EDSVS9332K-EXT
13375727

Global Drive

System Manual

(Extension)

9300 *0,37 ... 75 kW*

EVS9321xK ... EVS9332xK

Servo cam profiler

Lenze

1 Preface

Contents

1.1 How to use this System Manual

1.1.1 Information provided by the System Manual

Target group

This System Manual is directed at all persons who design, install, commission and adjust the 9300 servo cam profilers.

Together with the System Manual, document number EDSVS9332K, and the catalogue, it forms the project planning basis for the manufacturer of plants and machinery.

Contents

The System Manual (Extension) completes the System Manual, document number EDSVS9332K:

- The features and functions are described in detail.
- It describes additional possible applications in detail.
- The parameter setting for typical applications is explained with the help of examples.
- In case of doubt, the Mounting Instructions supplied with the 9300 servo cam profiler are valid.

Contents of System Manual	Contents of System Manual (Extension)
1 Preface	1 Preface
2 Safety instructions	-
3 Technical data	-
4 Installation of the standard device	-
5 Wiring of the standard device	-
6 Commissioning	-
7 Parameter setting	-
8 Configuration	2 Configuration
8.1 Monitoring	2.1 Configuration with Global Drive Control
8.2 Monitoring functions	2.2 Basic configurations
8.3 Code table	2.3 Operating modes
8.4 Selection lists	
8.5 Table of attributes	
-	3 Function library
-	4 Application examples
9 Troubleshooting and fault elimination	-
10 DC-bus operation	-
11 Safe standstill	-
12 Accessories	-
13 Appendix	5 Appendix

How to find information

Use the System Manual as the basis. It contains references to the corresponding chapters in the System Manual Supplement:

- Each chapter is a complete unit and comprehensively informs about a subject.
- The Table of Contents and Index help you to find all information about a certain topic.
- Descriptions and data of other Lenze products (Drive PLC, Lenze geared motors, Lenze motors, ...) can be found in the corresponding catalogs, Operating Instructions and manuals. The required documentation can be ordered at your Lenze sales partner or downloaded as PDF file from the Internet.

Note!

Information and tools concerning the Lenze products can be found in the download area under

http://www.Lenze.com

1.1.2 Document history

What is new / what has changed?

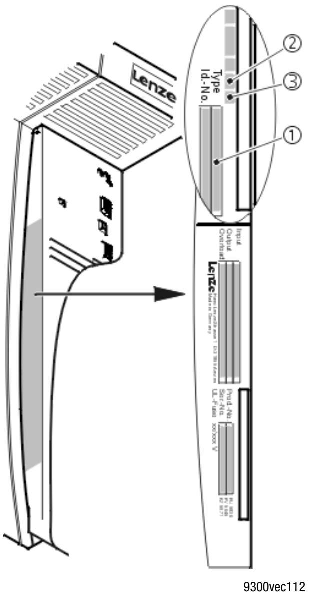
Material number	Version			Description
13375727	4.0	06/2011	TD23	Fault correction
13344177	3.0	07/2010	TD23	Extended by functions for software version 8.0 Fault correction
13190509	2.0	02/2007	TD23	Fault correction
13142002	1.0	06/2006	TD23	First edition for software version 7.0 Division of the System Manual into 2 parts (EDSVS9332K and EDSVS9332K-EXT)

1.1.3 Products to which the System Manual applies

This documentation is valid for 9300 servo cam profilers as of nameplate data:

① ② ③ **Nameplate**

EVS 93xx - x x Vxx 1x 8x



9300vec112

Product series

EVS = Servo controller

Type no. / rated power

	400 V	480 V
9321 =	0.37 kW	0.37 kW
9322 =	0.75 kW	0.75 kW
9323 =	1.5 kW	1.5 kW
9324 =	3.0 kW	3.0 kW
9325 =	5.5 kW	5.5 kW
9326 =	11 kW	11 kW
9327 =	15 kW	18.5 kW
3928 =	22 kW	30 kW
9329 =	30 kW	37 kW
9330 =	45 kW	45 kW
9331 =	55 kW	55 kW
9332 =	75 kW	90 kW

Type

E = Panel-mounted unit
C = Built-in unit in ”cold plate” technique

Design

K = Servo cam profiler

Variant

- Standard
V003 = In ”cold plate” technique
V004 = With ”safe standstill” function
V100 = For IT systems
V104 = With ”safe standstill” function and for IT systems

Hardware version

Software version

1.2 Definition of notes used

All safety information given in these instructions has the same layout:

> ⚠ Pictograph (indicates the type of danger)
>
> **Signal word!** (indicates the severity of danger)
>
> Note (describes the danger and explains how to avoid it)

Pictograph	Signal word		Consequences if disregarded
	Signal word	Meaning	
⚠ Dangerous electrical voltage ⚠ General danger	**Danger!**	**Impending danger for persons**	Death or severe injuries
	Warning!	**Possible, very dangerous situation for persons**	Death or severe injuries
	Caution!	**Possible, dangerous situation for persons**	Injuries
STOP	**Stop!**	**Possible damage to material**	Damage of the drive system or its environment
ℹ	**Note!**	**Useful tip** If you observe it, handling of the drive system will be easier.	

2 Configuration

Contents

2.1 Configuration with Global Drive Control

With Global Drive Control (GDC), Lenze offers an easy-to-understand, clearly-laid-out and convenient tool for the configuration of your specific drive task.

Function block library

GDC provides an easy-to-read library of available function blocks (FB). GDC also displays the complete assignment of an FB.

Signal configuration

The signal configuration is done with only one dialog box. It is a convenient way

- to display every FB as a block diagram.
- to see the assignment of all signal inputs at a glance.
- to enter the FB in the processing table.
- to print your signal configuration.

Terminal assignment

Freely assignable terminals can be configured using two dialog boxes:

- Dialog box - to link digital inputs and outputs.
- Dialog box - to link analog inputs and outputs.

2.2 Basic configurations

Stop!

It is possible to load predefined basic configurations via code C0005. If you load a configuration via C0005, the assignment of all inputs and outputs will be overwritten with the corresponding basic assignment.

Adapt the function assignment to the wiring.

The internal signal processing is adapted to the drive task by selecting a predefined basic configuration. You can, for instance, use the Lenze setting for speed control.

- A detailed description of the basic configurations with terminal assignments, signal flow diagrams, and application examples can be found in the chapter ”Application examples”.
- Before loading a basic configuration via C0005, the controller must be inhibited.

Several predefined signal configurations can be loaded by using code C0005. The selection numbers have the following meaning:

C0005 =	**1**	**X**	**X**	**X**	**X**	
					Control 0 - Terminal control 1 - Control via LECOM A/B/LI 3 - Control via AIF (INTERBUS,PROFIBUS) 5 - Control via system bus (CAN)	
				Terminal supply 0 - External supply of control terminals 1 - Internal supply of control terminals		
			Additional functions (see chapter 2.2.2 ff.) 0 - None 1 - Homing function 2 - Clutch function 3 - Switching points 8 - Mark-controlled correction of the master value 9 - Mark-controlled correction of the act. value			
		Operating mode 0 - Replacement of a mechanical cam* (see chapter 2.2.3) 1 - Welding bar drive* (see chapter 4.2) 2 - Operation with position storage* (see chapter 2.2.5) * - Incremental master value				
	Identification 1 - Cam profile					

Profile data

Before commissioning, the profile data must be generated with the Global Drive Control program and the transmitted to the drive. The below basic cam profiles are included in the Lenze setting. They are effective independently of the basic parameter setting.

Profile 1	Electronic gearbox (linear position profile)
Profile 2	Forward / backward movement with a standstill in the apex of the motion
Profile 3	Forward / backward movement with a standstill at the end of motion
Profile 4	Smooth feed
Profiles 5 - 8	No motion

Warning!

With Lenze setting, the motor must be operated at no-load (no mechanical connection to the machine).

2.2.1 Changing the basic configuration

If the basic configuration must be changed for a special application, proceed as follows:

1. Select a basic configuration via C0005 which largely meets the requirements.
2. Add functions by:
   – Reconfiguring inputs and/or outputs.
   – Setting parameters for function blocks. (🕮 3-6)
   – Inserting or removing function blocks. (🕮 3-12)

Note!

If you change the signal flow of the basic configuration, e. g. by adding function blocks, C0005 is set to 0. The display indicates ”COMMON”.

2.2.2 Basic configuration C0005 = 1xXxx

2.2.2.1 Basic configurations 1X0XX: No additional function

The signal flow corresponds to the basic functions described in chapters X.1 - X.3.

2.2.2.2 Basic configurations 1X1XX: Homing function

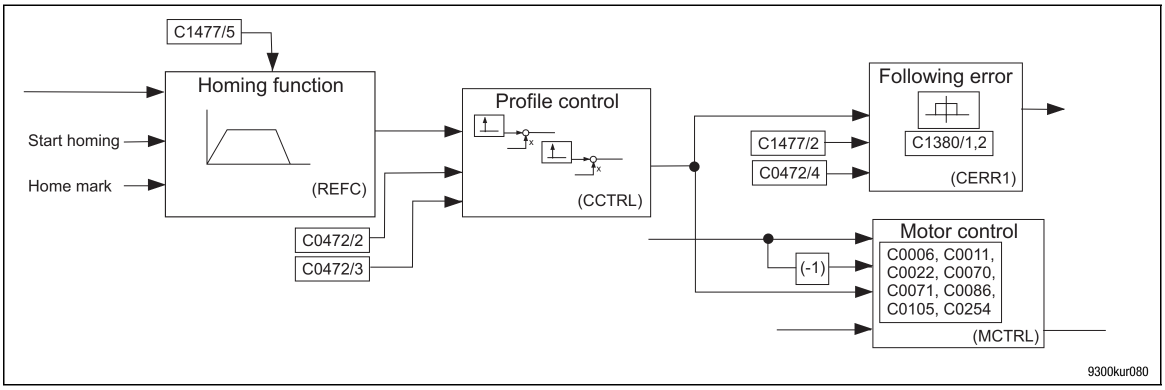


Fig. 2-1 Section of the signal flow diagram showing the basic configuration 1X1XX with homing function

		Function
Digital inputs	X5/28	Controller enable
	X5/E1	Event profile
	X5/E2	Profile *1
	X5/E3	Start homing
	X5/E4	Home mark
	X5/E5	Trip reset / profile acceptance
Digital outputs	X5/A1	TRIP
	X5/A2	Contouring error
	X5/A3	RDY
	X5/A4	Reference O.K.
Analog inputs	X6/1, X6/2	–
	X6/3, X6/4	–
Analog outputs	X6/62	Actual speed value
	X6/63	Actual torque value
Additional code	C1477/5	Home position
Parameter of FB REFC	C0011	Max. speed n_{max}

2.2.2.3 Basic configurations 1x2xx: Clutch function

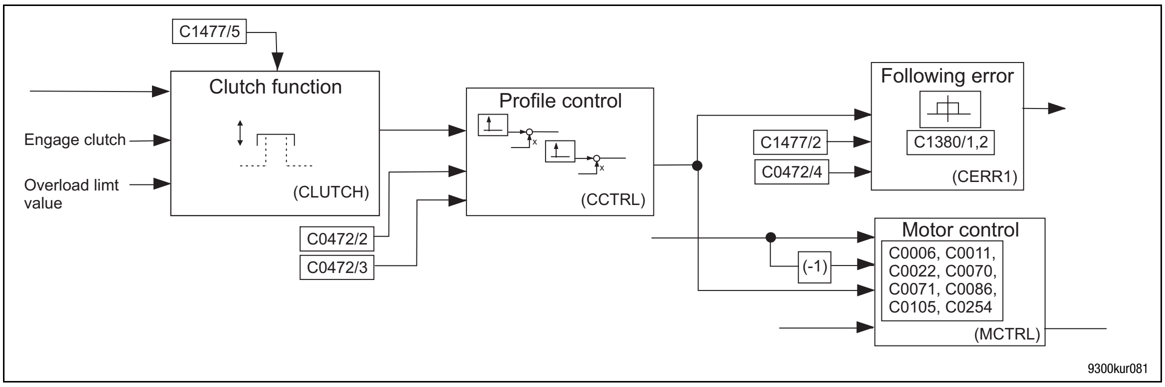


Fig. 2-2 Section of the signal flow diagram showing the basic configuration 1X2XX with clutch function

		Function
Digital inputs	X5/28	Controller enable
	X5/E1	Event profile
	X5/E2	Profile *1
	X5/E3	Profile *2
	X5/E4	Engage clutch
	X5/E5	Trip reset / profile acceptance
Digital outputs	X5/A1	TRIP
	X5/A2	Contouring error
	X5/A3	RDY
	X5/A4	Clutch disengaged
Analog inputs	X6/1, X6/2	–
	X6/3, X6/4	–
Analog outputs	X6/62	Actual speed value
	X6/63	Actual torque value
Additional code	C1477/5	Home position
Parameters of FB CLUTCH	C1410	Clutch mode
	C1411	Max. velocity
	C1412/1	Ramp opening time
	C1412/2	Ramp profile generator
	C1412/3	Overload time delay
	C1413	Catch hysteresis

2.2.2.4 Basic configurations 1x3xx: Switching points (cam group)

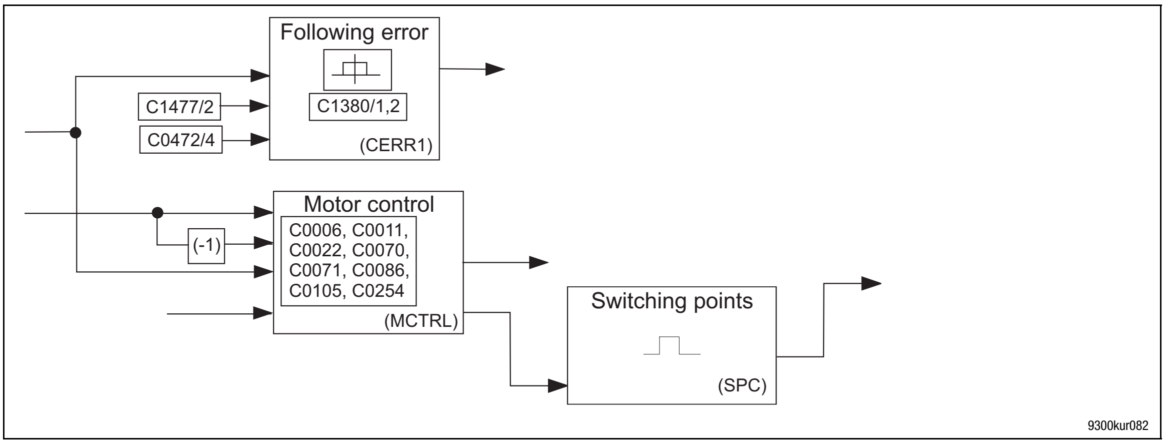


Fig. 2-3 Section of the signal flow diagram showing the basic configuration 1X3XX with switching points

		Function
Digital inputs	X5/28	Controller enable
	X5/E1	Event profile
	X5/E2	Profile *1
	X5/E3	Profile *2
	X5/E4	Profile *4
	X5/E5	Trip reset / profile acceptance
Digital outputs	X5/A1	TRIP
	X5/A2	Contouring error
	X5/A3	RDY
	X5/A4	Switching point 1
Analog inputs	X6/1, X6/2	–
	X6/3, X6/4	–
Analog outputs	X6/62	Actual speed value
	X6/63	Actual torque value
Additional codes	C1476/x C1477/x	Codes can be used as switching point values
Parameters of FBs SPC1 and SPC2	C1645	SPC1 mode
	C1655	SPC2 mode
	C1657/1 to C1657/4	SPC2 dead time
	C1658	SPC2 hysteresis
	C1659	Filters

2.2.2.5 Basic configurations 1x8xx: Mark-controlled correction of master value

		Changed terminal assignment
Digital inputs	X5/E1	Event
	X5/E2	Profile *1
	X5/E3	Profile *2
	X5/E4	Trip reset / profile acceptance
	X5/E5	TOUCH-PROBE signal input
Additional code	C1476/16	TOUCH-PROBE position X

2.2.2.6 Basic configurations 1x9xx: Mark-controlled correction of actual value

		Changed terminal assignment
Digital inputs	X5/E1	Event
	X5/E2	Profile *1
	X5/E3	Profile *2
	X5/E4	TOUCH-PROBE signal input X
	X5/E5	TOUCH-PROBE / profile acceptance Y
Additional code	C1476/16	TOUCH-PROBE position Y

2.2.3 Replacement of a mechanical cam (C0005 = 10000)

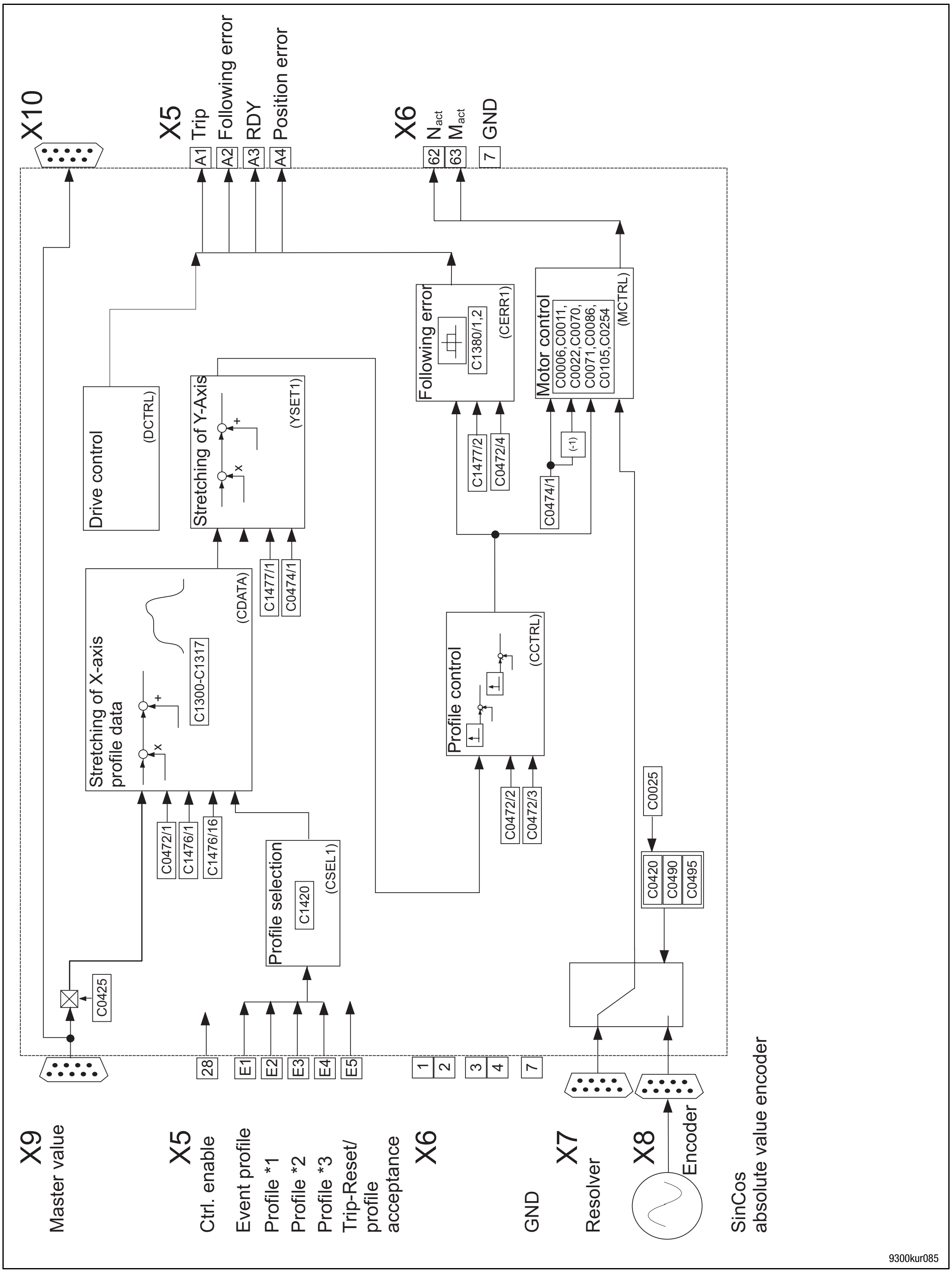


Fig. 2-4 Block diagram of the basic configuration C0005 = 10000 (cam)

	Code	Description
Basic configuration	C0005 = 10000	The configuration C0005 = 10000 provides an electronical solution for the demands on a mechanical cam. Additional functions such as stretching / compression / angle trimming in X-direction and Y-direction are available.
Master value	C0425	Encoder constant of the master value
Cam profile data	C1300-C1317	The cam profile data are determined with the generation of the profile. Usually, they do not have to be changed separately.
	C1420	Determines the profile to be used when an event input is activated (digital input X5/E1 = LOW).
Contouring error evaluation	C1380/1 and C1380/2	Determine comparison window and hysteresis of the contouring error evaluation.
Adjustment values	C0472/2	Influence of speed precontrol
	C0472/3	Influence of torque precontrol
	C1477/2	Contouring error limit (in s_units)
	C0472/4	Reduction factor for contouring error warning Warning limit: C0472/4 × C1477/2
Profile influence	C0472/1	Stretching/compression of X-axis (100 % = no stretching/compression)
	C1476/1	Angle trimming in X-direction
	C1477/1	Angle trimming in Y-direction
	C1476/16	TOUCH-PROBE position in X-direction
	C0472/9	Stretching/compression of Y-axis
	C0472/10	Torque limit value

2.2.4 Welding bar drive (C0005 = 11000)

See chapter 4.2. (🕮 4-5)

2.2.5 Operation with position storage (C0005 = 12000)

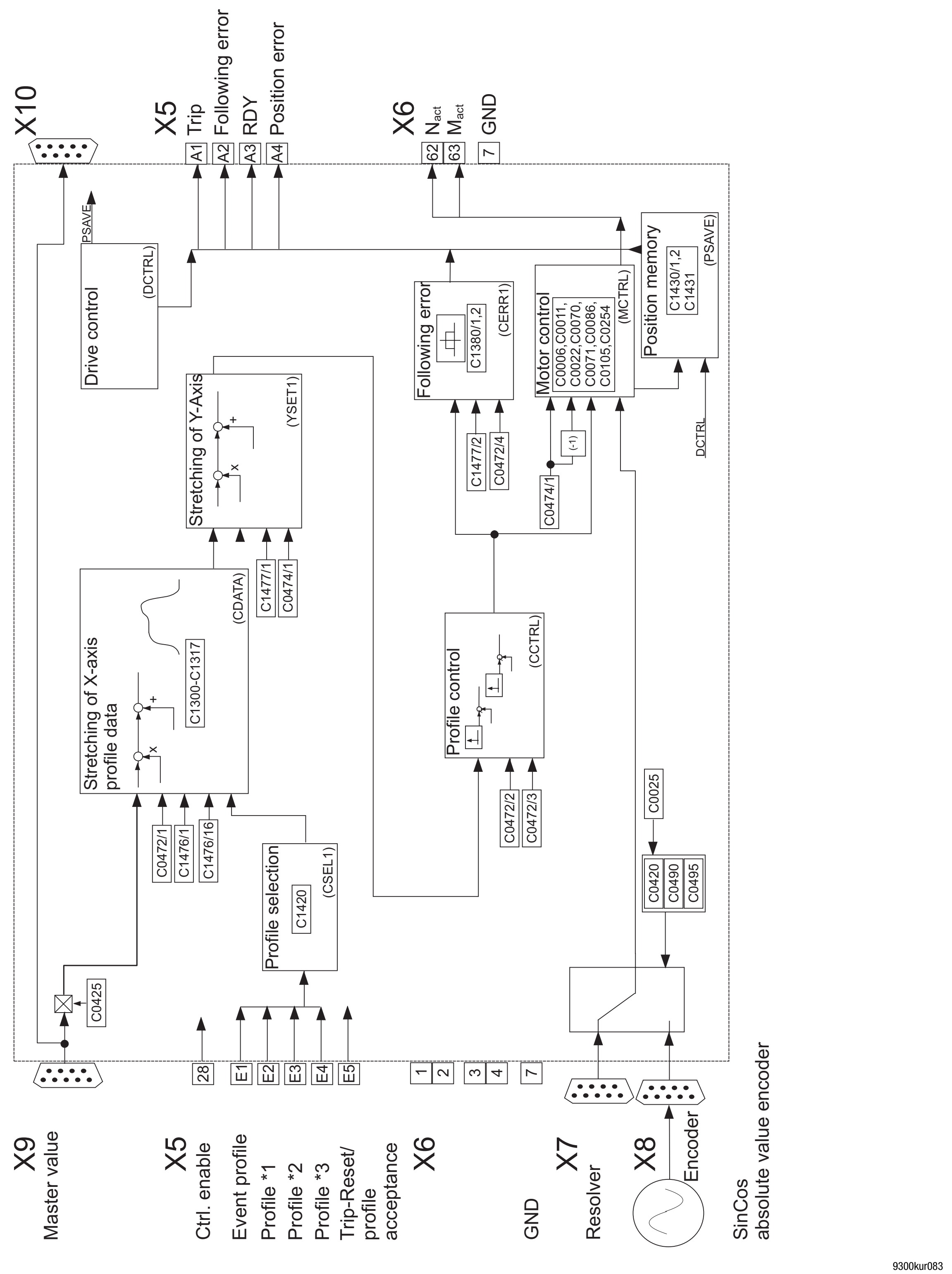


Fig. 2-5 Block diagram of the basic configuration C0005 = 12000 (cam with position storage)

An incremental encoder cannot be used as a feedback system with this configuration.

Configuration

Basic configurations

Operation with position storage (C0005 = 12000)

Code	Description
C0005 = 12000	With this configuration and an absolute feedback system (resolver or Sin/Cos absolute value encoder), the position values of the motor shaft can be stored when switching off the mains. When the mains is switched on again, the actual values are compared to the stored values.
• Master value	
C0425	Encoder constant of the master value
• Cam profile data	
C1300 ... C1317	The cam profile data are determined by the generation of the profile. Usually, they do not have to be changed separately.
C1420	Determines the profile to be used when an event input is activated (X5/E1 = LOW).
• Contouring error evaluation	
C1380/1 and C1380/2	Determine comparison window and hysteresis of the contouring error evaluation.
• Adjustment values	
C0472/2	Influence of speed precontrol
C0472/3	Influence of torque precontrol
C1477/2	Contouring error limit (in s/units)
C0472/4	Reduction factor for contouring error warning; warning limit = C0472/4 × C1477/2
• Profile influence	
C1472/1	Stretching/compression of X-axis (100 % = no stretching/compression)
C1476/1	Angle trimming in X-direction
C1477/1	Angle trimming in Y-direction
• Position memory	
C1430/1, C1430/2	Tolerance window of the comparison functions
C1431	Determination of values to be stored (master and/or actual value)
C1476/16	TOUCH-PROBE position in X-direction
C0472/9	Stretching/compression of Y-axis
C0472/10	Torque limit value

2.3 Operating modes

By selecting the operating mode you can also select the interface you want to use for parameter setting or control of the controller.

C0005 contains predefined configurations which allow a very easy change of the operating mode.

2.3.1 Parameter setting

Parameters can be set with one of the following modules:

- Communication module
  - 2102 (LECOM A/B/LI)
  - 2111, 2113 (INTERBUS)
  - 2131, 2133 (PROFIBUS)
  - 2175 (CANopen/DeviceNet)
- PC system bus module (CAN)
  - 2173

2.3.2 Control

The drive controller can be controlled via terminals (X5 and X6), via the fieldbus module at X1 or via the system bus (X4). Mixed forms are also possible.

3 Function library

Contents

3.1 Working with function blocks

The signal flow of the controller can be configured by connecting function blocks. The controller can thus be easily adapted to diverse applications.

3.1.1 Signal types

Each function block is provided with a certain number of inputs and outputs which can be interlinked. Corresponding to their functions, there are only certain types of signals at the inputs and outputs:

- Quasi analog signals
  - Symbol: ○
  - Unit: %
  - Designation: a
  - Value range: ±16384 = ±100 %
  - Resolution: 16 bits, scaling ±16384 ≙ ±100 %
- Digital signals
  - Symbol: □
  - Unit: binary, with HIGH or LOW level
  - Designation: d
  - Resolution: 1 bit
- Speed signals
  - Symbol: △
  - Unit: rpm (for display, internal representation in [inc/ms])
  - Designation: phd
  - Value range: $\pm 2^{15}$ - 1
  - Resolution: 16 bits
- Angle signals
  - Symbol: ▲
  - Unit: inc
  - Designation: ph
  - Value range: $\pm 2^{31}$ - 1
  - Resolution: 32 bits, scaling 1 revolution ≙ 65536 inc

Only the same signal types can be connected. Thus, an analog output signal of one function block can only be connected to the analog input of the other function block. If you try to connect two different signal types, the connection is rejected.

3.1.2 Elements of a function block

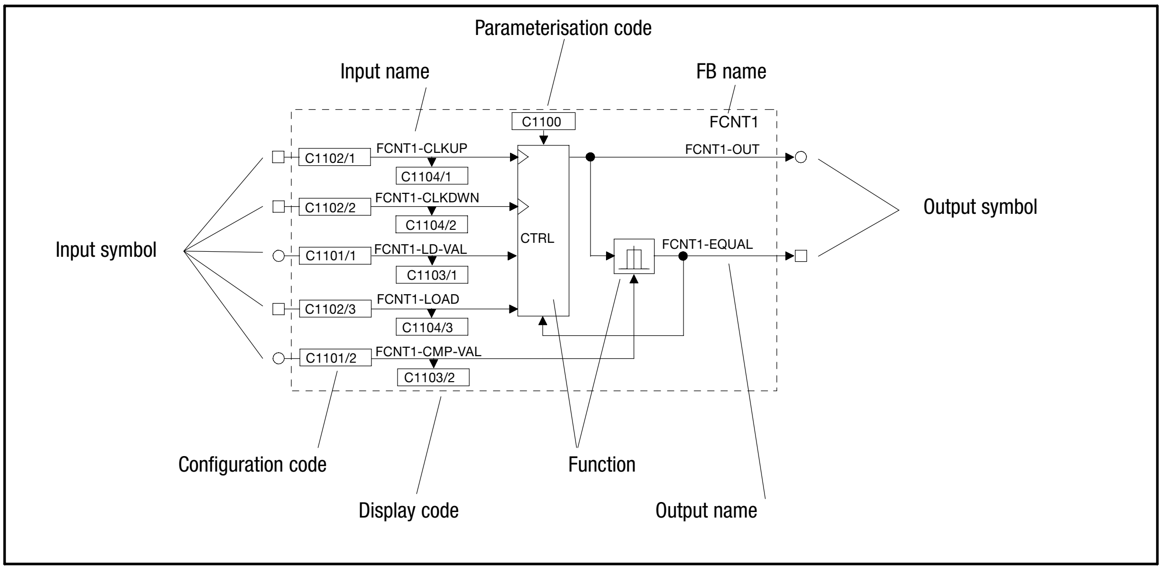


Fig. 3-1 Function block structure - using the example of FCNT1

FB name

Identifies fhe FB unambiguously. FBs with the same function are distinguished by a number behind the name.

Every FB is defined by a selection number. For calculating the FB, the selection number must be input into the processing table. (🕮 3-12)

The selection numbers are listed in selection list 5.

Example:

(FCNT1, see Fig. 3-1)

- FCNT1 ≙ selection number 6400 (selection list 5).

Input symbol

Designates the signal type which is allowed as signal source for this input. (🕮 3-5)

Tip!

Only linked inputs can be configured.

Input name

Consists of the FB name and a designation. Inputs with the same function are distinguished by the number that is added to the designation.

Configuration code

Configures the input with a signal source (e. g. terminal signal, control code, output of an FB, ...). Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are configured via the subcode.

It is not possible to connect an input with several signal sources.

Display code

Displays the current input value. Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are displayed via the subcode.

Display codes cannot be processed.

Function

Represents the mathematical function as a block diagram (see Fig. 3-1).

Parameter setting code

Adaptation of the function or behaviour to the drive task. Possible settings are described in the text and/or the line diagram. (📖 3-14)

Output symbol

Designates the signal type. Connections with inputs of the same signal type are possible. (📖 3-5)

Each output is defined by a selection number. The selection numbers are divided into selection lists (1 ... 4) according to the different signal types.

An output is linked to an input by the selection numbers.

Example:

(FCNT1, see Fig. 3-1)

- FCNT1-OUT ≙ selection number 6400 (analog signal, selection list 1).
- FCNT1-EQUAL ≙ selection number 6400 (digital signal, selection list 2).

Tip!

Only linked outputs can be configured.

Output name

Consists of the FB name and a designation. Outputs with the same function are distinguished by the number that is added to the designation.

3.1.3 Connection of function blocks

General rules

- Assign a signal source to an input.
- One input can have only one signal source.
- Inputs of different function blocks can have the same signal source.
- Only the same types of signals can be connected.

Stop!

Existing connections which are not required must be removed by reconfiguration. Otherwise the drive cannot perform the desired function.

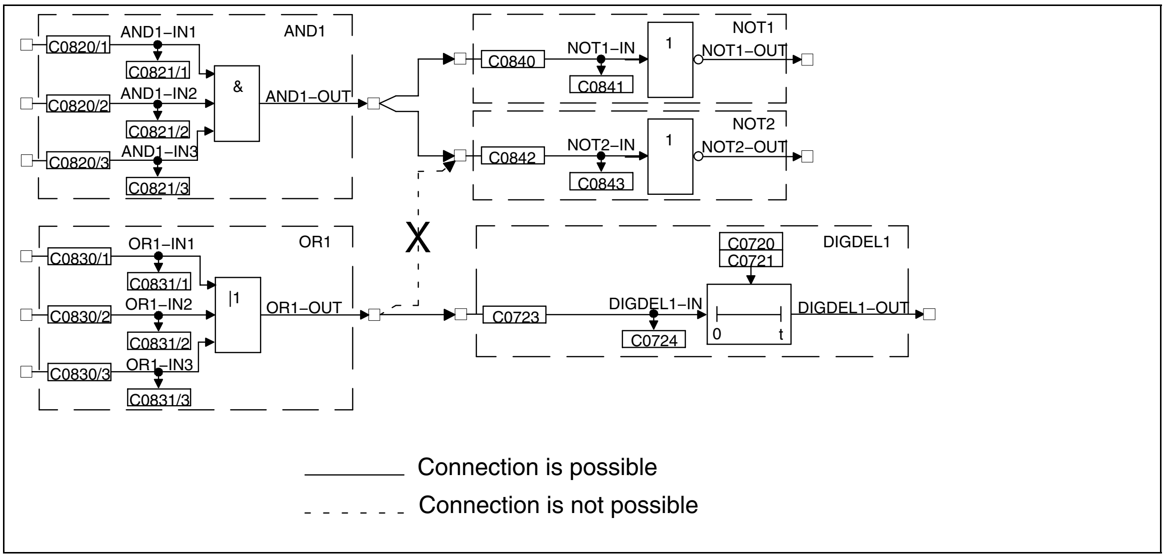


Fig. 3-2 Correct connection of function blocks

Basic procedure

1. Select the configuration code of the function block input which is to be changed.
2. Determine the source of the input signal for the selected input (e.g. from the output of another function block).
3. The function block input is assigned via a menu which contains only those signal sources which are of the same type as the function block input to be assigned.
4. Select and confirm the signal source.
5. Remove undesired connections, if any.
   - For this, select the corresponding signal assignment of the input via the configuration code (e.g. FIXED0, FIXED1, FIXED0%, ...).
6. Repeat 1. to 5. until the desired configuration is set.
7. Save modified configuration in the desired parameter set.

Example

- Condition:
  - Default setting
- Task:
  - Square the analog signal of X6/3, X6/4 and output to X6/62.
- Solution:
  - You need the function blocks AIN2, ARIT2 and AOUT2.

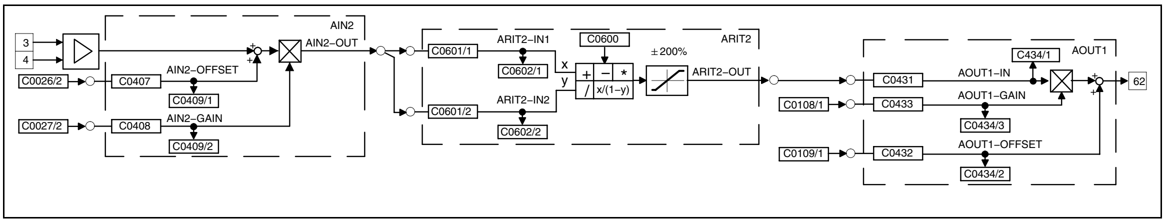


Fig. 3-3 Example of a simple configuration

Establish connections

1. Determine the signal source for ARIT2-IN1:
   - Change to the code level using the arrow keys
   - Select C0601/1 using ▲ or ▼.
   - Change to the parameter level using PRG.
   - Select output AIN2-OUT (selection number 55) using ▲ or ▼.
   - Confirm using SH + PRG
   - Change to the code level again using PRG.
2. Determine signal source for ARIT2-IN2:
   - Select C0601/2 using ▲.
   - Change to the parameter level using PRG.
   - Select output AIN2-OUT (selection number 55) using ▲ or ▼.
   - Confirm using SH + PRG
   - Change to the code level again using PRG.
3. Parameterise ARIT2:
   - Select C0600 using ▼.
   - Change to the parameter level using PRG.
   - Select multiplication (selection number 3).
   - Confirm using SH + PRG
   - Change to the code level again using PRG.
4. Determine signal source for AOUT1:
   - Select C0431 using ▼.
   - Change to the parameter level using PRG.
   - Select output ARIT2-OUT (selection number 5505).
   - Confirm using SH + PRG
   - Change to the code level again using PRG.
5. Enter function block ARIT2 in the processing table:
   - Select C0465 and subcode 8 using ▲.
   - Change to the parameter level using PRG.
   - Enter function block ARIT2 (selection number 5505).
   - Confirm using SH + PRG
   - Change to the code level again using PRG.
   - The sequence of the FB processing is thus determined.

Remove connections

- Since a source can have several targets, there may be further signal connections, which may not be wanted.
- Example:
  - – In the default setting of the basic configuration C0005 = 1000 (speed control), ASW1-IN1 and AIN2-OUT are connected.
  - – This connection is not automatically removed by the settings described above! If you do not want this connection, remove it.

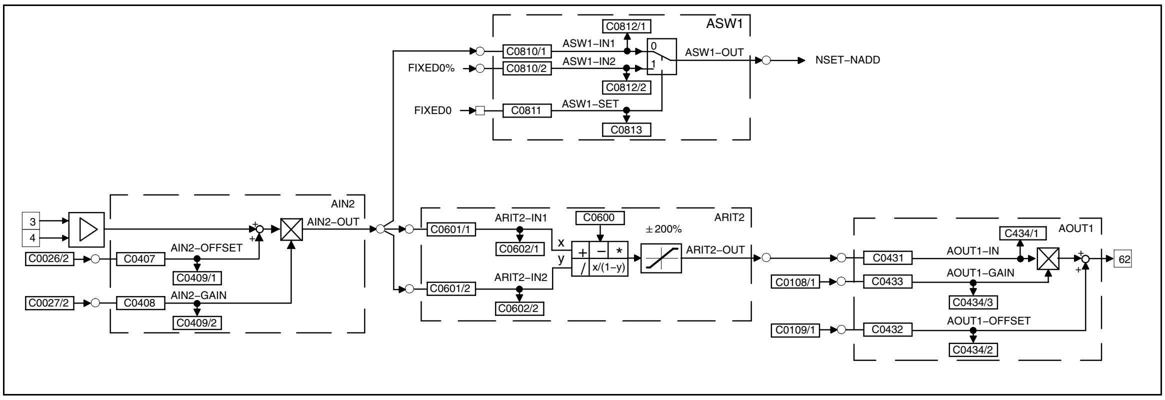


Fig. 3-4 Remove connections in a configuration

6. Remove connection between ASW1-IN1 and AIN2-OUT:
   - – Select C0810/1 using ▲ or ▼.
   - – Change to the parameter level using PRG.
   - – Select the constant FIXED0% (selection number 1000) using ▲ or ▼ .
   - – Confirm with SH + PRG
   - – Change to the code level again using PRG.

Now the connection is removed.

7. Save new configuration, if desired:
   - – If you do not want to lose the modifications after mains disconnection, save the new signal configuration in one of the parameter sets with C0003.

3.1.4 Entries into the processing table

The 93XX controller provides a certain calculating time for processing the FBs. Since the type and number of FBs to be used depends on the application and can vary strongly, not all available FBs are permanently calculated. A processing table is therefore provided under code C0465, where only the FBs used are listed. This means that the drive system is perfectly matched to the task. If further function blocks are integrated into an existing configuration, they must be listed in the processing table.

Several aspects must be observed:

The number of FBs to be processed is limited

A maximum of 50 FBs can be integrated into a configuration. Every FB requires a certain processing time. Code C0466 displays the residual time for the processing of FBs. If this time is used up, no further FBs can be integrated.

Entry sequence into the FBs

Normally, the entry sequence under C0465 is arbitrary, but it may be important for applications with high response. In general, the most favourable sequence is adapted to the signal flow.

Example:

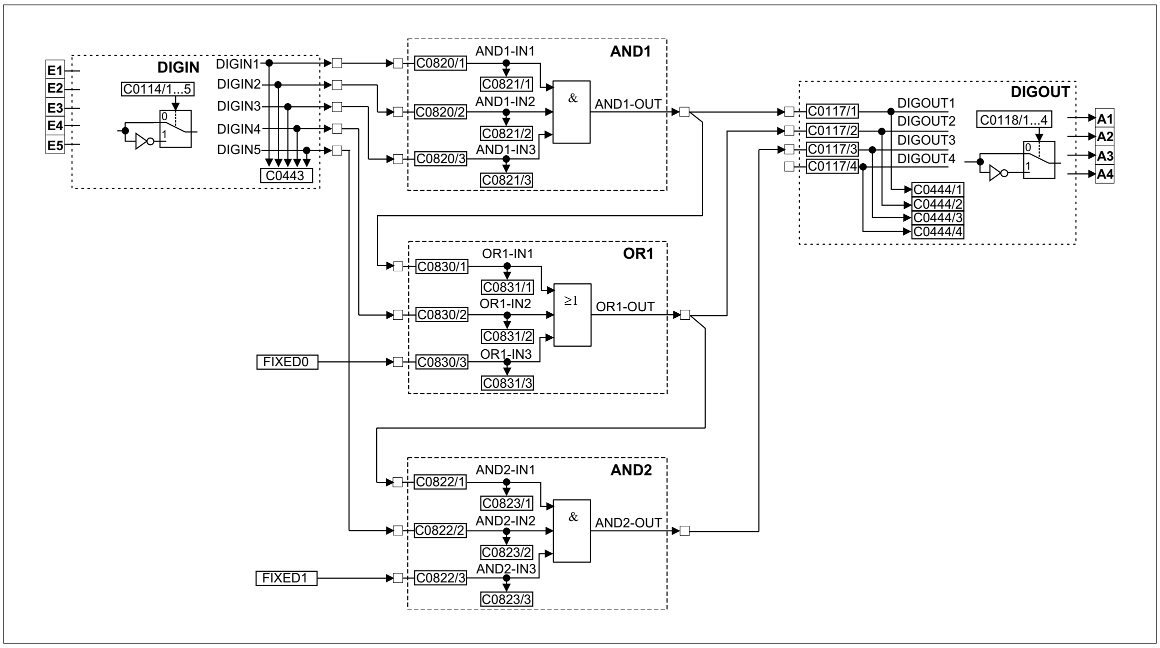


Fig. 3-5 Example of a configuration

Structure of the processing table for the configuration example of Fig. 3-5:

1. DIGIN does not have to be entered into the processing table
2. The first FB is AND1, since it receives its input signals from DIGIN and only has successors.
3. The second FB is OR1, since its signal source is the output of AND1 (predecessor). This means that the output signal in AND1 must be generated first, before it can be processed in OR1. At the same time, OR1 has a successor. This means that OR1 must be entered in the processing table before the successor.
4. The third FB is AND2, since it has a predecessor (see 3.)

5. The entries in C0465 are:
   - Position 10: AND1 10500
   - Position 11: OR1 10550
   - Position 12: AND2 10505

This example was started with position 10, because these positions are not assigned in the default setting.

FBs need not to be entered into the processing table one after the other. Empty positions in the processing table are permissible.

Tip!

It is also possible that other FBs are entered between the FBs listed in the example.

FBs which do not have to be entered into the processing table

The following signal sources are always executed and do not have to be entered into the processing table:

- AIF-IN
- CANx-IN
- DIGIN
- DIGOUT
- FCODE (all free codes)
- MCTRL
- fixed signal sources (FIXED0, FIXED0%, etc.)

Frequent faults in the configuration

Malfunction	Cause	Remedy
FB does not supply an output signal	FB was not entered into the processing table C0465	Enter FB
FB only supplies constant signals	FB was deleted from or overwritten in the procesing table C0465.	Enter FB again, possibly under a different subcode (position)
The output signal does not arrive at the following FB.	No connection between the FBs	Make connection (from the view of the next FB) via the configuration code (CFG)
FB cannot be entered in the table C0465	Residual process time is too short (see C0466)	Remove FBs not used (e.g. inputs and outputs not used) In networked drives, functions may be relocated to other controllers
The controller outputs internally calculated signals with a delay	FBs are processed in an incorrect sequence	Adapt processing table under C0465 to the signal flow

3.2 Function blocks

3.2.1 Table of function blocks

Function block	Description		CPU time [µs]	Used in basic configuration C0005			
				1000	10000	11000	12000
ABS1	Absolute value generator	📖 3-37	4		●	●	●
ADD1	Addition block	📖 3-38	8				
ADDPHD1	Addition block	📖 3-39	9				
AIF-IN	Fieldbus	📖 3-40	60				
AIF-OUT	Fieldbus	📖 3-43	56	●	●	●	●
AIN1	Analog input X6/1, X6/2	📖 3-45	10				
AIN2	Analog input X6/3, X6/4		28				
AND1	Logic AND, block 1	📖 3-47	6				
AND2	Logic AND, block 2						
AND3	Logic AND, block 3						
AND4	Logic AND, block 4						
AND5	Logic AND, block 5						
AND6	Logic AND, block 6						
AND7	Logic AND, block 7						
AND8	Logic AND, block 8		8				
AND9	Logic AND, block 9						
ANEG1	Analog inverter 1	📖 3-52	3	●	●	●	●
ANEG2	Analog inverter 2						
AOUT1	Analog output X6/62	📖 3-53	12	●	●	●	●
AOUT2	Analog output X6/63			●	●	●	●
ARIT1	Arithmetic block 1	📖 3-55	11				
ARIT2	Arithmetic block 2						
ARITPH1	32-bit arithmetic block 1	📖 3-56	15				
ARITPH2	32-bit arithmetic block 2						
ARITPH3	32-bit arithmetic block 3						
ARITPH4	32-bit arithmetic block 4						
ARITPH5	32-bit arithmetic block 5						
ARITPH6	32-bit arithmetic block 6						
ASW1	Analog changeover 1	📖 3-59	4	●			
ASW2	Analog changeover 2						
ASW3	Analog changeover 3						
ASW4	Analog changeover 4						
BRK	Triggering of holding brake	📖 3-61	15				
CAN-IN1	System bus	📖 3-66	-				
CAN-IN2	System bus						
CAN-IN3	System bus						
CAN-OUT1	System bus	📖 3-66	56	●	●	●	●
CAN-OUT2	System bus			●	●	●	●
CAN-OUT3	System bus			●	●	●	●
CCTRL	Setpoint conditioning	📖 3-67	30		●	●	●
CCTRL2	Setpoint conditioning	📖 3-74	45				
CDATA	Profile data conditioning	📖 3-20	140		●	●	●
CERR	Following error monitoring	📖 3-82	15		●	●	●
CLUTCH1	Virtual clutch 1	📖 3-85	47				
CLUTCH2	Virtual clutch 2	📖 3-89	30				
CLUTCH3	Virtual clutch 3	📖 3-91	60				
CMP1	Comparator 1	📖 3-103	15	●			
CMP2	Comparator 2						
CMP3	Comparator 3		15				

Function block	Description		CPU time [µs]	Used in basic configuration C0005			
				1000	10000	11000	12000
CONV1	Conversion of analog signals	🕮 3-108	8				
CONV2	Conversion of analog signals						
CONV3	Conversion of speed signals to analog signals						
CONV4	Conversion of speed signals to analog signals						
CONV5	Conversion of analog signals to speed signals						
CONVAD1	Analog/digital converter 1	🕮 3-112	4				
CONVAD2	Analog/digital converter 2						
CONVAPH1	Analog/angle converter 1	🕮 3-114	31				
CONVPHA1	Angle/analog converter 1	🕮 3-115	6				
CONVPHD1	Conversion of stretch factor	🕮 3-120	50				
CONVPHPH1	Angle converter 1	🕮 3-122	80				
CONVPHPHD1	Conversion of angle change to speed	🕮 3-123	27				
CONVPHPHD2	Conversion of angle change to speed	🕮 3-124	7				
CONVPP1	32 bit / 16 bit conversion	🕮 3-126	55				
CSEL1	Profile selection	🕮 3-127	10		•	•	•
CURVE1	Characteristic function	🕮 3-129	15				
CURVEC	Characteristic function	🕮 3-132	75				
DB1	Dead band	🕮 3-136	7				
DCTRL	Device control	🕮 3-137	-	•			
DFIN	Digital frequency input	🕮 3-141	5	•	•	•	•
DFOUT	Digital frequency output	🕮 3-144	35	•		•	•
DFRFG1	Digital frequency ramp function generator	🕮 3-148	40				
DFSET	Digital frequency processing	🕮 3-154	85				
DIGDEL1	Binary delay element 1	🕮 3-158	9				
DIGDEL2	Binary delay element 2						
DIGIN	Input terminals X5/E1…X5/E5	🕮 3-161	-	•	•	•	•
DIGOUT	Output terminals X5/A1…X5/A4	🕮 3-162	-	•	•	•	•
DT1	Derivative-action element	🕮 3-163	12				
EXTPOL1	Extrapolation	🕮 3-164	5				
EXTPOL2	Extrapolation	🕮 3-167	10				
FCNT1	Free piece counter, block 1	🕮 3-170	11				
FDO	Free digital outputs	🕮 3-172	-				
FEVAN1	Free analog input variable	🕮 3-174	4				
FEVAN2	Free analog input variable						
FIXSET1	Fixed setpoints	🕮 3-179	9				
FLIP1	D-flipflop 1	🕮 3-181	6				
FLIP2	D-flipflop 2						
FLIP3	D-flipflop 3						
FLIP4	D-flipflop 4						
GEARCOMP	Gearbox torsion	🕮 3-186	1				
LIM1	Limiter	🕮 3-187	5				
LIMPHD1	Speed limitation	🕮 3-188	12				
MCTRL	Servo control	🕮 3-190	-	•	•	•	•
MFAIL	Mains failure control	🕮 3-199	40				
MLP	Motor phase failure	🕮 3-210	30				
MONIT	Monitoring	🕮 3-211	-	•	•	•	•
MPOT1	Motor potentiometer	🕮 3-212	20				
MSEL1	Master selection	🕮 3-215	12				
MSEL2	Master selection	🕮 3-215	15				
NOT1	Logic NOT, block1	🕮 3-218	4				•
NOT2	Logic NOT, block2						
NOT3	Logic NOT, block3						
NOT4	Logic NOT, block4						
NOT5	Logic NOT, block5						

Function library

Function blocks

Table of function blocks

Function block	Description		CPU time [µs]	Used in basic configuration C0005			
				1000	10000	11000	12000
NSET	Speed setpoint conditioning	🕮 3-220	70	•			
OR1	Logic OR, block 1	🕮 3-226	6				•
OR2	Logic OR, block 2						
OR3	Logic OR, block 3						
OR4	Logic OR, block 4						
OR5	Logic OR, block 5						
OR6	Logic OR, block 6		8				
OR7	Logic OR, block 7						
OSC	Oscilloscope function	🕮 3-230	70				
PCTRL1	Process controller	🕮 3-234	58				
PHADD1	32-bit addition block	🕮 3-237	10				
PHCMP1	Comparator	🕮 3-238	8				
PHCMP2	Comparator						
PHCMP3	Comparator						
PHDIFF1	32 bit setpoint/act. value comparison	🕮 3-240	10				
PHDIV1	Conversion	🕮 3-241	8				
PHINT1	Angle integrator	🕮 3-242	7				
PHINT2	Angle integrator						
PHINT3	Angle integrator		10				
PHINT4	Angle integrator		11				
PHINT5	Master angle integrator	🕮 3-249	60				
PSAVE1	Position memory	🕮 3-255	10				•
PT1-1	1st order delay element	🕮 3-257	8				
PT1-2	1st order delay element	🕮 3-258	16				
CW/CCW/Q	QSP / setpoint inversion	🕮 3-260	8	•			
REFC	Homing function	🕮 3-261	100				
RFG1	Ramp function generator	🕮 3-268	16				
RFGPH1	Ramp function generator for angle signals	🕮 3-270	40				
RFGPH2	Profile generator (ramp function generator for angle signals)	🕮 3-275	32				
RFGPH3	Profile generator (ramp function generator for angle signals)		16				
S&H1	Sample and Hold	🕮 3-281	4				
SELPH1	Angle selection, block 1	🕮 3-282	6				
SELPH2	Angle selection, block 2						
SPC1	Switch points	🕮 3-284	80				
SPC2	Switch points		130				
SRFG1	S-shape ramp function generator	🕮 3-290	15				
STAT	Output of digital status signals	🕮 3-292	-				
STATE-BUS	Control of a drive network	🕮 3-293	-				
STORE1	Storage block 1	🕮 3-294	35				
STORE2	Storage block 2	🕮 3-297	20				
STORE3	Shift register	🕮 3-298	10				
SYNC1	Multi-axis positioning	🕮 3-305	55				
SYNC2	Multi-axis positioning		20				
SWPH1	Angle changeover	🕮 3-303	4				
SWPH2	Angle changeover						
SWPHD1	Digital frequency changeover switch	🕮 3-304	4				
SWPHD2	Digital frequency changeover switch						
TRANS1	Binary edge evaluation	🕮 3-314	7				
TRANS2	Binary edge evaluation						
TRANS3	Binary edge evaluation						
TRANS4	Binary edge evaluation						
VMAS1	Virtual master	🕮 3-317	20				

Function block	Description		CPU time [µs]	Used in basic configuration C0005			
				1000	10000	11000	12000
VTPCSC	Cam positioning control	🕮 3-321	45				
WELD1	Welding bar control	🕮 3-323	20			●	
YSET1	Stretching, compression, offset in Y direction	🕮 3-330	30		●		●

3.2.2 Table of free control codes

Code	Description	CPU time [µs]	Used in basic configuration C0005			
			1000	10000	11000	12000
FCODE 17	Q_{min}	-	●			
FCODE26/1	AIN Offset		●	●	●	●
FCODE26/2	AIN offset		●	●	●	●
FCODE27/1	AIN gain		●	●	●	●
FCODE27/2	AIN gain		●	●	●	●
FCODE32	Gearbox factor (numerator)					
FCODE 37	Setpoint selection (rpm)					
FCODE 108/1	AOUT gain		●	●	●	●
FCODE 108/2	AOUT gain		●	●	●	●
FCODE 109/1	AOUT offset		●	●	●	●
FCODE 109/2	AOUT offset		●	●	●	●
FCODE 141	Main setpoint					
FCODE250	1 bit digital					
FCODE 470/1	Bits 0 ... 7 %					
FCODE 470/2	Bits 8 ... 15 %					
FCODE 470/3	Bits 16 ... 23 %					
FCODE 470/4	Bits 24 ... 31 %					
FCODE 471	32 bits digital					
FCODE 472/1	Analog - %			●	●	●
FCODE 472/2				●	●	●
FCODE 472/3			●	●	●	●
FCODE 472/4				●	●	●
FCODE 472/5						
FCODE 472/6						
FCODE 472/7						
FCODE 472/8						
FCODE 472/9						
FCODE 472/10				●	●	●
FCODE 472/11						
FCODE 472/12						
FCODE 472/13						
FCODE 472/14						
FCODE 472/15						
FCODE 472/16						
FCODE 472/17						
FCODE 472/18						
FCODE 472/19						
FCODE 472/20						
FCODE 473/1	Analog - absolute					
FCODE 473/2						
FCODE 473/3						
FCODE 473/4						
FCODE 473/5						
FCODE 473/6						
FCODE 473/7						

Code	Description	CPU time [µs]	Used in basic configuration C0005			
			1000	10000	11000	12000
FCODE 473/8						
FCODE 473/9						
FCODE 473/10						
FCODE 474/1	Angle				•	
FCODE 474/2						
FCODE 474/3						
FCODE 474/4						
FCODE 474/5						
FCODE 472/6						
FCODE 474/7						
FCODE 474/8						
FCODE 474/9						
FCODE 474/10						
FCODE 475/1	Speed/digital frequency					
FCODE 475/2						
FCODE 475/3						
FCODE 475/4						
FCODE 475/5						
FCODE 1476/1	Master value [m_units]			•	•	•
FCODE 1476/2						
FCODE 1476/3						
FCODE 1476/4						
FCODE 1476/5						
FCODE 1476/6						
FCODE 1476/7						
FCODE 1476/8						
FCODE 1476/9						
FCODE 1476/10						
FCODE 1476/11						
FCODE 1476/12						
FCODE 1476/13						
FCODE 1476/14						
FCODE 1476/15						
FCODE 1476/16				•	•	•
FCODE 1477/1	Actual value [s_units]			•		•
FCODE 1477/2				•	•	•
FCODE 1477/3						
FCODE 1477/4						
FCODE 1477/5						
FCODE 1477/6						
FCODE 1477/7						
FCODE 1477/8						
FCODE 1477/9						
FCODE 1477/10						
FCODE 1477/11						
FCODE 1477/12						
FCODE 1477/13						
FCODE 1477/14						
FCODE 1477/15						
FCODE 1477/16						
FCODE 1478/1	[z_units]					
FCODE 1478/2						
FCODE 1478/3						
FCODE 1478/4						

Code	Description	CPU time [μs]	Used in basic configuration C0005			
			1000	10000	11000	12000
FCODE 1478/5						
FCODE 1478/6						

3.2.3 Function block CDATA

Purpose

CDATA is a profile generator especially made for cam profile applications. Up to 8 different profiles can be managed.

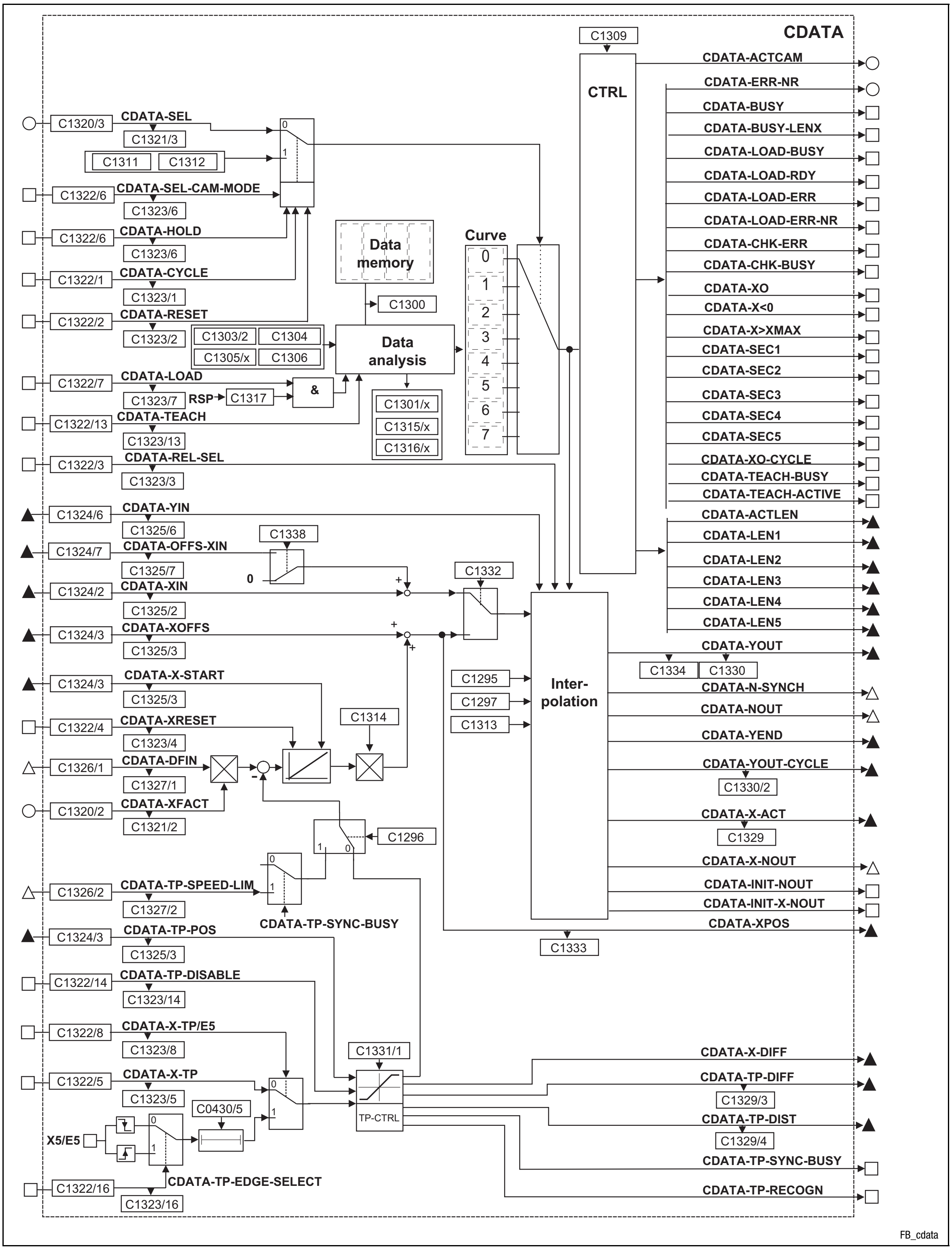


Fig. 3-6 Function block CDATA

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CDATA-SEL	a	C1321/3	dec [abs]	C1320/3	1	Profile selection, 0 = profile 0 (1st profile)
CDATA-SEL-CAM-MODE	d	C1323/15	bin	C132215	2	HIGH: profile changeover while travelling the profile. Hence, clutch functions can be implemented via profiles.
CDATA-HOLD	d	C1323/6	bin	C1322/6	2	HIGH: prevents profile switching, input has priority over CDATA-RESET
CDATA-CYCLE	d	C1323/1	bin	C1322/1	2	Automatic profile switching LOW: profile selection from input CDATA-SEL is active HIGH: the profiles from C1311 and C1312 are cyclically processed
CDATA-RESET	d	C1323/2	bin	C1322/2	2	If CDATA-RESET = HIGH and CDATA-CYCLE = LOW, the input CDATA-SEL is evaluated immediately If CDATA-RESET = HIGH and CDATA-CYCLE = HIGH, the profile from C1311 is processed
CDATA-LOAD	d	C1323/7	bin	C1322/7	2	Loaded profiles accepted with LOW-HIGH edge
CDATA-TEACH	d	C1323/13	bin	C1322/13	2	Teach function, contact Lenze
CDATA-REL-SEL	d	C1323/3	bin	C1322/3	2	HIGH: feed function active (relative positioning)
CDATA-YIN	ph	C1325/6	dec [inc]	C1324/6	3	Input for the teach function, contact Lenze
CDATA-OFFS-XIN	ph	C1325/7	dec [inc]	C1324/7	3	Offset on input CDATA-XIN if C1338 = 1 has been selected
CDATA-XIN	ph	C1325/2	dec [inc]	C1324/2	3	Input for master value position if C1332 = 1
CDATA-XOFFS	ph	C1325/3	dec [inc]	C1324/3	3	Input for offset in X direction (only if C1332 = 0)
CDATA-X-START	ph	C1325/1	dec [inc]	C1324/1	3	Input for the profile starting position on the X axis
CDATA-X-RESET	d	C1323/4	bin	C1322/4	2	HIGH: sets the master value integrator to the value at input CDATA-X-START
CDATA-DFIN	phd	C1327/1	dec [rpm]	C1326/1	4	Input for digital frequency if C1332 = 0
CDATA-XFACT	a	C1321/2	dec [%]	C1320/2	1	Stretching/compression factor +100 % = no compression/stretching, >100 % = compression, <100 % = stretching
CDATA-TP-SPEED-LIM	phd	C1327/2	dec [rpm]	C1326/2	4	Selection of a compensation speed. Input is activated via C1296. It is impermissible to select constant values, e.g. via free codes (FCODE).
CDATA-TP-POS	ph	C1325/4	dec [inc]	C1324/4	3	Touch probe position of the master value (only if C1332 = 0)
CDATA-TP-DISABLE	d	C1323/14		C1322/14		HIGH: suppression of touch probe
CDATA-X-TP/E5	d	C1323/8	-	-	-	Selection of the touch probe source (only for synchronisation) LOW: source CDATA-X-TP HIGH: terminal X5/E5
CDATA-X-TP	d	C1323/5	bin	C1322/5	2	LOW-HIGH edge sets master value integrator to position of input CDATA-TP-POS
CDATA-TP-EDGE-SELECT	d	C1323/16	bin	C1322/16	2	LOW: HIGH-LOW edge of the input signal at X5/E4 is evaluated. HIGH: LOW-HIGH edge of the input signal at X5/E5 is evaluated.
CDATA-ACTCAM	a					Output of the active profile
CDATA-ERR-NR	a					Display of the error number from the teach function
CDATA-BUSY	d					LOW-HIGH edge: the interpolation point distribution is not optimal, select fewer points
CDATA-BUSY-LENx	d					HIGH: CDATA-LENx and CDATA-Y-END are not valid and are being determined at present (e.g. profile switching)
CDATA-LOAD-BUSY	d					HIGH: new profile data is being accepted at present, the controller is inhibited (only if input CDATA-LOAD = HIGH)
CDATA-LOAD-RDY	d					Handshake signal for reloading profiles
CDATA-LOAD-ERR	d					HIGH: error in the current profile at check via C0500
CDATA-LOAD-ERR-NR	d					HIGH: error in the current profile at check via C0500
CDATA-CHK-ERR	d					HIGH: the checksum transferred to C0509 does not correspond to the profile data
CDATA-CHK-BUSY	d					HIGH: profile checksum checking is active and not yet completed
CDATA-X0	d					LOW-HIGH edge: zero crossing of the master value integrator
CDATA-X<0	d					HIGH: number range exceeded in X direction
CDATA-X>XMAX	d					HIGH: number range exceeded in X direction
CDATA-SEC1 1)	d					HIGH: section 1 active
CDATA-SEC2 1)	d					HIGH: section 2 active
CDATA-SEC3 1)	d					HIGH: section 3 active
CDATA-SEC4 1)	d					HIGH: section 4 active
CDATA-SEC5 1)	d					HIGH: section 5 active
CDATA-X0-CYCLE	d					LOW-HIGH edge: zero crossing of the master value integrator when a profile cycle from C1311 and C1312 is processed.
CDATA-TEACH-BUSY	d					Teach function, contact Lenze
CDATA-TEACH-ACTIVE	d					Teach function, contact Lenze

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CDATA-ACTLEN	ph					Output of the actual master value clock pulse length (65536 inc. = 1 encoder rev.)
CDATA-LEN1[1]	ph					Output of the actual X length of section 1 of the selected profile (65536 inc. = 1 encoder rev.)
CDATA-LEN2[1]	ph					Output of the actual X length of section 2 of the selected profile (65536 inc. = 1 encoder rev.)
CDATA-LEN3[1]	ph					Output of the actual X length of section 3 of the selected profile (65536 inc. = 1 encoder rev.)
CDATA-LEN4[1]	ph					Output of the actual X length of section 4 of the selected cam profile (65536 inc = 1 encoder rev.)
CDATA-LEN5[1]	ph					Output of the actual X length of section 5 of the selected cam profile (65536 inc = 1 encoder rev.)
CDATA-YOUT	ph	C1334 C1330/1				Drive setpoint position (65536 inc. = 1 motor revolution)
CDATA-N-SYNCH	phd					Link for synchronised compression/stretching
CDATA-NOUT	phd					Drive setpoint speed For the ”stretching and compression” function you have to preselect the limitation of the output signal in C1295. • Stretching and compression ≤ 100 % – Set C1295 = 0: the output signal is limited to ±29999 rpm (Lenze setting). • Stretching and compression > 100 % – Set C1295 = 1: the output signal is limited to ±14999 rpm.
CDATA-Y-END	ph					Y end value of the actual profile (65536 inc. = 1 motor revolution)
CDATA-YOUT-CYCLE	ph	C1330/2				Current value of the drive setpoint position within the limits of the profile (65536 inc. = 1 motor revolution)
CDATA-X-ACT	ph	C1329/1				Current position of the master shaft / master angle
CDATA-X-NOUT	phd					X-axis as speed, without jump back if C1332 = 0 (master value of CDATA-DFIN) is selected
CDATA-INIT-NOUT	d					**This output refers to the motor. Do not enable the drive after mains connection before CDATA-INIT-NOUT = LOW!** HIGH: the drive speed does not reach the setpoint defined by the position output. During this deviation which may last over several cycles, a great position change is output at the speed output. Increments do not get lost!
CDATA-INIT-X-NOUT	d					**This output refers to the master axis. Do not enable the drive after mains connection before CDATA-INIT-X-NOUT = LOW!** (for further description see CDATA-INIT-NOUT)
CDATA-XPOS	ph	C1333				Output of the master value integrator (65536 inc. = 1 encoder rev.)
CDATA-X-DIFF	ph					Outputs the difference between the integrator and the signal at CDATA-TP-POS if a touch probe pulse occurs.
CDATA-TP-DIFF	ph	C1329/3				Touch-Probe mode of cross cutter, current angular difference between TP position and actual X axis position
CDATA-TP-DIST	ph	C1329/4				Touch-Probe mode of cross cutter, distance between the last two TP positions
CDATA-TP-SYNC-BUSY	d					Compensation between TP position and current X axis position active (with adjusted compensation speed)
CDATA-TP-RECOGN[1]	d					Output is HIGH for 1 ms if a HIGH-LOW edge occurs at X5/E5 and CDATA-X-TP/E5 = HIGH

---

1) The outputs will not be output when using the absolute data model

Range of functions

- Select X position for the cam drive (🕮 3-23)
- Select X position directly (🕮 3-23)
- Create X position from a digital frequency (🕮 3-26)
- Change of direction (🕮 3-28)
- Profile changeover in the middle of the motion profile (🕮 3-29)
- Activation of profiles stored in the controller (🕮 3-29)
- Selection of one profile (🕮 3-30)
- Selection of several profiles (🕮 3-30)
- Inhibition of the profile selection (🕮 3-31)
- Online reloading of profiles (🕮 3-32)
- Stretching, compression, offset of the X axis (🕮 3-33)
- Synchronised stretching/compression in Y direction (🕮 3-34)
- Feed drive with profiles (🕮 3-35)
- Output of important status signals (🕮 3-36)

3.2.3.1 Select X position for the cam drive

- Select X position directly through
  - – the absolute shaft encoder (single-turn / multi-turn, programmable)
  - – upstream master drive
  - – calculation
- Create X position from a digital frequency (🕮 3-26)
  - – Synchronise X position and machine

3.2.3.2 Select X position directly

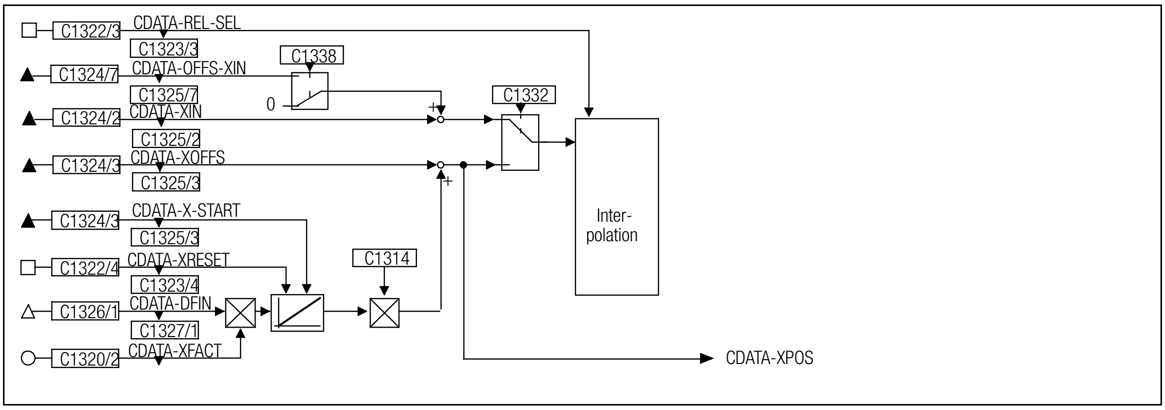


Fig. 3-7 Relevant section of function block CDATA

The absolute X position can be selected via the input CDATA-XIN - e.g. via a bus system:

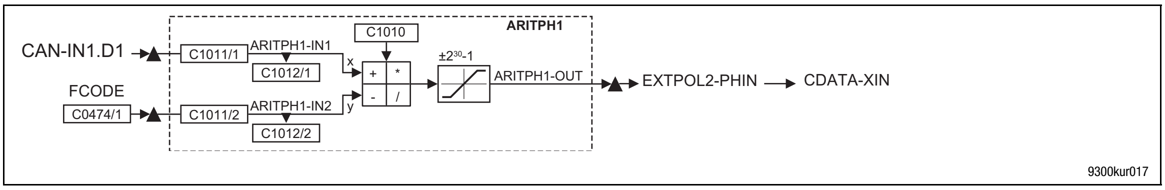
Selection of master value	Note
C1332 = 0	Master value source: CDATA-DFIN • Selection of a digital frequency
C1332 = 1	Master value source: CDATA-XIN • Selection of the absolute X position
C1332 = 2	Master value source: CDATA-XPOS • The output CDATA-XPOS is internally switched to the input CDATA-XIN. Therefore, the offset at CDATA-OFFS-XIN is effective.

CDATA-XIN input mode	Note
C1338 = 0	Without input CDATA-OFFS-XIN • The inputs CDATA-OFFS-XIN and CDATA-XFACT are not effective • If CDATA-XIN > CDATA-ACTLEN, CDATA-X>XMAX is set to HIGH. The master position is internally limited to Xmax. • If CDATA-XIN < 0, CDATA-X<0 is set to HIGH. The master position is internally limited to 0.
C1338 = 1	With input CDATA-OFFS-XIN • For absolute value encoder as master position encoder • If CDATA-XIN + CDATA-OFFS-XIN > CDATA-ACTLEN × 2, CDATA-X>XMAX is set to HIGH. The master position is internally limited to Xmax. • If CDATA-XIN < 0, CDATA-X<0 is set to HIGH. The master position is internally limited to 0.
C1338 = 2	With input CDATA-OFFS-XIN for CDATA-X-RESET • For absolute value encoder as master position encoder • If CDATA-XRESET = HIGH, CDATA-XIN is internally set to 0. CDATA-OFFS-XIN remains effective. • If CDATA-XIN + CDATA-OFFS-XIN > CDATA-ACTLEN × 2, CDATA-X>XMAX is set to HIGH. The master position is internally limited to Xmax. • If CDATA-XIN < 0, CDATA-X<0 is set to HIGH. The master position is internally limited to 0.

Create X axis through master angle encoder

If an external master angle encoder (programmable multi-turn or single-turn absolute value encoder) is used, the encoder must be adapted to the profile data:

- If possible, use an encoder with system bus (CAN) interface
- Use the following connection to adapt the encoder:



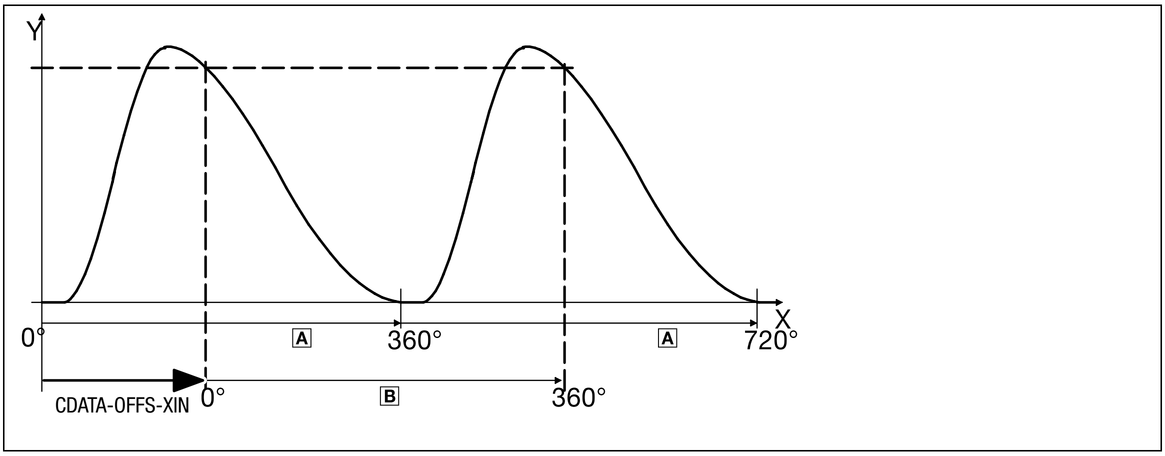
  - ARITPH1: C1010=13, set multiplication
  - FCODE C0474/1: 65536/enter encoder constant. (The encoder constant is indicated in “increments/revolution”, see data sheet, e.g. with encoder constant = 8192 increments/revolution the following results: C0474/1 = 8)
  - EXTPOL2: Should be used to improve the smooth running of the motor.

Extract from the table of attributes:

Code	Index dec	Index hex	DS	DA	DT	Format	DL	LCM-R/W	Operation
C1338	23237	5AC5	E	1	FIX32	VD	4	Ra/Wa	

Synchronisation of absolute value encoder and profile

In the ideal case, the profile pulse and encoder pulse are identical. But more commonly the case shown in the graphics occurs:



A Profile pulse
B Encoder pulse

In order to adapt the curve profile to the machine, the starting point of the profile can be shifted towards the zero point of the encoder with the entry of code C1476/x. The profile can be shifted by max. one profile pulse (+) compared to the encoder.

- Apply offset to the input CDATA-OFFS-XIN. The inputs CDATA-XOFFS and CDATA-XFACT have no effect!

The pulse lengths of profile and encoder will not be changed!

Note!

The encoder pulse of single-turn absolute value encoders is 360°. This corresponds to the number of increments of the encoder constant, e.g. 8192 increments/revolution. Then, the pulse recurs. The process can also be represented as follows:

- 360° = 1 revolution
- 720° = 2 revolutions etc.

3.2.3.3 Create X position from a digital frequency

The digital frequency incoming at CDATA-DFIN is integrated to an X position. In this operating mode it can be necessary to synchronise the controller to the master value (see “synchronisation of X position and machine“).

- The integrator can be set to and held at CDATA-XSTART with CDATA-XRESET = HIGH.
- At the same time the output CDATA-XPOS is also set to CDATA-XSTART. Thus, the values pending at the input CDATA-XOFFS are ineffective (see Fig. 3-6). Proceeding with CDATA-XRESET = LOW

Synchronisation of X position and machine

Due to slipping material or non-integer pulse lengths, the angle difference between master and cam drive may be constant or even increase. A sensor (e. g. touch probe initiator) can be used to **continuously** synchronise the cam drive to the position of the machine master angle.

Note!

- If the material is slipping, the sensor used for synchronisation should be in direct contact with the material.
- The sensor should be set to a position where accelerations do not occur at synchronous running to avoid as many accelerations (positive or negative) as possible during the compensation phase.This, for instance, always happens during a rest phase.

Synchronisation of the master axis through touch probe

The master axes synchronisation via touch probe is, for instance, used for mark-controlled cross cutters. The master value is generated by an incremental encoder or via the digital frequency output of an upstream controller.

- A synchronisation of the drive and machine measuring system may be required for the following reasons:
  - After mains connection, the measuring system of the controller and that of the machine can diverge very much. The distance to be compensated in such cases often is very long.
  - During operation, slipping may arise in the system (e.g. in conveying belts). During resynchronisation, the distance to make up is relatively short.

A deviation to the setpoint detected via the touch probe signal (mark synchronisation) is output at CDATA-X-DIFF. This deviation can be compensated by means of a compensation speed:

- Activating the function of the compensation speed (CDATA-TP-SPEED-MODE):
  - C1335 = 0: without compensation limitation (Lenze setting).
  - C1335 = 1: with compensation limitation (we recommend this setting).
  - C1335 = 2: cross cutter (contact Lenze if you want to use this function).
- Selecting the source of the compensation speed (C1296 is only effective if C1335 = 1):
  - C1296 = 0 (Lenze setting): The compensation speed is defined via C1331.
  - C1296 = 1: the compensation process is controlled by selecting a profile at CDATA-TP-SPEED-LIM.

Note!

- The CDATA function block does not include a profile generator. The profiles must be generated via additional function blocks (e.g. RFGPH2 or RFGPH2)
  Also see example (🕮 3-253)
- Do not select constant values at CDATA-TP-SPEED-LIM
  (e.g. via free codes FCODE).

Correction of the X position via the sensor

If the sensor switches,

- the value read in at CDATA-TP-POS is compared to the master angle and the compensation process selected is carried out and
- at the same time the corresponding Y position is output at CDATA-YOUT and CDATA-DFOUT (caution: the drive follows its position setpoint with the max. possible torque).

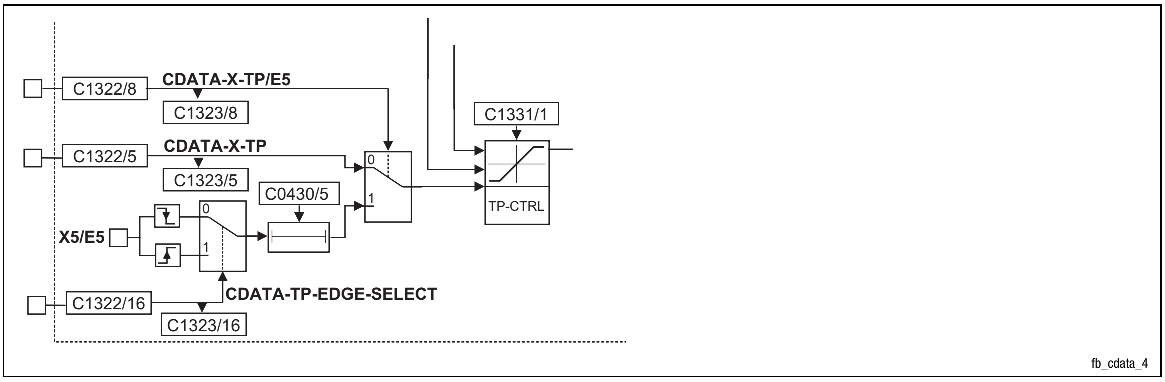


Fig. 3-8 Section of function block CDATA

1. Set CDATA-X-TP/E5 = HIGH to activate the function.
2. Connect the sensor X5/E5.
3. Define the edge of the sensor signal which is to be evaluated:
   – CDATA-TP-EDGE-SELECT = LOW: HIGH-LOW edge of the sensor signal is evaluated.
   – CDATA-TP-EDGE-SELECT = HIGH: LOW-HIGH edge of the sensor signal is evaluated.
4. Enter the position of the sensor at input CDATA-TP-POS (in the Lenze setting, the input is connected to C1476/16).

Note!

- For a synchronisation via touch probe, C1335 has to be set to 1.
- The input values at CDATA-TP-POS must correspond to the clock pulse (CDATA-ACTLEN):
  - For a clock pulse of e.g. 360°, only values in the range of -359° ... +719° may be selected at CDATA-TP-POS.
- Check the linking of terminal X5/E4 in the DIGIN function block. Where required, adapt the linking to your application.
- When responding, sensors may have delay times which cause a speed-dependent angular offset. This can be especially annoying at high speeds. The correction value for the angular offset can be entered in x.xxx[ms] via C0430/5.

One-time setting of X position

If slipping and non-integer pulse lengths can be ruled out, the X position must only be set **once**. Procedure:

- Set the master drive (machine) to the position applied to the input CDATA-TP-POS.
  - CDATA-X-TP/E5 = LOW
- X position is accepted with a LOW-HIGH edge at CDATA-X-TP.

3.2.3.4 Change of direction

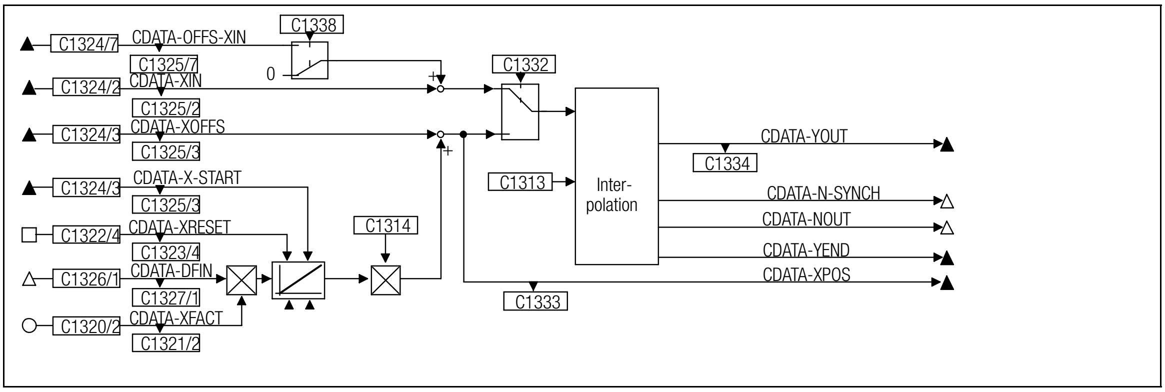
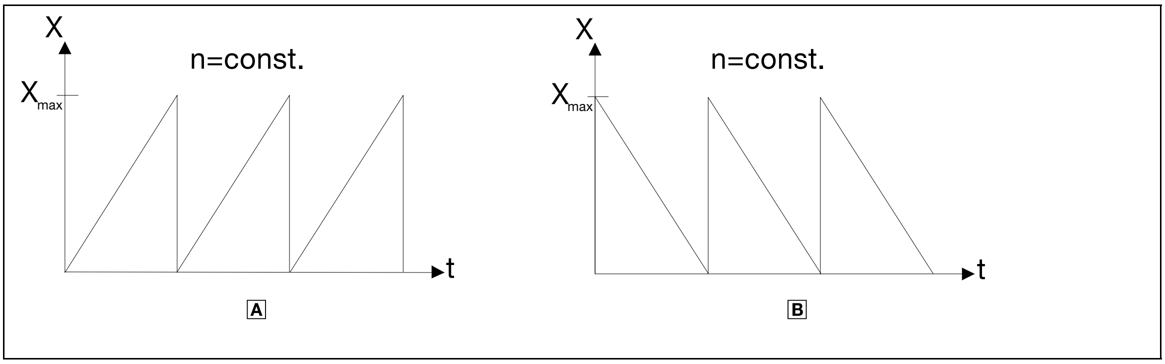


Fig. 3-9 Section of function block CDATA

The “direction” indicates the increase of the integrator (output CDATA-XPOS):

- With positive input values at CDATA-DFIN, the integrator runs from 0 to its clock pulse length (X cycle).
- With negative input values at CDATA-DFIN, the integrator runs from the clock pulse length (X cycle) to 0.



A Absolute value encoder, CW rotation or internal master angle integrator
B Absolute value encoder, CCW rotation or internal master angle integrator

Change of direction of rotation for connection at input CDATA-DFIN

(see also chapter 3.2.3.3)

This function is only available for the internal X integrator (C1332 = 0).

The direction can be reversed via code C1314 (see Fig. 3-9).

Stop!

The input CDATA-XOFFS is not affected by a reversal of the direction under C1314!

Change of direction of rotation for connection at input CDATA-XIN

(see also chapter 3.2.3.2)

Note!

The direction of rotation of an absolute shaft encoder connected to input CDATA-XIN (single-turn or programmable multi-turn) can only be reversed by changing the attachment.

3.2.3.5 Profile changeover in the middle of the motion profile

By means of 5th order polynomials you can implement a jerk-free, path-controlled clutch function. For this, motion profiles have to be changed over in the middle of a profile.

Requirements for trouble-free clutch function:

- The function can only be implemented with the absolute data model.
- The profiles between which the changeover is effected must be structured in the same manner:
  - Same clock pulse lengths in X direction
  - Same number of interpolation points
  - Same distribution of the interpolation points
  - Same lift at the changeover point

Activation of the clutch function:

- Set CDATA-SEL-CAM-MODE = HIGH.

3.2.3.6 Activation of profiles stored in the controller

The 9300 cam profiler provides the possibility to use one or several stored profiles for processing a product.

Depending on the profile(s) selected, the stored data is assigned to the actual master value position and output.

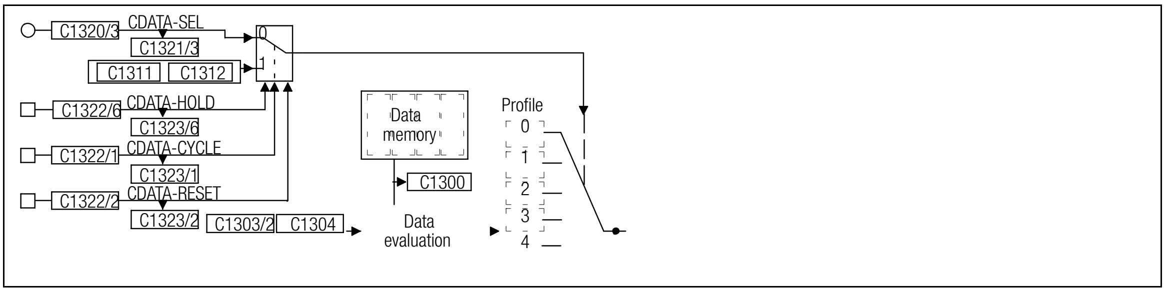


Fig. 3-10 Selection of one or several profiles

3.2.3.7 Selection of one profile

1. CDATA-CYCLE = LOW: deactivation of the automatic profile switching.
2. CDATA-SEL: Select the desired profile number (see Fig. 3-10).

3.2.3.8 Selection of several profiles

Permissible value range of CDATA-SEL:

- 0 to the number of profiles selected in the GDC dialog ’Basic cam data’ or ’Cam editor’.

Note!

- Values at CDATA-SEL < 0 are interpreted as 0
- Values at CDATA-SEL ≥ maximum number of profiles are limited to the values displayed in C1300/0 minus 1. Example:
  - You have reserved four profiles. Thus, the profiles 0 ... 3 can be selected. If you enter, for example, the value 5 at the input CDATA-SEL, profile 3 is selected.

The value at CDATA-SEL is accepted

- during operation at zero crossing of the X position.
  - It is thus for instance possible to change to a new profile program via PLC without the usually necessary times required to change the system.
- immediately if CDATA-RESET = HIGH.

Profile processing when the order remains the same

1. CDATA-CYCLE = HIGH: activation of the automatic profile switching
2. Code C1311: Determine initial profile
3. Code C1312: Determine cycle range
   - The cycle range is limited by the profile number entered in GDC.

Stop!

- After, for instance, a fault, CDATA-RESET = HIGH activates the profile selected under C1311 at CDATA-SEL **immediately** without waiting for zero crossing!
- In some cases torque peaks may occur and damage the machine.

Example	Profiles 2, 3 and 4 are to be processed cyclically: C1311 = 2 (first profile) C1312 = 2 (range: 2 further profiles)
Result	With CW rotation, the profiles are processed in ascending order (2 → 3 → 4 → 2). When the last profile is reached, the process starts again with the first profile.
	With CCW rotation, the profiles are selected in descending order. When the first profile is reached, the process starts again with the profile: • First profile + range. In our example: 2 → 4 → 3 → 2 → 4 etc. – Profiles 0 and 1 cannot be reached with this setting!

Profile processing with any order

1. CDATA-CYCLE = LOW: deactivation of the automatic profile switching.
2. CDATA-SEL: Profile selection via this analog input

Note!

For this purpose, an external control must be programmed in such a way that the profile number required is available at the input CDATA-SEL at a certain time.

Stop!

After, for instance, a fault, CDATA-RESET = HIGH activates the profile selected at CDATA-SEL **immediately** without waiting for zero crossing!

In some cases torque peaks may occur and damage the machine.

3.2.3.9 Inhibition of the profile selection

- CDATA-HOLD = HIGH

The profile selection and the automatic profile switching can be inhibited by setting the input CDATA-HOLD = HIGH (see Fig. 3-10). The profile being activated at that time is then processed endlessly.

The input has priority over CDATA-RESET, CDATA-CYCLE and CDATA-SEL.

Is used, for instance, for rotary tables with target position selection. For this purpose, other function blocks must be interconnected accordingly.

3.2.3.10 Online reloading of profiles

This function serves to accept and activate reloaded profiles during operation. This function is available from software version 3.4.

Stop!

- In the initial range, the motion profiles must be almost identical, otherwise a compensating movement with the max. possible torque is carried out.
- The function can only be used for master angle/digital frequency with **CW rotation**.

- Condition:
  - – Set code C1307 = 1 (permit online reloading of profiles)
  - – Set code C1317 = 1 (reload profiles without controller inhibit)
  - – Set input CDATA-CYCLE = LOW
- Initialisation
  - – Each LOW-HIGH edge at CDATA-RESET initialises a profile.

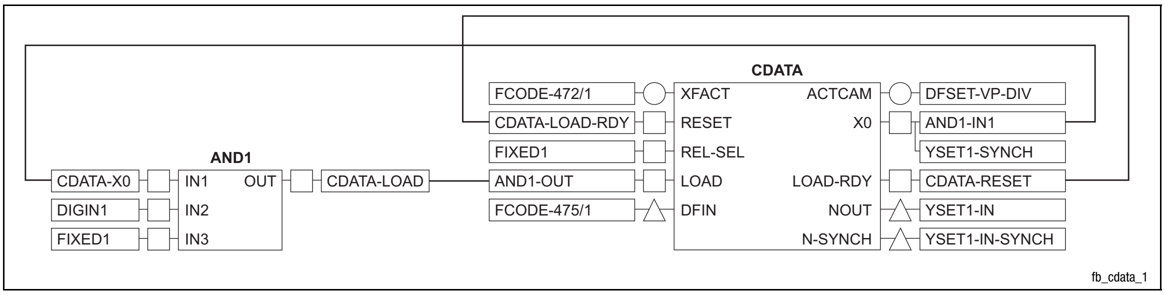


Fig. 3-11 Interconnection of the function block CDATA for initialising profiles online

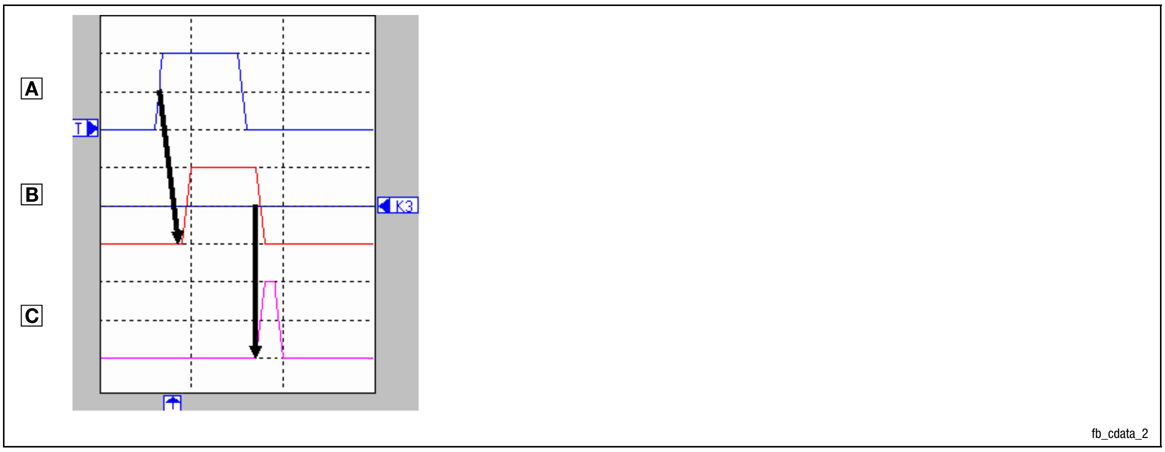


Fig. 3-12 Initialisation cycle, displayed with Global Drive Oscilloscope

A CDATA-X0, profile zero crossing
This causes the reloaded profile to be accepted. Reloading in the backup memory must be completed by then.

B CDATA-LOAD-BUSY
The acceptance of the reloaded profile in the foreground data field was activated via CDATA-LOAD (duration: approx. 50 ms)

C CDATA-LOAD-RDY
Displays that the acceptance was completed successfully. Now, CDATA-RESET = HIGH must be activated.

3.2.3.11 Stretching, compression, offset of the Y axis

Note!

This operating mode only works with digital frequency preselection (chapter 3.2.3.3), i.e. CDATA-DFIN must be selected with C1332 = 0.

Stretching / compression

The code C1319 serves to set the mode for stretching or compression. Two modes are used for differentiation:

C1319	Mode	Result if input CDATA-XFACT =			
		100 %	-100 %	>100%	<100%
0	$\frac{\text{DFIN} \cdot \text{XFACT}}{100\%}$	No stretching, no compression	No stretching, no compression, reversal of direction (profile is processed in backward direction)	Compression	Stretching
1	$\frac{\text{DFIN} \cdot 100\%}{\text{XFACT}}$		See TIP below	Stretching	Compression

Note!

- Values < 1% are internally limited to +1% at input XFACT via C1319=1 (compression).
- If you do not want a stretching or compression, connect CDATA-XFACT to FIXED100% (Lenze setting).

Offset

Use input CDATA-XOFFS to shift the X position by a constant value.

Stop!

The drive follows this position change with the max. possible torque! This is why
- CDATA-XOFFS should be changed while the drive is in a latch phase or
- a ramp function generator (e.g. RFGPHx) should be used.

3.2.3.12 Synchronised stretching/compression in Y direction

Stop!

- If input CDATA-X-RESET = 1, the stretching/compression factor must not be changed. Otherwise the drive may lose the synchronicity.
- If the FB YSET1 is not used, then set C1313 = 0 (asynchronous stretching/compression).
- Set C1295 = 1 for stretching/compression factors > 100 %.

This function is useful if more than 8 profiles are required for a lift changing process (Y axis) of the cam drive. The lift can be changed online via stretching and compression. The function is only valid for the cam drive, not for the master value.

Synchronised stretching/compression is required when the master value and the cam drive must run absolutely synchronously and the factor must be changed during operation.

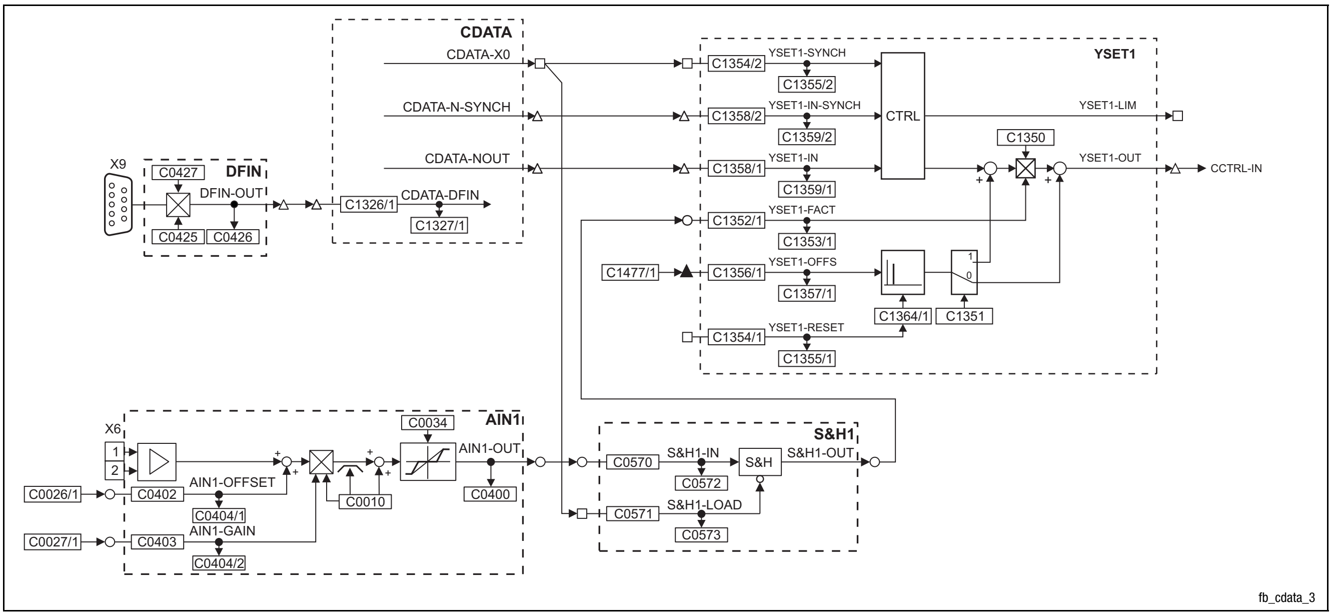


Fig. 3-13 Connection of the function blocks for the stretching/compression function in Y direction

The figure shows the minimum wiring. All function blocks used to generate the stretching/compression factor must be entered into the processing table between the function blocks CDATA and YSET1.

- The function is only active if C1313 = 1.
- The change-over between the stretching and compression factor is carried out during zero crossing of the profile.

