

Lenze

Manual



Global Drive

Software package - Cam

Template Cam

9300 Servo PLC

This Manual applies to **Template Cam** as of version 2.00.

Template Cam can be used for the following Lenze PLCs:

	Type designation	As of hardware version	As of software version
9300 Servo PLC	EVS93XX-XT	6A	6.0

System requirements **Drive PLC Developer Studio**:

DDS-P (ESP-DDS2-P) or DDS-PD (ESP-DDS2-PD) as of version 2.2

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.

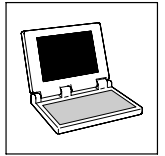
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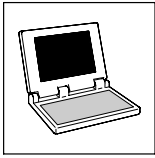
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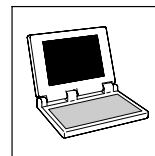
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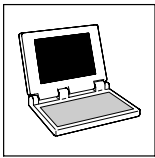
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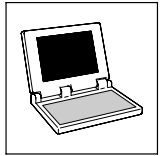
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1 Preface and general information

1.1 About this Manual

This Manual contains information on the **Template Cam** for the **Drive PLC Developer Studio (DDS)**.

- By means of the **Template Cam**, you can implement the "Cam profiler" function via the 9300 servo PLC.
- In addition to the cam profiler function, **Template Cam** includes many "predesigned" solutions, which can help to save precious time.
- The template is part of the **Software Package - Cam**.

1.1.1 Conventions used 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 variables of Lenze system blocks, function blocks and functions can be obtained from 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 recognised by their names. They always begin with an "L_":

- "The FB **L_CamControl...**"

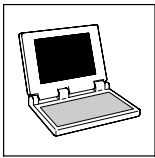
Program listings

are written in "Courier", keywords are printed in bold:

- "**IF** (ReturnValue < 0) **THEN...**"

1.1.2 Pictographs used in this Manual

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



Template Cam

Preface and general information

1.1.3 Terminology used

Term	In this Manual used for
Cxxxx/y	Subcode y of code Cxxxx (e.g. C0470/3 = subcode 3 of code C0470)
DDS	Drive PLC Developer Studio
FB	Function block
GDC	Global Drive Control (parameterization program from Lenze)
Parameters	Codes for setting the functionality of a function block or template function
PLC	9300 Servo PLC
QSP	Quick stop
SB	System block
System bus (CAN)	Lenze standard bus system based on <i>CANopen</i> for • Communication with a master system or with further controllers. • Parameterisation and diagnostics.
[unit]	Wildcard for the physical unit of the external measuring system used (e.g. "µm", "mm", "cm")

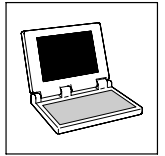
1.2 Version information about the template

The version of the **Template Cam** can be retrieved via the following global constants as of 1.05 template version:

Constant	Meaning	Example value
C_wLenzeTemplateCamSPLCVersionER	External release	01
C_wLenzeTemplateCamSPLCVersionEL	External level	05
C_wLenzeTemplateCamSPLCVersionIR	Internal release	00
C_wLenzeTemplateCamSPLCVersionBN	Build number	00

Version: 01 05 00 00

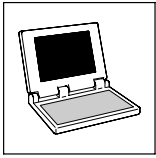
- In the example, the value "01050000" stands for version "1.05".
- Code C3999 indicates the version in form of the value "1050000".



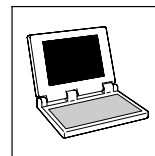
1.3 Supported functions

Template Cam supports the following functions:

- Override positioning
- Override manual homing/inching
- Torque precontrol
- Homing in different modes
- Virtual clutch
- Virtual master/real master
- Selection of an offset for master value and setpoint
- Stretching and compression of setpoint and master value
- Cyclic synchronisation of the x and y axis
- Parameter assignment via codes
- Creation of individual error routines and error messages
- Operation and diagnostics of template functions via a visualisation
- Visualisation of template states and signal flows



Template Cam



2 Cam profiler basics

The following sections describe cam profiler basics.

2.1 What does "cam profiler" mean?

"Cam profiler" means a clear assignment of positions between a master drive (master) and a slave drive (slave).

- The master drive can either be another drive, a position encoder, or a "virtual master".

Mechanical/electronic cam profiler

The electronic cam profiler is based on the operating principle of the mechanical cam profiler which converts a linear rotary motion into any cam profile motion you like.

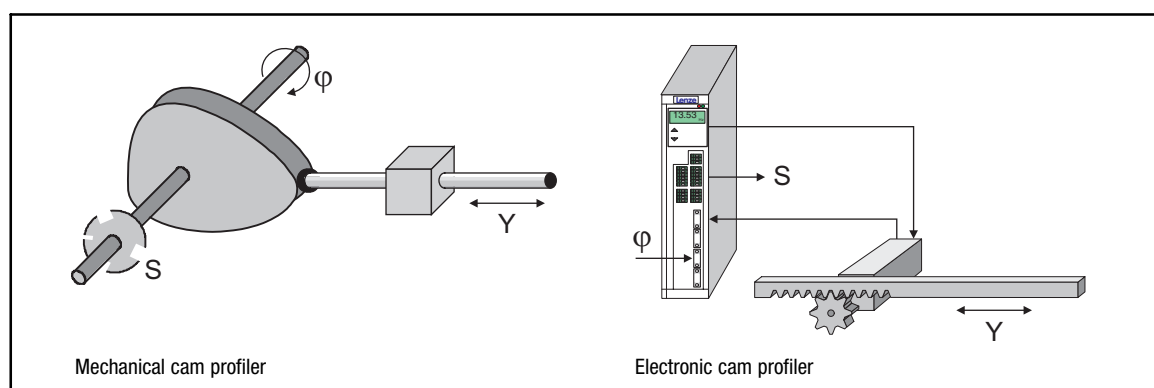


Fig. 2-1

Principle of the mechanical/electronic cam profiler

ϕ Master angle
 Y Setpoint position
 S Cam contactor

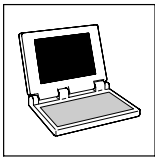
2.2 Advantages of an electronic cam profiler

Electronic cam profilers have the following advantages:

- Short set-up times in case of a product change through easy change of motion profiles.
- Easy stretching and compression of motion profiles and offset selection.
- Easy optimisation concerning jolt-free operation, maximum acceleration and vibration tendency.
- Virtual vertical shaft (master axis) means energy savings for multi-axis systems.
- Cam controller
- Easy creation of motion profiles with the Lenze CamDesigner.

Applications

- Packing machinery/seaming machinery
- Flying saw
- Cross cutter
- Bottle filling plant



Template Cam

Cam profiler basics

2.3 Basic terms

2.3.1 Motion profile

Motion profiles (or profiles) describe the dependency of the slave on the master drive. This is a two-dimensional graph in which the position setpoint is selected through the master value (position or angle):

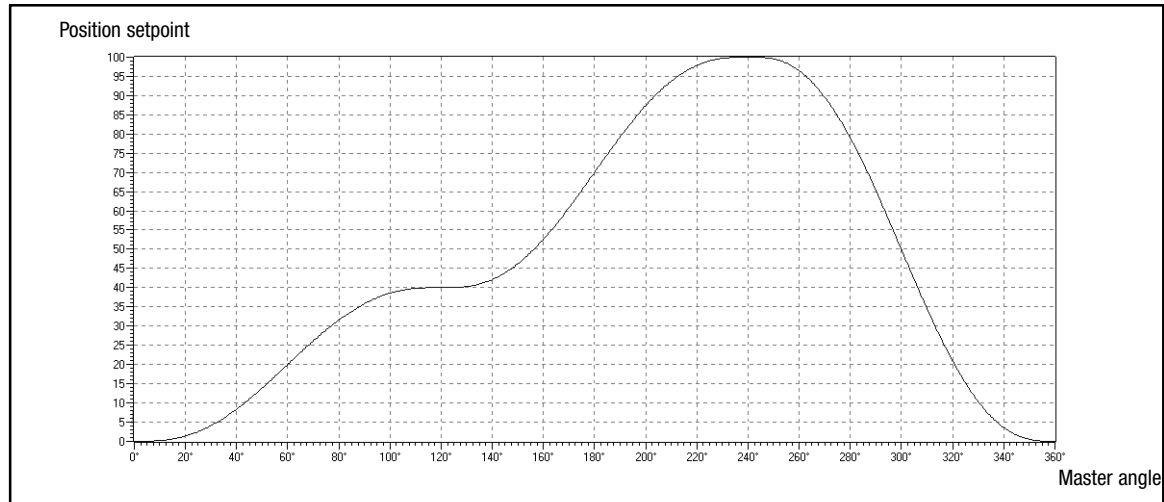
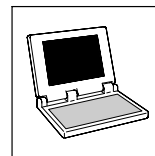


Fig. 2-2 Example of a motion profile

With this type of positioning, the slave derives its position from the angle of the master.

- This comparatively rigid connection allows high clock pulse numbers with little sensor technology. Tool synchronisation via the master angle is easier than via control/status signals since the sequence of motions is not interrupted.
- The characteristics for speed, acceleration/deceleration and jolt are automatically derived from the profile and the selected machine parameters.
- Motion profiles can consist of many individual profiles which are processed in a defined order.



2.3.2 Homing

The measuring system in the machine is selected by means of homing and the zero position is set within the possible traversing range.

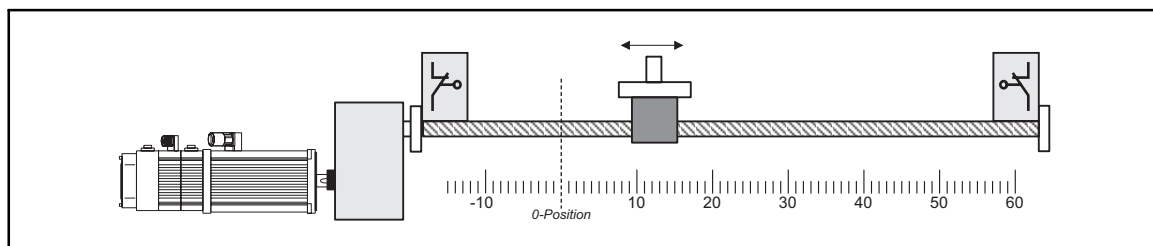


Fig. 2-3

Homing (selection of zero position)

The zero position (home) can be defined by a reference search or by setting a home position:

- If a reference search is carried out, the drive follows a previously selected path to find the home position.
- When the reference is set, it is selected manually when the drive stands still.

2.3.3 Limit positions (limit switches)

Not only the zero position but also the limits of the traversing range must be defined to avoid damage to the system, e.g. with manual homing. These limits, also called "limit positions", can be defined by means of limit switches connected to the PLC inputs. They activate certain actions (e.g. "quick stop").

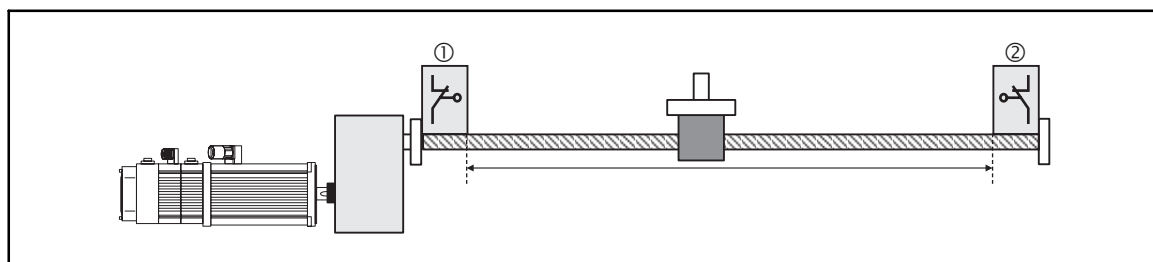
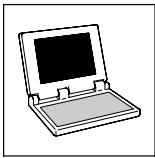


Fig. 2-4

Limit positions exemplified by a linear axis with spindle

- ① Left limit position (limit switch negative)
- ② Right limit position (limit switch positive)



Template Cam

Cam profiler basics

2.3.4 Manual control

Manual control - also referred to as "inching" - means that the drive is moved by manual operation:

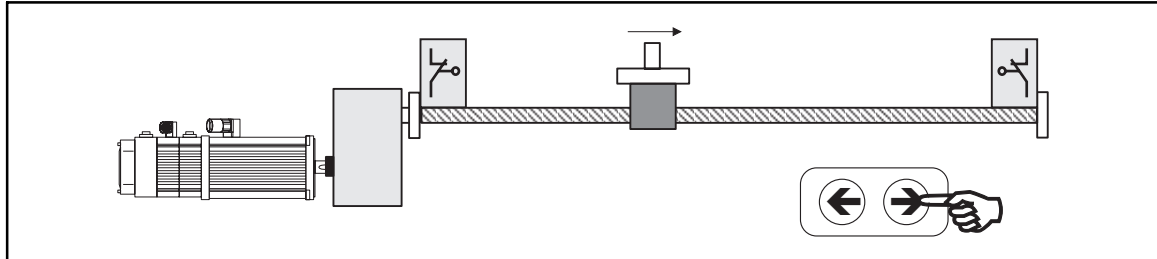


Fig. 2-5 Manual homing

You can choose between two ways of manual homing:

- Manual homing of the master axis (virtual master leads the whole network of drives)
- Manual homing not based on the motion profile (e. g. for machine cleaning)

Manual homing speed and acceleration/deceleration ramps can be selected for both ways of manual homing.

2.3.5 Synchronisation via touch probe or zero pulse

Synchronisation is necessary to ensure that setpoint and actual value do not diverge with slipping material. Synchronisation is possible through touch probe (activated by a sensor label) or the zero pulse of a position encoder (not with slip) for the actual value and the master value of a drive.

- X axis synchronisation is used to compensate for the slip between master angle and material being processed, e.g. with slipping conveyor belts.

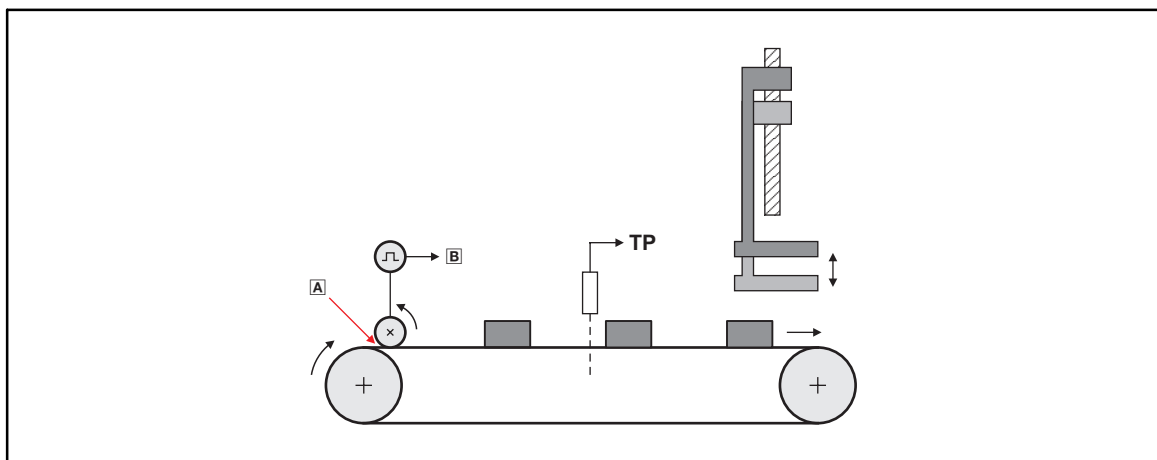


Fig. 2-6

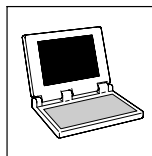
Example: Slip between the belt conveyor and master angle encoder

- A** Slip
B Master angle (due to the slip not synchronous to the material position anymore)
TP Touch probe sensor



Note!

Please note the touch probe interface. (6-4)



2.3.6 Stretching/compression and offset selection

Stretching/compression and offset selection are special features of the electronic cam profiler. Both the setpoint axis and the master value axis can be adapted.

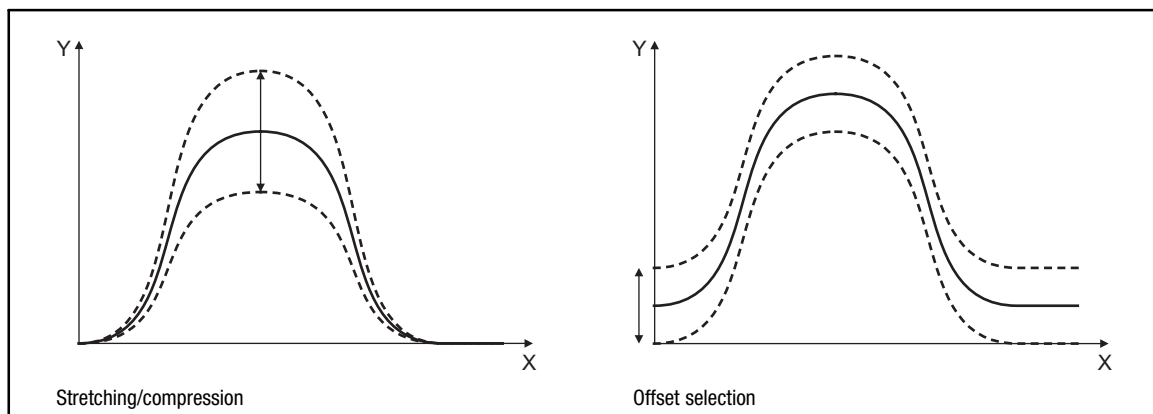


Fig. 2-7

Examples for stretching/compression and offset selection for the setpoint axis

2.3.7 Relative/absolute data model

Coordinate tables are used to store the motion profiles in the PLC memory. You can choose between a relative and an absolute data model:

In the relative data model, the distance between two points in x direction is constant.

- This ensures small changes from one point to the other. You can use more points than in the absolute data model.

In the absolute data model, the points are distributed as you choose.

- The absolute data model is more flexible than the relative data model, but requires more storage capacity.
- With CamDesigner it is possible to optimise the position of the points in accordance with the profile shape.

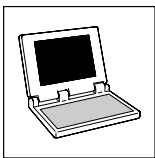


Stop!

The data model must be selected before the motion profiles are created. The selection will apply to all motion profiles of the drive.

- The relative data model is recommended if the motion profile consists of many polynomials.
- The absolute data model is recommended if the motion profile consists of many straight lines.

For both data models, the number of points depends on the number of motion profiles.



Template Cam

Cam profiler basics

2.3.8 Virtual master

Use this software function to generate a digital frequency or a master angle if a physical master is not available.

The below figure shows the drive and control structure of modern machinery/machine modules in which a number of tools have to be synchronised:

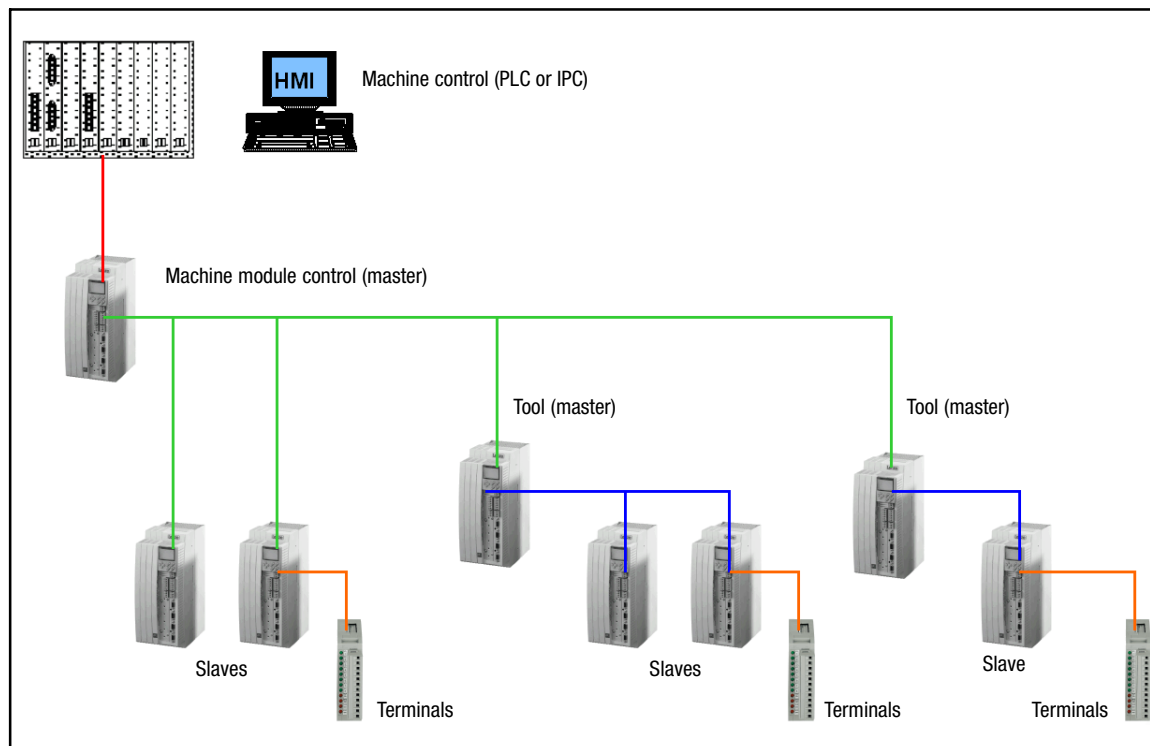


Fig. 2-8 Drive and control structure in modern machinery/machine modules

For commissioning it must be possible to operate the individual tools independently of each other. Several drives can form a group which controls a tool (e.g. "flying saw").

It must be possible to disconnect the master drive from the network of drives. The master drive must be the vertical shaft of the slave drives assigned to it.



Tip!

Use the **VirtualMaster** template function to implement a virtual master. (📖 5-51)

2.3.9 Virtual clutch

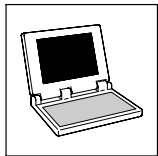
Use this software function to disconnect an axis from the network of drives or the master and re-connect it on-the-fly.

- Only at the end of clutching the slave will refer to the master.



Tip!

Use the **VirtualClutchXAxis** template function to implement a virtual clutch. (📖 5-74)



2.4 Machine parameters

The below figure shows a master drive and a cam profiler. The example explains the most important machine parameters for the motor.

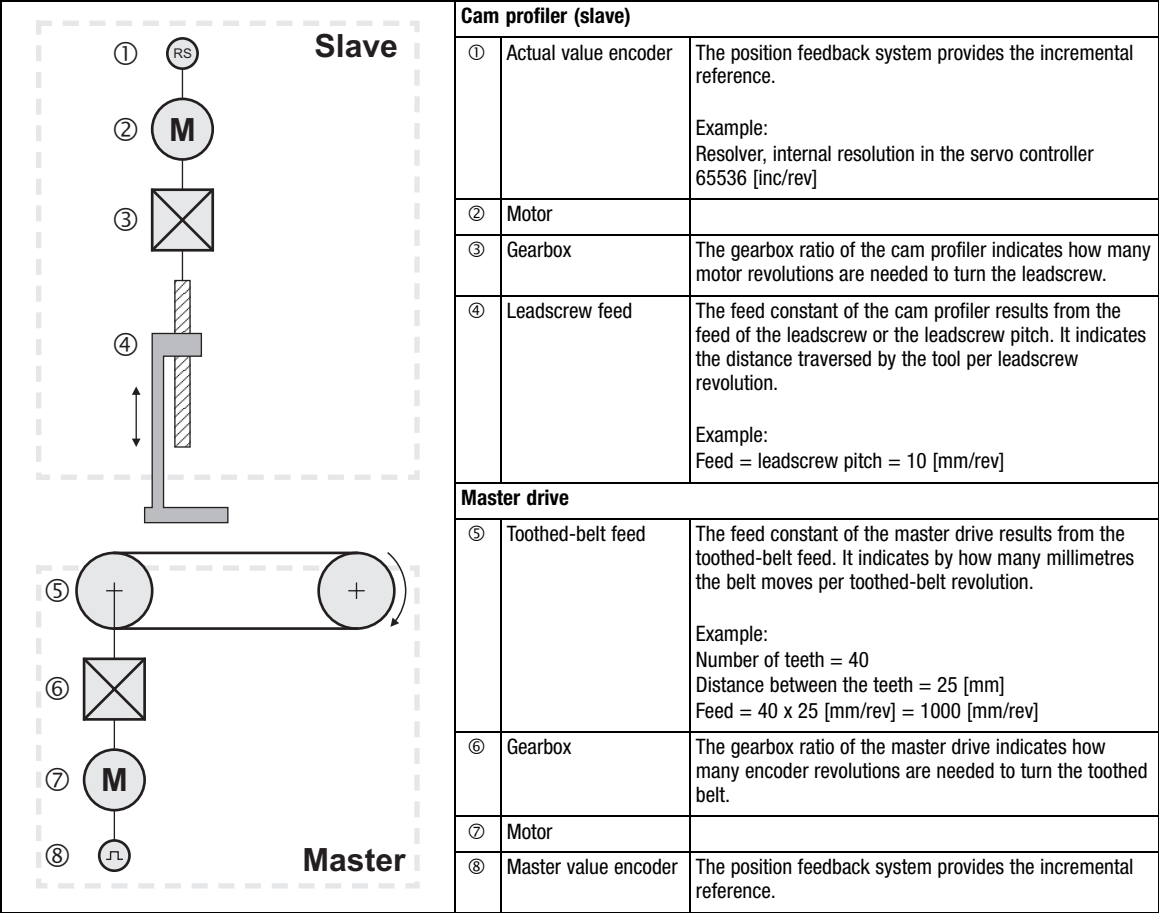
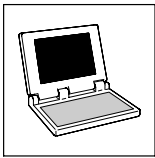


Fig. 2-9 Example: Cam profiler (slave) and master drive (master)

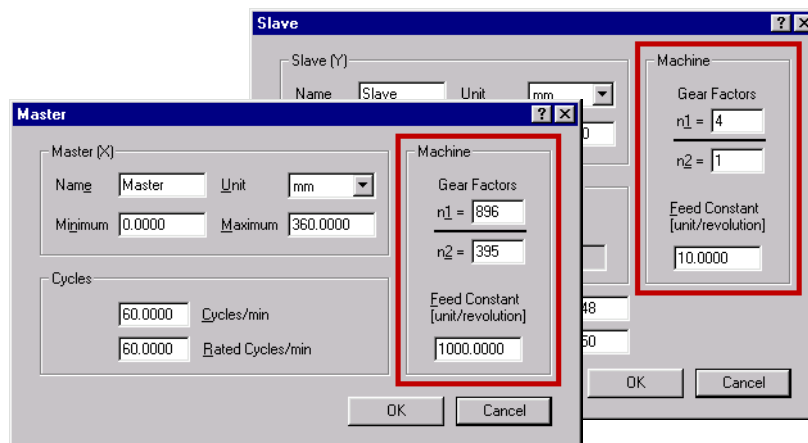


Template Cam

Cam profiler basics

Feed constant/gearbox ratio

Use the corresponding dialog boxes in the **CamDesigner/CamManager** to select the feed constants and gearbox ratios for master and slave:



Tip!

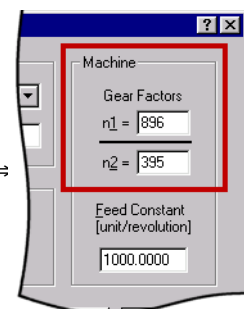
To avoid inaccuracies due to rounding errors, it is recommended to use the teeth numbers as shown in the following example for the selection of the gearbox ratio:

Extract from the gearbox catalog:

GST 03				
Actual ratio	1st stage		2nd stage	
	z1	z2	z3	z4
2,597	23	28	15	32

$$\text{Gearbox numerator} = z2 \cdot z4 = 28 \cdot 32 = 896 \Rightarrow$$

$$\text{Gearbox denominator} = z1 \cdot z3 = 23 \cdot 15 = 395 \Rightarrow$$



Reduced moment of inertia

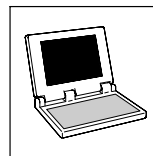
Moment of inertia converted to the motor side in kg/cm².

- The moment of inertia is important for the check of the drive selection.

Rated clock pulse number

Number of master axis cycles per minute.

- The clock pulse number is important for the degree of torque pre-control and the dynamic response of the cam controller.
- For selecting the rated clock pulse number in the **CamDesigner/CamManager** go to the **Master** dialog box (see above figure). The actual clock pulse number must not be higher than 199 % of this value.



3 Introduction

3.1 What is a template?

Templates are program patterns that are used to create IEC 61131 projects 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 different automation tasks.

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

- This functional demarcation ensures that the user program only contains program parts that have been tailored and optimised for the corresponding automation task.
- The use of uniform user interfaces and program structures makes program handling and program maintenance easier.
- The templates are based on the application know-how and technical expertise of Lenze.

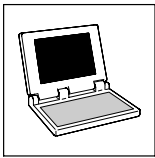
3.1.1 Applications for a template

We recommend to use a template if:

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

We do not recommend to use a template if:

- A task is very complex and the implementation of the core functions requires detailed know-how.
- 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 made by Lenze.



Template Cam

Introduction

3.2 Software architecture

The template is part of a multi-layer software architecture:

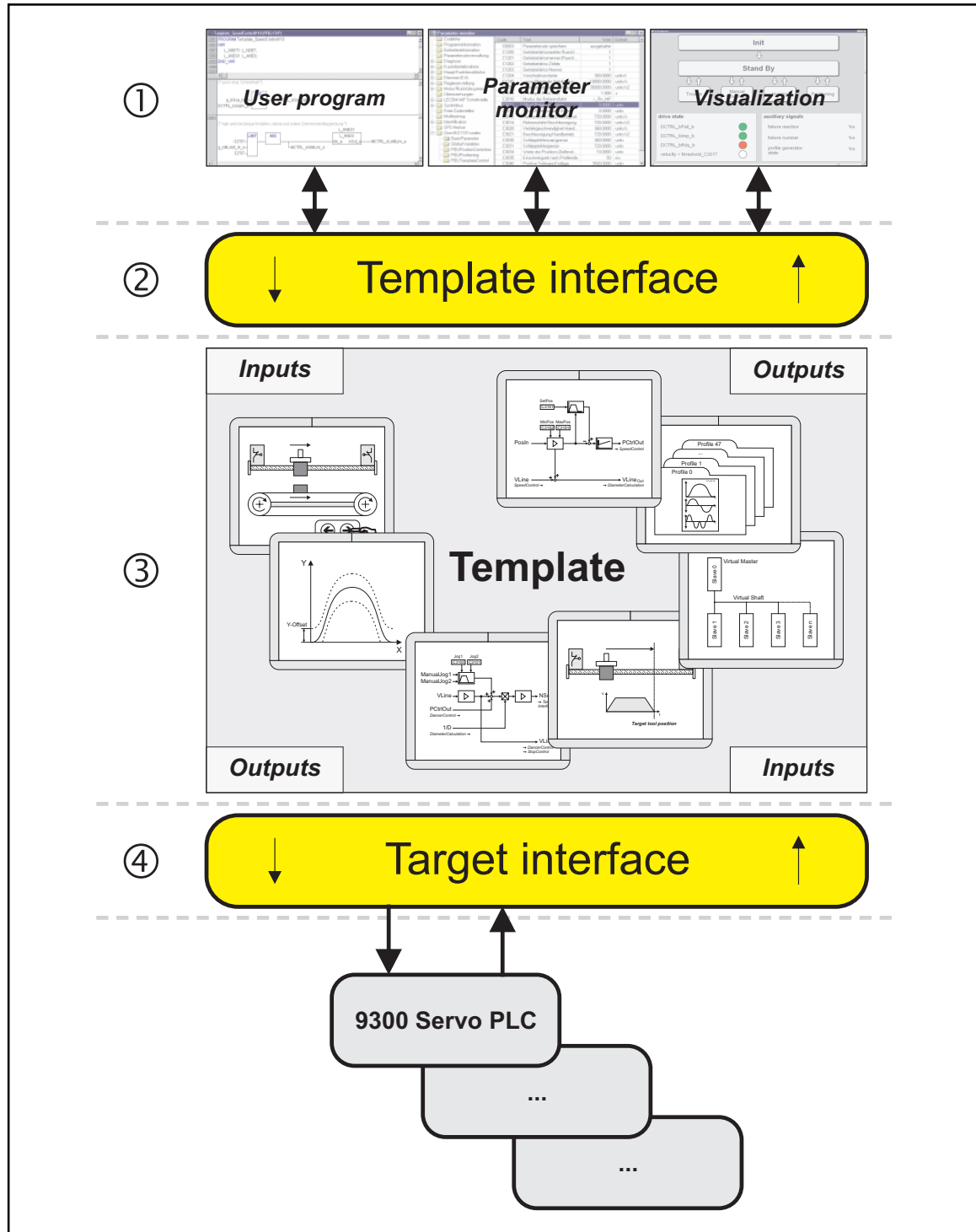
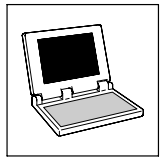


Fig. 3-1 Software architecture
 ① Application layer
 ② Defined interface between application layer and template
 ③ Template with pre-fabricated technology functions
 ④ Defined interface between template and target system



3.2.1 Basic concept

Basic concept for the use of templates:

- The template provides all core functions of the corresponding technology and cannot be modified by the user.
- The user uses the defined template interface to activate the core functions of the template from his program.
- All functional extensions or adaptations implemented by the user are implemented in a separate project area (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
- Connection of host systems or Human Machine Interfaces (HMIs)
- Monitoring of user-specific processes
- Control of peripheral devices (terminals, additional drive systems)

The application layer also includes:

- The **Parameter monitor** which can be used to parameterise codes "online".
- The **Visualisations** which make operation and handling of the template easier.



Tip!

Program Organisation Units (POUs)

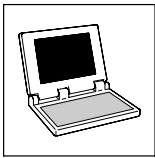
The template includes a variety of POUs which can be adapted and extended by the user. The name of these POUs begins with the word "user".

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.



Template Cam

Introduction

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. The template interface enables:

- Access to setpoint and actual template values
- Template control (e.g. start/stop of a drive function)
- Template status checks (e.g. query of error messages)
- Configuration and parameterisation of the template

Within the template, the template interface is represented by the global variables in the **TemplateInterface** folder and the template codes.



Note!

Codes 3000 to 3999 are designed for the configuration of the template.

We therefore recommend not to use any of these codes for your own extensions to make sure that the code numbers will not collide during subsequent updates 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.

The template and the target system communicate via a permanently defined interface (*target interface*). The *target interface* connects internal signals to the target system and re-normalises them.



Note!

The inputs of the *target interface* are written by the template and must **not** be written in parallel in the application layer!

- A list of the input variables of the *target interface* can be found in the appendix. (📖 7-19)

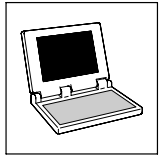
3.2.5 Template

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

- Via its "upper" inputs, the template cyclically reads all information from the *template interface* and then executes the corresponding functions.
- Via its "upper" outputs, the template cyclically sends 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 sends control information to the *target interface*. The target interface conditions the information and transfers it to the target system.
- Via its "lower" inputs, the template cyclically reads the status information of the target system via the *target interface*.



4 Template commissioning

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

1. **Resetting the PLC** (📖 4-4)
2. **Creating a new project in DDS** (📖 4-4)
3. **Adding motion profiles to the project** (📖 4-5)
4. **Adding individual error messages to the list of error messages** (📖 4-9)
5. **Changing to online mode** (📖 4-5)
6. **Selection of system parameters** (📖 4-6)
7. **Manual homing** (📖 4-10)
8. **Homing** (📖 4-11)
9. **Motion profile processing** (📖 4-14)
10. **Controller inhibit** (📖 4-15)



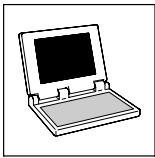
Note!

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



Tip!

Information about the commissioning of multi-axis applications can be found in section 4.3. (📖 4-16)



Template Cam

Template commissioning

4.1 Requirements

4.1.1 Basic structure of the system

System requirements for template commissioning:

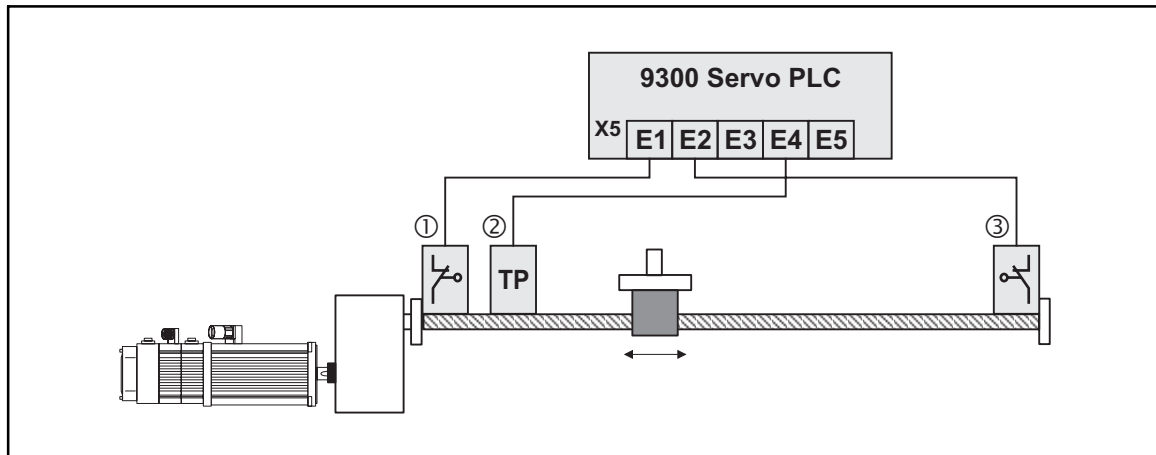


Fig. 4-1

System structure

- ① **Left limit switch** (LOW active), connected to digital input 1 (X5/E1).
- ② **Touch probe sensor** (optional), connected to digital input 4 (X5/E4).
- ③ **Right limit switch** (LOW active), connected to digital input 2 (X5/E2).



Stop!

Please read the Safety and Application Instructions for Lenze drive controllers in the Mounting Instructions for the 9300 Servo PLC!

4.1.2 Using the provided motion profile

Template Cam includes a motion profile example in the form of a *.lc9 file (**Slave1.lc9**) which can be used for template commissioning.



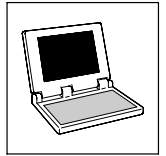
Stop!

If you use the provided file **Slave1.lc9** for the following commissioning, it may only be effected if the motor is free-running, in order to prevent property damage on drive components!



Tip!

- The motion profiles can be loaded to the PLC online via **CamDesigner/CamLoader** or offline via **Drive PLC Developer Studio (DDS)** or **Global Drive Loader**.
- Information about the creation of motion profiles can be found in the **CamDesigner/CamLoader** documentation.

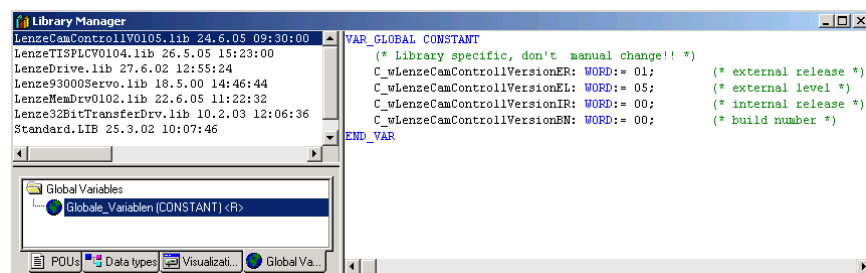


4.1.3 Required Identifier libraries for the template

If you want to create your own projects with Template Cam, please ensure that the following function libraries are available:

Function library	as of version
LenzeCamControl1V0105.lib	1.05
LenzeTISPLCV0104.lib	1.04
Lenze32BitTransferDrv.lib	1.02
LenzeMemDrv.lib	1.02
LenzeDrive.lib	X.XX
Standard.lib	X.XX

- The example projects supplied with Template Cam already include the required function libraries.
- Select the command **Window→Library manager** to open the Library manager in DDS.
- Select the **Global variables** tab and open the **Global variables** folder.
- Select *Global_variables...* to indicate the version in the Library manager.



Version identifier of the function libraries

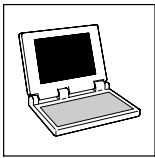
Function library version identifier **as of version 1.05**

- LenzeCamControl1Vxxxx.lib
- LenzeCamControl2Vxxxx.lib

Constant	Meaning	Example value
C_w[function library name]versionER	External release	01
C_w[function library name]versionEL	External level	05
C_w[function library name]buildIR	Internal release	00
C_w[function library name]versionBN	Build number	00

Version: 01 05 00 00

- In the example, the value "01050000" stands for version "1.05".



Template Cam

Template commissioning

4.2 Commissioning

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

4.2.1 Resetting PLC

1. Ensure that the program has been stopped in the PLC (C2108 = 2).
2. Set C0002 = 0
 - The factory setting is loaded.
3. Set C0003 = 1
 - The factory setting is permanently saved.
4. Set the inputs X5/E1 and E2 to HIGH level, all other PLC inputs to LOW level.

4.2.2 Creating a new project in the DDS

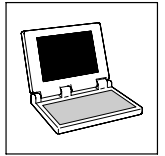
1. Select **File→New, with template** to open an existing project in the Drive PLC Developer Studio (DDS).
2. Go to the *Open* dialog box **Cam/PLC** directory, select the **TemplateCamVxxx.lpc** file and confirm with **Open**.
 - The dialog box *Password for working group* will be indicated.
3. Select **Level 2**, 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 Adding a motion profile to the project

Use the **Cam Support** which is an object in the **Resources** register of the *ObjectOrganizer* to add a motion profile (*.lc9 file) to your project.

1. Open the **Cam Support** (*ObjectOrganizer/register Resources*).
2. Go to the *Cam Support* dialog box and click the button **Add cam data to project...**
 - The *Open* dialog box opens.
3. Select the *.lc9 file to be added to your project and confirm with **OK**.
 - Information about the *.lc9 file will be displayed (e.g. file name, file size, creation date).
 - Close the *Cam Support* dialog box.



Tip!

- The template is installed on the PC together with the **Slave1.lc9** example file.
 - Directory: ... \<Installed DDS version> \Projects \Cam \PLC
- If you go to the *Cam Support* dialog box and activate the **Download cam data with program** check box, the profile data - provided that they have been changed - will be downloaded together with the program to the PLC (useful for the commissioning of production machinery).
- Use the button **Remove cam data from project** to delete the *.lc9 file from your project.
- By means of the **Cam designer** and **Cam loader** software tools, you can generate a *.lc9 file.

4.2.4 Changing to the online mode

The project must have been properly compiled to change to online mode.

1. Select **Project→Compile all** to compile the project.



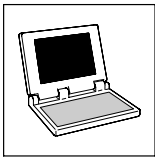
Tip!

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.

2. Select **File→Save** to save the project and the changes made.
3. Select **Online→Log in** to change to the online mode and log in.
4. Confirm the question "Do you want to load the new program?" with **Yes**.



Template Cam

Template commissioning

4.2.5 Entering the system parameters



Note!

Please observe the following:

A new program download overwrites the settings of codes > C2999 with the initialisation values!



Tip!

Initialisation values available after the new program download are selected as follows:

1. Go to the *ObjectOrganizer* and open the **Code initialisation values** (register **Resources**).
2. Enter the settings for the corresponding codes.
3. Save the project and log in.
4. Permanently save the parameter set in the PLC with C0003 = 1.

Codes can be saved as described in the following:

- Initialise the codes in the **Instance Parameter Manager** (*ObjectOrganizer/register Resources*).
- Create a parameter set file with your settings via **GDC/GDC easy**.
- The "Input assistant for motor data" of the GDC provides a convenient motor parameter setting.

The following settings are selected in online mode via the **Parameter monitor** (*Object Organizer, register Resources*).

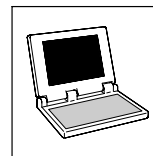
1. Open the **Parameter monitor** and enter the following settings in the corresponding folders.
 - Folder **Motor/feedback system** → folder **Motor settings**:

Motor parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C0022			R / W	$I_{\max}$ limit (depending on C0086) • A change in C0086 resets the value to the assigned Lenze setting ($1.5 \times I_{\text{motor}}$).
				0 {0.01 A} see technical data Device-dependent
C0086			R / W	Selection of the motor type • A change in C0086 resets C0006, C0022, C0070, C0071, C0081, C0084, C0085, C0087, C0088, C0089, C0090, C0091 to the assigned Lenze setting.
				0 = COMMON (no Lenze motor) Device-dependent
				1 ... 269 = (Lenze motors)



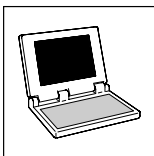
Note!

If an external motor is used, additional settings have to be entered.



– Folder **Motor/feedback system**→folder **Feedback systems**:

Motor parameters				
Code	Subcode	Data type	Access	Information
				Possible settings
C0025			R / W	Selection of the feedback system - Entering the encoder indicated on the nameplate of the Lenze motor - C0025 automatically alters C0420, C0490, C0495 0 = COMMON 10 = RSx (resolver) 110 = IT-512-5V 111 = IT-1024-5V 112 = IT-2048-5V 113 = IT-4096-5V 210 = IS-512-5V 211 = IS-1024-5V 212 = IS-2048-5V 213 = IS-4096-5V 310 = AS-8V 410 = AM-8V 0
C0420			R / W	Number of encoder increments 1 {1 inc/rev} 8192 1024 inc/rev
C0490			R / W	Selection of the feedback system for position control - C0490 = 0, 1, 2 can be mixed with C0495 = 0, 1, 2. - C0490 = 3, 4 also sets C0495 to the same value. 0 = resolver on X7 1 = TTL encoder on X8 2 = SinCos encoder on X8 3 = absolute value encoder (single-turn) on X8 4 = absolute value encoder (multi-turn) on X8 0
C0495			R / W	Selection of the feedback system for speed control - C0495 = 0, 1, 2 can be mixed with C0490 = 0, 1, 2. - C0495 = 3, 4 also sets C0490 to the same value. 0 = resolver on X7 1 = TTL encoder on X8 2 = SinCos encoder on X8 3 = absolute value encoder (single-turn) on X8 4 = absolute value encoder (multi-turn) on X8 0



Template Cam

Template commissioning

– Folder **Short commissioning**→folder **Speed control**:

Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C0011			R / W	Maximum speed (n_{max}) - Reference variable for the absolute and relative setpoint selection for acceleration and deceleration times - For parameterisation via interface: carry out greater changes in one step only if the controller is inhibited (CINH)! 500 {1 rpm} 16000 3000 rpm
C0070			R / W	Proportional gain of the speed controller (V_{pn}) A change in C0086 resets value to the assigned Lenze setting. 0.00 {0.05} 255.00 Depending on C0086
C0071			R / W	Integral-action time of the speed controller (T_{nn}) A change in C0086 resets value to the assigned Lenze setting. 1.0 {0.5 ms} 600.0 Depending on C0086 > 512 ms = switched off
C0105			R / W	Deceleration time for quick stop (QSP) relating to the speed variation (C0011) $n_{max} \dots 0$ rpm. 0.000 {0.001 s} 999.900 0.000 s
C0173			R / W	Adjustment of the DC-bus voltage thresholds - Check for commissioning and, where required, adjust. - All drive components in interconnected drives must have the same thresholds. 0 = mains < 400 V; with or without braking unit 1 = mains = 400 V; with or without braking unit 2 = mains = 460 V; with or without braking unit 3 = mains = 480 V; without braking unit 4 = mains = 480 V; with braking unit 1

– Folder **Controller settings**→folder **Angle**:

Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C0254			R / W	Gain (V_p) of the phase controller 0.0000 {0.0001} 3.9999 0.4000

– Folder **Individual IEC1131 codes**→folder **CamControl**:

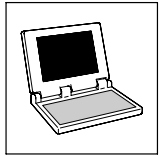
Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C3636			R / W	Motor mounting direction 0 = mounting on the right 1 = CCW connection 0

- Save the altered parameters via C0003/000 = 1 with mains failure protection in the controller. If you require the settings again (e.g. for serial applications), you can also accept the parameter values in the code initialisation table.



Tip!

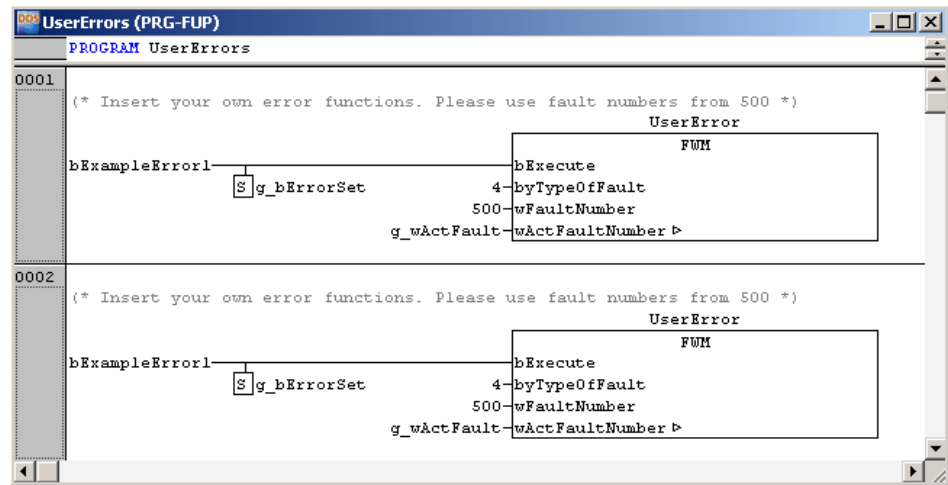
Use the visualisation **BasicParameters** to display the current settings of the system parameters.



4.2.6 List of error messages to complete individual error messages

Proceed as follows to add individual error messages to the list of error messages:

1. Go to the *ObjectOrganizer* program **UserErrors (PRG)**.
– Register **Organisation units**→folder **UserExtensions**→folder **Program_Task3**
2. Create new networks by copying and pasting the first network.
3. Assign an error number between 500 and 999 to the FB input *wFaultNumber* of every network.



4. Go to the *ObjectOrganizer* data type **ErrorCode (ENUM)**.
– Register **Data types**→folder **UserDataTypes**
5. Assign the corresponding text messages to the error numbers between 500 and 999:

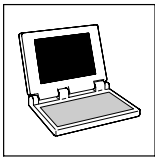
```
TYPE ErrorCode : (
    NoError:=0,
    ...
    ⇒ UserMessage1:=500,
    ⇒ UserMessage2:=501
);
END_TYPE
```



Note!

Do not change the entries of error numbers 0 ... 499 since they are the system error messages for the PLC and the template!

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



Template Cam

Template commissioning

4.2.7 Carrying out manual control

Use "manual homing" ("inching") to traverse the drive not based on the cam profile (or motion profile), for instance, to clean or exchange a tool.

Requirements for control via the visualisation:

- DDS is in online mode (**Online→Log in**).
- The program has been started in the PLC (**Online→Start**).
- The **Cam template** has to be in the "StandBy" status.

Adapt the parameters for manual homing:

Go to the **Parameter monitor** (*Object Organizer*, register **Resources**) to adapt the parameters for manual homing in online mode.

- The parameters are saved in the folder **Individual IEC1131 codes→folder ManualJog**:

Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings
C3622	1		R / W	Deceleration ramp (inching mode T _i time) for immediate stop relating to 4000 rpm.
				0.010 {0.01 s} 129.999 5.00 s
	2			Acceleration/deceleration ramp for normal operation
				0.010 {0.01 s} 129.999 5.00 s
	3			Deceleration ramp (inching mode T _i time) for manual control relating to 4000 rpm.
				0.010 {0.01 s} 129.999 5.00 s
C3623	1	R / W	Speed for manual homing in positive direction (CW)	
			0 {1 rpm} 15000 200 rpm	
	2		Speed for manual homing in negative direction (CCW)	
			0 {1 rpm} 15000 200 rpm	

Manual homing:

Proceed as follows to traverse the drive not based on the cam profile in inching mode:

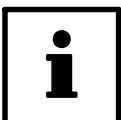
1. Open the visualisation **ManualJog_V** (*Object Organizer/register Visualization*).



Tip!

Click the **parameter save** button to save the selected parameters non-volatile in the PLC (corresponds to C0003 = 1).

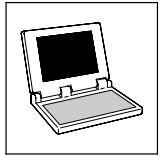
2. Deactivate the controller inhibit in the PLC (set terminal 28 to high level).
3. Click the **jog negative** button to traverse the drive in negative direction, or **jog positive** to traverse the drive in positive direction.



Tip!

"Retracting" from limit switches is also supported. In this case, the drive can only traverse in the corresponding clearance direction.

4. Reactivate the controller inhibit in the PLC after manual control (reset terminal 28 to low level).



4.2.8 Carrying out homing

During homing, the zero position is set within the possible traversing range.

The zero position can be defined by **homing** or **setting a home position**.

- With **homing**, the drive traverses in a previously selected mode to find the home position.
- When the **home position is set**, it is selected manually when the drive stands still.



Tip!

Selection help

A comparison of the procedures can be found on page 5-15. (📖 5-15)

Normalisation

Normalisation is carried out by selecting mechanical system parameters and encoder system parameters. The physical units for master drive and cam profiler can be freely selected (e.g. "mm", "pieces", "bottles", etc.).

- In this documentation, the wildcard **[m-unit]** stands for the unit of the master drive (master).
- In this documentation, the wildcard **[s-unit]** stands for the unit of the cam profiler (slave).

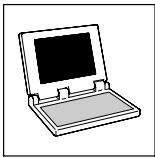
Please observe that the normalised machine parameters and the profile data are closely related. In the Cam Designer, the machine parameters are used to convert the profile data into the motor motion or the master angle.

When the machine parameters change, the profile data have to be re-compiled and downloaded again to the PLC!

Depending on the procedure selected for defining the home position, continue commissioning with section:

⇒ **Homing** (📖 4-12)

⇒ **Setting the home position** (📖 4-13)



Template Cam

Template commissioning

4.2.8.1 Carrying out reference search

Requirements for control via the visualisation:

- DDS is in online mode (**Online→Log in**).
- The program has been started in the PLC (**Online→Start**).

Proceed as follows to start homing:

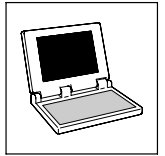
1. Open the visualisation **HomingHomeSet** (Object Organizer/register **Visualization**).
2. Enter the corresponding settings in the input fields for "homing":

Input field	Information/possible settings		
mode of homing procedure	Homing mode (C3010)		
	0	>_Rn_MP	Symbols: > Movement in positive direction < Movement in negative direction Lp Limit switch in positive direction (↗ = positive edge; ↘ = negative edge) Ln Limit switch in negative direction (↗ = positive edge; ↘ = negative edge) Rp Positive edge of home switch Rn Negative edge of home switch TP Touch probe edge of input X5/E4 MP Zero pulse edge of the motor (marker pulse, one per motor revolution) Information: When the last action listed is executed, the home position is set (e.g. marker pulse with "MP"), even if the drive continues traversing.
	1	<_Rn_MP	
	2	>_Lp_<_Rn_MP	
	3	<_Ln_>_Rn_MP	
	4	>_Rp_<_Rn_MP	
	5	<_Rp_>_Rn_MP	
	6	>_Rn_>_TP	
	7	<_Rn_<_TP	
	8	>_TP	
	9	<_TP	
	10	>_Lp_<_TP	
	11	<_Ln_>_TP	
	12	>_Lp↘_<_Lp↗	
	13	<_Ln↘_>_Ln↗	
homing speed cw	Speed for homing in positive direction (C3625/1) • Setting range: 0 ... 15000 rpm		
homing speed ccw	Speed for homing in negative direction (C3625/2) • Setting range: 0 ... 15000 rpm		
homing acceleration	Acceleration for homing (C3624/2) • Referred to 4000 rpm • Setting range: 0.01 ... 129.99 s		
homing deceleration	Deceleration for homing (C3624/3) • Referred to 4000 rpm • Setting range: 0.01 ... 129.99 s		
machine zero distance	Position of the home switch (measured from machine zero) • Input in fixed point format with 4 decimal positions ("1" ≡ 0.0001 [s-unit]). The value is internally converted into increments.		
target position	Target position of the tool after homing • Input in fixed point format with 4 decimal positions ("1" ≡ 0.0001 [s-unit]). The value is internally converted into increments.		



Tip!

Click the button **parameter save** to save the selected parameters non-volatile in the PLC (corresponds to C0003 = 1).



3. Deactivate the controller inhibit in the PLC (set terminal 28 to high level).
4. Go to **homing ==> mode x** and click the button **start** to start homing.
 - The drive traverses in the selected mode and stops at the selected target position.
 - As soon as homing has been completed, the display "homing done" lights up in green.
5. Reactivate the controller inhibit in the PLC (reset terminal 28 to low level).

