}	
			-199.99 {0.01 %} 199.99	0.00 %

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUDancerControl**							
Code	**Subcode**	**Data type**	**Access**	**Info**			
				Possible settings			**Presetting**
C3164			R / W	Acceleration/deceleration time for setpoint ramp generator			
				0.000	{0.001 sec}	30.000	0.000 s
C3165			R / W	Filter time constant for the actual dancer controller value			
				0.000	{0.001 sec}	10.000	0.000 s
C3166			R / W	Rate time constant for the actual dancer controller value			
				0.000	{0.001 sec}	30.000	0.000 s
C3167			R / W	Reduced gain of the deviation around the setpoint position			
				0.00	{0.01 %}	100.00	100.00 %
C3168			R / W	Range around the setpoint position with reduced gain			
				0.00	{0.01 %}	199.99	0.00 %
C3169			R / W	Dancer controller gain			
				0.00	{0.01 %}	100.00	0.00 %
C3170			R / W	Adjustment time of the dancer controller			
				0.001	{0.001 sec}	30.000	1,000 s
C3171			R / W	Rate time of the dancer controller			
				0	{1}	1000	0
C3172			R / W	Selection of a bipolar/unipolar output signal			
				0 1	bipolar output signal unipolar output signal		0
C3180			R / W	Filter time constant for the actual dancer value input signal			
				0	{1 msec}	1000	10 msec
C3181			R / W	Upper limit position of the dancer			
				-199.99	{0.01 %}	199.99	100.00 %
C3182			R / W	Lower limit position of the dancer			
				-199.99	{0.01 %}	199.99	-100.00 %
C3183			R / W	Material length in the dancer			
				0	{0 mm}	100000	0 mm
C3184			R / W	Reference value for upper limit position of the dancer			
				-199.99	{0.01 %}	199.99	90.00 %
C3185			R / W	Tolerance range for status signal "Dancer in setpoint position"			
				0.00	{0.01 %}	199.99	10.00 %
C3186			R / W	Reference value for lower limit position of the dancer			
				-199.99	{0.01 %}	199.99	-90.00 %
C3187			R / W	Delay time for status signals "Dancer in setpoint position" and "Dancer in limit position"			
				0.000	{0.001 sec}	50.000	0.100 s
C3188			R / W	Filter time constant for additional speed through dancer movement			
				0	{1 msec}	1000	10 msec
C3189			R / W	Dead band for damping signal			
				0.00	{0.01 %}	100.00	1.00 %
C3190			R / W	Damping factor for dancer control			
				0.00	{0.01}	10.00	0.00

Filtering the input signal

In most cases, the dancer position is analogously identified. Interference signals cannot be completely avoided.

To suppress high-frequency interference signals, the actual-value signal of the dancer is filtered by means of a low-pass filter.

- Under C3180 you can set the filter time constant for the low pass.

Determining the dancer limit positions

For calculating the normalised actual-value signal of the dancer with the correct sign, the position of the two limit positions has to be permanently set under C3181 and C3182.

Tip!

Detailed information about the determination of the dancer limit positions can be found in chapter 4.2.9 "Determining the dancer setting range". (📖 4-13)

Monitoring the dancer position

If the actual value of the dancer reaches the current dancer setpoint (C3161), the status signal *g_bInSetPosition* is set to TRUE.

- Under C3185 you can set the tolerance range around the setpoint position. If the actual value of the dancer leaves this tolerance range, the status signal *g_bInSetPosition* will be only reset to FALSE when the delay time set in C3187 has expired.
- Under C3181 and C3182 you can set the reference values for the limit position monitoring. If the actual value of the dancer exceeds the set reference value and approaches the limit position, the corresponding status signal *g_bPosOverrange* and / or *g_bNegOverrange* will be set to TRUE after expiry of the delay time set under C3187.

Second low pass and rate time in the actual-value channel

To improve the filtering of interference signals, you can activate a second low pass in the actual-value channel.

- Under C3165 you can set the filter time constant for the second low pass. We recommend to use the same settings as for the filter time constant of the first low pass (C3180).
- Under C3166 you can set the rate time constant for the feedback channel. In this way, interfering delay times can be compensated.

Reduced dynamic performance of the controller with little deviations

A reduction of the dynamic performance of the controller with deviations usually has a positive influence on the damping characteristics of the control circuit.

- Under C3168 you can set the tolerance range within which the deviation is transferred to the controller with a lower gain.
- Under C3167 you can set the percentage by which the gain in the set tolerance range is to be reduced.

Control characteristic

The dancer controller can be operated as a P, PI or PID controller.

- In the default setting, the PI algorithm is active.

Gain Vp (P component)

- Under C3169 you can set the gain of the controller.
- The gain can be directly adapted via the input *g_nVpAdapt_a*

Adjustment time Tn (I component)

- Under C3170 you can set the adjustment time of the controller.
- The integral component can be activated or deactivated via the input *g_bIOff*

Rate time (D component)

- Under C3171 you can set the rate time of the controller. A value > "0 ms" activates the D component of the controller.

Controller influence

Since the motor speed is already pre-controlled by the input signal *g_nVLine,* the dancer controller usually only requires a little controller influence to keep the dancer in the setpoint position.

- Under C3163 you can set the influence of the controller.

Note!

The controller influence evaluates the output signal by multiplying it. When the influence is changed, the dynamic performance of the controller changes as well!

Switching the dancer controller on/off

You can use the input *g_bPCtrlReset* to switch on or off the dancer controller.

- In case of a pulse inhibit, quick stop or manual control the dancer controller will be automatically switched off.
- Under C3160 you can permanently switch off the dancer controller. In this case, the template is configured in a way that the winder can be used as a master.

Loading the setpoint ramp generator automatically with the actual value

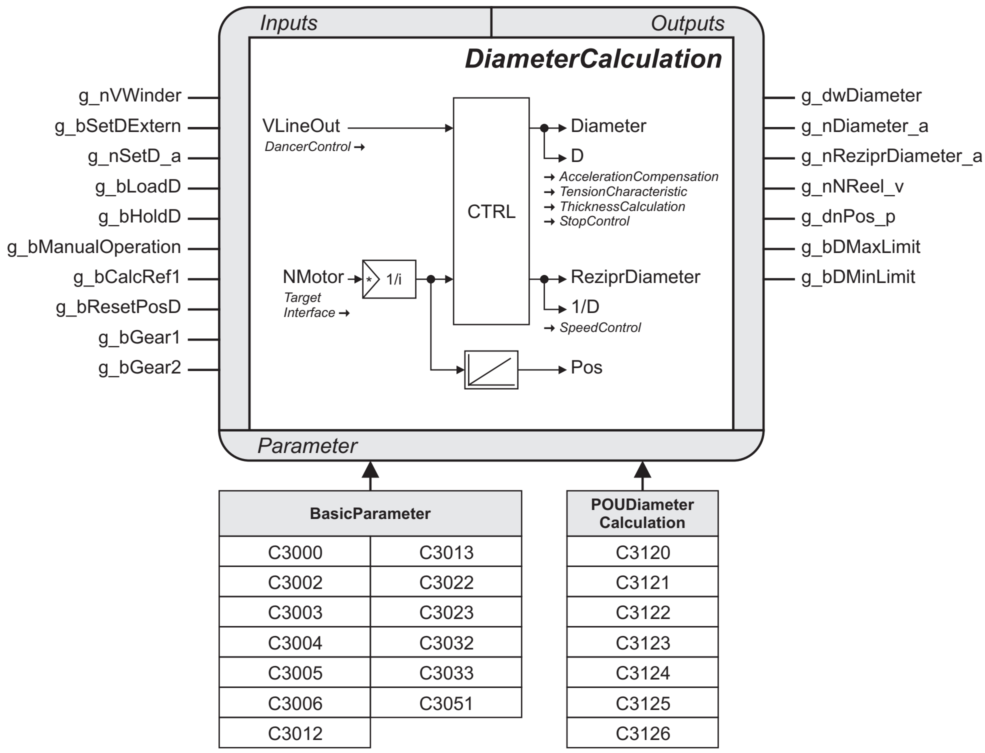
When the dancer controller is switched off, the normalised actual dancer value is automatically loaded in the setpoint ramp generator. This has the advantage that there is no deviation when the controller is enabled again.

- The dancer is always "collected" from the current position. The ramp generator brings it into the setpoint position. In this way, compensation is hardly required.

5.4 Function ”DiameterCalculation”

This template function is used to calculate the current diameter from the line speed and the motor speed.

- Normalised to the maximum diameter d_{max} and as reciprocal normalised to the minimum diameter d_{min} it is required for additional functions.
- In addition, the absolute diameter and the angle of rotation of the reel shaft are calculated for the material thickness calculation.



⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_nVWinder	Integer	R / W	Current circumferential speed • Identified by means of an encoder installed between dancer and reel.	
g_bSetDExtern	Bool	R / W	Activating input *g_nSetD_a* for the selection of the initial diameter value.	
			TRUE	Uses the initial diameter selected under *g_nSetD_a* instead of the value selected under C3006.
g_nSetD_a	Integer	R / W	Selecting an initial diameter value or an external diameter signal • Referred to d_{max} (C3005). • Set *g_bSetDExtern* to TRUE to use this selection. • Value is loaded by setting *g_bLoadD* to TRUE.	
g_bLoadD	Bool	R / W	Loading the preset diameter value	
			TRUE	The value set under C3006 or, if *g_bSetDExtern* = TRUE, the value selected under *g_nSetD_a* is loaded.
g_bHoldD	Bool	R / W	Holding the last diameter value	
			TRUE	The diameter value is maintained (remains unchanged).

⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_bManualOperation	Bool	R / W	Activating manual control TRUE: • The line speed signal is deactivated. • The latest diameter value is maintained (remains unchanged).
g_bCalcRef1	Bool	R / W	Selecting the calculation cycle FALSE: Setting in C3123 is active. TRUE: Setting in C3124 is active.
g_bResetPosD	Bool	R / W	Resetting the angle of rotation TRUE: Sets the angle of rotation of the reel shaft to "0".
g_bGear1 g_bGear2	Bool	R / W	Selection of the gearbox factor (binary coded) *g_bGear2* / *g_bGear1* FALSE / FALSE: Basic gearbox factor (C3002/C3003) FALSE / TRUE: Gearbox factor 1 (C3012/C3013) TRUE / FALSE: Gearbox factor 2 (C3022/C3023) TRUE / TRUE: Gearbox factor 3 (C3032/C3033)

Outputs ⇨			
Identifier	**Data type**	**Access**	**Value/meaning**
g_dwDiameter	Double word	R	Current diameter in [µm] • Value is internally limited to 10 m.
g_nDiameter_a	Integer	R	Current diameter • Referred to d_{max} (C3005)
g_nReziprDiameter_a	Integer	R	Reciprocal of the current diameter • Referred to d_{min} (C3004)
g_nNReel_v	Integer	R	Current reel speed in [inc/ms]
g_dnPos_p	Double integer	R	Current angle of rotation of the reel in [inc]
g_bDMaxLimit	Bool	R	Status signal "Maximum diameter has been reached" TRUE: The max. diameter (C3005) has been reached.
g_bDMinLimit	Bool	R	Status signal "Minimum diameter has been reached" TRUE: The min. diameter (C3004) has been reached.