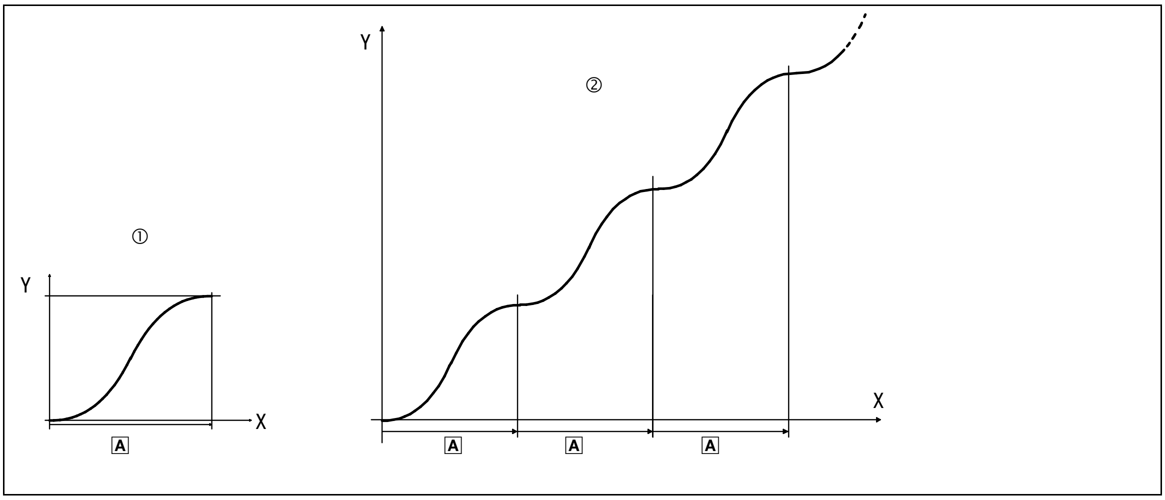
3.2.3.13 Feed drive with profiles

The main characteristic of such a profile is that initial and end value are not identical.

Application examples:

- Rotary table, conveying belt (movement in one direction), material guide

This function is selected with CDATA-REL-SEL = HIGH



① Individual profile
② Endless profile
A Profile length

Stop!

The input CDATA-REL-SEL must not be set to LOW with endless feeds.
In some cases torque peaks may occur and damage the machine.

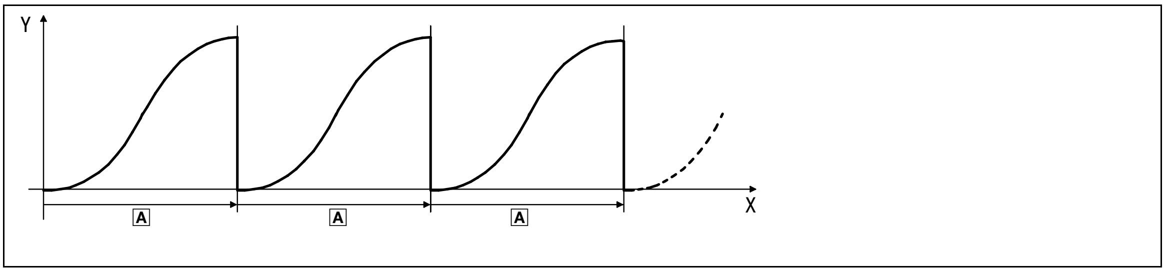


Fig. 3-14 CDATA_REL-SEL = LOW of an endless feed

A Profile length

Reset CDATA-NOUT

After a feeding process, the traverse path is backed with CDATA-REL-SEL = LOW (signal at CDATA-NOUT). In the case of long traverse paths, this procedure takes an accordingly long time.

You can set the signal at CDATA-NOUT to 0 directly:

1. Set C1297 = 1.
2. Set CDATA-REL-SEL = LOW and CDATA-X-RESET = HIGH.
   - The drive is disconnected from the CDATA function block, and the speed signal at CDATA-NOUT is reset to 0.

3.2.3.14 Output of important status signals

Display of the current profile section (only with relative data model)

The current profile section is indicated by the assigned digital outputs CDATA-SEC1 to CDATA-SEC5.

Section length / cycle length (only with relative data model)

The lengths of the individual sections are output at CDATA-LEN1 to CDATA-LEN5 in X direction. Added together they result in CDATA-ACTLEN.

The actual length of a master value cycle is output at CDATA-ACTLEN (image of code C1315/X).

Updating CDATA-LENx / CDATA-Y-END

CDATA-BUSY-LENx = HIGH indicates that the outputs CDATA-LENx and CDATA-Y-END are updated one after the other. They are not valid for the update period.

Profile processed currently

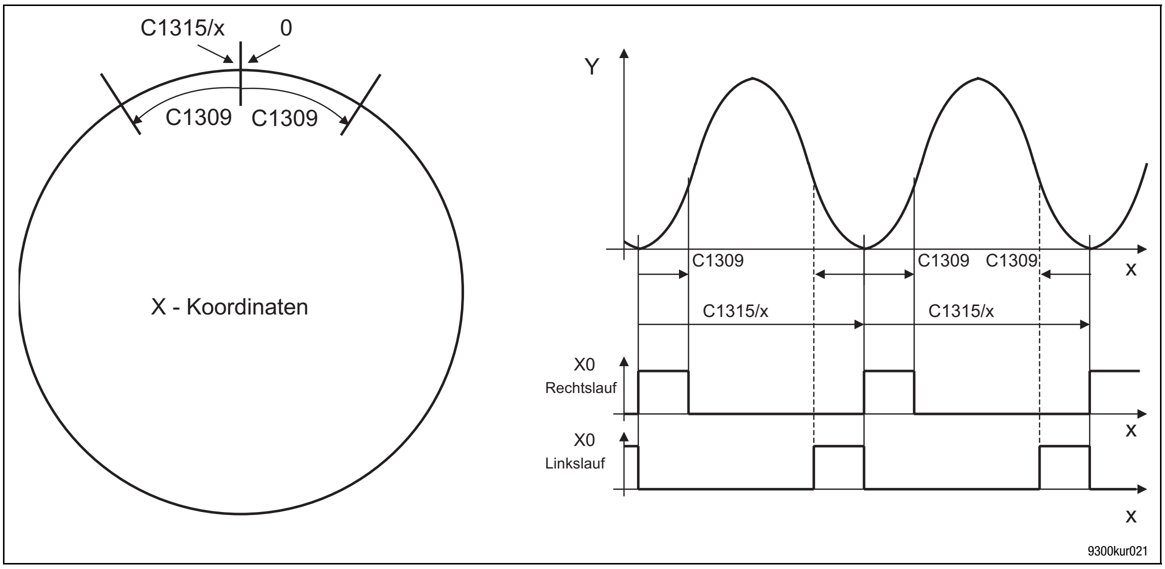
CDATA-ACTCAM indicates which profile is being processed.

Indication of profile zero crossing

CDATA-X0 signals a zero crossing of the master value. The window width for comparison is defined in C1309, the window is arranged symmetrically around the actual zero point of the master value.

Stop!

Observe when setting the X axis position to X0 = 0 within one cycle.
- if X position < 1/2 cycle, CDATA-X0 is not set.
- if X position >= 1/2 cycle, CDATA-X0 is set as for zero crossing.



3.2.4 Absolute value generator (ABS)

Purpose

This FB is used to convert bipolar signals into unipolar signals.

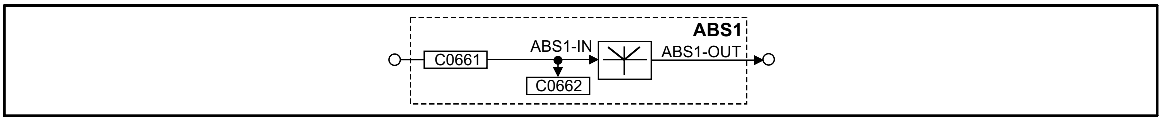


Fig. 3-15 Absolute value generator (ABS1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ABS1-IN1	a	C0662	dec [%]	C0661	1	1000	-
ABS1-OUT	a	-	-	-	-	-	-

Function

The absolute value of the input signal is generated.

3.2.5 Addition block (ADD)

Purpose

Adds or subtracts ”analog” signal depending on the input used.

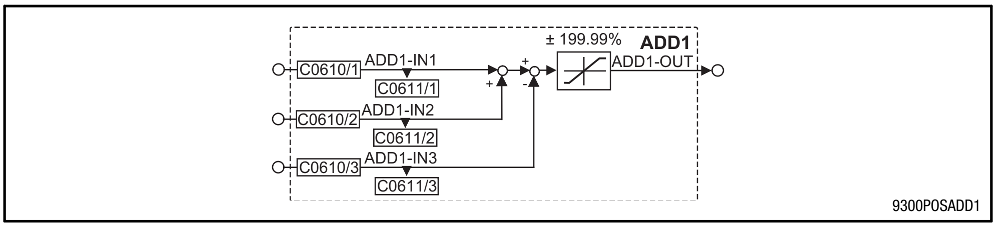


Fig. 3-16 Addition block (ADD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ADD1-IN1	a	C0611/1	dec [%]	C0610/1	1	1000	Addition input
ADD1-IN2	a	C0611/2	dec [%]	C0610/2	1	1000	Addition input
ADD1-IN3	a	C0611/3	dec [%]	C0610/3	1	1000	Subtraction input
ADD1-OUT	a	-	-	-	-	-	Limited to ±199.99%

Function

- Input ADD1-IN1 is added to input ADD1-IN2.
- The input ADD-IN3 is subtracted from the calculated result.
- Then, the result of the subtraction is limited to ±199.99 %.

3.2.6 Addition block (ADDPHD1)

Purpose

Superimposition of several curve profiles.

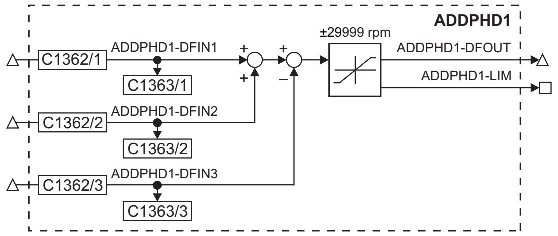


Fig. 3-17 Addition block (ADDPHD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ADDPHD1-DFIN1	phd	C1363/1	[rpm]	C1362/1	1	1000	Addition input
ADDPHD1-DFIN2	phd	C1363/2	[rpm]	C1362/2	1	1000	Addition input
ADDPHD1-DFIN3	phd	C1363/3	[rpm]	C1362/3	1	1000	Subtraction input
ADDPHD1-DFOUT	phd	-	-	-	-	-	Signal is limited to ±29999 rpm No position loss when signal is limited
ADDPHD1-LIM	phd	-	-	-	-	-	HIGH = signal at ADDPHD1-DFOUT is limited (Function is available from software version 3.4 onwards)

Function

- The signals of the cam profiles at the inputs ADDPHD1-DFIN1 and ADDPHD1-DFIN2 are added.
- The cam profile at the input ADDPHD1-DFIN3 is subtracted from the sum of ADDPHD1-DFIN1 and ADDPHD1-DFIN2.
- The result is output as speed in [rpm] at ADDPHD1-OUT.

Note!

- The integrated overflow buffer prevents the increments from getting lost when the signal at ADDPHD1-OUT exceeds the limit of ±29999 rpm.
- The overflow buffer behaves according to the cycle of numbers (32 bits).

3.2.7 Automation interface (AIF-IN)

Purpose

Interface for input signals of the plug-on fieldbus module (e.g. INTERBUS, PROFIBUS) for setpoints and actual values as binary, analog, or angle information. Please observe the corresponding Operating Instructions for the plug-on fieldbus module.

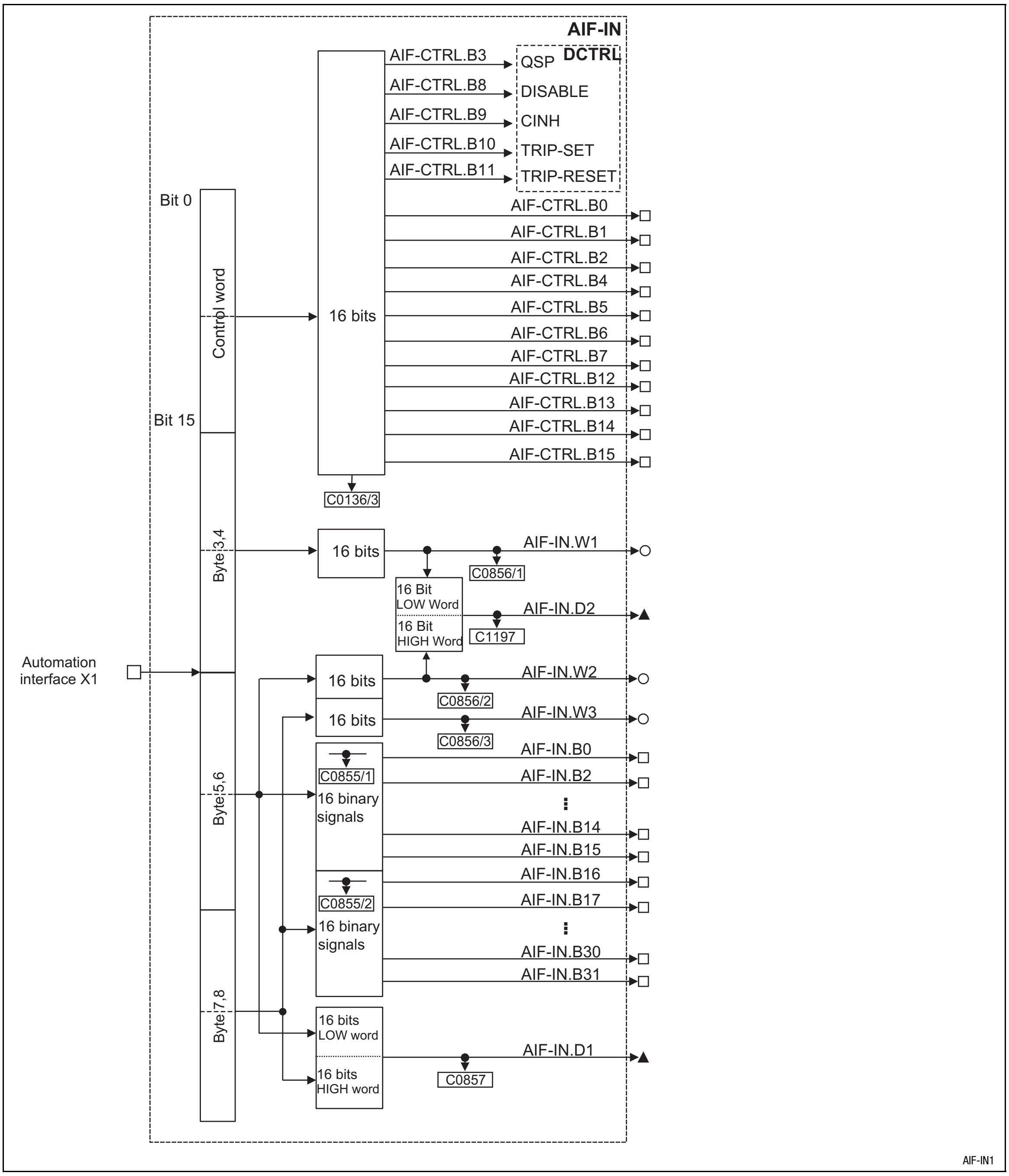


Fig. 3-18 Automation interface (AIF-IN)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIF-CTRL.B0	d	C0136/3	bin	-	-	-	
AIF-CTRL.B1	d	C0136/3	bin	-	-	-	
AIF-CTRL.B2	d	C0136/3	bin	-	-	-	
AIF-CTRL.B4	d	C0136/3	bin	-	-	-	
AIF-CTRL.B5	d	C0136/3	bin	-	-	-	
AIF-CTRL.B6	d	C0136/3	bin	-	-	-	
AIF-CTRL.B7	d	C0136/3	bin	-	-	-	
AIF-CTRL.B12	d	C0136/3	bin	-	-	-	
AIF-CTRL.B13	d	C0136/3	bin	-	-	-	
AIF-CTRL.B14	d	C0136/3	bin	-	-	-	
AIF-CTRL.B15	d	C0136/3	bin	-	-	-	
AIF-IN.W1	a	C0856/1	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.W2	a	C0856/2	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.W3	a	C0856/3	dec [%]	-	-	-	+16384 = +100 %
AIF-IN.D1	ph	C0857	dec [inc]	-	-	-	65536 = 1 rev.
AIF-IN.D2	ph	C1197	dec [inc]	-	-	-	65536 = 1 rev.
AIF-IN.B0	d	C0855/1	hex	-	-	-	
AIF-IN.B1	d	C0855/1	hex	-	-	-	
AIF-IN.B2	d	C0855/1	hex	-	-	-	
AIF-IN.B3	d	C0855/1	hex	-	-	-	
AIF-IN.B4	d	C0855/1	hex	-	-	-	
AIF-IN.B5	d	C0855/1	hex	-	-	-	
AIF-IN.B6	d	C0855/1	hex	-	-	-	
AIF-IN.B7	d	C0855/1	hex	-	-	-	
AIF-IN.B8	d	C0855/1	hex	-	-	-	
AIF-IN.B9	d	C0855/1	hex	-	-	-	
AIF-IN.B10	d	C0855/1	hex	-	-	-	
AIF-IN.B11	d	C0855/1	hex	-	-	-	
AIF-IN.B12	d	C0855/1	hex	-	-	-	
AIF-IN.B13	d	C0855/1	hex	-	-	-	
AIF-IN.B14	d	C0855/1	hex	-	-	-	
AIF-IN.B15	d	C0855/1	hex	-	-	-	
AIF-IN.B16	d	C0855/2	hex	-	-	-	
AIF-IN.B17	d	C0855/2	hex	-	-	-	
AIF-IN.B18	d	C0855/2	hex	-	-	-	
AIF-IN.B19	d	C0855/2	hex	-	-	-	
AIF-IN.B20	d	C0855/2	hex	-	-	-	
AIF-IN.B21	d	C0855/2	hex	-	-	-	
AIF-IN.B22	d	C0855/2	hex	-	-	-	
AIF-IN.B23	d	C0855/2	hex	-	-	-	
AIF-IN.B24	d	C0855/2	hex	-	-	-	
AIF-IN.B25	d	C0855/2	hex	-	-	-	
AIF-IN.B26	d	C0855/2	hex	-	-	-	
AIF-IN.B27	d	C0855/2	hex	-	-	-	
AIF-IN.B28	d	C0855/2	hex	-	-	-	
AIF-IN.B29	d	C0855/2	hex	-	-	-	
AIF-IN.B30	d	C0855/2	hex	-	-	-	
AIF-IN.B31	d	C0855/2	hex	-	-	-	

Function

The input signals of the 8-byte user data of the AIF object are converted into corresponding signal types. The signals can be used via further function blocks.

Byte 1 and 2

Byte 1 and 2 form the control word for the controller. The bits 3, 8, 9, 10, and 11 of these bytes are directly transferred into the function block DCTRL where they are linked with further signals. The other 11 bits can be used to control further function blocks.

Byte 3 and 4

form the signal to AIF-IN.W1.

Byte 5, 6, 7, and 8

This user data can be interpreted as different signal types. According to the requirement this data can be evaluated as up to two analog signals, 32 digital signals or one angle signal. Mixed forms are also possible.

3.2.8 Automation interface (AIF-OUT)

Purpose

Interface for output signals of the plug-on fieldbus modules (e.g. INTERBUS, PROFIBUS) for setpoints and actual values as binary, analog or angle information. Please observe the corresponding Operating Instructions for the plug-on fieldbus module.

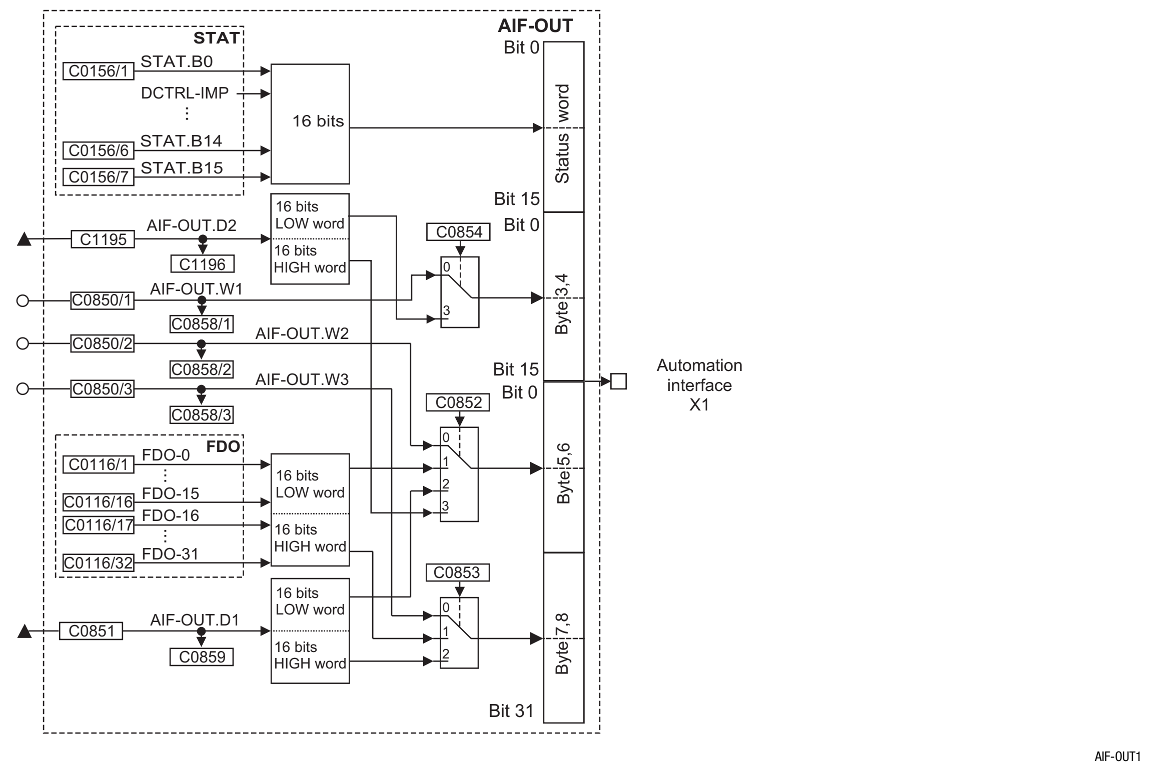


Fig. 3-19 Automation interface (AIF-OUT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIF-OUT.W1	a	C0858/1	dec [%]	C0850/1	1	1000	+100 % = +16384
AIF-OUT.W2	a	C0858/2	dec [%]	C0850/2	1	1000	+100 % = +16384
AIF-OUT.W3	a	C0858/3	dec [%]	C0850/3	1	1000	+100 % = +16384
AIF-OUT.D1	ph	C0859	abs [inc]	C0851	4	1000	1 rev. = 65536
AIF-OUT.D2	ph	C1196	abs [inc]	C1195	4	1000	1 rev. = 65536

Function

The input signals of this function block are copied into the 8-byte user data of the AIF object and assigned to the plug-on fieldbus module. The meaning of the user data can be determined very easily with C0852 and C0853 and the corresponding configuration code (CFG).

Byte 1 and 2

Here, the status word from the function block STAT is mapped. Some of the bits are freely assignable (see description of the function block STAT in chapter 3.2.91)

Byte 3 and 4

- C0854 = 0
  – The analog signal at AIF-OUT.W1 is output.
- C0854 = 3
  – The LOW-WORD of AIF-OUT.D2 is output.

Byte 5 and 6

- C0852 = 0
  – The analog signal at AIF-OUT.W2 is output at bytes 5 and 6.
- C0852 = 1
  – The bits 0 ... 15 of FDO are output.
- C0852 = 2
  – The LOW-WORD of AIF-OUT.D1 is output.
- C0852 = 3
  – The HIGH-WORD of AIF-OUT.D2 is output.

Byte 7 and 8

- C0853 = 0
  – The analog signal at AIF-OUT.W3 is output.
- C0853 = 1
  – The bits 16 ... 31 of FDO are output.
- C0853 = 2
  – The HIGH-WORD of AIF-OUT.D1 is output.

Example

You want to output 16 digital signals of FDO and the LOW-WORD of AIF-OUT.D1:

- The LOW-WORD of AIF-OUT.D1 can only be output at bytes 5 and 6.
  – For this purpose, C0852 is set to 2. The angle signal at C0851 is output at bytes 5 and 6.
- For the digital signals, only the bits 16 ... 31 (bytes 7 and 8) are available (bytes 5 and 6 are assigned):
  – For this purpose, C0853 is set to 1. Bits 16 ... 31 (FDO) are output at bytes 7 and 8.

3.2.9 Analog inputs via terminal X6/1, X6/2 and X6/3, X6/4 (AIN)

Purpose

These function blocks are the interface for analog signals as the

- setpoint input,
- actual value input and
- parameter control.

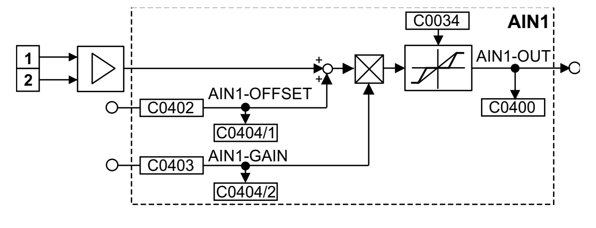


Fig. 3-20 Analog input via terminal X6/1, X6/2 (AIN1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIN1-OFFSET	a	C0404/1	dec [%]	C0402	1	19502	-
AIN1-GAIN	a	C0404/2	dec [%]	C0403	1	19504	-
AIN1-OUT	a	C0400	-	-	-	-	-

Special features of AIN1

- A dead band element can be integrated into the output signal at AIN1 via code C0034. Together with the jumper position X2 (controller front) the function 4 ... 20 mA can be implemented as a master current value.
- The signal is read cyclically (1 ms).

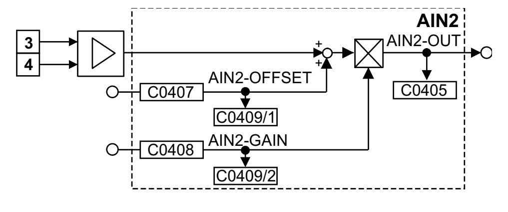


Fig. 3-21 Analog input via terminal X6/3, X6/4 (AIN2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AIN2-OFFSET	a	C0409/1	dec [%]	C0407	1	19503	-
AIN2-GAIN	a	C0409/2	dec [%]	C0408	1	19505	-
AIN2-OUT	a	C0405	-	-	-	-	-

Special feature of AIN2

- The signal is read cyclically every 250 μs.

Function

- The analog input value is added to the value at input AINx-OFFSET.
- The result of the addition is limited to ±200 %.
- The limited value is multiplied by the value which is applied to input AINx-GAIN.
- Then the signal is limited to ±200%.
- The signal is output at AINx-OUT.

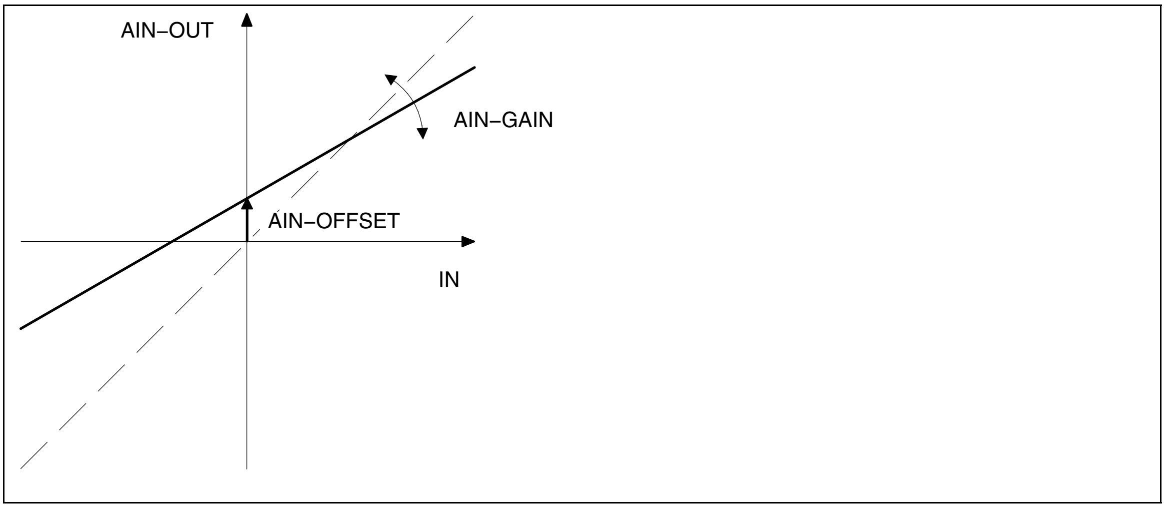


Fig. 3-22 Offset and gain of the analog input

3.2.10 AND operation (AND)

Purpose

With this function digital signals can be logically ANDed. These links can be used to control functions or to create status information.

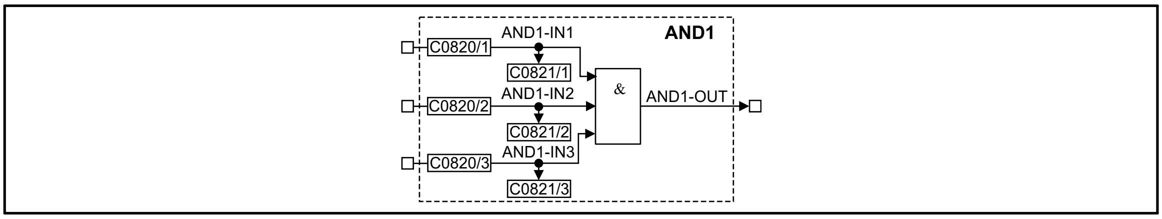


Fig. 3-23 AND operation (AND1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND1-IN1	d	C0821/1	bin	C0820/1	2	1000	-
AND1-IN2	d	C0821/2	bin	C0820/2	2	1000	-
AND1-IN3	d	C0821/3	bin	C0820/3	2	1000	-
AND1-OUT	d	-	-	-	-	-	-

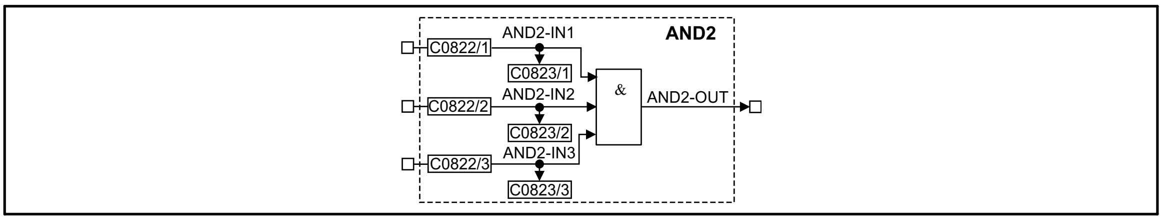


Fig. 3-24 AND operation (AND2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND2-IN1	d	C0823/1	bin	C0822/1	2	1000	-
AND2-IN2	d	C0823/2	bin	C0822/2	2	1000	-
AND2-IN3	d	C0823/3	bin	C0822/3	2	1000	-
AND2-OUT	d	-	-	-	-	-	-

Function blocks

AND operation (AND)

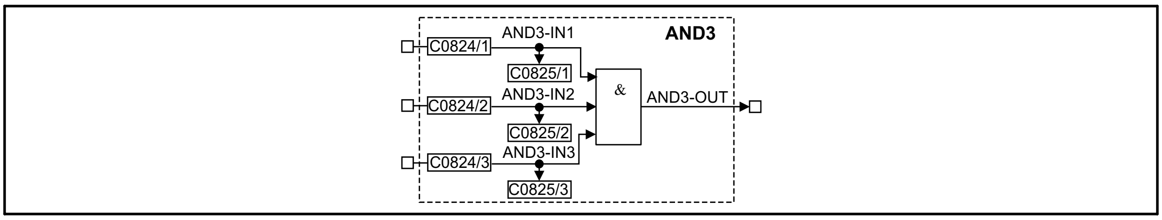


Fig. 3-25 AND operation (AND3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND3-IN1	d	C0825/1	bin	C0824/1	2	1000	-
AND3-IN2	d	C0825/2	bin	C0824/2	2	1000	-
AND3-IN3	d	C0825/3	bin	C0824/3	2	1000	-
AND3-OUT	d	-	-	-	-	-	-

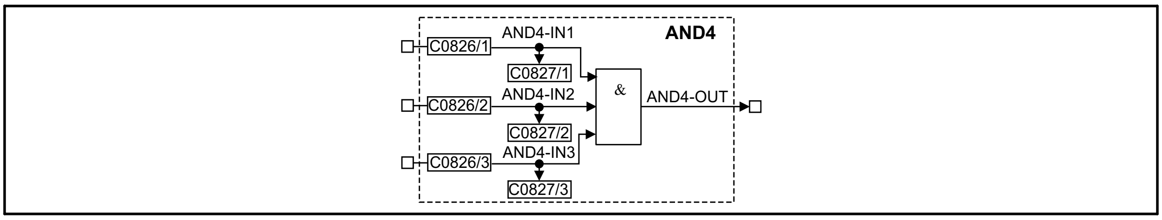


Fig. 3-26 AND operation (AND4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND4-IN1	d	C0827/1	bin	C0826/1	2	1000	-
AND4-IN2	d	C0827/2	bin	C0826/2	2	1000	-
AND4-IN3	d	C0827/3	bin	C0826/3	2	1000	-
AND4-OUT	d	-	-	-	-	-	-

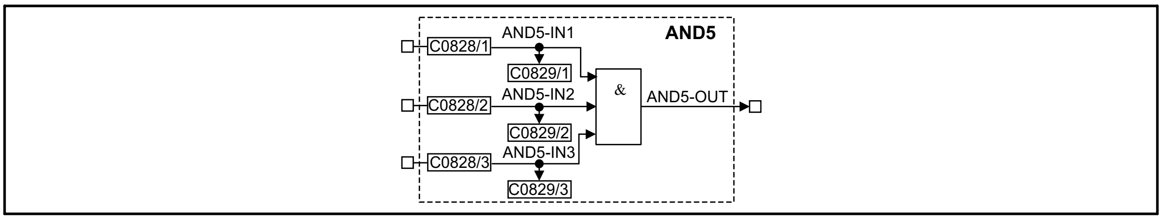


Fig. 3-27 AND operation (AND5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND5-IN1	d	C0829/1	bin	C0828/1	2	1000	-
AND5-IN2	d	C0829/2	bin	C0828/2	2	1000	-
AND5-IN3	d	C0829/3	bin	C0828/3	2	1000	-
AND5-OUT	d	-	-	-	-	-	-

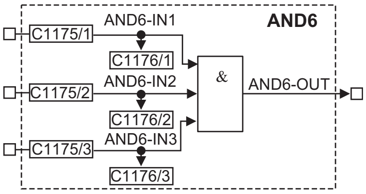


Fig. 3-28 AND operation (AND6)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND6-IN1	d	C1176/1	bin	C1175/1	2	1000	-
AND6-IN2	d	C1176/2	bin	C1175/2	2	1000	-
AND6-IN3	d	C1176/3	bin	C1175/3	2	1000	-
AND6-OUT	d	-	-	-	-	-	-

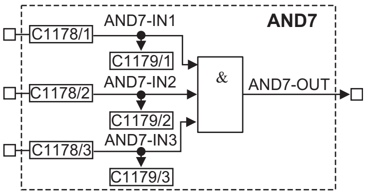


Fig. 3-29 AND operation (AND7)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND7-IN1	d	C1179/1	bin	C1178/1	2	1000	-
AND7-IN2	d	C1179/2	bin	C1178/2	2	1000	-
AND7-IN3	d	C1179/3	bin	C1178/3	2	1000	-
AND7-OUT	d	-	-	-	-	-	-

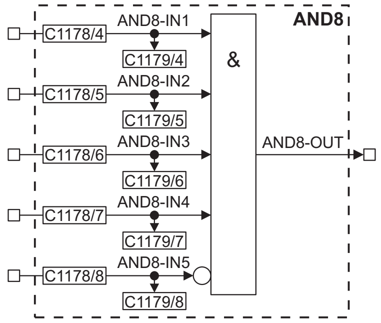


Fig. 3-30 AND operation (AND8)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND8-IN1	d	C1179/4	bin	C1178/4	2	1000	-
AND8-IN2	d	C1179/5	bin	C1178/5	2	1000	-
AND8-IN3	d	C1179/6	bin	C1178/6	2	1000	-
AND8-IN4	d	C1179/7	bin	C1178/7	2	1000	-
AND8-IN5	d	C1179/8	bin	C1178/8	2	1000	The input signal is inverted internally (NOT). The input does not have to be assigned to FIXED0 if it remains unused.
AND8-OUT	d	-	-	-	-	-	-

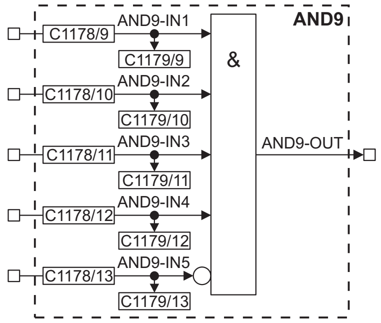


Fig. 3-31 AND operation (AND9)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AND9-IN1	d	C1179/9	bin	C1178/9	2	1000	-
AND9-IN2	d	C1179/10	bin	C1178/10	2	1000	-
AND9-IN3	d	C1179/11	bin	C1178/11	2	1000	-
AND9-IN4	d	C1179/12	bin	C1178/12	2	1000	-
AND9-IN5	d	C1179/13	bin	C1178/13	2	1000	The input signal is inverted internally (NOT). The input does not have to be assigned to FIXED0 if it remains unused.
AND9-OUT	d	-	-	-	-	-	-

Function of AND1 ... AND7

- $\text{ANDx-OUT} = \text{ANDx-IN1} \wedge \text{ANDx-IN2} \wedge \text{ANDx-IN3}$
- Equivalent network:

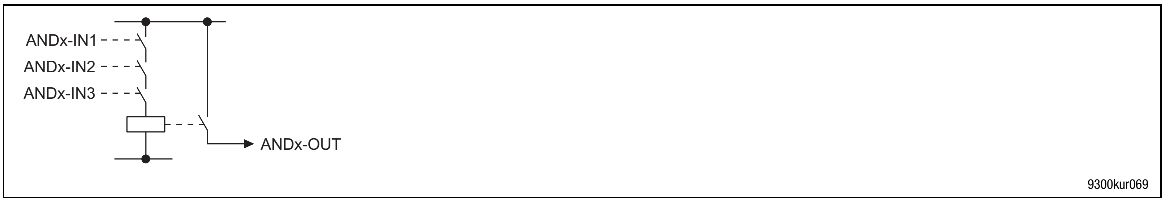


Fig. 3-32 Equivalent network of the AND operation for AND1 ... AND7

Note!

Connect inputs that are not used to FIXED1.

Function of AND8, AND9

- $\text{ANDx-OUT} = \text{ANDx-IN1} \wedge \text{ANDx-IN2} \wedge \text{ANDx-IN3} \wedge \text{ANDx-IN4} \wedge \overline{\text{ANDx-IN5}}$
- Equivalent network:

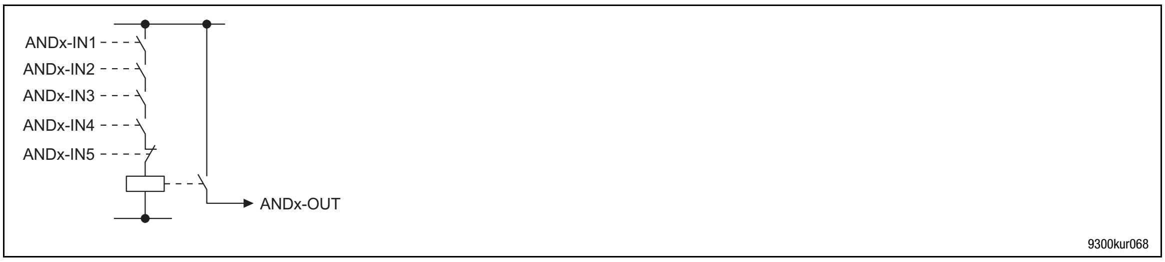


Fig. 3-33 Equivalent network of the AND operation for AND8 and AND9

Note!

- ANDx-IN1 ... ANDx-IN4: Connect inputs that are not used to FIXED1.
- Connect ANDx-IN5 to FIXED0 if you do not use the input.

3.2.11 Inverter (ANEG)

Purpose

This FB inverts the sign of an analog signal.

Two inverters are available:

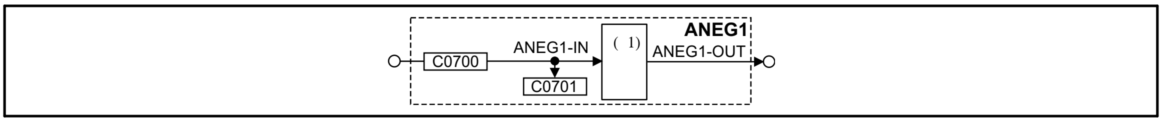


Fig. 3-34 Inverter (ANEG1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ANEG1-IN	a	C0701	dec [%]	C0700	1	19523	-
ANEG1-OUT	a	-	-	-	-	-	-

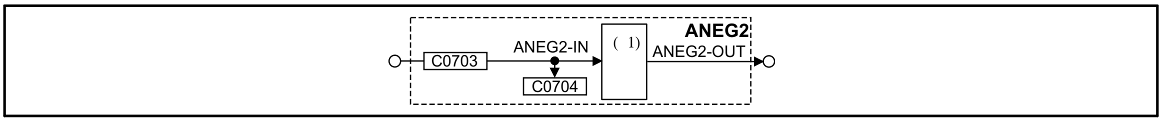


Fig. 3-35 Inverter (ANEG2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ANEG2-IN	a	C0704	dec [%]	C0703	1	1000	-
ANEG2-OUT	a	-	-	-	-	-	-

Function

The input value is multiplied by -1 and then output again.

3.2.12 Analog output via terminal 62/63 (AOUT)

Purpose

AOUT1 and AOUT2 can be used as monitor outputs.

Internal analog signals can be output as voltage signals and be used e.g. as display values or setpoints for slaves.

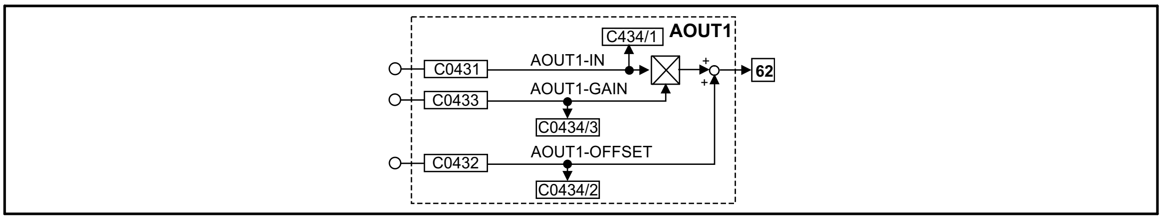


Fig. 3-36 Analog output via terminal X6/62 (AOUT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AOUT1-IN	a	C0434/1	dec [%]	C0431	1	5001	-
AOUT1-GAIN	a	C0434/3	dec [%]	C0433	1	19510	-
AOUT1-OFFSET	a	C0434/2	dec [%]	C0432	1	19512	-

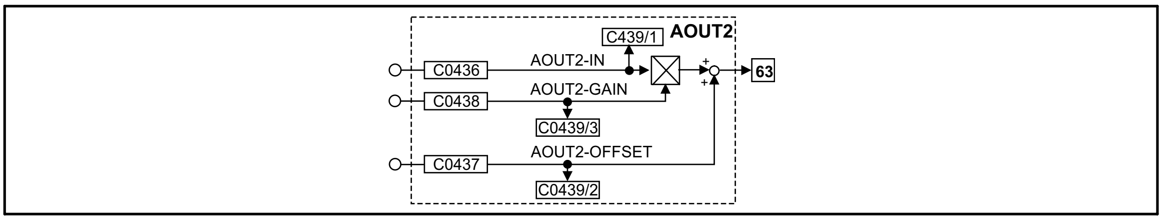


Fig. 3-37 Analog output via terminal X6/63 (AOUT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
AOUT2-IN	a	C0439/1	dec [%]	C0436	1	5002	-
AOUT2-GAIN	a	C0439/3	dec [%]	C0438	1	19511	-
AOUT2-OFFSET	a	C0439/2	dec [%]	C0437	1	19513	-

Function

- The value at input AOUTx-IN is multiplied by the value at input AOUTx-GAIN.
  - The formula for the multiplication is: 100% * 100% = 100%.
- The result of the multiplication is limited to ±200%.
- The limited value is added to the value which is applied at input AOUTx-OFFSET.
  - The formula for the addition is 50% + 10% = 60%. The result of the calculation is mapped in such a way that 100% = 10 V.
- The result of the addition is again limited to ±200%.
- The result of the calculation is mapped in such a way that 100% = 10 V and is output as a signal at terminal 62 or 63.

Example for an output value

AOUT1-IN = 50%, AOUT1-GAIN = 100%, AOUT1-OFFSET = 10%

Output terminal 62 = ((50% * 100% = 50%) + 10% = 60%) = 6 V

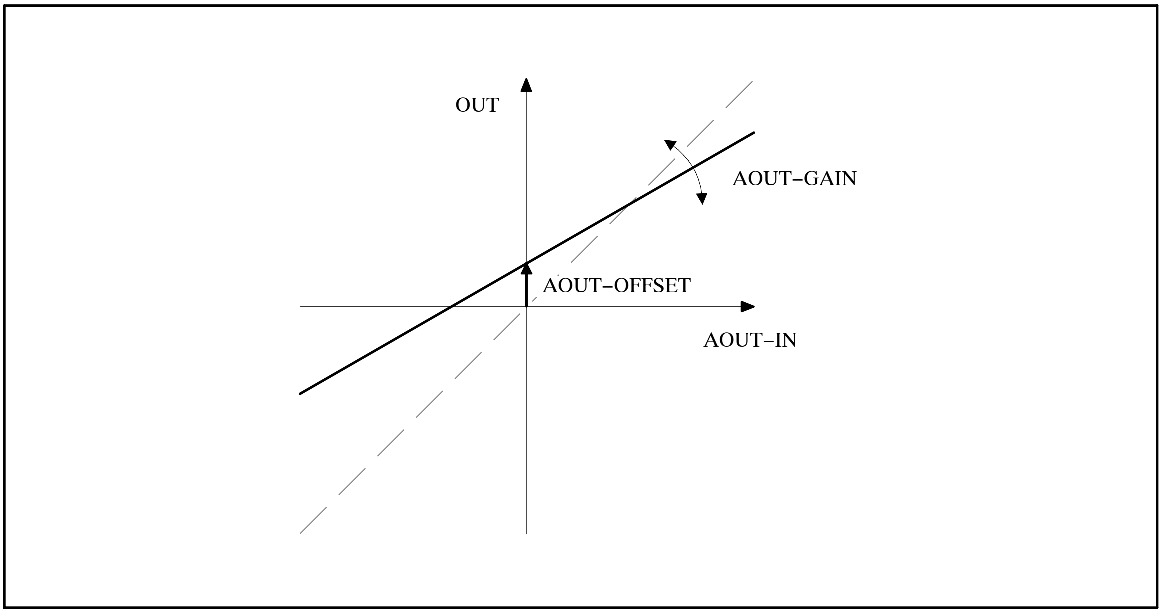


Fig. 3-38 Offset and gain of the analog output

3.2.13 Arithmetic block (ARIT)

Purpose

Arithmetic linking of two ”analog” signals.

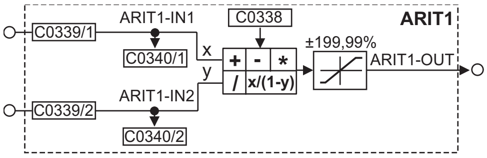


Fig. 3-39 Arithmetic block (ARIT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ARIT1-IN1	a	C0340/1	dec [%]	C0339/1	1	1000	-
ARIT1-IN2	a	C0340/2	dec [%]	C0339/2	1	1000	-
ARIT1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

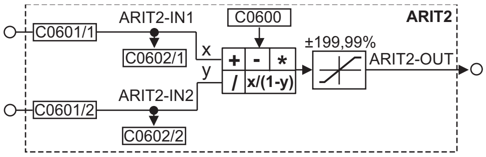


Fig. 3-40 Arithmetic block (ARIT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ARIT2-IN1	a	C0602/1	dec [%]	C0601/1	1	1000	-
ARIT2-IN2	a	C0602/2	dec [%]	C0601/2	1	1000	-
ARIT2-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

For both arithmetic blocks the following functions can be preselected:

Code	Subcode	Arithmetic function	Example	Note
ARIT1: C0338 ARIT2: C0600	0	OUT = IN1		IN2 is not processed
	1	OUT = IN1 + IN2	100% = 50% + 50%	
	2	OUT = IN1 - IN2	50% = 100% - 50%	
	3	OUT = IN1 × IN2	100% = 100% ×100%	
	4	OUT = IN1 ÷ | IN2 |	1% = 100% ÷100%	
	5	OUT = IN1 ÷ (100% - IN2)	200% = 100% ÷ (100% - 50%)	
	15	OUT = IN1 % IN2 % here means ”modulo”	• 20% = 200% [%] 60% • 40% = 160% [%] 60% • 0 = 180% [%] 60%	Remainder calculation: OUT = IN1 - (n × IN2) n = integer component of the quotient IN1 ÷ IN2

3.2.14 Arithmetic block (ARITPH)

Purpose

The FB ARITPH calculates a angle output signal from two angle input signals.

ARITPH1

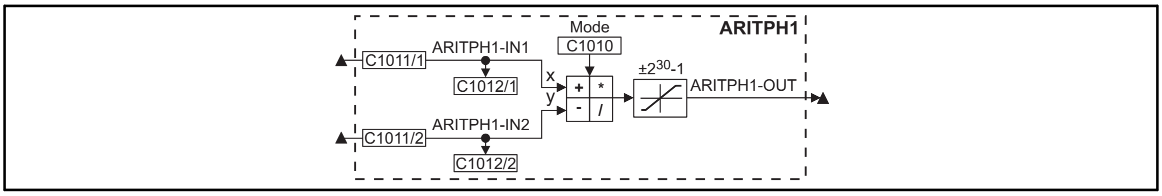


Fig. 3-41 Function block ARITPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH1-IN1	ph	C1012/1	dec [inc]	C1011/1	3	-
ARITPH1-IN2	ph	C1012/2	dec [inc]	C1011/2	3	-
ARITPH1-OUT	ph	-	-	-	-	

ARITPH2

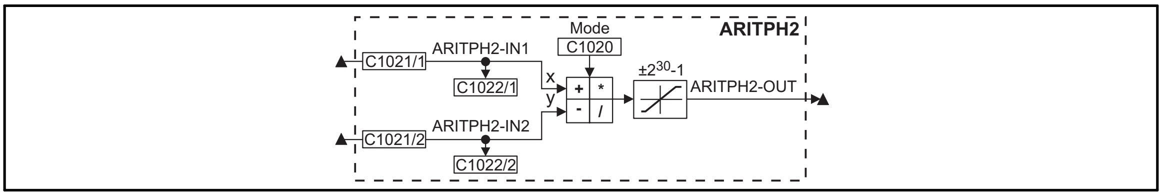


Fig. 3-42 Function block ARITPH2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH2-IN1	ph	C1022/1	dec [inc]	C1021/1	3	-
ARITPH2-IN2	ph	C1022/2	dec [inc]	C1021/2	3	-
ARITPH2-OUT	ph	-	-	-	-	

ARITPH3

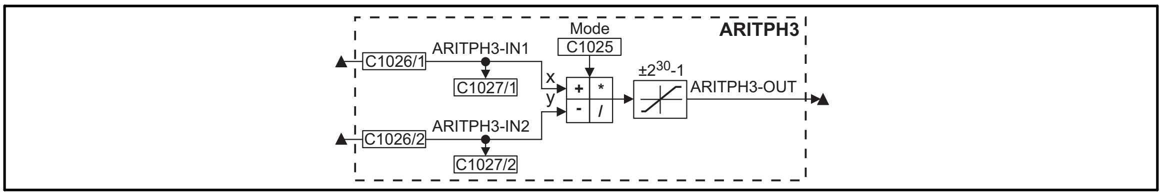


Fig. 3-43 Function block ARITPH3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH3-IN1	ph	C1027/1	dec [inc]	C1026/1	3	-
ARITPH3-IN2	ph	C1027/2	dec [inc]	C1026/2	3	-
ARITPH3-OUT	ph	-	-	-	-	

ARITPH4

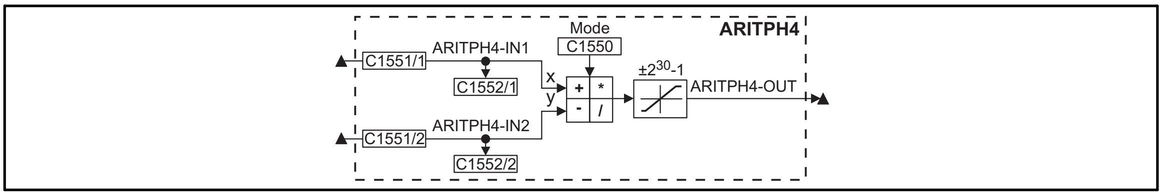


Fig. 3-44 Function block ARITPH4

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH4-IN1	ph	C1552/1	dec [inc]	C1551/1	3	-
ARITPH4-IN2	ph	C1552/2	dec [inc]	C1551/2	3	-
ARITPH4-OUT	ph	-	-	-	-	

ARITPH5

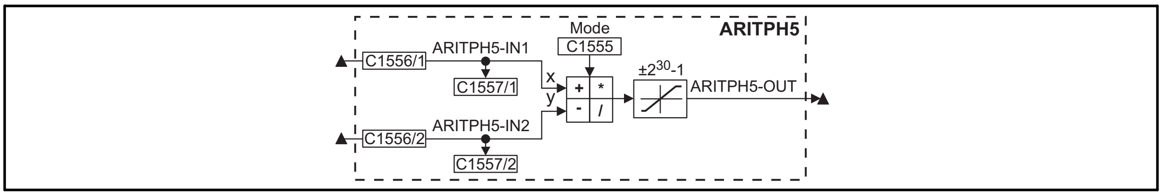


Fig. 3-45 Function block ARITPH5

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH5-IN1	ph	C1557/1	dec [inc]	C1556/1	3	-
ARITPH5-IN2	ph	C1557/2	dec [inc]	C1556/2	3	-
ARITPH5-OUT	ph	-	-	-	-	

ARITPH6

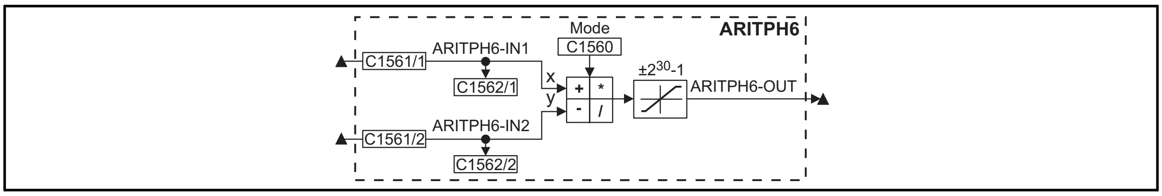


Fig. 3-46 Function block ARITPH6

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
ARITPH6-IN1	ph	C1562/1	dec [inc]	C1561/1	3	-
ARITPH6-IN2	ph	C1562/2	dec [inc]	C1561/2	3	-
ARITPH6-OUT	ph	-	-	-	-	

Function

- Selection of the arithmetic function with code ARITPH mode.
- The calculation is performed cyclically in the control program.
- The function block limits the results (see table)

Code	Selection number	Arithmetic function	Limitation	Note
ARITPH1: C1010 ARITPH2: C1020 ARITPH3: C1025 ARITPH4: C1550 ARITPH5: C1555 ARITPH6: C1560	0	OUT = IN1		Without limitation
	1	OUT = IN1 + IN2	2^{30} -1	
	2	OUT = IN1 - IN2	2^{30} -1	
	3	OUT = (IN1 × IN2) ÷ 2^{30}	2^{30} -1	Remainder not considered
	13	OUT = IN1 × IN2	2^{31}	
	14	OUT = IN1 ÷ IN2	2^{30} -1	Remainder not considered
	15	OUT = IN1 % IN2		Remainder output (Modulo)
	21	OUT = IN1 + IN2	No limit	Without limitation
	22	OUT = IN1 - IN2	No limit	Without limitation

3.2.15 Analog signal changeover switch (ASW)

Purpose

This FB changes between two analog signals.

This FB enables you to change e.g. during a winding process between an initial diameter and a calculated diameter.

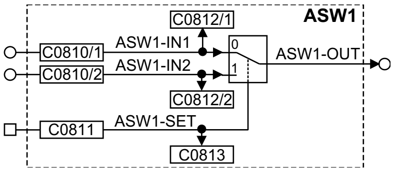


Fig. 3-47 Changeover switch for analog signals (ASW1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW1-IN1	a	C0812/1	dec [%]	C0810/1	1	55	-
ASW1-IN2	a	C0812/2	dec [%]	C0810/2	1	1000	-
ASW1-SET	d	C0813	bin	C0811	2	1000	-
ASW1-OUT	a	-	-	-	-	-	-

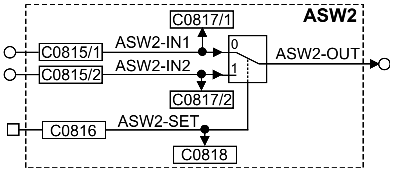


Fig. 3-48 Changeover switch for analog signals (ASW2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW2-IN2	a	C0817/1	dec [%]	C0815/1	1	1000	-
ASW2-IN1	a	C0817/2	dec [%]	C0815/2	1	1000	-
ASW2-SET	d	C0818	bin	C0816	2	1000	-
ASW2-OUT	a	-	-	-	-	-	-

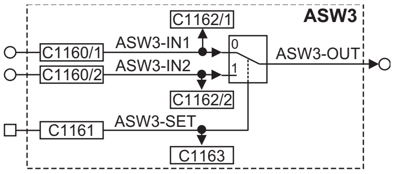


Fig. 3-49 Changeover switch for analog signals (ASW3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW3-IN2	a	C1162/1	dec [%]	C1160/1	1	1000	-
ASW3-IN1	a	C1162/2	dec [%]	C1160/2	1	1000	-
ASW3-SET	d	C1163	bin	C1161	2	1000	-
ASW3-OUT	a	-	-	-	-	-	-

Function blocks

Analog signal changeover switch (ASW)

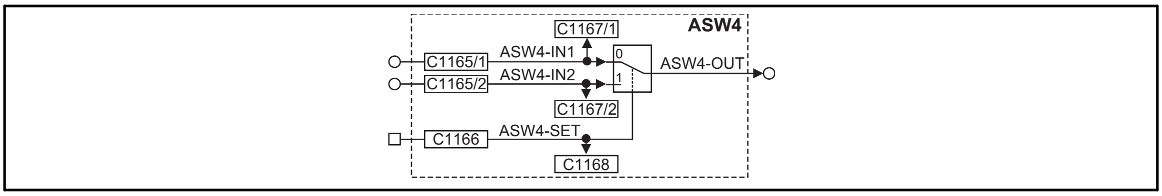


Fig. 3-50 Changeover switch for analog signals (ASW4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
ASW4-IN2	a	C1167/1	dec [%]	C1165/1	1	1000	-
ASW4-IN1	a	C1167/2	dec [%]	C1165/2	1	1000	-
ASW4-SET	d	C1168	bin	C1166	2	1000	-
ASW4-OUT	a	-	-	-	-	-	-

Function

This FB is controlled via the binary input. Depending on the input signal, different signals are sent to the output:

- If a HIGH signal is applied at the binary input, the signal which is applied at the ASWx-IN2 input is sent to the output.
- If a LOW signal is applied, the signal which is applied at the ASW-IN2 input is sent to the output.

3.2.16 Holding brake (BRK)

Danger!

Condition for using the BRK function block

Triggering the holding brake solely via the function block BRK is not permissible!

The **safe** triggering of the holding brake additionally requires a second switch-off path. Unsafe triggering creates the risk of severe personal injury and danger to material assets!

Applications with active loads

When the DC-bus voltage increases (e.g. by braking processes), the torque limitation may be activated via code C0172. The torque limitation becomes active if for instance the brake resistor is defective or the switching threshold set on the brake chopper or the brake module is not correctly adjusted.

Code C0172 is a pre-stage of the monitoring function “OU” (overvoltage of the DC-bus voltage). Code C0172 defines the voltage difference to OU causing a reduction in torque. In the Lenze setting, the torque is reduced to ”0” if the DC-bus voltage reaches 760 V (770 V - 10 V):

- OU threshold = 770V (C0173 = 0...3)
  - Exception: OU threshold 800 V for C0173 = 4 (see description in code table)
- C0172 = 10 V
- No message is generated.

Only after the DC-bus voltage has decreased below the OU reconnection threshold, the torque is reconnected.

With unchanged basic conditions the continuously ”chopping” drive behaviour may lead to undefined motions.

Remedy

1. Set C0172 = 0 V
2. MONIT-OU has to generate EEr-TRIP (e.g. by C0871/0 = 15011).
   - By this, the standstill brake is engaged via controller inhibit (CINH) if the braking energy cannot be dissipated.

Purpose

The FB is used to trigger a holding brake.

Possible applications:

- Hoists
- Traversing drives
- Active loads

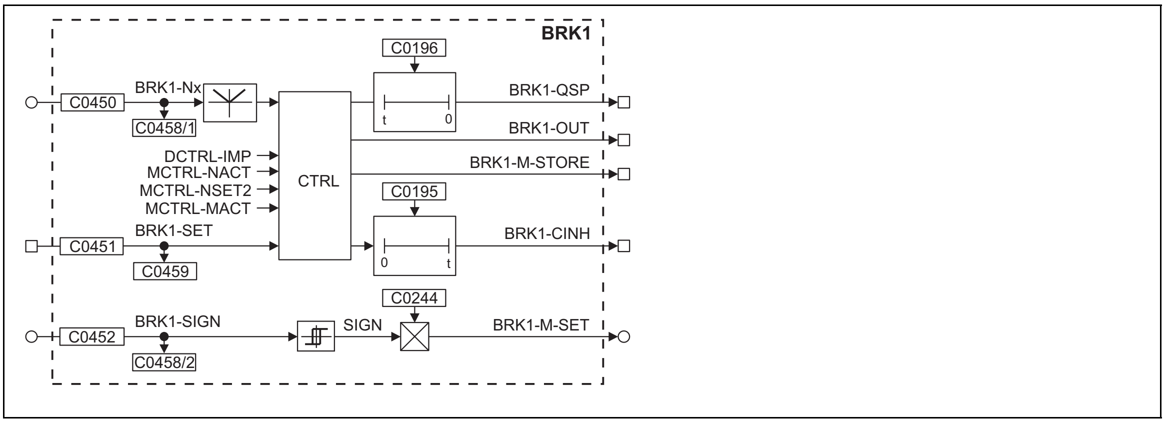


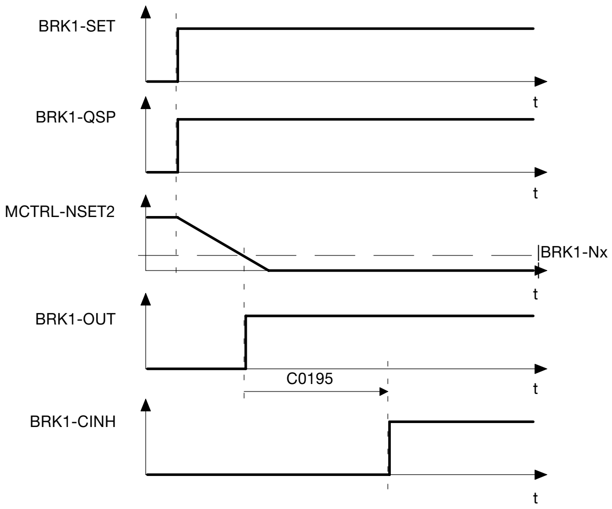
Fig. 3-51 Holding brake (BRK1)

Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
BRK1-SET	d	C0459	bin	C0451	2	1000	-
BRK1-NX	a	C0458/1	dec [%]	C0450	1	1000	Speed threshold from which the drive may output the signal ”Close brake”. The signal source for this input can be a control code, a fixed value, or any other analog FB output. The input signal is processed internally as an absolute value.
BRK1-SIGN	a	C0458/2	dec [%]	C0452	1	1000	Direction of the torque with which the drive is to set up a torque against the brake. The signal source for this input can be a control code, a fixed value, or any other FB output.
BRK1-M-SET	a						Feedforward control torque for releasing the brake 100 % = value of C0057

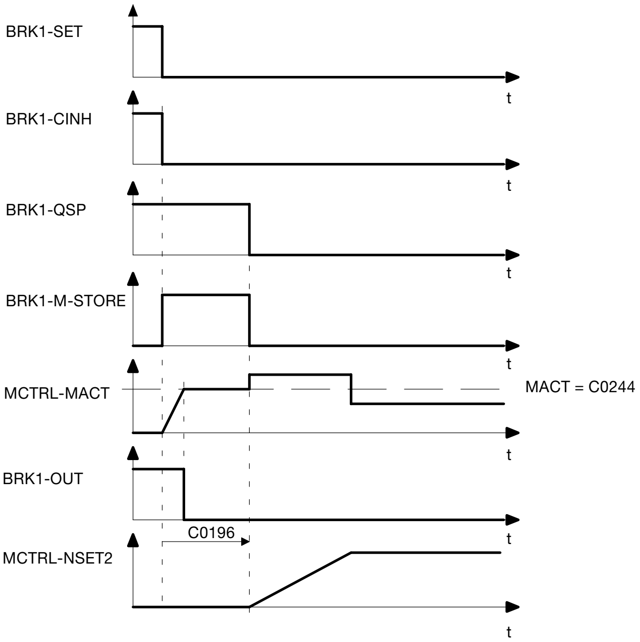
Note!

The internal signals MCTRL-NACT, MCTRL-MACT and MCTRL-NSET2 are processed as absolute values.

3.2.16.1 Engaging the brake

<table>
<tr><td>Purpose</td><td>A HIGH signal at the BRK1-SET input activates the function. The output BRK1-QSP is simultaneously switched to HIGH. This signal can be used to decelerate the drive to zero speed via a deceleration ramp.</td><td rowspan="2">
</td></tr>
<tr><td>Function</td><td>If the setpoint speed falls below the value set at the BRK1-Nx input, the output BRK1-OUT is set to HIGH. In order to ensure a fail-safe design this signal must be inverted at the output (e.g. via C0118).</td></tr>
</table>

3.2.16.2 Disengaging (releasing) the brake

<table>
<tr><td>Purpose</td><td>A LOW signal at the BRK-SET input immediately sets the BRK-CINH output to LOW. At the same time the BRK1-M-STORE output is set to HIGH. This signal can be used to generate a defined torque against the brake. The drive thus takes over the torque while the brake is released. The signal is only reset after the time set under C0196 has elapsed.</td><td rowspan="2">
</td></tr>
<tr><td>Function</td><td>As soon as the torque reaches the value set under C0244 (holding torque), the output BRK1-OUT is set to LOW. When the input is reset, a timing element is triggered. After the time set under C0196 has elapsed the BRK1-QSP output is reset. This signal serves to e.g. release the setpoint integrator after the brake release time has elapsed.</td></tr>
<tr><td>Note</td><td colspan="2">If an actual speed higher than the value at BRK1-Nx is detected before the brake release time (C0196) has elapsed, the signals BRK1-QSP and BRK1-M-STORE are reset immediately. The drive can operate in a speed or angle-controlled manner immediately. If the BRK1-QSP output acts on the QSP control word, then the drive is synchronised to the actual speed and follows its setpoint.</td></tr>
</table>

3.2.16.3 Setting controller inhibit

Setting controller inhibit may for instance be required in the case of a fault (LU, OU, ...).

Function

When the controller is inhibited (CINH), the BRK1-OUT signal is set to HIGH immediately. The drive is then braked via the mechanical brake.

If the fault is eliminated quickly, i.e. the controller inhibit (CINH) is reset before the actual speed falls below the threshold value BRK1-Nx, the BRK1-OUT signal is set to LOW immediately. The drive is synchronised to the actual speed and follows its setpoint.

If the value falls below the threshold, the drive starts as described under ”Release brake”.

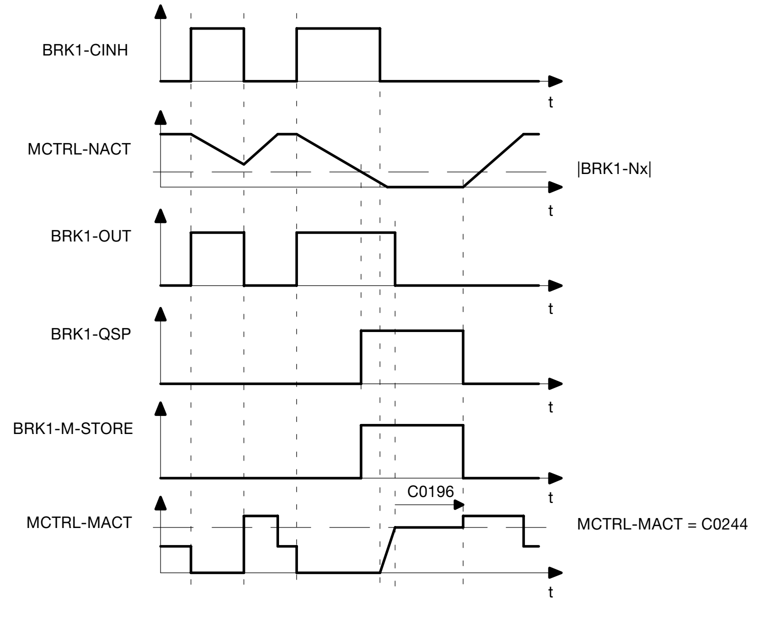


Fig. 3-52 Brake control with CINH

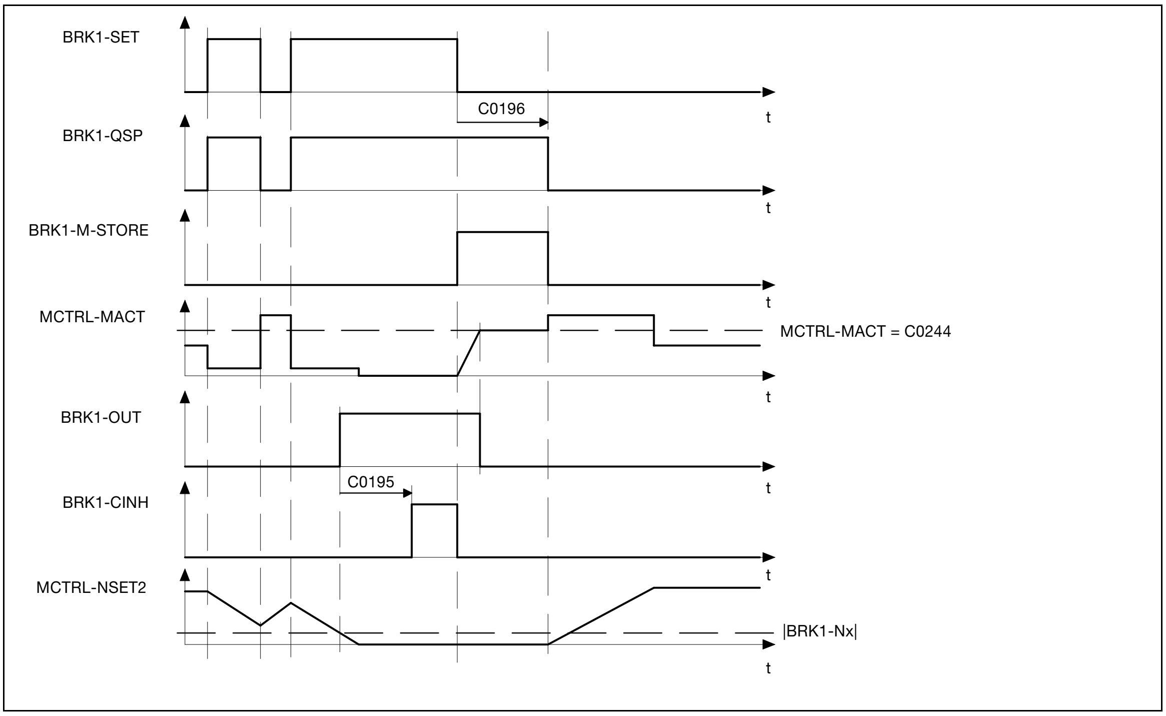


Fig. 3-53 Switching cycle when braking

3.2.17 System bus (CAN-IN)

A detailed description of the system bus (CAN) can be found in the ”CAN Communication Manual”.

3.2.18 System bus (CAN-OUT)

A detailed description of the system bus (CAN) can be found in the ”CAN Communication Manual”.

3.2.19 Setpoint conditioning (CCTRL)

Note!

For the CCTRL and CCTRL2 function blocks, partly the same codes are used. Therefore you may only use CCTRL or CCTRL2. On the basis of extended functions we recommend the use of CCTRL2.

Purpose

- Forming the set machine position (CCTRL-PHI-SET) from the set profile position (e. g. from the YSET1 function block).
- Additional functions like inching/manual jog, reference search (REFC), position override function with maintaining the set machine position from the cam via a second set machine position (CCTRL-PHI-SET2).
- Output of the actual machine position (CCTRL-PHI-ACT) after carrying out the "Set reference" function.
- Touch probe synchronisation of the drive.
- Calculation of the speed and acceleration precontrol.

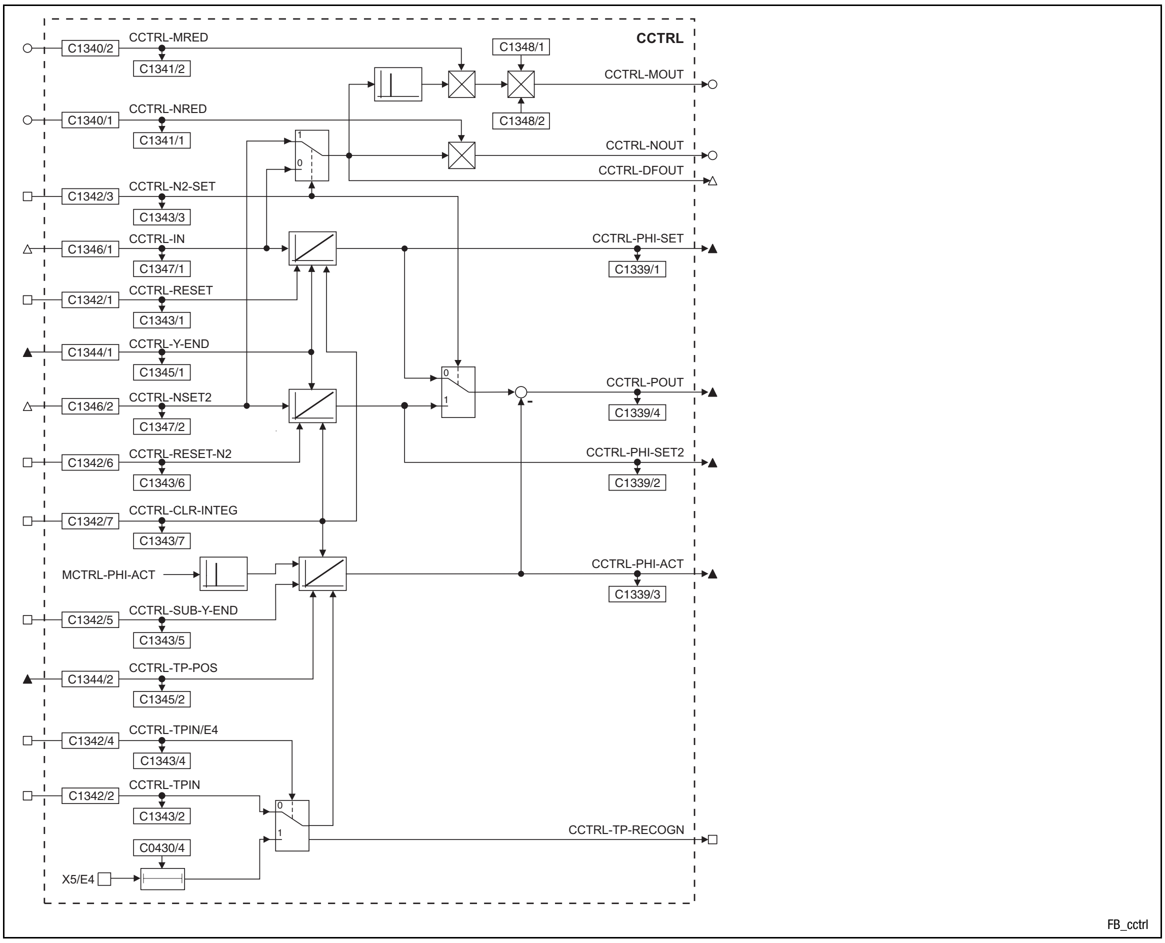


Fig. 3-54 Setpoint conditioning (CCTRL)

Signal				Source		Comment
Name	Type	DIS	DIS format	CFG	List	
CCTRL-MRED	a	C1341/2	dec [%]	C1340/2	1	Gain for the torque setpoint precontrol
CCTRL-NRED	a	C1341/1	dec [%]	C1340/1	1	Gain for the speed setpoint precontrol
CCTRL-N2-SET	d	C1343/3	bin	C1342/3	2	HIGH: input CCTRL-NSET2 active
CCTRL-IN	phd	C1347/1	rpm	C1346/1	4	Input for the set profile position
CCTRL-RESET	d	C1343/1	bin	C1342/1	2	HIGH: sets set angle = actual angle -> CCTRL-POUT = 0
CCTRL-Y-END	ph	C1345/1	inc	C1344/1	3	Final value of the profile (only required for touch probe)
CCTRL-NSET2	phd	C1347/2	rpm	C1346/2	4	Input for the second set machine position
CCTRL-RESET-N2	d	C1343/6	bin	C1342/6	2	Deletes the contouring error if CCTRL-N2-Set = HIGH
CCTRL-CLR-INTEG	d	C1343/7	bin	C1342/7	2	HIGH: Sets all integrators to 0
CCTRL-SUB-Y-END	d	C1343/5	bin	C1342/5	2	Only required for touch probe
CCTRL-TP-POS	d	C1345/2	bin	C1324/3	2	Only for synchronisation via touch probe. Position of the touch probe sensor in the traversing range
CCTRL-TPIN/E4	d	C1343/4	bin	C1342/4	2	HIGH: Touch probe is activated via terminal X5/E4 LOW: Touch probe is activated via CCTRL-TPIN
CCTRL-TPIN	d	C1343/2	bin	C1342/2	2	External mark for setting the position
CCTRL-MOUT	a				1	Torque setpoint for input MCTRL-M-ADD (torque feedforward control)
CCTRL-NOUT	a				1	Speed setpoint for input MCTRL-N-SET (speed feedforward control)
CCTRL-DFOUT	phd				4	Speed setpoint
CCTRL-PHI-SET	ph	C1339/1			3	Output of the set machine position
CCTRL-POUT	ph				3	Contouring error, input signal for MCTRL-PHI-SET
CCTRL-PHI-SET2	ph	C1339/2			3	Output of the set machine position of CCTRL-NSET2
CCTRL-PHI-ACT	ph	C1339/3			3	Output of the actual machine position
CCTRL-TP-RECOGN	d				2	Output is HIGH for 1 ms in the case of • a HIGH-LOW edge at terminal X5/E4 or • CCTRL-TPIN/E4 = HIGH

Function

- Set profile position and second set machine position (📖 3-68)
- Homing (📖 3-69)
- Set reference once (📖 3-71)
- Speed feedforward control (📖 3-73)
- Torque feedforward control (📖 3-73)

3.2.19.1 Set profile position and second set machine position

At CCTRL-IN, the set profile position is specified. The set machine position is output at CCTRL-PHI-SET. It is the reference value for controlling the cam.

For auxiliary functions like inching mode, position override function (e. g. approaching cleaning position) or homing, you can define a second set machine position at CCTRL-PHI-SET2. If a changeover to the second set machine position is effected, the set machine position at CCTRL-PHI-SET is maintained and can be approached again after the auxiliary function has been completed.

Activating set profile position at CCTRL-IN

STOP

Stop!

Destruction of the machine!

If the outputs CCTRL-PHI-SET2 and CCTRL-PHI-SET display different values when the set profile position is activated (CCTRL-N2-SET = LOW), this will result in uncontrolled machine movements due to following errors.

Protective measures:

Set the outputs CCTRL-PHI-SET2 and CCTRL-PHI-SET to equal values before activating the set profile position. You have two possibilities:

- Direct the value at CCTRL-PHI-SET2 to the value at CCTRL-PHI-SET via the input signal at CCTRL-NSET2.
- Set CCTRL-RESET = HIGH. By this, CCTRL-PHI-SET is set = CCTRL-PHI-ACT.

- Set the outputs CCTRL-PHI-SET2 and CCTRL-PHI-SET to equal values.
- Set CCTRL-N2-SET = LOW.
- The integrator for the second set machine position is reset. CCTRL-PHI-SET2 is set = CCTRL-PHI-ACT, in order to be able to traverse from the current position when the second set machine position is activated.

Activating the second set machine position at CCTRL-NSET2

- Set CCTRL-N2-SET = HIGH.

Resetting the set machine position

- CCTRL-PHI-SET = CCTRL-PHI-ACT is set with CCTRL-RESET = HIGH .

3.2.19.2 Homing

There are different possibilities of homing the drive:

- For commissioning, the reference is set once (reasonable for machines with risk of collision). (🕮 3-71)
- After mains connection, homing is carried out once, so that the drive finds the home position. Possibilities for carrying out the homing process:
  – Via the REFC function block (🕮 3-261)
  – Via the function ”Set reference dynamically” (see below).
- Permanent mark registration during running operation (mark synchronisation):
  – Synchronising via touch probe at terminal X5/E4. (🕮 3-70)
  – Synchronisation via touch probe at CCTRL-TPIN. (🕮 3-71)

Note!

For a faultless homing with the REFC function block you have to deactivate the touch probe function with CCTRL-TPIN/E4 = LOW during homing. (🕮 3-263)

Setting the reference dynamically

This function for instance can be used to traverse to the mark in the inching mode.

A) If you activate the function via the input CCTRL2-TPIN:

1. Set CCTRL-N2-SET = HIGH
2. Define the position of the touch probe sensor on the machine at CCTRL-TP-POS.
3. Set CCTRL-TPIN/E4 = LOW.
4. A LOW-HIGH edge at CCTRL-TPIN activates ”Set reference”.

B) If you activate the function via terminal X5/E4:

1. Set CCTRL-N2-SET = HIGH
2. Define the position of the touch probe sensor on the machine at CCTRL-TP-POS.
3. Set CCTRL-TPIN/E4 = HIGH.
4. A HIGH-LOW edge at terminal X5/E4 activates ”Set reference”.

Synchronisation via touch probe at terminal X5/E4

A touch probe signal at terminal X5/E4 is the quickest and most accurate mark registration and is suited for a cyclic synchronisation.

Application examples:

- For applications without a homing function.
- After mains connection, the measuring system of the controller and that of the machine can diverge very much. In the majority of cases the path to be compensated is very long.
- For applications (e. g. with conveying belts) an occurring slip has to be compensated by cyclic synchronisation. In the majority of cases the path to be compensated is relatively short.

Procedure:

1. Set CCTRL-TPIN/E4 = HIGH.
2. Define the position of the touch probe sensor on the machine at CCTRL-TP-POS.
3. Activate the compensation limitation with C1366 = 1.
4. Enter the value for the maximum compensation speed in C1365/1 (Lenze setting = 100 rpm).
5. A HIGH-LOW edge at terminal X5/E4 synchronises the drive to the set position which is output at CCTRL-PHI-SET.

Note!

- For applications with feed the final Y value of the profile must be assigned to the input CCTRL-Y-END (e.g. by the output CDATA-Y-END). The function is not suitable for stretching and compression.
- The input CCTRL-SUB-Y-END must be linked with the output CDATA-X0.
- Save the settings with C0003 = 1 and switch the mains voltage off and on again.
  - When the mark synchronisation is parameterised, the function block automatically changes to the ”Modulo” or ”Limited traversing range” mode. Only by mains switching the touch probe function is initialised with the mode selected.

Synchronisation via touch probe at CCTRL2-TPIN.

The input CCTRL-TPIN is suitable for a one-time synchronisation and sets the position of the drive in standstill.

Procedure:

1. Set CCTRL-TPIN/E4 = LOW.
2. Define the position of the touch probe sensor on the machine at CCTRL-TP-POS.
3. A LOW-HIGH edge at CCTRL-TPIN synchronises the drive to the set position which is output at CCTRL-PHI-SET.

3.2.19.3 Setting the reference once

STOP

Stop!

- If a parameter set is downloaded, C1367/1 is not transferred, as for **each** commissioning the actual, current position of the tool to the machine zero point has to be entered in the code. The position of the actual value encoder (multi-turn absolute value encoder) depends on the rotor position when the motor is mounted to the machine, and on the actual position of the tool. A new setting therefore is required as soon as a drive component is not tied positively anymore.
- If the feedback system is switched over, also the machine zero point has to be re-entered (the synchronisation always is effected via the feedback system and is specifically adapted to it).

The function “Set reference” only has to be carried out once:

1. Enter the current distance [s-units] of the tool to the machine zero point in C1367/1 (set reference).
2. Switch the controller off and then on again, in order to reinitialise the profile data.
    – After every mains connection, the controller automatically determines the current distance to the machine zero point, which is output at CCTRL-PHI-SET2 (C1339/2) and CCTRL-PHI-ACT (C1339/3).
    – The profile position is output at CCTRL-PHI-SET after mains connection.
3. Where required, position the drive to the profile via the RFGPH2 function block.

Frequent zero shifting

Procedure for applications with frequent zero shifting:

1. Disconnect the drive from the profile (CCTRL-N2-SET = HIGH)
2. Carry out function “Set reference” via touch probe
3. Set code C1349/0 to 2 (CCTRL-TP-MODE, absolute-value encoder)
4. Set input CCTRL-N2-SET to HIGH
5. Set input CCTRL-TPIN/E4 to LOW
6. Assign the current distance of the tool to the machine zero point to the input CCTRL-TP-POS.
   - Enter, for instance, a corresponding value via C1477/x [s-units] or C0474/x [inc].
7. Generate a LOW-HIGH edge at input CCTRL-TPIN and then reset the input to LOW.
   - The distance to the machine zero point is automatically saved with mains failure protection and is again available after mains connection.

Now the drive can be positioned to the profile position via the RFGPH2 or RFGPH3 function blocks. This function, however, must be configured manually since it is not included in the basic configuration.

Note!

- It is also possible to use absolute value encoders without homing function.
- Up to software version 3.3, the absolute value encoder must not have a zero crossing within the measuring system of the machine. If necessary, the motor must be turned during the commissioning procedure into the appropriate position before being mounted.
- From software version 3.4, the zero crossing is considered automatically.
- The following applies to all software versions:
  If the encoder is not supplied anymore (mains and DC 24 V are switched off), the encoder may only be turned within certain limits:
  – Single-turn absolute value encoders/resolvers by max. ±179.0 °
  – Multi-turn absolute value encoders by max. ±2079.9 revolutions

3.2.19.4 Speed feedforward control

Via the speed feedforward control the faster control loops are activated earlier. Use this function if the drive generates a following error (negative or positive) when accelerating.

- Via the input CCTRL-NRED the feedforward control can be decreased or increased proportionally to the angle setpoint change dφ/dt.
- Values > 100% increase the feedforward control. If the values are too high, the drive leads or runs unstable in dynamic processes.
- Values < 100% decrease the feedforward control. If the gain is too low, the drives generates a following error (drive lags) during acceleration or braking (dynamic).

Note!

The input value at CCTRL-NRED is processed as an absolute value, i.e. negative values are interpreted as positive.

3.2.19.5 Torque feedforward control

Via the torque feedforward control the faster (internal) control loops are activated earlier. Use this function if the drive generates a following error (negative or positive) when accelerating. Where required, you have to increase the reset time of the n-controller.

Stop!

The torque feedforward control has a much more sensitive influence on the drive than the speed feedforward control.

- The feedforward control can be increased or decreased proportionally to the speed change dn/dt via the input CCTRL-MRED.
  - Values > 100% increase the feedforward control. If the values are too high, the drive leads or runs unstable in dynamic processes.
  - Values < 100% decrease the feedforward control. If the gain is too low, the drives generates a following error (drive lags) during acceleration or braking (dynamic).
- With codes C1348/1 (numerator) and C1348/2 (denominator), the feedforward control can be adapted to the inertia of the machine.

Note!

The input value at CCTRL-MRED is processed as an absolute value, i.e. negative values are interpreted as positive.

3.2.20 Setpoint conditioning (CCTRL2)

Note!

For the CCTRL and CCTRL2 function blocks partly the same codes are used. Therefore you may only use CCTRL or CCTRL2. Due to its extended functions we recommend the use of CCTRL2.

Purpose

- Generation of the machine setpoint position (CCTRL2-PHI-SET) from the profile setpoint position (e.g. from the YSET1 function block).
- Additional functions like inching/manual jog, reference search (REFC), position override with maintaining the machine setpoint position from the cam via a second machine setpoint (CCTRL2-PHI-SET2).
- Output of the actual machine position (CCTRL2-PHI-ACT) after carrying out the ”Set reference” function.
- Touch probe synchronisation of the drive.
- Calculation of the speed and acceleration feedforword control.

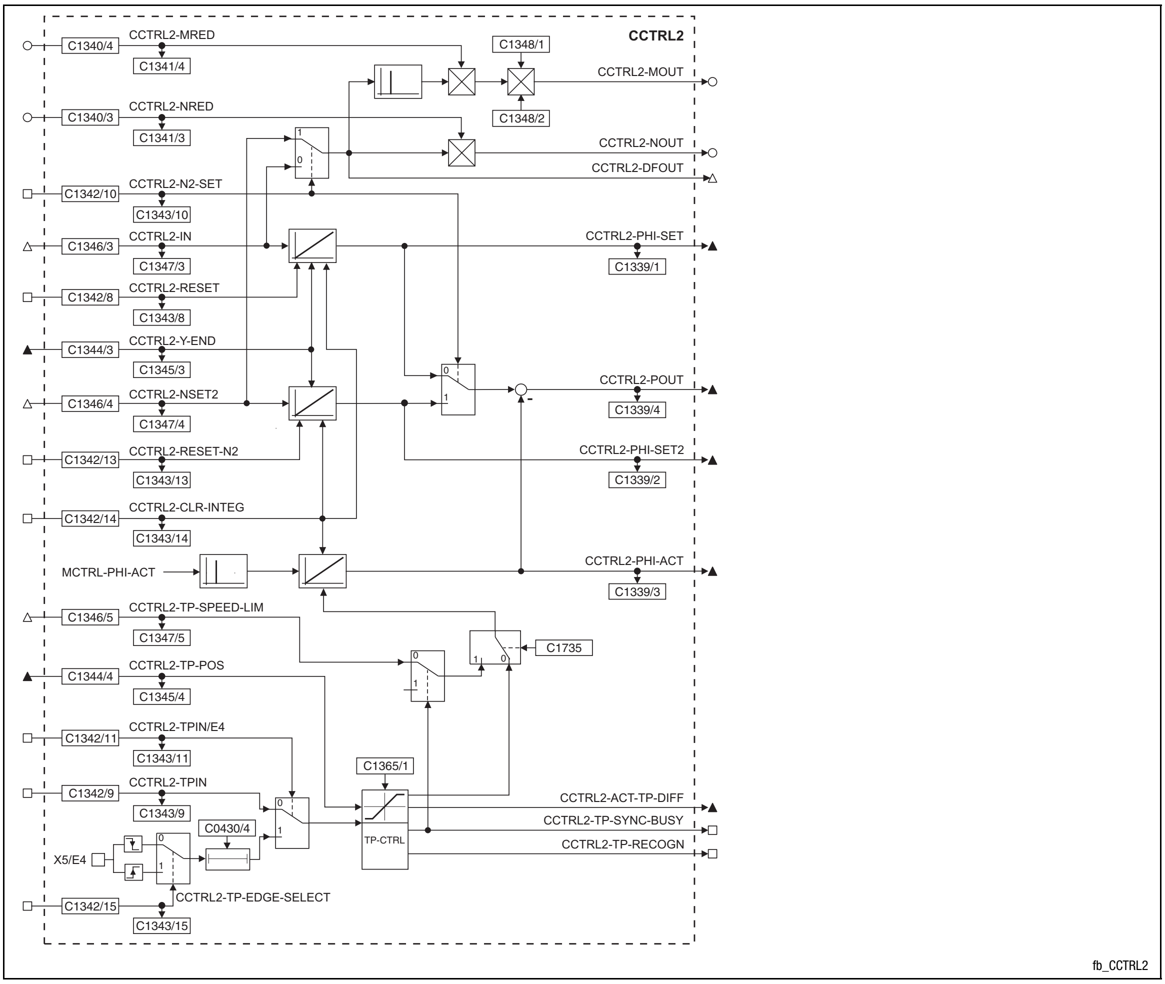


Fig. 3-55 Setpoint conditioning (CCTRL2)

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
CCTRL2-MRED	a	C1341/4	dec [%]	C1340/4	1	Gain for the torque setpoint feedforward control
CCTRL2-NRED	a	C1341/3	dec [%]	C1340/3	1	Gain for the speed setpoint feedforward control
CCTRL2-N2-SET	d	C1343/10	bin	C1342/10	2	HIGH: Input CCTRL-NSET2 active
CCTRL2-IN	phd	C1347/3	rpm	C1346/3	4	Input for the profile setpoint position
CCTRL2-RESET	d	C1343/8	bin	C1342/8	2	HIGH: Sets setpoint phase = actual phase -> CCTRL2-POUT = 0
CCTRL2-Y-END	ph	C1345/3	inc	C1344/3	3	Final value of the profile (only required for touch probe)
CCTRL2-NSET2	phd	C1347/4	rpm	C1346/4	4	Input for the second machine setpoint position
CCTRL2-RESET-N2	d	C1343/13	bin	C1342/13	2	Deletes the following error if CCTRL2-N2-Set = HIGH
CCTRL2-CLR-INTEG	d	C1343/14	bin	C1342/14	2	HIGH: Sets all integrators to 0
CCTRL2-TP-POS	d	C1345/4	bin	C1344/4	2	Only for touch probe synchronisation. Position of the touch probe sensor in the traversing range
CCTRL2-TP-SPEED-LIM	phd	C1347/5	dec [rpm]	C1346/5	4	Selection of a compensation speed. The input signal is active if CCTRL2-TP-SYNC-BUSY = HIGH and C1735 = 1.
CCTRL2-TPIN/E4	d	C1343/11	bin	C1342/11	2	HIGH: Touch probe via terminal X5/E4 is activated LOW: Touch probe via input CCTRL2-TPIN is activated
CCTRL2-TPIN	d	C1343/9	bin	C1342/9	2	External mark for setting the position
CCTRL2-TP-EDGE-SELECT	d	C1345/15	bin	C1342/15	2	LOW: The HIGH-LOW edge of the input signal at X5/E4 is evaluated. LOW: The LOW-HIGH edge of the input signal at X5/E4 is evaluated.
CCTRL2-MOUT	a				1	Torque setpoint for input MCTRL-M-ADD (torque feedforward control)
CCTRL2-NOUT	a				1	Speed setpoint for input MCTRL-N-SET (speed feedforward control)
CCTRL2-PHI-SET	ph				3	Output of the machine setpoint position
CCTRL2-DFOUT	phd					Speed setpoint
CCTRL2-POUT	ph				3	Following error, input signal for MCTRL-PHI-SET
CCTRL2-PHI-SET2	ph				3	Output of the machine setpoint position of CCTRL-NSET2
CCTRL2-PHI-ACT	ph				3	Output of the actual machine position
CCTRL2-ACT-TP-DIFF	ph				3	Outputs the deviation between the output signal at CCTRL2-PHI-ACT and the input signal at CCTRL2-TP-POS.
CCTRL2-TP-SYNC-BUSY	d				2	Touch probe evaluation: LOW: No deviation measured, or the deviation has already been compensated HIGH: There is a deviation between the integrator and the input signal at CCTRL2-TP-POS that has not been compensated. The compensation speed at CCTRL2-TP-SPEED-LIM is activated if C1740 is set to 1. LOW-HIGH edge: Compensation process completed
CCTRL2-TP-RECOGN	d				2	Output is HIGH for 1 ms in the case of • a HIGH-LOW edge at terminal X5/E4 or • CCTRL2-TPIN/E4 = HIGH

Function

- Profile setpoint position and second machine setpoint (📖 3-76)
- Homing (📖 3-77)
- Set reference once (📖 3-79)
- Speed feedforward control (📖 3-81)
- Torque feedforward control (📖 3-81)

3.2.20.1 Profile setpoint position and second machine setpoint

At CCTRL2-IN, the profile setpoint position is specified. The machine setpoint position is output at CCTRL2-PHI-SET. It is the reference value for controlling the cam.

For auxiliary function like inching mode, position override setpoint (e.g. approaching the cleaning position) or homing, you can define a second machine setpoint position at CCTRL2-PHI-SET2. If a changeover to the second machine setpoint position is effected, the machine setpoint position at CCTRL2-PHI-SET is maintained and can be approached again after the auxiliary function has been completed.

Activating profile setpoint position at CCTRL2-IN

Stop!

Destruction of the machine!

If the outputs CCTRL2-PHI-SET2 and CCTRL2-PHI-SET output different values when the profile setpoint position is activated (CCTRL2-N2-SET = LOW), this will result in uncontrolled machine movements due to following errors.

Protective measures:

Set the outputs CCTRL2-PHI-SET2 and CCTRL2-PHI-SET to the same values before activating the profile setpoint position. You have two possibilities:
- Direct the value at CCTRL2-PHI-SET2 to the value at CCTRL2-PHI-SET via the input signal at CCTRL2-NSET2.
- Set CCTRL2-RESET = HIGH. By this, CCTRL2-PHI-SET is set = CCTRL2-PHI-ACT.

- Set the outputs CCTRL-PHI-SET2 and CCTRL-PHI-SET to the same values.
- Set CCTRL2-N2-SET = LOW.
- The integrator for the second machine setpoint is reset. CCTRL2-PHI-SET2 is set = CCTRL2-PHI-ACT, in order to be able to traverse from the current position when the second machine setpoint is activated.

Activating the second machine setpoint at CCTRL2-NSET2

- Set CCTRL2-N2-SET = HIGH.

Resetting the machine setpoint

- Via CCTRL2-RESET = HIGH, CCTRL2-PHI-SET is set = CCTRL2-PHI-ACT.

3.2.20.2 Homing

There are different possibilities of homing the drive:

- For commissioning, the reference is set once (reasonable for machines with risk of collision). (🕮 3-77)
- After mains connection, homing is carried out once, so that the drive finds the home position. Possibilities for carrying out the homing process:
  - Via the REFC function block (🕮 3-261)
  - Via the function ”Set reference dynamically” (see below).
- Permanent mark registration during running operation (mark synchronisation):
  - Synchronising via touch probe at terminal X5/E4. (🕮 3-78)
  - Synchronising via touch probe at CCTRL2-TPIN. (🕮 3-79)

Note!

For a faultless homing with the REFC function block you have to deactivate the touch probe function with CCTRL2-TPIN/E4 = LOW during homing. (🕮 3-263)

Setting the reference dynamically

This function for instance can be used to traverse to the mark in the inching mode.

A) If you activate the function via the input CCTRL2-TPIN:

1. Set CCTRL2-N2-SET = HIGH
2. Define the position of the touch probe sensor on the machine at CCTRL2-TP-POS.
3. Set CCTRL2-TPIN/E4 = LOW.
4. A LOW-HIGH edge at CCTRL2-TPIN activates ”Set reference dynamically”.

B) If you activate the function via terminal X5/E4:

1. Set CCTRL2-N2-SET = HIGH
2. Define the position of the touch probe sensor on the machine at CCTRL2-TP-POS.
3. Set CCTRL2-TPIN/E4 = HIGH.
4. Select the signal edge for the input signal at terminal X5/E4:
   - In the case of CCTRL2-TP-EDGE-SELECT = LOW, HIGH-LOW edges are evaluated.
   - In the case of CCTRL2-TP-EDGE-SELECT = HIGH, LOW-HIGH edges are evaluated.
5. A corresponding signal edge at terminal X5/E4 activates ”Set reference dynamically”.

Synchronisation via touch probe at terminal X5/E4

A touch probe signal at terminal X5/E4 is the quickest and most accurate mark registration and is suited for a cyclic synchronisation.

By means of the touch probe signal, a deviation between CCTRL2-PHI-ACT and CCTRL2-TP-POS is measured. At CCTRL2-ACT-TP-DIFF the deviation is always output as the shortest way. The deviation can be compensated by a compensation speed.

Application examples:

- For applications without a homing function.
- After mains connection, the measuring system of the controller and that of the machine can diverge very much. In the majority of cases, the path to be compensated is very long.
- For applications (e. g. with conveying belts) an occurring slip has to be compensated by cyclic synchronisation. In the majority of cases, the path to be compensated is relatively short.