4.2.8.2 Carrying out the reference setting



Information about the encoder system

Please observe the following instructions for the encoder system:

- It is not possible to use incremental encoders for this function.
- When the machine is switched off (mains and 24 V supply off), single-turn absolute-value encoders and resolvers must not be rotated by more than a maximum of $\pm\frac{1}{2}$ revolution.
- When the machine is switched off, multi-turn absolute-value encoders must not be rotated by more than a maximum of $\pm\frac{1}{2}$ clock pulse length. (For encoders from Stegmann max. ± 2047 revolutions.)

Requirements for control via the visualisation:

- DDS is in online mode (**Online→Log in**).
- The program has been started in the PLC (**Online→Start**).

Proceed as follows to set the home position:

1. Open the visualisation **HomingHomeSet** (*Object Organizer/register Visualization*).
2. Ensure that controller inhibit is set in the PLC (terminal 28 to LOW level).
3. Measure the distance between tool and zero position (home position).
4. Enter this value into the **machine zero distance** input field in the visualisation.



Tip!

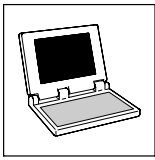
Input in fixed point format with 4 decimal positions ("1" = 0.0001 [s-unit]). The value is internally converted into increments.

5. Go to **home set** and click the button **load** to load the selected home position.
 - As soon as the home position has been set, the display "homing done" lights up in green.



Tip!

Click the button **parameter save** to save the selected parameters non-volatile in the PLC (corresponds to C0003 = 1).



Template Cam

Template commissioning

4.2.9 Executing the motion profile (cam)

Requirements for control via the visualisation:

- DDS is in online mode (**Online→Log in**).
- The program has been started in the PLC (**Online→Start**).
- The **Cam template** has to be in the "StandBy" status.

Proceed as follows to process a motion profile from the *.lc9 file, which you have added to the project via the **Cam Support**:

1. Open the visualisation **CamOperation** (*Object Organizer/register Visualization*).
2. Use the **motion profile no. set** input field to enter the profile number of the motion profile to be used.



Tip!

The product number will be assigned in the **CamDesigner**.

3. Deactivate the controller inhibit in the PLC (set terminal 28 to high level).
4. Click the button **lock to cam** to enable traversing the drive to profile position.



Tip!

The visualisation indicates when the drive is at profile position:

state of template = "CamOperation"

5. Click the button **Virtual Master** to go to the visualisation **VirtualMaster**.
6. Use the **speed vert. shaft** input field to enter the speed of the virtual vertical shaft.
7. Click the button **cycle** to process the selected motion profile once.



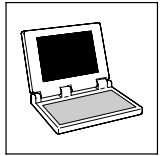
Tip!

- The selected motion profile will only be accepted when the X axis crosses zero, i.e. the previously selected motion profile will be used until the next profile zero crossing.
- The profile zero crossing is indicated in the visualisation:

vert shaft position In = "0"

- When selecting the speed of the virtual vertical shaft, the gearbox ratio must be observed. If the example file slave1.lc9 is used, the ratio will **be** 10:1 (e.g. 600 rpm = 60.0 clock pulses/minute).

8. Deactivate the button **lock to cam** after the motion profile has been processed once.
9. Reactivate the controller inhibit in the PLC (reset terminal 28 to low level).



4.2.10 Switch-off (controller inhibit)

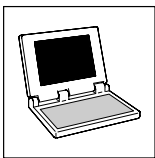


Note!

If controller inhibit (CINH) is set while the drive is still at profile position (*g_bLockToCam* = TRUE), an error message will be displayed!

Therefore ensure that the template is in "StandBy" mode before controller inhibit is set.

The controller inhibit (CINH) can be activated by setting terminal 28 to low level.



Template Cam

Template commissioning

4.3 Multi-axis application

With multi-axis applications, workpiece **A** is simultaneously processed via several cam profiles which are synchronously controlled by a vertical shaft **B**.

The below figure shows the mechanical and the electrical structure of a multi-axis application:

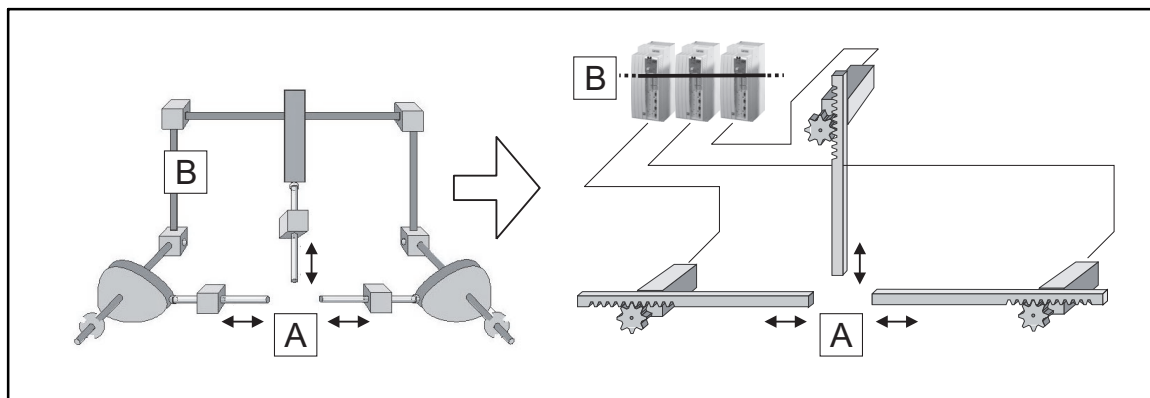


Fig. 4-2 Structure of a multi-axis application

- For the workpiece, the sequence of motions will be the same with both variants.
- For the user, the electronic variant provides much more flexibility.

Implementation of the electronic cam profiler

The electronic cam profiler is implemented by means of several PLCs which are connected to each other via the system bus (CAN). One PLC will be used as master. The master synchronously transmits the master angle of the virtual vertical shaft to the other PLCs (slaves):

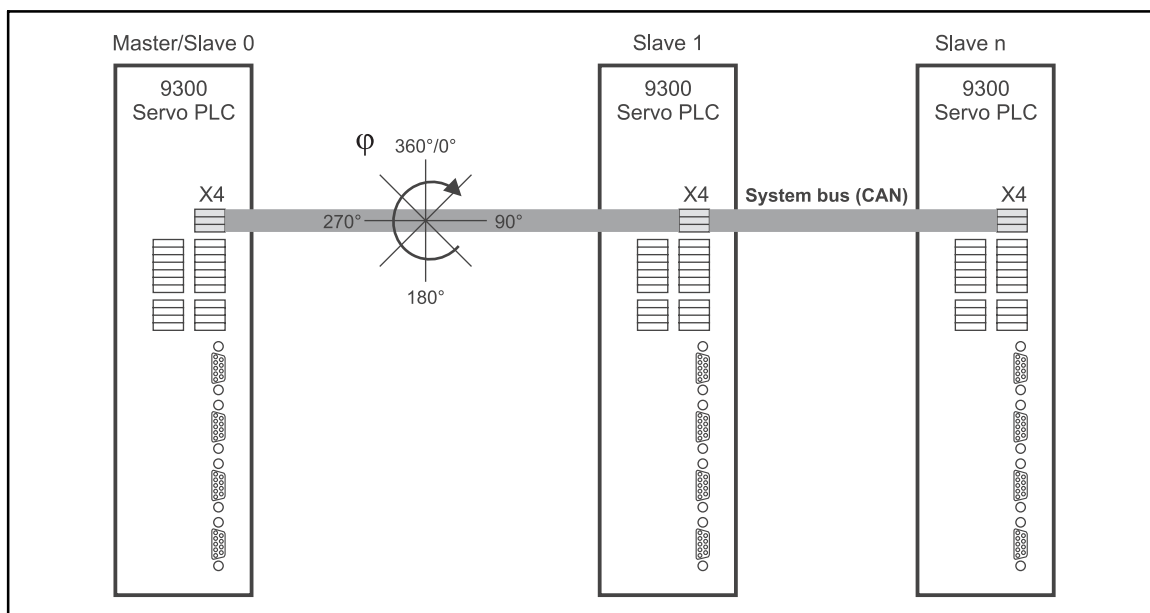
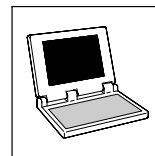


Fig. 4-3 Axis synchronisation between master and slave(s) of the type 9300 servo PLC
 φ Master angle



4.3.1 Requirements

The commissioning of a multi-axis application requires the following:

- The PLCs are networked via the system bus (CAN).
- An individual node address has been assigned to every PLC under C0350.
- The same baud rate has been selected for all PLCs under C0351.
- A **Template Cam**-based DDS project has been created for all PLCs (as described in chapter 4.2) and the corresponding system parameters have been configured.



Continuation of commissioning

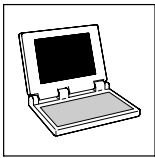
If the above preconditions are met, commissioning is continued as follows:

1. Parameterisation of the master PLC
2. Parameterisation of the slave PLC(s)
3. Start of the program in the slave PLCs
4. Start of the program in the master PLC



Tip!

- Together with the template, the **ExampleCamMasterSPLCVxxxx.pro** and **ExampleCamSlaveSPLCVxxxx.pro** example files are installed on the PC for commissioning of a multi-axis application.
 - Detailed information about the system bus (CAN) can be found in the Manual "System bus (CAN) for 9300 servo PLC & Drive PLC"
-



Template Cam

Template commissioning

4.3.2 Parameterisation of the master



Tip!

The following parameters are already preset in the provided **ExampleCamMasterSPLCVxxxx.pro** example file.

Settings in offline mode

1. Open the **PLC configuration** (*Object Organizer/register Resources*).
2. Add the system blocks **CAN2_IO** and **CAN_Management** to the **PLC configuration**.
3. Open the POU **UserProcessInput** (*Object Organizer/register Organization units → folder UserExtensions→Program_Task1*).
4. Add a new network with the following assignment to transfer the master angle via process data channel 2 of the system bus (CAN):

```
g_dnVertShaftPosSet_p --- CAN2_dnOutD1_p
```

5. Add another network with the following assignment to activate the synchronisation process for process data channel 2:

```
TRUE --- CAN_bTxCan2Synchronized_b
```

Settings in online mode

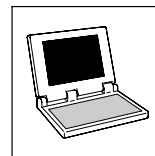
The following settings are selected in online mode via the **Parameter monitor** (*Object Organizer, register Resources*).

1. Select **Online→Log in** to log in the master PLC and change to online mode.
2. Confirm the question "Do you want to load the new program?" with **Yes**.
3. Open the **Parameter monitor** and enter the following settings in the folder **System bus→folder Sync management**.

Selection of the PLC as master

Use code C0352 to configure the PLC as master:

Parameter				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C0352			R / W	System bus: master/slave configuration • With selection 1 or 2, the PLC sends a system bus boot-up and is thus quasi" master. • Additional information about the "heartbeat" and "node guarding" function can be found in the Manual for the function library LenzeCanDSxDrv.lib.
				0 = slave (CAN boot-up not active) 1 = master (CAN boot-up active) 2 = master with node guarding 3 = slave and heartbeat producer 4 = slave with node guarding
				1



Configuration of the (axis) synchronisation

In order to ensure the synchronous transmission of the master angle, the drive axes have to be synchronised with regard to each other. The sync telegram is used as a synchronisation criterion which the master sends to the slaves 1 ... n in a cyclical manner.

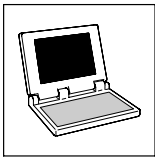
Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C0366			R / W	CAN response to a sync telegram via CAN1_Out
				0 = no response 1 = response 0
C0369			R / W	CAN cycle time for sync transmission telegram
				0 {1 ms} 65000 2 ms 0 = switched off

Configuration of the CAN identifier for transmission via SB CAN2_IO

The master angle is transmitted via the system block **CAN2_IO**. The corresponding CAN identifier is configured under codes C0353/2 and C0354/4:

Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C0353	2		R / W	Source for determining the identifiers for CAN2_IN/CAN2_OUT
				0 = automatically defined by C0350. (self-addressing) 1 = defined by C0354. (extra-addressing) 1
C0354	4		R / W	Definition of individual identifiers for the PDOs (C0353/002 = 1)
				• Value to be entered = Identifier - 384 1 {1} 512 259

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



Template Cam

Template commissioning

4.3.3 Parameterisation of the slaves 1 ... n



Note!

The following parameterisation is to be carried out separately for every single slave of the multi-axis application.



Tip!

The following parameters are already preset in the provided **ExampleCamSlaveSPLCVxxxx.pro** example file.

Settings in offline mode

1. Open the **PLC configuration** (*Object Organizer/register Resources*).
2. Add the system blocks **CAN2_IO** and **CAN_Synchronisation** to the **PLC configuration**.
3. Open the POU **UserTouchProbeInput** (*Object Organizer/register Organization units → folder UserExtensions→Program_Task1*).
4. Add a new network with the following assignment to receive the master angle via process data channel 2 of the system bus (CAN) from the master:

```
CAN2_dnInD1_p --- g_dnVertShaftExt_p
```

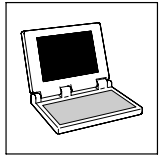
Settings in online mode

The following settings are selected in online mode via the **Parameter monitor** (*Object Organizer, register Resources*).

1. Select **Online→Log in** to log in the slave PLC and change to online mode.
2. Confirm the question "Do you want to load the new program?" with **Yes**.
3. Open the **Parameter monitor** and enter the corresponding settings in the folder **System bus→folder Sync management**.

Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C1120			R / W	Sync signal source 0 = Off 1 = Sync telegram via CAN bus 2 = Sync telegram via terminal X5/E5 (<i>DIGIN_bIn5_b</i>)
C0366			R / W	CAN response to a sync telegram via CAN1_Out 0 = no response 1 = response
C1121			R / W	Synchronisation cycle 1 {1 ms} 13 2 ms

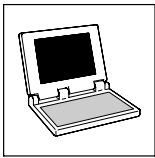
4. Permanently save the parameter set with C0003 = 1 in the PLC.



4.3.4 Starting the program in the slave PLCs

After the communication between master and slave(s) has been configured, you can start the program in the slave PLCs and activate the external master angle selection:

1. Select **Online→Log in** to log in the slave PLC and change to online mode.
2. Confirm the question "Do you want to load the new program?" with **Yes**.
3. Select **Online→Start** to start the program in the PLC.
4. Open the visualisation **CamOperation** (*Object Organizer/register Visualization*).
5. Use the **motion profile no. set** input field to enter the product number of the motion profile to be used (for slave 1 ... n).
6. Deactivate the controller inhibit in the PLC (set terminal 28 to high level).
7. Click the button **lock to cam** to enable traversing the drive to profile position.
8. Click the button **Virtual Master** to go to the visualisation **VirtualMaster**.
9. Click the button **ext. vertical shaft - on** to activate the external master angle selection.



Template Cam

Template commissioning

4.3.5 Starting the program in the master PLC

If all slaves are in standby, you can start the program in the master PLC to transfer the master angle to the slaves:

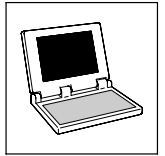
1. Select **Online→Log in** to log in the master PLC and change to online mode.
2. Confirm the question "Do you want to load the new program?" with **Yes**.
3. Select **Online→Start** to start the program in the PLC.
4. Open the visualisation **CamOperation** (*Object Organizer/register Visualization*).
5. Use the **motion profile no. set** input field to enter the product number of the motion profile to be used (for slave 0).
6. Deactivate the controller inhibit in the PLC (set terminal 28 to high level).
7. Click the button **lock to cam** to enable traversing the drive to profile position.
8. Click the button **Virtual Master** to go to the visualisation **VirtualMaster** to control the vertical shaft.



Tip!

For commissioning, the following sequence is recommended for the selection of the master angle:

1. Use the handwheel to process the motion profile (button **handwheel**).
 - This allows you to detect tool collisions, if any, without damage to the machine.
 - For the handwheel function you need an encoder at the digital frequency input (DFIN).
2. Slowly process the motion profile in inching mode (buttons **jog positive** and **jog negative**)
3. Completely process the motion profile once (button **one cycle**).
4. If all tests have been successfully completed, the test mode (continuous motion profile processing) can be started (button **continuous**).



5 Functions

5.1 Function overview

The following overview shows the signal flow between the individual template functions:

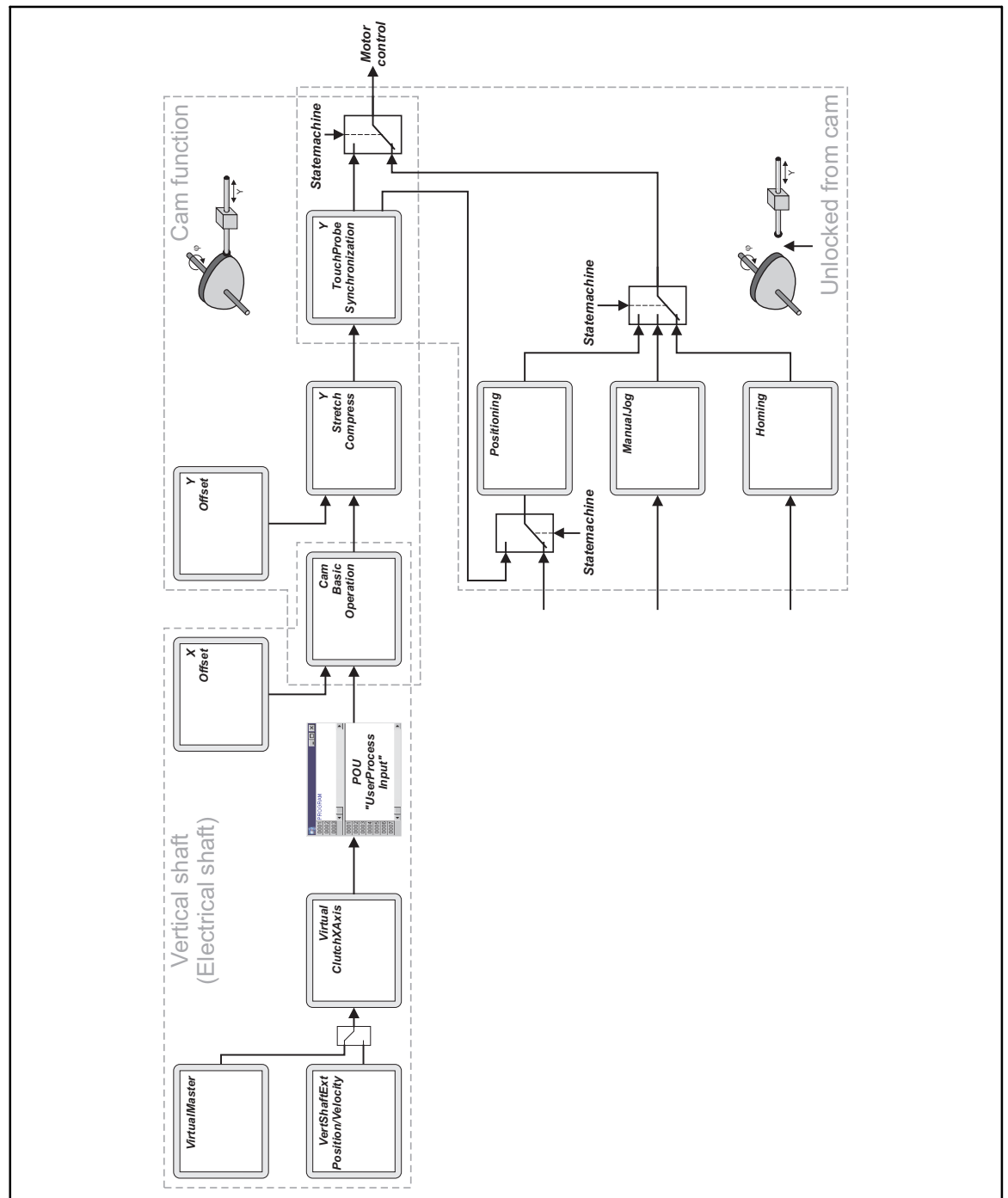
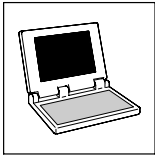


Fig. 5-1

Overview: template functions



Template Cam

Functions

Function overview

5.1.1 Vertical shaft (x axis)

The following overview shows in which template functions you can find the global variables for the "Vertical shaft" function.

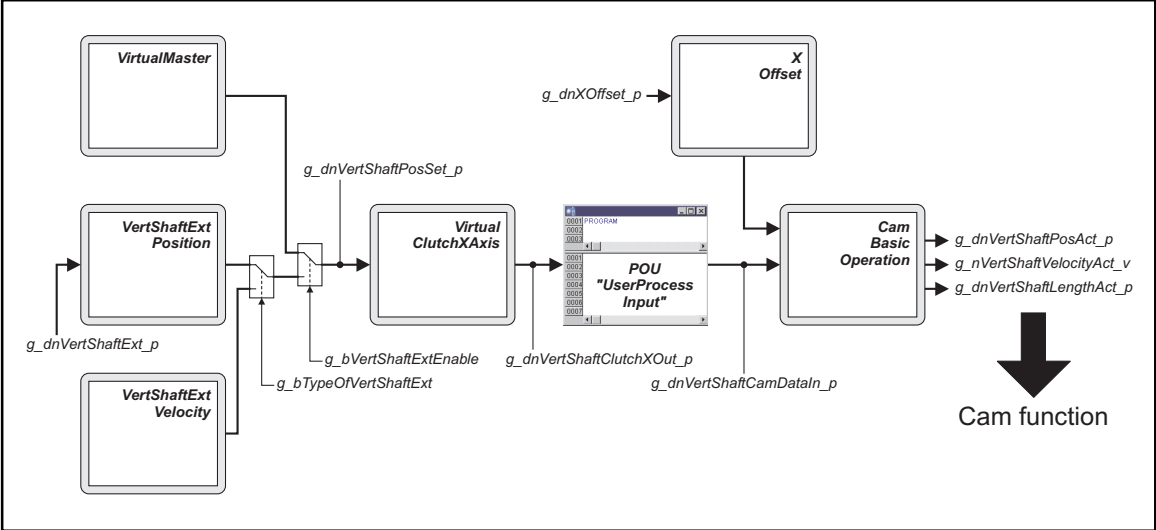


Fig. 5-2 Signal flow between the template functions for the "vertical shaft"

The master angle can be generated either internally by the virtual master or externally by a real master.

- Use *g_bVertShaftExtEnable* to change between virtual master and (external) real master.
- When a real master is used, you can either select a position (master angle) or a speed (digital frequency). The selection is made under *g_bTypeOfVertShaftExt*.

Selection of the master angle (x axis)	<i>g_bVertShaftExtEnable</i>	<i>g_bTypeOfVertShaftExt</i>	Information
Virtual master (internal generation of a master angle)	FALSE	FALSE	VirtualMaster function 5-51
Real master			
Selection of an external master angle (e.g. via system bus)	TRUE	FALSE	VertShaftExtPosition function 5-58
Selection of an external digital frequency (e.g. via incremental encoder signal/SB DFIN)	TRUE	TRUE	VertShaftExtVelocity function 5-61

External digital frequency

When "external digital frequency" is selected, additional functions such as stretching/compression and synchronisation of the x axis by means of touch probe are possible:

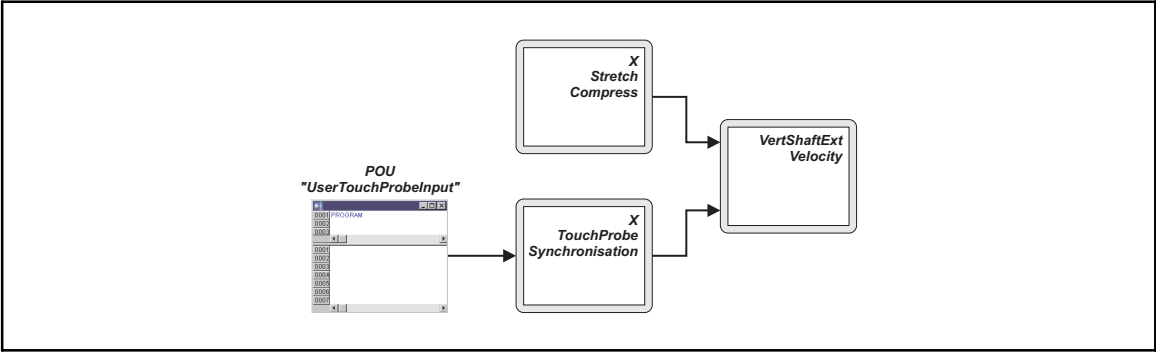
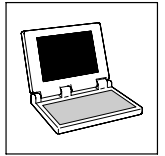


Fig. 5-3 Additional template functions for the "external digital frequency" function



5.1.2 Cam profile function

The following overview shows in which template functions you can find the global variables for the cam profile functionality.

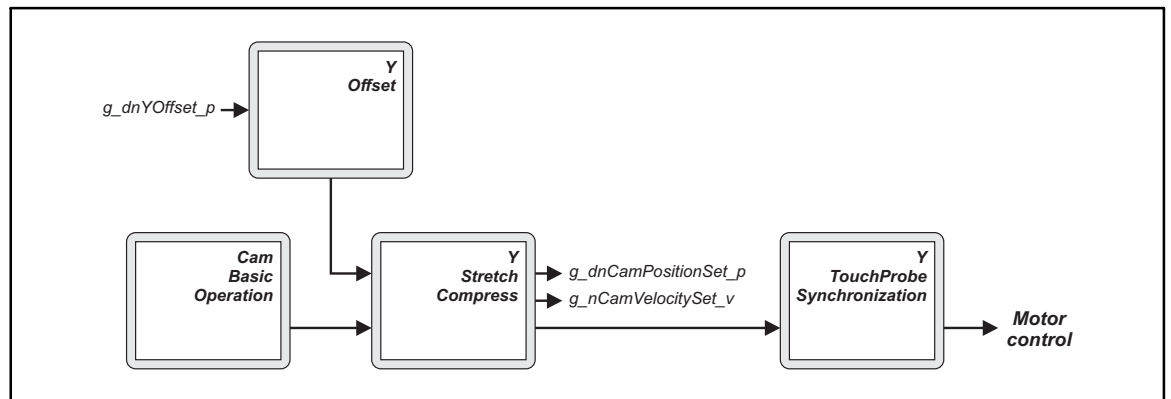
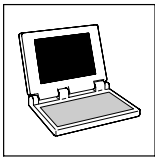


Fig. 5-4

Signal flow between the template functions for the "cam profile function"



Template Cam

Functions

Function overview

5.1.3 Functions unlocked from cam

For the following functions the slave drive need not be "locked to cam":

- Homing (▢ 5-15)
- Manual homing (inching) (▢ 5-23)
- Positioning the drive to a selected position (▢ 5-27)

"Unlocked from cam" means that the slave drive does not follow the cam profile (or motion profile) and is unlocked from the vertical shaft (e. g. for maintenance work at the tool).

The following figure shows a mechanical cam profiler. In example 2, the tool is unlocked from the cam profiler:

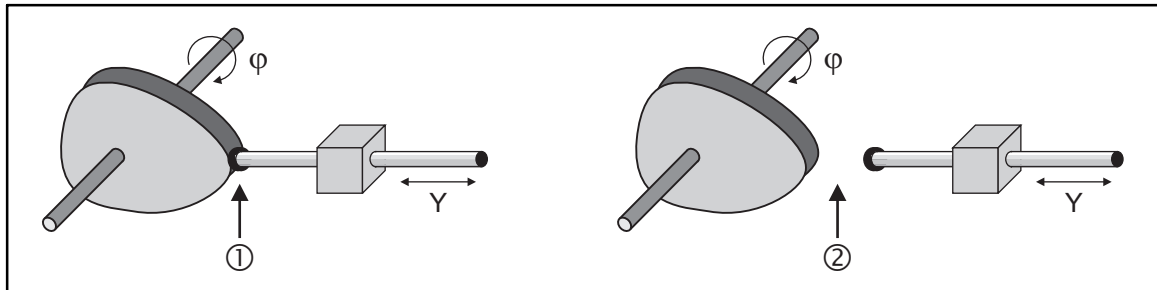


Fig. 5-5

Mechanical cam profiler

- φ Master angle
- Y Position setpoint
- ① Tool is "at cam profile position"
- ② Tool is "unlocked from cam"

The following overview shows which global variables are relevant for the functions "unlocked from cam" (homing, manual homing, positioning):

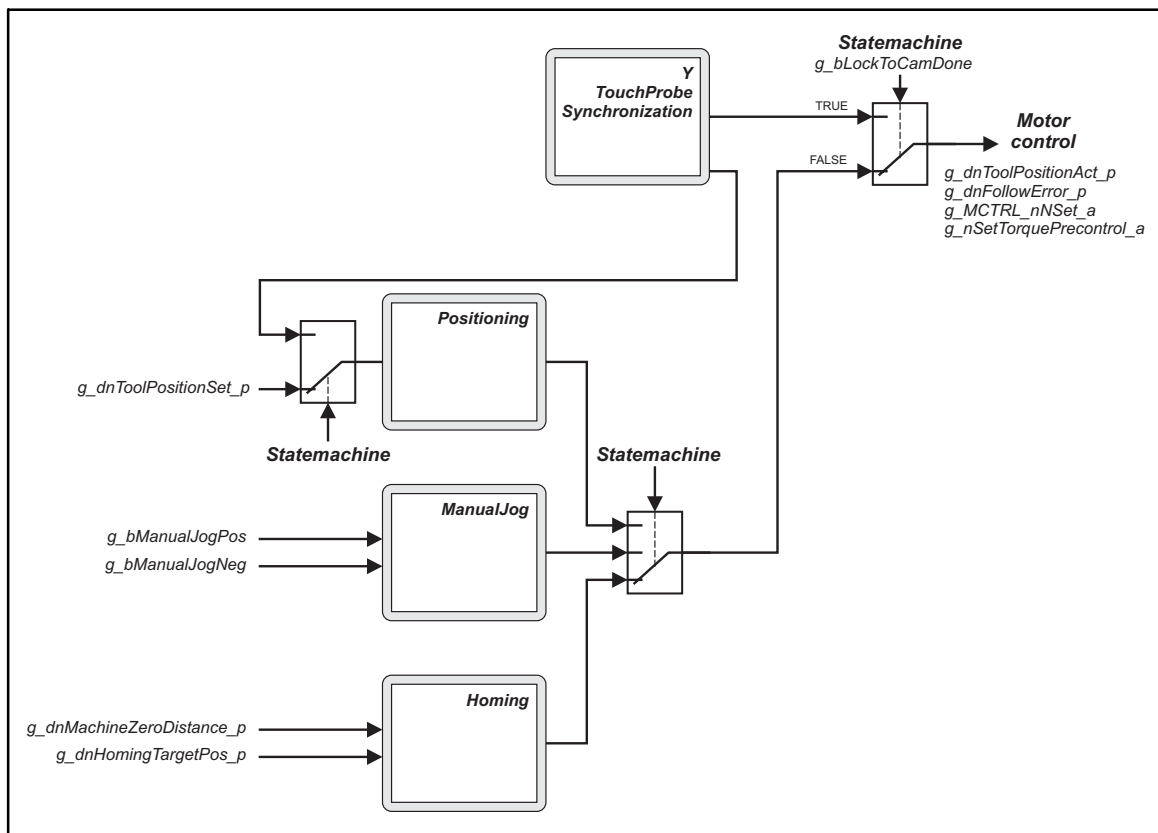
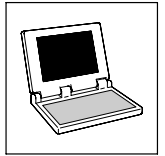


Fig. 5-6

Signal flow for the functions "unlocked from cam"



5.2 "Cam" status machine

The following figure shows the status machine which is the basis for the individual template functions:

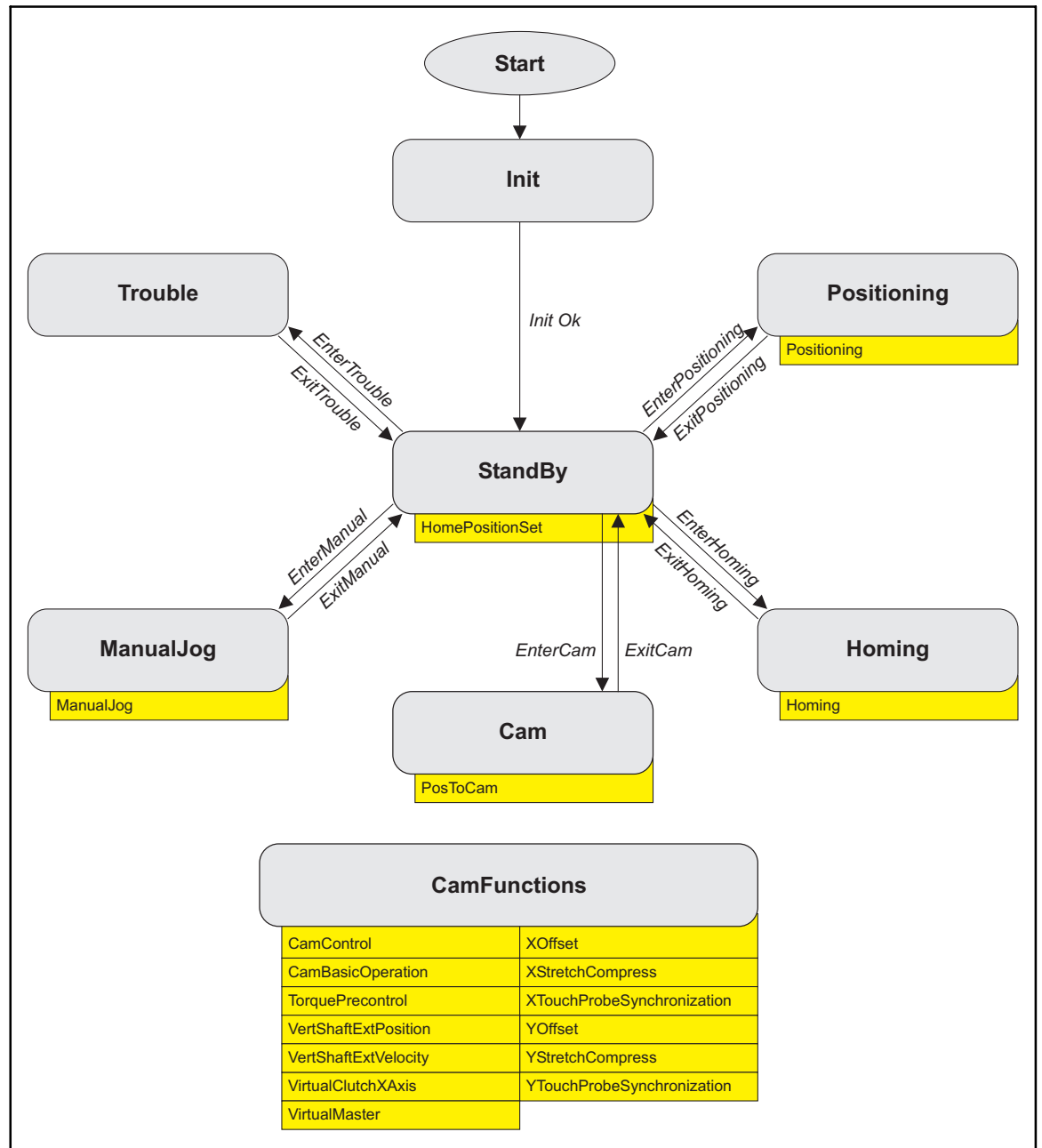
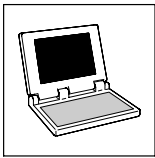


Fig. 5-7

"Cam" status machine



Template Cam

Functions

"Cam" status machine

The status machine comprises different statuses and defined status changes, so-called transitions.

- There is always only one status active. This makes diagnostics easier in case of an error.
- The function modules of the template are assigned to different statuses to ensure that specific functions cannot be activated at the same time. Manual homing cannot be carried out if positioning or homing is active.
- A status changes into another if the condition for the corresponding transition is met.
 - **Example:**
The status change from "StandBy" to "Cam" can only be carried out if the condition for the "EnterCam" transition is met. If the status is to change back to "StandBy" the condition for the "ExitCam" transition must be fulfilled.

5.2.1 Short status description

"Init" status

This status is activated after the PLC start.

The following actions are executed in "Init":

- Reading of machine constants.
- Checking whether the **HomePositionSet** function (setting of the home position) has been carried out before the last "power off". If so, the variable *g_bHomingDone* will be automatically set to TRUE.
- Reading of the actual value encoders and initialisation of the actual value displays.
- Copying of the product data (motion profiles) to the RAM of the PLC.



Note!

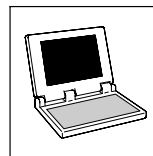
After initialisation, the template is in "StandBy" and can receive control commands.

"StandBy" status

This status is of central importance since it is always activated when a status changes into another. If you change from "Trouble" to "ManualJog", "StandBy" will be active for one cycle.

The following actions are executed in "StandBy":

- Check if the drive is ready to change to another status.
- Edge evaluation of the control variables
 - *g_bHomingStart*,
 - *g_bMotionStart*,
 - *g_bLockToCam*,to change over to another state.
- Braking of the drive along the "ManualJog" ramps if it is not yet at standstill, the controller is enabled and quick stop (QSP) is deactivated.
- Enabling of the **HomePositionSet** function (setting of the home position). Setting of the home position is only possible in "StandBy".



"Trouble" status

This status is activated if the operating system of the PLC or user program sends an error message. The following actions are executed in "Trouble":

- Error display.
- Enabling of the reset mechanism for user errors.

"ManualJog" status

This status is activated for manual traversing (manual homing/jog control, retracting from limit positions).

The following actions are executed in "ManualJog":

- Creation of motion profiles for the **ManualJog** function (manual homing).
- Evaluation of the traversing range limit switches during manual homing.
- Retracting from traversing range limit switches.

"Homing" status

This status is activated for automatic searching for the home position/zero position.

The following actions are executed in "Homing":

- Active homing in the selected mode.
- Evaluation of the traversing range limit switches during homing.
- Evaluation of touch probe (TP) / zero pulse (MP) of the position encoder or home switches during homing.

"Positioning" status

This status is activated for easy positioning of the drive system by selecting the target position.

"Cam" status

The core functions of the template are executed in the "Cam" status.



Note!

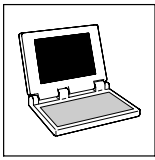
The following functions are executed independently of the "Cam" status:

- Clutch function of the vertical shaft
- Adjustment of the master value/setpoint value
- Cyclic touch probe synchronisation of the master value/setpoint value
- Calculation of the cam profile position from the position of the vertical shaft
- Stretching and compression (changing the motion profile online)
- Torque precontrol

The functions will only have an effect on the motor motion if the drive is at cam profile position!
(*g_bLockToCamDone* = TRUE)

The following functions are also independent of the status control. They are always active:

- Calculation of the monitoring functions (hardware limit positions, following errors, user-defined errors)
- Calculations for the visualisation
- Calculation of the following error



Template Cam

Functions

"Cam" status machine

5.2.2 Conditions for status changes (transitions)

The below figure shows the conditions to be fulfilled for the individual transitions in the form of logic operations:

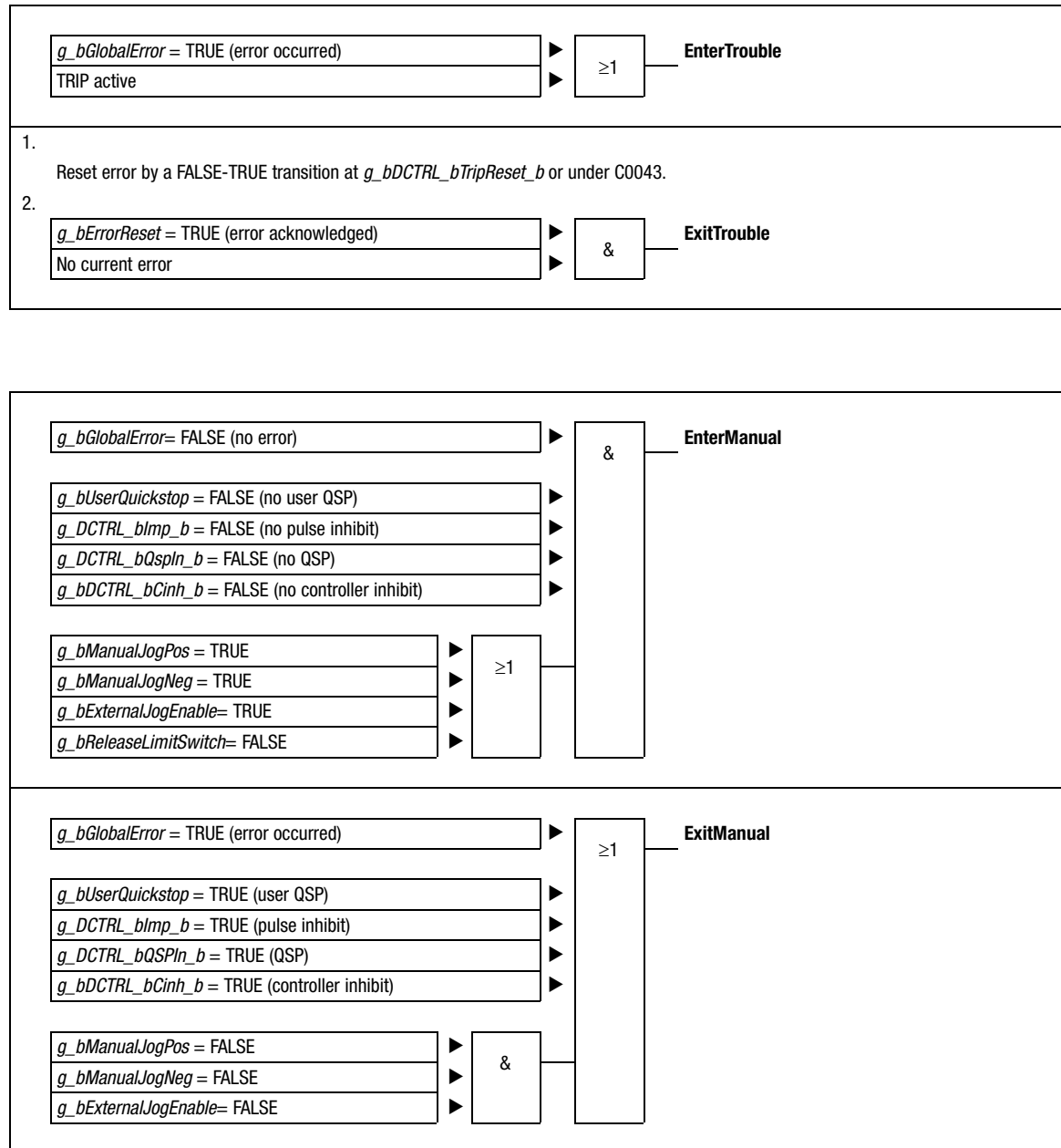


Fig. 5-8 Conditions for transitions of the "Cam" status machine
 $\&$ logic AND operation
 $\geq$ logic OR operation

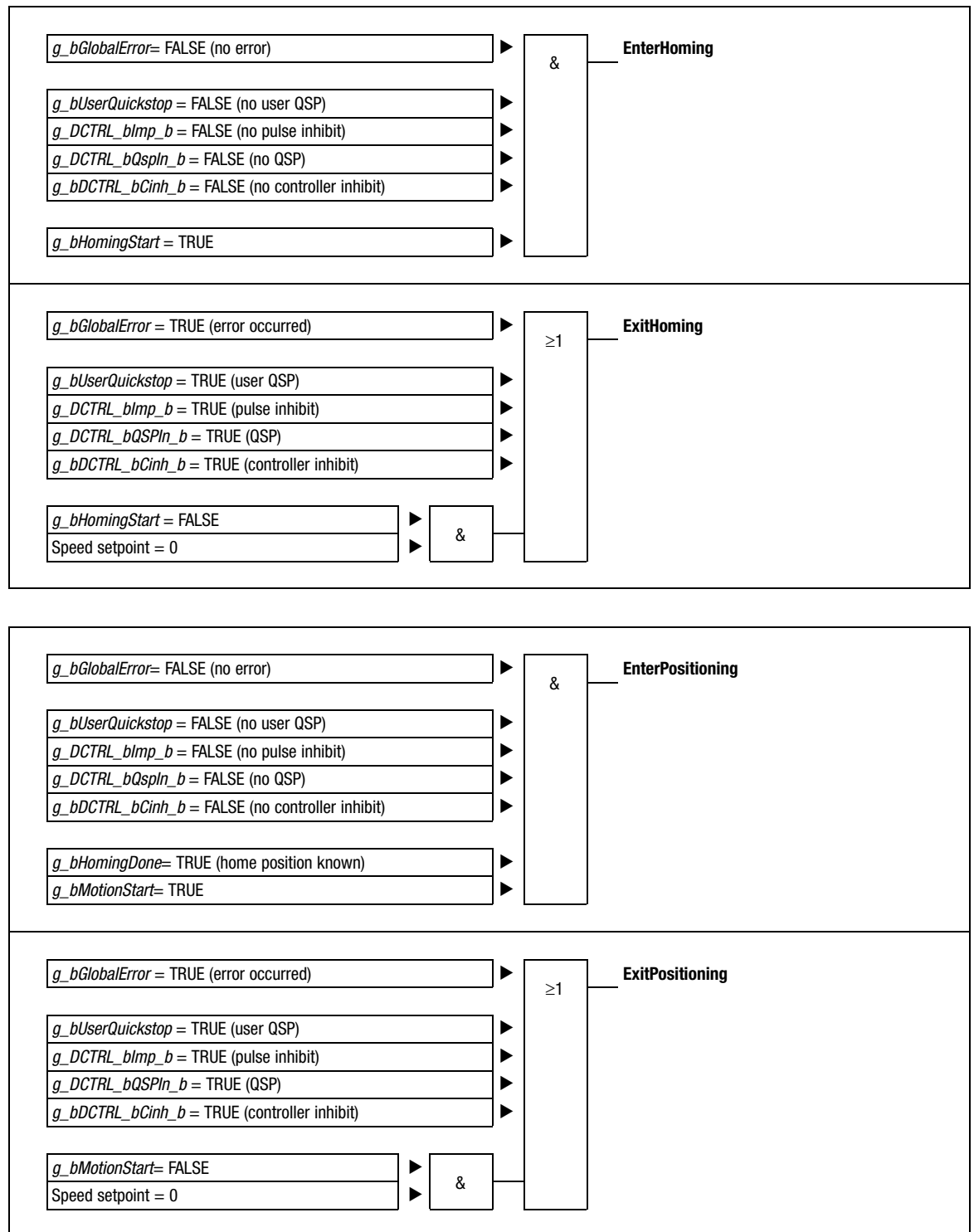
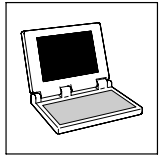
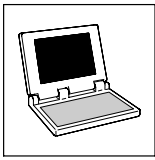


Fig. 5-9

Conditions for transitions of the "Cam" state machine (continued)

& logic AND operation
 $\geq$ logic OR operation



Template Cam

Functions

"Cam" status machine

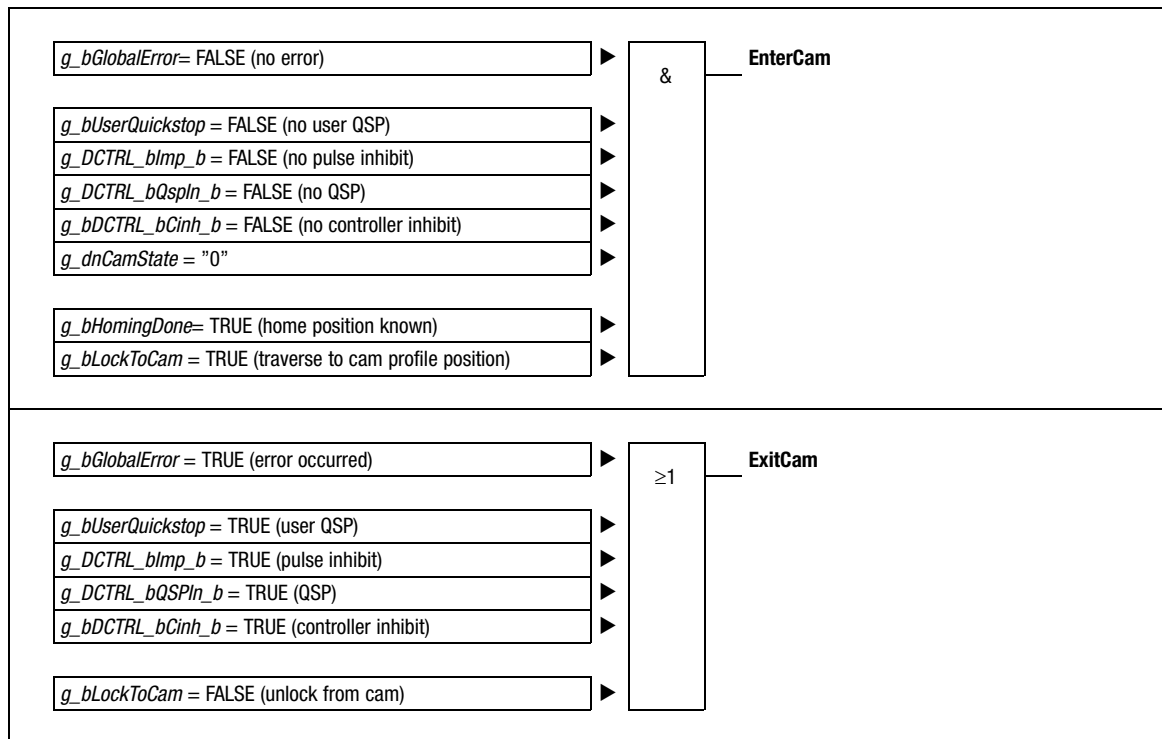
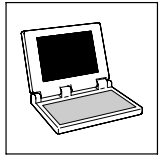


Fig. 5-10 Conditions for transitions of the "Cam" state machine (continued)
 & logic AND operation
 $\geq$ logic OR operation

- Use the "Enter..." transitions to change from "StandBy" to another status machine status ("Homing", "Trouble", ...).
- Use the "Exit..." transitions to change back to "StandBy".



5.3 Status "StandBy"

If controller inhibit is deactivated in the PLC, the drive remains in its current position "StandBy".

In this status, the following template functions can be executed:

Function	Info	
HomePositionSet	Set home position - When the home position is set, the tool is not actively moved, but the zero position is determined by measuring the current position of the tool and the result is entered via the program. "Set home position" is only possible when the controller is inhibited. The drive position is no longer controlled! Reset home position "Reset home position" is always possible in "StandBy".	5-12



Tip!

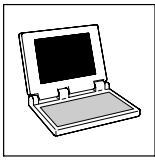
Instead of **setting the home position** you can use **homing**. Homing means that the drive traverses according to a previously selected mode and independently finds the zero position (home position) by means of a homing mark.

- Homing can be carried out in the status "Homing". (5-15)

Selection help

The following table compares the two procedures:

	Setting of the home position (HomePositionSet)	Homing (Homing)
Required feedback system:	Absolute-value encoder (single-turn/multi-turn encoder, resolver)	Incremental encoder, resolver, absolute-value encoder
Additional hardware required:	-	Touch probe sensor, hardware limit switches, if necessary
How do you select the home position?	Manual input of the distance between the current tool position and machine zero.	The drive carries out a homing process and traverses according to a previously selected mode to independently find the zero position of the machine by means of a homing mark.
Is machine zero beyond the traversing range possible?	Yes, it is.	Yes, it is.
Accuracy of the reference position	Depends on the accuracy of the measurement.	Depends on the accuracy and hysteresis of the home switch.
Is active tool traversing required?	No, it isn't.	Yes, it is.
Danger of crashes?	No, there isn't because the tool is not actively moved.	Must be considered because the tool is actively moved during homing.
Do you require a sequence control for multi-axis operations?	No, you don't.	Yes, you do.
Must the function be repeated after power-off/power-on (mains and 24 V) of the PLC?	- Single-turn absolute-value encoder: - No, it needn't, as long as the motor axis has not been turned by more than $\pm 179.9^\circ$ during power-off. - Multi-turn absolute-value encoder: - No, it needn't, as long as the motor axis has not been turned by more than ± 2048 (4096) revolutions during power-off.	Yes, it always must be repeated after power-on.
Is machine set-up possible during power-off?	Yes, it is.	No, it isn't.



Template Cam

Functions

"HomePositionSet" function - setting the home position (static)

5.3.1 "HomePositionSet" function - setting the home position (static)

This template function is used to set the home position during commissioning.

- The home position can only be set when the controller is inhibited in "StandBy".
- If the home position has been set, the tool position is saved with mains failure protection and will still be available after mains disconnection.
- Setting of the home position only has to be repeated during re-commissioning or in case of servicing (e.g. when drive components are exchanged).



Stop!

Ensure that the drive is not rotating when setting the home position.

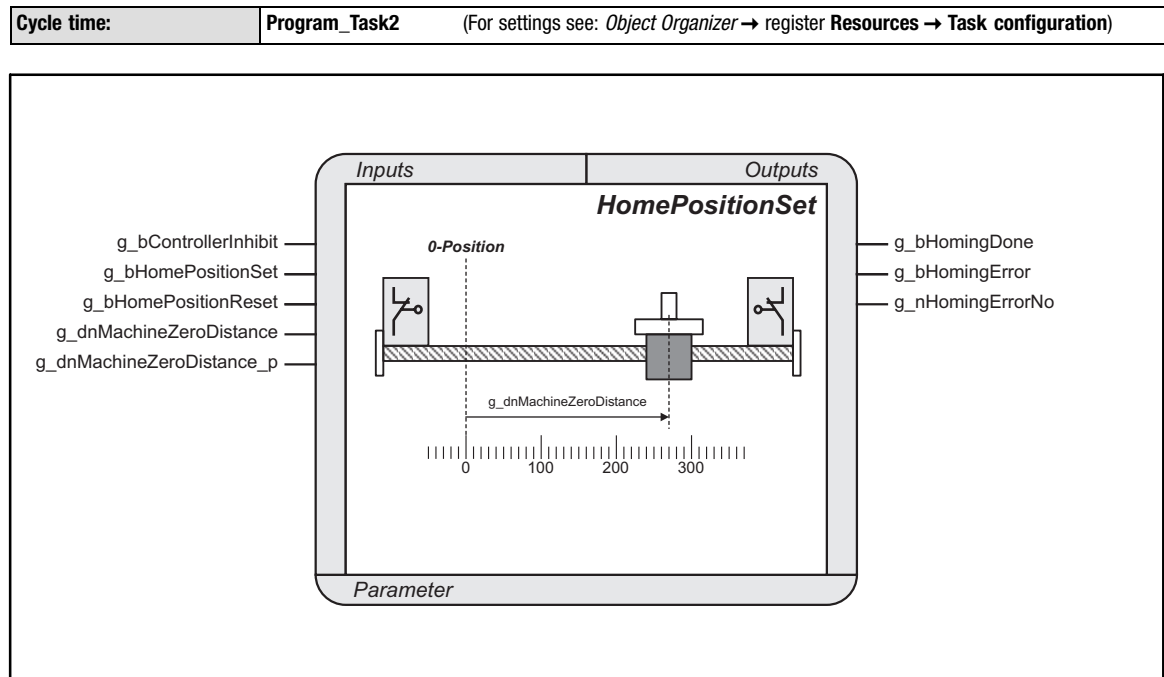
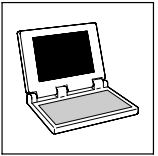


Fig. 5-11 "HomePositionSet" function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bControllerInhibit	BOOL	R / W	Input for status controller inhibit for one user TRUE Controller inhibit is set.
g_bHomePositionSet	BOOL	R / W	Acceptance of the home position • Only possible when controller is inhibited! FALSE → TRUE The setpoint selected at <i>g_dnMachineZeroDistance(_p)</i> is accepted and <i>g_bHomingDone</i> is set to TRUE.
g_bHomePositionReset	BOOL	R / W	Resetting the home position TRUE • Output <i>g_bHomingDone</i> is reset to FALSE. • The status "Home position known" is reset (<i>g_bHomingDone</i> = FALSE).



⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_dnMachineZeroDistance	Double integer	R / W	Distance between tool and zero position (home position) in [unit] - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See information at the end of the table.) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!
g_dnMachineZeroDistance_p	Double integer	R / W	Distance between tool and zero position (home position) in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!
Information: Conversion from [unit] into [inc]: If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]: $\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$ - The conversion takes approx. 50 ms (depending on the size of the user program). It will only be carried out if the value of the input variable has changed. - For time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies. - Use the <i>Project settings</i> dialog box in the CamDesigner to select the settings for feed constant and gearbox factors.			

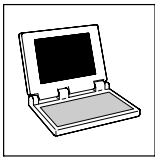
Outputs ⇨				
Identifiers	Data type	Access	Value/meaning	
g_bHomingDone	BOOL	R	Status signal "Status of the home position"	
			TRUE	The home position has been set and is known.
g_bHomingError	BOOL	R	Status signal "Error"	
			TRUE	An error occurred when the home position was set. • For details see <i>g_nHomingErrorNo</i> .
g_nHomingErrorNo	Integer	R	Error number	
			0	OK
			13	Invalid range of values
			111	More than 4 decimal positions specified or no fixed-point-format index.
			-10	Controller inhibit was not set.