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**				
Code / **Subcode**	**Data type**	**Access**	**Info** / **Possible settings**	**Presetting**
C3000		R / W	Maximum line speed (v_{max}) 0.0 {0.1 m/min} 3000	0.0 m/min
C3004		R / W	Minimum diameter (d_{min}) 1 {1 mm} 10000	1 mm
C3005		R / W	Maximum diameter (d_{max}) 1 {1 mm} 10000	1 mm
C3006		R / W	Setting an initial diameter value • Value is loaded by setting *g_bLoadD* to TRUE. • Value can be alternatively selected under *g_nSetD_a* . For this, set *g_bSetDExtern* to TRUE. 1 {1 mm} 10000	1 mm

Template DancerControl

Functions

Function "DiameterCalculation"

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**					
Code / **Subcode**	**Data type**	**Access**	**Info**		
			Possible settings		**Presetting**
		R / W	Gearbox factors • The gearbox factor is binary coded. It is selected via the inputs *g_bGear1* and *g_bGear2* . If both inputs are not assigned or set to FALSE, the basic gearbox factor will be used.		
C3002			Basic gearbox factor (numerator)		
			-32767 {1}	32767	1
C3003			Basic gearbox factor (denominator)		
			1 {1}	32767	1
C3012			Gearbox factor 1 (numerator)		
			-32767 {1}	32767	1
C3013			Gearbox factor 1 (denominator)		
			1 {1}	32767	1
C3022			Gearbox factor 2 (numerator)		
			-32767 {1}	32767	1
C3023			Gearbox factor 2 (denominator)		
			1 {1}	32767	1
C3032			Gearbox factor 3 (numerator)		
			-32767 {1}	32767	1
C3033			Gearbox factor 3 (denominator)		
			1 {1}	32767	1
C3051		R	Physical reel diameter		
			0 {1 µm}	10000000	display only

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUDiameterCalculation**					
Code / **Subcode**	**Data type**	**Access**	**Info**		
			Possible settings		**Presetting**
C3120		R / W	Selecting the circumferential speed signal		
			0 Line speed (with correction of the dancer movement) 1 Input *g_nVWinder* (circumferential speed)		0
C3121		R / W	Gain factor for the circumferential speed - numerator		
			-32767 {1}	32767	1
C3122		R / W	Gain factor for the circumferential speed - denominator		
			1 {1}	32767	1
C3123		R / W	Reference value 0 for diameter calculation		
			0.001 {0.001 rev}	2.000	1.000 rev
C3124		R / W	Reference value 1 for diameter calculation		
			0.001 {0.001 rev}	2.000	0.100 rev
C3125		R / W	Filter time constant for calculated diameter values		
			0.010 {0.001 sec}	30.000	1.000 s
C3126		R / W	Window for web-break monitoring		
			0.00 {0.01 %}	100.00	10 %

Setting the initial diameter value

Under C3006 you can set an initial value with which the diameter calculator can be loaded after every reel change.

- As an alternative, you can supply an external diameter signal via the input *g_nSetD_a*. For this, set *g_bSetDExtern* to TRUE.
- Set *g_bLoadD* to TRUE to load the selected initial value.

Calculating the diameter

For calculating the reel diameter, the circumferential speed and the current reel shaft speed are cyclically integrated.

- At the end of every integration interval, a new diameter value results from the division of the integrator values.
- Under C3120 you can select whether the line speed signal or the separately measured circumferential speed is to be used for the calculation.

Identifying the circumferential speed

Tip!
When the dancer is used as a material storage device, the circumferential speed has to be separately detected by means of an encoder.

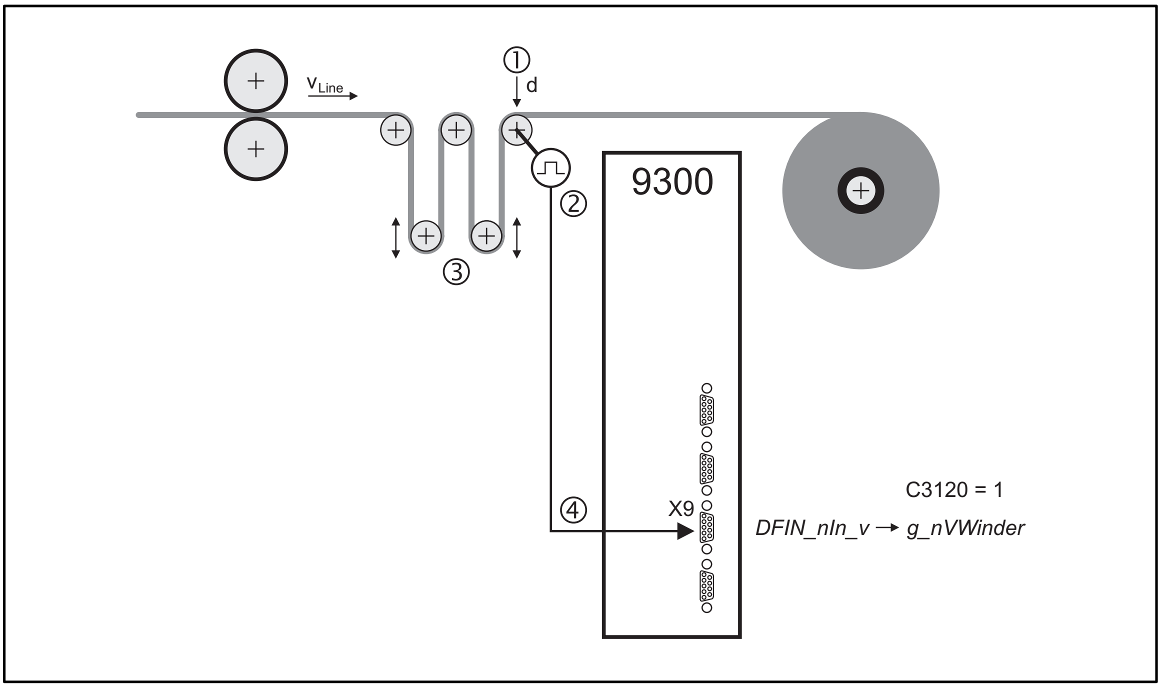


Fig. 5-3 Principle: Detection of the circumferential speed
① Diameter d_{Roller}
② Incremental encoder
③ Dancer as a material storage device
④ Digital frequency input

- Under C3121 and C3122, you can adapt the encoder signal to the internal normalisation:

$$\frac{C3121}{C3122} = \frac{15 \cdot d_{Roller}\,[mm] \cdot \pi \cdot \text{LF const input}}{v_{max}\,[m/min] \cdot \text{Encoder constant}}$$

Controlling the calculation cycle

You can set two different reference values (C3123 and C3124) for controlling the integration intervals.

- Through the input *g_bCalcRef1* you can select which of the two reference values is to be used.

Note!

After loading an initial value, the controller automatically changes over to reference value 1 (C3124) until the first calculation has been completed.

Recommended settings:

- C3124 = 0.1 [rev]
  – If a low value is set, you will quickly receive a first calculation value after loading the initial value.
- C3123 = 1 [rev]
  – Continue your calculation with this value to avoid that possible eccentricities adversely affect the diameter calculation.

Filtering the calculated values

For the further processing of the calculated values it is, on the one hand, important that discontinuities are avoided as far as possible (e.g. for the speed pre-control), on the other hand, the calculation intervals for the actual diameter value and the filter time constant must not be too large to be able to follow the real diameter changes.

- Under C3125 you can set a filter time constant for the diameter calculation. Guide value:

$$C3125 = \frac{d_{min}\,[m] \cdot \pi \cdot 60}{v_{max}\,[m/min]}$$

Note!

Here, the filtered diameter can already be delayed by more than one layer.

- This is why the diameter is passed on unfiltered to the function **StopControl**.

Holding the current diameter

In operating states in which the diameter calculation would lead to wrong results, the diameter has to be maintained. This is always the case when the line speed does not represent the circumferential speed of the reel (e.g. during machine set up or in the event of a web break).

If the line speed is very low, the diameter might also have to be maintained, in particular, if the line speed is used for diameter calculation and a precise compensation of the dancer movement is not possible.
(See also function **DancerControl**.)

- Set *g_bHoldD* to TRUE to maintain the current diameter.

Note!

When manual control is activated (*g_bManualOperation* = TRUE) the diameter calculation will be stopped automatically.

Saving the current diameter

The current diameter is automatically saved when the PLC is de-energised. After reconnecting the PLC, the saved value is automatically loaded back into the diameter calculator.

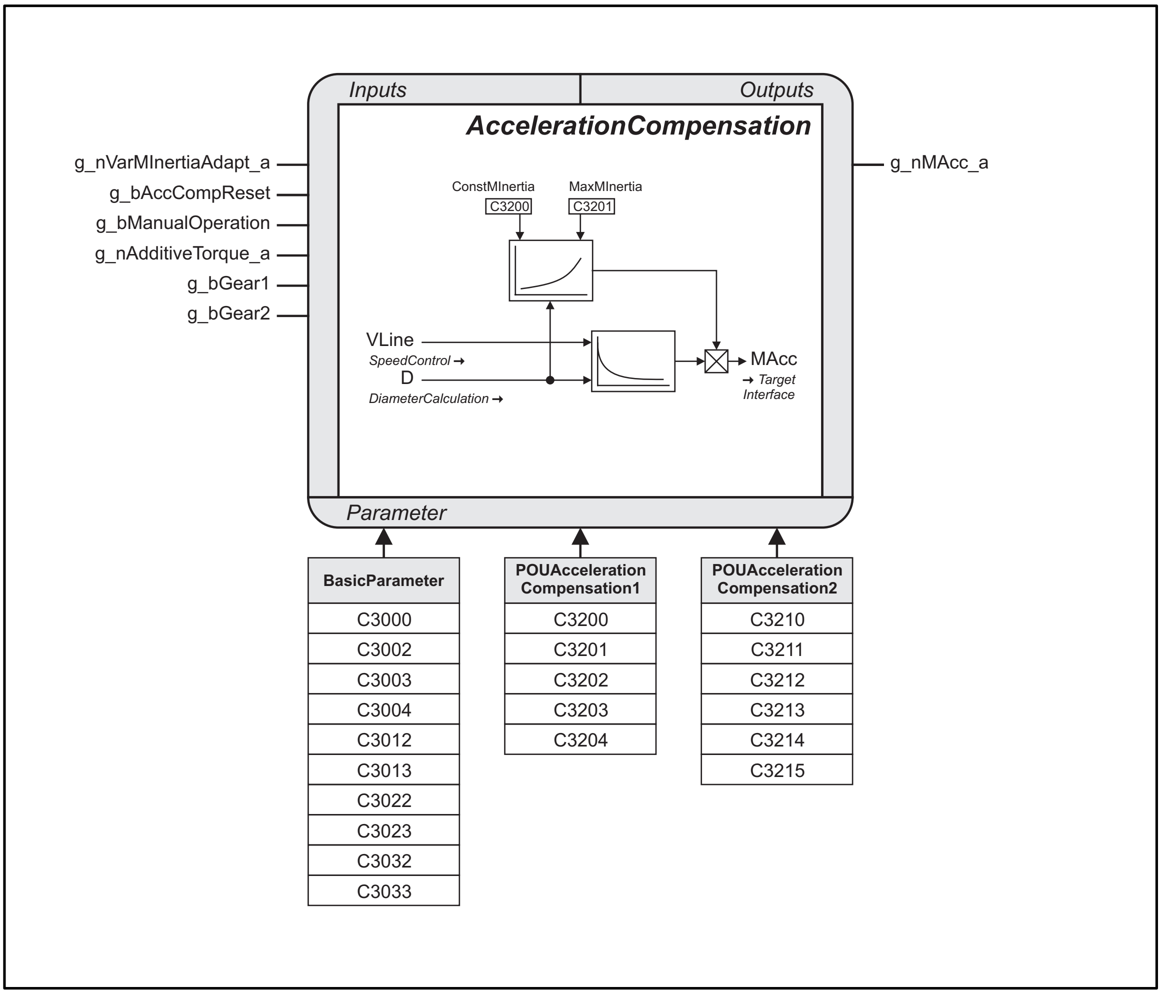
Note!

The diameter calculator therefore only has to be initialised if the reel has been changed.

5.5 Function "AccelerationCompensation"

This template function is used to calculate the acceleration torque from the altered line speed value and, if necessary, also from the altered diameter value.

