EDSVS9332P-EXT
13375728

Global Drive

System Manual

(Extension)

9300 *0.37 ... 75 kW*

EVS9321xP ... EVS9332xP

Servo position controllers

Lenze

Contents

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 addresses to all persons who dimension, install, commission, and set 9300 servo position controllers.

Together with the System Manual, document no. EDSVS9332P, and the catalog, it forms the basis for project planning for the manufacturer of plants and machinery.

Contents

The System Manual (supplement) completes the System Manual, document no. EDSVS9332P:

- The features and functions are described in detail.
- It describes additional possible applications in detail.
- The parameterisation for typical applications is pointed up by the use of examples.
- In case of doubt the Mounting Instructions supplied with the 9300 servo position controller are always valid.

Contents of System Manual	Contents of System Manual (supplement)
1 Preface	1 Preface
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4 Mounting the standard device	-
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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!

Documents and software updates for other Lenze products are available on the Internet in the ”Services & Downloads” area under

http://www.Lenze.com

1.1.2 Document history

What is new / what has changed?

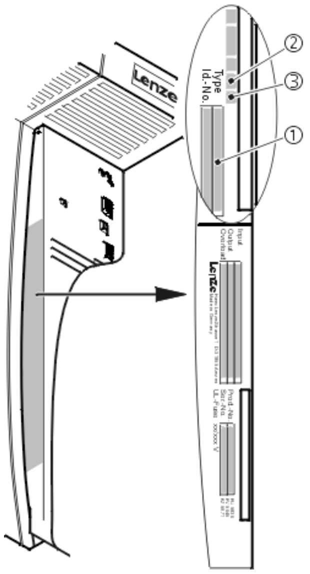
Material number	Version			Description
13375728	2.0	03/2012	TD23	Error corrections
13337389	1.0	03/2010	TD23	Extended by functions for software version 8.0 Error correction Division of the System Manual into 2 parts (EDSVS9332P and EDSVS9332P-EXT)

1.1.3 Products to which the System Manual applies

This documentation is valid for 9300 servo position controllers from nameplate data:

① ② ③ **Nameplate**

EVS 93xx - x P Vxx 1x 8x



9300vec112

Product series

EVS = servo controller

Type no. / rated power

	400V	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 = panel-mounted unit in ”cold plate” technology

Version

P = servo position controller

Variant

- standard
V003 = in ”cold plate” technology
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), a program for the PC, Lenze offers an easy-to-understand, clearly-laid-out and convenient tool for configuring your application-specific drive task.

Function block library

GDC provides a clear overview of the function blocks (FB) available in a library. GDC also lists the complete assignment of a function block.

Signal configuration

Signals can be configured in a single dialog box. This 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 configuration.

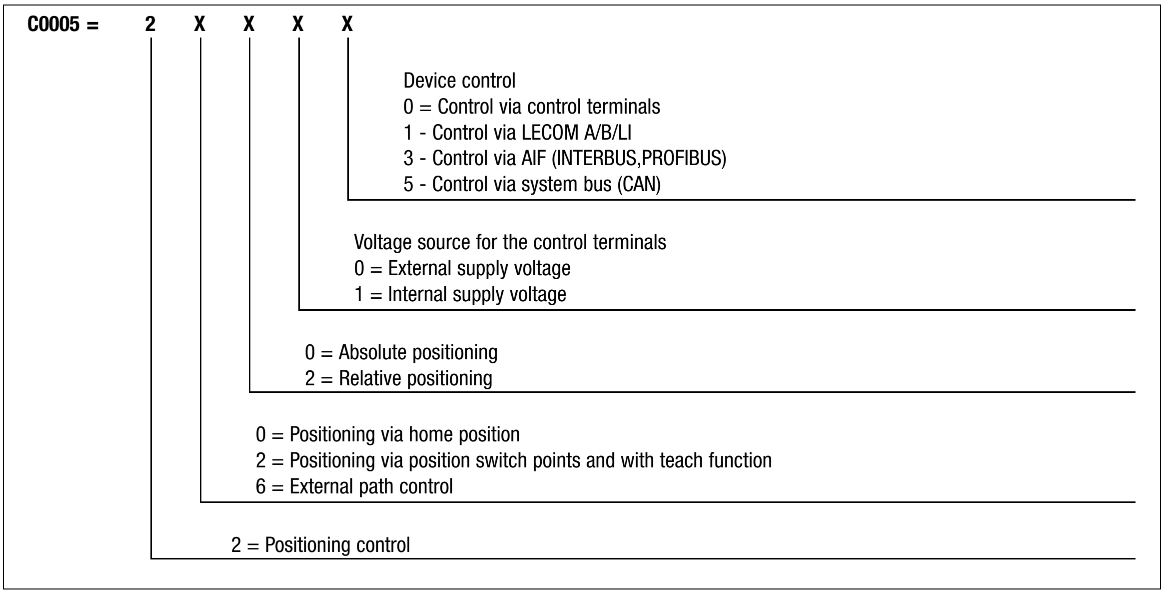
Adapt the function assignment to the wiring.

The internal signal processing is adapted to the drive task by selection of a predefined basic configuration in C0005. Lenze setting: C0005 = 20000 (standard absolute positioning).

- Application examples of basic configurations can be found in the chapter ”Application examples”.
- Before you can load a basic configuration via C0005, the controller must be inhibited.

The selection numbers in C0005 have the following meaning:

C0005 = **1 0 0 0** = Speed control



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 Speed control C0005 = 1XXX (1000)

For standard applications, with the default settings you can commission the drive immediately. In order to adapt it to specific requirements, observe the notes in the following sections.

2.2.2.1 Setpoint selection

Main setpoint

Via the setpoint n_{set} (display in C0046) the speed is defined, relating to the value n_{max} (C0011) which can be set. The setpoint is specified in a bipolar analog manner via input X6/1,2. By the settings carried out, the drive runs with the speed set in C0011 if a master voltage of 10 V is selected. If you want to actuate the drive at master voltages with low voltages you can adapt the system via codes C0026/1 (offset) and C0027/1 (gain).
Alternatively you can also specify the setpoints via

- Keyboard,
- Integrated system bus (CAN),
- Automation interface (LECOM, InterBus, Profibus DP, RS 232, RS 485, optical fibre).

Which input is active as setpoint source depends on the configuration selected in C0005, or the setpoint source can be set via configuration code C0780 in the NSET function block.

Current master value

If the analog main setpoint is to be specified as current master value via X6/1,2, you can select the current setting range with code C0034:

- For -20 mA … +20 mA: C0034 = 2
- For 4 … 20 mA: C0034 = 1 (can only be used in unipolar mode)

If the range 4…20 mA has been selected, the error message Sd5 appears when the value is lower than 2 mA.

The signal conditioning for this is effected in function block AIN1.

The change-over from the voltage master value to the current master value (current load 242R) has to be effected via the jumper position at X3:

- Voltage master value/potentiometer:
  – Jumper X3 in the lower position (default setting)
- Current master value:
  – Jumper X3 in the upper position

JOG setpoints

If you require specific fixed settings as main setpoint, you can call parameterisable setpoints from the memory via the JOG inputs. JOG setpoints replace the main setpoint. The JOG setpoints are entered in a relative manner in % of n_{max}. If you set input E3 to HIGH signal, the main setpoint is switched off and at the same time the first JOG setpoint is activated. A total of 15 JOG setpoints can be selected.

Inverting the main setpoint

Via terminals E1 and E2 the main setpoint can be inverted (i.e. the sign of the input value is changed). The following applies:

E1	E2	Main setpoint
0	0	Drive executes QSP (quick stop)
1	0	Main setpoint not inverted
0	1	Main setpoint inverted
1	1	Drive maintains its previous state

Acceleration and deceleration times for the main setpoint path

The main setpoint is controlled via a ramp function generator. Like this, input steps can be converted to a ramp.

The acceleration time and deceleration time refer to a change in speed from 0 to n_{max} (0% to 100%). The calculation of the times T_{ir} (C0012) and T_{if} (C0013) to be set is described in the NSET function block description.

Additional acceleration and deceleration times

For the ramp function generator of the main setpoint (NSET-N/JOG setpoint) you can call additional acceleration and deceleration times from the memory via the NSET-TI*x inputs, e.g. to change over the acceleration speed of the drive from a specific speed. For this, these inputs have to be assigned to a signal source. A maximum of 15 additional acceleration and deceleration times can be programmed.

S-shaped ramp function generator characteristic

For the ramp function generator of the main setpoint you can select two different characteristics via C0134:

- Linear characteristic for all acceleration processes requiring a constant acceleration
- S-shaped characteristic for all acceleration processes requiring a jerk-free acceleration

Code	Parameter	Meaning
C0134	0 1	Linear characteristic S-shaped characteristic
C0182	0.01 … 50.0 s	T_i-time for the S-shaped ramp function generator
C0012	0.00 … 999.9 s	T_{ir}-time for the acceleration
C0013	0.00 … 999.9 s	T_{if}-time for the deceleration

Additional setpoint

Via input X6/3,4 (or also another signal source) an analog additional setpoint (bipolar) can be connected. The additional setpoint (display in C0049) internally first goes to the NSET function block via an analog switch. Here the additional setpoint first is lead across a facility for inversion. This facility for inversion is deactivated. Furthermore there is a ramp function generator (acceleration and deceleration times via C0220/C0221) before the additional setpoint is linked with the main setpoint in the arithmetic block. The additional setpoint for instance can be used as a correcting signal for grinding machines (for controlling a constant circumferential speed when the grinding wheel diameter is decreased).

If you want to use the additional setpoint, set code C0190 to the desired arithmetic link. According to the default setting, code C0190 is parameterised to 0. Thus the additional setpoint is switched off.

Selection of direction of rotation

The selection of direction of rotation results from the sign of the speed setpoint at the input MCTRL-N-SET of the MCTRL function block.
In turn, the sign of this speed setpoint results from

- the sign of the main and additional setpoint,
- the level position at terminals E1 and E2,
- the selected link of the main and additional setpoint via the arithmetic block in the NSET function block

Limitation of the speed setpoint

The speed setpoint is always limited to 100% n_{max} (C0011) in the MCTRL function block. This means that the maximum speed is always specified to the greatest speed possible in C0011.

Example:

With this configuration a speed of 4500 rpm is to be travelled. The speed is to be corrected in the range from 0 to +10% using the additional setpoint. At inputs X6/1,2 and X6/3,4 a master voltage of 0 to +10 V is provided.

The following parameter setting results from this:

- C0011 = 5000 rpm, C0190 = 1 (addition)
- C0027/1 = 90%
- C0027/2 = 10%

Code C0909 presents another possibility of influencing the speed limit. Here the direction of rotation can be specified:

- C0909 = 0 → clockwise and counter-clockwise rotating direction permitted
- C0909 = 1 → only clockwise rotating direction permitted
- C0909 = 2 → only counter-clockwise rotating direction permitted

For systems that only permit one rotating direction this serves to prevent the drive from rotating backwards which would be caused by the setpoint.

Additional torque setpoint

For some applications it may be required to apply an additional torque setpoint.

Example: An acceleration connection for winding and positioning applications:

For this purpose, the input MCTRL-M-ADD is provided. This input is not active by default (is on FIXED0%). To use this input, an analog signal source has to be assigned to it.

Torque limitation

The torque can be limited in the range from 0 to +100% via code C0472/3.

Every other signal source can be assigned as well.

Actual speed value feedback

In this configuration all specified actual value encoders can be used. The corresponding actual value encoder can be selected via code C0025. An adjustment is not required.

Quick stop (QSP)

When the quick stop function is activated, the drive runs to speed 0 via the ramp set in C0105 and executes a holding torque with a drift-free standstill. The torque limitation and the additional torque setpoint have no effect. This means that the drive outputs the maximum possible torque (observe settings of motor data). When the QSP request is cancelled, the drive synchronises to the current speed.

Controller inhibit (CINH)

By setting controller inhibit the drive becomes torqueless, the machine coasts. When the controller inhibit request is cancelled, the drive synchronises to the current speed.

Shutting down the controller via TRIP (TRIP-SET)

With LOW signal at terminal X5/E4, the controller can be shut down via the monitoring function. This input mainly serves to evaluate external binary encoders.

The response to this input signal can be programmed.

Resetting a fault (TRIP-RESET)

With a LOW-HIGH edge at terminal X5/E5 a pending TRIP can be reset if the cause of the fault has been eliminated.

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.

Example: C0005 = 1005

This configuration corresponds to a speed control with control via system bus (CAN).

If more inputs of the function blocks are to be controlled via an interface, proceed as follows:

- Assign the function block inputs to be controlled to ”control objects” depending on the interface used (see System Manual):
  - Free control codes
    in case of control via LECOM A/B/LI (RS232, RS485 or optical fibre interface) or operating module.
  - AIF objects
    in case of control using InterBus S or Profibus DP.
  - CAN objects
    in case of control using system bus.
- Then the inputs can be controlled using these codes or input objects by accessing them via the interface.

Example for a distribution of the control on terminals and RS232:

The main speed setpoint in the configuration C0005=1000 is to be controlled via LECOM A/B/LI. All other inputs remain on terminal control.

1. Select C0780 via LECOM:
   - C0780 is the configuration code for the main setpoint NSET-N in the function block ”Speed setpoint conditioning” (NSET).
2. Assign a free control code via a selection number.
   - e.g. 19515 (control code C0141)

The main speed setpoint is now controlled by C0141.

2.4 Change of the terminal assignment

(see also chapter 3.1 ”Working with function blocks”)

If the configuration is changed via C0005, the assignment of all inputs and outputs is overwritten with the corresponding basic assignment. If necessary, the function assignment must be adapted to the wiring.

Tip!

Use the menu ”Terminal I/O” for the keypad 9371BB or the menu ”Terminal I/O” for Global Drive Control or LEMOC2.

Stop!

If you reassign an input, the signal source that has been assigned up to know will **not** be overwritten! Those active connections that are not required must be removed (see chapter 3.1.3).

2.4.1 Freely assignable digital inputs

Five freely assignable digital inputs are available (X5/E1 … X5/E5). You can define a polarity for each input which serves to determine the input to be HIGH active or LOW active.

Change assignment:

Tip!

Use the submenu ”DIGIN” for the keypad 9371BB or the submenu ”Digital inputs” for Global Drive Control or LEMOC2.

Example:
Menu ”Terminal I/O; DIGIN” (terminal I/O; digital inputs)

Here are the most important aims for digital inputs

Valid for the basic configuration C0005 = 1000.

Code			controlled by		Note
CFG	Subcode	Signal name	Signal (interface)	Selection list 2	
C0885	000	R/L/Q-R	DIGIN1 (Term. X5/E1)	0051	HIGH = do not invert main setpoint (CW rotation)
C0886	000	R/L/Q-L	DIGIN2 (Term. X5/E2)	0052	HIGH = Invert main setpoint (CCW rotation)
C0787	001	NSET-JOG*1	DIGIN3 (Term. X5/E3)	0053	HIGH = Main setpoint is substituted by the fixed speed from C0039/x The signals are binary coded.
	002	NSET-JOG*2	FIXED0 -	1000	
	003	NSET-JOG*4	FIXED0 -	1000	
	004	NSET-JOG*8	FIXED0 -	1000	
C0788	001	NSET-TI*1	FIXED0 -	1000	Additional acceleration and deceleration times from C0101/x and C0103/x The signals are binary coded.
	002	NSET-TI*2	FIXED0 -	1000	
	003	NSET-TI*4	FIXED0 -	1000	
	004	NSET-TI*8	FIXED0 -	1000	
C0880	001	DCTRL-PAR*1	FIXED0 -	1000	Parameter set selection: The signals are binary coded.
	002	DCTRL-PAR*2	FIXED0 -	1000	
C0881	000	DCTRL-PAR-LOAD	FIXED0 -	1000	Signal LOW-HIGH loads selected parameter set with DCTRL-PAR*x
C0871	000	DCTRL-TRIP-SET	DIGIN4 (Term. X5/E4)	0054	LOW = Controller sets TRIP (EEr)
C0876	-	DCTRL-TRIP-RES	DIGIN5 (Term. X5/E5)	0055	Signal LOW-HIGH = Resets active trip
C0920	000	REF-ON	FIXED0 -	1000	HIGH = Start homing
C0921	000	REF-MARK	FIXED0 -	1000	LOW-HIGH edge = Stop homing

1. Select the input of the function blocks which is to be assigned to a new source under the configuration code CFG in the code level.
   – Example:
   C0787/2 (CFG/subcode) determines the source for the input ”NSET-JOG*2” (signal name) in the function block ”Speed setpoint conditioning” (NSET).
2. Change to the parameter level with PRG. Select the source (signal) from the indicated list. Ask yourself: Where does the signal for controlling this input is to come from?
   – Example:
   ”NSET-JOG*2” is to be controlled by terminal X5/E5 (interface).
   – For this, select DIGIN5 (signal) and confirm with SHIFT + PRG.
3. Change to the code level with 2 * .
4. Determine the polarity of the input terminals X5/E1 to X5/E5 (HIGH active or LOW active) under code C0114 and subcode.
   – In the code level the terminal is selected via subcode.
   – Change to the parameter level using PRG and select the polarity.
   – Change to the code level by 2 * PRG.
5. Repeat steps 1. to 4. until all inputs required are assigned.
6. Remove undesired connections (see chapter 3.1.3). The connection so far of the terminal X5/E5 is not cancelled automatically. If the connection is to be cancelled:
   – Select C0876 in the code level (previous target of terminal X5/E5)
   – Change to the parameter level using PRG.
   – Select FIXED0 (signal) and acknowledge with SHIFT+PRG.

2.4.2 Freely assignable digital outputs

Four freely assignable digital outputs are available (X5/A1 … X5/A4). You can define a polarity for each input which serves to determine the input to be HIGH active or LOW active.

The most important codes can be found in the submenu: DIGOUT (digital outputs).

Change assignment:

1. Select the output which is to be assigned to another function via the subcode under C0117.
2. Change to the parameter level with PRG. Select the signal from the indicated list, which is to be output via the selected output terminal. Change to the code level with PRG.
3. Determine the polarity (HIGH active or LOW active) via the subcode of the output under C0118.
4. Repeat step 1. to 3., until all outputs desired are assigned.

2.4.3 Freely assignable analog inputs

The most important codes can be found in the submenu: AIN1 X6.1/2 or AIN2 X6.3/4 (analog input 1 (X6.1/2) or analog input 2 (X6.3/4))

Change assignment:

1. Select the input of the function block to be assigned to a new source in the code level.
   - Example
     Determine the source for the input ”Main setpoint” (NSET-N) in the function block ”Speed setpoint conditioning” (NSET) under C0780.
2. Change to the parameter level with PRG. Select the signal from the indicated list, which is to be used for the selected input.
3. Repeat steps 1. and 2. until all inputs required are assigned.
4. Remove unwanted links (see Chapter 3.1.3).

2.4.4 Freely assignable monitor outputs

Use the monitor outputs X6/62 and X6/63 to output internal signals as voltage signals.

Under C0108 and C0109 the outputs can be adapted to e.g. a measuring device or a slave drive.

The most important codes can be found in the submenu: AOUT1 X6.62 or AIN2 X6.63 (analog output 1 (X6.62) or analog output 1 (X6.63))

Change assignment:

1. Select the output to be assigned to another signal (source) (e.g. C0431 for output X6/62) in the code level.
2. Change to the parameter level with PRG. Select the signal from the indicated list which is to be output via the monitor output.
3. If necessary, adjust an offset in the hardware under C0109
4. If necessary, the signal gain can be adapted to the hardware under C0108.
5. Repeat steps 1. to 4. to assign the second output.

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 has a certain number of inputs and outputs, which can be interlinked. Corresponding to their respective functions, only particular signal types occur 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 bit
- 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 with each other. Thus, an analog output signal of one function block can only be connected to the analog output of the other function block. If two different signal types are connected, the connection will be rejected.

3.1.2 Elements of a function block

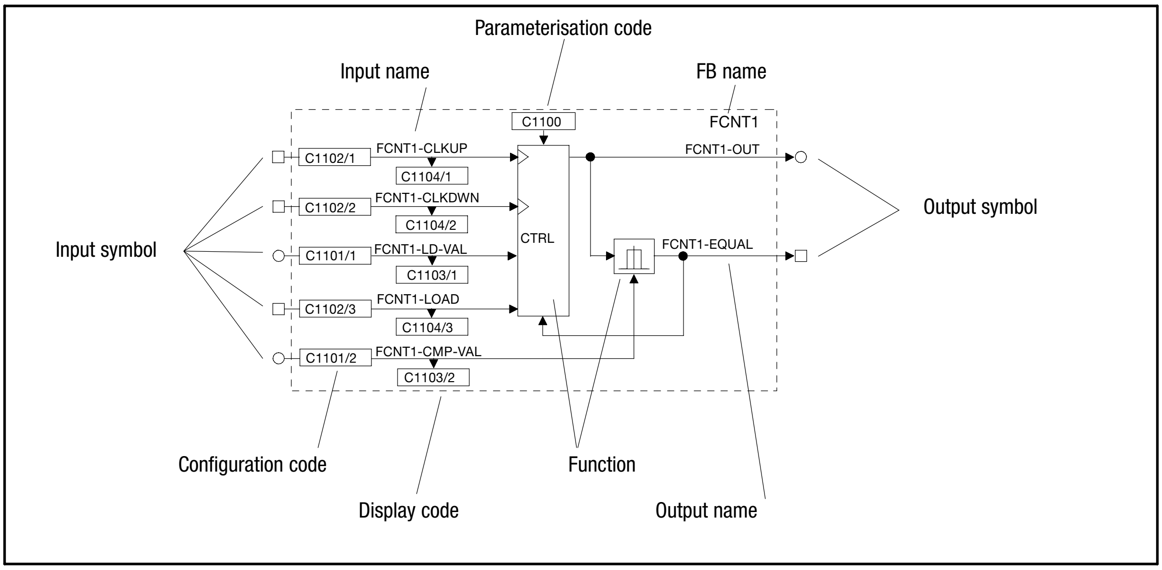


Fig. 3-1 Structure of a function block (FB) using the example of FCNT1

FB name

Clearly identifies the FB. The FB name is followed by a number distinguishing the function of the FB.

Each FB is defined via its selection number. For calculating the FB the input of the selection number into the processing table is always required. (🕮 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

Indicates the signal type which can be used as a signal source for this input. (🕮 3-5)

Note!

Only inputs led through the FB 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).

Parameterisation code

Adaptation of the function or behaviour to the drive task. Possible settings are described in the text editor and / or the line diagrams. (🕮 3-95)

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).

Note!

Only outputs brought out of the FB 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 Connecting 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 signals of the same type can be connected.

Stop!

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

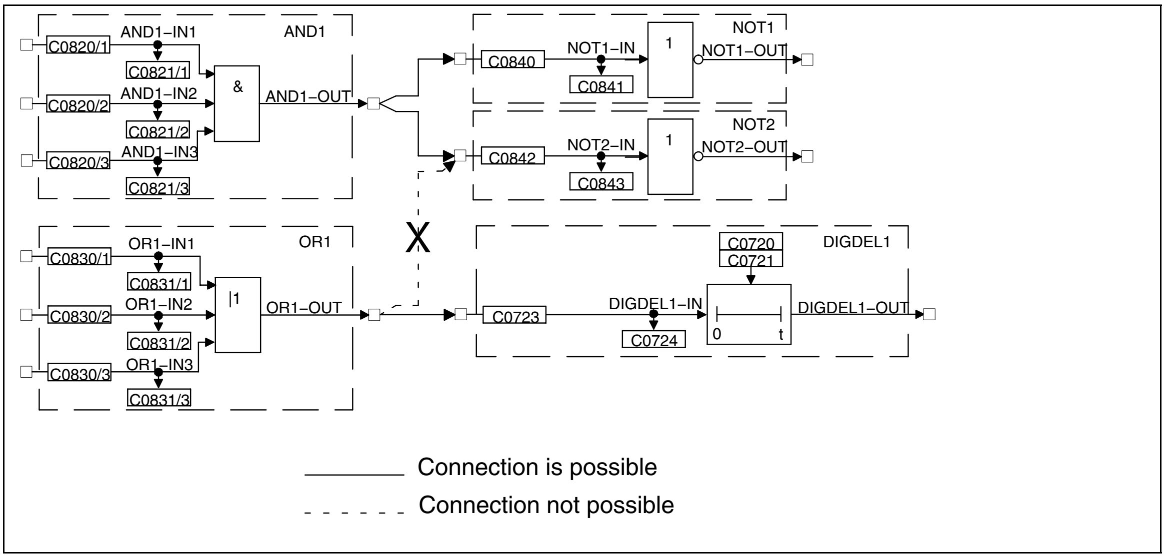


Fig. 3-2 Correct connection of function blocks

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.

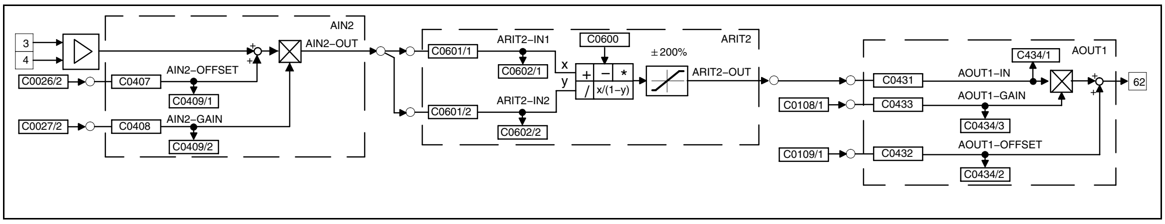


Fig. 3-3 Example of a simple configuration

Create 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 additional, unwanted signal connections.
- Example:
  - In the basic configuration C0005 = 1000, 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.

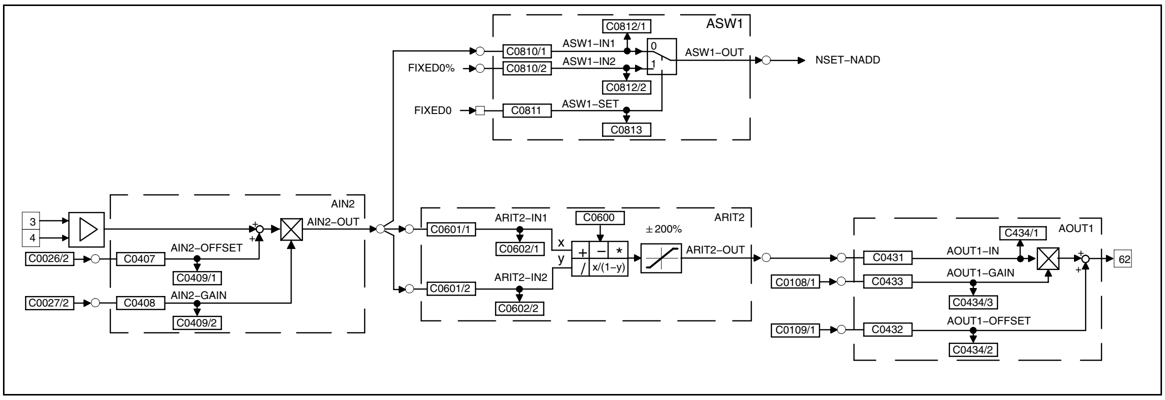


Fig. 3-4 Removing connections in a configuration

1. 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 using SH + PRG
   - Change to the code level again using PRG.

Now, the connection is removed.

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

3.1.4 Entries into the processing table

The 93XX drive controller provides a certain computing time for processing function blocks. Since the type and number of the function blocks used can vary considerably, not all function blocks available are permanently calculated. Therefore the code C0465 provides a processing table, in which only the FBs used are entered. This means that the drive system is perfectly adapted to the task to be solved. If further FBs are used in an extant configuration, they must be entered into the processing table.

The following aspects must be observed:

The number of FBs to be processed is limited

A maximum of 50 FBs can be integrated into a configuration. Each FB needs a certain processing time (operating time). The code C0466 shows the time still remaining for processing the FBs. If this time has elapsed, no further FBs can be integrated.

Sequence for entering FBs

Normally, the sequence of the entries into C0465 is discretionary, but it may be important for applications with a highly dynamic response. In general the most favourable sequence is adapted to the signal flow.

Example:

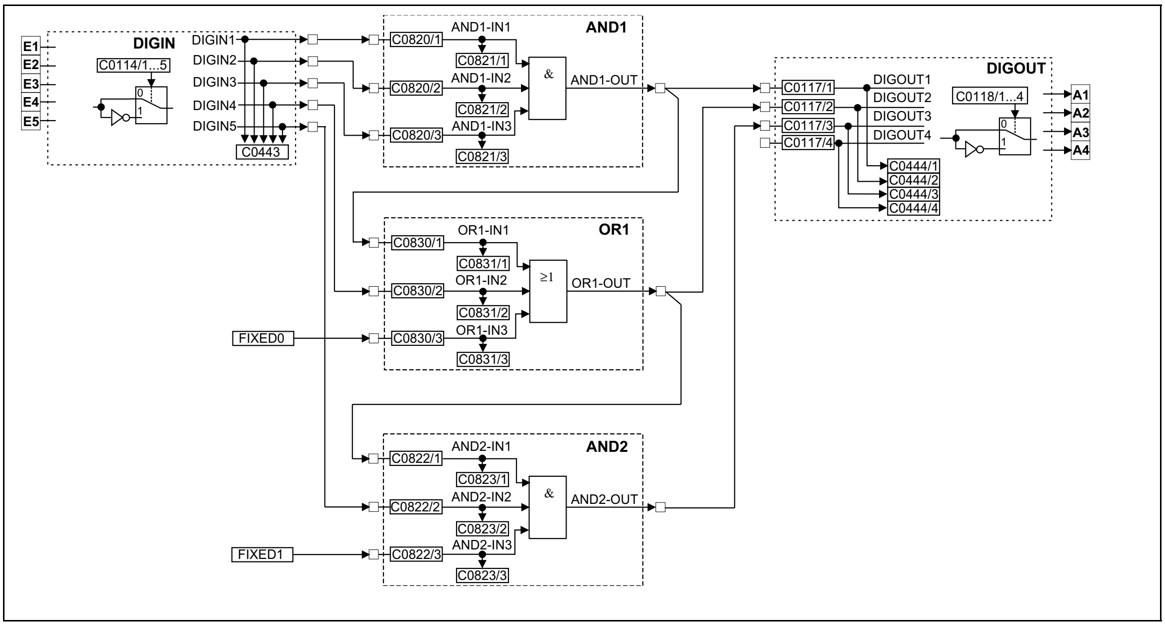


Fig. 3-5 Example of a configuration

Structure of the processing table for the configuration example 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). Hence, the output signal in AND1 must be generated first, before being processed in OR1. At the same time, OR1 has a successor. Hence, OR1 must be entered into the processing table before the successor.
4. The third FB is AND2, since it has a predecessor (see 3.)
5. The entries under C0465 are as follows:
   - Position 10: AND1 10500
   - Position 11: OR1 10550
   - Position 12: AND2 10505

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

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

Note!

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 therefore do not need 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 errors

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 processing table C0465	Enter FB again, possibly under a different subcode (list position)
The output signal does not arrive at the following FB	The connection between the FBs has not been established	Establish the connection (from the view of the following FB) via the configuration code (CFG)
FB cannot be entered into the table C0465	Residual processing time is too short (see C0466)	Delete unused FBs (e. g. inputs and outputs not used) In networked drives, functions may be assigned to other controllers
The drive controller transmits internally calculated signals with a delay to the outputs.	The FBs are processed in an incorrect sequence	Adapt the processing table under C0465 to the signal flow

3.2 Table of function blocks

Function block	Description		CPU time [µs]	Used in basic configuration			
				1000	20000	22000	26000
ABS1	Absolute value generator	🕮 3-95	4				
ADD1	Addition block	🕮 3-96	8				
AIF-IN	Fieldbus	🕮 3-97	60				
AIF-OUT	Fieldbus	🕮 3-100	56	•			
AIN1	Analog input X6/1, X6/2	🕮 3-102	10	•			
AIN2	Analog input X6/3, X6/4		28	•			
AND1	Logic AND, block1	🕮 3-104	6				
AND2	Logic AND, block2						
AND3	Logic AND, block3						
AND4	Logic AND, block4						
AND5	Logic AND, block5						
ANEG1	Analog inverter 1	🕮 3-107	3	•	•	•	•
ANEG2	Analog inverter 2						
AOUT1	Analog output X6/62	🕮 3-108	12	•	•	•	•
AOUT2	Analog output X6/63			•	•	•	•
ARIT1	Arithmetic block 1	🕮 3-110	11				
ARIT2	Arithmetic block 2						
ARITPH1	32-bit arithmetic block	🕮 3-111	15				
ARITPH2	32-bit arithmetic block 2						
ARITPH3	32-bit arithmetic block3						
ARITPH4	32-bit arithmetic block 4						
ARITPH5	32-bit arithmetic block 5						
ARITPH6	32-bit arithmetic block 6						
ASW1	Analog change-over switch 1	🕮 3-114	4	•			
ASW2	Analog change-over switch 2						
ASW3	Analog change-over switch 3						
ASW4	Analog change-over switch 4						
BCD1	BCD decade switch 1	🕮 3-116	30				
BCD2	BCD decade switch 2						
BCD3	BCD decade switch 3						
BRK	Holding brake control	🕮 3-127	15				
CAN-IN1	System bus	🕮 3-132	-				
CAN-IN2	System bus						
CAN-IN3	System bus						
CAN-OUT1	System bus	🕮 3-133	56	•	•	•	
CAN-OUT2	System bus			•	•	•	
CAN-OUT3	System bus			•	•	•	
CMP1	Comparator 1	🕮 3-134	15	•			
CMP2	Comparator 2						
CMP3	Comparator 3		15				
CMPPH1	Comparator 1	🕮 3-139	20				
CMPPH2	Comparator 2						
CMPPH3	Comparator 3						
CONV1	Conversion of analog signals	🕮 3-144	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	🕮 3-146	4				
CONVAD2	Analog-digital converter 2						
CONVAPH1	Analog phase converter 1	🕮 3-148	31				
CONVAPH2	Analog phase converter 2						
CONVAPH3	Analog phase converter 3						

Function block	Description		CPU time [µs]	Used in basic configuration			
				1000	20000	22000	26000
CONVDA1	Digital-analog converter 1	🕮 3-150	38				
CONVDA2	Digital-analog converter 2						
CONVDA3	Digital-analog converter 3						
CONVPHA1	Phase analog converter 1	🕮 3-153	6				
CONVPHA2	Phase analog converter 2						
CONVPHA3	Phase analog converter 3						
CONVPHPH2	Phase converter 2	🕮 3-155	80				•
CURVE1	Characteristic function	🕮 3-156	15			•	
DB1	Dead band	🕮 3-159	7				
DCTRL	Device control	🕮 3-160	-				
DFIN	Digital frequency input	🕮 3-164	5	•			
DFOUT	Digital frequency output	🕮 3-167	35	•	•	•	•
DFRFG1	Digital frequency ramp function generator	🕮 3-171	40				
DFSET	Digital frequency processing	🕮 3-177	85				
DIGDEL1	Binary delay element 1	🕮 3-182	9				
DIGDEL2	Binary delay element 2						
DIGIN	Input terminals X5/E1…X5/E5	🕮 3-185	-				
DIGOUT	Output terminals X5/A1…X5/A4	🕮 3-186	-				
DISA	Free analog display code	🕮 3-187	1				
DISPH	Free phase display code	🕮 3-189	1				
DT1	Differential element	🕮 3-190	12				
FCNT1	Free piece counter, block 1	🕮 3-191	11				
FCNT2	Free piece counter, block 2						
FCNT3	Free piece counter, block 3						
FDO	Free digital outputs	🕮 3-193	-				
FEVAN1	Free analog input variable	🕮 3-195	4				
FEVAN2	Free analog input variable						
FEVAN3	Free analog input variable						
FEVAN4	Free analog input variable						
FEVAN5	Free analog input variable						
FEVAN6	Free analog input variable						
FIXSET1	Fixed setpoints	🕮 3-202	9				
FLIP1	D-flipflop 1	🕮 3-204	6				
FLIP2	D-flipflop 2						
LIM1	Limiter	🕮 3-207	5				
MCTRL	Servo control	🕮 3-208	-				
MPOT1	Motor potentiometer	🕮 3-220	20				
NOT1	Logic NOT, block1	🕮 3-223	4		•	•	•
NOT2	Logic NOT, block2						•
NOT3	Logic NOT, block3						•
NOT4	Logic NOT, block4						
NOT5	Logic NOT, block5						
NSET	Speed setpoint conditioning	🕮 3-225	70	•			
OR1	Logic OR, block1	🕮 3-230	6				•
OR2	Logic OR, block2						•
OR3	Logic OR, block3						
OR4	Logic OR, block4						
OR5	Logic OR, block5						
OSC	Oscilloscope function	🕮 3-233	70				
PCTRL1	Process controller	🕮 3-237	58				
PHDIV1	Conversion	🕮 3-240	8				
PHINT1	Phase integrator	🕮 3-241	7				
POS	Positioning control	🕮 3-19	330		•	•	•
PT1-1	1st order delay element	🕮 3-244	8				
R/L/Q	QSP / setpoint inversion	🕮 3-245	8	•			
RFG1	Ramp function generator	🕮 3-246	16				
S&H1	Sample and Hold	🕮 3-248	4				

Table of function blocks

Function block	Description		CPU time [µs]	Used in basic configuration			
				1000	20000	22000	26000
SELPH1	Phase value selection, block 1	🕮 3-249	6				
SELPH2	Phase value selection, block 2						
SP1	Position switch points, block 1	🕮 3-251	80			•	
SP2	Position switch points, block 2		130				
STAT	Output of digital status signals	🕮 3-258	-				
STATE-BUS	Control of a drive network	🕮 3-259	-				
SYNC1	Multi-axis positioning	🕮 3-260	37				•
TEACH1	Teach in programming	🕮 3-268	10			•	
TRANS1	Binary edge evaluation	🕮 3-270	7				•
TRANS2	Binary edge evaluation						
VTACC	”Acceleration” variable table	🕮 3-273	20				
VTPCS	”Piece number” variable table	🕮 3-275	12				
VTPOS	”Target position” variable table	🕮 3-277	45				
VTTIME	”Waiting time” variable table	🕮 3-279	12				
VTVEL	”Speed” variable table	🕮 3-281	18				

3.3 Table of free control codes

Free control codes can be used for the selection of setpoints or as variables. The codes can be connected with inputs of function blocks.

Designation	Signal type	Code	Connection to the function block in the Lenze setting	Note
FCODE-17	a	C0017	-	
FCODE-26/1	a	C0026/1	AIN1-OFFSET	
FCODE-26/2	a	C0026/2	AIN2-OFFSET	
FCODE-27/1	a	C0027/1	AIN1-GAIN	
FCODE-27/2	a	C0027/2	AIN2-GAIN	
FCODE-32	a	C0032	-	
FCODE-37	a	C0037	-	
FCODE-108/1	a	C0108/1	AOUT1-GAIN	
FCODE-108/2	a	C0108/2	AOUT2-GAIN	
FCODE-109/1	a	C0109/1	AOUT1-OFFSET	
FCODE-109/2	a	C0109/2	AOUT2-OFFSET	
FCODE-141	a	C0141	-	
FCODE-1211	a	C1211	POS-START-PS	
FCODE-472/1	a	C0472/1	-	
FCODE-472/2	a	C0472/2	-	
FCODE-472/3	a	C0472/3	ANEG1-IN MCTRL-HI-M-LIM	
FCODE-472/4	a	C0472/4	-	
FCODE-472/5	a	C0472/5	-	
FCODE-472/6	a	C0472/6	MCTRL-PHI-LIM	
FCODE-472/7	a	C0472/7	-	
FCODE-472/8	a	C0472/8	-	
FCODE-472/9	a	C0472/9	-	
FCODE-472/10	a	C0472/10	-	
FCODE-472/11	a	C0472/11	-	
FCODE-472/12	a	C0472/12	-	
FCODE-472/13	a	C0472/13	-	
FCODE-472/14	a	C0472/14	-	
FCODE-472/15	a	C0472/15	-	
FCODE-472/16	a	C0472/16	-	
FCODE-472/17	a	C0472/17	-	
FCODE-472/18	a	C0472/18	-	
FCODE-472/19	a	C0472/19	-	
FCODE-472/20	a	C0472/20	-	
FCODE-473/1	a	C0473/1	-	
FCODE-473/2	a	C0473/2	-	
FCODE-473/3	a	C0473/3	-	
FCODE-473/4	a	C0473/4	-	
FCODE-473/5	a	C0473/5	-	
FCODE-473/6	a	C0473/6	-	
FCODE-473/7	a	C0473/7	-	
FCODE-473/8	a	C0473/8	-	
FCODE-473/9	a	C0473/9	-	
FCODE-473/10	a	C0473/10	-	
FCODE-250	d	C0250	-	
FCODE-471.B0	d	C0471	-	
FCODE-471.B1	d	C0471	POS-S-RAMPS	
FCODE-471.B2	d	C0471	-	
FCODE-471.B3	d	C0471	-	

Designation	Signal type	Code	Connection to the function block in the Lenze setting	Note
FCODE-471.B4	d	C0471	-	
FCODE-471.B5	d	C0471	-	
FCODE-471.B6	d	C0471	-	
FCODE-471.B7	d	C0471	-	
FCODE-471.B8	d	C0471	-	
FCODE-471.B9	d	C0471	-	
FCODE-471.B10	d	C0471	-	
FCODE-471.B11	d	C0471	-	
FCODE-471.B12	d	C0471	-	
FCODE-471.B13	d	C0471	-	
FCODE-471.B14	d	C0471	-	
FCODE-471.B15	d	C0471	-	
FCODE-471.B16	d	C0471	-	
FCODE-471.B17	d	C0471	-	
FCODE-471.B18	d	C0471	-	
FCODE-471.B19	d	C0471	-	
FCODE-471.B20	d	C0471	-	
FCODE-471.B21	d	C0471	-	
FCODE-471.B22	d	C0471	-	
FCODE-471.B23	d	C0471	-	
FCODE-471.B24	d	C0471	-	
FCODE-471.B25	d	C0471	-	
FCODE-471.B26	d	C0471	-	
FCODE-471.B27	d	C0471	-	
FCODE-471.B28	d	C0471	-	
FCODE-471.B29	d	C0471	-	
FCODE-471.B30	d	C0471	-	
FCODE-471.B31	d	C0471	-	
FCODE-135.B0	d	C0135	-	LECOM control word
FCODE-135.B1	d	C0135	-	LECOM control word
FCODE-135.B2	d	C0135	-	LECOM control word
FCODE-135.B3	d	C0135	-	LECOM control word, signal: QSP (see DCTRL)
FCODE-135.B4	d	C0135	-	LECOM control word
FCODE-135.B5	d	C0135	-	LECOM control word
FCODE-135.B6	d	C0135	-	LECOM control word
FCODE-135.B7	d	C0135	-	LECOM control word
FCODE-135.B12	d	C0135	-	LECOM control word
FCODE-135.B13	d	C0135	-	LECOM control word
FCODE-135.B14	d	C0135	-	LECOM control word
FCODE-135.B15	d	C0135	-	LECOM control word
FCODE-474/1	ph	C0474/1	-	
FCODE-474/2	ph	C0474/2	-	
FCODE-474/3	ph	C0474/3	-	
FCODE-474/4	ph	C0474/4	-	
FCODE-474/5	ph	C0474/5	-	
FCODE-474/6	ph	C0474/6	-	
FCODE-474/7	ph	C0474/7	-	
FCODE-474/8	ph	C0474/8	-	
FCODE-474/9	ph	C0474/9	-	
FCODE-474/10	ph	C0474/10	-	
FCODE-475/1	phd	C0475/1	-	
FCODE-475/2	phd	C0475/2	-	

3.4 Positioning control (POS)

Purpose

The function block ”positioning control (POS)” is the core of the 9300 servo position controller. It controls positioning in the controller.

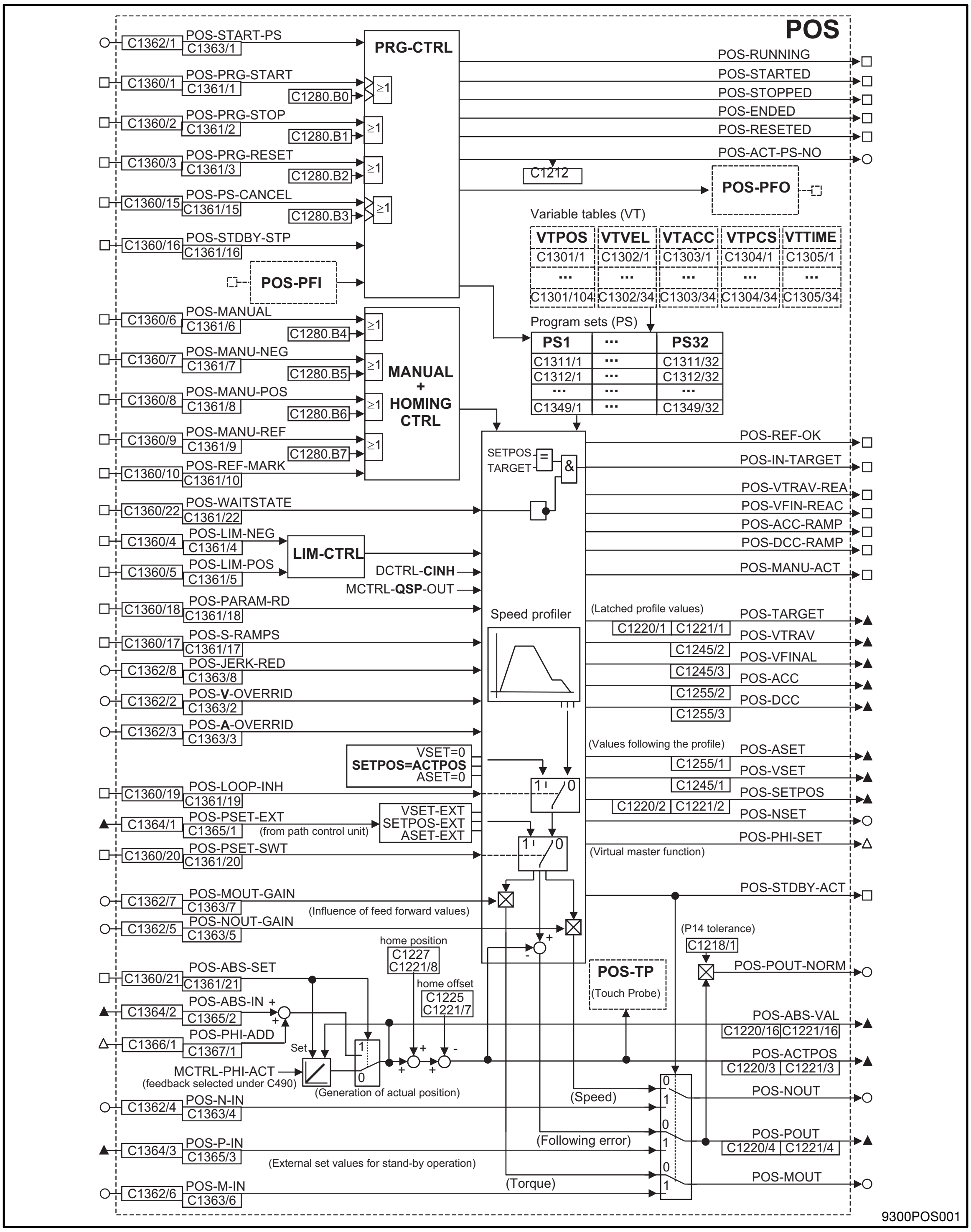


Fig. 3-6 Function block POS

Signal				Source		Note
Designation	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
POS-A-OVERRID	a	C1363/3	dec [%]	C1362/3	1	Reduces the acceleration and deceleration as well as the manual traversing acceleration and homing acceleration. Note: Only positive override values are effective, negative values will be evaluated as zero. (See ”Override” 🕮 3-62)
POS-ABS-IN	ph	C1365/2	dec [inc]	C1364/2	3	Input for external actual position value, e. g. when using an absolute value encoder with a CAN interface. (see “Absolute encoder via system bus” 🕮 3-40)
POS-ABS-SET	d	C1361/21	bin	C1360/21	2	HIGH = Phase value at POS-ABS-IN is read for generating the actual position value (POS-ACTPOS). The following values are considered for the POS-ACTPOS: position setpoint polarity (C1206), actual position polarity (C1208), actual home position (display C1220/8), actual dimension offset (display C1220/7).
POS-ABS-VAL	ph	C1220/16 C1221/16	dec [units] dec [inc]			Display as actual position POS-ACTPOS, but without considering setpoint position polarity (C1206), actual position (C1206), actual home position (display C1220/8) and actual reference dimension offset (display C1220/7).
POS-ACC	ph	C1255/2	dec [inc]	-	-	Deceleration, absolute value for current PS; for scaling see formula 3.
POS-ACC-RAMP	d	-	-	-	-	HIGH = Drive accelerates
POS-ACT-PS-NO	a	C1212	dec [inc]	-	-	Current program block
POS-ACTPOS	ph	C1220/3 C1221/3	dec [units] dec [inc]	-	-	Actual position; for scaling see formula 1
POS-ASET	ph	C1255/1	dec [inc]	-	-	Current acceleration/deceleration setpoint, for scaling see formula 3.
POS-DCC	ph	C1255/3	dec [inc]	-	-	Deceleration in current program block (positive display); for scaling see formula 3
POS-DCC-RAMP	d	-	-	-	-	HIGH = drive brakes
POS-ENDED	d	-	-	-	-	Position status display HIGH = program end reached. Current program block no.=0 (POS-ACT-PS-NO). (see “program control” 🕮 3-70)
POS-IN-TARGET	d	-	bin	-	-	HIGH = Position setpoint has reached target position, positioning is completed, the following function of the PS will be processed. LOW = Positioning is running or was cancelled by POS-PS-CANCEL. POS-IN-TARGET remains LOW, as long as POS-WAITESTATE = HIGH. 🕮 3-64
POS-JERK-RED	a	1363/8	dec [%]	C1362/8	1	Reduces the jerk of an S profile, or prolongs the jerk time (Tr) (see ”S ramps” 🕮 3-60). Note: will be evaluated as value.
POS-LIM-NEG	d	C1361/4	bin	C1360/4	2	HIGH = negative end of travel range limit switch approached. (see “Travel limits” 🕮 3-44)
POS-LIM-POS	d	C1361/5	bin	C1360/5	2	HIGH = positive travel range limit switch approached. (see “Travel range limits” 🕮 3-44)
POS-LOOP-INH	d	C1361/19	bin	C1360/19	2	HIGH = position control loop is switched off. (POS-SETPOS = POS-ACTPOS, POS-VSET = 0, POS-ASET = 0).
POS-M-IN	a	C1363/6	dec [%]	C1362/6	1	External torque precontrol, effective in stand-by operation (🕮 3-81)
POS-MANU-ACT	d	-	-	-	-	HIGH = manual operation active, no program operation Note: Signal will not be updated when the controller is inhibited (DCTRL-CINH = HIGH) or quick stop (MCTRL-QSP-OUT = HIGH) is set
POS-MANU-NEG	d	C1361/7	bin	C1360/7	2	HIGH = drive travels with v_manual (C1243) in negative direction. Acceleration with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have influence. LOW = drive is stopped with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have influence. Note: POS-MANU-REF has priority. When -NEG and -POS are controlled simultaneously the drive stops. (see ”Manual operation” 🕮 3-67)
POS-MANU-POS	d	C1361/8	bin	C1360/8	2	like POS-MANU-NEG, but in positive direction. (see ”Manual operation” 🕮 3-67)
POS-MANU-REF	d	C1361/9	bin	C1360/9	2	LOW-HIGH signal = Start manual homing HIGH level required for the time of homing (see “manual homing” 🕮 3-69)
POS-MANUAL	d	C1361/6	bin	C1360/6	2	Changeover Manual/program operation HIGH = manual operation; if necessary, running program is interrupted. If necessary, drive is decelerated to standstill with a-manual (C1252) and the influence of POS-A-OVERRID. LOW = Program mode (see “manual mode” 🕮 3-67)
POS-MOUT	a	-	-	-	-	Current torque precontrol value after influence of POS-MOUT-GAIN. Scaling: 100% acc. to a-max (C1250).

Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
POS-MOUT-GAIN	a	C1363/7	dec [%]	C1362/7	1	Reduces torque precontrol. The polarity of the input signal is considered.
POS-N-IN	a	C1363/4	dec [%]	C1362/4	1	External speed setpoint, effective in stand-by operation (📖 3-81)
POS-NOUT	a	-	-	-	-	Current speed setpoint for n controller after influence of POS-NOUT-GAIN. Scaling: 100% acc. to. nmax (C0011).
POS-NOUT-GAIN	a	C1363/5	dec [%]	C1362/5	1	Reduces speed precontrol. The polarity of the input signal is considered.
POS-NSET	a	-	-	-	-	Current speed setpoint (profile generator output), scaling: 100% acc. to nmax (C0011).
POS-P-IN	ph	C1365/3	dec [inc]	C1364/3	3	Externally calculated following error, effective in stand-by operation (📖 3-81)
POS-PARAM-RD	d	C1361/18	bin	C1360/18	2	LOW-HIGH signal = new profile parameters will be accepted immediately, even during positioning HIGH level accepts new parameters every 10 ms Profile parameters: target position, traversing speed, acceleration, deceleration, final speed, V-OVERRID, A-OVERRID, POS-S-RAMPS. Note: Not effective in stand-by operation (”Stand-By operation” see 📖 3-81)
POS-PHI-ADD	phd	C1367/1		C1366/1		Phase difference signal is added to POS-ABS-IN. Function: With POS-ABS-SET= HIGH the actual position is set to the value POS-ABS-IN. Encoder increments that have arrived in the setting cycle are not considered in the default. If required, the encoder change can be connected in the setting cycle; the signal MCTRL-PHI-ACT must be linked with the input POS-PHI-ADD.
POS-PHI-SET	phd	-	-	-	-	“Virtual Master” application: 📖 3-65)
POS-POUT	ph	-	-	-	-	Following error for phase controller
POS-POUT-NORM	d	-	dec [%]			Scaled analog following error output. The current following error POS-POUT is additionally output as follows: 100% equals first following error tolerance (C1218/1). Tip: for monitoring the dynamic drive response.
POS-PRG-RESET	d	C1361/3	bin	C1360/3	2	HIGH= interrupts the program processing and sets ”program end”. Parts counters and PFOs are reset. The Touch Probe inputs used by the program are disabled and, if required, the stand-by operation is interrupted. The drive is stopped with a-max (C1250) (no influence of POS-A-OVERRID). (see “program control” 📖 3-70)
POS-PRG-START	d	C1361/1	bin	C1360/1	2	Start of the program. LOW-HIGH edge = Start, from the beginning (POS-START-PS) or continued at the same position after program interruption. The program is executed to the ”program end”, even if POS-PRG-START is reset again. If POS-PRG-START = HIGH at the program end, the program will be processed again from its beginning. (see “program control” 📖 3-70)
POS-PRG-STOP	d	C1361/2	bin	C1360/2	2	HIGH = program processing and the running positioning are interrupted. The drive is stopped with the current delay of the program block (no influence of POS-A-OVERRID). LOW = Program processing is continued. Positioning is continued with the current profile parameters of the program block, if required. (see “program control” 📖 3-70)
POS-PS-CANCEL	d	C1361/15	bin	C1360/15	2	Cancel PS and continue program from another point. LOW-HIGH edge = aborts current program block. Drive is braked to standstill with the separately adjustable delay “a-cancel” (C1253). Afterwards the program is continued in the selected program block (C1333; JMP-TP-PS). (see “program control” 📖 3-70)
POS-PSET-EXT	ph	C1365/1	dec [inc]	C1364/1	3	External position setpoint.
POS-PSET-SWT	d	C1361/20	bin	C1360/20	2	HIGH = Phase value at POS-PSET-EXT will be accepted as position setpoint (POS-SETPOS) LOW = Position setpoint will be generated by the profile generator.
POS-REF-MARK	d	C1361/10	bin	C1360/10	2	Home position switch
POS-REF-OK	d	C1284/1	-	-	-	HIGH = Homing completed/reference known
POS-RESETED	d	-	-	-	-	Position status display HIGH = Position program in status “Prg-Reset” (see “program control” 📖 3-70)

Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
POS-RUNNING	d	-	-	-	-	Position status display POS-RUNNING = HIGH: Program run is started and is not interrupted by controller inhibit, faults or manual control. POS-RUNNING = LOW and POS-STARTED = HIGH: Program run interrupted; for continuing the program run a new edge to POS-PRG-START is required.
POS-S-RAMPS	d	C1361/17	bin	C1361/17	2	HIGH level = S profile is active (see S-shaped ramps" 🕮 3-60)
POS-SETPOS	ph	C1220/2 C1221/2	dec [units] dec [inc]	-	-	Current position setpoint; for scaling see formula 1
POS-START-PS	a	C1363/1	dec [inc]	C1362/1	1	Start program set Number of the program set with which the program run is to be started. In the standard configurations (see C0005) it is connected with C1211,
POS-STARTED	d	-	-	-	-	Position status display HIGH = Program started If the program has been interrupted by controller inhibit, fault or manual homing, POS-STARTED remains HIGH. The program can only continue if a new signal is applied to POS-PRG-START. (see "program control" 🕮 3-70)
POS-STDBY-ACT	d	-	-	-	-	HIGH = stand-by operation is active (see "Stand-by operation" 🕮 3-81)
POS-STDBY-STP	d	C1361/16	bin	C1360/16	2	HIGH = terminates the stand-by operation, if "STDBY" is selected in the POS mode (C1311 = 30). No other function. (see "Stand-by operation" 🕮 3-81)
POS-STOPPED	d	-	-	-	-	Position status display HIGH = Program and drive have been stopped or drive is being stopped (see "program control" 🕮 3-70)
POS-TARGET	ph	C1220/1 C1221/1	dec [units] dec [inc]	-	-	current target position in real measuring system; for scaling see formula 1
POS-V-OVERRID	a	C1363/2	dec [%]	C1362/2	1	Reduces the traversing and final speed as well as the manual traversing speed and the homing speed. Note: Only positive override values are effective, negative values will be evaluated as zero. (See "Override" 🕮 3-62)
POS-VFIN-REAC	d	-	-	-	-	HIGH = current final speed reached
POS-VFINAL	ph	C1245/3	dec [inc]	-	-	Acceleration, absolute value for current PS, for scaling see formula 3.
POS-VSET	ph	C1245/1	dec [inc]	-	-	Current speed setpoint; for scaling see formula 2
POS-VTRAV	ph	C1245/2	dec [inc]	-	-	Final speed, absolute value for current PS, for scaling see formula 2.
POS-VTRAV-REA	d	-		-	-	HIGH = current traversing speed reached
POS-WAITSTATE	d	C1360/22	bin	C1361/22	2002	Completion of positioning in the actual program block is delayed to wait until the possibly occurring following error has been eliminated when reaching the target. HIGH = POS-IN-TARGET is not set, the actual positioning is not completed. (see chapter "Target window" 🕮 3-64)

Formulae for scaling the signals (see preceding table, column ”Note”):

Formula 1: Position

$$\text{Position [inc]} = \text{Position [units]} \cdot \frac{65536\ \text{[inc/rev.]} \cdot \text{gear nominator}}{\text{Feed const. [units/rev.]} \cdot \text{gear denominator}} = \text{Position} \cdot \frac{65536 \cdot C1202}{C1204 \cdot C1203}$$

Formula 2: Speed (VEL)

$$\text{VEL } [\text{inc}_v/\text{ ms}] = \text{VEL [units/s]} \cdot \frac{65536\ \text{[inc/rev.]} \cdot \text{gear nominator} \cdot 16384\ [\text{inc}_v/\text{inc}]}{\text{Feed const. [units/rev.]} \cdot \text{gear denominator} \cdot 1000\ [1/s]} = \text{VEL} \cdot \frac{65536 \cdot C1202 \cdot 16384}{C1204 \cdot C1203 \cdot 1000}$$

Formula 3: Acceleration/deceleration (ACC/DCC)

$$\text{ACC}[\text{inc}_v/\text{ms}^2] = \text{ACC}[\text{units/s}^2] \cdot \frac{65536\text{[inc/rev.]} \cdot \text{gear nominator} \cdot 16384\ [\text{inc}_v/\text{inc}]}{\text{Feed const.[units/rev.]} \cdot \text{gear denominator} \cdot 1000000[1/s^2]} = \text{ACC} \cdot \frac{65536 \cdot C1202 \cdot 16384}{C1204 \cdot C1203 \cdot 1000000}$$

$$1\ \text{inc}_v = \frac{1\ \text{inc}}{2^{14}}$$

Function

- Dimensions (🕮 3-25)
- Machine parameters (🕮 3-26)
- Positioning mode “Relative Positioning” (🕮 3-30)
- Positioning mode “Absolute Positioning” (🕮 3-32)
- Measuring systems (🕮 3-34)
- Absolute positioning with saving (🕮 3-33)
- Absolute positioning through encoder connection X8 (🕮 3-38)
- Absolute positioning through system bus (CAN) (🕮 3-40)
- Travel range limits (🕮 3-44)
- Traversing profile generator and setpoints (🕮 3-58)
- Manual operation (🕮 3-67)
- Program operation (🕮 3-70)
- Variable tables (🕮 3-75)
- Program sets (PS) (🕮 3-76)
- POS-TP (touch probe saving of the actual position value) (🕮 3-91)
- POS-PFI (Program Function Inputs) (🕮 3-93)
- POS-PFO (Program Function Outputs) (🕮 3-94)

3.4.1 Dimensions

Absolute dimensions

An absolute target position is a defined position on the traversing path with reference to a zero point. The target position is approached irrespective of the current position.