Information on the encoder system

Please observe the following instructions for the encoder system:

- It is not possible to use incremental encoders for this function.
- When the machine is in the deenergised state, single-turn absolute-value encoders and resolvers must not be rotated by more than a maximum of $\pm 1/2$ revolution.
- When the machine is in the deenergised state (mains and 24 V supply off), multi-turn absolute-value encoders must not be rotated by more than a maximum of $\pm 1/2$ clock pulse length. (For encoders from Stegmann max. ± 2047 revolutions.)



Template Cam

Functions

"HomePositionSet" function - setting the home position (static)

Setting the home position

The home position is set as follows:

1. Set controller inhibit in the PLC.
2. Measure the distance between tool and zero position (home position).
3. Enter this value at *g_dnMachineZeroDistance* in fixed point format ([unit] * 10000).
 - As an alternative, you can select the distance between tool and zero position in [inc] at *g_dnMachineZeroDistance_p*.
4. Set *g_bHomePositionSet* from FALSE to TRUE (edge evaluation) to accept the value on *g_dnMachineZeroDistance(_p)* and transmit the home position to the PLC. In doing this, the drive may not rotate!

"Home position known"

If the home position has been set, the output *g_bHomingDone* is set to TRUE.

Error during setting the home position

If the home position could not be set, the output *g_bHomingError* is set to TRUE.

- An error number will be output under *g_nHomingErrorNo* giving details about the error.
- *g_bHomingError* is reset to FALSE if:
 - setting of the home position has been successful.
 - the status "Home position known" was reset by setting *g_bHomePositionReset* to TRUE.

Status identification after a fresh power-on

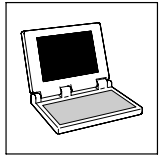
With every fresh power-on, the system checks in "Init" if the home position is known and saves the status in the variable *g_bHomingDone*:

- *g_bHomingDone* = TRUE $\Rightarrow$ Home position is known.
- *g_bHomingDone* = FALSE $\Rightarrow$ Home position is not known.

Status reset

By setting *g_bHomePositionReset* to TRUE you can reset the status "Home position known".

- The output *g_bHomingDone* and the status variable *g_bHomingDone* are reset to FALSE.
- CINH is not required for the status reset.



5.4 "Homing" status

In the "Homing" status you can approach the home position to display the position of the tool or material in the PLC and identify the zero position (home position).

The following function is used for homing:

Function	Information	
Homing	Homing The tool is actively moved to find a homing mark and approach a defined position.	5-16

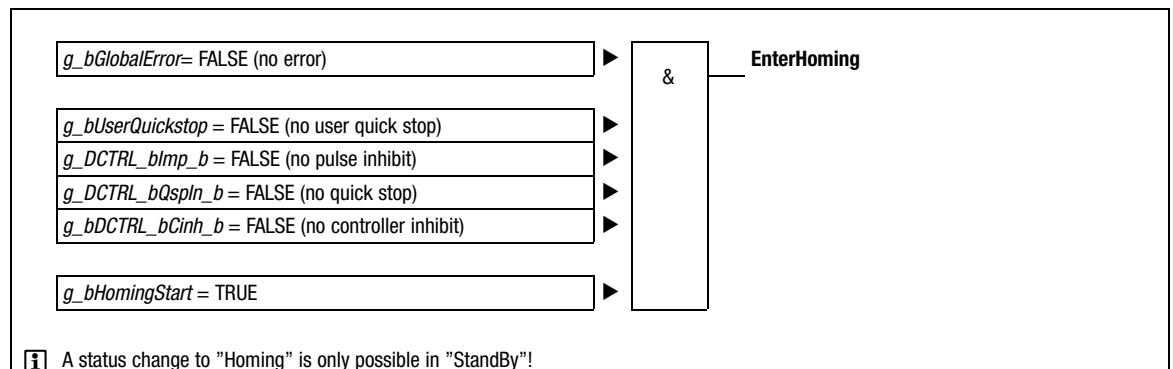


Tip!

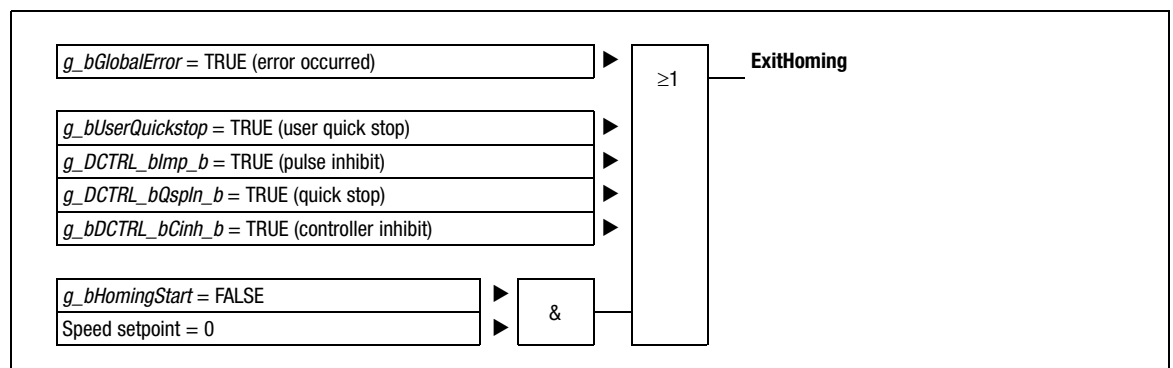
As an alternative to homing you can set the home position manually. In this case, the zero position is determined by measuring the current position of the tool and the result is entered via the program.

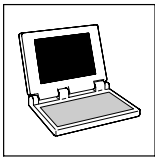
- The home position can be set in "StandBy" by means of the **HomePositionSet** function. (5-12)
- As selection help you can find a comparison of the two procedures in chapter 5.3. (5-11)

Condition (transition) for a status change to "Homing"



Condition (transition) for changing back to "StandBy"





Template Cam

Functions

"Homing" function - reference search

5.4.1 "Homing" function - reference search

This template function is used to carry out a homing process. The drive traverses in a preselected mode to identify the zero position (home position) by means of a homing mark and transfers it to the drive control. All position values refer to the home position.

- In general, "Homing" is carried out after every power-on.
- Possible home signals:
 - Zero pulse (signal edge of the encoder system for the actual position value, one per encoder revolution)
 - Touch probe (signal edge at the corresponding touch probe input of the PLC)
- It is possible to define a preliminary stop position by means of a home switch. In this case, the home position is the following zero position of the position encoder of the motor or the following touch probe (depending on the selected mode).

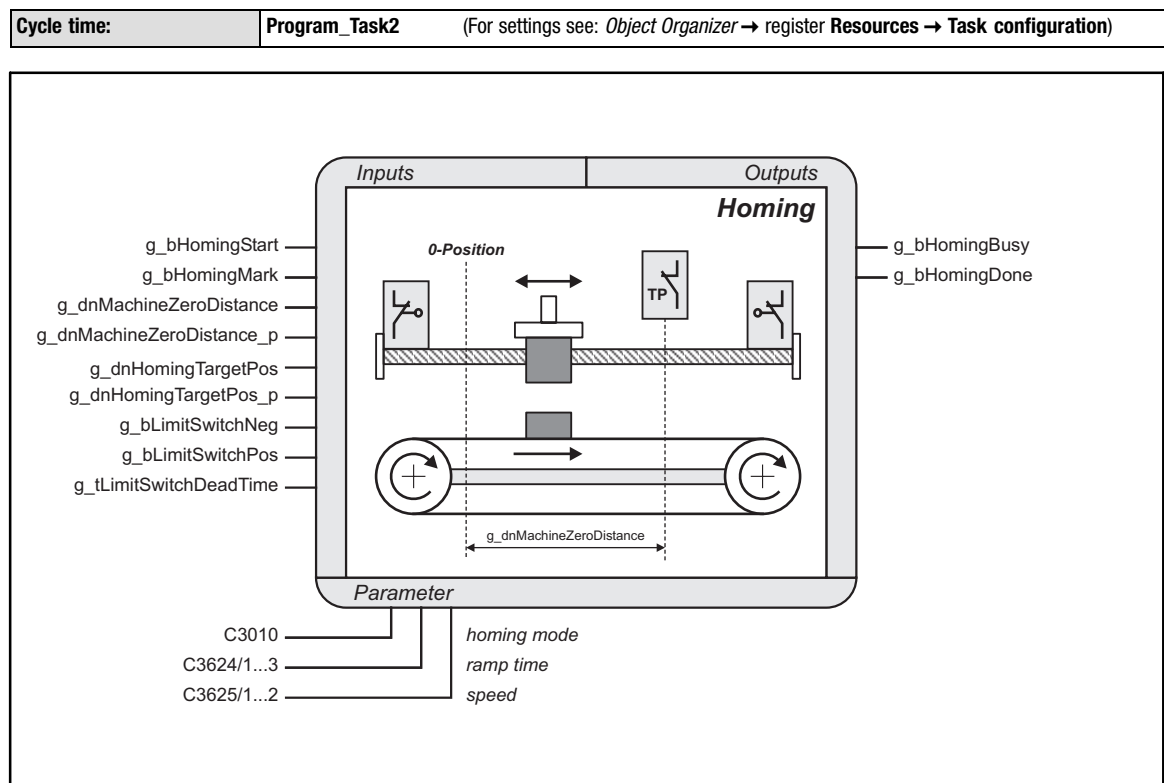
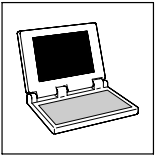


Fig. 5-12 "Homing" function

⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
g_bHomingStart	BOOL	R / W	Homing start/stop	
			● Only in connection with controller enable.	
			FALSE ↗ TRUE	Homing start
			FALSE	Homing stop / cancellation
g_bHomingMark	BOOL	R / W	Input for preliminary stop position home switch	
			FALSE	Depends on the selected mode
			TRUE	
g_dnMachineZeroDistance	Double integer	R / W	Home switch position in [unit] ● Input in fixed point format with 4 decimal positions (1 [unit] ≙ 10000). The value is internally converted into increments. (See information at the end of the table.) ● If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!	



⇒ Inputs

Identifiers	Data type	Access	Information/possible settings		
g_dnMachineZeroDistance_p	Double integer	R / W	Home switch position in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!		
g_dnHomingTargetPos	Double integer	R / W	Target position of the tool after homing in [unit] - Referred to machine zero. - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See information at the end of the table.) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!		
g_dnHomingTargetPos_p	Double integer	R / W	Target position of the tool after homing in [inc] - Referred to machine zero. - If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!		
g_bLimitSwitchNeg	BOOL	R / W	Input for limit switch (negative) <table><tr><td>FALSE</td><td>Limit switch reached</td></tr></table>	FALSE	Limit switch reached
FALSE	Limit switch reached				
g_bLimitSwitchPos	BOOL	R / W	Input for limit switch (positive) <table><tr><td>FALSE</td><td>Limit switch reached</td></tr></table>	FALSE	Limit switch reached
FALSE	Limit switch reached				
g_tLimitSwitchDeadTime	Time	R / W	Debounce time for limit switch - Relevant for all homing modes in which the drive reverses at limit switches. - After reversing at a limit switch, the limit position monitoring will be deactivated for the pre-selected time to suppress signals caused by the bounce of the limit switch. - Initialisation value: 15 ms		

Information: Conversion from [unit] into [inc]:
If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]:

$$\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$$

- The conversion takes approx. 50 ms (depending on the size of the user program). It will only be carried out if the value of the input variable has changed.
- With time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies.
- Use the *Project settings* dialog box in the **CamDesigner** to select the settings for feed constant and gearbox factors.

Outputs ⇨				
Identifiers	Data type	Access	Value/meaning	
g_bHomingBusy	BOOL	R	Status signal "Homing activated"	
			TRUE	Homing active
g_bHomingDone	BOOL	R	Home position status	
			FALSE	Home position is not known (possibly encoder error).
			FALSE ↗ TRUE	Position <i>g_dnHomingTargetPos(_p)</i> has been reached.
			TRUE	Homing process was carried out and home position is known.

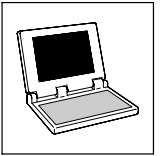


Template Cam

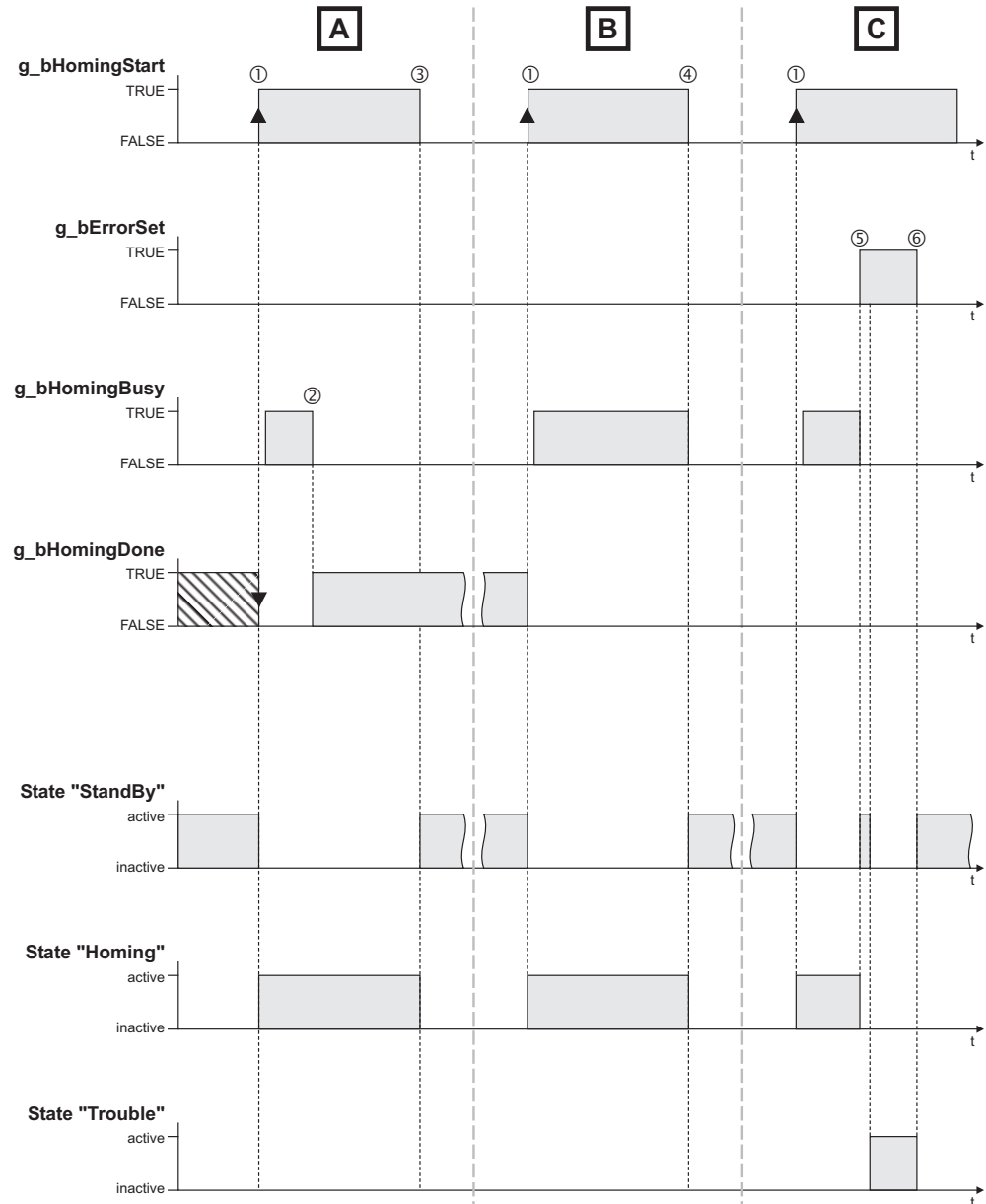
Functions

"Homing" function - reference search

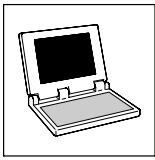
Parameters							
Code	Subcode	Data type	Access	Information			
				Possible settings	Presetting		
C3010			R / W	Homing mode			
				0	>_Rn_MP	0	
				1	<_Rn_MP		
				2	>_Lp<_Rn_MP		
				3	<_Ln>_Rn_MP		
				4	>_Rp<_Rn_MP		
				5	<_Rp>_Rn_MP		
				6	>_Rn>_TP		
				7	<_Rn<_TP		
				8	>_TP		
				9	<_TP		
				10	>_Lp<_TP		
				11	<_Ln>_TP		
				12	>_Lp↘<_Lp↗		
				13	<_Ln↘>_Ln↗		
	Symbols for code C3010: > Movement in positive direction < Movement in negative direction Lp Limit switch in positive direction (↗ = positive edge; ↘ = negative edge) Ln Limit switch in negative direction (↗ = positive edge; ↘ = negative edge) Rp Positive edge of home switch Rn Negative edge of home switch TP Touch probe edge of input E4 MP Zero pulse edge of the position encoder (one per encoder revolution) When the last action listed is executed, the home position is set (e.g. zero pulse with "MP"), even if the drive continues traversing.						
C3624	1		R / W	Acceleration/deceleration ramps			
				• Referred to 4000 rpm			
				Deceleration ramp for immediate stop (cancellation of the function)			
				0.01	{0.01 unit}	129.99	5.00 s
				Acceleration ramp			
				0.01	{0.01 unit}	129.99	5.00 s
C3624	2		R / W	Deceleration ramp			
				0.01	{0.01 unit}	129.99	5.00 s
C3625	1		R / W	Homing speed			
				In positive direction (CW)			
C3625	2		R / W	In negative direction (CCW)			
				0	{1 unit}	15000	200 rpm



Response of the function



Information		Status change
[A] Correct execution of the function		
①	Status change to "Homing" (signal evaluation of <i>g_bHomingStart</i>).	StandBy → Homing
②	The homing process was carried out and the home position is known (<i>g_bHomingDone</i> = TRUE).	
③	Homing is normally completed (level evaluation of <i>g_bHomingStart</i>).	Homing → StandBy
[B] Cancellation of the function		
①	Status change to "Homing" (signal evaluation of <i>g_bHomingStart</i>).	StandBy → Homing
④	Homing is cancelled before the homing process has been completed.	Homing → StandBy
[C] Fault scenario		
①	Status change to "Homing" (signal evaluation of <i>g_bHomingStart</i>).	StandBy → Homing
⑤	An error occurred, the positioning program changes to "Trouble".	Homing → StandBy → Trouble
⑥	If the error is acknowledged, the positioning program changes back to "StandBy".	Trouble → StandBy



Template Cam

Functions

"Homing" function - reference search

Using the limit switch as a homing switch

In case of homing modes 12 and 13 the limit switch is used as a reference switch.

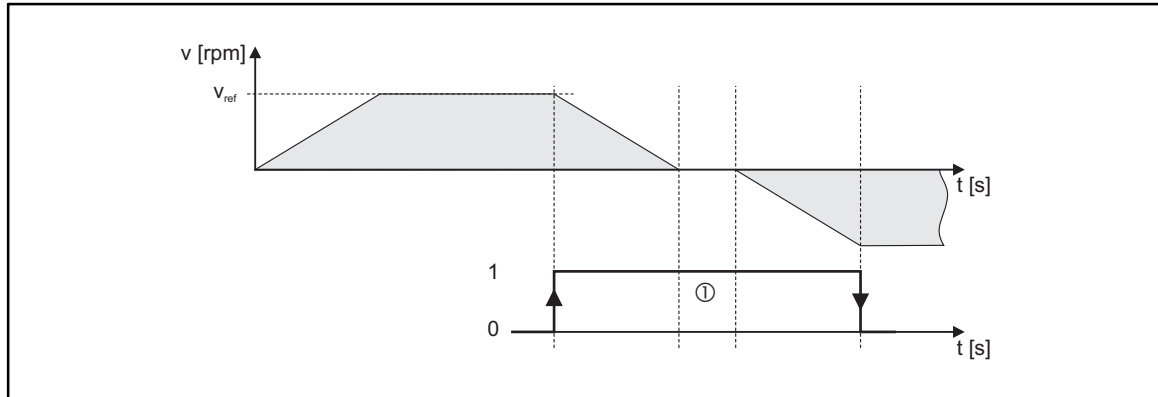


Fig. 5-13

Signal flow for a limit switch ① also used as a reference switch.



Note!

If you want to use a limit switch as reference switch, select the homing speed in a way that the drive stops **at the limit switch** and reverses from there!

Assigning the digital inputs of the PLC to the limits switch/homing switch variables

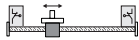
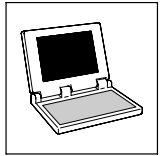
The digital inputs of the PLC are assigned via their direct addresses to the input variables for the limit switch/reference switch signals.

- The variable declarations can be found in the *Object Organizer* /register **Resources** in the folder **Global variables→TemplateUserVariables→UserVariables**.

Example:

- Left limit switch (negative) at digital input 1
- Right limit switch (positive) at digital input 2
- Reference switch at digital input 3

```
g_bLimitSwitchNeg AT %IX1.0.1: BOOL;      (* = DIGIN1 *)
g_bLimitSwitchPos AT %IX1.0.2: BOOL;      (* = DIGIN2 *)
g_bHomingMark    AT %IX1.0.3: BOOL;      (* = DIGIN3 *)
```



Example: Reference search with regard to a spindle drive (limited traversing range)

Settings:

- Select homing mode 13 "`<_Ln↘>_Ln↗`" by setting C3010 (HomingMode) to "13".
- Select the acceleration and deceleration ramps under C3624.
- Select the traversing speed under C3625.
- Use `g_dnMachineZeroDistance` to select the distance between zero pulse and machine zero.
- Use `g_dnHomingTargetPos` to select the target position at the end of homing.



Tip!

The distance between zero pulse and machine zero and the target position can be selected either in [unit] or in [inc].

- Please observe the instructions for the conversion from [unit] into [inc] on page 5-17. (5-17)
- Enter [unit] in fixed point format with four decimal positions, i. e. for 1.0000 [unit] enter "10000".

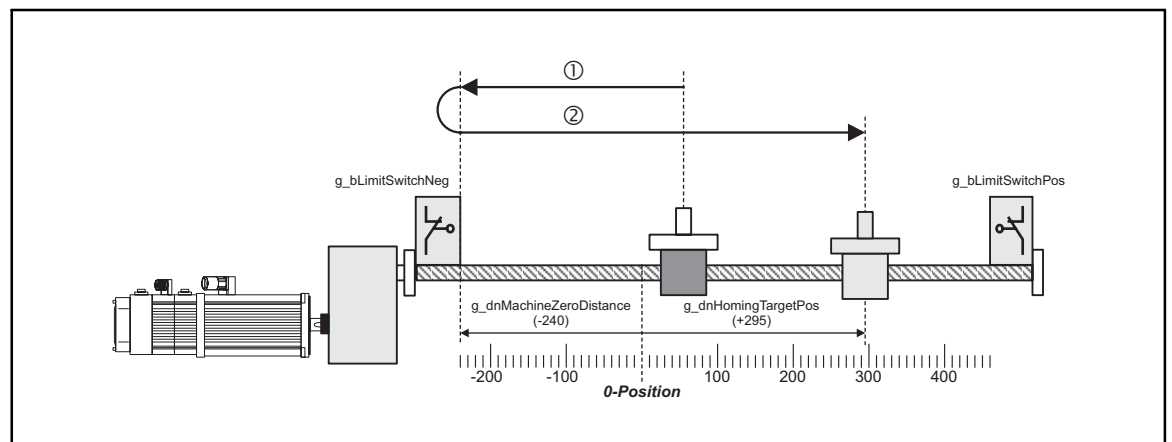
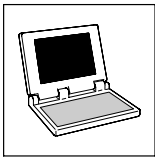


Fig. 5-14

Homing in mode 13 with a negative limit switch as home switch

Functional sequence:

1. Homing is started by setting `g_bHomingStart` to TRUE.
2. During homing `g_bHomingBusy` = TRUE.
3. The drive traverses to the negative limit switch and reverses. ①
4. Since the limit switch is also the home switch, the drive control knows the home position when leaving the limit switch (distance between `g_dnMachineZeroDistance` and limit switch).
5. The drive continues traversing to the target position `g_dnHomingTargetPos`. ②
6. Homing is completed as soon as the target position is reached and `g_bHomingDone` is set to TRUE.



Template Cam

Functions

"Homing" function - reference search



Example: Reference search with regard to a band drive (unlimited traversing range)

In applications with an unlimited traversing range (e.g. conveyor belts and rotary tables) homing is carried out by means of a touch probe sensor.

Settings:

- Select homing mode ">Tp" by setting C3010 (HomingMode) to "8".
- Select the acceleration and deceleration ramps under C3624.
- Select the traversing speed under C3625.
- Use *g_dnMachineZeroDistance* to select the distance between touch probe sensor and machine zero.
- Use *g_dnHomingTargetPos* to select the target position at the end of homing.



Tip!

The distance between touch probe sensor and machine zero and the target position can be selected either in [unit] or in [inc].

- Please observe the instructions for the conversion from [unit] into [inc] on page 5-17. (5-17)
- Enter [unit] in fixed point format with four decimal positions, i. e. for 1.0000 [unit] enter "10000".

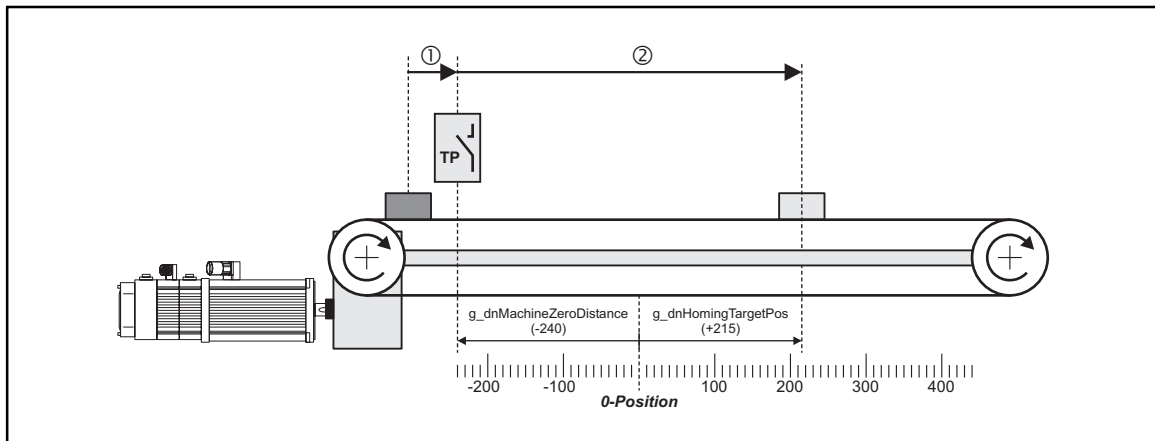
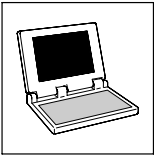


Fig. 5-15

Homing in mode 8

Functional sequence:

1. Homing is started by setting *g_bHomingStart* to TRUE.
2. During homing *g_bHomingBusy* = TRUE.
3. The drive traverses in positive direction. ①
4. As soon as the touch probe sensor is reached, the drive control knows the home position (distance between *g_dnMachineZeroDistance* and touch probe sensor).
5. The drive continues traversing to the target position *g_dnHomingTargetPos*. ②
6. Homing is completed as soon as the target position is reached and *g_bHomingDone* is set to TRUE.

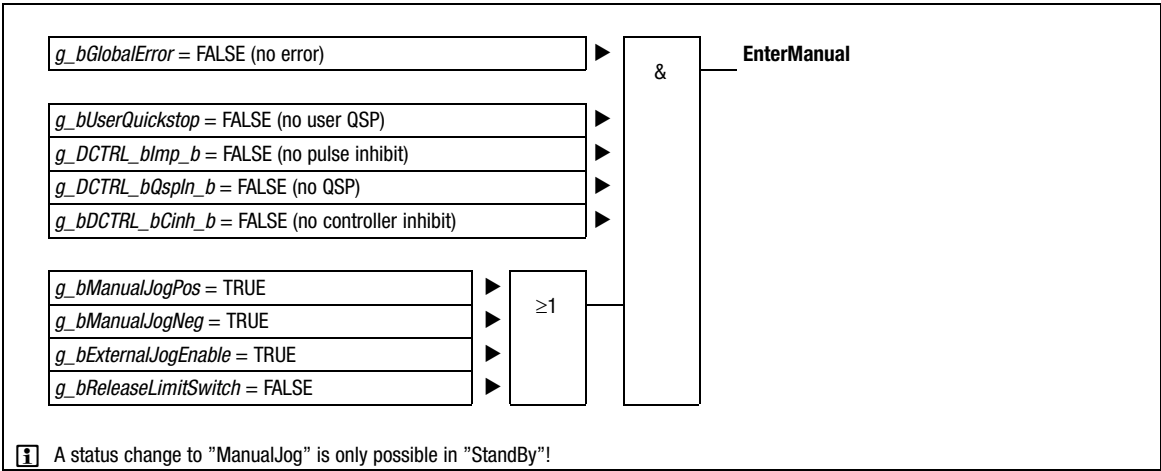


5.5 Status "ManualJog"

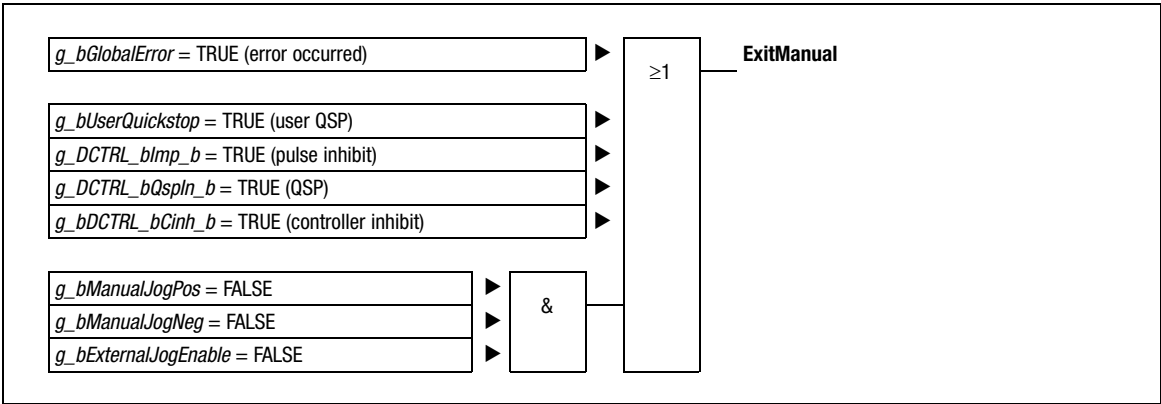
With "ManualJog" the drive or tool can be moved by manual operation.
The following function can be used for manual homing ("jog control"):

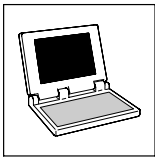
Function	Info
ManualJog	Override manual homing/jog control and retracting from limit switches 5-24

Condition (transition) for a status change to "ManualJog"



Condition (transition) for changing back to "StandBy"





Template Cam

Functions

"ManualJog" function - override manual control/inching mode

5.5.1 "ManualJog" function - override manual control/inching mode

Use "ManualJog" to traverse the drive manually unlocked from the cam (or motion) profile by means of "jog control", for instance, to clean or exchange a tool.

- "Retracting" from limit switches is also supported. In this case, the drive can only traverse in the corresponding clearance direction.

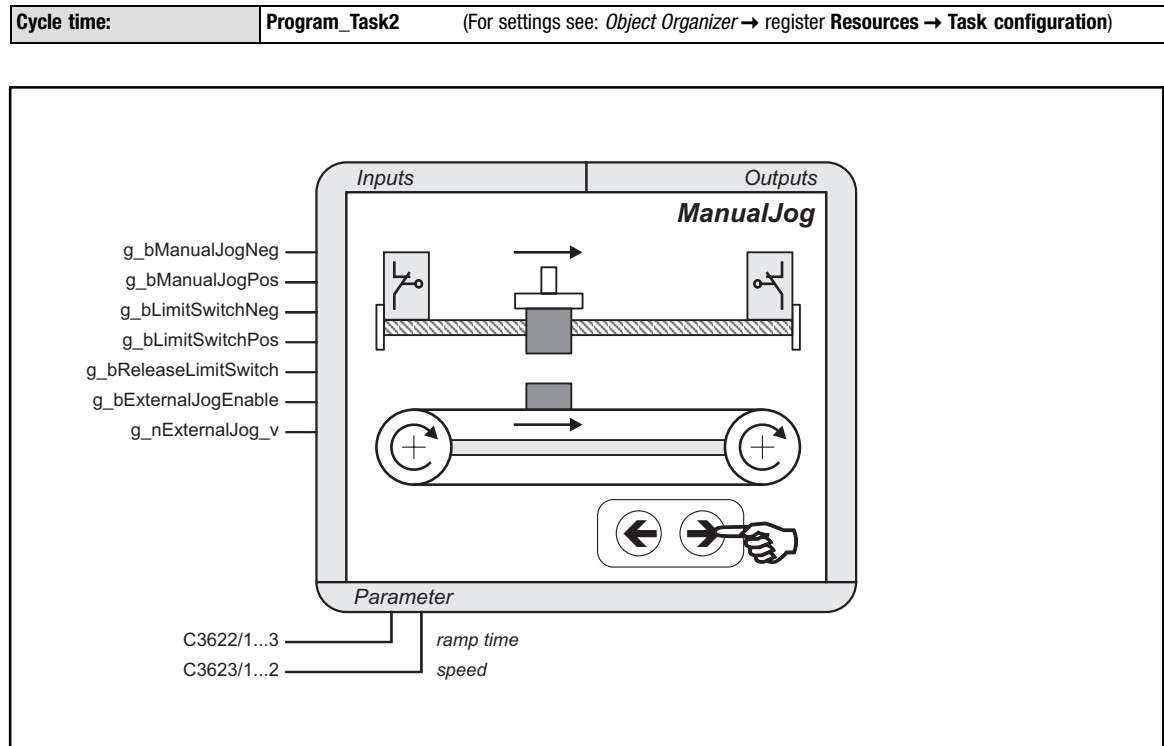
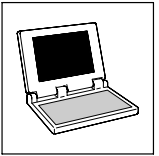


Fig. 5-16 "ManualJog"function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bManualJogNeg	BOOL	R / W	Manual homing in negative direction (CCW) TRUE Manual homing
g_bManualJogPos	BOOL	R / W	Manual homing in positive direction (CW) TRUE Manual homing
g_bLimitSwitchNeg	BOOL	R / W	Input for limit switch (negative) for "retracting" subfunction FALSE Limit switch reached
g_bLimitSwitchPos	BOOL	R / W	Input for limit switch (positive) for "retracting" subfunction FALSE Limit switch reached
g_bReleaseLimitSwitch	BOOL	R / W	"Retracting" subfunction During retracting, the selections under <i>g_bExternalJogEnable</i> and <i>g_nExternalJog_v</i> are ineffective.
			TRUE Retracting from the activated limit switch in the corresponding clearance direction until the limit switch is released (no longer activated): <i>g_bLimitSwitchPos</i> = TRUE: – Retracting in direction <i>g_bLimitSwitchNeg</i> until <i>g_bLimitSwitchPos</i> = FALSE <i>g_bLimitSwitchNeg</i> = TRUE: – Retracting in direction <i>g_bLimitSwitchPos</i> until <i>g_bLimitSwitchNeg</i> = FALSE



⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bExternalJogEnable	BOOL	R / W	Activation of the external speed selection Only possible if <i>g_bManualJogNeg</i> and <i>g_bManualJogPos</i> are set to FALSE.
			<table><tr><td>TRUE</td><td>External speed selection via <i>g_nExternalJog_v</i> activated.</td></tr></table>
TRUE	External speed selection via <i>g_nExternalJog_v</i> activated.		
g_nExternalJog_v	Integer	R / W	External speed selection in [inc/ms]

Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings
C3622	1	R / W	Acceleration/deceleration ramps	
			• Referred to 4000 rpm	
			Deceleration ramp for immediate stop	
	0.01		{0.01 unit} 129.99 5.00 s	
	Acceleration/deceleration ramp for normal operation (here no function)			
	2		0.01	{0.01 unit} 129.99 5.00 s
			Acceleration/deceleration ramp for manual homing	
3	0.01	{0.01 unit} 129.99 5.00 s		
C3623	1	R / W	Manual homing speed	
			In positive direction (CW)	
			0	{1 unit} 15000 200 rpm
	In negative direction (CCW)			
	2		0	{1 unit} 15000 200 rpm

Retracting of Limit switches

Set g_bReleaseLimitSwitch to TRUE to retract from an activated limit switch.

The drive then traverses in the corresponding clearance direction until the limit switch is deactivated.

- For g_bLimitSwitchPos = FALSE:
Retracting in direction g_bLimitSwitchNeg until g_bLimitSwitchPos = TRUE.
- For g_bLimitSwitchNeg = TRUE:
Retracting in direction g_bLimitSwitchPos until g_bLimitSwitchNeg = FALSE.

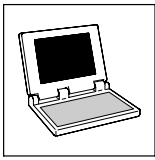


Note!

Retracting from a limit switch is only possible if the limit switch is activated.

- When approaching a limit switch therefore ensure that the tripping mechanism of the limit switch will not be "overrun", e.g. through an excessive mass or drive so that the limit switch will be activated.
- The other limit switch must not be activated.

If an activated limit switch is approached a second time, the template changes to "Trouble"!



Template Cam

Functions

"ManualJog" function - override manual control/inching mode

External speed selection for manual control

Set *g_bExternalJogEnable* to TRUE to activate the external speed selection. The drive follows the external speed selection *g_nExternalJog_v*.

- The ramps selected under C3622/3 are deactivated and the ramp functions have to be externally selected.
- The limit switch monitoring remains activated.
- If a limit switch is activated you can choose between the following options to retract from the limit switch:
 - External setpoint selection in reverse direction and error acknowledgement.
 - Deactivation of the external setpoint selection (*g_bExternalJogEnable* = FALSE) and manual homing in reverse direction.
 - Deactivation of the external setpoint selection (*g_bExternalJogEnable* = FALSE) and activation of the "Retracting" subfunction (*g_bReleaseLimitSwitch* = TRUE).

Manual homing with activated external speed selection

If manual homing in negative direction (*g_bManualJogNeg* = TRUE) or positive direction (*g_bManualJogPos* = TRUE) is activated while the external speed selection (*g_bExternalJogEnable* = TRUE) is activated, the drive accelerates/decelerates along the ramp selected under C3622/3 to the manual homing speed selected under C3623/x.

- If manual homing is deactivated again, the drive accelerates/decelerates along the ramp selected under C3622/2 for normal operation to the external speed selection:

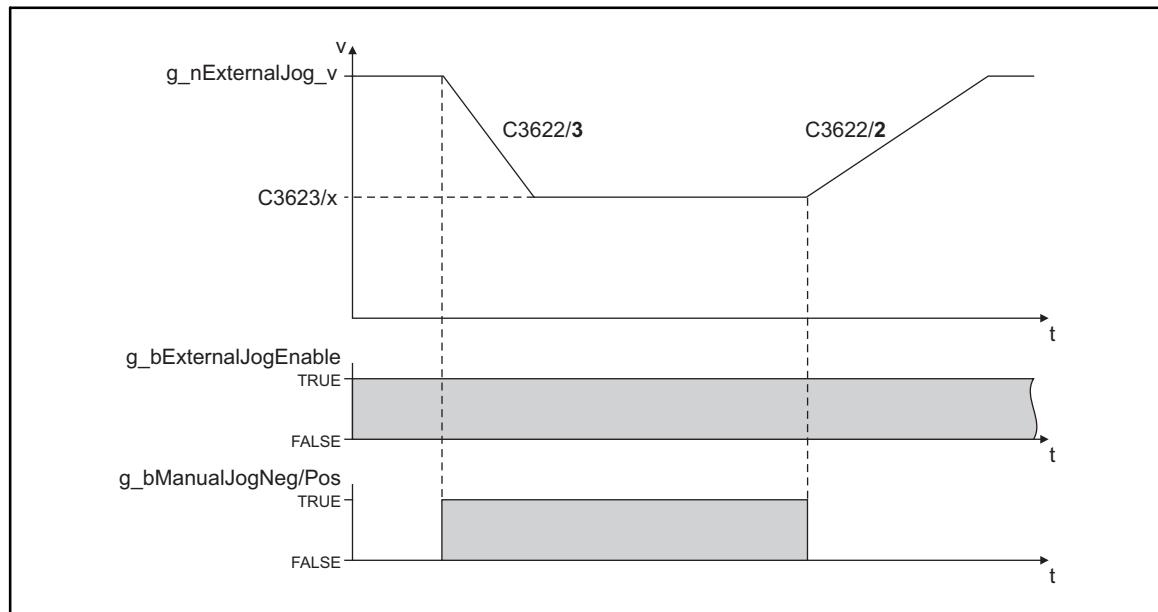
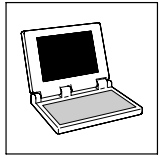


Fig. 5-17

Manual homing speed and states



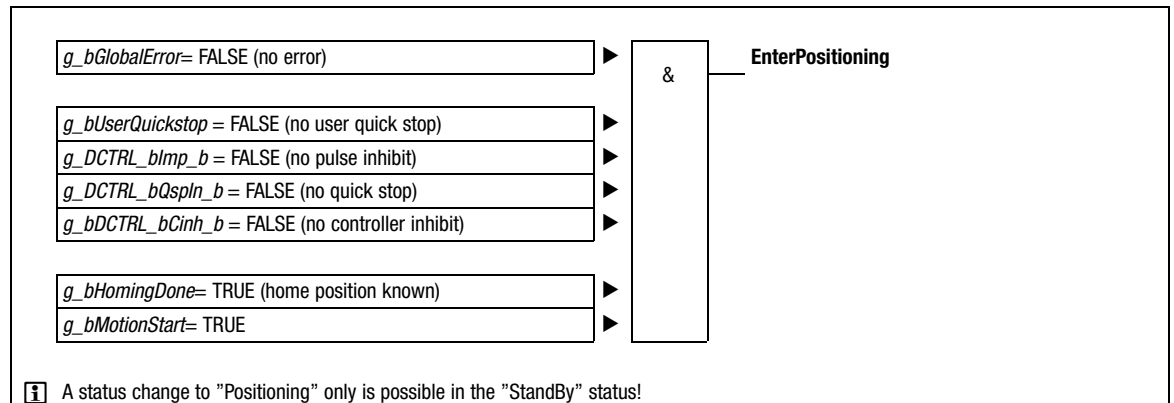
5.6 "Positioning" status

In the "Positioning" status, you can guide the drive to a defined position, e. g. for maintenance works on the tool in a manner that is separated from the motion profile. Afterwards the drive can be lead back to the motion profile.

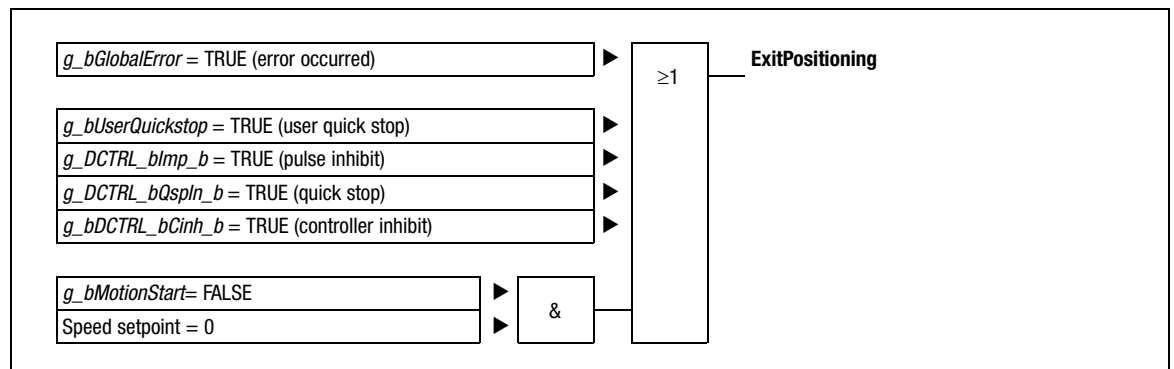
The following function is used for positioning:

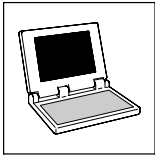
Function	Information
Positioning	Positioning the drive separated from the motion profile 5-28

Condition (transition) for a status change to "Positioning"



Condition (transition) for changing back to "StandBy"





Template Cam

Functions

"Positioning" function - override positioning

5.6.1 "Positioning" function - override positioning

Use "Positioning" to traverse the drive unlocked from the cam (or motion) profile to a selected position, for instance, for tool maintenance. After maintenance, the drive can be re-locked to the motion profile.

Cycle time:	Program_Task2	(For settings see: <i>Object Organizer</i> → register Resources → Task configuration)
--------------------	----------------------	--

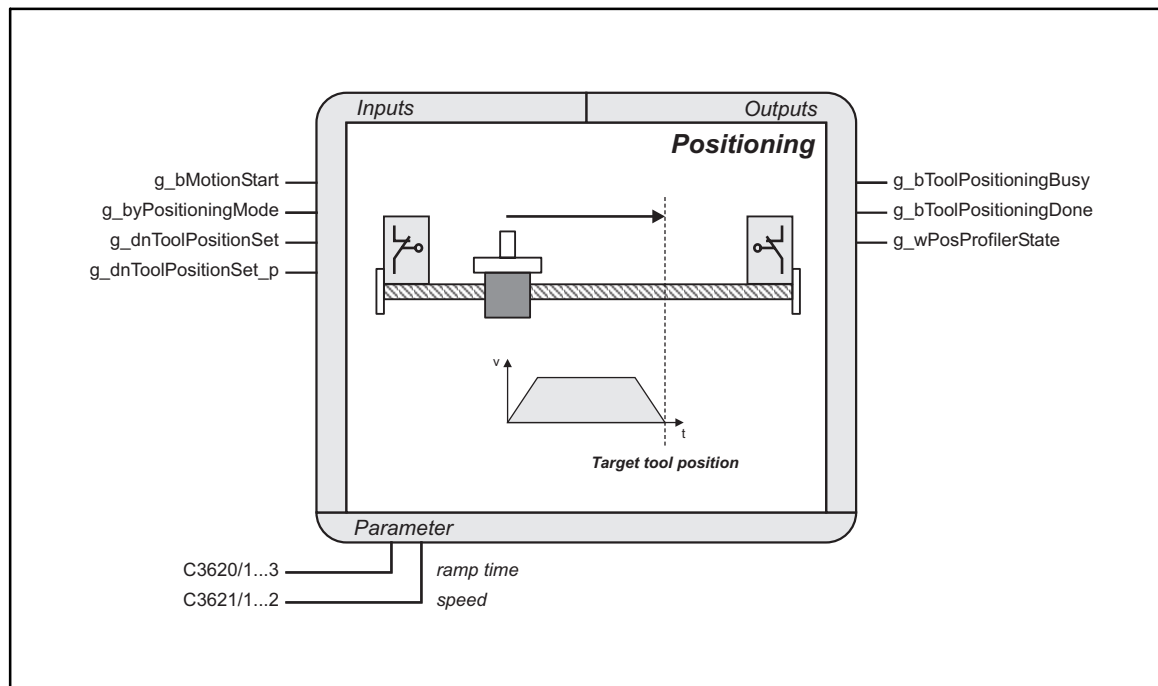
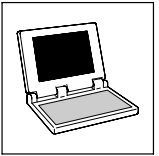


Fig. 5-18 "Positioning"function

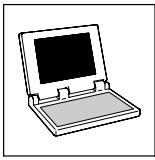
⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bMotionStart	BOOL	R / W	Execute positioning
			TRUE The drive traverses along the selected ramps at the selected speed to the target position <i>g_dnToolPositionSet_p</i> .
			FALSE Positioning is interrupted.
g_byPositioningMode	Byte	R / W	Positioning mode
			0 The shortest distance is used to approach the target position.
			1 The target position is approached in positive direction (CW).
			2 The target position is approached in negative direction (CCW).
			3 Reserved for "PosToCam" template function.
			4 Relative positioning via <i>g_dnToolPositionSet_p</i> .
g_dnToolPositionSet	Double integer	R / W	Target position in [unit] - Referred to machine zero. - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See information at the end of the table.) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!



⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_dnToolPositionSet_p	Double integer	R / W	Target position in [inc] - Referred to machine zero. - If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!
Information: Conversion from [unit] into [inc]: If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]: $\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$ - The conversion takes approx. 50 ms (depending on the size of the user program). It will only be carried out if the value of the input variable has changed. - For time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies. - Use the <i>Project settings</i> dialog box in the CamDesigner to select the settings for feed constant and gearbox factors.			

Outputs ⇨				
Identifiers	Data type	Access	Value/meaning	
g_bToolPositioningBusy	BOOL	R	Status signal "Positioning" is carried out	
			TRUE	Positioning is executed.
g_bToolPositioningDone	BOOL	R	Status signal "Target position reached"	
			TRUE	Target position <i>g_dnToolPositionSet_p</i> has been reached.
g_wPosProfilerState	WORD	R	Positioning status	
			0	≡ <i>NoAction</i> No action.
			1	≡ <i>PositioningDone</i> Target position <i>g_dnToolPositionSet_p</i> has been reached.
			13	≡ <i>PositioningBusy</i> Positioning is executed.
			14	≡ <i>PositioningToCamBusy</i> Positioning to profile position.
			102	≡ <i>AbortIsActive</i> Positioning is cancelled.

Parameters				
Code	Data type	Access	Information	
Subcode			Possible settings	Presetting
C3620		R / W	Acceleration/deceleration ramps Referred to 4000 rpm	
1			Deceleration ramp for immediate stop (cancellation of the function)	
			0.01 {0.01 unit} 129.99	5.00 s
2			Acceleration ramp for positioning	
			0.01 {0.01 unit} 129.99	5.00 s
3			Deceleration ramp for positioning	
			0.01 {0.01 unit} 129.99	5.00 s
C3621		R / W	Positioning speed	
1			In positive direction (CW)	
			0 {1 unit} 15000	200 rpm
2			In negative direction (CCW)	
			0 {1 unit} 15000	200 rpm

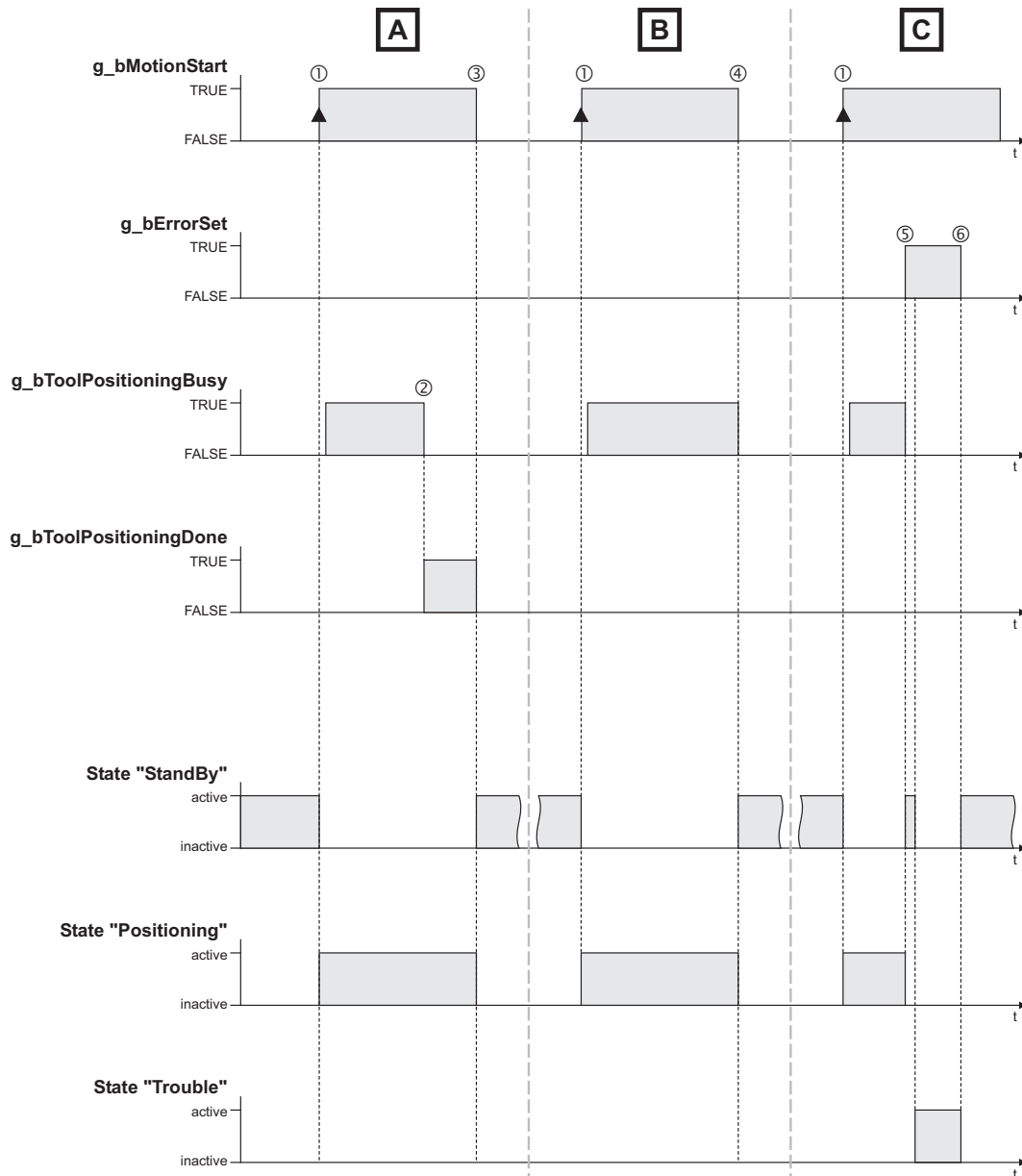


Template Cam

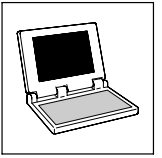
Functions

"Positioning" function - override positioning

Response of the function



Information		Status change
A Correct execution of the function		
①	Status change to "Positioning" (signal evaluation of <i>g_bMotionStart</i>).	StandBy → Positioning
②	Positioning has been completed and the target position has been reached (<i>g_bToolPositioningDone</i> = TRUE).	
③	Positioning is normally completed (level evaluation of <i>g_bMotionStart</i>).	Positioning → StandBy
B Cancellation of the function		
①	Status change to "Positioning" (signal evaluation of <i>g_bMotionStart</i>).	StandBy → Positioning
④	Positioning is cancelled before the target position has been reached.	Positioning → StandBy
C Fault scenario		
①	Status change to "Positioning" (signal evaluation of <i>g_bMotionStart</i>).	StandBy → Positioning
⑤	An error occurred, the positioning program changes to "Trouble".	Positioning → StandBy → Trouble
⑥	If the error is acknowledged, the positioning program changes back to "StandBy".	Trouble → StandBy



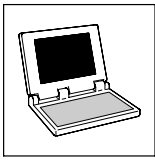
Example: relative positioning when using feed axes

A feed axis with a cycle length of 360 [s-units] is to be positioned by 380 [s-units] in a relative forward direction.

1. Set *g_bCircularAxis* = TRUE (presetting for a feed axis).
2. Set the relative positioning by means of *g_byPositioningMode* = 4.

Further positioning is not carried out by the set traverse path, but only by the remaining traverse path relating to a cycle length.

The amount of the preselected traverse path (*g_dnToolPositionSet* = 380 [s-units]) is greater than the amount of the cycle length (360 [s-units]). As the cycle length is considered, traversing only is effected by 20 [s-units].



Template Cam

Functions

"Cam" status

5.7 "Cam" status

The following functions are available in the "Cam" status:

Function	Information	
PosToCam	Reposition unlocked drive to feed profile	📖 5-34

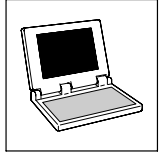


Note!

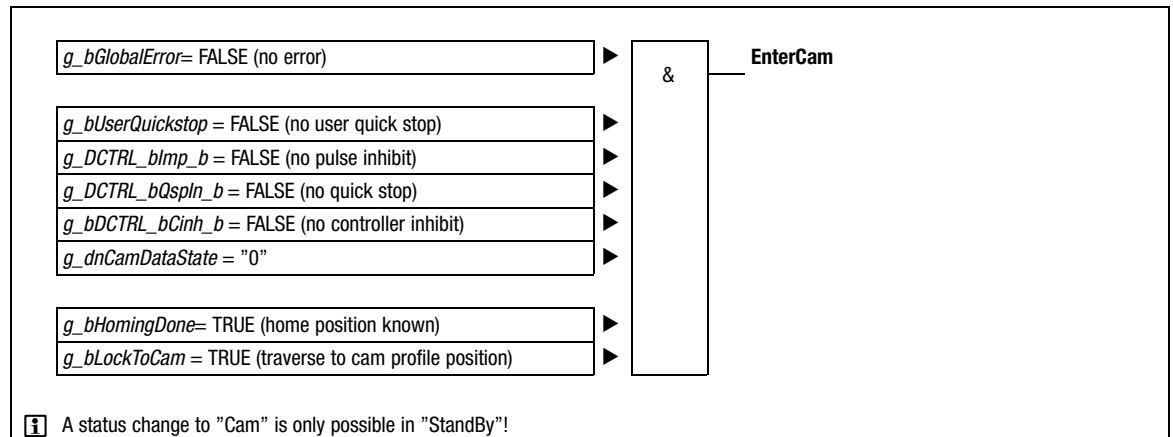
The following "cam profiler" functions are **always** executed as a parallel process to the status machine, but only influence the motor control in "Cam"!