- The acceleration torque pre-control has the advantage that the displacement of the dancer is considerably reduced in the event of speed changes. In this way, the commissioning engineer has more scope for action when assigning the parameters of the dancer control.
- The current mass moment of inertia is calculated from the current diameter and the following values:
  – Constant mass moment of inertia (C3200)
  – Maximum mass moment of inertia (C3201)



⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_nVarMInertiaAdapt_a	Integer	R / W	Adapting the mass moment of inertia (e.g. in the event of different widths) • Initialisation: 16384	
g_bAccCompReset	Bool	R / W	Deactivating the pre-control torque	
			TRUE	Pre-control torque = "0"
g_bManualOperation	Bool	R / W	Activating manual control	
			TRUE	• The line speed signal is deactivated. • The pre-control torque is deactivated.
g_nAdditiveTorque_a	Integer	R / W	Pre-control of the motor torque via additional functions	

⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_bGear1	Bool	R / W	Selection of the gearbox factor (binary coded)
g_bGear2			*g_bGear2* *g_bGear1* FALSE FALSE Basic gearbox factor (C3002/C3003) FALSE TRUE Gearbox factor 1 (C3012/C3013) TRUE FALSE Gearbox factor 2 (C3022/C3023) TRUE TRUE Gearbox factor 3 (C3032/C3033)

Outputs ⇨			
Identifier	**Data type**	**Access**	**Value/meaning**
g_nMAcc_a	Integer	R	Pre-control torque for motor control

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**				
Code	**Data type**	**Access**	**Info**	
Subcode			**Possible settings**	**Presetting**
C3000		R / W	Maximum line speed (v_{max})	
			0.0 {0.1 m/min} 3000	0.0 m/min
C3004		R / W	Minimum diameter (d_{min})	
			1 {1 mm} 10000	1 mm
		R / W	Gearbox factors • The gearbox factor is binary coded. It is selected via the inputs *g_bGear1* and *g_bGear2*. If both inputs are not assigned or set to FALSE, the basic gearbox factor will be used.	
C3002			Basic gearbox factor (numerator)	
			-32767 {1} 32767	1
C3003			Basic gearbox factor (denominator)	
			1 {1} 32767	1
C3012			Gearbox factor 1 (numerator)	
			-32767 {1} 32767	1
C3013			Gearbox factor 1 (denominator)	
			1 {1} 32767	1
C3022			Gearbox factor 2 (numerator)	
			-32767 {1} 32767	1
C3023			Gearbox factor 2 (denominator)	
			1 {1} 32767	1
C3032			Gearbox factor 3 (numerator)	
			-32767 {1} 32767	1
C3033			Gearbox factor 3 (denominator)	
			1 {1} 32767	1

Template DancerControl

Functions

Function "AccelerationCompensation"

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUAccelerationCompensation1**						
Code / **Subcode**	**Data type**	**Access**	**Info**			
			Possible settings			**Presetting**
C3200		R / W	Constant mass moment of inertia (with empty sleeve)			
			0	{0.1 kg cm^2}	4294967295	0 kg cm^2
C3201		R / W	Maximum mass moment of inertia (with Dmax and Wmax)			
			0	{0.1 kg cm^2}	4294967295	0 kg cm^2
C3202		R / W	Gain of the speed controller adaption			
			0.00	{0.01}	100.00	1.00
C3203		R / W	Upper limit of the speed controller adaption			
			0.00	{0.01 %}	199.99	100.00 %
C3204		R / W	Lower limit of the speed controller adaption			
			0.00	{0.01 %}	199.99	100.00 %

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUAccelerationCompensation2**						
Code / **Subcode**	**Data type**	**Access**	**Info**			
			Possible settings			**Presetting**
C3210		R / W	Filter time constant for calculated drive acceleration			
			10	{1 msec}	30000	100 msec
C3211		R / W	Selection for calculating the drive acceleration			
			0 1 2	No acceleration calculation Calculation from the line speed Calculation from the line speed and diameter		1
C3212		R / W	Nominal ramp time as a reference for acceleration torque control			
			0.200	{0.001 sec}	30.000	10.000 s
C3213		R / W	Dead band for current acceleration torque			
			0.00	{0.01 %}	100.00	1.00 %
C3214		R / W	Gain for positive acceleration torque			
			-199.99	{0.01 %}	199.99	100.00 %
C3215		R / W	Gain for negative acceleration torque			
			-199.99	{0.01 %}	199.99	100.00 %

Selecting the mass moment of inertia

Under C3200 and C3201 you can set the physical values for the machine-related mass moment of inertia and the maximum possible mass moment of inertia.

- The machine-related mass moment of inertia is mainly caused by the mass moment of inertia of the motor. Other machine parts, e.g. a gearbox or a reel shaft can usually be neglected.
- The maximum possible mass moment of inertia consists of the constant mass moment of inertia and the moment of inertia produced by the reel. In most cases, the mass moment of inertia of the reel is so dominating that the constant mass moment of inertia can be neglected:

$$J_{max} \approx J_{reel} = \frac{\pi}{32 \cdot 10^8} \cdot B \cdot \rho \cdot \frac{d_{max}^{\;4} - d_{min}^{\;4}}{i^2}$$

J_{reel}	= Mass moment of inertia of the reel in [kg cm^2]
B	= Material width in [mm]
ρ	= Material density in [kg/dm^3]
d_{max}	= Maximum diameter in [mm]
d_{min}	= Sleeve diameter in [mm]
i	= Gearbox factor

Tip!

The values can be automatically identified to make sure that there do not occur any errors when calculating the two parameters.

More information about this can be found in chapter 4.2.8 "Checking the acceleration compensation". (🕮 4-10)

Adaption in the event of different material widths and materials

The calculation or identification of the maximum possible mass moment of inertia must be based on the maximum width and the heaviest material.

- If shorter widths and/or lighter materials are processed later on during operation, the maximum mass moment of inertia can be reduced accordingly via the input *g_nVarMInertiaAdapt_a*.

Adapting the speed controller gain

If the motor and the reel are considered as a rigid single-mass system, the optimum gain of the speed controller is directly proportional to the mass moment of inertia.

Since the mass moment of inertia usually changes considerably during the winding process, it might be necessary to control the speed controller gain as a function of the mass moment of inertia to ensure good control characteristics.

This can be implemented as follows:

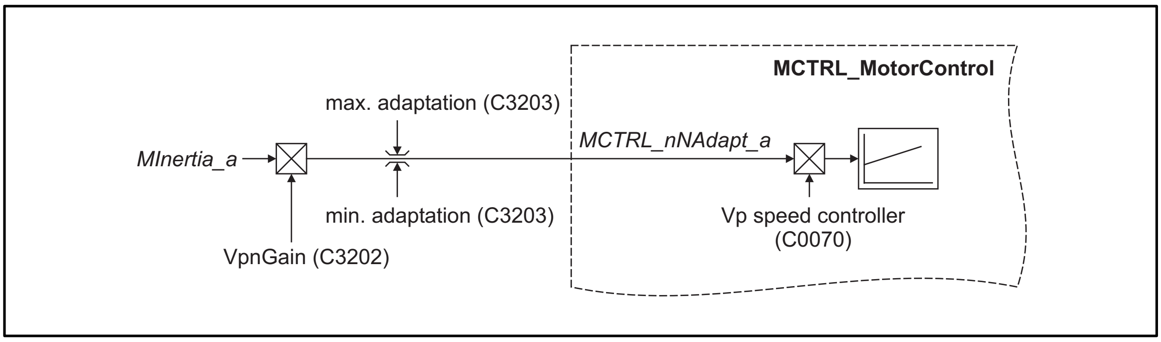


Fig. 5-4 Principle: Controlling the gain as a function of the mass moment of inertia

- Due to the upper and lower limitation of the speed controller adaption (C3203 and C3204), the mass moment of inertia referred to the maximum value can be amplified in a way that the speed controller gain is controlled accordingly in a certain range.

Other adaption possibilities

- A low-pass filter follows differentiation to damp the effects of the "noise" of the line speed input signal and, if necessary, of the diameter on the drive acceleration. The filter time constant can be set under C3210.
- For noise suppression, low acceleration torques can be suppressed by means of a configurable dead band (C3213).
- By adapting the gain settings (C3214 and C3215) accordingly, the acceleration torque can be increased or reduced as a function of the direction of acceleration (acceleration or deceleration).

Deactivating the acceleration compensation

By setting *g_bAccCompReset* to TRUE you can deactivate the acceleration compensation, i.e. the acceleration torque is set to zero.

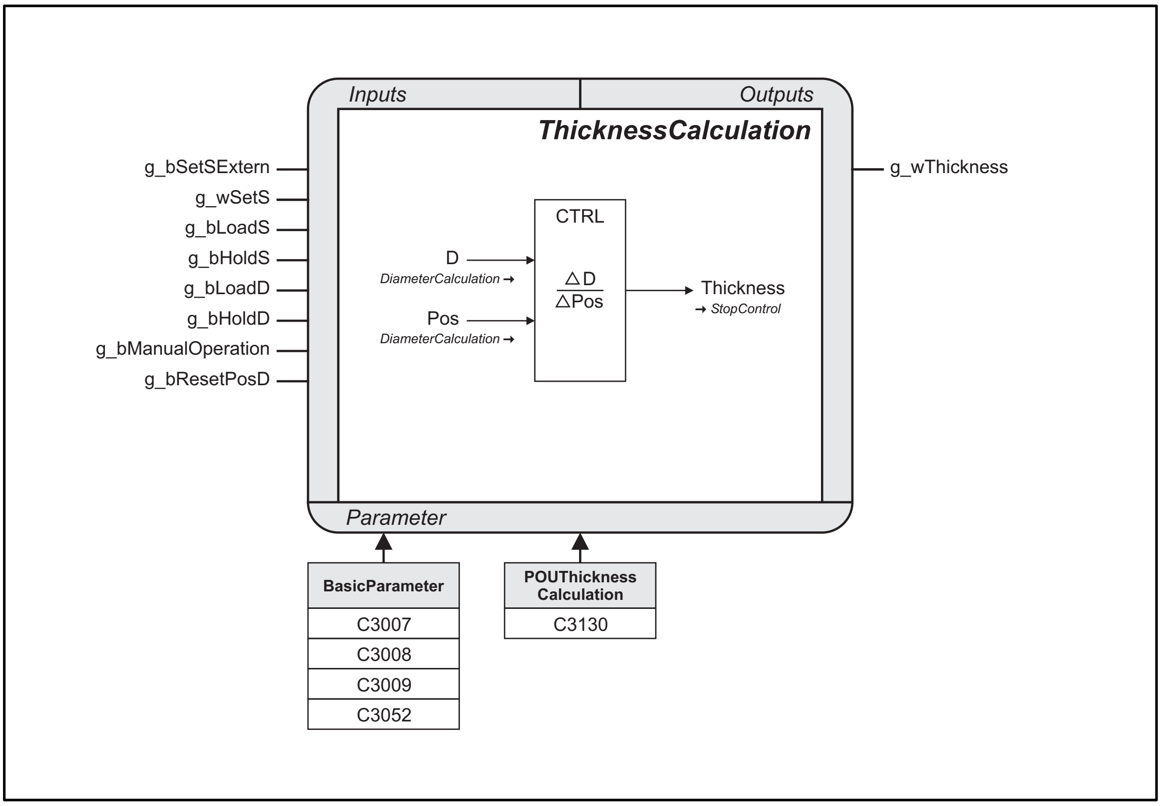
Note!

When manual control is activated (*g_bManualOperation* = TRUE) the acceleration compensation will be reset automatically.

5.6 Function "ThicknessCalculation"

This template function is used to calculate the mean material thickness from the change of the reel diameter and the change of the angle of rotation of the reel shaft.

- This function is closely related to the diameter calculation (function **DiameterCalculation**). It is also the precondition for the stop controller (function**StopControl**).
- To obtain a high resolution when calculating the material thickness, the number of layers/revolutions after which the calculation is to be made can be selected accordingly.



⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_bSetSExtern	Bool	R / W	Activating input *g_wSetS* for the selection of the initial material thickness. TRUE: Uses the initial material thickness selected under *g_wSetS* instead of the value selected under C3009.
g_wSetS	Word	R / W	Selection of an initial material thickness or an external material thickness signal • Set *g_bSetSExtern* to TRUE to use this selection.
g_bLoadS	Bool	R / W	Loading the preset material thickness value TRUE: The value set under C3009 or, if *g_bSetSExtern* = TRUE, the value selected under *g_nSetD_wSetS* is loaded.
g_bHoldS	Bool	R / W	Holding the last material thickness value TRUE: Material thickness is maintained (remains unchanged).
g_bLoadD	Bool	R / W	Loading the preset diameter and material thickness value TRUE: • The diameter value set under C3006 or, if *g_bSetDExtern* = TRUE, the value selected under *g_nSetD_a* is loaded. • The material thickness value set under C3009 or, if *g_bSetSExtern* = TRUE, the value selected under *g_wSetS* is loaded.
g_bHoldD	Bool	R / W	Holding the last diameter and material thickness value TRUE: Diameter and material thickness value are maintained (remain unchanged).