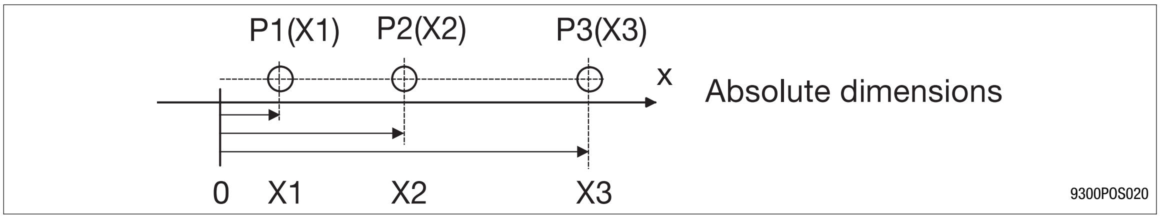


Fig. 3-7 Absolute dimensions

Relative dimensions

Relative dimensioning corresponds to incremental dimensioning. Each new target refers to the preceding target.

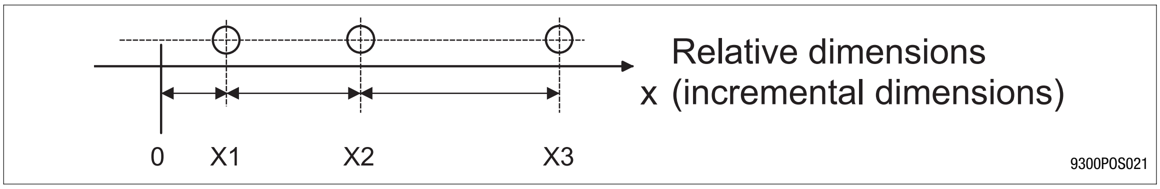


Fig. 3-8 Relative dimensions

Mixed dimensions

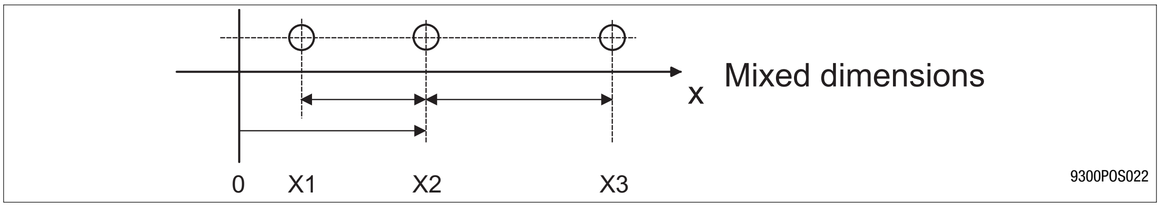


Fig. 3-9 Mixed dimensions

3.4.2 Machine parameters

Example

Purpose

- The physical unit (e.g.: mm, m, degrees) for a "unit" is defined via the entry of the machine parameters.

Function

- Entry of the gearbox ratio under C1202 and C1203, according to the nameplate data of the gearbox.

$$\frac{C1202}{C1203} \equiv \frac{Motor\_speed}{Getriebeabtriebsdrehzahl}$$

- Entry of the feed constant under C1204. Enter the number of units (e.g.: mm) to be fed during one revolution at the gearbox output side.
- Entry of the maximum motor speed (n_{max}) under C0011. The limitation mainly applies to the motor.
- Entry of the maximum speed (v_{max}) under C1240. Limitation mainly applies to the entire machine. It should be set lower than the speed that can be attained at maximum motor speed. The maximum speed v_{max} is considered as the reference for all speed data in the VTVEL variable table.

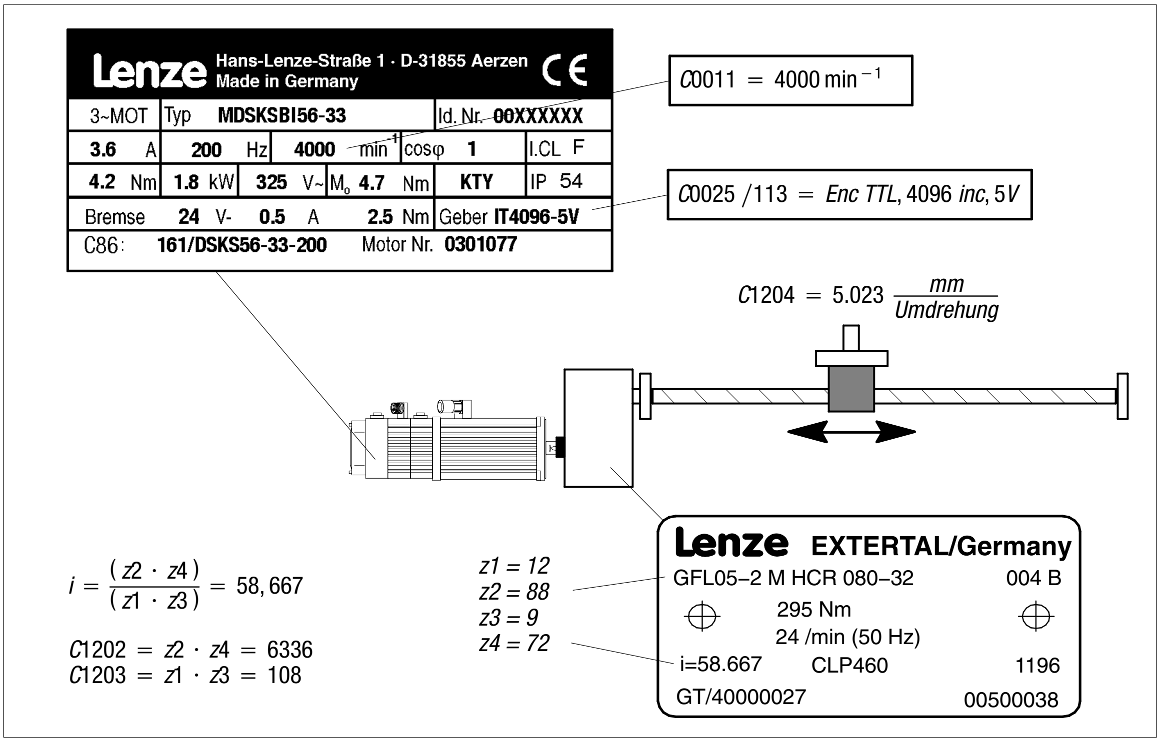
$$v_{\max} \leq n_{\max} \cdot \frac{v_k}{60 \cdot i}$$

$$C1240 \leq C0011 \cdot \frac{C1204 \cdot C1203}{60 \cdot C1202}$$

- Entry of the maximum acceleration (a_{max}) under C1250.
  The maximum acceleration is considered as the reference for all acceleration data given in per cent in the VTACC variable table.

Application example

For positioning a spindle feeding unit is driven via a gearbox. Instead of the standard resolver an incremental encoder is used as feedback system. The incremental encoder is mounted to the motor and has a number of increments of 4096 pulses / rev.. The gearbox has a ratio of i = 32 ($n_{motor}/n_{spindle}$). The spindle has a lead of h = 10 mm. The entries are to be made in mm (1 mm = 1 unit).



Settings:

Code	Designation	Entry	Notes
C0025	Encoder system selection	-113-	Incremental encoder, IT-4096-5V
C0420	Encoder constant X8	4096 incr	(automatically through C0025)
C0490	Position feedback system	-1-	(TTL encoder) (automatically through C0025)
C0495	Speed feedback system	-1-	(TTL encoder) (automatically through C0025)
C1202	Gearbox numerator	6336	Numerator corresponds to motor speed
C1203	Gearbox denominator	108	Denominator corresponds to gearbox output speed
C1204	Feed constant	5.023 units/rev	mm per rev. at gearbox output
C1207/1	Position encoder gearbox factor, numerator	1	(1/1 = no gearbox between encoder and motor) Numerator corresponds to motor speed
C1207/2	Position encoder gearbox factor, denominator	1	(1/1 = no gearbox between encoder and motor) Denominator corresponds to encoder speed

3.4.2.1 Position encoder at material path

Purpose

The gearbox backlash and, if applicable, the slip between the drive, machine, and material path should be eliminated to increase the accuracy of the calculation of an act. position value.

Function

- The position feedback is ensured by a separate position encoder (C0490) at the material path.
- The speed is fed back through an encoder mounted to the motor shaft (C0495).

Tip!

For defining the dimension of a unit (e.g. mm, cm), machine parameters are entered as if the position encoder was mounted to the motor shaft.

- There is a ratio between the position encoder and the motor. This ratio is adjusted via the ”encoder/gearbox factor” (C1207/1, C1207/2). Nominator and denominator are entered according to the speed ratio between the motor and position encoder.

$$\boxed{\frac{C1207/1}{C1207/2} = \frac{n_{motor}}{n_{encoder}}}$$

- The counting direction of the actual position value (GDC monitor, C1220/3) must increase with clockwise rotation of the motor.
  Condition: C1206 = 0 (position setpoint not inverted).

If this is not the case, the counting direction of the position encoder can be inverted as follows:

1. Exchanging the encoder tracks
2. Exchanging the polarity of the actual position (C1208)

Stop!

An opposing setting of the counting directions of the position setpoint and the actual position leads to a positive feedback in the control loop with the consequence that the drive may overspeed.

- For software version ≤ V2.1:
  - Inverting the counting direction via the actual value polarity (C1208) is not considered while executing the QSP function.This could lead to a positive feedback in the position control loop when the QSP or FAIL-QSP function is activated. The drive could accelerate to its speed limit n_{max} in an uncontrolled way (overspeed)!
  - Therefore the position controller must be switched off during the update of the QSP function (MCTRL-QSP-OUT = HIGH). In the case of QSP it is not enough to only switch the input MCTRL-PHI-ON = LOW. The analog input MCTRL-P-ADAPT = 0% must be switched e.g. by means of the function block ASW via MCTRL-QSP-OUT.
- For software version > V2.1:
  With QSP only the motor encoder is evaluated automatically to stop the motor.

Stop!

Increasing the ratio between the position encoder and the motor shaft reduces the position resolution information. This can have a negative effect on the stability of the control loop!

Example (refers to the previous safety information):
In the case of a quadruple evaluation of a position encoder with 1024 increments 4096 increments are available. Angle of rotation of the motor shaft per encoder increment:

$$\frac{360^\circ}{4096\,\mathit{incr}} = 0.0879\,^\circ = 0^\circ\,5.3' \quad (5.3\ \mathit{phase\ minutes})$$

Ratio of the position encoder e.g. i = 128:

$$0.0879^\circ \times 128 = 11.25^\circ = 11^\circ\,15' \quad (11\,^\circ\ \text{and}\ 15\ \mathit{phase\ minutes})$$

The motor should rotate by 11° to compensate an offset of one increment. A further increase of the ratio would raise the ”compensating path” of the motor.

Permanent slipping of a friction wheel running on the material web (= drive of the position encoder) results in a faulty actual position value. A web break could accelerate the drive to high speeds due to the missing actual position value.

Example:
The spindle drive mentioned in the previous example is driven with a separate position encoder connected to the spindle (gearbox output side).

Settings as described under machine parameters but:

C1206	Polarity of position setpoint	-0-: Not inverse -1-: Inverse	Reversal of traversing direction
C1207/1	Position encoder gearbox factor, numerator	32	Numerator corresponds to motor speed
C1207/2	Position encoder gearbox factor, denominator	1	Denominator corresponds to encoder speed
C1208	Polarity - actual position	-0-: Not inverse -1-: Inverse	If “inverse” is selected, observe the QSP function notes.

3.4.3 Positioning modes (C1210)

You can select the following positioning modes under C1210:

- Relative positioning (🕮 3-30)
- Absolute positioning (🕮 3-32)
- Absolute positioning with saving (🕮 3-33)

3.4.3.1 Relative positioning

Purpose

- Use with infinite applications, e.g. a cutter.

Function

- Set positioning mode (C1210) = 1.
- Absolute target positions cannot be approached. A fault is indicated (P07).
- The setpoint positions and actual positions are reset prior to a new positioning.
  - The current following error is maintained (POS-SETPOS = 0, POS-ACTPOS = current following error).
- The position limit values (C1223, C1224) determine the maximum feed length in the corresponding direction.

Tip!

If you do not need the travel range limit switch remove the connection to the digital input terminals (DIGIN) or switch to +24 V.

- Homing is not necessary, but can be used to set the machine to a defined position.

Rounding error

Without special measures for the mechanical design the path covered of a defined target position may amount to a fractional number of increments (e. g. 1554.4 inc.). The internal calculation merely considers the integer part of this value (= 1554 inc.).

For a relative positioning, the momentary target position of which always refers to the previous target position, rounding errors are propagated with each distance traversed.

This effect can lead to a drifting of the holding position of a conveyor. Therefore it must be observed that all required target positions can be displayed without decimal position of an increment (see position resolution).

Position resolution

- Display via code C1205.
  Display of the number of increments with which the units defined by the user are resolved (incr/unit).
- The position resolution can be used to check for rounding errors.

Calculation example:

C1301/1 = 100.2550 units (position value in VTPOS)

C1205 = 80.0000 inc/unit (position resolution)

Formula:

$$\text{Feed} = \text{C1301[units]} \cdot \text{C1205[inc/unit]}$$

$8020,4\ \text{inc} = 100,2550\ \text{units} * 80,0000\ \text{inc/unit}$

A difference of 0.4 inc results from every feed.

Tip!

If it is not possible to have increments without decimal positions, drifting of the holding position can be avoided by touch-probe positioning.

3.4.3.2 Absolute positioning

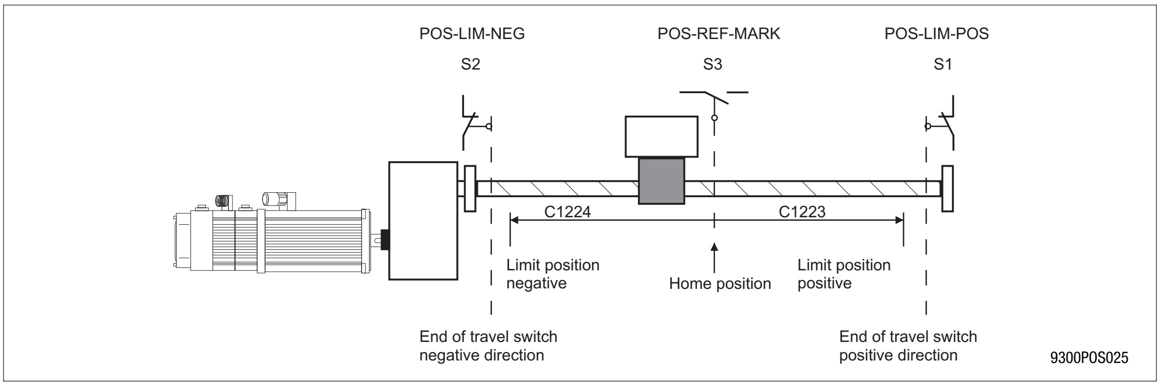


Fig. 3-10 Example of a machine with finite traversing range

Purpose

- Use in applications with finite traversing range, e. g. in warehousing or handling machines.

Function

- Set positioning mode (C1210) = 0 (default setting)
- Before starting a positioning drive homing must be carried out (output POS-REF-OK = 1, homing status C1284 = “REF-OK”). By homing the reference point of the measuring system to the machine is determined (🕮 3-46)
- In the absolute positioning mode absolute and relative target positions can be approached. There are two measuring systems (🕮 3-34):
  – the machine measuring system and
  – the real measuring system
- The travel range limit switches are located in front of the mechanical stops. They prevent the drive from touching the stops.
- Adjustable position limiting values (C1223, C1224) prevent the travel range limit switches from being approached under normal operating conditions. A target position located outside the position limiting value is not approached. In this case a fault is indicated (P04, P05).

3.4.3.3 Absolute positioning with saving

Purpose

Homing is not necessary after mains switching.

Function

- Resolver or absolute value encoder (single-turn) to X8 is required as position feedback system.
- Set positioning mode (C1210) = 2 (absolute positioning with saving).
- The actual position value (POS-ACTPOS) is automatically stored when the mains is switched off and reinitialised when the mains is switched on. In the OFF state the motor may rotate with a deviation of max. ±0,5 revolutions so that the actual position value is correctly initialised after switching on the mains.

All other function are identical with absolute positioning in chapter 3.4.3.2.

Homing status ”Homing known”

For absolute positioning the correct machine reference is required (”Homing known”)! Output POS-REF-OK = 1 and homing status C1284 = “REF-OK” .

During commissioning or after homing loss ((🕮 3-46) the drive must be referenced once. According to the requirements of the application homing can be carried out by “homing function”, “home setting” or the function “POS-ABS-SET”.

- With firmware version ≥V2.5:
  - The current homing status is stored at mains switch-off and is initialised correspondingly when the mains is switched on again.
    At the first commissioning the homing status is not set.
- With firmware version < V2.5:
  - Homing status “Homing known” is automatically set when the mains is switched on.

Tip!

Although POS-REF-OK = 1 is displayed the drive must be set once during commissioning or after a homing loss. This serves to re-establish the correct reference to the machine.

3.4.4 Measuring systems

Purpose

- Limitation of the traversing and determination of reference points for positioning.

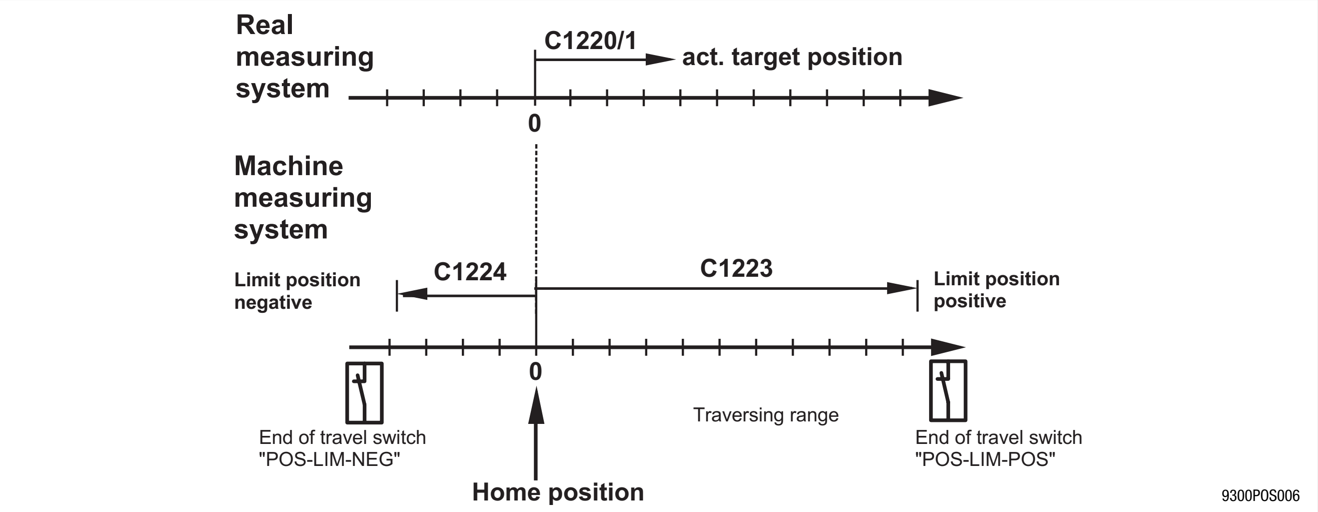


Fig. 3-11 Measuring systems for absolute positioning in default setting (C1225=0, C1227=0)

In default setting the reference point = machine zero = real zero (🕮 3-34).

Reference point

- The reference point is the reference for the “connection” of the measuring systems with the machine.
- Is detected through “referencing”.

Machine measuring system

- The permissible travelling range for the machine measuring system is determined through the position limit values (C1223 and C1224).
- The machine measuring system has a fixed reference to the machine because of the reference point.
- The reference point is detected by a “reference run” or “setting reference” and, usually, not shifted later. (🕮 3-46).

Real measuring system

- All indications (e.g.: target positions, position setpoint, and actual position) refer to the real zero of the real measuring system.
- The real measuring system can be shifted by entering a reference measuring offset.

3.4.4.1 Measuring systems and zero shifts

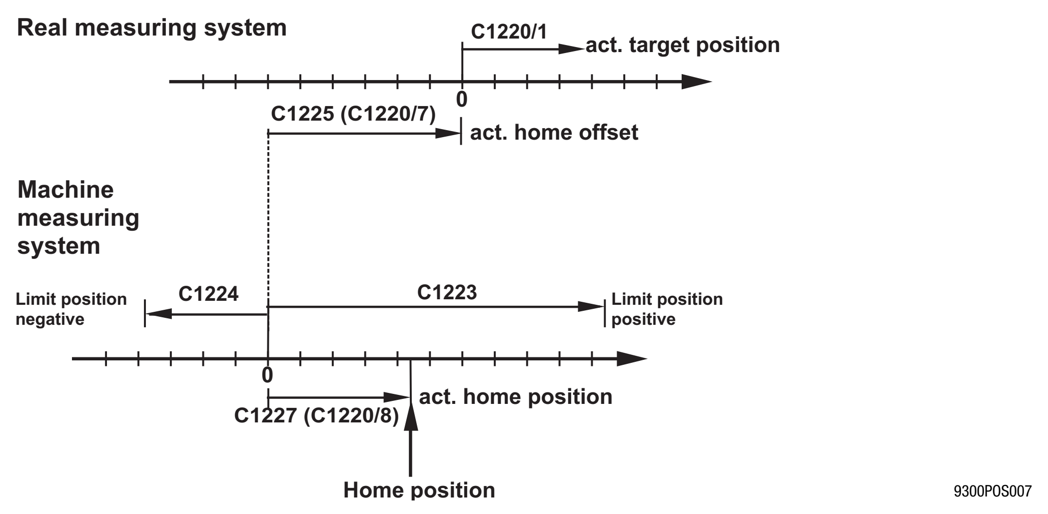


Fig. 3-12 Measuring systems for absolute positioning and zero point shifting

Shifting of machine zero

Purpose

- The reference run is to be carried out on one side of the traversing range when it is too time consuming to approach the machine zero.

Function

- Via the home position (C1227) the machine zero point is shifted with regard to the reference point. The home position is set at the reference point so that with a positive home position the machine zero point is situated in negative direction.
- The home position (C1227) will only be accepted as “actual home position” when being in “reference run” or “set reference point” mode.
- The effective “actual home position” is indicated under C1220/8 and C1221/8.

Shifting of real zero

Purpose

- The target positions must always refer e.g. to the front edge of the workpiece. This means the real measuring system must be shifted accordingly.

Function

- By means of the reference offset (C1225) the real zero point can be shifted with regard to the machine zero point. The input of a positive value results in a shift of the real zero point in positive direction.
- The reference measure offset takes directly effect with the input. The position setpoint (POS-SETPOS) and the actual position value (POS-ACTPOS) change in accordance with the change of the reference offset because of the change of its reference point (real zero point).
- The effective “actual reference offset” is indicated under C1220/7 and C1221/7.

Tip!

The input value C1225 and the actual reference offset can only be different when using the program function ”set position value”.

3.4.4.2 Measuring systems for absolute value encoders

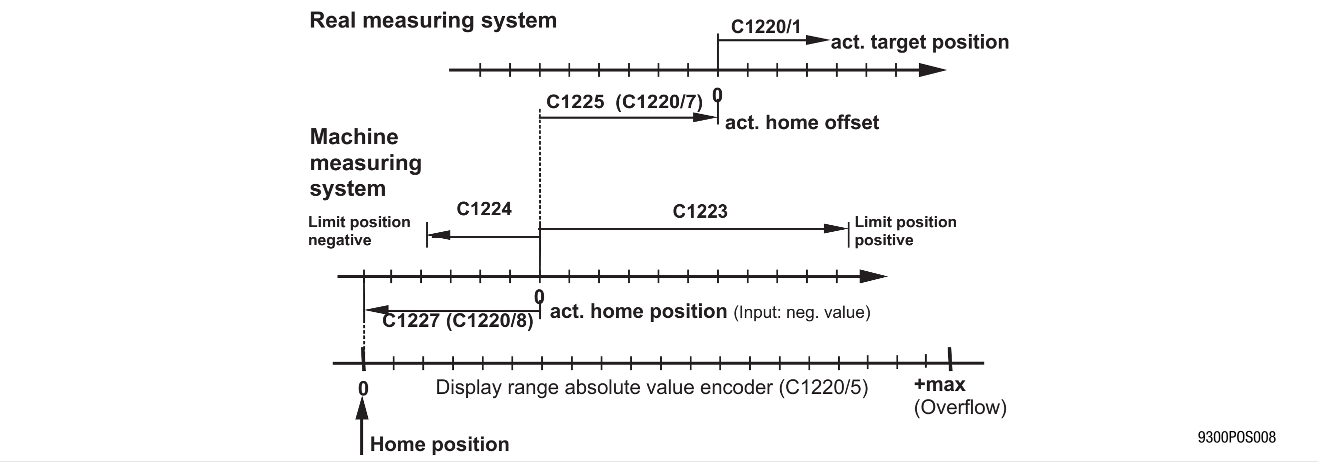


Fig. 3-13 Measuring systems with absolute value encoders

For absolute value encoders the same conditions than for positioning apply (see above) concerning the measuring systems and their references.The only difference is the definition of the reference point.

Encoder zero is defined as reference point.

- Actual home position
  - Use “actual home position” to move the machine zero further into the traversing range (negative value moves the machine zero in positive direction).
  - The “actual home position” is indicated under C1220/8 in “units” and C1221/8 in “incr”.
- Initialisation
  - After switch-on the ”actual home position” is initialised with the ”home position”.
  - “Actual home offset” (C1220/7, C1221/7) is set equal to the input value “home offset” (C1225).
- During operation
  - After changing, C1227 is not directly transferred to the ”actual home position”. During program operation, the transfer can be initialised via the function ”Acceptance home position (C1227)” (setting under PS mode (C1311) = 16).
- Set homing value
  - The program function ”set reference” enables the machine zero point to be set at the current position. Therefore the ”actual home position” is set to the negative value of the actual position value (POS-ACTPOS).
  - Transfer the value manually under C1220/8 to C1227 and save it under C0003 to ensure that the setting is available after mains switching.
  - The “actual reference offset” (C1220/7) is set equal to the input value “reference offset” (C1225) when setting the home position.

3.4.5 Absolute value encoder

Purpose

The absolute actual position value should be known immediately after mains switching so that homing is not necessary (for instance if homing is not possible because of machining or processing circumstances).

- The following functions **cannot** be executed for positioning with absolute value encoder:
  - – Homing in program operation,
  - – manual homing
  - – Program function "set position value" (PS mode C1311 = 5).

Tip!

Homing (to determine the machine zero) can be simulated when using touch probe positioning and the home position setting function.

3.4.5.1 Absolute value encoder via encoder connection X8

Function

- Connection of sine/cosine absolute value encoders with hyperface communication interfaces to encoder input X8. Absolute value encoders with a number of increments of 512 periods/rev and the corresponding data format of the initialisation value of 2^{14} inc/rev can be used (e. g. Stegmann SCS70, SCS60).
- The following absolute value encoders can be used as of the device version 33.93xx.EP.2x.**62**:

Number of increments [Periods/rev]	**Data format** [inc/rev]	**Tenderer**	**Type designation**
2048	2^{16}	–	–
1024	2^{15}	Stegmann	SRM50, SRS50
512	2^{14}	Stegmann	SCM70, SCM60
256	2^{13}	–	–
128	2^{12}	Stegmann	SKS36
64	2^{11}	–	–

Installation

The absolute value encoder must be mechanically mounted so that the encoder zero point is outside the travel range. Otherwise a value overflow would occur in the encoder within the travel range. This would result in a wrong actual position value after mains switching.

Commissioning

Observe the commissioning sequence to avoid a reset of C0420 to default setting.

1. Select the connected absolute value encoder under C0025 or C0495.
   - – After the selection the fault SD7 is indicated since the encoder has not yet been initialised. The initialisation only takes place by mains switching. (see step 5.).
2. Enter the number of increments of the absolute value encoder under C0420.
   - – By entering the number of increments the data format is automatically considered during initialisation. The data format determines the resolution to be reached of the initialised absolute value.
3. Carry out a fine adjustment under C1227 (home position).
   - – By entering a negative value (see Fig. 3-13) the machine zero point is shifted into the traversing range by means of the home position to enable the input of reasonable position limit values and monitoring of the traversing range. (🕮 3-37)
4. Save the settings under C0003.
5. Switch of the mains voltage off and on again.
   - – The absolute value encoder is initialised. The fault indication SD7 is reset.

Tip!

- Absolute value encoders have a finite area, e. g. 4096 revolutions. Within this area they can also be moved in a switch-off state; nevertheless they are able to deliver the correct absolute actual position value after switching on the mains.
- The overflow point of the encoder amounts to 65536 inc/rev × 4096 rev = 268.435.456 inc. (display: C1221/5)
  - – When the area to be described is exceeded the fault P12 is indicated.

3.4.5.2 Absolute value encoder via system bus (CAN)

Purpose

- Using absolute value encoders with CAN interface (e. g. laser measuring system).

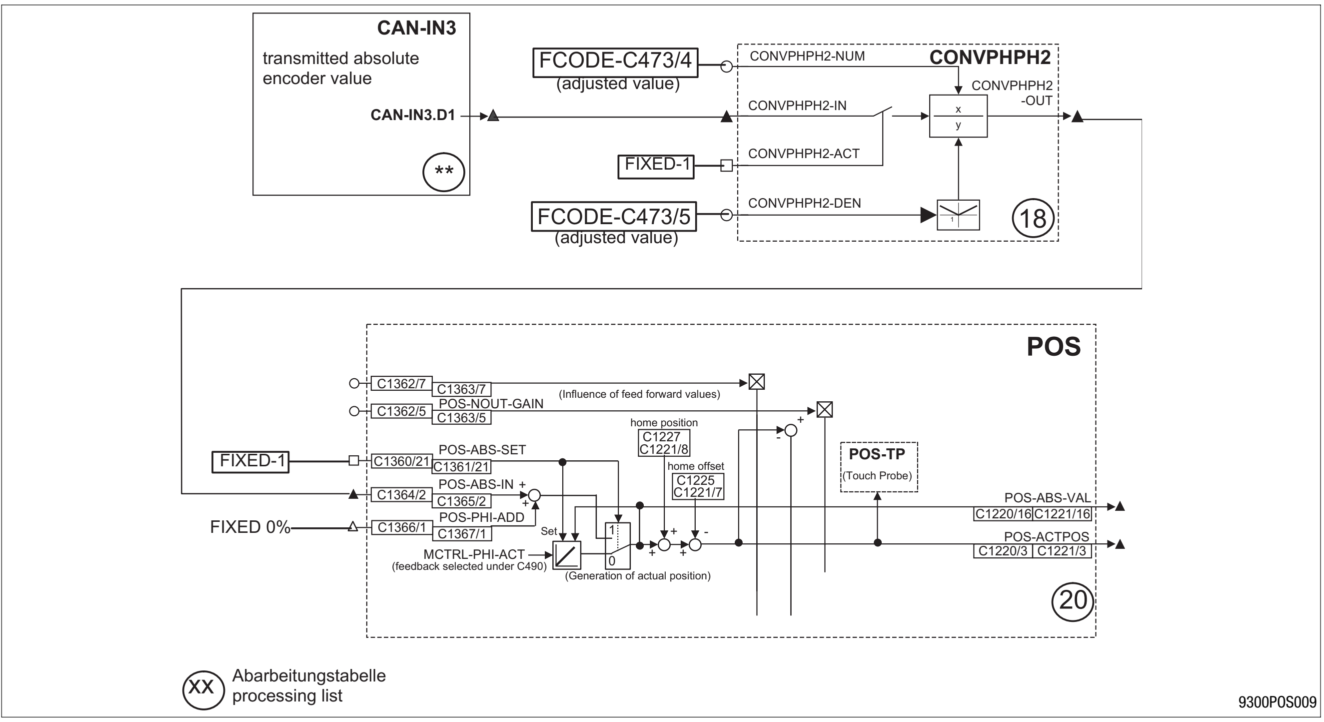


Fig. 3-14 Absolute value encoder via system bus (CAN)

Function

- All absolute value encoders with a CAN interface to specification “CAL DS-301” (CAN open) can be used.
- The CAN parameters, especially CAN baud rate, CAN identifier, and cycle time are to be set accordingly. The set CAN parameters must be storable in the encoder!
- The absolute value read via, for instance, CAN-IN3.D1 is sent to the input “POS-ABS-IN”.
- Input “POS-ABS-SET” is assigned to 1 signal (e.g.: FIXED1) and thus the acceptance of the absolute value at input POS-ABS-IN is activated.
- POS-ABS-SET = HIGH sets the homing status “REF-OK” automatically, homing is therefore not necessary.
- The encoder resolution is adapted to the internal position resolution of 65536 inc/rev via the function block CONVPHPH2. The adaptation factor is entered via the free codes C473/4 and C473/5.

Tip!

The input POS-PHI-ADD and the output POS-ABS-VAL are available as of firmware version ≥ 2.5

Example for the adaptation of the encoder resolution:

Gearbox between encoder and drive	i = 30
Effective wheel diameter	d = 50 mm
Position resolution of the measuring system	A_{meas} = 8 inc/mm
Internal position resolution (fix)	$A_{internal}$ = 65536 inc/rev

Position resolution of the measuring system (with regard to motor side):

$$Ax_{mess} = \frac{(A_{mess} \cdot d \cdot \pi)}{i} = \frac{(8\ inc/mm \cdot 50\ mm \cdot 3,14)}{30}$$
$$Ax_{mess} = 41,87\ inc/rev$$

Adaptation factor for CONVPHPH2:

$$\frac{C0473/4}{C0473/5} = \frac{A_{intern}}{Ax_{mess}} = \frac{65536 inc/rev}{41,87 inc/rev}$$
$$\frac{C0473/4}{C0473/5} = \frac{1565}{1}$$

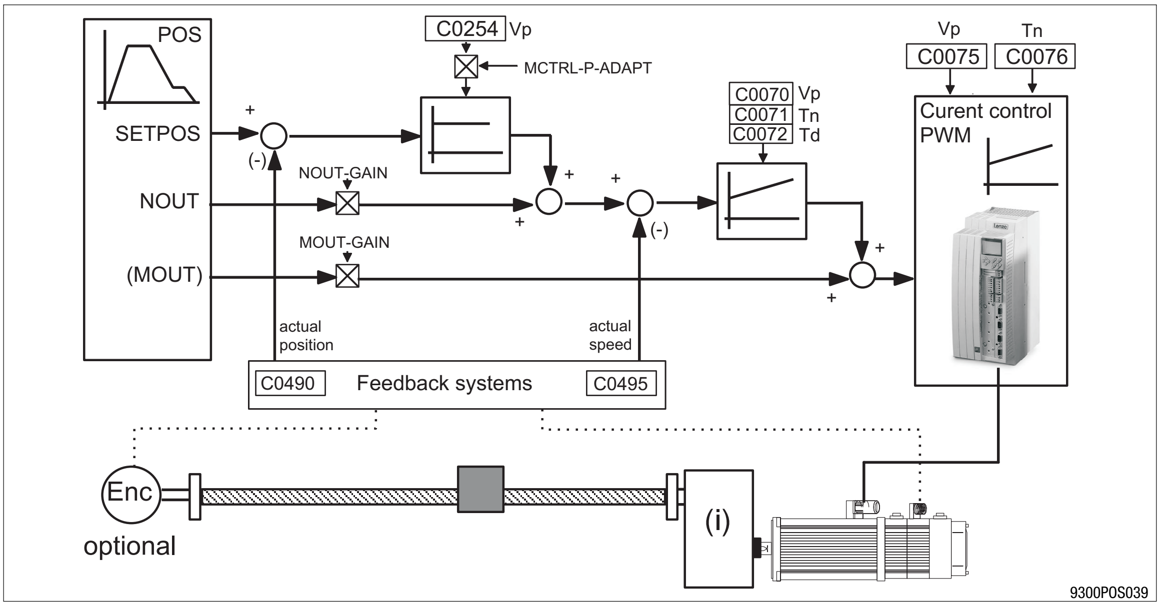
- Read the absolute value at POS-ABS-IN under consideration of the setpoint polarity (C1206) and the actual value polarity (C1208).
- The “actual home position” (C1220/8) is then added and the “actual home offset” (C1220/7) is subtracted.
- The “actual home position” is set equal to C1227 if POS-ABS-SET = HIGH during initialisation (switch on).

Tip!

The display values under C1220/5 and C1221/5 only correspond to the absolute value of the encoder read when using the absolute value encoder through X8!

3.4.6 Control structure

The following graphic representation provides an overview of the control structure realised in the 9300 servo position controller. It shows the parameters and codes that are decisive for the adjustment of the control loops.



Adjustment points of the control loops

- Speed controller (PID controller)
  - C0070: Gain Vp_n
  - C0071: Integral-action time Tn_n
  - C0072: Rate time Td_n (default setting $Td_n = 0$ is usually not changed)
  - POS-NOUT-GAIN: Speed feedforward control (default setting: 100%)
- Position controller (P controller)
  - C0254: Gain Vp position controller
  - MCTRL-P-ADAPT for adapting the gain depending on e.g. the speed
- Current controller (PI controller)
  - C0075: Vp (default setting is usually not changed)
  - C0076: Tn (default setting is usually not changed)

Important signals for adjusting the control loops

The following signals are especially suitable for evaluating the positioning behaviour and control features:

- POS-NOUT: Speed setpoint, 100 % ≡ n_{max} (C0011)
- MCTRL-NACT: Actual speed value, 100 % ≡ n_{max} (C0011)
- MCTRL-MSET2: Actual torque, 100 % ≡ M_{max} (C0057)
- POS-POUT-NORM: Actual following error, 100 % ≡ Following error tolerance (C1218/1)

Tip!

The code table can be found in the system manual, document number EDSVS9332P.

3.4.7 Travel range limits

You can prevent the mechanical stops of the limited travel range from being touched by

- the travel range limit switches (hardware),
- the position limiting values (software).

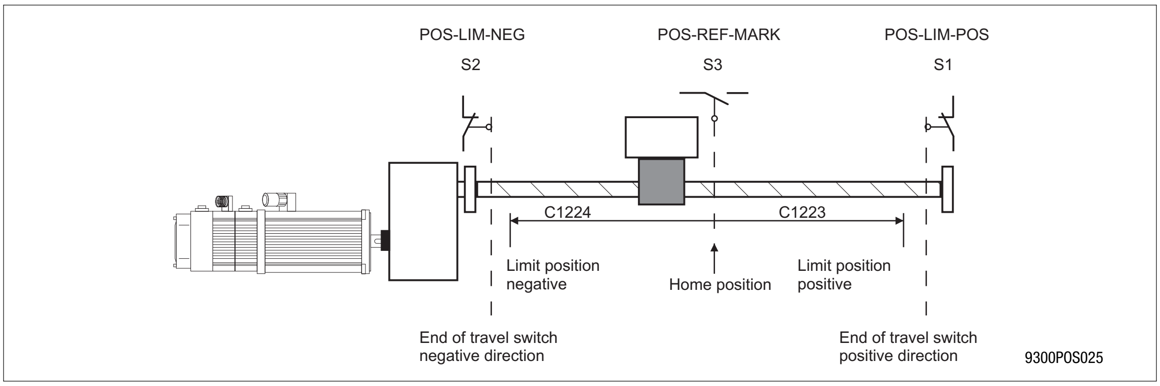


Fig. 3-15 Example of travel range limits

3.4.7.1 End of travel range limit switch

- The travel range limit switches are connected via the digital input terminals X5/E1 and X5/E2.
- In the default setting, X5/E1 and X5/E2 are configured for the function block inputs POS-LIM-POS and POS-LIM-NEG and are LOW active (protected against open circuit).
- A travel range limit switch indicates the fault P01 or P02 under the following circumstances:
  - In program operation if the speed setpoint (POS-NOUT) is unequal 0.
  - In manual operation if the drive moves outside the traversing range.
  - During homing, if the drive does not reverse when reaching the limit switch.
- In the event of a failure the drive brakes to standstill using the function “FAIL-QSP” (default setting); the ramp time “QSP-Tif” can be adjusted under C0105.

Tip!

The travel range limit switches should be mounted in positions that provide enough braking distance for the drive in the event of a failure.

3.4.7.2 Position limit values (C1223, C1224)

- Position limit values (C1223, C1224) define the permissible traversing range of the drive.
- The reference point for the position limiting values always is the machine zero point. Shifting the real zero point does not result in a shift of the position limiting value with the regard to the mechanical travel range limits. (📖 3-34).
- Exceeding the limit positions causes a fault (P04, P05).
- In the event of a failure the drive brakes to standstill using the function “FAIL-QSP” (default setting); the ramp time “QSP-Tif” can be adjusted under C0105.

Code	Name	Limits	Note
C1223	Pos.limit+	0.0000 ... 214000.0000 [units]	Positive position limiting value
C1224	Pos.limit-	-214000.0000 ... 0.0000 [units]	Negative positive limiting value

Tip!

- The settings should not allow that the end of travel limit switches are reached during operation.
- The max. traversing range amounts to ±16000 revolutions of position encoder.
- If the position limiting values exceed the internal area, the warning P18 (internal limitation) is triggered. The limiting values are internally automatically limited to the possible area. Positioning can only take place within these limits.
- The input values under C1223 and C1224 remain the same and need to be modified by the user (if necessary).
- Display of internally limited position limiting values under C1220/10 and C1220/11 [units] and under C1221/10 and C1221/11 [incr.].

3.4.8 Homing

Determination of the mechanical reference point for measuring systems.

After homing, the drive is in a defined position.

Functions

- Homing (🕮 3-46)
- Homing end (🕮 3-47)
- Homing status (🕮 3-48)
- Homing modes (🕮 3-49)ff.
- Second homing speed (🕮 3-56)
- Set homing value(🕮 3-57)

3.4.8.1 Homing

Purpose

Definition of the reference point in the absolute or relative positioning mode.

Function

- Selection of a sequence suitable for homing (🕮 3-49).
- Setting of the homing speed under C1242
  - Setting of a second homing speed under C1241 (if necessary) (🕮 3-56)
- Setting of the homing acceleration under C1251
- Definition of the final homing point under C1209.
- Execution of homing in
  - Manual operation via ”manual referencing” (🕮 3-67).
  - Program operation (GDC dialog ”Programming” under “PS mode” or selection under C1311/x = 3, program set mode)

Homing procedure

- The homing status POS-REF-OK is reset (see (🕮 3-48)) and the current reference offset initialised using the value entered under C1225.
- Homing is started and carried out according to the mode selected under C1213.
- If the reference point is found, the home position (C1227) is set and the reference offset (C1225) is added. The position data now refer to the real zero point (see Fig. 3-12).
- The homing status POS-REF-OK is set.

3.4.8.2 Final homing point

Purpose

- Determination of the final point where the drive stops after homing.
- Avoid reversing while homing

Selection of the final homing point (C1209)

- C1209 = 0 (default setting):
  Drive stops at **reference point** (index pulse / zero position / touch probe) or returns to that point.
- C1209 = 1:
  Drive does not stop until it has reached the **real zero point**. The distance covered additionally is determined by the reference offset and the home position.
- C1209 = 61:
  Drive does not stop until it has reached the target position **VTPOS-NO-60** (parameter C1301/60). The distance covered additionally is determined by the reference offset, the home position, and the target position.
- C1209 = 71:
  Drive stops at target position **VTPOS-NO-70** (function block input). The distance covered additionally is determined by the reference offset, the home position and the target position.
- C1209 = 101:
  Drive stops at target position **VTPOS-NO-100** (teach-in value). The distance covered additionally is determined by the reference offset, the home position, and the target position.

Tip!

When the drive must not reverse during homing:

- Select real zero as final homing point (C1209) and
- Enter reference offset.

Like this, the braking distance after homing is always long enough.

3.4.8.3 Homing status (POS-REF-OK)

The homing status is indicated via the function block output “POS-REF-OK” and displayed under C1284.

The homing status is displayed as ”Reference known” when the measuring systems have a defined reference to the machine. Absolute positioning (🕮 3-32) or (🕮 3-33) is only possible after a defined reference has been created.

The output POS-REF-OK is set if

- homing is completed,
- the program function “Set reference” is set,
- the absolute value encoder is selected as position feedback (C0490 = 4).
- Set Fb input POS-ABS-SET = 1.
- C1210 = 2 (absolute positioning with saving)

The output POS-REF-OK is reset by

- Start of homing
- Writing to the following codes:
  - C0011 (Nmax)
  - C0490 (feedback system for the position controller)
    Note:
    Please take into consideration that codes C0490 and C0025 have an impact on each other. A subsequent change of one of the codes overwrites the other.
  - C1202 (Gearbox factor, numerator)
  - C1203 (Gearbox factor, denominator)
  - C1204 (Feed constant)
  - C1207/1(Position encoder gearbox factor, numerator)
  - C1207/2 (Position encoder gearbox factor, denominator)
  - C1210 (Positioning mode)
- The following errors occur:
  - NMAX (limit speed from C0596)
  - P12 (encoder limit exceeded)
  - SD2 (resolver error) if resolver has been selected as position feedback system (C0490=0), SD7 (absolute value encoder).
- In relative positioning mode (C1210=1) if Prg-reset is carried out during a running positioning process.

3.4.8.4 Homing modes 0 and 1

Purpose

- Simple homing in all positioning modes (C1210 = 0, 1, 2).
- The homing switch (POS-REF-MARK) must be in direction of the movement.

Move to reference point via homing switch

Mode 0: Traversing direction to positive end of travel range limit switch

Set C1213 = 0.

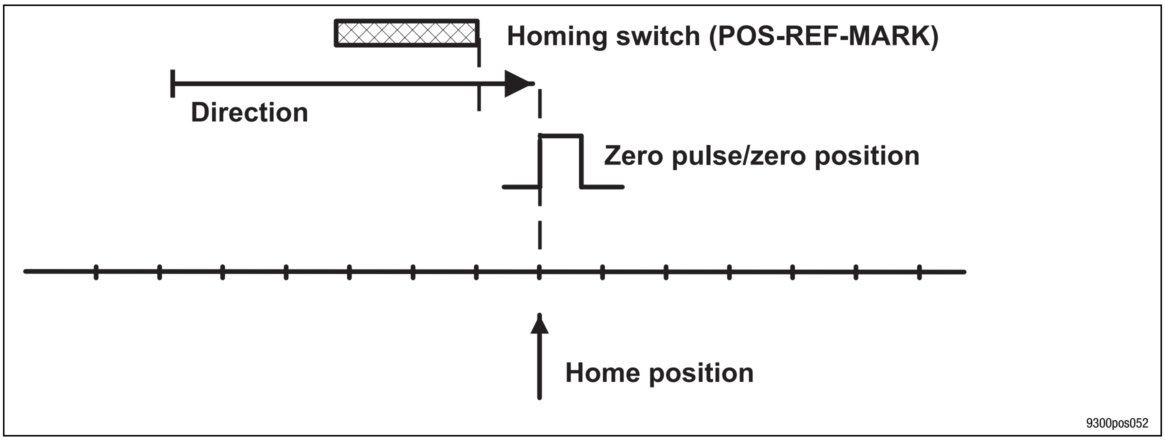


Fig. 3-16 Move to reference point via homing switch

Function sequence

- Move to the reference point with homing speed (C1242) towards positive end of travel range limit switch overtravelling the homing switch.
- The reference point is at the first zero pulse / zero position of the position encoder after leaving the homing switch.

The drive can be on the homing switch before homing.

Mode 1: Traversing direction to negative end of travel range limit switch

Set C1213 = 1.

Function sequence

- Like mode 0, but the drive traverses in negative direction to travel range limit switch.

3.4.8.5 Homing modes 2 and 3

Purpose

- Homing in absolute positioning mode (C1210 = 0, 2), with finite traversing range and existing travel range limit switches (POS-LIM-xxx).
- The homing switch (POS-REF-MARK) is always found. In the worst case the entire traversing range will be searched.

Approach end of travel range limit switch, reverse and move to reference point via homing switch

Mode 2: Traversing direction to positive end of travel range limit switch

Set C1213 = 2.

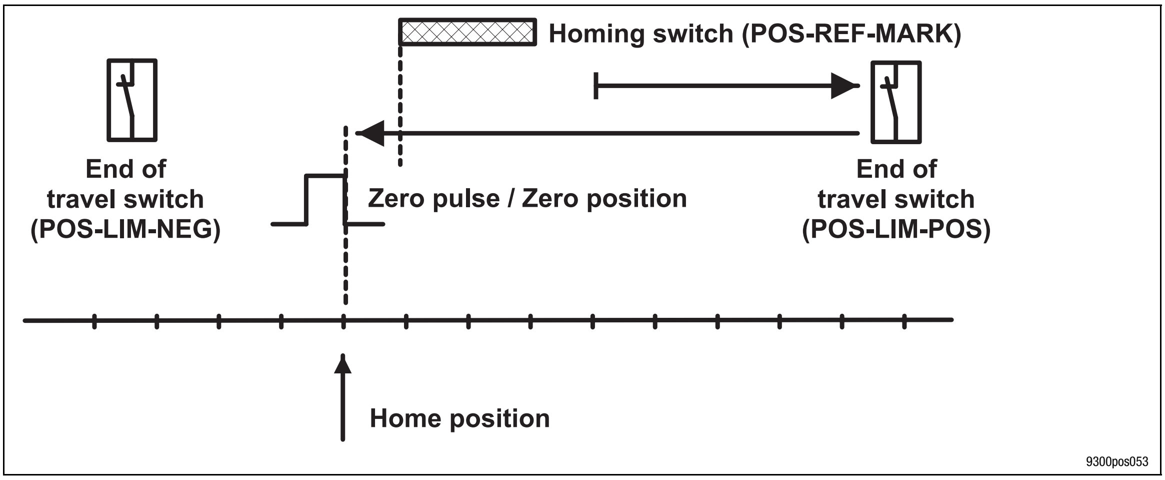


Fig. 3-17 Move to POS-LIM-POS, reverse, move to reference point via POS-REF-MARK

Function sequence

- Move to positive travel range limit switch with homing speed C1242.
- Reverse there and move beyond the reference switch to the reference point with homing speed C1242. In this case no fault (PO2) is indicated!
- The reference point is at the first zero pulse / zero position of the position encoder after leaving the homing switch.
- If the drive is already on the positive end of travel range limit switch before homing, it is reversed immediately.
- If the drive is positioned at the reference switch when homing is started, the switch will be overtravelled. The drive then goes on to the limit switch and reverses there.

Mode 3: Traversing direction to negative end of travel range limit switch

Set C1213 = 3.

Function sequence

- As ”Traversing direction to positive end of travel range limit switch”, but the drive moves towards the negative end of travel range limit switch.
- No fault indication (PO2)

Tip!

The limit switch (POS-LIM-xxx) can be used as homing switch (POS-REF-MARK) at the same time to save initiators.

3.4.8.6 Homing modes 4 and 5

Purpose

- Simple homing in all positioning modes (C1210 = 0, 1, 2).
- The homing switch (POS-REF-MARK) will not be overtravelled. Positions to the right of the homing switch cannot occur due to the mechanical design.
- The homing switch must be in direction of the movement.

Move to homing switch, reverse and move to reference point

Mode 4: Traversing direction to the positive end of the travel range limit switch

Set C1213 = 4.

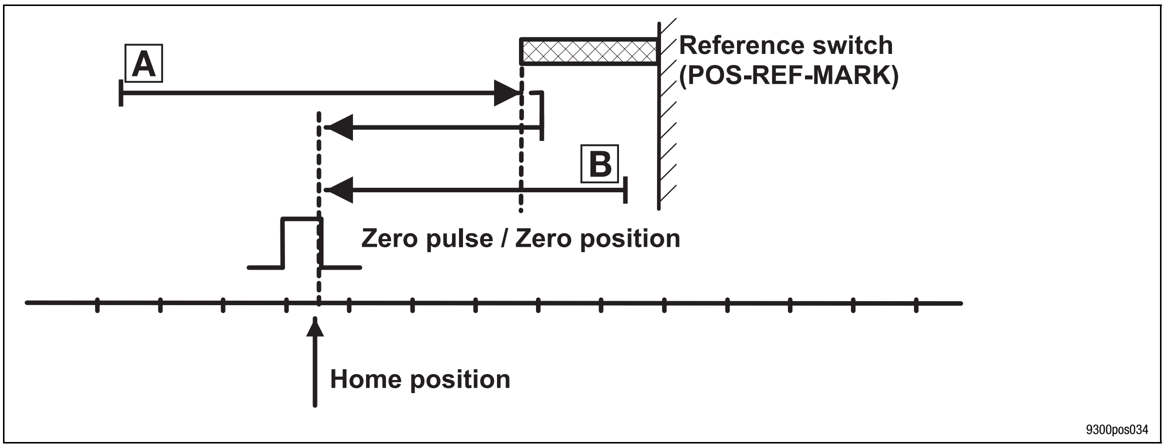


Fig. 3-18 Move to POS-REF-MARK, reverse and move to reference point

Function sequence

- Move towards travel range limit switch with homing speed C1242 up to homing switch (case A).
- Reverse there and move to the reference point. The homing switch must be assigned during the entire homing process!
- The reference point is at the first zero pulse / zero position of the position encoder after leaving the homing switch.
- If the drive is already positioned on the homing switch before homing it is reversed immediately (case B).

Mode 5: Traversing direction to negative end of travel range limit switch

Set C1213 = 5.

Function sequence

- Like mode 4, but the drive traverses in negative direction of travel range limit switch.

3.4.8.7 Homing modes 6 and 7

Purpose

- Homing in all positioning modes (C1210 = 0, 1, 2).
- Use of touch probe if the index pulse does not appear at the same place in a reproducible form due to the mechanical constellation. The index signal can also be mechanically shifted after a motor exchange.
- The homing switch (POS-REF-MARK) must be in direction of the movement.

Travelling to TP signal via homing switch

Mode 6: Traversing direction to the positive end of the travel range limit switch

Set C1213 = 6.

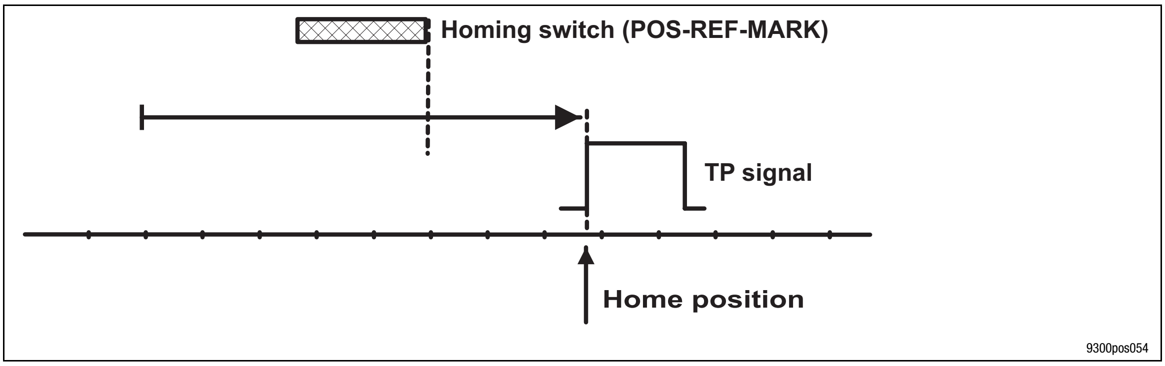


Fig. 3-19 Move to TP signal via POS-REF-MARK

The following settings are necessary:

- Select terminal for TP initiator via C1214.
  - C1214 = 1 ≙ terminal X5/E1.
  - C1214 = 2 ≙ terminal X5/E2.
  - C1214 = 3 ≙ terminal X5/E3.
  - C1214 = 4 ≙ terminal X5/E4 (This setting is recommended by LENZE).
- Select edge of the TP input via C1215.
  - C1215 = 0 ≙ LOW-HIGH edge.
  - C1215 = 1 ≙ HIGH-LOW edge.

Function sequence

- Move to the home position with homing speed (C1242) towards positive end of travel range limit switch overtravelling the homing switch.
- After leaving the homing switch the reference point is determined by the TP signal. TP signals that occurred before are ignored.
- The drive can be on the homing switch before homing.

Mode 7: Traversing direction to negative end of travel range limit switch

Set C1213 = 7.

Function sequence

- As ”Traversing direction to positive end of travel range limit switch”, but the drive moves towards the negative end of travel range limit switch.

3.4.8.8 Homing modes 8 and 9

Purpose

- Homing in all positioning modes (C1210 = 0, 1, 2).
- Use of touch probe if the index pulse does not appear at the same place in a reproducible form due to the mechanical constellation. The index signal can also be mechanically shifted after a motor replacement.
- The touch probe must be situated in direction of movement. The TP must not be assigned before starting homing.

Directly travel to TP signal

Mode 8: Traversing direction to the positive end of the travel range limit switch

Set C1213 = 8.

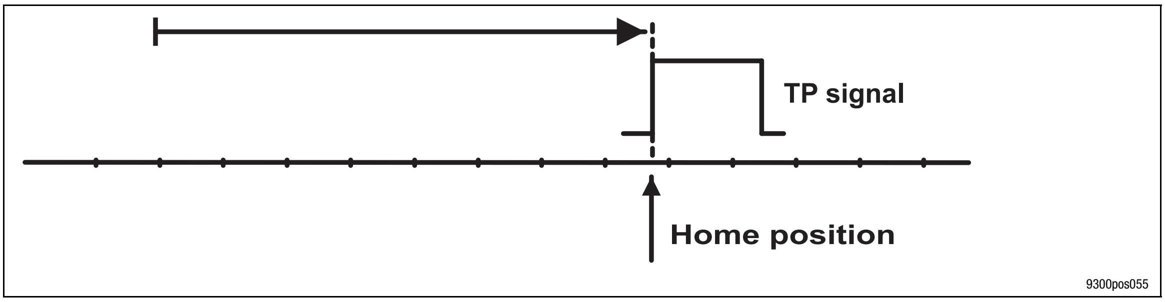


Fig. 3-20 Move to TP signal

The following settings are necessary:

- Select terminal for TP initiator via C1214.
  - C1214 = 1 ≙ terminal X5/E1.
  - C1214 = 2 ≙ terminal X5/E2.
  - C1214 = 3 ≙ terminal X5/E3.
  - C1214 = 4 ≙ terminal X5/E4 (This setting is recommended by LENZE).
- Select signal of the TP input via C1215/x.
  - C1215/x = 0 ≙ LOW-HIGH edge.
  - C1215/x = 1 ≙ HIGH-LOW edge.

Function sequence

- Move to the TP signal with homing speed (C1242) towards positive end of travel range limit switch.
- The first TP signal determines the reference point.

Mode 9: Traversing direction to negative end of travel range limit switch

Set C1213 = 9.

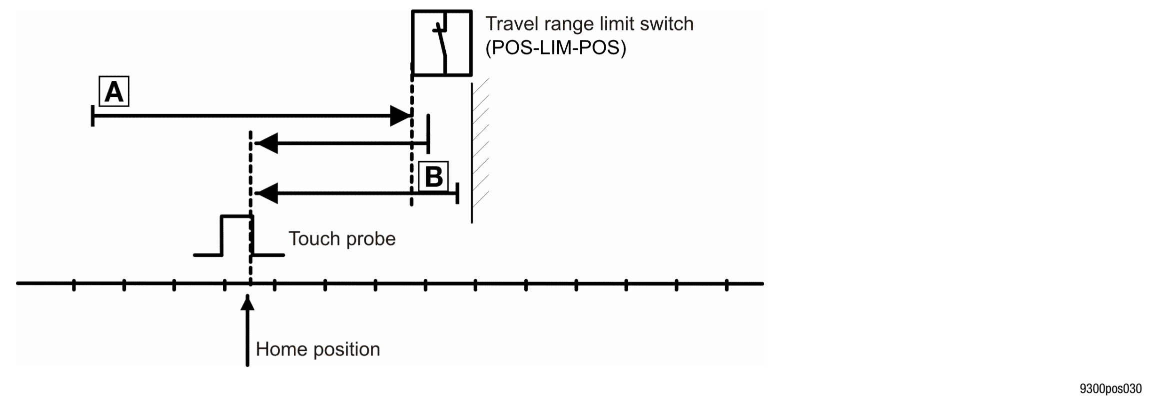
Function sequence

- As ”Traversing direction to positive end of travel range limit switch”, but the drive moves towards the negative end of travel range limit switch.