- The functions are calculated in the same time interval (**Program_Task1**).
- The master angle only has to be interpolated if an external position signal is selected for the x axis in a greater time interval, e. g. via the system bus (CAN).
(See **L_CamExtrapolate** FB of the **LenzeCamControl1Vxxx.lib**)
- function library

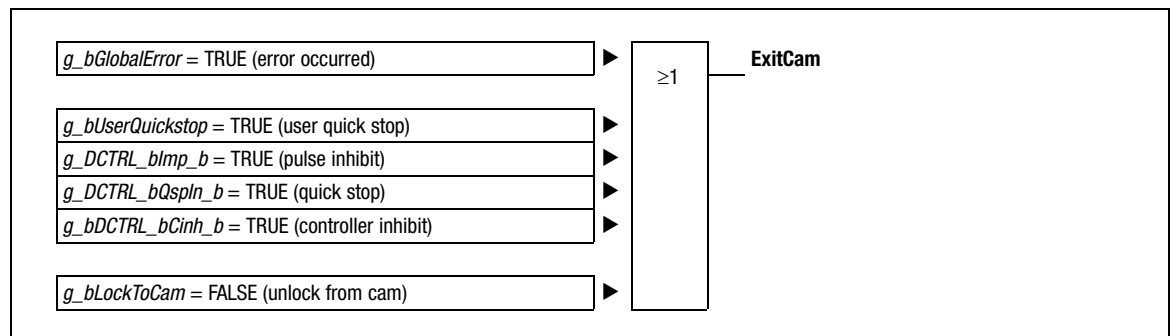
Function	Information	
CamControl	Setpoint conditioning and following error calculation	📖 5-41
CamBasicOperation	Selection of the motion profile	📖 5-45
PosToCam	Reposition unlocked drive to feed profile	📖 5-34
TorquePrecontrol	Torque precontrol	📖 5-48
VertShaftExtPosition	Vertical shaft (slave): acceptance of an external master value (master angle)	📖 5-58
VertShaftExtVelocity	Vertical shaft (slave): acceptance of an external master value (digital frequency)	📖 5-61
VirtualClutchXAxis	Virtual clutch	📖 5-74
VirtualMaster	Vertical shaft: virtual master	📖 5-51
XOffset	Selection of an offset for the master value	📖 5-77
XStretchCompress	Vertical shaft (slave): stretching and compression (digital frequency)	📖 5-67
XTouchProbeSynchronisation	Vertical shaft (slave): cyclic synchronisation of the master value	📖 5-70
YOffset	Selection of an offset for the setpoint	📖 5-81
YStretchCompress	Stretching and compression of the setpoint	📖 5-86
YTouchProbeSynchronisation	Cyclic setpoint synchronisation	📖 5-89



Condition (transition) for a status change to "Cam"



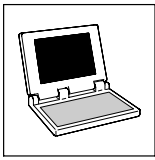
Condition (transition) for changing back to "StandBy"



Tip!

For easy creation, optimisation and transmission of motion profiles, you can use the Lenze engineering tools **CamManager** and **CamDesigner**.

You can use the **Drive PLC Developer Studio** or the **Global Drive Loader** to transfer the created motion profiles together with the PLC program to your PLC (e. g. for the commissioning of production machinery).



Template Cam

Functions

Function "PosToCam" - Reposition unlocked drive to motion profile

5.7.1

Function "PosToCam" - Reposition unlocked drive to motion profile

Use this template function to reposition ("PosToCam") a drive unlocked from the motion profile to the corresponding motion profile position and "lock" it to the cam profile ("LockToCam"). The following modes are available:

- Using the shortest distance to reposition the tool to the profile position (for feed motions).
- Repositioning the tool in positive direction to the profile position (only for rotary axes and feed motions).
- Repositioning the tool in negative direction to the profile position (only for rotary axes and feed motions).
- Rotating the virtual cam until profile position and tool position are identical.

When this function has been completed, the drive directly follows the master angle.



Note!

Dynamic synchronisation on a rotating Y axis is not possible with this function! Please ensure that the X axis does not move or that the clutch is not engaged so that the position of the Y axis does not change.

Cycle time:	Program_Task2	(For settings see: <i>Object Organizer</i> → register Resources → Task configuration)
-------------	---------------	--

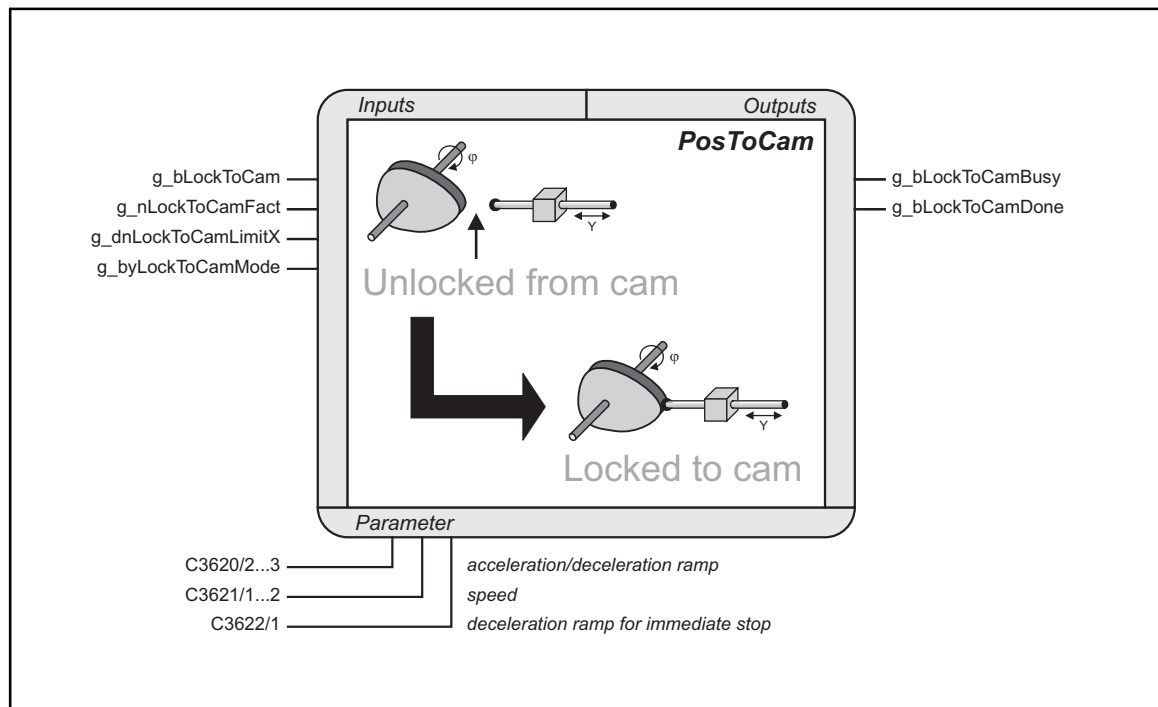
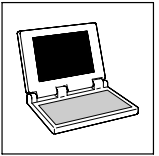


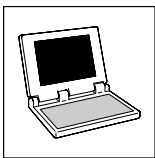
Fig. 5-19

Function "PosToCam"



⇒ Inputs			
Identifiers	Data type	Access	Info/possible settings
g_bLockToCam	Bool	R / W	Activation of "Lock to Cam"
			TRUE The drive is brought back to the corresponding motion profile position.
			TRUE ⇨ FALSE The drive is unlocked from the motion profile and brought to standstill.
g_nLockToCamFact	Integer	R / W	Factor for the $\Delta Y/\Delta X$ ratio (maximum pitch) of the profile. 16384 $\equiv$ 100 % - Presetting: 250 - Only relevant for mode 3
g_dnLockToCamLimitX	Double integer	R / W	Maximum number of increments per cycle necessary to reposition the drive. - Presetting: 300 - Only relevant for mode 3 - Example: $g_dnLockToCamLimitX = 1500$: – A maximum of 1500 increments per cycle are used to reposition the drive to the current tool position.
g_byLockToCamMode	Byte	R / W	Selection of the mode used to reposition the drive to the feed profile.
			0 Using the shortest distance to reposition the drive to the motion profile. This mode must be used for forward/backward profiles.
			1 Repositioning the drive in forward direction to the motion profile. When used for forward/backward profiles, an error message will be displayed. Quick stop (QSP) is set and the status changes to "Trouble".
			2 Repositioning the drive in backward direction to the motion profile. When used for forward/backward profiles, an error message will be displayed. Quick stop (QSP) is set and the status changes to "Trouble".
			3 The motion profile position is adapted to the drive/tool position. - Without motor compensation. $g_nLockToCamFact$ and $g_dnLockToCamLimitX$ have to be selected accordingly. Note: This mode uses the clutch function VirtualClutchXAxis. 5-74

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_bLockToCamBusy	Bool	R	Status signal "Traversing to Y position of motion profile active"
			TRUE The drive traverses to the corresponding motion profile position.
g_bLockToCamDone	Bool	R	Status signal "Y position of motion profile reached"
			TRUE The drive has been "locked" to profile position and directly follows the cam profile via master angle.

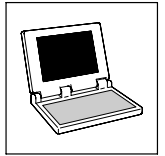


Template Cam

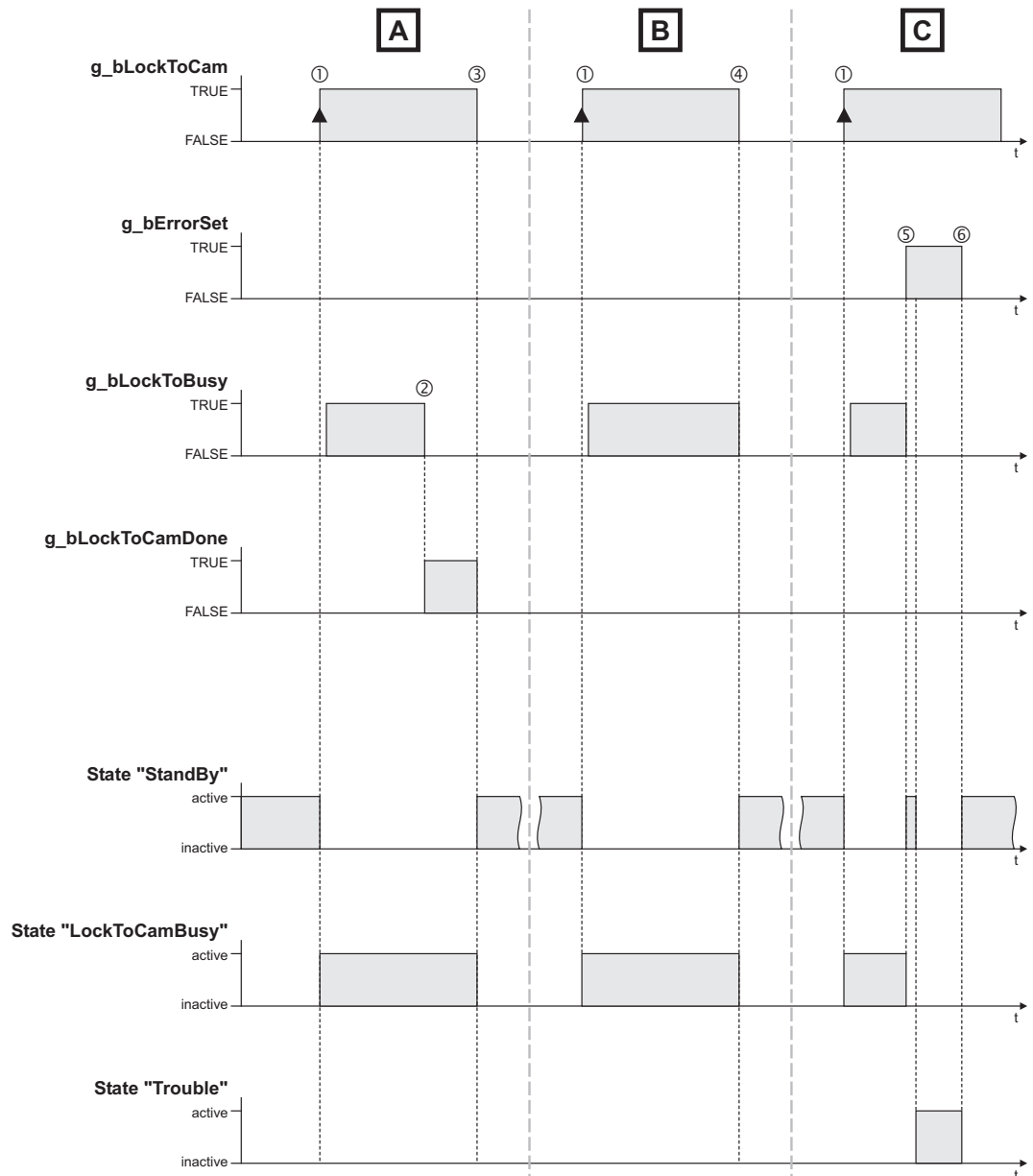
Functions

Function "PosToCam" - Reposition unlocked drive to motion profile

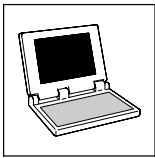
Parameter					
Code	Subcode	Data type	Access	Info	
				Possible settings	Presetting
C3620	2		R / W	Acceleration/deceleration ramps for positioning to profile position	
				• Referred to 4000 rpm	
	Acceleration ramp				
	0.01			{0.01 unit} 129.99 5.00 s	
	Deceleration ramp				
3		0.01	{0.01 unit} 129.99 5.00 s		
C3621	1		R / W	Speed for positioning to profile position	
				In positive direction (CW)	
	0			{1 unit} 15000 200 rpm	
	In negative direction (CCW)				
	2				0
C3622	1		R / W	Deceleration ramp for immediate stop (cancellation of the function)	
				• Referred to 4000 rpm	
				0.01	{0.01 unit} 129.99 5.00 s



Response of the function



Info		Status change
[A] Correct execution of the function		
①	Status change to "Cam" (signal evaluation of <i>g_bLockToCam</i>).	Standby → Cam
②	Positioning has been completed and the target position has been reached (<i>g_bLockToCamDone</i> = TRUE).	
③	PosToCam is normally completed (level evaluation of <i>g_bLockToCam</i>).	Cam → Standby
[B] Cancellation of the function		
①	Status change to "Cam" (signal evaluation of <i>g_bLockToCam</i>).	Standby → Cam
④	PosToCam is cancelled before the target position has been reached.	Cam → Standby
[C] Fault scenario		
①	Status change to "Cam" (signal evaluation of <i>g_bLockToCam</i>).	Standby → Cam
⑤	An error occurred, the positioning program changes to "Trouble".	Cam → Standby → Trouble
⑥	If the error is acknowledged, the positioning program changes back to "StandBy".	Trouble → StandBy



Template Cam

Functions

Function "PosToCam" - Reposition unlocked drive to motion profile

Mode selection

Use *g_byLockToCamMode* to select the mode for repositioning the drive to the feed profile.

The mode must be selected before traversing is activated (*g_bLockToCam* = TRUE) and must not be changed during traversing!

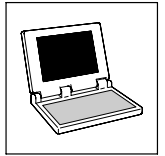
Activating traversing to motion profile

Set *g_bLockToCam* to TRUE to activate traversing to the corresponding feed profile position.



Note!

If traversing to the motion profile is interrupted by resetting *g_bLockToCam* to FALSE, the status changes to "StandBy" and the drive is decelerated along the deceleration ramp selected for immediate stop (C3622/1) to standstill.



Mode 1/2: Lock drive in positive or negative direction

If mode 1 or 2 is selected for a forward/backward profile and the profile position cannot be reached in positive direction, the error message "SwapPositionMode" will be displayed and quick stop (Fail-QSP) activated in the PLC. The template changes to "Trouble".

- Error message acknowledgement requires the selection of a valid motion profile mode.
- Forward/backward profiles have the same start and stop value in Y direction:

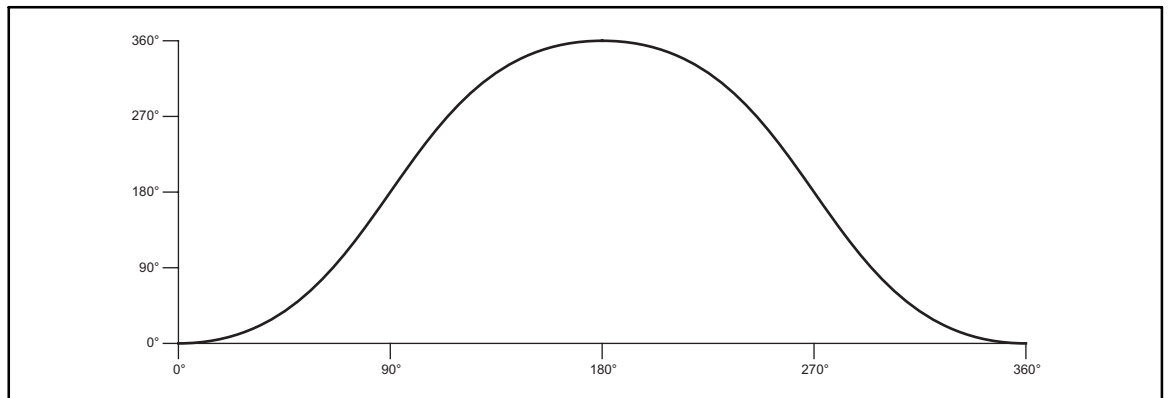


Fig. 5-20

Example: Forward/backward profile ($g_bCircularAxis = FALSE$)

- Feed profiles have a different start and stop value in Y direction:

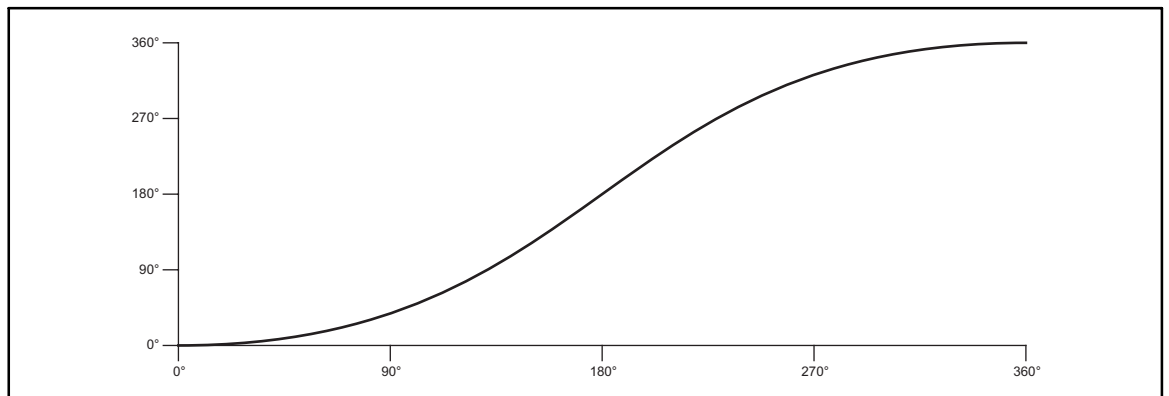
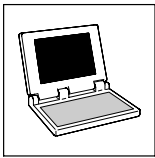


Fig. 5-21

Example: Feed profile ($g_bCircularAxis = TRUE$)



Template Cam

Functions

Function "PosToCam" - Reposition unlocked drive to motion profile

Mode 3: Lock drive by rotating the virtual cam

In mode 3, the drive is locked to the motion profile by rotating the X position, i. e. without compensation of the motor.



Tip!

Mode 3 is suitable for restarting a machine after a machine fault if more than 2 drives of the machine are connected via the vertical shaft. It can be used for feed motions and motions in a limited traversing range.

Functional sequence

If quick stop is used to bring a machine to standstill, the rigid network of drives is deactivated and the tool position no longer corresponds to the profile position.

Functional sequence for "on-the-fly synchronisation":

1. The network of drives is automatically deactivated.
 - For this, the inputs *g_bClutchXClose*, *g_bClutchXEnable* and *g_bClutchXOpenInstant* of the template function **VirtualClutchXAxis** are directly controlled by this template function and must not be written by the user.
 - The execution of the template function **VirtualClutchXAxis** may take some time, depending on the distance between profile and tool position.
2. If profile and tool position are identical, "LockToCamDone" will be displayed and the inputs of the template function **VirtualClutchXAxis** will be set as follows:
 - *g_bClutchXClose* = FALSE
 - *g_bClutchXEnable* = TRUE
 - *g_bClutchXOpenInstant* = FALSE
3. Start the vertical shaft and set *g_bClutchXClose* to TRUE to start "on-the-fly synchronisation".
 - The drive synchronises in the current process.

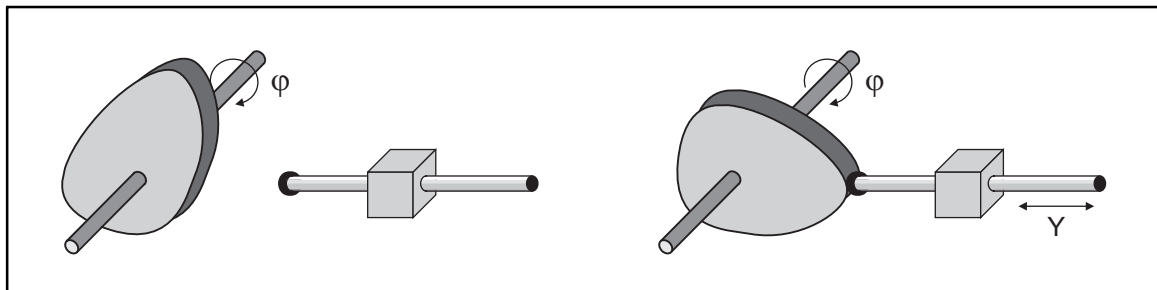


Fig. 5-22

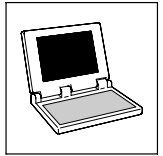
Schematic: "On-the-fly synchronisation"



Note!

The process can be accelerated or decelerated by changing the presets at *g_nLockToCamFact* and *g_dnLockToCamLimitX*.

Please observe that wrong settings can lead to an overshooting of the controller as a result of which it may not be possible to complete the function correctly!



5.7.2 "CamControl" function - setpoint conditioning & following error calculation

Use this template function for setpoint conditioning and the calculation of the following error for the transfer to the motor control (MCTRL).

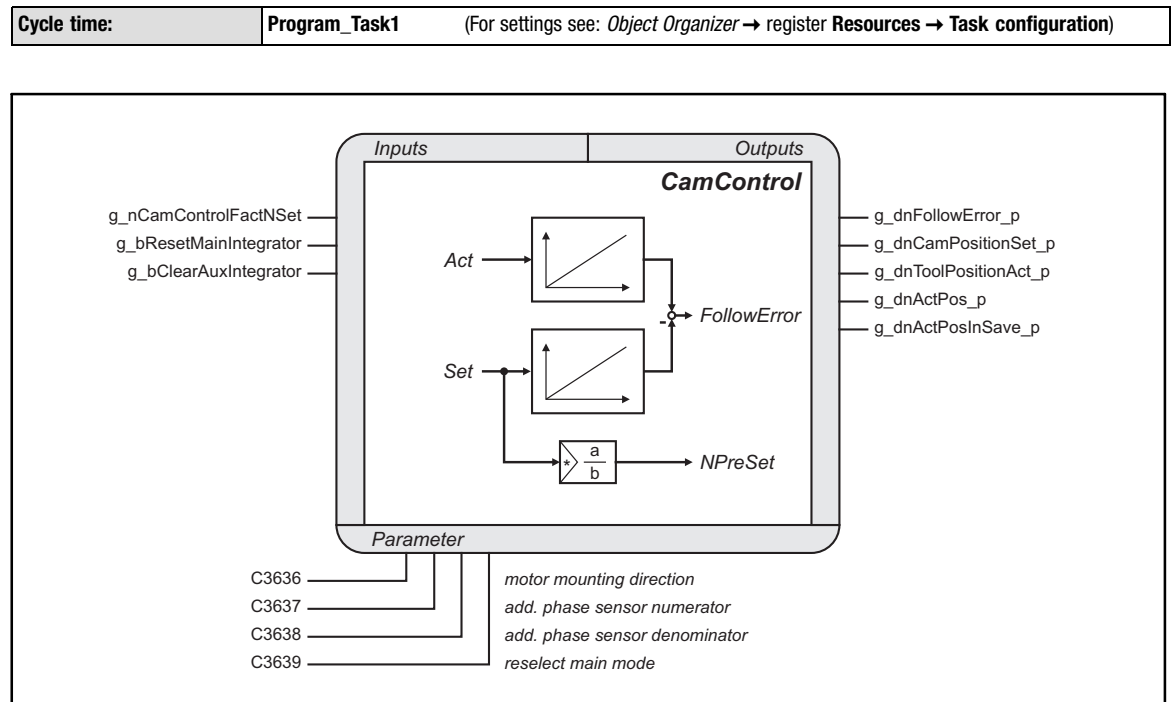
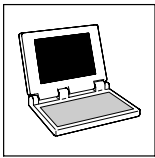


Fig. 5-23 "CamControl" function

⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
g_nCamControlFactNSet	Integer	R / W	Scaling factor for speed precontrol value The variable is assigned to <i>g_MCTRL_nNmaxC11</i> (POU UserProcessInput, network 2).	
g_bResetMainIntegrator	BOOL	R / W	Set profile position to actual value or zero position	
			TRUE	Profile position is set to actual position or zero position. Note: Please observe the dependence on code C3639.
g_bClearAuxIntegrator	BOOL	R / W	Set tool position to "0" or delete tool position Only possible, if the template is not in status CamOperation.	
			TRUE	Tool position and actual position are set to "0".

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_dnFollowError_p	Double integer	R	Following error or position difference in [inc] Transferred as setpoint to the position controller.
g_dnCamPositionSet_p	Double integer	R	Position setpoint of the motion profile in [inc]
g_dnToolPositionAct_p	Double integer	R	Calculated tool position in [inc]
g_dnActPos_p	Double integer	R	Relative actual position in [inc], i.e. within the Y motion profile Position is saved with mains failure protection and will be available after a new download.
g_dnActPosInSave_p	Double integer	R	Absolute actual position in [inc] Position is saved with mains failure protection and will be available after a new download.



Template Cam

Functions

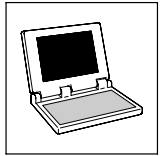
"CamControl" function - setpoint conditioning & following error calculation

Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C3636		BOOL	R / W	Selection of the direction of motor mounting
				• View on motor flange
				0 Motor and rotate tool in the same direction. 0
				1 Motor and tool rotate in opposite directions.
C3637		Integer	R / W	Factor (numerator) for additional position feedback adaptation
				-32767 {1} 32767 0
C3638		WORD	R / W	Factor (denominator) for additional position feedback adaptation
				1 {1} 32767 1
C3639		BOOL	R / W	Mode for response if <i>g_bResetMainIntegrator</i> = TRUE
				0 Sets main integrator to actual value. 0
				1 Sets main integrator to "0".



Tip!

Position setpoints and actual positions are output as increments for transfer to the motor control. You can use the **L_CamGetPosition** FB of the **LenzeCamControl1Vxxx.lib** function library to convert the values into physical units.



Changing the mounting direction

In compact machinery it is possible to change the direction of motor mounting. Under C3636, the direction of motor mounting can be inverted to obtain a "positive view" on the direction of the machine.

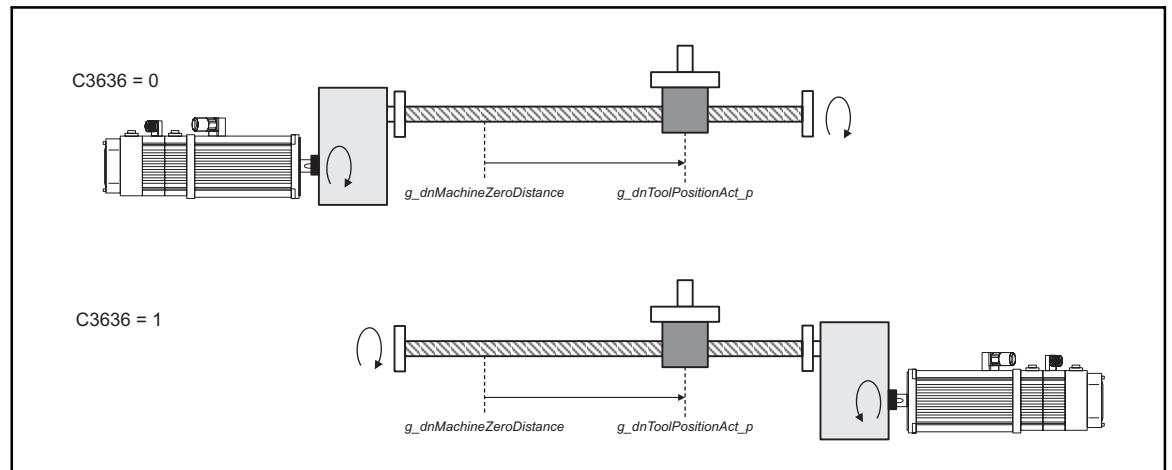


Fig. 5-24

Change of the direction of motor mounting

With C3636 = 0 (presetting), motor and tool rotate in the same direction with view on the motor flange.

Influence on the speed precontrol

The speed precontrol value results from the current speed setpoint ($g_nCamVelocitySet_v$) and is sent as analog value or percentage to the motor control.

Via $g_nCamControlFactNSet$ it is possible to influence the scaling of the value:

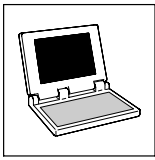
$$g_MCTRL_nNSet_a = \frac{g_nCamVelocitySet_v \cdot 15000}{g_nCamControlFactNSet [rpm]}$$



Tip!

In the POU **UserProcessInput** (network 2), the variable $g_nCamControlFactNSet$ receives the nominal motor speed in rpm from the system variable $g_MCTRL_nNmaxC11$.

This combination can be modified.



Template Cam

Functions

"CamControl" function - setpoint conditioning & following error calculation

Separate feedback for speed and position control

For slipping material, an additional sensor can be used to detect the position of the tool or material.

- Select the corresponding feedback system under C0490:

Code	LCD	Possible settings		Information
		Lenze	Selection	
[C0490]	Feedback pos	0		Feedback system for position controller
		0	Resolver on X7	
		1	Encoder TTL on X8	
		2	Sin/cos encoder on X8	
		3	Absolute value encoder ST on X8	
		4	Absolute value encoder MT on X8	

Use C3637 and C3638 to select the factor for the adaptation of the additional position feedback. The factor results from the machine constants:

$$\frac{C3637}{C3638} = \frac{vk2}{vk1} \cdot \frac{i1}{i2}$$

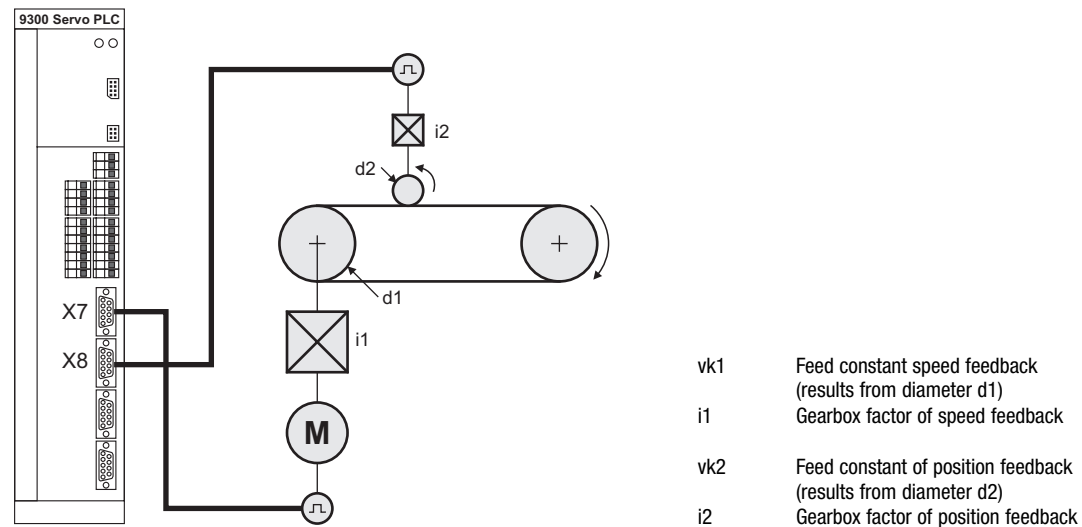


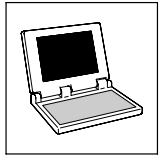
Fig. 5-25

Feedback system for speed and position control



Note!

When the **CamDesigner/CamLoader** is used to create the motion profile, only use the machine constants of the position sensor for the separate feedback and enter them as machine constants (vk2 and i2) in the *Project Settings* dialog box for the slave!



5.7.3 "CamBasicOperation" function - selection of the motion profile

Use this template function to preselect the motion profile which will be activated when the vertical shaft crosses zero.

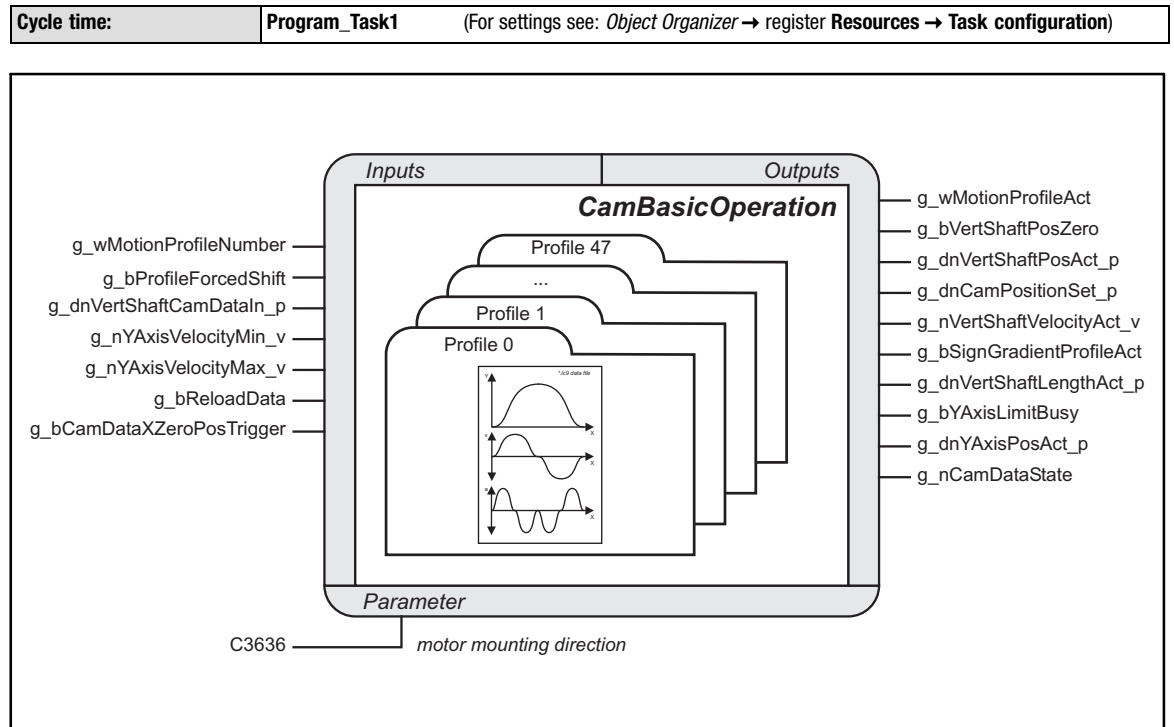
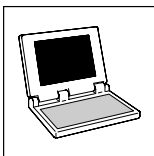


Fig. 5-26

"CamBasicOperation" function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_wMotionProfileNumber	WORD	R / W	Selection of the motion profile - Profile processing starts during zero crossing of the vertical shaft. - Immediate profile processing can be activated via the input <i>g_bProfileForcedShift</i>. 0 ... 47 Motion profile number (The selection range is limited to the number of motion profiles defined in the *.lcn file.)
g_bProfileForcedShift	BOOL	R / W	Forced changeover of motion profile FALSE → TRUE Forced changeover
g_dnVertShaftCamDataIn_p	Double integer	R / W	Setpoint angle of the vertical shaft in [inc] Internally limited to 0 ... X_{max} of the profile ($X_{max} \leq +2^{31} - 1$)
g_nYAxisVelocityMin_v	Integer	R / W	Minimum speed of Y axis in [inc/ms]
g_nYAxisVelocityMax_v	Integer	R / W	Maximum speed of Y axis in [inc/ms]
g_bReloadData	BOOL	R / W	Reset x axis to start value TRUE The x axis value in the L_CamData FB is reset to the starting value.
g_bCamDataXZeroPosTrigger	BOOL	R / W	Profile data initialisation via L_CamSectionShift FB If the L_CamSectionShift FB is used, connect this input with the output <i>bXZeroPosTrigger</i> of the L_CamSectionShift FB. TRUE Profile data initialisation.



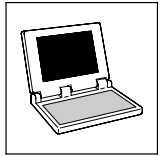
Template Cam

Functions

"CamBasicOperation" function - selection of the motion profile

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_wMotionProfileAct	WORD	R	Number of the current motion profile 0 ... 47 Motion profile number
g_bVertShaftPosZero	BOOL	R	Status signal "Profile zero crossing" TRUE Electrical shaft is crossing zero
g_dnVertShaftPosAct_p	Double integer	R	Actual angle of electrical shaft in [inc]
g_dnCamPositionSet_p	Double integer	R	Setpoint of Y axis in [inc]
g_nVertShaftVelocityAct_v	Integer	R	Current speed of electrical shaft
g_bSignGradientProfileAct	BOOL	R	Sign of the pitch of the current profile FALSE Positive pitch TRUE Negative pitch
g_dnVertShaftLengthAct_p	Double integer	R	X axis length of current profile in [inc]
g_bYAxisLimitBusy	BOOL	R	Status signal "Limitation of Y axis speed active" • Please observe that the motor will not exactly follow the motion profile as long as the limitation is active! TRUE The speed of the Y axis is not within the window defined via g_nYAxisVelocityMin_v and g_nYAxisVelocityMax_v.
g_dnYAxisPosAct_p	Double integer	R	Position of the Y axis • This variable is used for the Y integrator of the L_CamData FB. • The variable is used for the connection of a cam controller.
g_nCamDataState	Integer	R	Status of the L_CamData FB 0 No errors 10 Warning: Profile not available 20 Warning: Master value jump too big

Parameters			
Code	Subcode	Data type	Access
			Information
			Possible settings
			Presetting
C3636		R / W	Motor mounting direction 0 Positive direction of mounting 1 Negative direction of mounting 0



Selection of the motion profile

The motion profile is selected via *g_wMotionProfileNumber*.

- The preselected motion profile is synchronously accepted by all drives when the vertical shaft is crossing zero.
- Profile zero crossing is indicated by TRUE at the output *g_bVertShaftPosZero*.

Forced changeover of the motion profile

- After a FALSE-TRUE edge on the input *g_bProfileForcedShift*, the drives immediately change to the selected motion profile, irrespectively of the position of the electrical shaft.



Stop!

If the profile positions are not identical at the time of changeover, the difference will be compensated at the maximum possible motor torque. This can lead to damage to the machine!

Selection of the master angle

The selection of the master angle is effected via the output *g_dnVertShaftPosSet_p* of the **VirtualMaster** function (5-51).

- The value is internally limited to 0 ... $X_{\max}$ of the motion profile, i.e. if $> X_{\max}$ is selected, $X_{\max}$ will be used internally.
- The setpoint of the Y axis is output at *g_dnCamPositionSet_p*. The value depends on the selected master angle (x axis) and the selected motion profile.

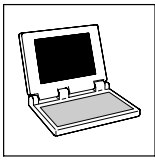


Note!

The master angle can be generated either internally by the virtual master or externally by a real master.

- When a real master is used, you can either select a position (master angle) or a speed (digital frequency).
- When changing between profiles with different x axis lengths, the master angle must only turn in positive direction.

Selection of the master angle (x axis)	<i>g_bVertShaftExtEnable</i>	<i>g_bTypeOfVertShaftExt</i>	Information
Virtual master (internal generation of a master angle)	FALSE	FALSE	VirtualMaster function 5-51
Real master			
Selection of an external master angle (e.g. via system bus)	TRUE	FALSE	VertShaftExtPosition function 5-58
Selection of an external digital frequency (e.g. via incremental encoder signal/SB DFIN)	TRUE	TRUE	VertShaftExtVelocity function 5-61



Template Cam

Functions

"TorquePrecontrol" function - torque precontrol

5.7.4 "TorquePrecontrol" function - torque precontrol

Use this template function for torque precontrol. Torque precontrol consists of acceleration precontrol and external torque precontrol.

- The acceleration profile is calculated in the **CamDesigner/CamLoader**.
- The external torque pre-control value is selected by the user.
- The resulting precontrol value is directly added to the torque controller.

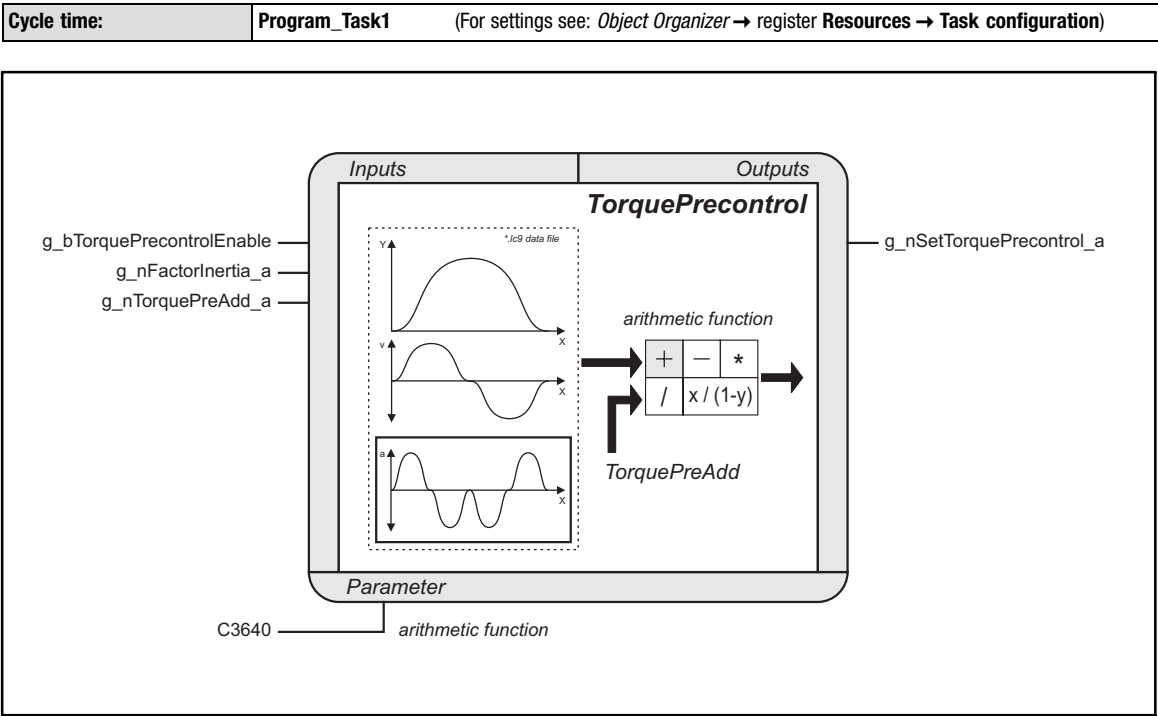
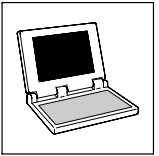


Fig. 5-27 "TorquePrecontrol" function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bTorquePrecontrolEnable	BOOL	R / W	Activation of acceleration precontrol The external torque precontrol remains activated even if the acceleration precontrol is deactivated. TRUE Acceleration precontrol activated.
g_nFactorInertia_a	Integer	R / W	Factor for adapting the precontrol value to the moment of inertia of the drive - Value range: -32767 ... 32767 16384 ≙ 100 %
g_nTorquePreAdd_a	Integer	R / W	External torque precontrol Remains activated, even if the acceleration precontrol is deactivated.

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_nSetTorquePrecontrol_a	Integer	R	Resulting precontrol for torque controller 16384 ≙ 100 %



Parameters						
Code	Subcode	Data type	Access	Information		
				Possible settings	Presetting	
C3640			R / W	Selection of the arithmetical operation		
				• For signal flow see Fig. 5-28		
				0	TorqueOut = TorqueIn1	1
				1	TorqueOut = TorqueIn1 + TorqueIn2	
				2	TorqueOut = TorqueIn1 - TorqueIn2	
				3	$\text{TorqueOut} = \frac{\text{TorqueIn1} \cdot \text{TorqueIn2}}{16384}$	
				4	$\text{TorqueOut} = \frac{\text{TorqueIn1}}{ \text{TorqueIn2} } \cdot 164$	
				5	$\text{TorqueOut} = \frac{\text{TorqueIn1}}{16384 - \text{TorqueIn2}} \cdot 16384$	

Arithmetic operation

Under C3640 you can select how the acceleration torque precontrol and the external torque precontrol values are to be combined arithmetically.

In the default setting, "Addition" is selected as arithmetic operation (C3640 = 1).

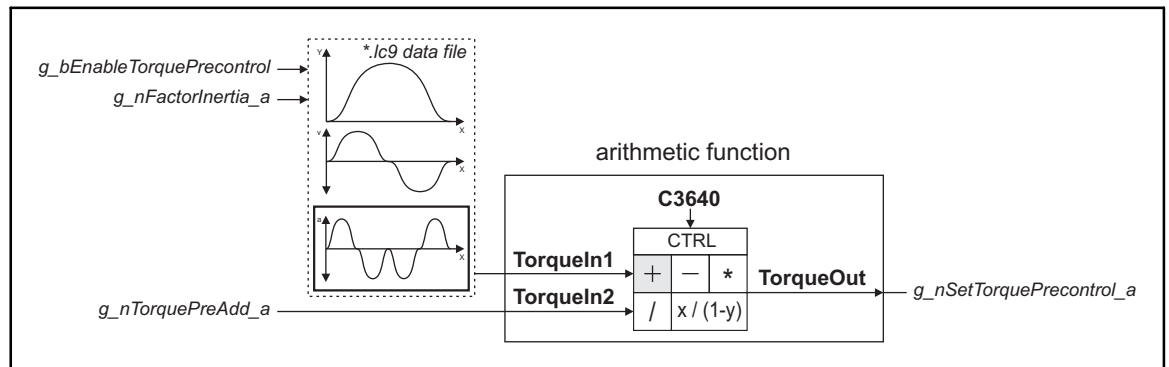


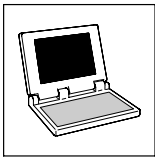
Fig. 5-28

Signal flow of the arithmetical operation



Note!

Please observe that a change of the arithmetic operation to multiplication or division can lead to a phase shift, which can, in turn, lead to vibrations!



Template Cam

Functions

"TorquePrecontrol" function - torque precontrol

Acceleration profile

For each motion profile, a corresponding acceleration profile is stored automatically as a point table within the cam file (*.lc9 file).

Acceleration precontrol

The acceleration precontrol is automatically converted into the machine speed of the line shaft.

- Current number of cycles: *g_nVertShaftVelocityAct_v* in [inc/ms]
- The rated clock pulse number for the individual motion profiles is to be selected in the **CamDesigner/ CamManager/CamLoader** by using the *Project settings master* dialog box (input field **Cycles**).
- Factor *g_nFactorInertia_a*.
The factor (0 ... 199.99 %) for the adaptation to the moment of inertia must be empirically calculated (observe following error).



Tip!

Torque precontrol automatically depends on the stretching/compression of the motion profile.

Activation of acceleration precontrol

Set *g_bTorquePrecontrolEnable* to TRUE to activate acceleration precontrol.

External torque precontrol

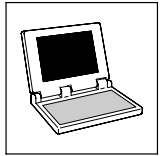
Use the input *g_nTorquePreAdd_a* to select the torque precontrol externally and compensate for

- active loads
- static and dynamic friction
- interferences.



Note!

If the torque precontrol is completely selected externally, ensure that the internal function is deactivated by setting *g_bTorquePrecontrolEnable* to FALSE!



5.7.5 "VirtualMaster" function - virtual master

This template function can be used to generate a master angle for the network of drives, e.g.

- for the commissioning of the machine.
- if no external master signal is used.

The function supports manual homing (inching) and the manual wheel function, which can be used to optimise and check the sequence of motions during commissioning and help to avoid collisions.

Cycle time:	Program_Task1	(For settings see: <i>Object Organizer</i> → register Resources → Task configuration)
-------------	---------------	--

Connection between machine clock pulse and virtual master

Due to the gearbox ratio and the difference between feed constant and x profile length, the required clock pulse number must be converted to the vertical shaft of the master.

The master speed to be selected in the virtual master is calculated as follows:

$$\text{master speed [rpm]} = \text{number of cycles [1/min]} \cdot \frac{\text{x profile length [mm]}}{\text{feed constant [mm]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$$

X profile length/feed constant ratio	
$\frac{\text{x profile length [mm]}}{\text{feed constant [mm]}}$	If x profile length and feed constant are not identical, one revolution of the feed roller does not correspond to a complete clock pulse. A corresponding x profile length (ΔX)/feed constant ($\pi \times d$) ratio must be considered.

Gearbox ratio	
$\frac{\text{gearbox numerator}}{\text{gearbox denominator}}$	If the motor of the master drive rotates by the gearbox ratio faster than the feed roller, a corresponding ratio must be considered.

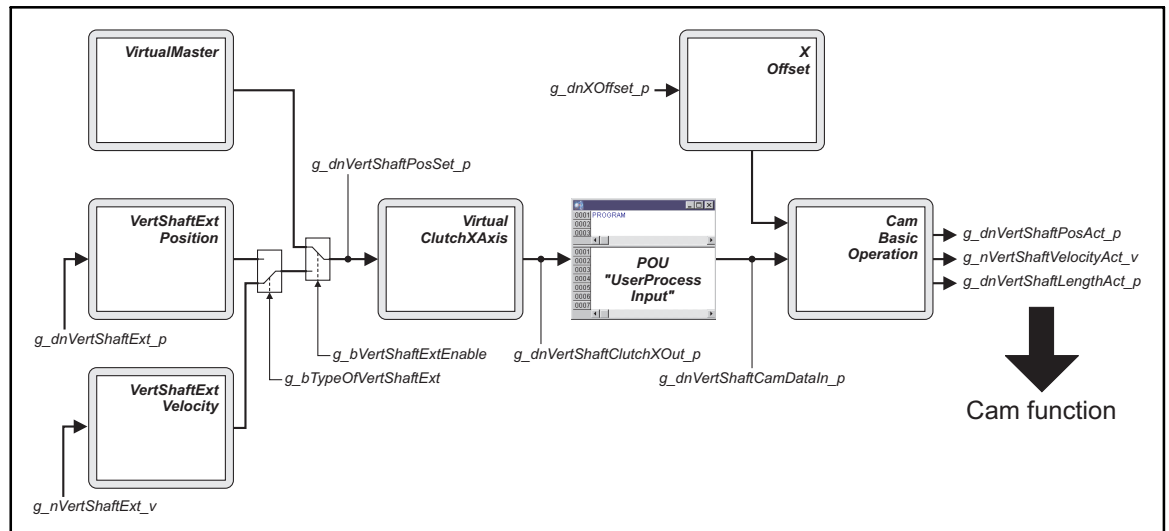
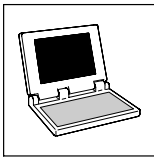


Fig. 5-29 Signal flow for the "VirtualMaster" function



Template Cam

Functions

"VirtualMaster" function - virtual master

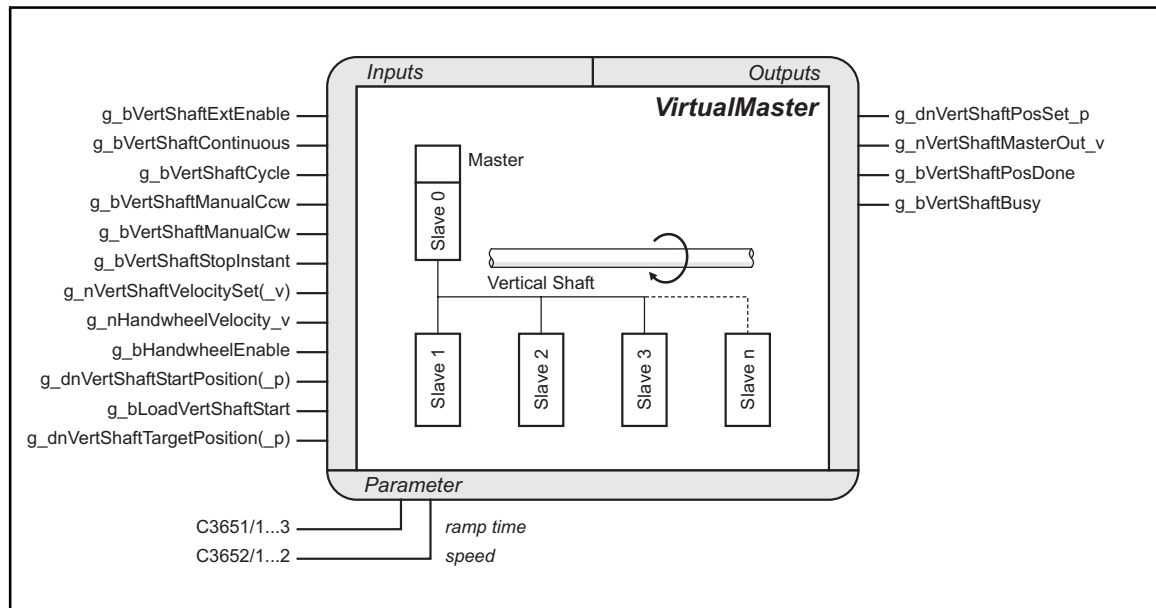
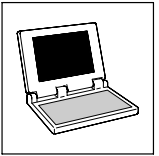


Fig. 5-30

"VirtualMaster" function

⇒ Inputs							
Identifiers	Data type	Access	Information/possible settings				
g_bVertShaftExtEnable	BOOL	R / W	Activation of the external master signal <table><tr><td>FALSE</td><td>X axis is generated by the virtual master.</td></tr><tr><td>TRUE</td><td>X axis is selected externally.</td></tr></table>	FALSE	X axis is generated by the virtual master.	TRUE	X axis is selected externally.
FALSE	X axis is generated by the virtual master.						
TRUE	X axis is selected externally.						
g_bVertShaftContinuous	BOOL	R / W	Continuous operation The acceleration/deceleration ramp is selected under C3651/2. <table><tr><td>FALSE ↗ TRUE</td><td>The x axis is accelerated along the ramp C3651/2 and rotated at the speed selected at <i>g_nVertShaftVelocitySet_v</i>.</td></tr><tr><td>TRUE ↘ FALSE</td><td>The x axis is decelerated along the ramp C3651/2 and led to the target position <i>g_dnVertShaftTargetPosition_p</i>.</td></tr></table>	FALSE ↗ TRUE	The x axis is accelerated along the ramp C3651/2 and rotated at the speed selected at <i>g_nVertShaftVelocitySet_v</i> .	TRUE ↘ FALSE	The x axis is decelerated along the ramp C3651/2 and led to the target position <i>g_dnVertShaftTargetPosition_p</i> .
FALSE ↗ TRUE	The x axis is accelerated along the ramp C3651/2 and rotated at the speed selected at <i>g_nVertShaftVelocitySet_v</i> .						
TRUE ↘ FALSE	The x axis is decelerated along the ramp C3651/2 and led to the target position <i>g_dnVertShaftTargetPosition_p</i> .						
g_bVertShaftCycle	BOOL	R / W	Cyclic operation The acceleration/deceleration ramp is selected under C3651/2. <table><tr><td>FALSE ↗ TRUE</td><td>The x axis is traversed at the speed selected at <i>g_nVertShaftVelocitySet_v</i> until the target position <i>g_dnVertShaftTargetPosition_p</i> is reached.</td></tr></table>	FALSE ↗ TRUE	The x axis is traversed at the speed selected at <i>g_nVertShaftVelocitySet_v</i> until the target position <i>g_dnVertShaftTargetPosition_p</i> is reached.		
FALSE ↗ TRUE	The x axis is traversed at the speed selected at <i>g_nVertShaftVelocitySet_v</i> until the target position <i>g_dnVertShaftTargetPosition_p</i> is reached.						
g_bVertShaftManualCw	BOOL	R / W	Manual homing of the x axis in positive direction (CW) - The acceleration/deceleration ramp is selected under C3651/3. - The traversing speed is selected under C3652/1. <table><tr><td>TRUE</td><td>Manual homing in positive direction</td></tr></table>	TRUE	Manual homing in positive direction		
TRUE	Manual homing in positive direction						
g_bVertShaftManualCcw	BOOL	R / W	Manual homing of the x axis in negative direction (CCW) - The acceleration/deceleration ramp is selected under C3651/3. - The traversing speed is selected under C3652/1. <table><tr><td>TRUE</td><td>Manual homing in negative direction</td></tr></table>	TRUE	Manual homing in negative direction		
TRUE	Manual homing in negative direction						
g_bVertShaftStopInstant	BOOL	R / W	Immediate stop (emergency stop) of the x axis - Cyclic operation, continuous operation and manual operation are interrupted. Exception: The hand wheel function is not interrupted. <table><tr><td>TRUE</td><td>The x axis is decelerated to standstill along the ramp C3651/1.</td></tr></table>	TRUE	The x axis is decelerated to standstill along the ramp C3651/1.		
TRUE	The x axis is decelerated to standstill along the ramp C3651/1.						
g_nVertShaftVelocitySet	Integer	R / W	Speed setpoint of the x axis in [rpm]				
g_nVertShaftVelocitySet_v	Integer	R / W	Speed setpoint of the x axis in [inc/ms]				
g_bHandwheelEnable	BOOL	R / W	Hand wheel function <table><tr><td>TRUE</td><td>The hand wheel function is activated.</td></tr></table>	TRUE	The hand wheel function is activated.		
TRUE	The hand wheel function is activated.						
g_nHandwheelVelocity_v	Integer	R / W	Speed input for hand wheel function				



⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
g_dnVertShaftStartPosition	Double integer	R / W	Start position of the x axis in [m-unit] - Internally limited to 0 ... <i>g_dnVertShaftLengthAct_p</i> - Input in fixed point format with 4 decimal positions (1 [m-unit] ≙ 10000). The value is internally converted into increments. (See conversion info) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!	
g_dnVertShaftStartPosition_p	Double integer	R / W	Start position of the x axis in [inc] - Internally limited to 0 ... <i>g_dnVertShaftLengthAct_p</i> - If you use this input, ensure that the input of the same name for the selection in [m-unit] is not written to avoid inconsistencies!	
g_bLoadVertShaftStart	BOOL	R / W	Accept start position	
			FALSE ↗ TRUE	The starting position at input <i>g_dnVertShaftStartPosition_p</i> is accepted for position output <i>g_dnVertShaftPosSet_p</i> .
			TRUE	The position output <i>g_dnVertShaftPosSet_p</i> is loaded with the starting position.
g_dnVertShaftTargetPosition	Double integer	R / W	Target position for cyclic and continuous operation in [m-unit] - Internally limited to 0 ... <i>g_dnVertShaftLengthAct_p</i> - Input in fixed point format with 4 decimal positions (1 [m-unit] ≙ 10000). The value is internally converted into increments. (See conversion info) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!	
g_dnVertShaftTargetPosition_p	Double integer	R / W	Target position for cyclic and continuous operation in [inc] - Internally limited to 0 ... <i>g_dnVertShaftLengthAct_p</i> - If you use this input, ensure that the input of the same name for the selection in [m-unit] is not written to avoid inconsistencies!	
Information: Conversion from [unit] into [inc]: If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]: $\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$ - The conversion takes approx. 50 ms (depending on the size of the user program). It will only be carried out if the value of the input variable has changed. - For time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies. - Use the <i>Project settings</i> dialog box in the CamDesigner/CamLoader to select the settings for feed constant and gearbox factors.				