Template DancerControl

Functions

Function "ThicknessCalculation"

⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_bManualOperation	Bool	R / W	Activating manual control	
			TRUE	• The line speed signal is deactivated. • The last material thickness value is maintained (remains unchanged.)
g_bResetPosD	Bool	R / W	Resetting the angle of rotation	
			TRUE	Sets the angle of rotation of the reel shaft to "0".

Outputs ⇨			
Identifier	**Data type**	**Access**	**Value/meaning**
g_wThickness	Word	R	Current material thickness in [µm] • Value is internally limited to 1 ... 30000 µm.

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**				
Code / **Subcode**	**Data type**	**Access**	**Info**	
			Possible settings	**Presetting**
C3007		R / W	Minimum material thickness	
			1 {1 µm} 30000	1 µ m
C3008		R / W	Maximum material thickness	
			1 {1 µm} 30000	1 µ m
C3009		R / W	Selection of an initial material thickness • Value is loaded by setting *g_bLoadS* to TRUE. • Value can be alternatively selected under *g_wSetS* . For this, set *g_bSetSExtern* to TRUE.	
			1 {1 µm} 30000	1 µ m
C3052		R	Physical material thickness	
			0 {1 µm} 30000	Only display

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUThicknessCalculation**				
Code / **Subcode**	**Data type**	**Access**	**Info**	
			Possible settings	**Presetting**
C3130		R / W	Number of reel shaft revolutions until next thickness calculation • With the setting 1000 rev., the material thickness is continuously calculated after 100 revolutions.	
			1 {1 rev} 1000	100 rev

Selection of the initial material thickness

Under C3009 you can set an initial value with which the material thickness calculator can be loaded after every reel change.

- As an alternative, you can supply an external material thickness signal via the input *g_wSetS* . For this, set *g_bSetSExtern* to TRUE.
- The initial value is
  – loaded manually by setting *g_bLoadS* to TRUE.
  – automatically loaded if a new start value is loaded in the diameter calculator.

Calculating the material thickness

After initialisation with the initial value, the first calculation cycle starts saving the input values of the current diameter and the current angle of rotation when the reel shaft has made 21/2 revolutions.

After the input values have been saved, the calculator waits until the number of reel shaft revolutions set in C3130 have been completed and then calculates the material thickness from the differential values.

- The input values are saved during each calculation so that the next calculation cycle can start.
- With the setting C3130 = 1000 [rev], the first calculation is already made after 100 revolutions. Subsequently, the calculation is continuously carried out whenever the function is processed (cycle time = 4 ms). The input values saved at the beginning of the calculation cycle are not permanently replaced, but are maintained. As soon as 10000 revolutions have been completed, there are no more calculations carried out.

Limiting the material thickness

Under C3007 and C3008 you can set the limit values for the material thickness to avoid higher variations of the output value.

Note!

Larger changes of the output value can, for instance, occur if the input values are unsteady or the selected calculation cycle is too small.

Holding the current material thickness

By setting *g_bHoldS* to TRUE maintains the last material thickness value *g_wThickness* . At the same time, the current calculation cycle is aborted.

- If *g_bHoldS* is reset to FALSE, the next calculation cycle starts saving the current input values as soon as the reel shaft has completed 21/2 revolutions.
- If the current diameter is maintained and manual control is activated (*g_bManualOperation* = TRUE), the material thickness calculation is not continued.

Saving the current material thickness

The current material thickness is automatically saved when the PLC is de-energised. After reconnecting the PLC, the saved value is automatically loaded back into the material thickness calculator.

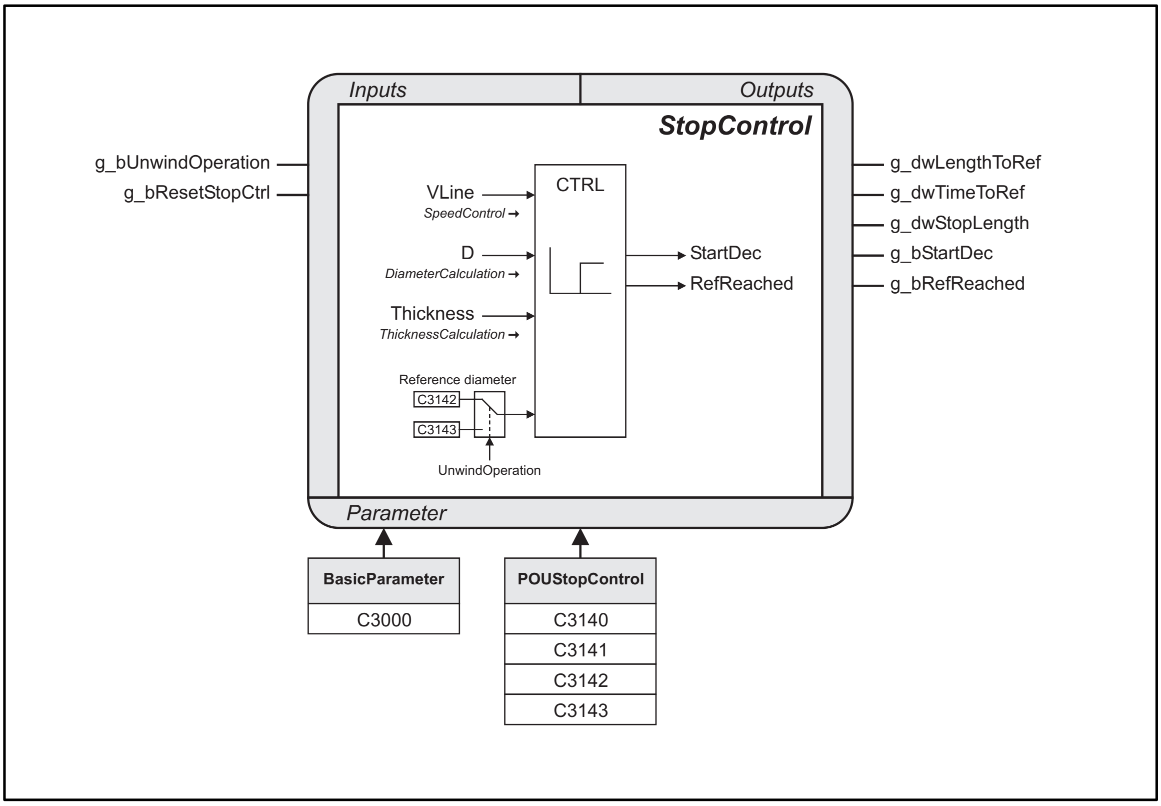
Note!

The material thickness calculator therefore only has to be initialised when the reel has been changed.

5.7 Function "StopControl"

This template function can be used to monitor the residual length to a preselected reference diameter through the current diameter and the current material thickness. A stop signal is released under consideration of a certain rate time, so that the braking of the machine can be initiated in time.

- The current diameter and the current material thickness are provided by the functions **DiameterCalculation** and **ThicknessCalculation**.
- The rate time for the stop signal is determined from the current line speed in connection with an adjustable deceleration time and an adjustable residual length.



⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_bUnwindOperation	Bool	R / W	Activating the reference diameter for unwind operation	
			TRUE	Uses the reference diameter for unwind operation (C3143) instead of the reference diameter for wind-up operation (C3142).
g_bResetStopCtrl	Bool	R / W	Reset of the stop controller	
			TRUE	Resets stop controller and digital output signals.

Outputs ⇨			
Identifier	**Data type**	**Access**	**Value/meaning**
g_dwLengthToRef	Double word	R	Residual length to reference diameter in [mm]
g_dwTimeToRef	Double word	R	Residual operating time to reference value in [s] • Assuming that speed = *g_wVMax* . • This value is only calculated every second call (alternating with *g_dwStopLength*) .
g_dwStopLength	Double word	R	Change of length during braking in [mm] • This value is only calculated every second call (alternating with *g_dwTimeToRef*).
g_bStartDec	Bool	R	Status signal to start braking TRUE: Starts braking.
g_bRefReached	Bool	R	Status signal "Reference diameter reached" TRUE: The reference diameter has been reached.

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**					
Code / **Subcode**	**Data type**	**Access**	**Info** / **Possible settings**		**Presetting**
C3000		R / W	Maximum line speed (v_{max})		
			0.0	{0.1 m/min} 3000.0	0.0 m/min

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUStopControl**					
Code / **Subcode**	**Data type**	**Access**	**Info** / **Possible settings**		**Presetting**
C3140		R / W	Nominal deceleration time for braking		
			0.000	{0.001 sec} 10000.000	0 s
C3141		R / W	Residual length after the stop		
			0.000	{0.001 m} 100000.000	0 m
C3142		R / W	Reference diameter for pre-stop and stop signal • Setting for wind up operation (*g_bUnwindOperation* = FALSE).		
			0	{1 µm} 10000000	0 µm
C3143		R / W	Reference diameter for pre-stop and stop signal • Setting for unwind operation (*g_bUnwindOperation* = TRUE).		
			0	{1 µm} 10000000	0 µm

Selecting the direction of winding

Use *g_bUnwindOperation* to select the direction of winding:

- FALSE = Wind up operation
- TRUE = Unwind operation

Depending on the selection, the corresponding reference diameter will be used to activate pre-stop and final stop.

Selecting the reference diameter

The reference diameter is separately selected for wind up and unwind operation. Depending on the direction of winding selected with *g_bUnwindOperation*, the corresponding reference diameter will be used to calculate the current residual length/residual operating time and to activate pre-stop and final stop.

- Select the reference diameter for wind up operation in C3142.
- Select the reference diameter for unwind operation in C3143.

Displaying the current residual length/residual operating time

Use *g_dwLengthToRef* to display the residual length to the corresponding reference diameter (depending on the selected direction of winding).

- Assuming that line speed = *g_wVMax*, the residual operating time *g_dwTimeToRef* can be calculated from the residual length.

Activating a pre-stop

For activating a pre-stop, the residual length to the reference diameter (depending on the selected direction of winding) is compared to the residual length after the stop (C3141) including the change of length during braking.

- The change of length during braking is output at *g_dwStopLength*. The value depends on the current line speed which is calculated from *g_wVMax* and *g_nVLine* as well as on the nominal deceleration time for braking (C3140).
- The signal required to activate the pre-stop is released at *g_bStartDec*.

Tip!

If you want a certain material length to be left to the reference diameter for safety reasons, you can set this length directly under C3141.

Activating a final stop

For activating a final stop, the residual length to the reference diameter (depending on the selected direction of winding) is compared to zero (current diameter = reference diameter).

- The signal required to activate the final stop is released at *g_bRefReached*.

Resetting the release signals

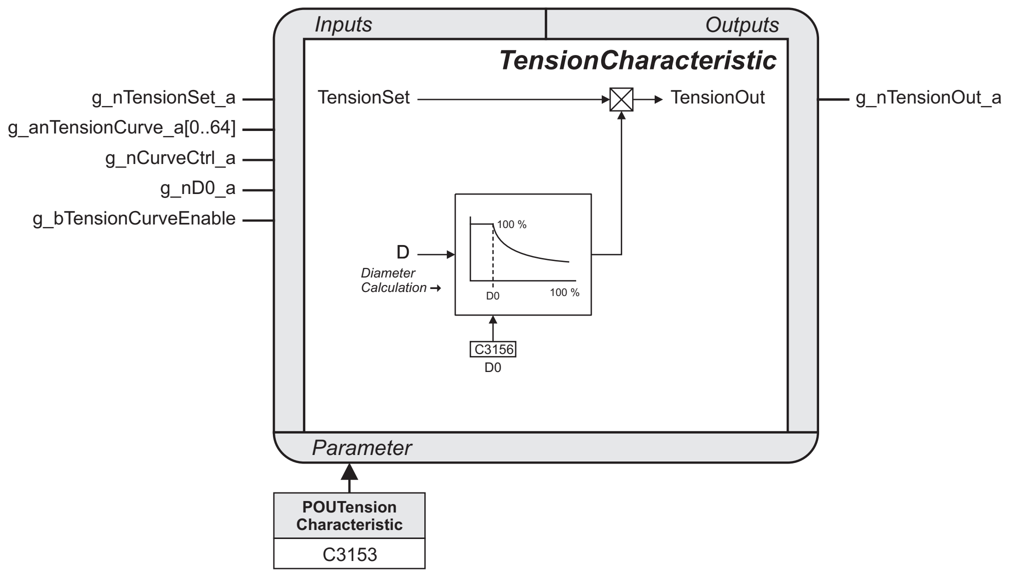
Set *g_bResetStopCtrl* to TRUE to reset the two digital outputs for activating pre-stop and final stop.