Procedure:

1. Set CCTRL2-TPIN/E4 = HIGH.
2. Define the position of the touch probe sensor on the machine at CCTRL2-TP-POS.
   – The input values have to correspond to the cycle (CCTRL2-Y-END). For example, for a cycle of 360 ° only values in the range of -359 ° ... +719 ° may be defined at CCTRL2-TP-POS.
3. Select the source for the compensation speed:
   – C1735 = 0: The compensation speed is defined via C1365/1 (Lenze setting).
   – C1735 = 1: The compensation process is controlled by selection of a profile at CCTRL2-TP-SPEED-LIM.

Note!

- The CCTRL2 function block does not contain a profile generator. The profiles have to be generated via additional function blocks (e.g. RFGPH2 or RFGPH3). See also example in fig. 3-205.
- Do not specify constant values at CCTRL2-TP-SPEED-LIM (e.g. via free codes (FCODE)).

4. Select the signal edge for the input signal at terminal X5/E4:
   – In the case of CCTRL2-TP-EDGE-SELECT = LOW, HIGH-LOW edges are evaluated.
   – In the case of CCTRL2-TP-EDGE-SELECT = HIGH, LOW-HIGH edges are evaluated.
5. A corresponding signal edge at terminal X5/E4 synchronises the drive to the set position which is output at CCTRL2-PHI-SET.

Note!

- The set profile position has to be activated (CCTRL2-N2-SET = LOW).
- For applications with feed, the final Y value of the profile must be assigned to the input CCTRL2-Y-END (e.g. by output CDATA2-Y-END). The function is not suitable for stretching and compression.
- Save the settings with C0003 = 1 and switch the mains voltage off and on again.
  – When the mark synchronisation is parameterised, the function block automatically changes to the ”Modulo” or ”Limited traversing range” mode. Only by mains switching the touch probe function is initialised with the mode selected.

Synchronisation via touch probe at CCTRL2-TPIN.

The input CCTRL2-TPIN is suitable for a one-time synchronisation and sets the position of the drive in standstill.

Procedure:

1. Set CCTRL2-TPIN/E4 = LOW.
2. Define the position of the touch probe sensor on the machine at CCTRL2-TP-POS.
3. A LOW-HIGH edge at CCTRL2-TPIN synchronises the drive to the set position which is output at CCTRL2-PHI-SET.

3.2.20.3 Setting the reference once

STOP

Stop!

- If a parameter set is downloaded, C1367/1 is not transferred, as for **each** commissioning the actual, current position of the tool to the machine zero point has to be entered in the code. The position of the actual value encoder (multi-turn absolute value encoder) depends on the rotor position when the motor is mounted to the machine, and on the actual position of the tool. A new setting therefore is required as soon as a drive component is not tied positively anymore.
- If the feedback system is switched over, also the machine zero point has to be re-entered (the synchronisation always is effected via the feedback system and is specifically adapted to it).

The function “Set reference” only has to be carried out once:

1. Enter the current distance [s-units] of the tool to the machine zero point in C1367/1 (set reference).
2. Switch the controller off and then on again, in order to reinitialise the profile data.
   - After every mains connection, the controller automatically determines the current distance to the machine zero point, which is output at CCTRL2-PHI-SET2 (C1339/2) and CCTRL2-PHI-ACT (C1339/3).
   - The profile position is output at CCTRL2-PHI-SET after mains connection.
3. Where required, position the drive to the profile via the RFGPH2 function block.

Frequent zero shifting

Procedure for applications with frequent zero shifting:

1. Disconnect the drive from the profile (CCTRL2-N2-SET = HIGH)
2. Carry out function “Set reference” via touch probe
3. Set input CCTRL2-N2-SET to HIGH
4. Set input CCTRL2-TPIN/E4 to LOW
5. Assign the current distance of the tool to the machine zero point to the input CCTRL2-TP-POS.
   - Enter, for instance, define a corresponding value via C1477/x [s-units] or C0474/x [inc].
6. Generate a LOW-HIGH edge at input CCTRL2-TPIN and then reset the input to LOW.
   - The distance to the machine zero point is automatically saved with mains failure protection and is again available after mains connection.

Now the drive can be positioned to the profile position via the RFGPH2 or RFGPH3 function blocks. This function, however, must be configured manually since it is not included in the basic configurations.

Note!

- It is also possible to use absolute value encoders without homing function.
- Up to software version 3.3, the absolute value encoder must not have a zero crossing within the measuring system of the machine. If necessary, the motor must be turned during the commissioning procedure into the appropriate position before being mounted.
- From software version 3.4, the zero crossing is considered automatically.
- The following applies to all software versions:
  If the encoder is not supplied anymore (mains and DC 24 V are switched off), the encoder may only be turned within certain limits:
  - Single-turn absolute value encoders/resolvers by max. ±179.0 °
  - Multi-turn absolute value encoders by max. ±2079.9 revolutions

3.2.20.4 Speed feedforward control

Via the speed feedforward control the faster control loops are activated earlier. Use this function if the drive generates a contouring error (negative or positive) when accelerating.

- Via the input CCTRL2-NRED the feedforward control can be decreased or increased proportionally to the phase setpoint change dφ/dt.
- Values > 100% increase the feedforward control. If the values are too high, the drive leads or runs unstable in dynamic processes.
- Values < 100% decrease the feedforward control. If the gain is too low, the drive generates a following error (drive lags) during acceleration or braking (dynamic).

Note!

The input value at CCTRL2-NRED is processed as an absolute value, i.e. negative values are interpreted as positive.

3.2.20.5 Torque feedforward control

Via the torque feedforward control the faster (internal) control loops are activated earlier. Use this function if the drive generates a following error (negative or positive) when accelerating. Where required, you have to increase the reset time of the n-controller.

Stop!

The torque feedforward control has a much more sensitive influence on the drive than the speed feedforward control.

- The feedforward control can be increased or decreased proportionally to the speed change dn/dt via the input CCTRL2-MRED.
  - Values > 100% increase the feedforward control. If the values are too high, the drive leads or runs unstable in dynamic processes.
  - Values < 100% decrease the feedforward control. If the gain is too low, the drive generates a following error (drive lags) during acceleration or braking (dynamic).
- With codes C1348/1 (numerator) and C1348/2 (denominator), the feedforward control can be adapted to the inertia of the machine.

Note!

The input value at CCTRL2-MRED is processed as an absolute value, i.e. negative values are interpreted as positive.

3.2.21 Following error monitoring (CERR)

One function block (CERR1) is available.

Purpose

Following error monitoring with pre-warning stage.

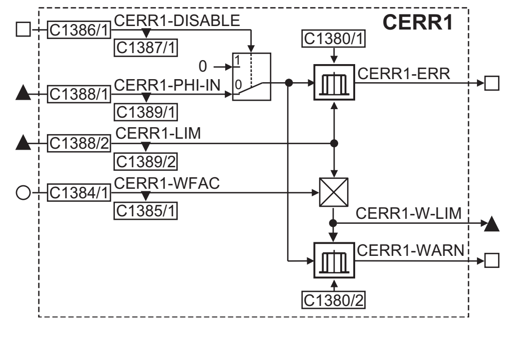


Fig. 3-56 Following error monitoring (CERR)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CERR1-WFAC	a	C1385/1	dec [%]	C1384/1	1	Reduction factor for CERR1-WARN: +100 % = no reduction <100 % = reduction >100 % = increase
CERR1-DISABLE	d	C1387/1	bin	C1386/1	1	HIGH sets CERR1-WARN and CERR1-EER = 0
CERR1-PHI-IN	ph	C1389/1	dec [inc]	C1388/1	4	Input
CERR1-LIM	ph	C1389/2	dec [inc]	C1388/2	4	Switching threshold, the absolute value is generated from the input value
CERR1-ERR	bin					Input value CERR1-PHI-IN has exceeded the limit CERR1-LIM
CERR1-WARN	bin					Input value CERR1-PHI-IN has exceeded the limit CERR1-LIM × CERR1-WFAC / 100 %
CERR1-WLIM	ph					Warning limit in inc

Function

- Evaluation of the following error
- Defenition of the following error limits
- Output of status signals
- Deactivation of the output

3.2.21.1 Evaluation of the following error

The actual following error signal is generated by the function block CCTRL (output CCTRL-POUT) and is read at CERR1-PHI-IN (see e.g. signal-flow diagramm, configuration 1000).

In the function block it is compared with the configurable following error limit CERR1-LIM. If the set limit is exceeded, the following error warning is output at CERR1-ERR.

Input signal		**Output signal**
CERR1-PHI-IN	Within the window	CERR1-ERR = LOW
	Outside the window	CERR1-ERR = HIGH

CERR1-LIM generates a window around 0 inc.

3.2.21.2 Definition of the following error limits

- The following error limit is defined at the input CERR1-LIM.
- The limit for the following error pre-warning is determined via the reduction value CERR1-WFAC.
  - – Limit value calculation for the following error pre-warning:

$$|\text{CERR1-LIM}| \cdot \frac{|\text{CERR1-WFAC}|}{100\ \%}$$

Note!

The input values at CERR1-LIM are limited to a maximum of 4194300 inc (4194300 inc = 63.9 × motor revolutions).

3.2.21.3 Output of status signals

The digital outputs CERR1-ERR and CERR1-WARN indicate if the actual limit values for following errors and following error pre-warning are exceeded or fallen below.

Enter a hysteresis under codes C1380/1 and C1380/2 to avoid instable behaviour at the change over point.

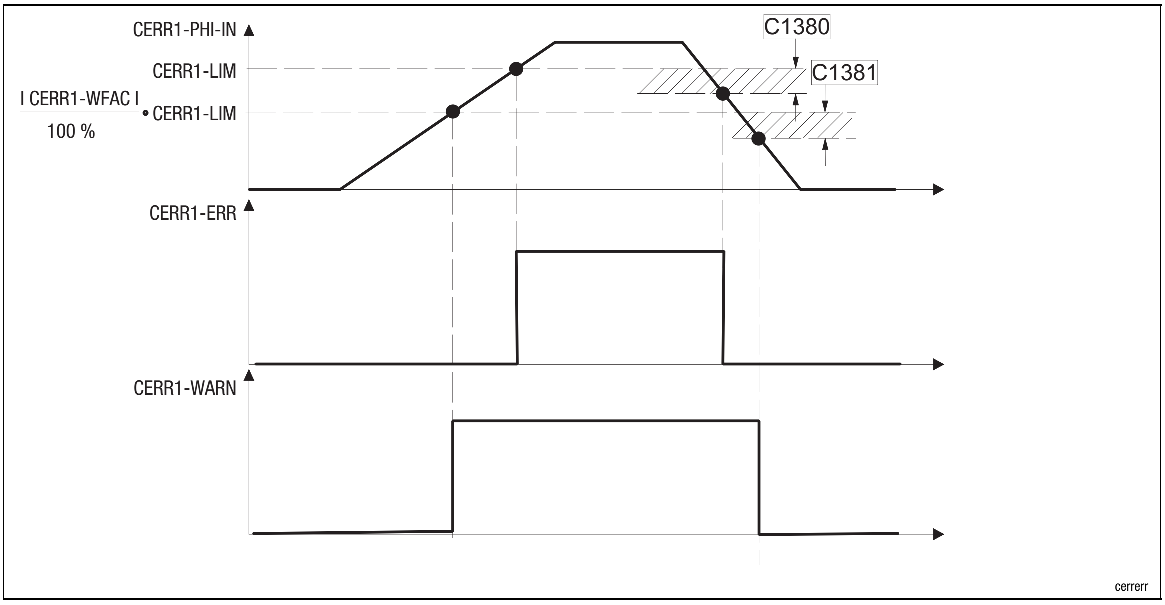


Fig. 3-57 Signal behaviour CERR1-ERR and CERR1-WARN

Code	Meaning	Note
C1380/1	Following error hysteresis	
C1380/2	Warning hysteresis	

3.2.21.4 Deactivating the output

The output of following errors and following error warnings can be deactivated with CERR1-DISABLE = HIGH.

3.2.22 Virtual clutch (CLUTCH1)

Purpose

Engagement and disenConnection and disengagement of the X or Y axis.

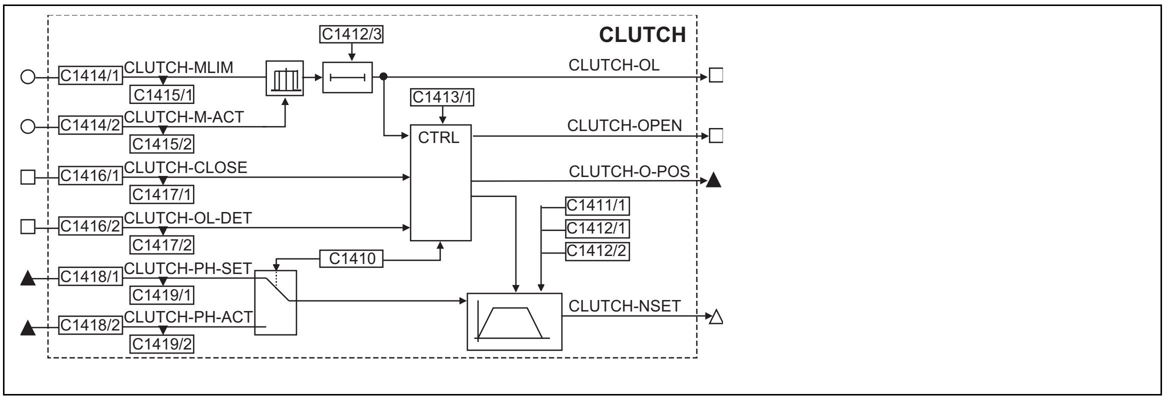


Fig. 3-58 Virtual clutch (CLUTCH1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CLUTCH1-MLIM	a	1415/1	dec [%]	1414/1	1	Threshold for ”overload” monitoring
CLUTCH1-MACT	a	1415/2	dec [%]	1414/2	1	Act. value for ”overload” monitoring
CLUTCH1-CLOSE	d	1417/1	bin	1416/1	2	HIGH: Close clutch LOW: Open clutch
CLUTCH1-OL-DET	d	1417/2	bin	1416/2	2	HIGH: Activate overload monitoring
CLUTCH1-PHI-SET	ph	1419/1	inc	1418/1	3	Set drive position
CLUTCH1-PHI-ACT	ph	1419/2	inc	1418/2	3	Actual drive position
CLUTCH1 -OPEN	d				1	HIGH: Clutch open
CLUTCH1-OL	d				1	HIGH: overload monitoring has responded
CLUTCH1-O-POS	ph				3	Position, in which the clutch has been disengaged (65536 inc = 1 motor rev.)
CLUTCH1-NSET	phd				4	Speed setpoint for: • Brake drive after command OPEN • Set drive to target position • Set drive to open-position

Function

- Overload monitoring (chapter. 3.2.22.1)
- Disengage clutch (chapter 3.2.22.2)
- Engage clutch (chapter 3.2.22.3)

3.2.22.1 Overload monitoring

The clutch function can be activated when overload occurs (e.g. torque overload).

Inputs for overload monitoring

- CLUTCH1-MACT
  - Assign the actual value of the value to be monitored (e.g. MCTRL-MACT). The input signal is processed as an absolute value.
- CLUTCH1-OL-DET = HIGH (e.g. assign FIXED1). Activating the overload monitoring.
  - CLUTCH1-OL-DET = LOW. Monitoring only sets the output CLUTCH1-OL = HIGH. **No** entry is made in the history buffer!
- CLUTCH1-MLIM
  - Definition of the monitoring threshold

Overload monitoring is active if

- CLUTCH1-MACT > CLUTCH1-MLIM
  - Output CLUTCH1-OL = HIGH (irrespective of input CLUTCH1-OL-DET). The output remains on HIGH until an L→H edge occurs at the input of CLUTCH1-CLOSE.
  - The clutch is disengaged when CLUTCH1-OL-DET=HIGH.

Note!

Code C1412/3 is used to set a delay time which has to expire before the time when the overload is indicated.

Monitoring will be reset if the load conditions go back to normal within the delay time set.

3.2.22.2 Disengage clutch

In contrast to the mechanical clutch, the clutch function CLUTCH1 only causes the drive to be really disconnected from the master value or profile shape. This serves to brake the drive to standstill in a controlled way.

- CLUTCH1-OPEN = HIGH (clutch open):
  - Input CLUTCH1-CLOSE = LOW or
  - Activation of the overload monitoring
- Speed control to standstill (CLUTCH1-NSET)

The output CLUTCH1-NSET provides a corresponding speed setpoint with which the drive is decelerated to standstill.

The deceleration time can be set under C1412/1.

3.2.22.3 Engage clutch

The function is activated with a HIGH signal at input CLUTCH1-CLOSE.

For the time required to start cam operation again, the function of the speed setpoint at CLUTCH1-NSET can be configured under C1410.The alternatives are as follows:

- Engage clutch immediately
- Set drive back to open-position, engage clutch
- Set drive to target position, engage clutch
- Latch at setpoint position

After the selected function has been processed the output CLUTCH1-OPEN is set to LOW.

Engage clutch immediately

- C1410 = 0
  - The output CLUTCH1-OPEN is immediately set to LOW.

Set drive back to open-position

- C1410 = 1
  - The actual position at input CLUTCH1-PHI-ACT is saved when the monitoring is responder or a HIGH LOW edge occurs at input CLUTCH1-CLOSE.

Note!

The actual position is **lost** after mains switching.

A LOW HIGH edge at input CLUTCH1-CLOSE starts a profile generator which can be used to set the drive back to the open-position.

- Acceleration/deceleration time adjustable under C1412/2
- Max. speed adjustable under C1411/1
- A corresponding speed setpoint is output at -NSET.

CLUTCH1-OPEN is set to LOW when the open-position is reached.

Set drive to target position

- C1410 = 2

A LOW→HIGH edge at the input CLUTCH1-CLOSE starts a profile generator which serves to take the drive to the target position. The target position must be defined at CLUTCH1-PHI-SET.

- Acceleration/deceleration time adjustable under C1412/2
- Max. speed adjustable under C1411/1

A corresponding speed setpoint is output at CLUTCH1-NSET.

CLUTCH1-OPEN is set to LOW when the target position is reached.

Latch at setpoint position

- C1410 = 3

The drive remains in standstill until CLUTCH - PHI-ACT = CLUTCH - PHI-SET.

After a LOW HIGH edge at input CLUTCH1-CLOSE

- the output CLUTCH1-NSET outputs the speed setpoint 0
- CLUTCH1-PHI-ACT = CLUTCH1-PHI-SET sets the output CLUTCH1-OPEN=LOW,
- the hysteresis is adjustable under C1413/1.

3.2.23 Virtual clutch (CLUTCH2)

Purpose

Position-accurate engagement of the X axis (line shaft) with adjustable acceleration and deceleration ramps.

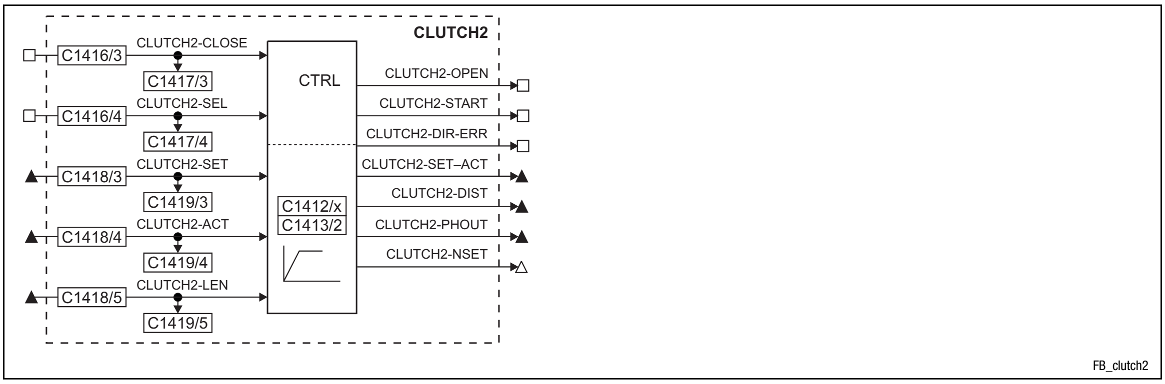


Fig. 3-59 Virtual clutch (CLUTCH2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CLUTCH2-CLOSE	d	1417/1	bin	1416/1	2	HIGH: Close clutch LOW: Open clutch
CLUTCH2-SEL	d	1417/2	bin	1416/2	2	HIGH: Close clutch immediately LOW: Wait for position setpoint, then close
CLUTCH2-SET	ph	1419/1	inc	1418/1	3	Setpoint position of X axis (line shaft)
CLUTCH2-ACT	ph	1419/2	inc	1418/2	3	Actual position of X axis (line shaft)
CLUTCH2-LEN	ph	1419/2	inc	1418/2	3	Clock pulse length (X axis)
CLUTCH2-OPEN	d	-	-	-	-	HIGH: Clutch open LOW: Clutch engaged
CLUTCH2-START	d	-	-	-	-	HIGH: Clutch received command to close
CLUTCH2-DIR-ERR	d	-	-	-	-	HIGH: Error of direction of rotation
CLUTCH2-SET–ACT	ph	-	-	-	-	Output of the differential signal of CLUTCH2-ACT – CLUTCH2-SET if CLUTCH2-CLOSE = HIGH • The output corresponds to the distance still to be compensated • The output refers to the set acceleration ramp and can take several clock pulses
CLUTCH2-DIST	ph	-	-	-	-	Distance required for acceleration
CLUTCH2-PHOUT	ph	-	-	-	-	Output of the ”internal” master angle position • The signal refers to one machine pulse (0 ... CDATA-ACTLEN) • Can be used as input signal for CDATA-XIN • The ”external” master angle is applied to CLUTCH2-SET. If the clutch is closed, the ”external” and ”internal” master angles are identical.
CLUTCH2-NSET	phd	-	-	-	-	Speed setpoint

Function

- Clutch engagement through ramp function with following synchronous running (chapter 3.2.23.1)
- Direct clutch engagement (chapter 3.2.23.2)
- Clutch disengagement (chapter 3.2.23.3)

3.2.23.1 Clutch engagement through ramp function with following synchronous running

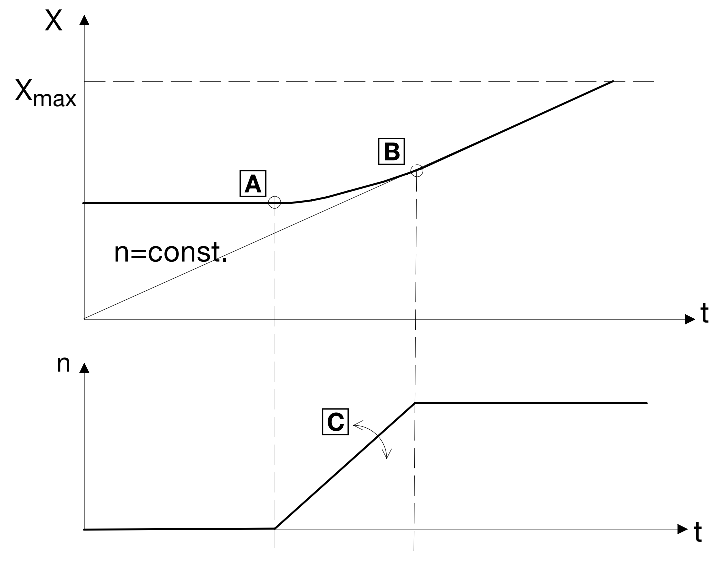


Fig. 3-60 Transition characteristic of a cam drive when engaging the clutch and then running synchronously

After the cam drive has paused - mostly process-related - it can be synchronized again to the process with a constantly operating master drive with CLUTCH2. At the time of engaging B both drives have synchronous speeds and the same positions.

In Fig. 3-60, A the catching-up process is started. The distance required at this time(CLUTCH2-DIST) is calculated from the following parameters:

- Ramp gradient, code C1412/5 (see Fig. 3-60, C)
- n_{max} of the cam drive

CLUTCH2-DIST is available at the output of the function block and is a measure for the distance still to be caught up. If CLUTCH2-DIST = 0, the clutch can be closed (CLUTCH2-CLOSE = HIGH) due to the synchronous behaviour of both drives (Fig. 3-60, B).

Note!

- Clutch engagement only possible when drive is rotating in CW direction.
- Connect the output CDATA-ACTLEN (function block CDATA) with the input CLUTCH2-LEN to determine the position of the X axis (master).

3.2.23.2 Direct clutch engagement

The clutch immediately closes when CLUTCH2-SEL = HIGH.

Note!

Please observe that the command CLUTCH2-SEL = HIGH has priority over all other commands at function block CLUTCH2.

This function is only suitable for drives at stand still.

3.2.23.3 Disengagement of the clutch

When CLUTCH2-CLOSE = LOW the clutch is opened immediately. The drive is braked to standstill via an adjustable ramp (C1412/4).

3.2.24 Clutch (CLUTCH 3)

Purpose

The CUTCH3 function block forms the interface between the external and internal master angle in synchronous systems. CLUTCH3 has the following features:

- Engaging and disengaging at positive or negative direction of rotation of the master angle.
- Disengaging with standstill at an adjustable target point or with synchronous running to a specified point.
- Engaging and disengaging in a time-controlled manner.
- Adjustable minimum speed in the disengaged state (e. g. for printing machines).

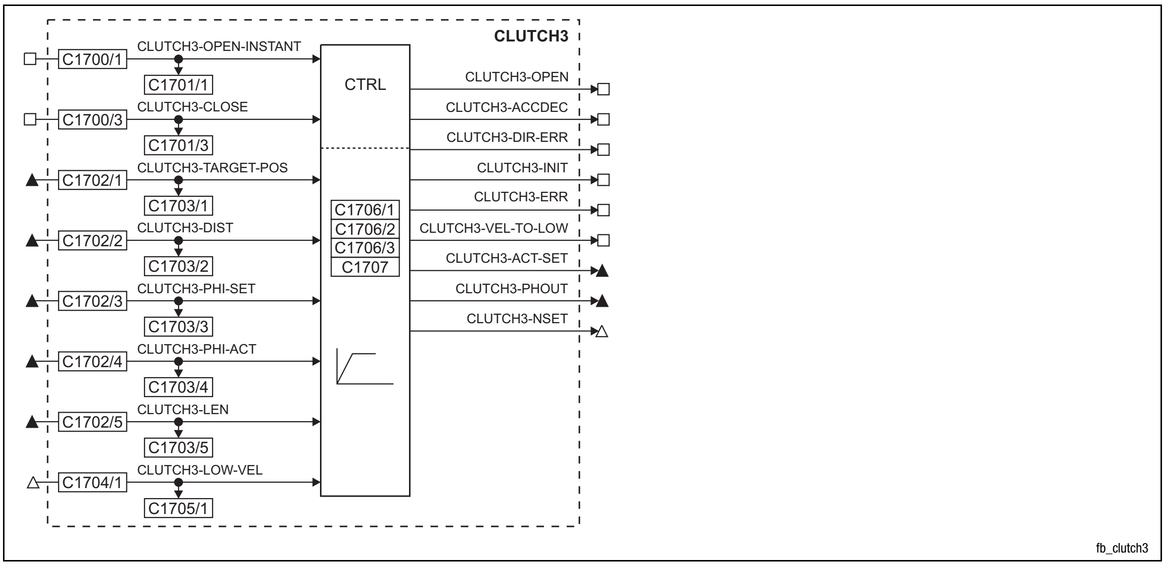


Fig. 3-61 Clutch (CLUTCH3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CLUTCH3-OPEN-INSTANT	d	C1701/1	bin	C1700/1	2	HIGH: Disengage immediately, reset fault messages
CLUTCH3-CLOSE	d	C1701/3	bin	C1700/3	2	HIGH: Close clutch LOW: Open clutch
CLUTCH3-TARGET-POS	ph	C1703/1	dec [inc]	C1702/1	3	Specification of the target position
CLUTCH3-DIST	ph	C1703/2	dec [inc]	C1702/2	3	Reserved
CLUTCH3-PHI-SET	ph	C1703/3	dec [inc]	C1702/3	3	Setpoint position of the external master angle
CLUTCH3-PHI-ACT	ph	C1703/4	dec [inc]	C1702/4	3	Actual position of the internal master angle
CLUTCH3-LEN	ph	C1703/5	dec [inc]	C1702/5	3	Clock pulse length (X axis)
CLUTCH3-LOW-VEL	phd	C1705/1	dec [rpm]	C1704/1	4	Specification of a minimum speed with which the internal master angle is to rotate after disengaging
CLUTCH3-OPEN	d				2	HIGH: Clutch disengaged LOW: Clutch engaged
CLUTCH3-ACC/DEC	d				2	HIGH: Signal at CLUTCH3-PHOUT and CLUTCH3-NSET is accelerated LOW: Signal at CLUTCH3-PHOUT and CLUTCH3-NSET is decelerated
CLUTCH3-DIR-ERR	d				2	HIGH: The input signals at CLUTCH3-PHI-SET and CLUTCH3-PHI-ACT have an opposite direction of rotation
CLUTCH3-INIT	d				2	Reserved
CLUTCH3-ERR	d				2	General error message from CLUTCH3 ● HIGH: The process of engaging the clutch has been started although the disengaging process had not yet been completed. ● The value 0 is applied at CLUTCH3-LEN.
CLUTCH3-VEL-TO-LOW	d				2	HIGH: The process of engaging the clutch cannot be carried out, as the speed at CLUTCH3-PHI-SET is $< 4\ \mathrm{min}^{-1}$
CLUTCH3-ACT-SET	ph				3	Differential signal between CLUTCH3-ACT-SET and CLUTCH3-PHI-SET if CLUTCH3-CLOSE is set = HIGH ● The differential signal corresponds to the distance of the internal master angle still be compensated until it runs synchronously with the external master angle.
CLUTCH3-PHOUT	ph				3	Output of the internal master angle position ● The signal refers to one machine clock pulse (CLUTCH3-LEN) ● The signal can be linked to CDATA-XIN. ● If the clutch is engaged, the external and internal master angles are running synchronously.
CLUTCH3-NSET	phd				4	Speed setpoint

Function

- Important notes (📖 3-93)
- Fault messages (📖 3-93)
- Disengage immediately (📖 3-93)
- Minimum speed after disengaging (📖 3-94)
- Time-controlled engaging (📖 3-95)
- Selection of the disengaging position (📖 3-96)
- Selection of the target position in the disengaged state (📖 3-97)
- Time-controlled disengaging in target position (📖 3-97)
- Time-controlled disengaging at the disengaging position (📖 3-99)
- Engaging the clutch at different positions of the external master angle (📖 3-100)
- Time-controlled engaging (📖 3-102)

3.2.24.1 Important notes

- A compensation function with an oversynchronous speed for engaging the clutch is not possible. This function can be implemented via the DFRFG function block.
- The following actions may only be carried out if the clutch is disengaged or engaged. During the process of engaging or disengaging the clutch, they will result in malfunctions.
  – Setting ramps in C1706/1 ... C1706/3
  – Altering clutch mode in C1707
  – Altering input value at CLUTCH3-DIST
  – Altering input value at CLUTCH3-LEN
  – Altering input value at CLUTCH3-LOW-VEL
  – Altering input value at CLUTCH3-TARGET-POS

3.2.24.2 Fault messages

If a fault occurs, the function block is automatically controlled to the status ”Declutch immediately“. The output CLUTCH3-PHOUT is directed to 0 at the ramp set in C1706/1.

Fault messages	**Cause**	**Remedy**	**Note**
CLUTCH3-DIR-ERR = HIGH	The master angles at CLUTCH3-PHI–SET and the actual angle at CLUTCH-PHI–ACT have an opposite direction of rotation.	• Apply signals with the same direction of rotation. • Check signal combination of the inputs. • Extend the speed window in C1708/1 if the master value is troubled or fluctuates.	Monitoring is only active during engaging the clutch.
CLUTCH3-ERR = HIGH	The process of engaging the clutch has been started although the declutching process had not yet been completed.	Wait until the declutching process is completed.	General error for requirements beyond the specification of the function block.
	The value 0 is applied at CLUTCH3-LEN.	Apply signal of the machine cycle or the register length. The value has to be > 0.	

- Fault messages are reset by CLUTCH3-OPEN-INSTANT = HIGH.

3.2.24.3 Disengaging immediately

Description

You can use the function for disengaging under normal operating conditions or for disengaging in the case of a fault.

Function sequence

- Start disengaging with CLUTCH3-OPEN-INSTANT = HIGH.
- The output CLUTCH3-PHOUT is directed immediately to the speed at CLUTCH3-LOW-VEL along the ramp set in C1706/1.
- In the case of speed variations at CLUTCH3-LOW-VEL, the output CLUTCH3-PHOUT is corrected along the ramp.

3.2.24.4 Minimum speed after disengaging

Description

For printing units, the drive may not be brought into standstill after disengaging, because the paint dries up. The printing unit has to continue rotating at a minimum speed.

Function sequence

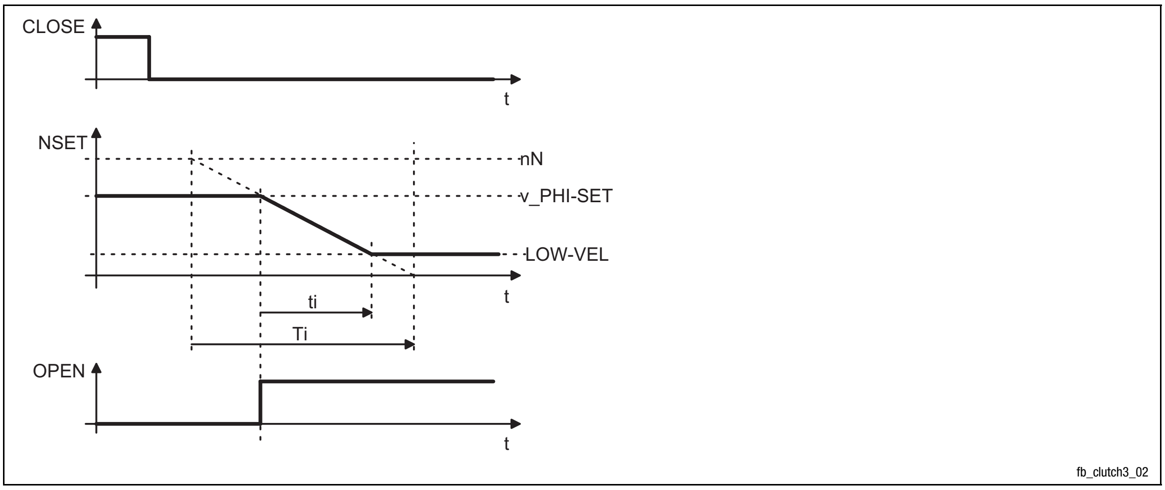


Fig. 3-62 Path-time diagram: Disengaging process

v_PHI-SET	Speed of the external master angle at CLUTCH3-PHI-SET
nN	Machine speed
NSET	Speed setpoint at CLUTCH3-NSET
LOW-VEL	The minimum speed which is taken up after disengaging is specified at CLUTCH3-LOW-VEL.
CLOSE	With CLUTCH3-CLOSE = LOW, the declutching process is started. After disengaging, all ramps are deactivated. In the case of speed variations at CLUTCH3-LOW-VEL, the output CLUTCH3-NSET is directly corrected.

3.2.24.5 Time-controlled engaging

Description

The engaging distance (acceleration distance), the start position and sync position result from the acceleration time Ti (C1706/3) or the deceleration time Ti (C1706/2) and from the speeds at CLUTCH3-PHI-SET and CLUTCH3-PHI–ACT.

The acceleration acts in accordance with the time Ti and therefore is independent of the machine speed.

The engaging distance depends on the machine speed. If the speed is high, the engaging distance and the duration of the asynchronism is longer than for a lower speed.

Function sequense

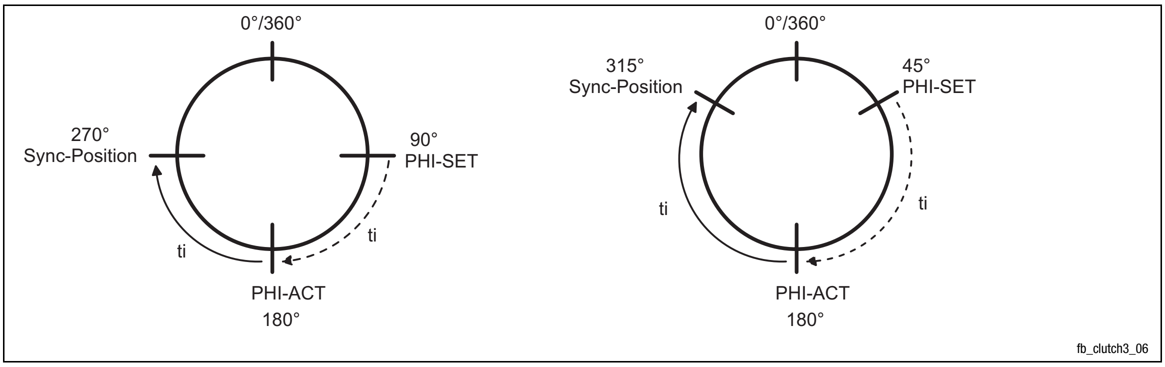


Fig. 3-63 Angle diagrams: Two clutch-engagement processes with different speeds

The two angle diagrams show two clutch-engagement processes at the start of synchronising with equal acceleration times Ti (C1706/3), but with different machine speeds. From this, different engaging distances result.

Engaging process for the angle diagram on the right:

- The internal master angle (PHI-ACT) is at 180 ° with a speed of 0 min^{-1}.
- On the basis of the Ti-time set and the speed of the external master angle (PHI-SET), an acceleration distance of 135 ° results.
- After the acceleration distance of 135 °, PHI-SET crosses the starting position and the process of engaging the clutch is automatically initiated if CLUTCH3-CLOSE = HIGH.
- In the sync position, PHI-SET and PHI-ACT are running synchronously with regard to speed and angle (position).
  – From the start position to the sync position, PHI-SET covers twice the distance of PHI-ACT.

Calculation of the ramps

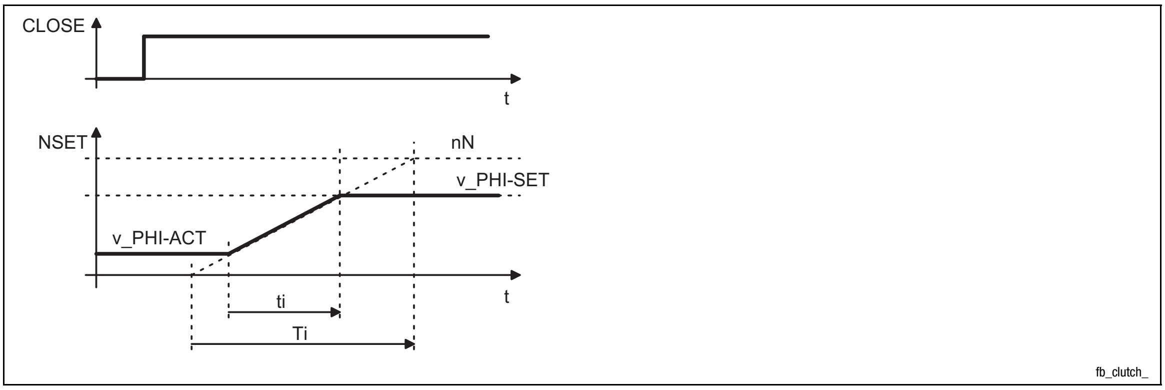


Fig. 3-64 Path-time diagram: Time-controlled engaging

$$ti = \frac{Ti \cdot nN}{(v\_PHI\text{-}SET - v\_PHI\text{-}ACT)}$$

ti	Actual duration of the process of engaging the clutch
Ti	Acceleration time of the ramp in C1706/3 for the clutch-engaging, relating to a speed variation from 0 to the machine speed nN
v_PHI-SET	Speed of the external master angle
v_PHI-ACT	Minimum speed at CLUTCH3-LOW-VEL (in the disengaged state, v_PHI-ACT is = CLUTCH3-LOW-VEL)

3.2.24.6 Selection of the disengaging position

Description

The disengaging position is specified if an operation has to be completed before the disengaging process may be initiated.

Function procedure

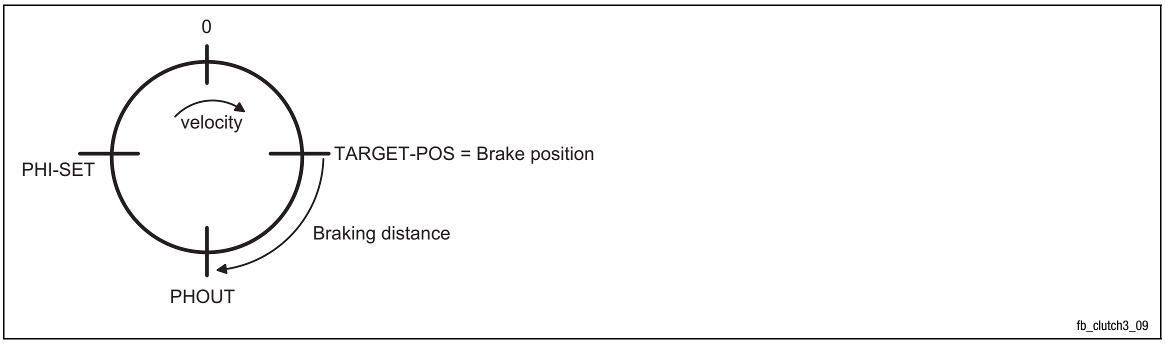


Fig. 3-65 Angle diagram: Disengaged status at zero speed

The internal master angle (PHOUT) is running synchronously to the external master angle (PHI-SET) until the position at CLUTCH3-TARGET-POS is crossed. Then drive is decelerated to the speed at CLUTCH3-LOW-VEL.

Adjustment

- Set C1707 = 1.
- Define the disengaging position at CLUTCH3-TARGET-POS.
- Start the disengaging process with CLUTCH3-CLOSE = LOW.

3.2.24.7 Selection of the target position in the disengaged state

Description

The target position is specified if the drive has to be set to a specific position in the disengaged state.

As the internal master angle corresponds to the target position, the tool position can be derived from the internal master angle.

Function sequence

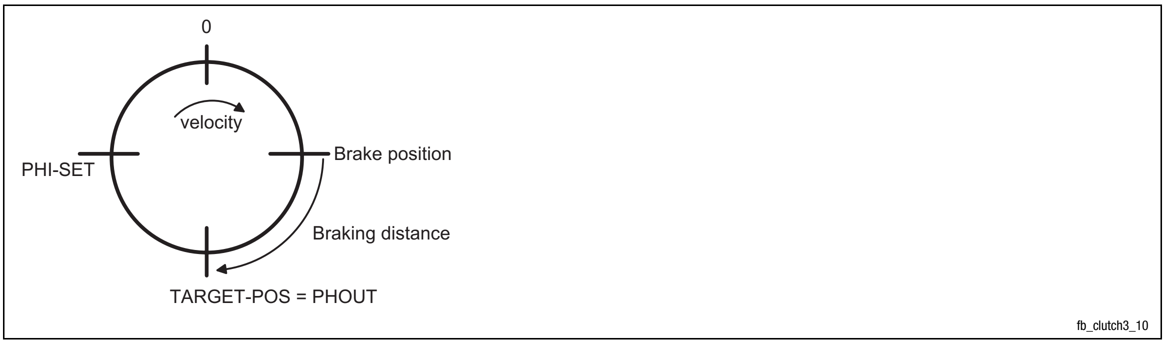


Fig. 3-66 Angle diagram: Disengaged status at zero speed

- The internal master angle (PHOUT) is running synchronously to the external master angle (PHI-SET) until the braking position has been crossed.
  - The braking position always is before the target position.
- If the braking position is crossed, the drive is celerated to the speed at CLUTCH3-LOW-VEL.
  - If CLUTCH3-LOW-VEL = 0, the internal master angle is exactly on the target position.

Adjustment

- Set C1707 = 0.
- Define the target position at CLUTCH3-TARGET-POS.
- Start the disengaging process with CLUTCH3-CLOSE = LOW.

3.2.24.8 Time-controlled disengaging in target position

Description

The function is required for applications with material transfer (e.g. placing caps on the bottles and screwing them).

If there are no bottles in the machine, no caps may be feeded. The cap feed is disengaged for one or several machine pulses, until bottles are available again. If disengaging is to be carried out, it may only be started with the following machine pulse. In the disengaged state, the cap feed has to be in a defined target position.

Function sequence

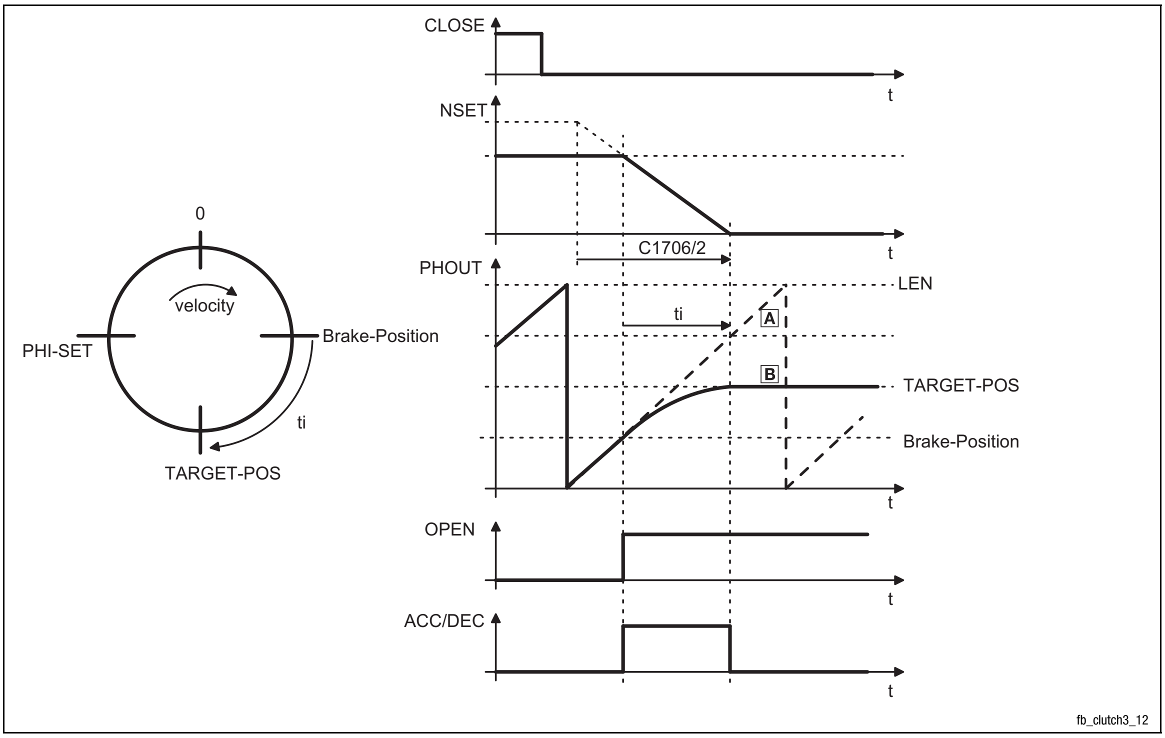


Fig. 3-67 Angle diagram and path-time diagram: Time-controlled disengaging in target position

A	External master angle at CLUTCH3-PHI-SET
B	Internal master angle at CLUTCH3-PHI-ACT
PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET after completion of the disengaging process
TARGET-POS	Target position specified at CLUTCH3-TARGET-POS
OPEN	If CLUTCH3-OPEN switches to HIGH, the clutch is disengaged
ACC/DEC	During the disengaging process, CLUTCH3-ACC/DEC = HIGH

- The internal master angle (PHOUT) synchronically follows the master value to the brake position. At the brake position the braking process is started.
  - The brake position is automatically calculated from the deceleration time Ti.
  - The brake position is variable and depends on the current machine speed.
- If the target position is reached, the braking process is completed.
- If CLUTCH3-LOW-VEL = 0, the internal master angle (PHOUT) is 0 at the target position.

Adjustment

- Set C1707 = 0.
- Define the target position at CLUTCH3-TARGET-POS.
- Set the deceleration time Ti [s] in C1706/2.
- Define the external master angle at CLUTCH3-PHI-SET.

3.2.24.9 Time-controlled disengaging at disengaging position

Description

In the case of printing machines, the last process (printing) must be completed before the tool or the drive may be disengaged.

Function sequence

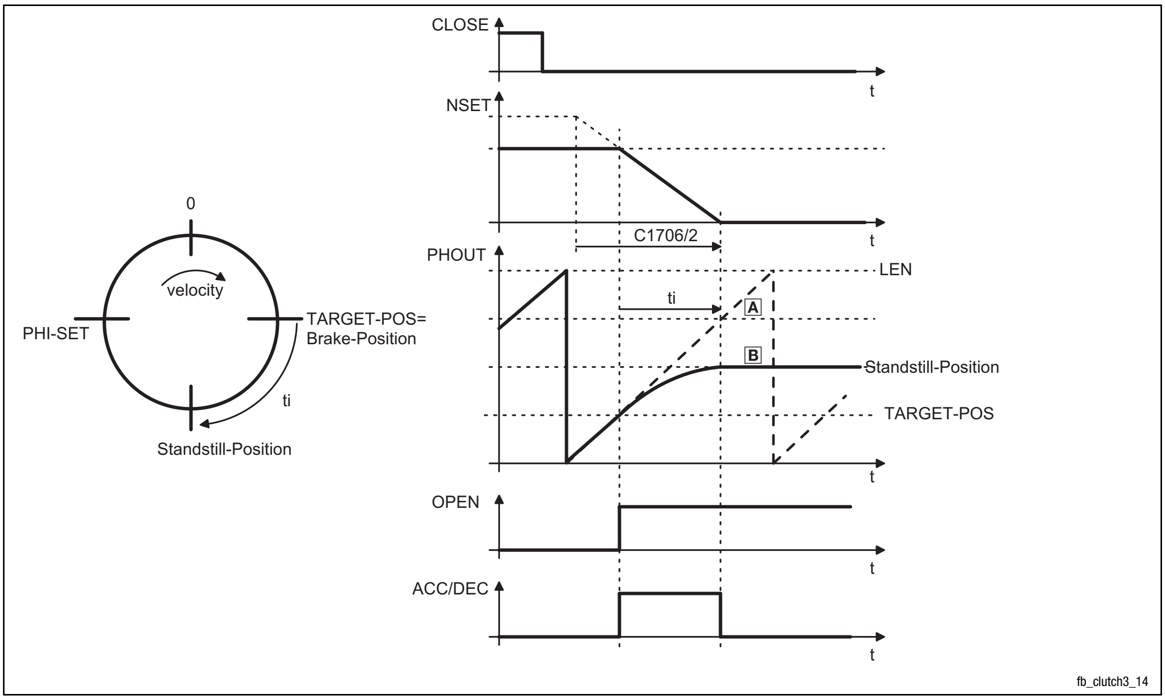


Fig. 3-68 Angle diagram and path-time diagram: Time-controlled disengaging at disengaging position

A	External master angle at CLUTCH3-PHI-SET
B	Internal master angle at CLUTCH3-PHI-ACT
PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET after completion of the disengaging process
TARGET-POS	Disengaging position specified at CLUTCH3-TARGET-POS
OPEN	If CLUTCH3-OPEN switches to HIGH, the clutch is disengaged
ACC/DEC	During the disengaging process, CLUTCH3-ACC/DEC = HIGH

- The external master angle (PHI-SET) and the internal master angle (PHOUT) run synchronously until the disengaging position is reached.
- If the external master angle (PHI-SET) crosses the disengaging position, the braking process is initiated.
- The position of the internal master angle (PHOUT) results from the deceleration time Ti and the machine speed.
- If CLUTCH3-LOW-VEL = 0, the internal master angle (PHOUT) is placed on the standstill position (PHOUT = 0), when the disengaging position has been crossed and the braking distance (DIST) has been travelld.

Adjustment

- Set C1707 = 1.
- Define the disengaging position at CLUTCH3-TARGET-POS.
- Set the deceleration time Ti [s] in C1706/2.
- Define the external master angle at CLUTCH3-PHI-SET.

3.2.24.10 Engaging the clutch at to different positions of the external master angle

Description

Engaging the clutch is effected by an advancing internal master angle (PHOUT). The required acceleration distance of the internal master angle (PHOUT) is automatically calculated from the machine speed and the acceleration time Ti. Thus the next possible start position is determined. Simultaneously the sync position results from this, from which the internal master angle (PHOUT) runs synchronously to the external master angle (PHI-SET). With CLUTCH3-CLOSE = HIGH, the engaging prcess is started. If the external master angle at CLUTCH3-PHI-SET crosses the start position, synchronising is started.

Engaging the clutch if the external master angle PHI-SET is before the start position

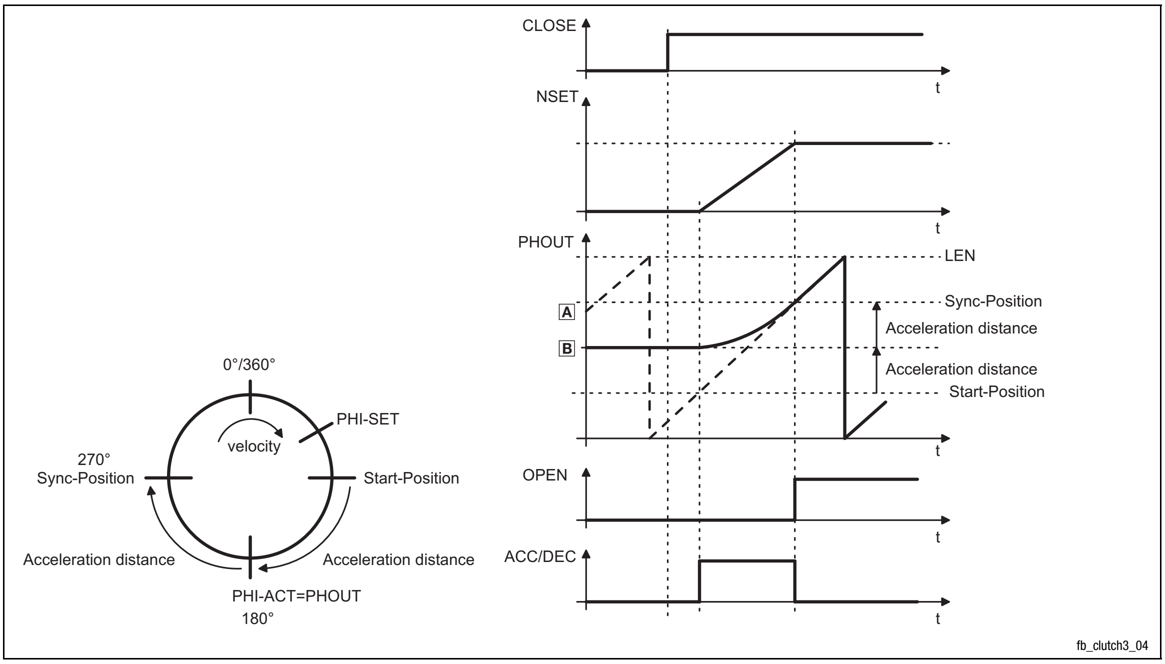


Fig. 3-69 Angle diagram and path-time diagram: Engaging the clutch if the external master angle is before the start position

A	External master angle at CLUTCH3-PHI-SET
B	Internal master angle at CLUTCH3-PHI-ACT
PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET at the start of the engaging process (CLUTCH3-CLOSE = HIGH)
PHI-ACT	Position of the internal master angle at CLUTCH3-PHI-ACT at the start of the engaging process (CLUTCH3-CLOSE = HIGH)
Start position	Position of the external master angle at which synchronising is initiated
Sync position	Position from which the external and internal master angles run synchronously
OPEN	If CLUTCH3-OPEN switches to HIGH, the clutch is engaged
ACC/DEC	During the process of engaging the clutch, CLUTCH3-ACC/DEC = HIGH

If CLUTCH3-CLOSE = HIGH, the external master angle is befor the start position calculated. The process of engaging the clutch is initiated during this clock pulse.

The internal master angle has to be synchronised to the external master angle with regard to position and angle. The external master angle runs at a constant speed. During the process of engaging the clutch, the internal master angle covers the ”Acceleration distance” to the sync position. The external master angle covers the ”Acceleration distance” twice.

Engaging the clutch if the external master angle PHI-SET is behind the start position

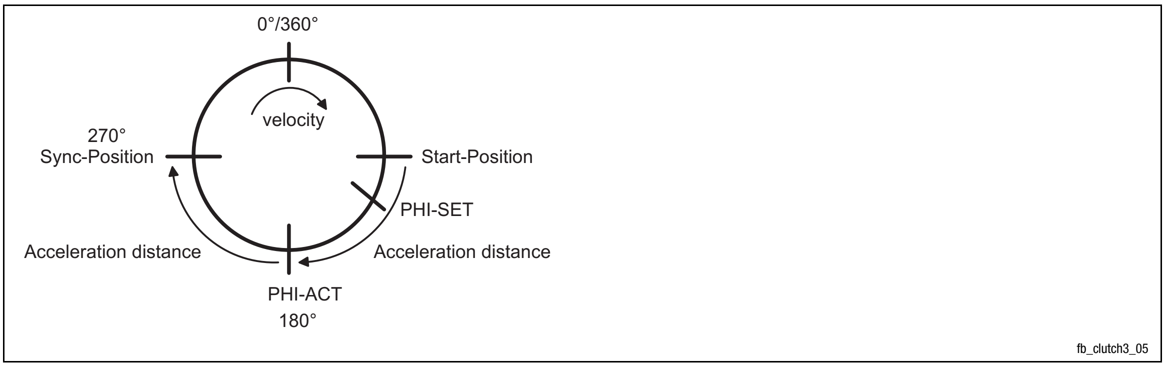


Fig. 3-70 Angle diagram: Engaging the clutch with external master angle being the calculated start position

PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET at the start of the process of engaging the clutch (CLUTCH3-CLOSE = HIGH)
PHI-ACT	Position of the internal master angle at CLUTCH3-PHI-ACT at the start of the process of engaging the clutch (CLUTCH3-CLOSE = HIGH)
Start position	Position at which synchronising is initiated
Sync position	Position from which the external and internal master angles run synchronously

If CLUTCH3-CLOSE = HIGH, the external master angle is behind the start position calculated. The process of engaging the clutch is not started in this clock pulse. It automatically starts in the next clock, if CLUTCH3-CLOSE remains = HIGH.

3.2.24.11 Time-controlled engaging

Function sequence

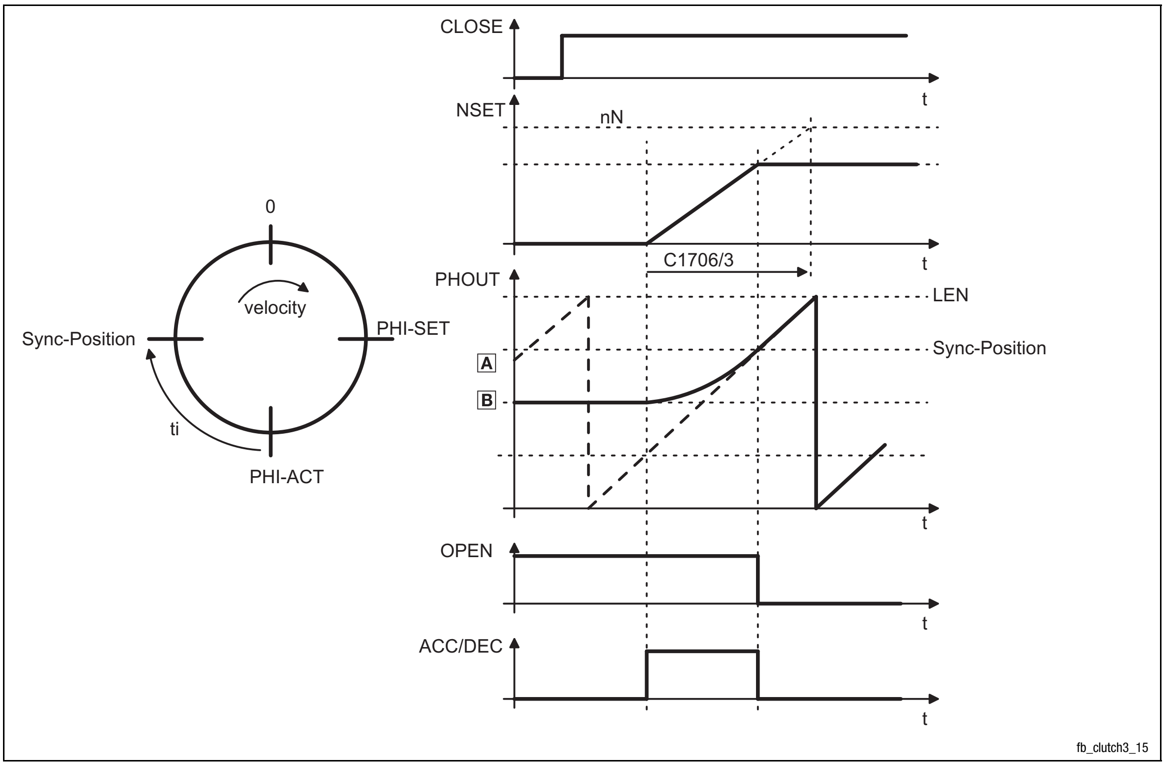


Fig. 3-71 Angle diagram and path-time diagram: Time-controlled engaging

A	External master angle at CLUTCH3-PHI-SET
B	Internal master angle at CLUTCH3-PHI-ACT
PHI-SET	Position of the external master angle at CLUTCH3-PHI-SET at the start of synchronising
PHI-ACT	Position of the internal master angle at CLUTCH3-PHI-ACT at the start of synchronising
Start position	Position of the external master angle at which synchronising is initiated
Sync position	Position from which the external and internal master angles run synchronously
OPEN	If CLUTCH3-OPEN switches to LOW, the clutch is engaged
ACC/DEC	During the process of engaging the clutch, CLUTCH3-ACC/DEC = HIGH

- The sync position is calculated from the acceleration (C1706/3) and the speed of the external master angle. From this, also the start position results.
- From the sync position, the external and internal master angles are synchronous with regard to speed and angle (position).

Adjustment

- Set C1707 = 0 or C1707 = 1. The process of engaging the clutch is the same for both modes.
- Set the desired acceleration in C1706/3.

3.2.25 Comparator (CMP)

Purpose

These FBs serve to compare two analog signals. Three comparators are available which serve to implement triggers.

CMP1

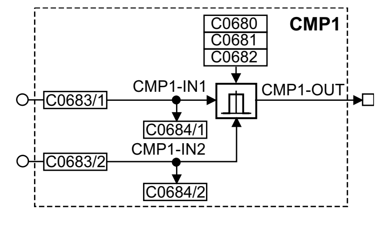


Fig. 3-72 Comparator (CMP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP1-IN1	a	C0684/1	dec [%]	C0683/1	1	5001	-
CMP1-IN2	a	C0684/2	dec [%]	C0683/2	1	19500	-
CMP1-OUT	a	-	-	-	-	-	-

CMP2

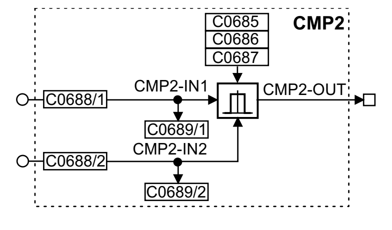


Fig. 3-73 Comparator (CMP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP2-IN1	a	C0689/1	dec [%]	C0688/1	1	1000	-
CMP2-IN2	a	C0689/2	dec [%]	C0688/2	1	1000	-
CMP2-OUT	a	-	-	-	-	-	-

CMP3

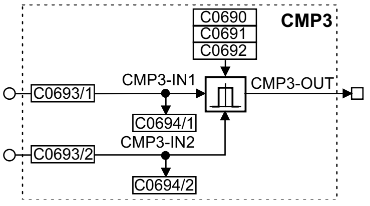


Fig. 3-74 Comparator (CMP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CMP3-IN1	a	C0694/1	dec [%]	C0693/1	1	1000	-
CMP3-IN2	a	C0694/2	dec [%]	C0693/2	1	1000	-
CMP3-OUT	a	-		-	-	-	-

Function

The description uses the example of CMP1 and also applies to CMP2 and CMP3.

The function of these function blocks can be set via code C0680 (CMP1). The following comparison operations are available:

- CMP1-IN1 = CMP1-IN2
- CMP1-IN1 > CMP1-IN2
- CMP1-IN1 < CMP1-IN2
- |CMP1-IN1| = |CMP1-IN2|
- |CMP1-IN1| > |CMP1-IN2|
- |CMP1-IN1| < |CMP1-IN2|

3.2.25.1 Function 1: CMP1-IN1 = CMP1-IN2

This function serves to compare two signals with regard to equality. Hence, the comparison ”actual speed equals setpoint speed ($n_{act} = n_{set}$)” can be carried out.

- Via code C0682 the window of equality can be set.
- Via code C0681 a hysteresis can be set if the input signals are not stable and cause the output to oscillate.

The exact function can be obtained from the line diagram.

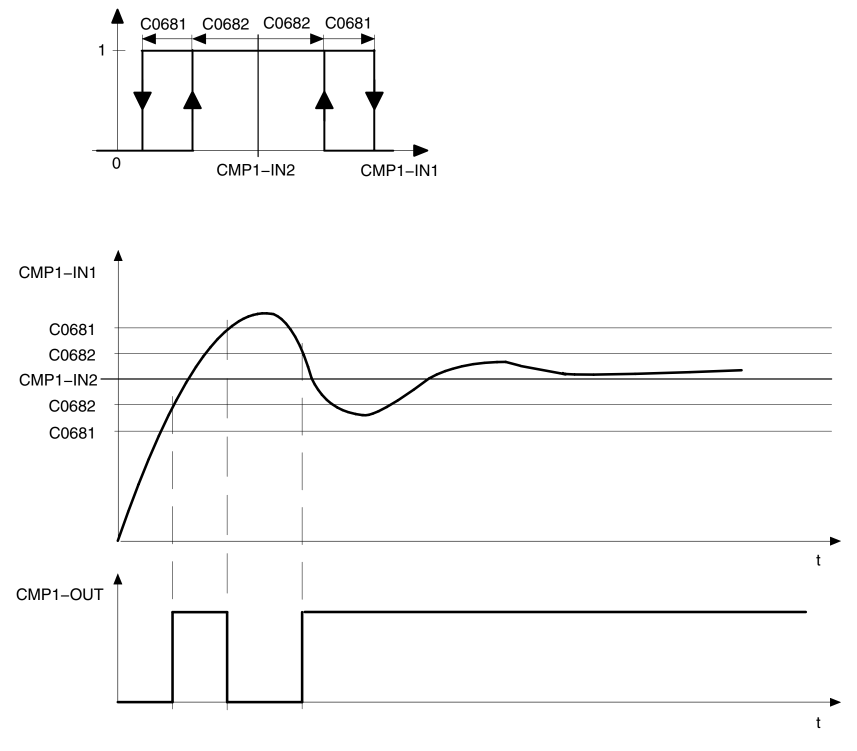


Fig. 3-75 Equality of signals (CMP1-IN1 = CMP1-IN2)

3.2.25.2 Function 2: CMP1-IN1 > CMP1-IN2

This function is used, for example, to implement the comparison ”Actual speed is higher than a limit value ($n_{act} > n_x$)” for a direction of rotation.

- If the value at input CMP1-IN1 exceeds the value at input CMP1-IN2, the output CMP1-OUT changes from LOW to HIGH.
- Only if the signal at input CMP1-IN1 falls below the value of CMP1-IN2 - C0681 again, the output changes from HIGH to LOW.

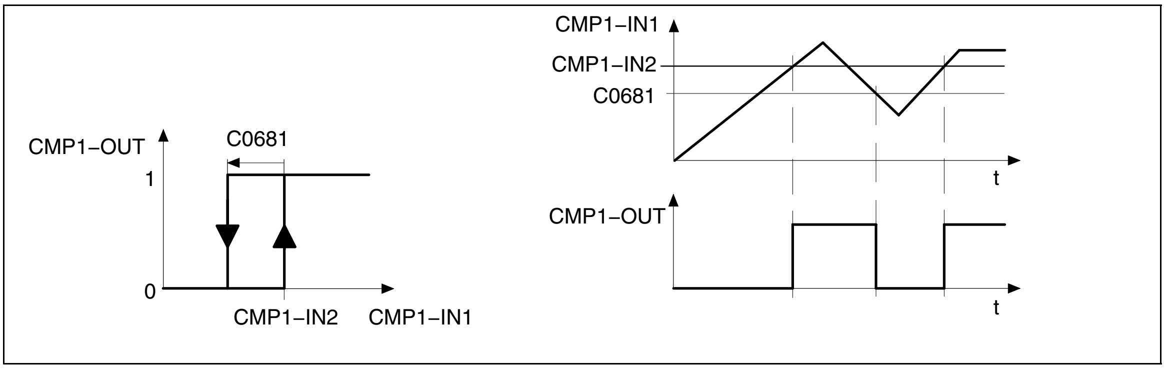


Fig. 3-76 Exceeding signal values (CMP1-IN1 > CMP1-IN2)

3.2.25.3 Function 3: CMP1-IN1 < CMP1-IN2

This function is used, for example, to implement the comparison ”Actual speed is lower than a limit value ($n_{act} < n_x$)” for a direction of rotation.

- If the value at input CMP1-IN1 falls below the value at input CMP1-IN2, the output CMP1-OUT changes from LOW to HIGH.
- Only if the signal at input CMP1-IN1 exceeds the value of CMP1-IN2 - C0681 again, the output changes from HIGH to LOW.

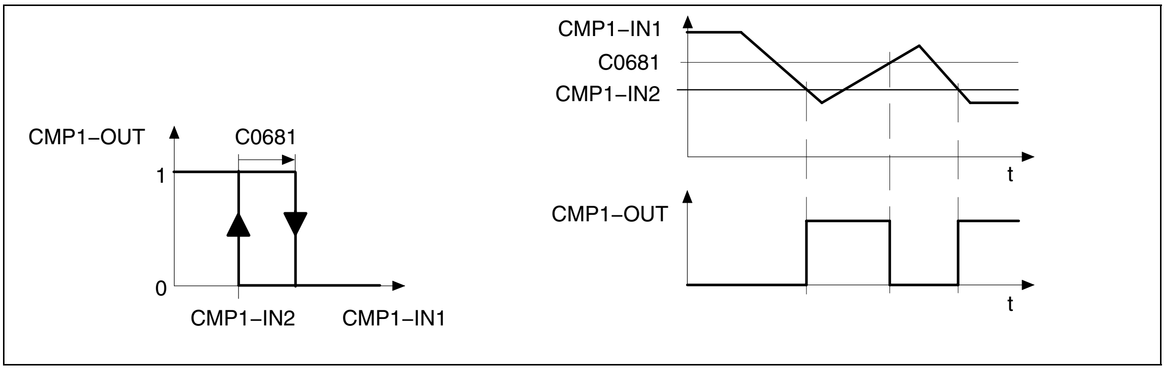


Fig. 3-77 Values falling below signal values (CMP1-IN1 CMP1-IN2)

3.2.25.4 Function 4: |CMP1-IN1| = |CMP1-IN2|

This function is the same as function 1. Before signal processing the absolute value of the input signals (without sign) is generated.

This can be used to implement the comparison ”$n_{act} = 0$”.

3.2.25.5 Function 5: |CMP1-IN1| > |CMP1-IN2|

This function is the same as function 3. Before signal processing the absolute value of input signals (without sign) is generated.

This can be used to implement the comparison ”$|n_{act}| > |n_x|$” irrespective of the direction of rotation.

3.2.25.6 Function 6: |CMP1-IN1| < |CMP1-IN2|

This function is the same as function 2. Before signal processing the absolute value of input signals (without sign) is generated.

This can be used to implement the comparison ”$|n_{act}| < |n_x|$” irrespective of the direction of rotation.

3.2.26 Signal conversion (CONV)

Purpose

These function blocks can be used to standardize signals or signal types or to convert signal types into different signal types.The conversion is very precise by providing the conversion factor as numerator and denominator.

CONV1

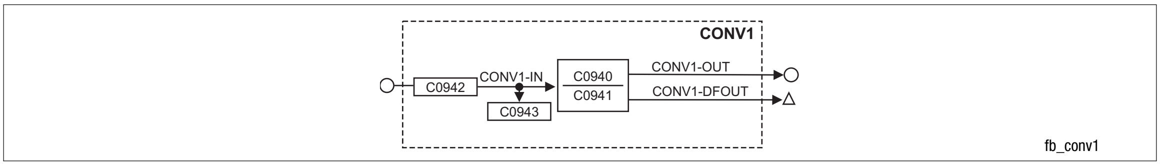


Fig. 3-78 Function block CONV1

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV1-IN	a	C0943	dec [%]	C0942	1	1000	
CONV1-OUT	a	-	-	-	-	-	Limited to ±199.99 %
CONV1-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to multiply or divide analog signals.

$$\text{CONV1-OUT} = \text{CONV1-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0940}}{\text{C0941}}$$

or

$$\text{CONV1-DFOUT} = \text{CONV1-IN} \cdot \frac{\text{C0940}}{\text{C0941}} \quad [rpm]$$

Example:

An analog signal is to be multiplied by 1.12.
For this, enter C0940 = 112 and C0941 = 100.

CONV2

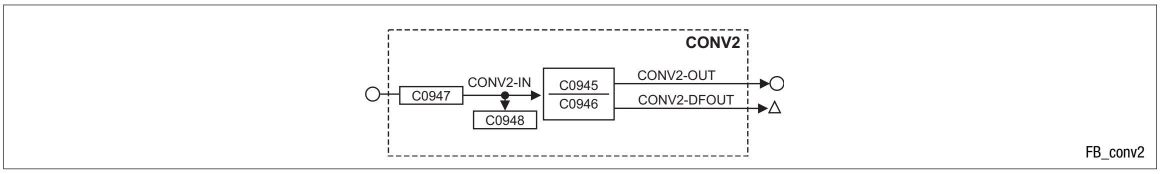


Fig. 3-79 Function block CONV2

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV2-IN	a	C0948	dec [%]	C0947	1	1000	
CONV2-OUT	a	-	-	-	-	-	Limited to ±199.99 %
CONV2-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to multiply or divide analog signals.

Conversion according to formula:

$$\text{CONV2-OUT} = \text{CONV2-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0945}}{\text{C0946}}$$

or

$$\text{CONV2-DFOUT} = \text{CONV2-IN} \cdot \frac{\text{C0945}}{\text{C0946}} \quad [rpm]$$

CONV3

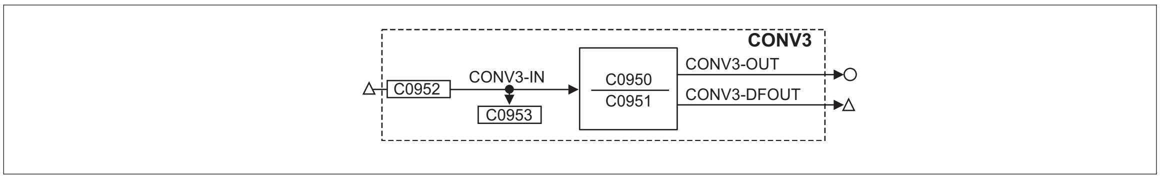


Fig. 3-80 Function block CONV3

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV3-IN	phd	C0953	dec [rpm]	C0952	4	1000	
CONV3-OUT	a	-	-	-	-	-	Limited to ±199.99 %
CONV3-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert speed signals into analog signals.

Conversion according to formula:

$$\text{CONV3-OUT} = \text{CONV3-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

or

$$\text{CONV3-DFOUT} = \text{CONV3-IN} \cdot \frac{\text{C0950}}{\text{C0951}} \quad [rpm]$$

CONV4

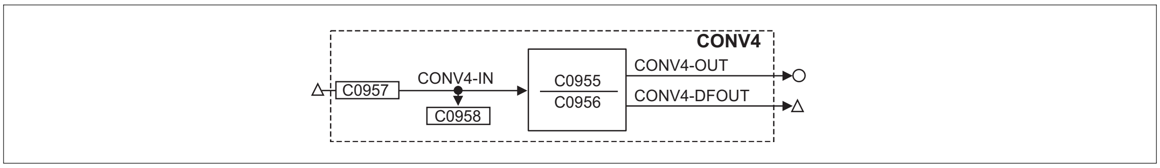


Fig. 3-81 Function block CONV4

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV4-IN	phd	C0958	dec [rpm]	C0957	4	1000	
CONV4-OUT	a	-	-	-	-	-	Limited to ±199.99 %
CONV4-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert speed signals into analog signals.

Conversion according to formula:

$$\text{CONV4-OUT} = \text{CONV4-IN} \cdot \frac{100\,\%}{15000\,\text{rpm}} \cdot \frac{\text{C0955}}{\text{C0956}}$$

or

$$\text{CONV4-DFOUT} = \text{CONV3-IN} \cdot \frac{\text{C0955}}{\text{C0956}} \quad [rpm]$$

CONV5

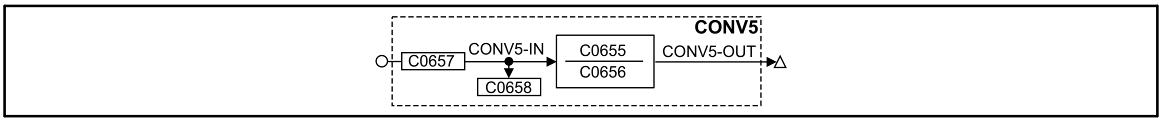


Fig. 3-82 Function block CONV5

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV5-IN	a	C0658	dec [%]	C0657	1	1000	
CONV5-OUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\text{CONV5-OUT} = \text{CONV5-IN} \cdot \frac{15000\,\text{rpm}}{100\,\%} \cdot \frac{\text{C0655}}{\text{C0656}}$$

CONV6

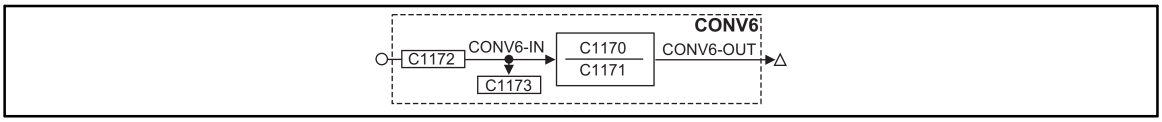


Fig. 3-83 Function block CONV6

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV6-IN	a	C1173	dec [%]	C1172	1	1000	
CONV6-OUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\text{CONV6-OUT} = \text{CONV6-IN} \cdot \frac{15000\,\text{rpm}}{100\,\%} \cdot \frac{\text{C1170}}{\text{C1171}}$$

CONV7

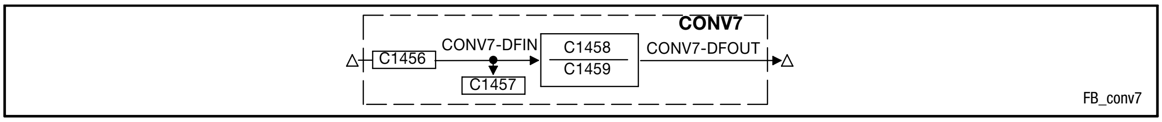


Fig. 3-84 Function block CONV7

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONV7-DFIN	phd	C1457	dec [%]	C1456	1	1000	
CONV7-DFOUT	phd	-	-	-	-	-	Limited to ±29999 rpm

This function block is used to convert analog signals into speed signals.

Conversion according to formula:

$$\boxed{\text{CONV7-DFOUT} = \text{CONV7-DFIN} \cdot \frac{\text{C1458}}{\text{C1459}} \qquad [\,rpm\,]}$$

3.2.27 Analog/digital converter (CONVAD)

Conversion of an analog value into individual digital signals.

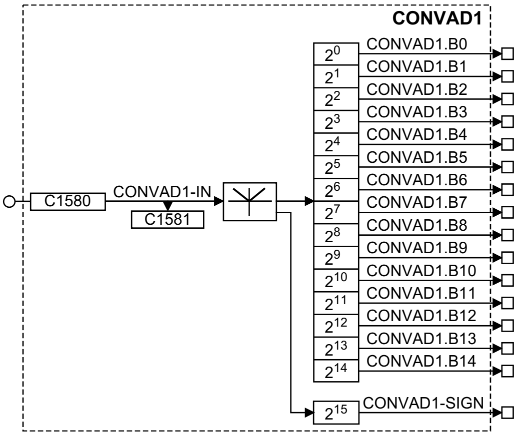


Fig. 3-85 Analog/digital converter (CONVAD1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAD1-IN	a	C1581	dec	C1580	1	-
CONVAD1.B0 ... B14	d	-	-	-	-	-
CONVAD1-SIGN	d	-	-	-	-	Sign digit

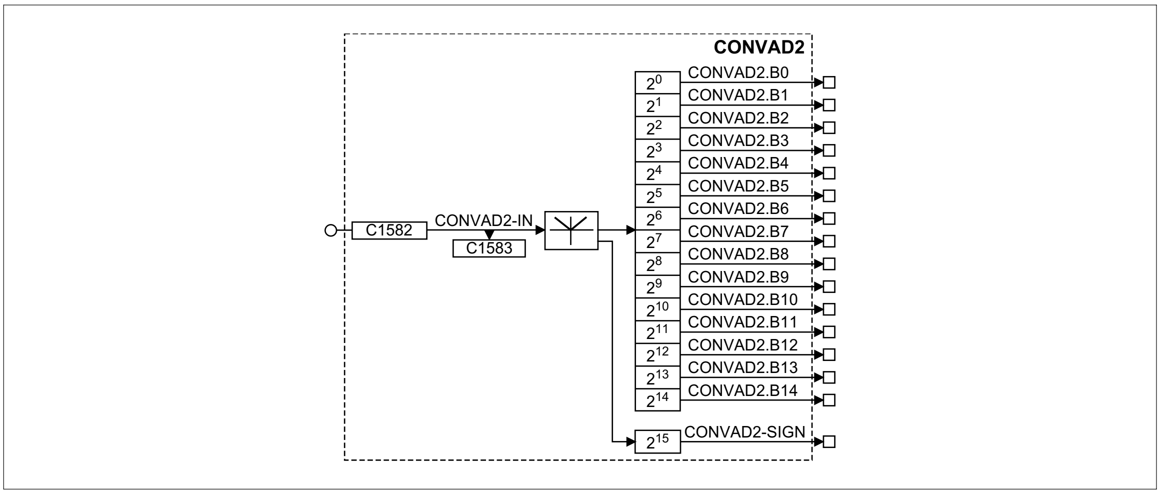


Fig. 3-86 Analog/digital converter (CONVAD2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAD2IN	a	C1583	dec	C1582	1	-
CONVAD2.B0 ... B14	d	-	-	-	-	-
CONVAD2-SIGN	d	-	-	-	-	Sign digit

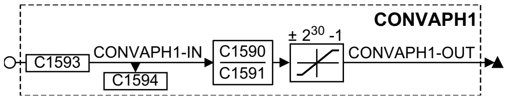
Function

- Represents the analog value as 16-bit binary word.
- Every binary digit is assigned to a digital output.
- The 16th bit (2^{15}) is the sign digit indicating whether it is a positive or negative analog value.

3.2.28 Analog/angle converter (CONVAPH)

Conversion of an analog value into a angle signal.

CONVAPH1



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH1-IN	a	C1594	dec	C1593	1	-
CONVAPH1-OUT	ph	-	-	-	-	Limited to $\pm 2^{30}$-1

Function

- Conversion with adaptation through multiplier and divisor.
- Conversion according to formula:

$$\text{CONVAPH1–OUT} = \text{CONVAPH1–IN} \cdot \frac{\text{C1590}}{\text{C1591}} \cdot \frac{16384}{100\%}$$

3.2.29 Angle conversion (CONVPHA)

Purpose

- Converts a angle signal into an analog signal

or

- converts a angle difference signal into a speed signal.

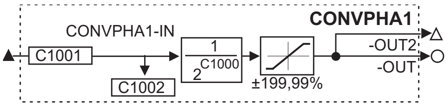


Fig. 3-87 Angle conversion (CONVPHA1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA1-IN	ph	C1002	dec [inc]	C1001	3	-
CONVPHA1-OUT	a	-	-	-	-	Limited to ±199.99 %, remainder considered
CONVPHA1-OUT2	phd	-	-	-	-	Limited to ±32767 rpm, remainder considered

Function

- Conversion with adaptation using a divisor.
- Conversion according to formula:

$$\text{CONVPHA1-OUT [\%]} = \text{CONVPHA1-IN [inc]} \cdot \frac{100}{2^{14} \cdot 2^{C1000}}$$

$$\text{CONVPHA1-OUT2 [rpm]} = \text{CONVPHA1-IN [inc]} \cdot \frac{15000}{2^{14} \cdot 2^{C1000}}$$

$$\text{CONVPHA1-OUT2 [inc]} = \text{CONVPHA1-IN [inc]} \cdot \frac{1}{2^{C1000}}$$

CONVPHA2

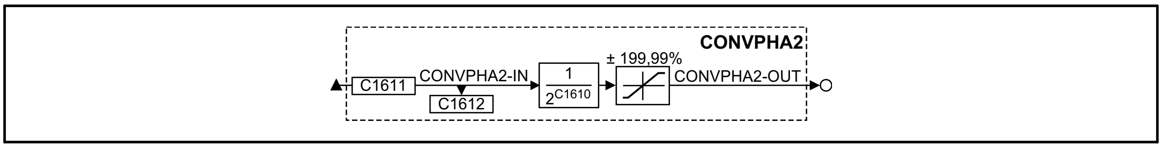


Fig. 3-88 Function block CONVPHA2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA2-IN	ph	C1612	dec [inc]	C1611	3	-
CONVPHA2-OUT	a	-	-	-	-	Limited to ±199.99 %, remainder not considered

Function

- Conversion with adaptation using divisor.
- Conversion according to formula:

$$\text{CONVPHA2–OUT} = \text{CONVPHA2–IN} \cdot \frac{1}{2^{\text{C1610}}} \cdot \frac{100\%}{16384}$$

CONVPHA3

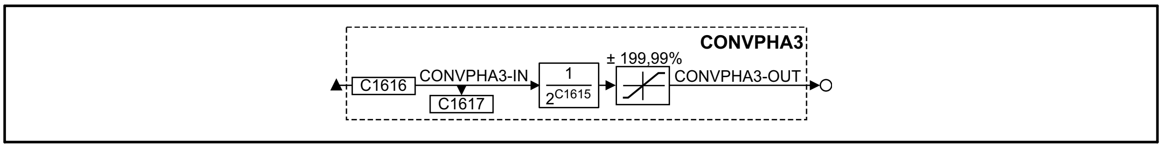


Fig. 3-89 Function block CONVPHA3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA3-IN	ph	C1617	dec [inc]	C1616	3	-
CONVPHA3-OUT	a	-	-	-	-	Limited to ±199.99 %, remainder not considered

Function

- Conversion with adaptation using divisor.
- Conversion according to formula:

$$\text{CONVPHA3–OUT} = \text{CONVPHA3–IN} \cdot \frac{1}{2^{C1615}} \cdot \frac{100\%}{16384}$$

3.2.30 Position signal conversion (CONVPHAA)

Purpose

Simultaneous transfer of two position signals by means of a CAN object.

CONVPHAA1

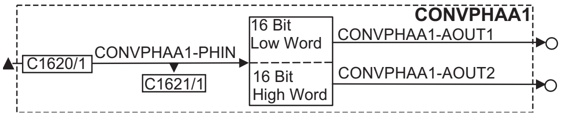


Fig. 3-90 Angle conversion (CONVPHAA1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHAA1-PHIN	ph	C1621/1	[inc]	C1620/1		-
CONVPHAA1-AOUT1	a	-	-	-	-	Low word (16 bits)
CONVPHAA1-AOUT2	a	-	-	-	-	High word (16 bits)

Function

The input signal is divided into a low word and a high word with 16 bits each.

The corresponding output signal can be processed as a position signal.

CONVPHAA2

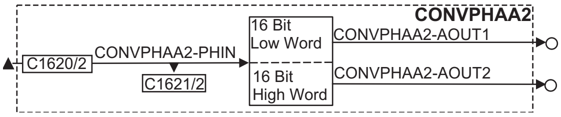


Fig. 3-91 Function block CONVPHAA2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHAA2-PHIN	ph	C1621/2	[inc]	C1620/2		-
CONVPHAA2-AOUT1	a	-	-	-	-	Low word
CONVPHAA2-AOUT2	a	-	-	-	-	High word

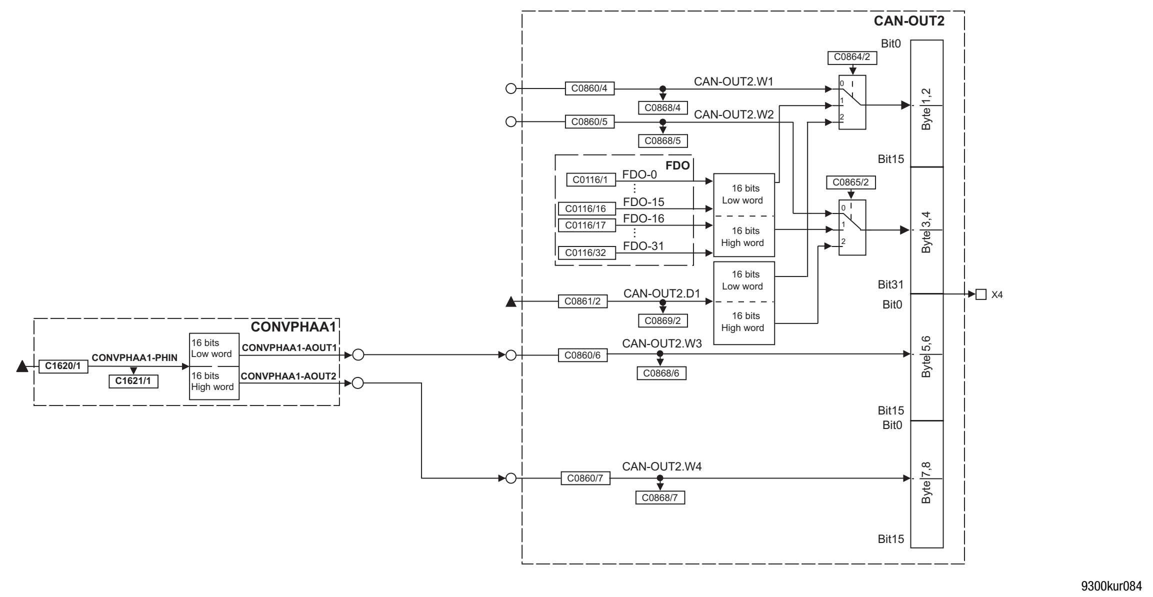
Function

The input signal is divided into a low word and a high word with 16 bits each.

The corresponding output signal can be processed as a position signal.

Use

If you want to transfer two position signals at the same time, the function block CONVPHAA1 or CONVPHAA2 must be linked with the CAN object (e.g. CAN-OUT2) as follows:



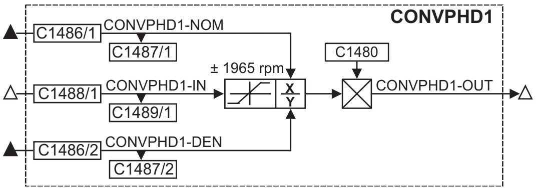
9300kur084

3.2.31 Conversion of stretch factor (CONVPHD)

One function block (CONVPHD1) is available.

Purpose

- Exact adaptation of the incremental encoder
- CONVPHD1 for the adjustment of the stretch factor via freely configurable inputs



Signal				Source		Note
Name	Type	DIS/selection	DIS format	CFG	List	
CONVPHD1-DEN	ph	1487/2	dec [inc]	1486/2	3	Stretch factor denominator, input limited to +1 to +200000000
CONVPHD1-IN	phd	1489/1	dec [inc]	1488/1	4	The input is limited to ±1965 rpm
CONVPHD1-NOM	ph	1487/1	dec [inc]	1486/1	3	Stretch factor numerator, input limited to ±1 to ±200000000
CONVPHD1-OUT	phd		-	-	-	Output in rpm

Function

- Function block interconnection
- Encoder settings increments of one
- Stretch factor setting over 6 decades

3.2.31.1 Function block interconnection

The function block is connected directly after the digital frequency input DFIN.

STOP!

The DFIN code C0425 must be set to selection 6 to evaluate the encoder signals correctly.

3.2.31.2 Encoder adaptation

The encoder is adapted to the controller using the freely adjustable encoder constants

- C1480 in CONVPHD1

Using this function block, the encoder can be adapted in increments of one (1, 2, 3, 4... 32767) instead of in increments of 2^0, 2^1, 2^3 etc., when using DFIN.

3.2.31.3 Stretch factor setting over 6 decades

The function blocks can be used for fine adjustment of the stretch factor (6 decades).

The stretch factor is set:

- CONVPHD1:
  via freely connectable inputs

Tip!

If only the stretch factor is used (in this case the function block is positioned elsewhere in the circuit), set the encoder constant to 16384 inc/rev. Otherwise the signal will be additionally amplified (small values) or attenuated (higher values).

When setting negative values in the numerator, the output signal will be inverted.

3.2.32 Angle conversion (CONVPHPH)

Purpose

Conversion of a angle signal with dynamic fraction.

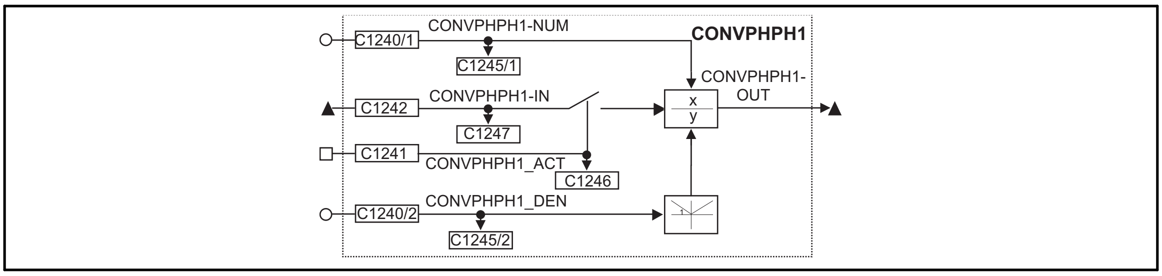


Fig. 3-92 Angle conversion (CONVPHPH1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHPH1-IN	ph	C1247	dec [inc]	C1242	3	-
CONVPHPH1-NUM	a	C1245/1	dec	C1240/1	1	Numerator
CONVPHPH1-DEN	a	C1245/2	dec	C1240/2	1	Denominator (with absolute value generation)
CONVPHPH1-ACT	d	C1246	bin	C1241	2	-
CONVPHPH1-OUT	ph	-	-	-	-	Without limitation, remainder considered

Function

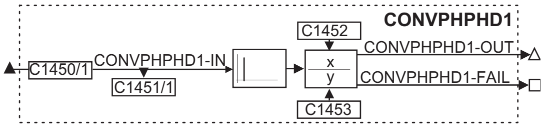
Caution!

The conversion result is not limited. The result must therefore not exceed the range of ±2147483647.

- C1241 = HIGH
  - The angle signal at CONVPHPH1-IN is evaluated using the factor from C1245/1 / C1245/2.
- C1241 = LOW
  - The value 0 is evaluated using the factor from C1245/1 / C1245/2.

3.2.33 Conversion (CONVPHPHD1)

A angle change is converted into a speed (digital frequency).



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHPHD1-IN	ph	1451/1	dec [inc]	1450/1	3	Angle input (ref.: 65536 inc = 1 motor revolution)
CONVPHPHD1-FAIL	d		-	-	-	HIGH: Resulting speed > 30000 rpm
CONVPHPHD1-OUT	phd		-	-	-	Output in rpm

Function

An angle change at input CONVPHPHD1-IN is converted into a speed.

- The speed at the output CONVPHPHD1-OUT can be adapted by means of a division ratio. The numerator (C1452) and denominator (C1453) can be set between -32767 and +32767.
- The output is limited to ±n = 30000 rpm.
- CONVPHPHD1-FAIL = HIGH for the time of limitation.

Note!

Angle errors can occur in the following function blocks if the output is limited. The profile position can thus be lost.

3.2.34 Conversion (CONVPHPHD2)

STOP!

This function block is not suitable for transmitting the virtual line shaft (electrical shaft).

Purpose

The function block converts a angle change into a speed (digital frequency).

Fig. 3-93 Conversion (CONVPHPHD2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CONVPHPHD2-IN	ph	1451/2	dec [inc]	1450/2	3	1000	Angle input (reference: 65536 inc = 1 revolution)
CONVPHPHD2-RESET	d	1455	dec [inc]	14554	2	1000	As long as CONVPHPHD2-RESET = HIGH, the signal at CONVPHPHD2-OUT is set to n = 0.
CONVPHPHD2-OUT	phd	-	-	-		-	Signal is limited to ±29999 rpm No position loss when signal is limited
CONVPHPHD2-LIM	d	-	-	-		-	HIGH = signal at CONVPHPHD2-OUT is limited (Function is available as of software version 3.4)

Function

An angle change at input CONVPHPHD2-IN is converted to a speed and output at CONVPHPHD2-OUT.

STOP!

The function block can evaluate signal jumps at the input CONVPHPHD2-IN up to max. 2147483647 inc (2^{31}-1). At higher signal jumps the sign of the output signal changes.

A position loss occurs which cannot be compensated anymore. You must carry out a reset (CONVPHPHD2-RESET = HIGH).

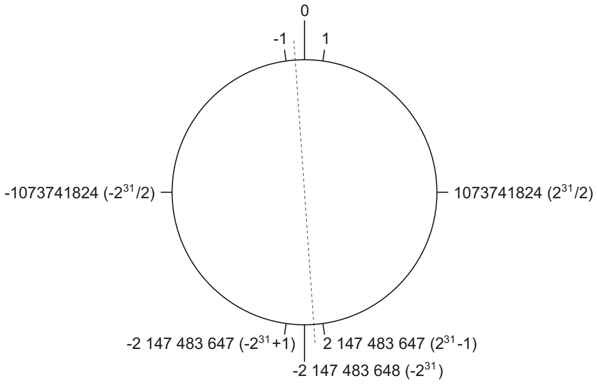


Fig. 3-94 32-bit data representation in the cycle of numbers

Example 1
1. The input signal at CONVPHPHD2-IN is 65536 inc.
2. Now it jumps to -65536 inc.
3. The output CONVPHPHD2-OUT outputs, as expected, negative values

Example 2
1. The input signal at CONVPHPHD2-IN is 65536 inc.
2. Now it jumps to -2^{31} -1 inc.
3. The output CONVPHPHD2-OUT, however, outputs positive values

3.2.35 Speed conversion (CONVPP)

Purpose

Conversion of a speed signal with dynamic fraction.

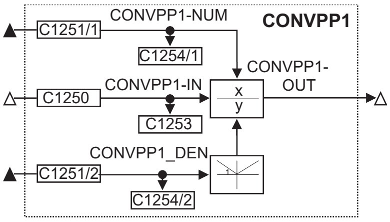


Fig. 3-95 Speed conversion (CONVPP1)

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
CONVPP1-IN	phd	C1253	dec [rpm]	C1250	4	-
CONVPP1-NUM	ph	C1254/1	dec [inc]	C1251/1	3	Numerator
CONVPP1-DEN	ph	C1254/2	dec [inc]	C1251/2	3	Denominator (with absolute value generation)
CONVPP1-OUT	phd	-	-	-	-	Without limitation, remainder considered

Function

Caution!

The conversion result is not limited. The result must therefore not exceed ±32767.

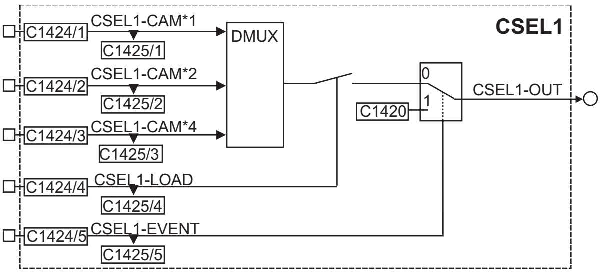
- The speed signal at CONVPP1-IN is evaluated using the factor from C1251/1 / C1251/2.

3.2.36 Profile selection (CSEL)

One function block (CSEL1) is available.

Purpose

- Selection of one profile out of eight possible profiles.
- Selection of an event profile



Signal				Source		Note
Name	Type	DIS/selection	DIS	CFG	List	
CSEL1-CAM*1	d	1425/1	bin	1424/1		Selection bit 0
CSEL1-CAM*2	d	1425/2	bin	1424/2		Selection bit 1
CSEL1-CAM*4	d	1425/3	bin	1424/3		Selection bit 2
CSEL1-LOAD	d	1425/4	bin	1424/4		Acceptance=LOW→HIGH edge
CSEL1-EVENT	d	1425/5	bin	1424/5		Event profile selection value
CSEL1-OUT	a	13651	-	-	-	

Function

- Conversion of a bit pattern into an analog value
- Acceptance of the converted value
- Event-dependent output of a fixed value

3.2.36.1 Change of the input bit pattern

1st input CSEL1-CAM*1	2nd input CSEL1-CAM*2	3rd input CSEL1-CAM*4	CSEL1-LOAD	CSEL1-Event	Output CSEL1-OUT
0	0	0	0 → 1	0	0
1	0	0	0 → 1	0	1
0	1	0	0 → 1	0	2
1	1	0	0 → 1	0	3
0	0	1	0 → 1	0	4
1	0	1	0 → 1	0	5
0	1	1	0 → 1	0	6
1	1	1	0 → 1	0	7
*	*	*	*	1	Value in C1420

* - Signal status has no meaning

- Depending on the number of profiles used, not all inputs must be assigned for the profile selection.