Note!

Depending on the motion profile used on the Y axis, position jumps on the X axis can generate such large position differences that the FBs involved (L_CamData, L_CamSetXAxisVelocity, L_CamSetYAxisVelocity) are no longer able to process the position differences for specific clock cycles.

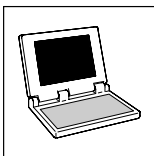
With the template cam in the "LockToCam" status, the resulting template error message "XYPosChangeLimit" will cause the individual system to break away from the axis grouping.

If this error message appears, you will need to reduce the master value speed and then check that the subsequent template variables have the specified values:

- g_nVertShaftExtVelState* = -11
- g_nCamDataState* = 20

To prevent this behaviour:

- Always apply the starting value prior to locking to the cam (*g_bLockToCam* = FALSE).
- Use fewer interpolation points if this phenomenon occurs sporadically during normal operation.



Template Cam

Functions

"VirtualMaster" function - virtual master

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_dnVertShaftPosSet_p	Double integer	R	Position output of vertical shaft Value is sent to the VirtualClutchXAxis clutch function.
g_nVertShaftMasterOut_v	Integer	R	Speed output of vertical shaft - Speed in [inc/ms]. - Can be used for the cam controller setpoint or the following network of drives.
g_bVertShaftPosBusy	BOOL	R	Status signal "Virtual master action is being executed" (Only g_bVertShaftContinuous, g_bVertShaftCycle, g_bVertShaftManualCcw, g_bVertShaftManualCw.)
g_bVertShaftPosDone	BOOL	R	Status signal "Target position reached" The status signal is automatically reset when a new action of the virtual master is started.
			TRUE The x axis has reached the target position g_dnVertShaftTargetPosition_p in cyclic or continuous operation.

Parameters						
Code	Subcode	Data type	Access	Information		
				<table><tr><th>Possible settings</th><th>Presetting</th></tr></table>	Possible settings	Presetting
Possible settings	Presetting					
C3651		R / W	Acceleration/deceleration ramps Referred to 4000 rpm			
	1		Deceleration ramp for immediate stop			
		0.01	{0.01 unit}	129.99 5.00 s		
	2		Acceleration/deceleration ramp for continuous/cyclic operation			
		0.01	{0.01 unit}	129.99 5.00 s		
	3		Acceleration/deceleration ramp for manual homing			
		0.01	{0.01 unit}	129.99 5.00 s		
C3652		R / W	Manual homing speed			
	1		In positive direction (CW)			
		0	{1 unit}	15000 10 rpm		
	2		In negative direction (CCW)			
		0	{1 unit}	15000 10 rpm		

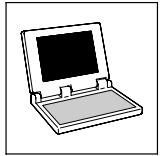
Activating the virtual master

Set *g_bVertShaftExtEnable* to FALSE to deactivate the external selection of the x axis and activate the virtual master.

Positioning to target position

A positioning process to the target position *g_dnVertShaftTargetPosition_p* is carried out in cyclic and continuous operation.

- g_dnVertShaftTargetPosition_p* is read when a new positioning process starts.
- The end of positioning (target position reached) is indicated by TRUE at the output *g_bVertShaftPosDone*. The status signal will be automatically reset to FALSE when a new positioning process is started.



Manual homing (inching mode)

With the hand wheel function the x axis or the network of drives can be manually traversed in positive and negative direction by means of "inching".

- Set *g_bVertShaftManualCw* to TRUE to activate manual homing in positive direction, or set *g_bVertShaftManualCcw* to TRUE to activate manual homing in negative direction.
- The manual homing speed is selected under C3652.
- The acceleration and deceleration ramps for manual homing are selected under C3651/3.

Continuous operation

In continuous operation, the virtual x axis is continuously rotated.

- Set *g_bVertShaftContinuous* to TRUE to activate continuous operation, i.e. the x axis will be accelerated along the ramp C3651/2 to the speed selected at *g_nVertShaftVelocitySet_v* and continuously rotated.
- If you reset *g_bVertShaftContinuous* to FALSE, continuous operation is deactivated, i.e. the x axis will be led along the ramp C3651/2 to the target position *g_dnVertShaftTargetPosition_p*.
- The end of positioning (target position reached) is indicated by TRUE at the output *g_bVertShaftPosDone*. The status signal will be automatically reset to FALSE when a new positioning process is started.

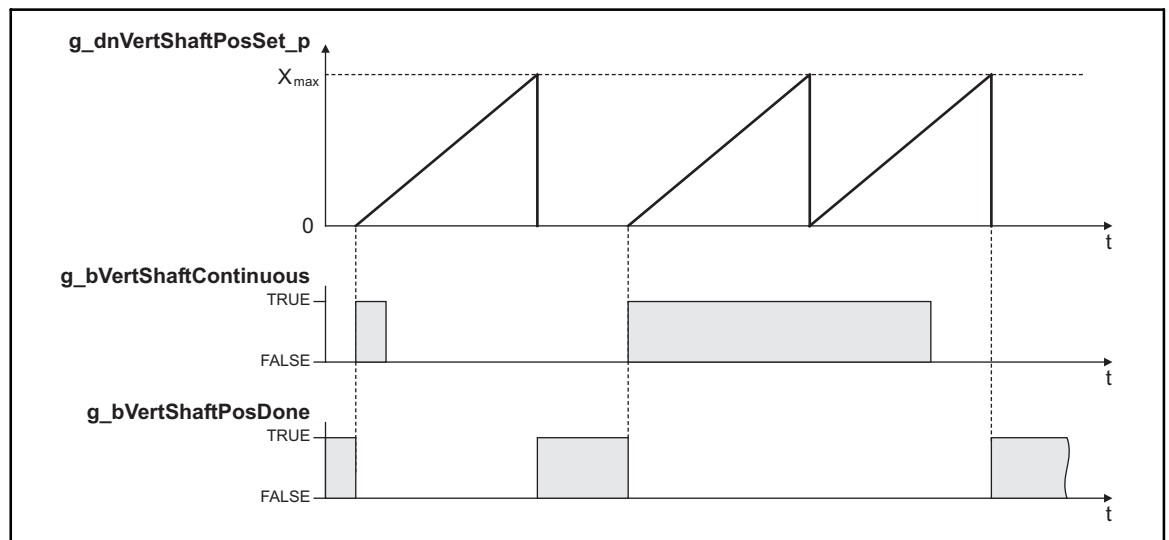


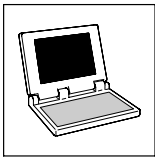
Fig. 5-31

Example: Continuous operation



Note!

When changing between profiles with different x axis lengths, the master angle must only turn in positive direction.



Template Cam

Functions

"VirtualMaster" function - virtual master

Cyclic operation

In cyclic operation, the virtual x axis is maximally traversed for one clock pulse.

- Set *g_bVertShaftCycle* to TRUE to activate the cyclic operation, i.e. the x axis will be accelerated along the ramp C3651/2 to the speed selected at *g_nVertShaftVelocitySet_v* and decelerated along the same ramp to the target position *g_dnVertShaftTargetPosition_p*.
- The end of positioning (target position reached) is indicated by TRUE at the output *g_bVertShaftPosDone*. The status signal will be automatically reset to FALSE when a new positioning process is started.



Tip!

Depending on the selection of the acceleration/deceleration ramp C3651/2 and the distance to be traversed, it may happen that the selected speed *g_nVertShaftVelocitySet_v* will not be reached.

Selection of a starting value

The position output *g_dnVertShaftPosSet_p* of the virtual master can be loaded with the position value before an action.

- The position value between "0" and the maximum clock pulse length *g_dnVertShaftLengthAct_p* is selected via the input *g_dnVertShaftStartPosition_p*.
- A FALSE/TRUE transition at *g_bLoadVertShaftStart* accepts the position value for position output *g_dnVertShaftPosSet_p* and holds it until *g_bLoadVertShaftStart* is reset to FALSE.



Note!

Depending on the motion profile used on the Y axis, position jumps on the X axis can generate such large position differences that the FBs involved (L_CamData, L_CamSetXAxisVelocity, L_CamSetYAxisVelocity) are no longer able to process the position differences for specific clock cycles.

With the template cam in the "LockToCam" status, the resulting template error message "XYPosChangeLimit" will cause the individual system to break away from the axis grouping.

If this error message appears, you will need to reduce the master value speed and then check that the subsequent template variables have the specified values:

- *g_nVertShaftExtVelState* = -11
- *g_nCamDataState* = 20

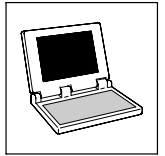
To prevent this behaviour:

- Always apply the starting value prior to locking to the cam (*g_bLockToCam* = FALSE).
- Use fewer interpolation points if this phenomenon occurs sporadically during normal operation.

Hand wheel function

It is recommended to use an incremental encoder at the digital frequency input for the hand wheel function.

- In this case, send the digital frequency input signal *g_DFIN_nIn_v* to the input variable *g_nHandwheelVelocity_v*.
- Set *g_bHandwheelEnable* to TRUE to activate the hand wheel function and deactivate the acceleration/deceleration ramps.



Immediate stop/emergency stop

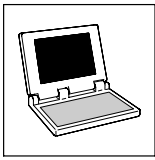
The emergency stop function has the highest priority and interrupts all other functions of the virtual master.

- The emergency stop function is activated by setting *g_bVertShaftStopInstant* to TRUE, i.e. the x axis is decelerated to standstill along the deceleration ramp C3651/1.
- The emergency stop function does not influence the hand wheel function.



Tip!

Ensure that the deceleration ramp for the emergency stop identifier is as short as possible so that the distance continued to be traversed on the x axis will be as short as possible.



Template Cam

Functions

Function "VertShaftExtPosition" - Acceptance of an external master angle

5.7.6

Function "VertShaftExtPosition" - Acceptance of an external master angle

For multi-axis synchronisation it is useful to send the X axis of the master drive as position signal (master angle) to the slave drives. In this way, the absolute signal will be led through the whole machine as "vertical shaft".

This template function can be used to accept and condition the external master angle from the master drive in the slave drives.

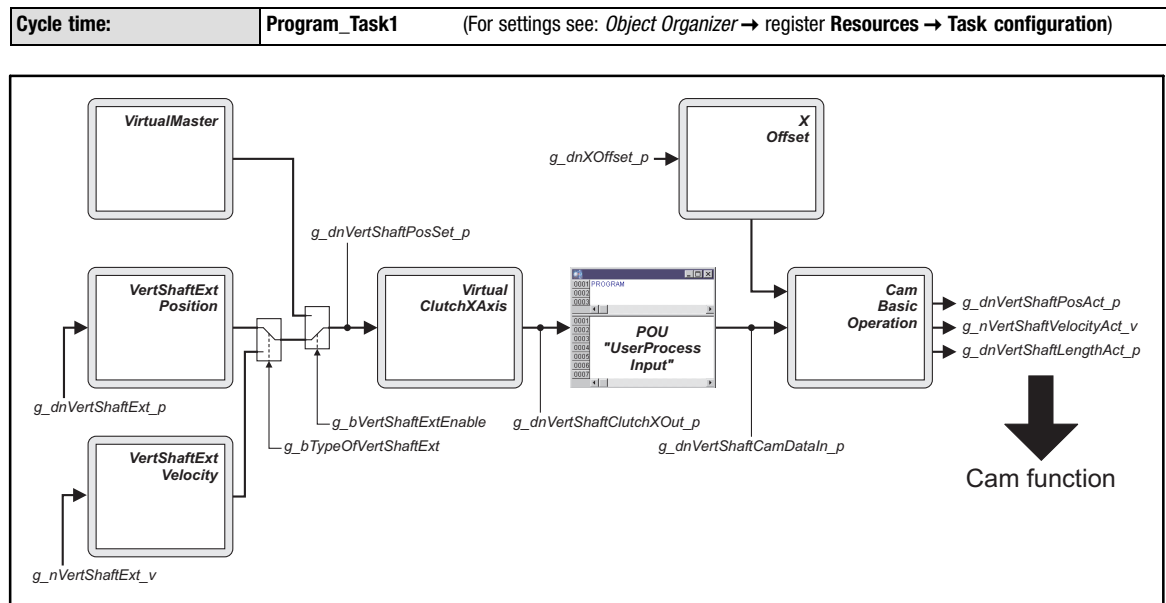


Fig. 5-32

Signal flow for the function "VertShaftExtPosition"

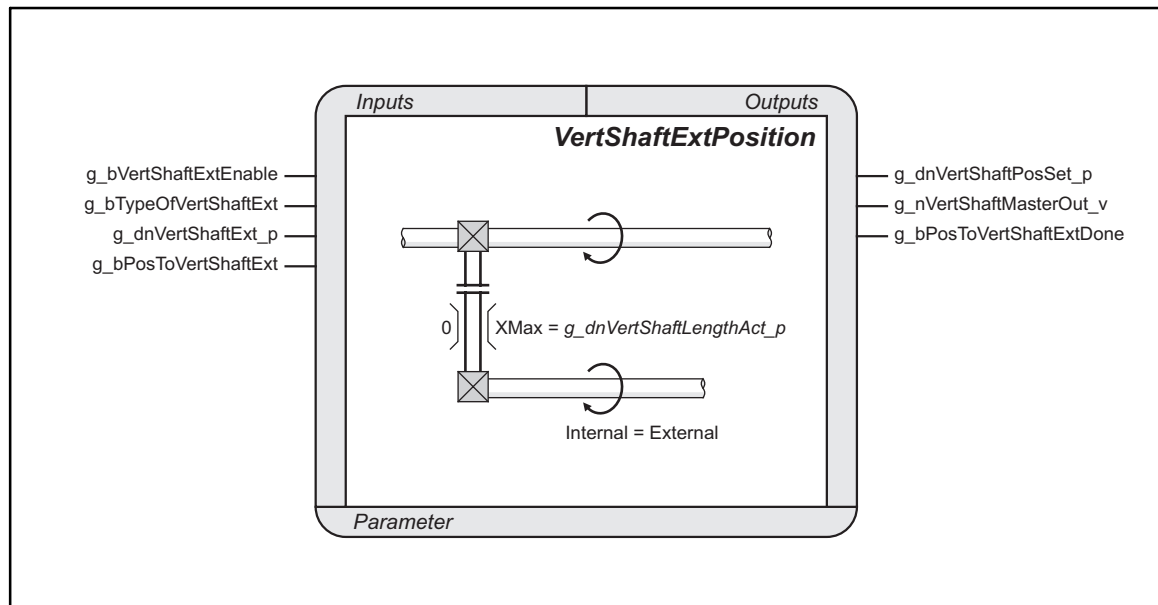
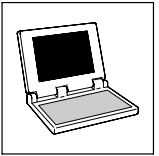


Fig. 5-33

Function "VertShaftExtPosition"



⇒ Inputs			
Identifiers	Data type	Access	Info/possible settings
g_bVertShaftExtEnable	Bool	R / W	Activation of the external master signal
			FALSE X axis is generated by the virtual master.
			TRUE X axis is selected externally.
g_bTypeOfVertShaftExt	Bool	R / W	Selection of the external master signal
			FALSE Master angle, e. g. via system bus (CAN).
			TRUE Digital frequency, e. g. via digital frequency input DFIN.
g_dnVertShaftExt_p	Double integer	R / W	Selection of the external master angle • Internally limited to 0 ... <i>g_dnVertShaftLengthAct_p</i>
g_bPosToVertShaftExt	Bool	R / W	Positioning to the external master angle
			FALSE Direct change to the external master angle.
			TRUE Positioning to the external master angle.

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_dnVertShaftPosSet_p	Double integer	R	Position output of vertical shaft • Value is also sent to the clutch function VirtualClutchXAxis .
g_nVertShaftMasterOut_v	Integer	R	Speed output of vertical shaft • Speed in [inc/ms]. • Can be used for the cam controller setpoint or the following network of drives.
g_bPosToVertShaftExtDone	Bool	R	Status signal "Positioning to external master angle completed" • The status signal remains active until <i>g_bVertShaftExtEnable</i> is reset to FALSE.
			TRUE Positioning to the external master angle has been completed.

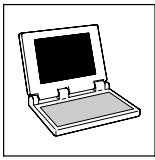
Selection of the external master angle

Use the variable *g_dnVertShaftExt_p* to transfer the external master angle, which the (slave) PLC receives via the system bus (CAN) from the master drive, to the template function.

- The variable has already been pre-configured in the POU **UserTouchProbeInput**.
- The value of the external master angle must always be positive and must not exceed the range of 0 ... $X_{\max}$ (*g_dnVertShaftLengthAct_p*).

Master angle/digital frequency selection

Use *g_bTypeOfVertShaftExt* to select if the master angle *g_dnVertShaftExt_p* or the digital frequency *g_nVertShaftExt_v* is to be used for the external selection. If "master angle" is selected, *g_bTypeOfVertShaftExt* must be set to FALSE.



Template Cam

Functions

Function "VertShaftExtPosition" - Acceptance of an external master angle

Positioning to new master angle

To avoid a position jump of the vertical shaft when the external master angle is activated, you can carry out a positioning process to the new setpoint instead of directly changing the master angle. This functionality is necessary if the network of drives must be adjusted to the external master angle.



Note!

Positioning to the external master angle is not suitable as a clutch function because the target position must be a static signal!

Use the template function **VirtualClutchXAxis** for engaging on a rotating vertical shaft. (▢ 5-74)

For positioning to the external master angle select a speed signal in [inc/ms] via `g_nVertShaftVelocitySet_v`.

Use `g_bPosToVertShaftExt` to select if a direct change or a positioning process is to be carried out. If "positioning" is selected, `g_bPosToVertShaftExt` must be set to TRUE.

- Positioning starts when the external master angle is activated.
- The end of positioning is indicated by TRUE at the output `g_bVertShaftPosDone`. The status signal will be automatically reset to FALSE when a new positioning process is started.

Activation of the external master angle

Set `g_bVertShaftExtEnable` to TRUE to activate the external selection of the X axis and deactivate the virtual master.

The master angle is directly changed or a positioning process to the new master angle setpoint is started, depending on the selection via `g_bPosToVertShaftExt`.



Note!

Depending on the motion profile used on the Y axis, position jumps on the X axis can generate such large position differences that the FBs involved (`L_CamData`, `L_CamSetXAxisVelocity`, `L_CamSetYAxisVelocity`) are no longer able to process the position differences for specific clock cycles.

With the template cam in the "LockToCam" status, the resulting template error message "XYPosChangeLimit" will cause the individual system to break away from the axis grouping.

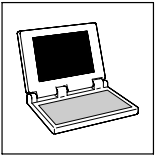
If this error message appears, you will need to reduce the master value speed and then check that the subsequent template variables have the specified values:

- `g_nVertShaftExtVelState` = -11
- `g_nCamDataState` = 20

To prevent this behaviour:

- Always apply the starting value prior to locking to the cam (`g_bLockToCam` = FALSE).
- Use fewer interpolation points if this phenomenon occurs sporadically during normal operation.

After the slave drives have accepted the external master angle, they can be brought to their profile position (`g_bLockToCam` = TRUE). After this, the vertical shaft can be started in the master drive.



5.7.7 "VertShaftExtVelocity" function - acceptance of an external master frequency

High-resolution incremental encoders are frequently used to connect a network of drives with a production machine. The slave drives thus receive the x axis of the master drive as a speed signal (digital frequency). This template function can be used to convert the relative signal in the slave drives into an absolute position value (master angle) of the x axis.



Note!

The template function is a precondition for

- the stretching/compression of the x axis
 - **XStretchCompress** template function (5-67)
- the cyclic synchronisation of the x axis by means of touch probe
 - **XTouchProbeSynchronisation** template function (5-70)

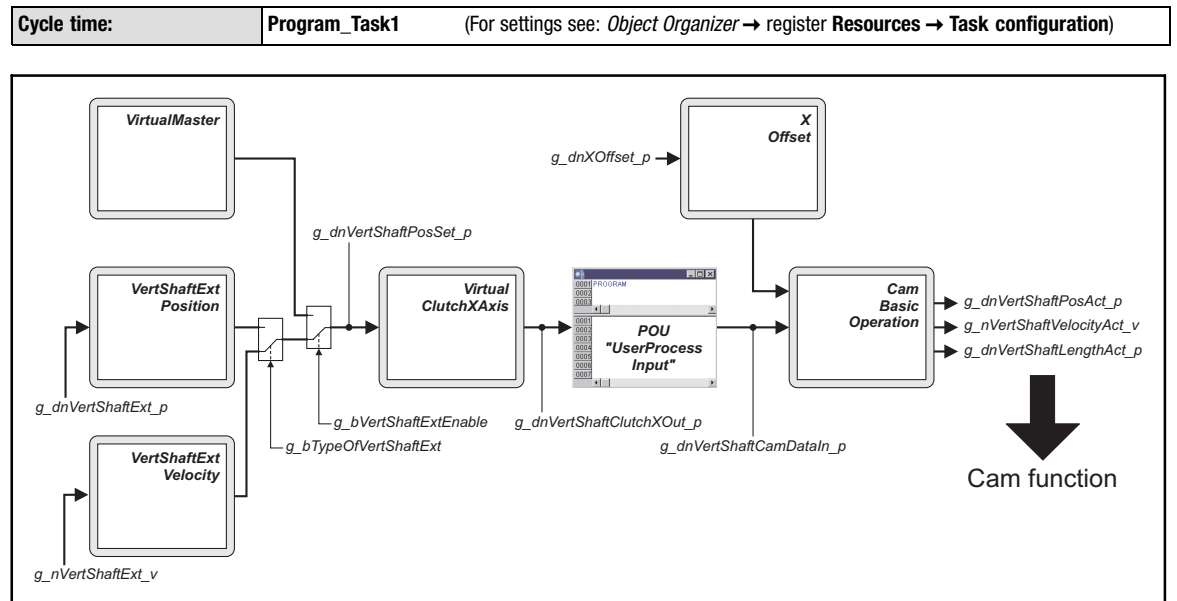
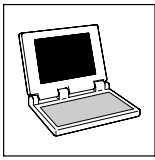


Fig. 5-34 Signal flow for the "VertShaftExtVelocity" function



Template Cam

Functions

"VertShaftExtVelocity" function - acceptance of an external master frequency

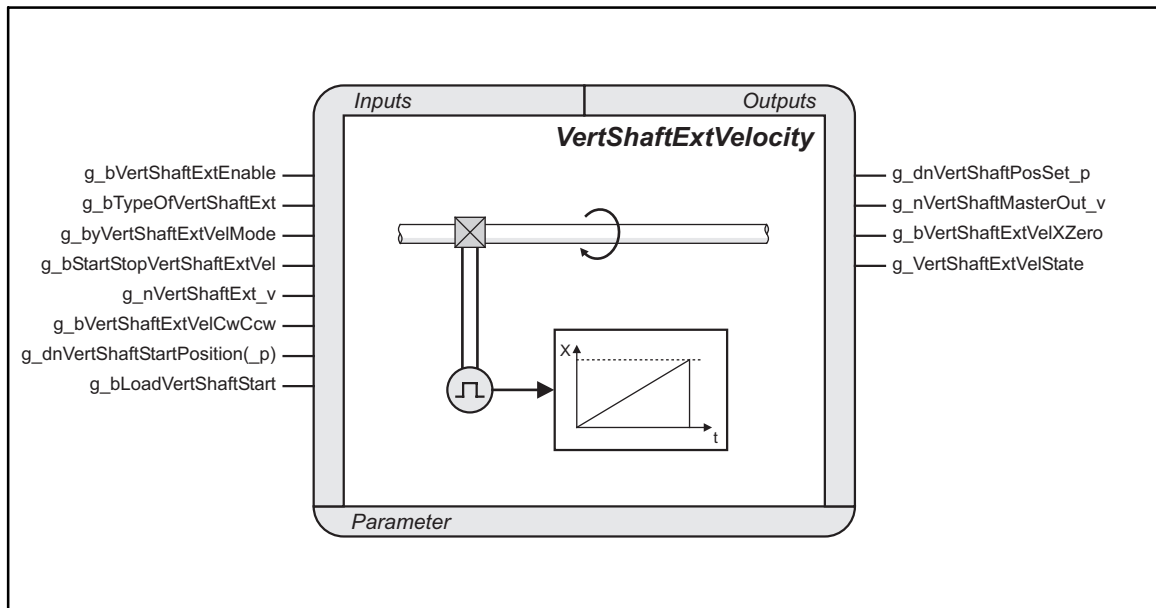
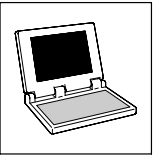


Fig. 5-35

"VertShaftExtVelocity" function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bVertShaftExtEnable	BOOL	R / W	Activation of the external master signal
			FALSE X axis is generated by the virtual master. TRUE X axis is selected externally.
g_bTypeOfVertShaftExt	BOOL	R / W	Selection of the external master signal
			FALSE Master angle, e. g. via system bus (CAN). TRUE Digital frequency, e. g. via digital frequency input DFIN.
g_byVertShaftExtVelMode	Byte	R / W	Selection of the control mode
			0 Continuous operation • The external digital frequency selection is continuously integrated. 1 Start/stop operation • The external digital frequency selection is only integrated after a start/stop signal at g_bStartStopVertShaftExtVel.
g_bStartStopVertShaftExtVel	BOOL	R / W	Start/stop signal for control mode "Start/stop operation"
			FALSE No integration or cancellation of a previously started integration during next zero crossing. TRUE Start integration. • Integration will be at least carried out until the next zero crossing.
g_nVertShaftExt_v	Integer	R / W	Selection of the external digital frequency or speed in [inc/ms]
g_bVertShaftExtVelCwCcw	BOOL	R / W	Invert external digital frequency selection
			TRUE g_nVertShaftExt_v is internally inverted.
g_dnVertShaftStartPosition	Double integer	R / W	Starting position of the x axis in [m-unit] • Internally limited to 0 ... g_dnVertShaftLengthAct_p • Input in fixed point format with 4 decimal positions (1 [m-unit] ≡ 10000). The value is internally converted into increments. (See conversion info) • If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!
g_dnVertShaftStartPosition_p	Double integer	R / W	Starting position of the x axis in [inc] • Internally limited to 0 ... g_dnVertShaftLengthAct_p • If you use this input, ensure that the input of the same name for the selection in [m-unit] is not written to avoid inconsistencies!
g_bLoadVertShaftStart	BOOL	R / W	Accept starting position



⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
			FALSE ↗ TRUE The starting position at input <i>g_dnVertShaftStartPosition_p</i> is accepted for position output <i>g_dnVertShaftPosSet_p</i> .
			TRUE The position output <i>g_dnVertShaftPosSet_p</i> is loaded with the starting position.
Information: Conversion from [unit] into [inc]: If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]: $\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 [\text{inc/rev}]}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$ - The conversion takes approx. 50 ms (depending on the size of the user program). It will only be carried out if the value of the input variable has changed. - For time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies. - Use the <i>Project settings</i> dialog box in the CamDesigner/CamLoader to select the settings for feed constant and gearbox factors.			

Outputs ⇒																					
Identifiers	Data type	Access	Value/meaning																		
g_dnVertShaftPosSet_p	Double integer	R	Position output of vertical shaft Value is sent to the VirtualClutchXAxis clutch function.																		
g_nVertShaftMasterOut_v	Integer	R	Speed output of vertical shaft - Speed in [inc/ms]. - Can be used for the cam controller setpoint or the following network of drives.																		
g_bVertShaftExtVelXZero	BOOL	R	Status signal "Zero crossing of x axis" <table><tr><td>TRUE</td><td>Zero crossing or zero position at standstill of x axis</td></tr></table>	TRUE	Zero crossing or zero position at standstill of x axis																
TRUE	Zero crossing or zero position at standstill of x axis																				
g_nVertShaftExtVelState	Integer	R	Status <table><tr><td>0</td><td>OK</td></tr><tr><td colspan="2">Warnings:</td></tr><tr><td>10</td><td>Starting position $g_dnVertShaftStartPosition_p < 0$</td></tr><tr><td>11</td><td>Starting position $g_dnVertShaftStartPosition_p > X_{\max}$</td></tr><tr><td>12</td><td>Stretching/compression factor denominator = 0</td></tr><tr><td>13</td><td>Resulting position change per cycle bigger than integer range, limitation active.</td></tr><tr><td colspan="2">Error: (acknowledgement required: $g_bErrorReset = TRUE$)</td></tr><tr><td>-11</td><td>Resulting position change per cycle too big for synchronised stretching/compression</td></tr><tr><td>-20</td><td>Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range</td></tr></table>	0	OK	Warnings:		10	Starting position $g_dnVertShaftStartPosition_p < 0$	11	Starting position $g_dnVertShaftStartPosition_p > X_{\max}$	12	Stretching/compression factor denominator = 0	13	Resulting position change per cycle bigger than integer range, limitation active.	Error: (acknowledgement required: $g_bErrorReset = TRUE$)		-11	Resulting position change per cycle too big for synchronised stretching/compression	-20	Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range
0	OK																				
Warnings:																					
10	Starting position $g_dnVertShaftStartPosition_p < 0$																				
11	Starting position $g_dnVertShaftStartPosition_p > X_{\max}$																				
12	Stretching/compression factor denominator = 0																				
13	Resulting position change per cycle bigger than integer range, limitation active.																				
Error: (acknowledgement required: $g_bErrorReset = TRUE$)																					
-11	Resulting position change per cycle too big for synchronised stretching/compression																				
-20	Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range																				

Selection of the external master frequency

Use the variable *g_nVertShaftExt_v* to transfer the external digital frequency, which the (slave) PLC receives via the digital frequency input DFIN from the master drive, to the template function.

The digital frequency selection can be inverted by setting *g_bVertShaftVelCwCcw* to TRUE.

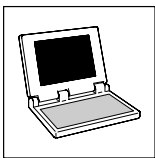


Note!

When changing between profiles with different x axis lengths, the master angle must only turn in positive direction.

Selecting the master angle/master frequency

Use *g_bTypeOfVertShaftExt* to select if the master angle *g_dnVertShaftExt_p* or the digital frequency *g_nVertShaftExt_v* is to be used for the external selection. If "digital frequency" is selected, *g_bTypeOfVertShaftExt* must be set to TRUE.



Template Cam

Functions

"VertShaftExtVelocity" function - acceptance of an external master frequency

Selecting the operating mode

Use `g_byVertShaftExtVelMode` to select the control mode.

- Continuous operation
 - By setting `g_byVertShaftExtVelMode` to "0" continuous operation is selected, i. e. the digital frequency signals are continuously integrated and the x axis is continuously calculated.
 - With continuous operation, the position output `g_dnVertShaftPosSet_p` can only be influenced by loading a start value via `g_dnVertShaftStartPosition_p`.
- Start/stop operation
 - By setting `g_byVertShaftExtVelMode` to "1" start/stop operation is selected, i. e. the incoming digital frequency signals are only integrated after a start/stop signal at `g_bStartStopVertShaftExtVel`:

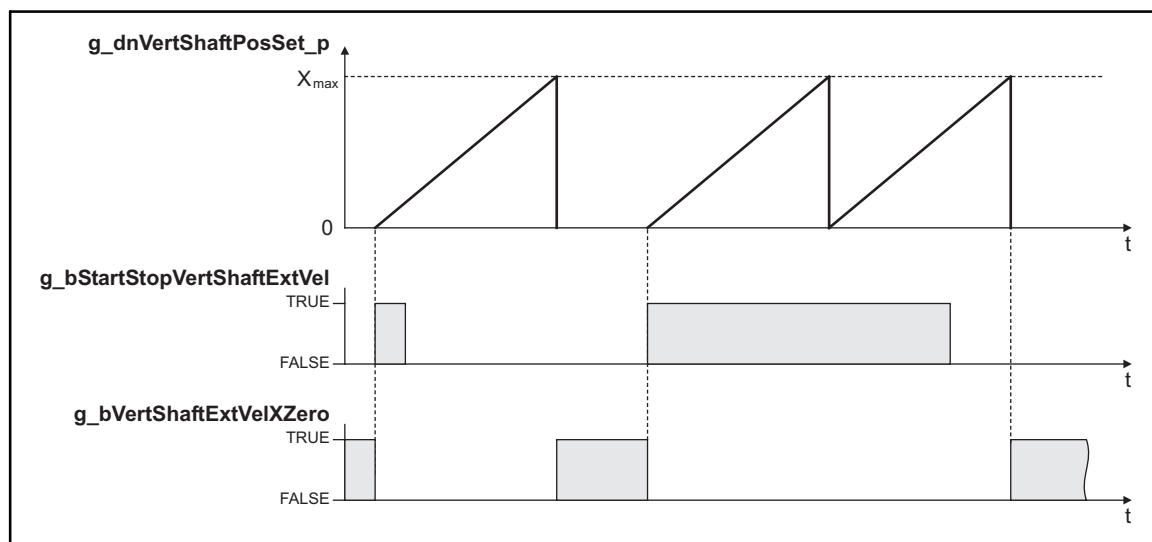


Fig. 5-36

Example: Start/stop operation

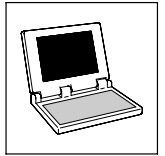


Note!

- During start/stop operation, the integration is continued until the next zero crossing (`g_dnVertShaftPosSet_p = 0`), even if a stop signal has been set. This control mode is therefore only suitable for harmonic motion profiles with a stop at zero crossing of the x axis.
- During start/stop operation, the start position `g_dnVertShaftStartPosition_p` must be set to "0" to avoid position jumps.

Activating the external digital frequency

Set `g_bVertShaftExtEnable` to TRUE to activate the external selection of the x axis and deactivate the virtual master.



Selecting a starting value

Use `g_dnVertShaftStartPosition_p` to select a starting value for the integration of the digital frequency.

A FALSE/TRUE edge on at `g_bLoadVertShaftStart` accepts the position value for position output `g_dnVertShaftPosSet_p` and holds it until `g_bLoadVertShaftStart` is reset to FALSE.



Note!

Depending on the motion profile used on the Y axis, position jumps on the X axis can generate such large position differences that the FBs involved (`L_CamData`, `L_CamSetXAxisVelocity`, `L_CamSetYAxisVelocity`) are no longer able to process the position differences for specific clock cycles.

With the template cam in the "LockToCam" status, the resulting template error message "XYPosChangeLimit" will cause the individual system to break away from the axis grouping.

If this error message appears, you will need to reduce the master value speed and then check that the subsequent template variables have the specified values:

- `g_nVertShaftExtVelState` = -11
- `g_nCamDataState` = 20

To prevent this behaviour:

- Always apply the starting value prior to locking to the cam (`g_bLockToCam` = FALSE).
- Use fewer interpolation points if this phenomenon occurs sporadically during normal operation.

Alternate operation of virtual master and external speed master

Select the following settings, if the virtual master (`g_bVertShaftExtEnable` = FALSE) and the external speed master (`g_bVertShaftExtEnable` = TRUE, `g_bTypeOfVertShaftExt` = TRUE) are to be alternately used as master value source:

- Use the **L_CamSetXAxisVelocity** FB (6-4) to add another network 9 at the end of the program part **UserTouchProbeInput**.
- Connect the **L_CamSetXAxisVelocity** FB as follows:

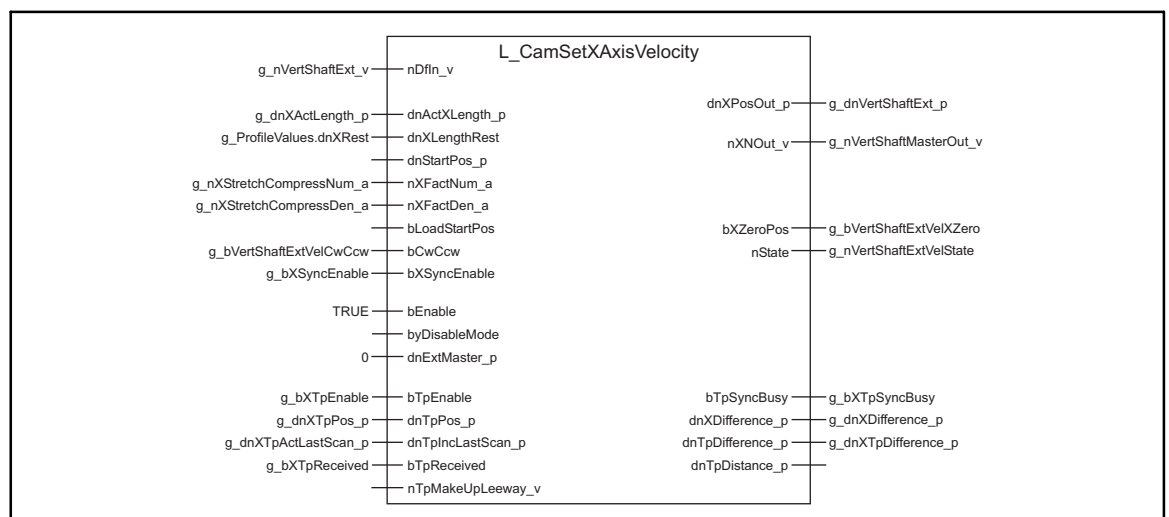
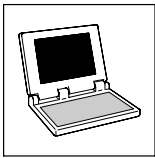


Fig. 5-37

"L_CamSetXAxisVelocity" function block

- Delete the assignment to the variable `g_dnVertShaftExt_p` in network 7.



Template Cam

Functions

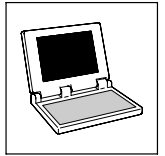
"VertShaftExtVelocity" function - acceptance of an external master frequency

- Use the *L_CamSetXAxisVelocity* FB to write the variable **g_dnVertShaftExt_p** in network 9.
- For a change between virtual master and external speed master, the variable *g_bTypeOfVertShaftExt* must be set to FALSE. Only use the variable *g_bVertShaftExtEnable* for the change (FALSE: virtual master, TRUE: external speed master).



Note!

This program addition with use of the touch probe function only supports the touch probe position selection in increments.



5.7.8 "XStretchCompress" function - stretching and compression of the digital frequency

This template function can be used to factorise and stretch or compress the digital frequency, i.e. the x axis will be rotated faster or slower.

The template function does not influence the length of the x axis (clock pulse length).



Note!

Stretching and compression of the x axis is only possible by means of the **VertShaftExtVelocity** template function. (5-61)

Cycle time:	Program_Task1	(For settings see: <i>Object Organizer</i> → register Resources → Task configuration)
-------------	---------------	--

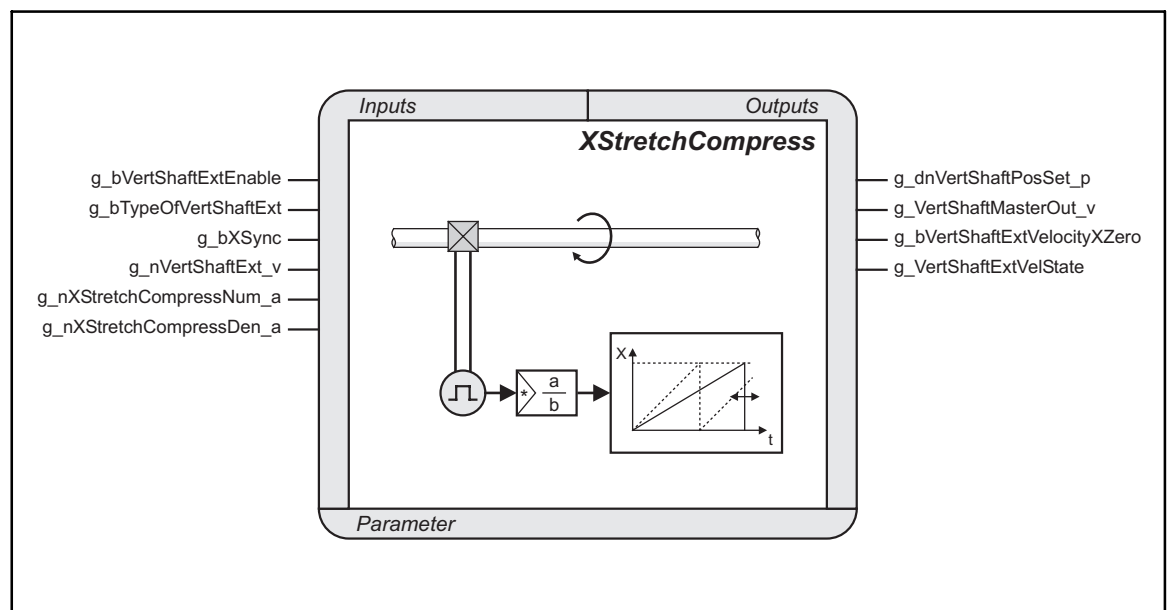
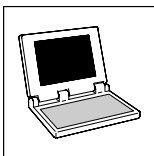


Fig. 5-38

"XStretchCompress" function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bVertShaftExtEnable	BOOL	R / W	Activation of the external master signal
			FALSE X axis is generated by the virtual master. TRUE X axis is selected externally.
g_bTypeOfVertShaftExt	BOOL	R / W	Selection of the external master signal
			FALSE Master angle, e. g. via system bus (CAN). TRUE Digital frequency, e. g. via digital frequency input DFIN.
g_bXSyncEnable	BOOL	R / W	Activate synchronised stretching/compression
			FALSE Synchronised stretching/compression deactivated. TRUE Synchronised stretching/compression activated. • The stretching/compression factor can only be accepted when the profile is crossing zero.
g_nVertShaftExt_v	Integer	R / W	Selection of the external digital frequency in [inc/ms]
g_nXStretchCompressNum_a	Integer	R / W	Stretching/compression factor - numerator
g_nXStretchCompressDen_a	Integer	R / W	Stretching/compression factor - denominator



Template Cam

Functions

"XStretchCompress" function - stretching and compression of the digital frequency

Outputs ⇨																					
Identifiers	Data type	Access	Value/meaning																		
g_dnVertShaftPosSet_p	Double integer	R	Position output of vertical shaft Value is sent to the VirtualClutchXAxis clutch function.																		
g_nVertShaftMasterOut_v	Integer	R	Speed output of vertical shaft - Speed in [inc/ms]. - Can be used for the cam controller setpoint or the following network of drives.																		
g_bVertShaftExtVelXZero	BOOL	R	Status signal "Zero crossing of x axis" <table><tr><td>TRUE</td><td>Zero crossing or zero position at standstill of x axis</td></tr></table>	TRUE	Zero crossing or zero position at standstill of x axis																
TRUE	Zero crossing or zero position at standstill of x axis																				
g_nVertShaftExtVelState	Integer	R	Status <table><tr><td>0</td><td>OK</td></tr><tr><td colspan="2">Warnings:</td></tr><tr><td>10</td><td>Starting position $g_dnVertShaftStartPosition_p < 0$</td></tr><tr><td>11</td><td>Starting position $g_dnVertShaftStartPosition_p > X_{\max}$</td></tr><tr><td>12</td><td>Stretching/compression factor denominator = 0</td></tr><tr><td>13</td><td>Resulting position change per cycle bigger than integer range, limitation active.</td></tr><tr><td colspan="2">Error: (acknowledgement required: $g_bErrorReset = TRUE$)</td></tr><tr><td>-11</td><td>Resulting position change per cycle too big for synchronised stretching/compression</td></tr><tr><td>-20</td><td>Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range</td></tr></table>	0	OK	Warnings:		10	Starting position $g_dnVertShaftStartPosition_p < 0$	11	Starting position $g_dnVertShaftStartPosition_p > X_{\max}$	12	Stretching/compression factor denominator = 0	13	Resulting position change per cycle bigger than integer range, limitation active.	Error: (acknowledgement required: $g_bErrorReset = TRUE$)		-11	Resulting position change per cycle too big for synchronised stretching/compression	-20	Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range
0	OK																				
Warnings:																					
10	Starting position $g_dnVertShaftStartPosition_p < 0$																				
11	Starting position $g_dnVertShaftStartPosition_p > X_{\max}$																				
12	Stretching/compression factor denominator = 0																				
13	Resulting position change per cycle bigger than integer range, limitation active.																				
Error: (acknowledgement required: $g_bErrorReset = TRUE$)																					
-11	Resulting position change per cycle too big for synchronised stretching/compression																				
-20	Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range																				

Selection of the external digital frequency

Use the variable $g_nVertShaftExt_v$ to transfer the external digital frequency, which the (slave) PLC receives via the digital frequency input DFIN from the master drive, to the template function.

Master angle/digital frequency selection

Use $g_bTypeOfVertShaftExt$ to select if the master angle $g_dnVertShaftExt_p$ or the digital frequency $g_nVertShaftExt_v$ is to be used for the external selection. If "digital frequency" is selected, $g_bTypeOfVertShaftExt$ must be set to TRUE.

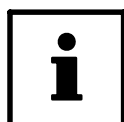
Activation of the external digital frequency

Set $g_bVertShaftExtEnable$ to TRUE to activate the external selection of the x axis and deactivate the virtual master.

Selection of the stretching/compression factor

The stretching/compression factor is selected as a fraction via $g_nXStretchCompressNum_a$ (numerator) and $g_nXStretchCompressDen_a$ (denominator).

- With a stretching/compression factor < 1 the x axis will be traversed slower.
- With a stretching/compression factor > 1 the x axis will be traversed faster.
- In the template, the stretching/compression factor is initialised with "1", i.e. the digital frequency selection is not changed.

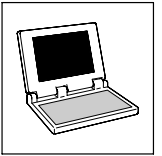


Note!

When selecting the stretching/compression factor, please ensure that the result of the following formula does not exceed the integer range (± 32767):

$$g_nVertShaftExt_v \cdot \frac{g_nXStretchCompressNum_a}{g_nXStretchCompressDen_a}$$

If the integer range is exceeded, warning "13" will be output at $g_nVertShaftExtVelState$.



Synchronised stretching/compression

Synchronised stretching/compression is necessary if the factor has to be changed during operation or product processing.

Set *g_bXSyncEnable* to TRUE to activate synchronised stretching/compression. A new stretching/compression factor will only be accepted when the x axis is crossing zero.



Note!

When selecting the stretching/compression factor, please ensure that the result of the following formula does not exceed the integer range (± 32767):

$$2 \cdot g_nVertShaftExt_v \cdot \frac{g_nXStretchCompressNum_a}{g_nXStretchCompressDen_a}$$

If the integer range is exceeded, error "-11" will be output at *g_nVertShaftExtVelState* and template error message "XYPosChangeLimit" will be indicated.



Note!

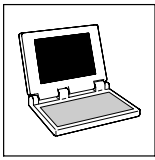
In the "Lock to Cam" template status, the "XYPosChangeLimit" template error message will cause the system to break away from the axis grouping.

If this error message appears, you will need to reduce the master value speed and then check that the subsequent template variables have the specified values:

- *g_nVertShaftExtVelState* = -11
- *g_nCamDataState* = 20

To prevent this behaviour:

- Always apply the starting value prior to locking to the cam (*g_bLockToCam* = FALSE).
- Use fewer interpolation points if this phenomenon occurs sporadically during normal operation.



Template Cam

Functions

"XTouchProbeSynchronisation" function - cyclic synchronisation of the master angle

5.7.9

"XTouchProbeSynchronisation" function - cyclic synchronisation of the master angle

Use this template function for a cyclic synchronisation of the master angle by means of touch probe.



Note!

Synchronisation is only possible if the digital frequency is used for the external selection of the x axis (see **VertShaftExtVelocity**) template function. (5-61)

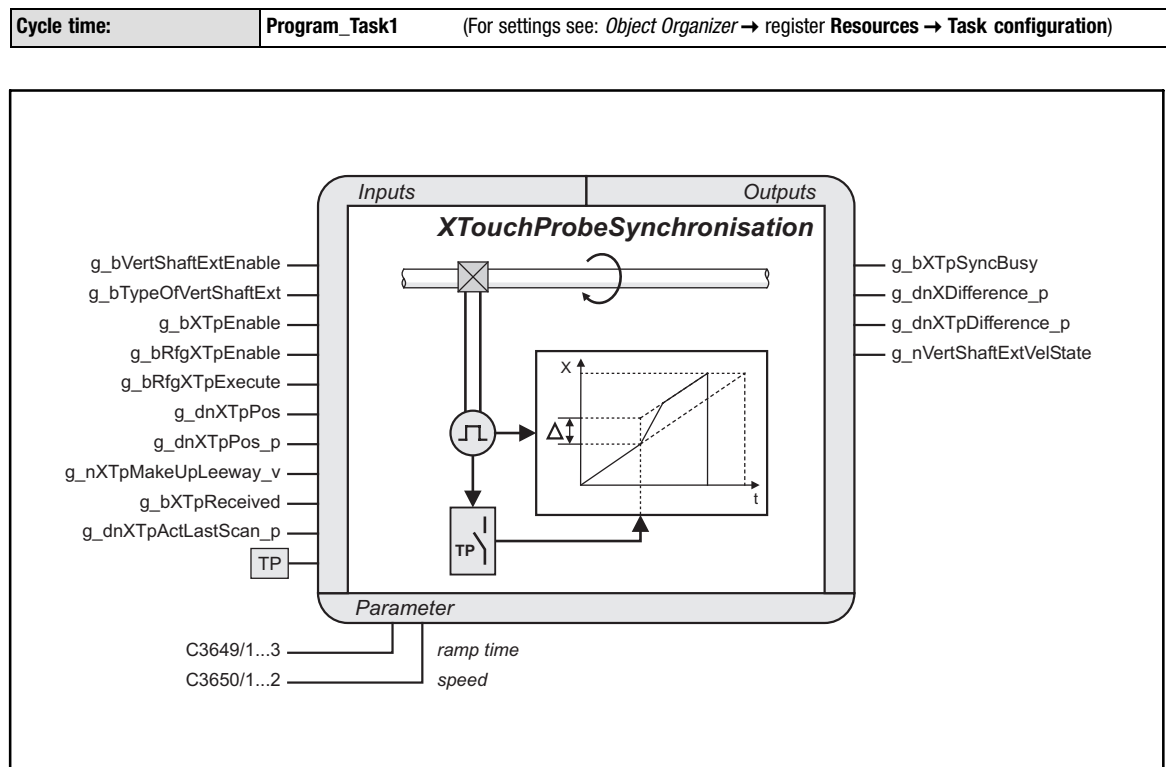
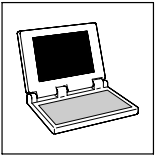


Fig. 5-39

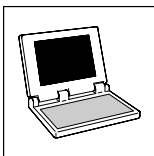
"XTouchProbeSynchronisation" function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bVertShaftExtEnable	BOOL	R / W	Activation of the external master signal
			FALSE X axis is generated by the virtual master. TRUE X axis is selected externally.
g_bTypeOfVertShaftExt	BOOL	R / W	Selection of the external master signal
			FALSE Master angle, e. g. via system bus (CAN). TRUE Digital frequency, e. g. via digital frequency input DFIN.
g_bXTpEnable	BOOL	R / W	Activation of cyclic synchronisation
			TRUE Cyclic synchronisation activated.
g_bRfgXTpEnable	BOOL	R / W	Selection of the compensation
			FALSE The difference is compensated by a constant speed value at <i>g_nXTpMakeUpLeeway_v</i> . TRUE The difference is compensated by means of the internal ramp generator.



⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bRfgXTpExecute	BOOL	R / W	Start ramp generator for compensation of position difference
			FALSE Ramp generator is not active, position difference is not compensated.
			FALSE → TRUE Position difference (<i>g_dnXDifference_p</i>) is compensated by means of the internal ramp generator.
g_dnXTpPos	Double integer	R / W	Distance between zero and touch probe sensor in [unit] - Internally limited to $0 \dots 2 * g_dnVertShaftLengthAct_p$ - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See conversion info) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!
g_dnXTpPos_p	Double integer	R / W	Distance between zero and TP sensor in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!
Information: Conversion from [unit] into [inc]: If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]: $\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$ - The conversion takes approx. 50 ms (depending on the size of the user program). It will only be carried out if the value of the input variable has changed. - For time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies. - Use the <i>Project settings</i> dialog box in the CamDesigner/CamLoader to select the settings for feed constant and gearbox factors.			
g_nXTpMakeUpLeeway_v	Integer	R / W	Speed in [inc/ms] for compensation of position difference Only relevant if the difference is compensated by a constant speed value (<i>g_bRfgXTpEnable</i> = FALSE).
g_bXTpReceived	BOOL	R / W	Trigger input for the calculation of the position difference If the DFIN_IO_DigitalFrequency SB is <u>not</u> to be used, connect this input to the corresponding output of the touch probe signal source used. (POU UserTouchProbeInput, NW1)
			FALSE → TRUE New calculation of position difference.
g_dnXTpActLastScan_p	Double integer	R / W	Δinc between touch probe and task start If the DFIN_IO_DigitalFrequency SB is <u>not</u> to be used, connect this input to the corresponding output of the touch probe signal source used. (POU UserTouchProbeInput, NW2)

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_bXTpSyncBusy	BOOL	R	Status of TP correction
			FALSE At present setpoints are not being corrected.
			TRUE Synchronisation is active, x difference is being compensated.
g_dnXDifference_p	Double integer	R	Correction value for touch probe signal Only to be used if <i>g_bRfgXTpEnable</i> = TRUE.
g_dnXTpDifference_p	Double integer	R	Difference between two touch probe signals Only to be used if <i>g_bRfgXTpEnable</i> = TRUE.