5.8 Function ”TensionCharacteristic”

With a great variety of materials, the tension has to be reduced with increasing diameter.

This template function can be used to generate an output signal for the direct control of a pneumatically operated dancer.

- The tension is controlled via an adjustable characteristic which is characterised by an initial range with constant tension and a second range in which the tension is reduced as a function of the diameter.



⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_nTensionSet_a	Integer	R / W	Tension setpoint • Referred to a max. output voltage of 10 V.
g_anTension Curve_a[0..64]	Array of integers	R / W	Array for characteristics table • The 65 values are distributed over the diameter range • The values are internally limited to 1 ... 32767. • 16384 ≡ 100 %
g_nCurveCtrl_a	Integer	R / W	Slope of the characteristic curve (torque characteristics) • Value is internally limited to -16383 ... 32767. • 16384 ≡ 100 % • With 100 % the tension characteristic is constant and the torque rises proportionally to d.

Template DancerControl

Functions

Function "TensionCharacteristic"

⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_nD0_a	Integer	R / W	Origin of the characteristic • Referred to d_{max} (C3005) • Value is internally limited to 16383 (~d_{max}).
g_bTensionCurveEnable	Bool	R / W	Activating the tension characteristic FALSE: Tension setpoint remains unchanged. TRUE: Tension setpoint is evaluated through the characteristic.

Outputs ⇨			
Identifier	**Data type**	**Access**	**Value/meaning**
g_nTensionOut_a	Integer	R	Current tension setpoint

Parameter monitor: Folder **Individual IEC1131 codes** → Folder **POUTensionCharacteristic**				
Code / **Subcode**	**Data type**	**Access**	**Info** / **Possible settings**	**Presetting**
C3153		R / W	Selection of the tension characteristic 0 Linear tension characteristics 1 Linear torque characteristics 2 Tension characteristics according to a set characteristic (*g_anTensionCurve_a*)	0

Selecting the characteristic curve

The part of the characteristic curve that depends on the diameter can be generated for linear tension characteristics, linear torque characteristics or by means of a selected characteristic curve. The selection is made under C3153.

Characteristic curve for linear tension characteristics

Set C3153 = 0 to select the characteristic curve for linear tension characteristics:

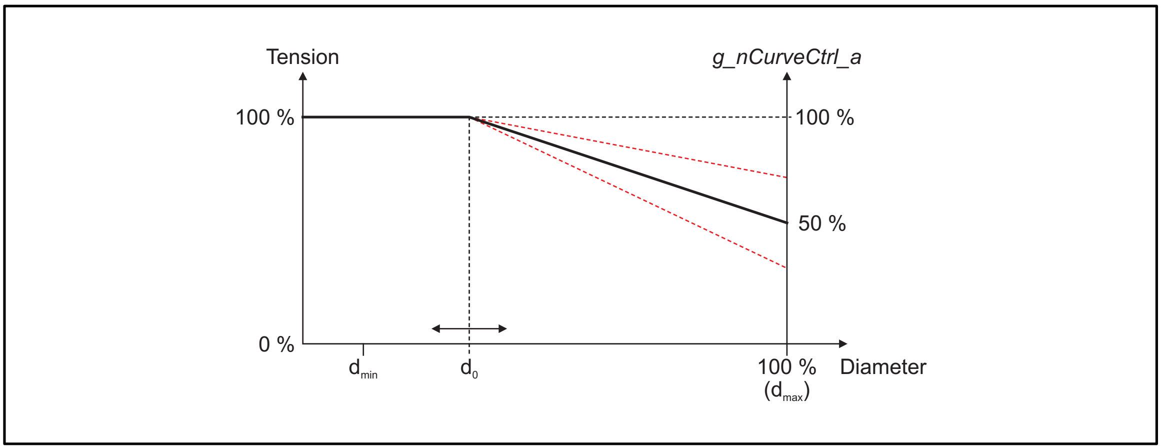


Fig. 5-5 Characteristic curve for linear tension characteristics

- Use *g_nD0_a* to determine with which diameter (d_0) the tension reduction is to be started.
- Use *g_nCurveCtrl_a* to select how many per cent of the original tension shall still be available when the maximum diameter is reached.

Characteristic curve for linear torque characteristics

Set C3153 = 1 to select the characteristic curve for linear torque characteristics with tension characteristics proportional to 1/d:

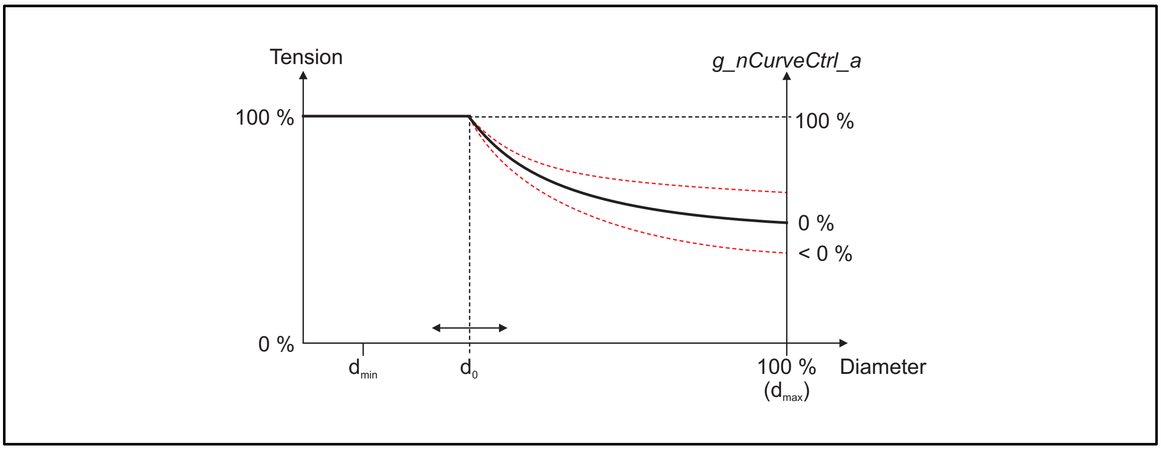


Fig. 5-6 Characteristic curve for linear torque characteristics

- Use *g_nD0_a* to determine with which diameter (d_0) the tension reduction is to be started.
- Since the linear torque characteristics are in the fore here, the slope of the torque curve is selected under *g_nCurveCtrl_a* :

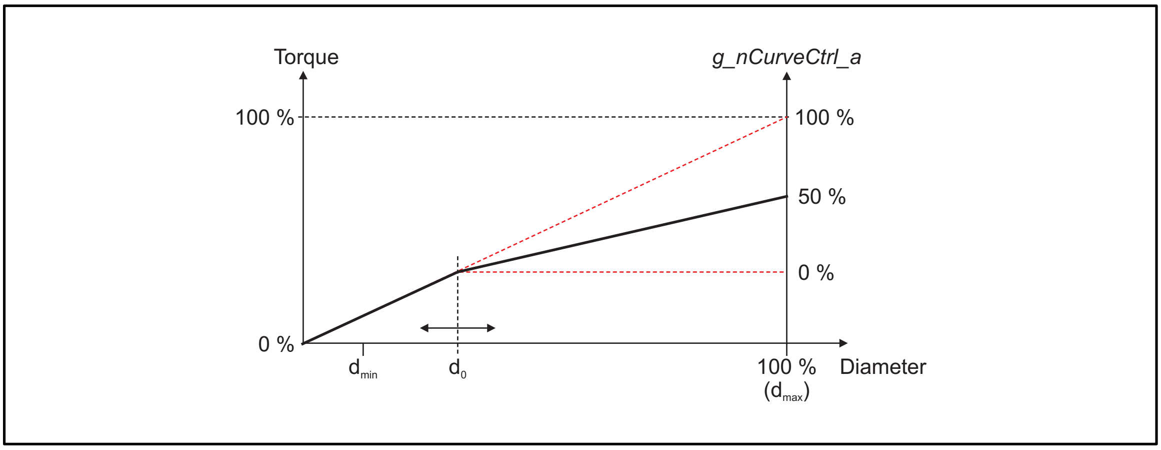


Fig. 5-7 Selecting the slope of the characteristic under *g_nCurveCtrl_a*

– If *g_nCurveCtrl_a* = 16384 (100 %) the tension remains unchanged. If *g_nCurveCtrl_a* = 0 (0 %), it is reduced to D_0/D_{max}.

Characteristic curve for individual tension characteristics

Set C3153 = 2 to select the characteristic curve for individual tension characteristics:

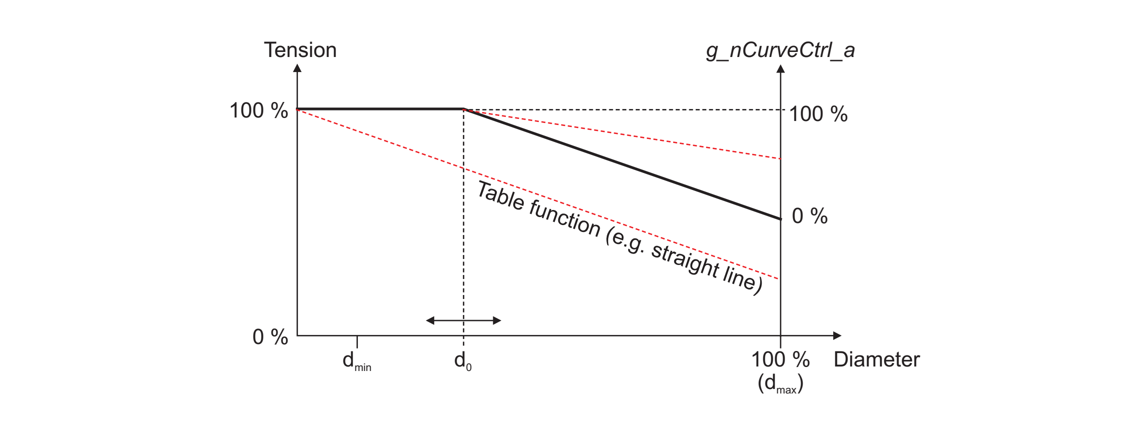


Fig. 5-8 Characteristic curve for individual tension characteristics based on a preselected table

The characteristic is defined through the array variable *g_anTensionCurve_a* in a table of 65 values:

Global variable	Characteristic value no.
g_anTensionCurve_a[0]	1
g_anTensionCurve_a[1]	2
g_anTensionCurve_a[2]	3
...	...
g_anTensionCurve_a[64]	65

- The 65 values are referred to the whole diameter range, i.e. the first array element [0] contains the value for d=0 and the last array element [64] the value for $d=d_{max}$.
- If you select an initial diameter > 0 under *g_nD0_a* the whole characteristic will be shifted by this value to the right.
- Use *g_nCurveCtrl_a* to select the slope of the characteristic.
  – If *g_nCurveCtrl_a* = 16384 (100 %) the tension remains unchanged. If *g_nCurveCtrl_a* = 0 (0 %) it is changed in accordance with the characteristic.
- It is possible to assign a code to the array variable *g_anTensionCurve_a* and to enter the individual coordinates of the curve under the corresponding subcodes.

Tip!

If you need more than one individual characteristics simply create as many array variables as characteristics required:

```
VAR
 ...
 anUserCurve1_a:  ARRAY [0..64] OF INT ;
 anUserCurve2_a:  ARRAY [0..64] OF INT ;
 anUserCurve3_a:  ARRAY [0..64] OF INT ;
 ...
END VAR
```

- Use a selection function (e. g. FB **L_ASW** from the **LenzeDrive.lib** function library) to connect the array variables with the input *g_anTensionCurve_a*.
- You can also assign user codes to the array variables.

Output signal for tension control

The output signal for controlling the dancer tension is obtained by multiplying the setpoint for the initial tension by the output signal of the selected characteristic function.

- In this way, you can select the initial tension and the further diameter-dependent characteristics separately.
- Use *g_nTensionSet_a* to select the initial tension.