3.4.8.9 Homing modes 10 and 11

Purpose

- Homing in absolute positioning mode (C1210 = 0, 2).
- Use of touch probe if the index pulse does not appear at the same place in a reproducible form due to the mechanical constellation. The index signal can also be mechanically shifted after a motor replacement.



Mode 10: Traversing direction to positive POS-LIM-POS

Traverse in positive direction up to POS-LIM-POS, reverse there and reference to TP (case A). During reversing the limit switch must always be assigned!

- Move to positive end of travel range limit switch in positive direction with homing speed C1242.
- Reverse and move in negative direction to the reference point via touch probe with homing speed C1242 or C1241 (depending on the setting in C1216, see second homing speed).
- If the drive is positioned on the positive end of the travel range limit switch before homing, it directly travels in negative direction (case B).
- The reference point is at touch probe + home position C1227.

Monitoring P02 does not respond!

Mode 11: Traversing direction to negative POS-LIM-NEG

Travel in negative direction up to POS-LIM-NEG, reverse there and reference to TP. TP can also be the negative edge of POS-LIM-NEG.

Otherwise identical with mode 10

Tip!

In order to save initiators the limit switch (POS-LIM-xxx) can be simultaneously used as touch probe. The TP input is selected under C1214.

Since the limit switches are factory-set to LOW active, select the rising edge for TP (C1215/x = 0). After homing, the drive must not directly stop on the reference point, since this may result in a response of the travel range limit switches. The reference limit point must be set accordingly.

3.4.8.10 Second homing speed

Second homing speed

A second homing speed (C1241) can be activated by C1216.

Homing procedure with activated second homing speed:

Modes 0, 1:

To POS-REF-MARK at first speed, then at second speed.

Modes 2, 3:

At first speed to limit switch POS-LIM-POS (mode 2) or POS-LIM-NEG (mode 3), second speed after reversing.

Modes 4, 5:

To limit switch POS-REF-MARK at first speed, second speed after reversing.

Modes 6, 7:

To POS-REF-MARK at first speed, then at second speed.

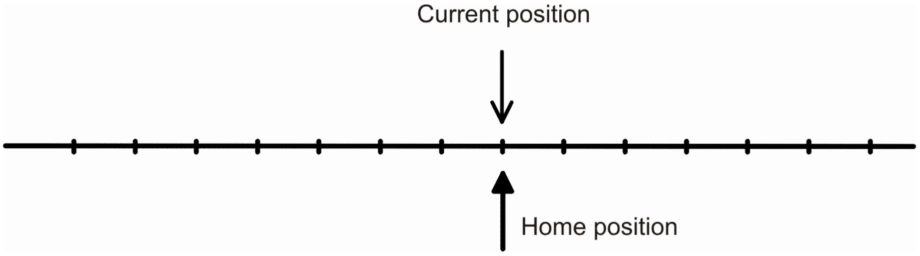
Modes 8, 9:

Only at first speed to reference point via TP.

Modes 10, 11:

To limit switch POS-LIM-POS or POS-LIM-NEG at first speed, second speed after reversing.

3.4.8.11 Set homing value



9300pos042

Purpose

If the home position is known (e.g. by a higher-level master system), homing is not necessary.

Function

- Select ”Set homing value” under ”PS mode” in the PS (C1311 = 4).
- In this case, the current position is the reference point.
- The zero points of the measuring systems are set accordingly (🕮 3-34).

3.4.9 Travel profile generator and setpoints

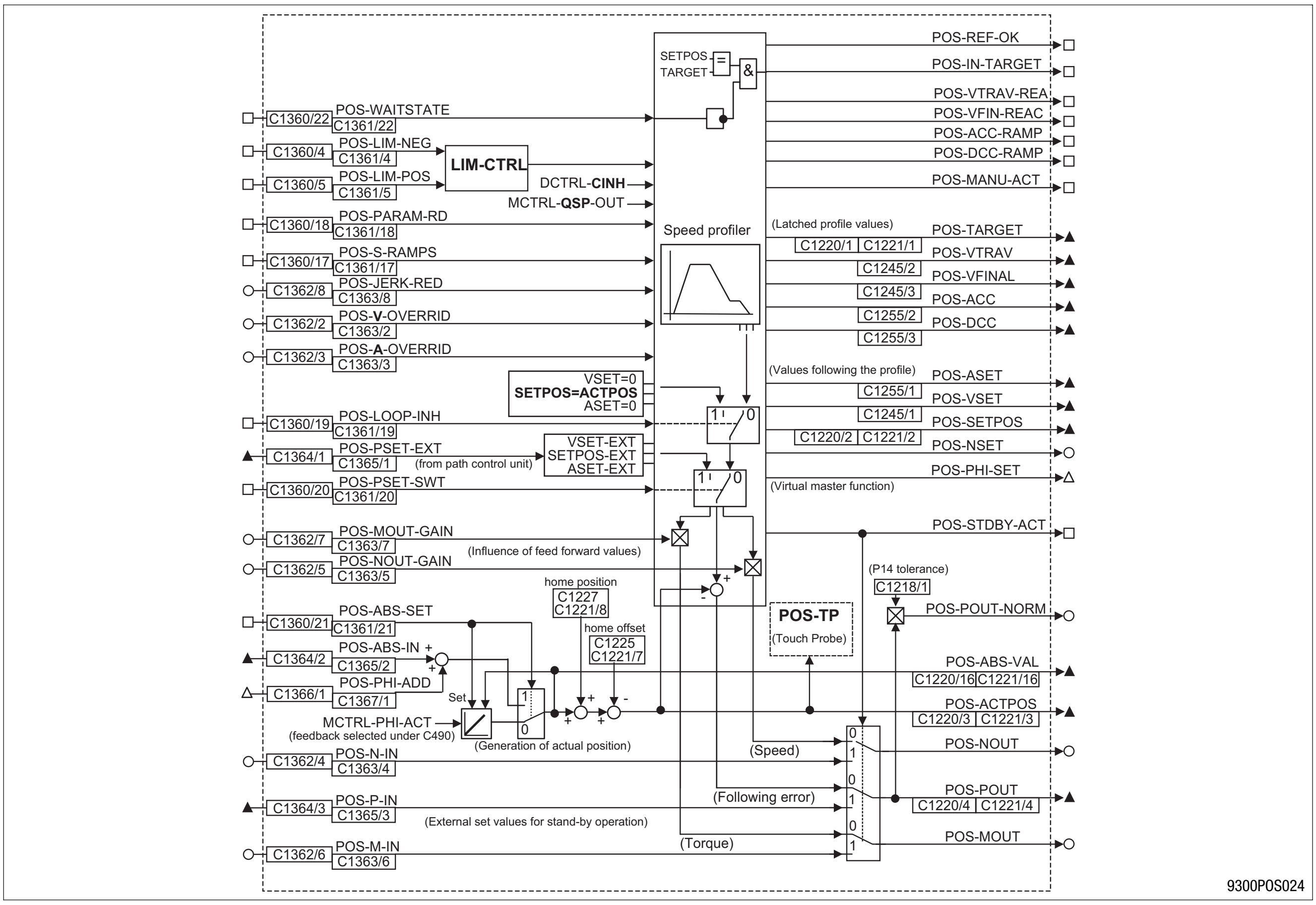


Fig. 3-21 Part of the POS function block

Purpose

- The travel profile generator of the POS function block generates a speed travel profile with the corresponding setpoints for:
  - position setpoint (POS-SETPOS),
  - speed feedforward control value and (POS-NOUT) and
  - torque precontrol value (POS-MOUT).
- The travel profile is generated with regard to the defined travel profile parameters:
  - target position (VTPOS),
  - traversing speed (VTVEL)
  - acceleration (VTACC)
  - deceleration (VTACC)
  - final speed (VTVEL).
- The travel profile parameters are always read by the profile generator at the beginning of a positioning process and remain unchanged for the entire positioning time. The override inputs (POS-V-OVERRID, POS-A-OVERRID) are taken into consideration during this process.
  The values given in the variable tables VTxxx can already be changed for the next positioning while the current positioning is still running.

- Traversing profile parameters can be changed via input POS-PARAM-RD even during a positioning process.

Stop!

For the ”Manual jog function with intermediate stop”, POS-PARAM-RD has to be set = LOW.

Function

- Linear ramps (L profile) (🕮 3-59)
- S ramps (S profile) (🕮 3-60)
- Override (POS-V-OVERRID, POS-A-OVERRID) (🕮 3-62)
- New traversing profile parameters during positioning (POS-PARAM-RD) (🕮 3-58)
- Influence of precontrol values (POS-NOUT-GAIN, POS-MOUT-GAIN) (🕮 3-62)
- Target window (POS-WAITSTATE) (🕮 3-64)
- Virtual master (POS-PHI-SET) (🕮 3-65)

3.4.9.1 Linear ramps (L profile)

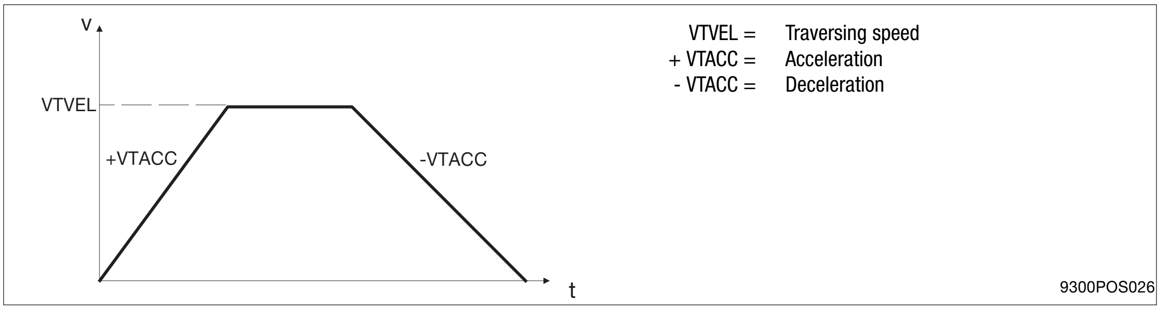


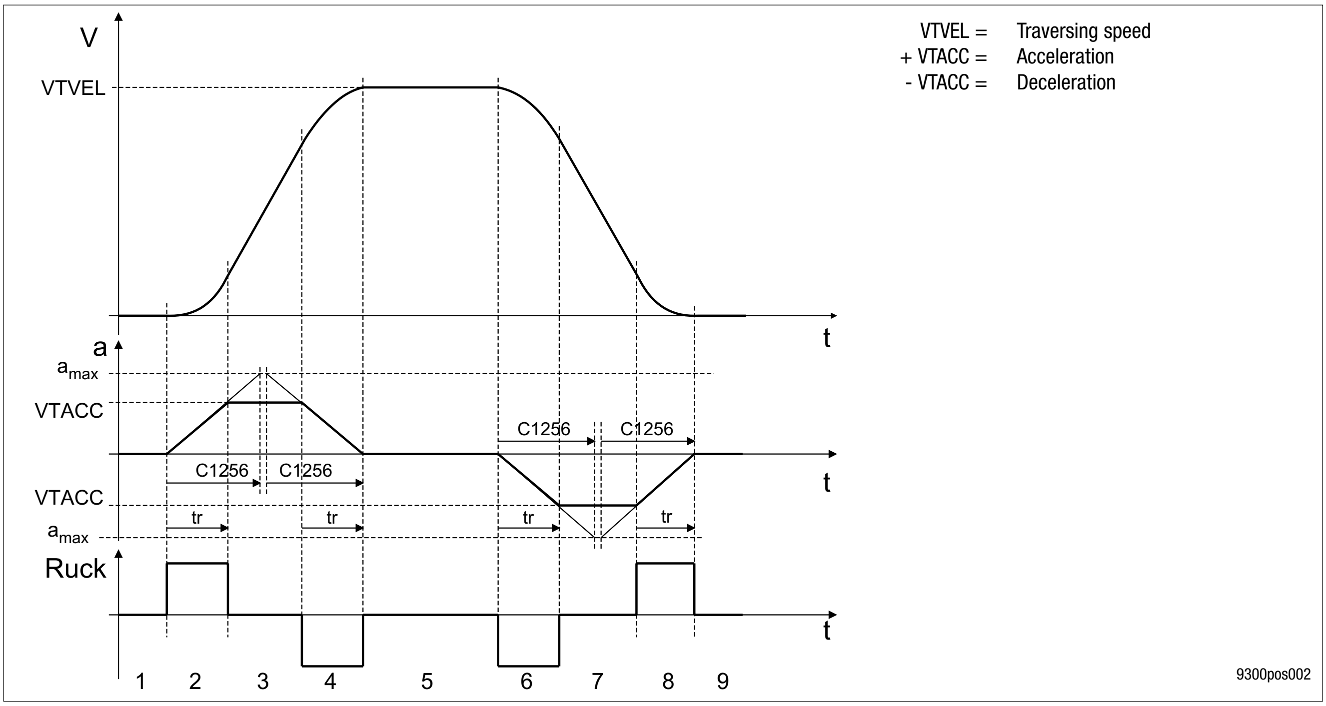
Fig. 3-22 Linear ramps (L profile)

- The profile generator works on an optimum time base using the L profile, i.e. the target position can be reached as quickly as possible with the acceleration and speed selected.
- The acceleration selected is effective immediately when the velocity is changed.
- Default setting: L profile.

3.4.9.2 S-shaped ramps (S profile)

Purpose

Protection from damage of the drive components by reducing the jerk during acceleration and deceleration.



VTVEL = Traversing speed
+ VTACC = Acceleration
- VTACC = Deceleration

Fig. 3-23 S-shaped ramps (S profile)

1. Standstill
2. Deceleration with set jerk
3. Acceleration with VTACC
4. Reduce acceleration with set jerk
5. Traversing with VTVEL
6. Deceleration with set jerk
7. Deceleration with VTACC
8. Reduce deceleration with set jerk
9. Drive in targetposition

- With the S profile acceleration and deceleration processes are started smoothly. The defined acceleration is only reached at the end of the jerk time.
  - A slower acceleration always leads to a longer positioning time - compared to the time-optimised L profile.
  - Set jerk time (T_r) via C1256.
    T_r corresponds to the time when the max. acceleration a-max (C1250) is reached. The actual jerk time tr decreases according to the actual acceleration a:

$$t_r = T_r \times \frac{a}{a_{max}} \rightarrow t_r = C1256 \times \frac{VTACC\ [\%]}{100\ \%}$$

  - Reducing the jerk or increasing the jerk time ($t_{r(RED)}$) can be set via the input "POS-JERK-RED" (default setting 100%).

$$t_{r(RED)} = t_r \times \frac{100\%}{POS\text{-}JERK\text{-}RED}$$

- The S profile must be activated before starting the positioning process.
- S profile is activated as follows:
  Connect input “POS-S-RAMPS” with 1-signal, e. g. assign FIXED1 directly or set FCODE-471.B1 = 1 (default setting).
- With “POS-PARAM-RD” you can switch between both profiles even during the positioning process.
  When changing from the L profile to the S profile during acceleration/deceleration, the S profile starts with acceleration 0 all the same. The process is prolonged accordingly.

Tip!

- The jerk remains unchanged when the acceleration is changed.
  - If a target position cannot be reached with these parameters (e. g. with TP positioning or velocity changeover) the target position is overtravelled. Afterwards the drives changes its direction of rotation and travels to the target position.
  - If a positioning process with or without final speed (changeover of velocity) is followed by a positioning process in opposite direction, the acceleration will be reduced to 0 before it is built up in opposite direction.
- For the S-profile, the deceleration is automatically equated with the acceleration in the PS. Inputs for the deceleration are not considered.
- Special feature when stopping in manual operation, homing, PS-CANCEL, program stop:
  → Stops are always realised with linear ramps!

  Firmware version ≥ 2.5:
  Under C1259/1.../3 it is possible to change to S ramps for stopping.

Stopping with S ramp

The corresponding setting parameters for the S ramp can be found in the GDC under the following menu: “POS functions / S-ramps”. This function can be set with code C1258.

When the S-ramp function is activated, the default settings of the controller cause the drive to be stopped in the case of the following functions with linear ramp:

- Manual jog,
- Prg-stop,
- PS-CANCEL and
- Homing

With firmware version ≥V2.5 the controller can be switched to stopping with S-ramp for the following functions when the S-ramp function is activated:

- Manual jog (C1258/1),
- Prg-Stop (C1258/2),
- PS-CANCEL (C1258/3)

3.4.9.3 Override

Purpose

- Dynamic change of the profile parameters (speed and acceleration).
  Example: Setting the traversing speed depending on the master speed.

Function

- Dynamic adaptation of traversing and final speed (POS-**V**-OVERRID).
- Dynamic adaptation of acceleration and deceleration (POS-**A**-OVERRID).
- The override inputs are considered before each positioning process. With the input POS-PARAM-RD this is also possible during the process (see chapter 3.4.9.4)
  - The parameter values are reduced according to the % values at the override inputs.
- In manual operation the override inputs are always effective.
  - Note: Only positive override values are effective, negative values will be evaluated as zero.

3.4.9.4 New traversing profile parameters during positioning (POS-PARAM-RD)

Purpose

- Change of the target position, speed or acceleration during positioning.

Function

- LOW-HIGH edge at POS-PARAM-RD immediately accepts - also while positioning is running - new profile parameters from the VT variable tables.
  Profile : Target position, traversing speed, acceleration, deceleration, final speed, V override, A override, POS-S-RAMPS (limited).
  - With a constant HIGH level: new profile parameters are accepted every 10 ms.

Tip!

Firmware version < 2.5: Not effective in stand-by operation.

Firmware version ≥ 2.5: Also effective in stand-by operation.

3.4.9.5 Influence of precontrol values (POS-NOUT-GAIN, POS-MOUT-GAIN)

Purpose

- Reduction of the influence of precontrol on speed and torque controller.

Function

- Adaptation of the speed precontrol (POS-NOUT) to the speed controller (MCTRL-N-SET) (POS-**N**OUT-GAIN, default setting: 100 %)
- Adaptation of the torque precontrol (POS-MOUT) to the torque controller (POS-**M**OUT-GAIN, default setting: switched off)
- The precontrol values are reduced according to the % values at the inputs.

Tip!

With dynamic positioning processes, a reduction of the speed precontrol (e.g. to 95%) can be advantageous for the travelling performance towards the target position.

3.4.9.6 ”Target-reached” message (POS-IN-TARGET)

Purpose

Messaging the termination of positioning.

Function

- A positioning process is terminated when the position setpoint POS-SETPOS of the profile generator has reached the target position POS-TARGET (”setpoint-based”).
- POS-IN-TARGET = HIGH messages that the position setpoint POS-SETPOS has reached the target position POS-TARGET.
- The other program functions are only processed further when → POS-IN-TARGET = HIGH.

Tip!

Because of mains failure, the drive may not be in the indicated position, although the message POS-IN-TARGET was indicated.

3.4.9.7 Target window (POS-WAITSTATE)

Purpose

Particularly high demands on the accuracy for reaching the target position (message: Target reached).

Function

Via the input POS-WAITSTATE the ”Target reached” message can be (🕮 3-63) delayed until the pending following error has been compensated and the drive has reached the target with sufficient accuracy (target window).

The program will not be processed until

- the position setpoint POS-SETPOS has reached the target and
- the input POS-WAITSTATE = LOW.

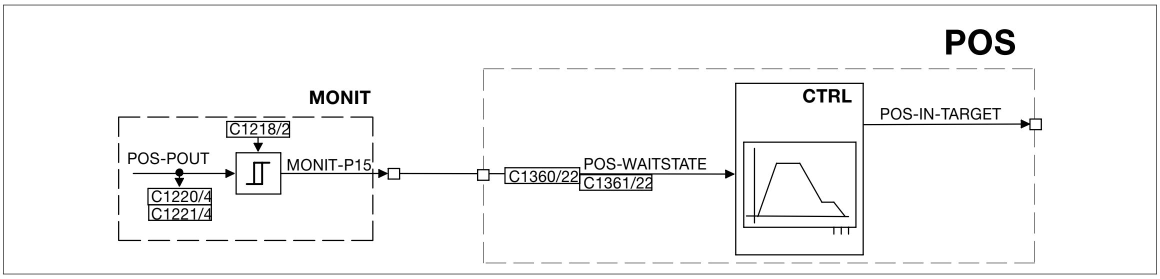


Fig. 3-24 Connect output MONIT-P15 with input POS-WAITSTATE

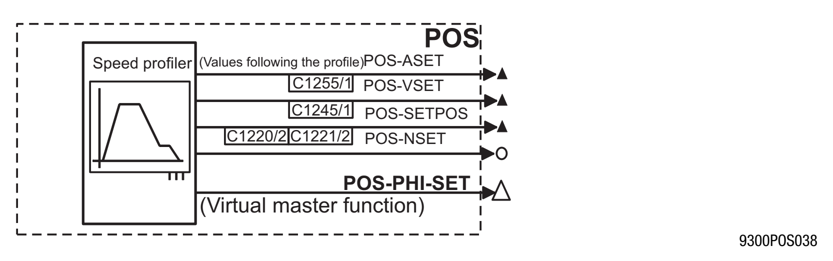
By the interconnection of the function blocks shown in Fig. 3-24 the continuation of the program is delayed within a narrow target window (POS-WAITSTATE = HIGH) until the actual position value is actually in the target window. For this the target window is preselected in a very narrow manner in C1218/2 (second following error tolerance). In order to be able to continue the program processing later on, the system deviation between the setpoint and the actual value, which is referred to as the following error, must be smaller than the target window defined before. The output MONIT-P15 also switches if monitoring P15 is switched off.

Output	Level	Description
POS-WAITSTATE	HIGH	POS-IN-TARGET is not yet set since the current positioning is still running. The functions of the next PS are not carried out yet. During homing, the function is not effective.
	LOW	Continuation of the program: The program is only continued if the difference between actual value and setpoint is compensated such that the difference is within the permissible following error tolerance. Under code C1218/2 you can enter a following error with less tolerance.
MONIT-P15	HIGH	Display when the current following error is greater than the target window.
		The output MONIT-P15 will be switched even if the second following error monitoring is switched off.

Tip!

- In practice, the ”Target window” function only has to be used for particularly high demands with regard to the accuracy of the target achievement. According to experience, in most applications the standard ”Target reached” message, which is derived from the setpoint of the profile generator, is sufficient.
- During homing the POS-WAITSTATE function is not effective. The end of a reference run is always indicated by the homing status (POS-REF-OK).

3.4.9.8 Virtual master (output POS-PHI-SET)



Purpose

- Phase- and speed-synchronous traversing of two or several drives.

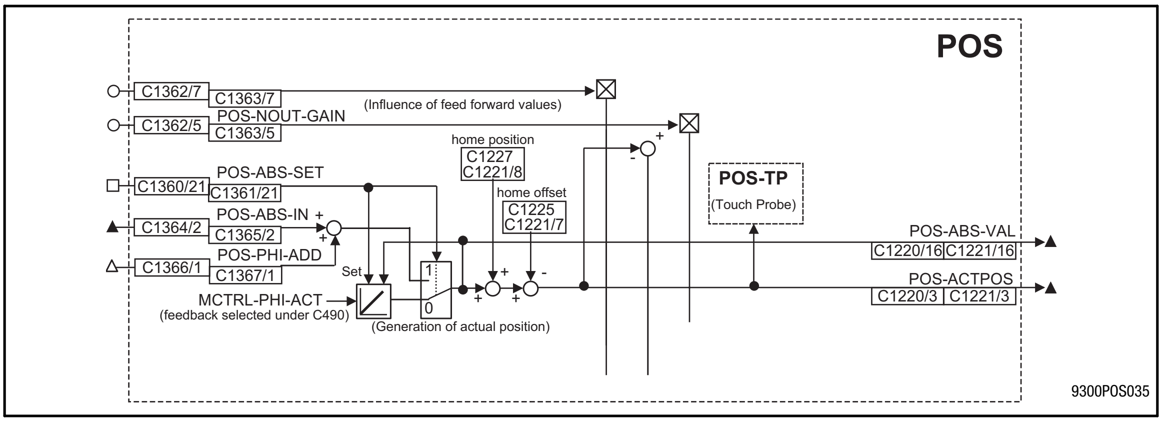
Function

- Definition of "virtual master":
  Via the required phase difference output (POS-PHI-SET) of the master drive the master drive itself and the "slave" drives are positioned in parallel.
  This does not lead to any reactions between the drives and no offset in positioning occurs in contrast to connecting the slave drives via the actual phase difference output (MCTRL-PHI-ACT).
- POS-PHI-SET is transmitted to the slave drives through digital frequency connection (DFOUT, DFIN, DFSET).
- A connection via system bus (CAN) is possible.
  - Advantage of clocked drives:
    For improving the dynamic features a speed precontrol can be transmitted in addition.

Tip!

With system bus coupling (CAN) the controllers must be synchronised, otherwise position information may get lost. The synchronisation is realised in the slave drives via the SYNC function block. In the master drive the "CAN sync telegram" must be generated.

3.4.9.9 Setting the actual position value (POS-ABS-SET)



POS-ABS-IN	C1365/2	C1364/2	Input for external actual position value, e. g. when using an absolute value encoder with a CAN interface. (see “Absolute encoders via system bus” 🕮 3-40)
POS-ABS-SET			Changeover (position encoder C490) / (ABS-IN)
POS-ABS-VAL	C1220/16 C1221/16		Display as actual position POS-ACTPOS, but without considering setpoint position polarity (C1206), actual position (C1206), actual home position (display C1220/8) and actual reference dimension offset (display C1220/7).
POS-ACTPOS	C1220/3 C1221/3	-	Actual position; position relating to real zero For rating see formula 1
POS-PHI-ADD	C1367/1	C1366/1	Phase difference signal is added to POS-ABS-IN. Function: With POS-ABS-SET= HIGH the actual position is set to the value POS-ABS-IN. Encoder increments that have arrived in the setting cycle are not considered in the default. If required, the encoder change can be connected in the setting cycle; the signal MCTRL-PHI-ACT must be linked with the input POS-PHI-ADD.

Home position

HIGH = Phase value at POS-ABS-IN is read in for actual position value generation (POS-ACTPOS).

The following values are considered when POS-ACTPOS is generated:

- Position setpoint polarity (C1206)
- Actual position value polarity (C1208)
- Actual home position (display C1220/8)
- Actual reference dimension offset (display C1220/7).

3.4.10 Manual operation

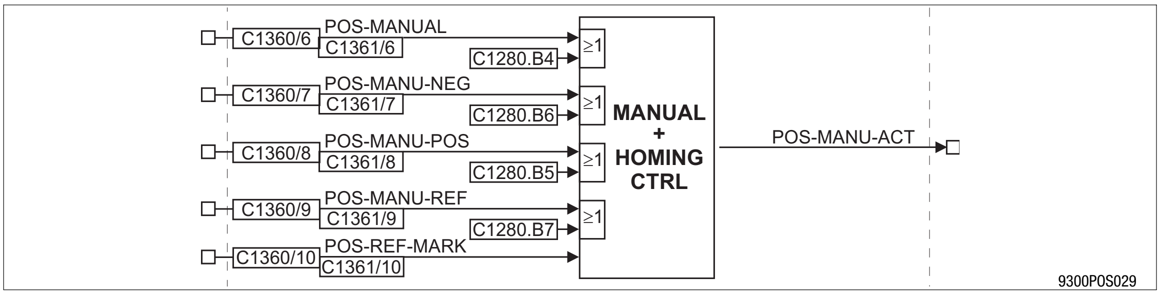


Fig. 3-25 Manual jog (part of the POS function block)

Signal				Source		Note
Designation	Type	DIS	DIS format	CFG	List	
POS-MANUAL	d	C1361/6	bin	C1360/6	2	Changeover Manual jog / program operation HIGH = manual operation; if necessary, running program is interrupted. If necessary, drive is decelerated to standstill with a-manual (C1252) and the influence of POS-A-OVERRID. LOW = Program operation
POS-MANU-NEG	d	C1361/7	bin	C1360/7	2	HIGH = drive travels with v_manual (C1243) in negative direction. Acceleration with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have influence. LOW = drive is stopped with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have influence. Note: POS-MANU-REF has priority. When -NEG and -POS are triggered simultaneously the drive stops.
POS-MANU-POS	d	C1361/8	bin	C1360/8	2	Like POS-MANU-NEG, but in positive direction
POS-MANU-REF	d	C1361/9	bin	C1360/9	2	LOW-HIGH signal = Start manual homing HIGH level required for the time of homing (see 3.4.10.3 ”Manual referencing”)
POS-REF-MARK	d	C1361/10	bin	C1360/10	2	Homing switch
POS-MANU-ACT	d	-	-	-	-	HIGH = manual operation active, no program operation Note: Signal will not be updated when the controller is inhibited (DCTRL-CINH = HIGH) or quick stop (MCTRL-QSP-OUT = HIGH) is set

Function

- Manual jog without intermediate stop (🕮 3-68)
- Manual jog with intermediate stop (🕮 3-69)
- Manual homing (🕮 3-69)

3.4.10.1 Manual positioning

- Set manual jog mode to “Manual jog without intermediate stop” (C1260 = 0)
- Activating manual operation: Activating manual operation:
  POS-MANUAL = HIGH and/or
  C1280/B4 = 1 (“manual jog” in the ”Control” GDC dialog)
- Manual control in positive direction:
  POS-MANU-POS = HIGH and/or
  C1280/B5 = 1 (“manual positive” in the “Control” GDC dialog).
- Manual control in negative direction:
  POS-MANU-NEG = HIGH and/or
  C1280/B6 = 1 (“manual negative” in the ”Control” GDC dialog).
- The drive brakes to standstill if none of the manual functions is activated or both of them.
- Manual positioning speed adjustable under C1243.
- Manual acceleration/deceleration adjustable under C1252.
- The override inputs POS-V-OVERRIDE and POS-A-OVERRIDE are always effective
- The drive stops when a travel range limit switch is reached. Fault messages P01 or P02 are activated.

Tip!

- Assigned travel range limit switches can be left again in manual operation in direction of the travel range. The fault must be reset before.
- In manual operation the drive stops with linear ramps (L-profile). From software version 2.5 the ramps can be set with C1256. (🕮 3-60)

The following conditions must be met to ensure that the drive can be traversed manually:

1. The drive must be enabled (DCTRL-CINH =0),
2. The QSP function must not be activated (MCTRL-QSP-OUT=0),
3. Manual homing must be inactive:
   POS-MANU-REF = LOW and
   C1280/B7 = 0 (“Manual homing” in the “Control” GDC dialog),
4. Only one direction is to be selected.
   If the positive and negative direction are activated at the same time, the drive is braked to standstill.

3.4.10.2 Manual jog with intermediate stop

Purpose

- During manual positioning, the drive is to stop at defined target positions (intermediate stops).

Activating this function

- Set manual jog mode to “Manual jog with intermediate stop” (C1260 = 1).
- Set input POS-PARAM-RD = LOW.
- Carry out the next steps like in chapter ”Manual jog”. (🕮 3-68)
- The intermediate stop positions are defined by selecting the target positions from the VTPOS variable table. Up to 16 target positions can be selected via C2161/1 to C1261/16. (GDC menu: “Positioning functions/manual jog”)
- The drive travels to the next target position and stops there. In order to continue, the control signal for ”manual positive” or ”manual negative” must be reset and then set again. The drive immediately brakes to standstill if the control signal is reset before reaching the next target position.

3.4.10.3 Manual homing

Purpose

Example: Homing during commissioning.

Activating the function

The homing parameters set apply to manual homing (🕮 3-46)

Procedure:

1. Activate manual operation
   - Set POS-MANUAL = HIGH and/or C1280/B4 = 1 (Activate the “Manual jog” option field in the ”Control” GDC dialog).
2. Start manual homing
   - Rising edge at POS-MANU-REF or rising edge at C1280/B7 (Activate the “Manual homing” option field in the ”Control” GDC dialog). The signal for manual referencing has to be pending until the end of the homing process, otherwise the process is interrupted.
   - A restart is effected with a rising edge again.
   - For ”Manual jog with intermediate stop”, set the input POS-PARAM-RD = LOW.

Tip!

- Manual homing has priority over manual jog, that means the signals for manual jog have no effect when manual homing is activated by a control signal.
- For manual homing the following conditions have to be met:
  - The drive must be enabled (DCTRL-CINH = 0).
  - The QSP function must not be activated (MCTRL-QSP-OUT = 0).
  - The interval between ”Activate manual operation” and a rising edge for ”Start manual homing” at least has to be 1 ms (1 x cycle time).

3.4.11 Program operation

Purpose

Positioning programs for automatic operation of the application can run during program operation.

Function

- Program control (🕮 3-70)
- Variable tables (VT) (🕮 3-75)
- Program blocks (PS) (🕮 3-76)

3.4.11.1 Program control

Purpose

The program control offers the possibility to influence program processing by a higher-level control (e.g. PLC) or directly from the operator's panel.

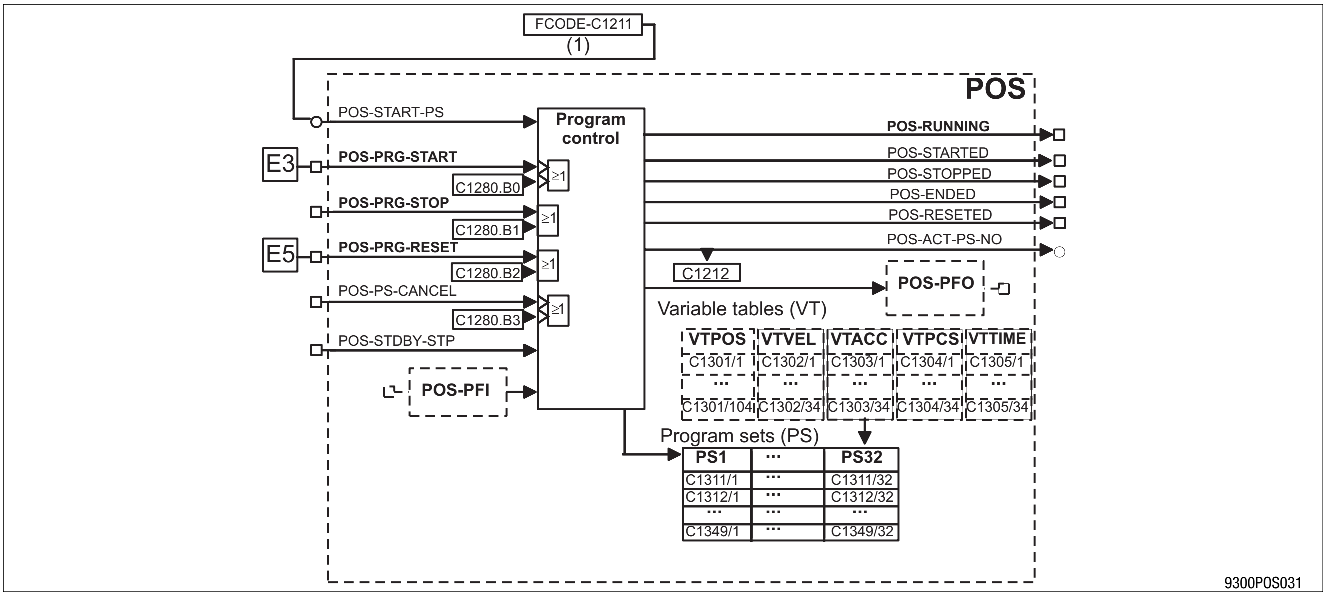


Fig. 3-26 Functionality of PS, VT, PFI and PFO (excerpt from the POS function block)

Starting the program (PRG-START)

- The beginning of the program to be started is determined by the FB input "POS-START-PS". In the standard configurations this input is connected with FCODE C1211. In the default setting the program starts with PS01.
- Starting the positioning program with
  - LOW-HIGH edge at POS-PRG-START or
  - C1280.B0 = 0 / 1 edge ("Program start" in the GDC dialog "Control").

Tip!

- The program processing is continued to the ”Program end” even if the start signal is reset immediately.
- If the start signal is still applied at ”program end” the program will be restarted automatically every time.
- A new edge at POS-PRG-START is required after interrupting the program processing (e.g. by controller inhibit) or by a fault message.
  Afterwards the program is continued from the same position (status display: C1283=15).

The start signal will only be accepted in program operation and when the controller is enabled.

The controller is enabled if

1. the power stage is supplied (DCTRL-RDY=1),
2. no fault applies (DCTRL-TRIP=0, DCTRL-FAIL-QSP=0),
3. the control enable signal is applied (DCTRL-CINH=0)
4. quick stop (QSP) is not activated (MCTRL-QSP-OUT=0)
5. manual operation is not activated (POS-MANUAL=0, C1280.B4=0)
6. program reset is not activated (POS-PRG-RESET=0, C1280.B2=0)

Stopping the program (PRG_STOP)

- POS-PRG-STOP = HIGH or C1280.B1 = 1 (“Program stop” in the GDC dialog ”Control”).
  - The signal ”program stop” interrupts the program processing and the running positioning process. The drive is stopped with the current delay of the program set (no influence of POS-A-OVERRID).
- POS-PRG-STOP = LOW **and** C1280.B1 = 0 (“Program stop” in the GDC dialog ”Control”).
  - The program is continued from the same position when “Program stop” = LOW. The positioning process is finished with the current profile parameters of the PS.

Resetting the program (PRG-RESET)

- POS-PRG-RESET = HIGH or C1280.B2 = 0 (“Program reset” in the GDC dialog ”Control”).
- When a program is reset,
  - the drive will be stopped with a-max (C1250) (no influence of POS-A-OVERRID)
  - the program will be interrupted
  - “Program end” will be set
  - the piece counter will be set to zero
  - the program function outputs (PFO) will be reset
  - the touch probe inputs used by the program will be “disabled”
  - and if necessary, stand-by operation will be cancelled.

Tip!

The signal for resetting the program is also accepted and saved in the inhibited state. The program reset will only be executed in the released state (see notes under ”starting the program”).

Cancelling the current PS (PS-CANCEL)

- LOW-HIGH signal at POS-PS-CANCEL or C1280.B3 = 0 / 1 signal.
  - The drive will be decelerated to standstill with the separately adjustable delay “a-cancel” (C1253).
  - The program will be continued in the PS selected (C1333; JMP-TP-PS).

3.4.11.2 Status of the program control

The actual state of the program control is displayed via the status outputs of the POS function block and the positioning status (C1283).

Status outputs

Update conditions of the status outputs ”RUNNING”, “POS-STARTED”, “POS-STOPPED”, “POS-ENDED”, “POS-RESETED” and the positioning status in code C1283:

- – The power stage is supplied (DCTRL-RDY=1)
- – The drive is enabled (DCTRL-CINH=0)
- – No fault applies (DCTRL-TRIP=0, DCTRL-FAIL-QSP=0)
- – Quick stop (QSP) is not activated (MCTRL-QSP-OUT=0)
- – Manual operation is not activated (POS-MANUAL=0, C1280.B4=0)

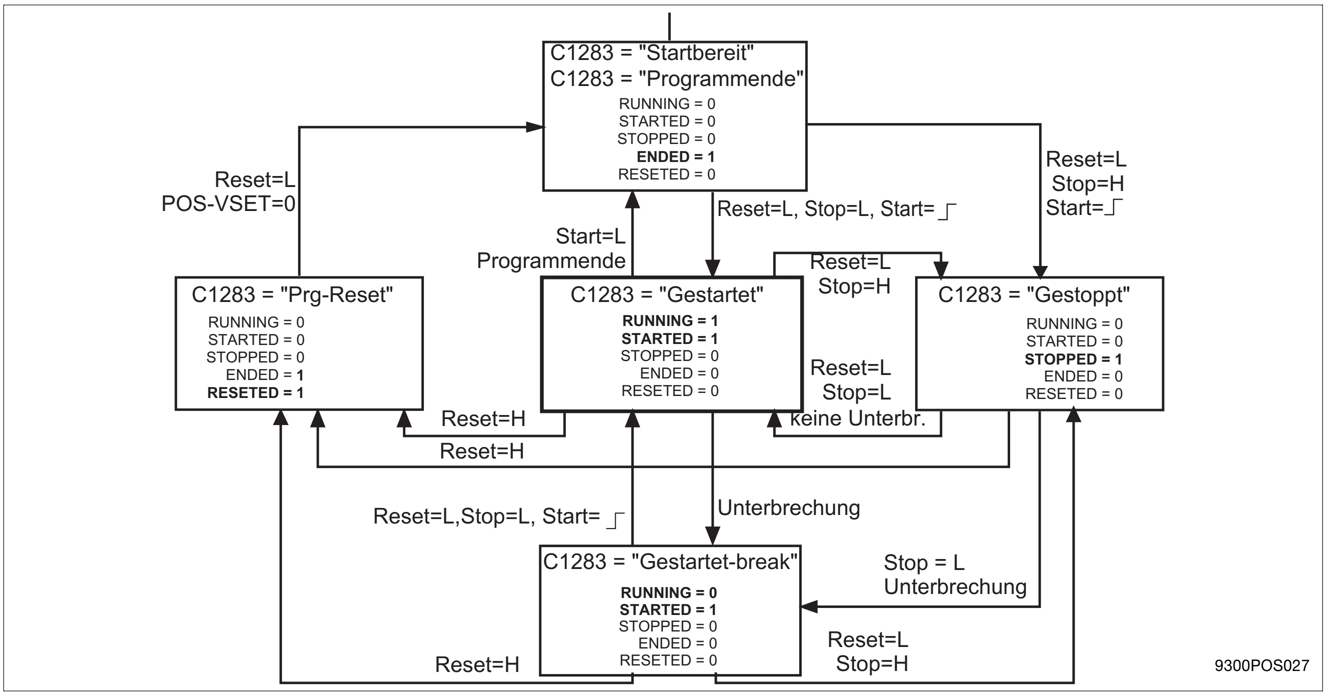


Fig. 3-27 Status machine of program control

Status ”Ready to start”

- Program control is ready to start but not started yet.
- Status output POS-ENDED = HIGH,
- Positioning status (C1283) = “Ready to start”,
- Current PS No. (POS-ACT-PS-NO) = 0 (program end)

Status “Started”

- Program has been started, the positioning program is running.
- Status output POS-STARTED = HIGH and
- Status output POS-RUNNING = HIGH (for firmware version ≥ 2.5)
- Positioning status (C1283) = “Started”,
  or “Started-rem”, if C1280.B0 = 1 (GDC control),
  or “Started-dig”, if input POS-PRG-START = HIGH.

Status “Started-break”

- Program processing is started but is interrupted by controller inhibit, QSP, TRIP, mains failure, Fail-QSP or manual control (interruption). In order to continue the program processing a new start edge is required.
- Status output POS-STARTED = HIGH and
- POS-RUNNING = LOW (for firmware version ≥ 2.5)
- Positioning status (C1283) = “Started break”.

Tip!

- Firmware version ≥2.5:
  The states ”Started” and ”Started-break” can be distinguished by the new status output “POS-RUNNING”.
- Firmware version < 2.5:
  When the stand-by operation is activated, ”Started-break” cannot be identified!
  The states “Started” and “Started-break” can only be distinguished via the positioning status (C1283).

“Stopped” status

- Program and drive stopped, or drive will be stopped.
- Status output POS-STOPPED = HIGH,
- Positioning status (C1283) = “Stopped”,
  or “Stopped-rem”, if C1280.B1 = 1 (GDC control),
  or “Stopped-dig”, if input POS-PRG-STOP = HIGH,

“Prg reset” status

- Program processing is aborted and the drive is stopped. Actual PS No. (POS-ACT-PS-NO) is set to ”program end”.
- Output POS-RESETED = HIGH,
- Output POS-ENDED = HIGH,
- Positioning status (C1283) = “Prg-Reset-rem”, if C1280.B2 = 1 (GDC control),
  or “Prg-Reset-dig”, if input POS-PRG-RESET = HIGH,
- Current PS No. (POS-ACT-PS-NO) = 0 (program end)

3.4.12 Variable tables (VT)

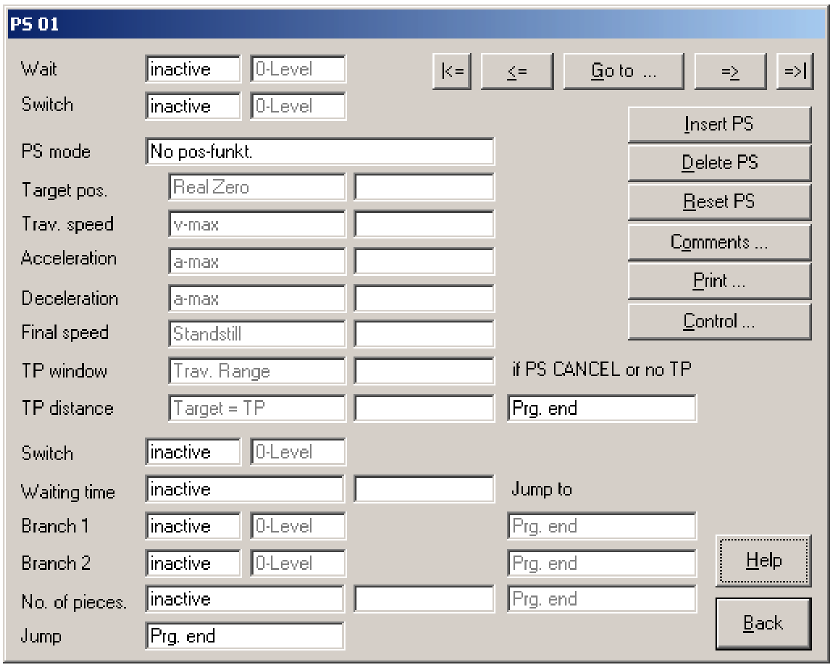
Five variable tables comprise the profile parameters determining the positioning.

- Function block: VTPOS (🕮 3-277)
  - – 104 variables for position values
- Function block: VTVEL (🕮 3-281)
  - – 34 variables for speeds
- Function block: VTACC (🕮 3-273)
  - – 34 variables for acceleration / deceleration
- Function block: VTTIME (🕮 3-279)
  - – 34 variables for waiting time
- Function block: VTPCS (🕮 3-275)
  - – 34 variables for piece numbers

3.4.13 Program sets (PS)

Function

- PS mode
- Point-to-point positioning
- Point-to-point positioning with velocity changeover
- Touch probe positioning
- Stand-by operation
- Set position value
- Prg. fct. “Wait for input”
- Prg. fct. “Switch output **before** positioning”
- Prg. fct. “Positioning or special function”
- Prg. fct. “Switch output **after** positioning”
- Prg. fct. “Waiting time”
- Prg. fct. “Branch 1”
- Prg. fct. “Branch 2”
- Prg. fct. “Repeat function - piece number”
- Prg fct. “Jump to next PS”



PS 01

Wait inactive 0-Level
Switch inactive 0-Level
PS mode No pos-funkt.
Target pos. Real Zero
Trav. speed v-max
Acceleration a-max
Deceleration a-max
Final speed Standstill
TP window Trav. Range
if PS CANCEL or no TP
TP distance Target = TP
Prg. end
Switch inactive 0-Level
Waiting time inactive
Jump to
Branch 1 inactive 0-Level Prg. end
Branch 2 inactive 0-Level Prg. end
No. of pieces. inactive Prg. end
Jump Prg. end

9300POS028

Fig. 3-28 Screenshot: GDC input: “Programming” dialog)

3.4.13.1 PS mode

Purpose

- Selection of which positioning or special function is to be carried out in the PS.

Function

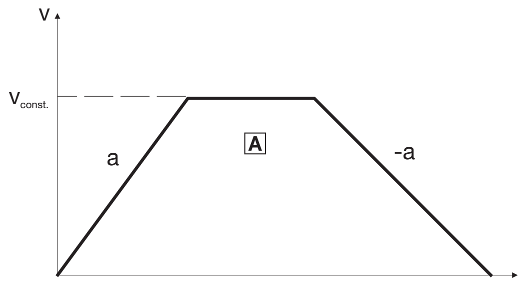
- GDC input: “Programming” dialog
- Factory setting: No positioning or special function
- Input under PS mode (C1311):

Value	Program functions
0	No positioning or special function
1	Absolute PS
2	Relative PS
3	Homing
4	Set homing value
5	Set position value to target position (C1312)
6	Absolute PS; TP positioning with E01
7	Absolute PS, TP positioning with E02
8	Absolute PS, TP positioning with E03
9	Absolute PS, TP positioning with E04
11	Relative PS, TP positioning with E01
12	Absolute PS, TP positioning with E02
13	Relative PS, TP positioning with E03
14	Relative PS, TP positioning with E04
16	Acceptance of home position (C1227)
30	Stand-by operation, cancel with STDBY-STP
31	Stand-by operation, cancel with TP E01 and traversing of the residual distance
32	Stand-by operation, cancel with TP E02 and traversing of the residual distance
33	Stand-by operation, cancel with TP E03 and traversing of the residual distance
34	Stand-by operation, cancel with TP E04 and traversing of the residual distance

3.4.13.2 Point-to-point positioning

Purpose

Point-to-point positioning of a defined target position A.



VTVEL = Traversing speed
+ VTACC = Acceleration
- VTACC = Deceleration

9300POS026

Fig. 3-29 Point-to-point positioning

Function

- PS mode (C1311): Select “Absolute PS” or “Relative PS”.
- The travel profile is generated according to the parameters selected (see also travel profile generator).
- The travel profile parameters can be adjusted individually for any PS. They are selected from the variable tables VTxxx:
  Select **target position** from “VTPOS” (selection under C1312/x)
  Select **traversing speed** from “VTVEL” (selection under C1313/x)
  Select **acceleration** from “VTACC” (selection under C1314/x)
  Select **deceleration** from “VTACC” (selection under C1315/x)
  Final speed = 0 (standstill) (selection under C1316/x)
- Point-to-point positioning is possible with the positioning modes (C1210) “absolute” and “relative positioning”.
- The travel profile parameters can be changed during positioning (see chapter 3.4.9.4)
- The travel profile parameters can be adjusted during operation with the override inputs (see chapter 3.4.9.3).
- The status output POS-IN-TARGET displays the end of a positioning process (see also 3.4.9.7)

3.4.13.3 Point-to-point positioning with changeover of velocity

Purpose

- Velocity changeover between two positioning processes without stopping.

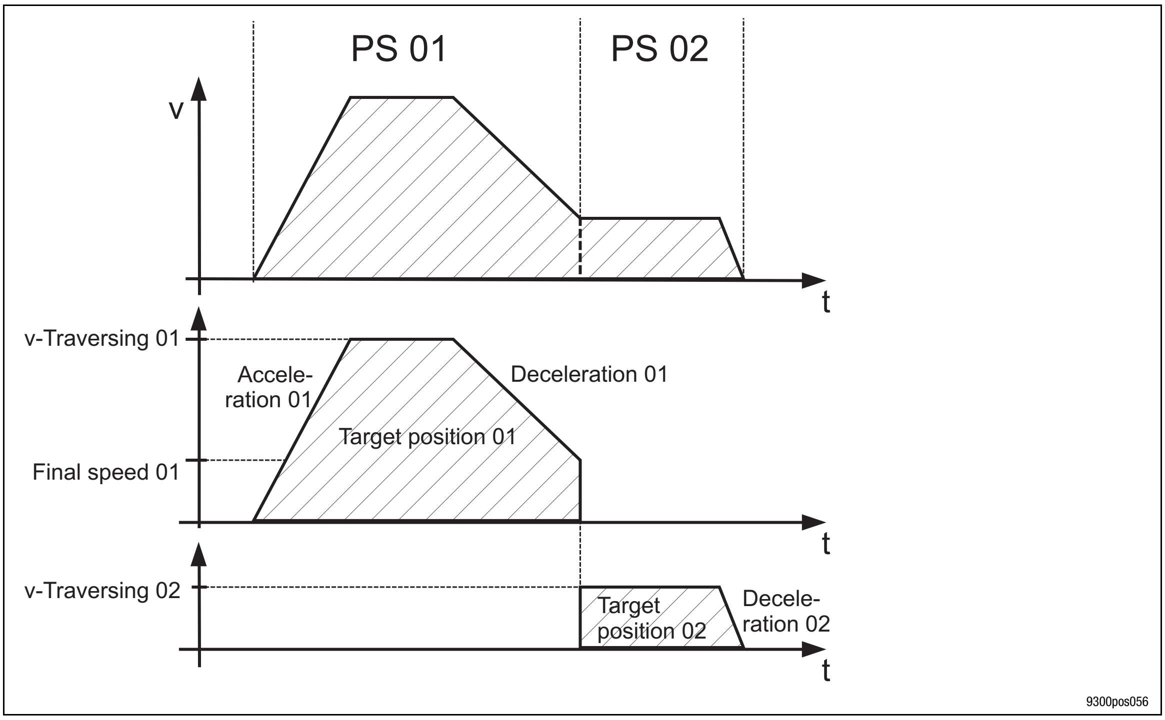


Fig. 3-30 Point-to-point positioning with velocity changeover

Function

- PS mode (C1311): Select “Absolute PS” or “Relative PS”.
- The travel profiles of two subsequent positioning processes are set as in point-to-point positioning except that one final speed is unequal 0. The final speed is reached when the target position is reached. Positioning will start at this speed. Positioning will start at this speed.
  Select **target position** from “VTPOS” (selection under C1312/x)
  Select **traversing speed** from “VTVEL” (selection under C1313/x)
  Select **acceleration** from “VTACC” (selection under C1314/x)
  Select **deceleration** from “VTACC” (selection under C1315/x)
  Select **final speed from “VTVEL”** (selection under C1316/x)
- Point-to-point positioning is possible with the positioning modes (C1210) “absolute” and “relative positioning”.

Tip!

If a PS with final speed unequal 0 is not followed by a positioning, for instance because of a jump to “Program end” or the function “Wait for input”, the fault message P09 (impermissible programming) will be activated. The drive brakes to standstill.

3.4.13.4 Touch probe positioning

Purpose

- Positioning depending on an external digital terminal signal (TP positioning).
- E. g.: The front edge of workpieces of different lengths is always to be positioned in the same position.

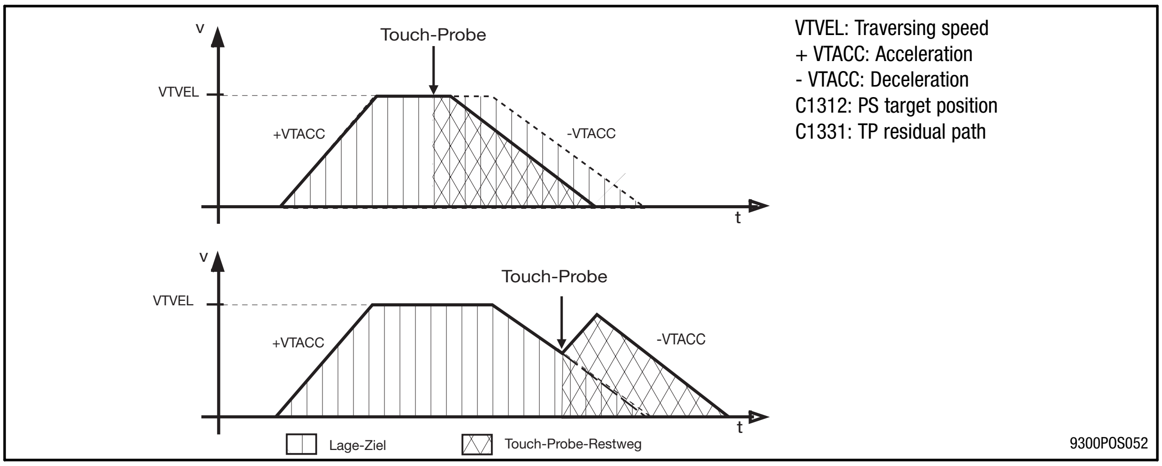


Fig. 3-31 Speed travel profile of a TP positioning

Function

- PS mode (C1311): Select 6...14 (“Absolute PS”, “Relative PS”, TP).
- TP positioning corresponds to a point-to-point positioning with / without velocity changeover. One of the four possible touch probe inputs (terminals X5/E1 ... X5/E4) is enabled during positioning.
- If TP occurs, the actual position value is saved as TP position and the target position of the current positioning is changed.

Calculation of the new target position when TP occurs

$$\textbf{TP position} + \left|\textbf{TP residual path}\right|$$

  – The value of the TP residual path is always added to the value of the TP position.
  – The direction of the TP residual path always corresponds to the traversing direction when TP occurs.
- The actual position value saving via TP is interrupt-controlled and has a very short response time:
  – rising edge at terminal: <0.010 ms
  – falling edge at terminal: <0.100 ms
- The TP input can be enabled for the entire TP positioning process or for parts of it. Target position, TP residual path and TP window determine the restricted area (fig. 7-37).

Tip!

- The TP position values saved are available in VTPOS-OUT-101 to -104 for further function block interconnections.
- The function “Touch-probe saving of the actual position value” via the function block inputs “POS-TPx-ENABL” is a separate function (see POS-TP). TP positioning has priority over “Touch-probe saving”.

3.4.13.5 Stand-by operation

Purpose

- Implementation of a “Flying saw”, with additional function block interconnection (on request).
- Enables the changeover between positioning and another setpoint source, e.g. master frequency of a main drive.