Template Cam

Functions

"XTouchProbeSynchronisation" function - cyclic synchronisation of the master angle

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_nVertShaftExtVelState	Integer	R	Status
			0 OK
			Warnings:
			10 Starting position $g_dnVertShaftStartPosition_p < 0$
			11 Starting position $g_dnVertShaftStartPosition_p > X_{max}$
			12 Stretching/compression factor denominator = 0
			13 Resulting position change per cycle bigger than integer range, limitation active.
			Error: (acknowledgement required: $g_bErrorReset = TRUE$)
			-11 Resulting position change per cycle too big for synchronised stretching/compression
			-20 Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range

Parameters				
Code	Subcode	Data type	Access	Information
C3649	1		R / W	Possible settings
				Presetting
				Acceleration/deceleration ramps
				• Referred to 4000 rpm
				Deceleration ramp for immediate stop (not effective)
				0.01 {0.01 unit} 129.99 5.00 s
				Acceleration ramp for compensation via internal ramp generator
C3650	2		R / W	0.01 {0.01 unit} 129.99 5.00 s
				Deceleration ramp for compensation via internal ramp generator
				0.01 {0.01 unit} 129.99 5.00 s
				Maximum speed for compensation via internal ramp generator
				In positive direction (CW)
				0 {1 unit} 15000 200 rpm
				In negative direction (CCW)
C3650	2		R / W	0 {1 unit} 15000 200 rpm

Selecting the external master frequency

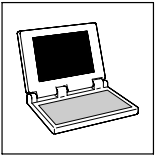
Use the variable **g_nVertShaftExt_v** to transfer the external digital frequency, which the (slave) PLC receives via the digital frequency input DFIN from the master drive, to the *VertShaftExtVelocity* template function.

Master angle/master frequency selection

Use $g_bTypeOfVertShaftExt$ to select if the master angle $g_dnVertShaftExt_p$ or the digital frequency $g_nVertShaftExt_v$ is to be used for the external selection. If "digital frequency" is selected, $g_bTypeOfVertShaftExt$ must be set to TRUE.

Activating the external master frequency

Set $g_bVertShaftExtEnable$ to TRUE to activate the external selection of the x axis and deactivate the virtual master.



Touch probe synchronisation

Required settings:

- Use *g_dnXTpPos_p* to select the position of the touch probe sensor referred to the zero crossing of the X axis.
- Use *g_bRfgXTpEnable* to select if the position difference is to be compensated by means of the internal ramp generator or by the speed selected at *g_nXTpMakeUpLeeway_v*.
- Set *g_bXTpEnable* to TRUE to activate the synchronisation function.



Tip!

If the incoming touch probe signals shall only be detected in specific position areas, the input *g_bXTpEnable* can be controlled by means of cams.

*Compensation by means of an internal ramp generator (*g_bRfgXTpEnable* = TRUE)*

A FALSE/TRUE transition at *g_bRfgXTpExecute* starts the internal ramp generator for compensation.

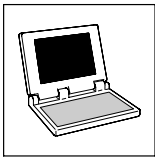
- The following compensation processes do not require a new FALSE-TRUE transition at *g_bRfgXTpExecute*.
- Use the parameters C3637 and C3638 to select the acceleration/deceleration ramps and the speed for compensation.

*Compensation through constant compensation speed (*g_bRfgXTpEnable* = FALSE)*

Use *g_nXTpMakeUpLeeway_v* to select the compensation speed. A difference between actual value and setpoint will only be compensated if the value is higher than "0".

Status of the touch probe synchronisation

As long as the compensation process is active and the difference between actual value and setpoint exists, TRUE will be indicated at the output *g_bXTpSyncBusy*.



Template Cam

Functions

Function "VirtualClutchXAxis" - Virtual clutch

5.7.10 Function "VirtualClutchXAxis" - Virtual clutch

Use this template function to engage and disengage the vertical shaft (X-axis) via adjustable acceleration and deceleration ramps.

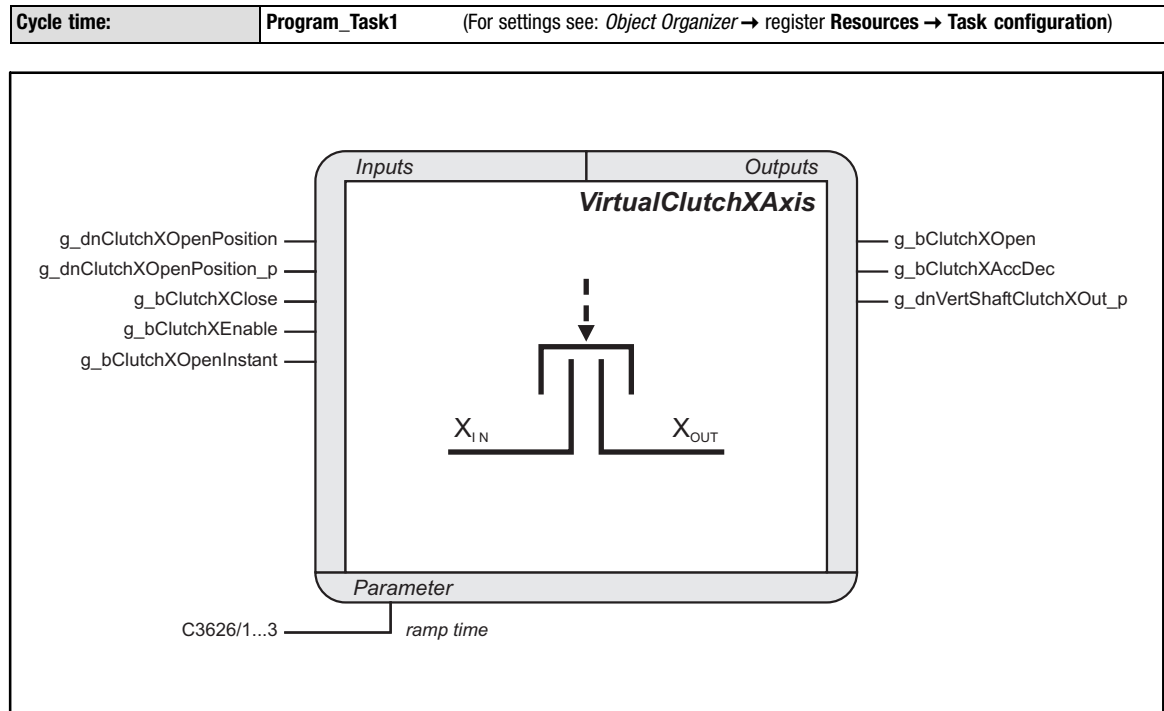


Fig. 5-40

Function "VirtualClutchXAxis"

⇒ Inputs

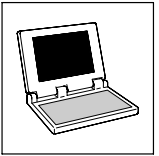
Identifiers	Data type	Access	Info/possible settings
g_dnClutchXOpenPosition	Double integer	R / W	Position setpoint of vertical shaft (internally, X_{out}) after clutch disengagement in [unit] Only positive values allowed.
g_dnClutchXOpenPosition_p	Double integer	R / W	Position setpoint of vertical shaft (internally, X_{out}) after clutch disengagement in [inc] Only positive values allowed.

Info: Conversion from [unit] into [inc]:
If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]:

$$\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox_factor_numerator}}{\text{gearbox_factor_denominator}}$$

- The conversion takes approx. 50 ms (depending on the size of the user program). It will only be carried out if the value of the input variable has changed.
- With time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies.
- Use the *Project settings* dialog box in the **CamDesigner/CamLoader** to select the settings for feed constant and gearbox factors.

g_bClutchXClose	Bool	R / W	Clutch	
			TRUE ⇒ FALSE	Disengage clutch, brake along ramp <i>C3626/3</i> and stop at <i>g_dnClutchXOpenPosition_p</i> .
			FALSE ⇨ TRUE	Synchronise along ramp <i>C3626/2</i> to <i>g_dnVerticalShaftPosSet_p</i> and engage clutch.
g_bClutchXEnable	Bool	R / W	Activation of the clutch function This input has highest priority.	
			FALSE	<i>g_dnVerticalShaftPosSet_p</i> is output directly, the ramp function is not active and the clutch is engaged.
			TRUE	Clutch function active



⇒ Inputs				
Identifiers	Data type	Access	Info/possible settings	
g_bClutchXOpenInstant	Byte	R / W	Immediate clutch disengagement	
			TRUE	The clutch disengages immediately and the vertical shaft (internal X axis) is decelerated along the deceleration ramp selected for the immediate stop function (C3626/1) to standstill.

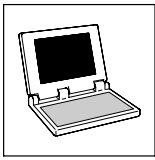
Outputs ⇨					
Identifiers	Data type	Access	Value/meaning		
g_bClutchXOpen	Bool	R	Status signal "Clutch disengaged"		
			<table><tr><td>TRUE</td><td>Clutch disengaged, vertical shaft (internal X axis) is not synchronous with <i>g_dnVerticalShaftPosSet_p</i></td></tr></table>	TRUE	Clutch disengaged, vertical shaft (internal X axis) is not synchronous with <i>g_dnVerticalShaftPosSet_p</i>
TRUE	Clutch disengaged, vertical shaft (internal X axis) is not synchronous with <i>g_dnVerticalShaftPosSet_p</i>				
g_bClutchXAccDec	Bool	R	Status signal "Acceleration/deceleration active"		
			<table><tr><td>TRUE</td><td>The drive accelerates or decelerates.</td></tr></table>	TRUE	The drive accelerates or decelerates.
TRUE	The drive accelerates or decelerates.				
g_dnVertShaftClutchXOut_p	Double integer	R	Master value position in [inc] after clutch		

Parameter							
Code	Subcode	Data type	Access	Info			
				Possible settings	Presetting		
C3626	1		R / W	Ramps for clutch engagement/disengagement Referred to 4000 rpm			
				Deceleration ramp for immediate stop (cancellation of the function)			
				0.01	{0.01 unit}	129.99	5.00 s
				Acceleration ramp for clutch engagement			
				0.01	{0.01 unit}	129.99	5.00 s
				Deceleration ramp for clutch disengagement			
				0.01	{0.01 unit}	129.99	5.00 s



Note!

- During clutch engagement, the start of acceleration depends on the selected acceleration ramp and the current position of the external X axis.
- At the time of clutch engagement, internal and external X axis run at synchronous speed and are in the same position. Oversynchronisation is avoided.
- During normal clutch disengagement, the start of deceleration depends on the selected deceleration ramp and the preselected target position.
- Clutch disengagement/engagement can take several X cycles if the selected ramps are too long.
- The clutch function must only be inhibited by resetting *g_ClutchXEnable* to FALSE when the X axis is at standstill.
- In mode 3 of function **PosToCam**, the inputs *g_bClutchXClose*, *g_bClutchXEnable* and *g_bClutchXOpenInstant* are written by the function **PosToCam**. (▢ 5-40)

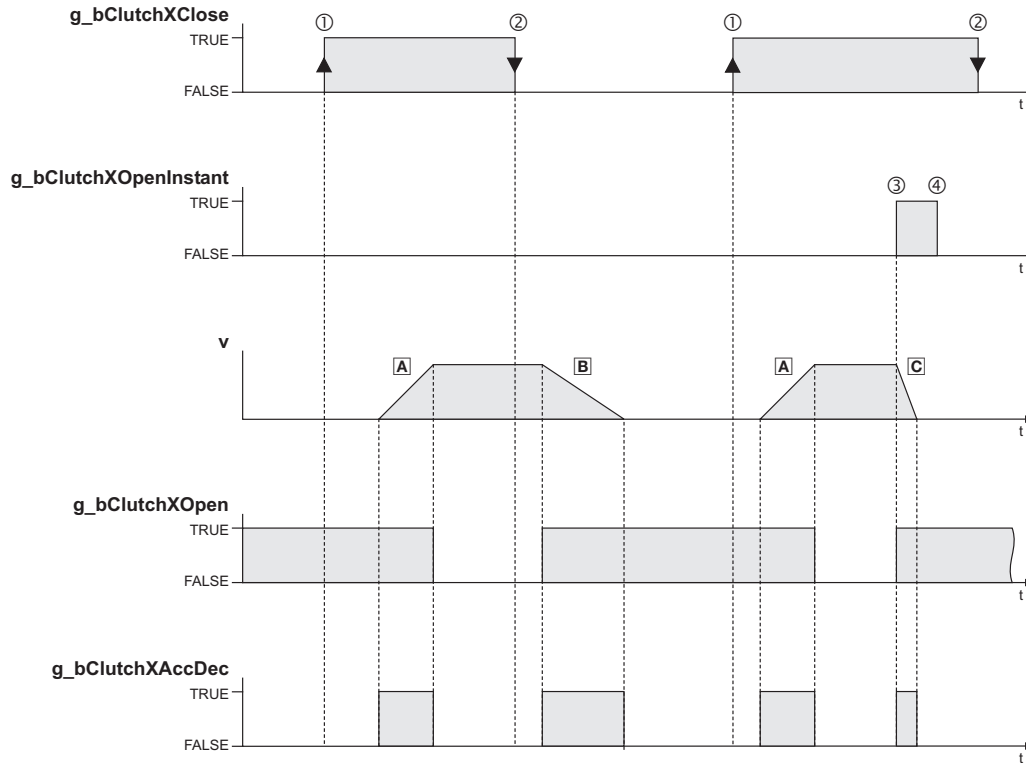


Template Cam

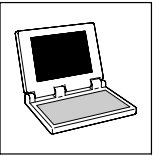
Functions

Function "VirtualClutchXAxis" - Virtual clutch

Response of the function



Info	
Message outputs	
	<code>g_bClutchXopen</code> = TRUE: The clutch is disengaged.
	<code>g_bClutchXAccDec</code> = TRUE: The drive is being accelerated/decelerated.
Clutch engagement	
①	A FALSE-TRUE transition at <code>g_bClutchXClose</code> activates clutch engagement. - Precondition: The clutch function is enabled (<code>g_bClutchXEnable</code> = TRUE). - The drive is synchronised along the acceleration ramp selected under C3626/2 [A] to the external X axis. - The start of acceleration depends on the current position and the acceleration ramp.
Clutch disengagement (normal)	
②	A TRUE-FALSE transition at <code>g_bClutchXClose</code> activates (normal) clutch disengagement. - The drive is decelerated along the deceleration ramp selected under C3626/3 [B] to the position <code>g_dnClutchXOpenPosition</code>. - The start of deceleration depends on the current position and the deceleration ramp.
Clutch disengagement (immediate stop)	
③	By setting <code>g_bClutchXOpenInstant</code> to TRUE, the clutch disengages immediately. The drive is immediately decelerated to standstill (emergency stop) along the deceleration ramp selected under C3626/1 [C], independently of the current position.
④	If you reset <code>g_bClutchXOpenInstant</code> to FALSE, the drive will be enabled again. After this, the clutch can be engaged by a new FALSE-TRUE transition at <code>g_bClutchXClose</code>.



5.7.11 "XOffset" function - selection of an offset for the master value

Use this template function to select an offset for the master value (x axis) *in online mode*.

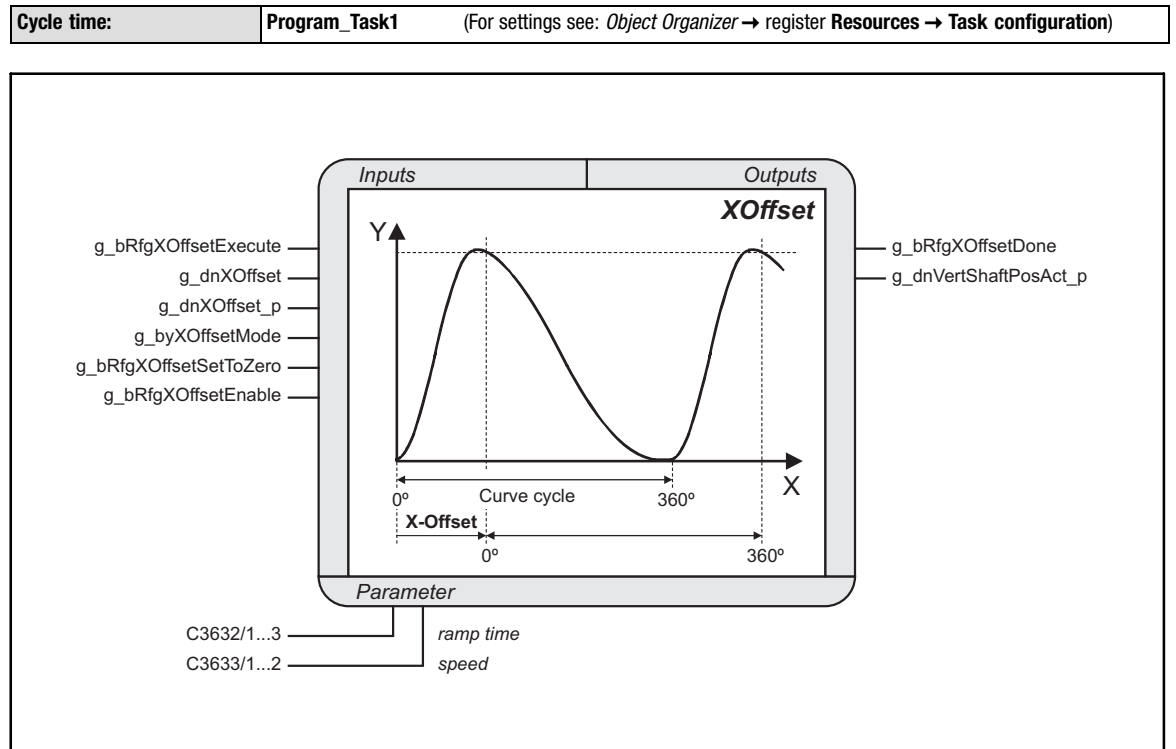
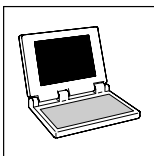


Fig. 5-41 "XOffset" function

⇒ Inputs							
Identifiers	Data type	Access	Information/possible settings				
g_bRfgXOffsetExecute	BOOL	R / W	Adjusting master value by offset Only possible, if <i>g_bRfgXOffsetEnable</i> is set to TRUE. <table><tr><td>TRUE</td><td>The master value is adjusted along the set ramp/speed by the selected offset <i>g_dnXOffset(_p)</i>.</td></tr></table>	TRUE	The master value is adjusted along the set ramp/speed by the selected offset <i>g_dnXOffset(_p)</i> .		
TRUE	The master value is adjusted along the set ramp/speed by the selected offset <i>g_dnXOffset(_p)</i> .						
g_dnXOffset	Double integer	R / W	Offset selection for the master value in [unit] - Input in fixed point format with 4 decimal positions (1 [unit] ≡ 10000). The value is internally converted into increments. (See conversion info) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!				
g_dnXOffset_p	Double integer	R / W	Offset selection for the master value in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!				
g_byXOffsetMode	Byte	R / W	Selection of the offset selection <table><tr><td>0</td><td>Dynamic offset selection in [inc] in ProgramTask1</td></tr><tr><td>1</td><td>Offset selection in [unit] When <i>g_bRfgXOffsetExecute</i> is set to TRUE, the offset selection is converted from [unit] into [inc] before the offset is executed. </td></tr></table>	0	Dynamic offset selection in [inc] in ProgramTask1	1	Offset selection in [unit] When <i>g_bRfgXOffsetExecute</i> is set to TRUE, the offset selection is converted from [unit] into [inc] before the offset is executed.
0	Dynamic offset selection in [inc] in ProgramTask1						
1	Offset selection in [unit] When <i>g_bRfgXOffsetExecute</i> is set to TRUE, the offset selection is converted from [unit] into [inc] before the offset is executed.						



Template Cam

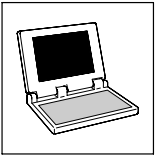
Functions

"XOffset" function - selection of an offset for the master value

⇒ Inputs							
Identifiers	Data type	Access	Information/possible settings				
Information: Conversion from [unit] into [inc]: If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]: $\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$ • The conversion takes approx. 50 ms (depending on the size of the user program PLC_PRG). It will only be carried out if the value of the input variable has changed and <i>g_bRfgXOffsetExecute</i> is set to TRUE. • For time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies. • Use the <i>Project settings</i> dialog box in the CamDesigner/CamLoader to select the settings for feed constant and gearbox factors.							
g_bRfgXOffsetSetToZero	BOOL	R / W	Reset offset • Only possible, if <i>g_bRfgXOffsetEnable</i> is set to TRUE. <table><tr><td>FALSE</td><td>Offset selection = <i>g_dnXOffset(_p)</i>.</td></tr><tr><td>TRUE</td><td>Offset selection = "0" (internally). • If an offset adjustment is active, the profile generator sets the existing offset to "0". </td></tr></table>	FALSE	Offset selection = <i>g_dnXOffset(_p)</i> .	TRUE	Offset selection = "0" (internally). • If an offset adjustment is active, the profile generator sets the existing offset to "0".
FALSE	Offset selection = <i>g_dnXOffset(_p)</i> .						
TRUE	Offset selection = "0" (internally). • If an offset adjustment is active, the profile generator sets the existing offset to "0".						
g_bRfgXOffsetEnable	BOOL	R / W	Activating ramp function<table><tr><td>FALSE</td><td><i>g_dnXOffset(_p)</i> has an immediate effect on the master value. Note: The selection is not restricted by limit values. The selection of inappropriate values may lead to following errors or jumps!</td></tr><tr><td>TRUE</td><td><i>g_dnXOffset(_p)</i> is added along the set ramps (C3632) to the master value.</td></tr></table>	FALSE	<i>g_dnXOffset(_p)</i> has an immediate effect on the master value. Note: The selection is not restricted by limit values. The selection of inappropriate values may lead to following errors or jumps!	TRUE	<i>g_dnXOffset(_p)</i> is added along the set ramps (C3632) to the master value.
FALSE	<i>g_dnXOffset(_p)</i> has an immediate effect on the master value. Note: The selection is not restricted by limit values. The selection of inappropriate values may lead to following errors or jumps!						
TRUE	<i>g_dnXOffset(_p)</i> is added along the set ramps (C3632) to the master value.						

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_bRfgXOffsetDone	BOOL	R	Status signal "Offset adjustment" TRUE Offset adjustment completed.
q_dnVertShaftPosAct_p	Double integer	R	Resulting master value position in [inc]

Parameters																			
Code	Subcode	Data type	Access	Information															
				<table><tr><th>Possible settings</th><th>Presetting</th></tr></table>	Possible settings	Presetting													
Possible settings	Presetting																		
C3632	1		R / W	Acceleration/deceleration ramps Referred to 4000 rpm <table><tr><td colspan="2">Deceleration ramp for immediate stop (cancellation of the function)</td></tr><tr><td>0.01</td><td>{0.01 unit} 129.99</td><td>5.00 s</td></tr><tr><td colspan="2">Acceleration ramp for adjustment</td></tr><tr><td>0.01</td><td>{0.01 unit} 129.99</td><td>5.00 s</td></tr><tr><td colspan="2">Deceleration ramp for adjustment</td></tr><tr><td>0.01</td><td>{0.01 unit} 129.99</td><td>5.00 s</td></tr></table>	Deceleration ramp for immediate stop (cancellation of the function)		0.01	{0.01 unit} 129.99	5.00 s	Acceleration ramp for adjustment		0.01	{0.01 unit} 129.99	5.00 s	Deceleration ramp for adjustment		0.01	{0.01 unit} 129.99	5.00 s
Deceleration ramp for immediate stop (cancellation of the function)																			
0.01	{0.01 unit} 129.99	5.00 s																	
Acceleration ramp for adjustment																			
0.01	{0.01 unit} 129.99	5.00 s																	
Deceleration ramp for adjustment																			
0.01	{0.01 unit} 129.99	5.00 s																	
	2																		
	3																		
C3633	1		R / W	Adjustment speed <table><tr><td colspan="2">In positive direction (CW)</td></tr><tr><td>0</td><td>{1 unit} 15000</td><td>200 rpm</td></tr><tr><td colspan="2">In negative direction (CCW)</td></tr><tr><td>0</td><td>{1 unit} 15000</td><td>200 rpm</td></tr></table>	In positive direction (CW)		0	{1 unit} 15000	200 rpm	In negative direction (CCW)		0	{1 unit} 15000	200 rpm					
In positive direction (CW)																			
0	{1 unit} 15000	200 rpm																	
In negative direction (CCW)																			
0	{1 unit} 15000	200 rpm																	
	2																		



Function

- The acceleration/deceleration ramps and the speed for adjusting the master value by the offset can be selected by means of parameters.
- The offset by which the master value is to be adjusted can be selected via $g_dnXOffset$ in [unit] or via $g_dnXOffset_p$ in [inc].
 - Please observe the instructions for the conversion from [unit] into [inc]. (▢ 5-78)
- The adjustment is activated by setting $g_bRfgXOffsetExecute$ to TRUE.
- When the adjustment has been completed, $g_bRfgXOffsetDone$ is set to TRUE.
- The resulting master value position is output at $g_dnVertShaftPosAct_p$ in [inc].

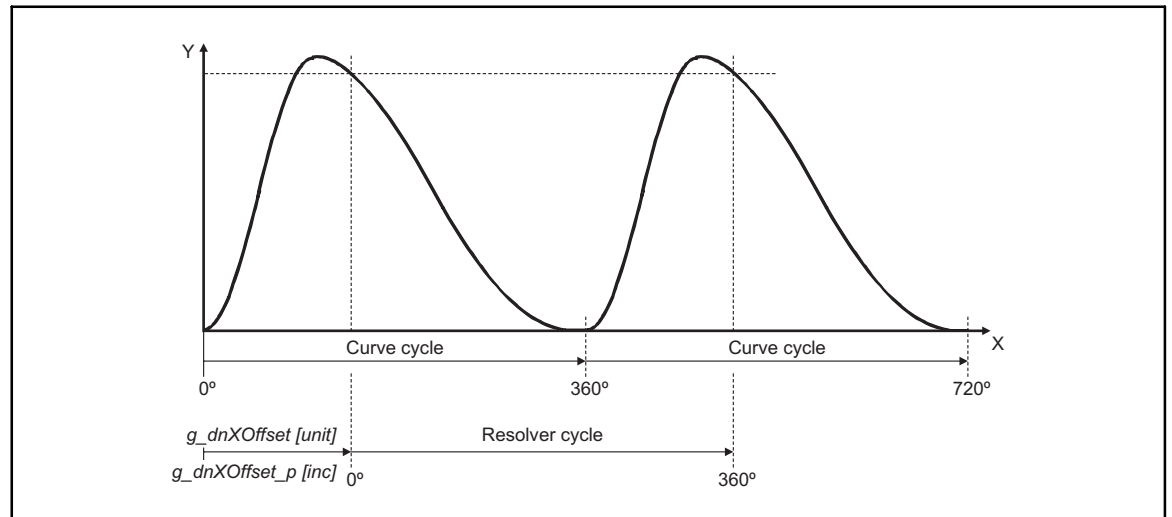
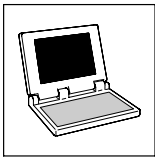


Fig. 5-42

Offset selection for the master value

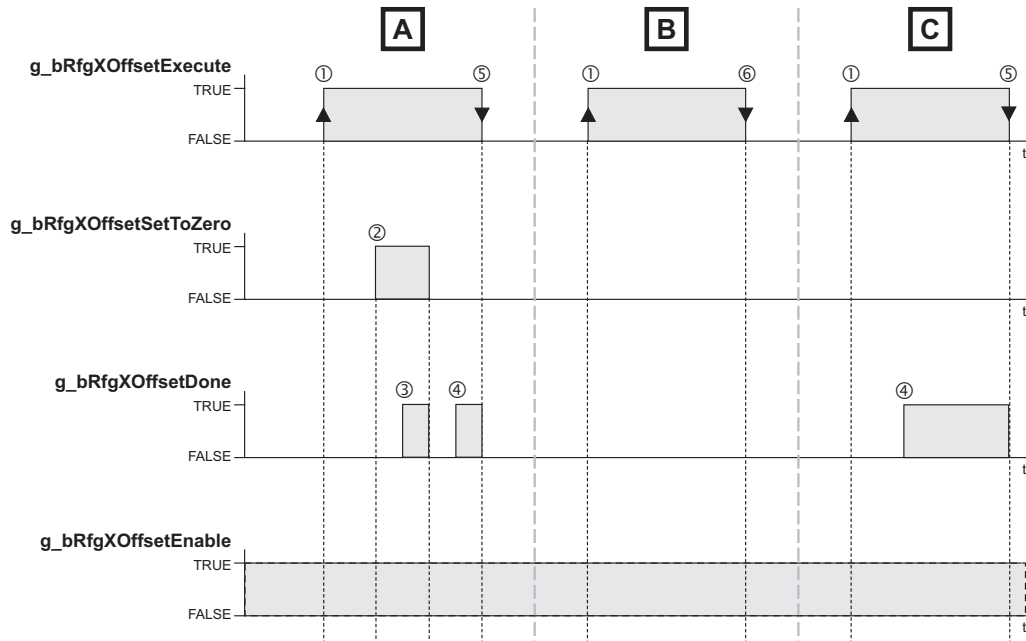


Template Cam

Functions

"XOffset" function - selection of an offset for the master value

Response of the function



Information	
A Execution of the function with offset reset	
①	Start of master value (x axis) adjustment by the x offset.
②	Start of offset reset to reset the corresponding offset part to "0".
③	Offset reset completed. (Offset value = 0)
④	Master value adjustment by means of the XOffset function has been completed. (Offset value = $g_dnXOffset$)
⑤	The offset adjustment is deactivated.
B Cancellation	
①	Start of master value (x axis) adjustment by the x offset.
⑥	Cancellation of the master value adjustment. Note: Part of the master value adjustment has been executed.
C Execution of the function without offset reset	
①	Start of master value (x axis) adjustment by the x offset.
④	Master value adjustment by means of the XOffset function has been completed. (Offset value = $g_dnXOffset$)
⑤	Master value adjustment has been completed.

Deactivate offset

Set $g_bRfgXOffsetSetToZero$ to TRUE to set the offset internally to "0", i.e. the profile generator sets the offset to "0". The master value is output 1:1 at the output $g_dnVertShaftPosAct_p$.

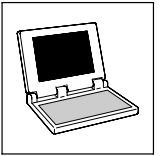
Activate/deactivate offset ramp

If $g_bRfgXOffsetEnable$ is set to TRUE, the master value is adjusted along the selected ramp by $g_dnXOffset(_p)$, if $g_bRfgXOffsetEnable = FALSE$, the ramp function is deactivated, i. e. the offset immediately influences the master value.



Note!

When changing from direct offset selection to ramp function, please observe that the internal ramp generator always retains the last offset value and sets the corresponding value when $g_bRfgXOffsetEnable$ is set to TRUE.



5.7.12 "YOffset" function - selection of an offset for the setpoint

Use this template function to select an offset for the setpoint (Y axis) *in online mode*.

Cycle time:	Program_Task1	(For settings see: <i>Object Organizer</i> → register Resources → Task configuration)
-------------	---------------	--



Note!

Only use the **YOffset** function for forward/backward motion profiles.

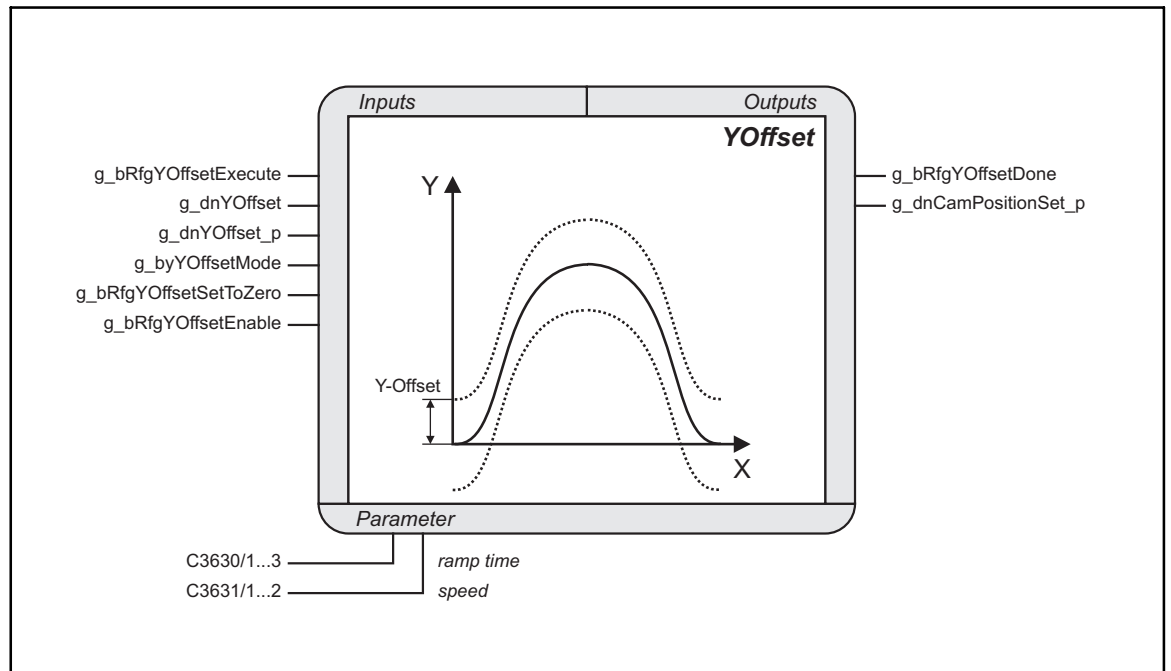
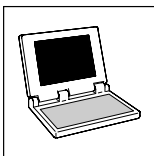


Fig. 5-43

"YOffset" function

⇒ Inputs							
Identifiers	Data type	Access	Information/possible settings				
g_bRfgYOffsetExecute	BOOL	R / W	Adjust setpoint by offset Only possible, if <i>g_bRfgYOffsetEnable</i> is set to TRUE. <table><tr><td>TRUE</td><td>The setpoint is adjusted along the set ramp/speed by the selected offset <i>g_dnYOffset</i>.</td></tr></table>	TRUE	The setpoint is adjusted along the set ramp/speed by the selected offset <i>g_dnYOffset</i> .		
TRUE	The setpoint is adjusted along the set ramp/speed by the selected offset <i>g_dnYOffset</i> .						
g_dnYOffset	Double integer	R / W	Offset selection for the setpoint in [unit] - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See conversion info) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!				
g_dnYOffset_p	Double integer	R / W	Offset selection for the setpoint in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!				
g_byYOffsetMode	Byte	R / W	Selection of the offset selection <table><tr><td>0</td><td>Dynamic offset selection in [inc] in ProgramTask1</td></tr><tr><td>1</td><td>Offset selection in [unit] When <i>g_bRfgYOffsetExecute</i> is set to TRUE, the offset selection is converted from [unit] into [inc] before the offset is executed. </td></tr></table>	0	Dynamic offset selection in [inc] in ProgramTask1	1	Offset selection in [unit] When <i>g_bRfgYOffsetExecute</i> is set to TRUE, the offset selection is converted from [unit] into [inc] before the offset is executed.
0	Dynamic offset selection in [inc] in ProgramTask1						
1	Offset selection in [unit] When <i>g_bRfgYOffsetExecute</i> is set to TRUE, the offset selection is converted from [unit] into [inc] before the offset is executed.						



Template Cam

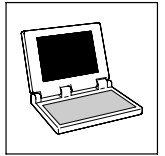
Functions

"YOffset" function - selection of an offset for the setpoint

⇒ Inputs							
Identifiers	Data type	Access	Information/possible settings				
Information: Conversion from [unit] into [inc]: If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]: $\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$ • The conversion takes approx. 50 ms (depending on the size of the user program PLC_PRG). It will only be carried out if the value of the input variable has changed and <i>g_bRfgYOffsetExecute</i> is set to TRUE. • For time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies. • Use the <i>Project settings</i> dialog box in the CamDesigner/CamLoader to select the settings for feed constant and gearbox factors.							
g_bRfgYOffsetSetToZero	BOOL	R / W	Reset offset • Only possible, if <i>g_bRfgYOffsetEnable</i> is set to TRUE. <table><tr><td>FALSE</td><td>Offset selection = <i>g_dnYOffset(_p)</i>.</td></tr><tr><td>TRUE</td><td>Offset selection = "0". • If an offset adjustment is active, the profile generator sets the existing offset to "0". </td></tr></table>	FALSE	Offset selection = <i>g_dnYOffset(_p)</i> .	TRUE	Offset selection = "0". • If an offset adjustment is active, the profile generator sets the existing offset to "0".
FALSE	Offset selection = <i>g_dnYOffset(_p)</i> .						
TRUE	Offset selection = "0". • If an offset adjustment is active, the profile generator sets the existing offset to "0".						
g_bRfgYOffsetEnable	BOOL	R / W	Activate ramp function <table><tr><td>FALSE</td><td><i>g_dnYOffset(_p)</i> has an immediate effect on the setpoint. Note: The selection is not restricted by limit values. The selection of inappropriate values may lead to following errors or jumps!</td></tr><tr><td>TRUE</td><td><i>g_dnYOffset(_p)</i> is added along the set ramps (C3630) to the setpoint.</td></tr></table>	FALSE	<i>g_dnYOffset(_p)</i> has an immediate effect on the setpoint. Note: The selection is not restricted by limit values. The selection of inappropriate values may lead to following errors or jumps!	TRUE	<i>g_dnYOffset(_p)</i> is added along the set ramps (C3630) to the setpoint.
FALSE	<i>g_dnYOffset(_p)</i> has an immediate effect on the setpoint. Note: The selection is not restricted by limit values. The selection of inappropriate values may lead to following errors or jumps!						
TRUE	<i>g_dnYOffset(_p)</i> is added along the set ramps (C3630) to the setpoint.						

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_bRfgYOffsetDone	BOOL	R	Status signal "Offset adjustment" TRUE Offset adjustment completed.
q_dnCamPositionSet_p	Double integer	R	Resulting setpoint position in [inc]

Parameters																
Code	Subcode	Data type	Access	Information												
				<table><tr><th>Possible settings</th><th>Presetting</th></tr></table>	Possible settings	Presetting										
Possible settings	Presetting															
C3630	1		R / W	Acceleration/deceleration ramps Referred to 4000 rpm <table><tr><td colspan="2">Deceleration ramp for immediate stop (cancellation of the function)</td></tr><tr><td>0.01</td><td>{0.01 unit}129.99</td></tr><tr><td colspan="2">Acceleration ramp for adjustment</td></tr><tr><td>0.01</td><td>{0.01 unit}129.99</td></tr><tr><td colspan="2">Deceleration ramp for adjustment</td></tr><tr><td>0.01</td><td>{0.01 unit}129.99</td></tr></table>	Deceleration ramp for immediate stop (cancellation of the function)		0.01	{0.01 unit}129.99	Acceleration ramp for adjustment		0.01	{0.01 unit}129.99	Deceleration ramp for adjustment		0.01	{0.01 unit}129.99
Deceleration ramp for immediate stop (cancellation of the function)																
0.01	{0.01 unit}129.99															
Acceleration ramp for adjustment																
0.01	{0.01 unit}129.99															
Deceleration ramp for adjustment																
0.01	{0.01 unit}129.99															
	2			<table><tr><td>0.01</td><td>{0.01 unit}129.99</td><td>5.00 s</td></tr></table>	0.01	{0.01 unit}129.99	5.00 s									
0.01	{0.01 unit}129.99	5.00 s														
	3			<table><tr><td>0.01</td><td>{0.01 unit}129.99</td><td>5.00 s</td></tr></table>	0.01	{0.01 unit}129.99	5.00 s									
0.01	{0.01 unit}129.99	5.00 s														
C3631	1		R / W	Adjustment speed <table><tr><td colspan="2">In positive direction (CW)</td></tr><tr><td>0</td><td>{1 unit}15000</td></tr><tr><td colspan="2">In negative direction (CCW)</td></tr><tr><td>0</td><td>{1 unit}15000</td></tr></table>	In positive direction (CW)		0	{1 unit}15000	In negative direction (CCW)		0	{1 unit}15000				
In positive direction (CW)																
0	{1 unit}15000															
In negative direction (CCW)																
0	{1 unit}15000															
	2			<table><tr><td>0</td><td>{1 unit}15000</td><td>200 rpm</td></tr></table>	0	{1 unit}15000	200 rpm									
0	{1 unit}15000	200 rpm														



Function

- The acceleration/deceleration ramps and the speed for adjusting the setpoint by the offset can be selected by means of parameters.
- The offset by which the setpoint is to be adjusted can be selected via *g_dnYOffsetin* [unit] or via *g_dnYOffset_p* in [inc].
 - Please observe the instructions for the conversion from [unit] into [inc]. (5-82)
- The adjustment is activated by setting *g_bRfgYOffsetExecute* to TRUE.
- When the adjustment has been completed, *g_bRfgYOffsetDone* is set to TRUE.
- The resulting setpoint position is output at *g_dnCamPositionSet_p* in [inc].

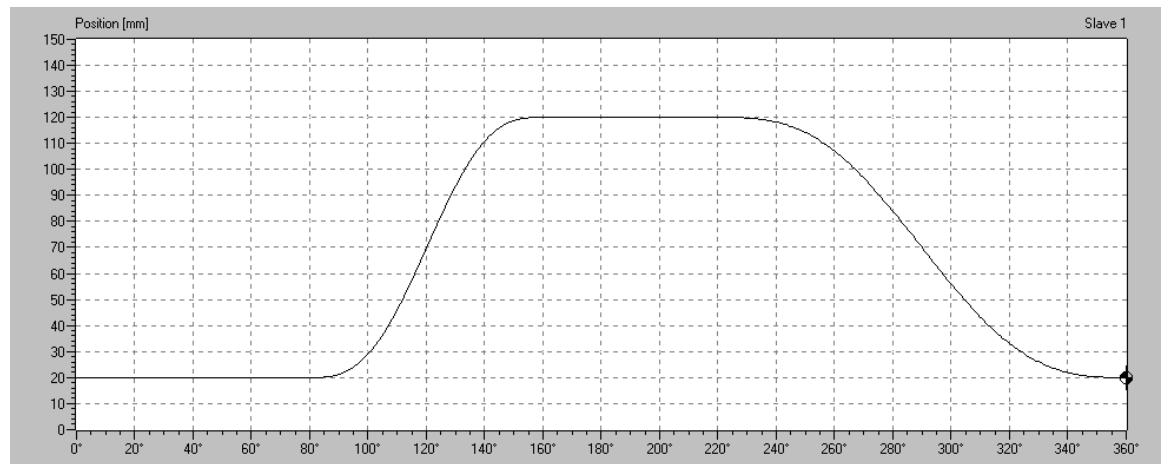
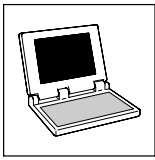


Fig. 5-44

Shifting of the profile in Y position by 20 mm through an offset.

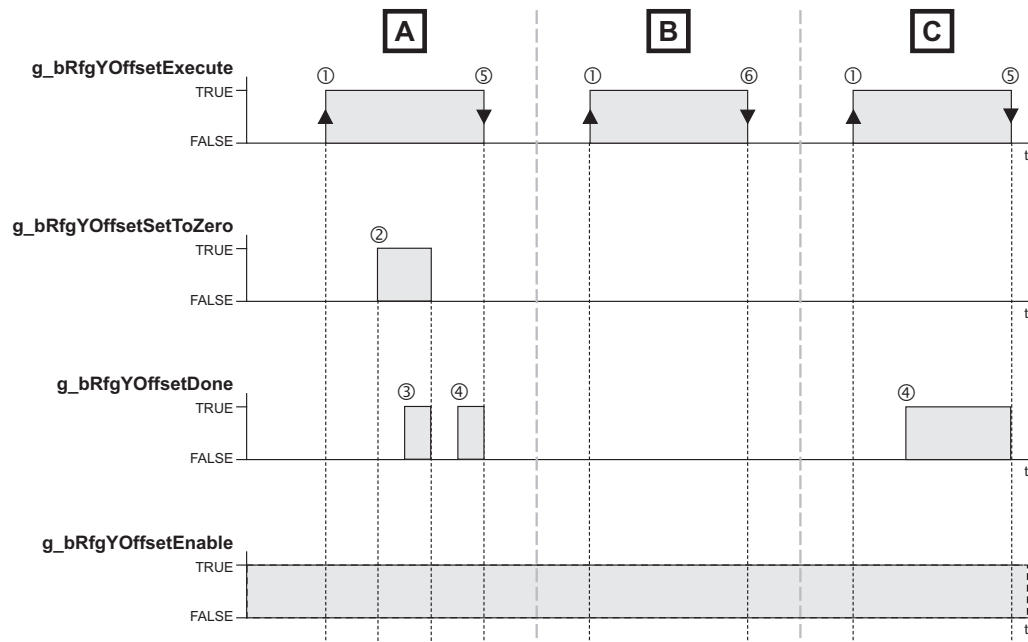


Template Cam

Functions

"YOffset" function - selection of an offset for the setpoint

Response of the function



Information	
A Execution of the function with offset reset	
①	Start of setpoint (Y axis) adjustment by the Y offset.
②	Start of offset reset to reset the corresponding offset part to "0".
③	Setpoint reset completed. (Offset value = 0)
④	Setpoint adjustment by means of the YOffset function has been completed. (Offset value = $g_dnYOffset$)
⑤	The offset adjustment is deactivated.
B Cancellation	
①	Start of setpoint (Y axis) adjustment by the Y offset.
⑥	Cancellation of the setpoint adjustment. Note: Part of the setpoint adjustment has been executed.
C Execution of the function without offset reset	
①	Start of setpoint (Y axis) adjustment by the Y offset.
④	Setpoint adjustment by means of the YOffset function has been completed. (Offset value = $g_dnYOffset$)
⑤	Setpoint adjustment has been completed.

Deactivate offset

Set $g_bRfgYOffsetSetToZero$ to TRUE to set the offset internally to "0", i.e. the profile generator sets the offset to "0".

The setpoint is output 1:1 at the output $g_dnCamPositionSet_p$.

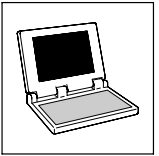
Activate/deactivate offset ramp

If $g_bRfgYOffsetEnable$ is set to TRUE, the setpoint is adjusted along the selected ramp by $g_dnYOffset_p$, if $g_bRfgYOffsetEnable$ = FALSE, the ramp function is deactivated, i.e. the offset immediately influences the setpoint.



Note!

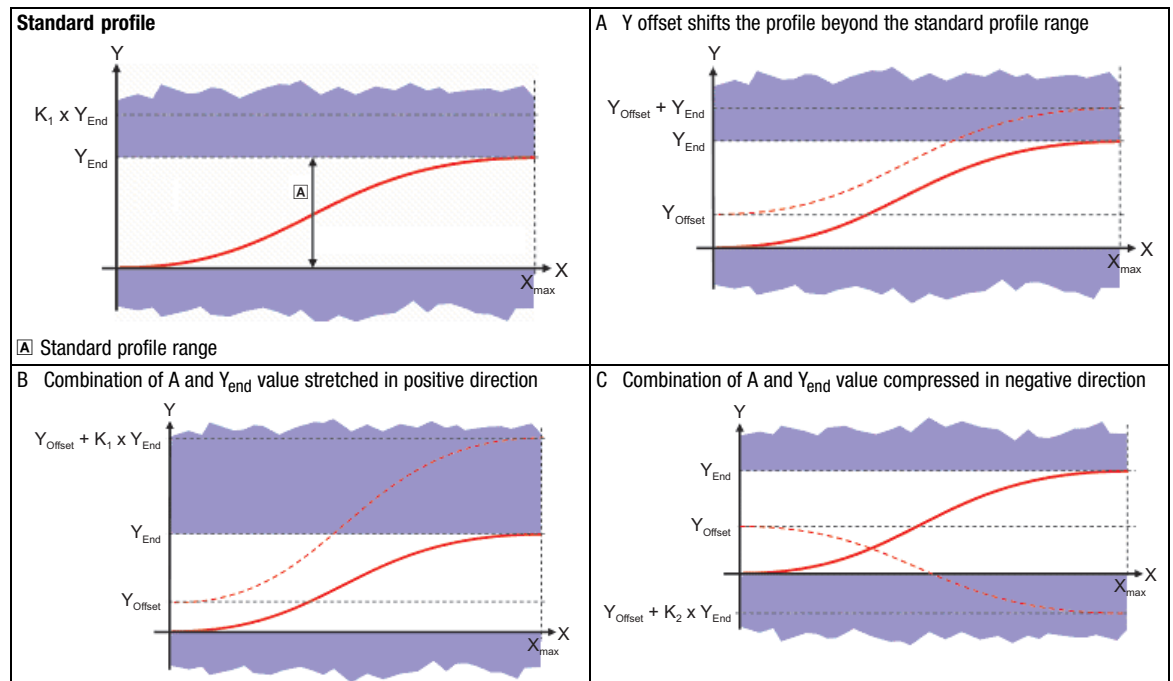
When changing from direct offset selection to ramp function, please observe that the internal ramp generator always retains the last offset value and sets the corresponding value when $g_bRfgYOffsetEnable$ is set to TRUE.



"Lock to Cam" command with stretched/shifted feed profiles

If motion profiles are shifted by means of an Y offset, torque jumps and, as a result, following errors will occur, if

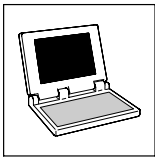
- Template Cam has been configured as a feed axis ($g_bCircularAxis = TRUE$).
- The "Lock to Cam" command ($g_bLockToCam = TRUE$) is used to approach a position which is not within the standard profile range ($y < 0$ or $y > y_{end}$):



With relative feed profiles ($g_bCircularAxis = TRUE$) only carry out positioning to profile position if the Y offset = 0.

If an Y offset is absolutely necessary with relative feed profiles ($g_bCircularAxis = TRUE$) when positioning to profile position (A, B and C), execute the "Lock to Cam" command as follows:

1. The drive is in "StandBy".
2. Ensure that the master value is not changed (e.g. by disengaging the clutch in the master value string).
3. Select linear profile operation ($g_bCircularAxis = FALSE$).
4. Carry out positioning to profile position ($g_bLockToCam = TRUE$) and wait until $g_bLockToCamDone = TRUE$.
5. Switch back to feed profiles ($g_bCircularAxis = TRUE$).
6. Enable the master value (e.g. by engaging the clutch in the master value string).



Template Cam

Functions

"YStretchCompress" function - stretching and compression of the setpoint

5.7.13 "YStretchCompress" function - stretching and compression of the setpoint

Use this template function to stretch or compress the setpoint (Y axis) *in online mode*.

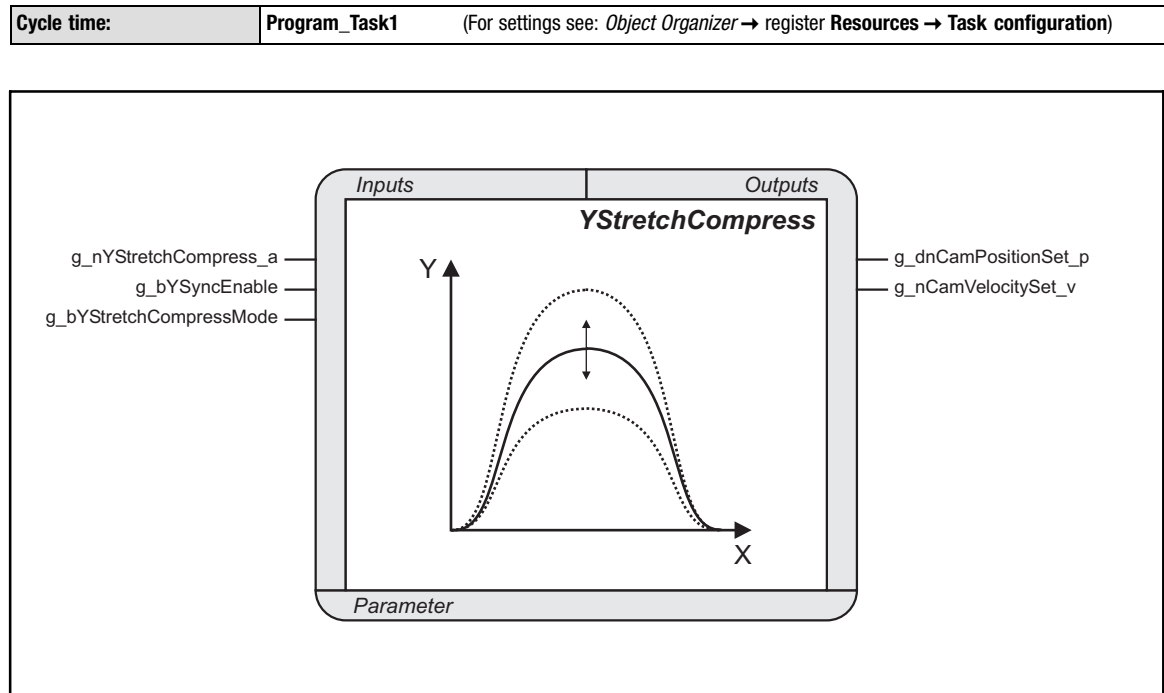
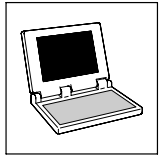


Fig. 5-45 "YStretchCompress" function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_nYStretchCompress_a	Integer	R / W	Stretching/compression factor for the motion profile.
			16384 = 100 % - If g_bYStretchCompressMode = TRUE also stretching/compression factor for the Y offset
			< 0 Inversion
			< 16384 Compression
			= 16384 No stretching/compression (factor = 100 %)
			> 16384 Stretching
g_bYSyncEnable	BOOL	R / W	Activate synchronised stretching/compression
			FALSE Synchronised stretching/compression deactivated. Increments will get lost if the stretching/compression factor is not changed at standstill.
			TRUE Synchronised stretching/compression activated. The stretching/compression factor can only be changed when the profile is crossing zero.
g_bYStretchCompressMode	BOOL	R / W	Apply stretching/compression also to the Y offset
			TRUE The stretching/compression factor is also applied to the Y offset.

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_dnCamPositionSet_p	Double integer	R	Resulting setpoint position in [inc]
g_nCamVelocitySet_v	Integer	R	Resulting profile speed (output)



Stretching & compression

The motion profile can be changed *online* via the stretching/compression factor.