Activating the tension characteristic

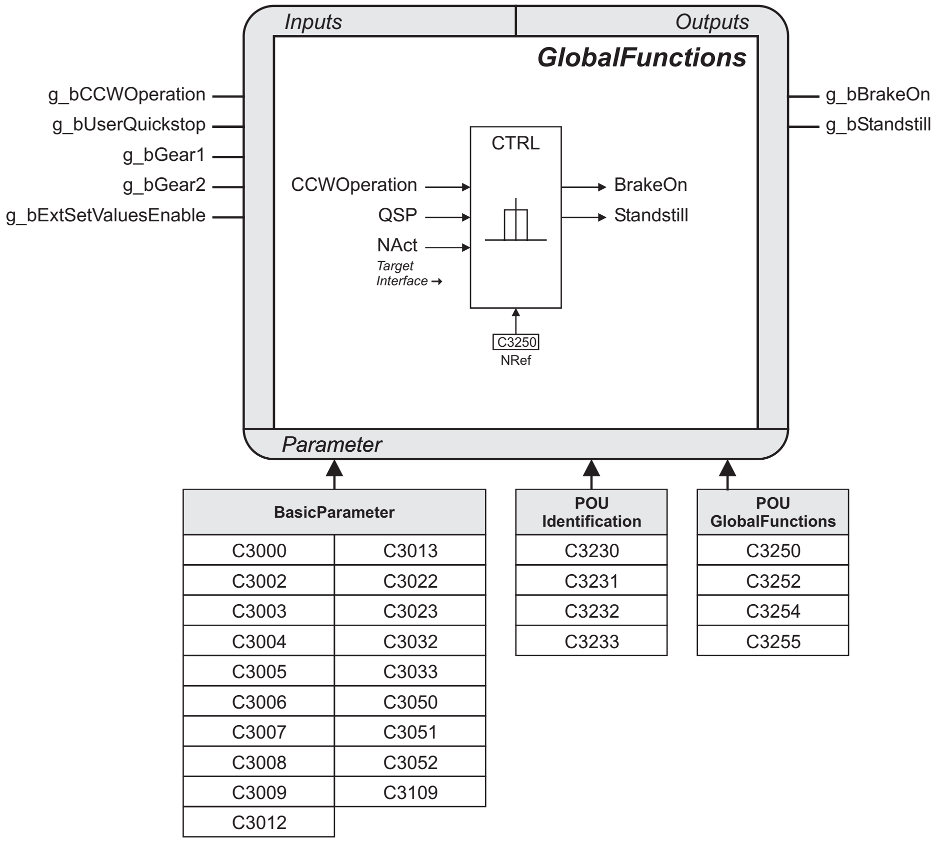
Set *g_bTensionCurveEnable* to TRUE to activate the evaluation of the tension setpoint with the preset characteristic.

Note!

Independently of the characteristic selected under C3153, you always have to select the origin and the characteristics of the characteristic curve under *g_nD0_a* and *g_nCurveCtrl_a*.

5.9 Function "GlobalFunctions"

This template function includes the most important parameters, control and auxiliary functions of the template.



⇨ **Inputs**			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_bCCWOperation	Bool	R / W	Inverting the direction of rotation TRUE: The direction of rotation is inverted.
g_bUserQuickstop	Bool	R / W	User quick stop (quick stop of the drive system) TRUE: Activates user quick stop. • The output *g_bBrakeOn* is simultaneously set to TRUE for motor brake control.
g_bGear1 g_bGear2	Bool	R / W	Selection of the gearbox factor (binary coded) *g_bGear2* / *g_bGear1* FALSE / FALSE: Basic gearbox factor (C3002/C3003) FALSE / TRUE: Gearbox factor 1 (C3012/C3013) TRUE / FALSE: Gearbox factor 2 (C3022/C3023) TRUE / TRUE: Gearbox factor 3 (C3032/C3033)
g_bExtSetValuesEnable	Bool	R / W	Changing the setpoint selection for the motor control FALSE: Setpoint selection through the template. TRUE: Setpoint selection via activated template interface. • See: Register **Resources** →**Global variables** →**TemplateInterface** → **VarExternalSetValues**

Outputs ⇨				
Identifier	**Data type**	**Access**	**Value/meaning**	
g_bBrakeOn	Bool	R	Control signal for motor brake • Activated by *g_bUserQuickstop* .	
			TRUE	Activates the motor brake.
g_bStandstill	Bool	R	Status signal "Standstill"	
			TRUE	Motor is at standstill.

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**							
Code	**Subcode**	**Data type**	**Access**	**Info**			
				Possible settings			**Presetting**
C3000			R / W	Maximum line speed (v_{max})			
				0.0	{0.1 m/min}	3000.0	0.0 m/min
C3004			R / W	Minimum diameter (d_{min})			
				1	{1 mm}	10000	1 mm
C3005			R / W	Maximum diameter (d_{max})			
				1	{1 mm}	10000	1 mm
C3006			R / W	Setting an initial diameter • Value is loaded by setting *g_bLoadD* to TRUE. • Value can be alternatively selected under *g_nSetD_a* . For this, set *g_bSetDExtern* to TRUE.			
				1	{1 mm}	10000	1 mm
C3007			R / W	Minimum material thickness			
				1	{1 µm}	30000	1 µ m
C3008			R / W	Maximum material thickness			
				1	{1 µm}	30000	1 µ m
C3009			R / W	Setting an initial material thickness • Value is loaded by setting *g_bLoadS* to TRUE. • Value can be alternatively selected under *g_wSetS* . For this, set *g_bSetSExtern* to TRUE.			
				1	{1 µm}	30000	1 µ m
			R / W	Gearbox factors • The gearbox factor is binary coded. It is selected via the inputs *g_bGear1* and *g_bGear2* . If both inputs are not assigned or set to FALSE, the basic gearbox factor will be used.			
C3002				Basic gearbox factor (numerator)			
				-32767	{1}	32767	1
C3003				Basic gearbox factor (denominator)			
				1	{1}	32767	1
C3012				Gearbox factor 1 (numerator)			
				-32767	{1}	32767	1
C3013				Gearbox factor 1 (denominator)			
				1	{1}	32767	1
C3022				Gearbox factor 2 (numerator)			
				-32767	{1}	32767	1
C3023				Gearbox factor 2 (denominator)			
				1	{1}	32767	1
C3032				Gearbox factor 3 (numerator)			
				-32767	{1}	32767	1
C3033				Gearbox factor 3 (denominator)			
				1	{1}	32767	1

Template DancerControl

Functions

Function "GlobalFunctions"

Parameter monitor: Folder **Individual IEC1131 codes** → folder **BasicParameter**

Code	Subcode	Data type	Access	Info	Possible settings			Presetting
C3050			R	Physical line speed	-6000.0	{0.1 m/min}	6000.0	Display only
C3051			R	Physical reel diameter	0	{1 µm}	10000000	Display only
C3052			R	Physical material thickness	0	{1 µm}	30000	Display only
C3109			R	Maximum speed setpoint ($v_{Line} = v_{max}$, $d = d_{min}$) • Referred to n_{max} (C0011)	0.00	{0.01 %}	5000.00	Display only

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUIdentification**

Code	Subcode	Data type	Access	Info	Possible settings			Presetting
C3230			R / W	Maximum speed during the identification of the mass moment of inertia • Referred to N_{max} (C0011)	5.00	{0.01 %}	100.00	10 %
C3231			R / W	Maximum torque during the identification of the mass moment of inertia • Referred to M_{max} (C0057)	-100.00	{0.01 %}	100.00	25 %
C3232			R / W	Start delay for identification run	0	{1 msec}	1000	500 msec
C3233			R / W	Filter time constant for actual speed value	0	{1 msec}	50	0 ms

Parameter monitor: Folder **Individual IEC1131 codes** → folder **POUGlobalFunctions**

Code	Subcode	Data type	Access	Info	Possible settings			Presetting
C3250			R / W	Reference speed range for motor standstill	0.00	{0.01 %}	100.00	1 %
C3252			R / W	Hysteresis for comparison function motor standstill	0.00	{0.01 %}	100.00	1 %
C3254			R / W	Automatic pulse inhibit	0 1	Quick stop without automatic pulse inhibit Quick stop with automatic pulse inhibit		0
C3255			R / W	Delay time for automatic pulse inhibit	1000	{1 msec}	10000	1000 ms

Changing the direction of rotation

To change the direction of rotation of the reel shaft without changing the material flow direction, you can either

- invert the sign of the gearbox factor for the numerator
  - or -
- set the input *g_bCCWOperation* to TRUE.

All relevant control signals for the motor control will be inverted accordingly.

Activating the quick stop of the drive system (QSP)

By setting *g_bUserQuickstop* to TRUE or via the corresponding button in the visualisation you can activate a quick stop, i.e. the drive brakes via the set quick stop ramp to standstill.

- The quick stop ramp can be set under the corresponding motor control parameters (e.g. C0105 with the 9300 Servo PLC).

Changing the gearbox factor

When using a winder with control gear, you can select up to four different gearbox factors via codes:

Configuration	Numerator	Denominator
Basic gearbox factor	C3002	C3003
Gearbox factor 1	C3012	C3013
Gearbox factor 2	C3022	C3023
Gearbox factor 3	C3032	C3033

The gearbox factor is binary coded and selected via the inputs *g_bGear1* and *g_bGear2* :

Selection	g_bGear2	g_bGear1
Basic gearbox factor	FALSE	FALSE
Gearbox factor 1	FALSE	TRUE
Gearbox factor 2	TRUE	FALSE
Gearbox factor 3	TRUE	TRUE

Motor brake control

When quick stop is activated, the output signal *g_bBrakeOn* is set to TRUE for motor brake control.

- The output signal *g_bBrakeOn* is even set to TRUE if, e.g. due to an error, a pulse inhibit was released.
- If the quick stop is deactivated again, the output signal *g_bBrakeOn* is reset to FALSE.

Standstill message

The message output *g_bStandstill* for the standstill of the motor will be set to TRUE if the motor speed is within the reference speed range set under C3250.

- Under C3152 you can set a hysteresis for resetting the standstill message.
- After coming to standstill and activating the motor brake through quick stop, the motor control remains switched on until controller inhibit is set in the PLC.

Automatic pulse inhibit

If you want an automatic pulse inhibit to be set during long standstill periods, you can activate this function by setting C3254 = "1".

- Under C3255 you can set a delay time for the pulse inhibit.
- When the quick stop is deactivated, the pulse inhibit is deactivated as well.

Automatic identification of the moment of inertia

The minimum and the maximum mass moment of inertia are required for setting the parameters of the acceleration compensation. The two values can be automatically determined by means of an identification run. A mathematical calculation is then no longer required.

- The identification run is started via the visualisation **VisCompensation**.
- Under C3232 you can set a delay time after which the identification run starts after controller enable. In this way, the magnetic flux of the motor can be built up before acceleration starts (only required for asynchronous motors).
- After expiry of the delay time defined in C3232, the drive is automatically accelerated and, if possible, brought to standstill again by means of a quick stop.
  – The rate of change of the reel shaft speed results from the set acceleration torque and the existing mass moment of inertia.
  – After completion of the identification run, the identified mass moment of inertia is displayed in the visualisation **VisCompensation**, field **identified moment of inertia**.

Tip!

Detailed information about the automatic identification of the mass moment of inertia can be found in chapter 4.2.8 "Checking the acceleration compensation". (4-10)

Filtering the actual speed value

If incremental encoders with a low pulse number per revolution are used, the speed signal has to be filtered.

- Under C3233 you can set the filter time constant. In most cases, settings between 5 ... 10 ms are sufficient.

6 Appendix

6.1 Global variables

The below variable declarations can be found in the *Object Organizer*/register **Resources** in the folder **Global variables →TemplateInterface**.