Number of profiles used (value of C1300)	Inputs to be assigned (CAM*1, CAM*2, CAM*4)
1 (only profile 0)	0
2 (profiles 0 and 1)	1 (CAM*1)
4 (profiles 0 to 3)	2 (CAM*1, CAM*2)
8 (profiles 0 to 7)	3 (CAM*1, CAM*2, CAM*4)

3.2.36.2 Acceptance of the converted value

Very often, a new profile is selected during operation. This new profile, i.e. the changed value, must only be accepted if the drive reaches a certain position. The acceptance is activated by a L→H edge at the input CSEL1-LOAD.

3.2.36.3 Event-dependent output of a fixed value

- The value entered under C1420 will be output at CSEL1-OUT (without signal edge at CSEL1-LOAD) when the input CSEL1-EVENT is selected.

Stop!

The activation of a cam profile, which has been additionally defined in CSEL but exceeds the number of profiles selected in the FB CDATA, will be ignored.
Example: Input in CDATA = 4 profiles; profile additionally defined in CSEL (profile 5).
The special profile would be ignored!

Code	Meaning	Note
C1420	Input of fixed values for the selection through CSEL1-EVENT	

If the signal at input CSEL1-EVENT = LOW, a L→H edge must again be set at the input CSEL1-LOAD to accept.

3.2.37 Characteristic function (CURVE)

Purpose

Conversion of an analog signal into a characteristic.

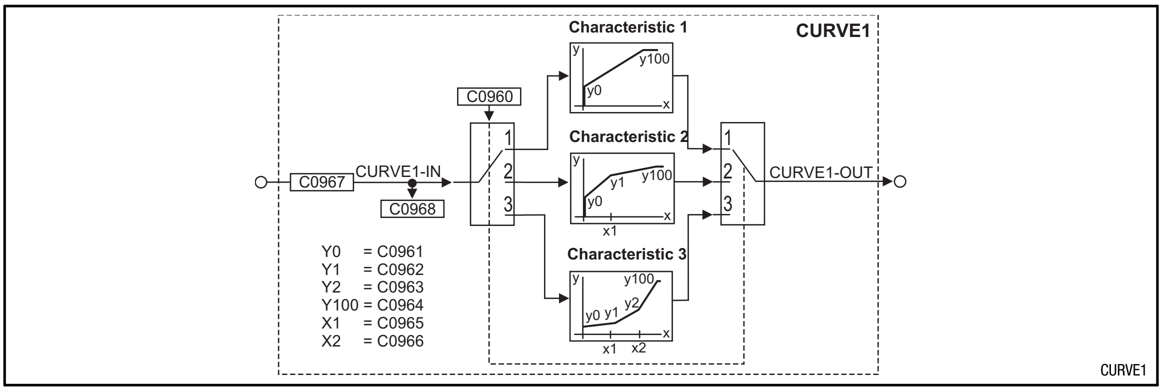


Fig. 3-96 Characteristic function (CURVE1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CURVE1-IN	a	C0968	dec [%]	C0967	1	5001	-
CURVE1-OUT	a	-	-	-	-	-	-

Range of functions

Under C0960, you can select the function:

- Characteristic with two interpolation points
- Characteristic with three interpolation points
- Characteristic with four interpolation points

The codes for entering the interpolation points can be obtained from the line diagrams.

Linear interpolation between the points.

For negative input values at CURVEx-IN, the settings of the interpolation points are processed inversely (see line diagrams). If this is not desired:

- Connect an absolute value generator (ABS) before or behind the CURVE function block

or

- connect a limiter (LIM) before or behind the CURVE function block

3.2.37.1 Characteristic with two interpolation points

Set C0960 = 1.

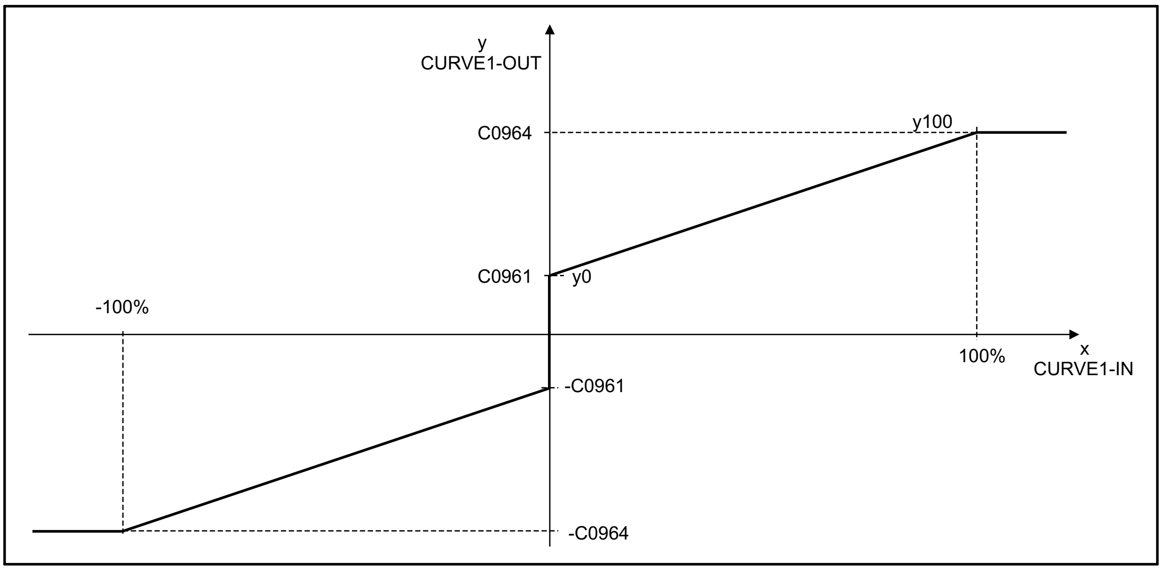


Fig. 3-97 Line diagram of characteristic with 2 interpolation points

3.2.37.2 Characteristic with three interpolation points

Set C0960 = 2.

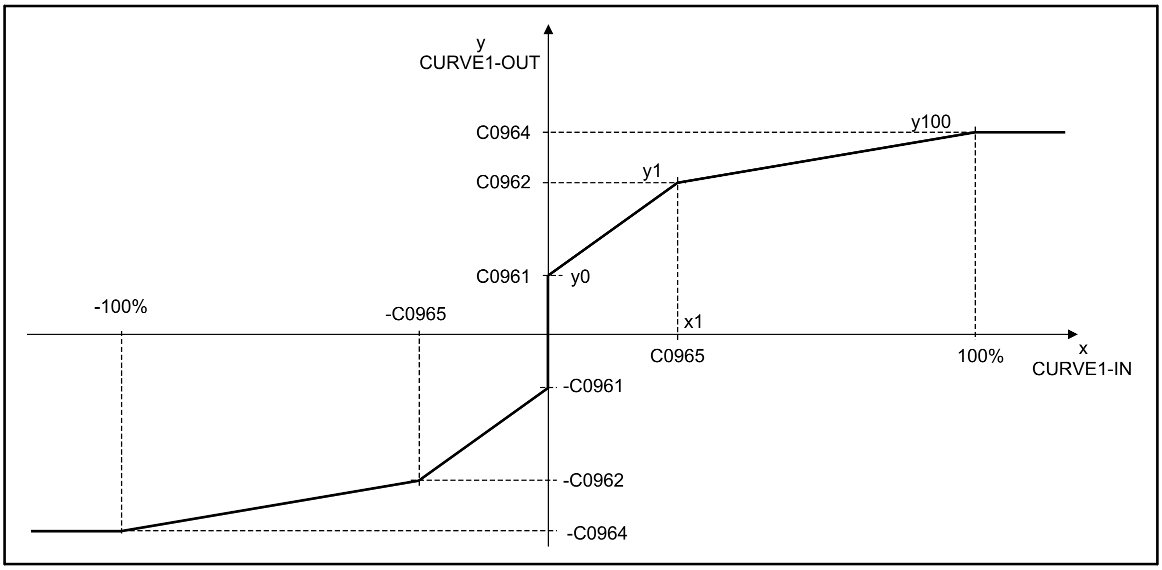


Fig. 3-98 Line diagram of characteristic with 3 interpolation points

3.2.37.3 Characteristic with four interpolation points

Set C0960 = 3.

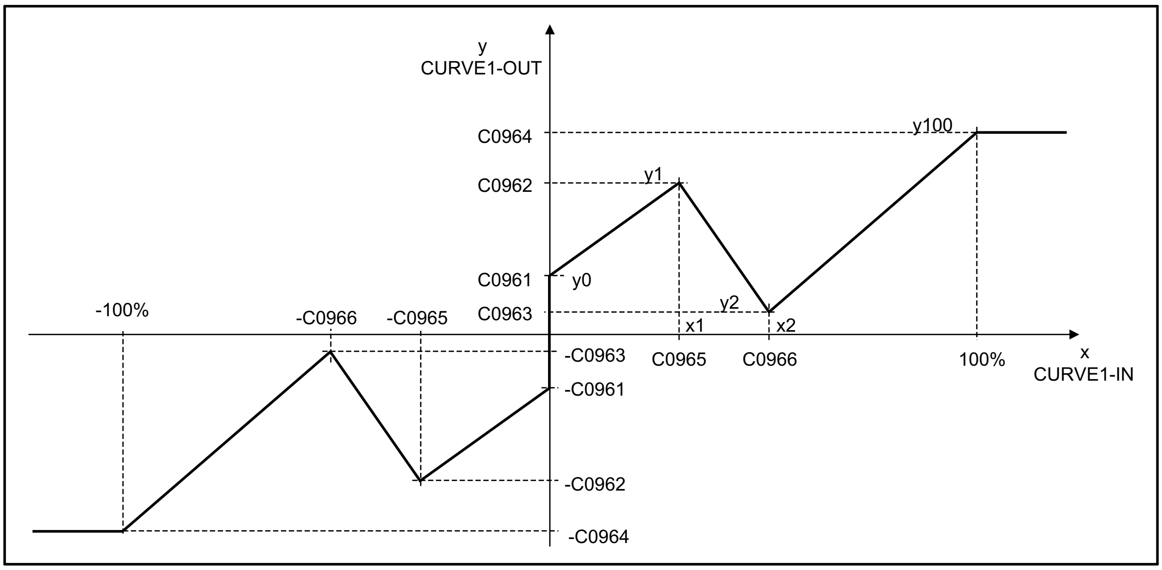


Fig. 3-99 Line diagram of characteristic with 4 interpolation points

3.2.38 Characteristic function (CURVEC)

Purpose

The function block serves to map analog profiles.

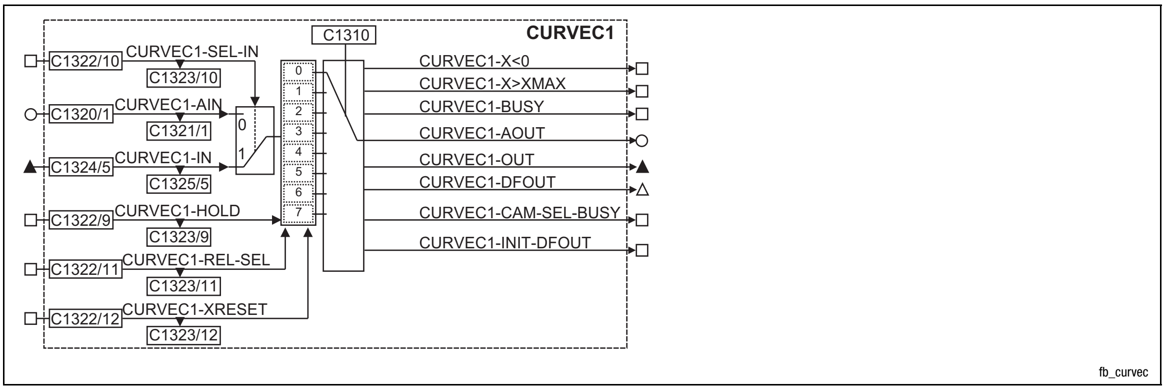


Fig. 3-100 Characteristic function (CURVEC)

Signal				Source		Note
Name	Type	DIS/selection	DIS format	CFG	List	
CURVEC1-SEL-IN	d	C1323/10		C1322/10	2	HIGH = input CURVEC-IN active
CURVEC1-AIN	a	C1321/1		C1320/1	1	Analog input (analog profile)
CURVEC1-IN	ph	C1325/5		C1324/5	3	Angle input
CURVEC1-HOLD	d	C1323/9		C1322/9	1	HIGH = outputs CURVEC-OUT and CURVEC-AOUT are stored DFOUT = 0
CURVEC1-REL-SEL	d	C1323/11		C1322/11	1	HIGH = feed function
CURVEC1-XRESET	d	C1323/12		C1322/12	1	HIGH = sets the input values internally = 0. See notes about CURVEC1-CAM-SEL-BUSY.
CURVEC1-X<0	d					HIGH = input value < 0
CURVEC1-X>Xmax	d					HIGH = input value > X_{max}
CURVEC1-BUSY	d					LOW-HIGH edge = “The point distribution is not optimal, select less points”
CURVEC1-AOUT	a					Analog output
CURVEC1-OUT	ph					Angle output
CURVEC1-DFOUT	phd					DF/speed output
CURVEC1-CAM-SEL-BUSY	d					The output remains HIGH as long as the profile changeover (C1310) is not completed. During this procedure, the input CURVEC1-XRESET must be HIGH.
CURVEC1-INIT-DFOUT	d					HIGH= the drive speed does not reach the setpoint defined by the position output. During this deviation which may last over several cycles, a great position change is output at the speed output. Increments do not get lost! Therefore, the drive should only be enabled after switching-on if CURVEC-INIT-DFOUT = LOW !

Function

- Identical with FB CDATA, but with reduced functionality (cam position profile)
- General characteristic

Selection between general cam position profile and characteristic function

Via CURVEC1-SEL-IN you can select which input (-AIN or -IN) is to be processed.

It is possible to change between a (quasi) analog input (16-bit input) and an input for angle signals (32 bit input).

Thus it is possible to use the CURVEC function block

- to implement any function within the limits of ±199.99 % (e.g. Vp adaptation)

or

- to implement a mechanical cam function.

Note!

The input should be assigned to a FIXED value to avoid an unintentional change to another input.

Freezing of the output value

With CURVEC1-HOLD = HIGH the output signals remain the same as of the switching instant, irrespectively of possibly changing input values.

With CURVEC1-HOLD = LOW the outputs are activated again. The output values immediately change in accordance with the profile function to the input values pending now.

STOP!

This change occurs abruptly!

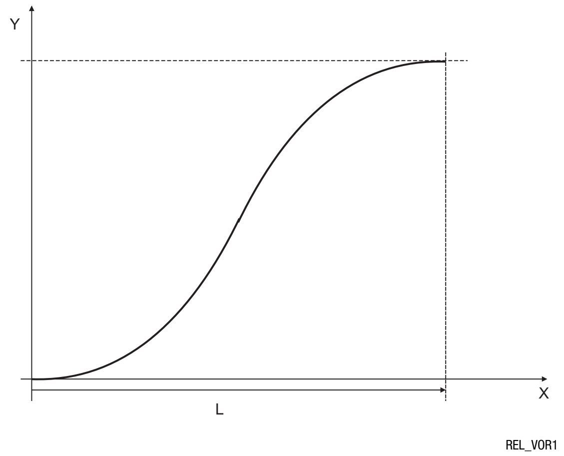
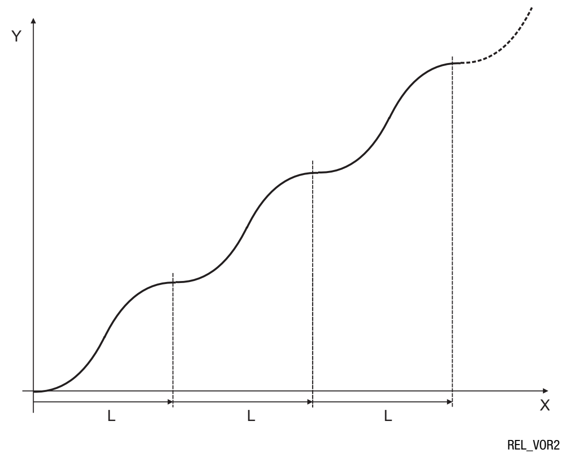
Profiles with relative feed

Profiles with relative feed are used in continuous drives. The final value of such profiles is not identical with its initial position.

Continuous drives are for instance:

- conveyor belts
- rotary tables with feed along the entire revolution.

This function is selected with CURVEC1-REL-SEL = HIGH (e.g. FIXED 1)

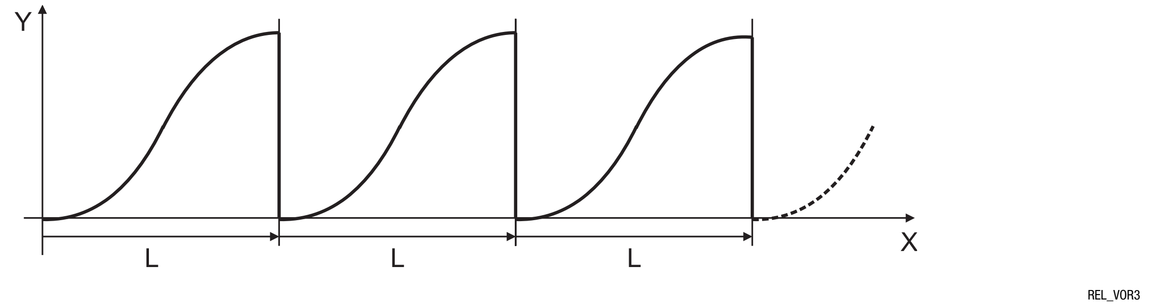
Example 1	**Example 2**
	

L Profile length

With CURVEC1-REL-SEL = LOW, the last Y value of the profile will not be stored!

STOP!

Depending on the cam profile data, this setting may result in a ’jump’ of the drive to the new value (see fig. below).



L Profile length

Negative input values

A fault is indicated for negative input values (X<0):

- CURVEC1-X < 0 = HIGH

Furthermore, the output will show the y value which would result from the profile function for x=0.

Max. permissible input value exceeded

A fault is indicated for input values X>Xmax:

- CURVEC1-X > X_{max} = HIGH

Furthermore, the output will show the y value which would result from the profile function for X=Xmax.

Note!

X_{max} is already determined when the profile is generated (GDC).

3.2.38.1 Selection of profiles stored in the controller

Procedure

1. Inhibit the controller or set CURVEC1-X-RESET = HIGH.

Note!

If you have neither inhibited the controller nor set CURVEC1-X-RESET = HIGH, it is not possible to change to another profile (error number 7; ILLEGAL_SYSTEM_ACCESS).

2. Select the new profile (e.g. with FEVAN)
3. Wait 20 ms for data transfer
4. Initialisation starts with CURVEC1-CAM-SEL-BUSY = HIGH
5. Wait (approx. 20 ms) until CURVEC1-CAM-SEL-BUSY = LOW
6. Then CURVEC1-X-RESET = LOW.

Note!

Even if the controller is not inhibited, the profile can be changed with CURVEC1-X-RESET = HIGH (e.g. via FEVAN).
During this procedure, the output CURVEC1-CAM-SEL-BUSY is HIGH.

3.2.39 Dead band (DB)

Purpose

The dead band element is used to set interfering influences around zero, e.g. interferences on analog input voltages, to digital zero.

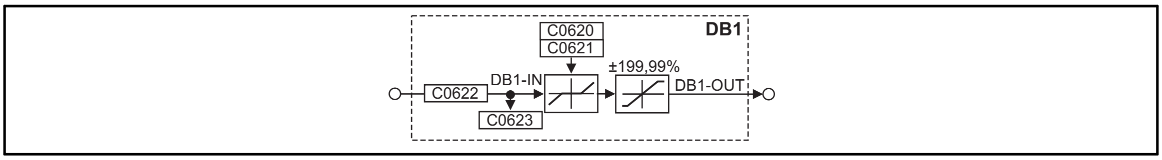


Fig. 3-101 Dead band element (DB1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DB1-IN	a	C0623	dec [%]	C0622	1	1000	-
DB1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

- The dead band is parameterised under C0621.
- The gain is set under C0620.

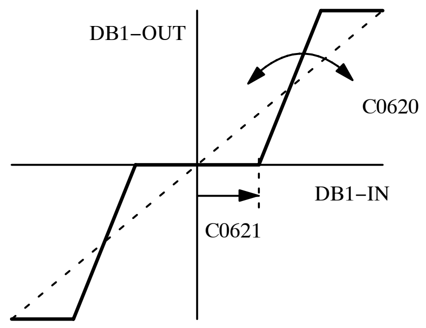


Fig. 3-102 Dead band and gain

3.2.40 Drive control (DCTRL)

Purpose

Sets certain controller states (e. g. trip, trip reset, quick stop or controller inhibit).

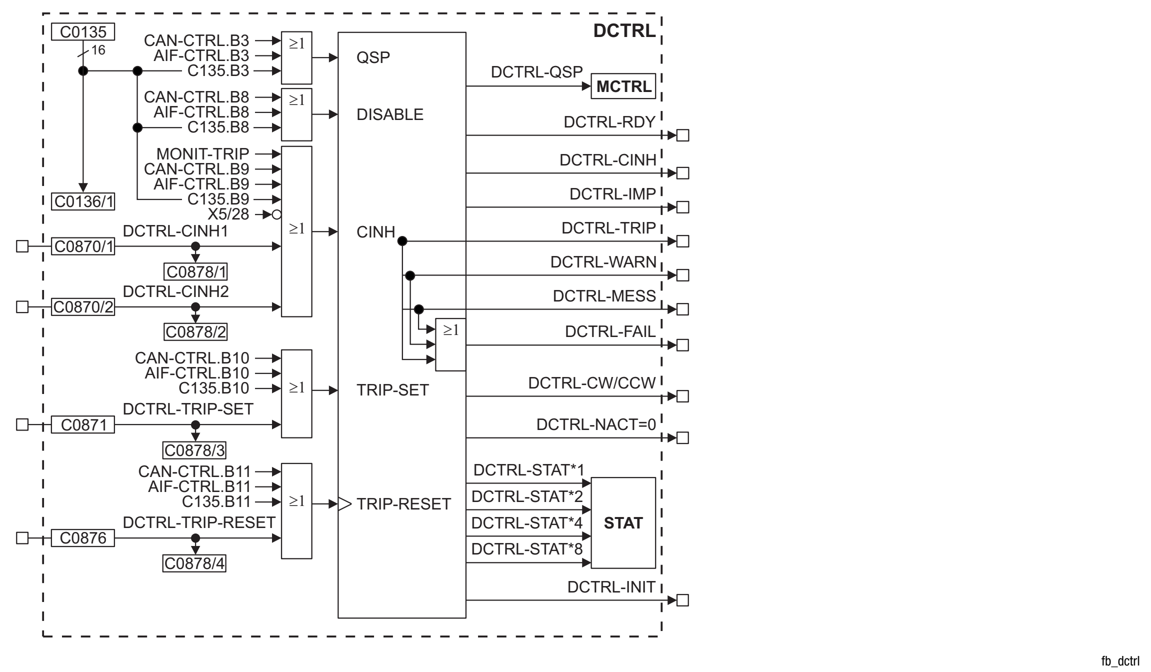


Fig. 3-103 Control of the controller (DCTRL)

Signal				Source			Note
Designation	Type	DIS	DIS format	CFG	List	Lenze	
DCTRL-CINH1	d	C0878/1	bin	C0870/1	2	1000	HIGH = inhibit controller
DCTRL-CINH2	d	C0878/2	bin	C0870/2	2	1000	HIGH = inhibit controller
DCTRL-TRIP-SET	d	C0878/3	bin	C0871	2	54	HIGH = error message EEr
DCTRL-TRIP-RESET	d	C0878/4	bin	C0876	2	55	LOW-HIGH signal = Trip reset
DCTRL-QSP	d	-	-	-	-	-	HIGH = drive performs quick stop
DCTRL-RDY	d	-	-	-	-	-	HIGH = Ready for operation
DCTRL-CINH	d	-	-	-	-	-	HIGH = Controller reset
DCTRL-IMP	d	-	-	-	-	-	HIGH = High-resistance power output stages
DCTRL-TRIP	d	-	-	-	-	-	HIGH = Fault active
DCTRL-WARN	d	-	-	-	-	-	HIGH = Active warning
DCTRL-MESS	d	-	-	-	-	-	HIGH = Active message
DCTRL-FAIL	d	-	-	-	-	-	-
DCTRL-CW/CCW	d	-	-	-	-	-	LOW = CW rotation, HIGH = CCW rotation
DCTRL-NACT=0	d	-	-	-	-	-	HIGH = Motor speed < C0019
DCTRL-STAT*1	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*2	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*4	d	-	-	-	-	-	General status (binary coded)
DCTRL-STAT*8	d	-	-	-	-	-	General status (binary coded)
DCTRL-INIT	d	-	-	-	-	-	-

Function

- Quick stop (QSP)
- Operation inhibited (DISABLE)
- Controller inhibit (CINH)
- TRIP set
- TRIP reset
- Change of parameter set (PAR)
- Controller state

3.2.40.1 Quick stop (QSP)

The drive is braked to standstill via the deceleration ramp C105 and generates a holding torque.

- The function can be controlled by three inputs
  - – Control word CAN-CTRL bit 3 of CAN-IN1
  - – Control word AIF-CTRL bit 3 of AIF-IN
  - – Control word C0135 bit 3
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.2.40.2 Operation inhibit (DISABLE)

In this state the drive cannot be started by the command: Controller enable. The power output stages are inhibited. All controllers are reset.

- The function can be controlled by three inputs
  - – Control word CAN-CTRL bit 8 of CAN-IN1
  - – Control word AIF-CTRL bit 8 of AIF-IN
  - – Control word C0135 bit 8
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.2.40.3 Controller inhibit (CINH)

Note!

When the controller changes to an LU message or an OU message, the signal DCTRL-CINH is not set.

The power output stages are inhibited. All controllers are reset.

- The function can be controlled via seven inputs:
  - Terminal X5/28 (LOW = controller inhibit)
  - Control word CAN-CTRL bit 9 of CAN-IN1
  - Control word AIF-CTRL bit 9 of AIF-IN
  - Control word C0135 bit 9
  - MONIT-TRIP (HIGH = A monitoring function that is configured to TRIP has been activated in the MONIT function block)
  - Free input DCTRL-CINH1
  - Free input DCTRL-CINH2
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.2.40.4 TRIP-Set

The drive is lead to the state selected under code C0581 and indicates EEr (external monitoring).

- The function can be controlled by four inputs
  - Control word CAN-CTRL bit 10 of CAN-IN1
  - Control word AIF-CTRL bit 10 of AIF-IN
  - Control word C0135 bit 10
  - Free input DCTRL-TRIP-SET
- All inputs are linked by an OR-operation.
- C0136/1 indicates the control word C0135

3.2.40.5 TRIP RESET

Resets a pending trip if the cause of malfunction has been eliminated. If the cause of malfunction is still active, no response is effected.

- The function can be controlled by four inputs
  - Control word CAN-CTRL bit 11 of CAN-IN1
  - Control word AIF-CTRL bit 11 of AIF-IN
  - Control word C0135 bit 11
  - Free input DCTRL-TRIP-RESET
- All inputs are linked by an OR-operation.
- This function is only carried out by a LOW-HIGH edge of the signal resulting from the OR operation.
- C0136/1 indicates the control word C0135

Note!

If one of the inputs is set to HIGH, it is not possible that a LOW-HIGH edge occurs at the resulting signal.

3.2.40.6 Controller state

The status is binary coded via the outputs DCTRL-STAT*x. These outputs are connected with the STAT function block inside the device.

The status can be evaluated via the status word C0150, CAN status word, and AIF status word.

STAT*8	STAT*4	STAT*2	STAT*1	Action of the controller
0	0	0	0	Initialisation after the supply voltage has been connected
0	0	0	1	Switch-on inhibit (LOCK MODE), restart protection is active C0142
0	0	1	1	Drive is inhibited
0	1	1	0	Controller enabled
0	1	1	1	The activation of a monitoring function resulted in a ”message”
1	0	0	0	The activation of a monitoring function resulted in a ”trip”
1	0	1	0	The activation of a monitoring function resulted in a ”FAIL-QSP”

3.2.40.7 Speed threshold n_{act}=0rpm

The standstill message (DCTRL-NACT=1) is set if the actual speed (MCTRL-NACT) is lower than the threshold set in C0019.

The standstill message (DCTRL-NACT=0) is cancelled if the actual speed (MCTRL-NACT) exceeds a threshold from C0019 plus hysteresis. The amount of hysteresis corresponds to 1 % of the max. speed n_{max} from C0011.

Note!

The hysteresis provides for a stable standstill signal, even in the case of a jittering actual speed value. The hysteresis only has an effect during start-up and is not active during a stop process.

3.2.41 Digital frequency input (DFIN)

Purpose

Converting and scaling a pulsed current at the digital frequency input X9 into a speed and angle setpoint. The digital frequency is transferred in a high-precision mode (without offset and gain errors).

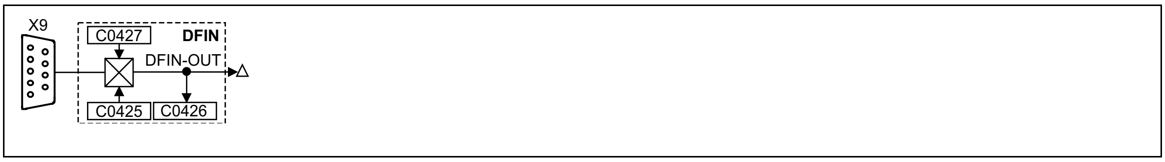


Fig. 3-104 Digital frequency input (DFIN)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFIN-OUT	phd	C0426	dec [rpm]	-	-	

Function

- The input X9 is designed for signals with TTL level.
- In the case of a digital frequency cascade or digital frequency bus, adapt the drive to the connected encoder or upstream controller via C0425.
- The input of a zero track is optional.
- Via C0427 the following input signals can be evaluated:

C0427 = 0

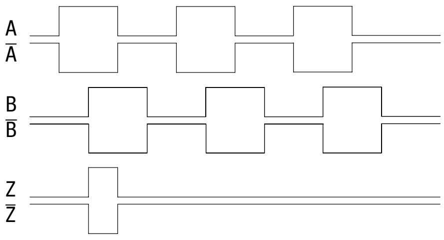


Fig. 3-105 Phase-shifted signal sequence (CW rotation)

CW rotation	Track A is leading track B by 90° (positive value at DFIN-OUT).
CCW rotation	Track A is lagging track B by 90° (negative value at DFIN-OUT).

C0427 = 1

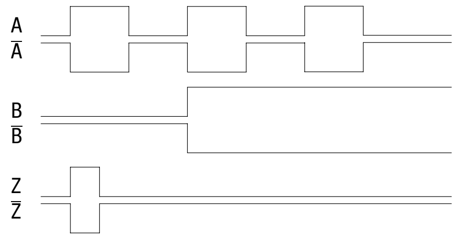


Fig. 3-106 Control of direction of rotation via track B

CW rotation	Track A transmits the speed Track B = LOW (positive value at DFIN-OUT)
CCW rotation	Track A transmits the speed Track B = HIGH (negative value at DFIN-OUT)

C0427 = 2

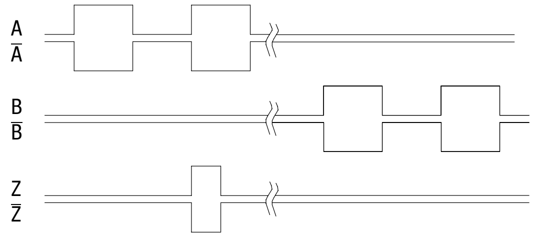


Fig. 3-107 Control of speed and direction of rotation via track A or track B

CW rotation	Track A transmits the speed and direction of rotation (positive value at DFIN-OUT) Track B = LOW
CCW rotation	Track B transmits the speed and direction of rotation (negative value at DFIN-OUT) Track A = LOW

Transfer function

$$\text{DFIN-OUT [rpm]} = \text{f [Hz]} \cdot \frac{60}{\text{Number of increments from C0425}}$$

Example:

Input frequency = 200 kHz

C0425 = 3 (≙ a number of increments of 2048 inc./rev.)

$$\text{DFIN-OUT [rpm]} = 200000\ \text{Hz} \cdot \frac{60}{2048} = 5859\ \text{rpm}$$

Signal adaptation

Finer resolutions than the power-of-two format can be implemented by the downstream connection of an FB (e.g. CONV3 or CONV4).

Example:

The FB CONV3 converts the speed signal into a quasi-analog signal. Conversion according to formula:

$$\text{CONV3-OUT [\%]} = \text{f [Hz]} \cdot \frac{0.4}{\text{Number of increments from C0425}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

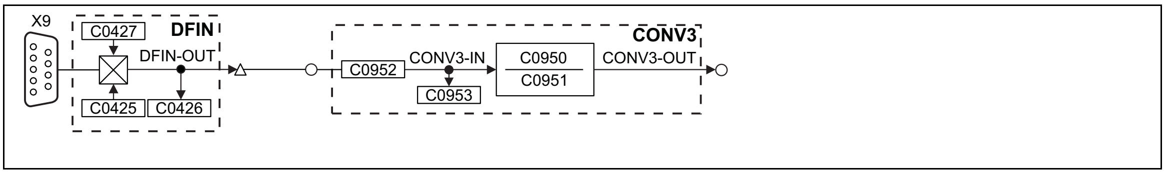


Fig. 3-108 Digital frequency input (DFIN) with downstream converter

STOP!

If C0540 = 0, 1, 2, 3 and feedback system C0025 > 10, you must not use the digital frequency input X9.

3.2.42 Digital frequency output (DFOUT)

Purpose

Converts internal speed signals into frequency signals and outputs them to subsequent drives. The transmission is highly precise (without offset and gain errors).

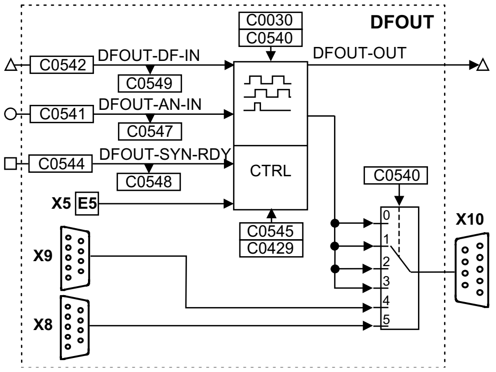


Fig. 3-109 Digital frequency output (DFOUT)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFOUT-DF-IN	phd	C0549	dec [rpm]	C0542	4	-
DFOUT-AN-IN	a	C0547	dec [%]	C0541	1	Input in [%] of nmax (C0011)
DFOUT-SYN-RDY	d	C0548	bin	C0544	2	-
DFOUT-OUT	phd	-	-	-	-	-

Function

- Output signals on X10
- Output of an analog signal
- Output of a speed signal
- Encoder simulation of the resolver with internal zero track
- Encoder simulation of the resolver with external zero track
- Direct output of X8
- Direct output of X9

3.2.42.1 Output signals on X10

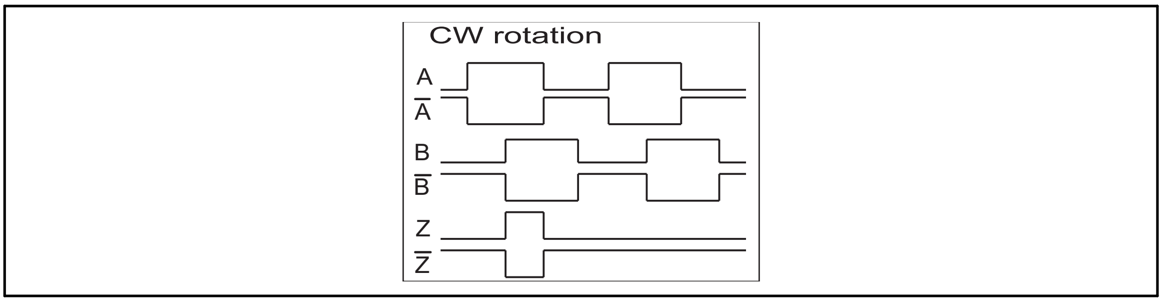


Fig. 3-110 Signal sequence for CW rotation (definition)

- The output signal corresponds to the simulation of an incremental encoder:
  - Track A, B and, if necessary, zero track as well as the corresponding inverted tracks are output with tracks shifted by 90 degrees.
  - The levels are TTL-compatible.
- Positive input values (CW rotation) result in the represented signal sequence.
- With negative input values (CCW rotation) track B is leading track A by 90° .
- The zero track is output according to the function set in C0540
- With C0030 the encoder constant of the encoder simulation is set.
- The function of the digital frequency output X10 is defined via C0540.

Stop!

C0540 = 0 to C0540 = 3 cannot be set if the connection to the digital frequency input DFIN X9 has been established and C0025 > 10 has been selected.

C0540	Signal at X10
0	DFOUT-AN-IN is output at X10; zero track can be input externally
1	DFOUT-DF-IN is output at X10; zero track can be input externally
2	Encoder simulation of the resolver with zero track in resolver zero position (mounted on the motor)
3	Encoder simulation of the resolver with external input of the zero track (terminal X5/E5)
4	The signal at input X9 is electrically amplified and directly output (C0030 is without function)
5	The signal at input X8 is electrically amplified and directly output (C0030 is without function)

Create zero track (Z track)

- Condition:
  - Set C0540 = 0, C0540 = 1 or C0540 = 3.
  - Encoder simulation must be active.
- Start creation:
  - The creation starts immediately with the first rising or falling edge on track A or track B.

3.2.42.2 Output of an analog signal

For this purpose, set code C0540 = 0. The value applied at input DFOUT-AN-IN is converted into a frequency.

Transfer function

$$f\,[\mathrm{Hz}] = \mathrm{DFOUT} - \mathrm{AN} - \mathrm{IN}\,[\%] \cdot \frac{\text{No. of increments from C0030}}{100} \cdot \frac{\mathrm{C0011}}{60}$$

Example:

DFOUT-AN-IN = 50 %

C0030 = 3, this corresponds to a number of increments of 2048 inc/rev.

C0011 = 3000 rpm

$$f\,[\mathrm{Hz}] = 50\,\% \cdot \frac{2048}{100} \cdot \frac{3000}{60} = 51200\ \mathrm{Hz}$$

Generating a zero pulse

An artificial zero pulse can be generated for the output frequency.

1. Activate the function through a LOW → HIGH edge at the input DFOUT-SYN-RDY.
2. A LOW → HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°. After this, every 360° a zero pulse is generated according to the setting in C0030.
3. The zero pulse is automatically shifted by the value C0545.

Note!

This procedure must be done after every mains switching.

3.2.42.3 Output of a speed signal

- Set C0540 = 1.
  - This setting only converts the value at input DFOUT-DF-IN into a frequency.

Transfer function

$$f\,[\mathit{Hz}] = \text{DFOUT-DF-IN}\,[\mathit{rpm}] \cdot \frac{\text{No. of increments from C0030}}{60}$$

Example:

DFOUT-DF-IN = 3000 rpm

C0030 = 3, this corresponds to a number of increments of 2048 inc/rev.

$$f\,[\mathit{Hz}] = 3000\,[\mathit{rpm}] \cdot \frac{2048}{60} = 102400\,[\mathit{Hz}]$$

Generating a zero pulse

An artificial zero pulse can be generated for the output frequency.

1. Set input DFOUT-SYN-RDY = edge from LOW → HIGH.
2. A LOW-HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°. After this, every 360° a zero pulse is generated according to the setting in C0030.
3. The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

3.2.42.4 Encoder simulation of the resolver

Set C0540 = 2 or C0540 = 3 (depending on the desired generation of the zero track)

- The function is used when a resolver is connected to X7.
- The encoder constant for output X10 is set in C0030.

Generating a zero pulse in resolver zero position (C0540 = 2)

The output of the zero pulse with regard to the rotor depends on how the resolver is mounted to the motor.

- The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

Generating an external zero pulse (C0540 = 3)

An artificial zero pulse can be generated for the output frequency.

- The function is activated through a LOW-HIGH edge at the input DFOUT-SYN-RDY.
- A LOW-HIGH edge at terminal X5/E5 causes the generation of the zero pulse after 360°.
  - After this, every 360° a zero pulse is generated according to the setting in C0030.
- The zero pulse can be shifted by +360° via C0545 (65536 inc = 360°).

Note!

The procedure for generating an artificial zero pulse must be repeated after every mains switching and after every setting of C0540 = 3.

3.2.42.5 Direct output of X8 (C0540 = 5)

- The input signal at X8 is electrically amplified and directly output.
- The signals depend on the assignment of the input X8.
- C0030 and C0545 have no function.
- The zero track is only output if it is connected to X8.

3.2.42.6 Direct output of X9 (C0540 = 4)

- The input signal at X9 is electrically amplified and directly output.
- The signals depend on the assignment of the input X9.
- C0030 and C0545 have no function.
- The zero track is only output if it is connected to X9.

Note!

For directly outputting X8 or X9 to the digital frequency output X10 the function block DFOUT does not need to be entered into the processing table.

3.2.43 Digital frequency ramp function generator (DFRFG)

Purpose

The drive (motor shaft) is synchronised to a digital frequency (phase selection). The drive then performs a phase-synchronous operation with the digital frequency.

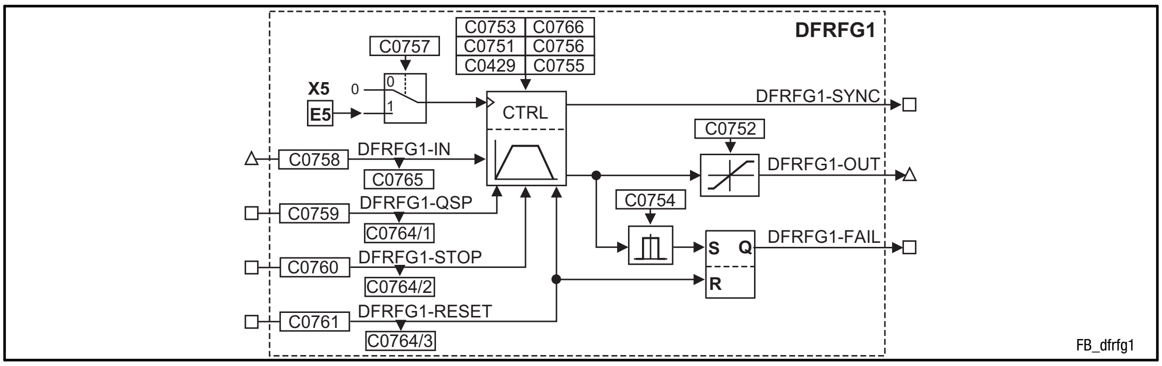


Fig. 3-111 Digital frequency ramp function generator (DFRFG1)

Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
DFRFG1-SET	phd	C0769	-	C0768	-	Initial speed
DFRFG1-IN	phd	C0765	dec [rpm]	C0758	4	Speed/Phase setpoint
DFRFG1-QSP	d	C0764/1	bin	C0759	2	HIGH = quick stop
DFRFG1-STOP	d	C0764/2	bin	C0760	2	HIGH = save setpoint
DFRFG1-RESET	d	C0764/3	bin	C0761	2	HIGH = reset
DFRFG1-OUT	phd	-	-	-	-	Speed/Phase setpoint
DFRFG1-SYNC	d	-	-	-	-	HIGH = drive runs synchronously
DFRFG1-FAIL	d	-	-	-	-	HIGH = phase difference exceeded

Function

- Profile generator
- Quick stop
- Ramp function generator stop
- RESET
- Detect phase difference
- Start via touch probe initiator (terminal X5/E5)
- Correction of the touch probe initiator (terminal X5/E5)

3.2.43.1 Profile generator

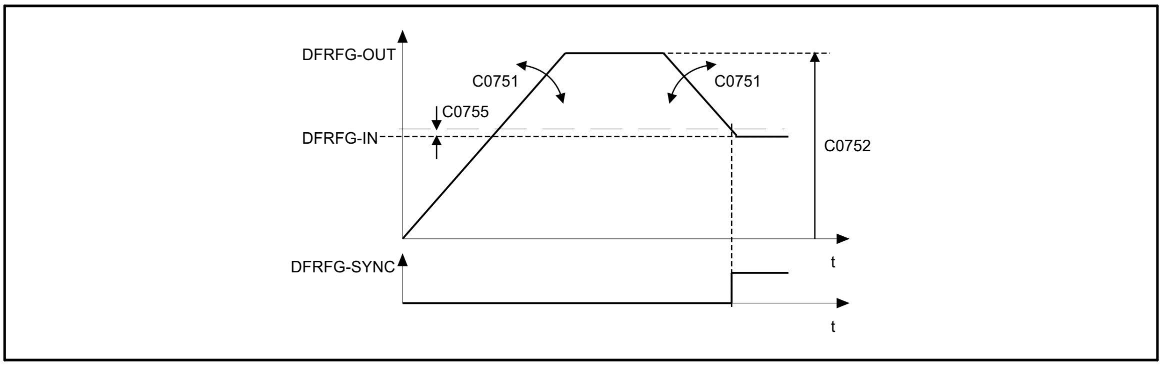


Fig. 3-112 Synchronisation on DFRFG

The profile generator generates ramps which lead the setpoint phase to its target position.

- Set acceleration and deceleration via C0751.
- Set max. speed via C0752.
- When the distance and speed reach their setpoints, the output switches DFRFG1-SYNC = HIGH. At the same time the FB switches the profile generator to ”inactive”.
- Set the switching point via C0755.

Stop!

Do not operate the drive with this function at the torque limitation M_{max}, I_{max}.

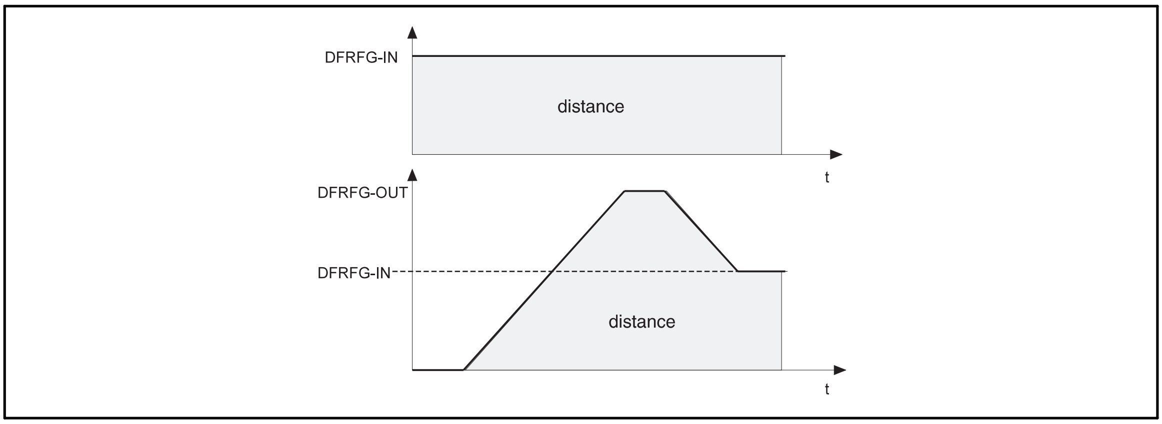


Fig. 3-113 Speed-time diagram DFRFG

The number of increments at DFRFG-IN (master drive) defines the target position. The target can be displayed as a path. The speed-time diagram shows the distance covered (angle) as the area below the speed profile. When synchronicity is reached, master and slave have covered the same distance (angle).

3.2.43.2 Quick stop

Removes the drive from the network and brakes it to standstill.

- Activate with DFRFG-QSP = HIGH.
- Set deceleration time via C0753.
- Store the setpoint phase detected at DFRFG-IN.
- Approach the setpoint phase via the profile generator after resetting the quick stop request.

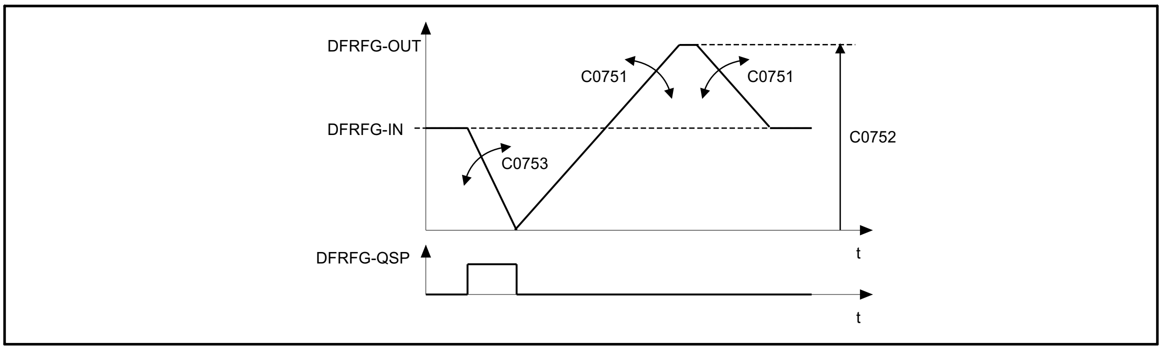


Fig. 3-114 Quick stop DFRFG

3.2.43.3 Ramp function generator stop

Maintains the state of the profile generator during operation.

- Activate with DFRFG-STOP = HIGH
- Output of the last state at DFRFG-OUT.
- Store the setpoint phase detected at DFRFG-IN.
- Approach the setpoint phase via the profile generator after resetting the stop request.

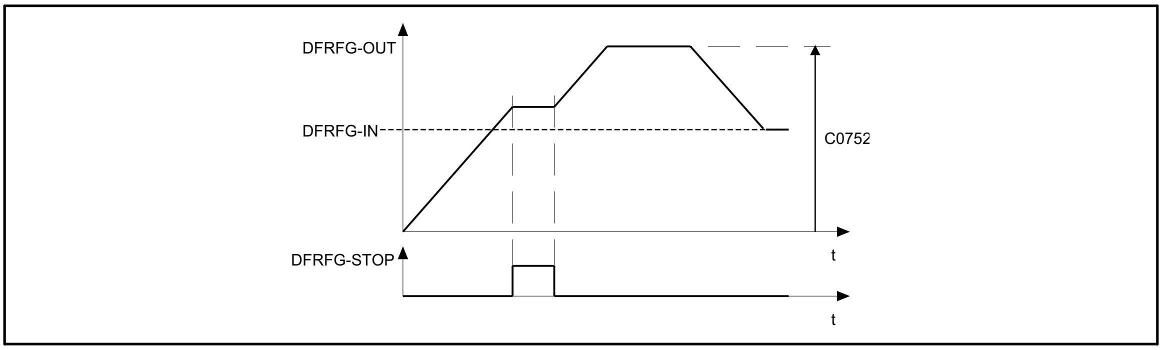


Fig. 3-115 Ramp function generator stop

3.2.43.4 RESET

DFRFG-RESET = HIGH:

- Resets setpoint phases which are internally added.
- Activates the profile generator.
- HIGH-LOW edge at DFRFG-RESET: Detecting the setpoint phase.

3.2.43.5 Detect phase difference

Monitoring the phase difference between input DFRFG-IN and output DFRFG-OUT.

- Set limit value of monitoring via C0754.
- Activates the monitoring: DFRFG-FAIL = HIGH
- Storing the signal until DFRFG-RESET = HIGH.
- The profile generator can accept a phase difference of up to ±2140000000 inc (= 32000 revolutions).

3.2.43.6 Start via touch probe initiator (terminal X5/E5)

Stop!

In the default setting the terminal X5/E5 is assigned to another function.

Function

- Set C0757 = 1.
- The function is activated by **simultaneously** setting the inputs:
  - – DFRFG-QSP and DFRFG-RESET = HIGH.
- Starting procedure:
  - – Signals at DFRFG-QSP and DFRFG-RESET = LOW.
  - – Otherwise touch probe signals are ignored.
- A LOW-HIGH edge at terminal X5/E5 starts the process:

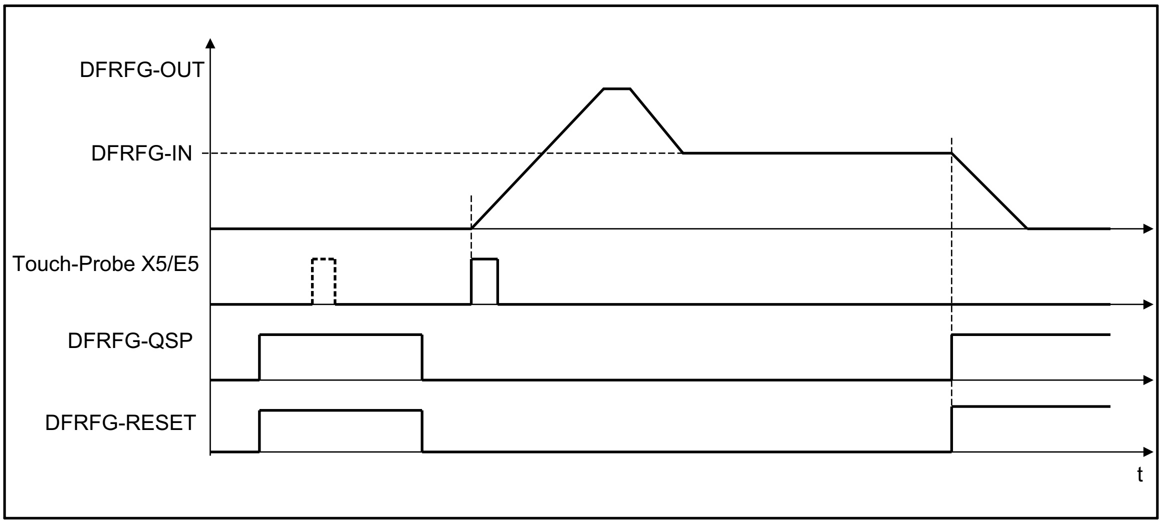


Fig. 3-116 Start via touch probe initiator (terminal X5/E5)

3.2.43.7 Correction of the touch probe initiator (terminal X5/E5)

Delay times during the activation of the initiator cause a speed-dependent phase offset (e.g. during positioning, synchronising).

In order to take this angular offset into account, the response time [ms] of the initiators as a function of the setpoint speed DFRFG-IN is converted to a phase angle correction and is then taken into consideration in the setpoint angle. For this, the response time [ms] has to be converted to a correction value [Inc.] first.

- Set correction value for the phase offset under C0429.
- Formula for input value in C0429:

$$\text{Input value C0429} = 16384 \times \text{response time [ms]}$$

- The response time [ms] can be gathered from the data sheet of the initiator or requested by the manufacturer.

3.2.43.8 Offset setting

The offset can be set with code C0756. The offset refers to the digital frequency input and is scaled to 1 revolution (≙ 65536 increments).

The touch probe (TP) initiates the start of the ramp function generator. The leading of the master drive from the moment of starting or the resulting path/phase difference is taken up during the acceleration phase.

- Setting: positive offset values
  - Causes a time shift of the TP
  - This means that less time is necessary - compared to the setting with e.g. offset = 0 - to obtain synchronism with the master drive.

Tip!

With high offsets and low input speeds the drive may reverse. To avoid this, a direction of rotation can be selected for the output via C0766.

3.2.44 Digital frequency processing (DFSET)

Purpose

Conditions the digital frequency for the controller. Input of the stretch factor, gearbox factor, and speed or phase trimming.

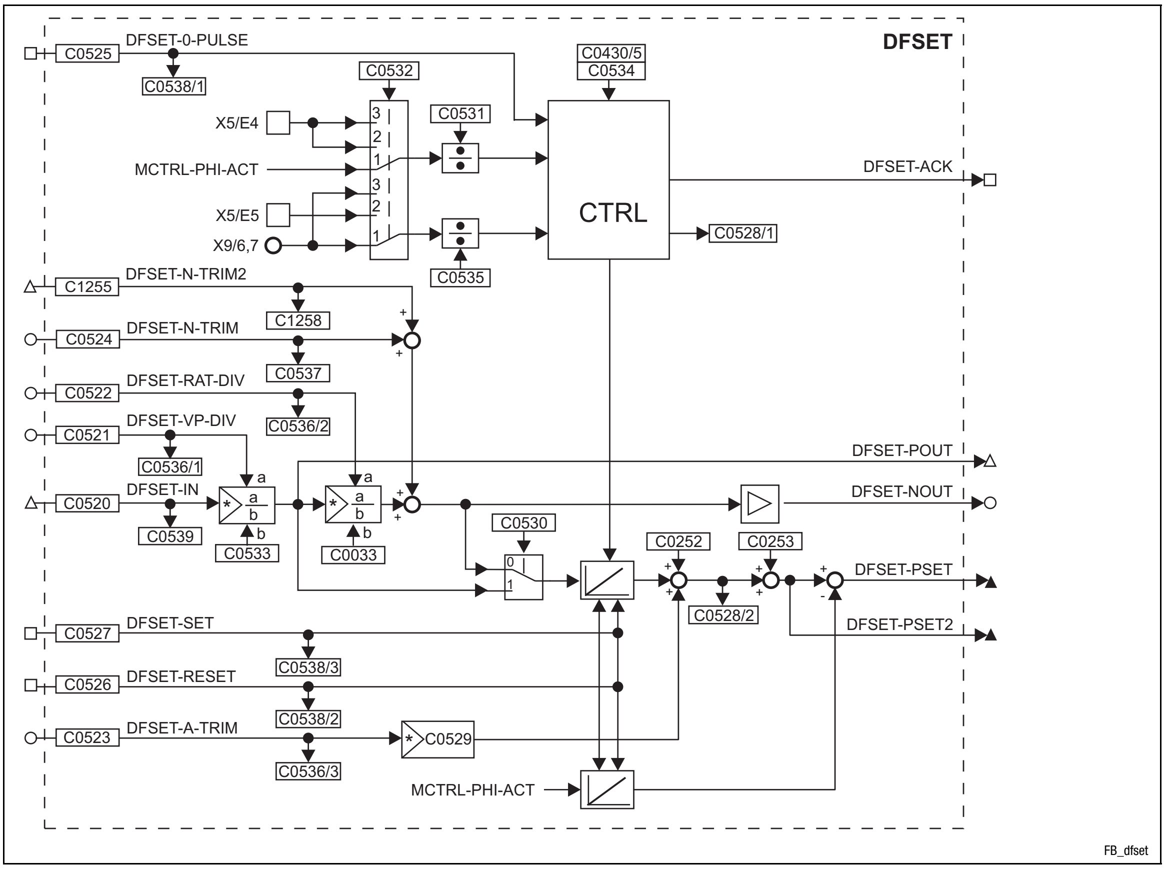


Fig. 3-117 Digital frequency processing (DFSET)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFSET-0-PULSE	d	C0538/1	bin	C0525	2	HIGH = release of zero pulse synchronising
DFSET-N-TRIM	a	C0537	dec [%]	C0524	1	Speed trimming in [%] of C0011
DFSET-N-TRIM2	phd	C1258	dec [rpm]	C1255	4	Speed trimming in [rpm] of C0011
DFSET-RAT-DIV	a	C0536//2	dec	C0522	1	Numerator of gearbox factor 100 % = 16384 inc
DFSET-VP-DIV	a	C0536/1	dec	C0521	1	Numerator of stretch factor 100 % = 16384 inc
DFSET-IN	phd	C0539	dec [rpm]	C0520	4	Speed/Phase setpoint
DFSET-SET	d	C0538/3	bin	C0527	2	• HIGH = Set phase integrators to equal values • LOW-HIGH edge sets DFSET-PSET = 0 • HIGH-LOW edge sets DFSET-PSET = current value of MCTRL-PHI-SET • DFSET-SET has a higher priority than DFSET-RESET
DFSET-RESET	d	C0538/2	bin	C0526	2	• HIGH = sets position difference = 0 • HIGH = sets DFSET-PSET and DFSET-PSET2 = 0
DFSET-A-TRIM	a	C0536/3	dec [inc]	C0523	1	Phase trimming 100% = 16384 inc
DFSET-ACK	d	-	-	-	-	HIGH = synchronising is performed
DFSET-POUT	phd	-	-	-	-	Speed/Phase setpoint
DFSET-NOUT	a	-	-	-	-	in [%] of nmax (C0011)
DFSET-PSET	ph	-	-	-	-	Following error for phase controller
DFSET-PSET2	ph	-	-	-	-	Phase setpoint 65536 inc = 1 revolution

Function

- Setpoint conditioning with stretch and gearbox factor
- Processing of correction values
- Synchronising to zero track or touch probe (for resolver feedback touch probe only)

3.2.44.1 Setpoint conditioning with stretch and gearbox factor

Stretch factor

Defines the ratio between the drive and the setpoint.

- The stretch factor evaluates the setpoint at DFSET-IN. DFSET-POUT outputs the result.
- The stretch factor results from numerator and denominator.
  - – Numerator is variable from analog signal source or fixed value by the code.
  - – Input of the denominator under C0533.
- Relationship:

$$\text{DFSET–POUT} = \text{DFSET–IN} \cdot \frac{\text{DFSET–VP–DIV}}{\text{C0533}}$$

Gearbox factor

Defines the transmission ratio of the drive. Enter the ratio of the drive.

- The gearbox factor evaluates the setpoint at DFSET-IN multiplied by the stretch factor. DFSET-NOUT outputs the result.
- The gearbox factor results from numerator and denominator.
  - – Numerator is variable from analog signal source or fixed value by the code.
  - – Input of the denominator under C0033.
- Relationship:

$$\text{DFSET–NOUT} = \text{Reckfaktor} \cdot \frac{\text{DFSET–RAT–DIV}}{\text{C0033}}$$

$$\text{DFSET–NOUT} = \text{DFSET–IN} \cdot \frac{\text{DFSET–VP–DIV}}{\text{C0533}} \cdot \frac{\text{DFSET–RAT–DIV}}{\text{C0033}}$$

Deactivate the gearbox factor and the DFSET-N-TRIM values as a basis for the setpoint angle integrator. If C0530 = 1, only the stretch factor is used for setpoint angle calculation.

3.2.44.2 Processing of correction values

Speed trimming

This is used to add correction values, e.g. by a superimposed control loop. This enables the drive to accelerate or decelerate.

- Adds an analog value at DFSET-N-TRIM to the setpoint speed.
  (see code C0537)
- Adds a speed value at DFSET-N-TRIM2 to the setpoint speed.
  - – The speed trimming via this input is more precise.
    (see code C1258)

Phase trimming

This adds a setpoint at DFSET-A-TRIM to the phase setpoint (see code C0536/3) and changes the rotor position to the setpoint with the number of increments provided in either direction (drive is leading or lagging). The phase is trimmed within a range of ±32767 increments (≙ ±1/2 rev.). Every analog signal can be used as a source.

- The input is done in increments (one revolution ≙ 65536 increments).
- When analog values are entered, 100% correspond to 1/4 revolution = 16384 increments.
- Extension of the setting range with a multiplier under C0529.

Phase offset

Addition of a fixed phase offset under C0252 to the setpoint of the drive.

Speed-proportional phase setting

Leading or lagging of the phase with rising speed.

- Enter a suitable setting in increments under code C0253.
- The set phase offset is reached at 15000 rpm of the drive (linear relationship).

3.2.44.3 Synchronising to zero track or touch probe

The synchronisation is selected under C0532.

- C0532 = 1, index pulse
  - zero track of digital frequency input X9 and zero track by the feedback system set under C0490 (not for resolver evaluation).
- C0532 = 2, touch probe
  - via terminals X5/E4 (actual pulse) and X5/E5 (set pulse).
- C0532 = 3, zero pulse (setpoint) and TOUCH-PROBE (actual value)
  - Zero track from the digital frequency input X9 for the setpoint and touch probe initiator via terminal X5/E4 for the actual value.

Note!

All three modes provide the possibility to define a divisor factor for the actual pulses with codes C0531 as well as for the setpoint pulses with codes C0535 (default setting = 1). Hence, it is possible to e.g. evaluate every 10th actual pulse if C0531 = 10. The other 9 pulses are ignored.

Touch probe initiators can have delay times which cause a speed-dependent phase offset.

To take this angular offset into account, the response time [ms] of the initiators is converted into an angular correction depending on setpoint speed DFSET-NOUT and then considered in the setpoint angle. For this purpose, the response time [ms] must be converted into a correction value [Inc.] first.

- Set correction value for the phase offset under C0430.
- Formula for the input value in C0430/x:

$$\boxed{\text{Eingabewert in C0430/x} = 16384 \cdot \text{Ansprechzeit[ms]}}$$

- Please take the response time [ms] from the data sheet of the initiator or contact the manufacturer.

Stop!

When the synchronisation via the terminals X5/E4 and X5/E5 (C0532 = 2) is activated, no further control signals must be taken from these terminals. Changing the configuration via C0005 assigns the terminals with a basic setting.

Synchronisation mode

For the synchronisation, different modes are available which can be set under C0534.

C0534	Synchronisation mode	Note
0	Inactive	Function inactive
1	Continuous synchronisation with correction in the shortest possible way	
2	Continuous synchronisation with correction in the shortest possible way	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out continuously if a HIGH level remains at DFSET-0-Pulse.
10	One synchronisation, a phase deviation is corrected in the shortest possible way	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out once
11	One synchronisation, a phase deviation is corrected in CW direction	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out once
12	One synchronisation, a phase deviation is corrected in CCW direction	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out once
13	Single synchronisation, a phase difference is determined between setpoint pulse and actual pulse and is corrected to the corresponding direction of rotation according to the sign	after a LOW-HIGH edge at DFSET-0-Pulse, synchronisation is carried out once

Code C0528/1 displays the number of increments (angular difference) between the setpoint pulse and the actual pulse prior to synchronisation.

Code C0528/2 displays the offset value from (C0523 x C0529 + C0252).

3.2.45 Delay elements (DIGDEL)

Purpose

This function is used to delay digital signals. This function can be used for the control of functions or the generation of status information.

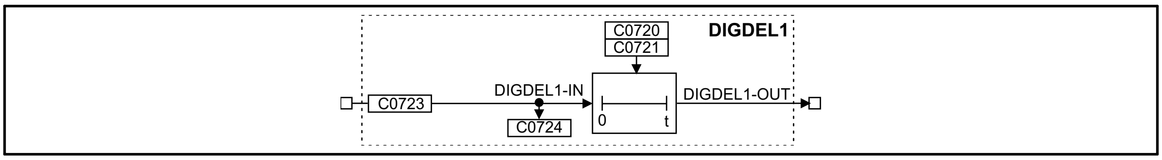


Fig. 3-118 Delay element (DIGDEL1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGDEL1-IN	d	C0724	bin	C0723	2	1000	-
DIGDEL1-OUT	d	-	-	-	-	-	-

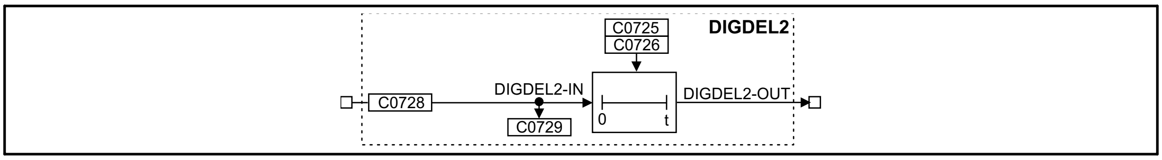


Fig. 3-119 Delay element (DIGDEL2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGDEL2-IN	d	C0729	bin	C0728	2	1000	-
DIGDEL-OUT	d	-	-	-	-	-	-

Function

You can select the following functions under C0720 (DIGDEL1) and C0725 (DIGDEL2):

- On-delay
- Off-delay
- General delay

3.2.45.1 On-delay

If the on-delay is set, a signal change from LOW to HIGH at the input DIGDELx-IN is passed on to the DIGDELx-OUT output after the delay time set under C0721 or C0726 has elapsed.

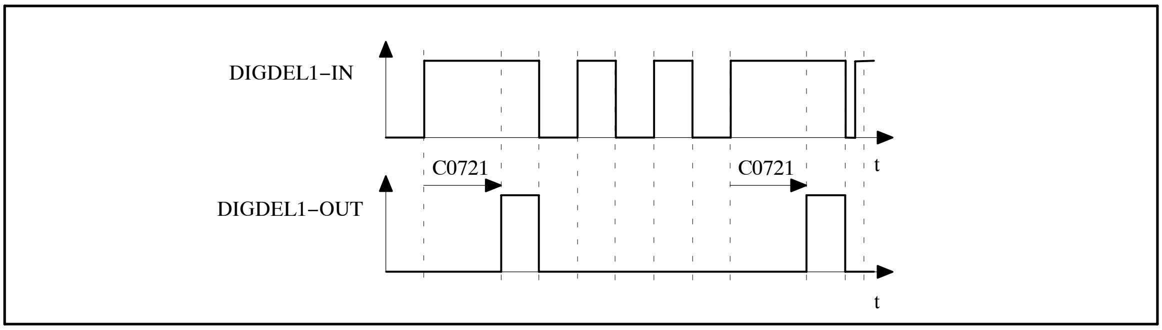


Fig. 3-120 On-delay (DIGDEL1)

In this function, the time element operates like a retriggerable monoflop:

- A LOW-HIGH edge at the input DIGDELx-IN starts the time element.
- If the delay time set under C0721 or C0726 has elapsed, the output DIGDELx-OUT is set to HIGH.
- The time element is reset and the output DIGDELx-OUT is set to LOW with a HIGH-LOW edge at the input DIGDELx-IN.

3.2.45.2 Off-delay

An off-delay causes a signal change from HIGH to LOW at the input DIGDELx-IN to be passed on to the output DIGDELx-OUT after the delay time set under C0721 or C0726 has elapsed.

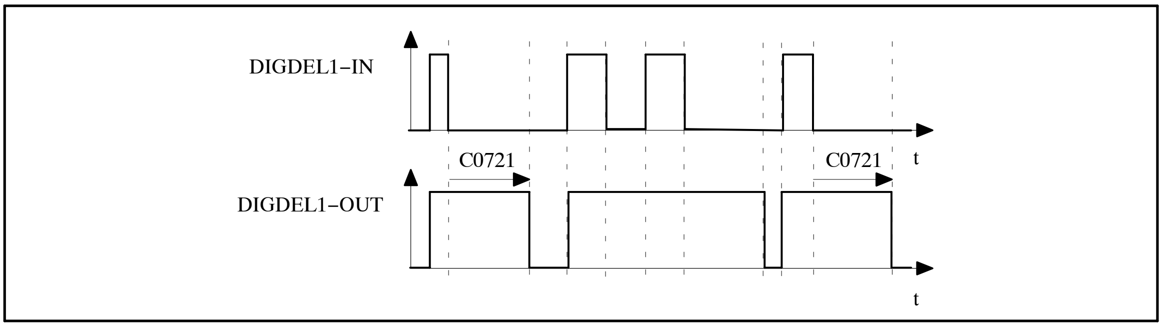


Fig. 3-121 Off-delay (DIGDEL1)

- A LOW-HIGH edge at the input DIGDELx-IN causes the output DIGDELx-OUT to be set to HIGH and the time element to be reset.
- The time element is started with a HIGH-LOW edge at the input DIGDELx-IN.
- After the delay time set under C0721 or C0726 has elapsed, the output DIGDELx-OUT is set to LOW.

3.2.45.3 General delay

A general delay causes any signal change at the input DIGDELx-IN to be passed onto the output DIGDELx-OUT only after the time set under C0721 or C0726 has elapsed.

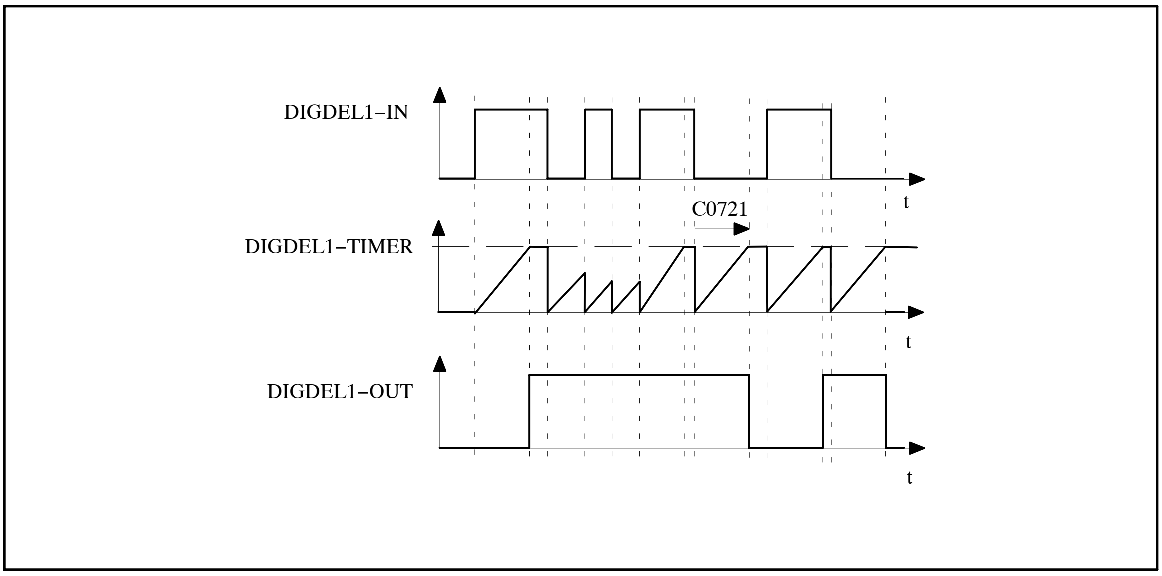


Fig. 3-122 General delay

- The time element is started with any edge at the input DIGDELx-IN.
- When the timer (can be set under C0721 or C0726) has reached the upper limit, the output DIGDELx-OUT is set to the same value as the input DIGDEL1-IN.

3.2.46 Freely assignable digital inputs (DIGIN)

Purpose

Reading and conditioning of the signals at the terminals X5/E1 to X5/E5.

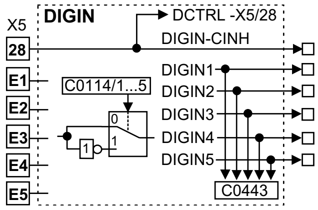


Fig. 3-123 Freely assignable digital inputs (DIGIN)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGIN-CINH	d	-	dec	-	-	-	Controller inhibit acts directly on the DCTRL control
DIGIN1	d	C0443	dec	-	-	-	-
DIGIN2	d	C0443	dec	-	-	-	-
DIGIN3	d	C0443	dec	-	-	-	-
DIGIN4	d	C0443	dec	-	-	-	-
DIGIN5	d	C0443	dec	-	-	-	-

Function

The terminals X5/E1 to X5/E5 are scanned every millisecond. The level for every input can be inverted. For this, proceed as follows:

- Select code C0114 with corresponding subcode (e.g. subcode 3 for input X5/E3)
- Enter the desired level as a parameter:
  – 0 = Level not inverted (HIGH active)
  – 1 = Level inverted (LOW active)

3.2.47 Freely assignable digital outputs (DIGOUT)

Purpose

Conditioning of the digital signals and output at the terminals X5/A1 to X5/A4.

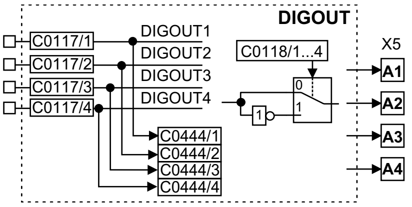


Fig. 3-124 Freely assignable digital outputs (DIGOUT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DIGOUT1	d	C0444/1	bin	C0117/1	2	15000	-
DIGOUT2	d	C0444/2	bin	C0117/2	2	10650	-
DIGOUT3	d	C0444/3	bin	C0117/3	2	500	-
DIGOUT4	d	C0444/4	bin	C0117/4	2	5003	-

Function

The terminals X5/A1 to X5/A4 are updated every millisecond. The level for every output can be inverted. For this, proceed as follows:

- Select code C0118 with corresponding subcode (e.g. subcode 3 for output X5/A3)
- Enter the desired level as a parameter:
  - 0 = Level not inverted (HIGH active)
  - 1 = Level inverted (LOW active)

3.2.48 First order derivative-action element (DT1)

Purpose

Derivative action on signals.

For instance, used for the acceleration processes (dv/dt).

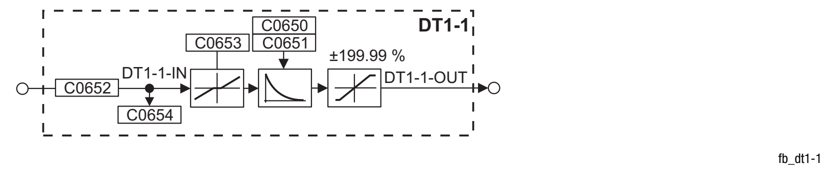


Fig. 3-125 First order derivative-action element (DT1-1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DT1-1-IN	a	C0654	dec [%]	C0652	1	1000	-
DT1-1-OUT	a	-	-	-	-	-	Limited to ±199.99 %

Function

- The gain is set under C0650.
- The delay T_v is set under C0651.
- The input sensitivity of the DT1-1 element can be reduced under C0653.
- The FB only evaluates the specified most significant bits, according to the setting.

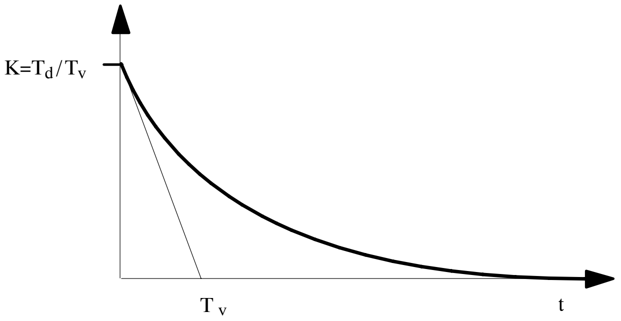
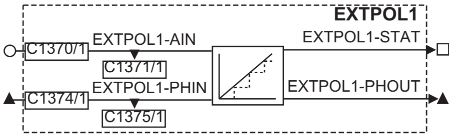


Fig. 3-126 Delay time T_v of the first order derivative-action element

3.2.49 Extrapolation (EXTPOL1)

Optimisation of running features



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
EXTPOL1-AIN	d	1371/1	bin	1370/1		Speed input
EXTPOL1-PHIN	ph	1375/1	ph	1374/1		Position input
EXTPOL1-STAT	d	13451	-	-	-	HIGH = extrapolation on LOW = new data at input PHIN
EXTPOL1-PHOUT	ph	13451	-	-	-	Extrapolated position of input PHIN

The function block EXTPOL1 is used when position information is exchanged between master and slave using a bus system.
The transfer cycle via a bus system is often longer than 1 ms, especially if

- for instance, a PLC or an industrial PC is connected to the bus
- the baud rate is < 1Mbaud (e.g. with cable lengths > 25 m)

The short response time required between setpoint and actual value of the controller is prolonged by the bus load. Especially when the position is changed, a linear speed characteristic is converted into a step-like characteristic. The suddenly changing speed results in corresponding torque peaks in all drive elements connected.

The function block EXTPOL1 smoothens this ’step’ character by ’fine-interpolation’ between the steps (see function block symbol). The improved smoothness of running can even be heard.

Function block interconnection

The function blocks must be connected in both drives (master and slave).

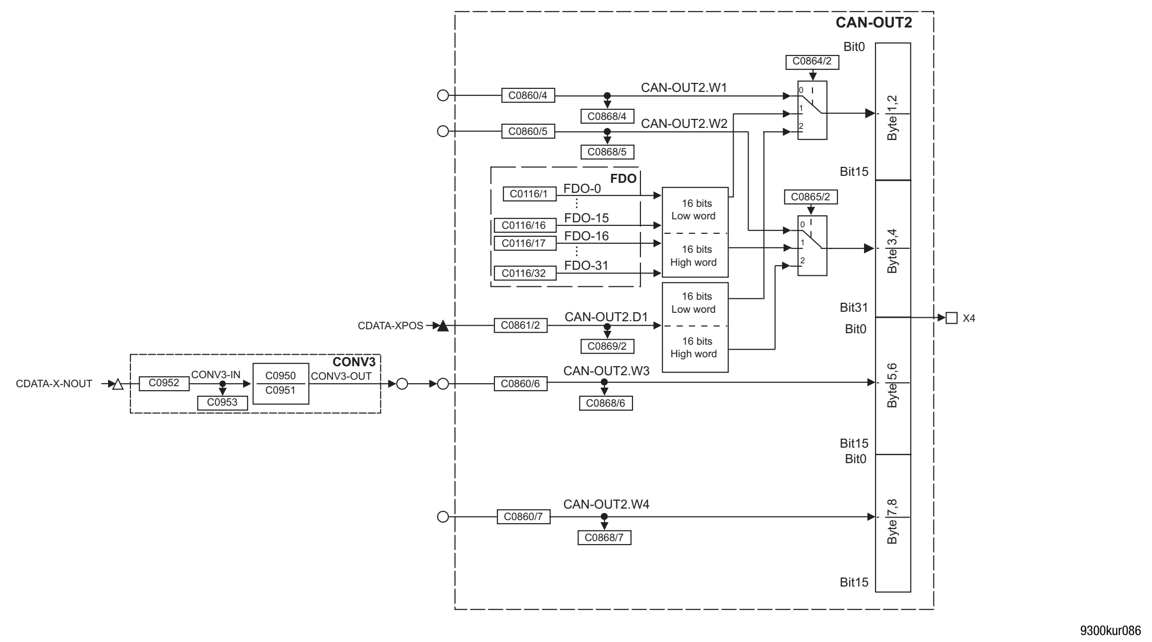


Fig. 3-127 Master connection

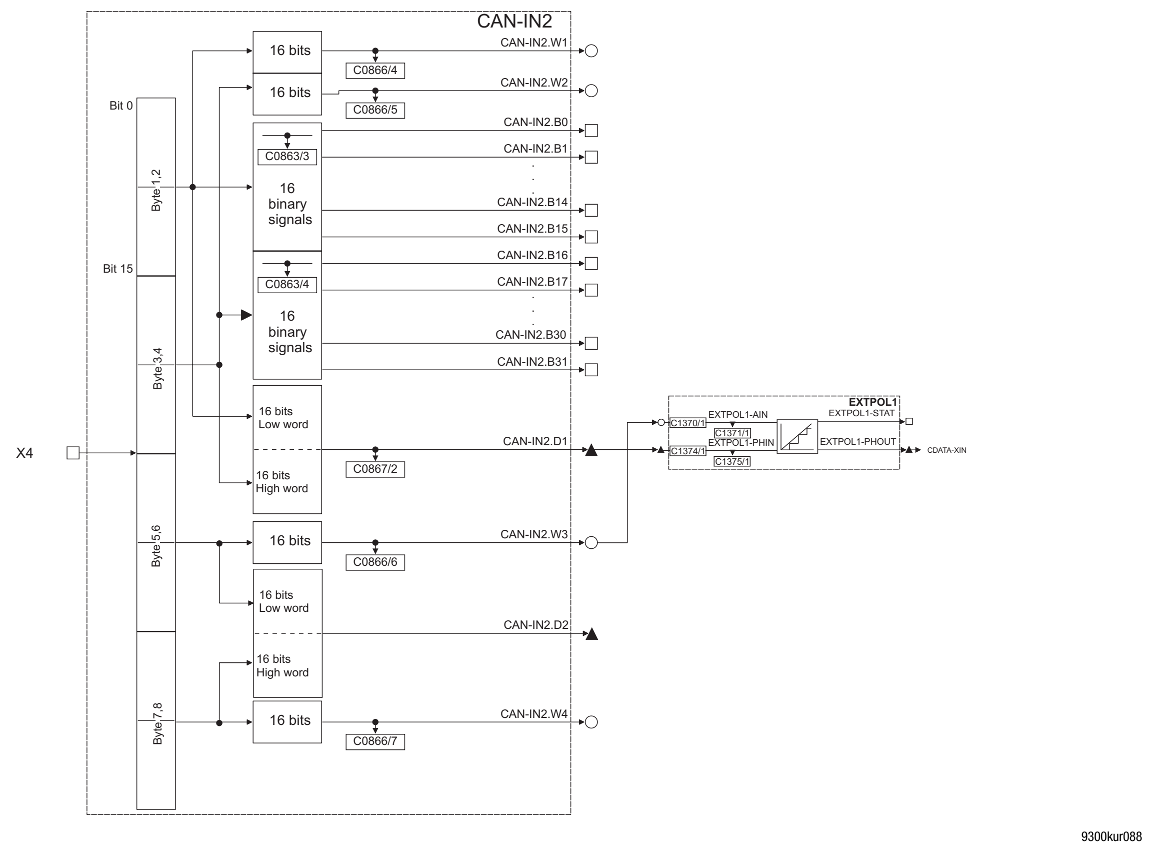


Fig. 3-128 Slave connection

Settings

Note!

FB EXTPOL1 does not require setting. It must however be ensured, that numerator (C0950) and denominator (C0951) are 1 in the function block CONV3 of the master.

Status signal

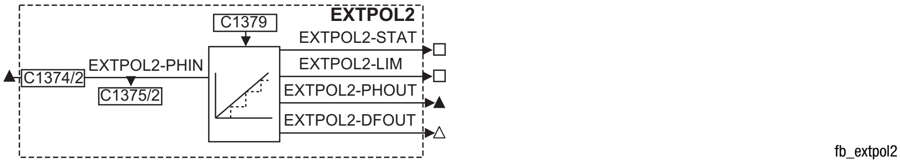
- EXTPOL1-STAT = HIGH
  - Function block extrapolates
- EXTPOL1-STAT = LOW
  - Input data is accepted directly.

3.2.50 Extrapolation (EXTPOL2)

Optimisation of running features (function like EXTPOL1)

Smoothing of a low-resolution absolute value encoder (angle encoder)

Position detection while “line shaft” crosses zero



Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
EXTPOL2-PHIN	ph	1425/2	ph	1374/1		Position input
EXTPOL2-STAT	d	13461	-	-		HIGH = extrapolation on LOW = new data at input -PHIN
EXTPOL2-LIM	d	13462	-	-		HIGH = time limit of C1379 exceeded, extrapolation is cancelled or master angle is in standstill LOW = time limit not exceeded, master angle running
EXTPOL2-PHOUT	ph	13461	-	-		Extrapolated position of input PHIN
EXTPOL2-DFOUT	phd	-	-	-		Extrapolated speed difference signals The output may be only used up to max. 10 extrapolation cycles per ms (C1379 = max. 10 ms)

Tip!

Please observe the computing time of the FBs.

- 5 µs (EXTPOL1)
- 10 µs (EXTPOL2)

Function block interconnection

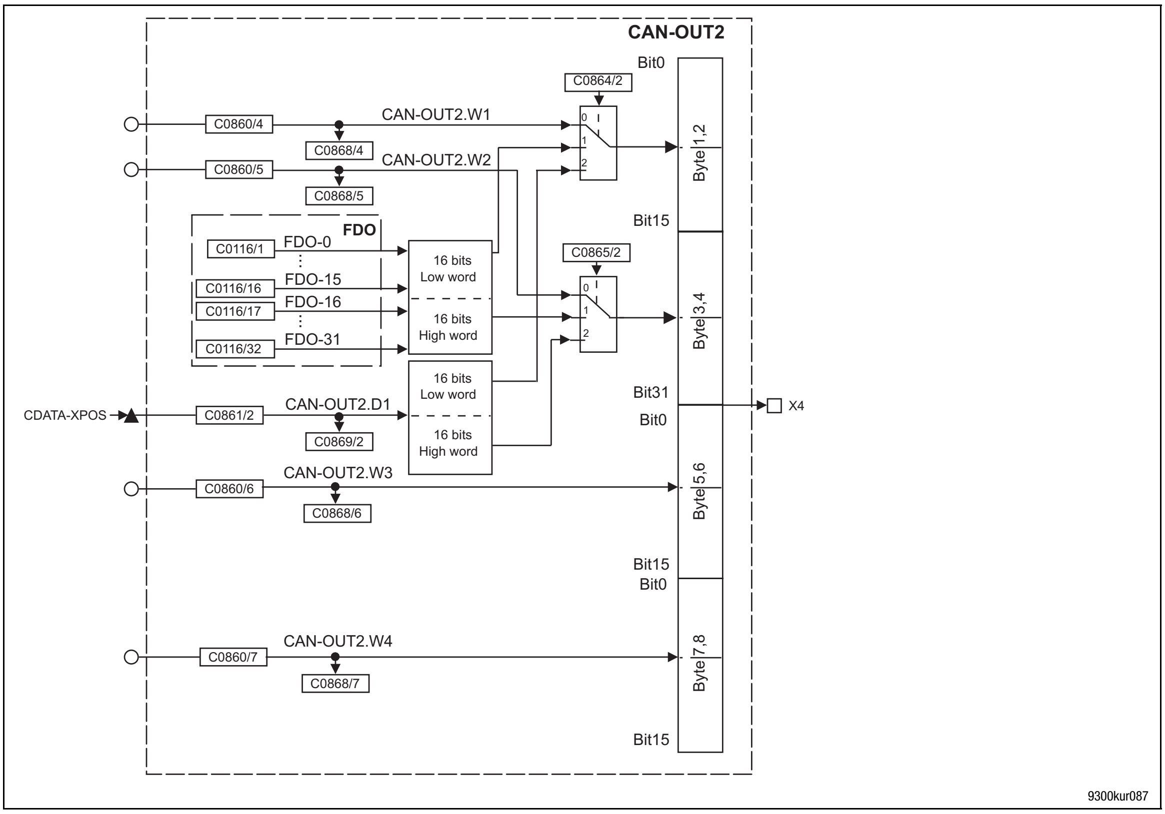


Fig. 3-129 Master connection

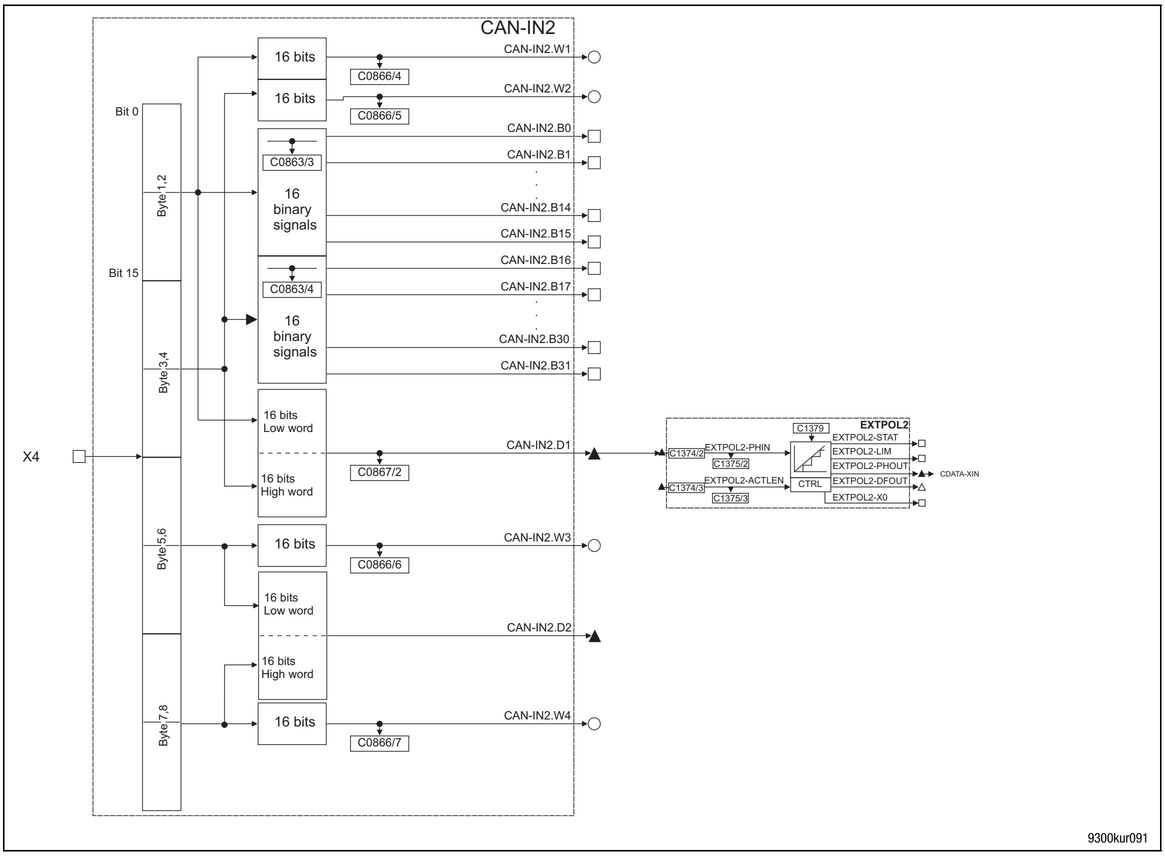


Fig. 3-130 Slave connection

Please see figures Fig. 3-129 and Fig. 3-130 for the interconnections of master and slave.

Differences to EXTPOL1:

- In the master only the X position (CDATA-X-POS) is sent
- The slave just receives the X position

Settings

- Code C1379
  - Use C1379 to adapt the number of extrapolation cycles per ms to the cycle time of the bus.

STOP!

This function does not replace the monitoring of the bus system. The bus system should be monitored with a ”toggle bit”.

Tip!

If, for instance, the transfer cycle is max. 5 ms, set at least 6 ms in C1379.

After the time set has been exceeded, the input EXTPOL2-PHIN is directly connected to the output EXTPOL2-PHOUT. Only when new positions are detected at the input, the extrapolation restarts.

3.2.51 Free piece counter (FCNT)

Purpose

Digital up/down counter

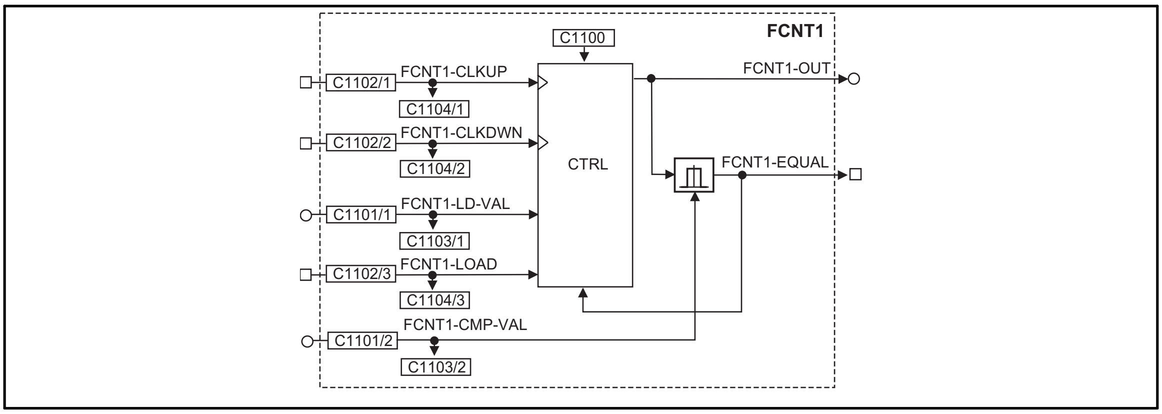


Fig. 3-131 Free piece counter (FCNT1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FCNT1-CLKUP	d	C1104/1	bin	C1102/1	2	LOW-HIGH edge = counts up by 1
FCNT1-CLKDWN	d	C1104/2	bin	C1102/2	2	LOW-HIGH edge = counts down by 1
FCNT1-LD-VAL	a	C1103/1	dec	C1101/1	1	Starting value
FCNT1-LOAD	d	C1104/3	bin	C1102/3	2	• HIGH = Accept starting value • The input has the highest priority
FCNT1-CMP-VAL	a	C1103/2	dec	C1101/2	1	Comparison value
FCNT1-OUT	a	-	-	-	-	Counter limited to ±199.99 % (≙ ±32767)
FCNT1-EQUAL	d	-	-	-	-	HIGH = comparison value reached

Function

- C1100 = 1
  - If | counter content | ≥ | FCNT1-CMP-VAL | (comparison value), FCNT1-EQUAL is set = HIGH for 1 ms. Afterwards the counter is reset to the starting value (FCNT1-LD-VAL).

Note!

If the signal is to be available longer, e. g. for a query of the output via a PLC, you can prolong the signal via the TRANS function block.

- C1100 = 2
  - If | counter content | ≥ | FCNT1-CMP-VAL | (comparison value), the counter is stopped.
  - Via FCNT1-LOAD = HIGH, the counter is reset to the starting value (FCNT1-LD-VAL).
- C1100 = 3
  - If | counter content| = | FCNT1-CMP-VAL | (comparison value), the counter is stopped.
  - Via FCNT1-LOAD = HIGH, the counter is reset to the starting value (FCNT1-LD-VAL).
  - FCNT1-OUT is limited to 32767 for counting upwards and to -32767 for counting downwards.

3.2.52 Free codes (FCODE) of the measuring systems

A measuring system is described via the gearbox factor (numerator and denominator) and the feed constant. These scaling factors have an effect on the conversion of units into increments.

The measuring systems have an effect on free codes.

Measuring system of the master phase (X axis)

- FCODE1476/1 ... FCODE1476/16
- Gearbox factor of the numerator: C1303/1
- Gearbox factor of the denomiator: C1303/2
- Feed constant: C1304
- The selection is effected in [m_units]

Measuring system of the actual value (Y axis)

- FCODE1477/1 ... FCODE1477/16
- Gearbox factor numerator: C1305/1
- Gearbox factor denomiator: C1305/2
- Feed constant: C1306
- The selection is effected in [s_units]

Measuring system Z (Z axis)

- FCODE1478/1 ... FCODE1478/6
- Gearbox factor numerator: C1680/1
- Gearbox factor denomiator: C1680/2
- Feed constant: C1681
- The selection is effected in [z_units]

Note!

The Z measuring system has no effect on the profiles and displays.

The profiles are calculated in PC programs. If you want to calculate profiles via the Z measuring system, you have to adapt the corresponding PC programs.

3.2.53 Free digital outputs (FDO)

Purpose

This function block can be used to connect digital signals via C0151, the function block AIF-OUT and function block CAN-OUT to the connected fieldbus systems.

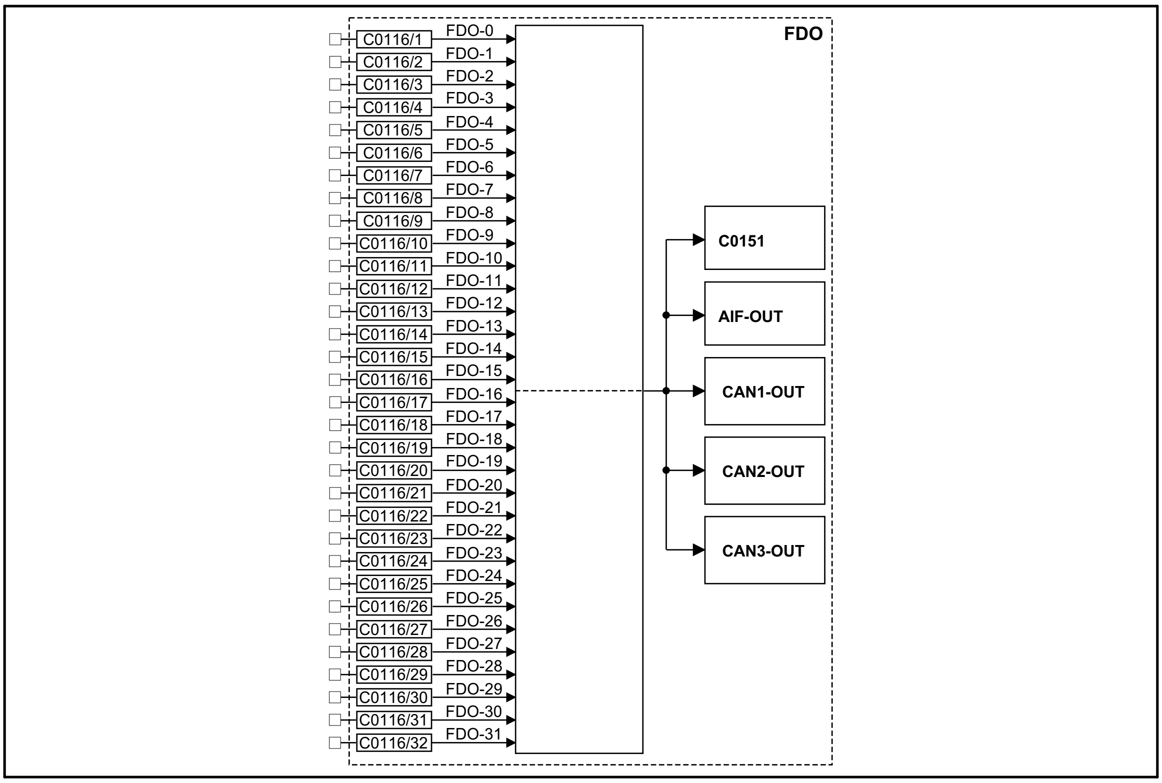


Fig. 3-132 Free digital outputs (FDO)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FDO-0	d	C0151	hex	C0116/1	2	1000	
FDO-1	d	C0151	hex	C0116/2	2	1000	
FDO-2	d	C0151	hex	C0116/3	2	1000	
FDO-3	d	C0151	hex	C0116/4	2	1000	
FDO-4	d	C0151	hex	C0116/5	2	1000	
FDO-5	d	C0151	hex	C0116/6	2	1000	
FDO-6	d	C0151	hex	C0116/7	2	1000	
FDO-7	d	C0151	hex	C0116/8	2	1000	
FDO-8	d	C0151	hex	C0116/9	2	1000	
FDO-9	d	C0151	hex	C0116/10	2	1000	
FDO-10	d	C0151	hex	C0116/11	2	1000	
FDO-11	d	C0151	hex	C0116/12	2	1000	
FDO-12	d	C0151	hex	C0116/13	2	1000	
FDO-13	d	C0151	hex	C0116/14	2	1000	
FDO-14	d	C0151	hex	C0116/15	2	1000	
FDO-15	d	C0151	hex	C0116/16	2	1000	
FDO-16	d	C0151	hex	C0116/17	2	1000	
FDO-17	d	C0151	hex	C0116/18	2	1000	
FDO-18	d	C0151	hex	C0116/19	2	1000	
FDO-19	d	C0151	hex	C0116/20	2	1000	
FDO-20	d	C0151	hex	C0116/21	2	1000	
FDO-21	d	C0151	hex	C0116/22	2	1000	
FDO-22	d	C0151	hex	C0116/23	2	1000	
FDO-23	d	C0151	hex	C0116/24	2	1000	
FDO-24	d	C0151	hex	C0116/25	2	1000	
FDO-25	d	C0151	hex	C0116/26	2	1000	
FDO-26	d	C0151	hex	C0116/27	2	1000	
FDO-27	d	C0151	hex	C0116/28	2	1000	
FDO-28	d	C0151	hex	C0116/29	2	1000	
FDO-29	d	C0151	hex	C0116/30	2	1000	
FDO-30	d	C0151	hex	C0116/31	2	1000	
FDO-31	d	C0151	hex	C0116/32	2	1000	

Function

You can freely select a digital signal source for every signal input.