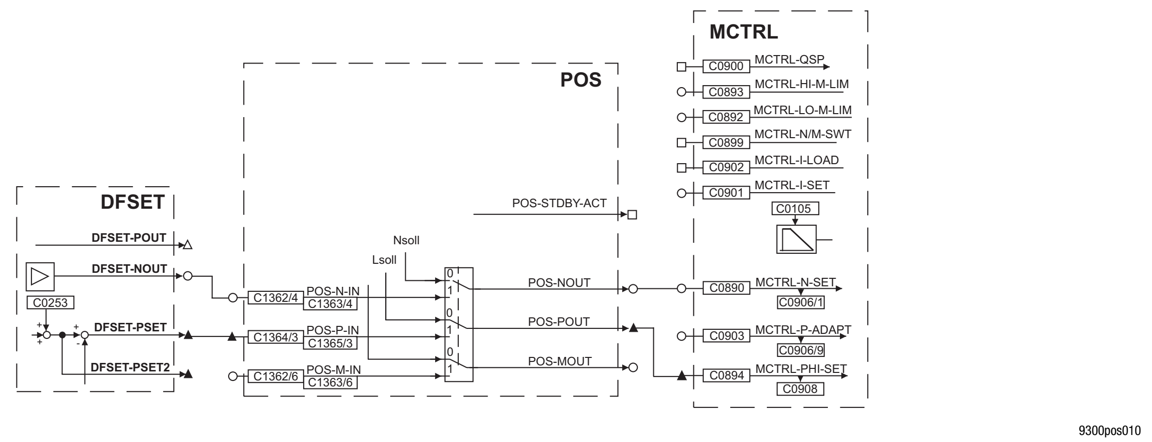


Fig. 3-32 Stand-by operation with selection via digital frequency

Function

- Stand-by operation is only possible during program operation.
- PS mode (C1311): Select 30...34 (stand-by operation and signal source for abort).
- In PS, stand-by operation is executed instead of positioning. As long as stand-by operation is active, ”positioning or special function” in the PS is not completed. The following PS functions are only processed when stand-by operation is terminated (see diagrams).
- After having started stand-by operation, the drive is accelerated or decelerated to the external speed setpoint at POS-N-N due to positioning. The profile parameters of the PS apply.
  When reaching the speed, the external setpoint inputs (POS-N-IN, POS-P-IN) are used. From now on, the position setpoint (POS-SETPOS) equals the actual position value (POS-ACTPOS):
  → POS-STDBY-ACT = HIGH

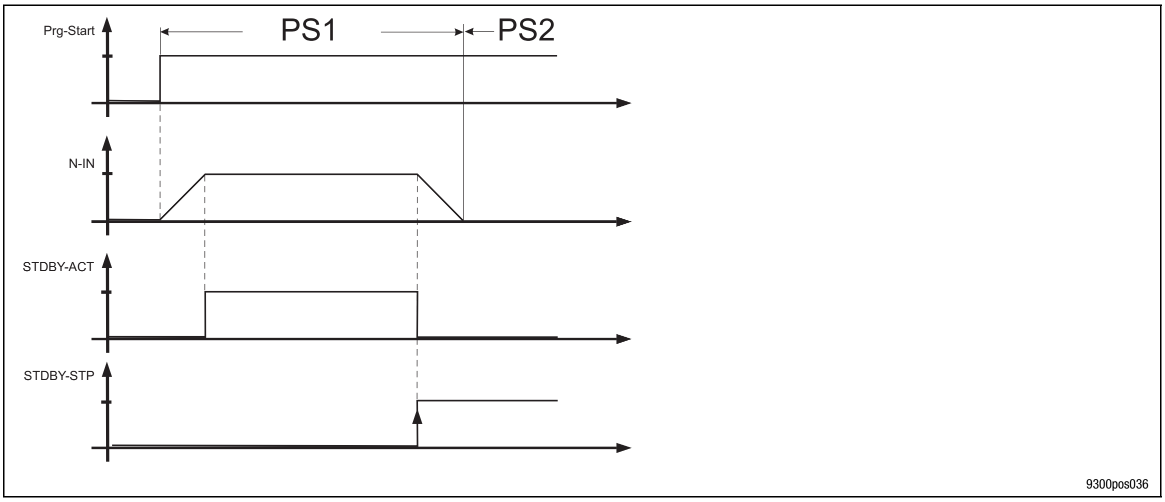
Cancelling stand-by operation

Stand-by operation can be cancelled via two ways:

1. Abortion via FB input "POS-STDBY-STP"
2. Abortion via touch-probe signal at terminal X5/E1 ... X5/E4

Abortion via FB input "POS-STDBY-STP"

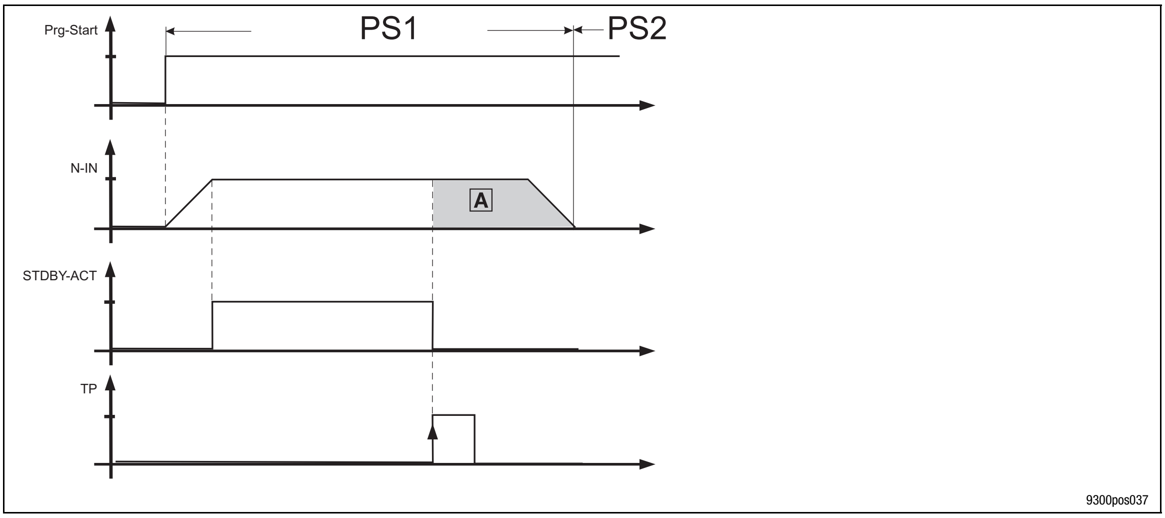
E.g.: Linkage with a digital control signal via a fieldbus or a function block interconnection.



Stand-by operation is aborted and the drive will be reset to positioning when POS-STDBY-STP = HIGH. Positioning accelerates /decelerates the drive with the profile parameters of the PS to the preset final speed of the PS. Further PS functions will only be processed when the final speed has been reached.

Abortion via touch-probe signal at terminal X5/E1 ... X5/E4

E. g.: For accurate positioning over a mark signal after operation with a digital frequency.



A TP input has been enabled during stand-by operation. When the TP signal occurs, stand-by operation is aborted and the drive is reset to positioning. A positioning action follows comprising the TP residual path and starting from the TP position. The positioning traverses the drive using the profile parameters of the PS. Only after positioning has been completed, the following PS functions will be processed.

Monitoring in stand-by operation

- Monitoring of the travel range limit switch is active (fault P01, P02).
- Monitoring of the position limit value is active (fault P04, P05).
- Continuous operation is possible with relative positioning (1210 = 1). The position values (POS-SETPOS and POS-ACTPOS) are reset to 0 when reaching half the position limiting value; the current following error remains the same (no jerk in the drive).
- The following error monitoring of the positioning (P14, P15) is not active in stand-by operation.

Tip!

Stand-by operation is terminated when the program is reset (see program control) or manual operation is activated (see manual operation).

- Firmware version ≥ 2.5:
  - If the program is interrupted by CINH or QSP stand-by operation is interrupted. After a renewed program start, stand-by operation will be continued.
  - New profile parameters can be accepted in stand-by operation using PARAM-RD.
- Firmware version < 2.5:
  - If the program is interrupted by CINH (controller inhibit) or QSP (see program control) stand-by operation will be continued. Stand-by operation cannot be aborted. The program must be restarted.
  - The profile parameters and override inputs are **not** read in again.

3.4.13.6 Set position value

Purpose

- Shifting of the real measuring system during program processing

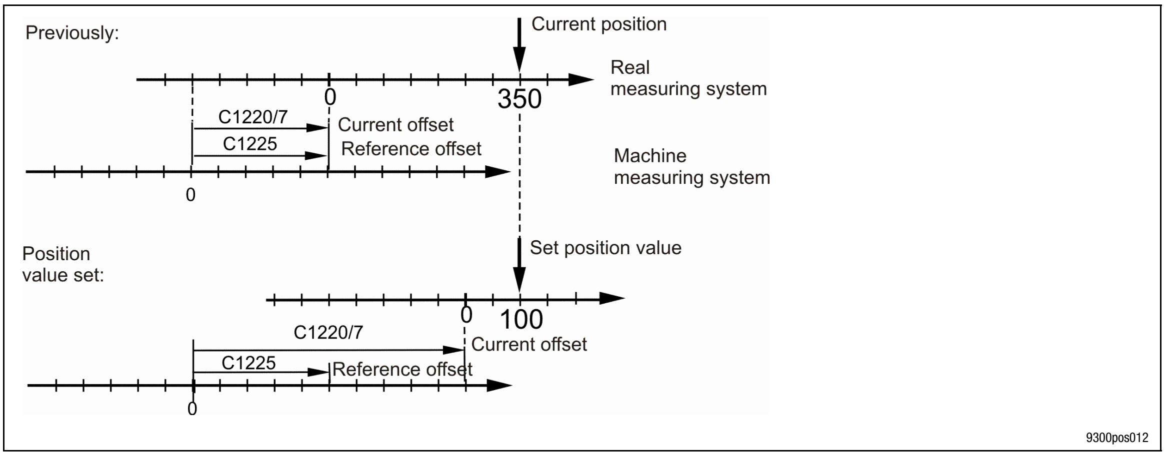


Fig. 3-33 Set position value

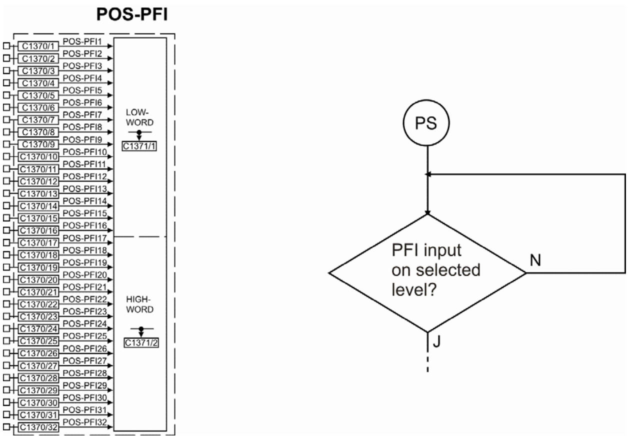
Function

- Selection of the function “Set position value” in PS under PS mode (C1311=5).
- The position setpoint (POS-SETPOS) is set to the target position selected in the PS.
- The actual position value (POS-ACTPOS) is set in order to keep the actual following error (no jerk).
- Setting the position value shifts the real zero; the actual reference offset (C1220/7) is changed. The actual reference offset does no longer correspond to the input value under C1225.
- The real zero can be shifted within the position limiting values (C1223, C1224). When exceeding these limits the error message “P08” (actual offset out of range) is set.

3.4.13.7 Prg. fct. “Wait for input”

Purpose

PS processing will not be continued before the selected digital input (POS-PFI) shows the level required.



9300pos013

Fig. 3-34 Diagram - Wait for input

Function

- Selection of any PFI under C1318/x
- Selection of the required level under C1319/x.
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.8 Prg. fct. “Switch output before positioning”

Purpose

Setting or resetting a digital output signal (POS-PFO), for instance, to control a machine function before positioning starts.

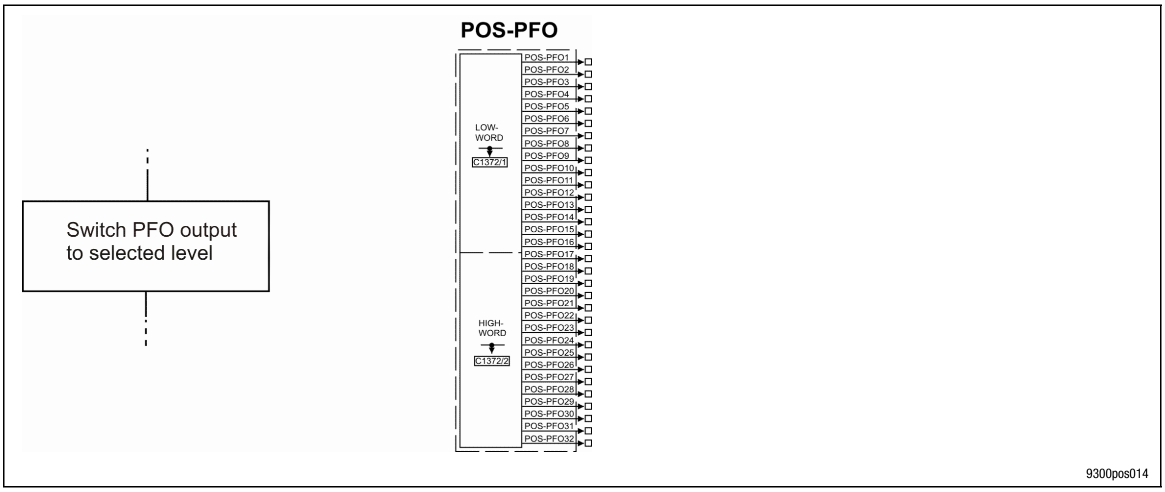


Fig. 3-35 Diagram - Switch output

Function

- Selection of any PFO under C1320/x. It is also possible to switch all PFO at the same time or in groups of 8.
- Selection of the signal level (setting or resetting) under C1321/x.
- 32 PFO are available (see POS-PFO).
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.9 Prg. fct. “Switch output after positioning”

Purpose

Like “Switch output before positioning”.

Function

- Selection of any PFO under C1322/x. It is also possible to switch all PFO at the same time or in groups of 8.
- Selection of the signal level (setting or resetting) under C1323/x.
- 32 PFO are available (see POS-PFO).
- GDC input: “Programming” dialog
- Default setting: not active

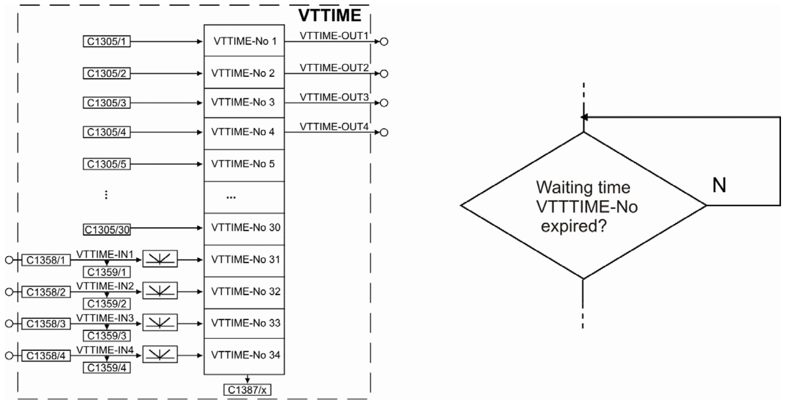
Tip!

If an output is to be set and reset before a positioning process, the output will not be switched if no positioning has taken place or the target position has been reached in the same cycle. As a remedy the output can be reset in one of the following PS. The output will then be switched for at least one cycle.

3.4.13.10 Prg. fct. “Waiting time”

Purpose

Continue program only after waiting time is over.



9300pos011

Fig. 3-36 Diagram - Waiting time

Function

- Waiting time selection from VTTIME under C1324/x.
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.11 Prg. fct. ”Branch 1”

Purpose

Branching during program processing depending on the digital input signals (PFI).

Branching because of conditional query of two variables (<, >, = <=, >=):

1. Comparison of two variables with function block “CMPPH” (7-109)
2. Connect the CMPPH output to the desired POS-PFI.

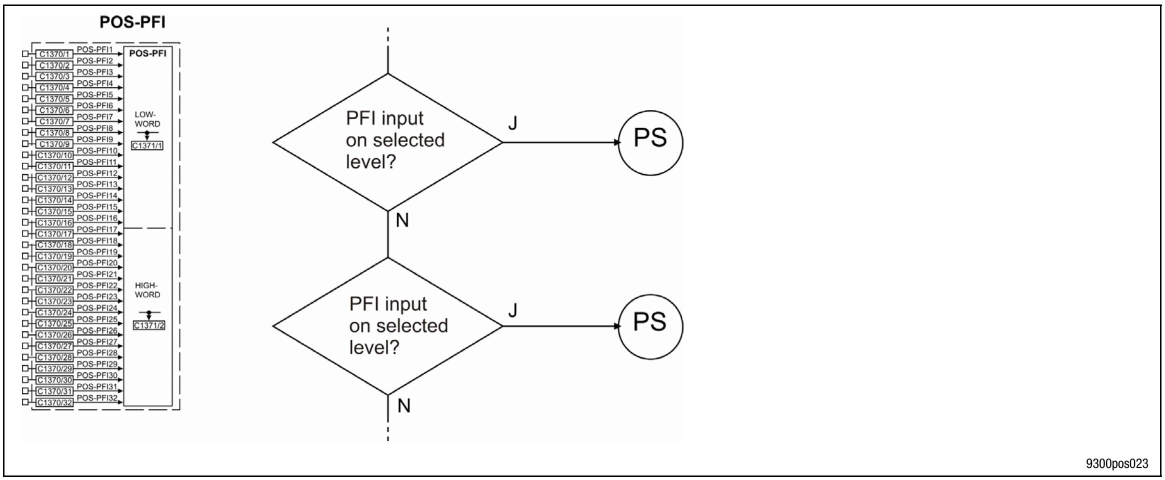


Fig. 3-37 Diagram - Branches 1 and 2

Function

- Selection of any PFI under C1325/x.
- Selection of the signal level under C1326/x.
- Selection of the PS to be branched to PS under C1327/x (if the PFI has the level selected).
- 32 PFO are available (see POS-PFO).
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.12 Prg. fct. “Branch 2”

Purpose

See branch 1

Function

- Selection of any PFI under C1334/x.
- Selection of the signal level under C1335/x.
- Selection of the PS to be branched to PS under C1336/x (if the PFI has the level selected).
- 32 PFO are available (see POS-PFO).
- GDC input: “Programming” dialog
- Default setting: not active

3.4.13.13 Prg. fct. "Repeat function - piece number"

Purpose

- Multiple repetition of the same PS or PS sequence.

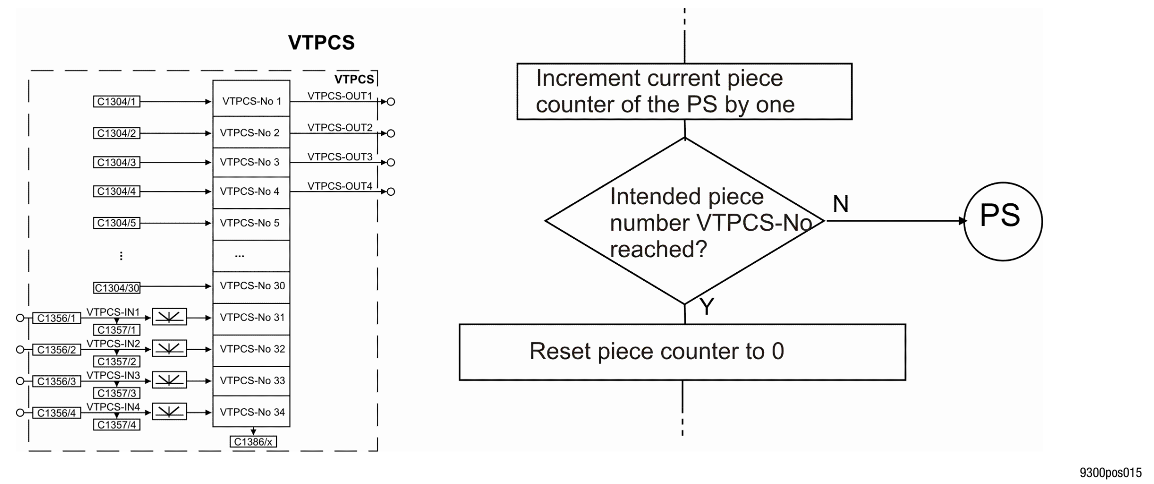


Fig. 3-38 Diagram - Piece number - repeat function

Function

- Selection of a no. of pieces from VTPCS under C1328/x.
- Selection of the PS to be branched to as long as the no. of pieces is not reached under C1229/x.
- Each PS has its own piece counter. C1299/x indicates the current count.
- With every PS cycle the corresponding piece counter is increased by 1, starting from 0. Afterwards the setpoint and actual values are compared and branched accordingly if the required no. of pieces has still not been reached. When the no. of pieces is reached, the piece counter is reset for the cycle and the piece number repeat function is terminated.
- "Program reset" resets all piece counters.
- GDC input: "Programming" dialog
- Default setting: not active

3.4.13.14 Prg fct. “Jump to next PS”

Purpose

- Link several PS in one program.

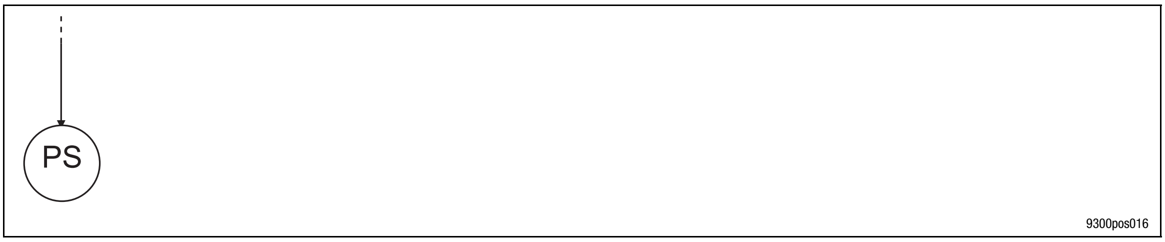


Fig. 3-39 Diagram - Jump to next PS

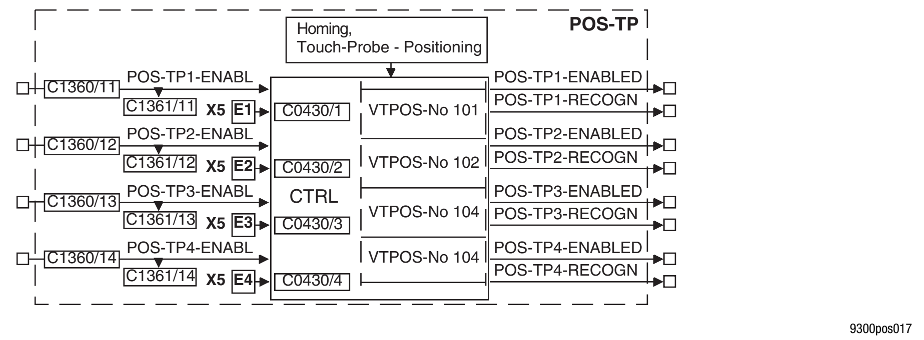
Function

- Selection of the next PS under C1349/x.
- GDC input: “Programming” dialog
- Default setting: Program end

3.4.14 POS-TP (Touch-probe saving of the actual position value)

Purpose

- Saving of the actual position value (POS-ACTPOS) is interrupt-controlled, the reaction times are very short.



- The values saved are available as position-targets for positioning or, for instance, for length calculation with arithmetic function blocks.

Fig. 3-40 Table inputs, outputs

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-TP1-ENABL	d	C1361/11	bin	C1360/11	2	HIGH = activate TP saving
POS-TP2-ENABL	d	C1361/12	bin	C1360/12	2	HIGH = activate TP saving
POS-TP3-ENABL	d	C1361/13	bin	C1360/13	2	HIGH = activate TP saving
POS-TP4-ENABL	d	C1361/14	bin	C1360/14	2	HIGH = activate TP saving
POS-TP1-ENABLED	d	-	-	-	-	Indicates the enabling of the TP input
POS-TP1-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E1
POS-TP2-ENABLED	d	-	-	-	-	Indicates the enabling of the TP input
POS-TP2-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E2
POS-TP3-ENABLED	d	-	-	-	-	Indicates the enabling of the TP input
POS-TP3-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E3
POS-TP4-ENABLED	d	-	-	-	-	Indicates the enabling of the TP input
POS-TP4-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E4

Function

The following table positions are assigned to the TP inputs:

- TP1 ≙ X5/E1 and saves in table position VTPOS-No 101.
- TP2 ≙ X5/E2 and saves in table position VTPOS-No 102.
- TP3 ≙ X5/E3 and saves in table position VTPOS-No 103.
- TP4 ≙ X5/E4 and saves in table position VTPOS-No 104.

The following settings are required:

Code	Subcode	Function
C1215	1 ... 4	Determine signal edge for the initiator at the TP input. • 0 = LOW-HIGH edge • 1 = HIGH-LOW edge • Subcode 1 ... 4 for terminal X5/E1 ... X5/E4
C1360	11 ... 14	Configuration of a signal source to activate the TP input.

Procedure:

1. A LOW-HIGH edge at POS-ENABLE-TPx
   – switches POS-TPx-RECOGN = LOW.
   – switches POS-TPx-ENABLED = HIGH.
2. A signal edge at TP input terminal X5/Ex
   – switches POS-TPx-RECOGN = HIGH,
   – switches POS-TPx-ENABLED = LOW.
3. The actual position at POS-ACTPOS valid at this time is saved in VTPOS at the corresponding table position.
4. Another LOW-HIGH edge at POS-ENABLE-TPx
   – switches POS-TPx-RECOGN = LOW.
   – switches POS-TPx-ENABLED = HIGH.

Tip!

The function block POS-TP is part of POS. Therefore it is not necessary to explicitly transfer it to the processing.

TP positioning has priority over the POS-TP function. When the same TP input is used simultaneously, TP positioning takes precedence with regard to the TP enable (also see chapter 3.4.13.4).

3.4.15 POS-PFI (Program Function Inputs)

Purpose

- Input for digital signals for controlling user programs, e. g. initiators at the machine or switches in the keyboard.

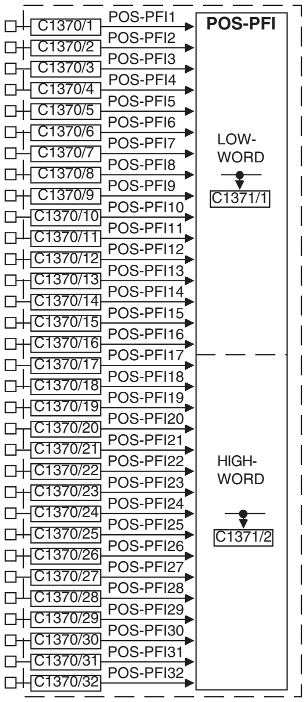


Fig. 3-41 POS-PFI, Program Function Inputs

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-PFI1	d	-	-	C1370/1	2	-
...	d	-	-	...	2	-
POS-PFI32	d	-	-	C1370/32	2	-
LOW-WORD	-	C1371/1	hex	-	-	-
HIGH-WORD	-	C1371/2	hex	-	-	-

Function

- The PFI are evaluated during PS processing through the following program functions:
  “Wait for input”,
  “Branch 1” and
  “Branch 2”.
- 32 PFI available.
- The PFI can be linked to any number of digital signal sources (e.g. the digital input terminals (DIGIN), fieldbus control signals (AIF-IN) or system bus control signals (CAN-IN) (function block interconnection).

Tip!

The function block POS-PFI is part of POS. Therefore it is not necessary to explicitly transfer it to the processing.

3.4.16 POS-PFO (Program Function Outputs)

Purpose

- Output of digital signals for controlling machine functions and operating status displays, e. g. start slave drive or activate spray jet.

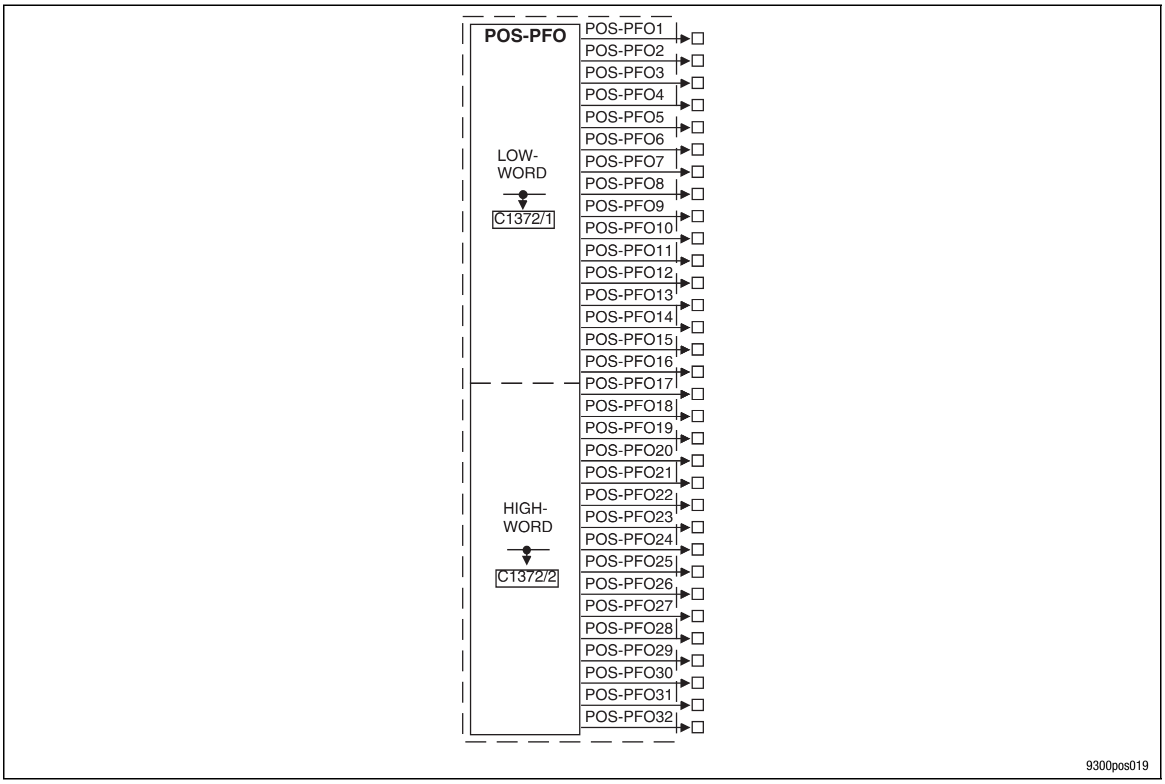


Fig. 3-42 POS-PFO, Program Function Outputs

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-PFO1	d	-	-	-	-	-
...	d	-	-	-	-	-
POS-PFO32	d	-	-	-	-	-
LOW-WORD	-	C1372/1	hex	-	-	-
HIGH-WORD	-	C1372/2	hex	-	-	-

Function

- The PFO are switched during PS processing through the following program functions:
  “Switch output **before** positioning”,
  “Switch output **after** positioning”.
- PFO can be used as single PFOs, altogether or in groups of 8 PFOs.
- PFOs are available as digital signal sources. They can be output via digital output terminals (DIGOUT) (function block interconnection).

Tip!

The function block POS-PFO is part of POS. Therefore it is not necessary to explicitly transfer it to the processing.

3.5 Function blocks

3.5.1 Absolute value generation (ABS)

Description

This function block converts bipolar signals to unipolar signals.

The absolute value is generated by the input signal and is provided at the output.

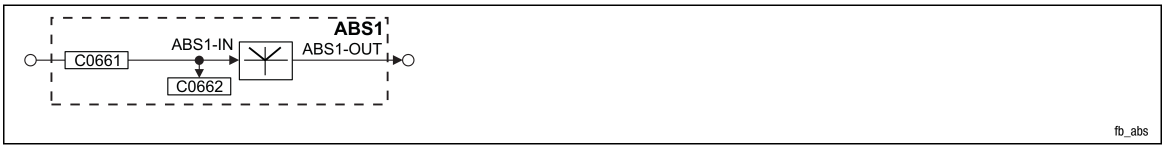


Fig. 3-43 Absolute value generator (ABS1)

3.5.2 Addition block (ADD)

Purpose

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

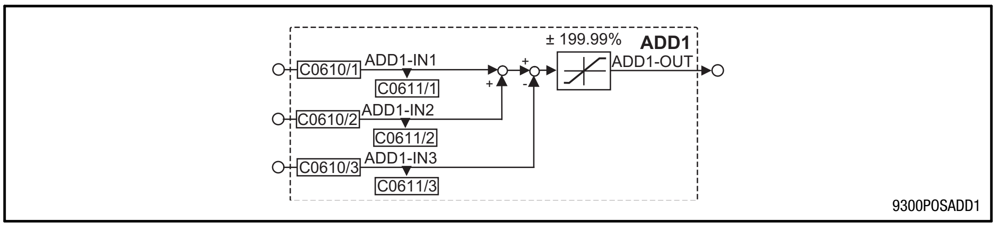


Fig. 3-44 Addition block (ADD1)

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 %.

3.5.3 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.

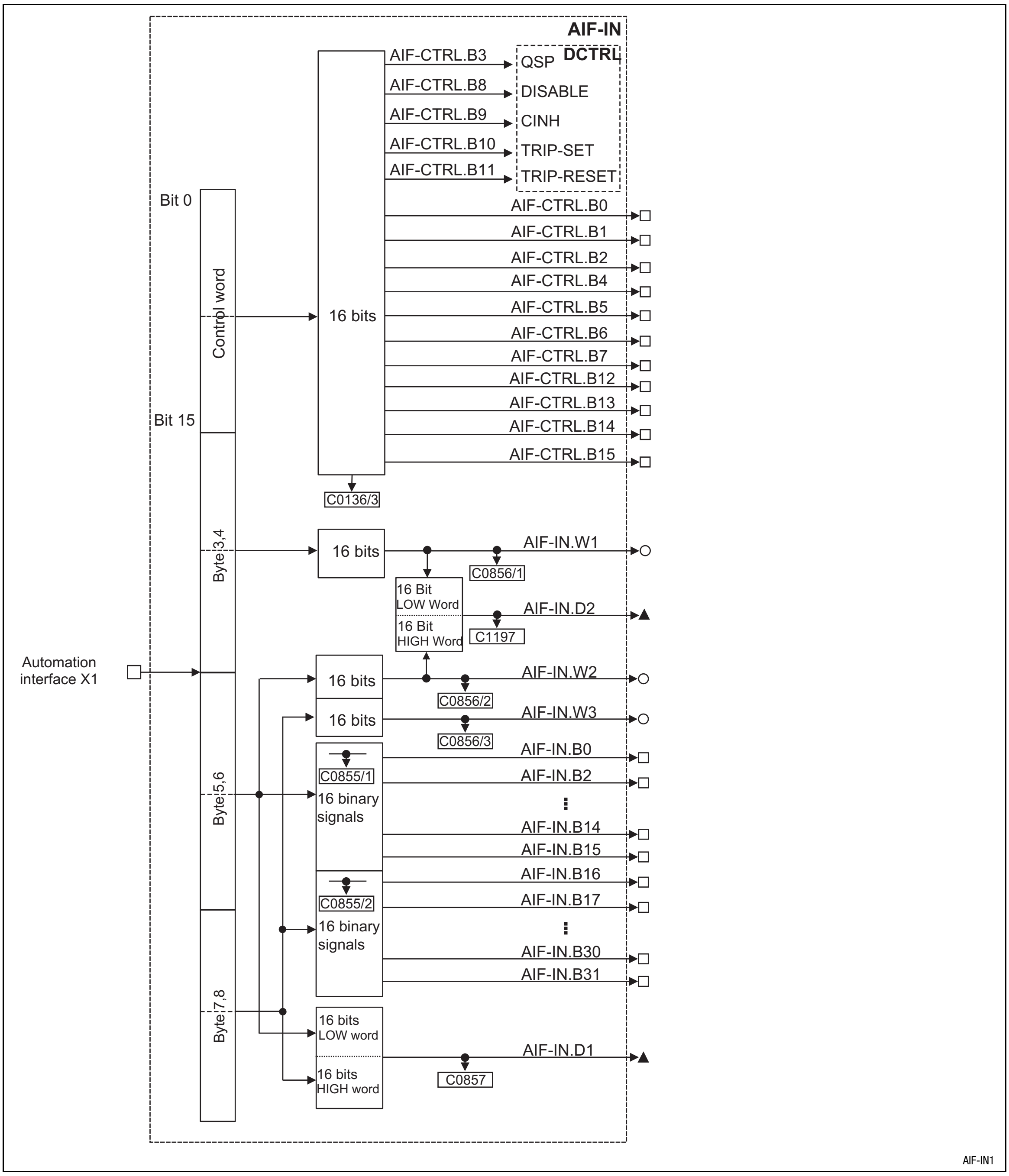


Fig. 3-45 Automation interface (AIF-IN)

Function library

Function blocks

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.

3.5.4 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.

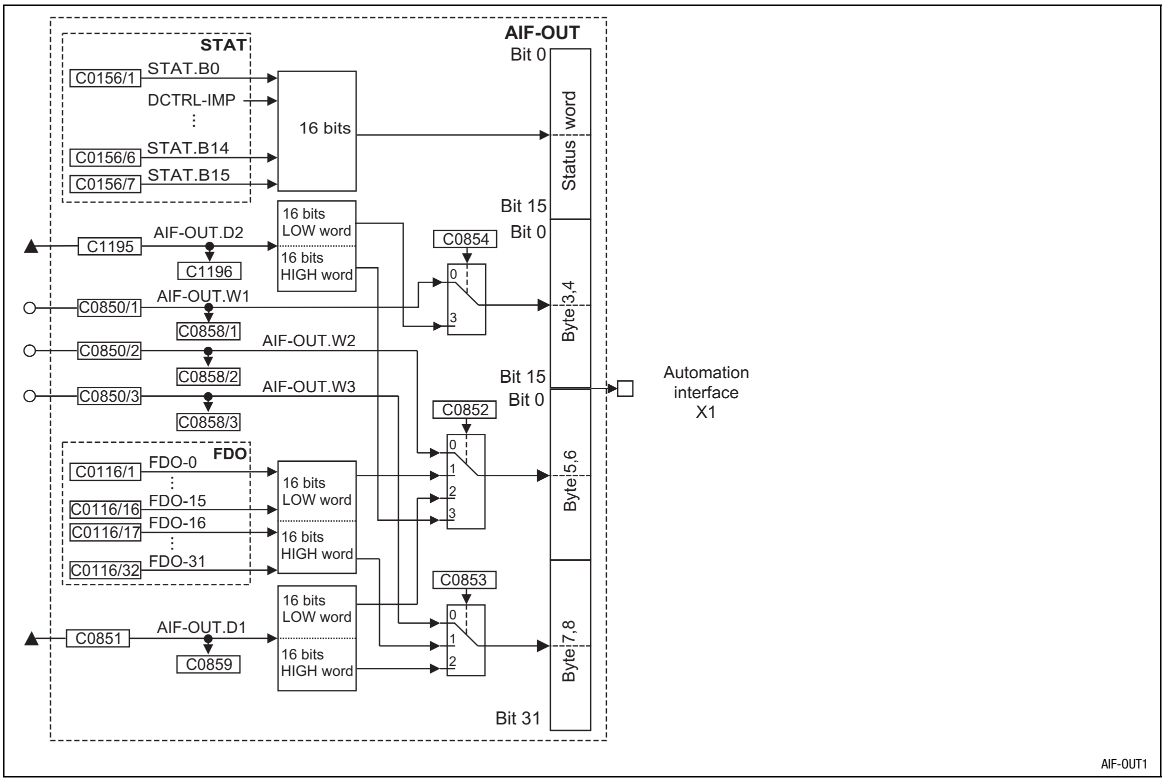


Fig. 3-46 Automation interface (AIF-OUT)

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 3.5.60)

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.

3.5.5 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.

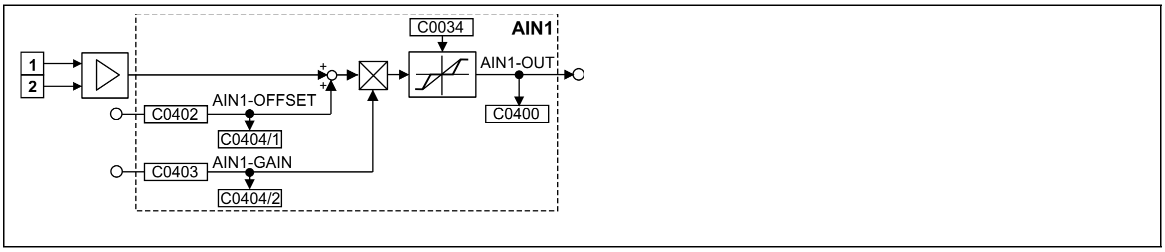


Fig. 3-47 Analog input via terminal X6/1, X6/2 (AIN1)

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).

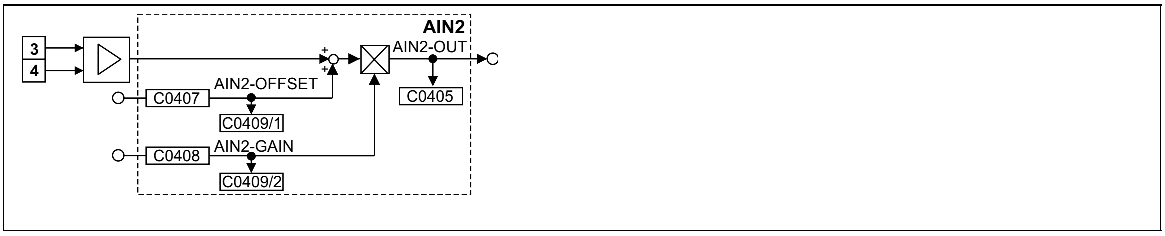


Fig. 3-48 Analog input via terminal X6/3, X6/4 (AIN2)

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.

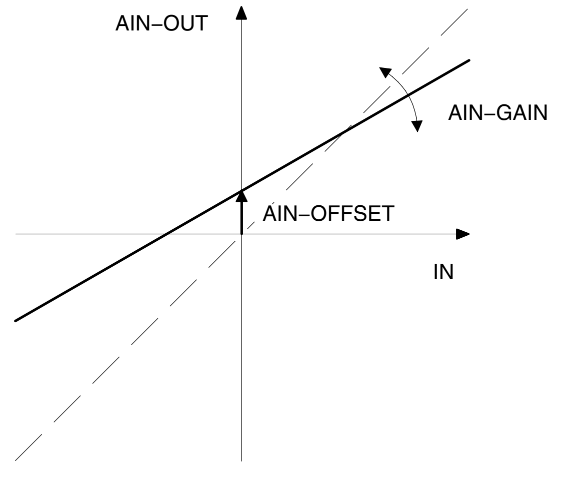


Fig. 3-49 Offset and gain of the analog input

3.5.6 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.

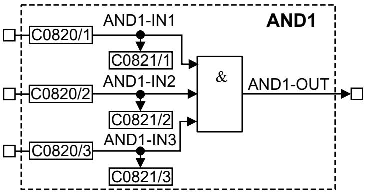


Fig. 3-50 AND operation (AND1)

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	-	-	-	-	-	-

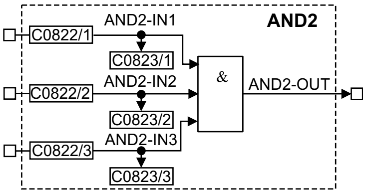


Fig. 3-51 AND operation (AND2)

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	-	-	-	-	-	-

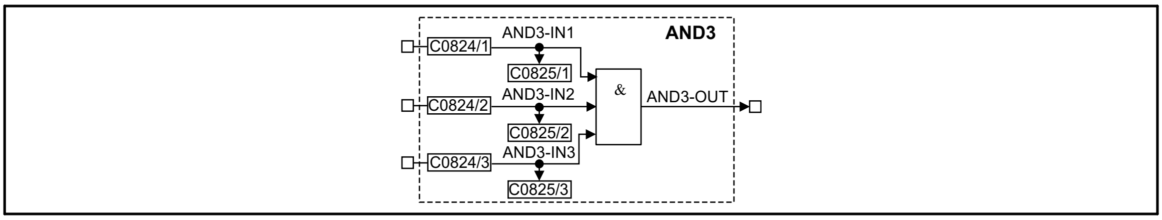


Fig. 3-52 AND operation (AND3)

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	-	-	-	-	-	-

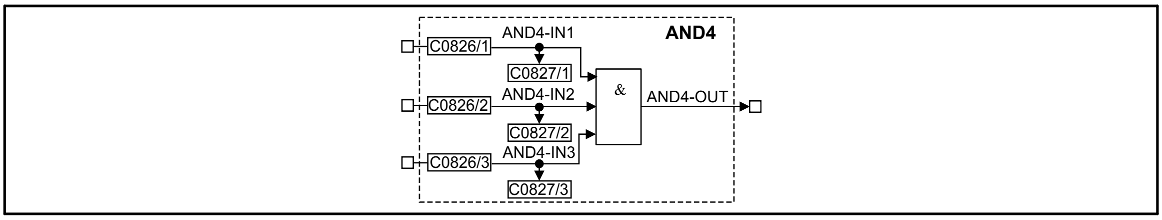


Fig. 3-53 AND operation (AND4)

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	-	-	-	-	-	-

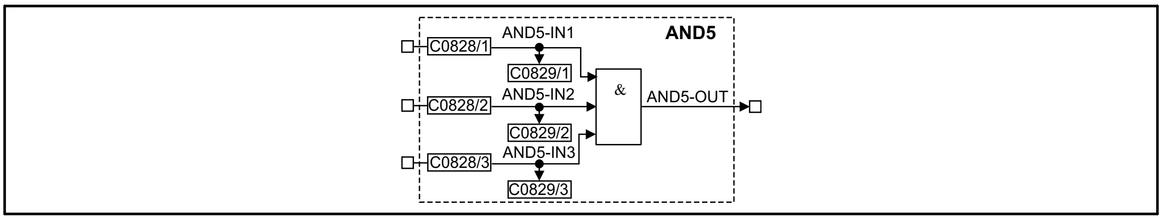


Fig. 3-54 AND operation (AND5)

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	-	-	-	-	-	-

Function

ANDx-IN1	ANDx-IN2	ANDx-IN3	ANDx-OUT
0	0	0	0
1	0	0	0
0	1	0	0
1	1	0	0
0	0	1	0
1	0	1	0
0	1	1	0
1	1	1	1

The function corresponds to a series connection of normally-open contacts in a contactor control.

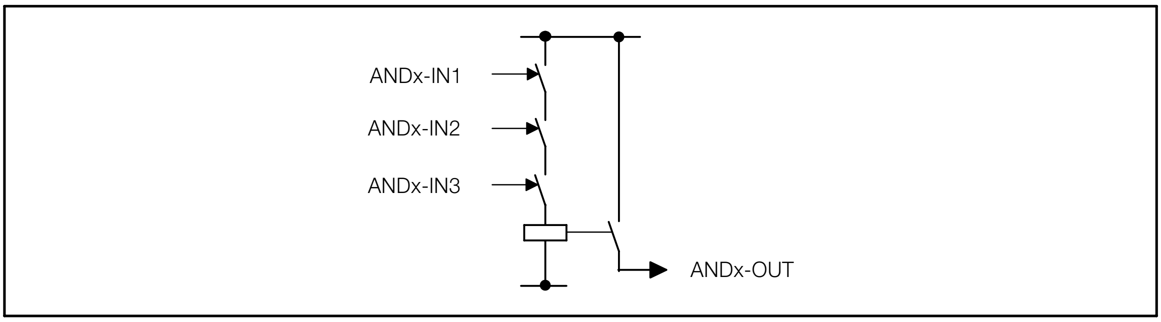


Fig. 3-55 AND function as a series connection of normally-open contacts

Tip!

If only two inputs are required, use the inputs ANDx-IN1 and ANDx-IN2. Assign the input ANDx-IN3 to the signal source FIXED1 via the configuration code.

3.5.7 Inverter (ANEG)

Purpose

This FB inverts the sign of an analog signal.

Two inverters are available:

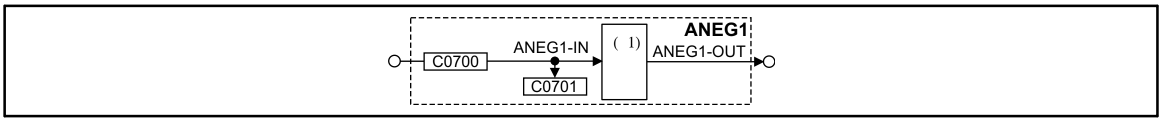


Fig. 3-56 Inverter (ANEG1)

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

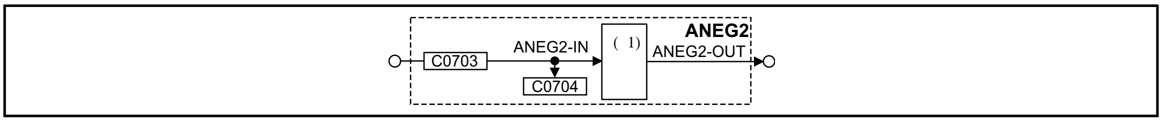


Fig. 3-57 Inverter (ANEG2)

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.

3.5.8 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.

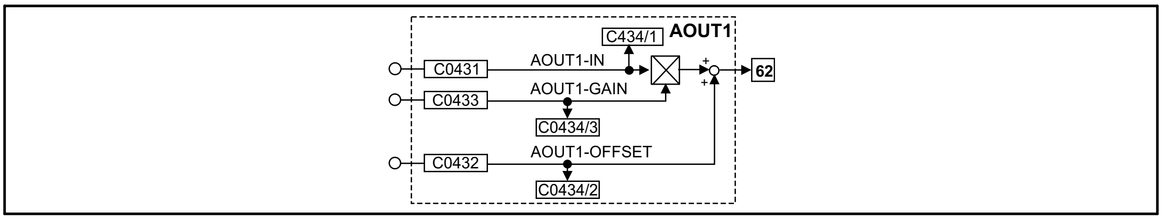


Fig. 3-58 Analog output via terminal X6/62 (AOUT1)

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	-

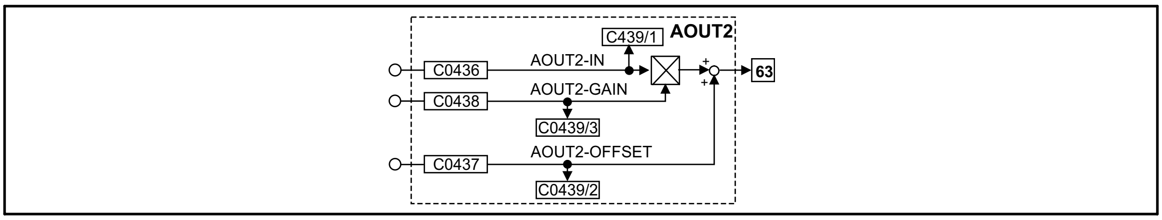


Fig. 3-59 Analog output via terminal X6/63 (AOUT2)

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

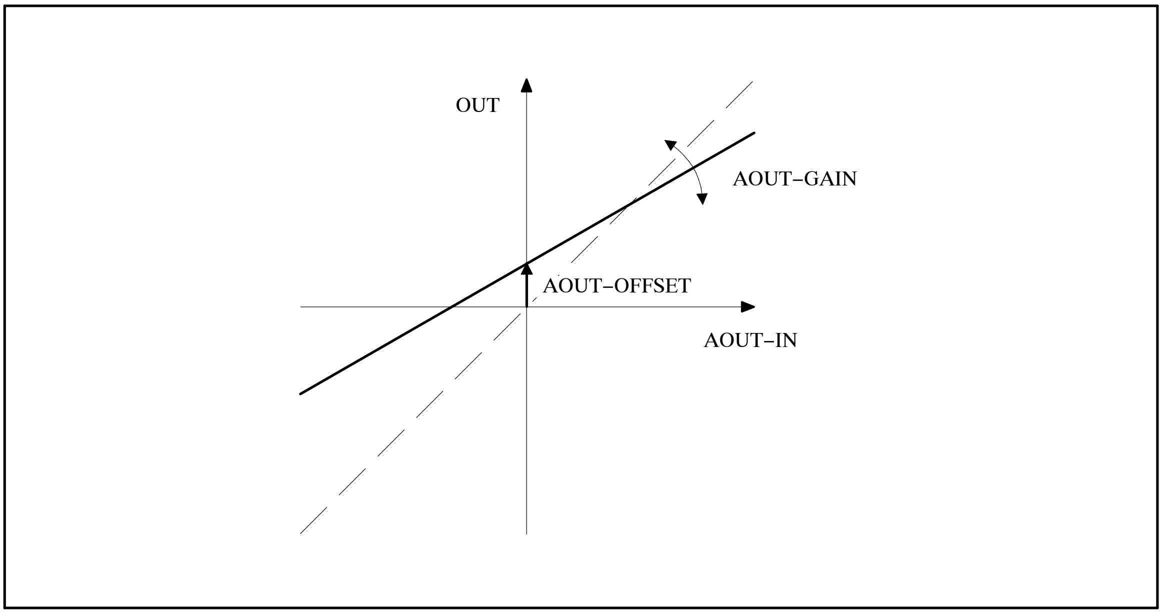


Fig. 3-60 Offset and gain of the analog output

3.5.9 Arithmetic block (ARIT)

Purpose

Arithmetic operation of two ”analog” signals.

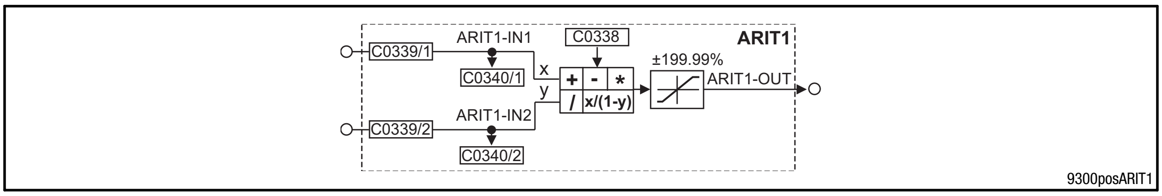


Fig. 3-61 Arithmetic block (ARIT1)

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 %

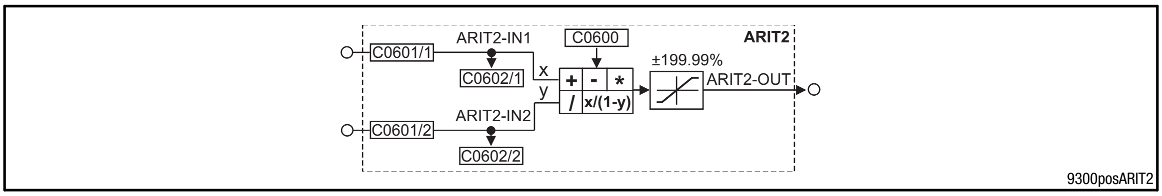


Fig. 3-62 Arithmetic block (ARIT2)

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
ARIT1: C0338	0	OUT = IN1 Note: IN2 will not be processed	
	1	OUT = IN1 + IN2	100% = 50% + 50%
	2	OUT = IN1 - IN2	50% = 100% - 50%
	3	OUT [inc] = IN1 [inc] ×IN2 [inc] ÷16384 OUT [%] = IN1 [%] × IN2 [%] ÷100	100% = 100% ×100% ÷(100)
	4	OUT [inc] = IN1 [inc] ×16384÷100 ÷ |IN2| [inc] OUT [%] = IN1 [%] ÷ | IN2 | [%]	1% = 100% ÷100%
	5	OUT [inc] = IN1 [inc] ×16384 ÷ (16384 - IN2 [inc]) OUT [%] = IN1 [%] × 100 ÷ (100 - IN2 [%])	200% = 100% × (100) ÷ (100 - 50%)

Conversion: [inc] = [%] ÷100 × 16384

3.5.10 Arithmetic block (ARITPH)

Purpose

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

ARITPH1

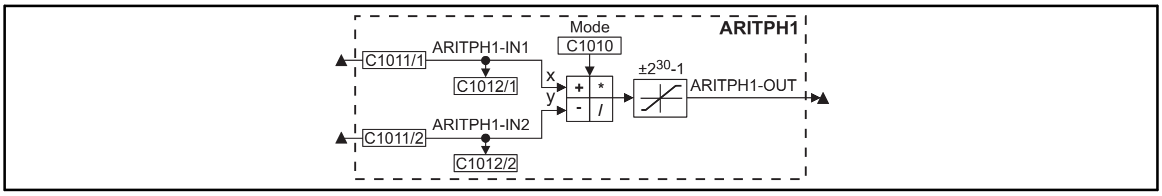


Fig. 3-63 Function block ARITPH1

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

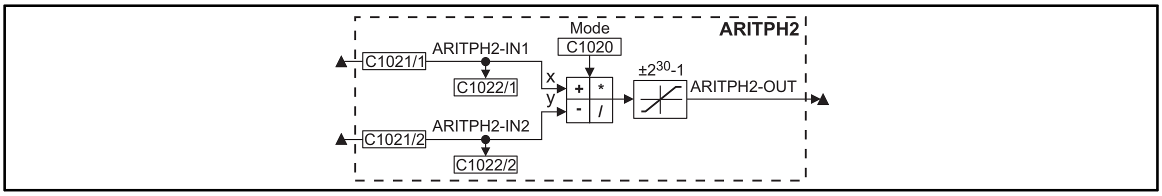


Fig. 3-64 Function block ARITPH2

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

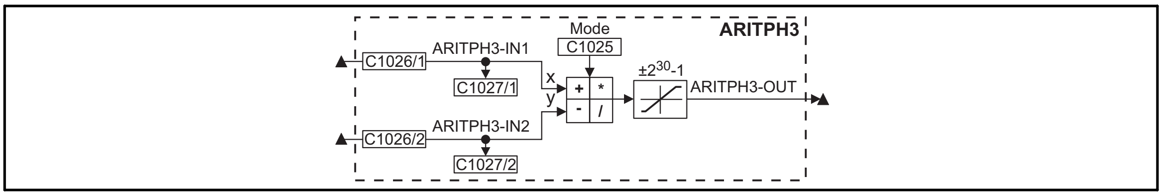


Fig. 3-65 Function block ARITPH3

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

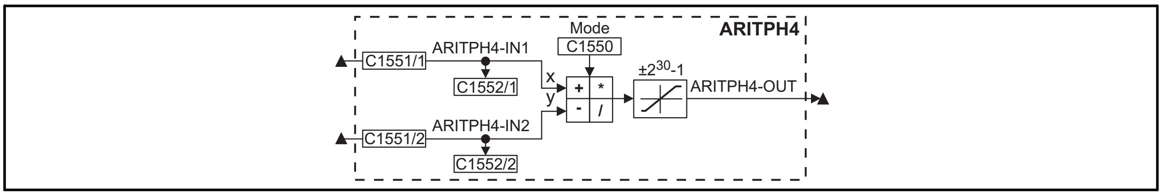


Fig. 3-66 Function block ARITPH4

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

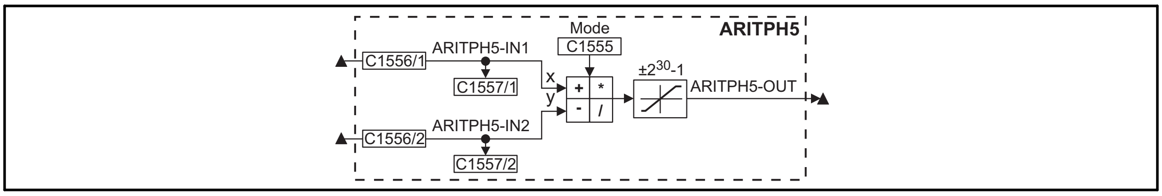


Fig. 3-67 Function block ARITPH5

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

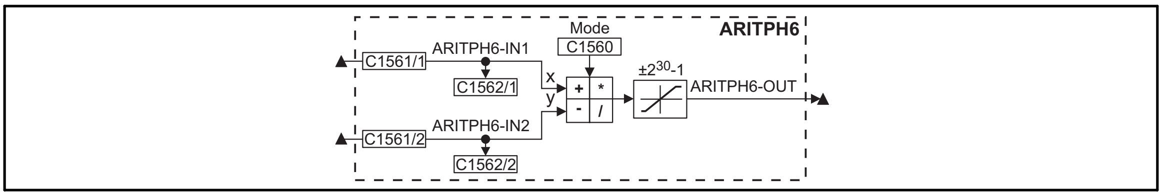


Fig. 3-68 Function block ARITPH6

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

3.5.11 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.

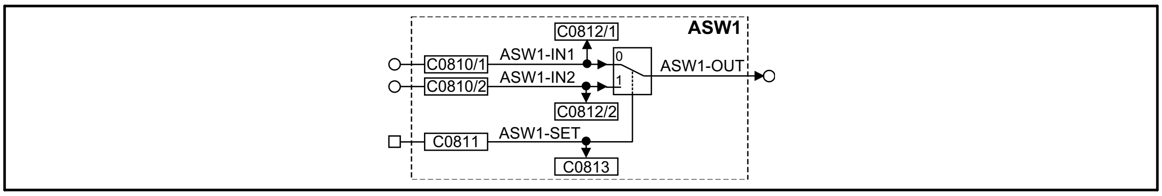


Fig. 3-69 Changeover switch for analog signals (ASW1)

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	-	-	-	-	-	-

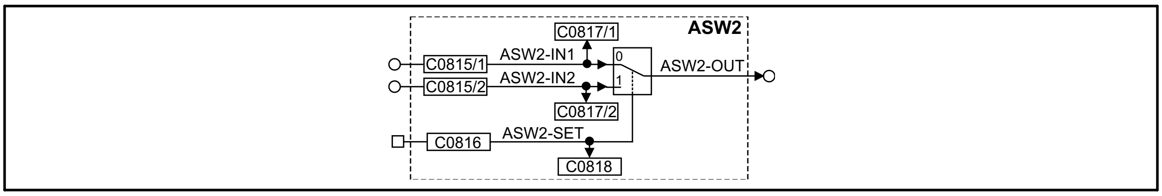


Fig. 3-70 Changeover switch for analog signals (ASW2)

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	-	-	-	-	-	-

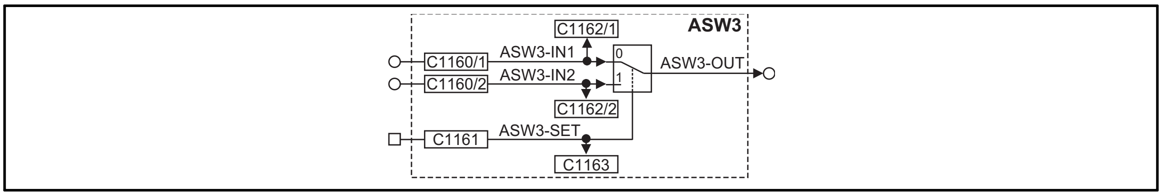


Fig. 3-71 Changeover switch for analog signals (ASW3)

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	-	-	-	-	-	-

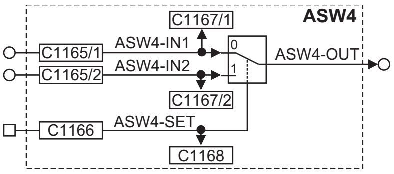


Fig. 3-72 Changeover switch for analog signals (ASW4)

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.

3.5.12 BCD decade switch (BCD)

Three FBs are available FB (BCD1 ... BCD3).