6.1.1 VarAccelerationCompensation

⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_nVarMInertiaAdapt_a	Integer	R / W	Adaptation of the mass moment of inertia (e.g. in the event of different widths) • Initialisation: 16384
g_bAccCompInact	Bool	R / W	Deactivating the pre-control torque
			TRUE: Pre-control torque = "0"
g_nAdditiveTorque_a	Integer	R / W	Motor torque pre-control via additional functions

Outputs ⇨			
Identifier	**Data type**	**Access**	**Value/meaning**
g_nMAcc_a	Integer	R	Pre-control torque for motor control

6.1.2 VarDancerControl

⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_bWriteMaxPos	Bool	R / W	Accepting the current dancer position as maximum position (upper limitation)
			TRUE: Accepting the entered value
g_bWriteMinPos	Bool	R / W	Accepting the current dancer position as minimum position (lower limitation)
			TRUE: Accepting the entered value
g_nPosIn_a	Integer	R / W	Current dancer position
g_nVpAdapt_a	Integer	R / W	Dancer controller gain
g_bIOff	Bool	R / W	Dancer control with/without I-component
			FALSE: Dancer control with I-component
			TRUE: Dancer control without I-component (I-component = zero)
g_bPCtrlReset	Bool	R / W	Activating/deactivating the dancer controller • Can be alternatively set under C3160.
			FALSE: Dancer controller activated
			TRUE: Dancer controller deactivated (dancer controller output = zero)

Outputs ⇨			
Identifier	**Data type**	**Access**	**Value/meaning**
g_nPosOut_a	Integer	R	Current dancer position • Normalised to the set setting range.
g_bInSetPosition	Bool	R	Status signal "Dancer in setpoint position"
			TRUE: The dancer is in the setpoint position.
g_bPosOverrange	Bool	R	Status signal "Maximum dancer position has been reached"
			TRUE: The maximum dancer position (C3181) has been reached.
g_bNegOverrange	Bool	R	Status signal "Minimum dancer position has been reached"
			TRUE: The minimum dancer position (C3182) has been reached.
g_nPCtrlOut_a	Integer	R	Output signal of the dancer controller

6.1.3 VarDiameterCalculation

⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_nVWinder	Integer	R / W	Current circumferential speed • Identified by means of an encoder installed between dancer and reel.	
g_bSetDExtern	Bool	R / W	Activating input *g_nSetD_a* for the selection of the initial diameter value.	
			TRUE	Not the value set under C3006, but the value selected under *g_nSetD_a* is loaded as initial diameter.
g_nSetD_a	Integer	R / W	Selecting an initial diameter value or an external diameter signal • Referred to d_{max} (C3005). • Set *g_bSetDExtern* to TRUE to use this selection. • Value is loaded by setting *g_bLoadD* to TRUE.	
g_bLoadD	Bool	R / W	Loading the preset diameter value	
			TRUE	The value set under C3006 or, if *g_bSetDExtern* = TRUE, the value selected under *g_nSetD_a* is loaded.
g_bHoldD	Bool	R / W	Holding the last diameter value	
			TRUE	The diameter value is maintained (remains unchanged).
g_bCalcRef1	Bool	R / W	Selecting the calculation cycle	
			FALSE	Setting in C3123 is active.
			TRUE	Setting in C3124 is active.
g_bResetPosD	Bool	R / W	Resetting the angle of rotation	
			TRUE	Sets the angle of rotation of the reel shaft to ”0”.

Outputs ⇨				
Identifier	**Data type**	**Access**	**Value/meaning**	
g_nDiameter_a	Integer	R	Current diameter • Referred to d_{max} (C3005)	
g_nReziprDiameter_a	Integer	R	Reciprocal of the current diameter • Referred to d_{min} (C3004)	
g_nNReel_v	Integer	R	Current reel speed in [inc/ms]	
g_dnPos_p	Double integer	R	Current angle of rotation of the reel in [inc]	
g_bDMaxLimit	Bool	R	Status signal “Maximum diameter has been reached”	
			TRUE	The max. diameter (C3005) has been reached.
g_bDMinLimit	Bool	R	Status signal “Minimum diameter has been reached”	
			TRUE	The min. diameter (C3004) has been reached.

6.1.4 VarExternalSetValues

⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_bExtSetValuesEnable	Bool	R / W	Changing the setpoint selection for the motor control	
			FALSE	Setpoint selection through the template.
			TRUE	Setpoint selection via activated template interface. • See: Register **Resources** → **Global variables** → **TemplateInterface** → **VarExternalSetValues**

⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
The below variables are used as interface for the motor control (MCTRL) if g_bExtSetValuesEnable is set to TRUE:				
g_bExtQspOut	Bool	R / W	Quick stop (QSP)	
			TRUE	Drive carries out QSP.
g_nExtHiMLim_a	Integer	R / W	Upper torque limit • In % of C0057	
g_nExtLoMLim_a	Integer	R / W	Lower torque limit • In % of C0057	
g_bExtNMSwt	Bool	R / W	Speed control/torque control selection	
			FALSE	Speed control
			TRUE	Torque control
g_nExtNAdapt_a	Integer	R / W	Adaptive Vp of the speed controller	
g_bExtILoad	Bool	R / W	Accepting the I-component of the n-controller from *MCTRL_nISet_a*	
			TRUE	I-component of the n-controller is accepted from *MCTRL_nISet_a*.
g_nExtNSet_a	Integer	R / W	Speed setpoint	
g_bExtPosOn	Bool	R / W	Activating the phase controller	
			TRUE	Phase controller is activated
g_nExtNStartMLim_a	Integer	R / W	Lower speed limit for speed restriction	
g_nExtMAdd_a	Integer	R / W	Additional torque setpoint or torque setpoint	
g_nExtFldWeak_a	Integer	R / W	Motor excitation	

6.1.5 VarGlobalFunctions

⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_bUserQuickstop	Bool	R / W	User quick stop (quick stop of the drive system)	
			TRUE	Initiates user quick stop. • At the same time, the output *g_bBrakeOn* is set to TRUE to control a motor brake.
g_bUnwindOperation	Bool	R / W	Activating the reference diameter for unwind operation	
			TRUE	Not the reference diameter for wind up operation (C3142), but the reference diameter for unwind operation (C3143) is used.
g_bCCWOperation	Bool	R / W	Inverting the direction of rotation	
			TRUE	The direction of rotation is inverted.
g_bGear1 g_bGear2	Bool	R / W	Selection of the gearbox factor (binary coded)	
			g_bGear2 *g_bGear1* FALSE FALSE Basic gearbox factor (C3002/C3003) FALSE TRUE Gearbox factor 1 (C3012/C3013) TRUE FALSE Gearbox factor 2 (C3022/C3023) TRUE TRUE Gearbox factor 3 (C3032/C3033)	

Outputs ⇨				
Identifier	**Data type**	**Access**	**Value/meaning**	
g_bBrakeOn	Bool	R	Control signal for motor brake • Activated through *g_bUserQuickstop*.	
			TRUE	Activates the motor brake.
g_bStandstill	Bool	R	Status signal "Standstill"	
			TRUE	Motor is at standstill.

6.1.6 VarSpeedControl

⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_bManualOperation	Bool	R / W	Activating manual control	
			TRUE	• The line speed signal is deactivated. • The control inputs *g_bManualJog1* and *g_bManualJog2* are enabled.
g_bManualJog1	Bool	R / W	Activating jog speed 1	
			TRUE	Activates the jog speed set in C3100.
g_bManualJog2	Bool	R / W	Activating jog speed 2	
			TRUE	Activates the jog speed set in C3101.
g_nVLine,	Integer	R / W	Current line speed	
g_dnPhiLine_p	Double integer	R / W	Current angle of rotation of a line drive • For alternative line speed calculation.	

6.1.7 VarStopControl

⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_bResetStopCtrl	Bool	R / W	Resetting the stop controller	
			TRUE	Resets stop controller and digital output signals.

Outputs ⇨				
Identifier	**Data type**	**Access**	**Value/meaning**	
g_dwLengthToRef	Double word	R	Residual length to reference diameter in [mm]	
g_dwTimeToRef	Double word	R	Residual operating time to reference value in [s] • Assuming that speed = *g_wVMax* . • This value is only calculated every second call (alternating with *g_dwStopLength*).	
g_dwStopLength	Double word	R	Change of length during braking in [mm] • This value is only calculated every second call (alternating with *g_dwTimeToRef*).	
g_bStartDec	Bool	R	Status signal to start braking	
			TRUE	Starts braking.
g_bRefReached	Bool	R	Status signal “Reference diameter reached”	
			TRUE	The reference diameter has been reached.

6.1.8 VarTemplateSettings

⇨ Inputs				
Identifier	**Data type**	**Access**	**Information/possible settings**	
g_bVisuOff	Bool	R / W	Deactivating the visualisation	
			TRUE	Visualisation is deactivated.

6.1.9 VarTemplateVersion

Constant			
Identifier	**Data type**	**Access**	**Value/meaning**
C_wLenzeTemplate WndVersion	Word	R	Template version • The value of this constant is hex-coded. • “16#0130” means, for example, “version 1.3”.

6.1.10 VarTensionCharacteristic

⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_nTensionSet_a	Integer	R / W	Tension setpoint • Referred to a max. output voltage of 10 V.
g_anTension Curve_a[0..64]	Array of integers	R / W	Array for characteristics table • The 65 values are distributed over the diameter range • The values are internally limited to 1 ... 32767. • 16384 ≡ 100 %
g_nCurveCtrl_a	Integer	R / W	Slope of the characteristic (torque characteristics) • Value is internally limited to -16383 ... 32767. • 16384 ≡ 100 % • With 100 % the tension characteristic is constant and the torque rises proportionally to d.
g_nD0_a	Integer	R / W	Origin of the characteristic • Referred to d_{max} (C3005) • Value is internally limited to 16383 (~d_{max}).
g_bTensionCurveEnable	Bool	R / W	Activating the tension characteristic FALSE: Tension setpoint remains unchanged. TRUE: Tension setpoint is evaluated through the characteristic.

Outputs ⇨			
Identifier	**Data type**	**Access**	**Value/meaning**
g_nTensionOut_a	Integer	R	Current tension setpoint

6.1.11 VarThicknessCalculation

⇨ Inputs			
Identifier	**Data type**	**Access**	**Information/possible settings**
g_bSetSExtern	Bool	R / W	Activating input *g_wSetS* for the selection of the initial material thickness. TRUE: Not the value set under C3009 but the value selected under *g_wSetS* is loaded as initial material thickness.
g_wSetS	Word	R / W	Selection of an initial material thickness or an external material thickness signal • Set *g_bSetSExtern* to TRUE to use this selection.
g_bLoadS	Bool	R / W	Loading the preset material thickness value TRUE: The value set under C3009 or, if *g_bSetSExtern* = TRUE, the value selected under *g_nSetD_wSetS* is loaded.
g_bHoldS	Bool	R / W	Holding the last material thickness value TRUE: Material thickness is maintained (remains unchanged).

6.2 Code list

Code	External					Internal			Access	CINH? [1]	SHIFT + PRG? [2]	Info
	Min. value	Max. value	Init. value	Unit	Data type	Min. value	Max. value	Data type				
3000	0.0	3000.0	0.0	m/min	DWORD	0	30000	Fixed point	R / W			Maximum line speed
3002	-32767	32767	1		INT.	-32767	32767	Fixed point	R / W			Basic gearbox factor - numerator
3003	1	32767	1		WORD	1	32767	Fixed point	R / W			Basic gearbox factor - denominator
3004	1	10000	1	mm	WORD	1	10000	Fixed point	R / W			Minimum diameter
3005	1	10000	1	mm	WORD	1	10000	Fixed point	R / W			Maximum diameter
3006	1	10000	1	mm	WORD	1	10000	Fixed point	R / W			Initial diameter
3007	1	30000	1	µm	WORD	1	30000	Fixed point	R / W			Minimum material thickness
3008	1	30000	1	µm	WORD	1	30000	Fixed point	R / W			Maximum material thickness
3009	1	30000	1	µm	WORD	1	30000	Fixed point	R / W			Initial material thickness
3012	-32767	32767	1		INT.	-32767	32767	Fixed point	R / W			Gearbox factor 1 - numerator
3013	1	32767	1		WORD	1	32767	Fixed point	R / W			Gearbox factor 1 - denominator
3022	-32767	32767	1		INT.	-32767	32767	Fixed point	R / W			Gearbox factor 2 - numerator
3023	1	32767	1		WORD	1	32767	Fixed point	R / W			Gearbox factor 2 - denominator
3032	-32767	32767	1		INT.	-32767	32767	Fixed point	R / W			Gearbox factor 3 - numerator
3033	1	32767	1		WORD	1	32767	Fixed point	R / W			Gearbox factor 3 - denominator
3050	-6000.0	6000.0		m/min	INT.	-60000	60000	Fixed point	R			Physical line speed
3051	0	10000000		µm	DWORD	0	10000000	32 bits without sign	R			Physical diameter
3052	0	30000		µm	WORD	0	30000	Fixed point	R			Physical material thickness
3100	-199.99	199.99	0.00	%	INT.	-32767	32767	Fixed point	R / W			Jog speed 1
3101	-199.99	199.99	0.00	%	INT.	-32767	32767	Fixed point	R / W			Jog speed 2
3102	0.000	999.999	5.000	s	DINT	0	999999	Fixed point	R / W			Acceleration time for jog speed
3103	0.000	999.999	1.000	s	DINT	0	999999	Fixed point	R / W			Deceleration time for jog speed
3104	0	1	0		BOOL	0	1	Fixed point	R / W		✓	Signal selection for line speed 0 *g_nVLine,* 1 *g_dnPhiLine_p*
3105	-32767	32767	1		INT.	-32767	32767	Fixed point	R / W			Line speed gain - numerator
3106	1	32767	1		WORD	1	32767	Fixed point	R / W			Line speed gain - denominator
3109	0.00	5000.00		%	DWORD	0	819200	Fixed point	R			Maximum speed setpoint with Vmax and Dmin
3120	0	1	0		BOOL	0	1	Fixed point	R / W		✓	Selection of the circumferential speed signal 0 Line speed *g_nVLine,* (with correction of the dancer movement) 1 Circumferential speed *g_nVWinder*
3121	-32767	32767	1		INT.	-32767	32767	Fixed point	R / W			Circumferential speed gain - numerator
3122	1	32767	1		WORD	1	32767	Fixed point	R / W			Circumferential speed gain - denominator

[1] Parameter can only be changed when controller is inhibited.
[2] Press SHIFT + PRG to change the parameter via the keypad.