- The corresponding bit in the data word (DWORD) is marked with FDO-x (e.g. FDO-0 for the LSB and FDO-31 for the MSB).
- The DWORD is transferred to code C0151 and to the function blocks AIF-OUT, CAN-OUT1, CAN-OUT2, and CAN-OUT3.

3.2.54 Freely assignable input variables (FEVAN)

Purpose

Transfer of analog signals to any code. At the same time, the FB converts the signal into the data format of the target code.

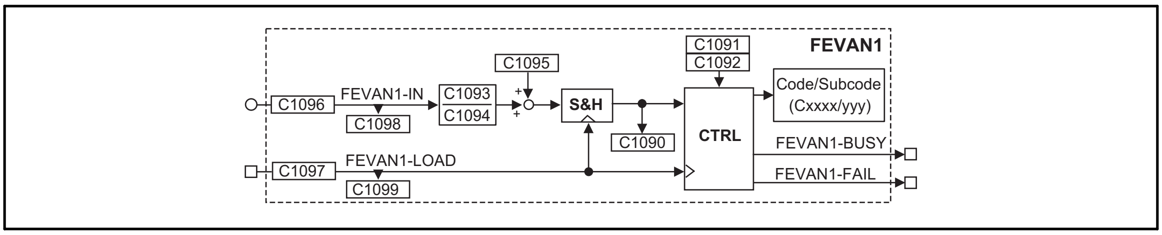


Fig. 3-133 Freely assignable input variables (FEVAN1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN1-IN	a	C1098	dec	C1096	1	Input value
FEVAN1-LOAD	d	C1099/1	bin	C1097/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN1-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN1-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN1-LOAD sets FEFAN1-FAIL = LOW.
-	-	C1090	-	-	-	Display of the converted signal

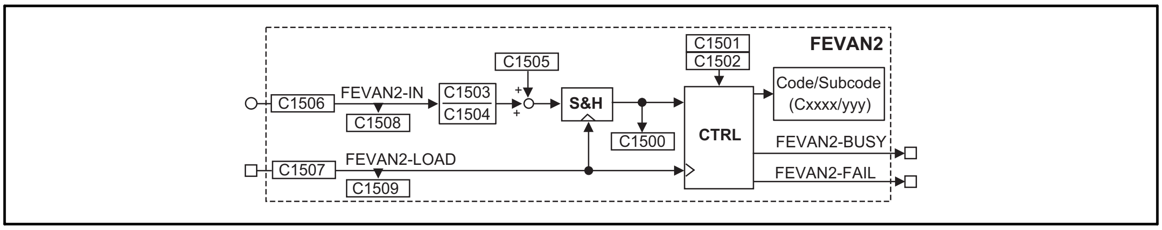


Fig. 3-134 Freely assignable input variables (FEVAN2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN2-IN	a	C1508	dec	C1506	1	Input value
FEVAN2-LOAD	d	C1509/1	bin	C1507/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN2-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN2-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN2-LOAD sets FEFAN2-FAIL = LOW.
-	-	C1500	-	-	-	Display of the converted signal

Function

- Conversion of the read data via:
  - Numerator, denominator.
  - Offset.
- Selection of a target code for the read data.

Codes for the conversion of the read data and for the selection of the target code

				Selection of the target code		
Function block	**Numerator**	**Denominator**	**Offset**	**Code**	**Subcode**	**Examples**
FEVAN1	C1093	C1094	C1095	C1091	C1092	
FEVAN2	C1503	C1504	C1505	C1501	C1502	

Data transmission

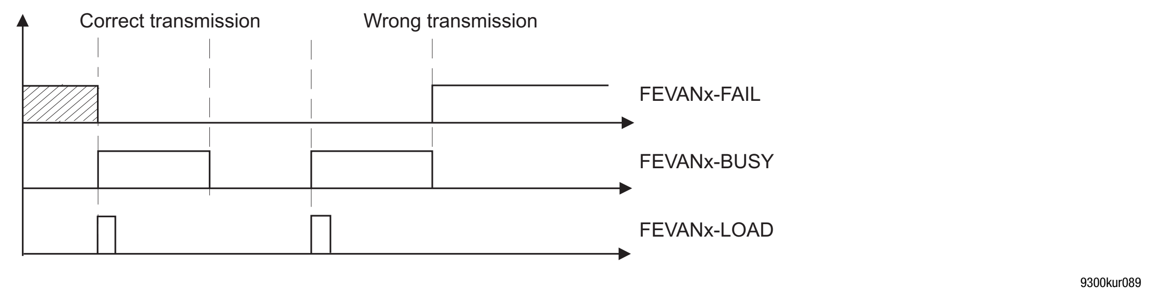


Fig. 3-135 Signal flow

Transmission errors may occur if

- the target code is not available,
- the target subcode is not available,
- the values transmitted are out of the target code limits,
- the target code is inhibited since it may only be written to if the controller is inhibited. Inhibit the controller (see code table).

Cyclic data transmission

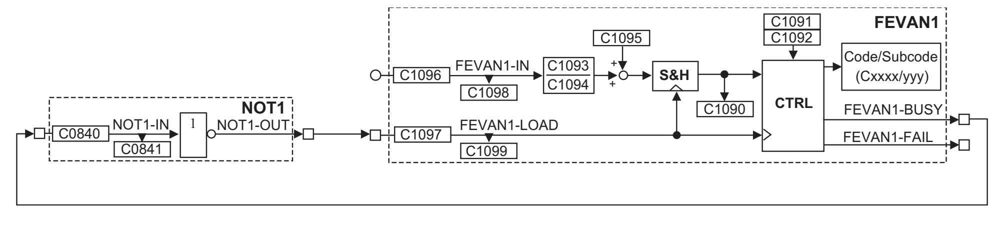


Fig. 3-136 Example for a cyclic data transmission to a target code

Conversion

Conversion at the example of FB FEVAN1.

- The data format of the target code is important for the conversion (see attribute table).
- Adapt the input signal to the data format of the target code with:
  - C1093 (numerator).
  - C1094 (denominator).
- C1094 also determines the decimal positions of the target code:
  - Set C1094 according to the existing decimal positions of the target code. The number of decimal positions can be obtained from the code table.
  - 0.0001 ≙ no decimal positions.
  - 0.001 ≙ one decimal position.
  - 0.01 ≙ two decimal positions.
  - 0.1 ≙ three decimal positions.
  - 1 ≙ four decimal positions.
- For target codes with % scaling the formula for conversion must include a scaling factor (see example 1).

Example 1 (only for FIX32 format with % scaling):

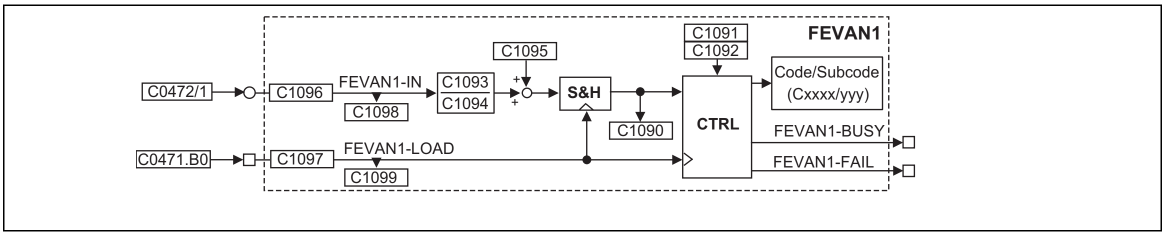


Fig. 3-137 Interconnection example of a circuit for FIX32 format with % scaling

Task:

- C0472/1 = 1.05 %. Write this value to C0141.

Configuration:

- Connect FEVAN1-IN (C1096) with FCODE-472/1 (19521).
- Connect FEVAN1-LOAD (C1097/1) with FCODE-471.B0 (19521).

Parameter setting:

- Set C1091 = 141 (≙ C0141)
- Set C1092 = 0 (no subcode available)
- C1093 = calculate numerator
- Set C1094 = 0.01 (two decimal positions)
- Set C1095 = 0 (no offset).

Calculation:

$$\text{FEVAN1–IN [\%]} \cdot \underbrace{\frac{1}{10000}}_{\text{Scaling factor}} \cdot \underbrace{\frac{16384}{100}}_{\text{Unit scaling factor}} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = \text{C0141 [\%]}$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data is transmitted to the target code.

Example for converting to C1093:

$$\underbrace{1.05\ \%}_{\text{Setpoint in C0141}} \cdot 10000 \cdot \frac{100}{16384} \cdot \text{C1094} \cdot \frac{1}{\underbrace{1.05\ \%}_{\text{FEVAN1-IN}}} = \text{C1093} = 0.6103$$

Display:

- C0141 = 1.00 %

Example 2 (only for FIX32 format without % scaling):

Task:

- C0473/1 = 1000. Write this value to C0011.

Configuration:

- Connect FEVAN1-IN (C1096) with FCODE-473/1 (19551).
- Connect FEVAN1-LOAD (C1097/1) with FCODE-471.B0 (19521).

Parameter setting:

- Set C1091 = 11 (≙ C0011)
- Set C1092 = 0 (no subcode available)
- Set C1093 = 1.0
- Set C1094 = 0.0001 (no decimal position)
- Set C1095 = 0 (no offset).

The source code has no unit. The unit scaling factor is dropped.

Calculation:

$$\text{FEVAN1–IN} \cdot \frac{1}{10000} \cdot \underbrace{\frac{\text{C1093}}{\text{C1094}}}_{\text{Scaling factor}} + \text{C1095} = \text{C0011 [rpm]}$$

$$1000 \cdot \frac{1}{10000} \cdot \frac{1.0}{0.0001} + 0 = 1000 \text{ rpm}$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data is transmitted to the target code.

Display:

- C0011 displays the value 1000 rpm.

The other formats are calculated with the following formula:

$$\text{FEVAN1–IN} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = x$$

3.2.55 Fixed setpoints (FIXSET)

Purpose

This FB serves to program up to 15 fixed setpoints which can be retrieved via digital terminals or control codes.

The fixed setpoints can e.g. be used for:

- different setpoint dancer positions for one dancer position control or
- different stretching ratios (gearbox factor) for a speed ratio control with digital frequency coupling

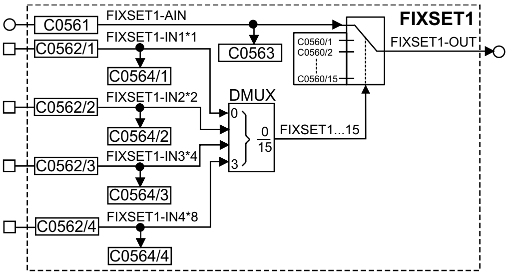


Fig. 3-138 Fixed setpoint (FIXSET1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FIXSET1-AIN	a	C0563	dec [%]	C0561	1	1000	The input is switched to the output if a LOW level is applied to all selection inputs FIXSET-INx.
FIXSET1-IN1*1	d	C0564/1	bin	C0562/1	2	1000	The number of the inputs to be assigned depends on the number of the FIXSET setpoints required.
FIXSET1-IN2*2	d	C0564/2	bin	C0562/2	2	1000	
FIXSET1-IN3*4	d	C0564/3	bin	C0562/3	2	1000	
FIXSET1-IN4*8	d	C0564/4	bin	C0562/4	2	1000	
FIXSET1-OUT	a	-	-	-	-	-	

Function

The FB output can be used as a setpoint source (signal source) for another FB (e.g. process controller, arithmetic block etc.). Parameter setting and handling are similar to JOG but independent of JOG (cp. FB NSET).

- Parameter setting of the fixed setpoints:
  - The single fixed setpoints are parameterised via the subcodes of C0560.
- Output of the fixed setpoint selected:
  - If the binary inputs are triggered with HIGH signal, a fixed setpoint from the table is switched to the output.
- Value range:
  - The values for the fixed setpoint can be set between -200% and +200%.

3.2.55.1 Release of the FIXSET1 setpoints

Number of the fixed setpoints required	**Number of inputs to be assigned**
1	at least 1
1 ... 3	at least 2
4 ... 7	at least 3
8 ... 15	4

System for decoding the binary input signals:

Output signal FIXSET1-OUT =	**1st input FIXSET1-IN1**	**2nd input FIXSET1-IN2**	**3rd input FIXSET1-IN3**	**4th input FIXSET1-IN4**
FIXSET1-Ain	0	0	0	0
C0560/1	1	0	0	0
C0560/2	0	1	0	0
C0560/3	1	1	0	0
C0560/4	0	0	1	0
C0560/5	1	0	1	0
C0560/6	0	1	1	0
C0560/7	1	1	1	0
C0560/8	0	0	0	1
C0560/9	1	0	0	1
C0560/10	0	1	0	1
C0560/11	1	1	0	1
C0560/12	0	0	1	1
C0560/13	1	0	1	1
C0560/14	0	1	1	1
C0560/15	1	1	1	1

3.2.56 Flipflop element (FLIP)

Purpose

This FB is a D flipflop. This function is used to evaluate and save digital signal edges.

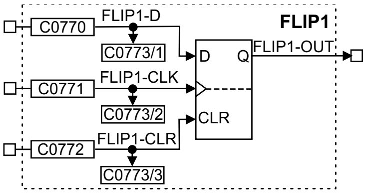


Fig. 3-139 Flipflop element (FLIP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP1-D	d	C0773/1	bin	C0770	2	1000	-
FLIP1-CLK	d	C0773/2	bin	C0771	2	1000	Evaluates LOW-HIGH edges only
FLIP1-CLR	d	C0773/3	bin	C0772	2	1000	Evaluates the input level only: input has highest priority
FLIP1-OUT	d	-	-	-	-	-	-

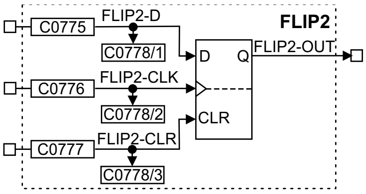


Fig. 3-140 Flipflop element (FLIP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP2-D	d	C0778/1	bin	C0775	2	1000	-
FLIP2-CLK	d	C0778/2	bin	C0776	2	1000	Evaluates LOW-HIGH edges only
FLIP2-CLR	d	C0778/3	bin	C0777	2	1000	Evaluates the input level only: input has highest priority
FLIP2-OUT	d	-	-	-	-	-	-

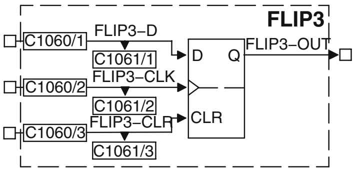


Fig. 3-141 Flipflop element (FLIP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP3-D	d	C1061/1	bin	C1060/1	2	1000	-
FLIP3-CLK	d	C1061/2	bin	C1060/2	2	1000	Evaluates LOW-HIGH edges only
FLIP3-CLR	d	C1061/3	bin	C1060/3	2	1000	Evaluates the input level only: input has highest priority
FLIP3-OUT	d	-	-	-	-	-	-

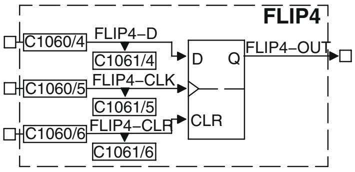


Fig. 3-142 Flipflop element (FLIP4)

Signal				Source	Source		Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIP4-D	d	C1061/4	bin	C1060/4	2	1000	-
FLIP4-CLK	d	C1061/5	bin	C1060/5	2	1000	Evaluates LOW-HIGH edges only
FLIP4-CLR	d	C1061/6	bin	C1060/6	2	1000	Evaluates the input level only: input has highest priority
FLIP4-OUT	d	-	-	-	-	-	-

Function

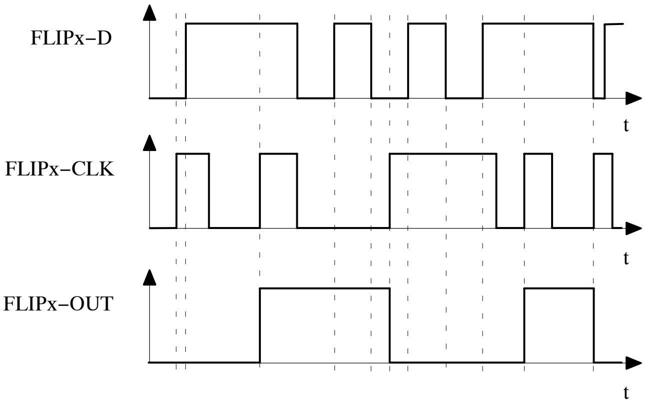


Fig. 3-143 Function sequence of a flipflop

- The input FLIPx-CLR always has priority.
- If a HIGH level is applied at the input FLIPx-CLR, the output FLIPx-OUT is set to and maintained at a LOW level al long as this input is at a HIGH level.
- With a LOW-HIGH edge at the input FLIPx-CLK, the level at the input FLIPx-D is switched to the output and saved until
  – another LOW-HIGH edge is applied at the input FLIPx-CLK or
  – the input FLIPx-CLR is set to a HIGH level.

3.2.57 Flipflop element (FLIPT)

Purpose

The function blockB is designed as D-flipflop. By means of this function, digital signal edges can be evaluated and saved.

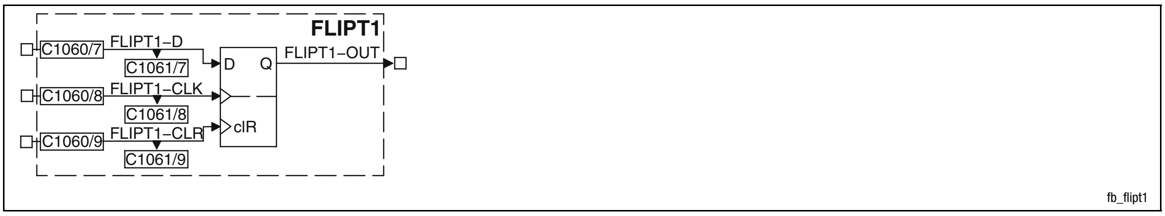


Fig. 3-144 Flipflop element (FLIPT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIPT1-D	d	C1061/7	bin	C1060/7	2	1000	-
FLIPT1-CLK	d	C1061/8	bin	C1060/8	2	1000	Evaluates LOW-HIGH edges only
FLIPT1-CLR	d	C1061/9	bin	C1060/9	2	1000	Evaluates LOW-HIGH edges only
FLIPT1-OUT	d	-	-	-	-	-	-

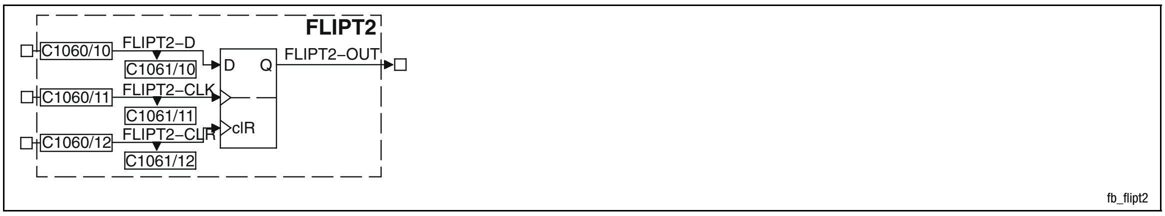


Fig. 3-145 Flipflop element (FLIPT2)

Signal				Source	Source		Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
FLIPT2-D	d	C1061/10	bin	C1060/10	2	1000	-
FLIPT2-CLK	d	C1061/11	bin	C1060/11	2	1000	Evaluates LOW-HIGH edges only
FLIPT2-CLR	d	C1061/12	bin	C1060/12	2	1000	Evaluates LOW-HIGH edges only
FLIPT2-OUT	d	-	-	-	-	-	-

Function

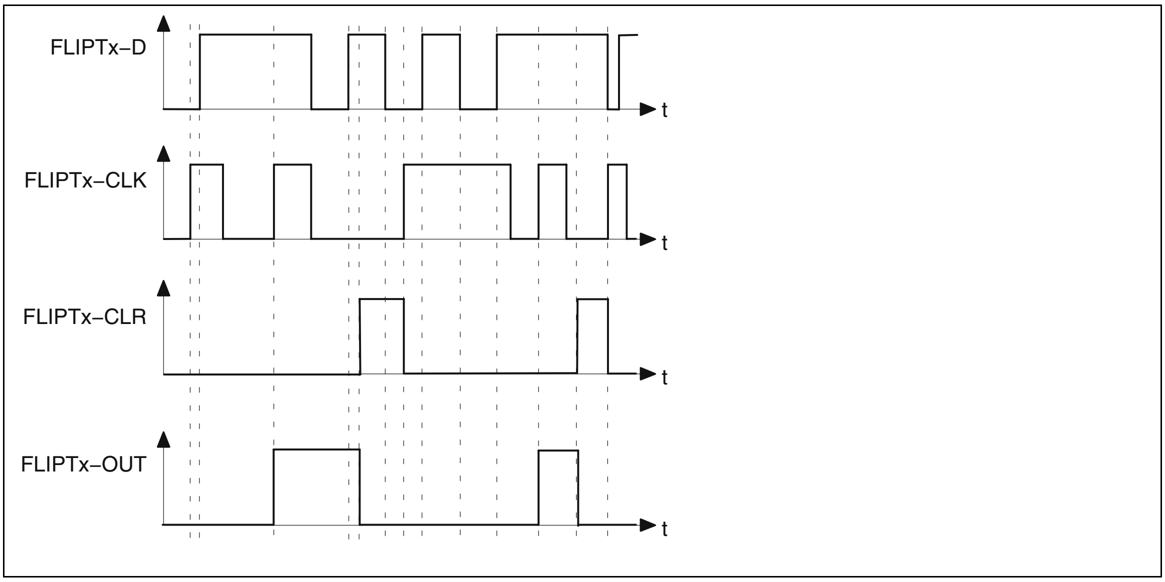


Fig. 3-146 Function sequence of the FLIPTx flipflop element

- Via a LOW-HIGH edge at input FLIPTx-CLK, the level at the input FLIPTx-D is switched to the output FLIPTx-OUT.
- The output FLIPTx-OUT is reset to LOW by means of a LOW-HIGH edge at input FLIPTx-CLR.

3.2.58 Gearbox compensation (GEARCOMP)

Purpose

Compensates elasticities in the drive train (e.g. gearbox torsion).

Implementation of an adaptive linkage of e.g. the phase setpoint (32 bits) and the torque feedforward control (14 bits).

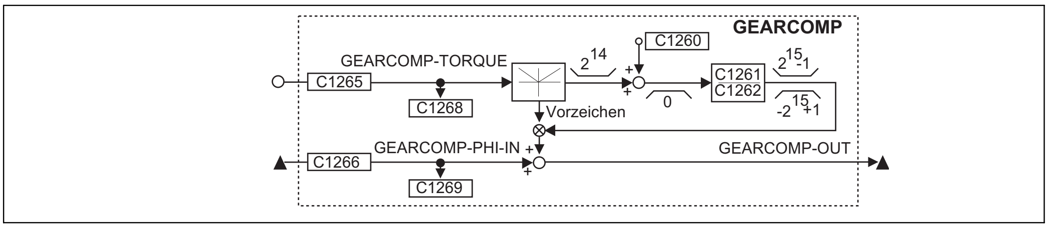


Fig. 3-147 Gearbox compensation (GEARCOMP)

Signal				Source		Comment
Name	Type	DIS	DIS format	CFG	List	
GEARCOMP-TORQUE	a	C1268	dec [%]	C1265	2	Input value
GEARCOMP-PHI-IN	ph	C1269	dec [inc]	C1266	3	
GEARCOMP-OUT	ph	-	-	-	-	Outputs the compensated phase setpoint.

Function

- The signal at GEARCOMP-TORQUE is broken down into the absolute value and the sign.
  – The absolute value is limited to 2^{14} (+16384) first.
- The absolute value is converted (via C1260, C1261, C1262).
- The result is evaluated with the sign and is added to the signal at GEARCOMP-PHI-IN.

Codes for the conversion of the absolute value:

Code	Function	Selection			Comment
C1260	Offset	-16383	{1}	16383	
C1261	Numerator	-32767	{1}	32767	Dynamic disconnection at C1261 = 0 (GEARCOMP-PHI-IN = GEARCOMP-OUT)
C1262	Denominator	1	{1}	32767	

3.2.59 Limiting element (LIM)

Purpose

This FB is used to limit signals to adjustable value ranges.

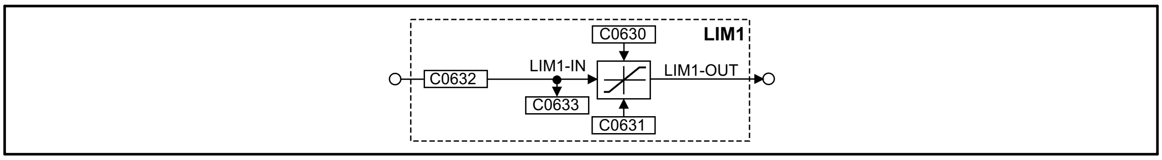


Fig. 3-148 Limiting element (LIM1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
LIM1-IN1	a	C0633	dec [%]	C0632	1	1000	-
LIM1-OUT	a	-	-	-	-	-	-

Function

- If the input signal exceeds the upper limit (C0630), the upper limit is effective.
- If the input signal falls below the lower limit (C0631), the lower limit is effective.

Tip!

The lower limit (C0631) must be smaller than the upper limit (C0630).

3.2.60 Limiting element (LIMPHD1)

Purpose

Speed limitation without position loss.

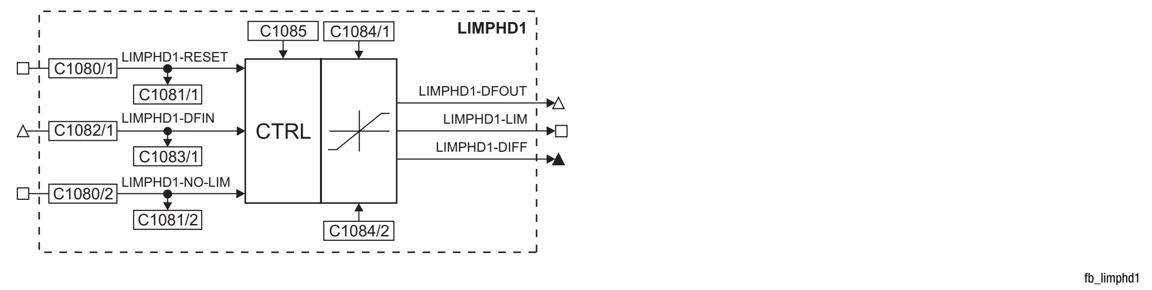


Fig. 3-149 Limiting element (LIMPHD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
LIMPHD1-RESET	d	C1081/1	bin	C1080/1	2	1000	HIGH = overflow buffer is cleared Input has the highest priority
LIMPHD1-NO-LIM	d	C1081/2	bin	C1080/2	2	1000	HIGH = The limitation set via C1084/1 and C1084/2 is switched off The overflow buffer is cleared. The position gets lost.
LIMPHD1-DFIN	phd	C1083/1	dec [rpm]	C1082/1	4	1000	Input of the speed setpoint
LIMPHD1-DFOUT	phd	-	-	-	-	-	Output of speed setpoint No position loss when signal is limited
LIMPHD1-LIM	d	-	-	-	-	-	HIGH = Signal at LIMPHD1-DFOUT is limited. Condition: LIMPHD1-NO-LIM = 0 and LIMPHD1-RESET = 0. (Function is available as of software version 3.4)
LIMPHD1-DIFF	ph	-	-	-	-	-	Output of the difference in position in [inc] between input signal at LIMPHD1-DFIN and output signal at LINPHD1-DFOUT (Function is available as of software version 3.4)

Function

An active speed limitation results in a position loss of the cam (e.g. compared with the master drive). While the speed limitation is active (asynchronous status), the overflow buffer is being filled.

The overflow buffer is cleared again if the signal at LIMPHD1-DFIN is lower then the upper and higher than the lower limit value.

- The speed limitation can be set via C1084/1 and C1084/2.
  - The speed is limited to the set maximum value via C1084/1.
  - The speed is limited to the set minimum value via C1084/2.
  - The lower limit (C1084/2) must be smaller than the upper limit (C1084/1).
- LIMPHD1-NO-LIM = HIGH is used to switch off the parameterisable limitation. The speed signal is limited to ±29999 rpm.
  - If C1085 = 0 (Lenze setting), the overflow buffer is cleared. The position gets lost.
  - If C1085 = 1, the overflow buffer is cleared. The increments at output LIMPHD1-DFOUT. The position is not lost.
  - Code C1085 is available from the software version 3.4.
- If LIMPHD1-RESET = HIGH, the overflow buffer is cleared. The input has the highest priority.
  - The limitations set via C1084/1 and C1084/2 remain active.

Note!

The overflow buffer behaves according to the cycle of numbers (32 bits).

3.2.61 Internal motor control (MCTRL)

Purpose

This function block controls the drive machine consisting of angle controller, speed controller, and motor control.

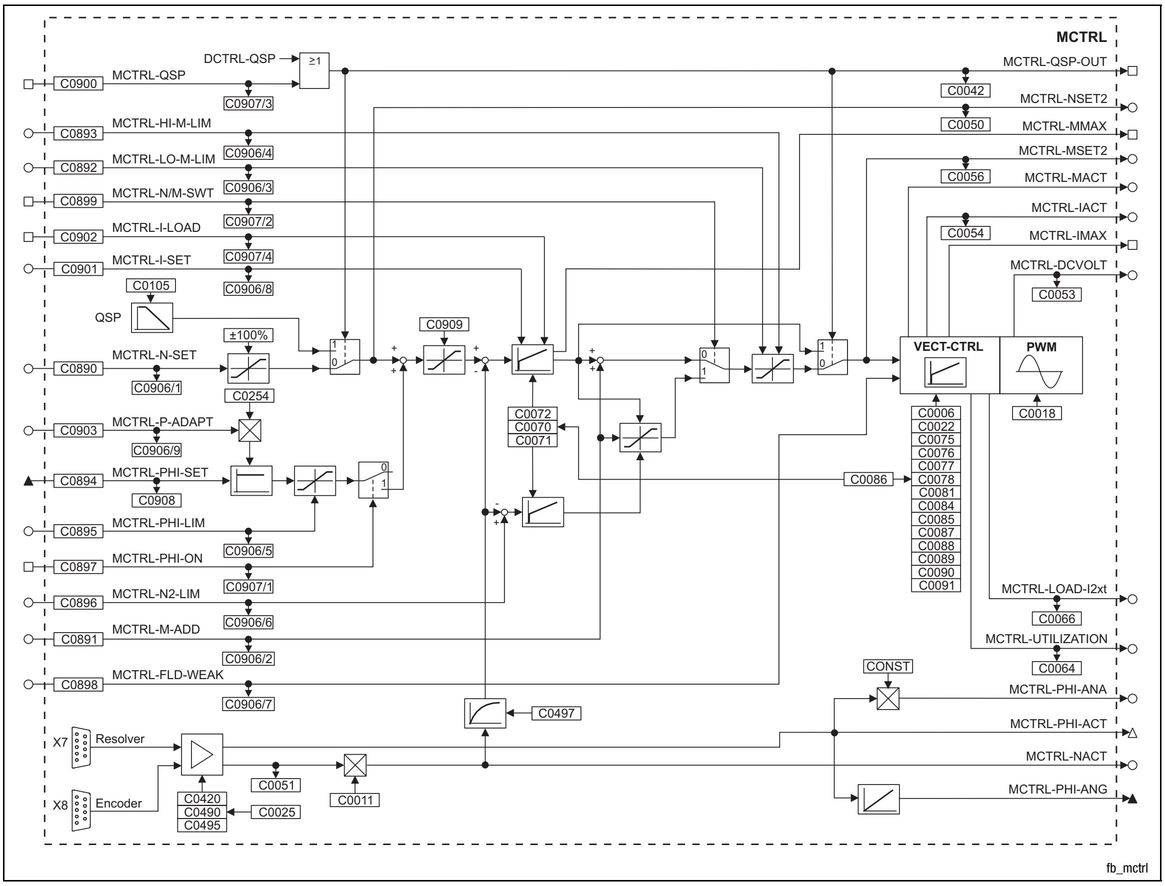


Fig. 3-150 Internal motor control (MCTRL)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MCTRL-PHI-SET	ph	C0908	dec [inc]	C0894	3	1000	Angle controller input for difference of setpoint angle to actual angle
MCTRL-N-SET	a	C0906/1	dec [%]	C0890	1	5050	Speed setpoint input
MCTRL-M-ADD	a	C0906/2	dec [%]	C0891	1	1000	Additional torque setpoint or torque setpoint
MCTRL-LO-MLIM	a	C0906/3	dec [%]	C0892	1	5700	Lower torque limitation in % of C0057
MCTRL-HI-MLIM	a	C0906/4	dec [%]	C0893	1	19523	Upper torque limitation in % of C0057
MCTRL-PHI-LIM	a	C0906/5	dec [%]	C0895	1	1006	Influence of angle controller in % of nmax C0011
MCTRL-N2-LIM	a	C0906/6	dec [%]	C0896	1	1000	Lower speed limit at speed limitation
MCTRL-FLDWEAK	a	C0906/7	dec [%]	C0898	1	1006	Motor excitation
MCTRL-I-SET	a	C0906/8	dec [%]	C0901	1	1006	Input for setting the I component of the speed controller
MCTRL-P-ADAPT	a	C0906/9	dec [%]	C0903	1	1006	Influence in % on V_P of C0254, the absolute value is processed (without sign)
MCTRL-PHI-ON	d	C0907/1	bin	C0897	2	1000	HIGH = Activation of angle controller
MCTRL-N/M-SWT	d	C0907/2	bin	C0899	2	1000	LOW = active speed control HIGH = active torque control
MCTRL-QSP	d	C0907/3	bin	C0900	2	10250	HIGH = drive performs QSP
MCTRL-I-LOAD	d	C0907/4	bin	C0902	2	1000	HIGH = I component of the n-controller is accepted by MCTRL-I-SET
MCTRL-QSP-OUT	d	-	-	-	-	-	HIGH = drive performs QSP
MCTRL-NSET2	a	-	-	-	-	-	In % of n_{max} (C0011)
MCTRL-MMAX	d	-	-	-	-	-	HIGH = speed controller operates within the limits
MCTRL-MSET2	a	-	-	-	-	-	In % of M_{max} (C0057)
MCTRL-MACT	a	-	-	-	-	-	In % of M_{max} (C0057)
MCTRL-IACT	a	-	-	-	-	-	MCTRL-IACT = 100 % = C0022
MCTRL-IMAX	d	-	-	-	-	-	HIGH = drive operates at the current limit C0022
MCTRL-DCVOLT	a	-	-	-	-	-	100 % = 1000 V
MCTRL-LOAD-I2xt	a	-	-	-	-	-	I^2 × t utilisation of the motor in %
MCTRL-UTILIZATION	a	-	-	-	-	-	Device utilisation I × t in %
MCTRL-PHI-ANA	a	-	-	-	-	-	Actual angle value as analog signal 90° = 100 %
MCTRL-PHI-ACT	phd	-	-	-	-	-	
MCTRL-NACT	a	-	-	-	-	-	In % of n_{max} (C0011)
MCTRL-PHI-ANG	ph	-	-	-	-	-	65536 inc = one revolution

Function

- Current controller
- Torque limitation
- Additional torque setpoint
- Speed controller
- Torque control with speed limitation
- Speed setpoint limitation
- Angle controller
- Quick stop QSP
- Field weakening
- Switching frequency changeover

3.2.61.1 Current controller

Adapt current controller via C0075 (proportional gain) and C0076 (reset time) to the machine connected.

Note!

Use C0086 to select a suitable motor from the motor selection list. In this way, the parameters of the current controller are automatically set to the correct values.

3.2.61.2 Additional torque setpoint

The input MCTRL-M-ADD serves as torque setpoint or additional torque setpoint, depending on the control of the input MCTRL-N/M-SWT. The additional torque setpoint can be used e.g. for friction compensation or speed injection (dv/dt).

- When MCTRL-N/M-SWT = LOW the speed control is active.
  - MCTRL-M-ADD is added to the output of the n-controller.
  - The limits defined by the torque limitations MCTRL-LO-M-LIM and MCTRL-HI-M-LIM cannot be exceeded.
- When MCTRL-N/M-SWT = HIGH, the torque control is active.
  - MCTRL-M-ADD acts as torque setpoint
  - The n-controllers have a monitoring function.
- The torque setpoint is specified in [%] of the max. possible torque (see C0057).
  - Negative values mean a torque with CCW rotation of the motor.
  - Positive values mean a torque with CW rotation of the motor.

3.2.61.3 Torque limitation

Via the inputs MCTRL-LO-M-LIM and MCTRL-HI-M-LIM an external torque limitation can be set. This serves to set different torques for the quadrants ”driving” and ”braking”.

- MCTRL-HI-M-LIM is the upper torque limit in [%] of the max. possible torque (C0057).
- MCTRL-LO-M-LIM is the lower torque limit in [%] of the max. possible torque (C0057).
- In case of quick stop (QSP) the torque limitation is deactivated.

STOP

Stop!

Only apply positive values to MCTRL-HI-M-LIM and negative values to MCTRL-LO-M-LIM. Otherwise the speed controller may lose control and the drive may rev up in an uncontrolled manner.

3.2.61.4 Speed controller

The speed controller is designed as an ideal PID controller.

Parameter setting

If you select a motor via C0086, the parameters are preset so that only a few (if any) adaptations to the application are necessary.

- Parameterisation of the proportional gain V_p in C0070:
  - Enter approx. 50 % of the speed setpoint
  - Increase C0070 until the drive becomes unstable (observe motor noises)
  - Reduce C0070 until the drive runs stable again
  - Reduce C0070 to approx. 50 %
- Parameterisation of the reset time T_n in C0071:
  - Reduce C0071 until the drive becomes unstable (observe motor noises)
  - Increase C0071 until the drive runs stable again
  - Set C0071 to the double value
- Parameterisation of the derivative gain T_d in C0072:
  - Increase C0072 during operation until an optimum behaviour is achieved.

Signal limitation

When the drive outputs the max. torque, the speed controller operates within the limits.

- The drive cannot follow the speed setpoint.
- This state is indicated with MCTRL-MMAX = HIGH.

Setting the integral component

To enter defined starting values for the torque the integral component of the n-controller can be set externally (e.g. when using the brake control).

- MCTRL-I-LOAD = HIGH
  - The n-controller accepts the value at input MCTRL-I-SET as its integral component.
  - The value at input MCTRL-I-SET acts as a torque setpoint for the motor control.
- MCTRL-I-LOAD = LOW
  - Function is switched off.

3.2.61.5 Torque control with speed limitation

This function is activated with MCTRL-N/M-SWT = HIGH. A second speed controller (auxiliary speed controller) is connected for the speed limitation.

- MCTRL-M-ADD acts as bipolar torque setpoint.
- The n-controller 1 is used to create the upper speed limit.
  - The upper speed limit is selected at the input MCTRL-N-SET in [%] of nmax (C0011) (pos. sign for CW rotation).
  - The upper speed limit is only to be used for CW rotation.
- The n-controller (auxiliary speed controller) is used to form the lower speed limit
  - The lower speed limit is selected at the input MCTRL-N2-LIM in [%] of nmax (C0011) (neg. sign for CCW rotation).
  - The lower speed limit is only to be used for CCW rotation.

3.2.61.6 Speed setpoint limitation

The speed setpoint is limited to ±100 % of nmax (C0011) at the MCTRL-N-SET input.

C0909 is used to set a limitation of the direction of rotation for the speed setpoint.

3.2.61.7 Angle controller

The angle controller is required to achieve angular synchronism and drift-free standstill.

Note!

Select a configuration with digital frequency coupling in C0005 since this serves to link all important signals automatically. On this basis the system can be optimised.

Activating the angle controller

1. Configure a signal source with C0894, which provides the angular difference between setpoint and actual angle (see ”Digital frequency configuration under C0005).
2. Select a value > 0 at the MCTRL-PHI-LIM input.
3. Trigger the input MCTRL-PHI-ON with HIGH (e.g. with FIXED1).
4. Set the gain of the angle controller > 0 in C0254 (see chapter 3.2.61.4)
   - Before setting C0254, select an as high as possible P-gain for the n-controller in C0070.
   - Increase C0254 during operation until the drive shows the required control response.

Influence of angle controller

The output of the angle controller is added to the speed setpoint.

- If the actual angle is lagging, the drive is accelerated
- If the actual angle is leading the drive is decelerated until the required angular synchronism is achieved.

The influence of the angle controller consists of:

- Angular difference multiplied by the P-gain C0254
- Additional influence via analog signal at MCTRL-P-ADAPT
- Limitation of the angle controller output to ±MCTRL-PHI-LIM

Limitation of the angle controller output

This limits the max. speed-up of the drive at high angular differences.

3.2.61.8 Quick stop QSP

The QSP function is used to stop the drive within an adjustable time independently of the setpoint selection.

The QSP function is active

- if the input MCTRL-QSP is triggered with HIGH.
- if the controller is triggered via the control words (DCTRL).

Function:

- If torque control has been selected, it will be deactivated. The drive is controlled by the speed controller.
- The speed runs with the deceleration time set under C0105 to zero speed.
- The torque limitations MCTRL-LO-M-LIM and MCTRL-HI-M-LIM are deactivated.
- The angle controller is activated. If the rotor position is shifted actively, the drive generates a torque against this displacement if:
  – C0254 is not zero
  – The input MCTRL-PHI-LIM is triggered with a value > 0 %.

STOP

Stop!

If the field is weakened manually (MCTRL-FLD-WEAK < 100%), the drive is unable to generate the max. torque.

3.2.61.9 Field weakening

The field weakening range does not need to be set if the motor type has been set in C0086. In this case all settings required are made automatically. The motor is operated in the field weakening mode if

- the output voltage of the controller exceeds the rated motor voltage set in C0090,
- the controller cannot increase the output voltage with rising speed any more because of the mains voltage / DC-bus voltage.

Manual field weakening

A manual field weakening is possible via the input MCTRL-FLD-WEAK. For reaching the maximum excitation this input must be triggered with +100 % (e.g. FIXED100%).

Stop!

The available torque is reduced by the field weakening.

3.2.61.10 Switching frequency changeover

The switching frequency of the inverter can be selected:

- 8 kHz fixed, for power-optimised operation (C0018 = 1)
  – maximum power output of the controller, but with audible pulse operation
- 16 kHz fixed, for noise-optimised operation (C0018 = 2)
  – inaudible pulse operation of the controller, but with reduced power output (torque)
- Automatic changeover between power-optimised and noise-optimised operation (C0018 = 0)

Automatic switching frequency changeover

The automatic switching frequency changeover can be used if the drive is to be operated in the noise-optimised range, but the available torque is not sufficient for acceleration processes.

Condition M = f(I)	Function
$M < M_{N16}$ (I_{N16})	Controller is operated with 16 kHz (noise-optimised)
M_{N16} (I_{N16}) $< M < M_{N8}$ (I_{N8})	Controller switches over to 8 kHz (power-optimised)
$M > M_{max8}$ (I_{max8})	Controller operates with 8 kHz in the current limitation

3.2.62 Mains failure control (MFAIL)

Purpose

If the supply voltage via L1, L2, L3 or +UG, -UG fails, the drive (drive network) can be decelerated (braked) in a controlled way. Without this function, the drive (drive network) would coast.

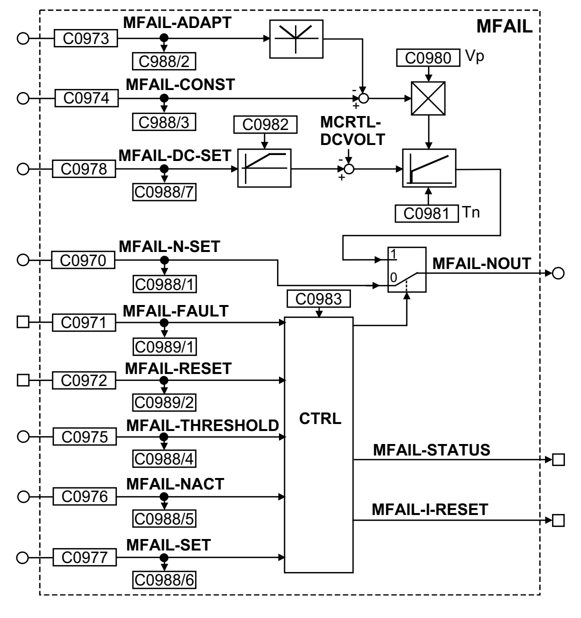


Fig. 3-151 Mains failure control (MFAIL)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MFAIL-N-SET	a	C0988/1	dec [%]	C0970	1	1000	Speed setpoint in [%] of C0011
MFAIL-ADAPT	a	C0988/2	dec [%]	C0973	1	1000	Dynamic adaptation of the proportional gain of the U_{Gset} controller in [%] of C0980
MFAIL-KONST	a	C0988/3	dec [%]	C0974	1	1000	Proportional gain of the U_{Gset} controller in [%] of C0980
MFAIL-THRESHOLD	a	C0988/4	dec [%]	C0975	1	1000	Restart threshold in [%] of C0011
MFAIL-NACT	a	C0988/5	dec [%]	C0976	1	1000	Comparison value for the restart threshold in [%] of C0011
MFAIL-SET	a	C0988/6	dec [%]	C0977	1	1000	Speed starting point for the deceleration in [%] of C0011
MFAIL-DC-SET	a	C0988/7	dec [%]	C0978	1	1000	Voltage setpoint on which the DC bus voltage is to be maintained, 100% = 1000V
MFAIL-FAULT	d	C0989/1	bin	C0971	2	1000	HIGH = activates the mains failure control
MFAIL-RESET	d	C0989/2	bin	C0972	2	1000	HIGH = reset
MFAIL-N-OUT	a	-	-	-	-	-	Speed setpoint in [%] of C0011
MFAIL-STATUS	d	-	-	-	-	-	HIGH = mains failure control active
MFAIL-I-RESET	d	-	-	-	-	-	HIGH = mains failure control active, the drive is braking

Range of functions

- Mains failure detection
- Mains failure control
- Restart protection
- Reset of the mains failure control
- Dynamic adaptation of the control parameters
- Fast mains recovery (auto reclosure)
- Application examples

3.2.62.1 Mains failure detection

A failure of the controller's power supply can be detected by

- evaluating the DC-bus voltage or
- an external system for mains failure detection (e.g. 934X supply module or voltage measuring relay).

It is possible to combine the two methods.

The type of the mains failure detection to be used depends on the drive system used.

DC-bus voltage evaluation

Use with single drives or multi-axis drives, which do not use external monitoring systems.

- For this you can use a comparator (e.g. CMP2). Link the signals as follows:
  - C0688/1 = 5005 (MCTRL-DCVOLT to CMP2-IN1)
  - C0688/2 = 19540 (free code C0472/20 to CMP2-IN2)
  - C0971 = 10655 (CMP2-OUT to MFAIL-FAULT)
  - Set function of the comparator CMP2 with C0685 = 3

Enter the function blocks CMP2 and MFAIL into free positions of the processing table in C0465.

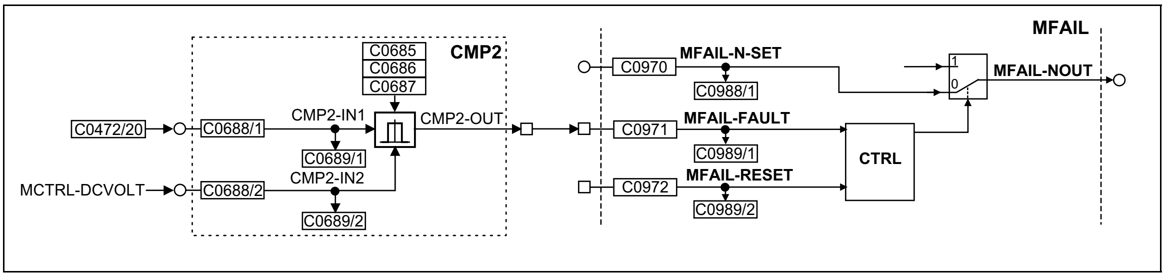


Fig. 3-152 Example of a mains failure detection with internal function blocks (section)

External system for mains failure detection (934x supply module)

- A digital output of the supply module 934x is connected to the function block MFAIL via the digital inputs DIGIN of the controller 93XX. In the example the input X5/E4 is used. For this purpose link the signals as follows:
  - – C0971 = 54 (DIGIN4 to MFAIL-FAULT)
  - – C0871 = 1000 (remove DCTRL-TRIP-SET from terminal X5/E4)
  - – Select level (HIGH or LOW active) with C0114/4

Enter the function block MFAIL into a free position of the processing table in C0465.

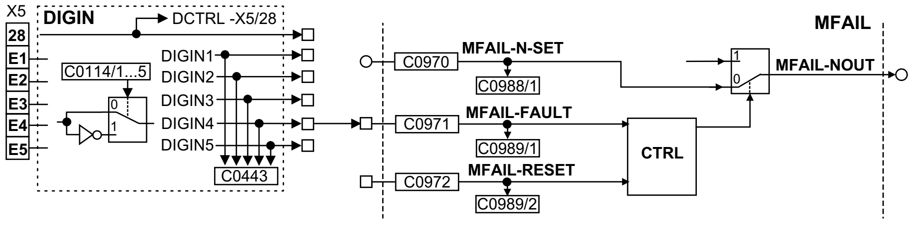


Fig. 3-153 Example of a mains failure detection by an external monitoring system

Combination of the two methods

- The combination of both processes is done via an OR operation with an internal function block. In the example, OR5 is used. For this, link the signals as follows:
  - – C0688/1 = 5005 (MCTRL-DCVOLT to CMP2-IN1)
  - – C0688/2 = 19540 (free code C0472/20 to CMP2-IN2)
  - – Set function of the comparator CMP2 with C0685 = 3
  - – C0838/1 = 10655 (CMP2-OUT to OR5-IN1)
  - – C0838/2 = 54 (DIGIN5 to OR5-IN2)
  - – C0971 = 10570 (OR5-OUT to MFAIL-FAULT)

Enter the function blocks CMP2, OR5 and MFAIL into free positions of the processing table in C0465.

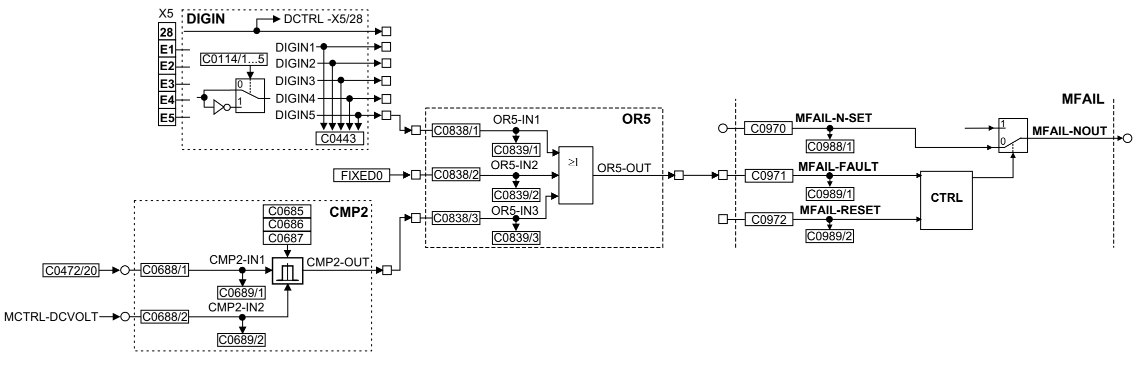


Fig. 3-154 Example of a mains failure detected by different sources

3.2.62.2 Mains failure control

Integration of the function block into the signal flow of the controller

As an example, the function block is integrated into the basic configuration C0005 = 1000 (speed control).

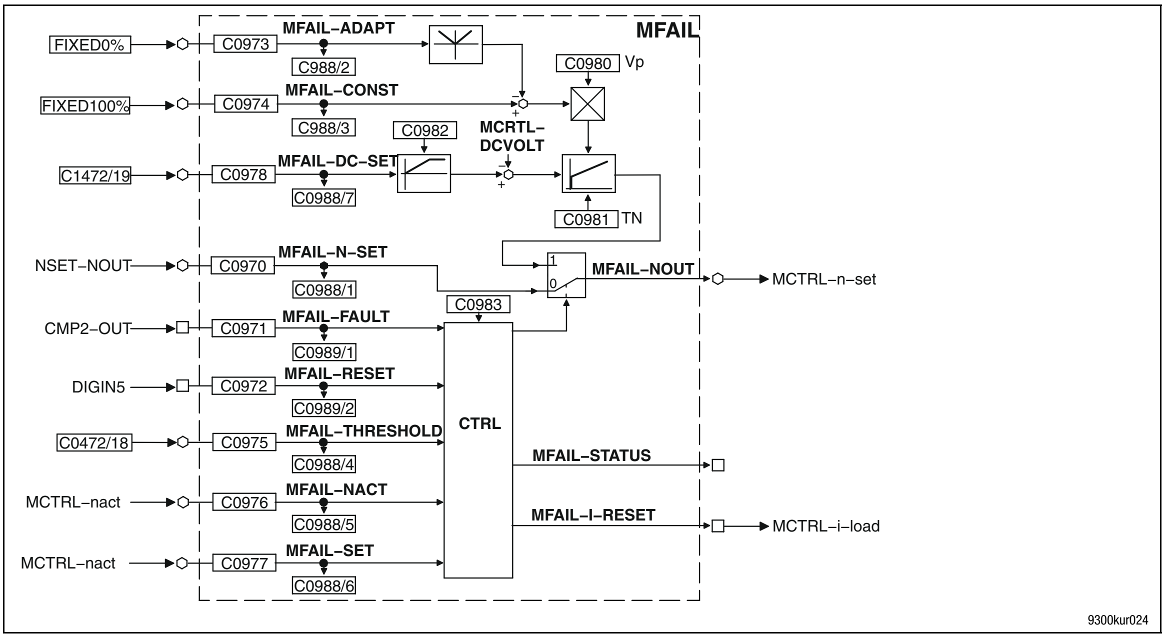


Fig. 3-155 Integration into basic configuration C0005 = 1000

1. Create speed setpoint path	• C0970 = 5050 (NSET-NOUT to MFAIL-N-SET) • C0890 = 6100 (MFAIL-NOUT to MCTRL-N-SET)
2. Start value selection (here: act. speed value)	• C0977 = 6100 (MFAIL-NOUT to MFAIL-SET)
3. Selection of setpoint source for DC-bus voltage (here: freely connectable code FCODE C0472/19)	• C0978 = 19539 (C0472/19 to MFAIL-DC-SET)
4. Selection of source which activates the mains failure control	• see chapter 3.2.62.1
5. Create proportional gain and adaptation DC-bus voltage controller	• C0974 = 1006 (FIXED100% to MFAIL-CONST) • C0973 = 1000 (FIXED0% to MFAIL-ADAPT)
6. Implement restart protection	• C0976 = 6100 (MFAIL-NACT to MCTRL-NACT) • C0975 = 19538 (C0472/18 to MFAIL-THRESHLD) • First enter approx. 2 % under C0472/18 (reference: nmax C0011)
7. Connect reset input (here with terminal X5/E5 TRIP-RESET)	• C0972 = 55 (DIGIN5 to MFAIL-RESET)
8. Enter all function blocks used (except for codes and digital inputs DIGIN) into free positions of the processing table in C0465.	

Note!

All settings must be saved non-volatilely in a parameter set under C0003.

Activation

- MFAIL-FAULT = HIGH activates the mains failure control.
- MFAIL-FAULT = LOW triggers a timing element. After the time set under C0983 has elapsed, the mains failure control is completed/cancelled (see description of mains recovery, chapter 3.2.62.6).
  - – The drive is accelerated to the speed setpoint if the restart protection is not active.
  - – The drive is continued to be braked to zero speed if the restart protection is active (see description for restart protection, chapter 3.2.62.3).
  - – If the restart protection is active, the drive can only be reset by a HIGH level signal at the MFAIL-RESET input.

Function

The controller generates the operational energy required from the rotational energy of the driving machine. The driving machine is braked via the power loss of the controller and the motor. Thus, the speed deceleration ramp is shorter than with a non-controlled system (coasting drive).

With the activation,

- the DC bus voltage is controlled to the value at the MFAIL-DC-SET input.
- an internally generated speed setpoint is output at output MFAIL-N-OUT. This serves to brake the drive (via the speed setpoint) to a speed of almost zero.
  - – Starting value for the controlled deceleration is the value at input MFAIL-SET. This input is generally connected to the output MCTRL-NACT (actual speed value) or MCTRL-NSET2, MFAIL-NOUT (speed setpoint).
  - – The speed deceleration ramp (and thus the brake torque) results from the moment of inertia of the driven machine(s), the power loss of the drive (drive network), and the parameterisation.

STOP!

- If a connected braking unit is activated, the drive is braked with the max. possible torque (Imax). In this case, it may be necessary to adapt the parameter setting (see description for parameter setting).
- If the power stage is not supplied, the drive cannot generate a standstill torque (important for active loads such as hoists).

Parameter setting

The parameters to be set depend strongly on the motor used, the inertia of the driven machine and the drive configuration (single drive, drive network, master/slave operation etc.). For this reason, this function must be adjusted to the prevailing application case.

The following specifications refer to chapter 3.2.62.1.

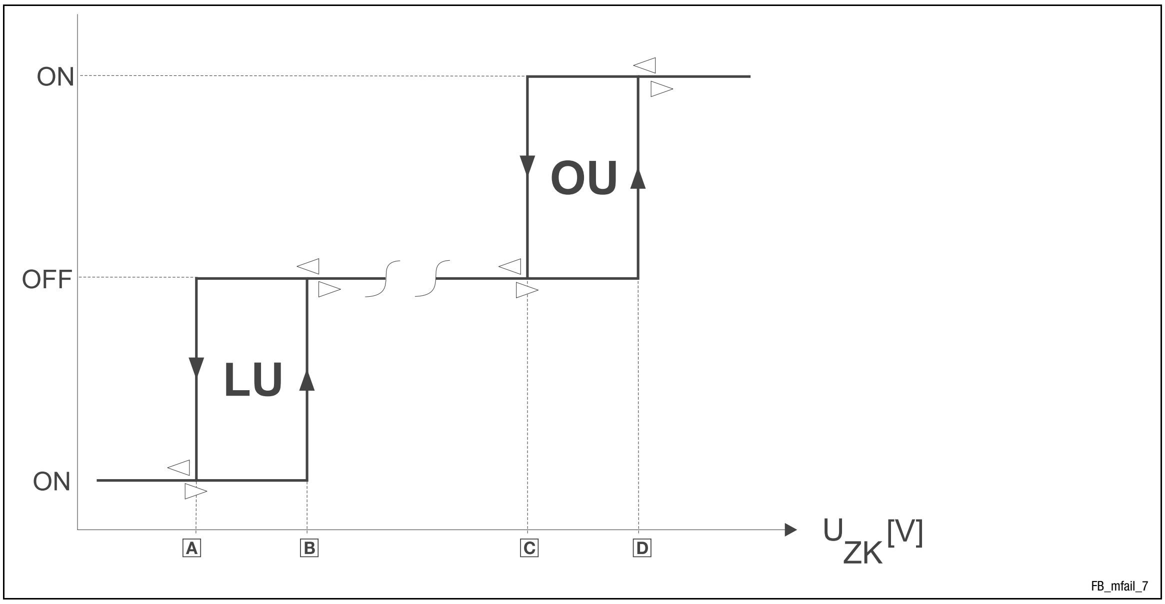
Important settings prior to the initial commissioning:

1. Save the previous setting in a parameter set (e.g. parameter set 4)

STOP!

For the internal voltage supply of the terminals (C0005 = xx1x), the terminal X6/63 is used as a voltage source for external potentiometers. In this case, measure at the terminals +UG, -UG.

2. Measure the DC-bus voltage with an oscilloscope (channel 1)
    - with a suitable voltage divider across terminals +UG, -UG. or
    - by outputting the DC-bus voltage e.g. to terminal X6/62. For this purpose set C0436 = 5005 (MCTRL-DCVOLT). 1 V at terminal X6/63 = 100 V across +UG, -UG.
3. Measure the speed with an oscilloscope (channel 2)
    - by outputting the speed e.g. to terminal X6/62 (standard setting). For this purpose set C0431 = 5001 (MCTRL-NACT). 10 V at terminal X6/62 = nmax (C0011).
4. Select the operating threshold for the mains failure detection in C0472/20. The selection depends on the setting in C0173.
    - Set the operating threshold approx. 50 V above the switch-off threshold LU (example for C0173 = 0.1; C0472/20 = 48 % ≙ 480 V).



Mains voltage range	C0173	Message LU		Message OU	
		A	B	C	D
< 400 V	0	285 V	430 V	755 V	770 V
400 V	1	285 V	430 V	755 V	770 V
400 V ... 460 V	2	328 V	473 V	755 V	770 V
480 V without brake chopper	3	342 V	487 V	755 V	770 V
Operation with brake chopper (up to 480 V)	4	342 V	487 V	785 V	800 V
		DC-bus voltage (U_{ZK})			

STOP!

This setpoint must be below the operating threshold of a possibly connected braking unit. If a connected braking unit is activated, the drive will be braked with the max. possible torque (Imax). The desired operational performance gets lost.

5. Set the setpoint to which the DC bus voltage is to be controlled:
   – Set the setpoint to approx. 700 V (C0472/19 = 70 %).

Commissioning

The commissioning should be carried out with motors without load.

1. The drive can be started with a LOW-HIGH edge at X5/E5.
2. Set the acceleration time Tir:
   - – Set speed setpoint to 100%, operate controller with maximum speed.
   - – Inhibit controller via terminal X5/28 (you can also use any other controller inhibit source, CINH) and measure deceleration time until standstill.
   - – Set approx. 1/10 of the deceleration time in C0982.
3. Set the retrigger time

- In case of mains failure detection by detecting the DC bus voltage level:
  - – Set measured deceleration time from (step 2.) under C0983.
- In case of mains failure detection via an external system (e.g. supply module 934X):
  - – Under C0983, you can set the time in which the drive is to be continued to be braked in a controlled way for short-term mains recovery.

4. Switch off supply voltage (mains or DC bus).

The oscilloscope should display the following characteristic:

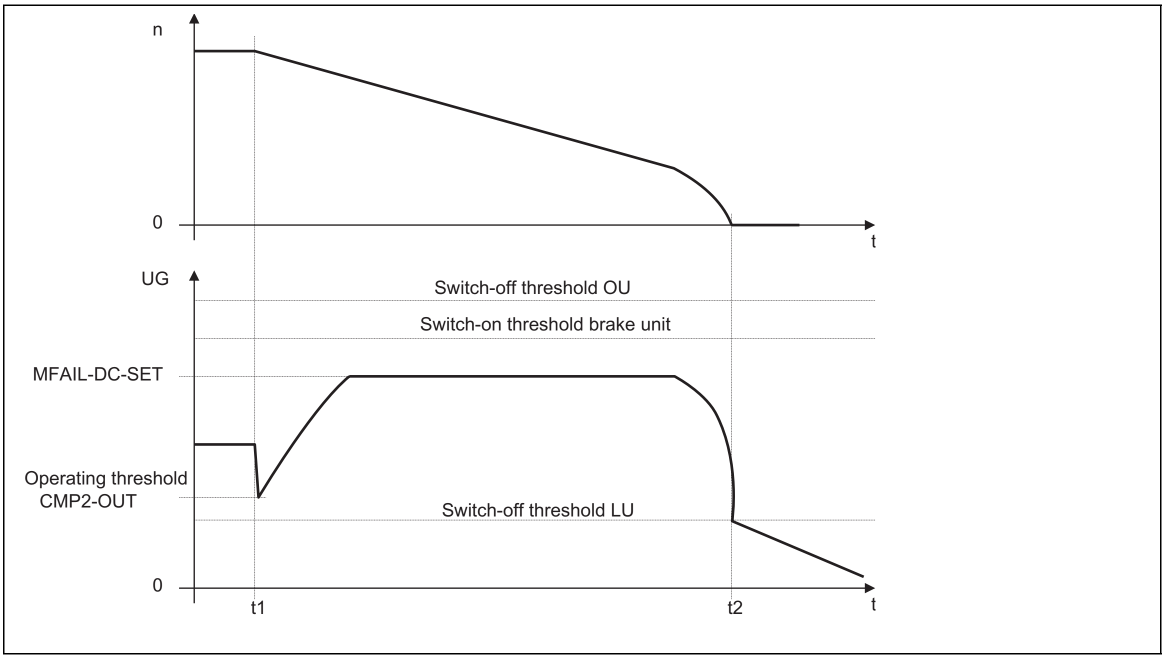


Fig. 3-156 Schematic representation with activated mains failure control (ideal characteristic)

t1 Mains failure
t2 Zero speed reached

Fine adjustment

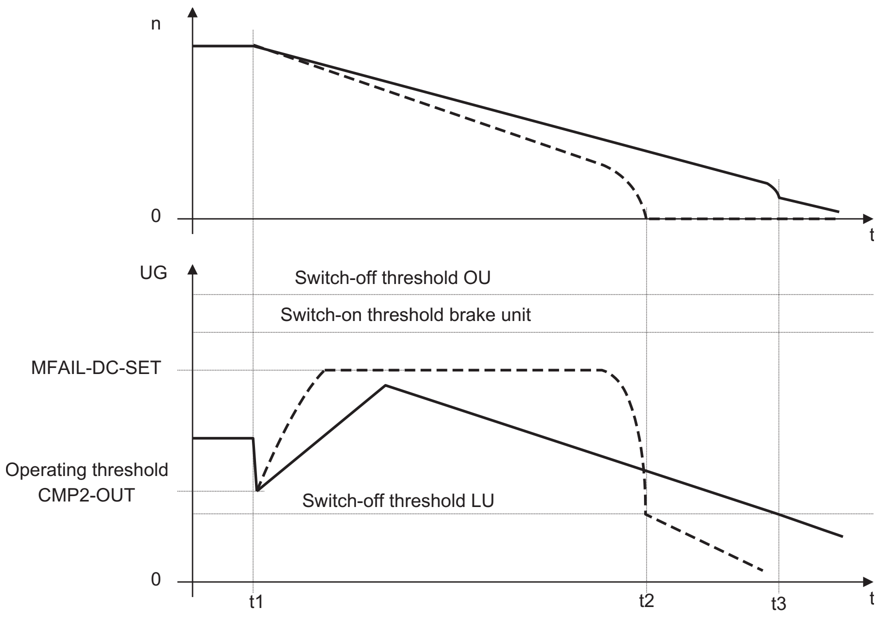


Fig. 3-157 Schematic representation with different brake torques

t = t1 Mains failure
t = t2 Zero speed with higher braking torque (short adjustment time)
t = t3 Drive reaches the LU switch-off threshold with lower brake torque (higher adjustment time) without reaching speed 0
t > t3 Drive is no longer controlled (is braked by friction)

Repeat the following steps several times.

1. Obtain a very low final speed before the controller reaches the undervoltage threshold LU:
   - Increase the proportional gain MFAIL V_p (C0980).
   - Decrease the reset time MFAIL T_n (C0981).
2. Avoid activation of the brake unit or the overvoltage threshold on:
   - Increase the reset time MFAIL T_n (C0981) until the characteristic in Fig. 3-156 is almost reached.
   - Additionally reduce the setpoint of the DC bus voltage at the input MFAIL-DC-SET (in the example C0472/19), if necessary.

3. Increase of the deceleration time or reduction of the brake torque (see Fig. 3-157) is only possible with restrictions:
   - An increase of the acceleration time MFAIL T_{ir} (C0982) reduces the initial brake torque and simultaneously increases the deceleration time.
   - Increasing the reset time MFAIL T_n (C0981) decreases the braking torque and simultaneously increases the deceleration time. If C0981 contains too high reset times, the controller runs into the LU threshold before speed 0 is reached. Thus, the drive is not controlled anymore.
4. If required, relink the signals to the outputs of the controller (terminals X6).

Note!

All settings must be saved non-volatilely in a parameter set under C0003.

3.2.62.3 Restart protection

The integrated restart protection is to avoid a restart in the lower speed range, after the supply voltage was interrupted for a short time only (mains recovery before the drive has come to standstill).

- How to protect the drive from a restart is explained in chapter 3.2.62.2.
- In C0472/18 you can enter the threshold in [%] of nmax (C0011) below which you do not want the drive to restart.
  - Speed at mains recovery < threshold in C0472/18: Drive is continued to be braked in a controlled way. This function can only be terminated by MFAIL-RESET = HIGH.
  - Speed after mains recovery > threshold in C0472/18 Drive accelerates to its setpoint along the set ramps.
- The function is deactivated by:
  - C0472/18 = 0 % or
  - C0975 = 1000 (FIXED0% to MFAIL-THRESHLD)
- Reset with MFAIL-RESET = HIGH
  - is required after every mains connection
  - is displayed by MFAIL-STATUS = HIGH, if MFAIL-FAULT = LOW

3.2.62.4 Reset of the mains failure control

- The mains failure control is reset with MFAIL-RESET = HIGH (in the example with terminal X5/E5).
- The reset pulse is always required if:
  - the restart protection is active.
  - the restart protection is used and the supply (mains or DC supply) was switched on.

3.2.62.5 Dynamic adaptation of the control parameters

In special cases a dynamic change of the proportional gain may be useful. For this purpose, the function block MFAIL is provided with two inputs (MFAIL-CONST and MFAIL-ADAPT). The resulting proportional gain arises from:

$$V_p = C0980 \cdot \frac{\text{MFAIL-CONST} - |\text{MFAIL-ADAPT}|}{100\ \%}$$

3.2.62.6 Fast mains recovery (auto reclosure)

The fast mains recovery leads to the restart of the controller if the restart protection is not activated. Then the drive runs to its setpoint. If this is not desired, the restart can be delayed via the retrigger time C0983 or prevented in connection with the restart protection.

A fast mains recovery occurs:

- Due to the system, the mains recovery is indicated by the mains failure detection via the level of the DC bus voltage (see chapter 3.2.62.1).
- Because of an ”auto reclosure” of the power supply company (e.g. in case of thunderstorms)
- Because of faulty components in the supply cables (e.g. slip rings)

Set the retrigger time C0983 higher than the measured deceleration time during braking.

3.2.62.7 Application example

Drive network with digital frequency coupling

STOP!

In drive networks which are coupled via digital frequency (a master and one or more slaves):

- The mains failure detection and control may only be activated for the master.
  - The mains failure control must be integrated correspondingly into the signal flow.
- All controllers must be operated via the terminals +UG, -UG in the DC-bus connection. For this, the information in the ”Dimensioning” chapter must be observed.

Note!

Further information and predefined configurations can be obtained from Lenze.

3.2.63 Motor phase failure detection (MLP)

Purpose

Motor phase monitoring.

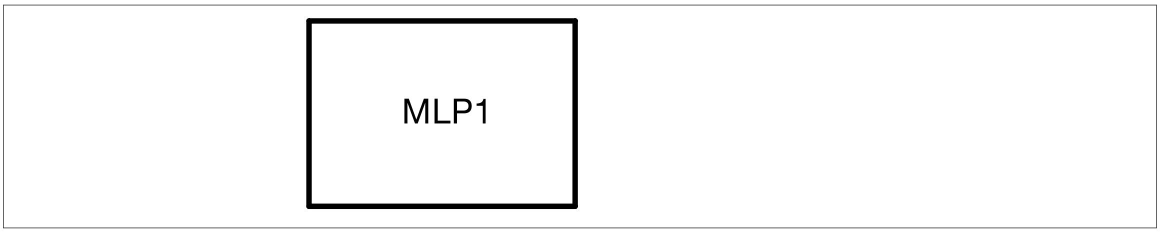


Fig. 3-158 Motor phase failure detection (MLP1)

Code	LCD	Possible settings		Important
		Lenze	Selection	
C0597	MONIT LP1	3	0 Trip 2 Warning 3 Off	**Conf. LP1** Configuration of motor phase failure monitoring
C0599	LIMIT LP 1	5.0	1.0 {0.1} 10.0	**Current limit LP1** Current limit for motor phase failure monitoring

Function

Detailed descriptions concerning monitoring/fault messages can be found in part E (Troubleshooting and fault elimination) of the System Manual.

The function block MLP1 must be entered into the processing table if the motor phase failure detection is to be used.

3.2.64 Monitor outputs of monitoring system (MONIT)

Purpose

The monitoring functions output digital monitor signals.

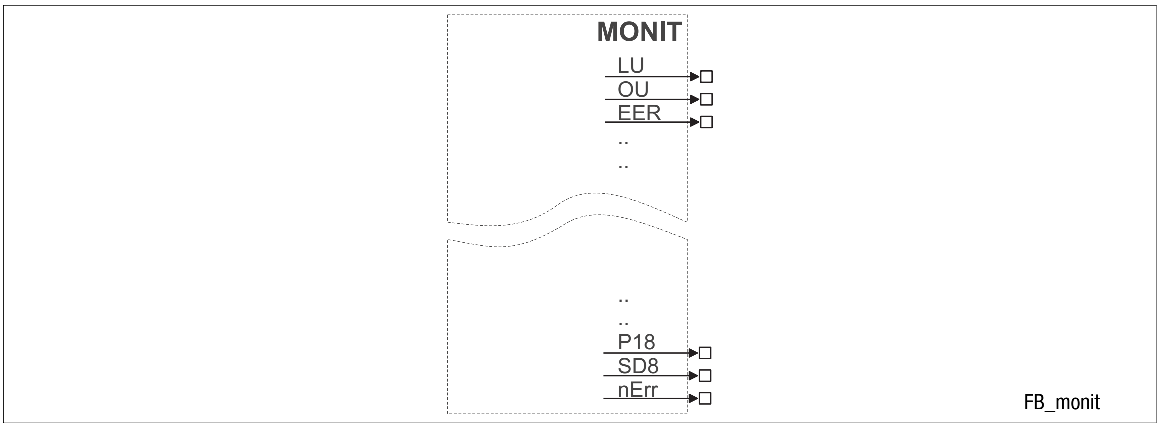


Fig. 3-159 Monitor outputs of the monitoring system (MONIT)

Function

The MONIT outputs switch to HIGH level if one of the monitoring functions responds.

The digital monitor signals switches dynamically, i.e.

- depending on the state of the monitoring function, but
- independent of the selected fault response (trip, fail-QSP, ...).

Example

MONIT-LP1 (motor phase monitoring) responds if an open circuit is detected in a motor connection phase, although the fault response of LP1 is set to ”Off” (C0597 = 3).

Tip!

- Only with a corresponding signal conditioning it is possible to use the MONIT outputs to detect the cause of malfunction afterwards (e.g. storing the signal by using function block FLIP).
- Detailed descriptions concerning monitoring /fault messages can be found in the chapter ”Troubleshooting and fault elimination”.

3.2.65 Motor potentiometer (MPOT)

Purpose

The FB replaces a hardware motor potentiometer.

The motor potentiometer is used as an alternative setpoint source, which is controlled via two terminals.

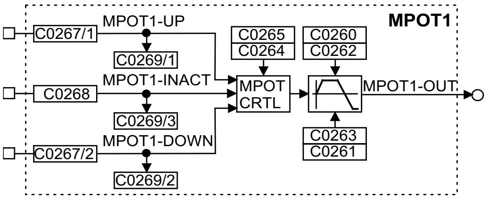


Fig. 3-160 Motor potentiometer (MPOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MPOT1-UP	d	C0269/1	bin	C0267/1	2	1000	-
MPOT1-INACT	d	C0269/3	bin	C0268	2	1000	-
MPOT1-DOWN	d	C0269/2	bin	C0267/2	2	1000	-
MPOT1-OUT	a	-	-	-	-		-

Function

Control of the motor potentiometer:

- MPOT1-UP = HIGH
  – The motor potentiometer approaches its upper limit value.
- MPOT1-DOWN = HIGH
  – The motor potentiometer approaches its lower limit value.
- MPOT1-UP = LOW and MPOT1-DOWN = LOW or
  MPOT1-UP = HIGH and MPOT1-DOWN = HIGH:
  – The motor potentiometer does not change the output signal.

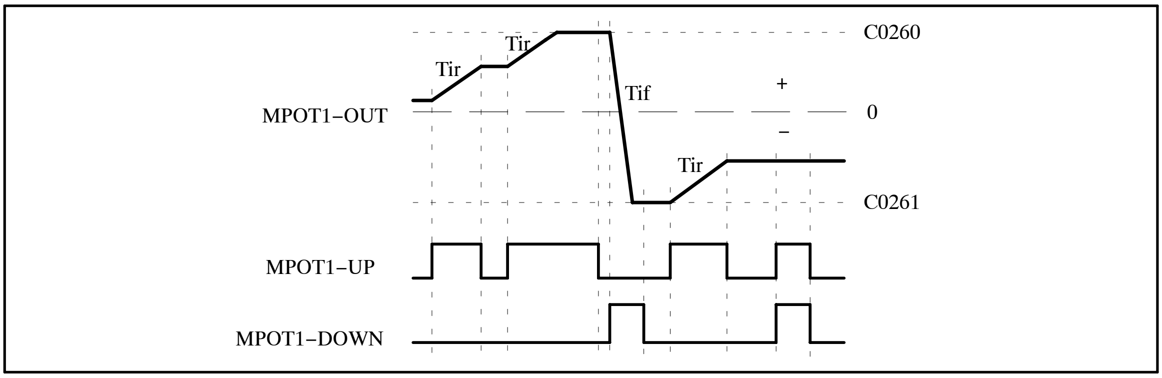


Fig. 3-161 Control signals of the motor potentiometer

In addition to the digital signals MPOT1-UP and MPOT1-DOWN another digital input exists (MPOT1-INACT). The input MPOT1-INACT is used to activate or deactivate the motor potentiometer function. Logic 1 at this input deactivates the motor potentiometer function. The input MPOT1-INACT has priority over the inputs MPOT1-UP and MPOT1-DOWN.

When the motor potentiometer is deactivated, the motor potentiometer output (MPOT1-OUT) follows the function set under C0264. The following functions can be set under C0264:

C0264 =	Meaning
0	No further action; the value of output MPOT1-OUT remains unchanged
1	The motor potentiometer returns to 0 % with the corresponding deceleration time
2	The motor potentiometer approaches the lower limit value with the corresponding deceleration time (C0261)
3	The motor potentiometer immediately changes its output to 0%. **(Important for EMERGENCY-OFF function)**
4	The motor potentiometer immediately changes its output to the lower limit value (C0261)
5	The motor potentiometer approaches the upper limit value with the corresponding acceleration time (C0260)

If the motor potentiometer is activated (input MPOT1-INACT = 0), the subsequent function depends on

- the current output signal,
- the set limit values of the MPOT,
- the control signals UP and DOWN.

If the output value is out of the set limits, the MPOT approaches the next limit with the set T_i times. This function is independent of the control inputs MPOT1-UP and MPOT1-DOWN

If the output value is within the set limits, the output follows the selected control function UP, DOWN or no action.

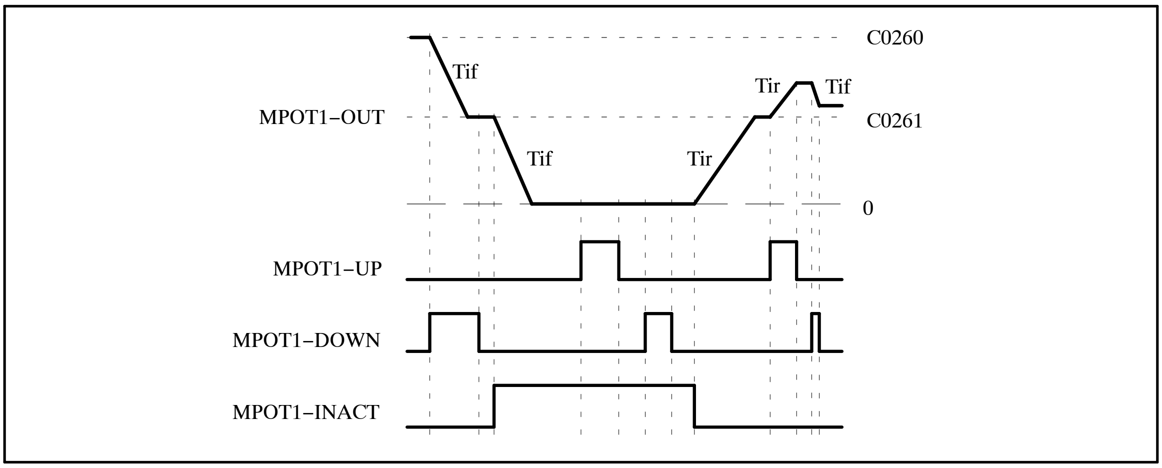


Fig. 3-162 Deactivation of the motor potentiometer via the input MPOT1-INACT

Initialisation

This function is used to save the output value of the MPOT non-volatilely in the internal memory of the device, when the mains is switched off. The value is saved automatically if this function was selected via the code. When the mains is switched on, the value is reloaded into the MPOT.

C0265 can be used to activate other initialisation functions (see code table).

When the initialisation is completed, the MPOT follows the applied control function.

3.2.66 Master selection (MSEL)

Two function blocks (MSEL1 and MSEL2) are available

Purpose

Selection of a master value source from four possible master values

- MSEL1: FB for digital frequency or speed signals
- MSEL2: FB for angle signals

MSEL1

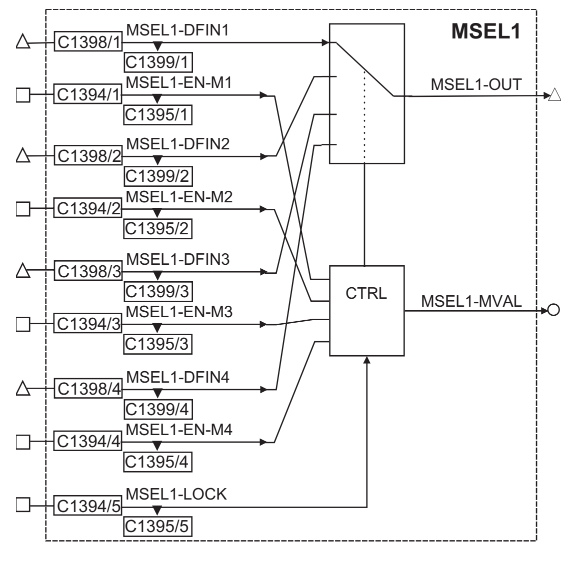


Fig. 3-163 Master selection (MSEL1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
MSEL1-EN-M1	d	1395/1	bin	1394/1	2	Activation of master value 1
MSEL1-EN-M2	d	1395/2	bin	1394/2	2	Activation of master value 2
MSEL1-EN-M3	d	1395/3	bin	1394/3	2	Activation of master value 3
MSEL1-EN-M4	d	1395/4	bin	1394/4	2	Activation of master value 4
MSEL1-LOCK	d	1395/5	bin	1394/5	2	Locking
MSEL1-DFIN1	phd	1399/1	dec [rpm]	1398/1	4	Master value input 1
MSEL1-DFIN2	phd	1399/2	dec [rpm]	1398/2	4	Master value input 2
MSEL1-DFIN3	phd	1399/3	dec [rpm]	1398/3	4	Master value input 3
MSEL1-DFIN4	phd	1399/4	dec [rpm]	1398/4	4	Master value input 4
MSEL1-OUT	phd	13701	-	-	-	Master value output
MSEL1-MVAL	a	13701	-	-	-	Currently selected master value input

MSEL2

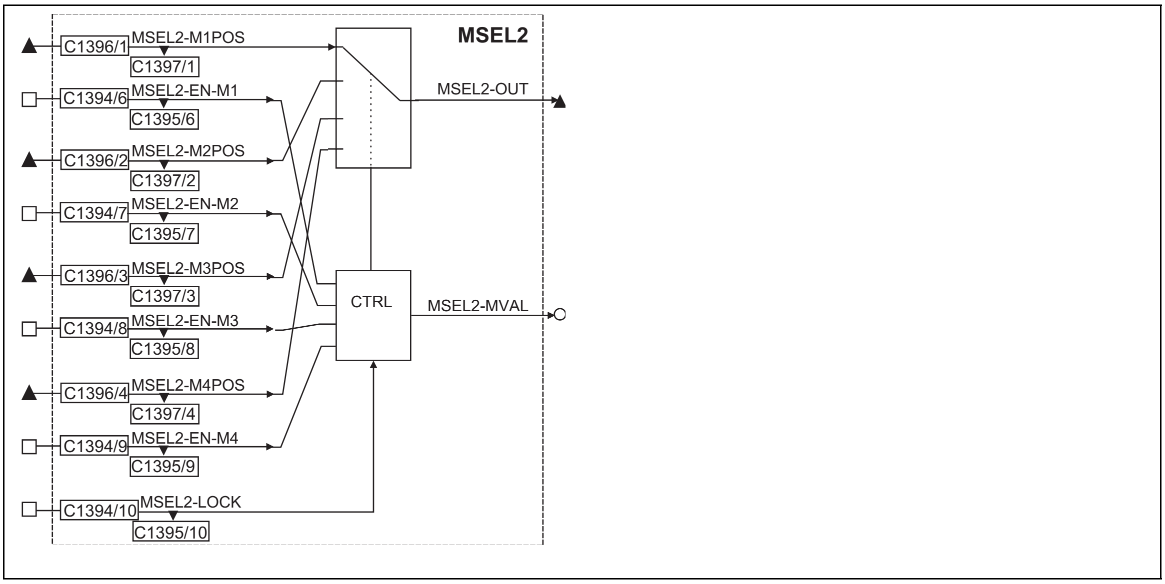


Fig. 3-164 Master selection (MSEL2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
MSEL2-EN-M1	d	1395/6	bin	1394/6	2	Activation of master value 1
MSEL2-EN-M2	d	1395/7	bin	1394/7	2	Activation of master value 2
MSEL2-EN-M3	d	1395/8	bin	1394/8	2	Activation of master value 3
MSEL2-EN-M4	d	1395/9	bin	1394/9	2	Activation of master value 4
MSEL2-LOCK	d	1395/10	bin	1394/10	2	Locking
MSEL2-M1POS	ph	1397/1	dec [inc]	1396/1	4	Master angle input 1
MSEL2-M2POS	ph	1397/2	dec [inc]	1396/2	4	Master angle input 2
MSEL2-M3POS	ph	1397/3	dec [inc]	1396/3	4	Master angle input 3
MSEL2-M4POS	ph	1397/4	dec [inc]	1396/4	4	Master angle input 4
MSEL2-OUT	ph	13711	-	-	-	Master angle output
MSEL2-MVAL	a	13711	-	-	-	Currently selected master angle input

Function

- 1 from 4 selection of the master value source
- Fixing the selection

The description applies to both function blocks. Please consider this for the following functional description of the MSEL1.

3.2.66.1 1 from 4 selection of the master value source

- One master value source each can be connected to the inputs MSEL1-DFIN(1...4). For selecting a master value source the assigned digital input MSEL1-EN-M(1...4) must be triggered with a LOW-HIGH edge. An input set once remains active until another master value source is selected.
- If two or more inputs are selected at the same time, the input with the lowest selection number is activated.
- The selected input value is directly connected to the output MSEL1-OUT.

If no input has been selected (inputs MSEL1-EN-M(1...4) = LOW), 0 inc is output a the output

3.2.66.2 Locking the selection

A change-over to a new source is prevented by a HIGH level at the input MSEL1-LOCK. The input channel last-output is locked until the input level at MSEL1-LOCK is reset to LOW.

3.2.67 Logic NOT

Purpose

Logic inversion of digital signals. The inversion can be used to control functions or generate status information.

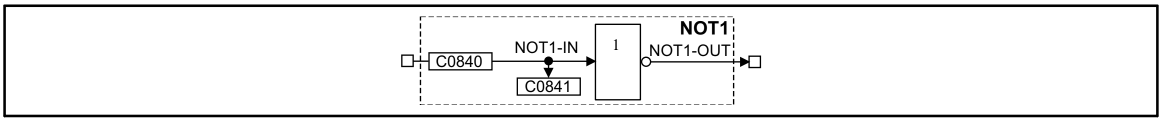


Fig. 3-165 Logic NOT (NOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT1-IN	d	C0841	bin	C0840	2	1000	-
NOT1-OUT	d	-	-	-	-	-	-

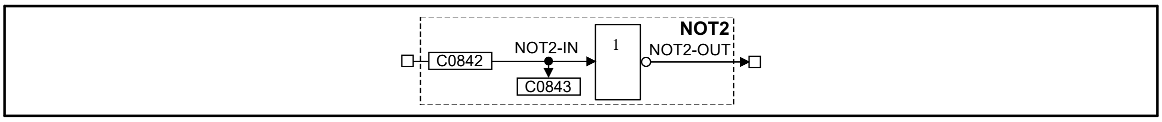


Fig. 3-166 Logic NOT (NOT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT2-IN	d	C0843	bin	C0842	2	1000	-
NOT2-OUT	d	-	-	-	-	-	-

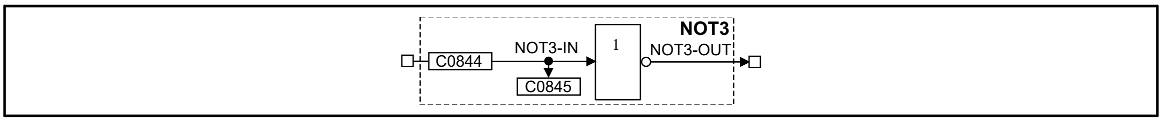


Fig. 3-167 Logic NOT (NOT3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT3-IN	d	C0845	bin	C0844	2	1000	-
NOT3-OUT	d	-	-	-	-	-	-

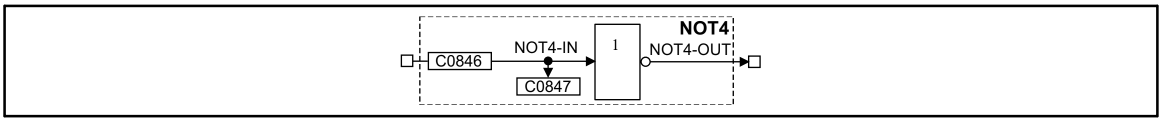


Fig. 3-168 Logic NOT (NOT4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT4-IN	d	C0847	bin	C0846	2	1000	-
NOT4-OUT	d	-	-	-	-	-	-

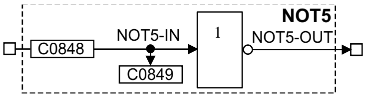


Fig. 3-169 Logic NOT (NOT5)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT5-IN	d	C0849	bin	C0848	2	1000	-
NOT5-OUT	d	-	-	-	-	-	-

Function

NOTx-IN1	NOTx-OUT
0	1
1	0

The function corresponds to a change from an NO contact to an NC contact in a contactor control.

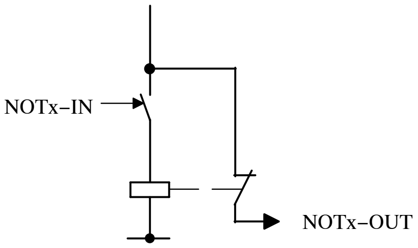


Fig. 3-170 Function of NOT when changing an NO contact to an NC contact.

3.2.68 Speed setpoint conditioning (NSET)

Purpose

This FB conditions

- the main speed setpoint and
- an additional setpoint (or other signals as well)

for the following control structure via ramp function generators or fixed speeds.

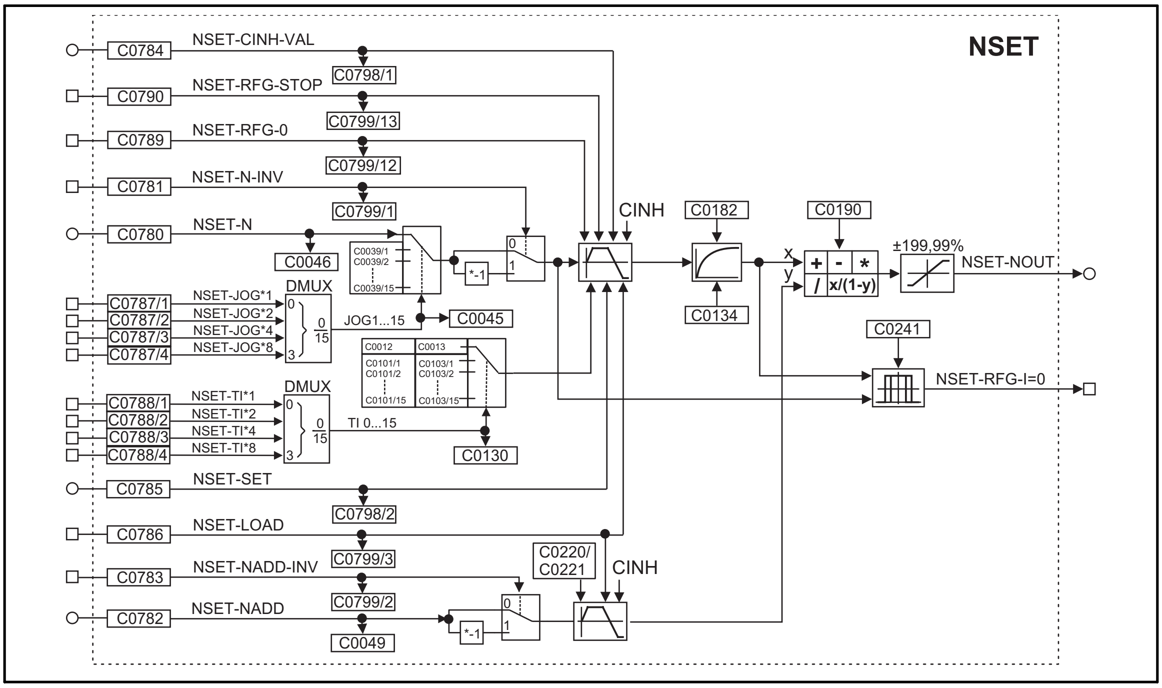


Fig. 3-171 Speed setpoint conditioning (NSET)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NSET-N	a	C0046	dec [%]	C0780	1	50	Intended for main setpoint, other signals are permissible
NSET-NADD	a	C0047	dec [%]	C0782	1	5650	Intended for additional setpoint, other signals are permissible
NSET-JOG*1	d	C0799/4	bin	C0787/1	2	53	Selection and control of overriding ”fixed setpoints” for the main setpoint
NSET-JOG*2	d	C0799/5	bin	C0787/2	2	1000	
NSET-JOG*4	d	C0799/6	bin	C0787/3	2	1000	
NSET-JOG*8	d	C0799/7	bin	C0787/4	2	1000	
NSET-TI*1	d	C0799/8	bin	C0788/1	2	1000	Selection and control of alternative ”fixed setpoints” for the main setpoint
NSET-TI*2	d	C0799/9	bin	C0788/2	2	1000	
NSET-TI*4	d	C0799/10	bin	C0788/3	2	1000	
NSET-TI*8	d	C0799/11	bin	C0788/4	2	1000	
NSET-N-INV	d	C0799/1	bin	C0781	2	10251	Control of the signal inversion for the main setpoint
NSET-NADD-INV	d	C0799/2	bin	C0783	2	1000	Control of the signal inversion for the additional setpoint
NSET-RFG-0	d	C0799/12	bin	C0789	2	1000	The main setpoint integrator is led to zero via the current T_i times.
NSET-RFG-STOP	d	C0799/13	bin	C0790	2	1000	Keeping (freezing) of the main setpoint integrator to its actual value.
NSET-CINH-VAL	a	C0798/1	dec [%]	C0784	1	5001	Here, the signal is applied which is to be accepted by the main setpoint integrator when the controller is inhibited
NSET-SET	a	C0798/2	dec [%]	C0785	1	5000	Here, the signal is applied which is to be accepted by the main setpoint integrator when the NSET-LOAD input is set
NSET-LOAD	d	C0799/3	bin	C0786	2	5001	Control of both ramp function generators in special situations, e.g. QSP
NSET-OUT	a	-	-	-	-	-	-
NSET-RFG-I=0	d	-	-	-	-	-	-

Function

- Main setpoint path
- JOG setpoints
- Setpoint inversion
- S ramp

3.2.68.1 Main setpoint path

- The signals in the main setpoint path are limited to the value range ±199.99 %.
- The signal at input NSET-N is led via the function JOG selection.
- The JOG function has priority over the setpoint input NSET-N. This means a selected JOG value deactivates the input. The subsequent signal conditioning uses the JOG value instead.

3.2.68.2 JOG setpoints

- Are fixed values which are saved in the memory.
- JOG values can be retrieved from the memory via the inputs NSET-JOG*x.
- The inputs NSET-JOG*x are binary coded so that 15 JOG values can be retrieved.
- The decoding for enabling the JOG values (retrieval from the memory) is carried out according to the following table:

Output signal	**1st input NSET-JOG*1**	**2nd input NSET-JOG*2**	**3rd input NSET-JOG*4**	**4th input NSET-JOG*8**
NSET-N	0	0	0	0
JOG 1	1	0	0	0
JOG 2	0	1	0	0
JOG 3	1	1	0	0
JOG 4	0	0	1	0
JOG 5	1	0	1	0
JOG 6	0	1	1	0
JOG 7	1	1	1	0
JOG 8	0	0	0	1
JOG 9	1	0	0	1
JOG 10	0	1	0	1
JOG 11	1	1	0	1
JOG 12	0	0	1	1
JOG 13	1	0	1	1
JOG 14	0	1	1	1
JOG 15	1	1	1	1

- When all inputs are assigned with 0, the input NSET-N is active.
- The number of inputs that must be assigned depends on the required number of JOG setpoints. Four inputs and thus 15 possible selections are available. A digital signal source is assigned via C0787 and the corresponding subcode.

Number of required JOG setpoints	**Number of inputs to be assigned**
1	At least 1
1 ... 3	At least 2
4 ... 7	At least 3
8 ... 15	4

3.2.68.3 Setpoint inversion

The output signal of the JOG function is led to an inverter.

The sign of the setpoint is inverted if the input NSET-N-INV is triggered with HIGH signal.

Ramp function generator for the main setpoint

The setpoint is then led to a ramp function generator with linear characteristic. Setpoint step-changes at the input are thus converted into a ramp.

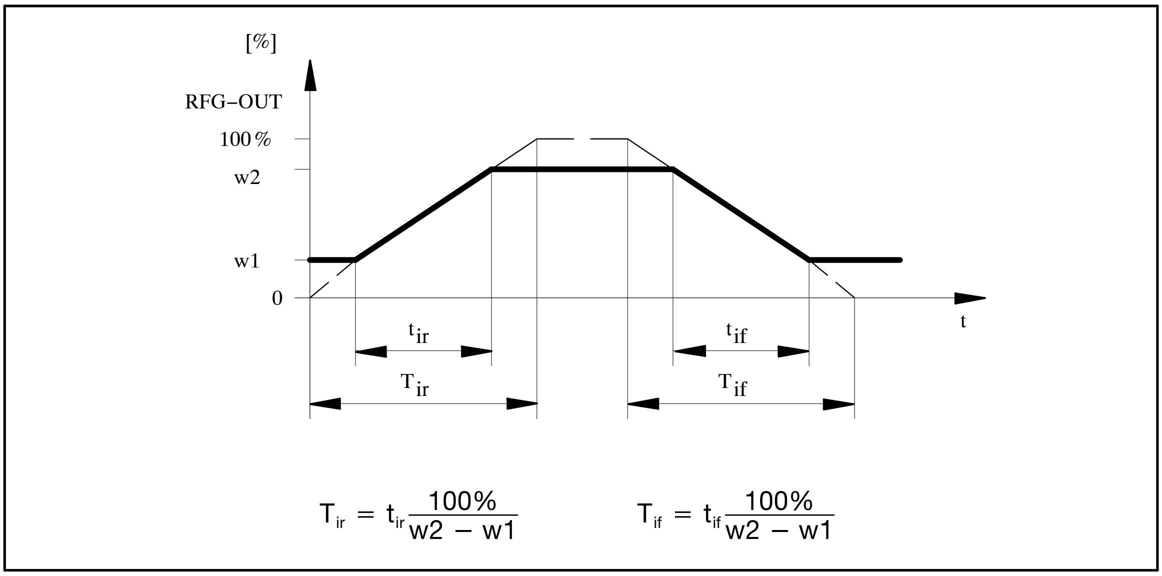


Fig. 3-172 Acceleration and deceleration times of the ramp function generator

- The ramps can be set separately for acceleration and deceleration.
  - Different acceleration and deceleration times can be activated via the inputs NSET-TI*x 16 (for table and function see JOG setpoints; the decoding must be done according to the signal graphic).
  - The T_i times can only be activated in pairs.
- When the controller is inhibited (CINH), the ramp function generator accepts the value applied to the input NSET-CINH-VAL and transmits it to the next function. This function has priority over all other functions.
- NSET-RFG-STOP = HIGH
  - The ramp function generator is stopped. Changes at the input of the ramp function generator have no effect on the output.
- NSET-RFG-0 = HIGH
  - The ramp function generator decelerates to zero along the deceleration ramp.
- It is also possible to load the ramp function generator online with a defined value. For this, the input NSET-LOAD must be set to HIGH. As long as this input is set, the value at input NSET-SET is accepted by the ramp function generator and passed to the output.