Purpose

Reads eight absolute value digits and a sign in binary coding and transmits it to a code.

BCD1

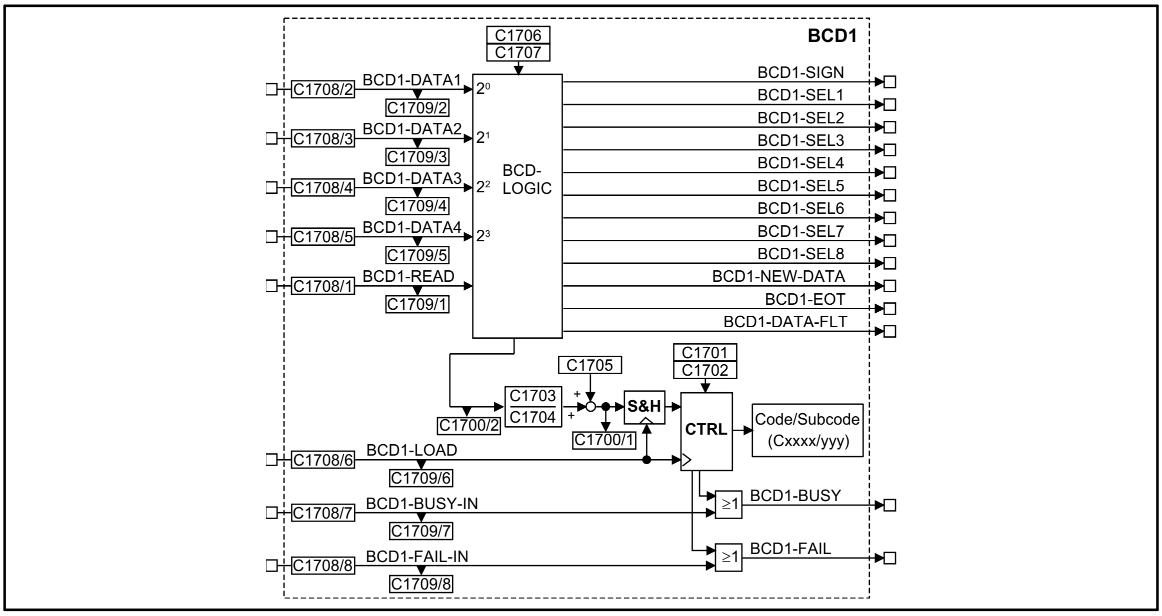


Fig. 3-73 Function block BCD1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
BCD1-DATA1	d	C1709/2	bin	C1708/2	2	Data input (LSB)
BCD1-DATA2	d	C1709/3	bin	C1708/3	2	Data input
BCD1-DATA3	d	C1709/4	bin	C1708/4	2	Data input
BCD1-DATA4	d	C1709/5	bin	C1708/5	2	Data input (MSB).
BCD1-READ	d	C1709/1	bin	C1708/1	2	Only required for handshake mode: • Signal must be applied at the controller for at least 2 ms. • LOW-HIGH edge starts the data transmission for a BCD.
BCD1-LOAD	d	C1709/6	bin	C1708/6	2	LOW-HIGH edge = Write data to the code.
BCD1-BUSY-IN	d	C1709/7	bin	C1708/7	2	Generating a collective busy signal
BCD1-FAIL-IN	d	C1709/8	bin	C1708/8	2	Generating a collective fail signal
BCD1-SIGN	d	-	-	-	-	HIGH = Read sign.
BCD1-SEL1	d	-	-	-	-	HIGH = Read 1st BCD.
BCD1-SEL2	d	-	-	-	-	HIGH = Read 2nd BCD.
BCD1-SEL3	d	-	-	-	-	HIGH = Read 3rd BCD.
BCD1-SEL4	d	-	-	-	-	HIGH = Read 4th BCD.
BCD1-SEL5	d	-	-	-	-	HIGH = Read 5th BCD.
BCD1-SEL6	d	-	-	-	-	HIGH = Read 6th BCD.
BCD1-SEL7	d	-	-	-	-	HIGH = Read 7th BCD.
BCD1-SEL8	d	-	-	-	-	HIGH = Read 8th BCD.
BCD1-NEW-DATA	d	-	-	-	-	HIGH = BCD accepted, transmit next BCD.
BCD1-EOT	d	-	-	-	-	HIGH = all BCDs read or ”CANCEL” recognised.
BCD1-DATA-FLT	d	-	-	-	-	HIGH = BCD code (see chapter 3.5.12.1).
BCD1-BUSY	d	-	-	-	-	HIGH = Data are being transmitted to code.
BCD1-FAIL	d	-	-	-	-	HIGH = Data transmission to code is faulty.

BCD2

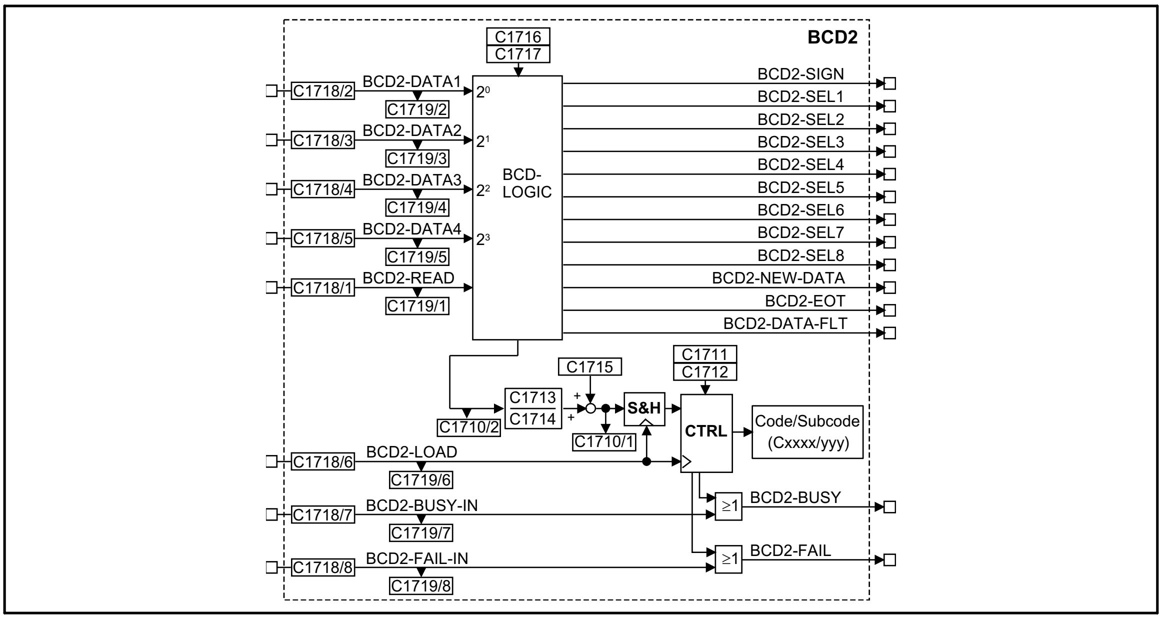


Fig. 3-74 Function block BCD2

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
BCD2-DATA1	d	C1719/2	bin	C1718/2	2	Data input (LSB)
BCD2-DATA2	d	C1719/3	bin	C1718/3	2	Data input
BCD2-DATA3	d	C1719/4	bin	C1718/4	2	Data input
BCD2-DATA4	d	C1719/5	bin	C1718/5	2	Data input (MSB)
BCD2-READ	d	C1719/1	bin	C1718/1	2	Only required for handshake mode: • Signal must be applied at the controller for at least 2 ms. • LOW-HIGH edge starts the data transmission for a BCD.
BCD2-LOAD	d	C1719/6	bin	C1718/6	2	LOW-HIGH edge = Write data to the code.
BCD2-BUSY-IN	d	C1719/7	bin	C1718/7	2	Generating a collective busy signal
BCD2-FAIL-IN	d	C1719/8	bin	C1718/8	2	Generating a collective fail signal
BCD2-SIGN	d	-	-	-	-	HIGH = Read sign.
BCD2-SEL1	d	-	-	-	-	HIGH = Read 1st BCD.
BCD2-SEL2	d	-	-	-	-	HIGH = Read 2nd BCD.
BCD2-SEL3	d	-	-	-	-	HIGH = Read 3rd BCD.
BCD2-SEL4	d	-	-	-	-	HIGH = Read 4th BCD.
BCD2-SEL5	d	-	-	-	-	HIGH = Read 5th BCD.
BCD2-SEL6	d	-	-	-	-	HIGH = Read 6th BCD.
BCD2-SEL7	d	-	-	-	-	HIGH = Read 7th BCD.
BCD2-SEL8	d	-	-	-	-	HIGH = Read 8th BCD.
BCD2-NEW-DATA	d	-	-	-	-	HIGH = BCD accepted, transmit next BCD.
BCD2-EOT	d	-	-	-	-	HIGH = all BCDs read or ”CANCEL” recognised.
BCD2-DATA-FLT	d	-	-	-	-	HIGH = BCD code (see chapter 3.5.12.1).
BCD2-BUSY	d	-	-	-	-	HIGH = Data are being transmitted to code.
BCD2-FAIL	d	-	-	-	-	HIGH = Data transmission to code is faulty.

BCD3

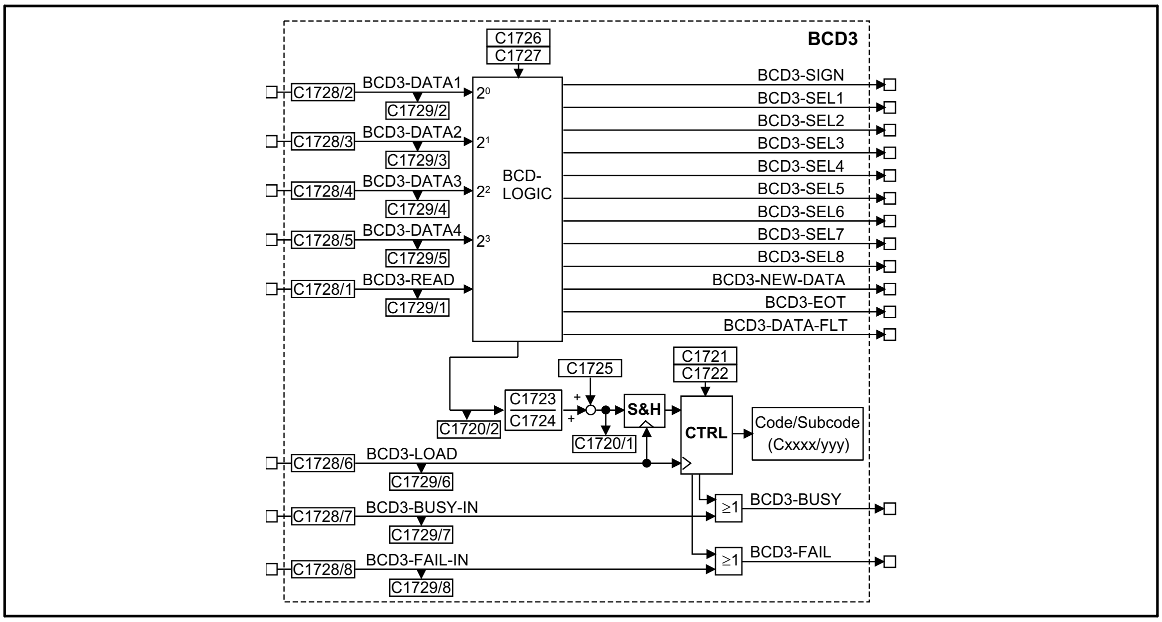


Fig. 3-75 Function block BCD3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
BCD3-DATA1	d	C1729/2	bin	C1728/2	2	Data input (LSB)
BCD3-DATA2	d	C1729/3	bin	C1728/3	2	Data input
BCD3-DATA3	d	C1729/4	bin	C1728/4	2	Data input
BCD4-DATA4	d	C1729/5	bin	C1728/5	2	Data input (MSB)
BCD3-READ	d	C1729/1	bin	C1728/1	2	Only required for handshake mode: • Signal must be applied at the controller for at least 2 ms. • LOW-HIGH edge starts the data transmission for a BCD.
BCD3-LOAD	d	C1729/6	bin	C1728/6	2	LOW-HIGH edge = Write data to the code.
BCD3-BUSY-IN	d	C1729/7	bin	C1728/7	2	Generating a collective busy signal
BCD3-FAIL-IN	d	C1729/8	bin	C1728/8	2	Generating a collective fail signal
BCD3-SIGN	d	-	-	-	-	HIGH = Read sign.
BCD3-SEL1	d	-	-	-	-	HIGH = Read 1st BCD.
BCD3-SEL2	d	-	-	-	-	HIGH = Read 2nd BCD.
BCD3-SEL3	d	-	-	-	-	HIGH = Read 3rd BCD.
BCD3-SEL4	d	-	-	-	-	HIGH = Read 4th BCD.
BCD3-SEL5	d	-	-	-	-	HIGH = Read 5th BCD.
BCD3-SEL6	d	-	-	-	-	HIGH = Read 6th BCD.
BCD3-SEL7	d	-	-	-	-	HIGH = Read 7th BCD.
BCD3-SEL8	d	-	-	-	-	HIGH = Read 8th BCD.
BCD3-NEW-DATA	d	-	-	-	-	HIGH = BCD accepted, transmit next BCD.
BCD3-EOT	d	-	-	-	-	HIGH = all BCDs read or "CANCEL" recognised.
BCD3-DATA-FLT	d	-	-	-	-	HIGH = BCD code (see chapter 3.5.12.1).
BCD3-BUSY	d	-	-	-	-	HIGH = Data are being transmitted to code.
BCD3-FAIL	d	-	-	-	-	HIGH = Data transmission to code is faulty.

Overview of the codes for the evaluation of the read data and for the selection of the target code.

Function	BCD1	BCD2	BCD3
Output signal (DIS)	C1700/1	C1710/1	C1720/1
BCD result of the read data (DIS)	C1700/2	C1710/2	C1720/2
Target code	C1701	C1711	C1721
Subcode of the target code	C1702	C1712	C1722
Numerator (evaluation of the result)	C1703	C1713	C1723
Denominator (evaluation of the result)	C1704	C1714	C1724
Offset (evaluation of the result)	C1705	C1715	C1725

Function

- BCD decade switch
- Data inputs
- Signal processing
- ”CANCEL” function
- ”RESET” function
- BCD decade switch
- Complete BCD reading
- BCD mode

3.5.12.1 Data inputs

Evaluation of the read data:

BCDx-Datax MSB ... LSB	**BCD ABSOLUTE VALUE**	**BCD-SIGN**
0000	0	(+)
0001	1	
0010	2	
0011	3	
0100	4	
0101	5	
0110	6	
0111	7	
1000	8	(-)
1001	9	
1010	CANCEL	CANCEL
1011	RESET	RESET
1100	BCD error	BCD error
1101		
1110		
1111		

3.5.12.2 Signal processing

Reading the BCDs:

Output	Signal	Function
BCDx-EOT	LOW	Beginning of the BCD reading.
	HIGH	If • all 8 absolute value digits and the sign are transmitted or • "CANCEL" has been identified.
BCDx-NEW-DATA	LOW	After a LOW-HIGH edge at BCD-READ.
	HIGH	After the transmission of a BCD is completed.
BCDx-DATA-FLT	HIGH	If "BCD error" has been identified (see table in chapter 3.5.12.1).
BCDx-FAIL	HIGH	If • the permissible value range for the target code is exceeded or • BCDx-DATA-FLT = HIGH has occurred before.

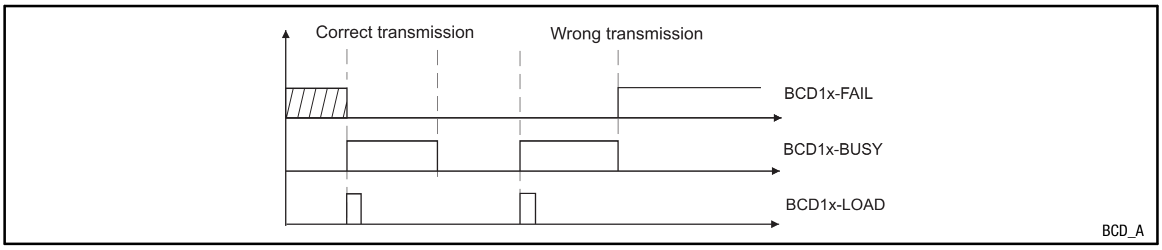


Fig. 3-76 Signal shape for FB BCD1 for the transmission to the target code

Transmission sequence of data to the target code:

Output	Signal	Function
BCDx-LOAD	LOW-HIGH edge	Transmits the signal to the target code.
BCDx-BUSY	HIGH	For the time of transmission
BCDx-FAIL	HIGH	If a transmission error occurs. Only another LOW-HIGH edge at BCDx-LOAD switches BCDx-FAIL = LOW. Transmission error: • No target code • No target subcode. • transmitted data are out of the target code limits. • "BCD error" has been identified (BCDx-DATA-FLT = HIGH). • The target code is inhibited. Code can only be written when the controller is inhibited.

For the data conditioning for the target code see FB FEVAN. (🕮 3-195)

3.5.12.3 ”CANCEL” function

The identification for ”CANCEL” at the inputs BCDx-DATAx results in the following state:

Input/output	**Signal**	**Function**
BCDx-EOT	HIGH	Switches
BCDx-NEW-DATA	HIGH	Switches
-	-	Sets BCDs which are not yet read to zero and stops reading.
-	-	The inputs BCDx-DATAx expect the sign as the next BCD.

3.5.12.4 ”RESET” function

The identification for ”RESET” at the inputs BCDx-DATAx results in the following state:

Function	**Input/output**	**Signal**
Switches	BCDx-EOT	LOW
Switches	BCDx-DATA-FLT	LOW
Switches for a millisecond	BCDx-NEW-DATA	LOW
Switches if BCDx-FAIL-IN = LOW is switched at the same time (internal OR link).	BCDx-FAIL	LOW
Switches if BCDx-BUSY-IN = LOW is switched at the same time (internal OR link).	BCDx-BUSY	LOW
The inputs BCDx-DATAx expect the sign as the next BCD.	-	-
The BCD read last remains and can be transmitted to the target code.	-	-

3.5.12.5 BCD decade switch

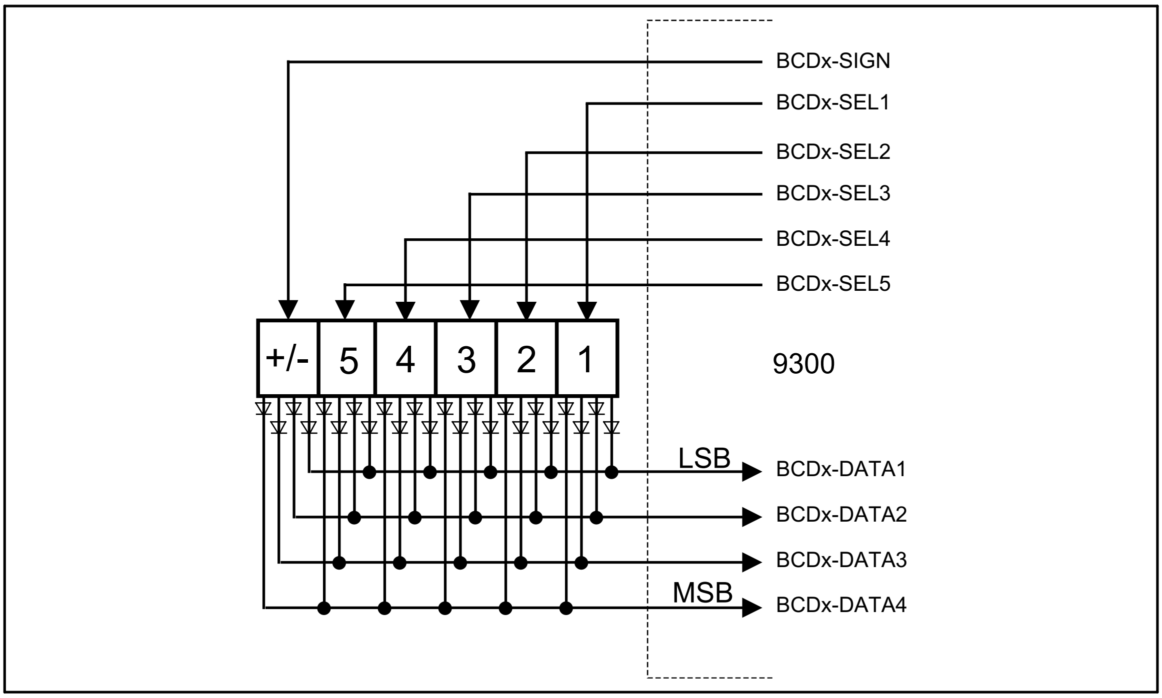


Fig. 3-77 Connection of a BCD decade switch

- The data outputs of the BCD decade switch must be decoupled via diodes. If necessary, use a terminal extension (via system bus CAN).
  - LENZE offers this terminal extension.

Function

A BCD is transmitted to the target code as follows:

Input/output	Signal	Function
BCDx-SELx or BCDx-SIGN	HIGH	Triggers the corresponding BCD decade switch. Reading and temporary storing of the BCD data to BCDx-DATA1 ... BCDx-DATA4.
BCDx-LOAD	LOW-HIGH edge	Writes BCD data to the target code.

3.5.12.6 Complete BCD reading

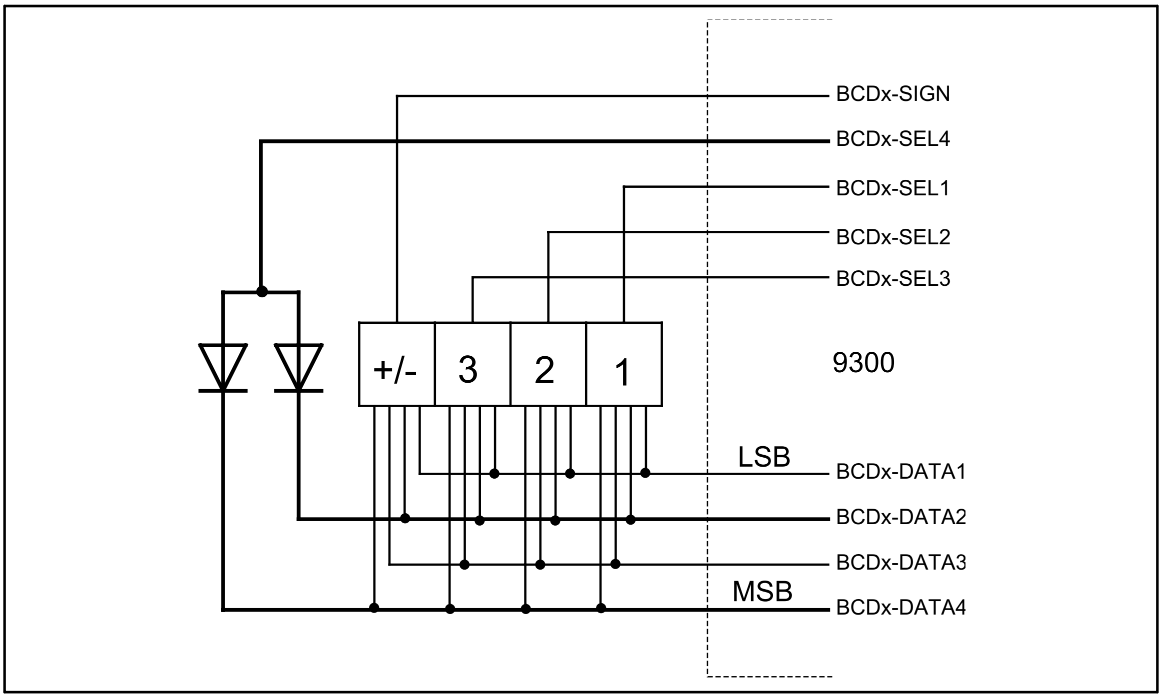


Fig. 3-78 Cancel after the 3rd absolute value digit (diode circuit)

Function

Reading can be shortened if BCDs are not required.

- The FB does not read the following BCDs if the value A_{hex} (1010_{bin}) for ”ABORT” is transmitted after a BCD has been read. The reading stops with the identification of ”ABORT”.
- In the case of the abort via a value digit, the least significant bit (LSB) is to be assigned with ”ABORT”, because the reading sequence stops at the least significant bit.
- In the handshake mode, ”CANCEL” should be identified at the beginning of the data transmission (see also the following chapter).

3.5.12.7 BCD mode

The BCD mode defines the type of BCD transmission (not the transmission to the target code).

Overview of the settings in the BCD mode:

Function	BCD1	BCD2	BCD3
BCD mode • 0 = no handshaking • 1 = handshaking	C1706	C1716	C1726
BCD delay in ms (only for data transmission without handshaking)	C1707	C1717	C1727

No handshaking, minimum wiring

Set BCD mode = 0.

Function

- Cyclic reading of BCDs
  - No acceptance signal (BCDx-READ), e.g. for reading a BCD decade switch required.
- Set BCD delay (see table)
  - Defines the period between reading the individual BCDs. The setting may be necessary if a bus system provides the data transfer between the BCD decade switch and the FB BCDx (e.g. terminal extension via system bus).
  - The bus system used, the baud rate, and the bus load determine the time to be set.

The BCDs are read in the following sequence:

1. Sign
2. BCD 1
3. BCD 2
4. etc.

With handshaking, minimum wiring

Set BCD mode = 1.

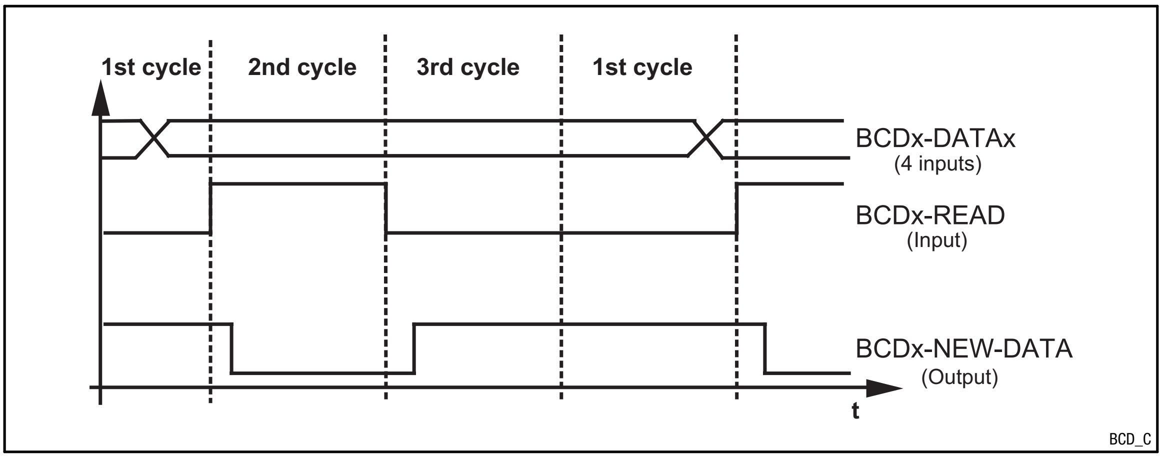


Fig. 3-79 Sequence of handshaking

Function

- The superimposed control (e.g. PLC) determines the time of data transmission.
- After the acceptance signal has been sent from the control to BCDx-READ the BCD is read.
  - The signal must be sent for every BCD.
  - The reading routine of the FB BCD remains in waiting position until the data transmission is started.

The BCDs are read in the following sequence:

1. Sign
2. BCD 1
3. BCD 2
4. etc.

Transmission sequence of a BCD:

Input/output	Signal	Function
BCDx-DATA1 ... BCDx-DATA4		Generating data for the first or next BCD via PLC.
BCDx-NEW-DATA	HIGH	Enables the transmission for the next BCD.
BCDx-READ	LOW-HIGH edge	Reading of the BCD data to the FB BCD.
BCDx-NEW-DATA	LOW	Inhibits the transmission for the next BCD.
BCDx-READ	LOW	Set via PLC.

3.5.13 Holding brake (BRK)

Danger!

Condition for applying the BRK function block

Exclusively triggering the holding brake via the function block BRK is not permissible!

The **safe** triggering of the holding brake additionally requires a second switch-off mode. Without the second switch-off mode there is a risk of severe personal injury and danger to material assets!

Applications with active loads

With an increase of the DC-bus voltage (e.g. by braking processes) the torque limitation may intervene due to code C0172. The torque limitation is activated if e.g.

- the brake resistor is damaged.
- the switching threshold set at the brake chopper or brake module is not adapted correctly.

Code C0172 is a pre-stage of the monitoring function “OU” (overvoltage of the DC-bus voltage). Code C0172 defines which differential mode voltage causes a reduction in torque before OU. With the default setting the torque is reduced to ”0” if the DC-bus voltage amounts to 760 V (770 V - 10 V):

- OU threshold = 770V (C0173 = 0...3)*
- C0172 = 10 V
- No message is generated.

Only after the DC-bus voltage is decreased below the OU reclosing threshold the torque is reconnected.

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

Remedy:

5. Set C0172 = 0 V
6. MONIT-OU must generate EEr-TRIP (e.g. with C0871/0 = 15011).
   This serves to apply the standstill brake over the controller inhibit (CINH) if the braking energy cannot be dissipated.

*) Exception: OU threshold 800 V with C0173 = 4 (see description in code table)

Purpose

The FB is used to trigger a holding brake.

Possible applications:

- Hoists
- Traversing drives
- Active loads

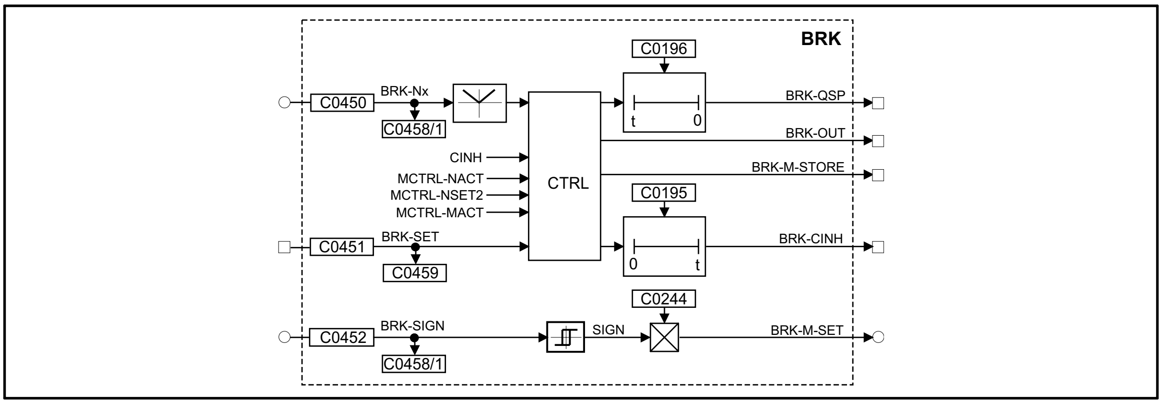


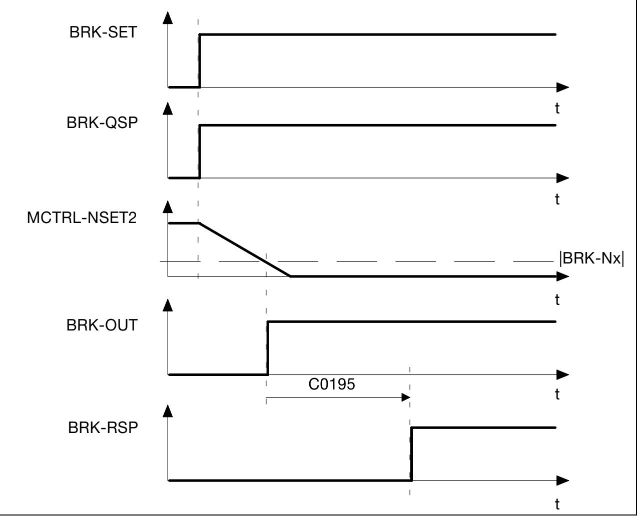
Fig. 3-80 Holding brake (BRK)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
BRK-SET	d	C0459	bin	C0451	2	1000	-
BRK-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.
BRK-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.
BRK-M-SET	a	-	dec [%]	C0244	-	0.00	Holding torque of the DC injection brake 100 % = value of C0057
BRK-T-ACT	a	-	dec	C0195	-	99.9	Brake application time
BRK-T-RELEASE	a	-	dec	C0196	-	0.0	Brake release time

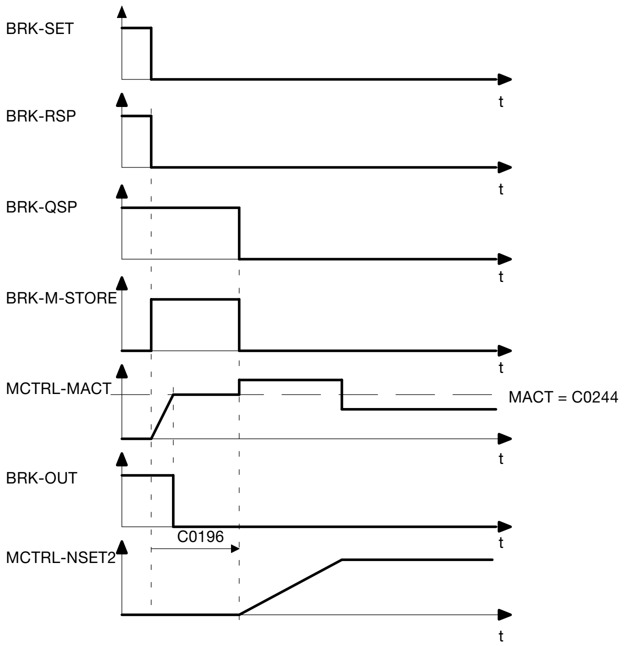
Function

The signals N-ACT, M-ACT, N-SET and BRK-Nx are processed as absolute values within the function block.

3.5.13.1 Applying the brake

Purpose	A HIGH-Signal at the BRK-SET input activates the function. The BRK-QSP output is simultaneously set to HIGH. This signal can be used to decelerate the drive to zero speed via a deceleration ramp.	
Function	If the setpoint speed falls below the value set at the BRK-Nx input, the BRK-OUT output is set to HIGH. In order to ensure a fail-safe design this signal must be inverted at the output (e.g. via C0118).	

3.5.13.2 Opening the brake (release)

Purpose	A LOW signal at the BRK-SET input immediately sets the BRK-CINH output to LOW. At the same time the BRK-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 is elapsed.	
Function	The BRK-OUT output signal is set to LOW as soon as the torque reaches the value set under C0244 (holding torque). When the input is reset, a time element is triggered. After the time set under C0196 has elapsed the BRK-QSP output is reset. This signal serves to e.g. release the setpoint integrator after the brake release time has elapsed.	
Note	If an actual value higher than the value at BRK-Nx is detected before the brake release time (C0196) has elapsed, the signals BRK-QSP and BRK-M-STORE are reset immediately. The drive can immediately operate speed or phase-controlled. If the BRK-QSP output acts on the QSP control word the drive is synchronised to the actual speed and follows its setpoint.	

3.5.13.3 Setting controller inhibit

Purpose

Controller inhibit can be set e.g. in case of a fault (LU, OU, ...).

Function

When the controller is inhibited (CINH) the BRK-OUT signal is immediately set to HIGH. 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 falls below the threshold value BRK-Nx, the BRK-OUT signal is set immediately to LOW. 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 ”Opening the brake”.

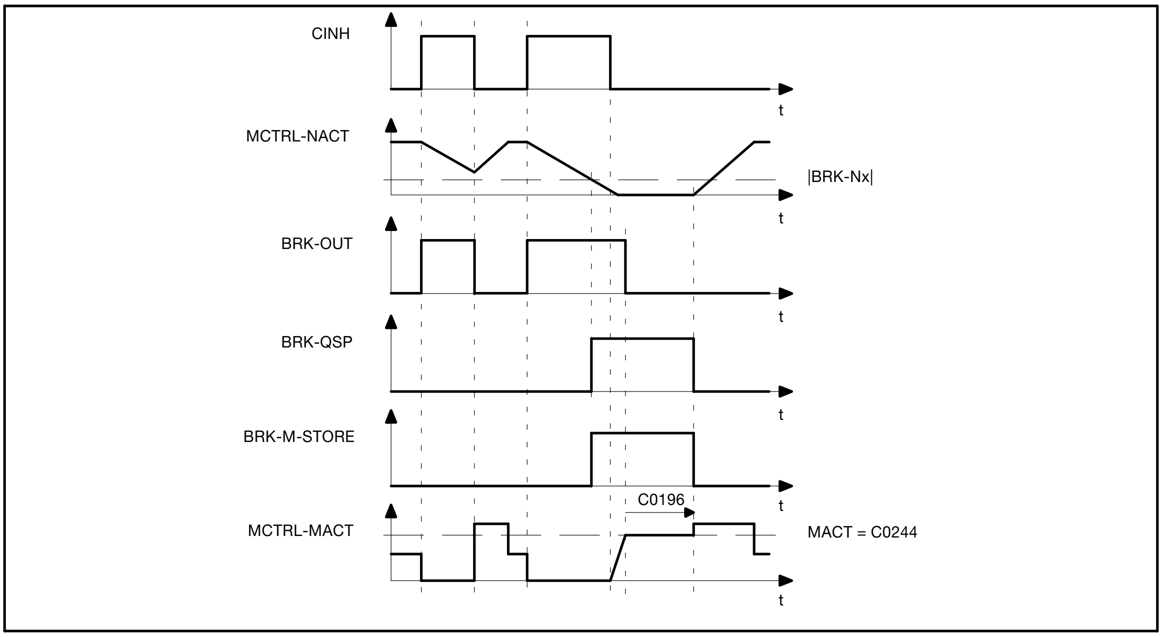


Fig. 3-81 Control brake by CINH

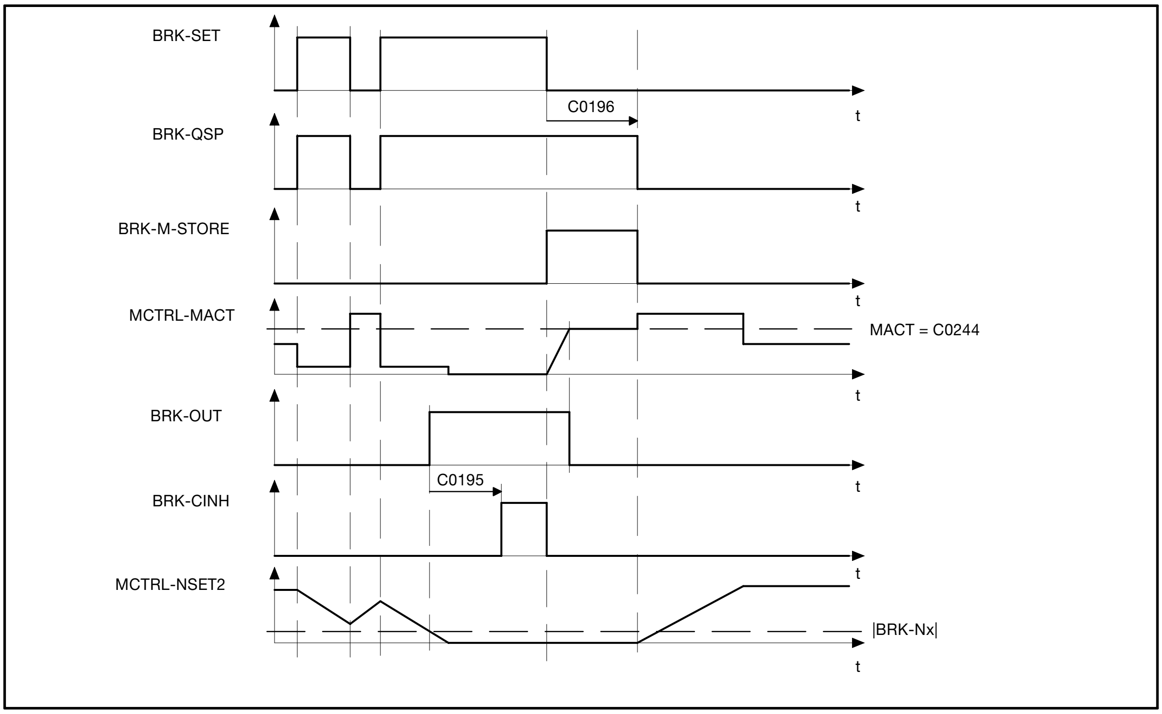


Fig. 3-82 Switching cycle when braking

3.5.14 System bus (CAN-IN)

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

3.5.15 System bus (CAN-OUT)

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

3.5.16 Comparator (CMP)

Purpose

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

CMP1

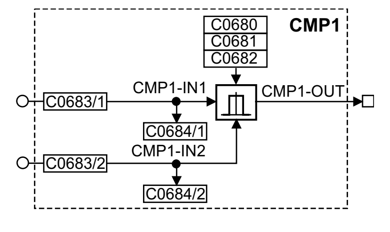


Fig. 3-83 Comparator (CMP1)

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

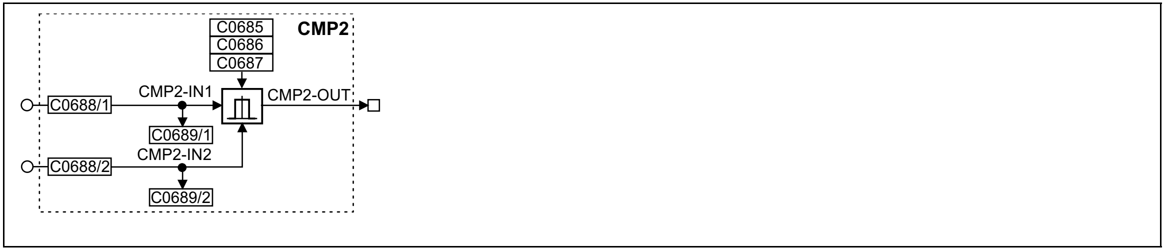


Fig. 3-84 Comparator (CMP2)

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

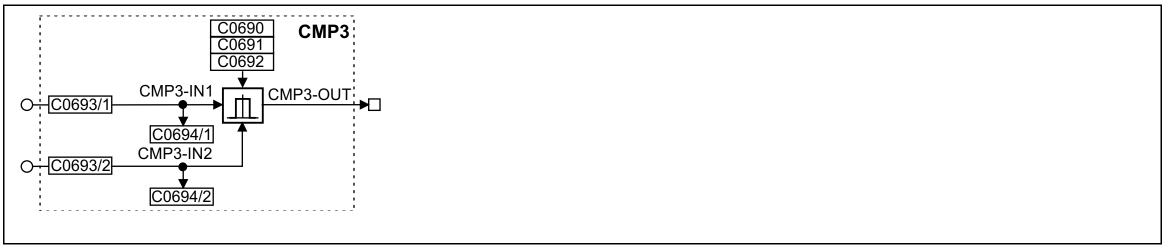


Fig. 3-85 Comparator (CMP3)

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|

3.5.16.1 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.

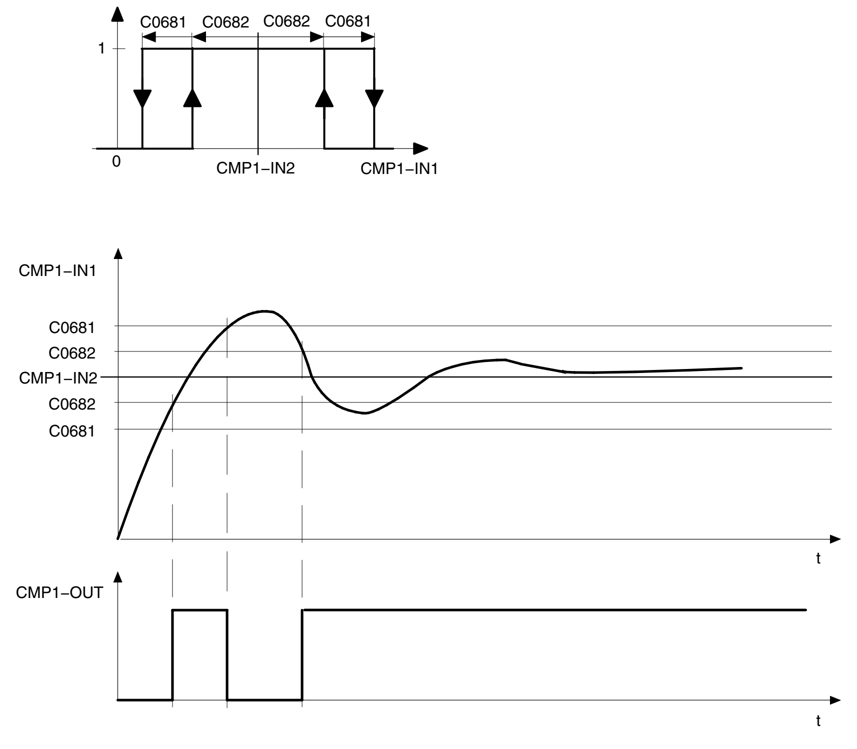


Fig. 3-86 Equality of signals (CMP1-IN1 = CMP1-IN2)

3.5.16.2 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.

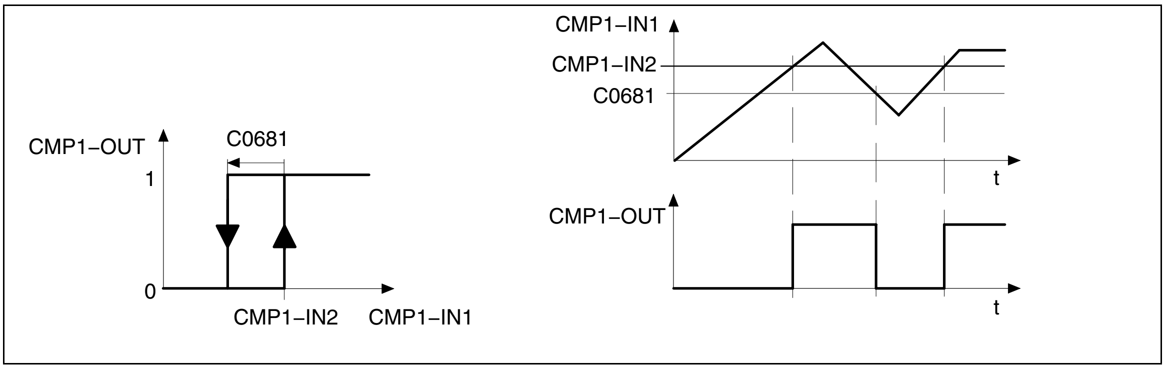


Fig. 3-87 Exceeding signal values (CMP1-IN1 > CMP1-IN2)

3.5.16.3 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.

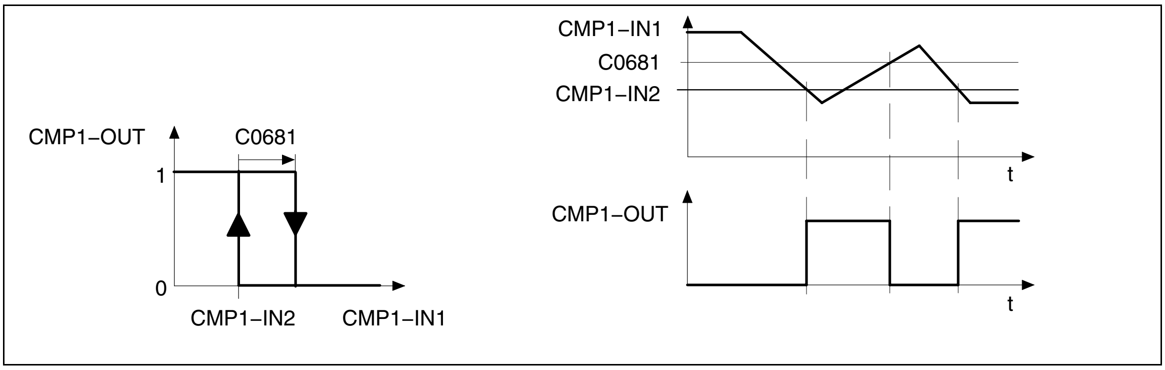


Fig. 3-88 Values falling below signal values (CMP1-IN1 CMP1-IN2)

3.5.16.4 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”.

3.5.16.5 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.

3.5.16.6 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.

3.5.17 Long comparator (CMPPH)

Three FBs are available (CMPPH1 ... CMPPH3).

Purpose

Comparison of two phase signals or their absolute values to achieve triggers.

CMPPH1

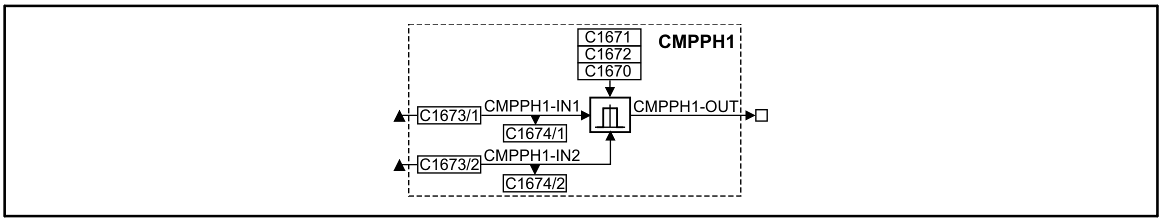


Fig. 3-89 Function block CMPPH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CMPPH1-IN1	ph	C1674/1	dec [inc]	C1673/1	3	-
CMPPH1-IN2	ph	C1674/2	dec [inc]	C1673/2	3	-
CMPPH1-OUT	d	-	-	-	-	-

CMPPH2

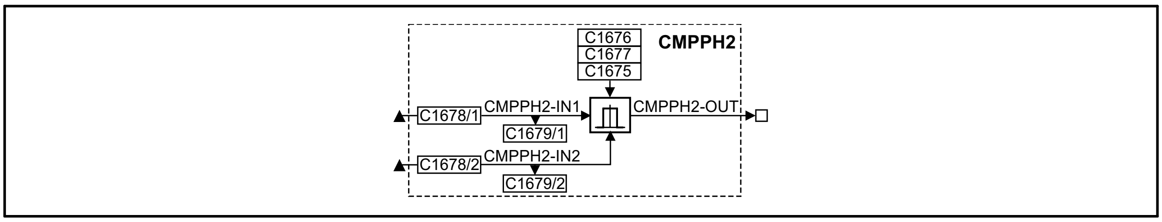


Fig. 3-90 Function block CMPPH2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CMPPH2-IN1	ph	C1679/1	dec [inc]	C1678/1	1	-
CMPPH2-IN2	ph	C1679/2	dec [inc]	C1678/2	1	-
CMPPH2-OUT	d	-	-	-	-	-

CMPPH3

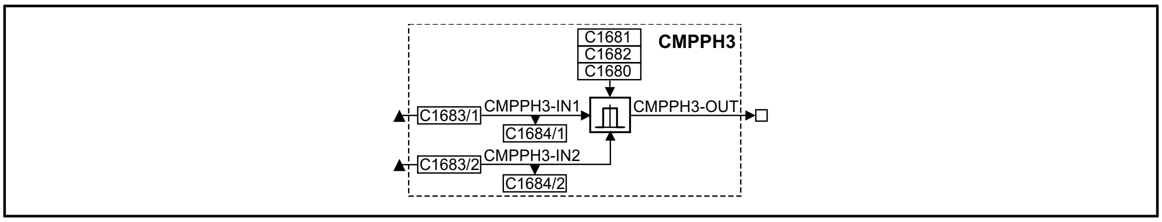


Fig. 3-91 Function block CMPPH3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CMPPH3-IN1	ph	C1684/1	dec [inc]	C1683/1	1	-
CMPPH3-IN2	ph	C1684/2	dec [inc]	C1683/2	1	-
CMPPH3-OUT	d	-	-	-	-	-

Function

FB CMPPH1 serves as example for the functions. They are also applicable for the FB CMPPH2 and CMPPH3.

The following functions can be selected via C1670 (CMPPH1):

- Function 1: CMPPH1-IN1 = CMPPH1-IN2
- Function 2: CMPPH1-IN1 > CMPPH1-IN2
- Function 3: CMPPH1-IN1 < CMPPH1-IN2
- Function 4: |CMPPH1-IN1| = |CMPPH1-IN2|
- Function 5: |CMPPH1-IN1| > |CMPPH1-IN2|
- Function 6: |CMPPH1-IN1| < |CMPPH1-IN2|

3.5.17.1 Function 1: CMPPH1-IN1 = CMPPH1-IN2

Comparison of two phase signals.

- Set the window under C1672, where the equality is to be effective.
- Set a hysteresis under C1671 if the input signals are not stable and the output oscillates.

The exact function can be obtained from the line diagram.

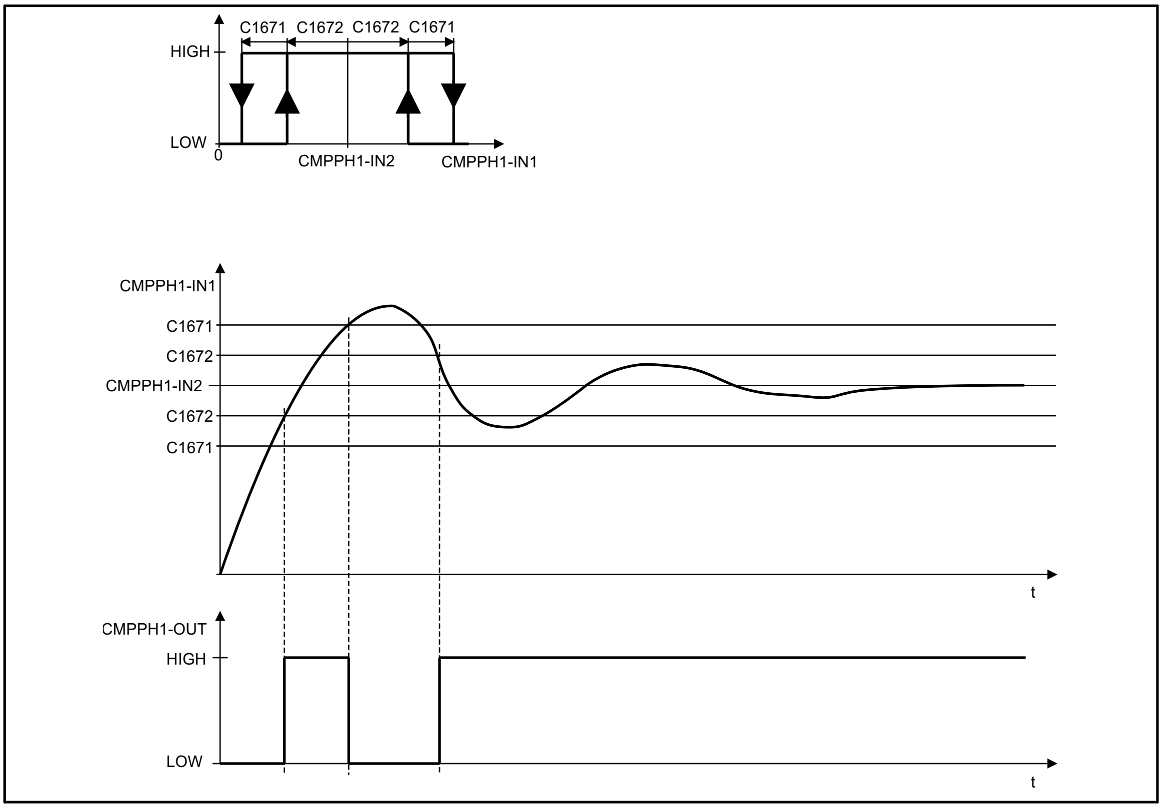


Fig. 3-92 Equality of signals (CMPPH1-IN1 = CMPPH1-IN2)

Example:
This function is for the comparison ”Actual phase equal to setpoint phase ($ph_{act.}= ph_{set}$)”.

3.5.17.2 Function 2: CMPPH1-IN1 > CMPPH1-IN2

- CMPPH1-IN1 > CMPPH1-IN2
  – CMPPH1-OUT = HIGH
- CMPPH1-IN1 < CMPPH1-IN2
  – CMPPH1-OUT = LOW

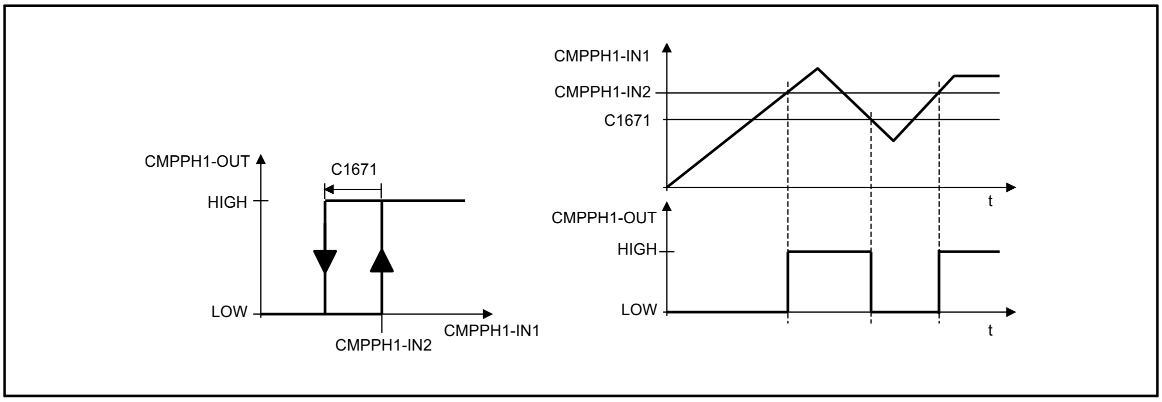


Fig. 3-93 Exceeding signal values (CMPPH1-IN1 > CMPPH1-IN2)

Example:
This function is for the comparison ”Actual phase equal to limit value ($ph_{act.}> ph_{x}$)”.

3.5.17.3 Function 3: CMPPH1-IN1 < CMPPH1-IN2

- CMPPH1-IN1 < CMPPH1-IN2
  – CMPPH1-OUT = HIGH
- CMPPH1-IN1 > CMPPH1-IN2
  – CMPPH1-OUT = LOW

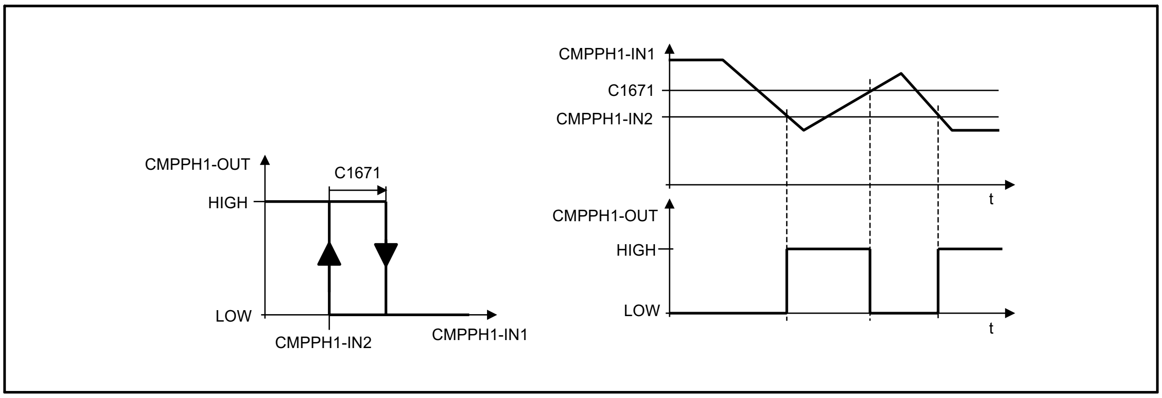


Fig. 3-94 Falling below signal values (CMPPH1-IN1 < CMPPH1-IN2)

Example:
This function is for the comparison ”Actual phase smaller than a limit value ($ph_{act.} < ph_{x}$)”.

3.5.17.4 Function 4: |CMPPH1-IN1| = |CMPPH1-IN2|

This function is the same as function 1.

- The absolute value of the input signals (without sign) is generated prior to the signal processing.

Example:
This function is for the comparison ”$ph_{act.} = 0$”.

3.5.17.5 Function 5: |CMPPH1-IN1| > |CMPPH1-IN2|

This function is the same as function 3.

- The absolute value of the input signals (without sign) is generated prior to the signal processing.

Example:
This function is for the comparison ”$|ph_{act.}| > |ph_x|$”.

3.5.17.6 Function 6: |CMPPH1-IN1| < |CMPPH1-IN2|

This function is the same as function 2.

- The absolute value of the input signals (without sign) is generated prior to the signal processing.

Example:
This function is for the comparison ”$|ph_{act.}| < |ph_x|$”.