Example for the travel change of a mechanical cam:	Stretching/compression factor		Stretching/ compression	Reversal of direction
	Selection at <i>g_nYStretchCompress_a</i>	≡ Value in percent		
	+16384	+100 %	No	No
	-16384	-100 %	No	Yes, in Y position
	> 16384	>100 %	Stretching	No
	0 ... 16384	0 ... 100 %	Compression	No
	< 0	< 0 %	Compression	Yes
	< -16384	< -100 %	Stretching	Yes

Examples

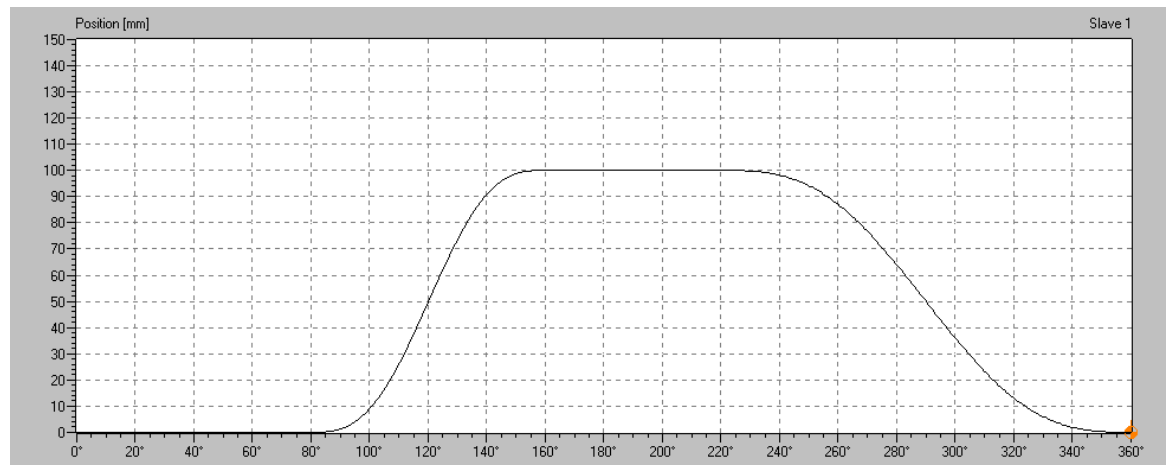


Fig. 5-46

g_nYStretchCompress_a = 16384 (100 % of 100 mm travel)

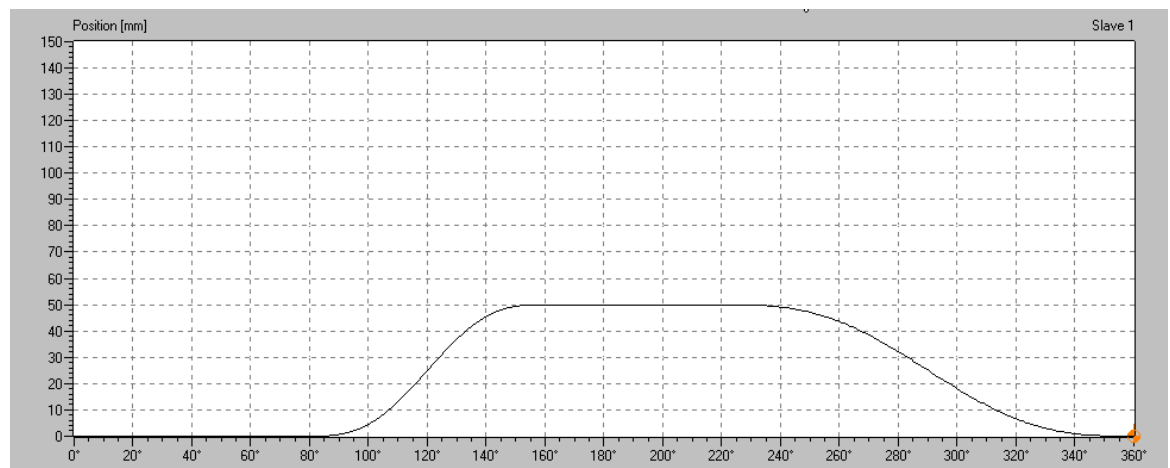
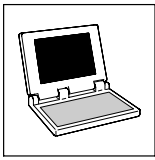


Fig. 5-47

Compression: *g_nYStretchCompress_a* = 8192 (50 % of 100 mm travel)



Template Cam

Functions

"YStretchCompress" function - stretching and compression of the setpoint

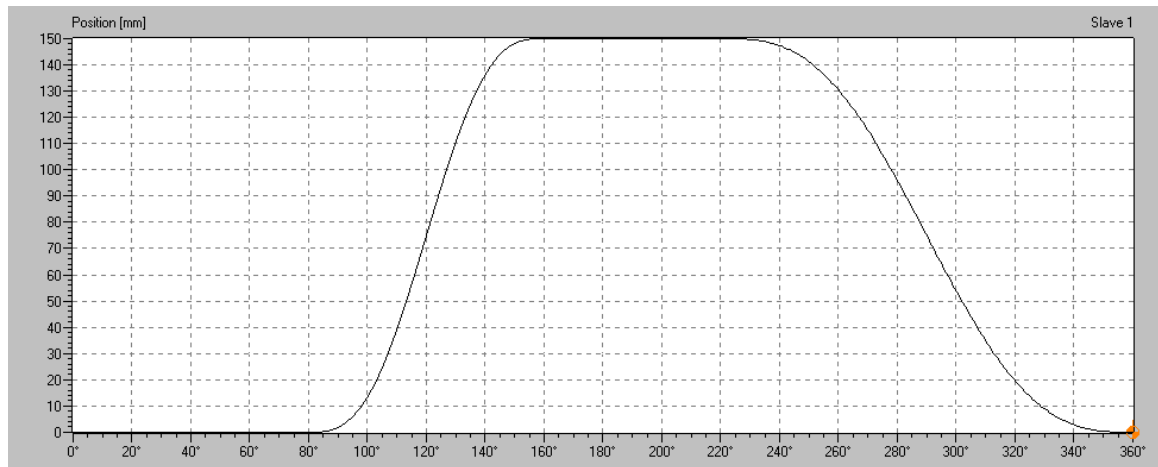


Fig. 5-48

Stretching: $g_nYStretchCompress_a = 24576$ (150 % of 100 mm travel)

Synchronised stretching/compression

Synchronised stretching/compression is necessary if the factor has to be changed during operation (speed $\neq 0$).

- In Template Cam, this function is activated by default ($g_bYSyncEnable = TRUE$).
- The stretching/compression factor is automatically changed when the X axis is crossing zero.



Note!

Please note that the Y stretching/compression is not directly applied to position values, but to speed values. A stretching/compression that is not synchronised can result in the loss of the cam position.

Asynchronous stretching/compression

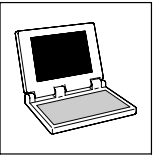
Here, the stretching/compression factor may only be changed in a latch phase at $x = 0$. Otherwise, increments will get lost.0

The function is activated by setting $g_bYSyncEnable$ to FALSE.

Stretching/Compression of the offset

If $g_bStretchCompressMode$ is set to TRUE, the stretching/compression factor will also be applied to the offset selection of the **YOffset** function, i.e. the Y offset will also be stretched or compressed.

(5-81)



5.7.14 "YTouchProbeSynchronisation" function - cyclic synchronisation

Use this template function for a cyclic synchronisation to machine or material-dependent labels to compensate for the slip in systems which are "subject to slip" (e.g. conveyor belts).

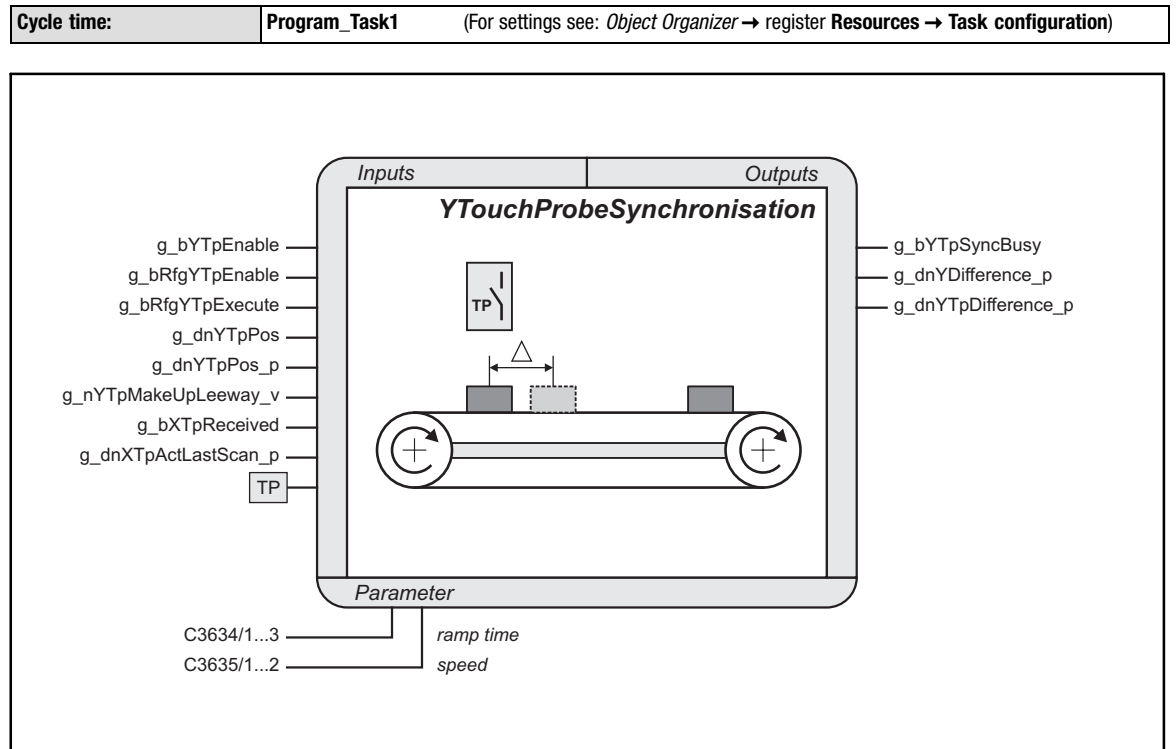
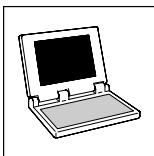


Fig. 5-49

"YTouchProbeSynchronisation" function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bYTpEnable	BOOL	R / W	Activation of cyclic synchronisation
			TRUE Cyclic synchronisation activated.
g_bRfgYTpEnable	BOOL	R / W	Selection of the compensation
			FALSE The difference is compensated by a constant speed value at g_nYTpMakeUpLeeway_v. TRUE The difference is compensated by means of the internal ramp generator.
g_bRfgYTpExecute	BOOL	R / W	Start ramp generator for compensation of position difference
			FALSE Ramp generator is not active, position difference is not compensated. FALSE ↗ TRUE Position difference (g_dnYDifference_p) is compensated by means of the internal ramp generator.



Template Cam

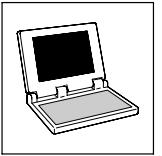
Functions

"YTouchProbeSynchronisation" function - cyclic synchronisation

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_dnYTpPos	Double integer	R / W	Distance between zero and TP sensor in [unit] - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See conversion info) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!
g_dnYTpPos_p	Double integer	R / W	Distance between zero and TP sensor in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!
Information: Conversion from [unit] into [inc]: If the value is selected in [unit], it will be internally converted into [inc] by means of the following formula and written to the input variable for [inc]: $\text{value in [inc]} = \text{value in [unit]} \cdot \frac{65536 \text{ [inc/rev]}}{\text{feed constant [unit/rev]}} \cdot \frac{\text{gearbox numerator}}{\text{gearbox denominator}}$ - The conversion takes approx. 50 ms (depending on the size of the user program). It will only be carried out if the value of the input variable has changed. - For time-critical applications, the value should be directly selected in [inc] because this value is directly accepted. In this case, the variable for the selection in [unit] should be set to "0" to avoid inconsistencies. - Use the <i>Project settings</i> dialog box in the CamDesigner/CamLoader to select the settings for feed constant and gearbox factors.			
g_nYTpMakeUpLeeway_v	Integer	R / W	Speed in [inc/ms] for compensation of position difference Only relevant if the difference is compensated by a constant speed value (<i>g_brfgYTpEnable</i> = FALSE).
g_bYTpReceived	BOOL	R / W	Trigger input for the calculation of the position difference FALSE ↗ TRUE New calculation of position difference.
g_dnYTpActLastScan_p	Double integer	R / W	Δinc between touch probe and task start

Outputs ⇨				
Identifiers	Data type	Access	Value/meaning	
g_bYTpSyncBusy	BOOL	R	Status of TP correction	
			FALSE	At present setpoints are not being corrected.
			TRUE	Synchronisation is active, Y difference is being compensated.
g_dnYDifference_p	Double integer	R	Correction value for touch probe signal in [inc] • Only to be used if <i>g_brfgYTpEnable</i> = TRUE.	
g_dnYTpDifference_p	Double integer	R	Difference between two touch probe signals in [inc] • Only to be used if <i>g_brfgYTpEnable</i> = TRUE.	

Parameters				
Code	Subcode	Data type	Access	Information
C3634	1		R / W	Acceleration/deceleration ramps Referred to 4000 rpm
				Deceleration ramp for immediate stop (not effective)
				0.01 {0.01 unit} 129.99 5.00 s
				Acceleration ramp for adjustment
				0.01 {0.01 unit} 129.99 5.00 s
				Deceleration ramp for adjustment
C3635	1		R / W	Speed for compensation
				In positive direction (CW)
				0 {1 unit} 15000 200 rpm
				In negative direction (CCW)
				0 {1 unit} 15000 200 rpm



Touch probe synchronisation

Required settings:

- The position of the touch probe sensor referred to the zero crossing of the Y axis is selected via *g_dnYTpPos* in [unit] or via *g_dnYTpPos_p* in [inc].
– Please observe the instructions for the conversion from [unit] into [inc]. (▢ 5-90)
- Use *g_bRfgYTpEnable* to select if the position difference is to be compensated by means of the internal ramp generator or the speed selected at *g_nYTpMakeUpLeeway_v*.
- Set *g_bYTpEnable* to TRUE to activate the synchronisation function.



Tip!

If the incoming touch probe signals shall only be detected in specific position areas, the input *g_bYTpEnable* can be controlled by means of cams.

*Compensation by means of an internal ramp generator (*g_bRfgYTpEnable* = TRUE)*

A FALSE/TRUE edge on *g_bRfgYTpExecute* starts the internal ramp generator for compensation.

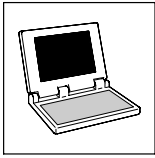
- The following compensation processes do not require a new FALSE-TRUE transition at *g_bRfgYTpExecute*.
- Use the parameters C3634 and C3635 to select the acceleration/deceleration ramps and the speed for compensation.

*Compensation through constant compensation speed (*g_bRfgYTpEnable* = FALSE)*

Use *g_nYTpMakeUpLeeway_v* to select the compensation speed. A difference between actual value and setpoint will only be compensated if the value is > 0.

Status of the touch probe synchronisation

As long as the compensation process is active and the difference between actual value and setpoint exists, TRUE will be indicated at the output *g_bYTpSyncBusy*.



Template Cam

Functions

Parallel functions

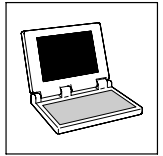
5.8 Parallel functions



Note!

The following functions are **always** executed as a parallel process to the status machine!

Function	Info	
ErrorProcedure	Troubleshooting	5-93



5.8.1 "ErrorProcedure" function - troubleshooting

Use this template function to display faulty process states by means of error messages and activate a corresponding response (TRIP, warning, etc.) in the PLC. The template function also includes the following error monitoring.

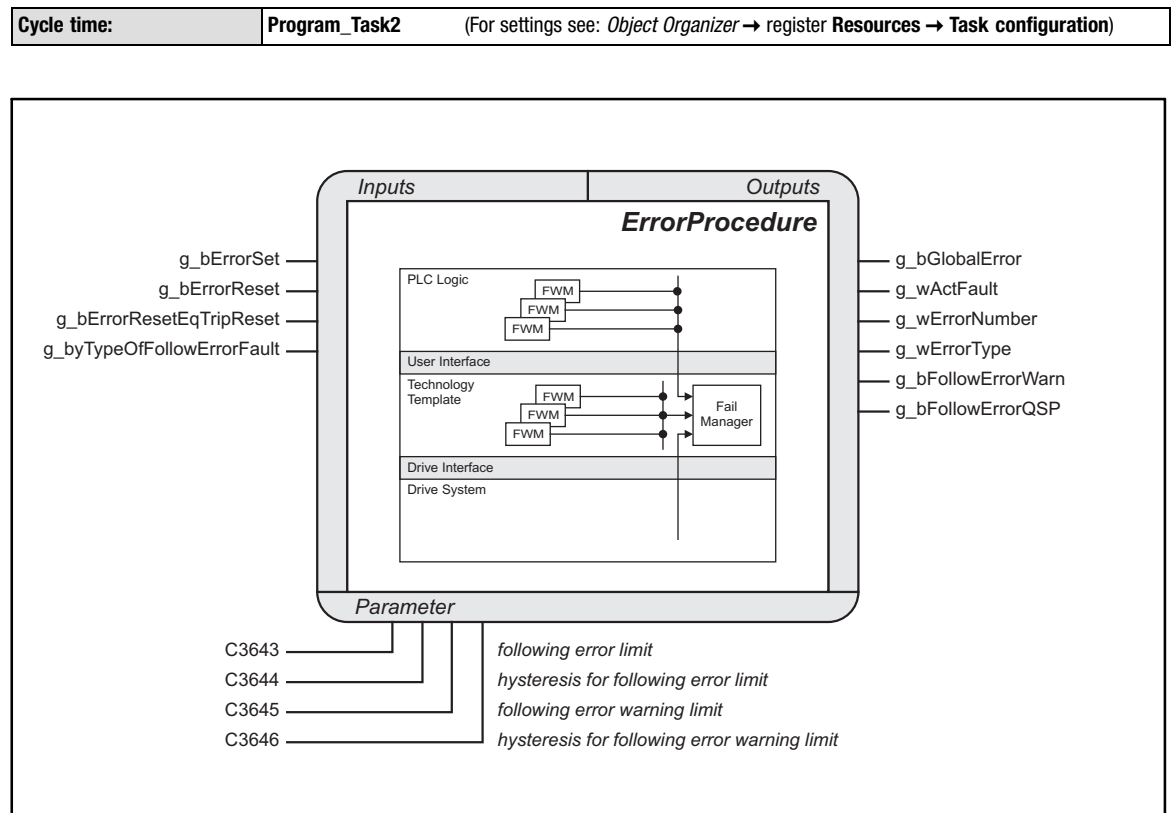
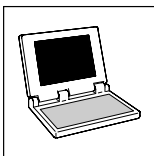


Fig. 5-50 "ErrorProcedure"function

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
<code>g_bErrorSet</code>	BOOL	R / W	Change to "Error" - This variable can be set by means of the "Set" instruction. - It is automatically reset to FALSE by the template. TRUE Change to "Trouble"
<code>g_bErrorReset</code>	BOOL	R / W	Reset of template-internal and user-defined errors If the variable <code>g_bErrorResetEqTripReset</code> is set to TRUE, a TRIP reset will be carried out together with the error reset. TRUE Error reset
<code>g_bErrorResetEqTripReset</code>	BOOL	R / W	TRIP reset will be carried out when template-internal and user-defined errors are reset. TRUE Error reset <code>g_bErrorReset</code> = TRUE activates TRIP reset in the PLC.
<code>g_byTypeOfFollowErrorFault</code>	Byte	R / W	Selection of the response to following errors 0 TRIP 1 Message (do not use!) 2 Warning 3 Following error evaluation deactivated (no response) 4 FAIL-QSP



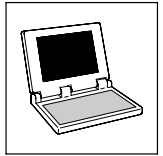
Template Cam

Functions

"ErrorProcedure" function - troubleshooting

Outputs ⇨													
Identifiers	Data type	Access	Value/meaning										
g_bGlobalError	BOOL	R	Status signal "Global error" - The template is in "Trouble". - In case of template or user errors, <i>g_bErrorSet</i> will also be TRUE. <table><tr><td>TRUE</td><td>A PLC, template or user error has occurred.</td></tr></table>	TRUE	A PLC, template or user error has occurred.								
TRUE	A PLC, template or user error has occurred.												
g_wActFault	WORD	R	Error channel for communication with the "FailManager". This variable can only be used for the FWM block.										
g_wErrorNumber	ErrorCode	R	Display of the error name See <i>Object Organizer</i>: Register Data types→folder UserDataTypes→ ErrorCode (ENUM)										
g_wErrorType	ErrorReaction	R	Output of the error response <table><tr><td>0</td><td>TRIP</td></tr><tr><td>1</td><td>Message</td></tr><tr><td>2</td><td>Warning</td></tr><tr><td>3</td><td>FAIL-QSP</td></tr><tr><td>4</td><td>Ready</td></tr></table>	0	TRIP	1	Message	2	Warning	3	FAIL-QSP	4	Ready
0	TRIP												
1	Message												
2	Warning												
3	FAIL-QSP												
4	Ready												
g_bFollorErrorWarn	BOOL	R	Status signal "Following error warning" <table><tr><td>TRUE</td><td>The following error warning limit (C3645) has been exceeded.</td></tr></table>	TRUE	The following error warning limit (C3645) has been exceeded.								
TRUE	The following error warning limit (C3645) has been exceeded.												
g_bFollorErrorQSP	BOOL	R	Status signal "Following error" <table><tr><td>TRUE</td><td>The following error limit (C3643) has been exceeded.</td></tr></table>	TRUE	The following error limit (C3643) has been exceeded.								
TRUE	The following error limit (C3643) has been exceeded.												

Parameters								
Code	Subcode	Data type	Access	Information				
				<table><tr><th>Possible settings</th><th>Presetting</th></tr></table>	Possible settings	Presetting		
Possible settings	Presetting							
C3643			R / W	Following error limit for activation of Fail-QSP <table><tr><td>0.0000</td><td>{0.0001 unit}</td><td>214000.0000</td><td>0 unit</td></tr></table>	0.0000	{0.0001 unit}	214000.0000	0 unit
0.0000	{0.0001 unit}	214000.0000	0 unit					
C3644			R / W	Hysteresis for following error limit Value by which the following error limit (C3643) must be fallen below for following error reset. <table><tr><td>0.0000</td><td>{0.0001 unit}</td><td>214000.0000</td><td>0 unit</td></tr></table>	0.0000	{0.0001 unit}	214000.0000	0 unit
0.0000	{0.0001 unit}	214000.0000	0 unit					
C3645			R / W	Following error warning limit <table><tr><td>0.0000</td><td>{0.0001 unit}</td><td>214000.0000</td><td>0 unit</td></tr></table>	0.0000	{0.0001 unit}	214000.0000	0 unit
0.0000	{0.0001 unit}	214000.0000	0 unit					
C3646			R / W	Hysteresis for following error warning limit Value by which the following error warning limit (C3645) must be fallen below for following error warning reset. <table><tr><td>0.0000</td><td>{0.0001 unit}</td><td>214000.0000</td><td>0 unit</td></tr></table>	0.0000	{0.0001 unit}	214000.0000	0 unit
0.0000	{0.0001 unit}	214000.0000	0 unit					



5.8.1.1 Error types and responses

Error types

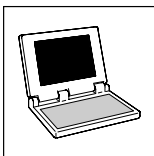
With regard to error handling, the following error messages are distinguished:

	Error number	Information
System error messages	0 ... 399	System error messages are firmly implemented in the PLC and cannot be changed by the user.
Template error messages	400 ... 499	Template error messages are firmly implemented in the template and cannot be changed by the user.
User error messages	500 ... 999	User error messages can be freely defined by the user.

Responses

Depending on the error, one or several of the following responses are possible:

Response	Effects / description	Danger warning
TRIP (highest priority)	- Controller is inhibited ($g_bDCTRL_bCinh_b = TRUE$). - Variable $g_wErrorType$ is set to "0". - Error display under code C0168/1 and/or C3998 - The error status remains active until the cause of the error has been eliminated and the error has been acknowledged ($g_bErrorReset = 1$)	
FAIL-QSP	- Controller is not inhibited. - Quick stop is activated, the drive decelerates along the quick stop ramp (C0105) to standstill. (The drive is not inhibited.) - Variable $g_wErrorType$ is set to "3". - FAIL-QSP is only activated by Template Cam and only indicated under code C3998. - The error status remains active until the cause of the error has been eliminated and the error has been acknowledged ($g_bErrorReset = 1$)	
Warning	- Controller is not inhibited. - The operation of the drive is not influenced. Warnings are used to provide additional information about the status of the drive. - Variable $g_wErrorType$ is set to "2". - Error display under code C0168/1 and/or C3998 - The warning is available until the cause is eliminated. If the cause has been eliminated, the warning is reset automatically.	 Stop! Since this response does not have any effects on the behaviour of the drive, the drive may be destroyed.
Message (lowest priority)	- Controller is inhibited ($g_bDCTRL_bCinh_b = TRUE$). - Variable $g_wErrorType$ is set to "1". - Error display under code C0168/1 and/or C3998 - The message is available until the cause is eliminated. If the cause has been eliminated, the message is reset automatically.	 Danger! The drive restarts automatically when the message is no longer active.



Template Cam

Functions

"ErrorProcedure" function - troubleshooting

Template error messages

The following template error messages are implemented in the templates of the software packages:

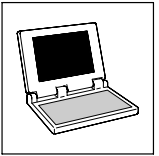
Error message	Error number	Cause	Relevant for template	
			Cam	Positioner
PosLimitSwitch	400	The positive limit switch has been activated.	✓	✓
NegLimitSwitch	401	The negative limit switch has been activated.	✓	✓
PosPositionLimit	402	The positive software limit position has been reached.		✓
NegPositionLimit	403	The negative software limit position has been reached.		✓
FollowErrWarning	404	The following error warning limit has been reached or exceeded.	✓	✓
FollowErrFail	405	The following error limit has been reached or exceeded.	✓	✓
HomePosError	406	Positioning with unknown home position		✓
Initialisation	407	A warning has occurred during initialisation.		✓
UserQuickstop ¹	408	A user quick stop has been actuated.	✓	
MaxVelConflict	409	The maximum permissible speed has been exceeded.		✓
DriveNotReady ¹	410	The PLC is not ready.	✓	
VisuQuickstop ¹	411	A quick stop has been activated via the visualisation.	✓	
InitError	412	An error has occurred during initialisation.		✓
ParameterSaveError	413	An error has occurred during saving of the parameters.	✓	
SwapPositionMode	414	A wrong positioning mode has been selected.	✓	
XYPosChangeLimit	415	The speed selected for the x axis is too high.	✓	
PosToExtNoSpeed	416	The positioning speed has not been selected.	✓	
InvalidSoftwareLimits	417	Invalid/non plausible selections for the software limit positions.		✓
XTPPositionOutOfLimit	418	The position of the touch probe sensor (x axis) is not within the adjustable range.	✓	
StateBusError	419	Another device has indicated an error via the state bus.	✓	
OU_MCTRL_TemplateError	420	DC bus overvoltage.	✓	
LU_MCTRL_TemplateError	421	DC bus undervoltage.	✓	
InvalidProfileData	422	Error in the profile parameter set.		✓
OverflowInternalSetPos	423	Internal path integrator overflow		✓
UserError	500	User error (can be defined by the user, see 7-21)	✓	

¹ These error messages only represent errors in template states in which the tool is actively moved.



Note!

- Detailed information on the **system error messages** can be found in the "Appendix" of your **9300 servo PLC Manual**.
- The definition of **user error messages** is given within the **UserErrors (PRG)** POU (see chapter 6.1. (6-1), which you can adjust and extend accordingly.



5.8.1.2 Monitoring with regard to following errors

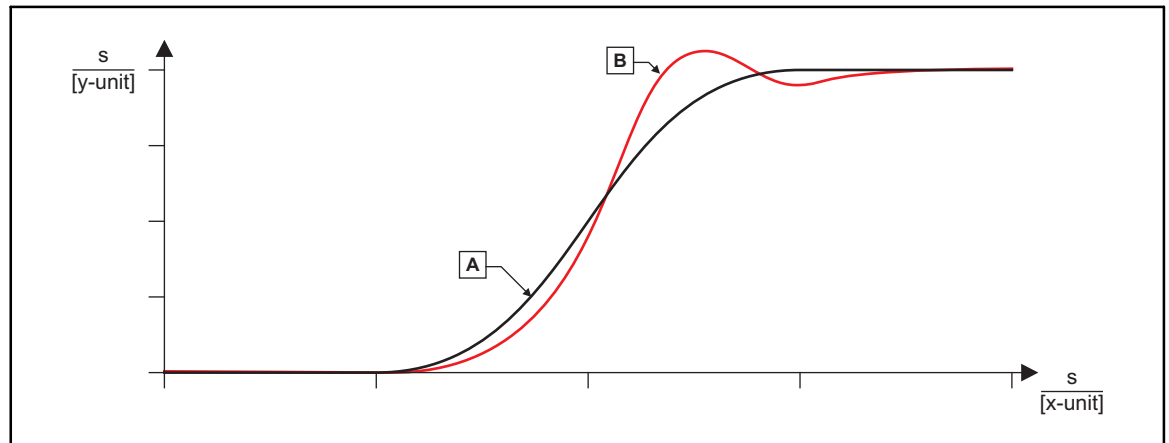
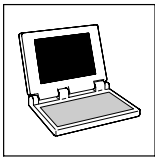


Fig. 5-51

Following error
A Setpoint profile
B Processed profile

The following error monitoring is configured under the following parameters:

Parameters				
Code	Subcode	Data type	Access	Information
				Possible settings Presetting
C3643			R / W	Following error limit for activation of Fail-QSP 0.0000 {0.0001 unit} 214000.0000 0 unit
C3644			R / W	Hysteresis for following error limit • Value by which the following error limit (C3643) must be fallen below for following error reset. 0.0000 {0.0001 unit} 214000.0000 0 unit
C3645			R / W	Following error warning limit 0.0000 {0.0001 unit} 214000.0000 0 unit
C3646			R / W	Hysteresis for following error warning limit • Value by which the following error warning limit (C3645) must be fallen below for following error warning reset. 0.0000 {0.0001 unit} 214000.0000 0 unit



Template Cam

Functions

"ErrorProcedure" function - troubleshooting

Following error warning unit (C3645)

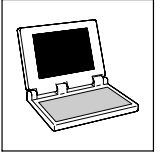
If the difference between setpoint and actual position is bigger than the value set under C3645, a following error warning will be activated.

- The hysteresis for the following error warning is selected under C3646. (Value by which the following error warning limit (C3645) must be fallen below for following error warning reset.)
- The variables *g_byErrorType* and *g_wErrorNumber* indicate the following error warning.

Following error limit (C3643)

If the difference between setpoint and actual position is bigger than the value set under C3643 the drive brakes along the set quick stop ramp to standstill and changes to "Trouble".

- The quick stop ramp can be set under the corresponding motor control parameter (C0105).
- The hysteresis for the following error is selected under C3644. (Value by which the following error limit (C3643) must be fallen below for following error reset.)
- Following errors are monitored in all movement states of the drive.



5.8.1.3 Error handling for single drives



Note!

The following explanations do not include the troubleshooting for "messages" and "warnings" because both of them are reset automatically by the controller.

Please note, however, that Template Cam under some circumstances evaluates "messages" as "TRIP". E.g. with profile operation, the undervoltage message (variable *g_bLockToCam* = TRUE) is evaluated both as a "message" from the operating system (C0168/1) and as a (template) error.

For troubleshooting, proceed as follows:

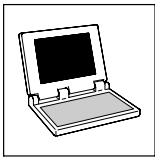
1. TRIP/FAIL-QSP occurs.
 - An error message/FAIL-QSP message is activated.
 - The cam template changes to "Trouble" (*g_byOperationState* = 1).
2. Remove the cause of TRIP/FAIL-QSP.
 - Eliminating the cause of the error does not influence the status of Template Cam (*g_byOperationState*).
3. Acknowledge the error message/FAIL-QSP message
 - Set the variable *g_bErrorReset* = 1.
 - Template Cam changes to "Standby" (*g_byOperationState* = 10).

The drive is ready for operation again.



Note!

If TRIP/FAIL-QSP has occurred in an operating status other than "Standby", use the corresponding control commands to change back to the required status (e.g. "Cam Operation").



Template Cam

Functions

"ErrorProcedure" function - troubleshooting

5.8.1.4 Error handling for multi-axis applications

In multi-axis applications, an error on an individual axis represents a danger for the entire machine module. Moving machine parts may collide with non moving parts and damage to machinery and/or faulty production parts may occur. Template Cam therefore allows you to interconnect several axes via the state bus (terminals ST1, ST2) to decelerate the entire multi-axis network to standstill.

State bus

The state bus been exclusively designed for Lenze controllers/PLCs and transfers only one single status (LOW and HIGH):

- $g_STATE_BUS_bIn_b = TRUE \Rightarrow HIGH \text{ level} = 0 \text{ V}$
- $g_STATE_BUS_bIn_b = FALSE \Rightarrow LOW \text{ level} = 13 \text{ V}$
 - There is no defined signal level. Therefore, the state bus cannot be used as a PLC interface!

Every single Lenze servo controller connected to the state bus, can use the variable $g_STATE_BUS_bOut_b$ to set the state bus level to 0 V. In this way, all devices connected to the state bus can be set to a preselected status (e.g. TRIP, QSP or controller inhibit).

If a different device sets the state bus to HIGH level, this will be detected by the state bus and the control signal can thus be processed in the PLC program.

Each device connected to the state bus can set the state bus to LOW level (multi-master capability). Max. 20 devices (9300 controllers) can be interconnected via the state bus.

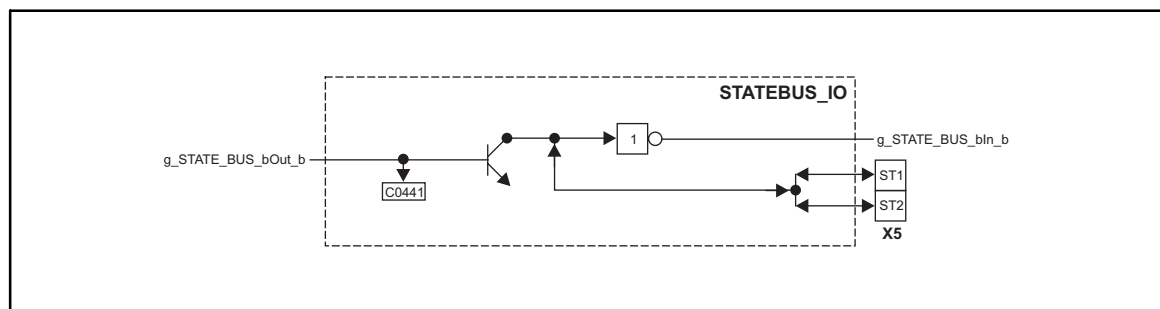
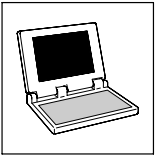


Fig. 5-52

STATEBUS_IOFB



Individual errors in multi-axis applications

For troubleshooting, proceed as follows:

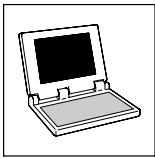
1. TRIP/FAIL-QSP occurs in a single drive.
 - An error message/FAIL-QSP message is activated in the drive in which the error has occurred.
 - Template Cam of the drive changes to "Trouble" ($g_byOperationState = 1$)
 - The variable $g_wErrorNumber$ indicates the error number.
 - The state bus is set to HIGH level (0 V) ($g_STATE_BUS_bln_b = TRUE$).
 - All other (faultless) drives connected to the state bus also change to "Trouble" and indicate a "StateBusErr" (error code 419) under code C3998.
2. Remove the cause of TRIP/FAIL-QSP at the drive in which the error has occurred.
 - Eliminating the cause of the error does not influence the status of Template Cam ($g_byOperationState$).
3. Acknowledge the error message/FAIL-QSP message for the drive in which the error has occurred.
 - Set the variable $g_bErrorReset = 1$.
 - Template Cam changes to "Standby" ($g_byOperationState = 10$).
 - The state bus is set to LOW level (13 V) ($g_STATE_BUS_bln_b = FALSE$).
 - The drive in which the error has occurred is ready for operation again.
 - The other drives continue to send FAIL-QSP "StateBusErr" – although the state bus has been reset.
4. Acknowledge the error message/FAIL-QSP message for the other (faultless) drives.
 - Set the variable $g_bErrorReset = 1$.
 - Template Cam changes back to "Standby" ($g_byOperationState = 10$)

The whole network of drives is ready for operation again.



Note!

If TRIP/FAIL-QSP has occurred in an operating status other than "Standby", use for every single drive the corresponding control commands to change back to the required status (e.g. "Cam Operation"). Only after this, the single drives will be able to operate as a network of drives.



Template Cam

Functions

"ErrorProcedure" function - troubleshooting

Global error in multi-axis applications

For the troubleshooting of errors occurring within a short time or at the same time in several drives in multi-axis applications, proceed as follows:

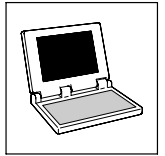
1. TRIP/FAIL-QSP occurs in several drives within a short time or at the same time (example: undervoltage).
 - An error message/FAIL-QSP message is activated in the drives in which the error has occurred.
 - Template Cam of the drives changes to "Trouble" ($g_byOperationState = 1$)
 - The variable $g_wErrorNumber$ indicates the error number.
 - The state bus is set to HIGH level (0 V) ($g_STATE_BUS_bIn_b = TRUE$).
 - All other (faultless) drives connected to the state bus also change to "Trouble" and indicate a "StateBusErr" (error code 419) under code C3998.
2. Remove the cause of TRIP/FAIL-QSP at the drives in which the error has occurred.
 - Eliminating the cause of the error does not influence the status of Template Cam ($g_byOperationState$).
3. Acknowledge the error message/FAIL-QSP message for the drives in which the error has occurred.
 - Set the variable $g_bErrorReset = 1$.
 - Template Cam changes to "Standby" ($g_byOperationState = 10$).
 - The state bus will only be reset to LOW level (13 V) when the first error has been acknowledged ($g_STATE_BUS_bIn_b = FALSE$).
4. Acknowledge the error message/FAIL-QSP message for the other (faultless) drives.
 - Set the variable $g_bErrorReset = 1$.
 - Template Cam changes to "Standby" ($g_byOperationState = 10$)

The whole network of drives is ready for operation again.



Note!

If TRIP/FAIL-QSP has occurred in an operating status other than "Standby", use for every single drive the corresponding control commands to change back to the required status (e.g. "Cam Operation"). Only after this, the single drives will be able to operate as a network of drives.

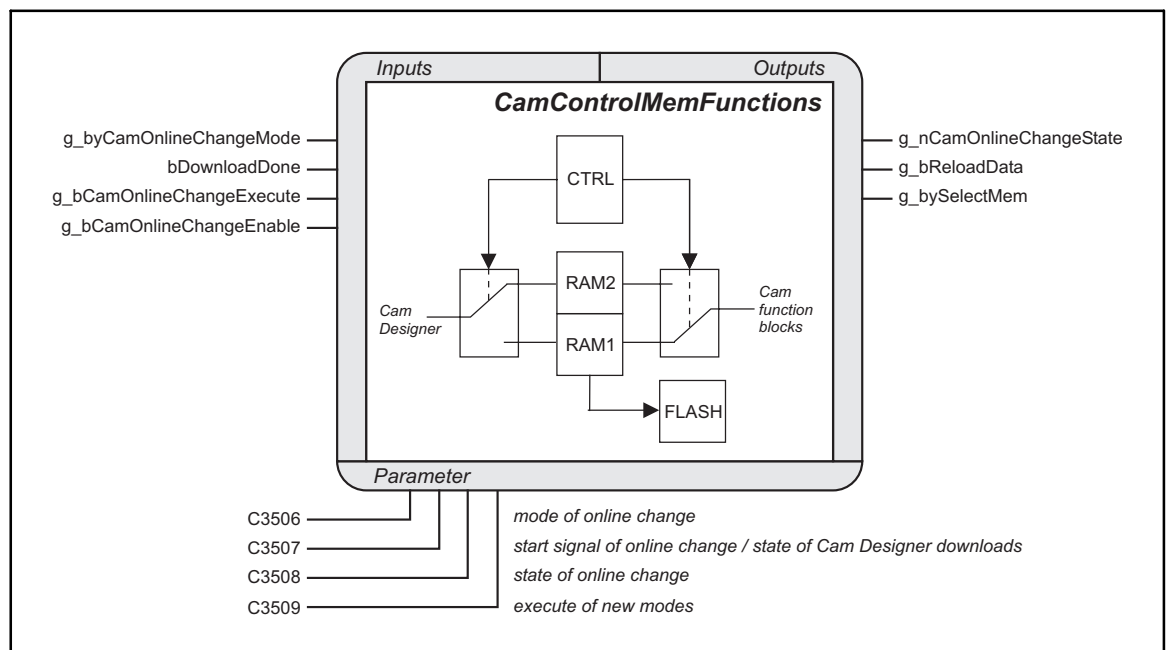


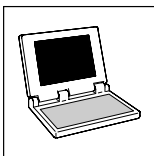
5.9 Motion profile management

5.9.1 "CamControlMemFunctions" function - online change

Changing the memory and accepting modified profile data.

The 9300 Servo PLC features two RAM storage blocks (RAM1 and RAM2) for processing the profile data. The **CamControlMemFunctions** function block controls a change between the RAM storage blocks as well as the acceptance of modified profile data. The modified data can be saved in the FLASH memory of the PLC with mains failure protection. The duration of a storage or loading function depends on the utilisation of the PLC.



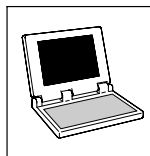


Template Cam

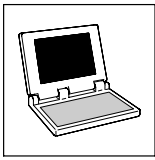
Functions

Motion profile management

Parameters (Variable type: VAR_INPUT)				
Identifiers Code*	Data type	Signal type	Information	
			Possible settings	Presetting
g_byCamOnline ChangeMode C3506	Byte	-	Selection of the operating mode of the online profile change	
			10	Mode 1: Changing the RAM storage block with a controlled acceptance by means of <i>g_bCamOnlineChangeExecute</i>
			15	Mode 1: Changing the RAM storage block with automatic acceptance
			20	Mode 2: Modifying the profile data in the same RAM storage block with automatic acceptance
			30	Saving the contents of the currently selected RAM storage block in the FLASH memory
bDownloadDone C3507	BOOL	Binary	Starting signal for the selected operating mode of the online profile changeover or status of the cam designer download - State change FALSE↗TRUE: starting change/acceptance Not write to C3507 if a profile download is to be effected by the cam designer!	
			TRUE	The Cam designer has completed the profile download.
g_bCamOnline ChangeExecute C3509	BOOL	Binary	Starting signal for the selected operating mode of the online profile change-over (<i>g_byCamOnlineChangeMode</i> = 10) - State change FALSE↗TRUE: start of the acceptance of the new profile data controlled by the user, as well as of the change of the RAM storage block. Only possible if a profile download by the cam designer has been carried out before.	
			TRUE	User-driven acceptance of the profile data and changeover of the RAM storage block has been effected.
g_bCamOnline ChangeEnable	BOOL	-	Selection of the operating mode of the online profile change	
			TRUE	Function is active.
			FALSE	Function is deactivated.
* Code of the first instance				



Parameters		(Variable type: VAR_OUTPUT)			
Identifiers	Data type	Signal type	Information		
			Possible settings		Presetting
g_nCamOnline ChangeState C3508	Integer	-	Carrying out the new modes of the online profile changeover		
			-6	Memory access at present not possible	0
			0	Ready for operation	
			5	Initialisation	
			7	Saving active	
			8	Loading active	
			10	Operating mode 10 active	
			11	Waiting for controlled acceptance in operating mode 10	
			15	Operating mode 15 active	
			20	Operating mode 20 active	
			30	Operating mode 30 active	
bReloadData	BOOL	Binary	Acceptance bit for the function blocks accessing the profile data. • <i>bReloadData</i> = TRUE additionally shows how long the function takes to switch over to the new profile data and to copy them into the new background data field (RAM storage block). • <i>bReloadData</i> is connected to the global variable <i>g_bReloadData</i>.		
bySelectMem	Byte	-	Controlled selection of the RAM storage block to place the function blocks of the CAM template to the current RAM storage block with the modified profile data. • <i>bySelectMem</i> is connected to the global variable <i>g_bySelectMem</i> and to the corresponding inputs of the function blocks used.		
* Code of the first instance					



Template Cam

Functions

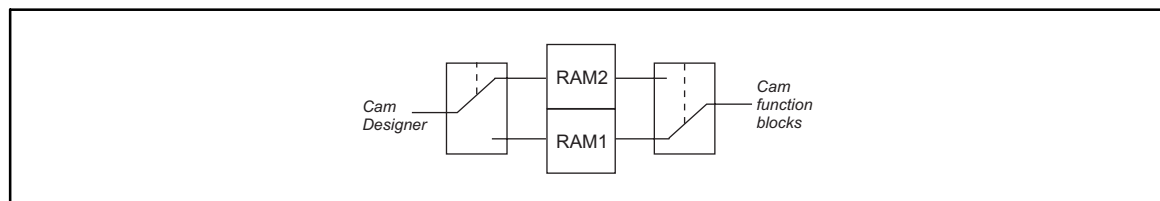
Motion profile management

Changeover functions

The profile data in the 9300 Servo PLC can be modified online via the following interfaces:

- Access via **cam designer/cam loader**
 - all product-specific variables (such as cams)
 - absolute and relative data model
- Access via the **L_CamEditProfileData**
- FB
 - modification of existing base points of the motion profile via PLC or PLC internal calculation functions.
 - absolute data model only

The modifications are effected in **mode 1** ($g_byCamOnlineChangeMode = 10$ or 15) in the so-called "background data field". This means that the function blocks with access to the profile data always work on the other RAM storage block, respectively. The "background data field" in this case always is the RAM storage block to which the profile function blocks currently do not access.

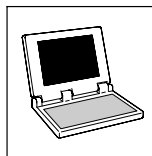


- The function blocks accessing to the profile data in the RAM storage block for the changeover to the modified data in the background data field require activation for changing over to the respective RAM storage block via the selection $g_bySelectMem$ and an acceptance edge ($g_bReloadData$).
- In controlled operation ($g_byCamOnlineChangeMode = 10$), the $g_bCamOnlineChangeExecute$ acceptance edge can be effected manually and together in the axis interconnection.
- For automatic operation ($g_byCamOnlineChangeMode = 15$) no acceptance edge is required. The new data is accepted automatically after setting the operating mode.

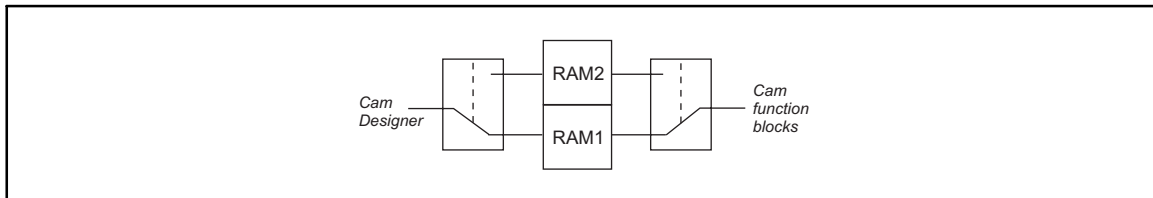


Note!

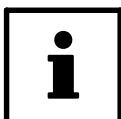
Please note that the global variables $g_bySelectMem$ and $g_bReloadData$ are connected to the template-internal **LenzeCamMemFunctions** FB and are therefore operated by the FB.



In **mode 2** ($g_byCamOnlineChangeMode = 20$), at the time the changes are effected the function blocks operate on the same RAM storage block - the so-called "foreground data field".



- Operating mode 20 operates as operating mode 15, only that it is simultaneously written to the same data field (always RAM storage block 1).



Stop!

If the cam used for the motion control of the drive at the same time also is the cam to be modified, there may be compensation movements. Therefore mode 2 is primarily suitable for optimising the motion sequences with a stagnant master angle.

- In mode 2, the function blocks do not receive a reload signal ($g_bReloadData$ is not triggered), as the data field is not changed.



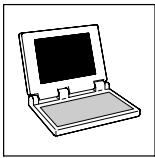
Tip!

Mode 1

After downloading the modified data, the changes are copied to the *previously used* data field in the background. The contents of the RAM storage blocks are identical until the next modification.

Mode 2

After downloading the modified data, in the background the changes are copied to the data field that is *not used*. The contents of the RAM storage blocks are identical until the next modification.



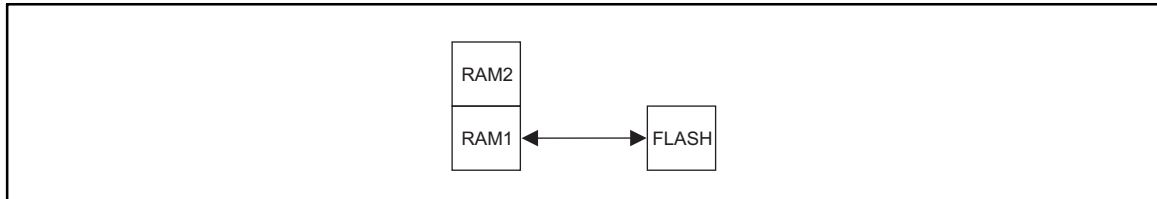
Template Cam

Functions

Motion profile management

Saving and loading functions

After optimisation or the "Online change", the data can be saved in the FLASH memory with mains failure protection.

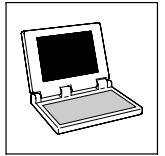


For operating mode $g_byCamOnlineChangeMode = 30$, the data of the current RAM storage block are saved in the FLASH memory.



Note!

- All saving or loading functions require a FALSE-TRUE edge on $g_bCamOnlineChangeExecute$ for starting.
- No other actions can be triggered parallelly to saving or loading data of a RAM storage block.



6 Program Organisation Units (POUs)

The template already includes the following POUs which can be adapted and extended, if desired:

- The POU **UserErrors (PRG)** to eliminate user-defined errors.
- The POU **UserProcessInput (PRG)** to add functions which must be processed in the same time interval and quasi parallel to the cam functions. (▢ 6-3)
- The POU **UserTouchProbeInput (PRG)** to adapt the touch probe interface to your hardware and to add functions which must be processed in the same time interval, but before the x axis. (▢ 6-4)

6.1 "UserErrors" POU - Troubleshooting

This POU serves to define user error messages by means of the **FWM** function block included in the template



Tip!

The **FWM** FB is used to transmit error messages to the PLC.

- With this FB it is possible to activate TRIP, FAIL-QSP, message or warning in the PLC directly by the PLC program.

The POU **UserErrors (PRG)** is in the register **Organization units**→folder **UserExtensions**→folder **Program_Task3** of the *Object Organizer* and already includes a network example:

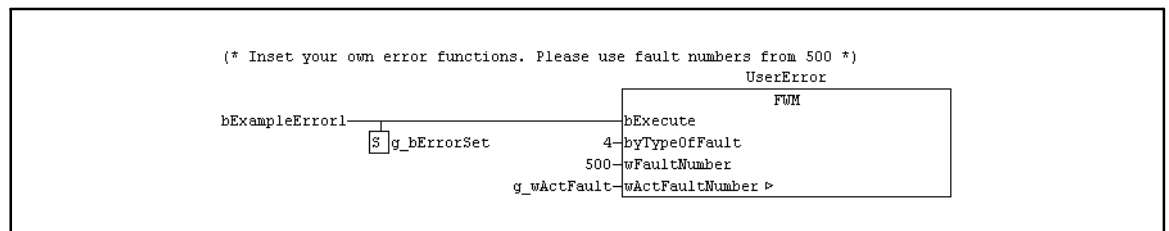


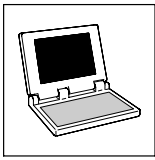
Fig. 6-1

Network example in the POU "UserErrors (PRG)" with an instance of the **FWM**

Fig. 6-2

FB

bExampleError1 is the variable for error detection in the network example, i.e. this variable activates the configured error message by means of a HIGH signal at the input *bExecute* of the **FWM** FB and sets the global variable *g_bErrorSet* to TRUE.



Template Cam

Program Organisation Units (POUs)

"UserErrors" POU - Troubleshooting

6.1.1 Adding user error messages to the template

If you want to monitor special machine states, you can add additional user error messages to the template in the POU **UserErrors (PRG)**.

Proceed as follows to add additional user error messages to the template:

1. Create a new network by copying and pasting the network example contained in the POU **UserErrors (PRG)**.
2. Connect the input *bExecute* of the FB **FWM** with the Boolean variable you want to monitor.
 - For correct error triggering, the Boolean variable to be monitored must only be TRUE if the special machine state occurs.
 - The release signal must be applied for at least 5 ms. For this, you for instance can use a pulse timer (ensure **TP**) FB.
3. Select the error number at the input *wFaultNumber* of the FB **FWM**:

⇒ Inputs FB FWM			
Identifiers	Data type	Access	Information/possible settings
wFaultNumber	WORD	R / W	Error number of the user error message
			500 ... 999 Error number

- In data type **ErrorCode (ENUM)** you can assign an error message (text message) to the selected error number. (7-21)

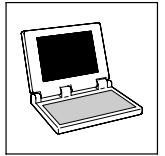
4. Go to the input *byTypeOfFault* and select the desired error response:

⇒ Inputs FB FWM			
Identifiers	Data type	Access	Information/possible settings
byTypeOfFault	Byte	R / W	Selection of the response to the user error message
			0 TRIP
			1 Message
			2 Warning
			3 Off (no response)
			4 FAIL-QSP



Note!

The input *wActFaultNumber* of the FB **FWM** is used as error channel for communication with the template-internal "FailManager" and must be connected with the global error channel variable *g_wActFault*.



6.2 "UserProcessInput" POU - Parallel process processing

To this POU you can add functions which must be processed in the same time interval and quasi parallel to the cam functions.

The POU **UserProcessInput (PRG)** is in the register **Organization units**→folder **UserExtensions**→folder **Program_Task1** of the *Object Organizer* and contains the following logic operations:

```
g_dnVertShaftClutchXOut_p --> g_dnVertShaftCamDataIn_p
g_MCTRL_nNmaxC11 --> g_nCamControlFactNSet
```



Note!

The logic operations included in the POU must not be deleted, but can be extended!

Example: Functions are added to the POU:

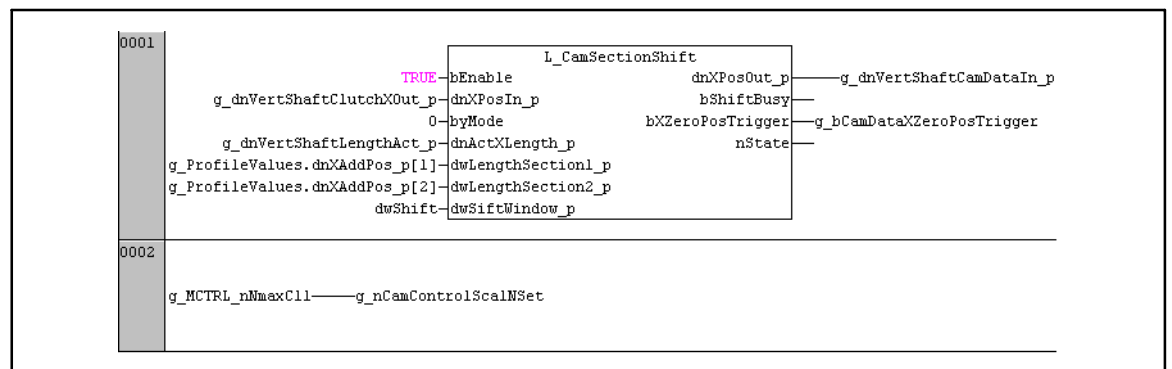
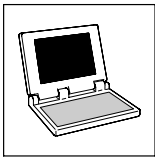


Fig. 6-3

Example: FB **L_CamSectionShift** is added to the POU



Template Cam

Program Organisation Units (POUs)

"UserTouchProbeInput" POU - Touch probe interface

6.3 "UserTouchProbeInput" POU - Touch probe interface

In this POU you can adapt the touch probe interfaces of the X and Y axis to your hardware. You can also add functions which must be processed in the same time interval, but before the X axis.

The POU **UserTouchProbeInput (PRG)** is in the register **Organization units**→folder **UserExtensions**→folder **Program_Task1** of the *Object Organizer* and contains the following logic operations:

```

g_DFIN_bTPReceived_b --> g_bXTPReceived
g_DFIN_dnIncLastScan_p --> g_dnXTPActLastScan_p
g_MCTRL_bActTPReceived_b --> g_bYTPReceived
g_MCTRL_dnActIncLastScan --> g_dnYTPActLastScan_p
      g_DFIN_nIn_v --> nDummy1_v
      g_MCTRL_nNAct_v --> nDummy2_v

```



Note!

The logic operations included in the POU must not be deleted, but can be extended!

The variables *g_DFIN_dnIncLastScan_p*, *g_DFIN_bTPReceived_b* and *g_DFIN_nIn_v* act as an additional interface in the target interface. Their name has therefore been adapted to the global variables. In fact, they are, however, locally declared and saved under the corresponding absolute memory addresses.

Example: Functions are added to the POU:

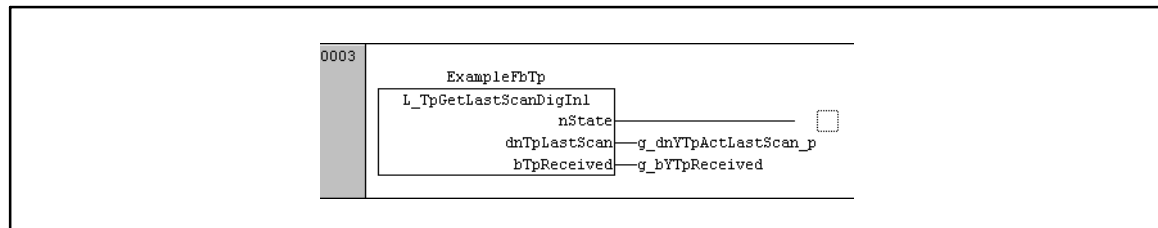
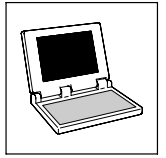


Fig. 6-4

Example: FB **L_TpGetLastScanDigIn1** is added to network 3



6.4 "UserProgram1 POU"

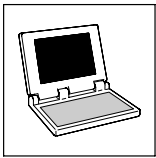
Use this POU to easily add user program parts. You can add function blocks for signal generation and connect them in the function block diagram.

The POU is called in a 7-ms cycle and is in the register **Organization units**→folder **UserExtensions**→folder **Program_Task3** of the *Object Organizer*. It does not contain any logic operations of the template.

6.5 "UserProgram2 POU"

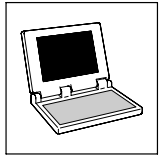
Use this POU to easily add user program parts. It is possible to create sequencers for process control in SFC (sequential function chart).

The POU is called in a 7-ms cycle and is in the register **Organization units**→folder **Users**→folder **Program_Task3** of the *Object Organizer*. It does not contain any logic operations of the template.