Priorities:

CINH	NSET-LOAD	NSET-RFG-0	NSET-RFG-STOP	Function
0	0	0	0	RFG follows the input value via the set ramps
0	0	0	1	The value at the output of RFG is frozen
0	0	1	0	RFG decelerates to zero within the set deceleration time
0	0	1	1	
0	1	0	0	RFG accepts the value applied to input NSET-SET and passes it to its output
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	RFG accepts the value applied to input CINH-VAL and passes it to its output
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

3.2.68.4 S ramp

The linear ramp function generator is connected to a PT1 element. This arrangement implements an S ramp for an almost jerk-free acceleration and deceleration.

- The PT1 element is switched on and off via C0134.
- The time constant is set via C0182.

3.2.68.5 Arithmetic operation

The output value is led to an arithmetic FB. This FB links the main setpoint and the additional setpoint arithmetically. The arithmetic operation is selected via C0190 (see the following table).

C0190	Function	Example
0	Output = X (Y is not processed)	-
1	Output = X + Y	100 % = 50 % + 50 %
2	Output = X - Y	50 % = 100 % - 50%
3*	Output = X * Y	100 % = 100 % * 100%
4*	Output = X/|Y|	1 % = 100 % / 100%
5	Output = X/(100% - Y)	200 % = 100 % / (100 % - 50 %)

*) Please observe the note for C0190 = 3, 4 in the following chapter

3.2.68.6 Additional setpoint

- An additional setpoint (e. g. a correction signal) can be linked with the main setpoint via the input NSET-NADD.
- The input signal can be inverted via the input NSET-NADD-INV before affecting the ramp function generator. The ramp function generator has a linear characteristic and an acceleration time and deceleration time each.
- With NSET-LOAD = HIGH the ramp function generator is set to zero and kept there without considering the T_i times.The same applies when the controller is inhibited.

Tip!

Do not link the main setpoint with negative additional setpoints when C0190 = 3 or C0190 =4! Otherwise the drive may change its direction of rotation!

The drive behaviour depends on the times set for the main setpoint and additional setpoint at the ramp function generator.

3.2.69 OR operation (OR)

Purpose

Logical ORing of digital signals. The operations are used for controlling functions or creating status information.

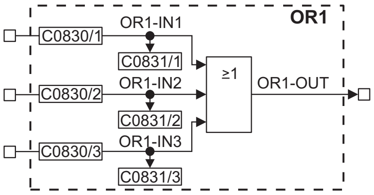


Fig. 3-173 OR operation (OR1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR1-IN1	d	C0831/1	bin	C0830/1	2	1000	-
OR1-IN2	d	C0831/2	bin	C0830/2	2	1000	-
OR1-IN3	d	C0831/3	bin	C0830/3	2	1000	-
OR1-OUT	d	-	-	-	-	-	-

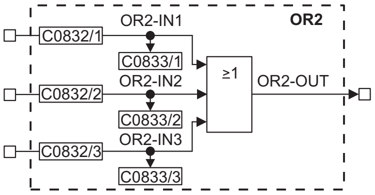


Fig. 3-174 OR operation (OR2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR2-IN1	d	C0833/1	bin	C0832/1	2	1000	-
OR2-IN2	d	C0833/2	bin	C0832/2	2	1000	-
OR2-IN	d	C0833/3	bin	C0832/3	2	1000	-
OR2-OUT	d	-	-	-	-	-	-

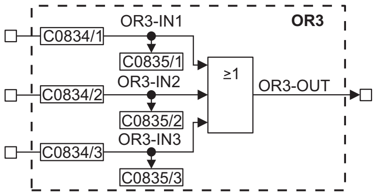


Fig. 3-175 OR operation (OR3)

Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
OR3-IN1	d	C0835/1	bin	C0834/1	2	1000	-
OR3-IN2	d	C0835/2	bin	C0834/2	2	1000	-
OR3-IN3	d	C0835/3	bin	C0834/3	2	1000	-
OR3-OUT	d	-	-	-	-	-	-

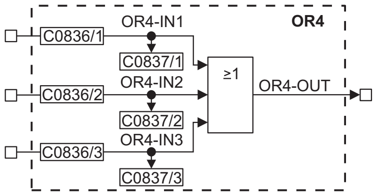


Fig. 3-176 OR operation (OR4)

Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
OR4-IN1	d	C0837/1	bin	C0826/1	2	1000	-
OR4-IN2	d	C0837/2	bin	C0826/2	2	1000	-
OR4-IN3	d	C0837/3	bin	C0826/3	2	1000	-
OR4-OUT	d	-	-	-	-	-	-

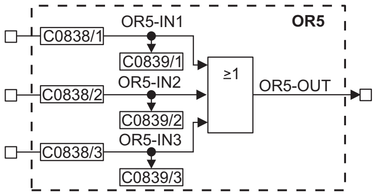


Fig. 3-177 OR operation (OR5)

Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
OR5-IN1	d	C0839/1	bin	C0828/1	2	1000	-
OR5-IN2	d	C0839/2	bin	C0828/2	2	1000	-
OR5-IN3	d	C0839/3	bin	C0828/3	2	1000	-
OR5-OUT	d	-	-	-	-	-	-

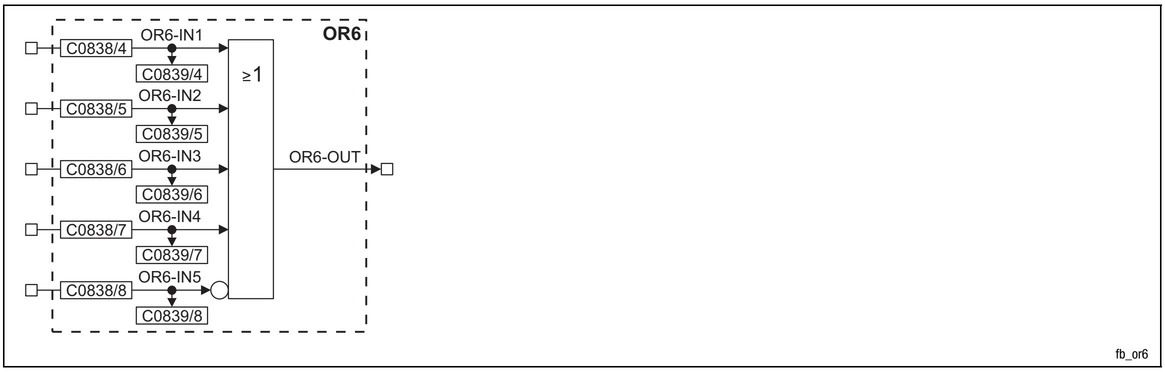


Fig. 3-178 OR operation (OR6)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR6-IN1	d	C0839/4	bin	C0838/4	2	1000	-
OR6-IN2	d	C0839/5	bin	C0838/5	2	1000	-
OR6-IN3	d	C0839/6	bin	C0838/6	2	1000	-
OR6-IN4	d	C0839/7	bin	C0838/7	2	1000	-
OR6-IN5	d	C0839/8	bin	C0838/8	2	1000	The input signal is inverted internally (NOT). The input has to be assigned to FIXED1 if it remains unused.
OR6-OUT	d	-	-	-	-	-	-

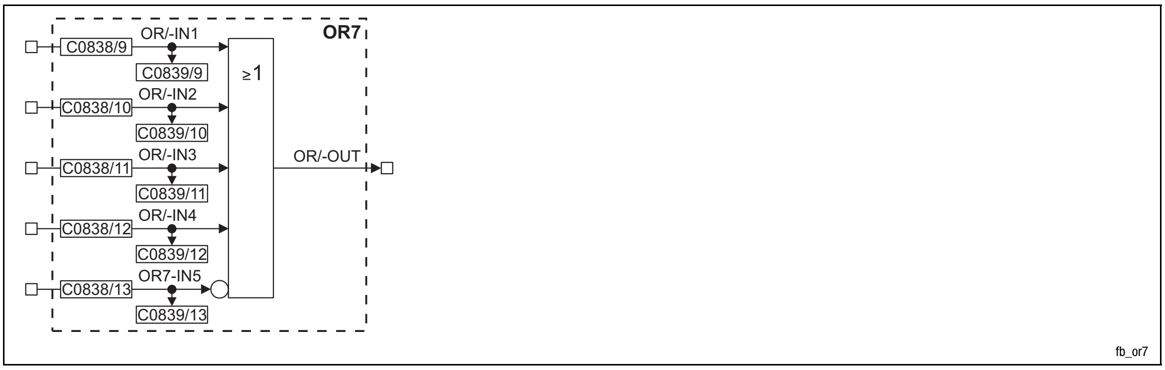


Fig. 3-179 OR operation (OR7)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OR7-IN1	d	C0839/9	bin	C0838/9	2	1000	-
OR7-IN2	d	C0839/10	bin	C0838/10	2	1000	-
OR7-IN3	d	C0839/11	bin	C0838/11	2	1000	-
OR7-IN4	d	C0839/12	bin	C0838/12	2	1000	-
OR7-IN5	d	C0839/13	bin	C0838/13	2	1000	The input signal is inverted internally (NOT). The input has to be assigned to FIXED1 if it remains unused.
OR7-OUT	d	-	-	-	-	-	-

Function of OR1 ... OR5

- ORx-OUT = ORx-IN1 $\vee$ ORx-IN2 $\vee$ ORx-IN3
- Equivalent network:

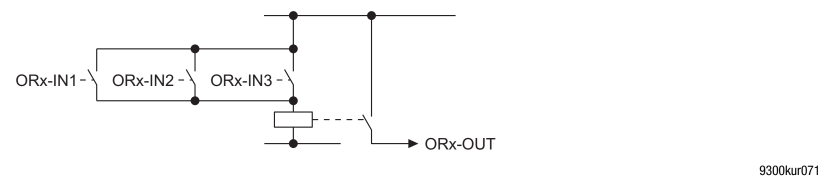


Fig. 3-180 Equivalent network of the OR operation for OR1 ... OR5

Note!

Connect inputs that are not used to FIXED0.

Function of OR6, OR7

- ORx-OUT = ORx-IN1 $\vee$ ORx-IN2 $\vee$ ORx-IN3 $\vee$ ORx-IN4 $\vee$ $\overline{\text{ORx-IN5}}$
- Equivalent network:

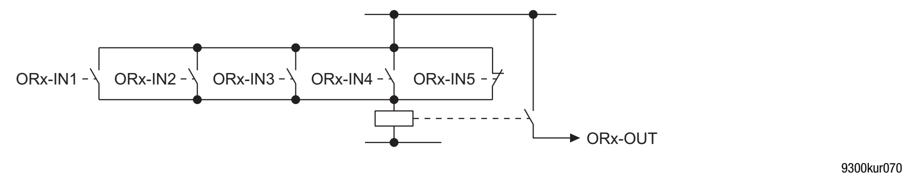


Fig. 3-181 Equivalent network of the OR operation for OR6 and OR7

Note!

- ORx-IN1 ... ORx-IN4: Assign FIXED0 to inputs that are not used.
- Connect ORx-IN5 to FIXED1 if you don’t use the input.

3.2.70 Oscilloscope function (OSZ)

Purpose

Detection of any measured variable (e. g. speed setpoint, actual speed, torque etc.). They are visualised in Global Drive Control.

Supports the commissioning of controllers and the troubleshooting.

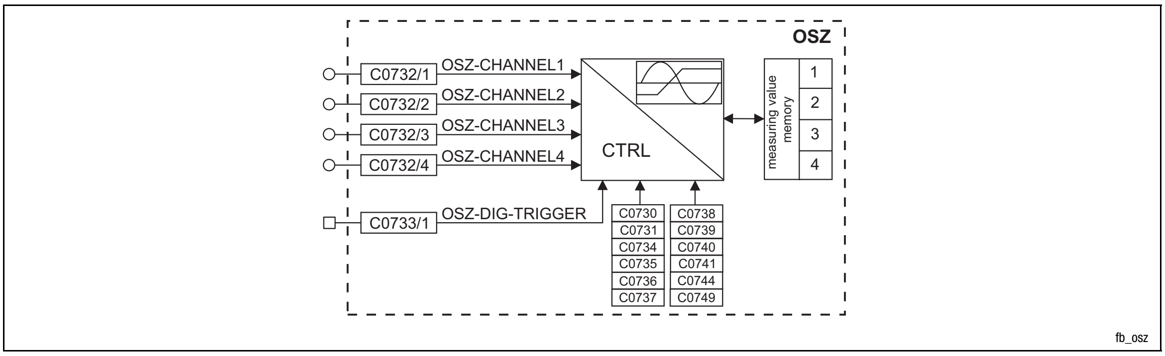


Fig. 3-182 Oscilloscope function (OSZ)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OSZ CHANNEL1	a	-	-	C0732/1	1	-	-
OSZ CHANNEL2	a	-	-	C0732/2	1	-	-
OSZ CHANNEL3	a	-	-	C0732/3	1	-	-
OSZ CHANNEL4	a	-	-	C0732/4	1	-	-
OSZ-DIG-TRIGGER	d	-	-	C0733/1	2	-	-

Function

The FB has three function units:

- Trigger check
  - Monitoring of the digital trigger source for a valid trigger event
- Processing of the measured signal
  - Linking the measurement inputs
  - Calculating the time base
  - Monitoring of the analog trigger source for a valid trigger event.
- Measuring value memory
  - Scaling the ring buffer
  - Filing the measured data in the ring buffer
  - Saving the measuring points for image generation

Functional description

Function	Code	Selection	Description
OSZ mode			Controls the measurement in the controller
	C0730	1	• Starts the recording of the measured values
		0	• Cancels a running measurement
OSZ status			Displays five different operating states
	C0731	1	• Measurement completed – The memory of the measured values is completely filled with measured data. The measured values can be accessed via the PC.
		2	• Measurement active – A measurement was started with C0730 = 1. The FB is waiting for a valid trigger event.
		3	• Trigger detected – The FB has detected a valid trigger event. Depending on the trigger delay the saving of the measured data is not yet completed. It is automatically completed with the entry into the last memory unit.
		4	• Measurement cancelled – Cancel of a running recording of the measured values (C0730 = 0). The memory of the measured values is filled with the data that has just been measured. The data can be accessed via the PC.
		5	• Read data memory – The measured data memory is being read at the moment. No settings are possible in this operating state.
Configuration OSZ channel 1 ... 4	C0732/1 to C0732/4		• Links the measuring channels of the FB with the signals of the process environment – The four measuring channels can be assigned with any analog signal. Enter the corresponding signal number into C0732/1 ... C0732/4. – Always start linking with channel 1, then channel 2 and so on. Unused channels are automatically assigned with signal FIXED 0%.
Configuration OSZ trigger	C0733/1		Links the digital trigger input with a digital signal in the process environment. – The trigger input can be assigned with any digital signal. Enter the corresponding signal number into C0733/1.
Trigger source			Defines the trigger source
	C0734	1	Source is one of the four measuring channels (C0734/1 ... C0734/4)
		0	Source is the digital trigger input (C0733/1)
Trigger level	C0735	-32767 ... 32767	• Defines the trigger level which activates the triggering when the level is exceeded. – The trigger level is only monitored when the triggering is done on one of the four channels. – The trigger level is not effective with digital triggering.
Trigger edge			Defines the trigger edge which activates the triggering. • Triggering on an analog input channel – With a LOW-HIGH trigger edge the analog trigger signal must exceed a defined trigger level to activate the triggering. – With a HIGH-LOW trigger edge the analog trigger signal must fall below a defined trigger level to activate the triggering. • Triggering on a digital trigger input – With a LOW-HIGH trigger edge the digital trigger signal must change from LOW to HIGH to activate the triggering. – With a HIGH-LOW trigger edge the digital trigger signal must change from HIGH to LOW to activate the triggering. Fig. 3-183 shows the triggering of an analog signal with a positive edge.
	C0736	1	– HIGH-LOW trigger edge
		0	LOW-HIGH trigger edge

Function	Code	Selection	Description
Trigger delay			The trigger delay defines when to begin with the saving of the measured values with regard to the trigger time.
	C0737	-100.0 % ... 0 %	• Negative trigger delay (pre-triggering) – Defines a percentage of the whole memory content. This part of the memory content is filled with measured values **before** the triggering (see Fig. 3-184).
		0 % ... 999.9 %	• Positive trigger delay (post-triggering) – Defines a percentage of the whole memory content. The saving of the measured values **after** triggering is delayed by this part of the memory content (Fig. 3-183).
Sampling period	C0738	1 ms ... 10 min	• Setting of the sampling period – The sampling period is the time between two measurements – The measurements are carried out simultaneously for all channels (e. g. value measured at channel 1 is measured at the same time as the measured value at channel 2, 3 or 4. – The sampling period can be set in steps of 1, 2 and 5.
Number of Channels	C0739		Number of channels used for measurements.
Read data memory			The code is required if the GDC is not used for the visualisation.
	C0740/1	0 ... 16383	• Defines the starting point for reading the data memory and thus enables the memory array to be selectively accessed. – In order to read the data memory bit by bit (e. g. reading only the measured values of one channel or reading with reduced memory depth), the starting point can be changed.
	C0740/2	1	• Enable “Read memory” – Enables the access to the memory to read the data
		0	• Inhibit “Read memory” – Inhibits the access to the memory. The access must be inhibited after every reading of the data
Information about the function block			Provides information on the function block
	C0741/1		Version of the function block (e. g. 120: Version 1.20)
	C0741/2		Data memory size (1024 ... 16384 bytes)
	C0741/3		Data width of the measured values (1 byte / 2 bytes)
	C0741/4		Number of the available measuring channels (1 ... 4)

Function	**Code**	**Selection**	**Description**
Memory size	C0744	0 ... 6	Set memory depth of the data memory – Max. size of the data memory: 8192 measured values ≙ 16384 bytes (C0744 = 6) – Min. size of the data memory: 512 measured values ≙ 1024 bytes (C0744 = 0) – Changing the memory depth from 512 to 8192 measured values/step – A memory depth which is optimally adapted to the corresponding measuring task reduces the data transmission time.
Information on saving			Information on saving the measured values in the data memory The FB saves the data in a ring format. For reconstructing the chronological signal sequence the following three ”graphic points” are marked.
	C0749/1		Measured value no. of the instant of abortion
	C0749/2		Measured value no. of the instant of triggering
	C0749/3		Measured value no. of the instant of completion

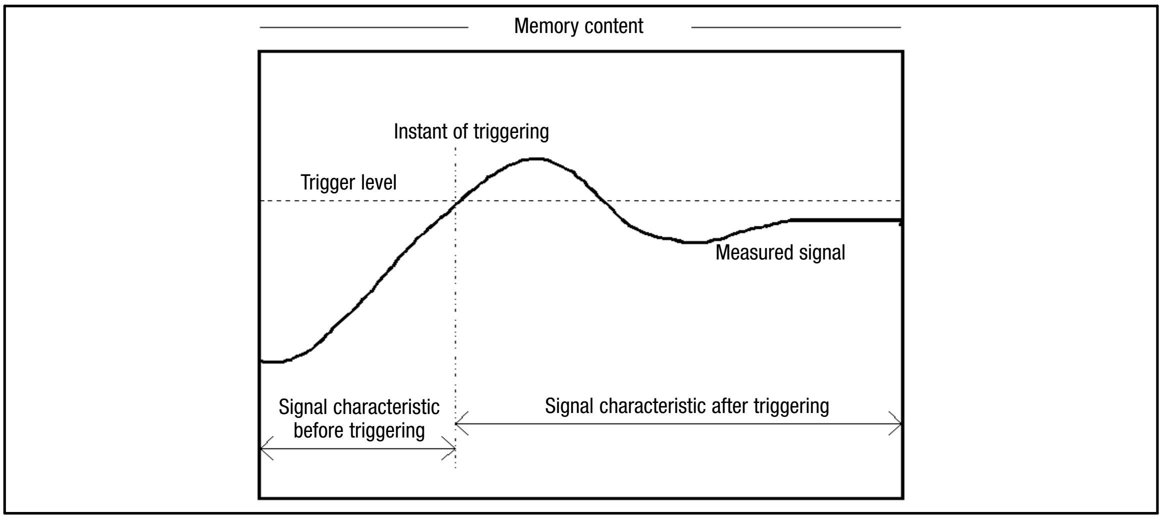


Fig. 3-183 Example: Trigger level and trigger delay with approx. -30 % of pre-triggering

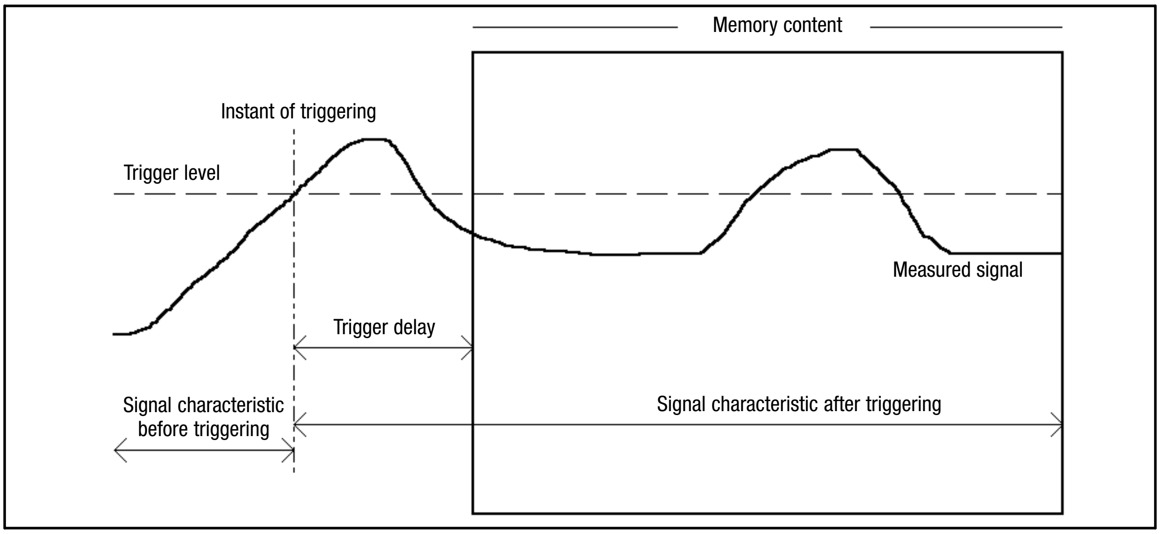


Fig. 3-184 Example: Trigger level and trigger delay with approx. -30 % of post-triggering

3.2.71 Process controller (PCTRL1)

Purpose

The FB is used, for instance, as a higher-level controller (dancer position controller, tension controller, pressure controller etc.).

The control characteristic follows the ideal PID algorithm, but it can also be changed over to a PI or P characteristic.

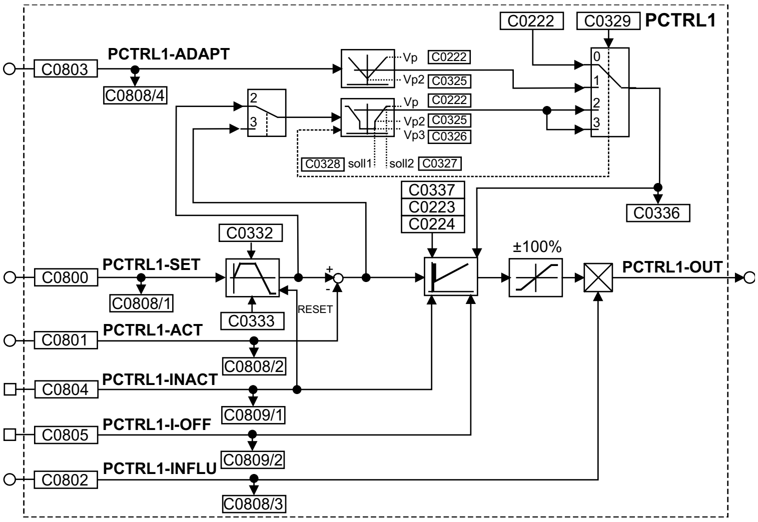


Fig. 3-185 Process controller (PCTRL1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PCTRL1-SET	a	C0808/1	dec [%]	C0800	1	1000	Input of the process setpoint. Possible value range: ±200%. The time characteristic of step-change signals can be affected via the ramp function generator (C0332 for the acceleration time; C0333 for the deceleration time).
PCTRL1-ACT	a	C0808/2	dec [%]	C0801	1	1000	Actual value input; value range ±200%
PCTRL1-INFLU	a	C0808/3	dec [%]	C0802	1	1000	Evaluation or suppression of the output signal; value range ±200%
PCTRL1-ADAPT	a	C0808/4	dec [%]	C0803	1	1000	Online change of the P gain; value range ±200%
PCTRL1-INACT	d	C0809/1	bin	C0804	2	1000	Online deactivation of the process controller
PCTRL1-I-OFF	d	C0809/2	bin	C0805	2	1000	Online setting of the I component to zero
PCTRL1-OUT	a	-	-	-	-	-	-

Function

Setpoint and actual value are sent to the process controller via the corresponding inputs and processed according to the selected control algorithm (control chararacteristic).

3.2.71.1 Control characteristic

- In the default setting, the PID algorithm is active.
- The D-component can be deactivated by setting code C0224 to zero. Thus, the controller becomes a PI-controller (or P-controller if the I-component is also switched off).
- The I-component can be switched on or off online via the PCTRL-I-OFF input. For this, the input is assigned a digital signal source (e.g. one of the freely assignable digital input terminals). If the I-component is to be switched off permanently, the input is assigned the signal source ”FIXED1”.
  - PCTRL-I-OFF = HIGH switches off the I-component
  - PCTRL-I-OFF = LOW switches on the I-component
- The reset time is parameterised via C0223.
- The P-gain can be set in different ways. The function providing the P-gain is selected under C0329:
  - C0329 = 0
    The P-gain is entered under C0222.
  - C0329 = 1
    The P-gain is entered via the PCTRL-ADAPT input. The input value is led via a linear characteristic. The slope of the characteristic is set under C0222 (upper limit) and C0325 (lower limit). The value under C0222 is valid if the input value = +100 % or -100 %. The value under C0325 applies if the input value is 0 %.

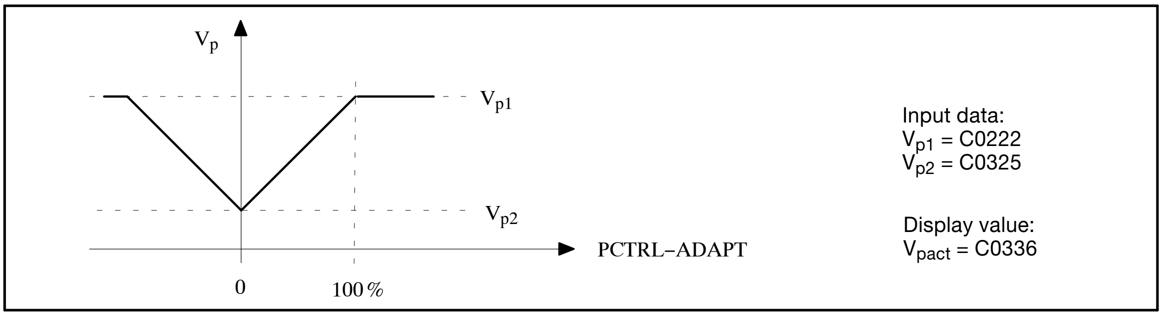


Fig. 3-186 Input of the P-gain via PCTRL-ADAPT input

  - C0329 = 2
    The P-gain is derived from the process setpoint PCTRL-SET. The setpoint is measured after the ramp function generator and calculated by means of a characteristic with three interpolation points.

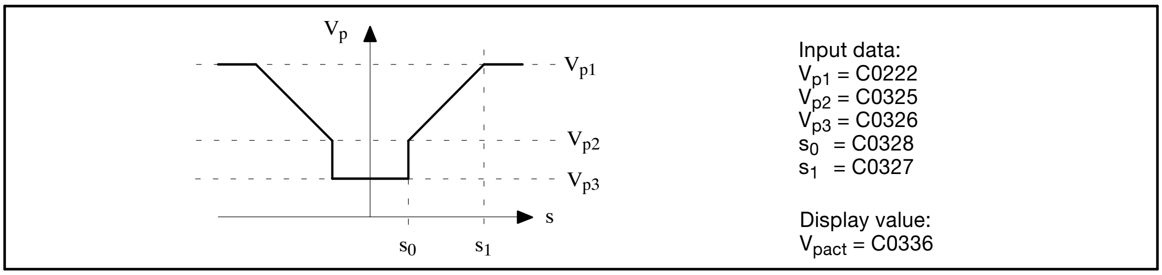
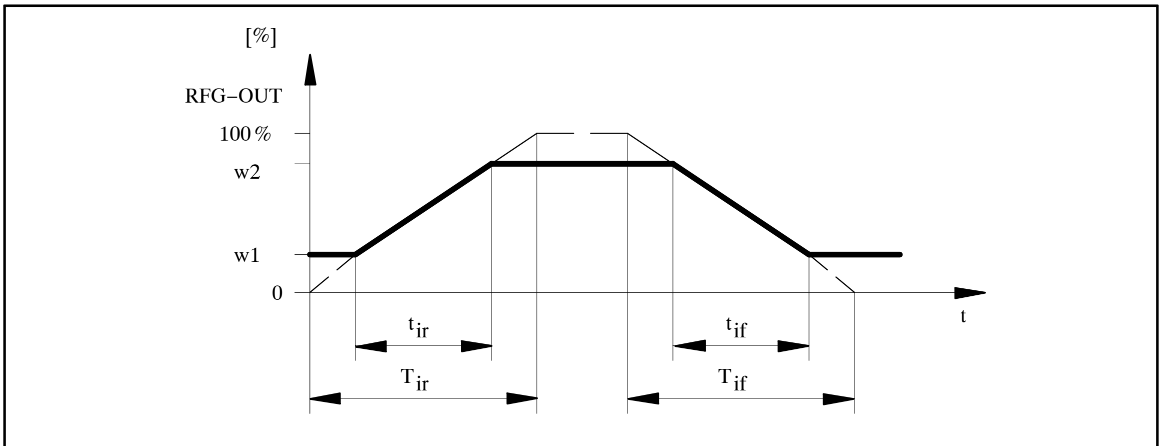


Fig. 3-187 P-gain derived from the PCTRL-SET process setpoint

  - C0329 = 3
    The P-gain is derived from the control difference and calculated by means of a characteristic as for C0329 = 2.

3.2.71.2 Ramp function generator

The setpoint PCTRL-SET is led via a ramp function generator with linear characteristic. Thus, setpoint step-changes at the input can be transformed into a ramp.



$$T_{ir} = t_{ir}\frac{100\%}{w2 - w1} \qquad T_{if} = t_{if}\frac{100\%}{w2 - w1}$$

Fig. 3-188 Acceleration and deceleration times of the ramp function generator

- The ramps can be adjusted separately for acceleration and deceleration.
  - Acceleration time t_{ir} with C0332.
  - Deceleration time t_{if} with C0333.
- PCTRL-INACT = HIGH
  - The ramp function generator is immediately set to zero.

3.2.71.3 Value range of the output signal

- The process controller operates in bipolar mode in the default setting.
  - The output value is limited to ±100 %.
- The function can be set to unipolar mode under C0337.
  - The output value is limited to 0 ... +100 %.

3.2.71.4 Evaluation of the output signal

- The output signal can be evaluated after the limitation block via PCTRL-INFLU.
  - The process controller can be hidden or unhidden with this evaluation.
  - The calcuation is done according to the following formula:
    100 % (PCTRL-OUT) = 100 % * 100 % (PCTRL-INFLU).

3.2.71.5 Deactivation of the process controller

- PCTRL-INACT = HIGH deactivates the process controller
  - PCTRL-OUT is set to zero.
  - The I-component is set to zero.
  - The ramp function generator is set to zero.

3.2.72 Angle addition block (PHADD)

Purpose

Adds or subtracts angle signals depending on the input used.

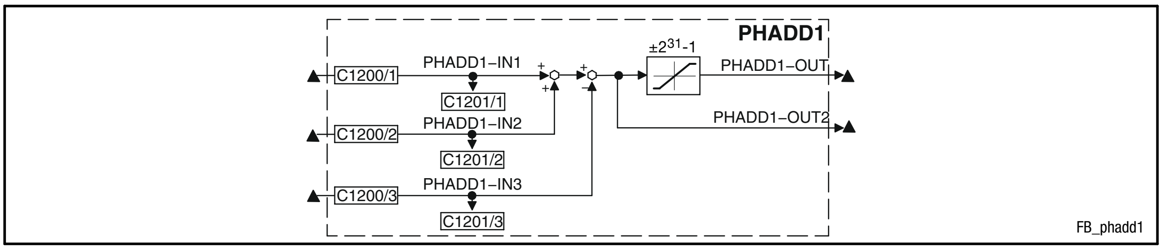


Fig. 3-189 Angle addition block (PHADD1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHADD1-IN1	ph	C1201/1	dec [inc]	C1200/1	3	1000	Addition input
PHADD1-IN2	ph	C1201/2	dec [inc]	C1200/2	3	1000	Addition input
PHADD1-IN3	ph	C1201/3	dec [inc]	C1200/3	3	1000	Subtraction input
PHADD1-OUT	ph	-	-	-	-	-	Limited to ±2147483647
PHADD1-OUT2	ph	-	-	-	-	-	-

Function

- Input PHADD1-IN1 is added to input PHADD1-IN2.
- The input PHADD-IN3 is subtracted from the calculated result.
- Then the result of the subtraction
  - – is limited to ±2147483647 and output at PHADD1-OUT.
  - – is output at PHADD1-OUT2 without limitations.

3.2.73 Angle comparator (PHCMP)

Purpose

Compares two angle signals (distances) with each other.

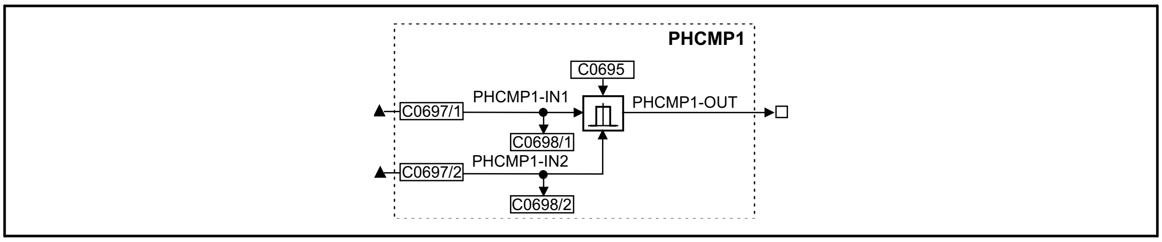


Fig. 3-190 Angle comparator (PHCMP1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP1-IN1	ph	C0698/1	dec [inc]	C0697/1	3	1000	Signal to be compared
PHCOMP1-IN2	ph	C0698/2	dec [inc]	C0697/2	3	1000	Comparison value
PHCOMP1-OUT	d	-	-	-	-	-	

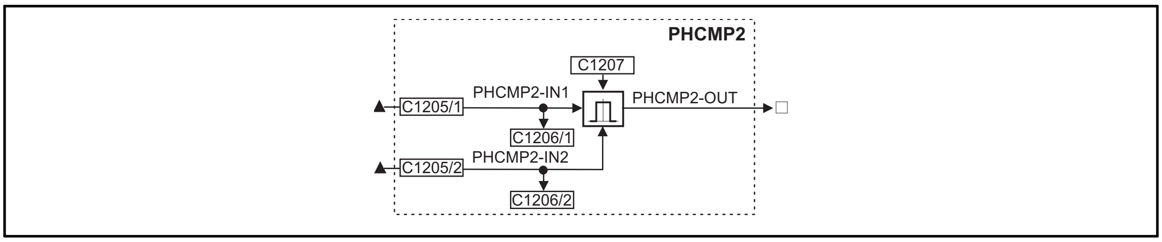


Fig. 3-191 Angle comparator (PHCMP2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP2-IN1	ph	C1206/1	dec [inc]	C1205/1	3	1000	Signal to be compared
PHCOMP2-IN2	ph	C1206/2	dec [inc]	C1205/2	3	1000	Comparison value
PHCOMP2-OUT	d	-	-	-	-	-	

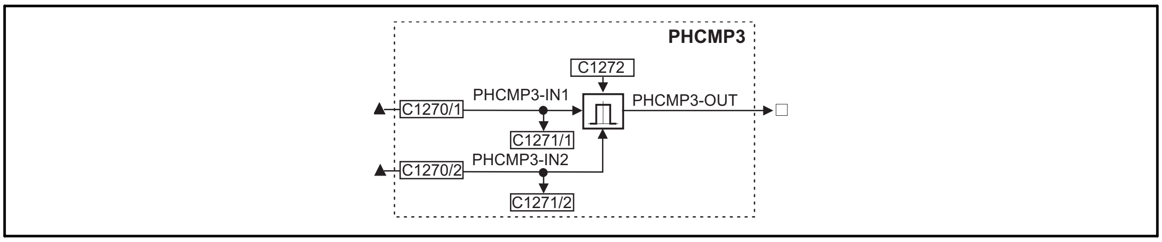


Fig. 3-192 Angle comparator (PHCMP3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHCOMP3-IN1	ph	C1271/1	dec [inc]	C1270/1	3	1000	Signal to be compared
PHCOMP3-IN2	ph	C1271/2	dec [inc]	C1270/2	3	1000	Comparison value
PHCOMP3-OUT	d	-	-	-	-	-	

Function

Function block	Code	Function	Note
PHCMP1	C0695 = 1	- If PHCMPx-IN1 < PHCMPx-IN2, PHCMPx-OUT switches to HIGH - If PHCMPx-IN1 ≥ PHCMPx-IN2, PHCMPx-OUT switches to LOW	
PHCMP2	C1207 = 1		
PHCMP3	C1272 = 1		
PHCMP1	C0695 = 2	- If I PHCMPx-IN1 I < I PHCMPx-IN2 I, PHCMPx-OUT switches to HIGH - If I PHCMPx-IN1 I ≥ I PHCMPx-IN2 I, PHCMPx-OUT switches to LOW	Compares the absolute values of the inputs
PHCMP2	C1207 = 2		
PHCMP3	C1272 = 2		

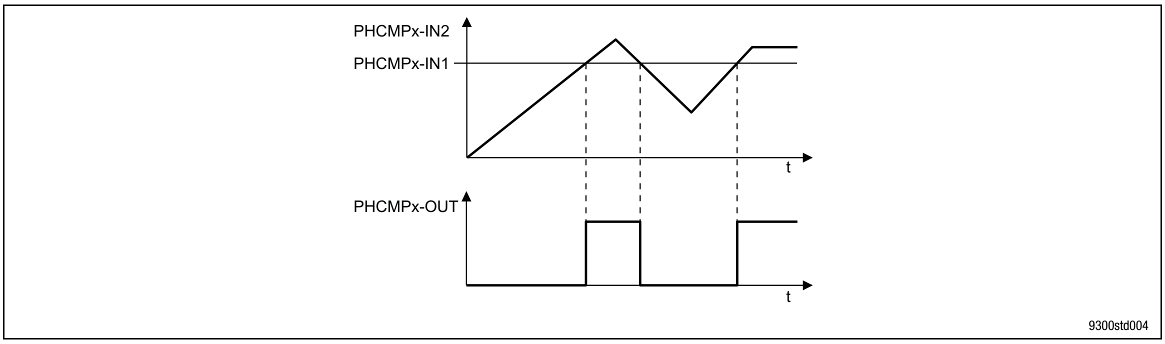


Fig. 3-193 Diagram of the function

3.2.74 Actual angle integrator (PHDIFF)

Purpose

Selective addition of a angle signal to the setpoint angle.

It is also possible to compare setpoint and actual angle signals.

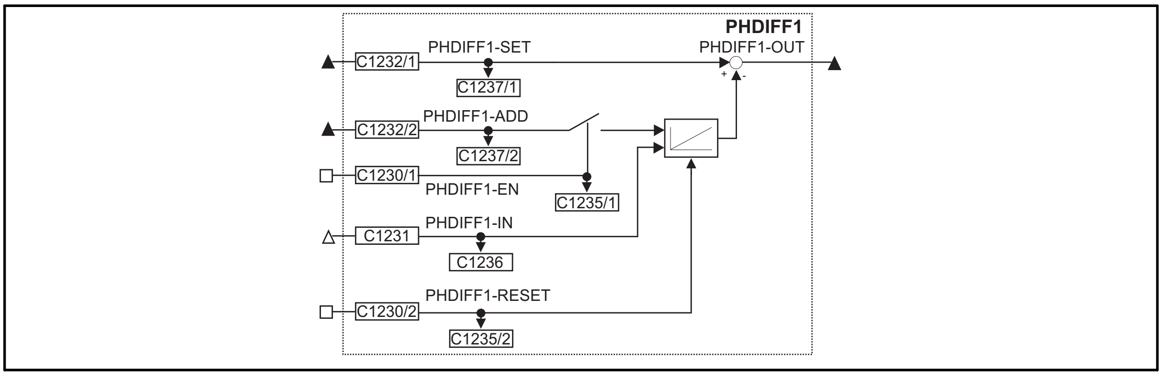


Fig. 3-194 Actual angle integrator (PHDIFF1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHDIFF1-IN	phd	C1236	dec [rpm]	C1231	4	-
PHDIFF1-SET	ph	C1237/1	dec [inc]	C1232/1	3	-
PHDIFF1-ADD	ph	C1237/2	dec [inc]	C1232/2	3	-
PHDIFF1-EN	d	C1235/1	bin	C1230/1	2	-
PHDIFF1-RESET	d	C1235/2	bin	C1230/2	2	HIGH = sets the actual angle integrator = 0
PHDIFF1-OUT	ph	-	-	-	-	Without limit

Function

C1230/1 = HIGH

- The speed signal at PHDIFF1-IN is integrated by the actual angle integrator.
- The angle signal at PHDIFF1-ADD is added to the integrated speed signal.
- The result of the actual angle integrator is subtracted from the angle signal at PHDIFF1-SET.

C1230/1 = LOW

- The speed signal at PHDIFF1-IN is integrated by the actual angle integrator.
- The result of the actual angle integrator is subtracted from the angle signal at PHDIFF1-SET.

3.2.75 Signal adaptation for angle signals (PHDIV)

Purpose

Power-of-two division or multiplication of angle signals.

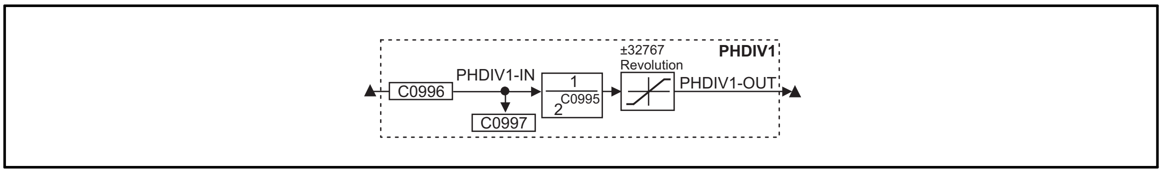


Fig. 3-195 Signal adaptation for angle signals (PHDIV1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHDIV1-IN	ph	C0997	dec [inc]	C0996	3	1000	
PHDIV1-OUT	ph	-	-	-	-	-	65536 inc = one encoder revolution

Function

- Arithmetic function:

$$\text{PHDIV1-OUT} = \frac{\text{PHDIV1-IN}}{2^{\text{C0995}}}$$

  – Positive values in C0995 result in a division.
  – Negative values in C0995 result in a multiplication.
- The output value is limited to ±(2^{31}-1) inc (corresponds to ±32767 encoder revolutions).
  – If the limit is exceeded, the output is kept at the limit value.

3.2.76 Angle integrator (PHINT1, PHINT2, PHINT3)

Integrates a speed or a velocity to a angle (distance).

The integrator can accept max. ±32000 encoder revolutions.

PHINT3 can recognise a relative distance.

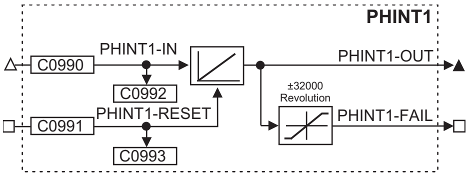


Fig. 3-196 Angle integrator (PHINT1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT1-IN	phd	C0992	dec [rpm]	C0990	4	1 revolution = 65536 increments
PHINT1-RESET	d	C0993	bin	C0091	2	HIGH = sets the angle integrator to 0 and PHINT1-FAIL = LOW
PHINT1-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT1-FAIL	d	-	-	-	-	HIGH = overflow

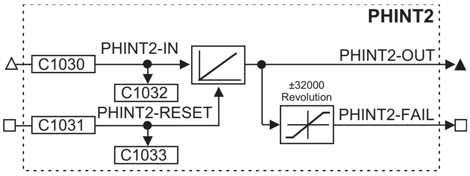


Fig. 3-197 Angle integrator (PHINT2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT2-IN	phd	C1032	dec [rpm]	C1030	4	1 revolution = 65536 increments
PHINT2-RESET	d	C1033	bin	C1031	2	HIGH = sets the angle integrator to zero and PHINT2-FAIL = LOW
PHINT2-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT2-FAIL	d	-	-	-	-	HIGH = overflow

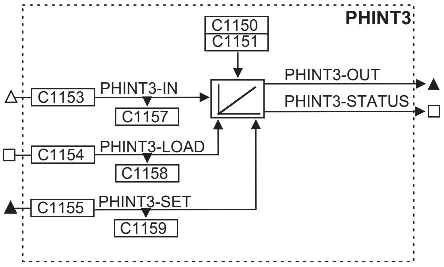


Fig. 3-198 Angle integrator (PHINT3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PHINT3-IN	phd	C1157	dec [rpm]	C1153	4	1 revolution = 65536 increments
PHINT3-LOAD	d	C1158	bin	C1154	2	HIGH = sets the angle integrator to the input signal of PHINT3-IN and PHINT3-STATUS = LOW
PHINT3-SET	ph	C1159	dec [inc]	C1155	3	
PHINT3-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT3-STATUS	d	-	-	-	-	HIGH = overflow or processing of distance completed

Function

- Constant input value (PHINT1, PHINT2 and PHINT3)
- Input value with change of sign (PHINT3)
- Scaling of PHINTx-OUT

3.2.76.1 Constant input value (PHINT1 and PHINT2)

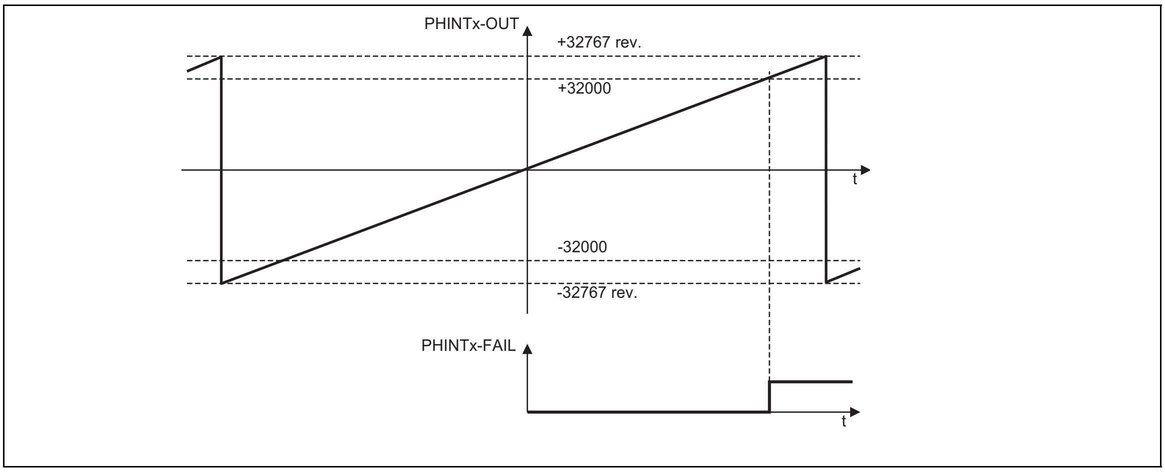


Fig. 3-199 Function of PHINTx with constant input value

- The FB integrates speed or velocity values at PHINTx-IN to a angle (distance).
- PHINTx-OUT outputs the counter content of the bipolar integrator.
  - A positive value at PHINTx-IN increments the integrator (counter content is increased).
  - A negative value at PHINTx-IN decrements the integrator (counter content is reduced).
- If the counter content exceeds the value of +32767 encoder revolutions (≙ +2147483647 inc)
  - an overflow occurs. The counting is continued with the value -32768.
  - PHINTx-FAIL switches to HIGH when the value ≥ +32000 is reached.
- If the counter content falls below the value of -32768 encoder revolutions (≙ -2147483648 inc)
  - an overflow occurs. The counting starts at the value +32767.
  - PHINTx-FAIL switches to HIGH when the value ≤ -32000 is reached.
- PHINTX-RESET = HIGH
  - sets the integrator to 0
  - sets PHINTx-OUT = 0, as long as a HIGH level is applied to PHINTx-IN.
  - sets PHINTx-FAIL = LOW.

3.2.76.2 Constant input value (PHINT3)

The FB PHINT3 has three modes which can be set under C1150.

Mode C1150 = 2 is described in chapter 3.2.76.3.

C1150 = 0	**C1150 = 1**
The input PHINT3-LOAD is state-triggered (HIGH level). ● PHINT3-LOAD = HIGH – The integrator is loaded with the input value at PHINT3-SET. – Sets the output PHINT3-STATUS = LOW	The input PHINT3-LOAD is edge-triggered (LOW-HIGH edge). ● PHINT3-LOAD = LOW-HIGH edge – The integrator is loaded with the input value at PHINT3-SET and starts adding from this point – Sets the output PHINT3-STATUS = LOW

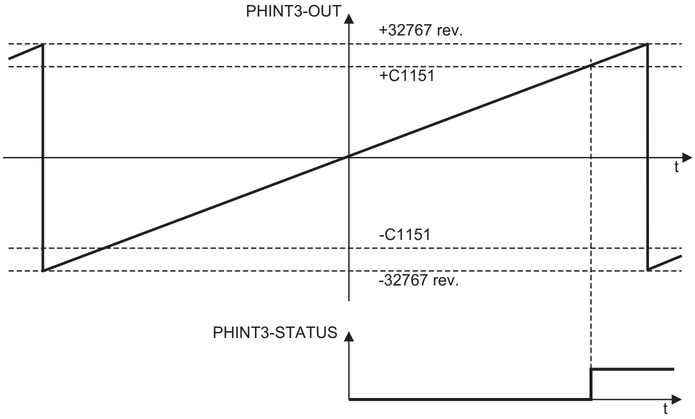


Fig. 3-200 Function of PHINT3 with constant input value when C1150 = 0 and C1150 = 1

- The FB integrates speed or velocity values at PHINT3-IN to a angle (distance).
- PHINT3-OUT outputs the counter content of the bipolar integrator.
  – A positive value at PHINT3-IN increments the integrator (counter content is increased).
  – A negative value at PHINT3-IN decrements the integrator (counter content is reduced).
- If the counter content exceeds the value of +32767 encoder revolutions (≙ +2147483647 inc)
  – an overflow occurs. The counting is continued with the value -32768,
  – PHINT3-STATUS switches to HIGH when the value (+) C1151 is reached
- If the counter content falls below the value of -32768 encoder revolutions (≙ -2147483648 inc)
  – an overflow occurs. The counting starts at the value +32767,
  – PHINT3-STATUS switches to HIGH when the value (-) C1151 is reached

3.2.76.3 Input value with sign reversal (PHINT3)

C1150 = 2

The input PHINT3-LOAD is state-triggered (HIGH level).

- PHINT3-LOAD = HIGH
  - – The integrator is loaded with the input value at PHINT3-SET.
  - – Sets the output PHINT3-STATUS = LOW.

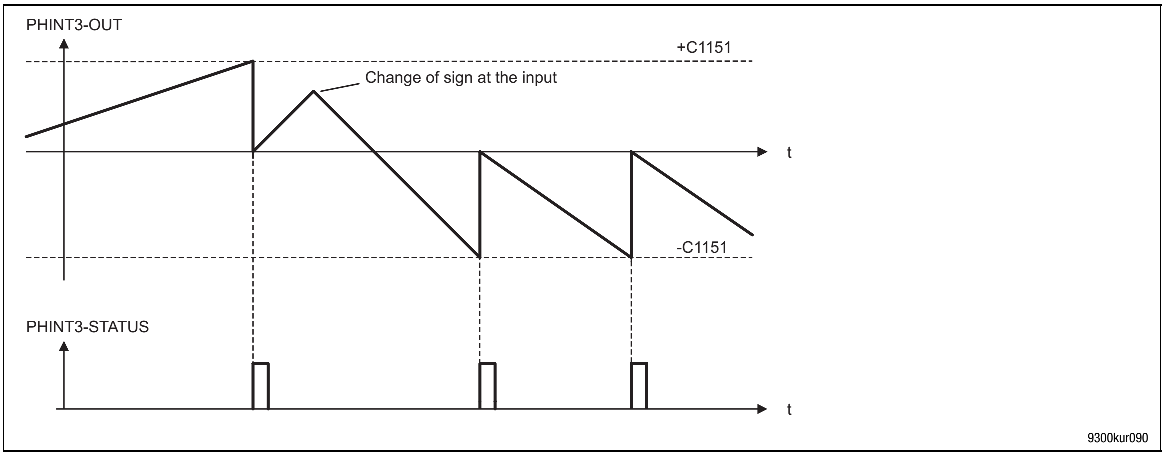


Fig. 3-201 Function of PHINT3 with sign reversal of the input value when C1150 = 2

- The FB integrates speed or velocity values at PHINT3-IN to a angle (distance).
- PHINT3-OUT outputs the counter content of the bipolar integrator.
  - – A positive value at PHINT3-IN increments the integrator (counter content is increased).
  - – A negative value at PHINT3-IN decrements the integrator (counter content is reduced).
- If the counter content exceeds the value of (+) C1151,
  - – the value of C1151 is subtracted from the counter content
  - – PHINT3-STATUS switches to HIGH for 1 ms.
- If the counter content falls below the value of (-) C1151,
  - – the value of C1151 is added to the counter content
  - – PHINT3-STATUS switches to HIGH for 1 ms.

3.2.76.4 Scaling of PHINTx-OUT

Mathematic description of PHINTx-OUT:

$$\mathrm{PHINTx - OUT[inc]} = \mathrm{PHINTx - IN[rpm]} \cdot \mathrm{t[s]} \cdot \mathrm{65536[inc/rev.]}$$

t = integration time

Example:

You want to determine the counter content of the integrator at a certain speed at the input and a certain integration time.

- Given values:
  - PHINTx-IN = 1000 rpm
  - t = 10 s
  - Start value of the integrator = 0
- Solution:
  - Conversion of PHINTx-IN:

$$1000\ \mathrm{rpm} = \frac{1000\ \mathrm{rev.}}{60\ \mathrm{s}}$$

  - Calculation of PHINTx-OUT:

$$\mathrm{PHINTx - OUT} = \frac{1000\ \mathrm{rev.}}{60\ \mathrm{s}} \cdot 10\ \mathrm{s} \cdot \frac{65536\ \mathrm{inc}}{\mathrm{rev.}} = 10922666\ \mathrm{inc}$$

3.2.77 Angle integrator (PHINT4)

The function block simulates the basic function of the integrator in the CDATA function block.

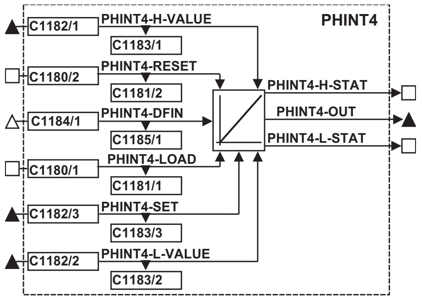


Fig. 3-202 Angle integrator (PHINT4)

Signal				Source	Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	
PHINT4-LOAD	d	C1181/1	bin	C1180/1	A LOW→HIGH edge loads the integrator with the value at PHINT4-SET, then the integrator continues running immediately.
PHINT4-RESET	d	C1181/2	bin	C1180/2	HIGH: Continuously loads the integrator with the value of input PHINT4-SET. This input has priority
PHINT4-H-VALUE	ph	C1183/1	dec [inc]	C1182/1	Upper value for the return
PHINT4-L-VALUE	ph	C1183/2	dec [inc]	C1182/2	Lower value for the return
PHINT4-SET	ph	C1183/3	dec [inc]	C1182/3	Starting value
PHINT4-DFIN	phd	C1185/1	dec [rpm]	C1184/1	Master speed input • A positive value at PHINT4-DFIN increases the value at PHINT4-OUT • A negative value at PHINT4-DFIN decreases the value at PHINT4-OUT
PHINT4-H-STAT	d				1. LOW-HIGH edge: Integrator value has reached PHINT4-H-VALUE; the counting process is continued from PHINT4-L-VALUE 2. HIGH: Return is not possible, as PHINT4-H-VALUE is too low for the speed at PHINT4-DFIN
PHINT4-L-STAT	d				1. LOW-HIGH edge: Integrator value has reached PHINT4-L-VALUE; the counting process is continued from PHINT4-H-VALUE 2. HIGH: Return is not possible, as PHINT4-L-VALUE is too low for the speed at PHINT4-DFIN
PHINT4-OUT	ph				Output of the angle/position signal (65536 inc = 1 revolution)

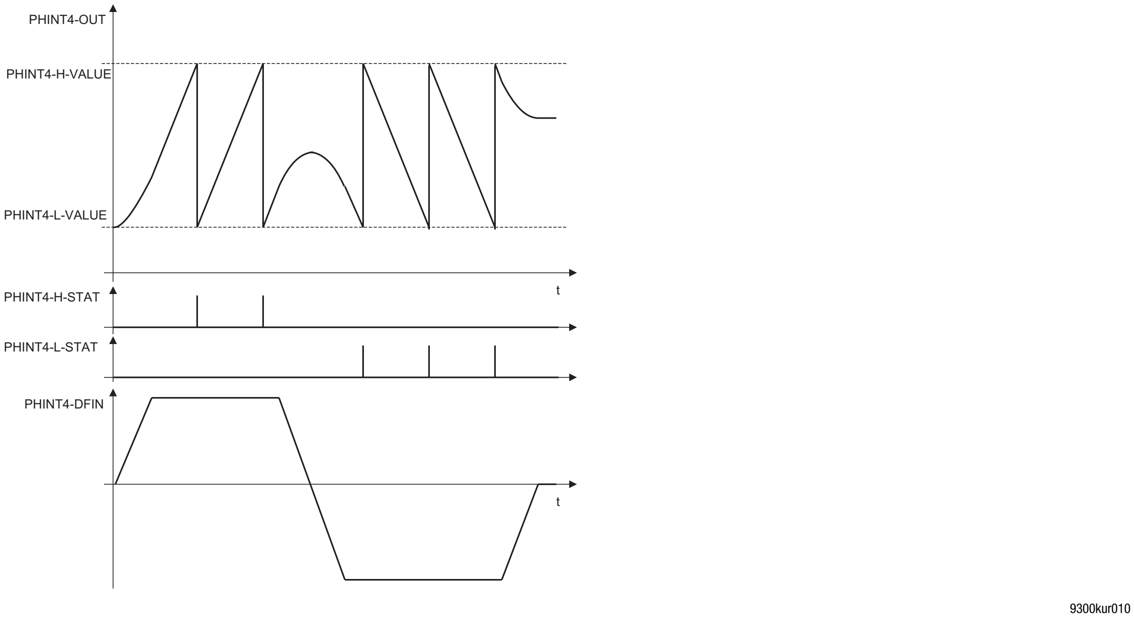


Fig. 3-203 Function of PHINT4

3.2.78 Phase integrator (PHINT5)

The PHINT5 function block is a master phase integrator without remainder considered and contains an integrated mark synchronisation.

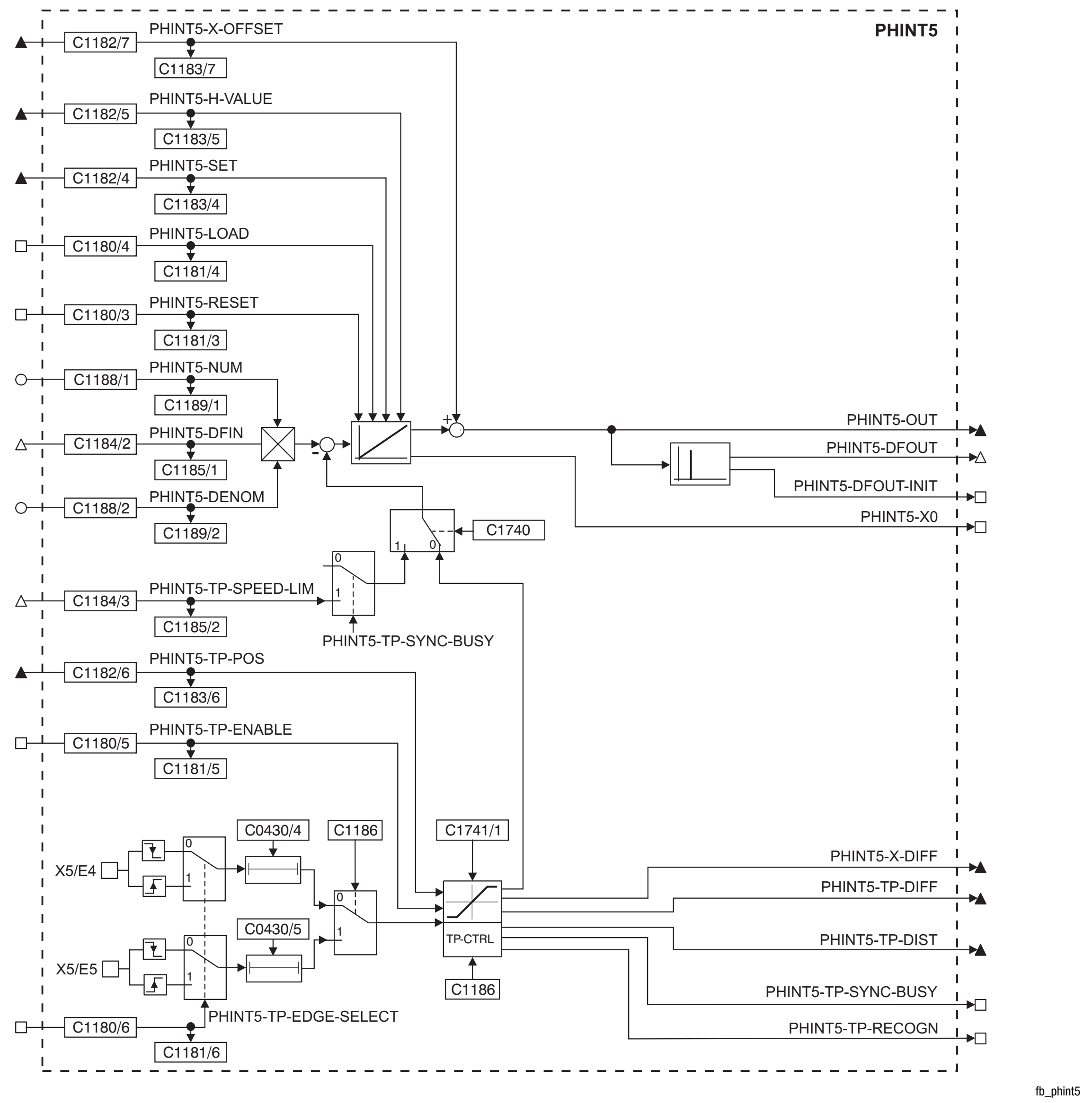


Fig. 3-204 Phase integrator (PHINT5)

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
PHINT5-X-OFFSET	ph	C1183/7	dec [inc]	C1182/7	3	Selection of an offset for the X direction
PHINT5-H-VALUE	ph	C1183/5	dec [inc]	C1182/5	3	Upper limit value of the integrator Only positive input values are permissible. A check for negative values is not carried out.
PHINT5-X-SET	ph	C1183/4	dec [inc]	C1182/4	3	Setpoint with which the integrator is to start.
PHINT5-LOAD	d	C1181/4	bin	C1180/4	2	A LOW-HIGH edge loads the integrator with the value at PHINT5-X-SET, then the integrator continues running immediately.
PHINT5-RESET	d	C1181/3	bin	C1180/3	2	HIGH: • The integrator is reset to the value at PHINT5-X-SET. • The touch probe function is deactivated. Available touch probe requirements are reset. • PHINT5-TP-SYNC-BUSY, PHINT5-X0, and PHINT5-TP-RECOGN are set to LOW.
PHINT5-NUM	a	C1189/1	dec [%]	C1188/1	1	Numerator for evaluation of the input signal at PHINT5-DFIN.
PHINT5-DFIN	phd	C1185/1	dec [rpm]	C1184/2	4	Master speed input • A positive value at PHINT5-DFIN increases the value at PHINT5-OUT • A negative value at PHINT5-DFIN decreases the value at PHINT5-OUT
PHINT5-DENOM	a	C1189/2	dec [%]	C1188/2	1	Denominator for evaluation of the input signal at PHINT5-DFIN.
PHINT5-TP-SPEED-LIM	phd	C1185/2	dec [rpm]	C1184/3	4	Selection of a compensation speed. The input signal is active if PHINT5-TP-SYNC-BUSY = HIGH and C1740 = 1. It is impermissible to select constant values (e.g. via free codes (FCODE)).
PHINT5-TP-POS	ph	C1183/6	dec [inc]	C1182/6	3	Distance of the touch probe position to the zero point of the integrator.
PHINT5-TP-ENABLE	d	C1181/5	bin	C1180/5	2	HIGH: The touch probe signal is evaluated. LOW: The touch probe signal is not evaluated.
PHINT5-TP-EDGE-SELECT	d	C1181/6	bin	C1180/6	2	LOW: The HIGH-LOW edge of the input signal at X5/E4 or X5/E5 is evaluated. HIGH: The LOW-HIGH edge of the input signal at X5/E4 or X5/E5 is evaluated.
PHINT5-OUT	ph					Integrator position + offset of PHINT5-X-Offset. The output signal is placed between 0 (fixedly) and the specified limit value at PHINT5-H-VALUE.
PHINT5-DFOUT	phd					Speed signal + offset of PHINT5-X-Offset.
PHINT5-DFOUT-INIT	d					HIGH: The output PHINT5-DFOUT is within the limitation ±29999 rpm
PHINT5-X0	d					LOW-HIGH edge: Zero crossing of the integrator. The zero crossing is only signalised for one cycle (1 ms).
PHINT5-X-DIFF	ph					Outputs the difference between the integrator and the signal at PHINT5-TP-POS if a touch probe pulse occurs. The output only is effected if PHINT5-ENABLE-TP is set = HIGH.
PHINT5-TP-DIFF	ph					Outputs the distance between 2 successive touch probe pulses (relating to the integrator) The output only is effected if PHINT5-ENABLE-TP is set = HIGH.
PHINT5-TP-DIST	ph					Outputs the distance of the touch probe pulse to the zero point of the integrator The output only is effected if PHINT5-ENABLE-TP is set = HIGH.
PHINT5-TP-SYNC-BUSY	d					Touch probe evaluation: LOW: No deviation measured, or the deviation has already been compensated HIGH: There is a deviation between the integrator and the input signal at PHINT5-TP-POS that has not been compensated. The compensation speed at PHINT5-TP-SPEED-LIM is activated if C1740 is set to 1. LOW-HIGH edge: compensation process completed
PHINT5-TP-RECOGN	d					Signalises a recognised touch probe pulse. LOW-HIGH edge: Compensation process completed. The signal is output for one cycle (1 ms).

Range of functions

- Select touch probe mode (🕮 3-251)
- Evaluate touch probe signal edge (🕮 3-251)
- Activate touch probe evaluation (🕮 3-252)
- Compensate for a detected deviation(🕮 3-252)
- Example of a mark synchronisation (🕮 3-254)

Note!

For a faultless homing with the REFC function block you have to deactivate the touch probe function with PHINT5-TP-ENABLE = LOW during homing. (🕮 3-263)

3.2.78.1 Select touch probe mode

- C1186 = 0: terminal E4
  - The input for the touch probe signal is terminal X5/E4. The signal refers to the function block output MCTRL-PHI-ACT.
  - The compensation function is activated immediately.
- C1186 = 1: terminal E5
  - The input for the touch probe signal is terminal X5/E5. The signal refers to the master angle at X9 (DFIN function block).
  - The compensation function is activated immediately.
- C1186 = 2: rotary knife
  - The input for the touch probe signal is terminal X5/E5. The signal refers to the master angle at X9 (DFIN function block).
  - The compensation function is activated at zero crossing.
  - **Important:** For this function, you have to connect the input PHINT5-DFIN to the output DFIN-OUT.
  - Select this mode for applications with a rotary cutter.

Note!

Save the settings with C0003 = 1 and switch the mains voltage off and on again.

- When the mark synchronisation is parameterised, the function block automatically changes to the ”Modulo” or ”Limited traversing range” mode. Only by mains switching the touch probe function is initialised with the mode selected.

3.2.78.2 Evaluate touch probe signal edge

Via the input PHINT5-TP-EDGE-SELECT you can set the edge evaluation for the terminals X5/E4 and X5/E5.

- PHINT5-TP-EDGE-SELECT = LOW
  - Only the HIGH-LOW edges of the touch probe signal are evaluated.
- PHINT5-TP-EDGE-SELECT = HIGH
  - Only the LOW-HIGH edges of the touch probe signal are evaluated.

3.2.78.3 Activate touch probe evaluation

Via the input PHINT5-ENABLE-TP you can activate or inhibit the evaluation of the touch probe signals.

- PHINT5-ENABLE-TP = HIGH
  - The touch probe signal is evaluated.
  - The evaluated signal is output at PHINT5-TP-DIFF, PHINT5-TP-DIST and PHINT5-X-DIFF.
- PHINT5-ENABLE-TP = LOW
  - The touch probe signal is not evaluated.
  - The output signals at PHINT5-TP-DIFF, PHINT5-TP-DIST and PHINT5-X-DIFF are not updated. The signal evaluated last is output.

3.2.78.4 Compensation of a recognised deviation

If a touch probe signal arrives, the deviation between the current value of the integrator and the signal is determined at PHINT5-TP-POS and is output at PHINT5-X-DIFF. In C1740 you can set the source for the compensation speed.

- C1740 = 0: code 1741/1
  - Deviations that are recognised are compensated directly and immediately with the speed defined in C1741/1.
  - Value in C1741/1 = 0: no compensation of deviations.
  - Via PHINT5-X-OFFSET you can apply an offset to the output signal at PHINT5-OUT.
- C1740 = 1: input PHINT5-TP-SPEED-LIM
  - Deviations that are recognised are compensated with the defined speed at PHINT5-TP-SPEED-LIM.
  - Signal at PHINT5-TP-SPEED-LIM = 0: no compensation of deviations.
  - The input only is active if PHINT5-TP-SYNC-BUSY = High.
  - The input signal solely takes effect on the integrator.
  - Via PHINT5-X-OFFSET you can apply an offset to the output signal at PHINT5-OUT.

Note!

- By separation of the functions ”Measure the deviation” and ”Compensate the deviation”, you can for instance measure material lengths.
- The compensation process can be controlled by selecting a profile at PHINT5-TP-SPEED-LIM.
- The PHINT5 function block does not contain a profile generator. The profiles have to be generated via additional function blocks (e.g. RFGPH2 or RFGPH3). See also example in fig. 3-205.
  - Do not specify constant values at PHINT5-TP-SPEED-LIM (e.g. via free codes (FCODE)).

RFGPH function block as profile generator for the compensation speed

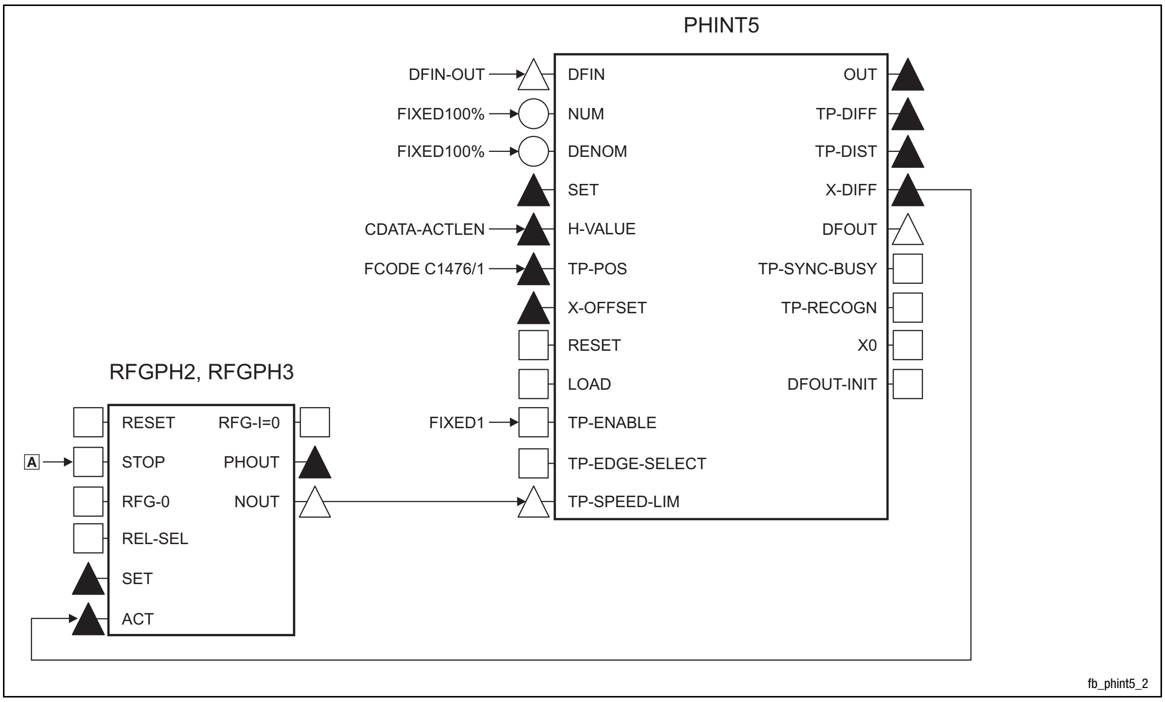


Fig. 3-205 RFGPH function block as profile generator for the compensation speed

- The deviation determined between the integrator and the defined touch probe position (input PHINT-TP-POS) is output as the shortest path at PHINT5-X-DIFF and is compensated via the RFGPH2 (or RFGPH3) function block.
- Apply the value to be compensated to the input RFGPHx-ACT and activate the profile generator by means of a HIGH-LOW edge A at the input RFGPHx-STOP.

3.2.78.5 Example of a mark synchronisation

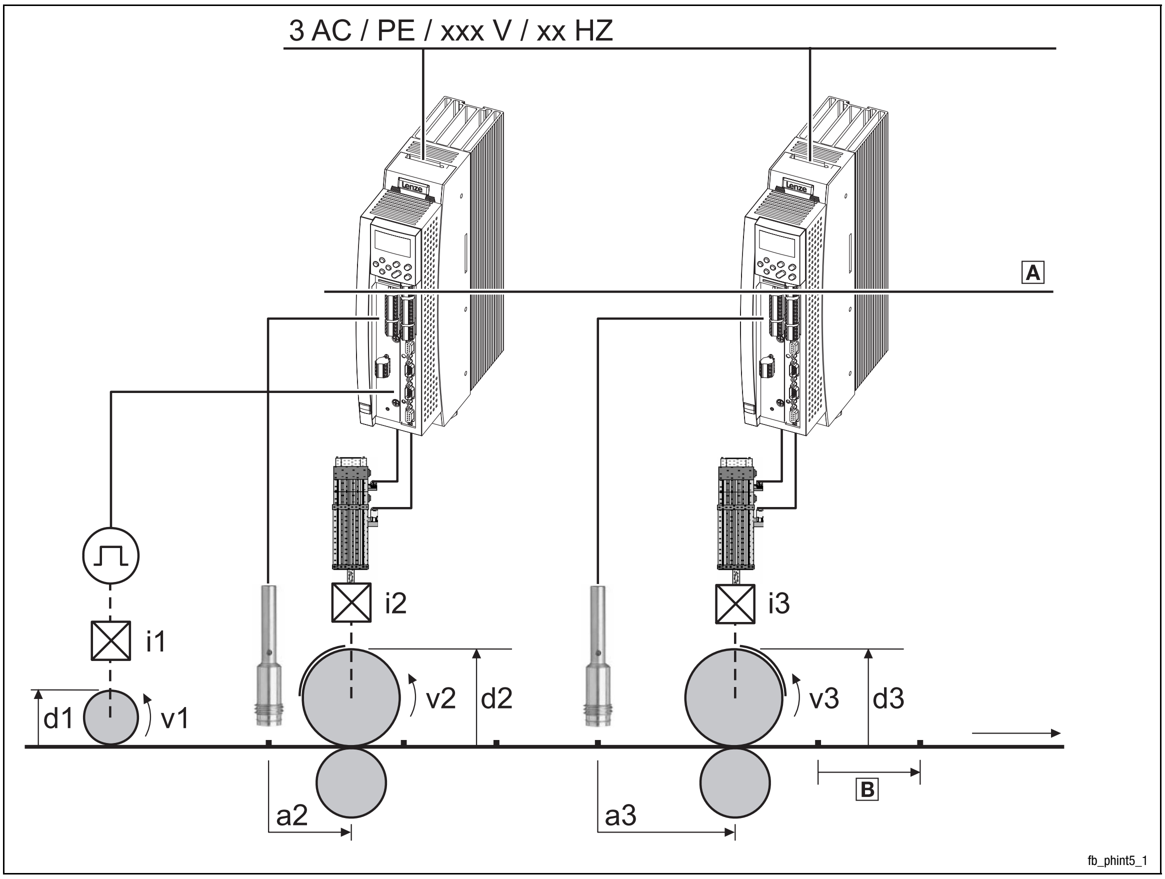


Fig. 3-206 Principle of the mark synchronisation

A	Transmission of the master angle via system bus (CAN) or digital frequency
B	Register
v1	Speed of the material path
v2, v3	Speed of the material path ± correction
d1, d2, d3	Roller diameters
a2, a3	Distance of the touch probe sensor to the zero point
i1, i2, i3	Gearbox

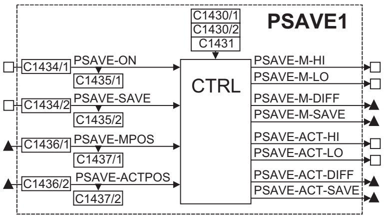
- At input PHINT5-TP-POS the distance of the touch probe sensor to the zero point of the integrator has to be set (a2, a3)
  - The value has to be between 0 and the value at PHINT5-H-VALUE.
- When the touch probe signal occurs, the deviation between the value of the integrator and the value at PHINT5-TP-POS is determined, is output at PHINT5-X-DIFF, and is compensated via the mode set in C1740.

3.2.79 Position memory (PSAVE)

One function block (PSAVE1) is available.

Purpose

Storage (mains-failure protected) of positions (master value and/or actual value) and comparison to the actual values. After mains connection it can be checked whether the master value position or the actual value position have changed. This is however only reasonable when using absolute value encoders (resolvers or SinCos encoders).



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
PSAVE1-ON	d	1435/1	bin	1434/1	2	HIGH = Comparison of inputs MPOS/ACTPOS with values saved and output of difference
PSAVE1-SAVE	d	1435/2	bin	1434/2	2	HIGH =
PSAVE-MPOS	ph	1437/1	dec[inc]	1436/1	3	Input for master position
PSAVE-ACTPOS	ph	1437/2	dec[inc]	1436/2	3	Input for actual position (e.g. rotor position)
PSAVE-M-HI	d		-	-	-	HIGH = Input value > stored position
PSAVE-M-LO	d		-	-	-	HIGH = Input value < stored position
PSAVE-ACT-HI	d		-	-	-	HIGH = Input value > stored position
PSAVE-ACT-LO	d		-	-	-	HIGH = Input value < stored position
PSAVE-M-DIFF	ph		-	-	-	Position difference = Stored position - input
PSAVE-M-SAVE	ph		-	-	-	Stored position of master drive
PSAVE-ACT-DIFF	ph		-	-	-	Position difference = Stored position - input
PSAVE-ACT-SAVE	ph		-	-	-	Stored position of cam drive

Function

- Store position value
- Compare actual position with values stored
- Output of status signals

3.2.79.1 Store position value

- With PSAVE-SAVE = HIGH data from the inputs PSAVE-MPOS and PSAVE-ACTPOS is accepted and output at PSAVE-M-SAVE and PSAVE-ACT-SAVE. The reading and writing processes are repeated cyclically (1000 $\frac{1}{s}$).
- The input data is stored if a H → L edge occurs at PSAVE-SAVE, i.e. they are available even if the controller has been disconnected from the mains.
- When the mains is switched on again, the data is transferred to the main memory of the controller and output at PSAVE-M-SAVE and PSAVE-ACT-SAVE.

3.2.79.2 Compare actual position with values stored

- PSAVE-ON = HIGH:
  - The inputs PSAVE-MPOS and PSAVE-ACTPOS are compared with the stored values. The deviations are output at PSAVE-M-DIFF or PSAVE-ACT-DIFF.

    $PSAVE\text{–}M\text{–}DIFF = \text{stored value} - \{PSAVE\text{–}MPOS\}$

    $PSAVE\text{–}ACT\text{–}DIFF = \text{stored value} - \{PSAVE\text{–}ACTPOS\}$
  - The evaluation of one of the channels can be suppressed by means of a code. In this case, PSAVE-DIFF = 0
- PSAVE-ON = LOW:
  - The outputs PSAVE-DIFF = 0.

3.2.79.3 Output of status signals

The digital outputs are set according to the difference calculated (PSAVE-DIFF) if PSAVE-ON = HIGH.

- A hysteresis can be set via code:
  - for MPOS C1430/1 in m-units
  - for ACTPOS C1430/2 in s-units
- As long as -DIFF < ±C1430/x:
  - -M-HI = LOW
  - -M-LO = LOW
  - ACT-HI = LOW
  - ACT-LO = LOW
- If -DIFF pos. and > +C1430/x
  - -M-LO = HIGH and/or
  - ACT-LO = HIGH
- If -DIFF neg. and < -C1430/x
  - -M-HI = HIGH and/or
  - ACT-HI = HIGH
- If one channel is suppressed through code C1431, the outputs of the corresponding channel are set to LOW.

3.2.80 Delay element (PT1-1)

Purpose

Filtering and delaying of analog signals.

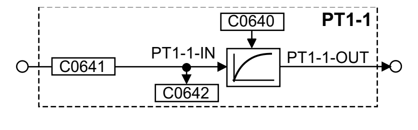


Fig. 3-207 Delay element (PT1-1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PT1-1-IN	a	C0642	dec [%]	C0641	1	1000	-
PT1-1-OUT	a	-	-	-	-	-	-

Function

- The delay time T is set under C0640.
- The proportional coefficient is fixed at K = 1.

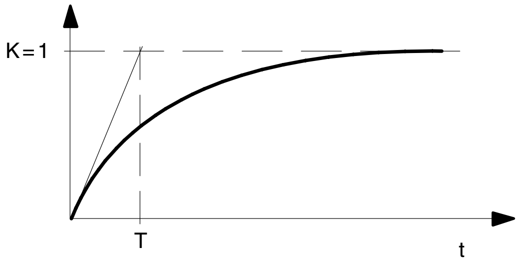


Fig. 3-208 Delay time T of the first order delay element

3.2.81 Delay element (PT1-2)

Purpose

The function block filters and smoothes speed signals. This serves to e.g. filter the digital frequency.

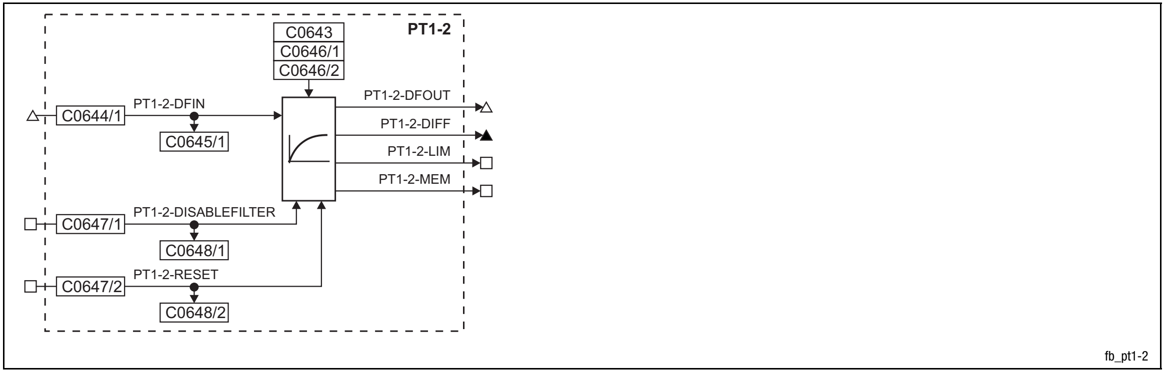


Fig. 3-209 Delay element (PT1-2)

Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
PT1-2-DFIN	phd	C0645/1	dec [rpm]	C0644/1	4	1000	-
PT1-2-DISABLEFILTER	d	C0648/1	bin	C0647/1	2	1000	LOW = filter is on HIGH = filter is off
PT1-2-RESET	d	C0648/2	bin	C0647/2	2	1000	HIGH = overflow buffer is cleared. PT1-2-DFOUT is immediately set to 0. The position gets lost. (Function is available as of software version 3.4)
PT1-2-DFOUT	phd	-	-	-	-	-	Signal is limited to ±29999 rpm
PT1-2-DIFF	ph	-	-	-	-	-	Outputs the phase displacement between input and output signal.
PT1-2-LIM	d	-	-	-	-	-	HIGH = signal at PT1-2-DFOUT is limited (Function is available as of software version 3.4)
PT1-2-MEM	d	-	-	-	-	-	HIGH = overflow buffer still contains values. A query is sensible if PT1-2-DISABLEFILTER = HIGH. (Function is available as of software version 3.4)

Function

Jumps and variations of the input signal are smoothed via the PT1 behaviour without pulse/position losses. An overflow buffer ensures that all increments of the input signal are output again at the output.

Note!

The overflow buffer behaves according to the cycle of numbers (32 bits).

Setting the filter time constant

C0643 serves to set the filter time constant T (delay time). The proportional coefficient is predefined as K = 1.

Setting information

- The higher the value set, the greater the filter effect.
- The higher the value set, the greater the phase displacement between input and output signal.

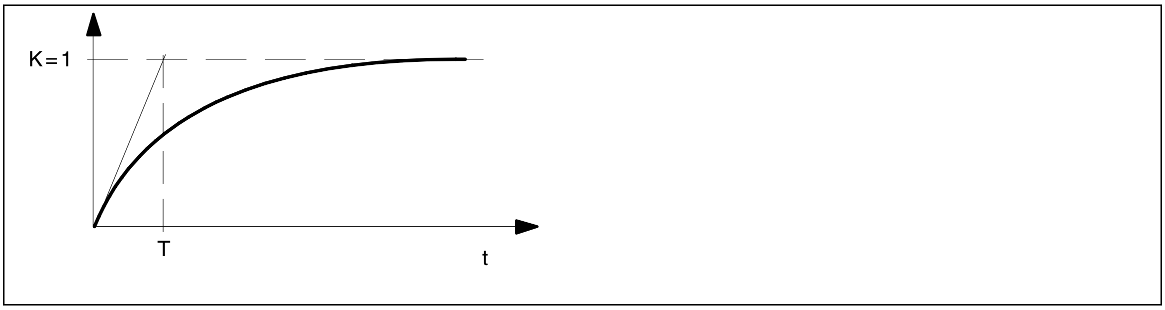


Fig. 3-210 Delay T of the first order delay element

Switching off filter and compensating phase displacement

The filter is switched on and off via the input PT1-2-DISABLEFILTER.

- PT1-2-DISABLEFILTER = LOW
  - The filter is switched on.
- PT1-2-DISABLEFILTER = HIGH
  - The filter is switched off. All increments in the filter and overflow buffer are still output.
  - The input signal is directly output at the output.

Note!

Always set the input PT1-2-DISABLEFILTER = HIGH

- when the controller is inhibited,
- during acceleration phases.

Compensation of the phase displacement when filter is on

C0646/1 serves to set the compensation of the phase displacement (compensating speed).

- Setting information
  - The higher the value set, the greater the dynamics.
  - The higher the value set, the worse the filter effect.
  - If C0646/1 = 0, the position will be lost.

Compensation of the phase displacement when filter is off

C0646/2 serves to set a compensating speed to compensate the phase displacement between input and output signal. The output phase displacement at PT1-2-DIFF is compensated ”smoothly”.

- Setting information
  - The smaller the value set, the slower the compensation of the phase displacement.
  - If C0646/2 = 0, the position will be lost.

3.2.82 CW/CCW/QSP linking (R/L/Q)

Purpose

The FB provides a fail-safe connection for the selection of a rotation direction and the QSP function.

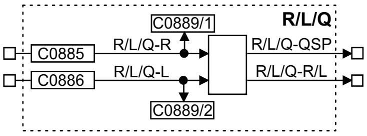


Fig. 3-211 CW/CCW/QSP linking (R/L/Q)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
R/L/Q-R	d	C0889/1	bin	C0885	2	51	-
R/L/Q-L	d	C0889/2	bin	C0886	2	52	-
R/L/Q-QSP	d	-	-	-	-	-	-
R/L/Q-R/L	d	-	-	-	-	-	-

Function

- After mains connection and simultaneous HIGH level at both inputs, the outputs are set as follows:

Inputs		Outputs	
R/L/Q-R	R/L/Q-L	R/L/Q-R/L	R/L/Q-QSP
1	1	0	1

- The following truth table results if one of the inputs is set to LOW once after mains connection:

Inputs		Outputs	
R/L/Q-R	R/L/Q-L	R/L/Q-R/L	R/L/Q-QSP
0	0	0	1
1	0	0	0
0	1	1	0
1	1	unchanged	unchanged

- If both inputs are set to HIGH during operation, the values at both outputs remain unchanged.

3.2.83 Homing function (REFC)

Purpose

The homing function is used to bring the drive shaft to a specific position.

Note!

First, select a predefined configuration in C0005 which already includes the REFC function block. This ensures that all important signal connections are created automatically. After this, adapt the configuration to your application.

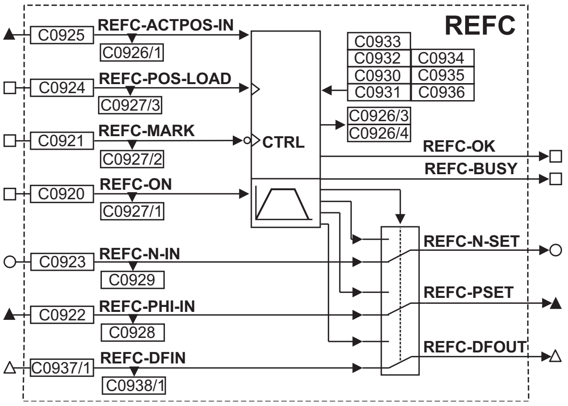


Fig. 3-212 Homing function (REFC)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
REFC-ACTPOS-IN	ph	C0926/1	dec [inc]	C0925	3	Loading value for the current position (REFC-ACTPOS)
REFC-DFIN	phd	C0938/1	dec [rpm]	C0937/1	4	Speed input
REFC-MARK	d	C0927/2	bin	C0921	2	Homing switch
REFC-N-IN	a	C0929	dec [%]	C0923	1	Speed setpoint in [%] of nmax C0011
REFC-ON	d	C0927/1	bin	C0920	2	HIGH = start homing
REFC-PHI-IN	ph	C0928 C0926/2	dec [inc]	C0922	3	Phase setpoint (contouring error for phase controller in FB MCTRL)
REFC-POS-LOAD	d	C0927/3	bin	C0924	2	LOW-HIGH edge = angle at the REFC-ACTPOS-IN input is loaded in REFC-ACTPOS (starting value)
REFC-PSET	ph	-	-	-	-	Phase setpoint (contouring error for phase controller in FB MCTRL)
REFC-BUSY	d	-	-	-	-	HIGH = homing function active
REFC-DFOUT	phd	-	-	-	4	Speed output
REFC-N-SET	a	-	-	-	-	Speed setpoint for n-controller
REFC-OK	d	-	-	-	-	HIGH = homing completed/homing known

Range of functions

- Homing
- Homing modes
- Control via input signals
- Output of status signals
- Speed/digital frequency input and output

3.2.83.1 Homing

There are different possibilities of homing the drive:

- ”Setting the reference once” is carried out for commissioning. For this, you enter the current distance [s-units] of the tool to the machine zero point in C1367/1. This proecedure is reasonable for machines with risk of collision).
  - The function is carried out via the CCTRL or CCTRL2 function blocks. (🕮 3-71 or 3-79)
- A homing usually is carried out once after mains connection. By this, the home position of the drive is found automatically. A homing is carried out via
  - the REFC function block
  - the CCTRL or CCTRL2 function blocks with the function ”Set reference dynamically”. (🕮 3-69 or 3-77)

Profile generator

The homing speed profile can be adapted to the application.

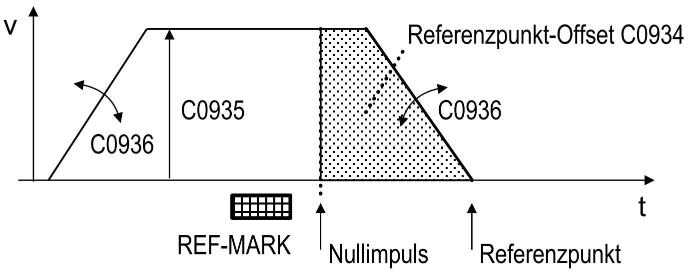


Fig. 3-213 Homing speed profile

Code	Meaning	Note
C0930	Encoder-gearbox factor numerator (motor speed)	Setting is required only if the actual value encoder is not mounted to the motor
C0931	Encoder-gearbox factor denominator (encoder speed)	
C0933	Selection of the edge of the touch probe signal at X5/E4	Regarding the homing modes with touch probe functionality, the TP edge is the reference point for the home position offset
C0934	Homing point offset = number of increments after the zero pulse	This reference applies: 65536 inc = 1 revolution. Selection up to 2140000000 inc possible
C0935	Homing speed	Entry in [%] of n_{max} (C0011)
C0936	Homing acceleration/deceleration time	Linear ramps
C0926/3	REFC-ACTPOS, current actual position	Read only
C0926/4	REFC-TARGET, current target position	Read only

The profile generator calculates the speed profile from the set profile parameters.

- Parameter changes are possible during homing.
  - C0935 and C0936 become effective if REFC-ON = LOW.
- The drive should not be operated at the torque limit (MCTRL-MMAX = HIGH), otherwise the drive cannot follow the speed profile.
  - Increase acceleration / deceleration time C0936 until MCTRL-MMAX is no longer activated.
- The phase controller in the MCTRL function block must be switched active.

3.2.83.2 Reference run modes

The home position is defined by:

- the homing mode C0932
- the signal edge of the zero pulse or touch probe signal C0933
- the home position offset C0934

Note!

For position feedback via resolver, the zero position (depending on the rotor attached to the motor) applies instead of the zero pulse, and, accordingly, the touch probe phase for homing via touch probe.

Precondition for an error-free homing function

Note!

Parameterising the signal edge via C0933 only is effective if the touch probe function of the PHINT5 and CCTRL or CCTRL2 function blocks is deactivated. Otherwise the signal edge for homing is not defined via C0933, but via the setting on the activated function blocks.

- The touch probe function is deactivated if PHINT5-TP-ENABLE and CCTRL-TPIN/E4, or CCTRL2-TPIN/E4 are set to LOW.
- Fig. 3-214 shows a connection example for deactivating the touch probe function during homing.

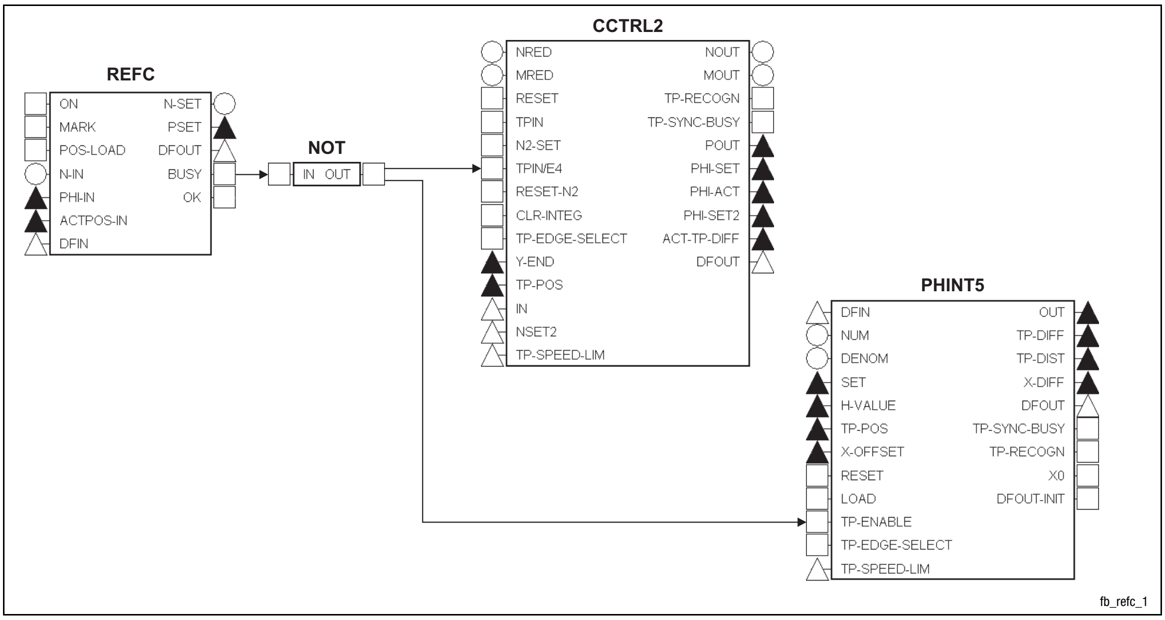


Fig. 3-214 Connection example for deactivating the touch probe function during homing

Homing with homing switch to zero pulse/zero position

Behind the negative edge of the homing switch REFC-MARK, the home position is at the next zero pulse/zero position plus the home position offset:

- Mode 0 (C0932 = 0):
  - Move to the home position in CW rotation.
  - Enter positive homing offset C0934.

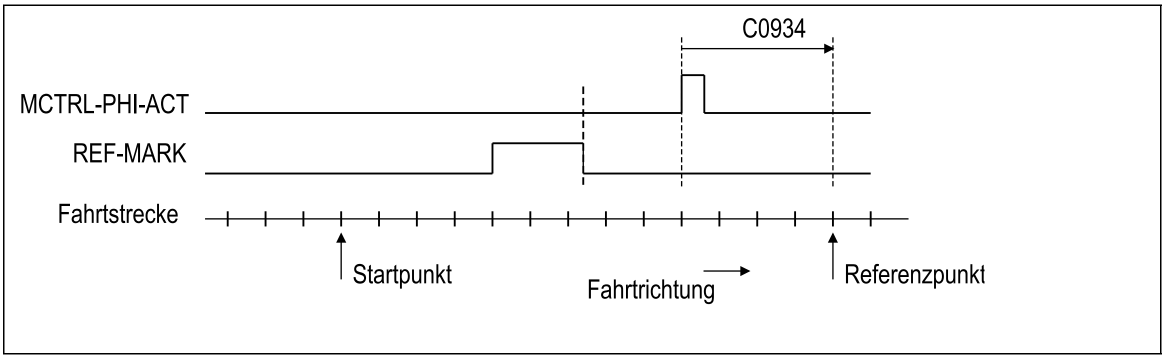


Fig. 3-215 Homing with zero pulse/zero position: mMve to the home position in CW rotation.

- Mode 1 (C0932 = 1):
  - Move to the home position in CCW rotation.
  - Enter negative homing offset C0934.