3.5.18 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

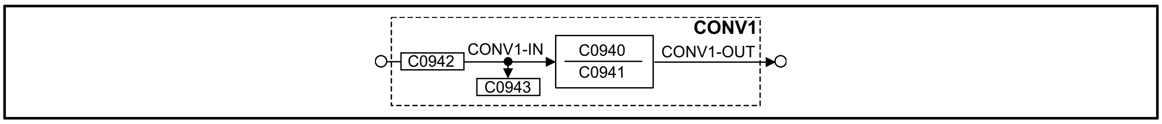


Fig. 3-95 Function block CONV1

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 %

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

The conversion is done according to the formula:

$$\mathrm{CONV1{-}OUT} = \mathrm{CONV1{-}IN} \cdot \frac{\mathrm{C0940}}{\mathrm{C0941}}$$

Example:

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

CONV2

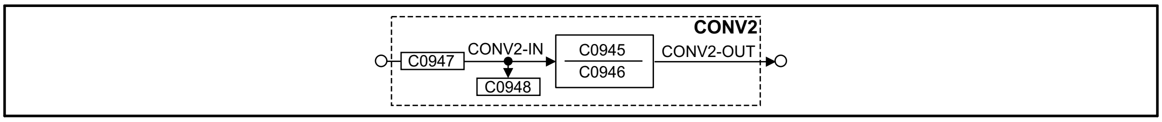


Fig. 3-96 Function block CONV2

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 %

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

The conversion is done according to the formula:

$$\mathrm{CONV2{-}OUT} = \mathrm{CONV2{-}IN} \cdot \frac{\mathrm{C0945}}{\mathrm{C0946}}$$

CONV3

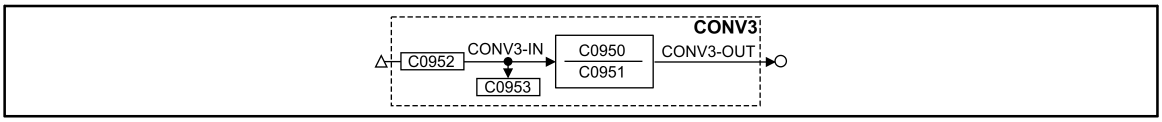


Fig. 3-97 Function block CONV3

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 %

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

The conversion is done according to the formula:

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

CONV4

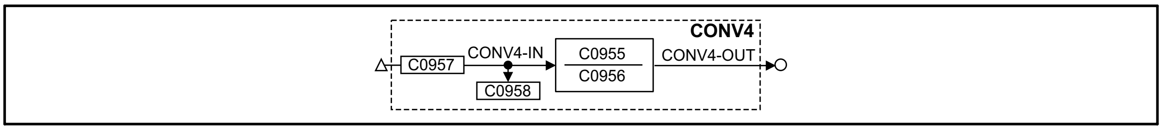


Fig. 3-98 Function block CONV4

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 %

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

The conversion is done according to the formula:

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

CONV5

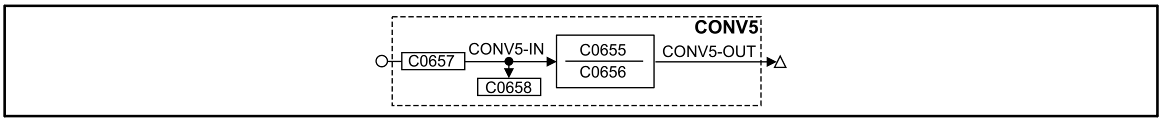


Fig. 3-99 Function block CONV5

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:

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

3.5.19 Analog-digital converter (CONVAD)

Conversion of an analog value into individual digital signals.

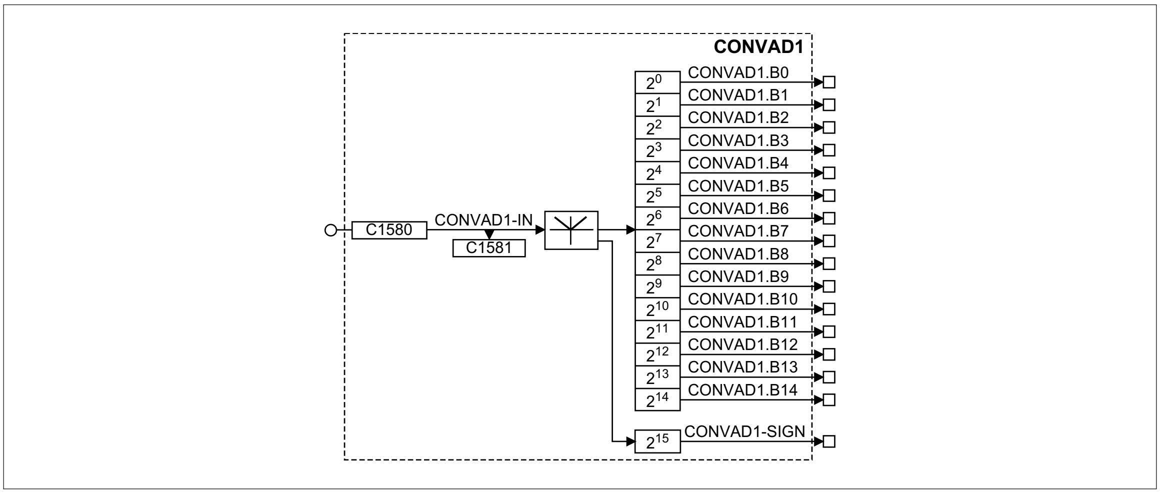


Fig. 3-100 Analog/digital converter (CONVAD1)

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

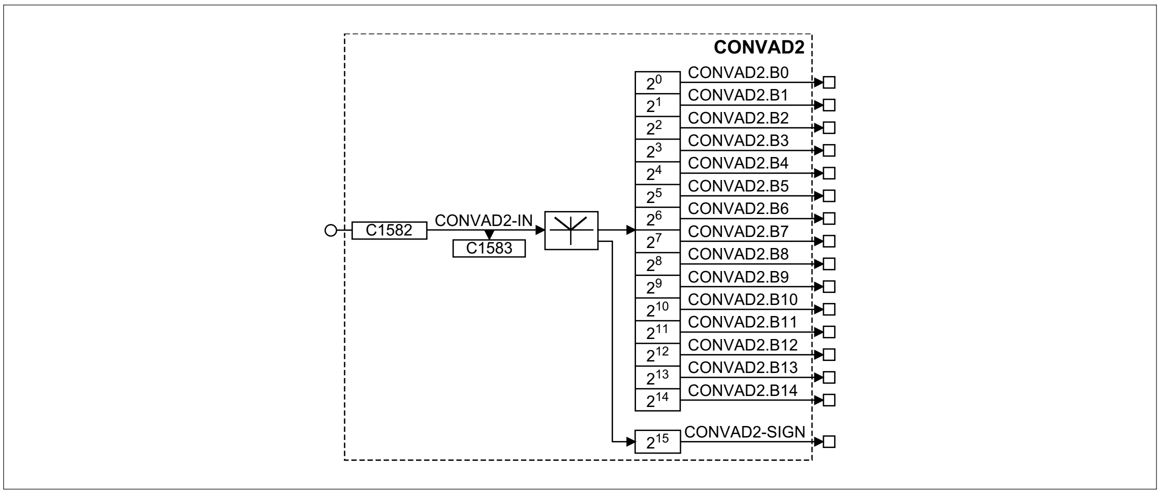


Fig. 3-101 Analog/digital converter (CONVAD2)

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

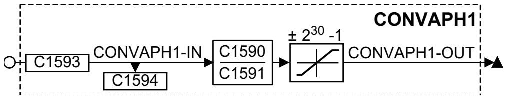
Function

- 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.

3.5.20 Analog-phase converter (CONVAPH)

Conversion of an analog value into a phase signal.

CONVAPH1



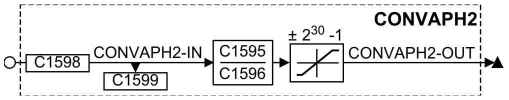
Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH1-IN	a	C1594	dec	C1593	1	-
CONVAPH1-OUT	ph	-	-	-	-	Limited to $\pm 2^{30}$-1

Function

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

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

CONVAPH2



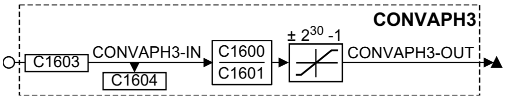
Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH2-IN	a	C1599	dec	C1598	1	-
CONVAPH2-OUT	ph	-	-	-	-	Limits to $\pm 2^{30}$-1

Function

- Conversion with adaptation using multiplier and divisor.
- The conversion is performed according to the formula:

$$\text{CONVAPH1} - \text{OUT} = \text{CONVAPH1} - \text{IN} \cdot \frac{\text{C1595}}{\text{C1596}} \cdot \frac{16384}{100\%}$$

CONVAPH3



Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH3-IN	a	C1604	dec	C1603	1	-
CONVAPH3-OUT	ph	-	-	-	-	Limits to $\pm 2^{30}$-1

Function

- Conversion with adaptation using multiplier and divisor.
- The conversion is performed according to the formula:

$$\text{CONVAPH1} - \text{OUT} = \text{CONVAPH1} - \text{IN} \cdot \frac{\text{C1600}}{\text{C1601}} \cdot \frac{16384}{100\%}$$

3.5.21 Digital-analog converter (CONVDA)

Three function blocks (CONVDA1 ... CONVDA3) are available.

Purpose

Conversion of individual digital signals to an analog value.

CONVDA1

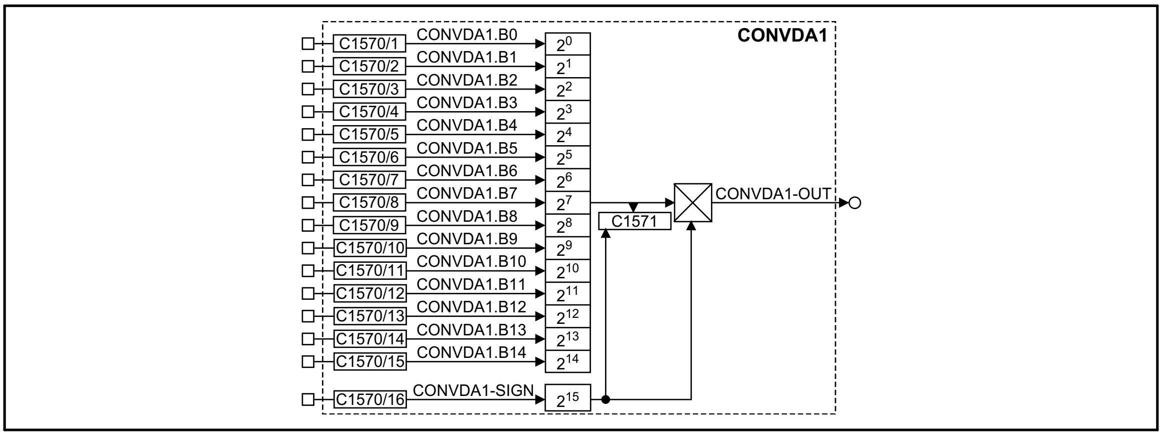


Fig. 3-102 Function block CONVDA1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVDA1.B0	d	-	-	C1570/1	2	-
CONVDA1.B1	d	-	-	C1570/2	2	-
CONVDA1.B2	d	-	-	C1570/3	2	-
CONVDA1.B3	d	-	-	C1570/4	2	-
CONVDA1.B4	d	-	-	C1570/5	2	-
CONVDA1.B5	d	-	-	C1570/6	2	-
CONVDA1.B6	d	-	-	C1570/7	2	-
CONVDA1.B7	d	-	-	C1570/8	2	-
CONVDA1.B8	d	-	-	C1570/9	2	-
CONVDA1.B9	d	-	-	C1570/10	2	-
CONVDA1.B10	d	-	-	C1570/11	2	-
CONVDA1.B11	d	-	-	C1570/12	2	-
CONVDA1.B12	d	-	-	C1570/13	2	-
CONVDA1.B13	d	-	-	C1570/14	2	-
CONVDA1.B14	d	-	-	C1570/15	2	-
CONVDA1-SIGN	d	-	-	C1570/16	2	Sign HIGH $\triangleq$ negative sign LOW $\triangleq$ positive sign
CONVDA1-OUT	a	-	-	-	-	-
-	-	C1571	hex	-	-	Indicates the result

CONVDA2

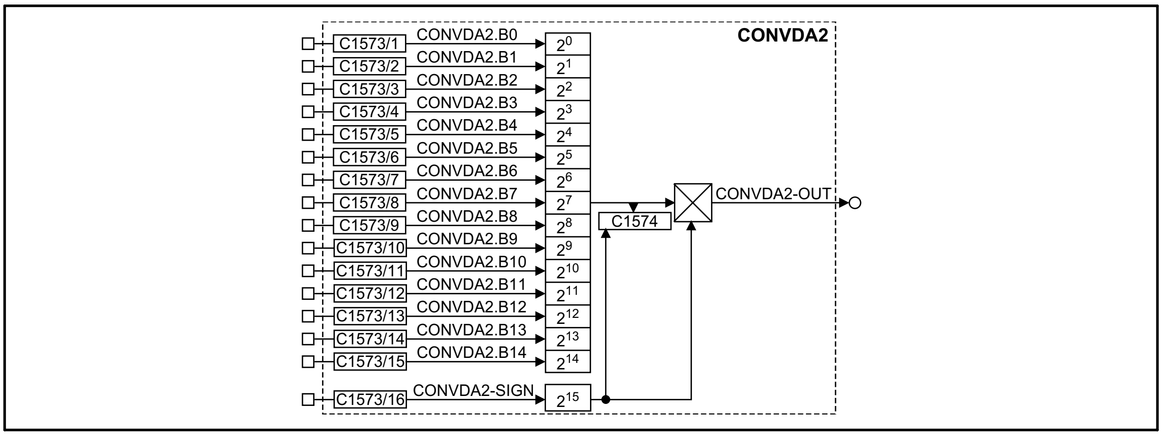


Fig. 3-103 Function block CONVDA2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVDA2.B0	d	-	-	C1573/1	2	-
CONVDA2.B1	d	-	-	C1573/2	2	-
CONVDA2.B2	d	-	-	C1573/3	2	-
CONVDA2.B3	d	-	-	C1573/4	2	-
CONVDA2.B4	d	-	-	C1573/5	2	-
CONVDA2.B5	d	-	-	C1573/6	2	-
CONVDA2.B6	d	-	-	C1573/7	2	-
CONVDA2.B7	d	-	-	C1573/8	2	-
CONVDA2.B8	d	-	-	C1573/9	2	-
CONVDA2.B9	d	-	-	C1573/10	2	-
CONVDA2.B10	d	-	-	C1573/11	2	-
CONVDA2.B11	d	-	-	C1573/12	2	-
CONVDA2.B12	d	-	-	C1573/13	2	-
CONVDA2.B13	d	-	-	C1573/14	2	-
CONVDA2.B14	d	-	-	C1573/15	2	-
CONVDA2-SIGN	d	-	-	C1573/16	2	Sign HIGH $\triangleq$ negative sign LOW $\triangleq$ positive sign
CONVDA2-OUT	a	-	-	-	-	-
-	-	C1574	hex	-	-	Indicates the result

CONVDA3

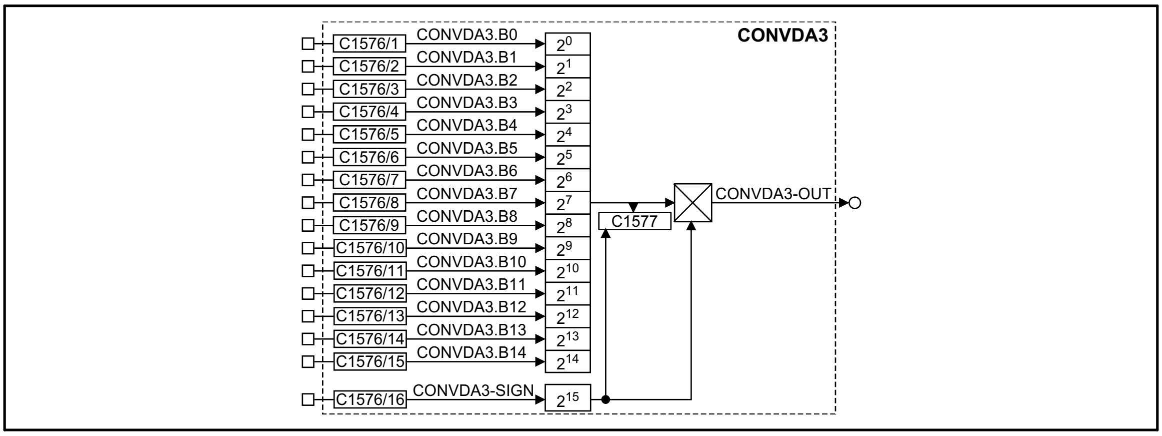


Fig. 3-104 Function block CONVDA3

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
CONVDA3.B0	d	-	-	C1576/1	2	-
CONVDA3.B1	d	-	-	C1576/2	2	-
CONVDA3.B2	d	-	-	C1576/3	2	-
CONVDA3.B3	d	-	-	C1576/4	2	-
CONVDA3.B4	d	-	-	C1576/5	2	-
CONVDA3.B5	d	-	-	C1576/6	2	-
CONVDA3.B6	d	-	-	C1576/7	2	-
CONVDA3.B7	d	-	-	C1576/8	2	-
CONVDA3.B8	d	-	-	C1576/9	2	-
CONVDA3.B9	d	-	-	C1576/10	2	-
CONVDA3.B10	d	-	-	C1576/11	2	-
CONVDA3.B11	d	-	-	C1576/12	2	-
CONVDA3.B12	d	-	-	C1576/13	2	-
CONVDA3.B13	d	-	-	C1576/14	2	-
CONVDA3.B14	d	-	-	C1576/15	2	-
CONVDA3-SIGN	d	-	-	C1576/16	2	Sign HIGH $\triangleq$ negative sign LOW $\triangleq$ positive sign
CONVDA3-OUT	a	-	-	-	-	-
-	-	C1577	hex	-	-	Indicates the result

Function

- Input of 15 absolute values (2^0 ... 2^{14})
- The 16th bit (2^{15}) is the sign to indicate whether the analog value is positive or negative.
- Display of the analog value via a code in the hex format
  - C1571 for CONVDA1
  - C1574 for CONVDA2
  - C1577 for CONVDA3

3.5.22 Phase-analog converter (CONVPHA)

Three function blocks (CONVPHA1 ... CONVPHA3) are available.

Purpose

Conversion of a phase signal into an analog value.

CONVPHA1

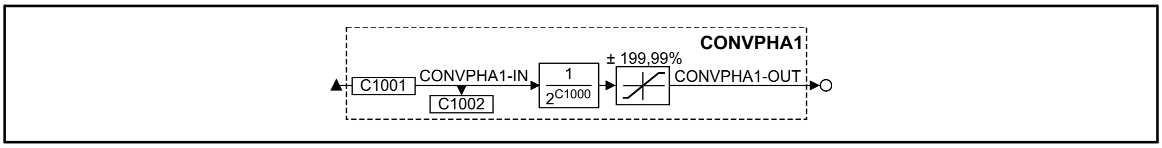


Fig. 3-105 Function block CONVPHA1

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 %

Function

- Conversion with adaptation using divisor.
- The conversion is performed according to the formula:

$$\text{CONVPHA1–OUT} = \text{CONVPHA1–IN} \cdot \frac{1}{2^{C1000}} \cdot \frac{100\%}{16384}$$

CONVPHA2

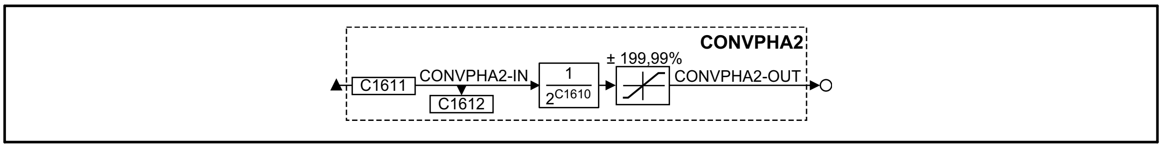


Fig. 3-106 Function block CONVPHA2

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 %

Function

- Conversion with adaptation using divisor.
- The conversion is performed according to the formula:

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

CONVPHA3

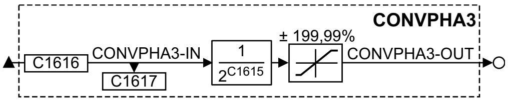


Fig. 3-107 Function block CONVPHA3

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 %

Function

- Conversion with adaptation using divisor and exact residual value treatment.
- The conversion is performed according to the formula:

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

3.5.23 Phase conversion (CONVPHPH2)

Purpose

Conversion of a phase signal with dynamic fracture.

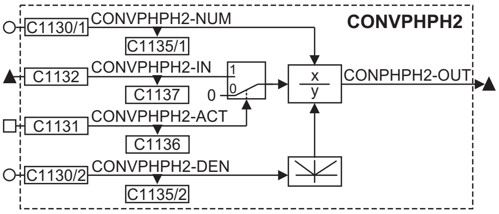


Fig. 3-108 Phase conversion (CONVPHPH2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHPH2-IN	ph	C1137	dec [inc]	C1132	3	-
CONVPHPH2-NUM	a	C1135/1	dec	C1130/1	1	Numerator
CONVPHPH2-DEN	a	C1135/2	dec	C1130/2	1	Denominator (with absolute-value generation)
CONVPHPH2-ACT	d	C1136	bin	C1131	2	-
CONVPHPH2-OUT	ph	-	-	-	-	Without limitation, residual value considered

Function

Caution!

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

- C1131 = HIGH
  - The phase signal at CONVPHPH2-IN is evaluated with the factor from C1135/1 / C1135/2.
- C1131 = LOW
  - The value 0 is evaluated with the factor from C1135/1 / C1135/2.

3.5.24 Characteristic function (CURVE)

Purpose

Conversion of an analog signal into a characteristic.

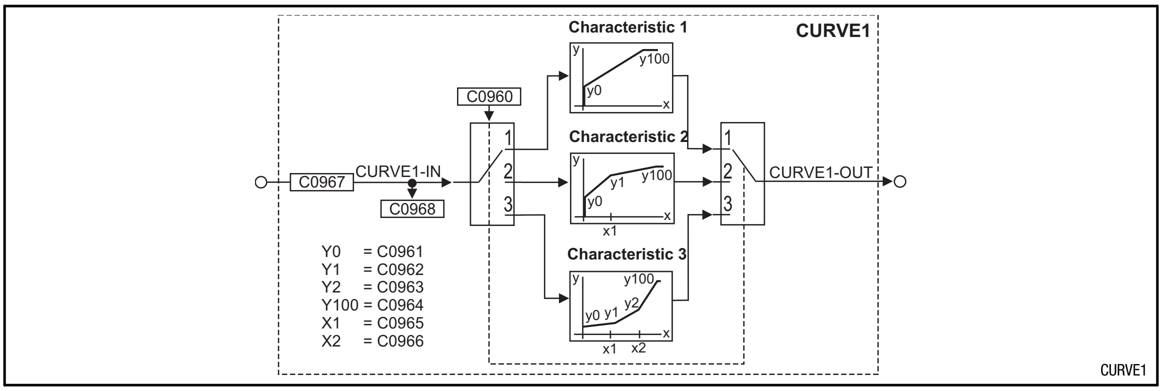


Fig. 3-109 Characteristic function (CURVE1)

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

3.5.24.1 Characteristic with two interpolation points

Set C0960 = 1.

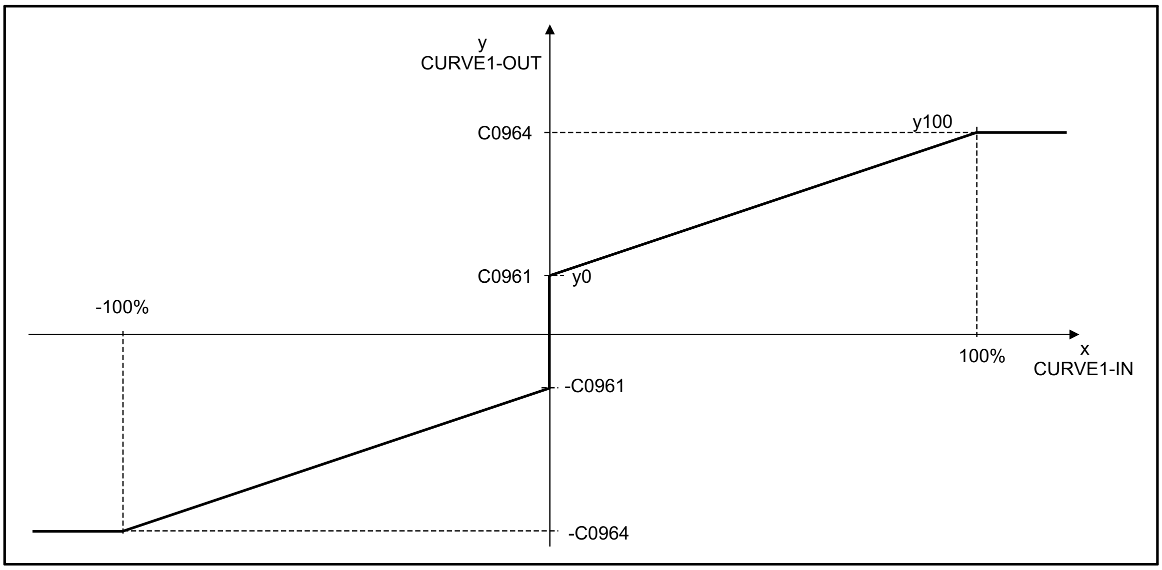


Fig. 3-110 Line diagram of characteristic with 2 interpolation points

3.5.24.2 Characteristic with three interpolation points

Set C0960 = 2.

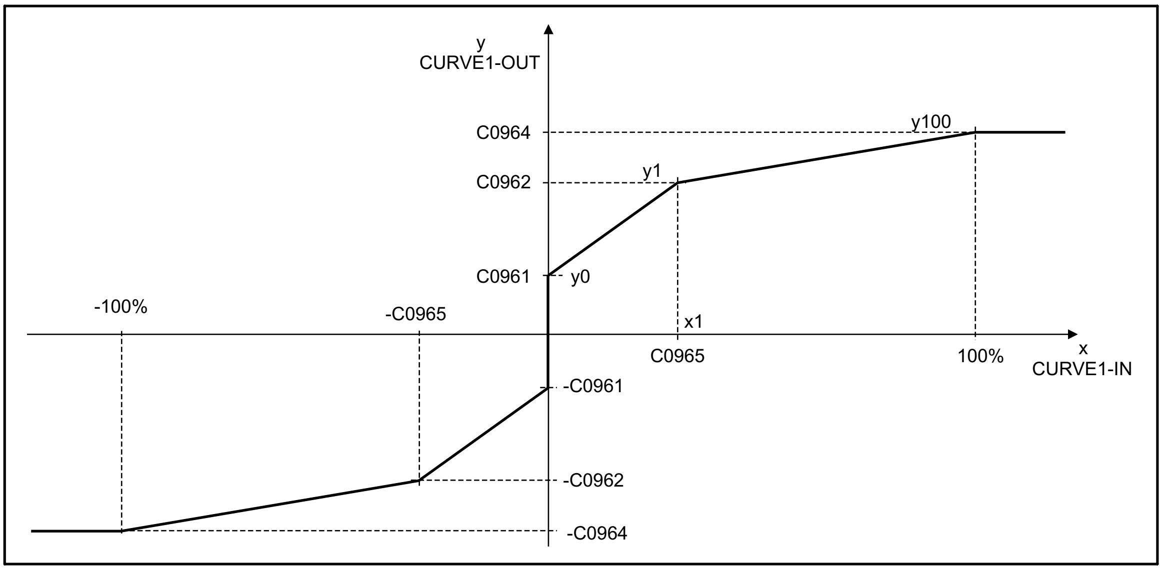


Fig. 3-111 Line diagram of characteristic with 3 interpolation points

3.5.24.3 Characteristic with four interpolation points

Set C0960 = 3.

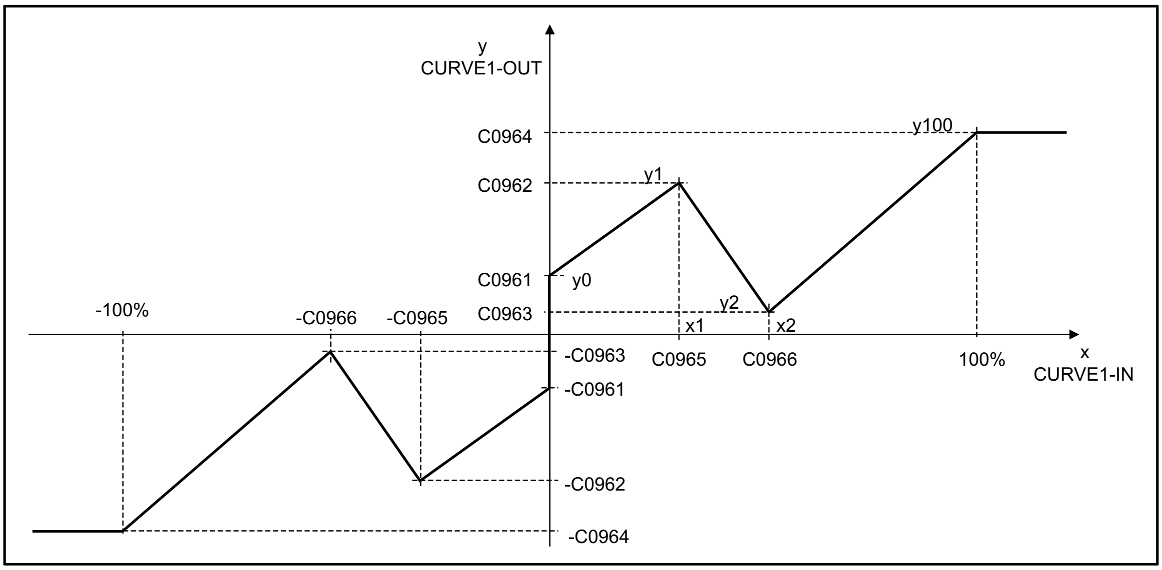


Fig. 3-112 Line diagram of characteristic with 4 interpolation points

3.5.25 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.

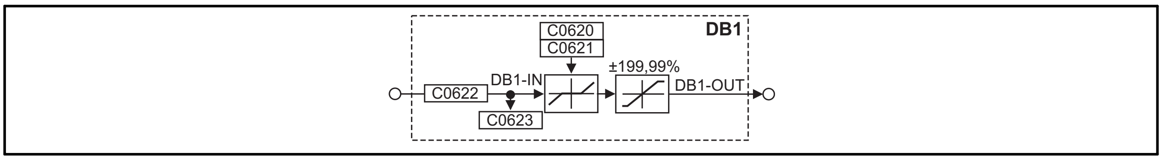


Fig. 3-113 Dead band element (DB1)

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.

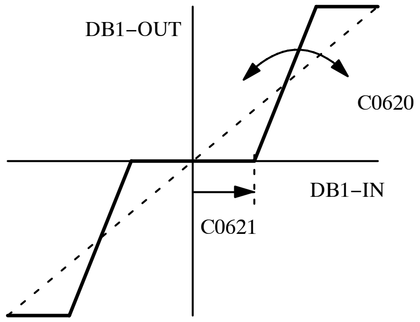


Fig. 3-114 Dead band and gain

3.5.26 Drive control (DCTRL)

Purpose

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

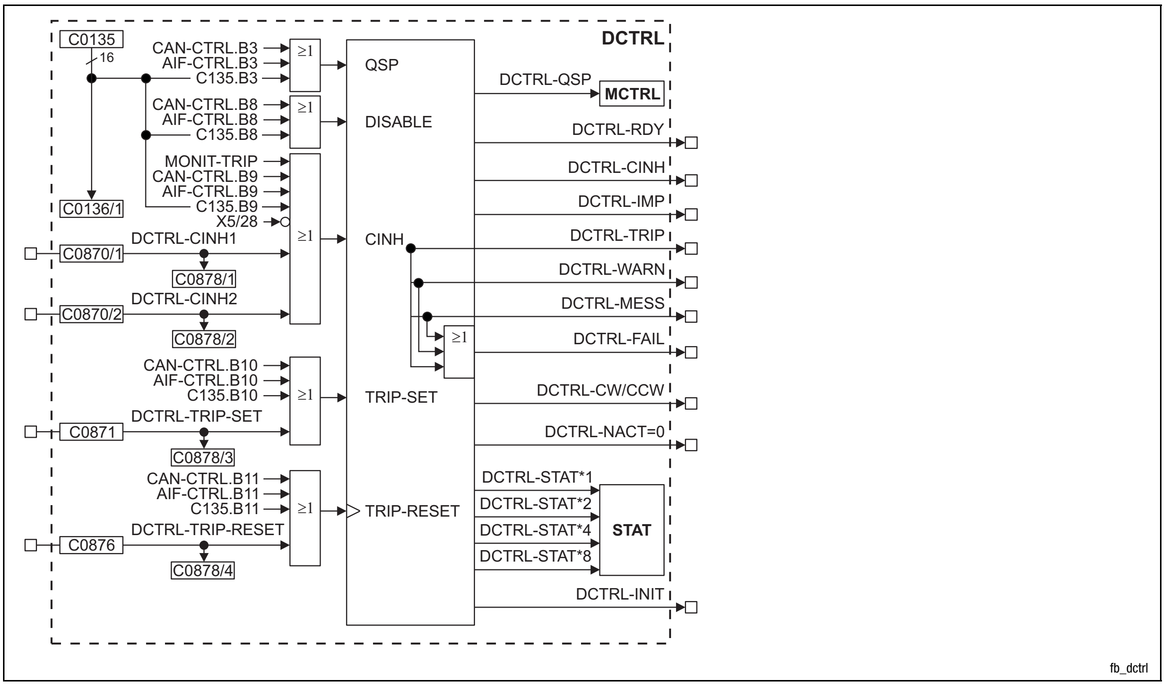


Fig. 3-115 Control of the controller (DCTRL)

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

3.5.26.1 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

3.5.26.2 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

3.5.26.3 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

3.5.26.4 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

3.5.26.5 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.

3.5.26.6 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”

3.5.26.7 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.

3.5.27 Master frequency input (DFIN)

Purpose

Converting and scaling a power pulse current at the digital frequency input X9 into a speed and phase setpoint. The digital frequency is transferred in a high-precision mode (with offset and gain errors).

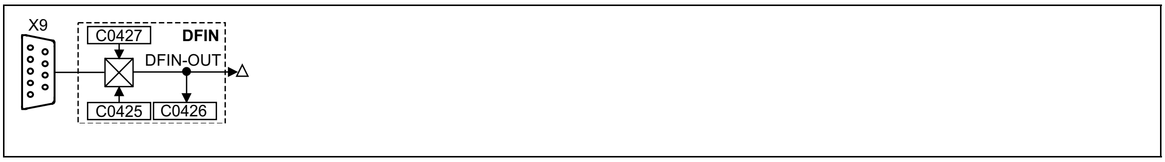


Fig. 3-116 Digital frequency input (DFIN)

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 event of digital frequency cascade or digital frequency rail, adapt the drive to the connected encoder or controller via C0425.
- The input of a zero track is optional.
- Via C0427 the following input signals can be evaluated:

C0427 = 0

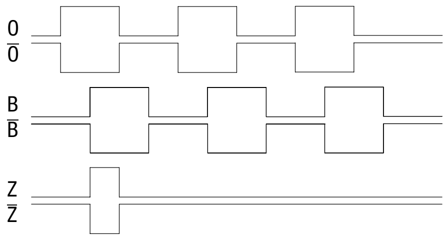


Fig. 3-117 Phase-delayed signal sequence (CW rotation)

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

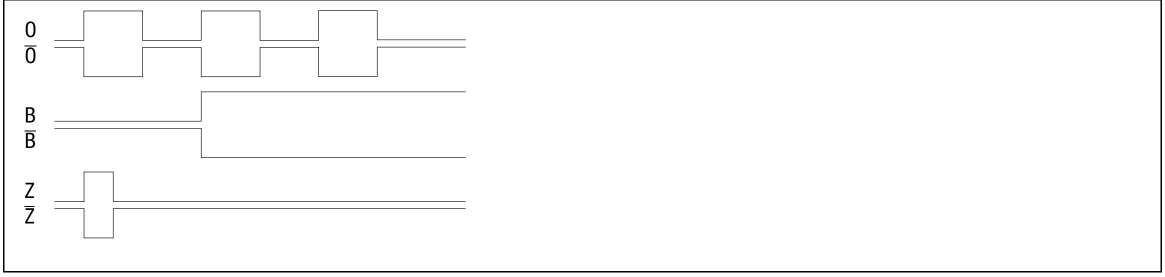


Fig. 3-118 Control of direction of rotation via track B

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

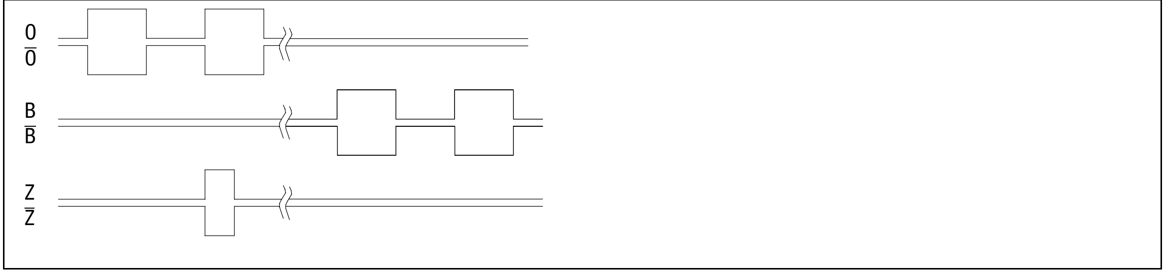


Fig. 3-119 Control of speed and direction of rotation via track A or track B

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 realised by connecting an FB (e.g. CONV3 or CONV4).

Example:

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

$$\text{CONV3-OUT [\%]} = \text{f [Hz]} \cdot \frac{0,4}{\text{Number of increments from C0425}} \cdot \frac{\text{C0950}}{\text{C0951}}$$

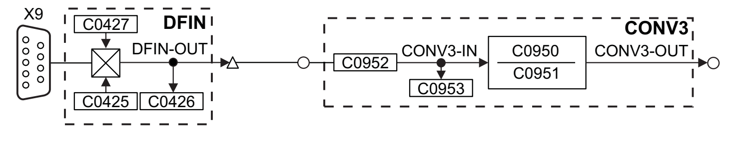


Fig. 3-120 Digital frequency input (DFIN) with connected converter

STOP!

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

3.5.28 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).

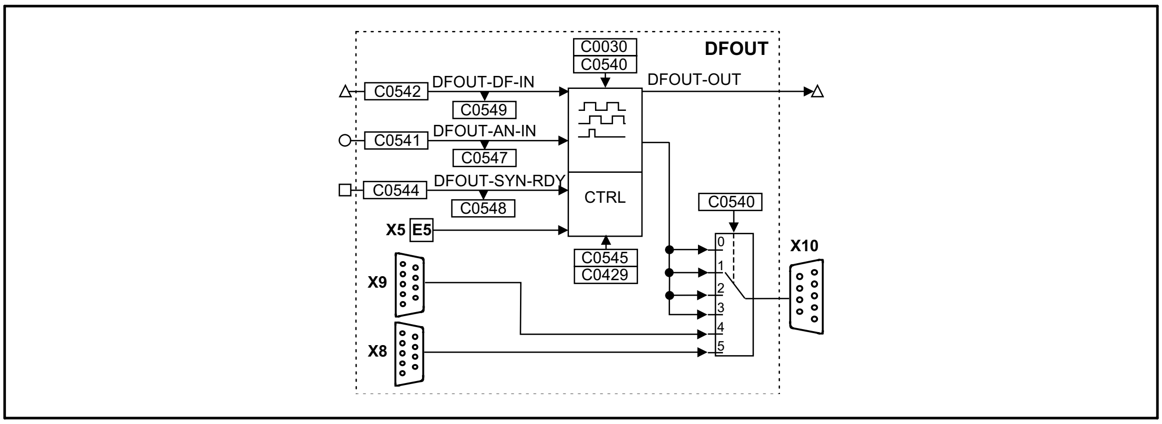


Fig. 3-121 Digital frequency output (DFOUT)

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

3.5.28.1 Output signals on X10

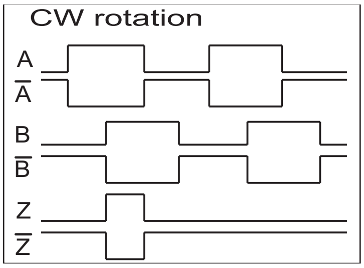


Fig. 3-122 Signal sequence for CW rotation (definition)

- 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.

3.5.28.2 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.

3.5.28.3 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°).

3.5.28.4 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.

3.5.28.5 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.

3.5.28.6 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.

3.5.29 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.

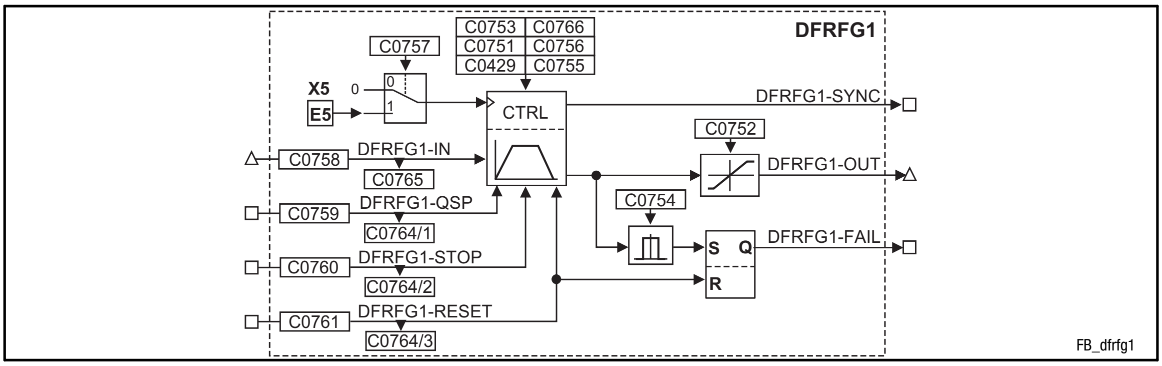


Fig. 3-123 Digital frequency ramp function generator (DFRFG1)

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)

3.5.29.1 Profile generator

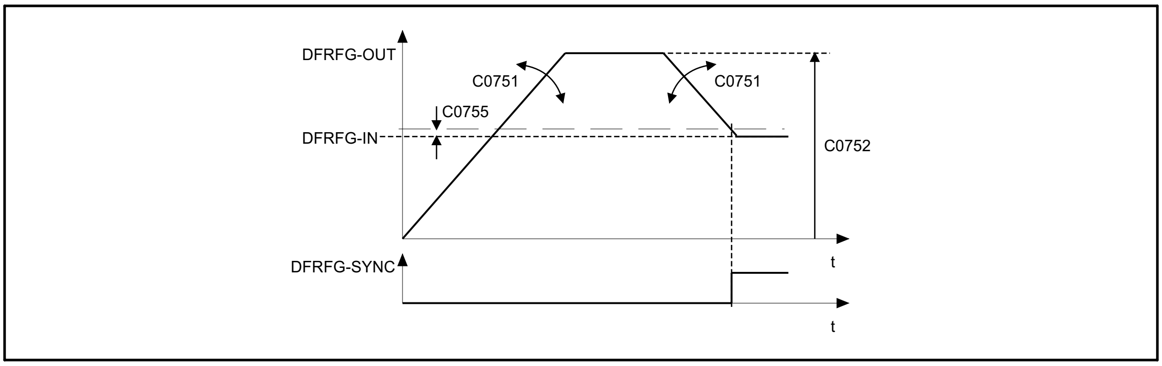


Fig. 3-124 Synchronisation on DFRFG

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}.

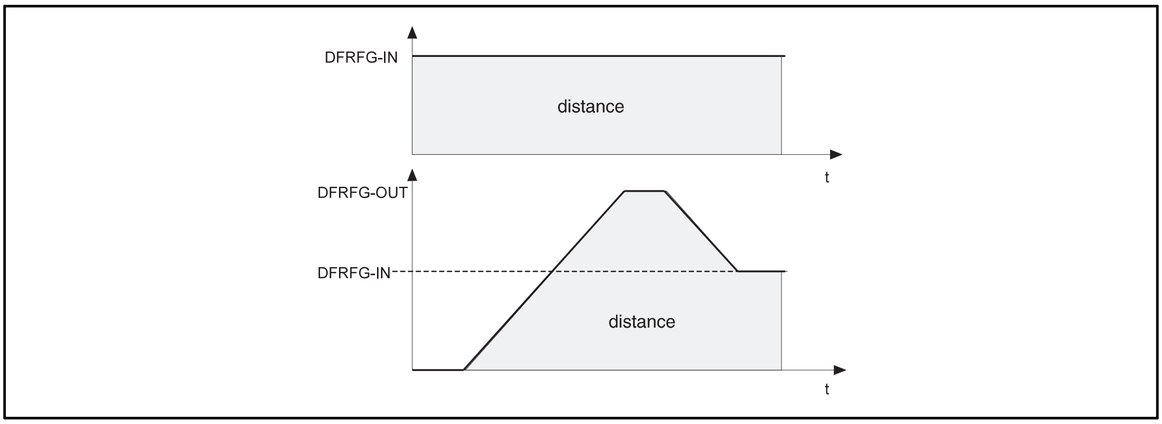


Fig. 3-125 Speed-time diagram DFRFG

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).

3.5.29.2 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.

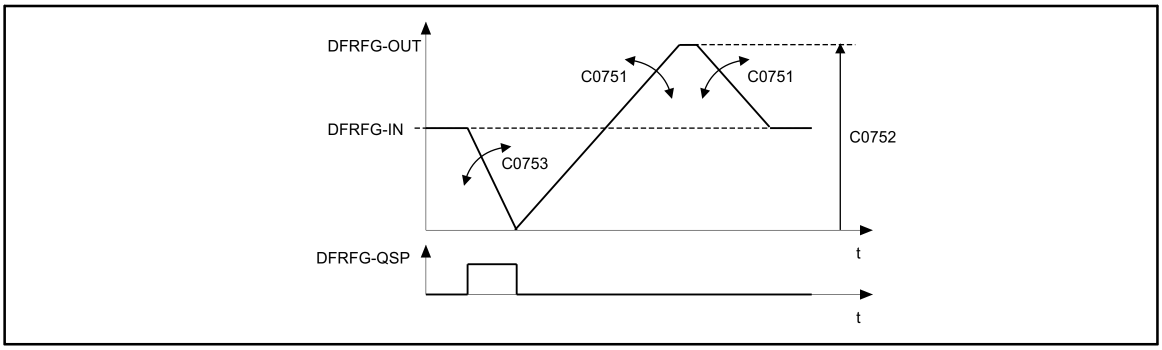


Fig. 3-126 Quick stop DFRFG

3.5.29.3 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.

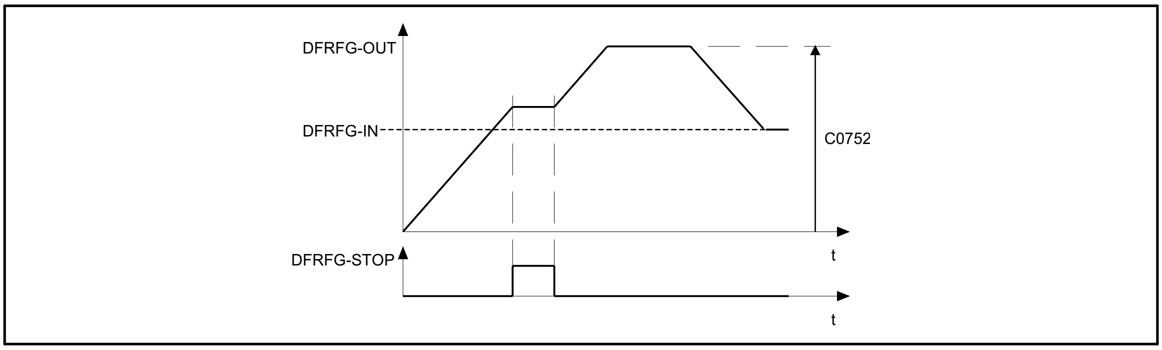


Fig. 3-127 Ramp function generator stop

3.5.29.4 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.

3.5.29.5 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).

3.5.29.6 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:

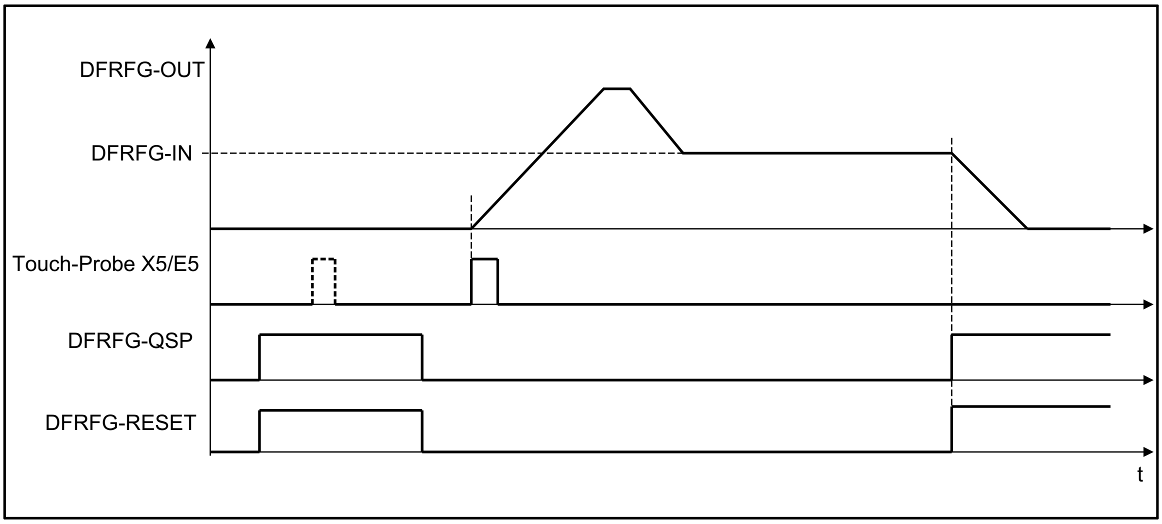


Fig. 3-128 Start via touch probe initiator (terminal X5/E5)

3.5.29.7 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.

3.5.29.8 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.

3.5.30 Digital frequency processing (DFSET)

Purpose

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

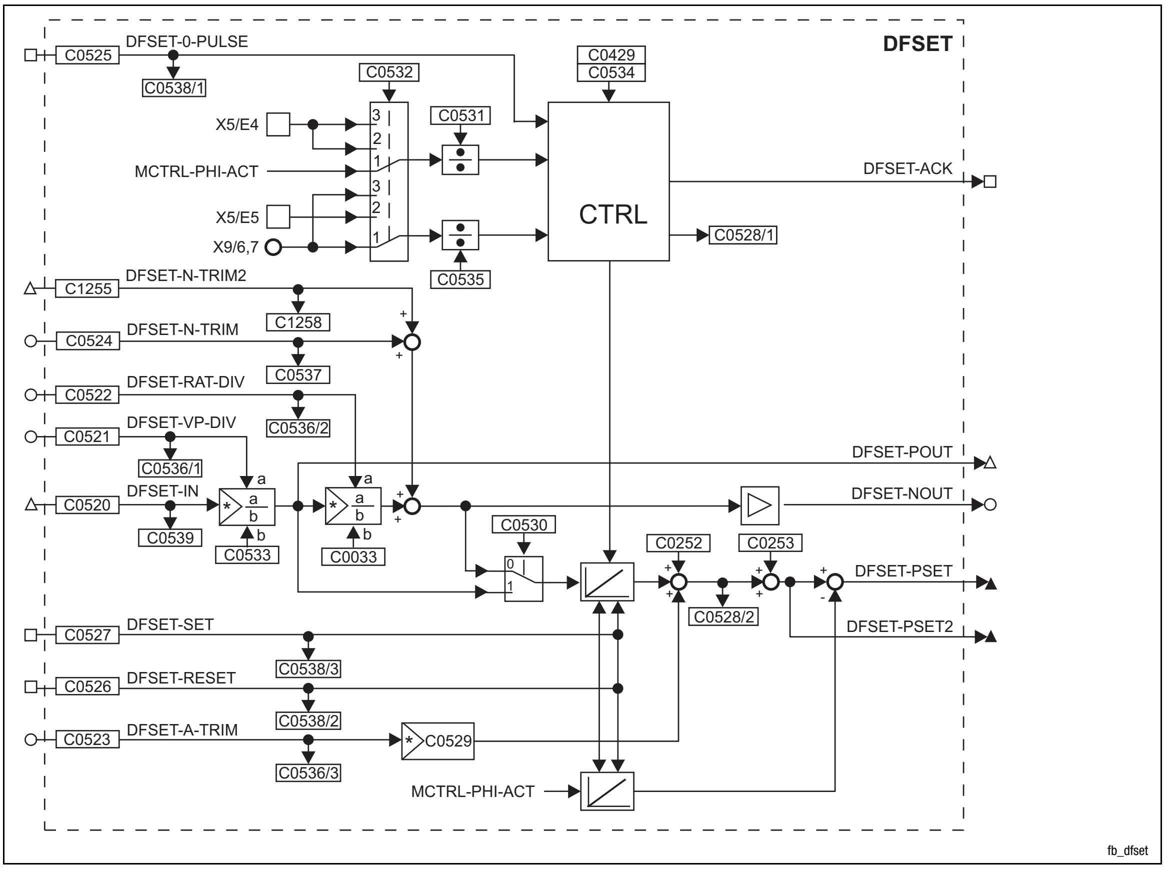


Fig. 3-129 Digital frequency processing (DFSET)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFSET-IN	phd	C0539	dec [rpm]	C0520	4	Speed/angle setpoint
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-A-TRIM	a	C0536/3	dec [inc]	C0523	1	Phase trimming 100% = 16384 inc
DFSET-VP-DIV	a	C0536/1	dec	C0521	1	Numerator of stretch factor 100 % = 16384 inc
DFSET-RAT-DIV	a	C0536//2	dec	C0522	1	Numerator of gearbox factor 100 % = 16384 inc
DFSET-0-PULSE	d	C0538/1	bin	C0525	2	HIGH = enable of zero pulse synchronisation
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-NOUT	a	-	-	-	-	in [%] of nmax (C0011)
DFSET-POUT	phd	-	-	-	-	Speed/angle setpoint
DFSET-PSET	ph	-	-	-	-	Following error for phase controller
DFSET-PSET2	ph	-	-	-	-	Phase setpoint 65536 inc = 1 revolution
DFSET-ACK	d	-	-	-	-	HIGH = synchronising is performed

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)

3.5.30.1 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 gearbox 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 the numerator and denominator.
  - – Numerator is variable from analog signal source or fixed value by the code.
  - – Input of the denominator under C0033.
- Relationship:

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

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

Tip!

With C0530 the gearbox factor and the DFSET-N-TRIM values can be deactivated as a basis for the setpoint angle. In the case of C0530 = 1, only the stretch factor is used for calculating the setpoint angle.

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

Phase trimming

This adds a setpoint at DFSET-A-TRIM (see C0536/3) to the phase setpoint 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 revolution). Every analog signal can be used as a source.

- The entry is made 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.

Angular 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).

3.5.30.3 Synchronising to zero track or touch probe

Stop!

When the synchronisation via terminals X5/E4 and X5/E5 (C0532 = 2) is activated, these terminals must not contain any other signal connections. If a basic configuration is selected via C0005, the terminals receive a basic setting.

Synchronisation is selected in 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).

Note!

For both modes you can define a dividing factor for the actual pulses in C0531 and for the set pulses in C0535.

- For C0531 = 10, for example, only every 10. actual pulse is evaluated. The other 9 pulses are ignored.
- Lenze setting: C0531 = 1, C0535 = 1

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

Delay times when activating the initiator cause a speed-dependent angular offset (e.g. in the case of 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 is converted to a phase angle correction and is then taken into consideration in the setpoint angle.

How to determine the phase angle correction value:

1. Convert the response time [ms] to a correction value [inc] using the formula:

   Phase angle correction value in C0429 = 16384 × response time [ms]
   - The response time [ms] can be gathered from the data sheet or requested from the manufacturer of the initiator.
2. Set the phase angle correction value for the angular offset in C0429.

Synchronisation mode

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

C0534	Synchronisation mode	Note
0	Synchronisation not active	
1	Permanent synchronisation with direct correction of the angular difference (counter-clockwise or clockwise rotation).	
2	Permanent synchronisation with direct correction of the angular difference (counter-clockwise or clockwise rotation).	A LOW-HIGH edge at DFSET-0-pulse activates a continuous synchronisation.
10	One-time synchronisation with direct correction of the angular difference (counter-clockwise or clockwise rotation).	A LOW-HIGH edge at DFSET-0-pulse activates a one-time synchronisation.
11	One-time synchronisation with correction of the angular difference in clockwise rotation.	A LOW-HIGH edge at DFSET-0-pulse activates a one-time synchronisation.
12	One-time synchronisation with correction of the angular difference in counter-clockwise rotation.	A LOW-HIGH edge at DFSET-0-pulse activates a one-time synchronisation.
13	One-time synchronisation with correction of the angular difference. The difference is determined between the setpoint pulse and actual pulse and is corrected to the corresponding direction of rotation according to the sign.	A LOW-HIGH edge at DFSET-0-pulse activates a one-time synchronisation.

3.5.31 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.

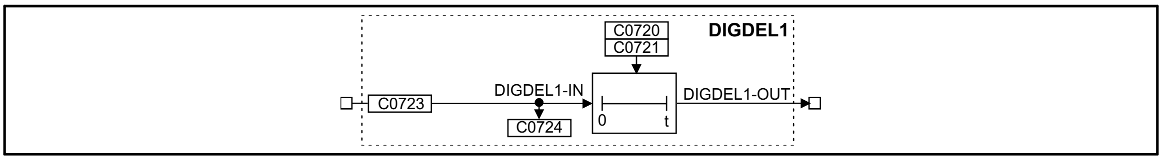


Fig. 3-130 Delay element (DIGDEL1)

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

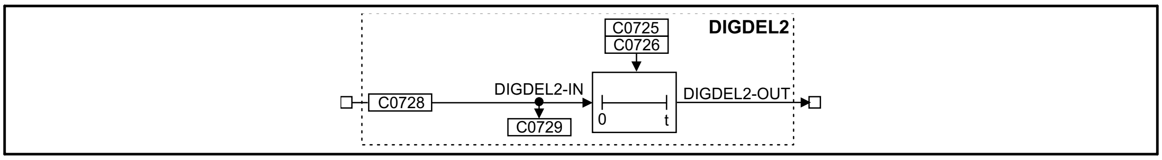


Fig. 3-131 Delay element (DIGDEL2)

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

3.5.31.1 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.

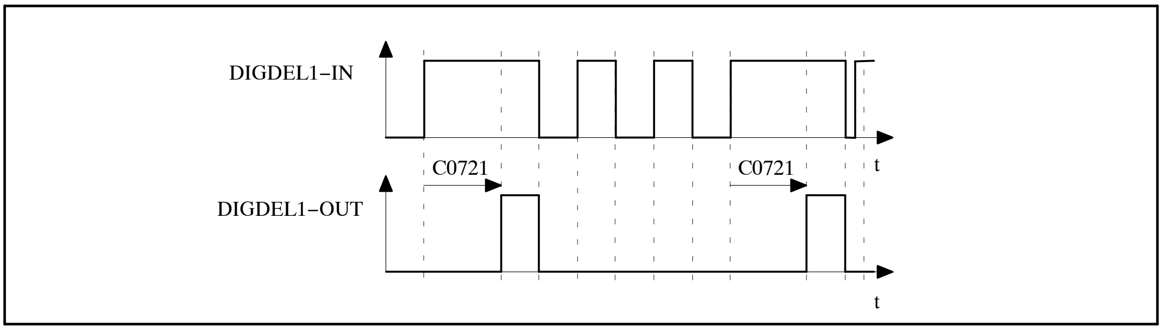


Fig. 3-132 On-delay (DIGDEL1)

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.

3.5.31.2 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.