Template Cam

Program Organisation Units (POUs)



7 Appendix

7.1 Global variables

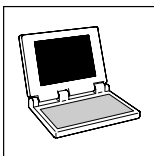
7.1.1 TemplateInterface

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

7.1.1.1 VarBasicOperation

⇒ Inputs			
Identifiers	Data type	Access	Information/rmation/possible settings
g_wMotionProfileNumber	Word	R / W	Selection of the motion profile - Profile processing starts during zero crossing of the vertical shaft. - Immediate profile processing can be activated via the input <i>g_bProfileForcedShift</i>.
			0 ... 47 Motion profile number (The selection range is limited to the number of motion profiles defined in the *.lc9 file.)
g_bProfileForcedShift	Bool	R / W	Forced changeover of motion profile
			FALSE ↗ TRUE Forced changeover
g_dnVertShaftCamDataIn_p	Double integer	R / W	Setpoint angle of the vertical shaft in [inc] Internally limited to 0 ... X_{max} of the profile ($X_{max} \leq + 2^{31} - 1$)
g_nYAxisVelocityMin_v	Integer	R / W	Minimum speed of Y axis in [inc/ms]
g_nYAxisVelocityMax_v	Integer	R / W	Maximum speed of Y axis in [inc/ms]
g_bReloadData	Bool	R / W	Resetting x axis to starting value
			TRUE The x axis value in the L_CamData FB is reset to the starting value.
g_bCamDataXZeroPosTrigger	Bool	R / W	Profile data initialisation via L_CamSectionShift FB If the L_CamSectionShift FB is used, connect this input with the output <i>bXZeroPosTrigger</i> of the L_CamSectionShift FB.
			TRUE Profile data initialisation.
g_bySelectMem	Byte	R / W	Selection of the data structure (*.lc9 file).
			0 RAM block 1 (foreground data field, standard)
			1 RAM block 2 (background data field)

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_wMotionProfileAct	Word	R	Number of the current motion profile
			0 ... 47 Motion profile number
g_bVertShaftPosZero	Bool	R	Status signal "Profile zero crossing"
			TRUE Vertical shaft is crossing zero
g_dnVertShaftPosAct_p	Double integer	R	Actual angle of vertical shaft in [inc]
g_dnCamPositionSet_p	Double integer	R	Setpoint of Y axis in [inc]
g_nVertShaftVelocityAct_v	Integer	R	Current speed of vertical shaft
g_bSignGradientProfileAct	Bool	R	Sign of the pitch of the current profile
			FALSE Positive pitch
			TRUE Negative pitch
g_dnVertShaftLengthAct_p	Double integer	R	X axis length of current profile in [inc]
g_bYAxisLimitBusy	Bool	R	Status signal "Limitation of Y axis speed active" Please observe that the motor will not exactly follow the motion profile as long as the limitation is active!



Template Cam

Appendix Global variables

Outputs ⇨				
Identifiers	Data type	Access	Value/meaning	
			TRUE	The speed of the Y axis is not within the window defined via <i>g_nYAxisVelocityMin_v</i> and <i>g_nYAxisVelocityMax_v</i> .
g_dnYAxisPosAct_p	Double integer	R	Position of the Y axis - This variable is used for the Y integrator of the FB L_CamData. - The variable is used for the connection of a cam controller.	
g_nCamDataState	Integer	R	Status of the FB L_CamData	
			0	No errors
			10	Warning: Profile not available
			20	Warning: Master value jump too big
g_nCamVelocitySet_v	Integer	R	Speed setpoint of profile to be processed	
g_dnYEndPos_p	Integer	R	Current travel at the end of a feed profile	
g_CamAxis	CAM_AXIS_REF	R / W	Profile parameters Data structure with machine parameters in the internal measuring system.	
g_ProfileValues	CAM_PROFILE_REF	R / W	Data structure with the most important points of the selected profile Positions in [inc]	

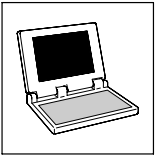
7.1.1.2 VarCamControl

⇒ Inputs						
Identifiers	Data type	Access	Information/rmation/possible settings			
g_nCamControlFactNSet	Integer	R / W	Scaling factor for speed pre-control value The variable is assigned to <i>g_MCTRL_nNmaxC11</i> (POU UserProcessInput, network 2).			
g_bResetMainIntegrator	Bool	R / W	Set profile position to actual value or zero position <table><tr><td>TRUE</td><td>Profile position is set to actual position or zero position. Note: Please observe the dependence on code C3639.</td></tr></table>		TRUE	Profile position is set to actual position or zero position. Note: Please observe the dependence on code C3639.
TRUE	Profile position is set to actual position or zero position. Note: Please observe the dependence on code C3639.					
g_bClearAuxIntegrator	Bool	R / W	Set tool position to "0" or delete tool position Only possible, if the template is not in status CamOperation. <table><tr><td>TRUE</td><td>Tool position and actual position are set to "0".</td></tr></table>		TRUE	Tool position and actual position are set to "0".
TRUE	Tool position and actual position are set to "0".					

Outputs ⇨				
Identifiers	Data type	Access	Value/meaning	
<i>g_dnFollowError_p</i>	Double integer	R	Following error or position difference in [inc] Transferred as setpoint to the position controller.	
<i>g_dnCamPositionSet_p</i>	Double integer	R	Position setpoint of the motion profile in [inc]	
<i>g_dnToolPositionAct_p</i>	Double integer	R	Calculated tool position in [inc]	
<i>g_dnActPos_p</i>	Double integer	R	Relative actual position in [inc], i.e. within the Y motion profile Position is saved fail-safe and will be available after a new download.	
<i>g_dnActPosInSave_p</i>	Double integer	R	Absolute actual position in [inc] Position is saved fail-safe and will be available after a new download.	

7.1.1.3 VarClutchXAxis

⇨ Inputs				
Identifiers	Data type	Access	Information/possible settings	
<i>g_dnClutchXOpenPosition</i>	Double integer	R / W	Position setpoint of vertical shaft (internally, <i>X_{out}</i>) after clutch disengagement in [unit] Only positive values allowed.	
<i>g_dnClutchXOpenPosition_p</i>	Double integer	R / W	Position setpoint of vertical shaft (internally, <i>X_{out}</i>) after clutch disengagement in [inc] Only positive values allowed.	
<i>g_bClutchXClose</i>	Bool	R / W	Clutch	

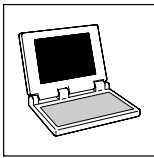


⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
			TRUE ⇨ FALSE	Disengage clutch, brake along ramp C3626/3 and stop at <i>g_dnClutchXOpenPosition_p</i> .
			FALSE ⇨ TRUE	Synchronise along ramp C3626/2 to <i>g_dnVerticalShaftPosSet_p</i> and engage clutch.
<i>g_bClutchXEnable</i>	Bool	R / W	Activation of the clutch function This input has highest priority.	
			FALSE	<i>g_dnVerticalShaftPosSet_p</i> is output directly, the ramp function is not active and the clutch is engaged.
			TRUE	Clutch function active
<i>g_bClutchXOpenInstant</i>	Byte	R / W	Immediate clutch disengagement	
			TRUE	The clutch disengages immediately and the vertical shaft (internal x axis) is decelerated along the deceleration ramp selected for the immediate stop function (C3626/1) to standstill.

Outputs ⇒				
Identifiers	Data type	Access	Value/meaning	
<i>g_bClutchXOpen</i>	Bool	R	Status signal "Clutch disengaged"	
			TRUE	Clutch disengaged, vertical shaft (internal X axis) is not synchronous with <i>g_dnVerticalShaftPosSet_p</i>
<i>g_bClutchXAccDec</i>	Bool	R	Status signal "Acceleration/deceleration active"	
			TRUE	The drive accelerates or decelerates.
<i>g_dnVertShaftClutchXOut_p</i>	Double integer	R	Master value position in [inc] after clutch	

7.1.1.4 VarHoming

⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
<i>g_bHomingStart</i>	Bool	R / W	Homing start/stop Only in connection with controller enable.	
			FALSE ⇨ TRUE	Homing start
			FALSE	Homing stop / cancellation
<i>g_dnMachineZeroDistance</i>	Double integer	R / W	Home switch position in [unit] - Input in fixed point format with 4 decimal positions (1 [unit] ≡ 10000). The value is internally converted into increments. (See Information at the end of the table.) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!	
<i>g_dnMachineZeroDistance_p</i>	Double integer	R / W	Home switch position in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!	
<i>g_dnHomingTargetPos</i>	Double integer	R / W	Target position of the tool after homing in [unit] - Referred to machine zero. - Input in fixed point format with 4 decimal positions (1 [unit] ≡ 10000). The value is internally converted into increments. (See Information at the end of the table.) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!	
<i>g_dnHomingTargetPos_p</i>	Double integer	R / W	Target position of the tool after homing in [inc] - Referred to machine zero. - If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!	
<i>g_bHomePositionSet</i>	Bool	R / W	Acceptance of the home position Only possible when controller is inhibited!	
			FALSE ⇨ TRUE	The setpoint selected at <i>g_dnMachineZeroDistance(_p)</i> is accepted and <i>g_bHomingDone</i> is set to TRUE.



Template Cam

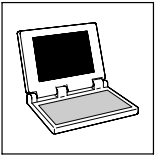
Appendix Global variables

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bHomePositionReset	Bool	R / W	Reset of the home position
			TRUE • Output <i>g_bHomingDone</i> is reset to FALSE. • "Home position known" status is reset (<i>g_bHomingDone</i> = FALSE).
g_bLimitSwitchNeg	Bool	R / W	Input for limit switch (negative)
			FALSE Limit switch reached
g_bLimitSwitchPos	Bool	R / W	Input for limit switch (positive)
			FALSE Limit switch reached

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_bHomingBusy	Bool	R	Status signal "Homing activated"
			TRUE Homing active
g_bHomingDone	Bool	R	Home position status
			FALSE Home position is not known (possibly encoder error).
			FALSE → TRUE Position <i>g_dnHomingTargetPos(_p)</i> has been reached.
			TRUE Homing process was carried out and home position is known.
g_bHomingError	Bool	R	Status signal "Error"
			TRUE An error occurred when the home position was set. • For details see <i>g_nHomingErrorNo</i> .
g_nHomingErrorNo	Integer	R	Error number
			0 Ok
			1 Error during bus transport
			2 Time-out
			4 Subindex does not exist
			5 Index does not exist
			13 Invalid range of values
			111 More than 4 decimal positions specified or no fixed-point-format index
			117 Communication channel does not exist
			-10 Controller inhibit was not set

7.1.1.5 VarManualJog

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bManualJogNeg	Bool	R / W	Manual homing in negative direction (CCW)
			TRUE Manual control
g_bManualJogPos	Bool	R / W	Manual homing in positive direction (CW)
			TRUE Manual control
g_bLimitSwitchNeg	Bool	R / W	Input for limit switch (negative) for subfunction "retracting"
			FALSE Limit switch reached
g_bLimitSwitchPos	Bool	R / W	Input for limit switch (positive) for subfunction "retracting"
			FALSE Limit switch reached
g_bReleaseLimitSwitch	Bool	R / W	Subfunction "Retracting"
			• During retracting, the selections under <i>g_bExternalJogEnable</i> and <i>g_nExternalJog_v</i> are ineffective.

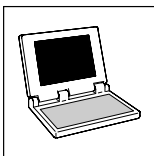


⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
			TRUE	Retracting from the activated limit switch in the corresponding clearance direction until the limit switch is released (no longer activated): $g_bLimitSwitchPos = TRUE$: – Retracting in direction $g_bLimitSwitchNeg$ until $g_bLimitSwitchPos = FALSE$ $g_bLimitSwitchNeg = TRUE$: – Retracting in direction $g_bLimitSwitchPos$ until $g_bLimitSwitchNeg = FALSE$
$g_bExternalJogEnable$	Bool	R / W	Activation of the external speed selection Only possible if $g_bManualJogNeg$ and $g_bManualJogPos$ are set to FALSE.	
			TRUE	External speed selection via $g_nExternalJog_v$ activated.
$g_nExternalJog_v$	Integer	R / W	External speed selection in [inc/ms]	

7.1.1.6 VarPositioning

⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
$g_bMotionStart$	Bool	R / W	Execute positioning	
			TRUE	The drive traverses along the selected ramps at the selected speed to the target position $g_dnToolPositionSet_p$.
			FALSE	Positioning is interrupted.
$g_byPositioningMode$	Byte	R / W	Positioning mode	
			0	The shortest distance is used to approach the target position.
			1	The target position is approached in positive direction (CW).
			2	The target position is approached in negative direction (CCW).
			3	Reserved for template function "PosToCam".
			4	Relative positioning via $g_dnToolPositionSet_p$.
$g_dnToolPositionSet$	Double integer	R / W	Target position in [unit] - Referred to machine zero. - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See Information at the end of the table.) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!	
$g_dnToolPositionSet_p$	Double integer	R / W	Target position in [inc] - Referred to machine zero. - If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!	

Outputs ⇒				
Identifiers	Data type	Access	Value/meaning	
$g_bToolPositioningBusy$	Bool	R	Status signal "Positioning is being executed"	
			TRUE	Positioning is executed.
$g_bToolPositioningDone$	Bool	R	Status signal "Target position reached"	
			TRUE	Target position $g_dnToolPositionSet_p$ has been reached.
$g_wPosProfilerState$	Word	R	Positioning status	
			0	≡ NoAction No action.
			1	≡ PositioningDone Target position $g_dnToolPositionSet_p$ has been reached.
			13	≡ PositioningBusy Positioning is executed.
			14	≡ PositioningToCamBusy Positioning to profile position.
			102	≡ AbortsActive Positioning is cancelled.



Template Cam

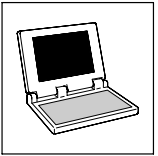
Appendix

Global variables

7.1.1.7 VarStateMachine

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bLockToCam	Bool	R / W	Activation of "Lock to Cam"
			TRUE The drive is brought back to the corresponding motion profile position.
			TRUE ⇒ FALSE The drive is unlocked from the motion profile and brought to standstill.
g_nLockToCamFact	Integer	R / W	Factor for the $\Delta Y/\Delta X$ ratio (maximum pitch) of the profile. 16384 = 100 % - Presetting: 250 - Only relevant for mode 3
g_dnLockToCamLimitX	Double integer	R / W	Maximum number of increments per cycle necessary to reposition the drive. - Presetting: 300 [inc] - Example: $g_dnLockToCamLimitX = 1500$: - A maximum of 1500 increments per cycle are used to reposition the drive to the current tool position.
g_dnLockToCamWindow_p	Double integer	R / W	After compensation in mode 3, tool and profile position are within the window. Presetting: 30 [inc]
g_byLockToCamMode	Byte	R / W	Selection of the mode used to reposition the drive to the feed profile.
			0 Using the shortest distance to reposition the drive to the motion profile. This mode must be used for forward/backward profiles.
			1 Repositioning the drive in forward direction to the motion profile. When used for forward/backward profiles, an error message will be displayed. Quick stop (QSP) is set and the status changes to "Trouble".
			2 Repositioning the drive in backward direction to the motion profile. When used for forward/backward profiles, an error message will be displayed. Quick stop (QSP) is set and the status changes to "Trouble".
			3 The motion profile position is adapted to the drive/tool position. - Without motor compensation. $g_nLockToCamFact$ and $g_dnLockToCamLimitX$ have to be selected accordingly. Note: This mode uses the clutch function VirtualClutchXAxis. 5-74

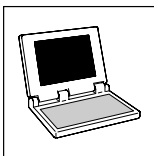
Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_bLockToCamBusy	Bool	R	Status signal "Traversing to x position of motion profile active"
			TRUE The drive traverses to the corresponding motion profile position.
g_bLockToCamDone	Bool	R	Status signal "X position of motion profile reached"
			TRUE The drive has reached the corresponding motion profile position.



Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_byOperationState	OperationMode	R	Display of the main template states
			100 Status "Init"
			51 Status "LockToCamBusy"
			50 Status "CamOperation"
			40 Status "PositioningOperation"
			30 Status "HomingOperation"
			20 Status "ManualOperation"
			10 Status "StandBy" • Status from which the drive changes to all other states.
			1 Status "Trouble"
g_nTemplateState	INT	R	Display of the main template states
			100 Status "Init"
			51 Status "LockToCamBusy"
			50 Status "CamOperation"
			40 Status "PositioningOperation"
			30 Status "HomingOperation"
			20 Status "ManualOperation"
			10 Status "StandBy" • Status from which the drive changes to all other states.
			1 Status "Trouble"

7.1.1.8 VarTemplateSettings (CONSTANT)

⇨ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bVisuOff	Bool	R / W	Activation/deactivation of the visualisation
			FALSE Visualisation is activated
			TRUE Visualisation is deactivated
g_bErrorResetEqTripReset	Bool	R / W	Configuration of error reset with/without Trip reset
			FALSE Error reset (<i>g_bErrorReset</i> = TRUE) does not activate TRIP reset in the PLC.
			TRUE Error reset (<i>g_bErrorReset</i> = TRUE) activates TRIP reset in the PLC.
g_byTypeOfFollowErrorFault	Byte	R / W	Response of following error monitoring
			0 TRIP
			1 Message
			2 Warning
			3 Off
			4 Fail-QSP
g_bCircularAxis	Bool	R / W	Type of Y axis
			FALSE Template expects forward/backward profiles. • Current position is output as an absolute value.
			TRUE Template expects feed profiles. • Current position is output as a relative value to the current clock pulse.
g_tLimitSwitchDeadTime	Time	R / W	Debounce time for limit switch • Relevant for all homing modes in which the drive reverses at limit switches. • After reversing at a limit switch, the limit position monitoring will be deactivated for the pre-selected time to suppress signals caused by the bounce of the limit switch. • Initialisation value: 15 ms



Template Cam

Appendix

Global variables

7.1.1.9 VarTorquePrecontrol (RETAIN)

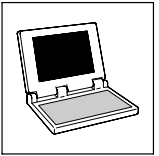
⇒ Inputs							
Identifiers	Data type	Access	Information/possible settings				
g_bTorquePrecontrolEnable	Bool	R / W	Activation of acceleration pre-control The external torque pre-control remains activated even if the acceleration pre-control is deactivated. <table><tr><td>TRUE</td><td>Acceleration pre-control activated.</td></tr></table>	TRUE	Acceleration pre-control activated.		
TRUE	Acceleration pre-control activated.						
g_nFactorInertia_a	Integer	R / W	Factor for adapting the pre-control value to the moment of inertia of the drive - Value range: -32767 ... 32767 16384 = 100 %				
g_nTorquePreAdd_a	Integer	R / W	External torque precontrol Remains activated, even if the acceleration precontrol is deactivated.				
g_byTorquePreCtrlMode	Byte	R / W	Precontrol mode <table><tr><td>0</td><td>Off</td></tr><tr><td>1</td><td>The precontrol profile is evaluated with the factor <i>g_nFactorInertia_a</i> and used for torque precontrol.</td></tr></table>	0	Off	1	The precontrol profile is evaluated with the factor <i>g_nFactorInertia_a</i> and used for torque precontrol.
0	Off						
1	The precontrol profile is evaluated with the factor <i>g_nFactorInertia_a</i> and used for torque precontrol.						

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_nSetTorquePrecontrol_a	Integer	R	Resulting torque controllerprecontrol 16384 ≙ 100 %

7.1.1.10 VarTrouble

⇒ Inputs					
Identifiers	Data type	Access	Information/possible settings		
g_bErrorSet	Bool	R / W	Change to "Error" - This variable can be set by means of the "Set" instruction. - It is automatically reset to FALSE by the template. <table><tr><td>TRUE</td><td>Change to "Trouble"</td></tr></table>	TRUE	Change to "Trouble"
TRUE	Change to "Trouble"				
g_bErrorReset	Bool	R / W	Reset of template-internal and user-defined errors If the variable <i>g_bErrorResetEqTripReset</i> is set to TRUE a TRIP reset will be carried out together with the error reset. <table><tr><td>TRUE</td><td>Error reset</td></tr></table>	TRUE	Error reset
TRUE	Error reset				
g_bUserQuickstop	Bool	R / W	User quick stop (quick stop of the drive system) <table><tr><td>TRUE</td><td>Activates user quick stop.</td></tr></table>	TRUE	Activates user quick stop.
TRUE	Activates user quick stop.				
g_bControllerInhibit	Bool	R / W	Controller inhibit (CINH) <table><tr><td>TRUE</td><td>Set controller inhibit in the PLC.</td></tr></table>	TRUE	Set controller inhibit in the PLC.
TRUE	Set controller inhibit in the PLC.				
g_bUserStateBus	Bool	R / W	Output of control signal via state bus <table><tr><td>TRUE</td><td>Set state bus to LOW level to control all devices connected to the state bus as set earlier (e.g. TRIP, QSP or controller inhibit).</td></tr></table>	TRUE	Set state bus to LOW level to control all devices connected to the state bus as set earlier (e.g. TRIP, QSP or controller inhibit).
TRUE	Set state bus to LOW level to control all devices connected to the state bus as set earlier (e.g. TRIP, QSP or controller inhibit).				

Outputs ⇨					
Identifiers	Data type	Access	Value/meaning		
g_bGlobalError	Bool	R	Status signal "Global error" • The template is in "Trouble". • In case of template or user errors, <i>g_bErrorSet</i> will also be TRUE. <table><tr><td>TRUE</td><td>A PLC, template or user error has occurred.</td></tr></table>	TRUE	A PLC, template or user error has occurred.
TRUE	A PLC, template or user error has occurred.				
g_wActFault	Word	R	Error channel for communication with the "FailManager". • This variable can only be used for the FWM block.		
g_wErrorNumber	ErrorCode	R	Display of the error name • See <i>Object Organizer</i>: Register Data types→folder UserDataTypes→ ErrorCode (ENUM)		



Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_wErrorType	ErrorReaction	R	Response to error
			0 TRIP
			1 Message
			2 Warning
			3 Fail-QSP
			4 Ready
g_bFollorErrorWarn	Bool	R	Status signal "Following error warning"
			TRUE The following error warning limit (C3645) has been exceeded.
g_bFollorErrorQSP	Bool	R	Status signal "Following error"
			TRUE The following error limit (C3643) has been exceeded.
g_bErrorResetBusy	Bool	R / W	Status signal "Error reset active"
			TRUE Reset of template-internal and user-defined errors is active.

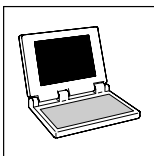
7.1.1.11 VarVertShaftExtPosition

⇨ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bVertShaftExtEnable	Bool	R / W	Activation of the external master signal
			FALSE X axis is generated by the virtual master.
			TRUE X axis is selected externally.
g_dnVertShaftExt_p	Double integer	R / W	Selection of the external master angle
			• Internally limited to 0 ... <i>g_dnVertShaftLengthAct_p</i>
g_bPosToVertShaftExt	Bool	R / W	Positioning to the external master angle
			FALSE Direct change to the external master angle.
			TRUE Positioning to the external master angle.

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_dnVertShaftPosSet_p	Double integer	R	Position output of vertical shaft
			• The value is sent to the VirtualClutchXAxis clutch function.
g_nVertShaftMasterOut_v	Integer	R	Speed output of vertical shaft
			• Speed in [inc/ms].
			• Can be used for the cam controller setpoint or the following network of drives.
g_bPosToVertShaftExtDone	Bool	R	Status signal "Positioning to external master angle completed"
			• The message remains active until <i>g_bVertShaftExtEnable</i> is reset to FALSE.
			TRUE Positioning to the external master angle has been completed.

7.1.1.12 VarVertShaftExtVelocity

⇨ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bTypeOfVertShaftExt	Bool	R / W	Selection of the external master signal
			FALSE Master angle, e. g. via system bus (CAN).
			TRUE Digital frequency, e. g. via digital frequency input DFIN.
g_byVertShaftExtVelMode	Byte	R / W	Selection of the control mode
			0 Continuous operation
			• The external digital frequency selection is continuously integrated.
			1 Start/stop operation
			• The external digital frequency selection is only integrated after a start/stop signal at <i>g_bStartStopVertShaftExtVel</i> .



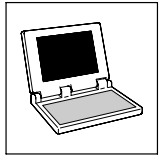
Template Cam

Appendix

Global variables

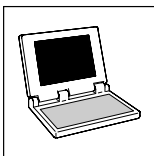
⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bStartStopVertShaftExtVel	Bool	R / W	Start/stop signal for control mode "Start/stop operation"
			FALSE No integration or cancellation of a previously started integration during next zero crossing.
			TRUE Start integration. • Integration will be at least carried out until the next zero crossing.
g_nVertShaftExt_v	Integer	R / W	Selection of the external digital frequency or speed in [inc/ms]
g_bVertShaftExtVelCwCcw	Bool	R / W	Invert external digital frequency selection
			TRUE <u>g_nVertShaftExt_v</u> is internally inverted.

Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_bVertShaftExtVelXZero	Bool	R	Status signal "Zero crossing of x axis"
			TRUE Zero crossing or zero position at standstill of x axis
g_nVertShaftExtVelState	Integer	R	Status
			0 OK
			Warnings:
			10 Starting position <u>g_dnVertShaftStartPosition_p</u> < 0
			11 Starting position <u>g_dnVertShaftStartPosition_p</u> > $X_{\max}$
			12 Stretching/compression factor denominator = 0
			13 Resulting position change per cycle bigger than integer range, limitation active.
			Error: (acknowledgment required: <u>g_bErrorReset</u> = TRUE)
			-11 Resulting position change per cycle too big for synchronised stretching/compression
			-20 Touch probe sensor position <u>g_dnTpPos_p</u> is not within the adjustable range



7.1.1.13 VarVirtualMaster

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bVertShaftContinuous	Bool	R / W	Continuous operation FALSE ↗ TRUE The x axis is accelerated along the ramp C3651/2 and rotated at the speed selected at <i>g_nVertShaftVelocitySet_v</i>. TRUE ↘ FALSE The x axis is decelerated along the ramp C3651/2 and led to the target position <i>g_dnVertShaftTargetPosition_p</i>.
g_bVertShaftCycle	Bool	R / W	Cyclic operation FALSE ↗ TRUE The x axis is traversed at the speed selected at <i>g_nVertShaftVelocitySet_v</i> until the target position <i>g_dnVertShaftTargetPosition_p</i> is reached.
g_bVertShaftManualCw	Bool	R / W	Manual homing of the x axis in positive direction (CW) TRUE Manual homing in positive direction
g_bVertShaftManualCcw	Bool	R / W	Manual homing of the x axis in negative direction (CCW) TRUE Manual homing in negative direction
g_bVertShaftStopInstant	Bool	R / W	Immediate stop (emergency stop) of the x axis TRUE The x axis is decelerated to standstill along the ramp C3651/1.
g_nVertShaftVelocitySet	Integer	R / W	Speed setpoint of the x axis in [rpm]
g_nVertShaftVelocitySet_v	Integer	R / W	Speed setpoint of the x axis in [inc/ms]
g_bHandwheelEnable	Bool	R / W	Hand wheel function TRUE The hand wheel function is activated.
g_nHandwheelVelocity_v	Integer	R / W	Speed input for hand wheel function
g_dnVertShaftStartPosition	Double integer	R / W	Starting position of the x axis in [m-unit] TRUE The starting position at input <i>g_dnVertShaftStartPosition_p</i> is accepted for position output <i>g_dnVertShaftPosSet_p</i>.
g_dnVertShaftStartPosition_p	Double integer	R / W	Starting position of the x axis in [inc] TRUE The position output <i>g_dnVertShaftPosSet_p</i> is loaded with the starting position.
g_bLoadVertShaftStart	Bool	R / W	Accepting starting position FALSE ↗ TRUE The starting position at input <i>g_dnVertShaftStartPosition_p</i> is accepted for position output <i>g_dnVertShaftPosSet_p</i>. TRUE The position output <i>g_dnVertShaftPosSet_p</i> is loaded with the starting position.
g_dnVertShaftTargetPosition	Double integer	R / W	Target position for cyclic and continuous operation in [m-unit] TRUE The position output <i>g_dnVertShaftPosSet_p</i> is loaded with the starting position.
g_dnVertShaftTargetPosition_p	Double integer	R / W	Target position for cyclic and continuous operation in [inc] TRUE The position output <i>g_dnVertShaftPosSet_p</i> is loaded with the starting position.



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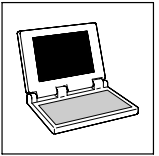
Appendix

Global variables

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_dnVertShaftPosSet_p	Double integer	R	Position output of vertical shaft The value is sent to the VirtualClutchXAxis clutch function.
g_nVertShaftMasterOut_v	Integer	R	Speed output of vertical shaft - Speed in [inc/ms]. - Can be used for the cam controller setpoint or the following network of drives.
g_bVertShaftPosBusy	Bool	R	Status signal "Virtual master action is being executed" (Only <i>g_bVertShaftContinuous</i> , <i>g_bVertShaftCycle</i> , <i>g_bVertShaftManualCcw</i> , <i>g_bVertShaftManualCw</i> .)
g_bVertShaftPosDone	Bool	R	Status signal "Target position reached" The status signal is automatically reset when a new action of the virtual master is started.
			TRUE The x axis has reached the target position <i>g_dnVertShaftTargetPosition_p</i> in cyclic or continuous operation.

7.1.1.14 VarXOffset (RETAIN)

⇨ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bRfgXOffsetExecute	Bool	R / W	Adjust master value by offset Only possible, if <i>g_bRfgXOffsetEnable</i> is set to TRUE.
			TRUE The master value is adjusted along the set ramp/speed by the selected offset <i>g_dnXOffset(_p)</i> .
g_dnXOffset	Double integer	R / W	Offset selection for the master value in [unit] - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See conversion Information) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!
g_dnXOffset_p	Double integer	R / W	Offset selection for the master value in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!
g_byXOffsetMode	Byte	R / W	Selection of the offset selection
			0 Dynamic offset selection in [inc] in ProgramTask1 1 Offset selection in [unit] When <i>g_bRfgXOffsetExecute</i> is set to TRUE, the offset selection is converted from [unit] into [inc] before the offset is executed.
g_bRfgXOffsetSetToZero	Bool	R / W	Reset offset Only possible, if <i>g_bRfgXOffsetEnable</i> is set to TRUE.
			FALSE Offset selection = <i>g_dnXOffset(_p)</i> . TRUE Offset selection = "0" (internally). If an offset adjustment is active, the profile generator sets the existing offset to "0".
g_bRfgXOffsetEnable	Bool	R / W	Activating ramp function
			FALSE <i>g_dnXOffset(_p)</i> has an immediate effect on the master value. Note: The selection is not restricted by limit values. The selection of inappropriate values may lead to following errors or jumps! TRUE <i>g_dnXOffset(_p)</i> is added along the set ramps (C3632) to the master value.



Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_bRfgXOffsetDone	Bool	R	Status signal "Offset adjustment"
			TRUE Offset adjustment completed.
g_dnVertShaftPosAct_p	Double integer	R	Resulting master value position in [inc]

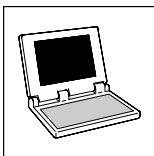
7.1.1.15 VarXStretchCompress

⇨ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bVertShaftExtEnable	Bool	R / W	Activation of the external master signal
			FALSE X axis is generated by the virtual master.
			TRUE X axis is selected externally.
g_bTypeOfVertShaftExt	Bool	R / W	Selection of the external master signal
			FALSE Master angle, e. g. via system bus (CAN).
			TRUE Digital frequency, e. g. via digital frequency input DFIN.
g_bXSyncEnable	Bool	R / W	Activate synchronised stretching/compression
			FALSE Synchronised stretching/compression deactivated.
			TRUE Synchronised stretching/compression activated.
			• The stretching/compression factor can only be accepted when the profile is crossing zero.
g_nVertShaftExt_v	Integer	R / W	Selection of the external digital frequency in [inc/ms]
g_nXStretchCompressNum_a	Integer	R / W	Stretching/compression factor - numerator
g_nXStretchCompressDen_a	Integer	R / W	Stretching/compression factor - denominator

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_dnVertShaftPosSet_p	Double integer	R	Position output of vertical shaft
			• The value is sent to the VirtualClutchXAxis clutch function.
g_nVertShaftMasterOut_v	Integer	R	Speed output of vertical shaft
			• Speed in [inc/ms].
			• Can be used for the cam controller setpoint or the following network of drives.
g_bVertShaftExtVelXZero	Bool	R	Status signal "Zero crossing of x axis"
			TRUE Zero crossing or zero position at standstill of x axis
g_nVertShaftExtVelState	Integer	R	Status
			0 OK
			Warnings:
			10 Starting position $g_dnVertShaftStartPosition_p < 0$
			11 Starting position $g_dnVertShaftStartPosition_p > X_{max}$
			12 Stretching/compression factor denominator = 0
			13 Resulting position change per cycle bigger than integer range, limitation active.
			Error: (acknowledgment required: $g_bErrorReset = TRUE$)
			-11 Resulting position change per cycle too big for synchronised stretching/compression
			-20 Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range

7.1.1.16 VarXTouchProbeSynchronisation (RETAIN)

⇨ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bVertShaftExtEnable	Bool	R / W	Activation of the external master signal
			FALSE X axis is generated by the virtual master.

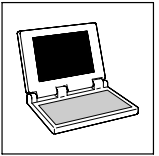


Template Cam

Appendix Global variables

⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
			TRUE	X axis is selected externally.
g_bTypeOfVertShaftExt	Bool	R / W	Selection of the external master signal	
			FALSE	Master angle, e. g. via system bus (CAN).
			TRUE	Digital frequency, e. g. via digital frequency input DFIN.
g_bXTpEnable	Bool	R / W	Activation of cyclic synchronisation	
			TRUE	Cyclic synchronisation activated.
g_bRfgXTpEnable	Bool	R / W	Selection of the compensation	
			FALSE	The difference is compensated by a constant speed value at <i>g_nXTpMakeUpLeeway_v</i> .
			TRUE	The difference is compensated by means of the internal ramp generator.
g_bRfgXTpExecute	Bool	R / W	Start ramp generator for compensation of position difference	
			FALSE	Ramp generator is not active, position difference is not compensated.
			FALSE → TRUE	Position difference (<i>g_dnXDifference_p</i>) is compensated by means of the internal ramp generator.
g_dnXTpPos	Double integer	R / W	Distance between zero and touch probe sensor in [unit] - Internally limited to $0 \dots 2 * g_dnVertShaftLengthAct_p$ - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See conversion Information) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!	
g_dnXTpPos_p	Double integer	R / W	Distance between zero and TP sensor in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!	
g_nXTpMakeUpLeeway_v	Integer	R / W	Speed in [inc/ms] for compensation of position difference Only relevant if the difference is compensated by a constant speed value (<i>g_bRfgXTpEnable</i> = FALSE).	
g_bXTpReceived	Bool	R / W	Trigger input for the calculation of the position difference If the DFIN_IO_DigitalFrequency SB is <u>not</u> to be used, connect this input to the corresponding output of the touch probe signal source used. (POU UserTouchProbeInput, NW1)	
			FALSE → TRUE	New calculation of position difference.
g_dnXTpActLastScan_p	Double integer	R / W	Δinc between touch probe and task start If the DFIN_IO_DigitalFrequency SB is <u>not</u> to be used, connect this input to the corresponding output of the touch probe signal source used. (POU UserTouchProbeInput, NW2)	

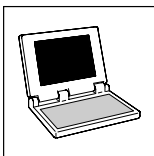
Outputs ⇒				
Identifiers	Data type	Access	Value/meaning	
g_bXTpSyncBusy	Bool	R	Status of TP correction	
			FALSE	At present setpoints are not being corrected.
			TRUE	Synchronisation is active, x difference is being compensated.
g_dnXDifference_p	Double integer	R	Correction value for touch probe signal Only to be used if <i>g_bRfgXTpEnable</i> = TRUE.	
g_dnXTpDifference_p	Double integer	R	Difference between two touch probe signals Only to be used if <i>g_bRfgXTpEnable</i> = TRUE.	



Outputs ⇒			
Identifiers	Data type	Access	Value/meaning
g_nVertShaftExtVelState	Integer	R	Status
			0 Ok
			Warnings:
			10 Starting position $g_dnVertShaftStartPosition_p < 0$
			11 Starting position $g_dnVertShaftStartPosition_p > X_{max}$
			12 Stretching/compression factor denominator = 0
			13 Resulting position change per cycle bigger than integer range, limitation active.
			Error: (acknowledgment required: $g_bErrorReset = TRUE$)
			-11 Resulting position change per cycle too big for synchronised stretching/compression
			-20 Touch probe sensor position $g_dnTpPos_p$ is not within the adjustable range

7.1.1.17 VarYOffset (RETAIN)

⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_bRfgYOffsetExecute	Bool	R / W	Adjust setpoint by offset Only possible, if $g_bRfgYOffsetEnable$ is set to TRUE.
			TRUE The setpoint is adjusted along the set ramp/speed by the selected offset $g_dnYOffset$.
g_dnYOffset	Double integer	R / W	Offset selection for the setpoint in [unit] - Input in fixed point format with 4 decimal positions (1 [unit] = 10000). The value is internally converted into increments. (See conversion Information) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!
g_dnYOffset_p	Double integer	R / W	Offset selection for the setpoint in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!
g_byYOffsetMode	Byte	R / W	Selection of the offset selection
			0 Dynamic offset selection in [inc] in ProgramTask1
			1 Offset selection in [unit] When $g_bRfgYOffsetExecute$ is set to TRUE, the offset selection is converted from [unit] into [inc] before the offset is executed.
g_bRfgYOffsetSetToZero	Bool	R / W	Reset offset Only possible, if $g_bRfgYOffsetEnable$ is set to TRUE.
			FALSE Offset selection = $g_dnYOffset_p$.
			TRUE Offset selection = "0". If an offset adjustment is active, the profile generator sets the existing offset to "0".
g_bRfgYOffsetEnable	Bool	R / W	Activating ramp function
			FALSE $g_dnYOffset_p$ has an immediate effect on the setpoint. Note: The selection is not restricted by limit values. The selection of inappropriate values may lead to following errors or jumps!
			TRUE $g_dnYOffset_p$ is added along the set ramps (C3630) to the setpoint.



Template Cam

Appendix

Global variables

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_bRfgYOffsetDone	Bool	R	Status signal "Offset adjustment"
			TRUE Offset adjustment completed.
g_dnCamPositionSet_p	Double integer	R	Resulting setpoint position in [inc]

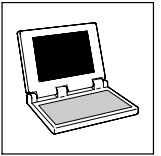
7.1.1.18 VarYStretchCompress

⇒ Inputs											
Identifiers	Data type	Access	Information/possible settings								
g_nYStretchCompress_a	Integer	R / W	Stretching/compression factor for the motion profile. 16384 ≡ 100 % - With <i>g_bYStretchCompressMode</i> = TRUE also stretching/compression factor for the Y offset <table><tr><td>< 0</td><td>Inversion</td></tr><tr><td>< 16384</td><td>Compression</td></tr><tr><td>= 16384</td><td>No stretching/compression (factor = 100 %)</td></tr><tr><td>> 16384</td><td>Stretching</td></tr></table>	< 0	Inversion	< 16384	Compression	= 16384	No stretching/compression (factor = 100 %)	> 16384	Stretching
< 0	Inversion										
< 16384	Compression										
= 16384	No stretching/compression (factor = 100 %)										
> 16384	Stretching										
g_bYSyncEnable	Bool	R / W	Activating synchronised stretching/compression <table><tr><td>FALSE</td><td>Synchronised stretching/compression deactivated. - Increments will get lost if the stretching/compression factor is not changed at standstill. </td></tr><tr><td>TRUE</td><td>Synchronised stretching/compression activated. - The stretching/compression factor can only be changed when the profile is crossing zero. </td></tr></table>	FALSE	Synchronised stretching/compression deactivated. Increments will get lost if the stretching/compression factor is not changed at standstill.	TRUE	Synchronised stretching/compression activated. The stretching/compression factor can only be changed when the profile is crossing zero.				
FALSE	Synchronised stretching/compression deactivated. Increments will get lost if the stretching/compression factor is not changed at standstill.										
TRUE	Synchronised stretching/compression activated. The stretching/compression factor can only be changed when the profile is crossing zero.										
g_bYStretchCompressMode	Bool	R / W	Apply stretching/compression also to the Y offset <table><tr><td>TRUE</td><td>The stretching/compression factor is also applied to the Y offset.</td></tr></table>	TRUE	The stretching/compression factor is also applied to the Y offset.						
TRUE	The stretching/compression factor is also applied to the Y offset.										

Outputs ⇨			
Identifiers	Data type	Access	Value/meaning
g_dnCamPositionSet_p	Double integer	R	Resulting setpoint position in [inc]
g_nCamVelocitySet_v	Integer	R	Resulting profile speed (output)

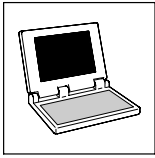
7.1.1.19 VarYTouchProbeSynchronisation (RETAIN)

⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
g_bYTpEnable	Bool	R / W	Activation of cyclic synchronisation	
			TRUE	Cyclic synchronisation activated.
g_bRfgYTpEnable	Bool	R / W	Selection of the compensation	
			FALSE	The difference is compensated by a constant speed value at <i>g_nYTpMakeUpLeeway_v</i> .
			TRUE	The difference is compensated by means of the internal ramp generator.
g_bRfgYTpExecute	Bool	R / W	Starting ramp generator for compensation of position difference	
			FALSE	Ramp generator is not active, position difference is not compensated.
			FALSE ↗ TRUE	Position difference (<i>g_dnYDifference_p</i>) is compensated by means of the internal ramp generator.



⇒ Inputs			
Identifiers	Data type	Access	Information/possible settings
g_dnYTpPos	Double integer	R / W	Distance between zero and TP sensor in [unit] - Input in fixed point format with 4 decimal positions (1 [unit] ≡ 10000). The value is internally converted into increments. (See conversion Information) - If you use this input, ensure that the input of the same name for the selection in [inc] is not written to avoid inconsistencies!
g_dnYTpPos_p	Double integer	R / W	Distance between zero and TP sensor in [inc] If you use this input, ensure that the input of the same name for the selection in [unit] is not written to avoid inconsistencies!
g_nYTpMakeUpLeeway_v	Integer	R / W	Speed in [inc/ms] for compensation of position difference Only relevant if the difference is compensated by a constant speed value (<i>g_bRfgYTpEnable</i> = FALSE).
g_bYTpReceived	Bool	R / W	Trigger input for the calculation of the position difference FALSE ↗ TRUE New calculation of position difference.
g_dnYTpActLastScan_p	Double integer	R / W	Δinc between touch probe and task start

Outputs ⇨				
Identifiers	Data type	Access	Value/meaning	
g_bYTpSyncBusy	Bool	R	Status of TP correction	
			FALSE	At present setpoints are not being corrected.
			TRUE	Synchronisation is active, Y difference is being compensated.
g_dnYDifference_p	Double integer	R	Correction value for touch probe signal in [inc] • Only to be used if <i>g_bRfgYTpEnable</i> = TRUE.	
g_dnYTpDifference_p	Double integer	R	Difference between two touch probe signals in [inc] • Only to be used if <i>g_bRfgYTpEnable</i> = TRUE.	



Template Cam

Appendix

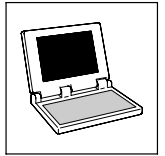
Global variables

7.1.2 TemplateUserVariables

The following variable declarations can be found in the *Object Organizer/register Resources*, folder **Global variables→TemplateUserVariables**.

7.1.2.1 UserVariables

⇒ Inputs				
Identifiers	Data type	Access	Information/possible settings	
g_bHomingMark	Bool	R / W	Input for preliminary stop position home switch	
			FALSE	Depends on the selected mode
			TRUE	
g_bLimitSwitchNeg	Bool	R / W	Input for limit switch (negative)	
			FALSE	Limit switch reached
g_bLimitSwitchPos	Bool	R / W	Input for limit switch (positive)	
			FALSE	Limit switch reached



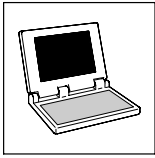
7.2 Reserved input variables of the target interface



Note!

Via the variables listed in the following table, control information is transmitted from the template to the *Target interface*; these variables therefore may **not** be written in parallel from the user level!

Identifiers	Template			
	Cam	Positioner	Winder	
			DancerControl	TensionControl
<i>g_DCTRL_bClnh1_b</i>	•	•	•	•
<i>g_DCTRL_bTripReset_b</i>	•	•	•	•
<i>g_DCTRL_bTripSet_b</i>	•	•		
<i>g_MCTRL_bIload_b</i>			•	•
<i>g_MCTRL_bNMSwt_b</i>			•	•
<i>g_MCTRL_bPosOn_b</i>			•	•
<i>g_MCTRL_bQspOut_b</i>	•	•	•	•
<i>g_MCTRL_dnPosSet_p</i>	•	•		
<i>g_MCTRL_nFldWeak_a</i>			•	•
<i>g_MCTRL_nHiMlim_a</i>	•	•	•	•
<i>g_MCTRL_nLoMlim_a</i>	•	•	•	•
<i>g_MCTRL_nMAdd_a</i>	•	•	•	•
<i>g_MCTRL_nNAdapt_a</i>			•	•
<i>g_MCTRL_nNSet_a</i>	•	•	•	•
<i>g_MCTRL_nNStartMlim_a</i>			•	•
<i>g_STATE_BUS_bOut_b</i>	•			
<i>g_STATE_BUS_bIn_b</i>	•			



Template Cam

Appendix Settings

7.3 Settings

7.3.1 Configuration of the hardware limit switches

The digital inputs X5/E1 and E2 are designed for the connection of the hardware limit switches. In the template, the corresponding global variables have already been assigned to them.

If required, the assignment can be adapted accordingly in the variable list **UserVariables:** (*ObjectOrganizer/register Resources*→folder **TemplateUserVariables**)

```
VAR_GLOBAL
(* Hardware signals *)
...
→ g_bLimitSwitchNeg AT %IX1.0.1: BOOL; (* DIGIN1 *)
→ g_bLimitSwitchPos AT %IX1.0.2: BOOL; (* DIGIN2 *)
...
END_VAR
```



Note!

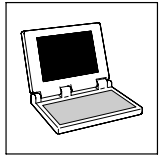
The polarity of the digital inputs can be configured under C0114/1 and C0114/2.

If limit switches are used, do not change the default setting ("HIGH level active")!

Deactivation of the limit switch evaluation for band drives

If the traversing range need not be limited (e.g. when using band drives), you can deactivate the limit switch evaluation by setting the two variables to TRUE:

```
VAR_GLOBAL
(* Hardware signals *)
...
→ g_bLimitSwitchNeg : BOOL:=TRUE;
→ g_bLimitSwitchPos : BOOL:=TRUE;
...
END_VAR
```



7.3.2 Error messages - Data type "ErrorCode (ENUM)"

The error messages for user-defined errors are defined in the data type **ErrorCode (ENUM)** (*Object Organizer*→Register **Data types**→ folder **UserDataTypes**):

```
TYPE ErrorCode : (  
  NoError:=0,  
  CCr:=71,  
  ...  
  UserError:=500  
) ;  
END_TYPE
```

- The texts for the user-defined errors (error numbers 500 ... 999) can be freely selected.
- It is also possible to add or take away entries in the field of user-defined errors (error numbers 500 ... 999). (Every entry needs 2 bytes RAM.)
- The last entry must not be closed by a comma.



Caution!

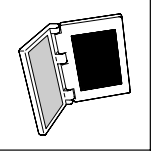
Do not change the entries of error numbers 0 ... 499 since they are the system error messages for the PLC and the template.

More information about troubleshooting can be found in chapter 5.8.1, "Function ErrorProcedure".
(5-93)

7.4 Code list

Code	External					Internal			Access	CINH? ¹	SHIFT + PRG? ²	Information
	Min. value	Max. value	Init. value	Unit	Data type	Min. value	Max. value	Data type				
3010	0	255	3		BYTE	0	255	Fixed point	R / W			Homing mode: 0: >_Rn_MP 1: <_Rn_MP 2: >_Lp_<_Rn_MP 3: <_Ln_>_Rn_MP 4: >_Rp_<_Rn_MP 5: <_Rp_>_Rn_MP 6: >_Rn_>_TP 7: <_Rn_<_TP 8: >_TP 9: <_TP 10: >_Lp_<_TP 11: <_Ln_>_TP 12: >_Lp_>_<_Lp_↗ 13: <_Ln_>_<_Ln_↗
3303	0	65535	0		WORD	0	65535	Fixed point	R			Master gearbox numerator
3304	0	65535	0		WORD	0	65535	Fixed point	R			Master gearbox denominator
3305	0.0000	214748.0000	0		WORD	0	2147480000	Fixed point	R			Master feed constant
3306	0	65535	0		WORD	0	65535	Fixed point	R			Slave gearbox numerator
3307	0	65535	0		WORD	0	65535	Fixed point	R			Slave gearbox denominator
3308	0.0000	214748.0000	0		WORD	0	2147480000	Fixed point	R			Slave feed constant
3350	-214748.0000	214748.0000	0.0000	m_units	DINT	-2147480000	2147480000	Fixed point	R			Master angle setpoint
3351	-214748.0000	214748.0000	0.0000	m_units	DINT	-2147480000	2147480000	Fixed point	R			Current master angle
3355	-214748.0000	214748.0000	0.0000	s_units	DINT	-2147480000	2147480000	Fixed point	R			Current position
3356	-214748.0000	214748.0000	0.0000	s_units	DINT	-2147480000	2147480000	Fixed point	R			Set profile position
3357	-214748.0000	214748.0000	0.0000	s_units	DINT	-2147480000	2147480000	Fixed point	R			Auxiliary integrator
3359	-214748.0000	214748.0000	0.0000	s_units	DINT	-2147480000	2147480000	Fixed point	R			Following error
3360	-2147483647	2147483647	0	inc	DINT	-2147483647	2147483647	32 bits with sign	R			Master angle setpoint
3361	-2147483647	2147483647	0	inc	DINT	-2147483647	2147483647	32 bits with sign	R			Current master angle
3366	-2147483647	2147483647	0	inc	DINT	-2147483647	2147483647	32 bits with sign	R			Auxiliary integrator
3367	-2147483647	2147483647	0	inc	DINT	-2147483647	2147483647	32 bits with sign	R			Set profile position

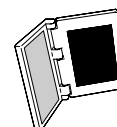
¹ The parameter can only be changed when the controller is inhibited (CINH).
² Press **SHIFT** + **PRG** to change the parameter via the keypad.

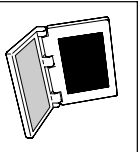


Code	External					Internal			Access	CINH? ¹	SHIFT + PRG? ²	Information
	Min. value	Max. value	Init. value	Unit	Data type	Min. value	Max. value	Data type				
3369	-2147483647	2147483647	0	inc	DINT	-2147483647	2147483647	32 bits with sign	R			Following error
3505	-32767	32767	0		INT	-32767	32767	Fixed point	R			Status of the template cam
3506	0	255	15		BYTE	0	255	Fixed point	R / W			Mode of the online profile change
3507	0	1	0		BOOL	0	1	Fixed point	R / W			Online profile change for cam profiles
3508	-32767	32767	0		INT	-32767	32767	Fixed point	R / W			Status of the online profile change
3509	0	1	0		BOOL	0	1	Fixed point	R / W			Carrying out the new modes
3619	0	1	0		BOOL	0	1	Fixed point	R / W			Type of tool axis: 0: linear axis 1: rotary axis
3620	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			Positioning: Ti times
3621	0	15000	200	rpm	INT	0	16384	Fixed point	R / W			Positioning: speed
3622	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			Jog control: Ti times
3623	0	15000	200	rpm	INT	0	16384	Fixed point	R / W			Jog control: speed
3624	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			Active homing: Ti times
3625	0	15000	200	rpm	INT	0	16384	Fixed point	R / W			Active homing: speed
3626	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			Virtual clutch: Ti times
3630	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			Y offset: Ti times
3631	0	15000	200	rpm	INT	0	16384	Fixed point	R / W			Y offset: speed
3632	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			X offset: Ti times
3633	0	15000	200	rpm	INT	0	16384	Fixed point	R / W			X offset: speed
3634	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			Y axis synchronisation: Ti times
3635	0	15000	200	rpm	INT	0	16384	Fixed point	R / W			Y axis synchronisation: speed
3636	0	1	0		BOOL	0	1	Fixed point	R / W	✓		Motor mounting direction: 0: motor and tool rotate in the same direction 1: motor and tool rotate in opposite direction
3637	-32767	32767	0		INT	-32767	32767	Fixed point	R / W			Evaluation factor for additional position sensor (numerator)
3638	1	32767	1		WORD	1	32767	Fixed point	R / W			Evaluation factor for additional position sensor (denominator)
3639	0	1	0		BOOL	0	1	Fixed point	R / W			Reset main mode
3640	0	5	1		BYTE	0	5	Fixed point	R / W			Torque precontrol: Selection of the arithmetical operation (□ 5-48)
3643	-214000.0000	214000.0000	3.0000	s_units	DINT	-2140000000	2140000000	Fixed point	R / W			Following error: limit for FAIL-QSP
3644	-214000.0000	214000.0000	0.5000	s_units	DINT	-2140000000	2140000000	Fixed point	R / W			Following error: hysteresis for FAIL-QSP
3645	-214000.0000	214000.0000	1.5000	s_units	DINT	-2140000000	2140000000	Fixed point	R / W			Following error: limit for warning
3646	-214000.0000	214000.0000	0.5000	s_units	DINT	-2140000000	2140000000	Fixed point	R / W			Following error: hysteresis for warning

¹ The parameter can only be changed when the controller is inhibited (CINH).

² Press **SHIFT** + **PRG** to change the parameter via the keypad.



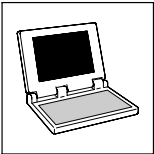


Template Cam

Appendix

Code list

Code	External					Internal			Access	CINH? ¹	SHIFT + PRG? ²	Information
	Min. value	Max. value	Init. value	Unit	Data type	Min. value	Max. value	Data type				
3649	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			X axis synchronisation: Ti times
3650	0	15000	200	rpm	INT	0	16384	Fixed point	R / W			X axis synchronisation: speed
3651	0.010	129.999	5.000	s	DINT	10	129999	Fixed point	R / W			Virtual master: Ti times
3652	0	15000	10	rpm	INT	0	16384	Fixed point	R / W			Virtual master: speed
3998	0	65535	0		WORD	0	65535	Fixed point	R / W			Current PLC or template error
3999	0	65535	0		WORD	0	65535	Fixed point	R			Template Cam version
¹ The parameter can only be changed when the controller is inhibited (CINH). ² Press SHIFT + PRG to change the parameter via the keypad.												



7.5 Visualisation

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

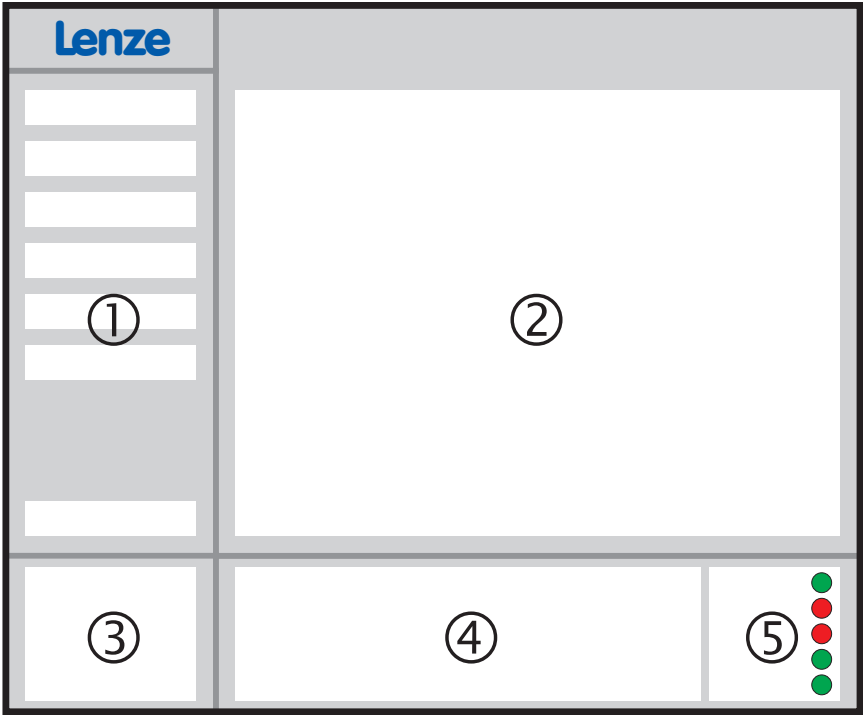


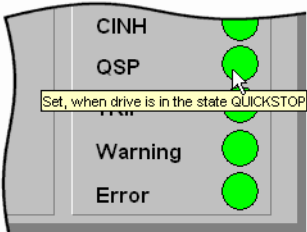
Fig. 7-1 Basic structure of the visualisation used in the template

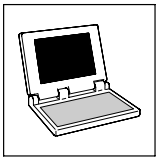
①	Menu	You can select the desired template function from the menu. After selection, the function is visualised in the dialog area.
②	Dialog area	
③	Control fields	Area for cross-function control fields (buttons).  Important: The "software switches" QSP and CINH only trigger quick stop or controller inhibit when online connected to the PLC. They therefore do <u>not</u> 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!

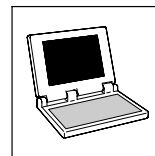
You can obtain additional information on a visualisation object by positioning the mouse pointer over the object until a "tool tip" is displayed:





Template Cam

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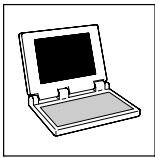
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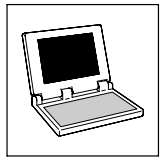
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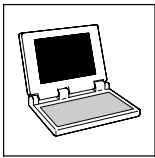
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