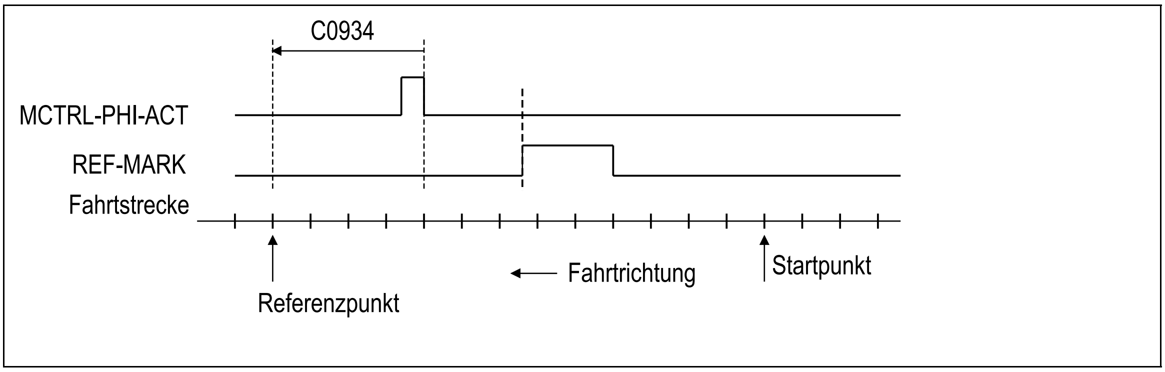


Fig. 3-216 Homing with zero pulse/zero position: mMve to the home position in CCW rotation.

Homing with home switch and touch probe (TP)

Behind the negative edge of the homing switch REFC-MARK, the home position is at the touch probe signal (terminal X5/E4) plus the home position offset:

- Mode 6 (C0932 = 6):
  - Move to the home position in CW rotation.
  - Enter positive homing offset C0934.

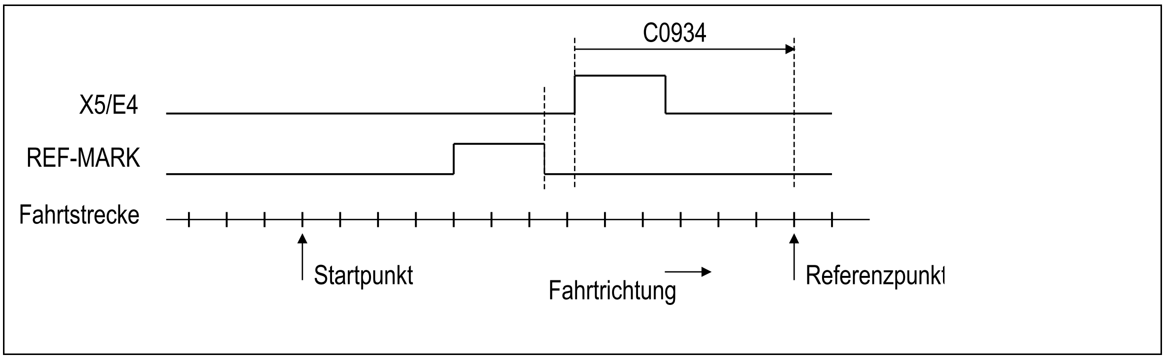


Fig. 3-217 Homing with touch probe: Move to the home position in CW rotation.

- Mode 7 (C0932 = 7):
  - Move to the home position in CCW rotation.
  - Enter negative homing offset C0934.

Homing with touch probe (TP)

The home position is at the next touch probe signal (terminal X5/E4) plus the home position offset.

- Mode 8 (C0932 = 8):
  - Move to the home position in CW rotation.
  - Enter positive homing offset C0934.
- Mode 9 (C0932 = 9):
  - Move to the home position in CCW rotation.
  - Enter negative homing offset C0934.

Direct homing

The home position is on the home position offset.

- Mode 20 (C0932 = 20):
  - The drive moves from the actual position (REF-ACTPOS) to the home position immediately after the activation (REFC-ON = HIGH).
  - The actual position (REFC-ACTPOS) can previously be loaded with the input value REFC-ACTPOS-IN.
  - The travel path and the direction of travel result from the actual position (REFC-ACTPOS) and the set home position offset (C0934).

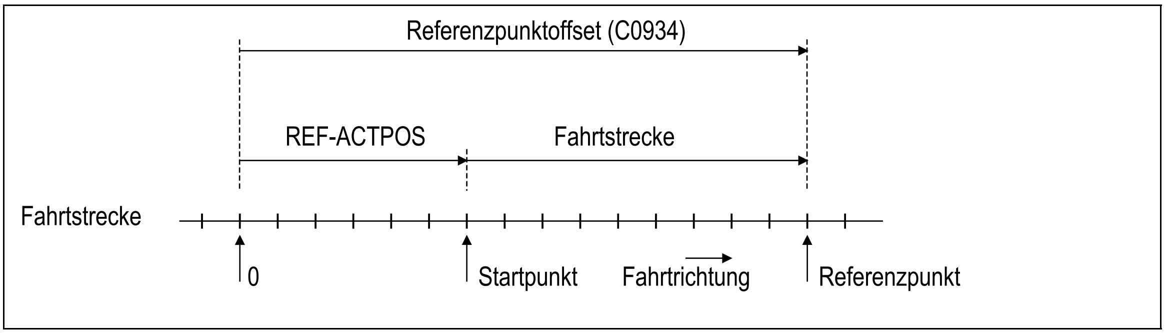


Fig. 3-218 Direct homing; move to the home position in CW rotation

- Mode 21 (C0932 = 21) as mode 20, but in addition:
  - The actual position (REFC-ACTPOS) is saved during mains disconnection and is loaded again at mains connection.

3.2.83.3 Control via input signals

- REFC-ON = LOW-HIGH edge starts homing
  - The input must remain on HIGH until the end of the homing mode. Homing is aborted when the input is set to LOW before reaching the home position.
- REFC-ON = LOW interrupts homing
  - The drive is decelerated to zero speed along the ramp set under C0936.
  - The inputs REFC-N-IN and REFC-PHI-IN are set for the outputs REFC-N-SET and REFC-PSET.
  - Has no effect if homing has already been completed (REFC-BUSY = LOW).
- REFC-POS-LOAD = LOW-HIGH edge
  - The profile generator accepts the phase applied at input REFC-ACTPOS-IN as starting value for the actual position REFC-ACTPOS.
  - The function is only effective if REFC-ON = LOW.
  - The function is only effective in modes 20 and 21.

3.2.83.4 Output of status signals

- REFC-BUSY = HIGH: the homing function is active.
  - The profile generator is connected to the outputs REFC-PSET and REFC-N-SET.
- REFC-BUSY = LOW: the homing function is not active or completed
  - The inputs REFC-PHI-IN and REFC-N-IN are set for the outputs REFC-PSET and REFC-N-SET.
- REFC-OK = HIGH: homing was completed successfully
  - Homing is completed if the setpoint of the profile generator has reached the home position.
- REFC-OK = LOW:
  - homing is currently executed or
  - the home position is no longer known, e.g. due to an interference or
  - homing was interrupted.

3.2.83.5 Speed/digital frequency input and output

The digital frequency/speed signal already contains phase and speed information.

3.2.83.6 Connection of the function block

- REFC-PSET supplies the phase setpoint belonging to REFC-N-SET (contouring error) for the phase controller in the MCTRL function block.
- REFC-DFOUT already includes the phase and speed information. Connect this signal to the signal CCTRL-IN.

3.2.84 Ramp function generator (RFG)

Purpose

The ramp function generator limits the rise of signals.

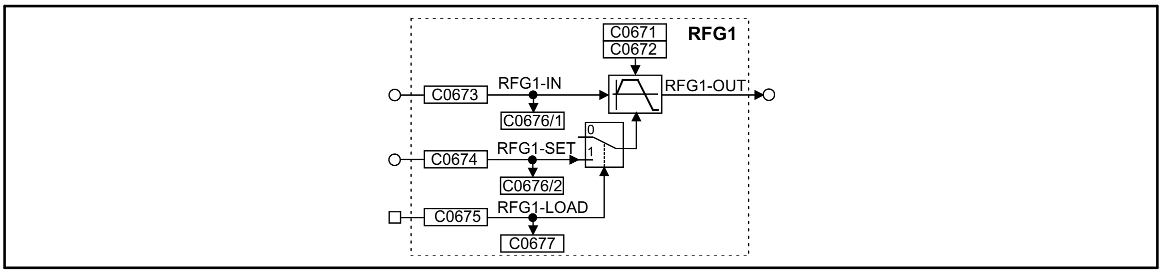


Fig. 3-219 Ramp function generator (RFG1)

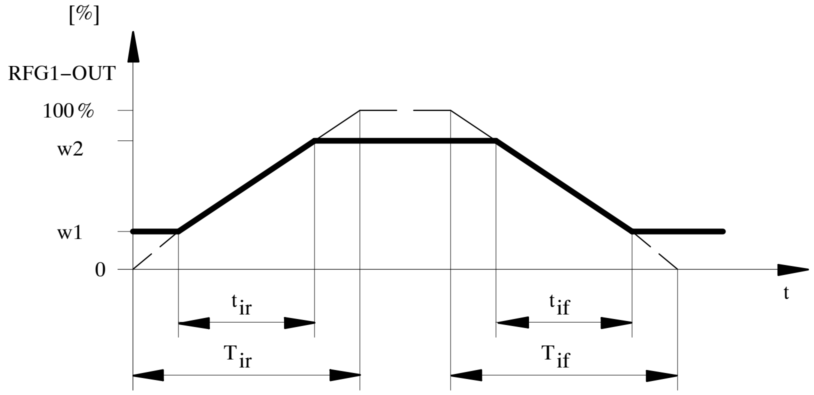
Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
RFG1-IN	a	C0676/1	dec [%]	C0673	1	1000	-
RFG1-SET	a	C0676/2	dec [%]	C0674	1	1000	-
RFG1-LOAD	d	C0677	-	C0675	2	1000	-
RFG1-OUT	a	-	-	-	-	-	-

Function

- Calculation and setting of the times T_{ir} and T_{if}
- Loading of the ramp function generator

3.2.84.1 Calculation and setting of the times T_{ir} and T_{if}

The acceleration time and deceleration time refer to a change of the output value from 0 to 100 %. The times T_{ir} and T_{if} to be set can be calculated as follows:



$$T_{ir} = t_{ir}\frac{100\%}{w2 - w1} \qquad T_{if} = t_{if}\frac{100\%}{w2 - w1}$$

Fig. 3-220 Acceleration and deceleration times of the ramp function generator

t_{ir} and t_{if} are the times desired for the change between w $_1$ and w_2.The values for T_{ir} and T_{if} can be set under C0671 and C0672.

3.2.84.2 Loading of the ramp function generator

The ramp function generator can be initialised with defined values via the inputs RFG1-SET and RFG1-LOAD.

- As long as the input RFG1-LOAD = HIGH, the input RFG1-SET is switched to the output.
- If the input RFG1-LOAD = LOW, the ramp function generator accelerates/decelerates from this value to its input value within the set T $_i$ times.

3.2.85 Ramp function generator for angle signals (RFGPH1)

Purpose

Path or time controlled (jump) application to change position/angle (e.g. offset) relative to the master drive.

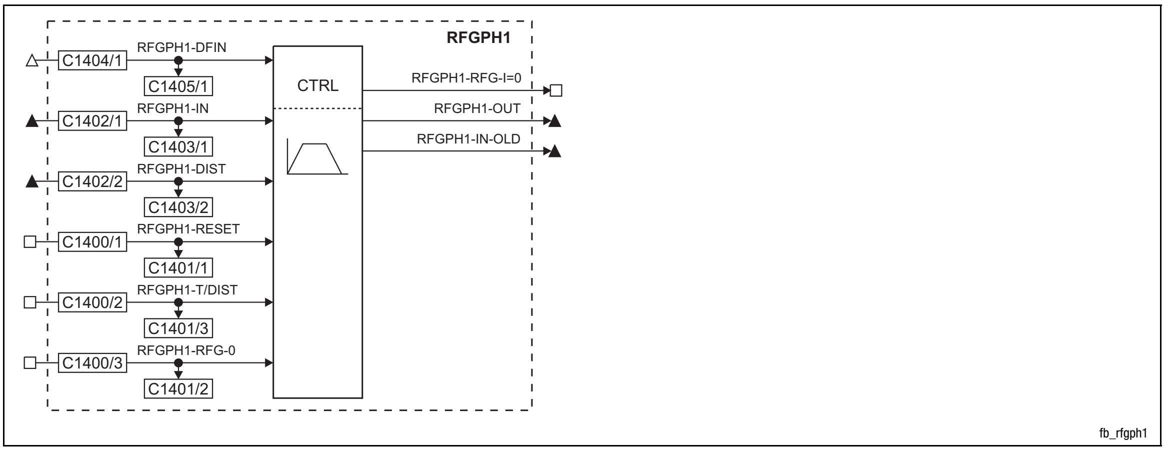


Fig. 3-221 Ramp function generator for phase signals (RFGPH1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
RFGPH1-RESET	d	1401/1	bin	1400/1	2	HIGH: Sets RFGPH1-OUT = 0 (jump) LOW : RFGPH1-OUT is set to the value at RFGPH1-IN according to the selected function Input has priority over RFGPH1-RFG-0
RFGPH1-RFG-0	d	1401/2	bin	1400/2	2	HIGH : proceeds according to the selected function RFGPH1-OUT = 0 LOW : RFGPH1-OUT is set to the value at RFGPH1-IN according to the selected function
RFGPH1-T/DIST	d	1401/3	bin	1400/3	2	Function changeover HIGH: Path based change LOW: Time-based change in path (position via defined speed)
RFGPH1-IN	ph	1403/1	dec [inc]	1402/1	3	Position setpoint (65536 inc. = 1 rev.)
RFGPH1-DIST	ph	1403/2	dec [inc]	1402/2	3	Path difference by which the phase is to be changed at the input RFGPH1-IN (65536 inc. = 1 rev.) • Condition for accepting the value at RFGPH1-DIST: – RFGPH1-OUT = 0 or – the value at the RFGPH1-IN input is changing.
RFGPH1-DFIN	phd	1405/1	dec [inc]	1404/1	4	Digital frequency input Please observe that the modes to be set for this input are selected under C1409 (see ”Phase/position to be changed through a defined path”)
RFGPH1-RFG-I=0	d		-	-	-	HIGH: RFGPH1-OUT = RFGPH1-IN
RFGPH1-OUT	ph		-	-	-	Output
RFGPH1-IN-OLD	ph		-	-	-	Display of the value (65536 inc. = 1 rev.) last-applied at the input RFGPH1-IN

Range of functions

- Change phase/position through a defined speed (chapter 3.2.85.1)
- Change phase/position through a defined path (chapter 3.2.85.2)
- Output of status signals (chapter 3.2.85.3)

Description of functions by means of an example

The function block ”ramp function generator for phase signals” serves to adjust the path compared to the master drive. Before, it must be defined if the drive is to take the desired position

- at a predefined speed (RFGPH1-T/DIST = LOW) or
- after a certain distance (RFGPH1-T/DIST = HIGH) depending on the master drive speed.

The drive is to be moved by 5 m units starting with the 0 position of the profile. It is enabled via the terminal X5/E1.

Note!

m-units (master units) are units which can be directly measured in the system at the object to be displaced. These can be mm, m, phases etc.. With regard to the motor, these actual values become slave units (s-units). The s-units are converted to encoder increments in the controller.

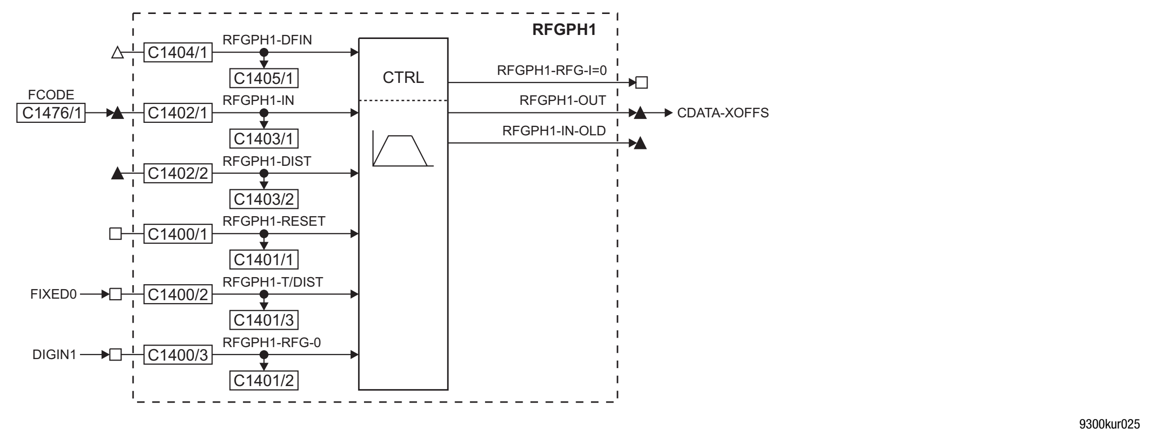


Fig. 3-222 Circuit proposal

The inputs not used do not need to be assigned.

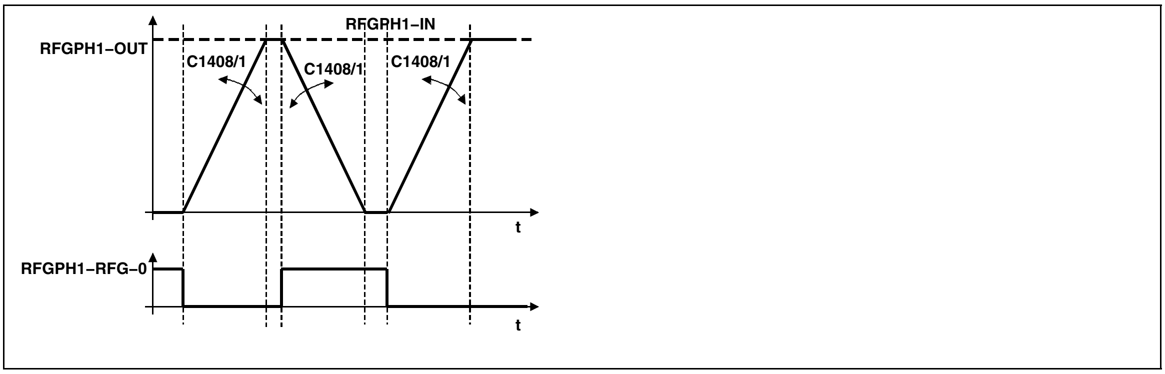
3.2.85.1 Change phase/position through a defined speed

Inputs for parameter setting:

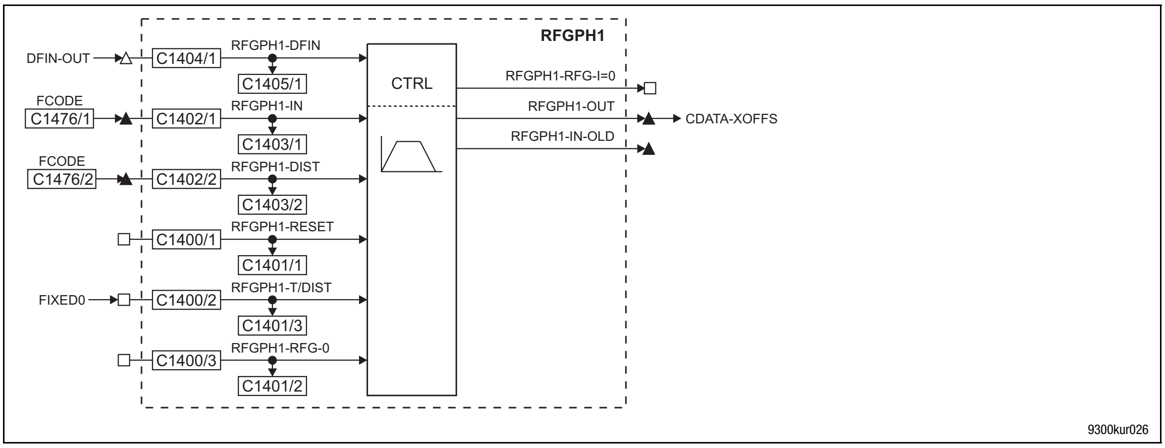
- FCODE C1476/1 = 5 m-units (position)
- C1408/1 = 200.0 rpm: the drive travels to the target position with a master value speed of 200 rpm.

Control:

- X5/E1 = HIGH: CDATA-XOFFS is traversed to 5 m-units at n = 200 rpm
- X5/E1 = LOW: CDATA-XOFFS is traversed to 0 m-units at n = 200 rpm
- The time required to reach the position results from the physical parameters selected.



3.2.85.2 Change phase/position through a defined path

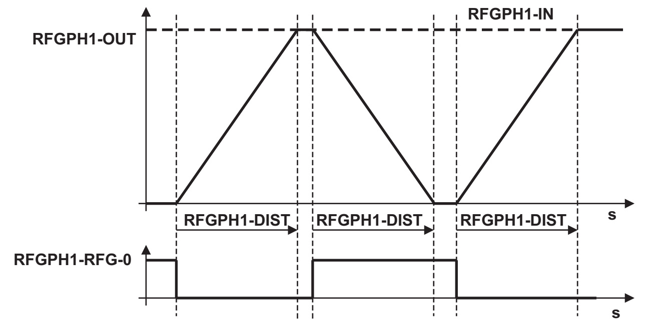


Wiring of the inputs:

- FCODE C1476/2 = 10 m-units (=RFGPH1-DIST)
- FCODE C1476/1 = 2.5 m-units (=RFGPH1-IN)
- Master value at RFGPH1-DFIN.

The following modes can be set with C1409 for this input:

C1409	Mode	Explanation
0	Absolute value generation (Default setting)	The output RFGPH1-OUT always reaches its end value (with negative and positive speeds).
1	Forward/backward movement	The output RFGPH1-OUT with positive values (speeds) at input RFGPH1-DFIN reaches its final value (value at the input RFGPH1-IN). The output RFGPH1-OUT runs with negative values (speed) at input RFGPH1-DFIN to the value which was pending at the RFGPH1-IN before. This is indicated at the output RFGPH1-IN-OLD. The gradient of the function is determined by the inputs IN/DIST.
2	Forward/backward movement with end value	This mode is similar to C1409=1, the only difference, however, is that if the output RFGPH1-OUT has reached the value at input RFGPH1-IN, the output keeps this value (even if a negative value occurs at RFGPH1-DFIN). Only if a new value is applied to the RFGPH1-IN input or if RFGPH1-RFG-0 = 1, the output may change again.

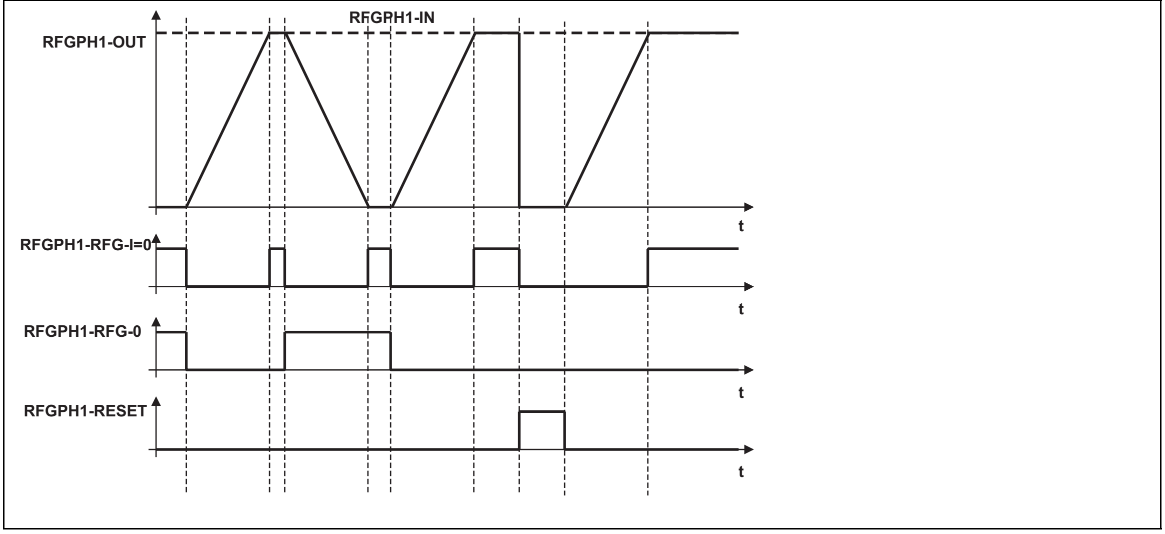


Note!

- Values at RFGPH1-IN are only permitted to change if RFGPH1-OUT = 0 or if the RFGPH1-OUT output is still approaching its final value at RFGPH1-IN.
- While the output signal at RFGPH1-OUT is approaching its final value, the sign of the setpoint at RFGPH1-IN must not be reversed.
- The drive to be adjusted must catch up a distance of 2.5 m-units set in RFGPH1-IN while the master drive covers a distance of 10 m-units. Its speed is determined by the speed of the master drive (RFGPH1-DFIN) and the path difference (RFGPH1-DIST).
- When the master value has covered the distance (RFGPH1-DIST), then RFGPH1-OUT = RFGPH1-IN. Hence, the process of position change is completed. Master drive and electronic cam run in synchronism again.

3.2.85.3 Status signals

RFGPH1-RFG-I=0 = HIGH indicates that the output RFGPH1-OUT has reached the end value selected (the output is not adjusted any more).



3.2.86 Ramp function generator for angle signals (RFGPH2 and RFGPH3)

Purpose

Easy positioning via linear profile generator

Note!

With RFGPH2 and RFGPH3 ”easy” positionings can be performed. Compared to the 9300 servo position controller, the following restrictions apply:

- No programmable positioning
- No positioning with velocity changeover
- No touch probe position

RFGPH2

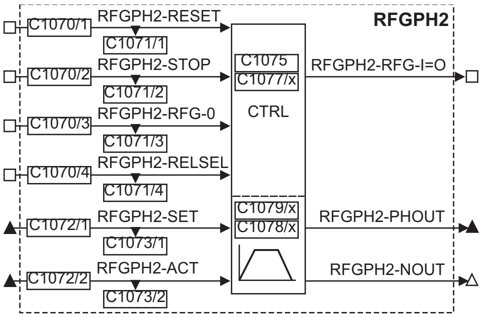


Fig. 3-223 Ramp function generator for angle signals (RFGPH2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
RFGPH2-RESET	d	1071/1	bin	1400/1	2	HIGH: Sets RFGPH2-OUT = 0 (jump) LOW: RFGPH2-PHOUT is set according to the input values RFGPH2-SET and RFGPH2-ACT The input has priority over all other inputs
RFGPH2-STOP	d	1071/2	bin	1070/2	2	HIGH: Output RFGPH2-NOUT is decelerated to 0 rpm along the ramp C1079/1, output RFGPH2-PHOUT remains the same. LOW: RFGPH2-PHOUT is set according to the input values RFGPH2-SET and RFGPH2-ACT. The input has priority over RFGPH2-RFG-0
RFGPH2-RFG-0	d	1071/3	bin	1070/3	2	HIGH: Traverses according to the ramp selected for RFGPH2-ACT = 0 LOW: RFGPH2-OUT is set according to the input values RFGPH2-SET and RFGPH2-ACT.
RFGPH2-REL-SEL	d	1071/4	bin	1070/4	2	HIGH: Relative positioning LOW: Absolute positioning
RFGPH2-SET	ph	1073/1	dec [inc]	1072/1	3	Position setpoint (65536 inc. = 1 rev.)
RFGPH2-ACT	ph	1073/2	dec [inc]	1072/2	3	Position setpoint (65536 inc = 1 rev.)
RFGPH2-RFG-I=0	d		-	-	-	HIGH: RFGPH2-SET = RFGPH2-ACT
RFGPH2-PHOUT	ph		-	-	-	Output (65536 inc = 1 rev.)
RFGPH2-NOUT	phd		-	-	-	Output RFGPH2-PHOUT as speed

RFGPH3

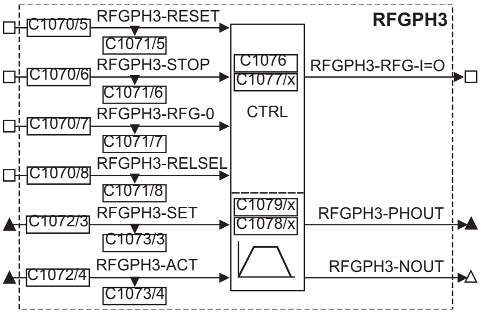


Fig. 3-224 Ramp function generator for angle signals (RFGPH3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
RFGPH3-RESET	d	1071/5	bin	1400/4	2	HIGH: Sets RFGPH3-OUT = 0 (jump) LOW: RFGPH3-PHOUT is set according to the input values RFGPH3-SET and RFGPH3-ACT The input has priority over all other inputs.
RFGPH3-STOP	d	1071/6	bin	1070/5	2	HIGH: Output RFGPH3-NOUT is decelerated to 0 rpm along the ramp C1079/1, output RFGPH3-PHOUT remains the same. LOW: RFGPH3-PHOUT is set according to the input values RFGPH3-SET and RFGPH3-ACT. The input has priority over RFGPH3-RFG-0
RFGPH3-RFG-0	d	1071/7	bin	1070/6	2	HIGH: Traverses according to the ramp selected for RFGPH3-ACT = 0 LOW: RFGPH3-OUT is set according to the input values RFGPH3-SET and RFGPH3-ACT.
RFGPH3-REL-SEL	d	1071/8	bin	1070/8	2	HIGH: Relative positioning LOW: Absolute positioning
RFGPH3-SET	ph	1073/3	dec [inc]	1072/3	3	Position setpoint (65536 inc. = 1 rev.)
RFGPH3-ACT	ph	1073/4	dec [inc]	1072/4	3	Position setpoint (65536 inc = 1 rev.)
RFGPH3-RFG-I=0	d		-	-	-	HIGH: RFGPH3-SET = RFGPH3-ACT
RFGPH3-PHOUT	ph		-	-	-	Output (65536 inc = 1 rev.)
RFGPH3-NOUT	phd		-	-	-	Output RFGPH3-PHOUT as speed

Table of attributes

Code	Index dec	Index hex	DS	DA	DT	Format	DL	LCM-R/W	Condition
C1075	23500	5BCCh	E	1	FIX32	VD	4	Ra/Wa	
C1076	23499	5BCBh	E	1	FIX32	VD	4	Ra/Wa	
C1077	23498	5BCAh	A	2	U32	VH	4	Ra/Wa	
C1078	23497	5BC9h	A	4	FIX32	VD	4	Ra/Wa	
C1079	23496	5BC8h	A	6	FIX32	VD	4	Ra/Wa	

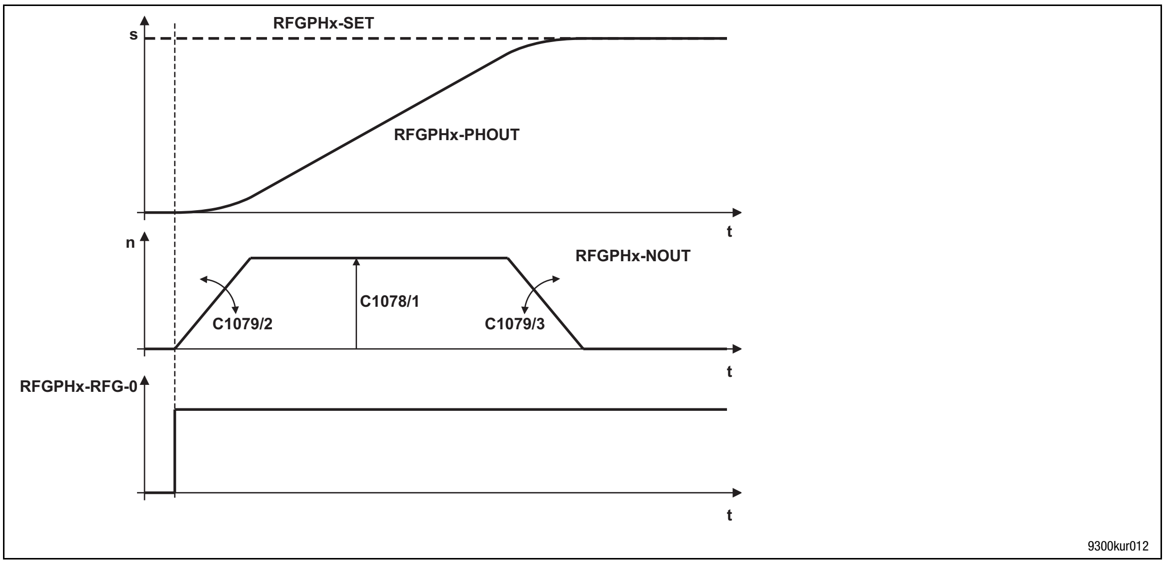
Range of functions

- Positioning of the X axis by means of X offset
- Positioning of the Y axis by means of Y offset
- Set the drive back to the profile position after MANUAL JOG (mode).
- Ensure save drive position
- Output of status signals

3.2.86.1 Description of functions by means of an example

Defining an offset for the Y axis

The following travel profile is to be implemented with RFGPH2:



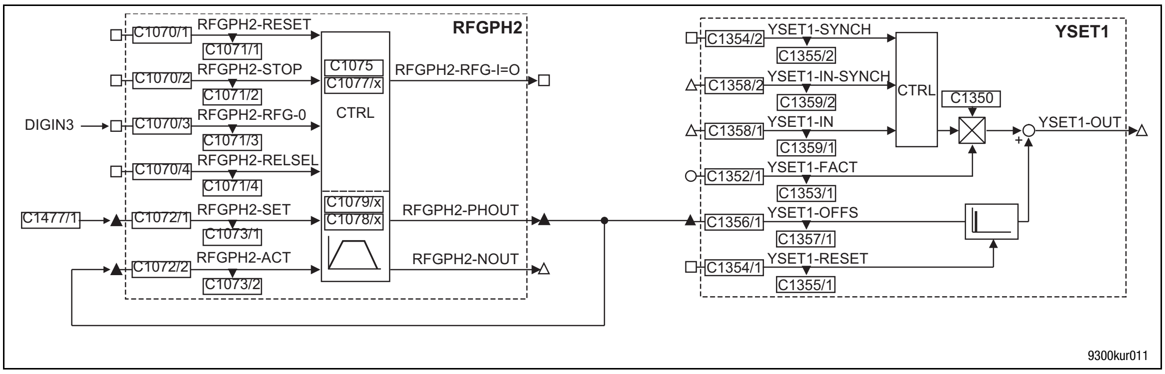


Fig. 3-225 Circuit proposal

Control:

Here, the set position is defined via the code C1477/1. The actual position is directly taken from the output RFGPH2-PHOUT. The digital input DIGIN3 serves to switch between the setpoint position = 0 (the setpoint position is internally set to 0) and the setpoint position defined via the input RFGPH2-SET.

The following parameter setting is required:

- Acceleration time: C1079/2
- Deceleration time: C1079/3
- Speed: C1078/1

The inputs not used do not have to be assigned.

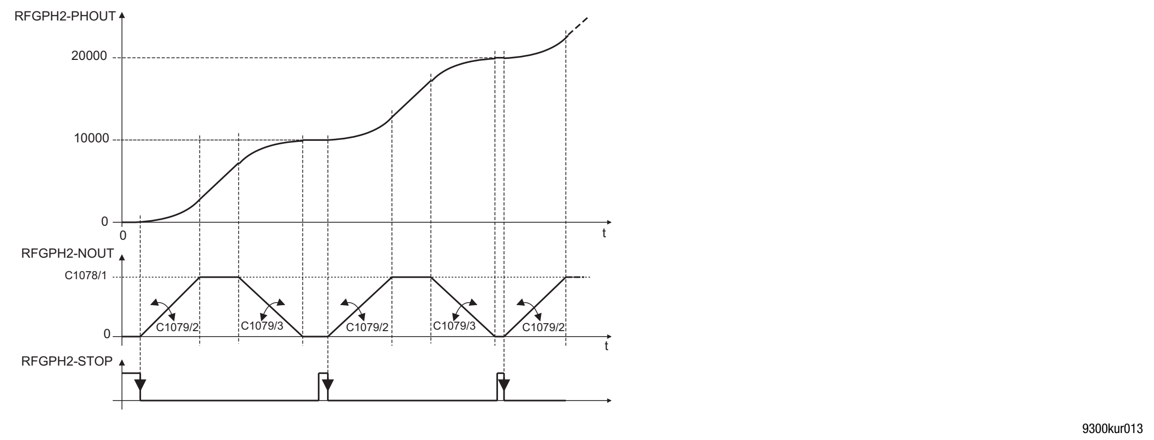
How to stop the positioning

The input RFGPH2-STOP serves to interrupt the positioning process. RFGPH2-STOP = HIGH serves to decelerate the speed at output RFGPH2-NOUT along the ramp C1079/1 and for RFGPH3-NOUT via C1079/4 until zero speed (standstill) is reached.

End switch off

The function blocks provide two modes. They are set via C1075 for RFGPH2 and C1076 for RFGPH3.

- Without limit stop
  - – In this operating mode the outputs always follow the setpoint at RFGPHx-SET.
- With limit stop
  - – In this operating mode the outputs follow the setpoint at RRFGPHx-SET **for one positioning**. If the setpoint position at RFGPH2-SET is changed, the outputs only follow the setpoint if a HIGH-LOW edge has occurred at the input RFGPH2-STOP. This edge is the start signal for the next positioning.



Relative positioning

In order to implement a relative positioning, the input RFGPHx-REL-SEL must be set to HIGH. This serves to process the value at RFGPH2-SET as “feed”.

This means, the profile generator continues running by the position value applied at RFGPH2-PHIN.

Condition: Mode “with limit stop” must be selected!

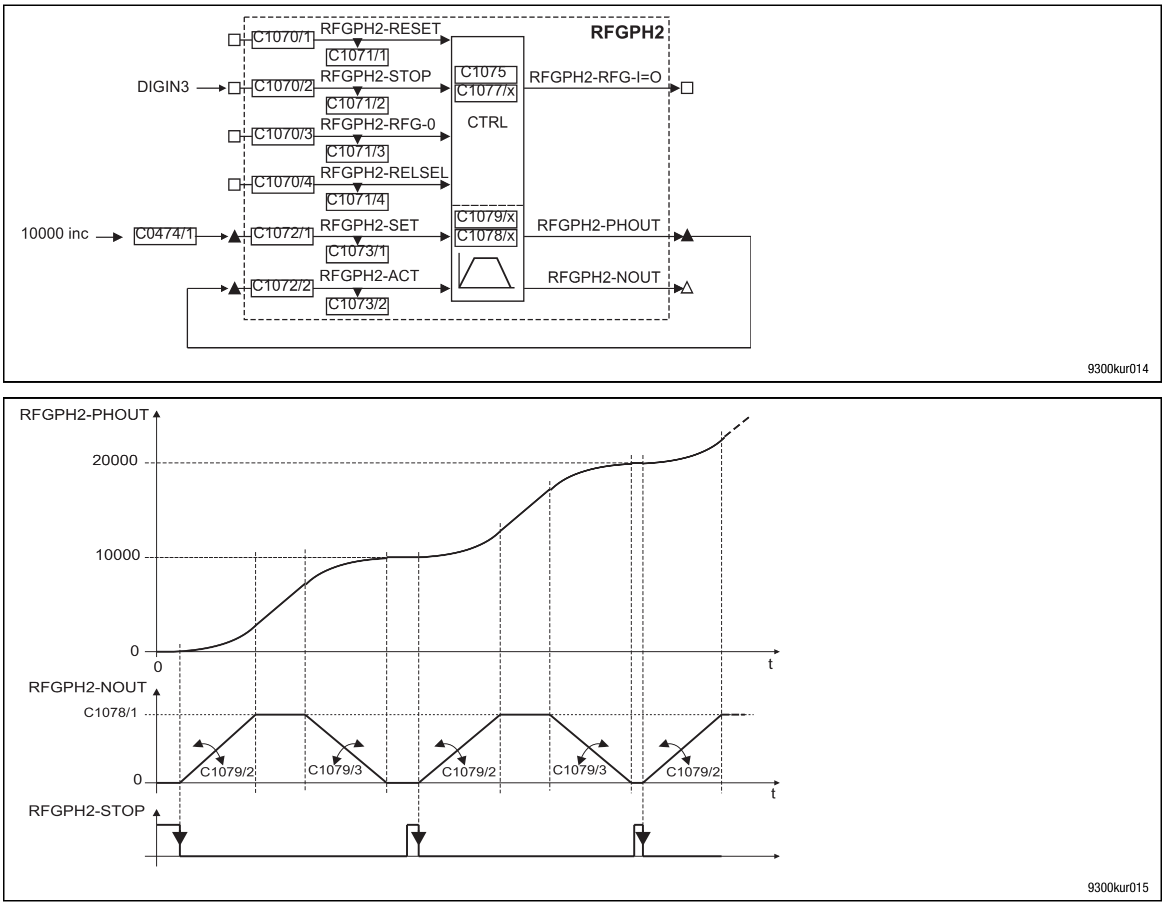


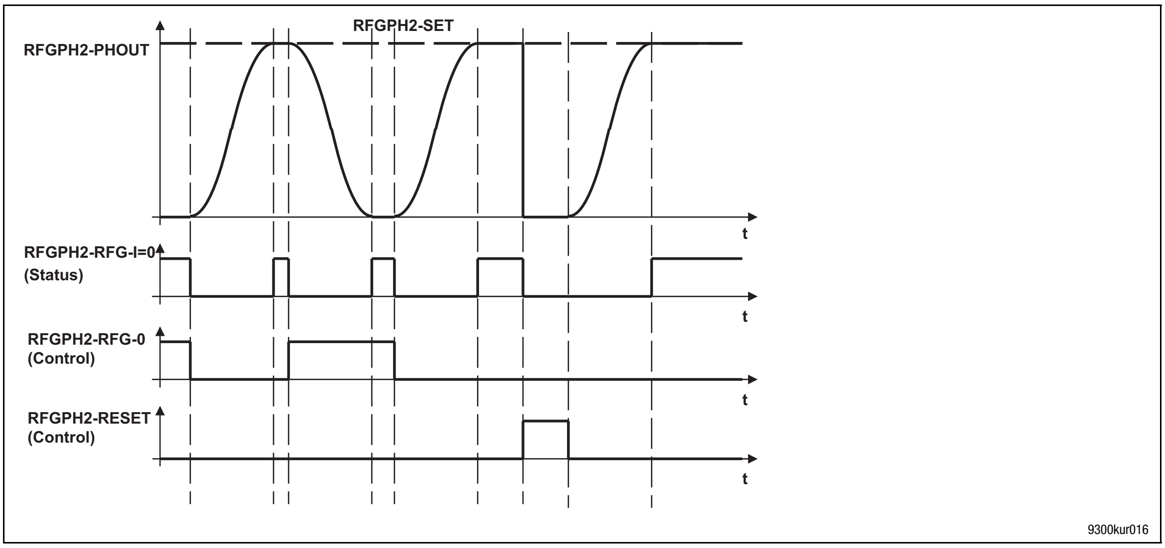
Fig. 3-226 Circuit proposal

Relative positioning

- With RFGPH2-STOP = HIGH the positioning process is only interrupted. With RFGPH2-STOP = LOW the residual path is travelled.
- The position value refers to the last start point if
  – the position value at input RFGPH2-SET changes during the positioning process or
  – the input RFGPH2-STOP changes from LOW → HIGH.
- The positioning process is completed when the target position has been reached. The level at output RFGPH2-RFG-I=0 is HIGH.

Status signals

RFGPH2-RFG-I=0 = HIGH indicates that the output RFGPH2-OUT has reached the final value selected (the output is not adjusted any more).



RESET mode

Use C1074/1 (RFGPH2) and C1074/2 (RFGPH3) to set the status for the output RFGPHx-PHOUT after a RESET command (RFGPHx-RESET = HIGH):

C1074/x	RFGPHx-POUT
0	0
1	ACT
2	SET

3.2.87 Sample and hold function (S&H)

Purpose

The FB can save analog signals. The saved value is also available after mains switching.

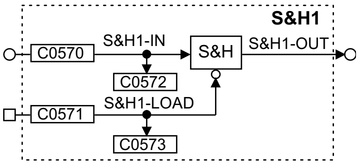


Fig. 3-227 Sample and hold function (S&H1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
S&H1-IN	a	C0572	dec [%]	C0570	1	1000	
S&H1-LOAD	d	C0573	bin	C0571	2	1000	LOW = save
S&H1-OUT	a	-	-	-	-	-	

Function

- With S&H1-LOAD = HIGH the signal at the input S&H1-IN is switched to the output S&H1-OUT.
- With S&H1-LOAD = LOW the output S&H1-OUT is disconnected from the input S&H1-IN and outputs the value which was last valid.

Saving in the case of mains disconnection:

- Keep S&H1-LOAD at LOW level when disconnecting the supply voltage (mains, DC bus or terminal 59).
- Keep S&H1-LOAD at LOW level when connecting the supply voltage (mains, DC bus or terminal 59).

3.2.88 Angle value selection (SELPH)

Two FBs (SELPH1, SELPH2) are available.

Purpose

Select one angle value from nine angle values and switch it to the output.

SELPH1

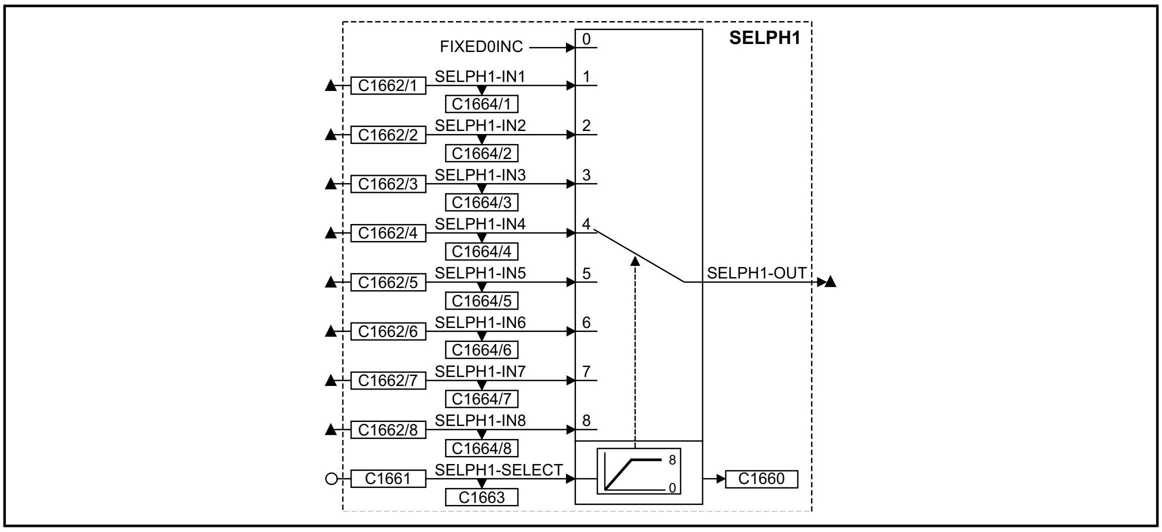


Fig. 3-228 Function block SELPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SELPH1-SELECT	a	C1663	dec	C1661	1	-
SELPH1-IN1	ph	C1664/1	dec [inc]	C1662/1	3	-
SELPH1-IN2	ph	C1664/2	dec [inc]	C1662/2	3	-
SELPH1-IN3	ph	C1664/3	dec [inc]	C1662/3	3	-
SELPH1-IN4	ph	C1664/4	dec [inc]	C1662/4	3	-
SELPH1-IN5	ph	C1664/5	dec [inc]	C1662/5	3	-
SELPH1-IN6	ph	C1664/6	dec [inc]	C1662/6	3	-
SELPH1-IN7	ph	C1664/7	dec [inc]	C1662/7	3	-
SELPH1-IN8	ph	C1664/8	dec [inc]	C1662/8	3	-
SELPH1-OUT	ph	-	-	-	-	-
-	-	C1660	dec	-	-	Displays the current selection

SELPH2

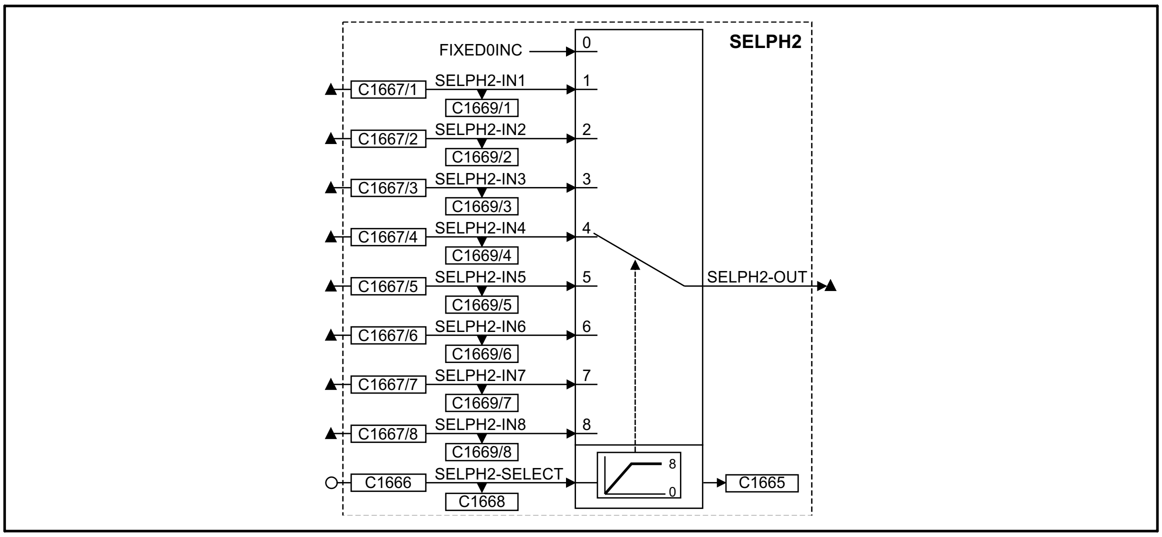


Fig. 3-229 Function block SELPH2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SELPH2-SELECT	a	C1668	dec	C1666	1	-
SELPH2-IN1	ph	C1669/1	dec [inc]	C1667/1	3	-
SELPH2-IN2	ph	C1669/2	dec [inc]	C1667/2	3	-
SELPH2-IN3	ph	C1669/3	dec [inc]	C1667/3	3	-
SELPH2-IN4	ph	C1669/4	dec [inc]	C1667/4	3	-
SELPH2-IN5	ph	C1669/5	dec [inc]	C1667/5	3	-
SELPH2-IN6	ph	C1669/6	dec [inc]	C1667/6	3	-
SELPH2-IN7	ph	C1669/7	dec [inc]	C1667/7	3	-
SELPH2-IN8	ph	C1669/8	dec [inc]	C1667/8	3	-
SELPH2-OUT	ph	-	-	-	-	-
-	-	C1665	dec	-	-	Displays the current selection

Function

- An analog signal at SELPHx-SELECT directly selects an input and switches it to SELPHx-OUT.
  - If SELPHx-SELECT = 0, SELPHx-OUT switches to FIXED 0 INC.
  - If SELPHx-SELECT < 0, SELPHx-OUT switches to FIXED 0 INC.
  - If SELPHx-SELECT > 8, SELPHx-OUT switches to SELPHx-IN8.

Tip!

You can select an input via a digital signal by connecting the FB CONVDAx upstream of SELPHx-SELECT.

3.2.89 Position switch points (SPC)

Two function blocks (SPC1, SPC2) are available.

Purpose

Switches an output signal if the drive is within a defined position range (implementation of a cam group, control of injection nozzles).

SPC1

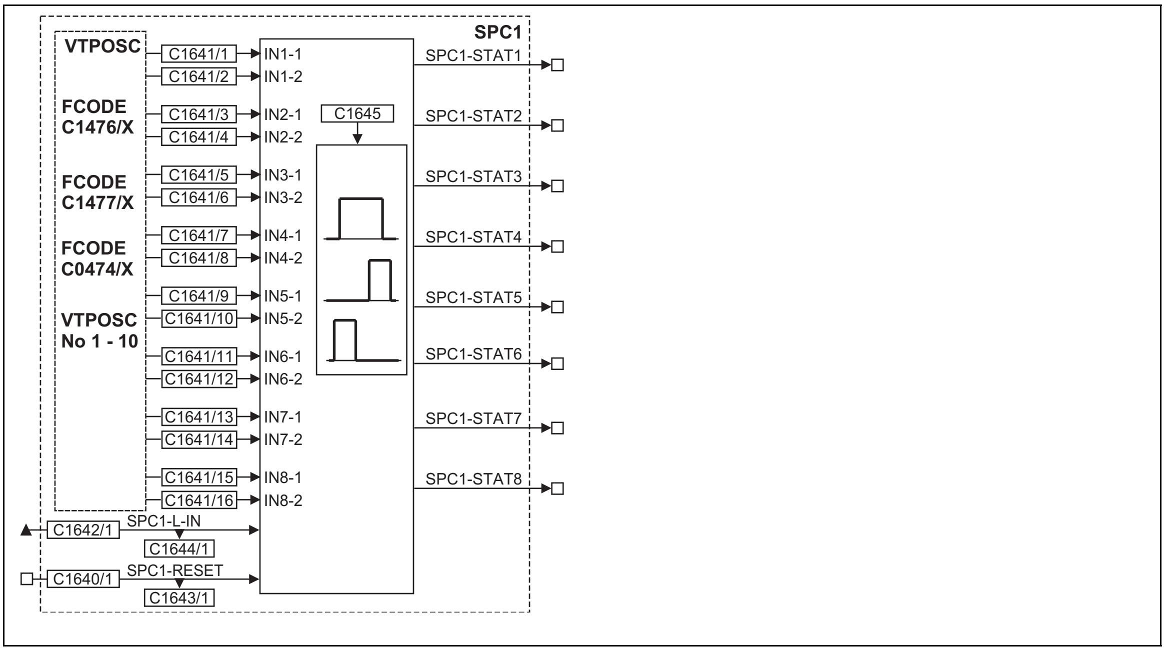


Fig. 3-230 Function block SPC1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SPC1-L-IN	ph	C1644/1	dec [inc]	C1642/ 1	3	65536 inc = 1 revolution
SPC1-RESET	d	C1643/1	bin	C1640/ 1	2	-
SPC1-STAT1	d	-	-	-	-	-
SPC1-STAT2	d	-	-	-	-	-
SPC1-STAT3	d	-	-	-	-	-
SPC1-STAT4	d	-	-	-	-	-
SPC1-STAT5	d	-	-	-	-	-
SPC1-STAT6	d	-	-	-	-	-
SPC1-STAT7	d	-	-	-	-	-
SPC1-STAT8	d	-	-	-	-	-

SPC2

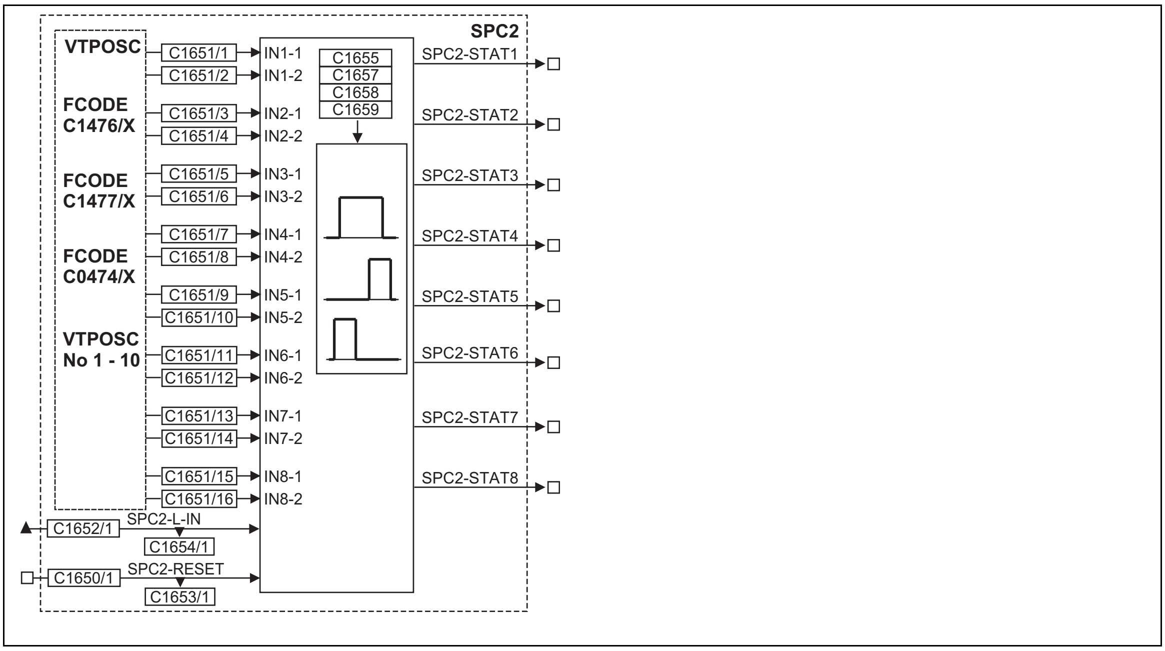


Fig. 3-231 Function block SPC2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SPC2-L-IN	ph	C1654/1	dec [inc]	C1652/1	3	65536 inc = 1 revolution
SPC2-RESET	d	C1653/1	bin	C1650/1	2	-
SPC2-STAT1	d	-	-	-	-	-
SPC2-STAT2	d	-	-	-	-	-
SPC2-STAT3	d	-	-	-	-	-
SPC2-STAT4	d	-	-	-	-	-
SPC2-STAT5	d	-	-	-	-	-
SPC2-STAT6	d	-	-	-	-	-
SPC2-STAT7	d	-	-	-	-	-
SPC2-STAT8	d	-	-	-	-	-

Function

- Switching points (start/end, centre/range)
- Switching hysteresis
- Switching dead time
- Switch filter time constant

3.2.89.1 Switching points

- Switching points can be set in two ways:
  - – Mode 1: Start and end position
  - – Mode 2: Centre with switching range
- The switching points are selected by means of the variable table VTPOSC.
  - – Direct input of switch-on and switch-off positions, centre and switching range in VTPOSC.
- If the value at SPCx-L-IN is within the range of the switching points sets, SPCx-STATx = HIGH

Assignment of switch-on and switch-off positions for SPC1 (see Fig. 3-230):

Code	Subcode	Switching point	Output FB
C1641	1	IN1-1	SPC1-STAT1
	2	IN1-2	
...	...	...	...
C1641	15	IN8-1	SPC1-STAT8
	16	IN8-2	

Assignment of switch-on and switch-off positions for SPC2 (see Fig. 3-231):

Code	Subcode	Switching point	Output FB
C1651	1	IN1-1	SPC2-STAT1
	2	IN1-2	
...	...	...	...
C1651	15	IN8-1	SPC2-STAT8
	16	IN8-2	

Mode 1: Start and end position

C1645 = Set 0 (SPC1)

C1655 = Set 0 (SPC2)

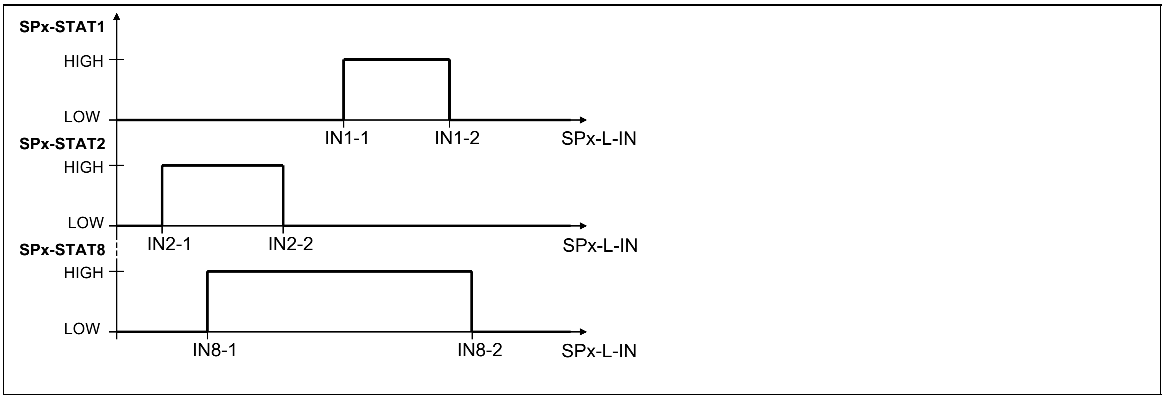


Fig. 3-232 Switch-on and switch-off positions for SPCx-STAT1, SPCx-STAT2 and SPCx-STAT8

Switch-on and switch-off positions depend on the travel direction:

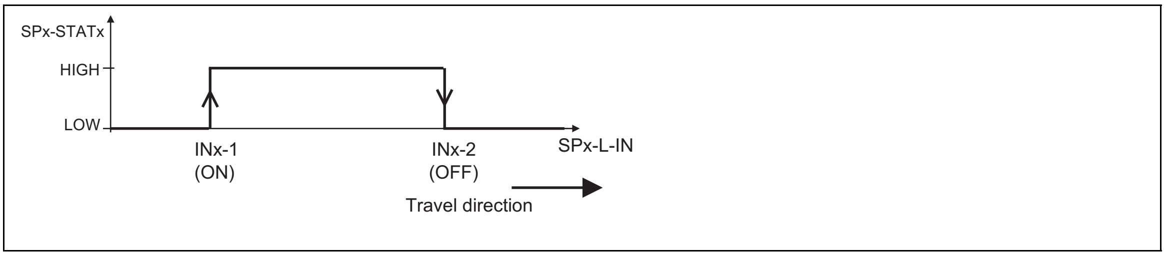


Fig. 3-233 Definition of a switch-on and switch-off position according to the travel direction

Mode 2: Centre with switching range

C1645 = Set 1 (SPC1)

C1655 = Set 1 (SPC2)

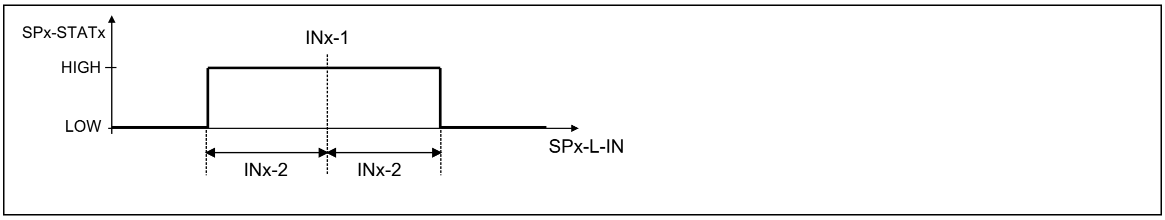


Fig. 3-234 Centre with switching range

- INx-1 determines the centre
- INx-2 determines the switching range with centre

3.2.89.2 Hysteresis

This function is only available for FB SPC2.

Purpose

Avoids undefined switching of the output signals (in standstill the drive is exactly on a switching point).

Function

- The hysteresis is selected under C1658.
  - – The setting is valid for SPC2-STAT1 ... SPC2-STAT8.

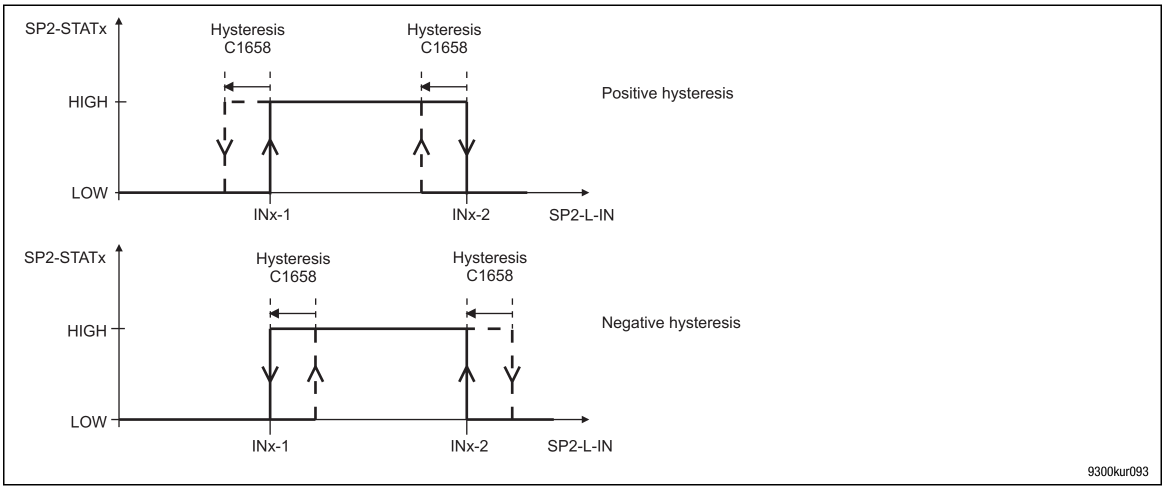


Fig. 3-235 Hysteresis for positive and negative values

3.2.89.3 Dead time

This function is only available for FB SPC2.

Purpose

Delayed activation of downstream components (e.g. injection nozzles).

Function

- The dead time is selected under C1657.
  - This setting is only possible for SPC2-STAT1 ... SPC2-STAT4.

Assignment of codes and outputs:

Code	Subcode	Output FB SPC2
C1657	1	SPC2-STAT1
	2	SPC2-stat2
	3	SPC2-stat3
	4	SPC2-stat4

- The dead time has an effect on the switching points and the hysteresis.

Positive dead time

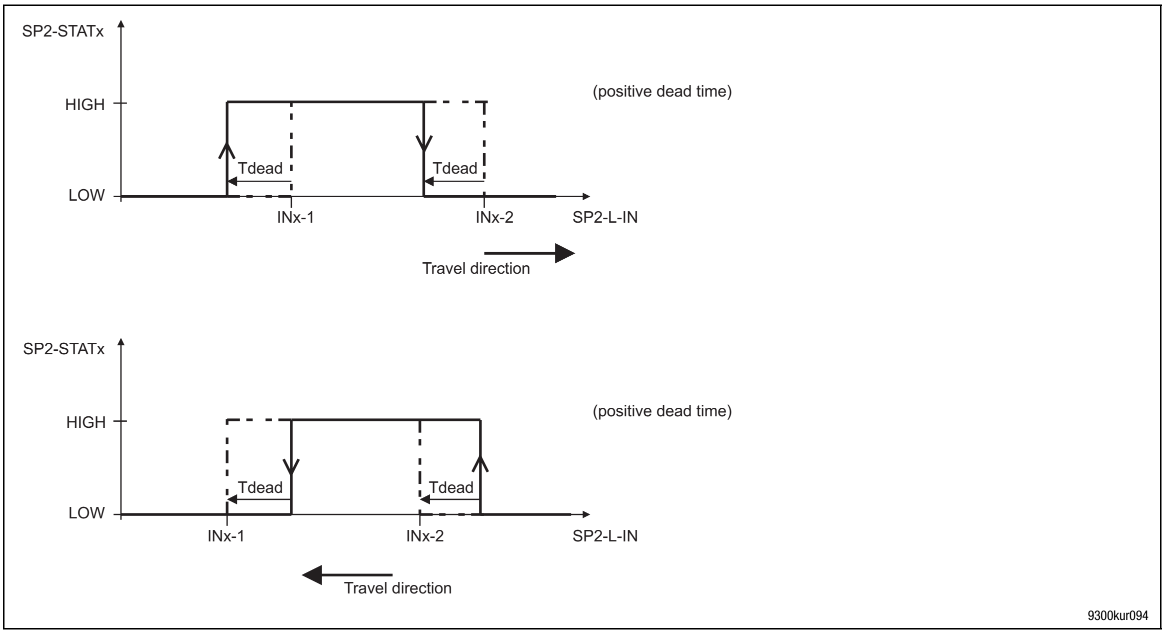


Fig. 3-236 Function of the positive dead time for different travel directions

- With a positive dead time, the switching of the output is advanced by the time set.

Negative dead time

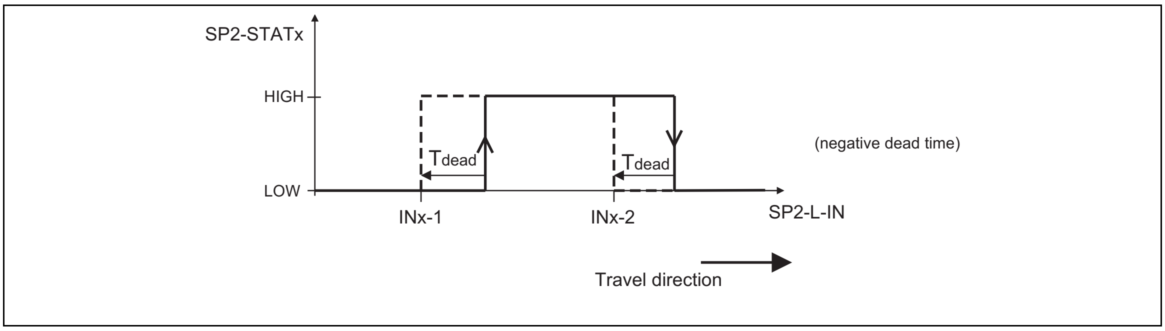


Fig. 3-237 Function of the negative dead time

- With a negative dead time, the switching of the output is delayed by the time set.

3.2.89.4 Filter time constant

This function is only available for FB SPC2.

Purpose

Avoids undefined switching of the output signals at SPC2-STAT1 ... SPC2-STAT4 when the motor is running at low speed.

Function

- The filter time constant is selected under C1659.
  - This setting is valid for SPC2-STAT1 ... SPC2-STAT4.

Assignment of code and filter time constants:

Code	Value	Filter time constant
C1659	0	Off
	1	1 ms
	2	2 ms
	4	4 ms
	8	8 ms
	16	16 ms

Note!

The correct setting can only be determined by testing. Basically, however, the following applies:

The lower the resolution of the actual position encoder and the lower the travel speed, the higher the filter time constant.

3.2.90 S-shaped ramp function generator (SRFG)

Purpose

The function block serves to direct the input signal via a jerk-limited ramp generator (S shape) in order to avoid setpoint step-changes.

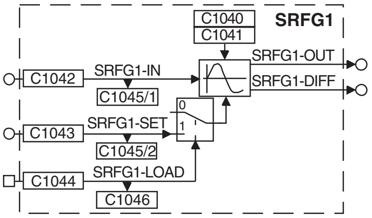


Fig. 3-238 S-shaped ramp function generator (SRFG1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SRFG1-IN	a	C1045/1	dec [%]	C1042	1	input
SRFG1-SET	a	C1045/2	dec [%]	C1043	1	Starting value for the ramp function generator, will be accepted if SRFG1-LOAD = High
SRFG1-LOAD	d	C1046	bin	C0144	2	HIGH = accepts the value at SRFG1-SET and provides it at SRFG1-OUT; SRFG1-DIFF always remains at 0 %
SRFG1-OUT	a	-	-	-	-	Output limited to ±100 %
SRFG1-DIFF	a	-	-	-	-	Output limited to ±100 %, provides the acceleration of the ramp function generator

SRFG1-LOAD

- Via digital input SRFG1-LOAD, the ramp function generator is loaded (set) with the signal from SRFG1-SET.
- This value is immediately accepted, i.e. there is no acceleration/deceleration via S shape (the output skips to this value).
- As long as SRFG-LOAD = HIGH, the ramp function generator remains inhibited.

Function

The maximum acceleration and the jerk can be set separately.

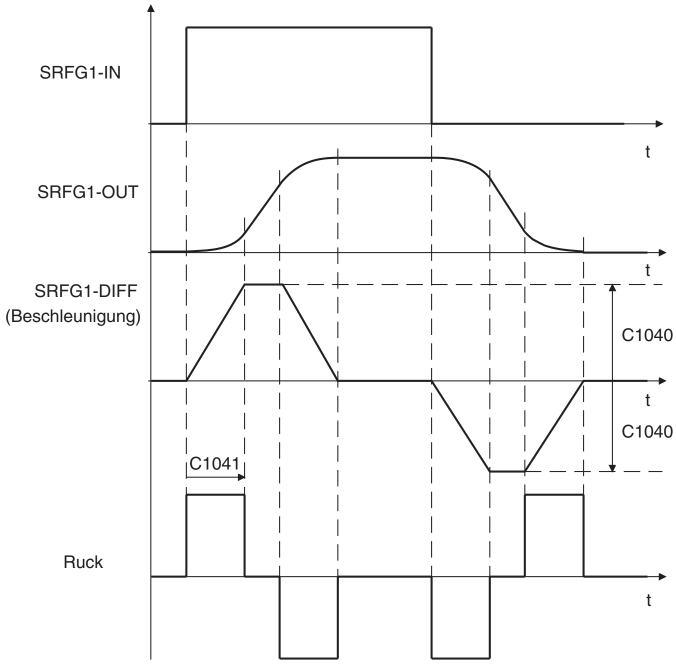
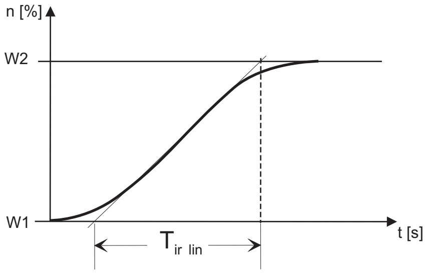


Fig. 3-239 Line diagram

- Max. acceleration:
  - C1040 applies to both the positive and the negative acceleration.
  - Setting according to formula:

$$T_{\text{ir lin}} = 1\text{s} \cdot \frac{W_2\,[\%] - W_1\,[\%]}{\text{C1040}\,[\%]}$$



K35.0272

- Jerk (C1041):
  - The jerk is selected in [s] until the ramp function generator operates at max. acceleration (see Fig. 3-239).

3.2.91 Output of digital status signals (STAT)

Purpose

The FB evaluates digital signals of function blocks and the status of the controller and passes them on to C0150 and FB AIF-OUT and CAN-OUT1.

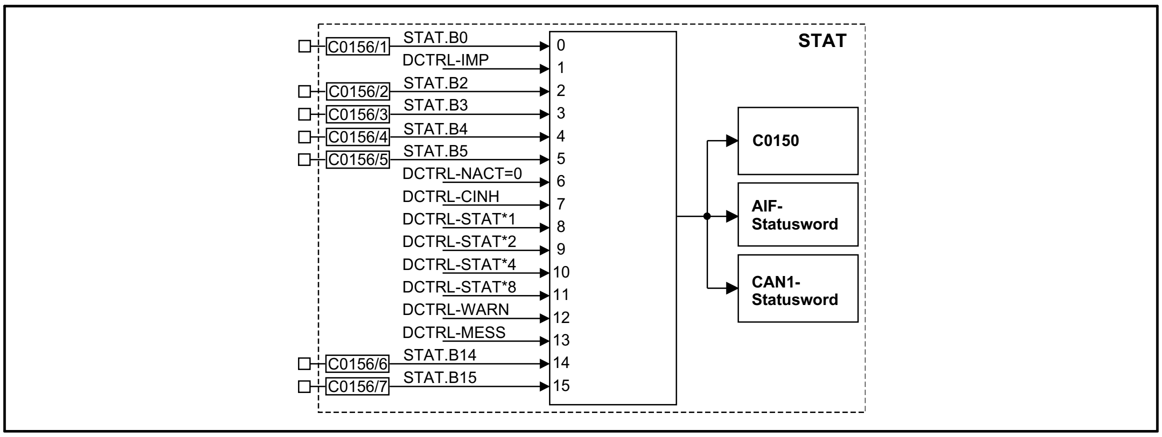


Fig. 3-240 Output of digital status signals (STAT)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STAT.B0	d	-	bin	C0156/1	2	2000	
STAT.B2	d	-	bin	C0156/2	2	5002	
STAT.B3	d	-	bin	C0156/3	2	5003	
STAT.B4	d	-	bin	C0156/4	2	5050	
STAT.B5	d	-	bin	C0156/5	2	10650	
STAT.B14	d	-	bin	C0156/6	2	505	
STAT.B15	d	-	bin	C0156/7	2	500	

Function

The status word consists of some fixedly linked (DCTRL-xxxx-) and some freely linkable signal inputs (STAT.Bx).

- Digital signal sources can be freely assigned to the inputs STAT.Bx.
- The corresponding bit in the data word is marked with STAT.Bx (e.g. STAT.B0 for the LSB)
- The status word is transferred to code C0150 and to the function blocks AIF-OUT and CAN-OUT1.
- The inputs with the name DCTRL-xxxx are directly accepted from the function block DCTRL. (🕮 3-137)

3.2.92 Control of a drive network (STATE-BUS)

Purpose

The FB controls the drive network to specified states (e.g. trip, quick stop or controller inhibit).

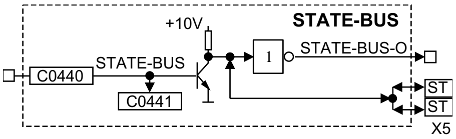


Fig. 3-241 Control of a function block STATE-BUS

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STATE-BUS	d	C0441	bin	C0440	2	1000	
STATE-BUS-O	d	-	-	-	-	-	
TERMINAL X5/ST	d	-	-	-	-	-	

Function

The STATE-BUS is a device-specific bus system which is designed for Lenze controllers only. The function block STATE-BUS acts on the terminals X5/ST or reacts on a LOW signal at these terminals (multi-master capable).

- Every connected controller can set these terminals to LOW.
- All connected controllers evaluate the signal level at these terminals and control the internally configured function blocks.
- Up to 20 controllers can be connected.

Stop!

Do not apply an external voltage at terminals X5/ST.

3.2.93 Storage block (STORE1)

Purpose

Stores a setpoint angle signal which is generated from a speed signal. The storage process is activated via the TP input X5/E5.

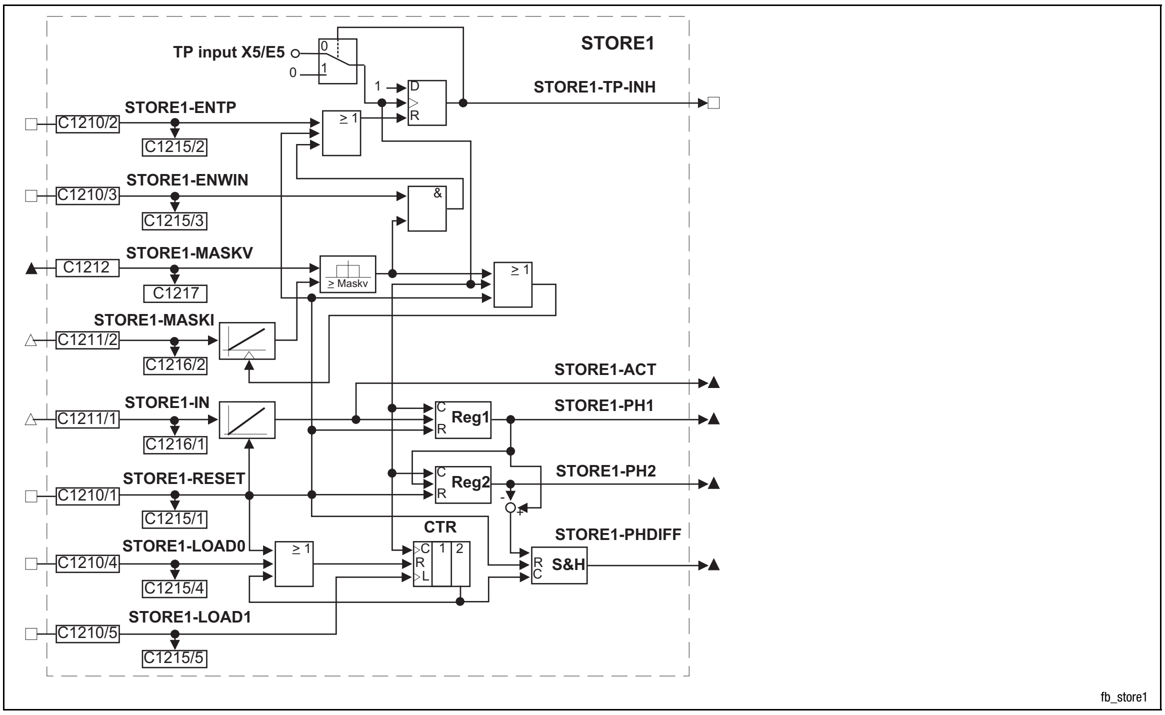


Fig. 3-242 Storage block (STORE1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE1-IN	phd	C1216/1	dec [rpm]	C1211/1	4	1000	-
STORE1-RESET	d	C1215/1	bin	C1210/1	2	1000	HIGH = resets all functions
STORE1-ENTP	d	C1215/2	bin	C1210/2	2	1000	HIGH = releases triggering via the TP input E5
STORE1-MASKI	phd	C1216/2	dec [rpm]	C1211/2	4	1000	-
STORE1-MASKV	ph	C1217	dec [inc]	C1212	3	1000	-
STORE1-ENWIN	d	C1215/3	bin	C1210/3	2	1000	HIGH = releases the signal for I STORE1-MASKI I ≥ STORE1-MASKV
STORE1-LOAD0	d	C1215/4	bin	C1210/4	2	1000	HIGH = resets the counter which controls the output on STORE1-PHDIFF
STORE1-LOAD1	d	C1215/5	bin	C1012/5	2	1000	LOW-HIGH edge = sets the counter = 1 which controls the output on STORE1-PHDIFF
STORE1-ACT	ph	-	-	-	-	-	Outputs the currently integrated value
STORE1-PH1	ph	-	-	-	-	-	Outputs the last value saved by X5/E5
STORE1-PH2	ph	-	-	-	-	-	Outputs the next to last value saved by X5/E5
STORE1-PHDIFF	ph	-	-	-	-	-	Outputs the difference of STORE1-PH1 and STORE1-PH2
STORE1-TP-INH	d	-	-	-	-	-	HIGH = triggering via TP input E5 has been effected. For further triggering, a positive edge has to occur at the input STORE1-ENTP.

Function

- Control via TP input X5/E5
- Saving the angle signal

3.2.93.1 Control via TP input X5/E5

The triggering signal STORE1-TP-INH indicates by means of a HIGH signal a triggering effected via the TP input E5 (LOW-HIGH edge on X5/E5). At the same time STORE1-TP-INH signalises that the triggering is deactivated and has to be reset to the active state. This can be effected via

- STORE1-RESET = HIGH
- STORE1-ENTP = LOW-HIGH edge
- STORE1-ENWIN = HIGH **and** the comparison of angle signals

Comparison of angle signals

The speed signal on STORE1-MASKI is integrated to a angle signal and is compared to the angle signal on STORE1-MASKV.

If the condition | STORE1-MASKI | ≥ STORE1-MASKV

is met,

- the TP input E5 is enabled for the next triggering process with STORE1-ENWIN = HIGH,
- the integrator for the speed signal on STORE1-MASKI is reset.

3.2.93.2 Saving the angle signal

A speed signal at input STORE1-IN is integrated to a angle signal. In addition to the saving, the following procedure shows the possibilities for the signal output.

- The current angle signal is output at STORE1-ACT.

1. A LOW-HIGH edge at the TP input E5 saves the last angle signal and outputs it at STORE1-PH1.
2. STORE1-ENTP = LOW-HIGH edge enables the TP input E5 for the next triggering process.
3. A new LOW-HIGH edge at the TP input E5 saves the last angle signal.
   – STORE1-PH1 outputs this last angle signal.
   – STORE1-PH2 outputs the next to last angle signal.
   – STORE1-PHDIFF outputs the difference of STORE1-PH1 and STORE1-PH2.

- STORE1-RESET = HIGH resets the memory, counters, and integrators and enables the TP input E5 for the triggering process.

Outputting the difference of the two angle signals saved

- A two-stage counter controls the output at STORE1-PHDIFF.
- Every second triggering via the TP input E5 results in a new output at STORE1-PHDIFF.
- STORE1-LOAD0 = HIGH resets the counter.

Additional control

1. STORE1-LOAD1 = LOW-HIGH edge resets the counter to the 1st stage (preparation of the output at STORE1-PHDIFF).
2. Triggering via the TP input E5 sets the counter to the 2nd stage (output at STORE1-PHDIFF is effected).

Note!

If STORE1-LOAD1 is set cyclically, STORE1-PHDIFF outputs a new differential signal after each triggering process.

3.2.94 Storage block (STORE2)

Purpose

Stores a setpoint angle signal which is generated from a speed signal. The storage process is activated via the TP input X5/E4.

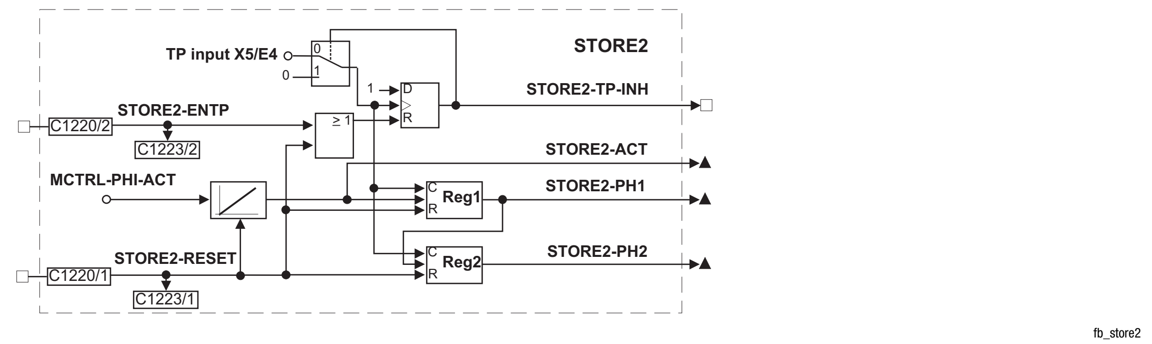


Fig. 3-243 Storage block (STORE2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE2-RESET	d	C1223/1	bin	C1220/1	2	1000	HIGH = resets all functions
STORE2-ENTP	d	C1223/2	bin	C1220/2	2	1000	HIGH = enables the triggering process via the TP input E4
STORE2-ACT	ph	-	-	-	-	-	Outputs the currently integrated value
STORE2-PH1	ph	-	-	-	-	-	Outputs the last value saved by X5/E5
STORE2-PH2	ph	-	-	-	-	-	Outputs the next to last value saved by X5/E5
STORE2-TP-INH	d	-	-	-	-	-	HIGH = triggering via TP input E4 has been effected. For further triggering, a positive edge has to occur at the input STORE1-ENTP.

Saving the angle signal

A speed signal at MCTRL-PHI-ACT is integrated to a angle signal. In addition to the saving, the following procedure shows the possibilities for the signal output.

- The current angle signal is output at STORE2-ACT.

1. A LOW-HIGH edge at the TP input E4 saves the last angle signal and outputs it at STORE2-PH1.
2. STORE2-ENTP = LOW-HIGH edge enables the TP input E4 for the next triggering process.
3. A new LOW-HIGH edge at the TP input E4 saves the last angle signal.
   - STORE2-PH1 outputs this last angle signal.
   - STORE2-PH2 outputs the next to last angle signal.

- STORE2-RESET = HIGH resets the memory and the integrators and enables the TP input E4 for the triggering process.

3.2.95 Shift register (STORE3)

Description

The function block is a shift register with 16 memory locations. The shift register is designed as a ring buffer.

You can use the function block in cross cutter applications, where the mark sensor is mounted several format lengths away from the cutter.

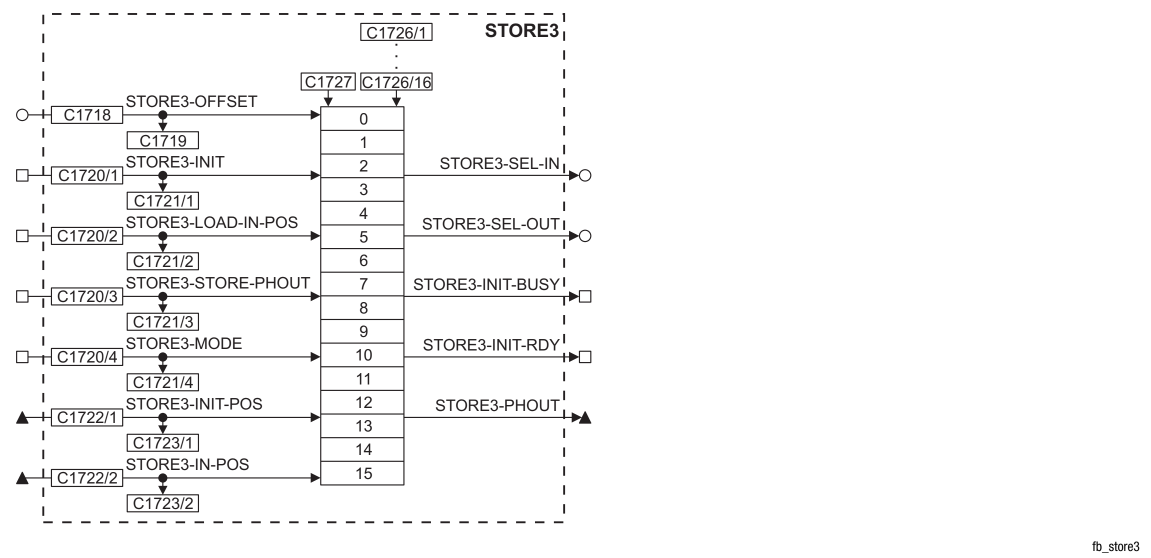


Fig. 3-244 Shift register (STORE3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE3-OFFSET	a	C1719	dec [%]	C1718	1	1000	Selects the memory to be output Memory location = SEL-IN-OFFSET The value is internally set to the correct memory location in the ring buffer
STORE3-INIT	d	C1721/1	bin	C1720/1	2	1000	Initialisation of all memory locations with the value at STORE3-INIT-POS. The input has the highest priority. LOW-HIGH edge: start initialisation LOW: sets STORE3-INIT-RDY = LOW HIGH: inhibits all other functions
STORE3-LOAD-IN-POS	d	C1721/2	bin	C1720/2	2	1000	LOW-HIGH edge: transfers the value of STORE3-IN-POS to the memory location STORE3-SEL-IN
STORE3-STORE-PHOUT	d	C1721/3	bin	C1720/3	2	1000	LOW: outputs the contents of the STORE3-SEL-OUT memory location at STORE3-PHOUT HIGH: inactive, no transmission Important: The function depends on the input signal at STORE3-Mode
STORE3-MODE	d	C1721/4	bin	C1720/4	2	1000	LOW: If STORE3-STORE-PHOUT = LOW, the contents of the STORE3-SEL-OUT memory location is output at STORE3-PHOUT HIGH: The memory location resulting from the calculation of STORE3-SEL-IN – STORE3-OFFSET is output at STORE3-PHOUT. The output is effected permanently.

Name	Type	DIS	DIS format	CFG	List	Lenze	
STORE3-INIT-POS	ph	C1723/1	ph	C1722/1	3	1000	Value for initialising all memory locations. The value is accepted via a LOW-HIGH edge at STORE3-INIT.
STORE3-IN-POS	ph	C1723/2	ph	C1722/2	3	1000	Value for the transfer to the memory location which has been selected via STORE3-SEL-IN. The value is accepted with a LOW-HIGH edge at STORE3-INIT.
STORE3-SEL-IN	a						Memory location to which the next value at STORE3-IN-POS is written.
STORE3-SEL-OUT	a						Memory location from which the next value is output at STORE3-PHOUT.
STORE3-INIT-BUSY	d						Handshake signal HIGH: initialisation of the memories is active
STORE3-INIT-RDY	d						Handshake signal LOW: initialisation of the memories is active or STORE3-INIT = LOW HIGH: initialisation of the memories is completed
STORE3-PHOUT	ph						Output of the memory location values

Direct parameter setting of the memory locations

- Via C1726/1 ... C1726/16, you can write values [inc] directly into the memory locations 0 ... 15. Or you can have the registered values displayed via the codes.
- In code C1727/1 you can directly define a memory location. Save the setting with C0003 = 1.
  - Then the value at STORE3-IN-POS is written to the defined memory location with a LOW-HIGH edge at STORE3-LOAD-IN-POS after mains connection.

Initialising all memory locations with default values

Before starting, all memory locations with default values (e. g. set register lengths) have to be initialised. Mains power-up initialises all memory locations with the value ”0”. Data on the memory locations is not saved with mains failure protection (C0003).

The initialisation is effected in a slow task. The message to the higher-level control system is effected via STORE3-BUSY and STORE3-RDY (handshake signals).

Procedure:

1. Apply a default value to the input STORE3-INIT-POS.
2. Via a LOW-HIGH edge at STORE3-INIT the value at STORE3-INIT-POS is written to all 16 memory locations.
   - STORE3-BUSY is set to HIGH immediately.
   - As long as STORE3-INIT = HIGH, all other functions remain inhibited.
3. After the initialisation,
   - STORE3-BUSY is set to LOW,
   - STORE3-RDY is set to HIGH.
4. Set STORE3-INIT = LOW.
   - STORE3-RDY is set to LOW.

Note!

If different cutting lengths are lying between the point of cutting/register and the mark recognition, no initialisation can be effected.

In this case you have to enter the default values directly in C1726/1 ... C1726/16.

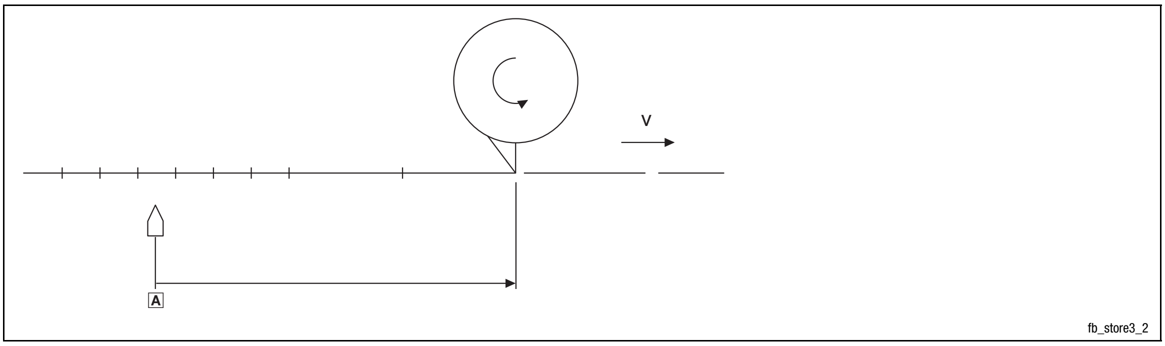


Fig. 3-245 Different cutting lengths between point of cutting and mark recognition (sensor)

A Mark recognition (sensor)

Writing data to a memory location (teaching)

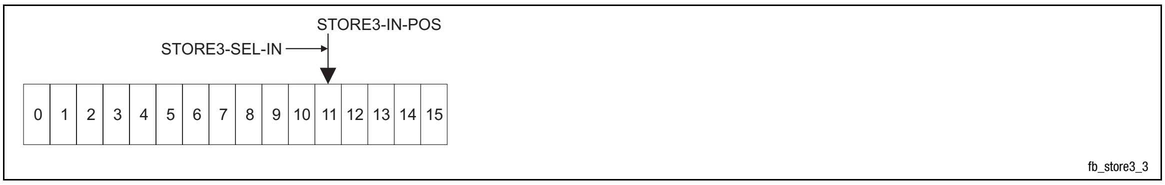


Fig. 3-246 Writing data to a memory location

1. Apply a value to STORE3-IN-POS. STORE3-SEL-IN shows the memory location which is to be written to (in Fig. 3-246 memory location 11).
2. Via a LOW-HIGH edge at STORE3-LOAD-IN-POS, the value is written to the memory location.
3. Afterwards the pointer STORE3-SEL-IN automatically is increased by one (in Fig. 3-246 from memory location 11 to 12).

Reading data from the memory location

- STORE3-MODE = LOW
  - The functions ”Write data to the memory location” and ”Read data from the memory location” are carried out independently of each other.
  - In this mode, a flying splice of the cutting lengths can be achieved.

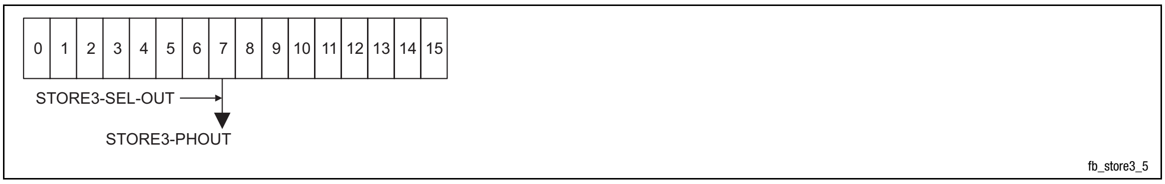


Fig. 3-247 Reading data independently of writing data

1. STORE3-SEL-OUT indicates the memory location, the value of which is to be transmitted to STORE3-PHOUT.
2. Via a LOW-HIGH edge at STORE3-STORE-PHOUT, the value is read from the memory location.
3. Afterwards the pointer STORE3-SEL-OUT automatically is increased by one (in Fig. 3-247 from memory location 7 to 8).

- STORE3-MODE = HIGH
  - The functions ”Write data to the memory location” and ”Read data from the memory” are combined.

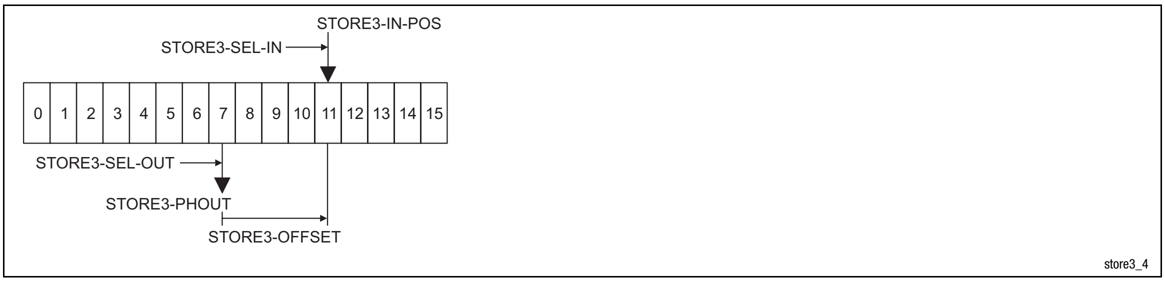


Fig. 3-248 Reading data combined with writing data

Application example

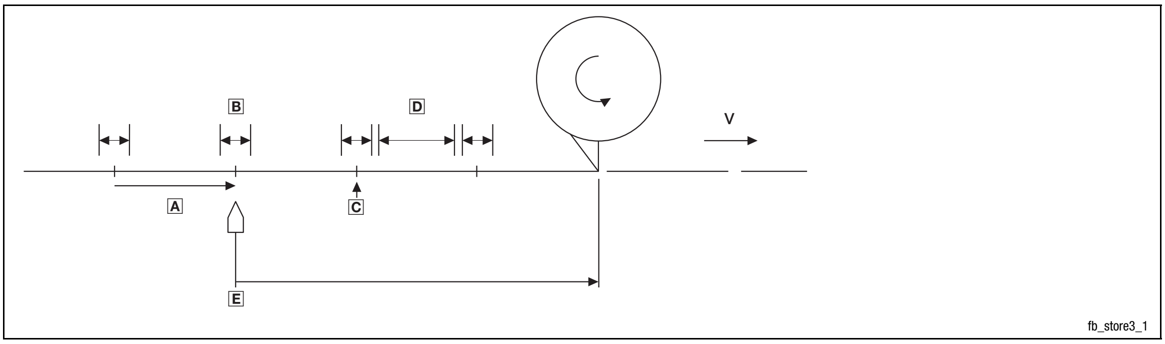


Fig. 3-249 Automatic detection of the formats via cutting marks

A	Format length
B	Window for cutting mark
C	Cutting mark
D	Print image
E	Mark recognition (sensor)

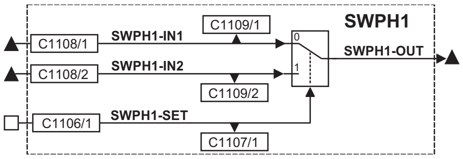
The distance between two cutting marks is the format length. STORE3 supports the automatic measurement of the format length. For this purpose, at least two cutting marks have to be detected via a sensor.

Between the sensor and cutter (cutting point) there can be 16 different format lengths at a maximum.

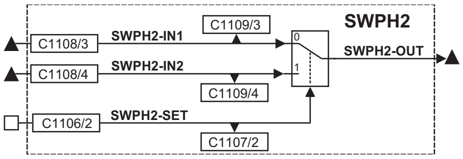
The product is cut if a cutting mark reaches the cutter.