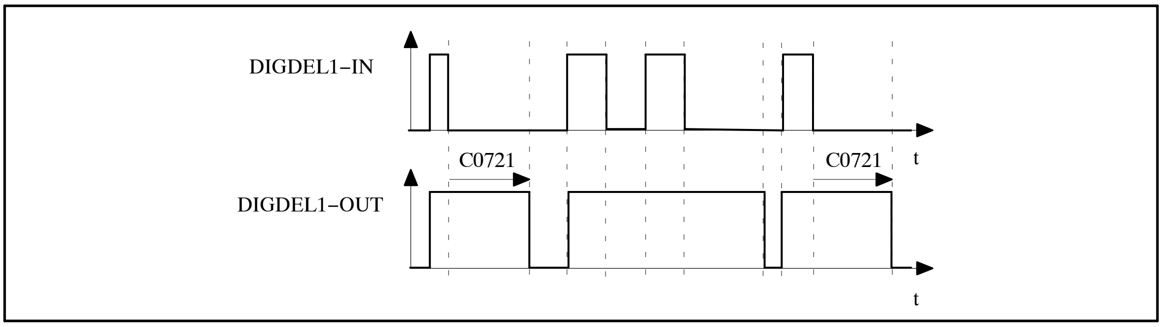


Fig. 3-133 Off-delay (DIGDEL1)

- 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.

3.5.31.3 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.

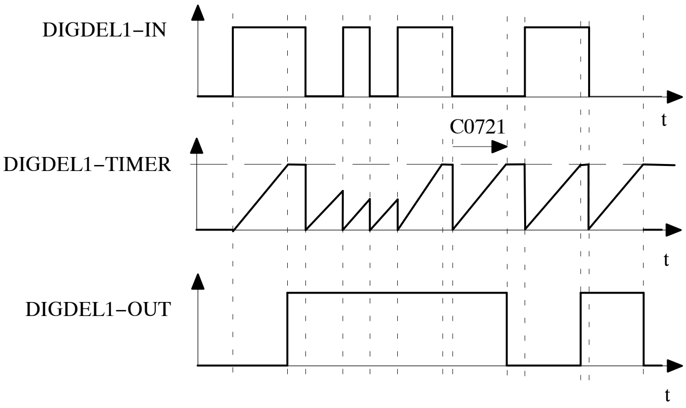


Fig. 3-134 General delay

- 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.

3.5.32 Freely assignable digital inputs (DIGIN)

Purpose

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

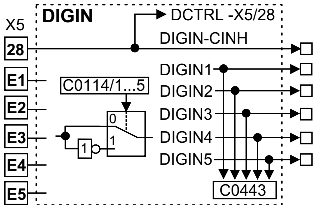


Fig. 3-135 Freely assignable digital inputs (DIGIN)

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)

3.5.33 Freely assignable digital outputs (DIGOUT)

Purpose

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

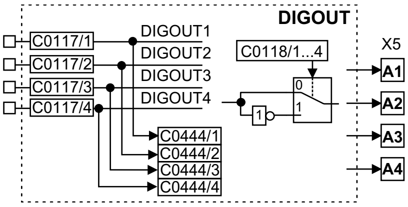


Fig. 3-136 Freely assignable digital outputs (DIGOUT)

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)

3.5.34 Free analog display code (DISA)

One function block (DISA) is available.

Purpose

Display analog values in the following formats:

- Analog (%)
- Decimal (dec)
- Hexadecimal (hex)

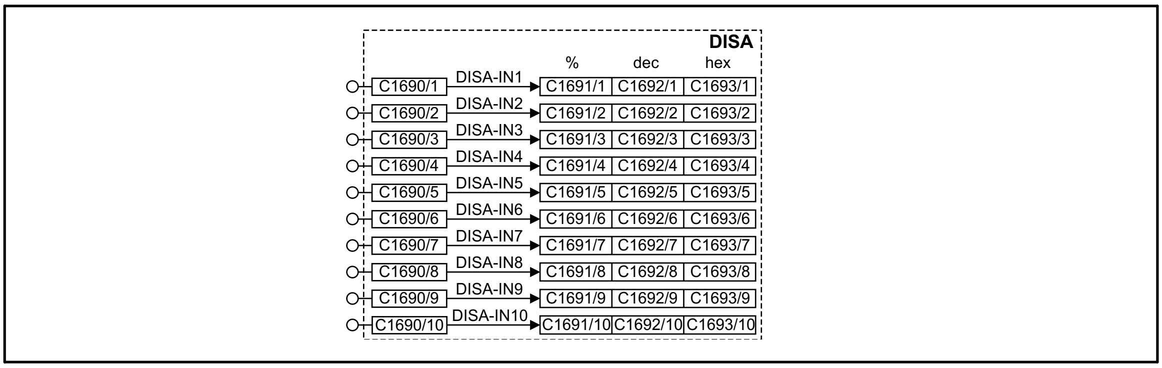


Fig. 3-137 Function block DISA

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DISA-IN1	a	C1691/1	dec [%]	C1690/1	1	-
		C1692/1	dec			
		C1693/1	hex			
DISA-IN2	a	C1691/2	dec [%]	C1690/2	1	-
		C1692/2	dec			
		C1693/2	hex			
DISA-IN3	a	C1691/3	dec [%]	C1690/3	1	-
		C1692/3	dec			
		C1693/3	hex			
DISA-IN4	a	C1691/4	dec [%]	C1690/4	1	-
		C1692/4	dec			
		C1693/4	hex			
DISA-IN5	a	C1691/5	dec [%]	C1690/5	1	-
		C1692/5	dec			
		C1693/5	hex			

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
DISA-IN6	a	C1691/6	dec [%]	C1690/6	1	-
		C1692/6	dec			
		C1693/6	hex			
DISA-IN7	a	C1691/7	dec [%]	C1690/7	1	-
		C1692/7	dec			
		C1693/7	hex			
DISA-IN8	a	C1691/8	dec [%]	C1690/8	1	-
		C1692/8	dec			
		C1693/8	hex			
DISA-IN9	a	C1691/9	dec [%]	C1690/9	1	-
		C1692/9	dec			
		C1693/9	hex			
DISA-IN10	a	C1691/10	dec [%]	C1690/10	1	-
		C1692/10	dec			
		C1693/10	hex			

3.5.35 Free phase display code (DISPH)

One function block (DISPH) is available.

Purpose

Display phase values.

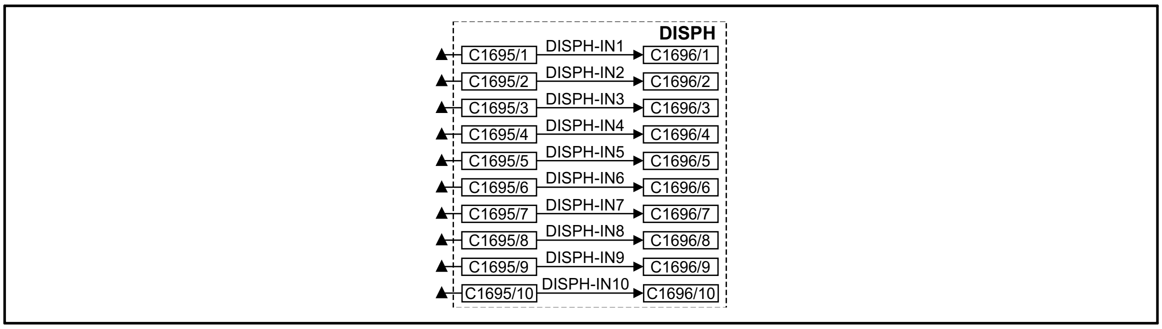


Fig. 3-138 Function block DISPH

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DISPH-IN1	ph	C1696/1	dec [inc]	C1695/1	3	-
DISPH-IN2	ph	C1696/2	dec [inc]	C1695/2	3	-
DISPH-IN3	ph	C1696/3	dec [inc]	C1695/3	3	-
DISPH-IN4	ph	C1696/4	dec [inc]	C1695/4	3	-
DISPH-IN5	ph	C1696/5	dec [inc]	C1695/5	3	-
DISPH-IN6	ph	C1696/6	dec [inc]	C1695/6	3	-
DISPH-IN7	ph	C1696/7	dec [inc]	C1695/7	3	-
DISPH-IN8	ph	C1696/8	dec [inc]	C1695/8	3	-
DISPH-IN9	ph	C1696/9	dec [inc]	C1695/9	3	-
DISPH-IN10	ph	C1696/10	dec [inc]	C1695/10	3	-

3.5.36 First order derivative-action element (DT1)

Purpose

Derivative action on signals.

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

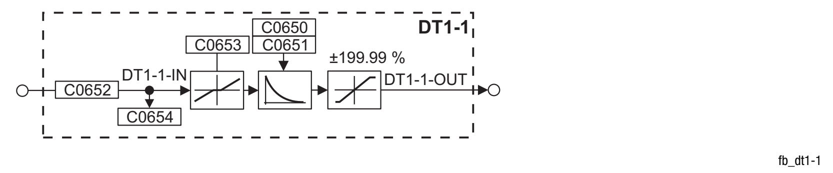


Fig. 3-139 First order derivative-action element (DT1-1)

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.

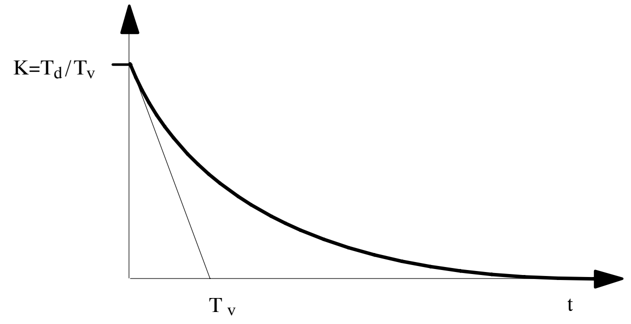


Fig. 3-140 Delay time T_V of the first order derivative-action element

3.5.37 Free piece counter (FCNT)

Purpose

Digital up/down counter

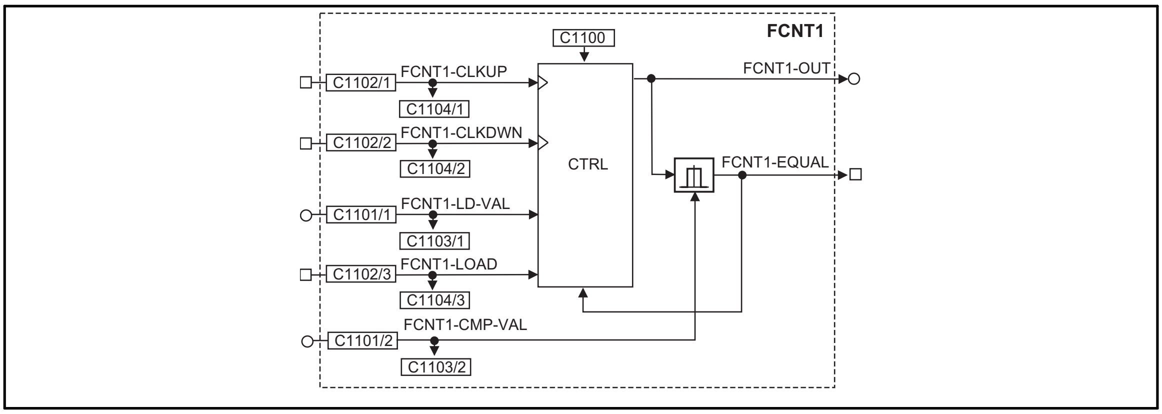


Fig. 3-141 Free piece counter (FCNT1)

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

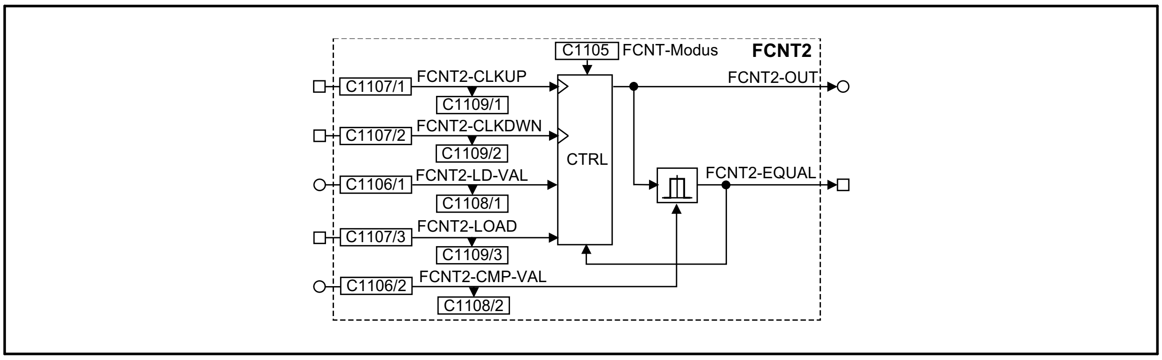


Fig. 3-142 Free piece counter (FCNT2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FCNT2-CLKUP	d	C1109/1	bin	C1107/1	2	LOW-HIGH edge = Increment counter by 1
FCNT2-CLKDWN	d	C1109/2	bin	C1107/2	2	LOW-HIGH edge = Decrement counter by 1
FCNT2-LD-VAL	a	C1108/1	dec	C1106/1	1	Start value
FCNT2-LOAD	d	C1109/3	bin	C1107/3	2	HIGH = Accept start value
FCNT2-CMP-VAL	a	C1108/2	dec	C1106/2	1	Comparison value
FCNT2-OUT	a	-	-	-	-	Count limited to ±199.99% corresponds to ±32767
FCNT2-EQUAL	d	-	-	-	-	HIGH = comparison value reached

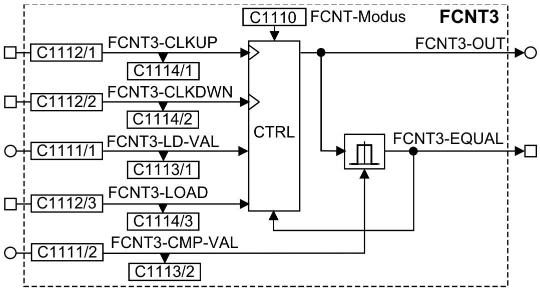


Fig. 3-143 Free piece counter (FCNT3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FCNT3-CLKUP	d	C1114/1	bin	C1112/1	2	LOW-HIGH edge = Increment counter by 1
FCNT3-CLKDWN	d	C1114/2	bin	C1112/2	2	LOW-HIGH edge = Decrement counter by 1
FCNT3-LD-VAL	a	C1113/1	dec	C1111/1	1	Start value
FCNT3-LOAD	d	C1114/3	bin	C1112/3	2	HIGH = Accept start value
FCNT3-CMP-VAL	a	C1113/2	dec	C1111/2	1	Comparison value
FCNT3-OUT	a	-	-	-	-	Count limited to ± 199.99% corresponds to ± 32767
FCNT3-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.

3.5.38 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.

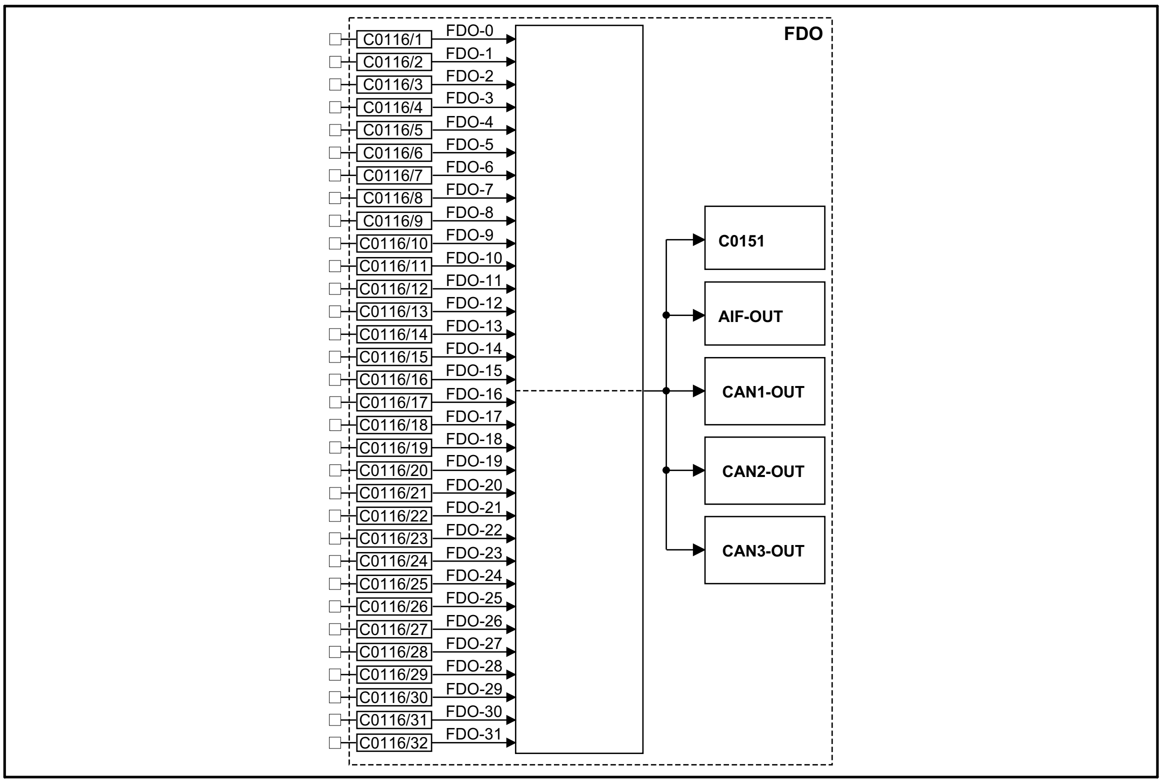


Fig. 3-144 Free digital outputs (FDO)

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.

3.5.39 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.

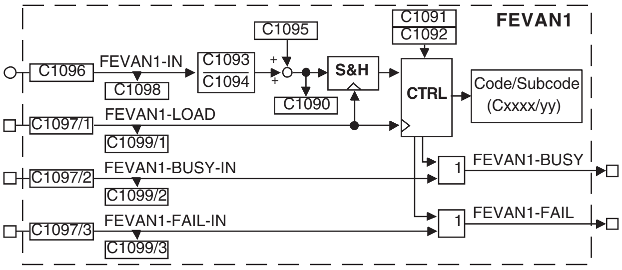


Fig. 3-145 Freely assignable input variables (FEVAN1)

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-IN	d	C1099/2	bin	C1097/2	2	HIGH = transmitting
FEVAN1-FAIL-IN	d	C1099/3	bin	C1097/3	2	High = transmission failed
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

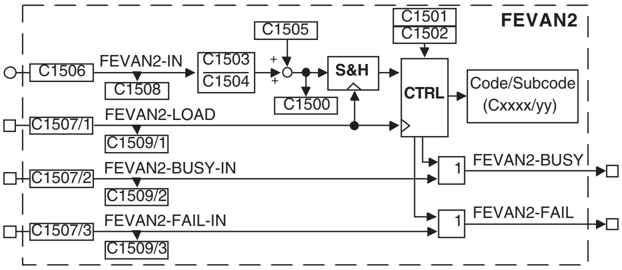


Fig. 3-146 Freely assignable input variables (FEVAN2)

Function blocks

Freely assignable input variables (FEVAN)

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-IN	d	C1509/2	bin	C1507/2	2	HIGH = transmitting
FEVAN2-FAIL-IN	d	C1509/3	bin	C1507/3	2	HIGH = transmission failed
FEVAN2-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN2-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN2-LOAD switches FEFAN2-FAIL = LOW.
-	-	C1500	-	-	-	Display of the converted signal

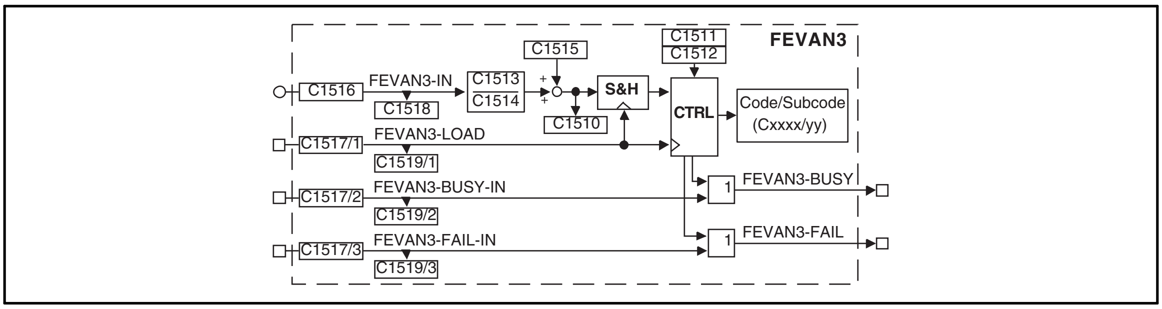


Fig. 3-147 Freely assignable input variables (FEVAN3)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN3-IN	a	C1518	dec	C1516	1	Input value
FEVAN3-LOAD	d	C1519/1	bin	C1517/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN3-BUSY-IN	d	C1519/2	bin	C1517/2	2	HIGH = transmitting
FEVAN3-FAIL-IN	d	C1519/3	bin	C1517/3	2	High = transmission failed
FEVAN3-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN3-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN3-LOAD sets FEFAN3-FAIL = LOW.
-	-	C1510	-	-	-	Display of the converted signal

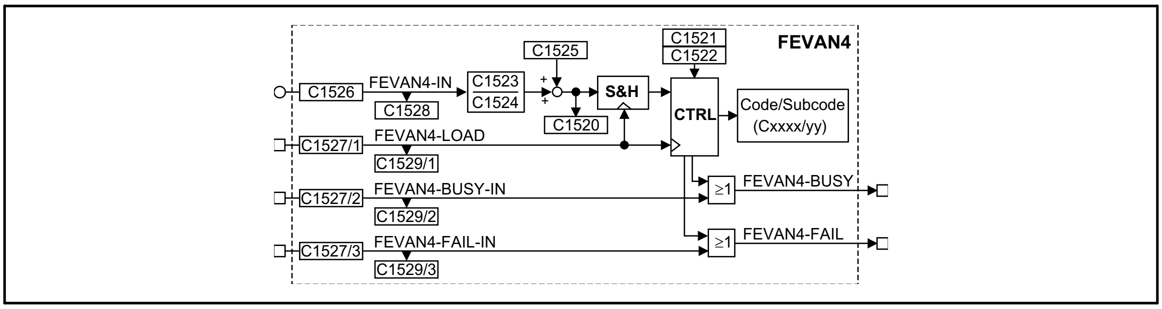


Fig. 3-148 Freely assignable input variables (FEVAN4)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN4-IN	a	C1528	dec	C1526	1	Input value
FEVAN4-LOAD	d	C1529/1	bin	C1527/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN4-BUSY-IN	d	C1529/2	bin	C1527/2	2	HIGH = transmitting
FEVAN4-FAIL-IN	d	C1529/3	bin	C1527/3	2	HIGH = transmission failed
FEVAN4-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN4-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN4-LOAD sets FEFAN4-FAIL = LOW.
-	-	C1520	-	-	-	Display of the converted signal

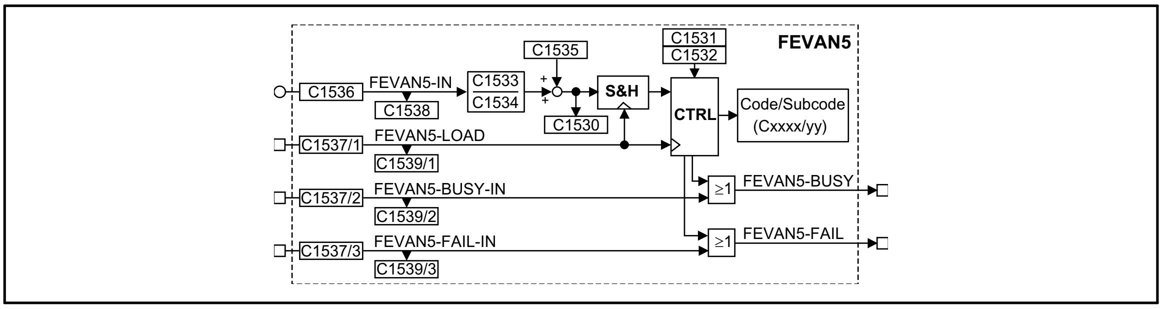


Fig. 3-149 Freely assignable input variables (FEVAN5)

Signal				**Source**		**Note**
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
FEVAN5-IN	a	C1538	dec	C1536	1	Input value
FEVAN5-LOAD	d	C1539/1	bin	C1537/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN5-BUSY-IN	d	C1539/2	bin	C1537/2	2	HIGH = transmitting
FEVAN5-FAIL-IN	d	C1539/3	bin	C1537/3	2	HIGH = transmission failed
FEVAN5-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN5-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN5-LOAD sets FEFAN5-FAIL = LOW.
-	-	C1530	-	-	-	Display of the converted signal

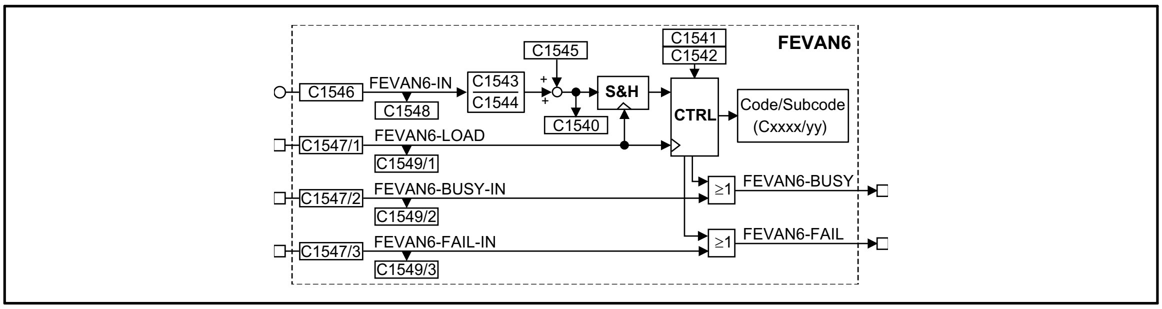


Fig. 3-150 Freely assignable input variables (FEVAN6)

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
FEVAN6-IN	a	C1548	dec	C1546	1	Input value
FEVAN6-LOAD	d	C1549/1	bin	C1547/1	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN6-BUSY-IN	d	C1549/2	bin	C1547/2	2	HIGH = transmitting
FEVAN6-FAIL-IN	d	C1549/3	bin	C1547/3	2	High = transmission failed
FEVAN6-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN6-FAIL	d	-	-	-	-	HIGH = transmission failed A LOW-HIGH edge at FEFAN6-LOAD sets FEFAN6-FAIL = LOW.
-	-	C1540	-	-	-	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 data read 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	
FEVAN3	C1513	C1514	C1515	C1511	C1512	
FEVAN4	C1523	C1524	C1525	C1521	C1522	
FEVAN5	C1533	C1534	C1535	C1531	C1532	
FEVAN6	C1543	C1544	C1545	C1541	C1542	

Data transmission

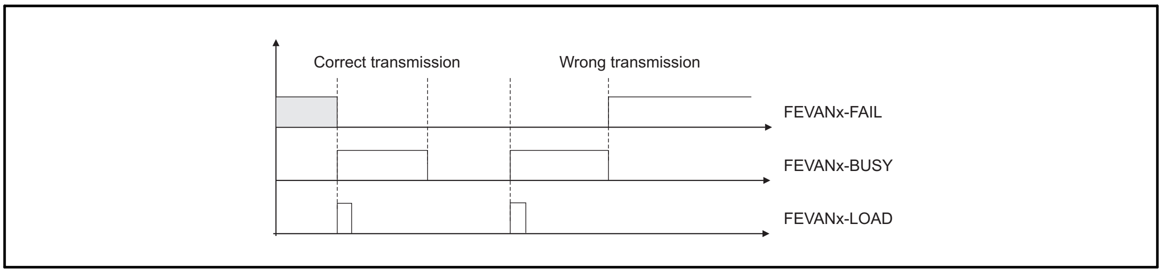


Fig. 3-151 Signal flow

Transmission errors may occur if

- no target code is available,
- no target subcode is available,
- the data transmitted are out of the target code limits,
- the target code is inhibited since it may only be written if the controller is inhibited. Inhibit the controller (see code table).

Cyclic data transmission

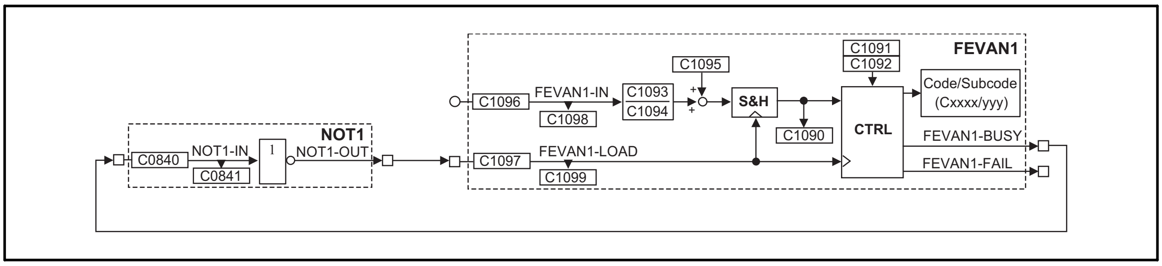


Fig. 3-152 Example for a cyclic data transmission to a target code

Conversion

In the example, the conversion is made at 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:
  - – C1093 (numerator).
  - – C1094 (denominator).
- C1094 also fixes 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):

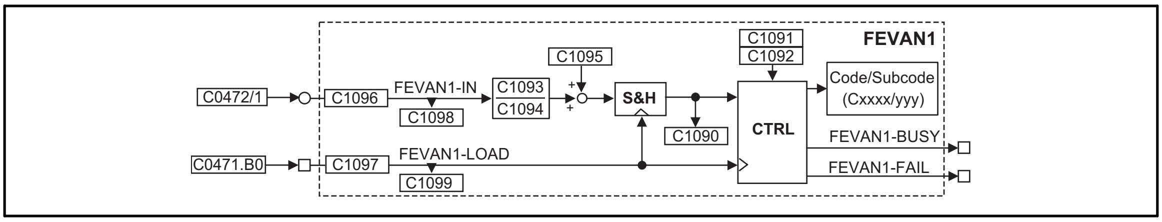


Fig. 3-153 Example of a circuit for FIX32 format with % scaling

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:

$$\text{FEVAN1–IN [\%]} \cdot \underbrace{\frac{1}{10000}}_{\text{Scaling factor}} \cdot \underbrace{\frac{16384}{100}}_{\text{Scaling factor}} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = \text{C0141 [\%]}$$

Control:

- Set C0471.B0 = 1 (≙ 00000001h) so that the data are transmitted to the target code.

Example for converting to C1093:

$$\underbrace{1.05\ \%}_{\text{Setpoint in C0141}} \cdot 10000 \cdot \frac{100}{16384} \cdot \text{C1094} \cdot \underbrace{\frac{1}{1.05\ \%}}_{\text{FEVAN1-IN}} = \text{C1093} = 0.6103$$

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 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 are transmitted to the target code.

Display:

- C0011 displays the value 1000 rpm.

The other formats are calculated with the following formula:

$$\text{FEVAN1–IN} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = x$$

3.5.40 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

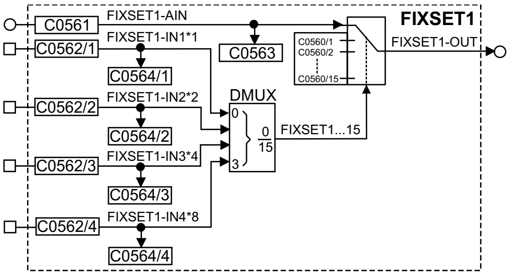


Fig. 3-154 Fixed setpoint (FIXSET1)

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%.

3.5.40.1 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

3.5.41 Flipflop element (FLIP)

Purpose

This FB is a D flipflop. This function is used to evaluate and save digital signal edges.

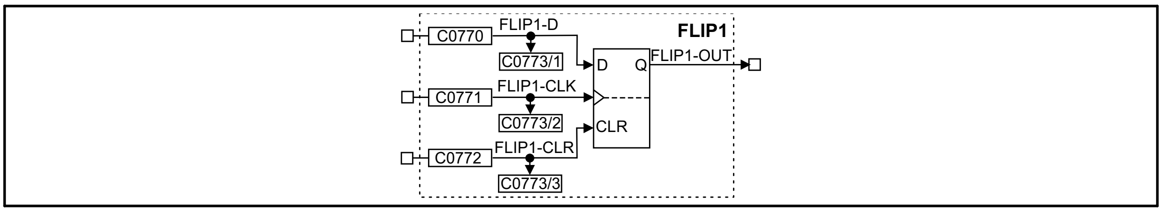


Fig. 3-155 Flipflop element (FLIP1)

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	-	-	-	-	-	-

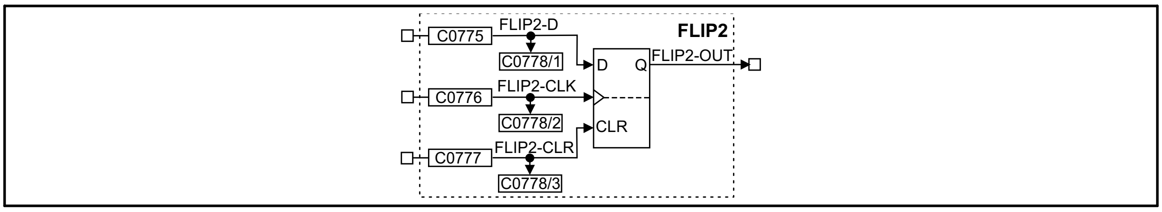


Fig. 3-156 Flipflop element (FLIP2)

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	-	-	-	-	-	-

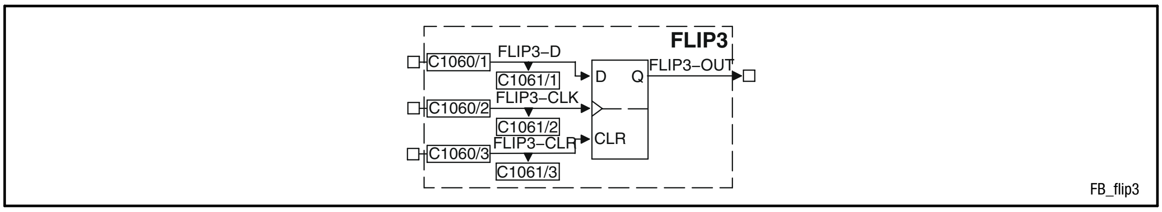


Fig. 3-157 Flipflop element (FLIP3)

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	-	-	-	-	-	-

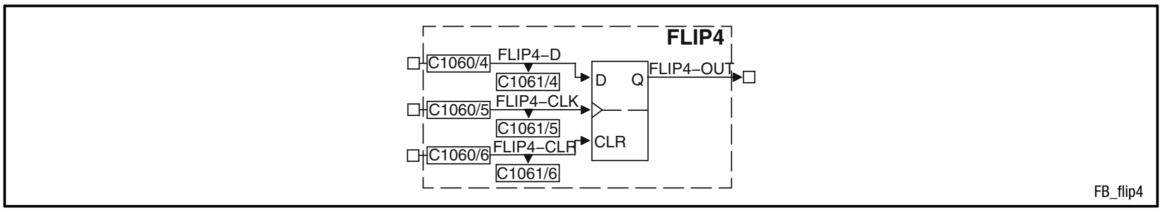


Fig. 3-158 Flipflop element (FLIP4)

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

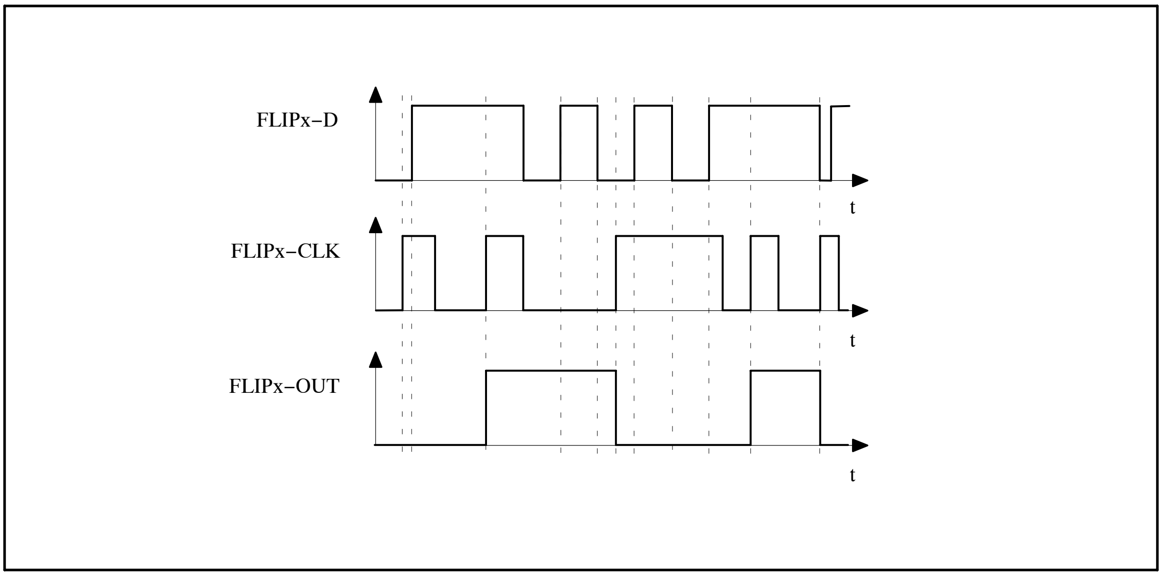


Fig. 3-159 Function sequence of a flipflop

- 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.

3.5.42 Limiting element (LIM)

Purpose

This FB is used to limit signals to adjustable value ranges.

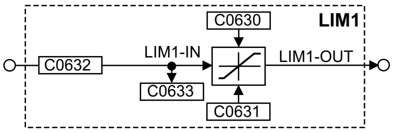


Fig. 3-160 Limiting element (LIM1)

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).

3.5.43 Internal motor control (MCTRL)

Purpose

This function block controls the drive machine consisting of angle controller, speed controller, and motor control.

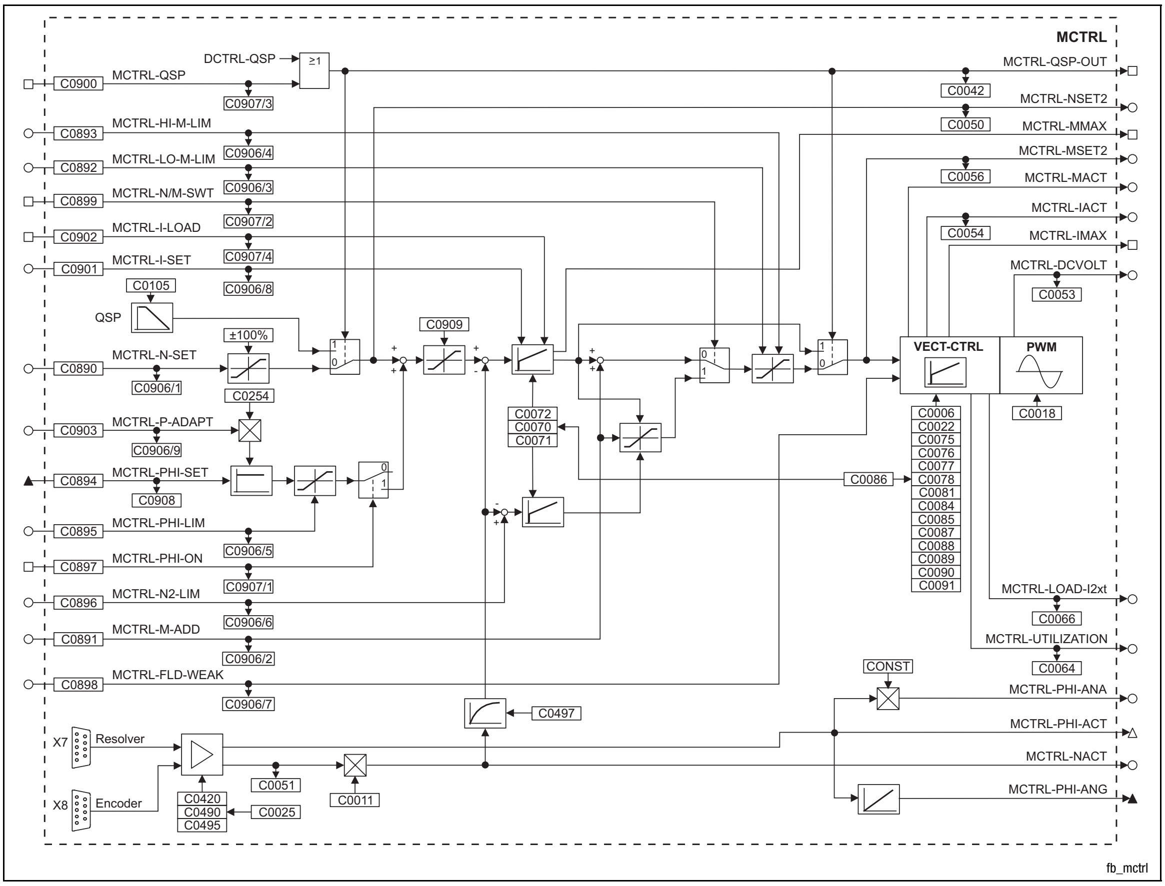


Fig. 3-161 Internal motor control (MCTRL)

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	-	-	-	-	-	$I^2 \times t$ 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

3.5.43.1 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.

3.5.43.2 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.

3.5.43.3 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!

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.

3.5.43.4 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.

3.5.43.5 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.

3.5.43.6 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.

3.5.43.7 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 3.5.43.4)
   – 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.

3.5.43.8 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.

3.5.43.9 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.

3.5.43.10 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

3.5.44 Motor phase failure detection (MLP)

Purpose

Motor phase monitoring.

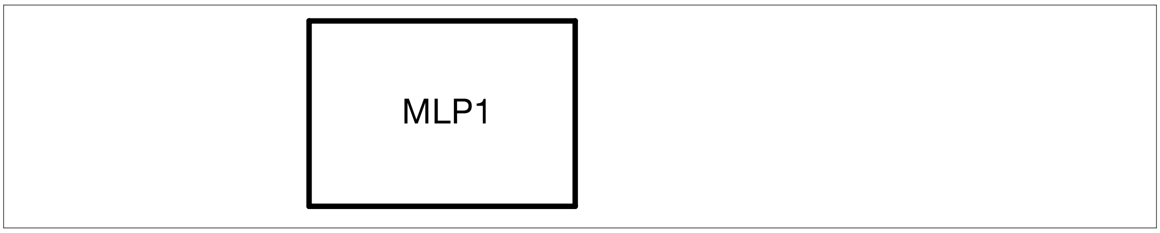


Fig. 3-162 Motor phase failure detection (MLP1)

Code	LCD	Possible settings				Important
		Lenze	Selection			
C0597	MONIT LP1	3	0 2 3	Trip Warning 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 of monitoring systems and error messages can be found in the system manual, document number EDSVS9332P.

The function block MLP1 must be entered in the processing table if the motor phase failure detection is to be used.

3.5.45 Monitor outputs of monitoring system (MONIT)

Purpose

The monitoring functions output digital monitor signals.

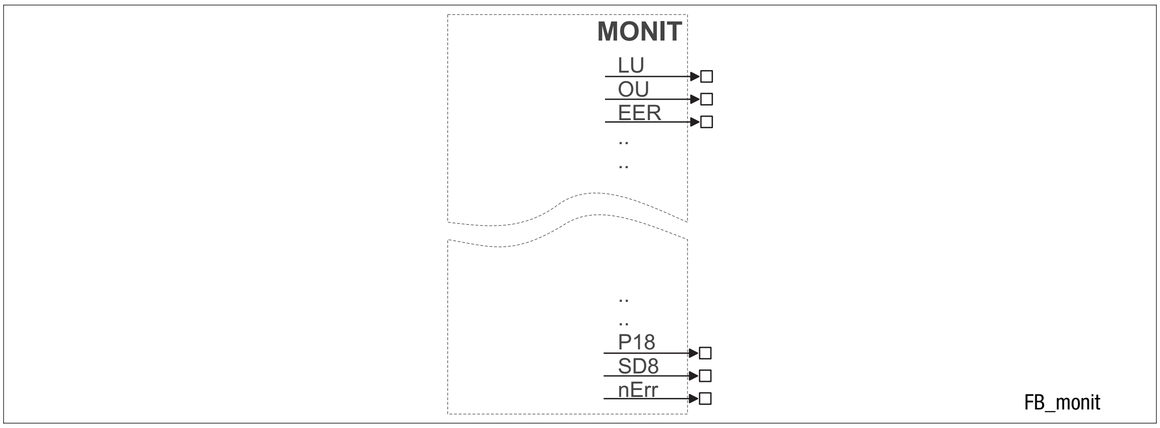


Fig. 3-163 Monitor outputs of the monitoring system (MONIT)

Function

The MONIT outputs switch to HIGH level if one of the monitoring functions responds.

The digital monitor signals respond dynamically, i.e.

- depending on the state of the monitoring function, but
- independently of the selected fault reaction (e.g. TRIP).

Example

MONIT-LP1 (motor phase monitoring) responds if a cable disruption is detected in a motor connection phase, although the fault reaction of LP1 is set to ”Off” (C0597 = 3).

Note!

- With appropriate signal conditioning, the MONIT outputs can be used to locate the cause of malfunction (e.g. by storing the MONIT output signal via the FLIP function block).
- More detailed descriptions of the monitoring functions / error messages can be found in the chapter ”Troubleshooting and fault elimination”.

MONIT outputs

MONIT output	Description
CE0	Communication error - automation interface (AIF)
CE1	Communication error - process data input object CAN1_IN
CE2	Communication error - process data input object CAN2_IN
CE3	Communication error - process data input object CAN3_IN
CE4	BUS-OFF state of system bus (CAN)
EEr	External monitoring, triggered via DCTRL
H05	Internal fault (memory)
H07	Internal fault (power section)
H10	Thermal sensor error - heatsink
H11	Thermal sensor error - inside the device
LP1	Motor phase failure
LU	Undervoltage in the DC bus
nErr	Speed control error
NMAX	Maximum speed (C0596) exceeded
OC2	Earth fault - motor cable
OC5	I x t overload
OC6	I^2 x t overload
OC8	I^2 x t overload advance warning
OH	Heatsink temperature > +90 °C
OH3	Motor temperature > +150 °C threshold (temperature detected via resolver or incremental value encoder)
OH4	Heatsink temperature > C0122
OH7	Motor temperature > C0121 (temperature detected via resolver or incremental value encoder)
OH8	Motor temperature measured via inputs T1 and T2 too high
OU	DC-bus overvoltage
P03	Following error
P16	Faulty transmission of sync telegram on system bus (CAN)
P19	Limitation of input values at X9
PL	Error during rotor position adjustment
Sd2	Resolver error at X7
Sd3	Encoder error at X9
Sd5	Encoder error at X6 pins 1 and 2
Sd6	Thermal sensor error - motor (X7 or X8)
Sd7	Absolute value encoder at X8 Initialisation error or communication error during rotor position adjustment
Sd8	Sin/cos encoder at X8 transmits no or inconsistent data

3.5.46 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.

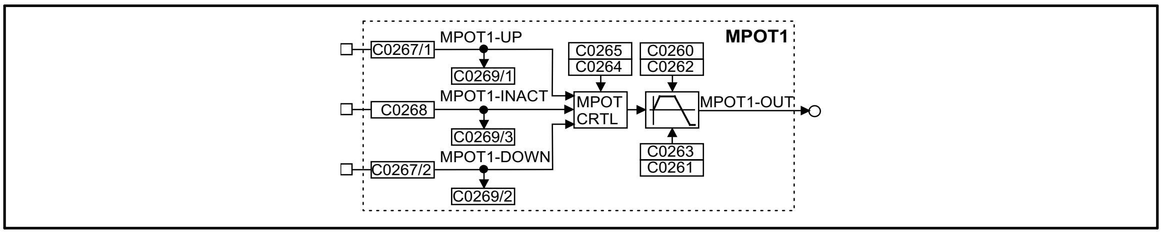


Fig. 3-164 Motor potentiometer (MPOT1)

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.

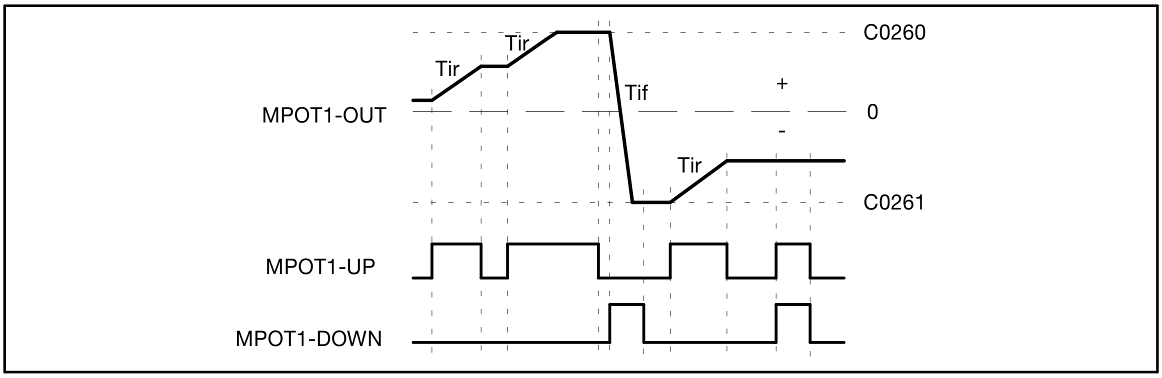


Fig. 3-165 Control signals of the motor potentiometer

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 output MPOT1-OUT keeps its value
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.

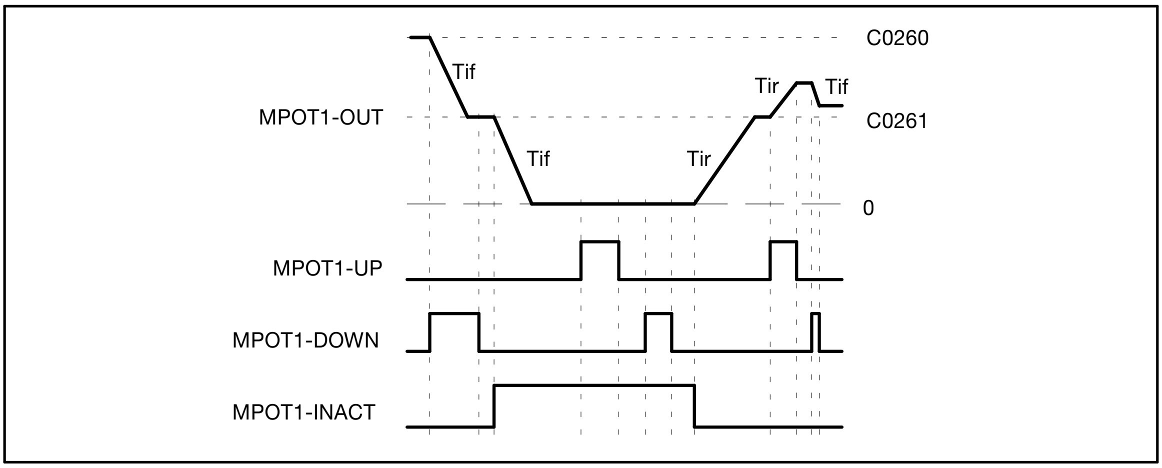


Fig. 3-166 Deactivation of the motor potentiometer via the input MPOT1-INACT

Initialisation

This function is used to store 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.

3.5.47 Logic NOT

Purpose

Logic inversion of digital signals. The inversion can be used to control functions or generate status information.

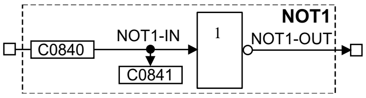


Fig. 3-167 Logic NOT (NOT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT1-IN	d	C0841	bin	C0840	2	1000	-
NOT1-OUT	d	-	-	-	-	-	-

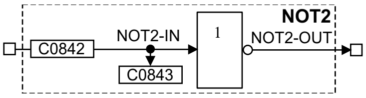


Fig. 3-168 Logic NOT (NOT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT2-IN	d	C0843	bin	C0842	2	1000	-
NOT2-OUT	d	-	-	-	-	-	-

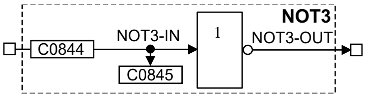


Fig. 3-169 Logic NOT (NOT3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT3-IN	d	C0845	bin	C0844	2	1000	-
NOT3-OUT	d	-	-	-	-	-	-

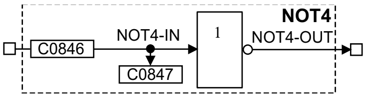


Fig. 3-170 Logic NOT (NOT4)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NOT4-IN	d	C0847	bin	C0846	2	1000	-
NOT4-OUT	d	-	-	-	-	-	-

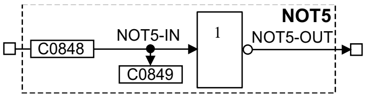


Fig. 3-171 Logic NOT (NOT5)

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.

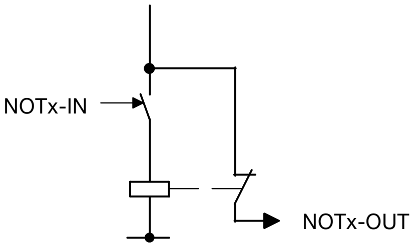


Fig. 3-172 Function of NOT when changing an NO contact to an NC contact.

3.5.48 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 generator or fixed speeds.

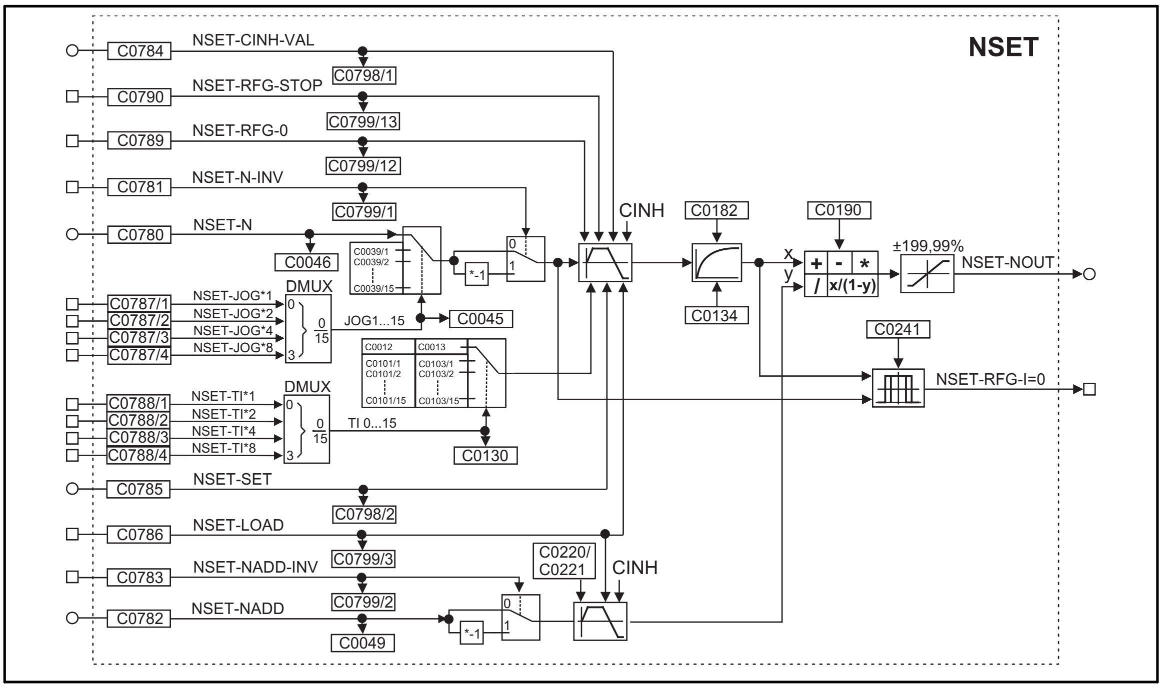


Fig. 3-173 Speed setpoint conditioning (NSET)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NSET-N	0	C0046	dec [%]	C0780	1	50	Intended for main setpoint, other signals are permissible
NSET-NADD	0	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 acceleration and deceleration times 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	0	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	0	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	0	-	-	-	-	-	-
NSET-RFG-I=0	d	-	-	-	-	-	-

Function

- Main setpoint path
- JOG setpoints
- Setpoint inversion
- S ramp

3.5.48.1 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 the JOG value instead.

3.5.48.2 JOG setpoints

- Are fixed values which are stored in the memory.
- JOG values can be called from the memory via the inputs NSET-JOG*x.
- The inputs NSET-JOG*x are binary coded so that 15 JOG values can be called.
- The decoding for enabling the JOG values (called 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 values. 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

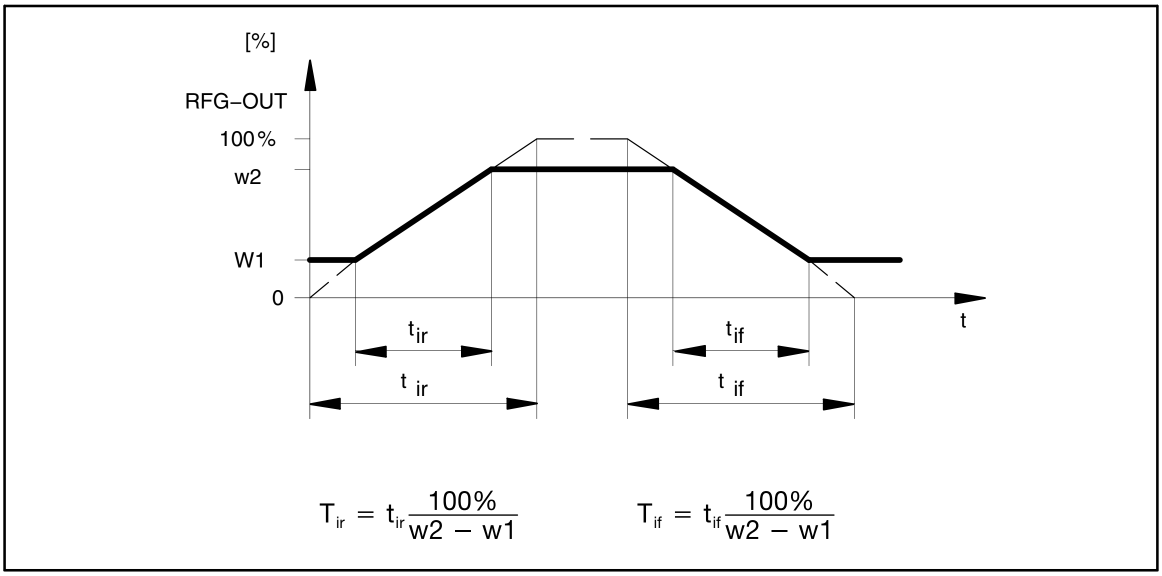
3.5.48.3 Setpoint inversion

The output signal of the JOG function is led via 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 via a ramp function generator with linear characteristic. Setpoint step-changes at the input are thus led into a ramp.



$$T_{ir} = t_{ir}\frac{100\%}{w2 - w1} \qquad T_{if} = t_{if}\frac{100\%}{w2 - w1}$$

Fig. 3-174 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 that was 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 provided 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 along the set deceleration time
0	0	1	1	
0	1	0	0	RFG accepts the value applied to input NSET-SET and provides it at 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 provides it at 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	

3.5.48.4 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.

3.5.48.5 Arithmetic operation

The output value is led to an arithmetic module. This module 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 %)

3.5.48.6 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.

3.5.49 OR operation (OR)

Purpose

Logic OR operation of digital signals. The operations are used for controlling functions or creating status information.