Code	External					Internal			Access	CINH? [1]	SHIFT + PRG? [2]	Info
	Min. value	Max. value	Init. value	Unit	Data type	Min. value	Max. value	Data type				
3123	0.001	2.000	1.000	rev	WORD	1	2000	Fixed point	R / W			Calculation interval 0 for diameter calculation
3124	0.001	2.000	0.100	rev	WORD	1	2000	Fixed point	R / W			Calculation interval 1 for diameter calculation
3125	0.010	30.000	1.000	s	WORD	10	30000	Fixed point	R / W			Filter time constant for diameter calculation
3126	0.00	100.00	10.00	%	INT.	0	16384	Fixed point	R / W			Window for web-break monitoring
3130	1	1000	100	rev	WORD	1	1000	Fixed point	R / W			Reference value for thickness calculation
3140	0.000	10000.000	0.000	s	DWORD	0	10000000	Fixed point	R / W			Deceleration time for braking
3141	0.000	100000.000	0.000	m	DWORD	0	100000000	Fixed point	R / W			Residual length after the stop
3142	0	10000000	0	µm	DWORD	0	10000000	32 bits without sign	R / W			Reference diameter of winding-up unit for stop controller
3143	0	10000000	0	µm	DWORD	0	10000000	32 bits without sign	R / W			Reference diameter of unwinder for stop controller
3153	0	2	0		WORD	0	2	Fixed point	R / W		✓	Selection of the tension characteristic: 0 Linear tension characteristics 1 Linear torque characteristics 2 Tension characteristics according to a set characteristic (*g_anTensionCurve_a*)
3160	0	1	0		BOOL	0	1	Fixed point	R / W		✓	Selection: Operation with/without dancer control 0 Dancer controller activated 1 Dancer controller deactivated
3161	-199.99	199.99	0.00	%	INT.	-32767	32767	Fixed point	R / W			Setpoint dancer position
3163	-199.99	199.99	10.00	%	INT.	-32767	32767	Fixed point	R / W			Influence of the dancer controller
3164	0.000	30.000	0.000	s	WORD	0	30000	Fixed point	R / W			Acceleration/deceleration time for setpoint ramp generator
3165	0.000	10.000	0.000	s	WORD	0	10000	Fixed point	R / W			Filter time constant for actual dancer controller value
3166	0.000	30.000	0.000	s	WORD	0	30000	Fixed point	R / W			Rate time constant for actual dancer controller value
3167	0.00	100.00	100.00	%	INT.	0	16384	Fixed point	R / W			Reduced gain of the tension deviation
3168	0.00	199.99	0.00	%	INT.	0	32767	Fixed point	R / W			Range of reduced gain
3169	0.00	100.00	0.00	%	WORD	0	10000	Fixed point	R / W			Dancer controller gain
3170	0.001	30.000	1.000	s	WORD	1	30000	Fixed point	R / W			Adjustment time of the dancer controller
3171	0	1000	0	ms	WORD	0	1000	Fixed point	R / W			Rate time of the dancer controller
3172	0	1	0		BOOL	0	1	Fixed point	R / W			Selection of a bipolar/unipolar output signal 0 Bipolar output signal 1 Unipolar output signal
3180	0	1000	10	ms	WORD	0	1000	Fixed point	R / W			Filter time constant for dancer input signal
3181	-199.99	199.99	100.00	%	INT.	-32767	32767	Fixed point	R / W			Input value for upper limit position of dancer
3182	-199.99	199.99	-100.00	%	INT.	-32767	32767	Fixed point	R / W			Input value for lower limit position of dancer
3183												Material length stored in the dancer
3184	-199.99	199.99	90.00	%	INT.	-32767	32767	Fixed point	R / W			Reference value for upper limit position of the dancer
3185	0.00	199.99	10.00	%	INT.	0	32767	Fixed point	R / W			Tolerance range for dancer in setpoint position

[1] Parameter can only be changed when controller is inhibited.
[2] Press SHIFT + PRG to change the parameter via the keypad.

	External					Internal						
Code	Min. value	Max. value	Init. value	Unit	Data type	Min. value	Max. value	Data type	Access	CINH? [1]	SHIFT + PRG? [2]	Info
3186	-199.99	199.99	-90.00	%	INT.	-32767	32767	Fixed point	R / W			Reference value for lower limit position of the dancer
3187	0.000	50.000	0.100	s	WORD	0	50000	Fixed point	R / W			Delay time for dancer position status signals
3188	0	1000	10	ms	WORD	0	1000	Fixed point	R / W			Filter time constant for dancer speed
3189	0.00	100.00	1.00	%	INT.	0	16384	Fixed point	R / W			Dead band for additional torque
3190	0.00	10.00	0.00		WORD	0	1000	Fixed point	R / W			Damping factor for additional torque
3200	0	4294967295	0	0.1 kgcm2	DWORD	0	4294967295	32 bits without sign	R / W			Constant mass moment of inertia
3201	0	4294967295	0	0.1 kgcm2	DWORD	0	4294967295	32 bits without sign	R / W			Maximum mass moment of inertia
3202	0.00	100.00	1.00		WORD	0	10000	Fixed point	R / W			Gain of speed controller adaption
3203	0.00	199.99	100.00	%	INT.	0	32767	Fixed point	R / W			Upper limit of speed controller adaption
3204	0.00	199.99	100.00	%	INT.	0	32767	Fixed point	R / W			Lower limit of speed controller adaption
3210	10	30000	100	ms	WORD	10	30000	Fixed point	R / W			Filter time constant for motor acceleration
3211	0	2	0		WORD	0	2	Fixed point	R / W			Selection for calculating the motor acceleration: 0 No acceleration calculation 1 Calculation from the line speed 2 Calculation from line speed and diameter
3212	0.200	30.000	10.000	s	WORD	200	30000	Fixed point	R / W			Nominal ramp time for acceleration control
3213	0.00	100.00	1.00	%	INT.	0	16384	Fixed point	R / W			Dead band for current acceleration torque
3214	-199.99	199.99	100.00	%	INT.	-32767	32767	Fixed point	R / W			Gain for pos. acceleration torque
3215	-199.99	199.99	100.00	%	INT.	-32767	32767	Fixed point	R / W			Gain for neg. acceleration torque
3230	5.00	100.00	10.00	%	INT.	819	16384	Fixed point	R / W			Maximum speed for identification run
3231	-100.00	100.00	25.00	%	INT.	-16384	16384	Fixed point	R / W			Maximum torque for identification run
3232	0	1000	500	ms	WORD	0	1000	Fixed point	R / W			Start delay for identification run
3233	0	50	0	ms	WORD	0	50	Fixed point	R / W			Filter time constant for actual speed
3250	0.00	100.00	1.00	%	INT.	0	16384	Fixed point	R / W			Reference speed for motor standstill
3252	0.00	100.00	1.00	%	INT.	0	16384	Fixed point	R / W			Hysteresis for motor standstill
3254	0	1	0		BOOL	0	1	Fixed point	R / W		✓	Selection: QSP without/with autom. pulse inhibit 0 QSP without autom. pulse inhibit 1 QSP with autom. pulse inhibit
3255	1000	10000	1000	ms	WORD	1000	10000	Fixed point	R / W			Delay time for autom. pulse inhibit
3999	0	65535			WORD	0	65535	Fixed point	R / W			Template version, hex-coded

[1] Parameter can only be changed when controller is inhibited.
[2] Press SHIFT + PRG to change the parameter via the keypad.

6.3 Visualisation

All visualisations used in the Lenze templates have the same structure:

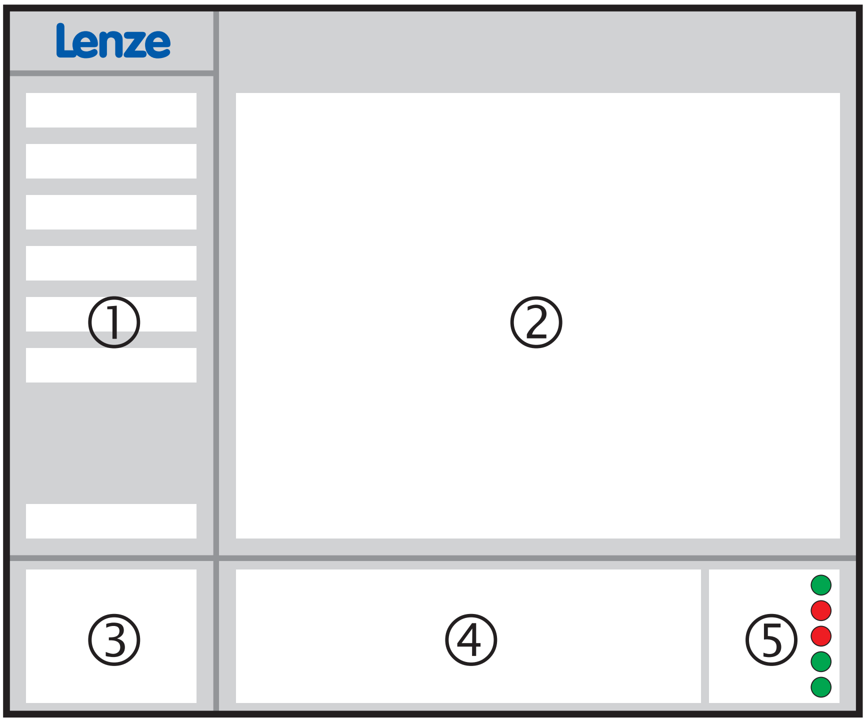
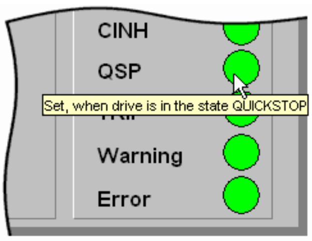


Fig. 6-1 Basic structure of the visualisation used in the template

①	**Menu**	You can select the desired template function from the menu. After selection, the function is visualised in the dialog area.
②	**Dialog area**	
③	**Control fields**	Area for cross-function control fields (buttons). **Important:** **The "software switches" QSP and CINH only trigger quick stop or controller inhibit when online connected to the PLC. They therefore do not fulfill the safety requirements for EMERGENCY STOP devices which have to be effective in all operating states of the plant or system.**
④	**Current values**	Area in which the current parameter values of the template are displayed.
⑤	**Status messages**	Area in which cross-function status messages from the PLC or the template are displayed.

Tip!

You can obtain additional information on a visualisation object by positioning the mouse pointer over the object until a "tool tip" is displayed.



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