3.2.96 Angle signal changeover switch (SWPH1 and SWPH2)

Changeover switch for selecting between two angle signals



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SWPH1-IN1	ph	C1109/1	dec [inc]	C1108/1	3	–
SWPH1-IN2	ph	C1109/2	dec [inc]	C1108/2	3	–
SWPH1-SET	d	C1107/1	bin	C1106/1	2	–
SWPH1-OUT	ph	–	–	–	–	–



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SWPH2-IN1	ph	C1109/3	dec [inc]	C1108/3	3	–
SWPH2-IN2	ph	C1108/4	dec [inc]	C1108/4	3	–
SWPH2-SET	d	C1106/2	bin	C1107/2	2	–
SWPH2-OUT	ph	–	–	–	–	–

Function

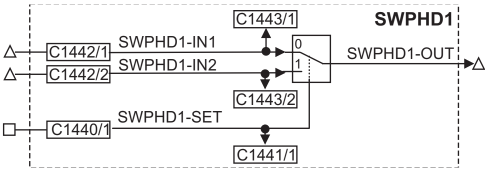
- Different signals are assigned to the inputs SWPHx-IN1 and -IN2. One of the signals can be assigned to the output SWPHx-OUT.
- The input is selected with SWPHx-SET
  - – SWPHx-SET = LOW:
    Input SWPHx-IN1
  - – SWPHx-SET = HIGH:
    Input SWPHx-IN2

3.2.97 Digital frequency changeover switch (SWPHD)

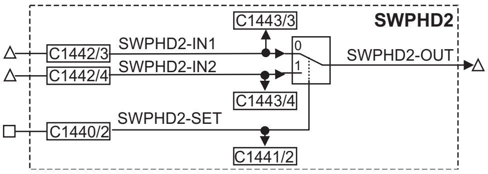
Two function blocks (SWPHD1, SWPHD2) are available

Purpose

Changeover switch for selecting between two speed signals



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SWPHD1-IN1	phd	C1443/1	dec [rpm]	C1442/1	4	–
SWPHD1-IN2	phd	C1443/2	dec [rpm]	C1442/2	4	–
SWPHD1-SET	d	C1441/1	bin	C1440/1	2	–
SWPHD1-OUT	phd	–	–	–	–	–



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SWPHD1-IN1	phd	C1443/3	dec [rpm]	C1442/3	4	–
SWPHD1-IN2	phd	C1443/4	dec [rpm]	C1442/4	4	–
SWPHD1-SET	d	C1441/2	bin	C1440/2	2	–
SWPHD1-OUT	phd	–	–	–	–	–

Function

- Different signals are assigned to the inputs SWPHDx-IN1 and -IN2. One of the signals can be assigned to the output SWPHDx-OUT.
- The input is selected with SWPHDx-SET
  - SWPHDx-SET = LOW:
    Input SWPHDx-IN1
  - SWPHDx-SET = HIGH:
    Input SWPHDx-IN2

3.2.98 Multi-axis synchronisation (SYNC1 and SYNC2)

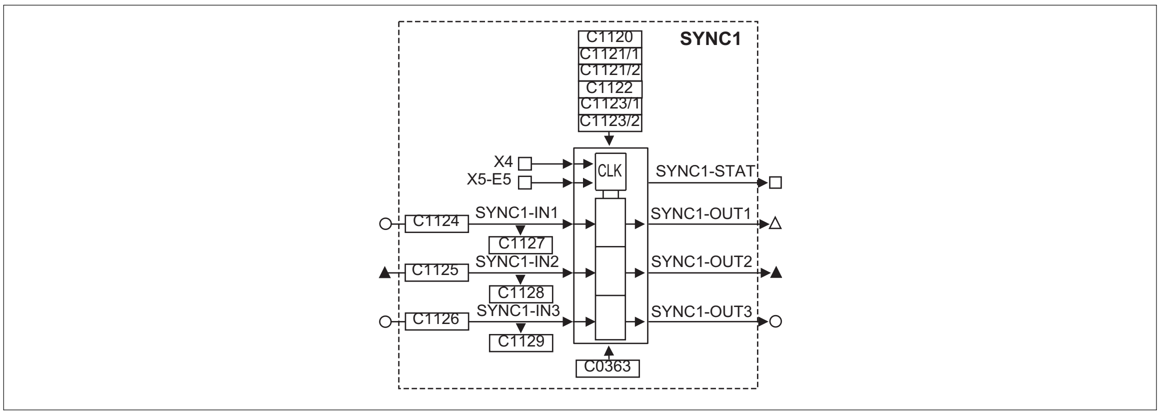
Purpose

Synchronises the control program cycle of the drives to the cycle of a master control.

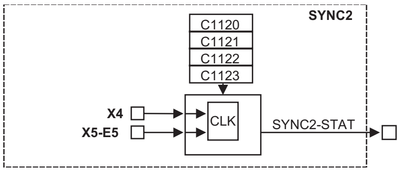
STOP!

Do **not** use both function blocks together for cam applications

---



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
SYNC1-IN1	a	C1127	dec [inc]	C1124	1	1000	-
SYNC1-IN2	ph	C1128	dec [inc]	C1125	3	1000	-
SYNC1-IN3	a	1129	dec	C1126	1	1000	
SYNC1-STAT	d	-	-	-	-	-	After the synchronisation is completed, SYNC1-STAT switches to HIGH. If the synchronisation is quit, SYNC1-STAT switches to LOW.
SYNC1-OUT1	phd	-	-	-	-	-	Cannot be used for angle-accurate speed/angle difference transmission
SYNC1-OUT2	ph	-	-	-	-	-	With interpolation, for cyclically synchronised position information
SYNC1-OUT3	a	-	-	-	-	-	With interpolation, for analog values



Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
SYNC2-STAT	d	-	-	-	-	-	After completion of the synchronisation SYNC2-STAT switches to HIGH. If the synchronity is quit, SYNC2-STAT switches to LOW.

Tip!

- Communication via CAN bus
  - Use the function block SYNC2, when sending/receiving the data of the X or Y axis via the CAN bus. Observe the calculating times of both function blocks (see chapter ”Function block description”).
  - Enter the function block into the processing table when speed values are to be transferred via the CAN bus. The signals of the CAN bus must not be guided via the function block FB SYNC1 but must be used directly.
- If you use software versions >V2.2, please see the commissioning example “Multi-axis application” in part C of this Manual.

Function

- Possible axis synchronisations (chapter 3.2.98.1)
- Cycle times (chapter 3.2.98.2)
- Phase displacement (chapter 3.2.98.3)
- Synchronisation window for synchronisation via terminal (SYNC WINDOW) (chapter 3.2.98.4)
- Correction value of phase controller (SYNC CORRECT) (chapter 3.2.98.5)
- Fault indications (chapter 3.2.98.6)
- Configuration examples (chapter 3.2.98.7)
- Scaling (chapter 3.2.98.8)

3.2.98.1 Possible axis synchronisations

Operating mode

Code	Value	Function
C1120	0	FB without function. Assigns the data at the inputs directly to the outputs.
	1	CAN Sync active Synchronises the controllers to the sync telegram of the system bus.
	2	Terminal Sync active Synchronises the controllers to the sync signal of terminal X5/E5.

Synchronisation time

In addition to certain mains connection and initialisation time of the controller, the FB SYNC1 also requires a synchronisation time.

The synchronisation time depends on

- the baud rate of the system bus (CAN-SYNC),
- the starting time (reception of the first SYNC telegram / signal),
- the time between the SYNC telegrams,
- the SYNC correction factor (C0363),
- the operating mode of the FB SYNC1.

Axis synchronisation via system bus (CAN)

The system bus (CAN) transmits the sync telegram and the process signals.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis positioning via the system bus (CAN).

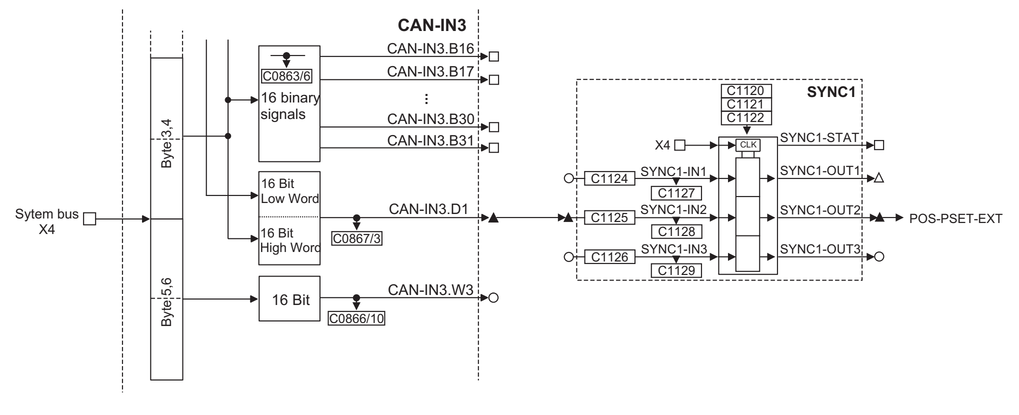


Fig. 3-250 Example for linking the FB SYNC1

Axis synchronisation via terminal control (X5/E5)

The transmission paths for the sync signal and the process signals are separated.

- The process signals are connected via a freely selectable input channel (e. g. AIF interface, DF input).
- The sync signal is injected via terminal X5/E5.

Application examples:

- Selection of cyclic, synchronised position setpoint information for multi-axis positioning via other bus systems (e. g. Interbus).
- Synchronisation of the internal processing cycles of the FB to higher-level process controls.

3.2.98.2 Cycle times

Sync cycle time (SYNC CYCLE)

The master (e. g. PLC) sends the periodic sync telegram1) (sync signal2)).

The controllers (slaves) receive the sync telegram and compare the time between two LOW-HIGH edges of the signal with the selected cycle time (1121/1).

The cycle time is entered in integers (1 ms, 2 ms, 3 ms, ...).

1) Designation for the synchronisation via system bus (CAN)

2) Designation for the synchronisation via terminal

Code	Value	Function
C1121/1	1 ... 13 ms	Definition of the cycle time of the sync telegram (sync signal). Parameters must only be set for the slave. • C1120 = 1 (CAN sync) – Time between two sync telegrams of the master. Adapt the time to the master SYNC. C0362 indicates the time (CAN sync cycle) for the slave. Set the value in C1121/1 higher than the value in C0362. • C1120 = 2 (terminal SYNC) – Time between two sync signals of the master at X5/E5. Adapt the time to the master SYNC. Set the value in C1121/1 ≥ the cycle time of the master.

Interpolation cycle time (INTPOL. CYCLE)

The FB interpolates the input signals (C1124, C1125, C1126) between the sync telegrams or sync signals and transmits them to the corresponding output. This ensures an optimum signal course with regard to the internal processing cycle (e. g. minimising signal jumps in the output variable when operating with high sync cycles).

The interpolation is restarted with every sync signal (LOW-HIGH edge).

Code	Value	Function
C1121/2	1 ... 13 ms	Definition of the interpolation cycles/steps • C1120 = 1 – C1121/2 has no effect. – The interpolation cycles are derived from the sync cycle (C1121/1). • C1120 = 2 – The interpolation cycle can be selected irrespective of the sync cycle. – The parameter setting of C1121/2 must be selected according to the cycle of the process value input.

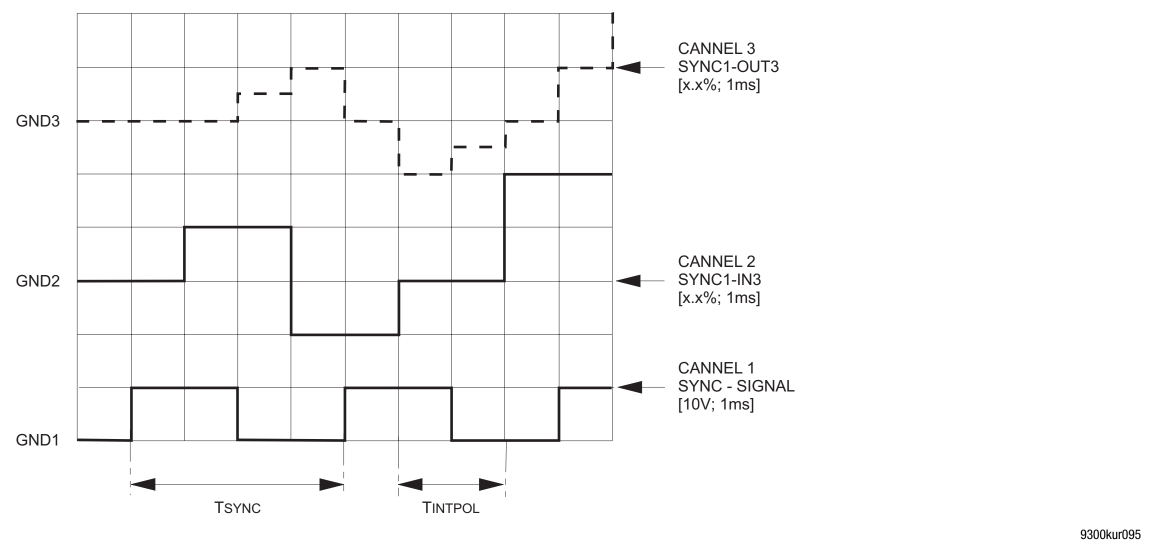


Fig. 3-251 Interpolation example

See Fig. 3-251:

An analog value at SYNC1-IN3 is output as an interpolated value at SYNC1-OUT3.

- Sync cycle (C1121/1) = 4 ms
- Interpol. cycle (C1121/2) = process cycle = 2 ms
- Phase displacement (C1123/1) = 0 ms

3.2.98.3 Phase displacement

Phase displacement for synchronisation via system bus (SYNC TIME)

Code	Value	Function
C1122	0 ...10.000 μs	• C1120 = 1 – Phase displacement between the sync telegram and the start of the internal control program. – The parameters are set automatically depending on the parameter setting of the system bus (CAN). • C1120 = 2 – C1122 has no effect.

Phase displacement for synchronisation via terminal (PHASESHIFT)

Code	Value	Function
C1123/1	-1.000 ms to +1.000 ms	• C1120 = 1 – C1123/1 has no effect. • C1120 = 2 – Phase displacement between the sync signal and the start of the internal control program (e. g. for compensating the effects of signal propagation delays/dead times for the sync signal of the single slave drives).

3.2.98.4 Time slot for synchronisation via terminal

Code	Value	Function
C1123/2	0 ... 1.000 ms	• C1120 = 1 – C1123/2 has no effect. • C1120 = 2 – Definition of a ”time slot” for the LOW-HIGH edges of the sync signal for the slave (defined via C1121/1). – If the sync signal sent by the master is within the ”time slot”, the SYNC1-STAT is switched to HIGH.

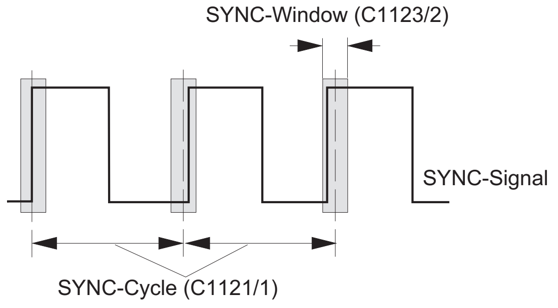


Fig. 3-252 “Time slot” for the LOW-HIGH edges of the sync signal

Tip!

A jitter of up to ±200 μs on the LOW-HIGH edges of the sync signal is permissible. The size of the jitter affects the parameter setting of the ”time slot”.

3.2.98.5 Correction value of the phase controller

Code	Value	Function
C0363	1 ... 5	• Correction values for C0363 = 1 → 0.8 µs 2 → 1.6 µs 3 → 2.4 µs 4 → 3.2 µs 5 → 4.0 µs • C1120 = 1 – The value is automatically derived from the internal parameters of the system bus (CAN). • C1120 = 2 – Optimising the rise time of the phase controller depending on the frequency of the sync signal. – Increase the value if the frequency of the sync signal decreases. – A stable signal at SYNC1-STAT is an indicator for an optimal parameter setting.

3.2.98.6 Fault indications

Fault indications for the synchronisation via system bus

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronised state (SYNC1-STAT = LOW)	Only enable the controller when SYNC1-STAT = HIGH
	The time between two sync telegrams is faulty	C0362 indicates the time between two sync telegrams • Set the time in C1121/1 to the time in C0362 • Adapt the time interval of the sync telegram from the master

Fault indications for the synchronisation via terminal

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronised state (SYNC1-STAT = LOW)	Only enable the controller when SYNC1-STAT = HIGH
	Sync signal is missing	Connect sync signal with terminal X5/E5
	The period of the sync signal is not a multiple of 1 ms	Adapt the period
	Sync window is too small	Adapt C1123/2 to the conditions

3.2.98.7 Configuration examples

Configuration example CAN-SYNC

Observe the following order for commissioning:

Step	Where	Operation
1.	-	Commission controller and system bus without FB SYNC1
2.	-	Inhibit controller
3.	CAN master	Define the sequence of the telegrams 1. Send new setpoint to all slaves 2. Send sync telegram 3. All slaves must respond
4.	CAN slave drives	Enter FB SYNC1 into the first position of the processing table
5.		Parameterise the signal assignment of the inputs at FB SYNC1
6.		Select C1120 = 1 (sync mode for FB SYNC1)
7.	CAN master	Start communication, send sync telegrams
8.	CAN slave drives	FB SYNC1 (CAN SYNC-CYCLE) • Retrieve cycle time of the SYNC telegram from the master via C0362
9.		FB SYNC1 (SYNC CYCLE) • Set C1121 according to the time interval of the sync telegrams from the control • Set C1121 ≥ C0362
10.		Parameterise the monitoring function P16 via C1290
11.		Connect the output signals of SYNC1 with the required inputs of the corresponding FB
12.		Via FB DIGOUT • Detect signal of SYNC1-STAT
13.		Only enable the controller when SYNC1-STAT = HIGH

Configuration example TERMINAL-SYNC

Observe the following order for commissioning:

Step	Where	Operation
1.	-	Commission controller without FB SYNC1
2.	-	Inhibit controller
3.	Slave drives	Enter FB SYNC1 into the first position of the processing table
4.		Apply sync signal to terminal X5/E5
5.		Parameterise the signal assignment of the inputs at FB SYNC1
6.		Select C1120 = 2 (sync mode for FB SYNC1)
7.	Sync master	Start communication, send sync signals
8.	Slave drives	FB SYNC1 (SYNC CYCLE) • Parameterise the sync cycle time of the sending source via C1121
9.		Parameterise the monitoring function P16 via C1290
10.		Connect the output signals of SYNC1 with the required inputs of the corresponding FB
11.		Via FB DIGOUT • Output signal of SYNC1-STAT
12.		FB SYNC1 (SYNC WINDOW) • Enter the optimal size of the "time slot" via C1123/2 • If the sync signal jitters strongly, increase the "time slot"
13.		Only enable the controller when SYNC1-STAT = HIGH

3.2.98.8 Scaling

The signal at input is transmitted in a scaled form to SYNC1-OUT1.

Scaling formula:

$$\text{SYNC1-OUT1 [rpm]} = \text{SYNC1-IN1 [inc]} \cdot \frac{1875\ \text{rpm}}{2048\ \text{inc}}$$

The inputs SYNC1-IN2 and SYNC1-IN3 are not scaled. The FB transmits the data to SYNC1-OUT2 or SYNC1-OUT3 without any evaluation.

3.2.99 Edge evaluation (TRANS)

Purpose

This function is used to evaluate digital signal edges and convert them into pulses of a defined duration.

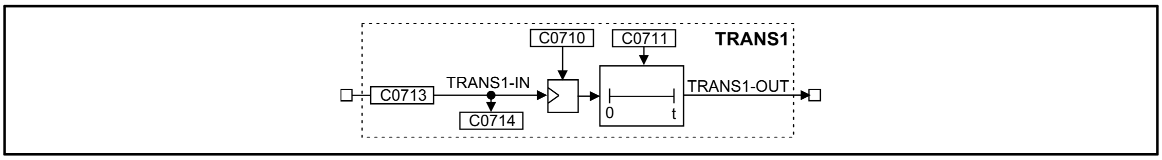


Fig. 3-253 Edge evaluation (TRANS1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS1-IN	d	C0714	bin	C0713	2	1000	-
TRANS1-OUT	d	-	-	-	-	-	-

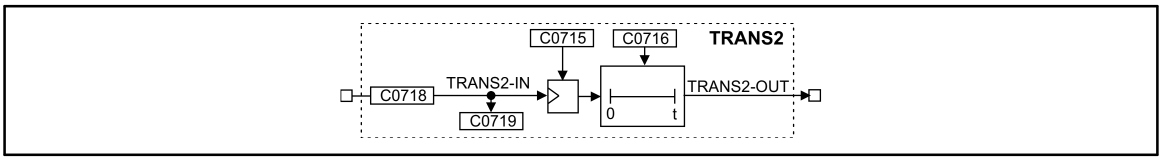


Fig. 3-254 Edge evaluation (TRANS2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS2-IN	d	C0719	bin	C0718	2	1000	-
TRANS2-OUT	d	-	-	-	-	-	-

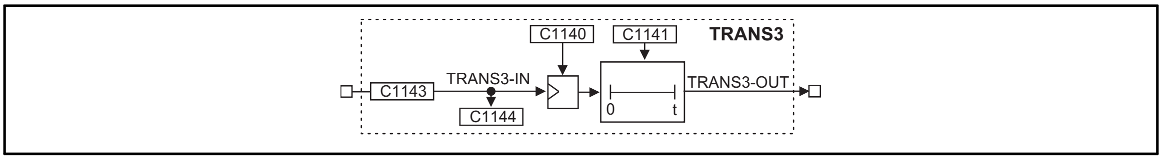


Fig. 3-255 Edge evaluation (TRANS3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS3-IN	d	C1144	bin	C1143	2	1000	-
TRANS3-OUT	d	-	-	-	-	-	-

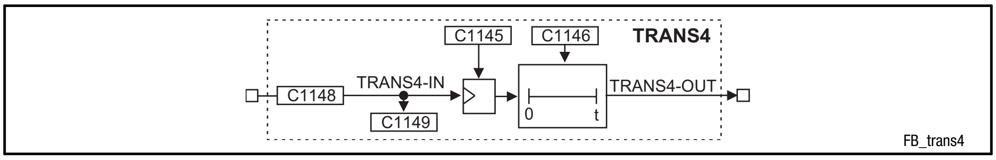


Fig. 3-256 Signal evaluation (TRANS4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TRANS4-IN	d	C1149	bin	C1148	2	1000	-
TRANS4-OUT	d	-	-	-	-	-	-

Function

This FB is an edge evaluator which can be retriggered. This FB can react to different events. The following functions can be selected under code C0710 or C0716:

- Positive edge
- Negative edge
- Positive or negative edge

3.2.99.1 Evaluate positive edge

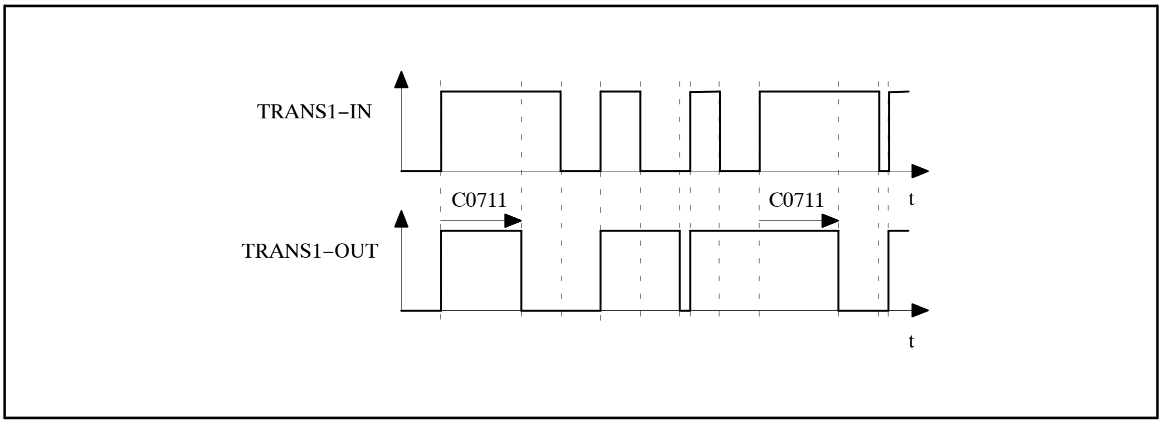


Fig. 3-257 Evaluation of positive edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a LOW-HIGH edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW unless there is another LOW-HIGH edge at the input.

3.2.99.2 Evaluate negative edge

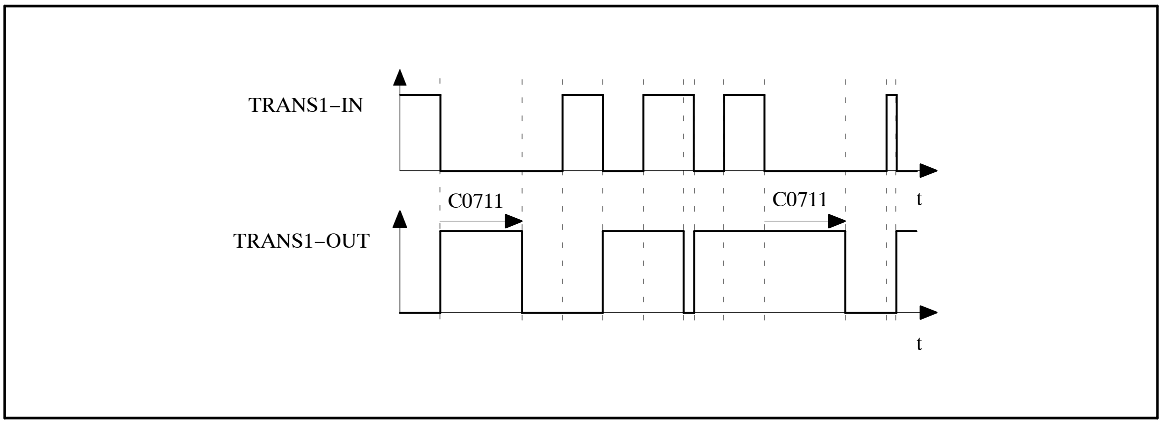


Fig. 3-258 Evaluation of negative edges (TRANS1)

- The output TRANSx-OUT is set to HIGH as soon as a HIGH-LOW edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW, unless there is another HIGH-LOW edge at the input.

3.2.99.3 Evaluate positive or negative edge

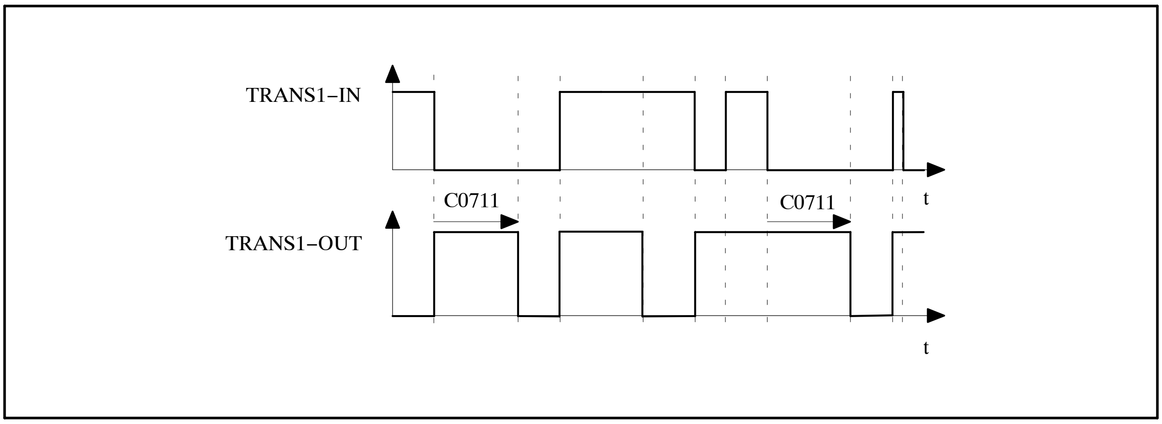


Fig. 3-259 Evaluation of positive and negative edges (TRANS1)

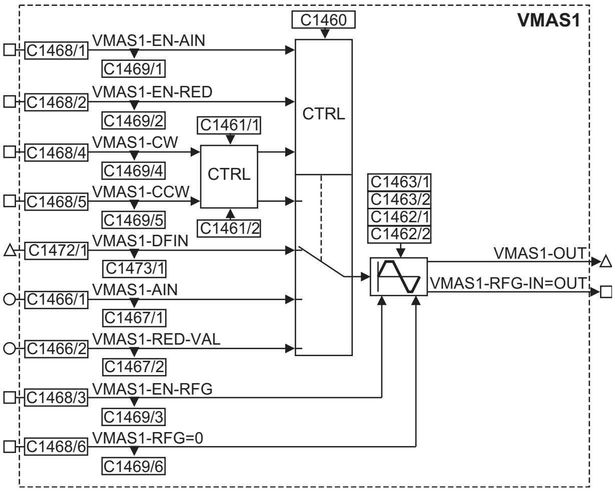
- The output TRANSx-OUT is set to HIGH as soon as a HIGH-LOW edge or a LOW-HIGH edge is sent to the input.
- After the time set under C0711 or C0716 has elapsed, the output changes again to LOW unless there is another HIGH-LOW edge or LOW-HIGH edge at the input.

3.2.100 Virtual master (VMAS)

Generation of a virtual digital frequency

Contents

- Generation of a virtual master value (digital frequency) (chapter 3.2.100.1)
- Digital frequency input (chapter 3.2.100.2)
- Switch to alternative master value (chapter 3.2.100.3)
- Inching mode (chapter 3.2.100.4)
- Ramp function generator (chapter 3.2.100.5)
- STOP function with VMAS1-RFG=0 (chapter 3.2.100.6)



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VMAS1-AIN	a	1467/1	dec [%]	1466/1		Analog setpoint
VMAS1-RED-VAL	a	1467/2	dec [%]	1466/2		Alternative analog setpoint, target for speed reduction
VMAS1-EN-AIN	d	1469/1	bin	1468/1		HIGH: Activates the analog input VMAS1-AIN or VMAS1-DFIN (depending on the selection under C1460)
VMAS1-EN-RED	d	1469/2	bin	1468/2		HIGH: Activates the analog input VMAS1-RED-VAL
VMAS1-EN-RFG	d	1469/3	bin	1468/3		HIGH: Activates the ramp function generator LOW: Input values are processed directly
VMAS1-CW	d	1469/4	bin	1468/4		Input CW rotation (set speed under C1461/1)
VMAS1-CCW	d	1469/5	bin	1468/5		Input CCW rotation (set speed under C1461/2)
VMAS1-DFIN	phd	1473/1	dec [rpm]	1472/1		Master speed input (digital frequency)
VMAS1-RFG-IN=0	d	1469/6	bin	1468/6		HIGH: Decelerates VMAS1-OUT to 0 rpm along the adjustable ramp C1463/3. The function has priority over all other functions.
VMAS1-RFG-IN=OUT	d	13851	bin	-		HIGH: RFG has accelerated (input = output)
VMAS1-DFOUT	phd	13851	-	-		Output of the digital frequency setpoint

3.2.100.1 Generation of a virtual master value

If, for instance, no master system is available, a virtual master value (potentiometer setpoint) can be applied to the input VMAS1-AIN. This can be the case when the drive is not operated in a system and thus no synchronous operation is required.

The input signal is switched to the output VMAS1-DFOUT if

- VMAS1-EN-AIN = HIGH and
- code C1460 = 0

The analog setpoint selection at VMAS1-AIN = 100% corresponds to the maximum motor speed, which is input in C0011 during commissioning (see Operating Instructions 9300 cam profiler).

3.2.100.2 Digital frequency input

As an alternative to the analog input VMAS1-AIN (input in [%]), a signal, which must be input as an absolute value [rpm], can be assigned to the digital frequency input VMAS1-DFIN.

The input signal is switched to the output VMAS1-DFOUT if

- VMAS1-EN-AIN = HIGH and
- code C1460 = 1

STOP!

When using the digital frequency input (-DFIN), pulse losses occur when the ramp function generator (VMAS1-EN-RFG = HIGH) is/will be activated. The drive loses the contact with its master. If a ramp function generator is required in connection with the digital frequency input, the FB DFRFG1 can be connected upstream of the input. For this purpose, VMAS1-EN-RFG must be set to LOW.

3.2.100.3 Changeover to alternative master value

This function, for instance, is required when a rough-running drive in the drive system creates an impermissibly high following error. Due to the arising asynchronous operation between master drive and cam the plant may be damaged.

The master speed (input -AIN) can be decreased by changing over to an alternative master value. Then, the drive setpoint is created by the input VMAS1-RED-VAL, e.g. via code, analog input, motor potentiometer, etc..... This master value input has priority over all other setpoint sources.

Before changeover, the input -RED-VAL must be activated:

- VMAS1-EN-RED = HIGH

Tip!

When VMAS1-EN-RFG = HIGH, the ramp function generator is activated. With this, the changeover to the alternative setpoint is made via adjustable ramps (C1462/1 and -/2).

3.2.100.4 Inching mode

- Activate: VMAS1-EN-AIN = LOW
- Activate inching speed from C1461/1:
  VMAS1-CW = HIGH and VMAS1-CCW = LOW
- Parameter setting for inching speed: C1461/1
- Activate inching speed from C1461/2:
- VMAS1-CCW = HIGH and VMAS1-CW = LOW
- Set inching speed n = 0: VMAS1-CCW = LOW and VMAS1-CW = LOW
- With VMAS1-CCW = HIGH and VMAS1-CW = HIGH the status remains the same.

Tip!

For inching, activate the ramp function generator by setting VMAS1-EN-RFG = HIGH.

Code	Meaning	Note
C1461/1	Speed for VMAS1-CW = HIGH	in rpm
C1461/2	Speed for VMAS1-CCW = HIGH	in rpm

3.2.100.5 Ramp function integrator

With the ramp function integrator the setpoint can be smoothly set to the target point.

- Activate: VMAS1-EN-RFG = HIGH

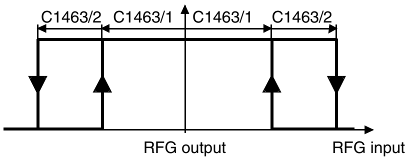
Code	Meaning	Note
C1462/1	Acceleration time	in seconds
C1462/2	Deceleration time	in seconds

The ramps set under C1462/1 and -/2 are assigned to the output VMAS1-DFOUT.

STOP!

If the ramp function generator is used together with the input VMAS-DFIN, pulse losses occur (no phase synchronism) and this drive loses the contact with the master.

The HIGH signal at the output VMAS1-RFG-IN=OUT indicates that the ramp function generator has reached its setpoint. For this status message a window (C1463/1) and a hysteresis (C1463/2) can be set.



3.2.100.6 STOP function with RFG=0

The STOP function (VMAS1-RFG=0 =HIGH) serves to decelerate the digital frequency setpoint (output VMAS1-DFOUT) to n=0 in a controlled way. For this, the "braking time" of the ramp can be adjusted with code C1462/3.

The STOP function has priority over all other functions. Therefore, a LOW potential at the input VMAS1-EN-RFG has no influence.

STOP!

The output (VMAS1-DFOUT) jumps immediately to its end value if

- VMAS1-RFG=0 =LOW (STOP function deactivated)

and

- VMAS1-EN-RFG =LOW (ramp function generator switched off)

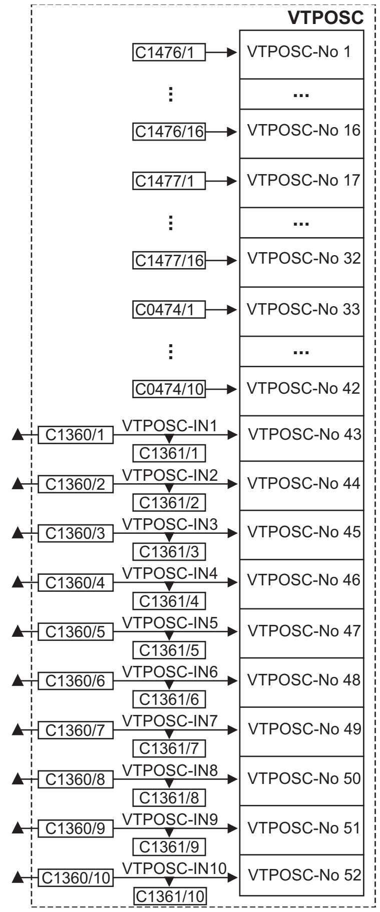
The status signal VMAS-RFG-I=O remains LOW, as long as VMAS1-EN-RFG =HIGH1!

3.2.101 Positioning control (VTPOSC)

One function block (VTPOSC) is available.

Purpose

The FB is similar to the FB VTPOSC of the servo position controller (see System Manual Servo Position Controller). Changes were made to adapt the FB to the cam profiler. It is used to provide the switching point positions for the switching point function blocks (SPC1/2).



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTPOSC-IN1	ph	C1361/1	dec[inc]	C1360/1		VTPOSC-No 43
VTPOSC-IN2	ph	C1361/2	dec[inc]	C1360/2		VTPOSC-No 44
VTPOSC-IN3	ph	C1361/3	dec[inc]	C1360/3		VTPOSC-No 45
VTPOSC-IN4	ph	C1361/4	dec[inc]	C1360/4		VTPOSC-No 46
VTPOSC-IN5	ph	C1361/5	dec[inc]	C1360/5		VTPOSC-No 47
VTPOSC-IN6	ph	C1361/6	dec[inc]	C1360/6		VTPOSC-No 48
VTPOSC-IN7	ph	C1361/7	dec[inc]	C1360/7		VTPOSC-No 49
VTPOSC-IN8	ph	C1361/8	dec[inc]	C1360/8		VTPOSC-No 50
VTPOSC-IN9	ph	C1361/9	dec[inc]	C1360/9		VTPOSC-No 51
VTPOSC-IN10	ph	C1361/10	dec[inc]	C1360/10		VTPOSC-No 52

Function

52 table positions are available.

- Enter fixed position values in m_units under C1476/x
  - 16 table positions (VTPOSC-No1 ... VTPOSC-No16) are available.
- Enter fixed position values in s_units under C1477/x
  - 16 table positions (VTPOSC-No17 ... VTPOSC-No32) are available.
- Enter fixed position values in [inc] under C0474.
  - 10 table positions (VTPOSC-No33 ... VTPOSC-No42) are available.
- Enter variable position target values via VTPOS-INx.
  - 10 table positions (VTPOS-No43 ... VTPOS-No52) are available.
  - Signal input via function blocks
  - The position target values must be transmitted to the table positions before the corresponding program set starts and accesses these values.

Note!

Entries in the processing table are only required if FB inputs and outputs are used.

3.2.102 Welding bar control (WELD1)

Purpose

This function block is used for the implementation of a welding bar control.

Note!

If you use the function block WELD1:

- Profiles must be created in a relative data model. The data model can be set in GDC (parameter menu → basic data dialog).
- Code C1308 must be set to "1".
  - If you select a basic configuration **with** the FB WELD1, C1308 is automatically set to 1.
  - If you select a basic configuration **without** the FB WELD1, C1308 is automatically set to 0.

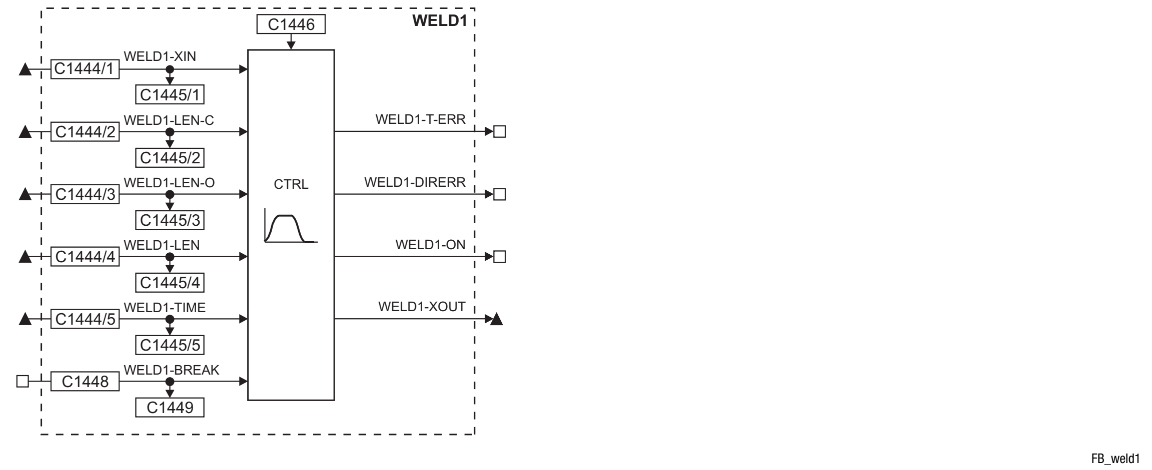


Fig. 3-260 Welding bar control (WELD1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
WELD1-XIN	ph	1445/1	dec [inc]	1444/1	3	Input X position
WELD1-LEN-C	ph	1445/2	dec [inc]	1444/3	3	Length of the closing phase
WELD1-LEN-O	ph	1445/3	dec [inc]	1444/2	3	Length of the opening phase
WELD1-LEN	ph	1445/4	dec [inc]	1444/4	3	Length of the cam profile
WELD1-TIME	ph	1445/5	dec [inc]	1444/5	3	The following modes can be selected under C1446: ● "Time" – Welding time in [ms] (1 inc = 1 ms) ● "Distance" – Option to shift the profile sections 2 and 3 by representing the parameter "WELD1-TIME" (C1445/5) as a distance (see explanation 🕮 3-328). ● "Distance with storage" – Option to shift the profile sections 2 and 3 by representing the parameter "WELD1-TIME" (C1445/5) as distance. "WELD1-TIME" is kept constant for the further cycle at the time of transition into phase 2 (see explanation 🕮 3-329).
WELD1-BREAK		1449	bin	C1448	2	HIGH = Abort the welding process
WELD1-T-ERR	d	-	-	-	-	Welding time error
WELD1-DIR-ERR	d	-	-	-	-	Fault in the direction of rotation
WELD1-ON	d	-	-	-	-	Welding time active
WELD1-XOUT	ph	-		-	-	Output for profile control

Range of functions

- Basics of welding bar control
- Power-controlled welding bar
- Profile data selection
- Weld1 mode: Time (C1446 = 0)
- Weld1 mode: Distance (C1446 = 1)
- Weld1 mode: Distance with saving (C1446 = 2)

3.2.102.1 Basics of welding bar control

General

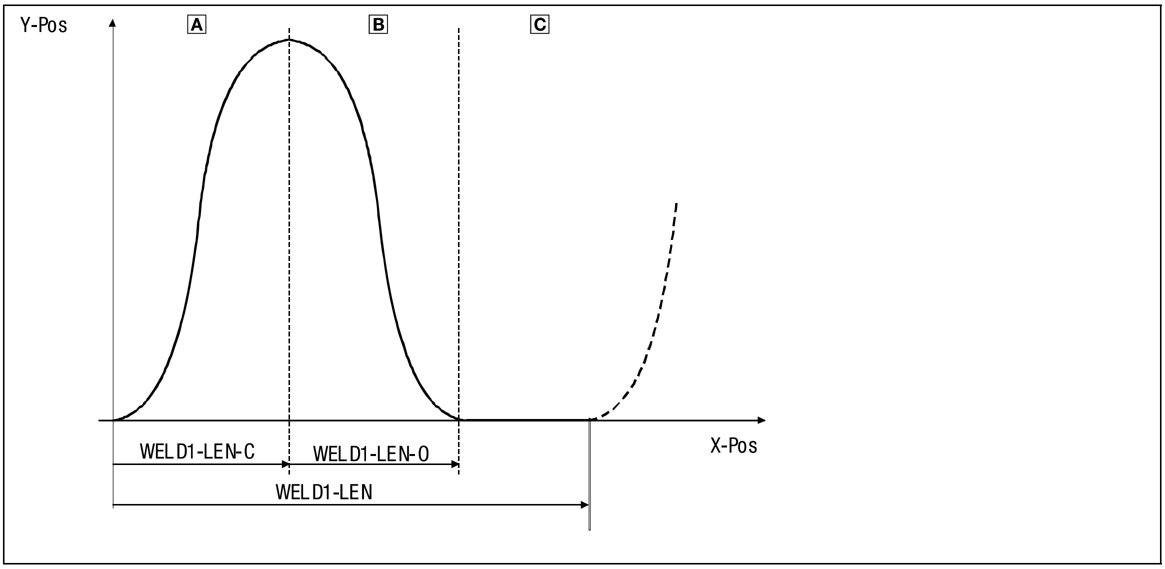
The feed drive positions the material. Then, the welding bar moves down and carries out the welding process with the preset time. After the time has elapsed, the welding bar is moved back into its waiting position and the interval time for a machining process is completed. The next cycle is initiated by a renewed material feed.

Generation of a cam profile for welding bar control

Because of the motion sequences described above a welding bar control can usually be divided into 3 or more sections (max. 5 for Lenze controllers).

Example for 3 sections:

- Phase 1 = Welding bar moves down on material (section 1)
- Phase 2 = Welding, drive remains in position
- Phase 3 = Welding bar is brought into waiting position (section 2)
- Phase 4 = Welding bar remains in waiting position (section 3).



A Section 1
B Section 2
C Section 3

3.2.102.2 Power-controlled welding bar

This function is available from software version 3.4.

The welding bar is controlled by an external control. This control determines the welding current and welding time. After the welding time has elapsed, the opening of the welding bar is forced by setting WELD1-BREAK = HIGH via the external control. The function block WELD1 only carries out the motion control via the profile sections.

Note!

The output WELD1-T-ERR must not be evaluated in this operating mode since the function is only implemented in connection with the internal welding time control. The level at WELD1-T-ERR is not defined.

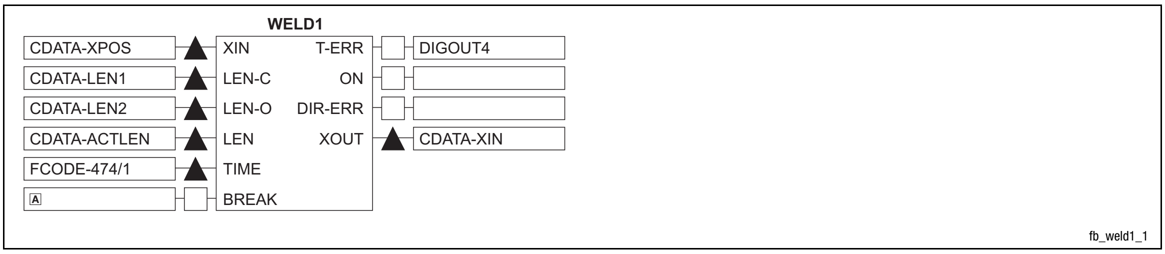


Fig. 3-261 Connection of WELD1 for power-controlled welding bar

WELD1-TIME	At WELD1-TIME, you must set a higher value than the actual welding time will be. Only then the function block reacts to the input WELD1-BREAK. The motion control is also ensured for very high values at WEDL1-TIME, even if no abort is requested (WELD1-BREAK = HIGH). The function block behaves as if a welding time error (WELD1-T-ERR) has occured.
A	WELD1-BREAK is triggered by the external control, e.g. via input terminal (X5/Ex)

3.2.102.3 Profile data selection

Phase 1

Start position:

- X0 = 0 (master value) and Y0 = waiting position of the welding bar

End position

- X1 = WELD1-LEN-C (time until the welding bar contacts the material)
- Y1 = Welding bar in welding position (= start position of phase 2)

Note!

The slope of the profile should be dimensioned to the max. possible acceleration of the welding drive at max. line speed.

Phase 2

The drive is kept in the welding position for the time set at WELD1-TIME. For this purpose, a waiting phase (standstill phase) is automatically set at the transition from section 1 to section 2 (independently of the line speed). The waiting phase is **not** set when the profile data is created.

Phase 3

The end position must be selected such that the max. permissible acceleration of the welding drive at max. line speed will not be exceeded (see also description of phase 1).

Phase 4

Add a standstill phase at the end of the motion profile.

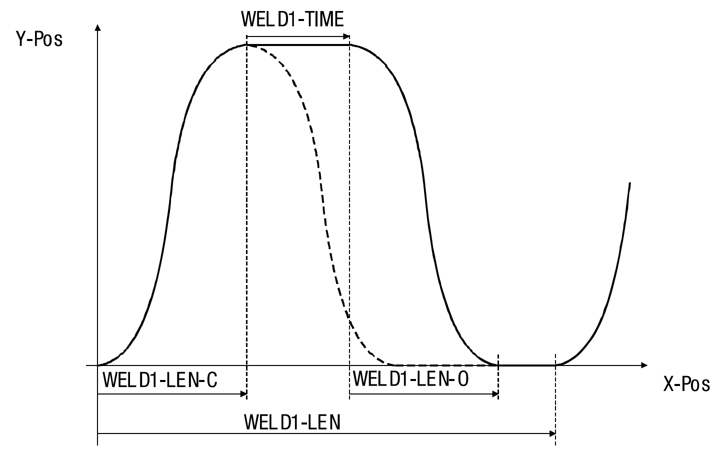


Fig. 3-262 Profile characteristic after entering the profile data at corresponding line speed

The selected welding time is converted to a distance.

Due to the welding time set (WELD1-TIME) the opening phase (WELD1-LEN-O) is automatically delayed by the preselected welding time. This automatically reduces the standstill phase at the end of the profile. The phases 1 and 3 are not influenced. When the line speed increases, the standstill phase at the end of the profile is automatically reduced.

Interconnection and parameterisation of the function blocks

For implementing the welding bar function, the function block CDATA is required with a profile stored accordingly. For this purpose, select the basic configuration C0005 = 11XXX. In this basic configuration the function blocks CDATA, WELD1 and CCTRL are already included:

- The profile data in CDATA determine the motion profile (path profile) of the welding bar.
- The function block WELD1 controls the welding time. The welding time set in WELD1-TIME serves to keep the welding bar in welding position, independent of the master speed.
- The function block CCTRL converts the path information to a rotor position at the motor.

Interconnection of inputs and outputs

STOP!

The welding bar control can only process positive master phases (see 1444/1 and 1445/1). If negative master angles are selected, the drive does not move!

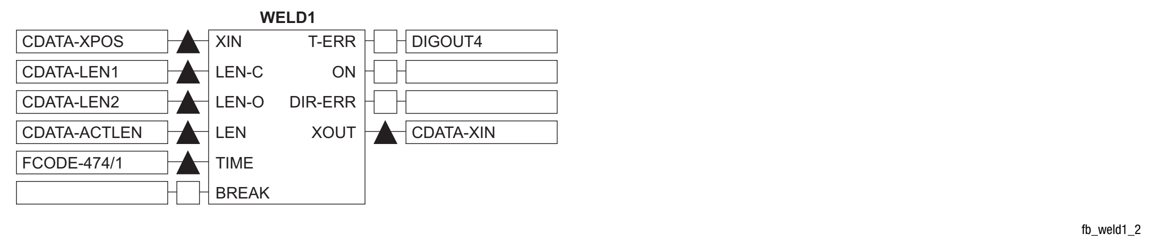


Fig. 3-263 Connection of WELD1 in the basic configuration C0005 = 11000

Input CDATA-XIN must be selected as master value input for function block CDATA.

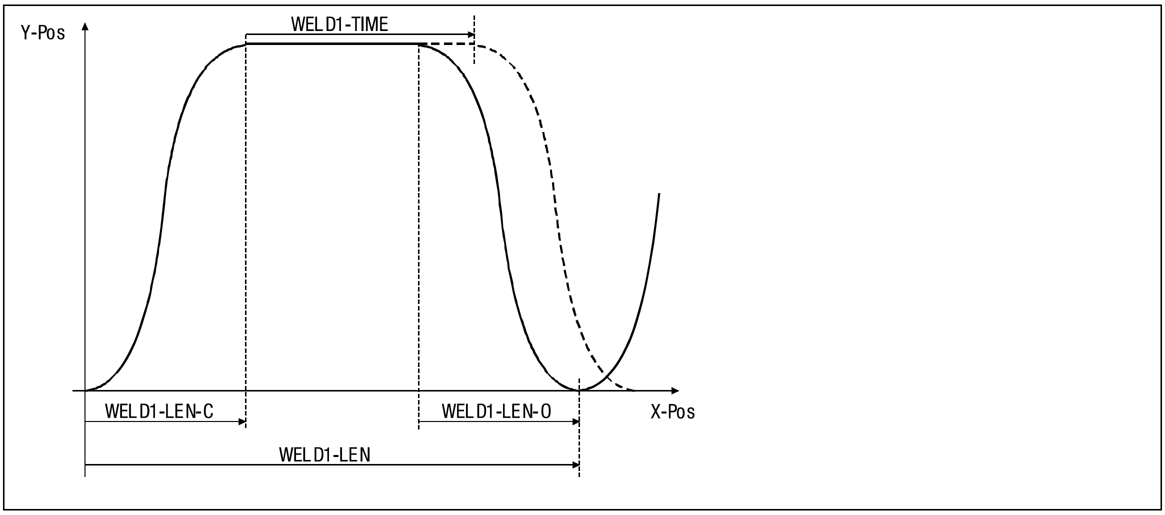
3.2.102.4 Weld1 mode: Time (C1446 = 0)

The value at the input WELD1-TIME is interpreted as a **time** value.

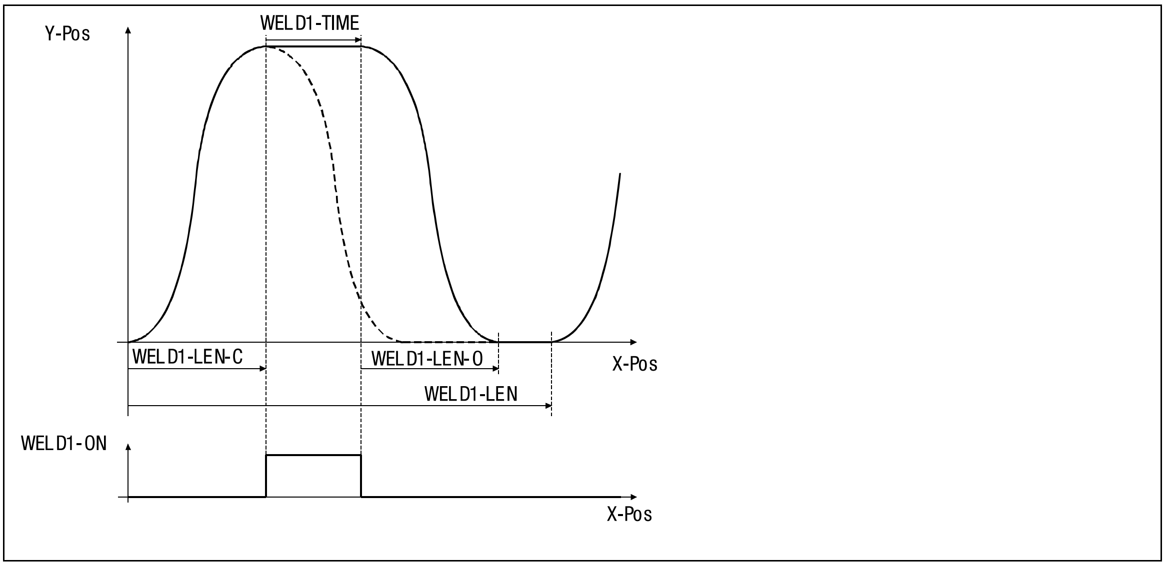
Output of status information

- WELD1-T-ERR = HIGH: The total length and the sum of times of the three sections WELD1-LEN-C (close), WELD1-TIME (weld) and WELD1-LEN-O (open) do not agree. The reasons may be as follows:
  - Wrong profile selection
  - Line speed too high

In such a case the welding time will be automatically reduced to avoid a disturbance of the motion sequence.



- WELD1-DIR-ERR = HIGH: A negative master angle is assigned to the input WELD1-XIN. Remedy:
  - Invert master angle
  - Invert direction of rotation of the welding bar drive at the function block CCTRL.
- WELD1-ON = HIGH: Welding phase is active



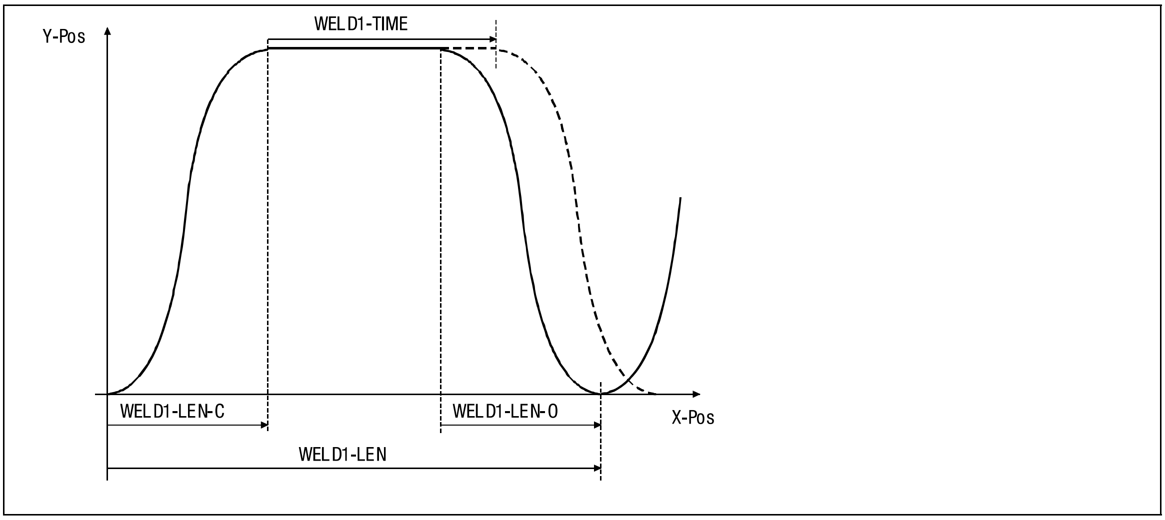
3.2.102.5 Weld1 mode: Distance (C1446 = 1)

The value at the input WELD1-TIME is interpreted as a **distance**.

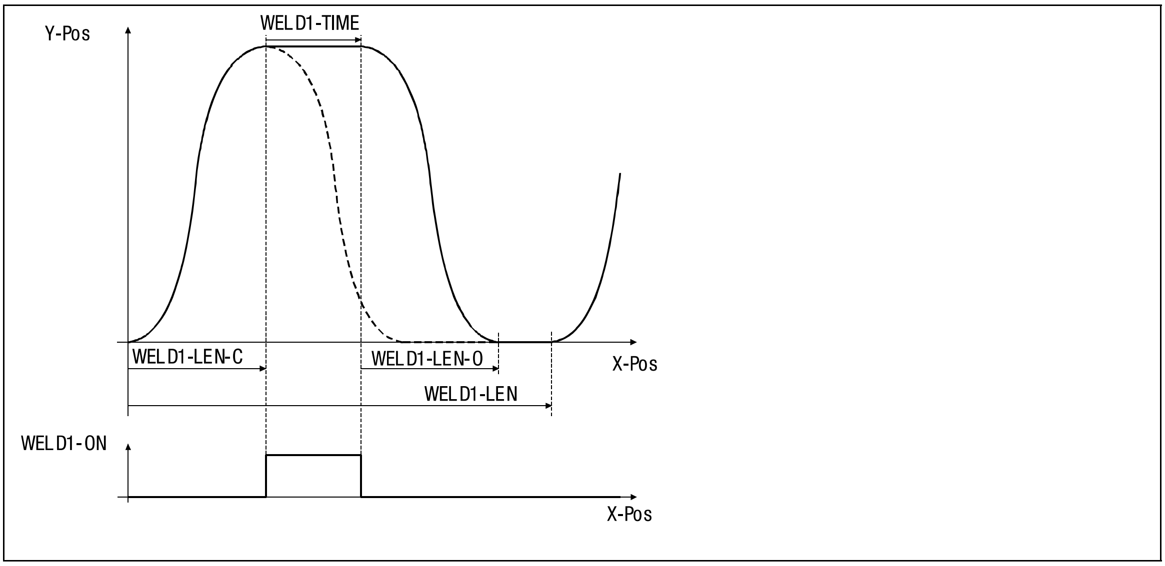
Output of status information

- WELD1-T-ERR = HIGH: The total length of the three sections WELD1-LEN-C (close), WELD1-TIME (weld) and WELD1-LEN-O (open) do not agree. The reasons may be as follows:
  - – Wrong profile selection
  - – Line speed too high

In this case the welding time is automatically reduced to avoid a disturbance of the motion sequence.



- WELD1-DIR-ERR = HIGH: A negative master angle is assigned to the input WELD1-XIN. Remedy:
  - – Invert master angle
  - – Invert direction of rotation of the welding bar drive at the function block CCTRL.
- WELD1-ON = HIGH: Welding phase is active



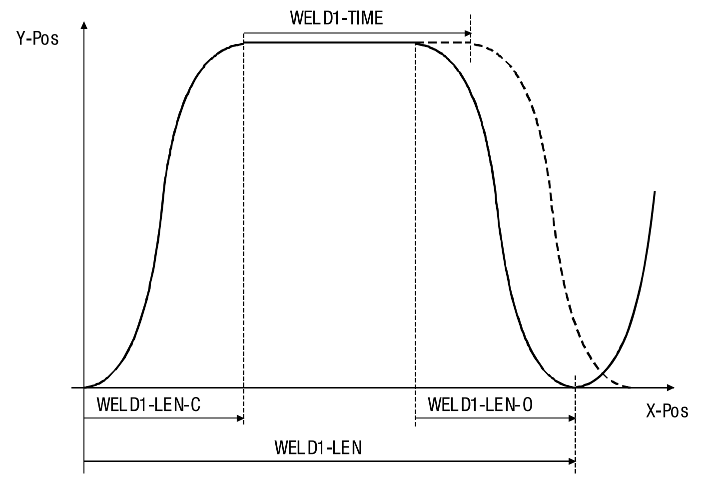
3.2.102.6 Weld1 mode: Distance with saving (C1446 = 2)

The value at the input WELD1-TIME is interpreted as a **distance**. WELD1-TIME is saved for the further cycle when phase 2 of the profile is started (see basics of welding bar control).

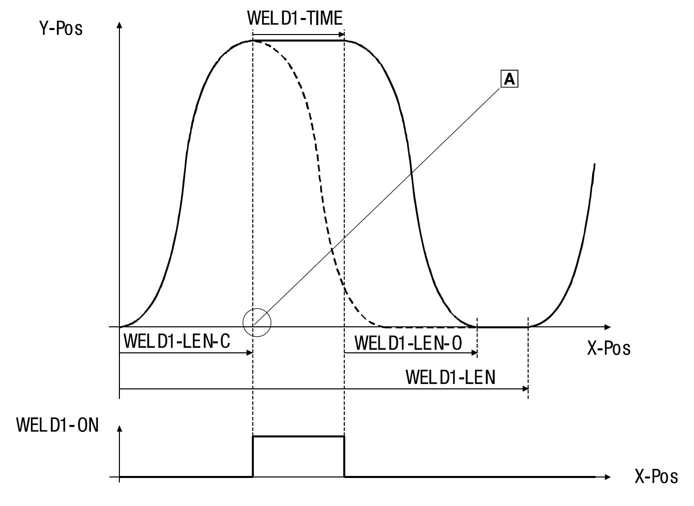
Output of status information

- WELD1-T-ERR = HIGH: The total length and the sum of times of the three sections WELD1-LEN-C (close), WELD1-TIME (weld) and WELD1-LEN-O (open) do not agree. The reasons may be as follows:
  - Wrong profile selection
  - Line speed too high

In this case the welding time is automatically reduced to avoid a disturbance of the motion sequence.



- WELD1-DIR-ERR = HIGH: A negative master angle is assigned to the input WELD1-XIN. Remedy:
  - Invert master angle
  - Invert direction of rotation of the welding bar drive at the function block CCTRL.
- WELD1-ON = HIGH: Welding phase is active



A WELD1-TIME is ”frozen” when phase 2 is started by setting C1446 = 2 (distance with saving).
The distance “WELD1-TIME” remains constant for the cycle.

3.2.103 Stretching, compression, offset in Y direction (YSET1)

Purpose

Evaluation of the setpoint position of the cam drive (stretching/compression/offset in Y direction).

Note!

If you do not use the function block YSET1, you must set C1313 = 0.

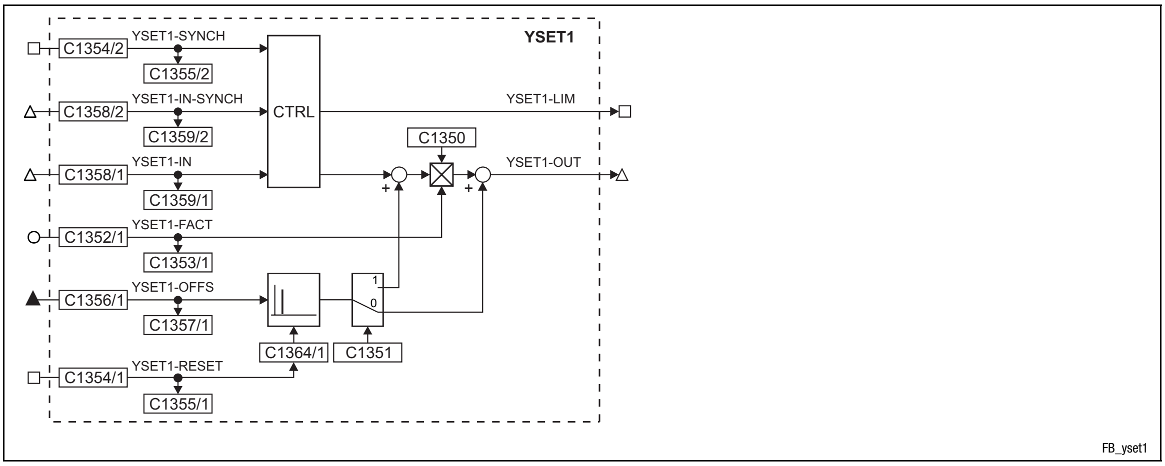


Fig. 3-264 Stretching, compression, offset in Y direction (YSET1)

Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
YSET1-IN	phd	1359/1	dec [inc]	1358/1	4	1000	Input in [rpm]
YSET1-IN-SYNCH	phd	1359/2	dec [inc]	1358/2	4	1000	Input in [rpm]
YSET1-FACT	a	1353/1	dec [abs]	1352/1	1	1000	Stretching/compression factor: ±100 % = no stretching/compression >100 % = stretching < 100% = compression
YSET1-OFFS	ph	1357/1	dec [inc]	1356/1	3	1000	Offset value
YSET1-RESET	d	1355/1	dec [inc]	1354/1	2	1000	Reset of the YSET1-OFFS input
YSET1-SYNCH	d	1355/2	dec [inc]	1354/2	2	1000	Clock pulse input for synchronous switching of the stretching/compression factor
YSET1-LIM	d	-	-	-		-	HIGH = Signal at YSET1-OUT is within the limits (Function is available as of software version 3.4)
YSET1-OUT	phd	-	-	-		-	Setpoint speed of the cam drive Signal is limited to ±29999 rpm No position loss when signal is limited

Function

- Stretching/compression
- Offset
- Reset of the offset
- Stretching/compression of the offset
- Direction reversal

3.2.103.1 Stretching/compression

YSET1-FACT	Stretching/compression	Direction reversal
+100 %	No	No
-100%	No	Yes, in Y position
>100 %	Stretching	No
<100 %	Compression	No
FIXED100%	No	No

Synchronised stretching/compression of drive motion

Synchronised stretching/compression of the drive motion is required for the following:

- If master value and cam drive must run absolutely synchronously and
- the factor must be changed during operation.

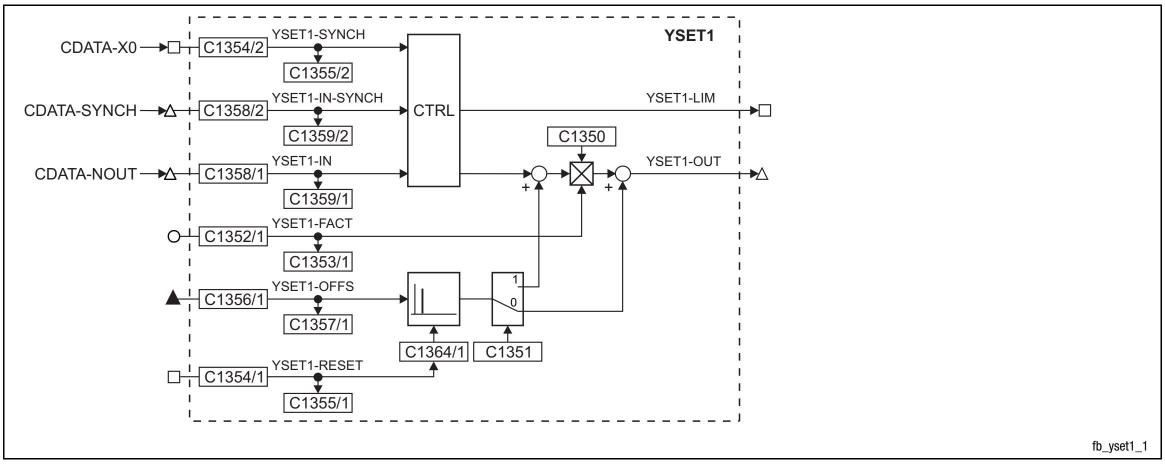
Note!

This function is only valid for the cam drive, not for the master drive!

This function should be used if more than 8 profiles are required to change the lift of the cam drive.

The lift can be changed online via stretching and compression.

Function block interconnection



Activate function

Activate function with C1313 = 1.

The changeover is carried out during zero crossing of the profile.

Note!

Stretching/compression in X direction can be carried out via the input CDATA-XFACT.

3.2.103.2 Offset

Use input YSET1-OFFS to shift the Y position by a constant value.

3.2.103.3 Reset of the offset

The function "OFFS-RESET mode" has the following effect on the output signal YSET1-OUT:

- C1364/1 = 0: (Lenze setting). Output YSET1-OUT is not affected by
  - signal at input YSET1-RESET,
  - signal at YSET1-OFFS, as long as YSET1-RESET = HIGH.
- C1364/1 = 1: When YSET1-RESET = HIGH, the offset is subtracted from the output signal at YSET1-OUT.

3.2.103.4 Stretching/compression of the offset

With C1351 the offset is automatically adapted to the profile zero according to the extension factor.

- C1351 = 0: no stretching/compression of the offset (Lenze setting)
- C1351 = 1: stretching/compression of the offset

3.2.103.5 Direction reversal

There are two possibilities to reverse the direction of rotation:

1. Via C1350
   - CW rotation: C1350 = 0
   - CCW rotation: C1350 = 1
2. Application of a stretching/compression factor
   - YSET1-FACT = –100 % (see also table in chapter 3.2.103.1)

4 Application examples

Contents

4.1 Replacement of a mechanical cam

Select the basic configuration C0005 = 10000 for this application example.

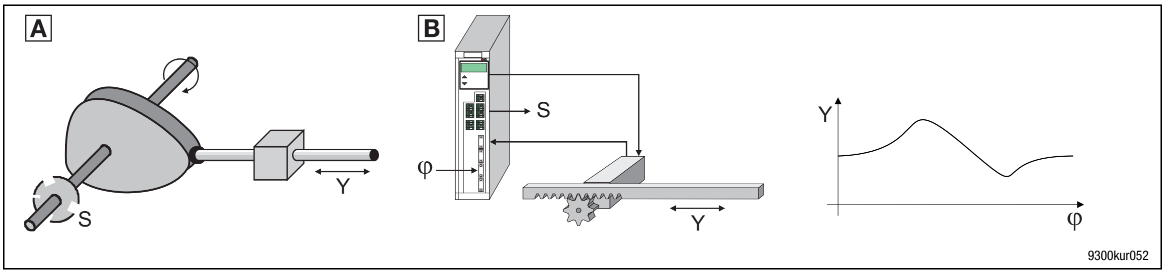


Fig. 4-1 Principle of the mechanical and electronic cam

A	Mechanical cam
B	Electronic cam
φ	Master angle
Y	Setpoint position
S	Camshaft controller

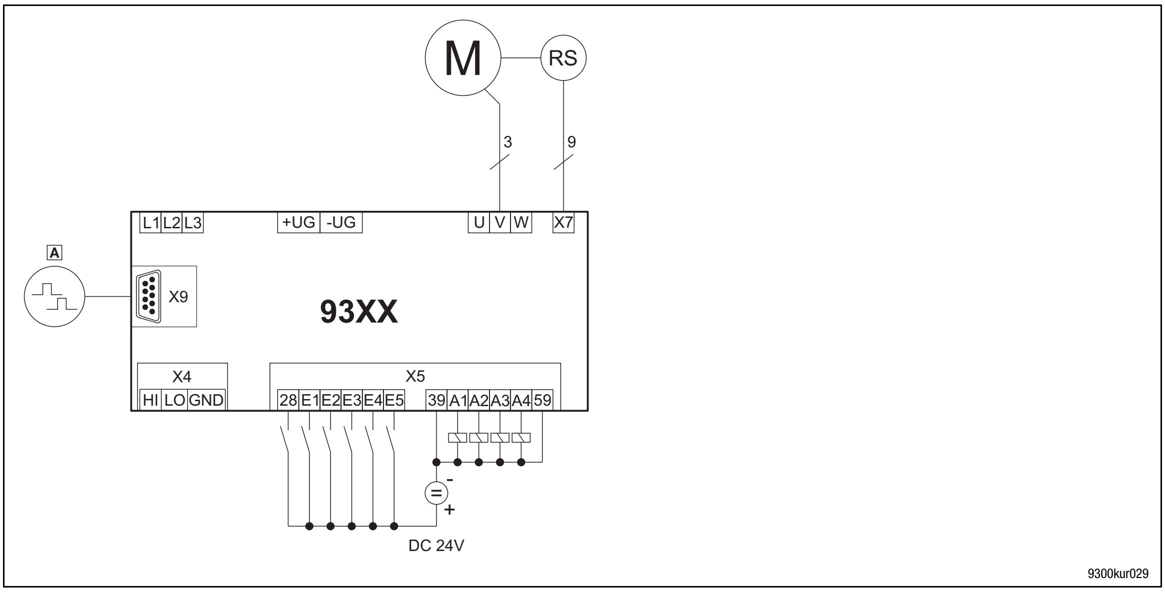


Fig. 4-2 Wiring principle for the controller

A	Master value encoder
RS	Resolver

Features

- Optimum adaptation of motion sequences to the process
- Easy changeover in the case of product changes
- Master value via incremental encoder

Digital signals

Terminal	Function
X5/28	Controller enable
X5/E1	Selection of event profile (C1420)
X5/E2	Profile selection (see table for terminal layout)
X5/E3	Profile selection (see table for terminal layout)
X5/E4	Profile selection (see table for terminal layout)
X5/E5	Error reset (TRIP reset) / profile acceptance
X5/A1	Error (TRIP)
X5/A2	Following error limit reached
X5/A3	Ready for operation (RDY)
X5/A4	Following error warning limit reached

Analog signals

Terminal	Function
Analog input 1: X6/1, X6/2	Not assigned
Analog input 2: X6/3, X6/4	Not assigned
Analog output 1: X6/62	Actual speed
Analog output 2: X6/63	Actual torque

Terminal layout for profile selection

Profile No.	0	1	2	3	4	5	6	7
X5/E2	0	1	0	1	0	1	0	1
X5/E3	0	0	1	1	0	0	1	1
X5/E4	0	0	0	0	1	1	1	1

Application-specific codes

Code	Function
C0425	Encoder constant of the master value
C1420	Selection of the event profile (X5/E1 = HIGH)
C1380/1	Hysteresis of following error evaluation
C1380/2	Hysteresis of following error warning
C0472/1	Stretching/compression of X axis (100% = no stretching/compression)
C0472/2	Influence of speed feedforward control
C0472/3	Influence of torque feedforward control
C0472/4	Reduction factor for following error warning (warning limit = C0472/4 x C1477/2)
C0472/9	Stretching/compression of Y axis (100% = no stretching/compression)
C0472/10	Torque limit value
C1476/1	Angle trimming in X direction
C1476/16	Touch-probe position in X direction
C1477/1	Angle trimming in Y direction
C1477/2	Following error limit (in s_units)

For the generation of profile data and its transmission to the controller please refer to the System Manual.

4.2 Welding bar

Select the basic configuration C0005 = 14000 for this application example.

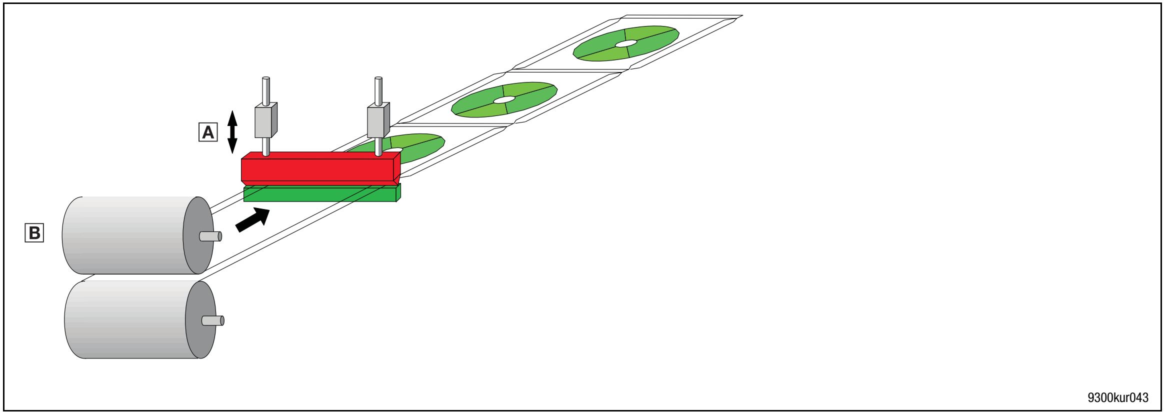


Fig. 4-3 Schematic diagram of a welding bar

- A Welding bar drive
- B Feed drive

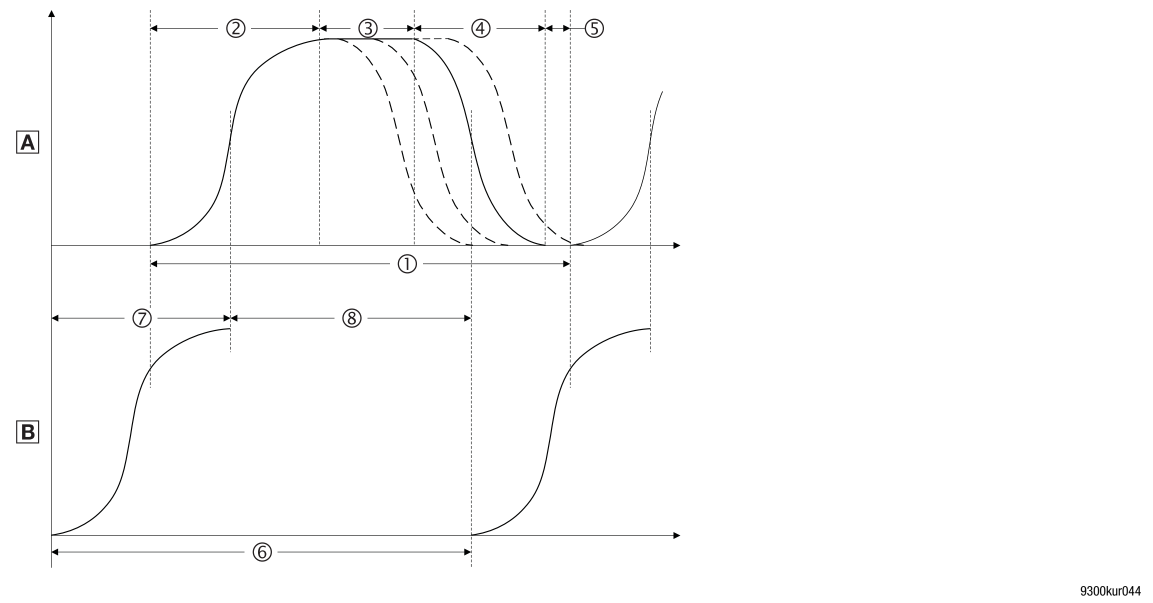


Fig. 4-4 Profiles (in principle)

- A Profile of welding bar drive
- B Profile of feed drive
- ① Machine cycle of welding bar drive
- ② Closing of welding bar (welding bar drive moves)
- ③ Welding time (welding bar drive is at standstill)
- ④ Opening of welding bar (welding bar drive moves)
- ⑤ Standstill phase (welding bar drive is at standstill)
- ⑥ Machine cycle of feed drive
- ⑦ Feed phase (feed drive moves)
- ⑧ Standstill phase (feed drive is at standstill)

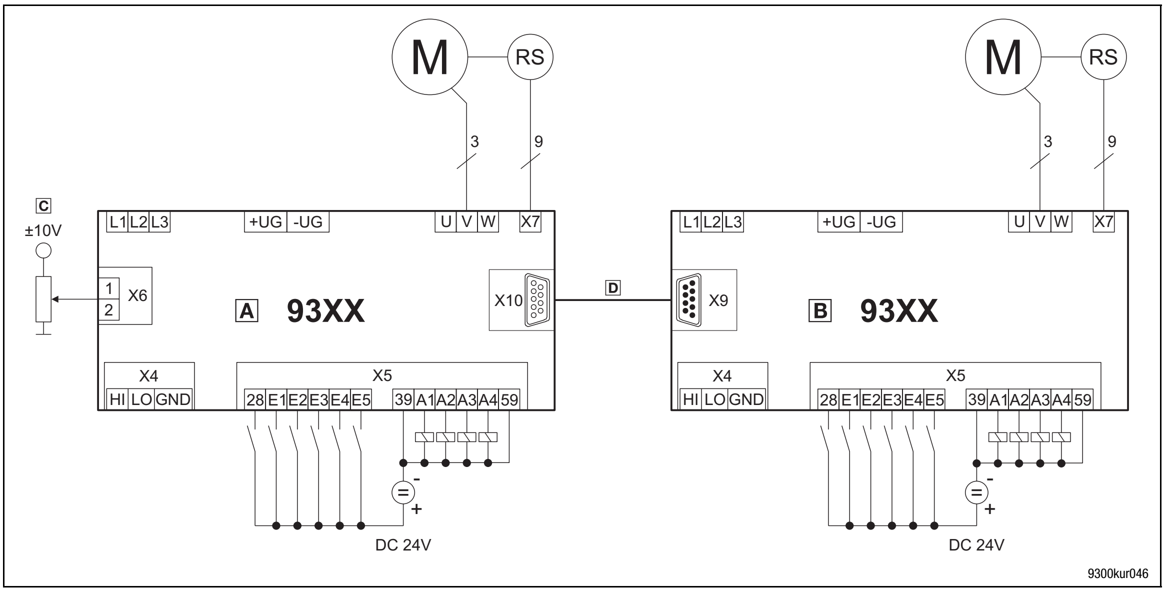


Fig. 4-5 Wiring principle for the controllers

A	Controller for welding bar drive
B	Controller for feed drive
C	Speed setpoint
D	Virtual master value
RS	Resolver

Features

- Speed-independent welding time
- Adjustable welding time
- Easy changeover in the event of material changes
- Material-specific feed
- Virtual master for coordination of feed and welding bar

Digital signals

Terminal	Function
X5/28	Controller enable
X5/E1	Selection of event profile (C1420)
X5/E2	Profile selection (see table for terminal layout)
X5/E3	Profile selection (see table for terminal layout)
X5/E4	Profile selection (see table for terminal layout)
X5/E5	Error reset (TRIP reset) / profile acceptance
X5/A1	Error (TRIP)
X5/A2	Following error limit reached
X5/A3	Ready for operation (RDY)
X5/A4	Welding time error

Analog signals

Terminal	Function
Analog input 1: X6/1, X6/2	Setpoint of the virtual master
Analog input 2: X6/3, X6/4	Not assigned
Analog output 1: X6/62	Actual speed
Analog output 2: X6/63	Actual torque

Digital frequency output X10: virtual master value

Terminal layout for profile selection

Profile No.	0	1	2	3	4	5	6	7
X5/E2	0	1	0	1	0	1	0	1
X5/E3	0	0	1	1	0	0	1	1
X5/E4	0	0	0	0	1	1	1	1

Application-specific codes

Code	Function
C1420	Selection of the event profile (X5/E1 = HIGH)
C1380/1	Hysteresis of following error evaluation
C1380/2	Hysteresis of following error warning
C0250	Activation of the master value reduction (C0250 = 1 => reduction value C0472/7 active)
C0472/1	Stretching/compression of X-axis (100% = no stretching/compression)
C0472/2	Influence of speed feedforward control
C0472/3	Influence of torque feedforward control
C0472/4	Reduction factor for following error warning (warning limit = C0472/4 x C1477/2)
C0472/7	Reduced master value
C0472/10	Torque limit value
C0474/1	Welding time (1 inc. = 1 ms)
C1476/1	Angle trimming in X direction
C1476/16	Touch probe position in X direction
C1477/2	Following error limit (in s_units)

4.3 Filling process

Select the basic configuration C0005 = 13000 or C0005 = 13300 for this application example.

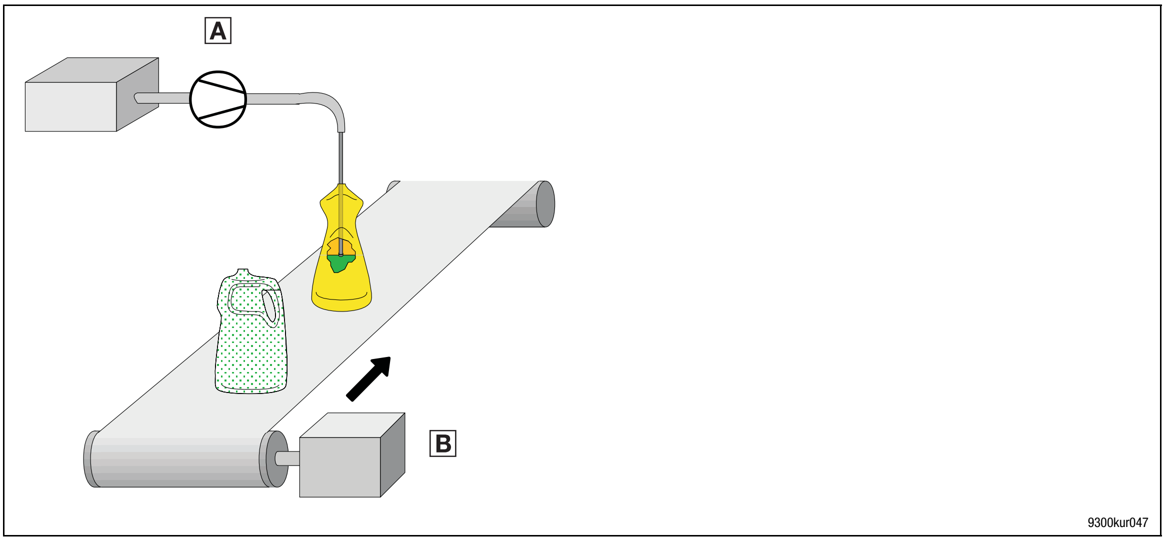


Fig. 4-6 Schematic diagram of a filling device

- A Pump drive (cam drive)
- B Feed drive

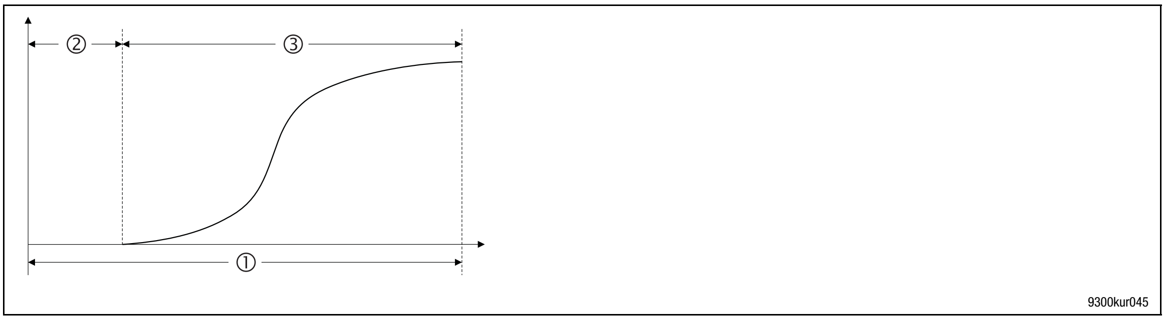


Fig. 4-7 Profile of the pump drive (in principle)

① Machine cycle of pump drive
② Pump drive: standstill phase (drive is at standstill)
Feed drive: feed phase (drive moves)
③ Filling process (pump drive moves)

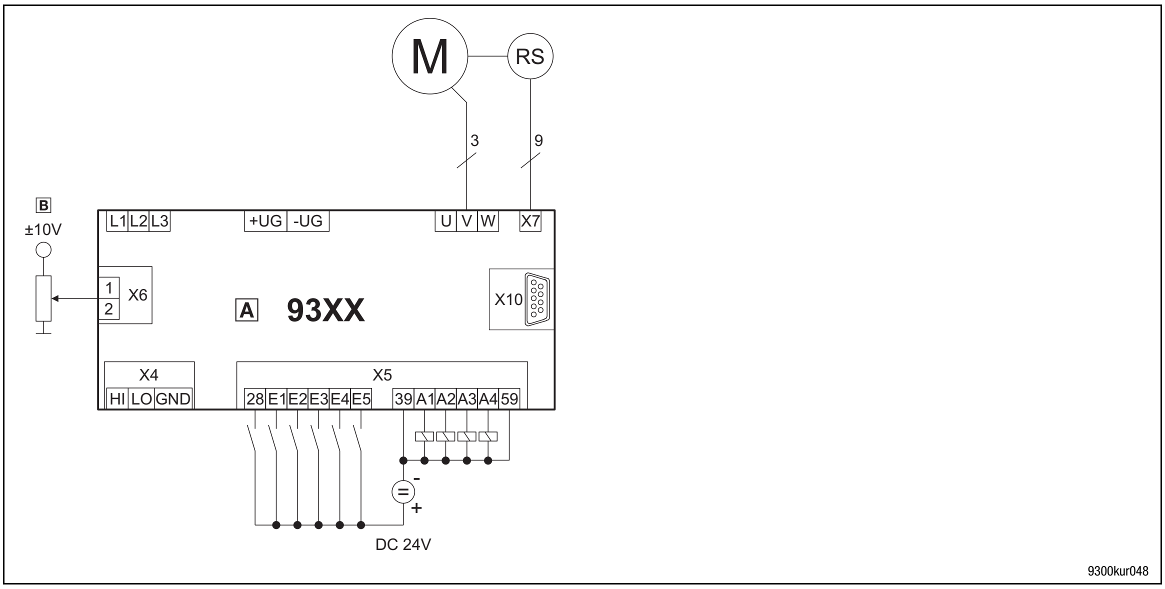


Fig. 4-8 Wiring principle for the controller

A	Controller for pump drive
B	Speed setpoint
RS	Resolver

Features

- Product-specific filling with minimum bubble generation
- Virtual master value
- Product changes possible at every clock pulse
- Option: Switching point for handshake with conveyor belt

Digital signals (C0005 = 13000)

Terminal	Function
X5/28	Controller enable
X5/E1	Selection of event profile (C1420)
X5/E2	Profile selection (see table for terminal layout)
X5/E3	Profile selection (see table for terminal layout)
X5/E4	Profile selection (see table for terminal layout)
X5/E5	Error reset (TRIP reset) / profile acceptance
X5/A1	Error (TRIP)
X5/A2	Following error limit reached
X5/A3	Ready for operation (RDY)
X5/A4	Following error warning limit reached

Analog signals (C0005 = 13000)

Terminal	Function
Analog input 1: X6/1, X6/2	Setpoint of virtual master
Analog input 2: X6/3, X6/4	Not assigned
Analog output 1: X6/62	Actual speed
Analog output 2: X6/63	Actual torque

Digital frequency output X10: virtual master value

Terminal layout for profile selection (C0005 = 13000)

Profile No.	0	1	2	3	4	5	6	7
X5/E2	0	1	0	1	0	1	0	1
X5/E3	0	0	1	1	0	0	1	1
X5/E4	0	0	0	0	1	1	1	1

Application-specific codes (C0005 = 13000)

Code	Function
C1420	Selection of the event profile (X5/E1 = HIGH)
C1380/1	Hysteresis of following error evaluation
C1380/2	Hysteresis of following error warning
C0250	Activation of the master value reduction (C0250 = 1 => reduction value C0472/7 active)
C0472/1	Stretching/compression of X axis (100% = no stretching/compression)
C0472/2	Influence of speed feedforward control
C0472/3	Influence of torque feedforward control
C0472/4	Reduction factor for following error warning (warning limit = C0472/4 x C1477/2)
C0472/7	Reduced master value
C0472/9	Stretching/compression of Y axis (100% = no stretching/compression)
C0472/10	Torque limit value
C1476/1	Angle trimming in X direction
C1476/16	Touch probe position in X direction
C1477/1	Angle trimming in Y direction
C1477/2	Following error limit (in s_units)

4.4 Mark-controlled cam profile start

Select the basic configuration C0005 = 10800 for this application example.

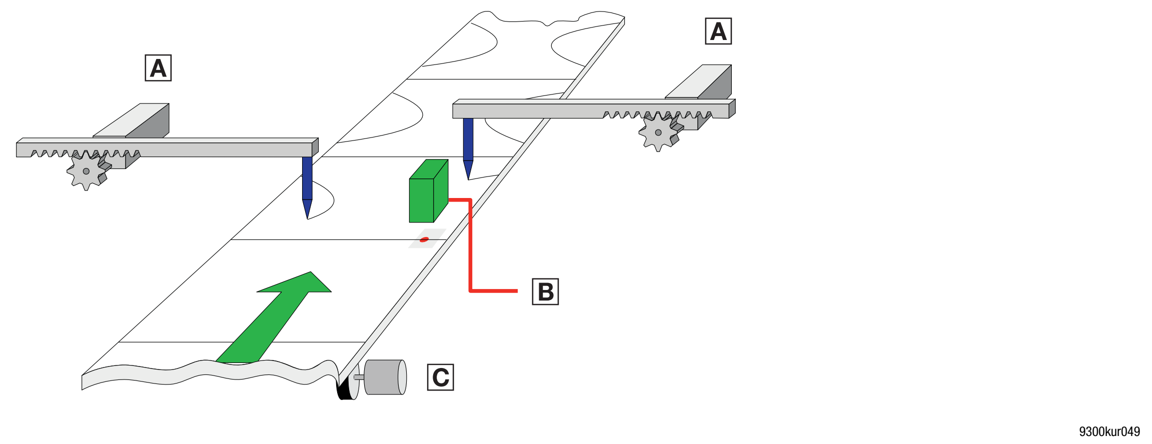


Fig. 4-9 Schematic diagram of a cutting drive

- A Cutting drive
- B Mark sensor
- C Master value encoder

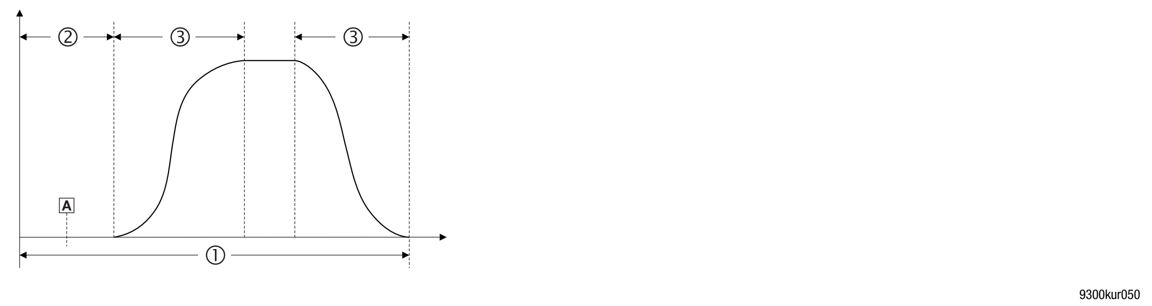


Fig. 4-10 Profile of the cutting drive (in principle)

- ① Machine cycle of cutting drive
- ② Standstill phase (cutting drive is at standstill)
- ③ Machining phase (cutting drive moves)
- A Position of mark sensor

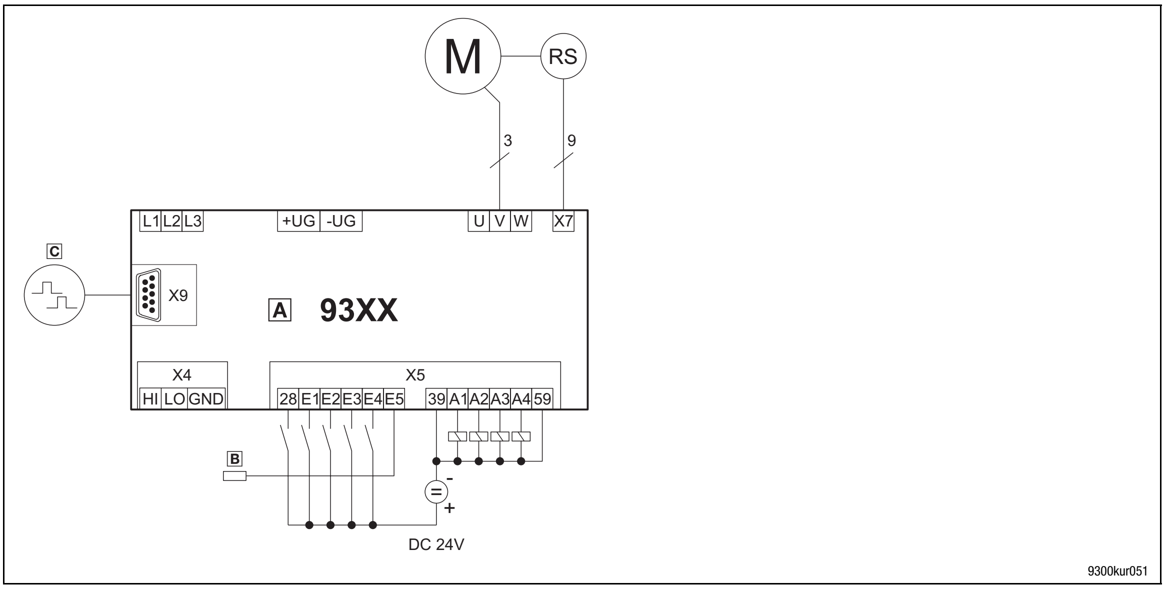


Fig. 4-11 Wiring principle for the controller

A	Controller for cutting drive
B	Mark sensor
C	Master value encoder
RS	Resolver

Features

- Mark-controlled start for the correct position for the cut
- Offset selection for the fine adjustment of the position
- Easy changeover in the case of format changes

Digital signals

Terminal	Function
X5/28	Controller enable
X5/E1	Selection of event profile (C1420)
X5/E2	Profile selection (see table for terminal layout)
X5/E3	Profile selection (see table for terminal layout)
X5/E4	Error reset (TRIP reset) / profile acceptance
X5/E5	Mark signal touch probe X direction
X5/A1	Error (TRIP)
X5/A2	Following error limit reached
X5/A3	Ready for operation (RDY)
X5/A4	Following error warning limit reached

Analog signals

Terminal	Function
Analog input 1: X6/1, X6/2	Not assigned
Analog input 2: X6/3, X6/4	Not assigned
Analog output 1: X6/62	Actual speed
Analog output 2: X6/63	Actual torque

Terminal layout for profile selection

Profile no.	0	1	2	3	4	5	6	7
X5/E2	0	1	0	1	Not selectable			
X5/E3	0	0	1	1				

Application-specific codes

Code	Function
C0425	Encoder constant of the master value
C1420	Selection of the event profile (X5/E1 = HIGH)
C1380/1	Hysteresis of following error evaluation
C1380/2	Hysteresis of following error warning
C0472/1	Stretching/compression of X axis (100% = no stretching/compression)
C0472/2	Influence of speed feedforward control
C0472/3	Influence of torque feedforward control
C0472/4	Reduction factor for following error warning (warning limit = C0472/4 x C1477/2)
C0472/9	Stretching/compression of Y axis (100% = no stretching/compression)
C0472/10	Torque limit value
C1476/1	Angle trimming in X direction
C1476/16	Touch probe position in X direction
C1477/1	Angle trimming in Y direction
C1477/2	Following error limit (in s_units)

5 Appendix

Contents

5.1 Glossary

5.1.1 Terminology and abbreviations used

🕮	Cross-reference to a chapter with the corresponding page number
AC	AC current or AC voltage
AIF	**Automation interface** AIF interface, interface for communication modules
CE	Communauté Européene
Controller	Any frequency inverter, servo inverter, or DC speed controller
Cxxxx/y	Subcode y of code Cxxxx (e. g. C0404/2 = subcode 2 of code C0404)
DC	DC current or DC voltage
DIN	Deutsches Institut für Normung(German Institute for Standardization)
Drive	Lenze controller in combination with a geared motor, a three-phase AC motor, and other Lenze drive components
EMC	Electromagnetic compatibility
EN	European standard
f_r [Hz]	Rated motor frequency
I_a [A]	Current output current
IEC	International Electrotechnical Commission
I_{mains} [A]	Mains current
I_{max} [A]	Maximum output current
IP	International Protection Code
IPC	Industrial PC
I_{PE} [mA]	Discharge current
I_r [A]	Rated output current
L [mH]	Inductance
M_r [Nm]	Rated motor torque
NEMA	National Electrical Manufacturers Association
P_{DC} [kW]	Power that can be additionally taken from the DC bus if a power-adapted motor is used for operation
PLC	Programmable control system
P_{loss} [W]	Power loss of inverter
P_r [kW]	Rated motor power
R [Ω]	Resistance

S_N [kVA]	Controller output power
U_{DC} [V]	DC supply voltage
UL	Underwriters Laboratories
U_M [V]	Output voltage
U_{mains} [V]	Mains voltage
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)
Xk/y	Terminal y on terminal strip Xk (e. g. X5/28 = terminal 28 on terminal strip X5)

5.2 Index

© 06/2011

Lenze Automation GmbH
Hans-Lenze-Str. 1
D-31855 Aerzen
Germany

☎ +49 (0)51 54 / 82-0

+49 (0)51 54 / 82 - 28 00

Lenze@Lenze.de

www.Lenze.com

Service

Lenze Service GmbH
Breslauer Straße 3
D-32699 Extertal
Germany

☎ 00 80 00 / 24 4 68 77 (24 h helpline)

+49 (0)51 54 / 82-11 12

Service@Lenze.de

EDSVS9332K-EXT ▪ 13375727 ▪ EN ▪ 4.0 ▪ TD23

10 9 8 7 6 5 4 3 2 1