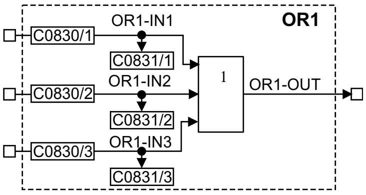


Fig. 3-175 OR operation (OR1)

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	-	-	-	-	-	-

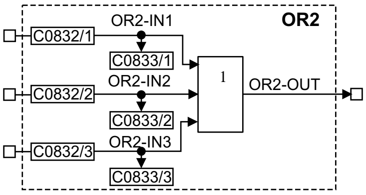


Fig. 3-176 OR operation (OR2)

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	-	-	-	-	-	-

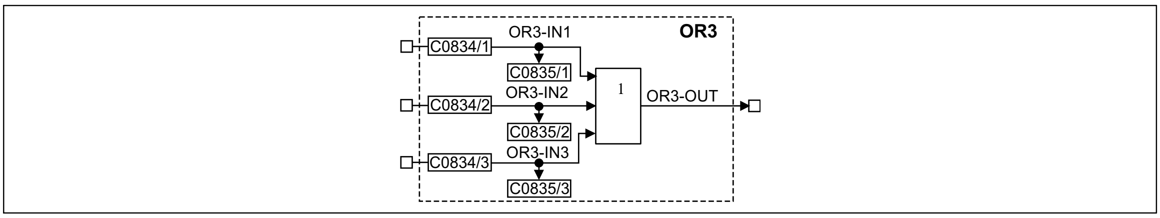


Fig. 3-177 OR operation (OR3)

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	-	-	-	-	-	-

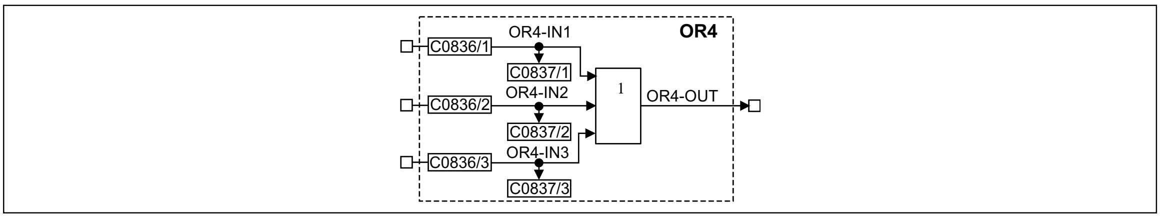


Fig. 3-178 OR operation (OR4)

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	-	-	-	-	-	-

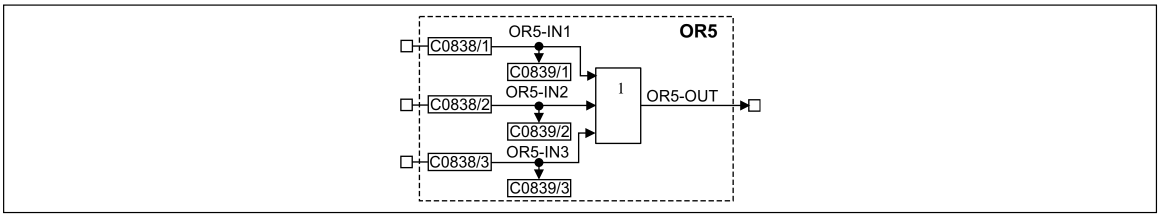


Fig. 3-179 OR operation (OR5)

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	-	-	-	-	-	-

Function

ORx-IN1	ORx-IN2	ORx-IN3	ORx-OUT
0	0	0	0
1	0	0	1
0	1	0	1
1	1	0	1
0	0	1	1
1	0	1	1
0	1	1	1
1	1	1	1

The function corresponds to a connection in parallel of NO contacts in a contactor control.

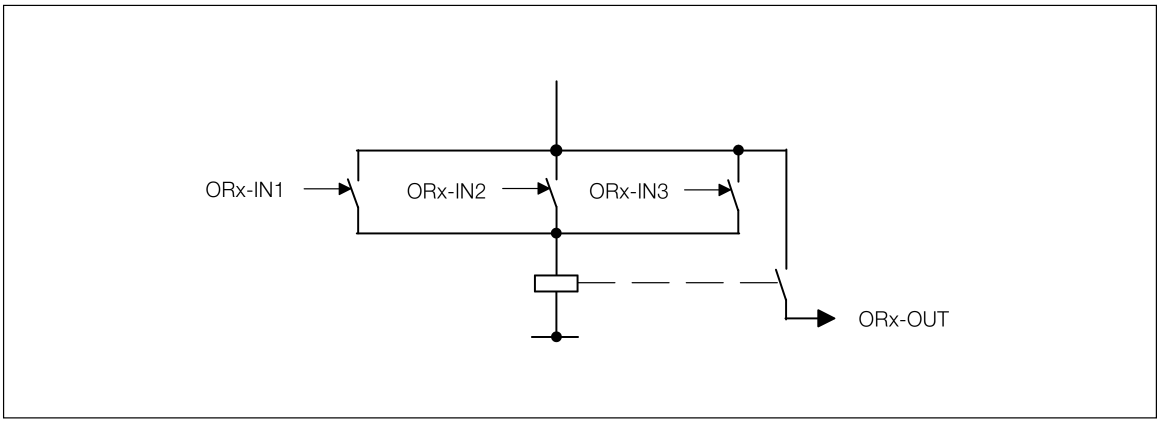


Fig. 3-180 Function of the OR operation as a parallel connection of NO contacts.

Tip!

If only two inputs are needed, use the inputs ORx-IN1 and ORx-IN2. Assign the input ORx-IN3 with the signal source FIXED0.

3.5.50 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.

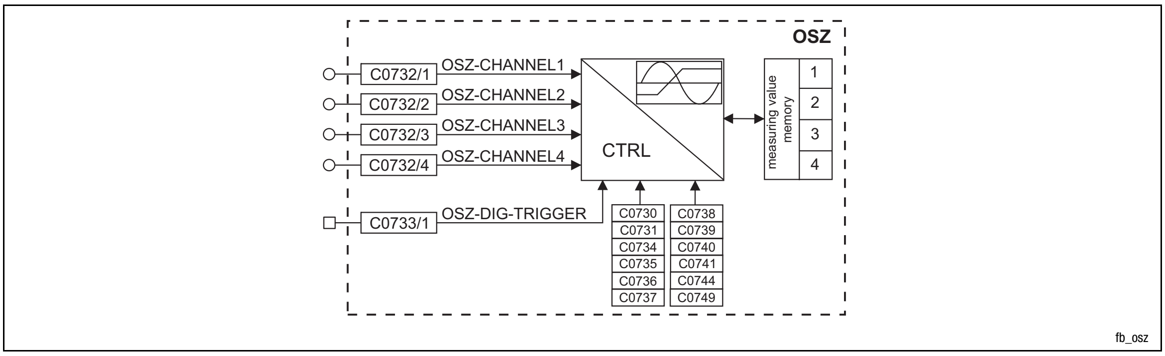


Fig. 3-181 Oscilloscope function (OSZ)

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. 3-182 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. 3-183).
		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. 3-182).
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

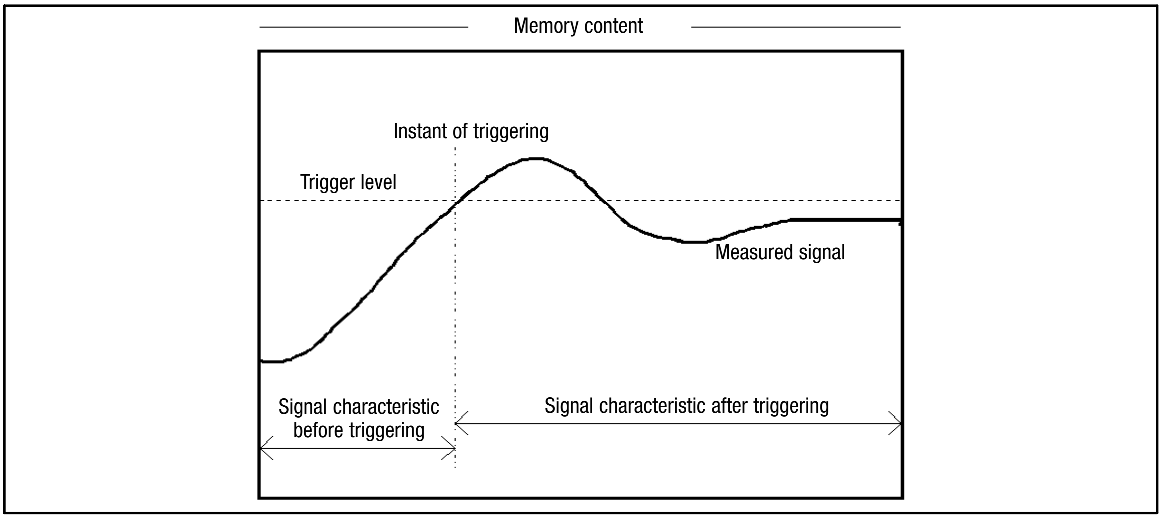


Fig. 3-182 Example: Trigger level and trigger delay with approx. -30 % of pre-triggering

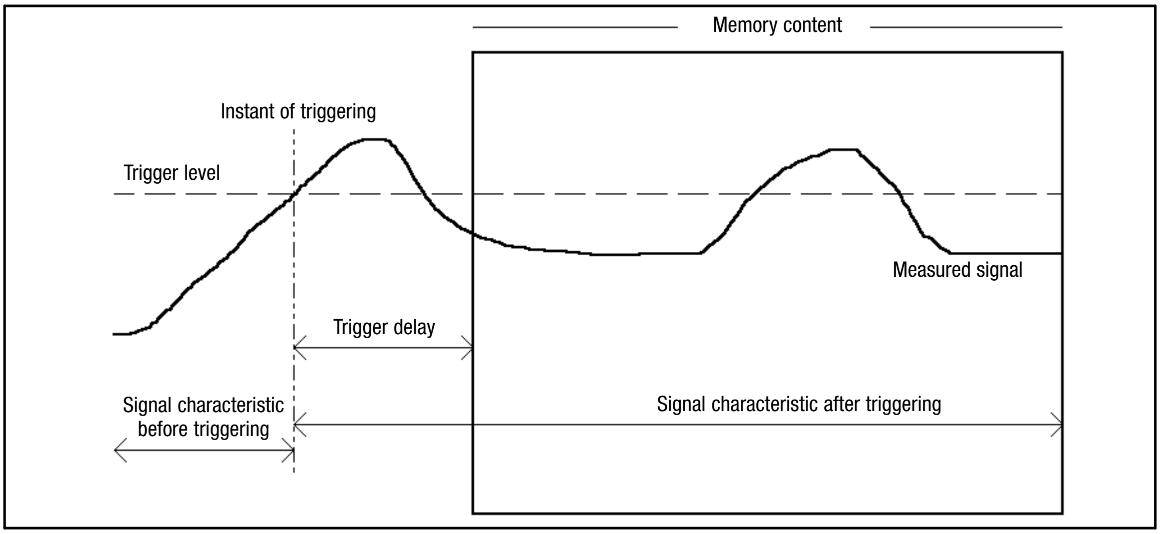


Fig. 3-183 Example: Trigger level and trigger delay with approx. -30 % of post-triggering

3.5.51 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.

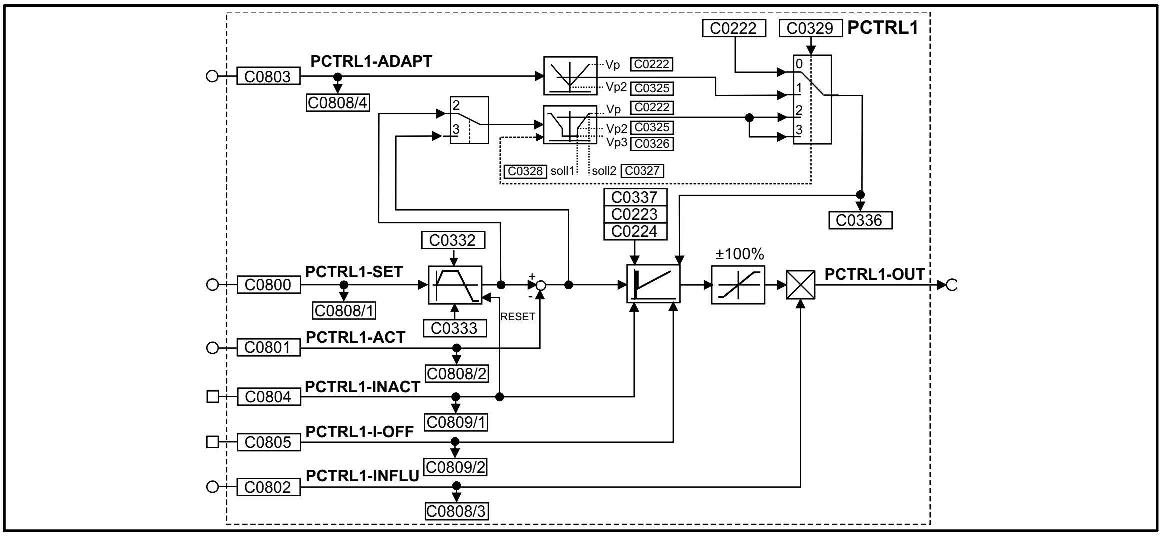


Fig. 3-184 Process controller (PCTRL1)

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).

3.5.51.1 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 %.

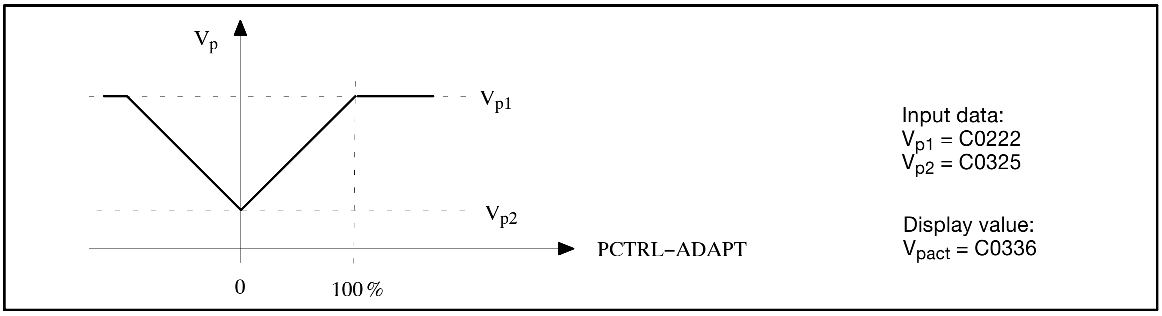


Fig. 3-185 Input of the P-gain via PCTRL-ADAPT input

  - – 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.

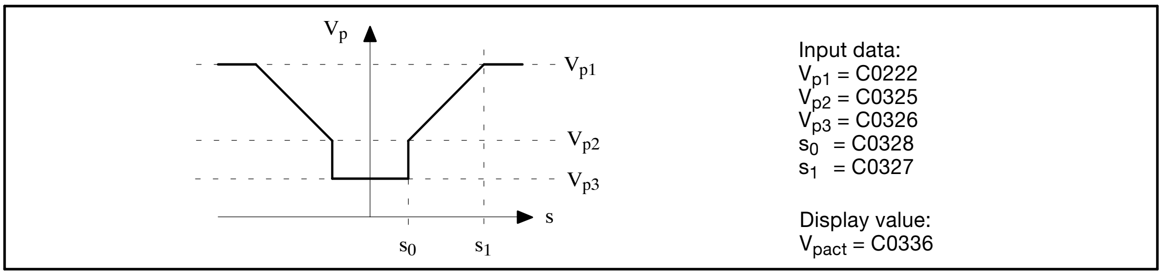
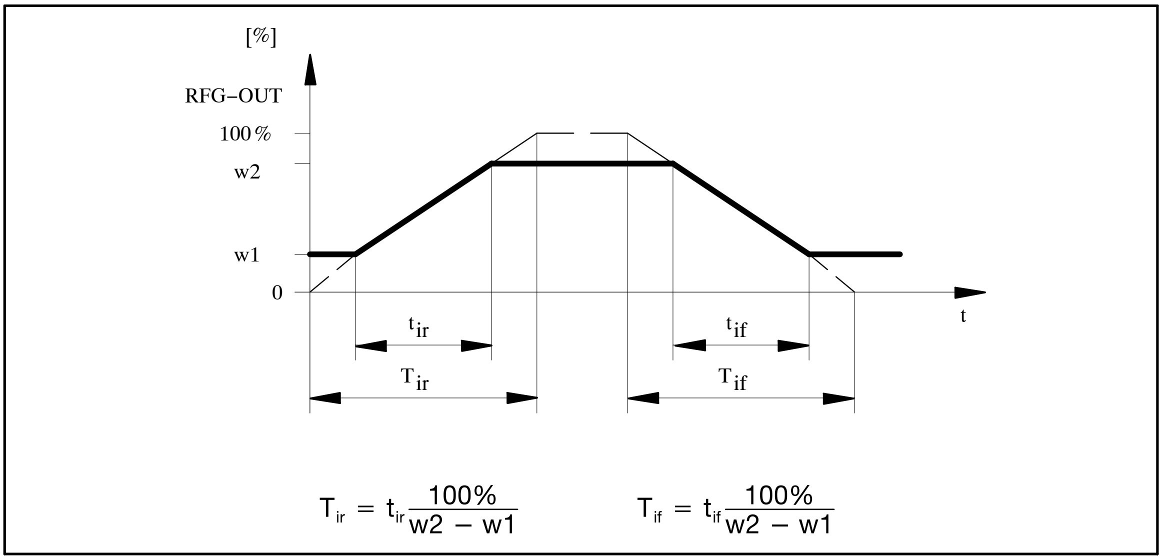


Fig. 3-186 P-gain derived from the PCTRL-SET process setpoint

  - – C0329 = 3
    The P-gain is derived from the control difference and calculated by means of a characteristic as for C0329 = 2.

3.5.51.2 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. 3-187 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.

3.5.51.3 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 %.

3.5.51.4 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).

3.5.51.5 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.

3.5.52 Signal adaptation for angle signals (PHDIV)

Purpose

Power-of-two division or multiplication of angle signals.

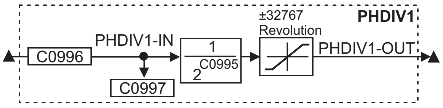


Fig. 3-188 Signal adaptation for angle signals (PHDIV1)

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:

$$\text{PHDIV1-OUT} = \frac{\text{PHDIV1-IN}}{2^{C0995}}$$

  – 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.

3.5.53 Phase integrator (PHINT)

Purpose

Integrates a speed or a velocity to a phase (distance). The integrator can maximally accept ±32000 encoder revolutions.

PHINT3 can recognise a relative distance.

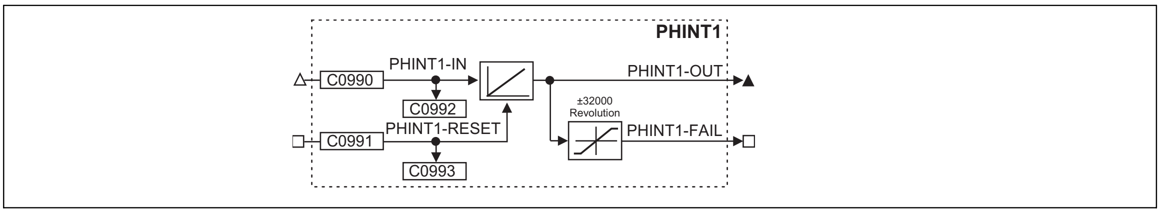


Fig. 3-189 Phase integrator (PHINT1)

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 phase integrator to 0 and PHINT1-FAIL = LOW
PHINT1-OUT	ph	-	-	-	-	65536 inc = 1 encoder revolution, overflow is possible
PHINT1-FAIL	d	-	-	-	-	HIGH = overflow

Function

- constant input value
- Scaling of PHINTx-OUT

3.5.53.1 Constant input value

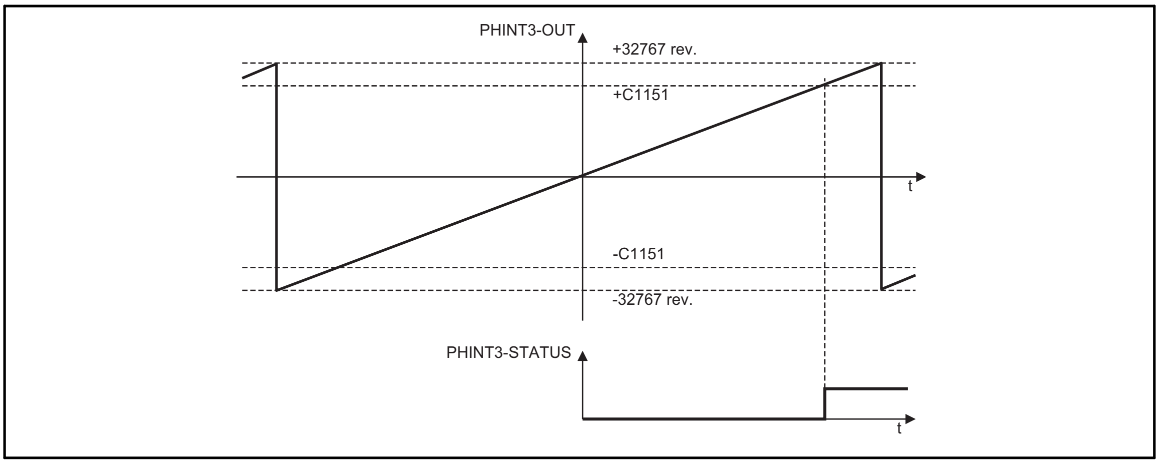


Fig. 3-190 Function of PHINTx with constant input value

- The FB integrates speed or velocity values at PHINTx-IN to a phase (distance).
- PHINTx-OUT outputs the count of the bipolar integrator.
  - – A positive value at PHINTx-IN increments the integrator (count is increased).
  - – A negative value at PHINTx-IN decrements the integrator (count is reduced).
- If the count 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 count 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.

3.5.53.2 Scaling of PHINTx-OUT

Mathematic description of PHINTx-OUT:

$$\text{PHINTx–OUT[inc]} = \text{PHINTx–IN[rpm]} \cdot \text{t[s]} \cdot \text{65536[inc/Umdr.]}$$

t = integration time

Example:

You want to determine the count of the integrator with 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:

$$1000\text{ rpm} = \frac{1000\text{ rev.}}{60\text{ s}}$$

  - – Calculation of PHINTx-OUT:

$$\text{PHINTx} - \text{OUT} = \frac{1000\text{ rev.}}{60\text{ s}} \cdot 10\text{ s} \cdot \frac{65536\text{ inc}}{\text{rev.}} = 10922666\text{ inc}$$

3.5.54 Delay element (PT1-1)

Purpose

Filtering and delaying of analog signals.

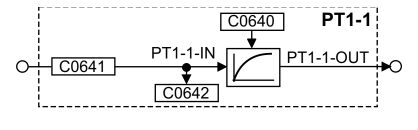


Fig. 3-191 Delay element (PT1-1)

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.

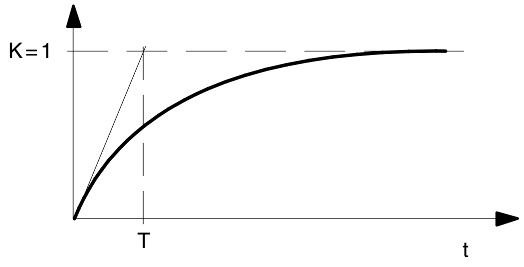


Fig. 3-192 Delay time T of the first order delay element

3.5.55 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.

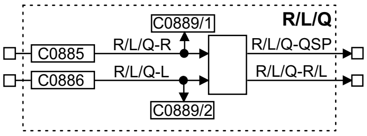


Fig. 3-193 CW/CCW/QSP linking (R/L/Q)

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.

3.5.56 Ramp function generator (RFG)

Purpose

The ramp function generator limits the rise of signals.

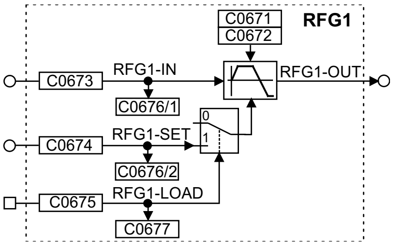


Fig. 3-194 Ramp function generator (RFG1)

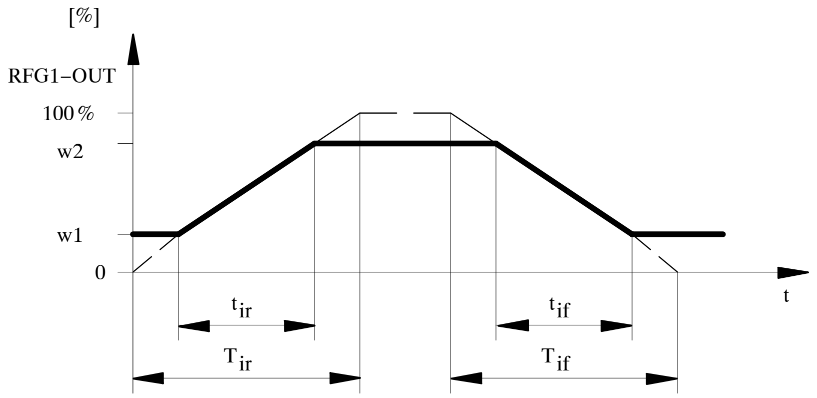
Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
RFG1-IN	a	C0676/1	dec [%]	C0673	1	1000	-
RFG1-SET	a	C0676/2	dec [%]	C0674	1	1000	-
RFG1-LOAD	d	C0677	-	C0675	2	1000	-
RFG1-OUT	a	-	-	-	-	-	-

Function

- Calculation and setting of the times T_{ir} and T_{if}
- Loading of the ramp function generator

3.5.56.1 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. 3-195 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.

3.5.56.2 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.

3.5.57 Sample and hold function (S&H)

Purpose

The FB can save analog signals. The saved value is also available after mains switching.

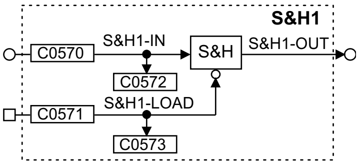


Fig. 3-196 Sample and hold function (S&H1)

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).

3.5.58 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

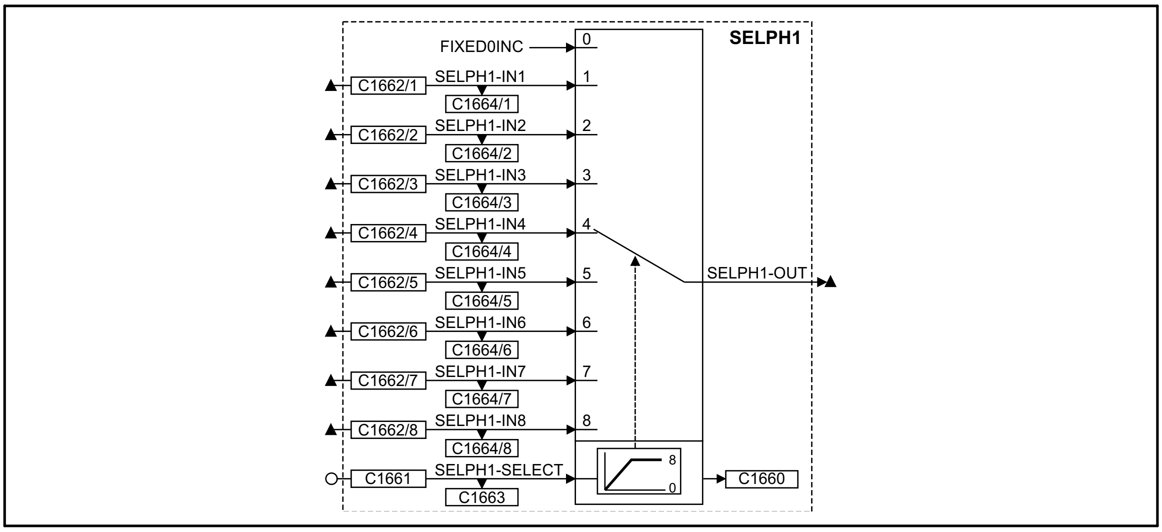


Fig. 3-197 Function block SELPH1

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

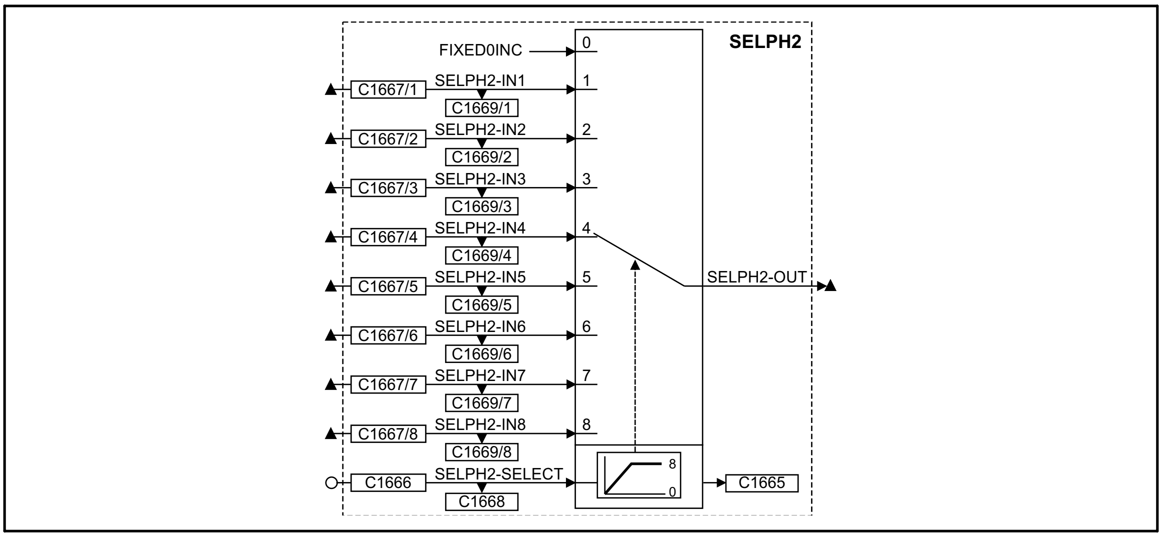


Fig. 3-198 Function block SELPH2

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.

3.5.59 Switching points (SP)

Two FBs (SP1, SP2) are available.

Purpose

Switches an output signal if the drive moves within a certain range (achieving a camgroup, triggering spray jets).

SP1

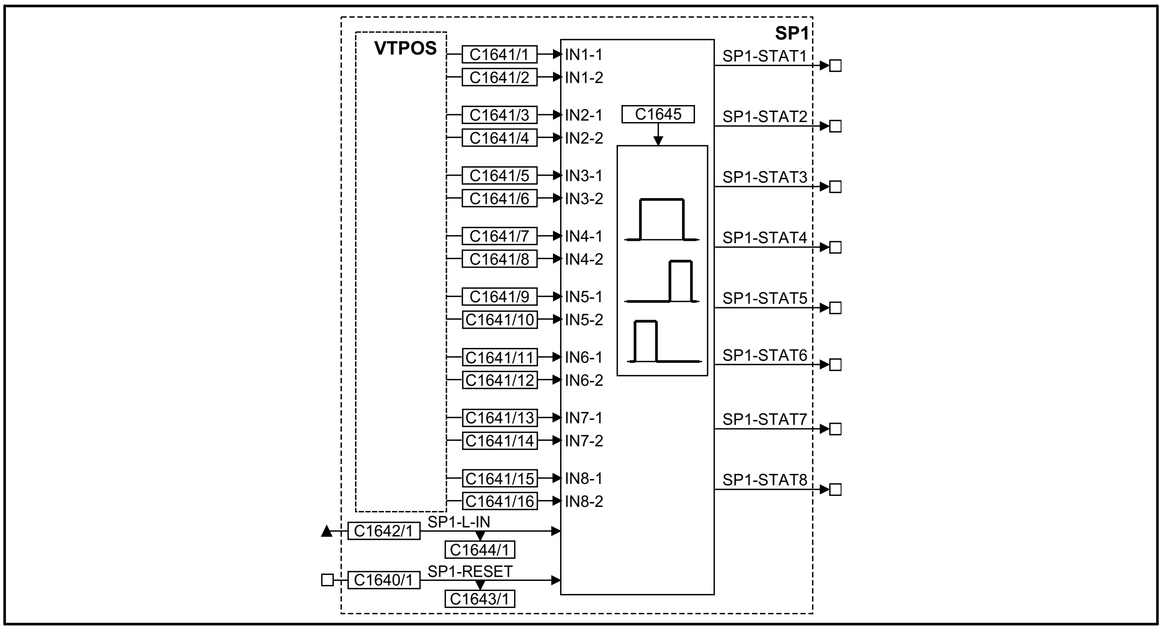


Fig. 3-199 Function block SP1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SP1-L-IN	ph	C1644/1	dec [inc]	C1642/1	3	65536 inc = 1 revolution
SP1-RESET	d	C1643/1	bin	C1640/1	2	-
SP1-STAT1	d	-	-	-	-	-
SP1-STAT2	d	-	-	-	-	-
SP1-STAT3	d	-	-	-	-	-
SP1-STAT4	d	-	-	-	-	-
SP1-STAT5	d	-	-	-	-	-
SP1-STAT6	d	-	-	-	-	-
SP1-STAT7	d	-	-	-	-	-
SP1-STAT8	d	-	-	-	-	-

SP2

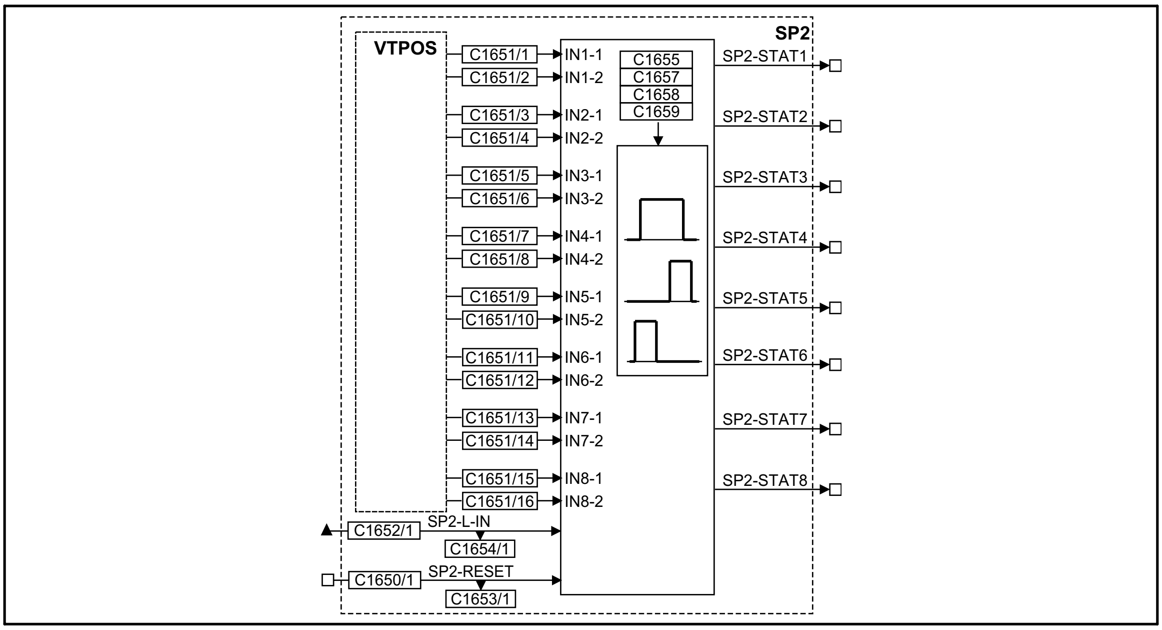


Fig. 3-200 Function block SP2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
SP2-L-IN	ph	C1654/1	dec [inc]	C1652/1	3	65536 inc = 1 revolution
SP2-RESET	d	C1653/1	bin	C1650/1	2	-
SP2-STAT1	d	-	-	-	-	-
SP2-STAT2	d	-	-	-	-	-
SP2-STAT3	d	-	-	-	-	-
SP2-STAT4	d	-	-	-	-	-
SP2-STAT5	d	-	-	-	-	-
SP2-STAT6	d	-	-	-	-	-
SP2-STAT7	d	-	-	-	-	-
SP2-STAT8	d	-	-	-	-	-

Function

- Switching points (start/end, center/range)
- Switching hysteresis
- Switching dead time
- Switching filter time constant

3.5.59.1 Switching points

- The switching points can be set in two ways:
  - Mode 1: Start and end point
  - Mode 2: Centre point with switching range
- The switching points are entered via the variable table VTPOS.
  - Direct input of the switch-on and switch-off points or centre point and range in VTPOS.
- If the value at SPx-L-IN is within the range of the switching points set, SPx-STATx switches HIGH
- In factory setting, SPx-L-IN is connected to the actual position value (POS-ACTPOS) of the FB POS.
  - Therefore, the switching points refer to the distance traversed by the motor.

Assignment of the switch-on and switch-off points for SP1 (see also Fig. 3-199):

Code	Subcode	Switching point	Output FB
C1641	1	IN1-1	SP1-STAT1
	2	IN1-2	
...	...	...	...
C1641	15	IN8-1	SP1-STAT8
	16	IN8-2	

Assignment of the switch-on and switch-off points for SP2 (see also Fig. 3-200):

Code	Subcode	Switching point	Output FB
C1651	1	IN1-1	SP2-STAT1
	2	IN1-2	
...	...	...	...
C1651	15	IN8-1	SP2-STAT8
	16	IN8-2	

Mode 1: Start and end point

C1645 = set 0 (SP1)

C1655 = set 0 (SP2)

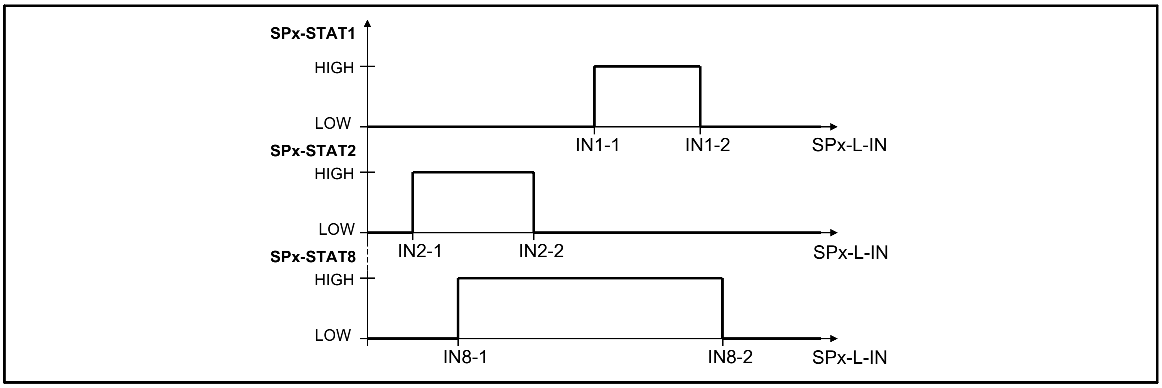


Fig. 3-201 Switch-on and switch-off points for SPx-STAT1, SPx-STAT2 and SPx-STAT8

Switch-on and switch-off positions depend on the travel direction:

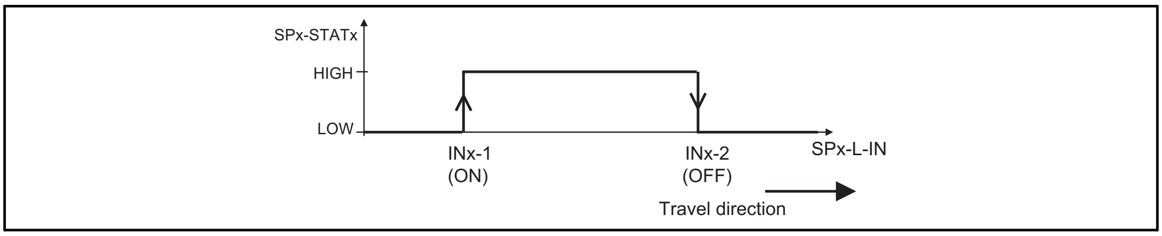


Fig. 3-202 Definition of a switch-on and switch-off position according to the travel direction

Mode 2: Centre point with switching range

C1645 = set 1 (SP1)

C1655 = set 1 (SP2)

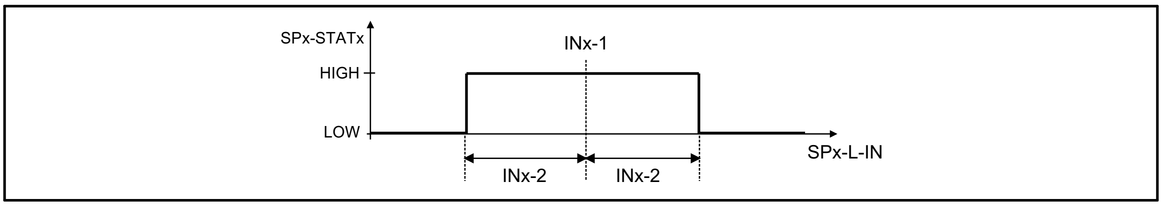


Fig. 3-203 Centre point with switching range

- INx-1 determines the centre point.
- INx-2 determines the switching range around the centre point.

3.5.59.2 Hysteresis

This function is available only for the FB SP2.

Purpose

Avoids indefined switching of the output signals (in standstill the drive is located exactly on a switching point).

Function

- The hysteresis is entered via C1658.
  – The setting is effective for SP2-STAT1 ... SP2-STAT8.

Function library

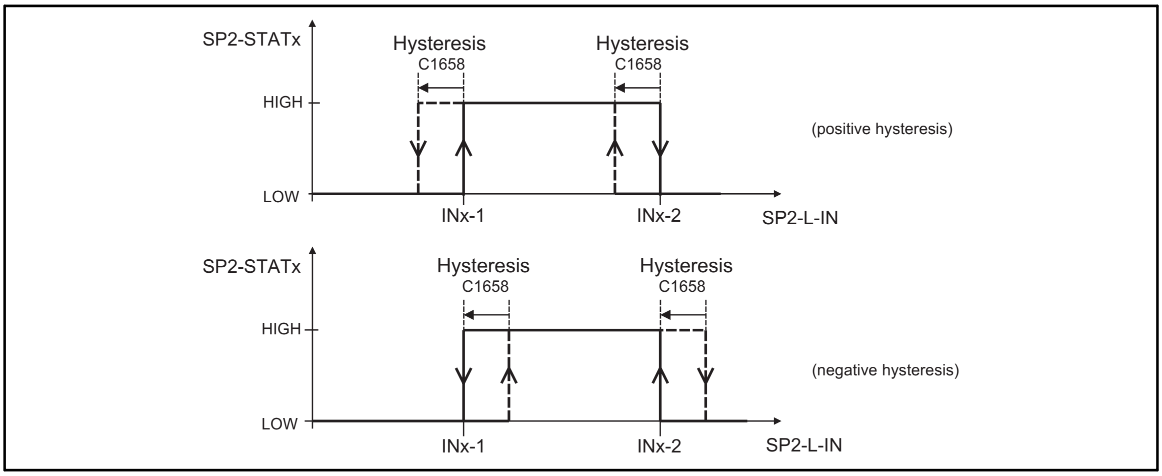


Fig. 3-204 Hysteresis for positive and negative values

3.5.59.3 Dead time

This function is available only for the FB SP2.

Purpose

Delayed triggering of subsequent machine parts (e.g. spray jets).

Function

- The dead time is entered via C1657.
  - The setting is possible for SP2-STAT1 ... SP2-STAT4 only.

Assignment of the code to the outputs:

Code	Subcode	Output FB SP2
C1657	1	SP2-STAT1
	2	SP2-STAT2
	3	SP2-STAT3
	4	SP2-STAT4

- The dead time acts on switching points and hysteresis.

Positive dead time

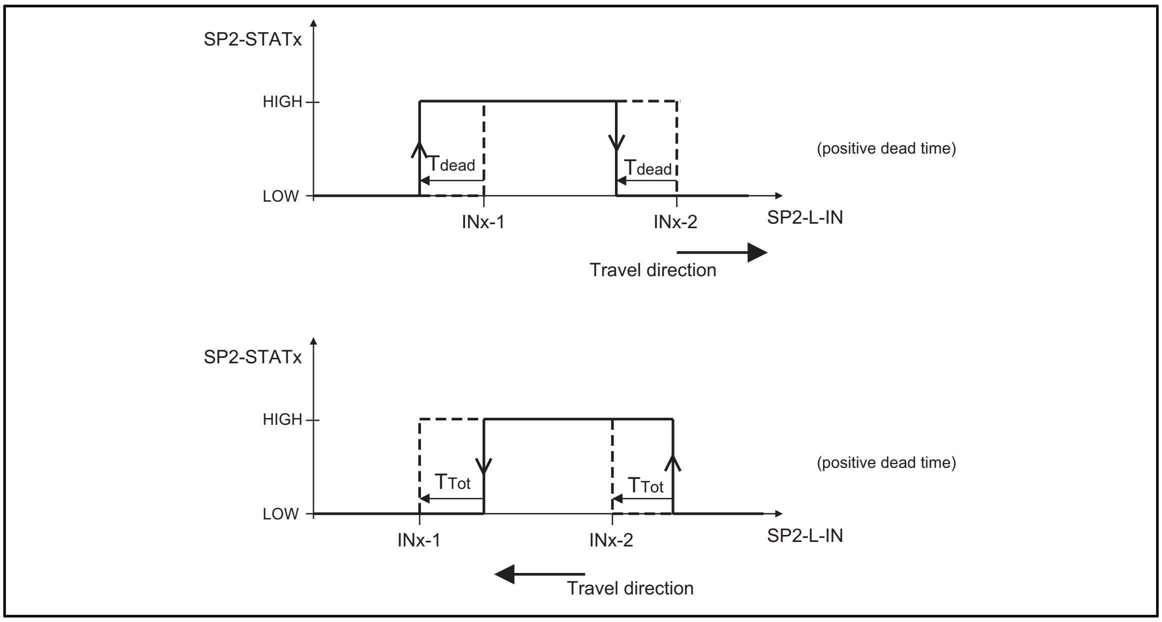


Fig. 3-205 Function of the positive dead time with different travel directions

- With a positive dead time, the drive reacts earlier by the time period set.

Negative dead time

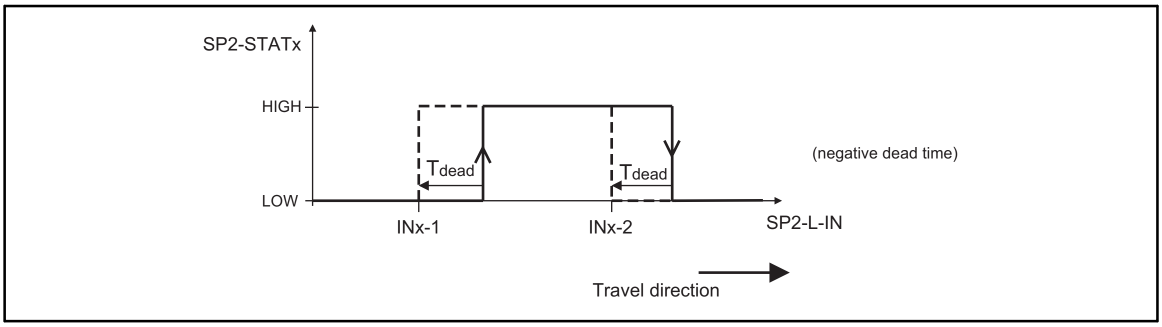


Fig. 3-206 Function of the negative dead time

- With a negative dead time, the drive reacts later by the time period set.

3.5.59.4 Filter time constant

This function is available only for the FB SP2.

Purpose

Avoids undefined switching of the output signals at SP2-STAT1 ... SP2-STAT4 when the motor is running at low speed.

Function

- The filter time constant is entered via C1659.
  - – The setting is valid for SP2-STAT1 ... SP2-STAT4.

Assignment of the codes to the filter time constant:

Code	Value	Filter time constant
C1659	0	Off
	1	1 ms
	2	2 ms
	4	4 ms
	8	8 ms
	16	16 ms

Tip!

The correct setting can only be found by testing.

In general:

- The lower the resolution of the actual position encoder and the lower the travel speed, the higher the filter time constant.

3.5.60 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.

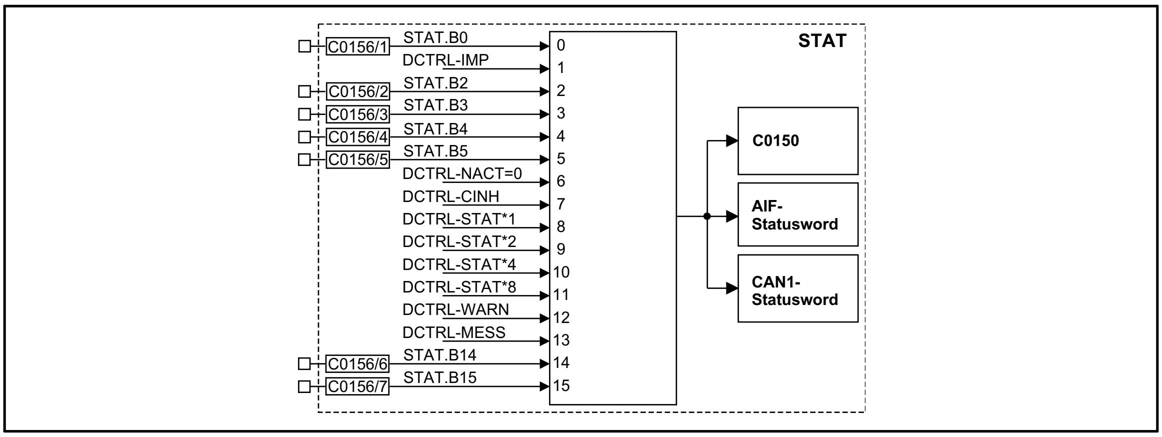


Fig. 3-207 Output of digital status signals (STAT)

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. (🕮 3-160)

3.5.61 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).

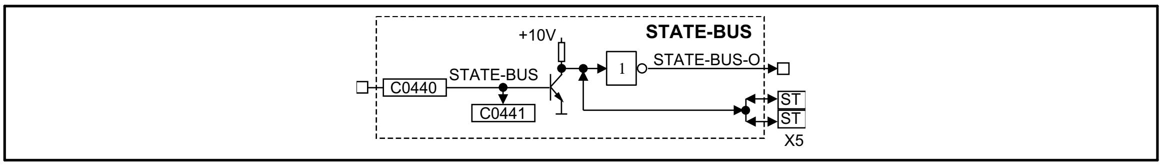


Fig. 3-208 Control of a function block STATE-BUS

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.

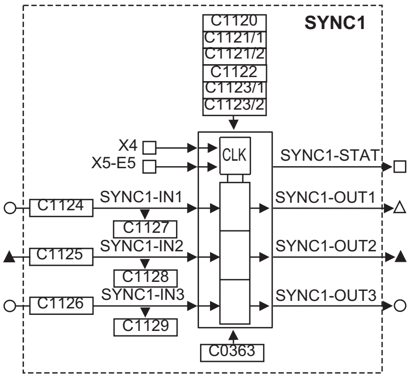
Stop!

Do not apply an external voltage at terminals X5/ST.

3.5.62 Multi-axis synchronisation (SYNC1)

Purpose

Synchronises the control program cycle of the drives to the cycle of a master control.



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

Function

- Possible axis synchronisations (chapter 3.5.62.1)
- Cycle times (chapter 3.5.62.2)
- Phase displacement (chapter 3.5.62.3)
- Synchronisation window for synchronisation via terminal (SYNC WINDOW) (chapter 3.5.62.4)
- Correction value of phase controller (SYNC CORRECT) (chapter 3.5.62.5)
- Fault indications (chapter 3.5.62.6)
- Configuration examples (chapter 3.5.62.7)
- Scaling (chapter 3.5.62.8)

3.5.62.1 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).

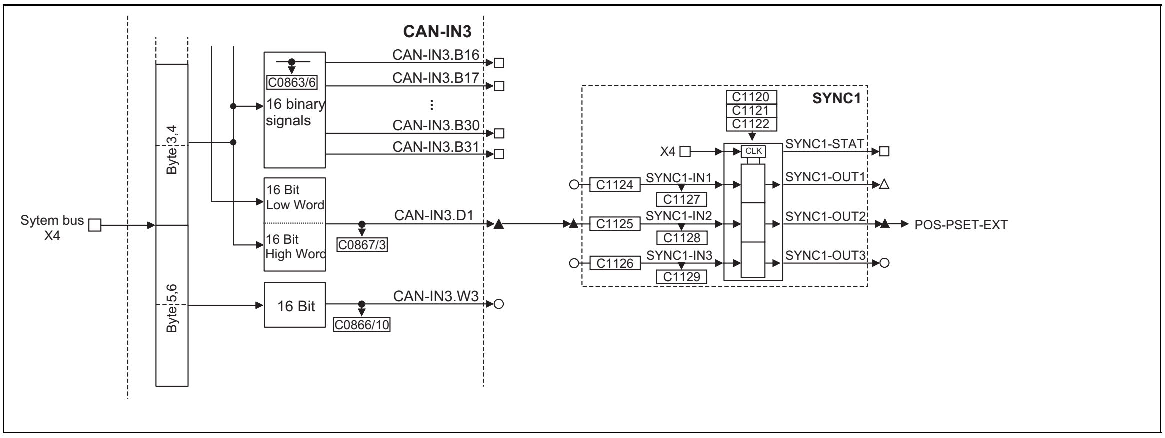


Fig. 3-209 Example for linking the FB SYNC1

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.

3.5.62.2 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.

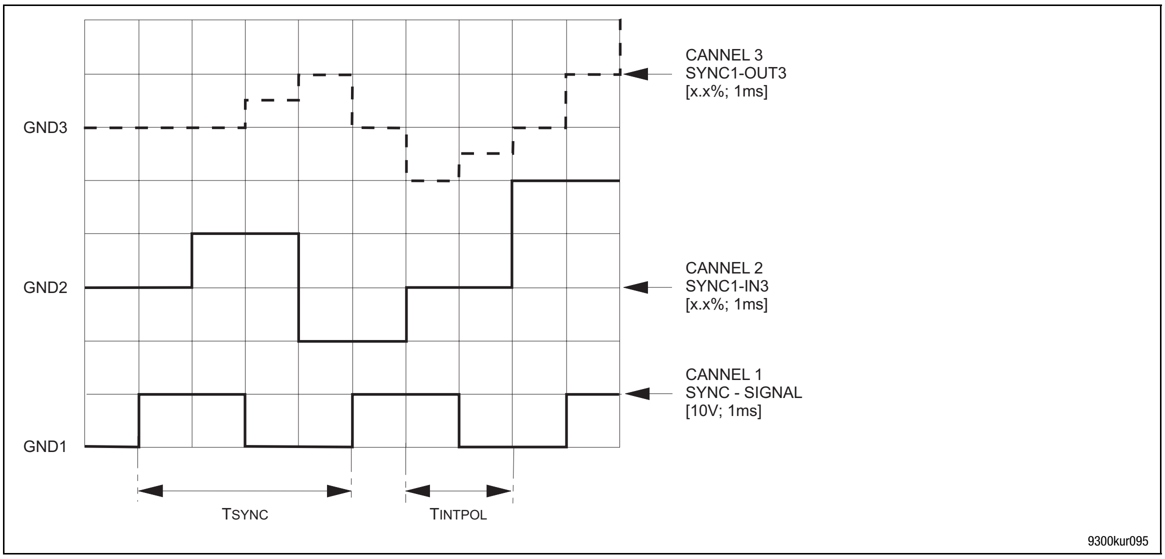


Fig. 3-210 Interpolation example

See Fig. 3-210:

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

3.5.62.3 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).

3.5.62.4 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.

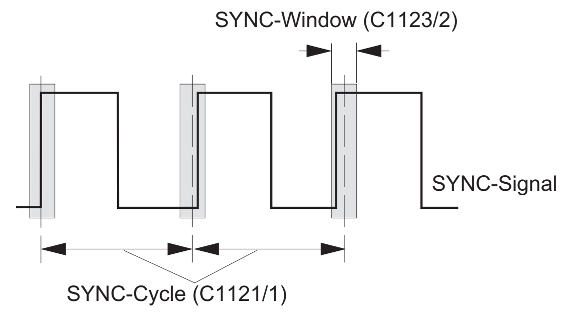


Fig. 3-211 “Time slot” for the LOW-HIGH edges of the sync signal

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”.

3.5.62.5 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.

3.5.62.6 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

3.5.62.7 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 $\geq$ 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

3.5.62.8 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.

3.5.63 Teach-in in programming (TEACH)

A function block (TEACH1) is available.

Purpose

Accepting actual position values and saving them in the VTPOS table. These values are then available as position setpoints.

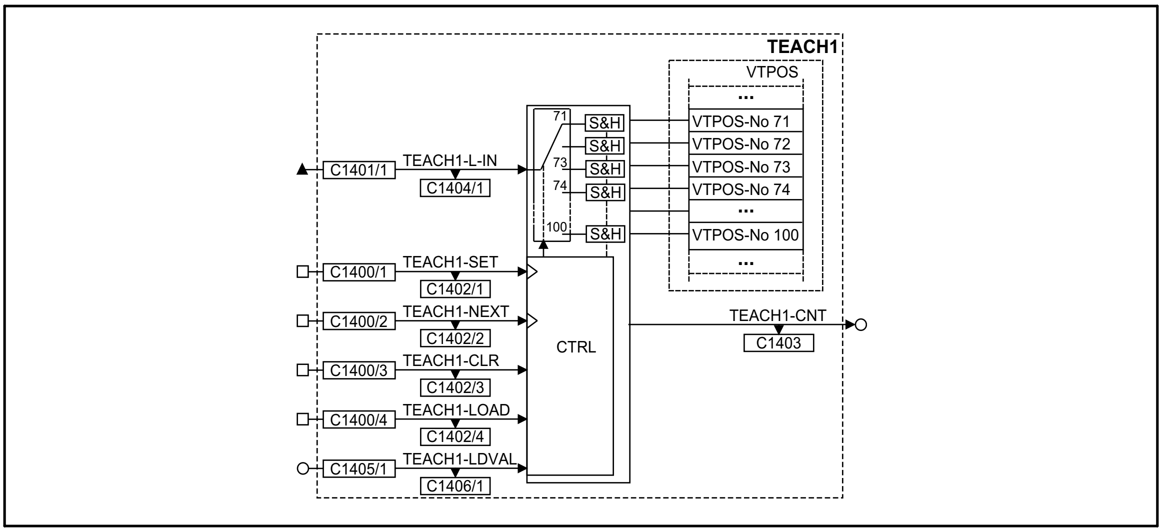


Fig. 3-212 Function block TEACH1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
TEACH1-L-IN	ph	C1404/1	dec [inc]	C1401/1	3	Input for actual position
TEACH1-SET	d	C1402/1	bin	C1400/1	2	-
TEACH1-NEXT	d	C1402/2	bin	C1400/2	2	-
TEACH1-CLR	d	C1402/3	bin	C1400/3	2	-
TEACH1-LOAD	d	C1402/4	bin	C1400/4	2	-
TEACH1-LDVAL	a	C1406/1	dec [inc]	C1405/1	1	-
TEACH1-CNT	a	C1403	dec [inc]	-	-	Display of the table position which is selected as memory unit (table position = C1403 + 70)

Function

- The FB accepts a value (e.g. actual position) at TEACH1-L-IN.
- A LOW HIGH edge at TEACH1-SET transmits the value TEACH1-L-IN to the selected table position in VTPOS.
- A LOW-HIGH edge at TEACH-NEXT selects the next table position.
  - – 30 table positions (VTPOS-No 71 ... VTPOS-No 100) are available.
  - – The number of the selected table position can be displayed via C1403.
  - – TEACH1-CNT transmits the number of the table position as analog signal.
- TEACH1-CLR = HIGH resets all values in the table positions to zero and selects simultaneously the table position VTPOS-No 71.
- An analog signal at TEACH1-LDVAL selects directly a table position (VTPOS-No).
  - – Signal values < 71 = interpreted as VTPOS-No 71.
  - – Signal values > 100 = interpreted as VTPOS-No 100.
  - – TEACH1-LOAD = HIGH selects the position.
- If the levels are applied at the same time to the digital inputs, the following priority is valid:
  - – TEACH1-CLR (1)
  - – TEACH1-LOAD (2)
  - – TEACH1-NEXT (3)
  - – TEACH1-SET (4)

Tip!

Save the target positions permanently using C0003.

3.5.64 Edge evaluation (TRANS)

Purpose

This function is used to evaluate digital signal edges and convert them into pulses of a defined duration.

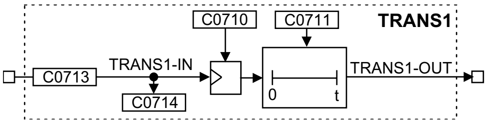


Fig. 3-213 Edge evaluation (TRANS1)

Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
TRANS1-IN	d	C0714	bin	C0713	2	1000	-
TRANS1-OUT	d	-	-	-	-	-	-

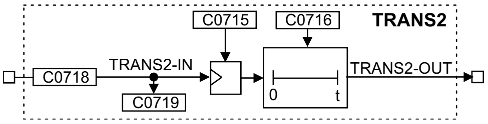


Fig. 3-214 Edge evaluation (TRANS2)

Signal				Source			Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	**Lenze**	
TRANS2-IN	d	C0719	bin	C0718	2	1000	-
TRANS2-OUT	d	-	-	-	-	-	-

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

3.5.64.1 Evaluate positive edge

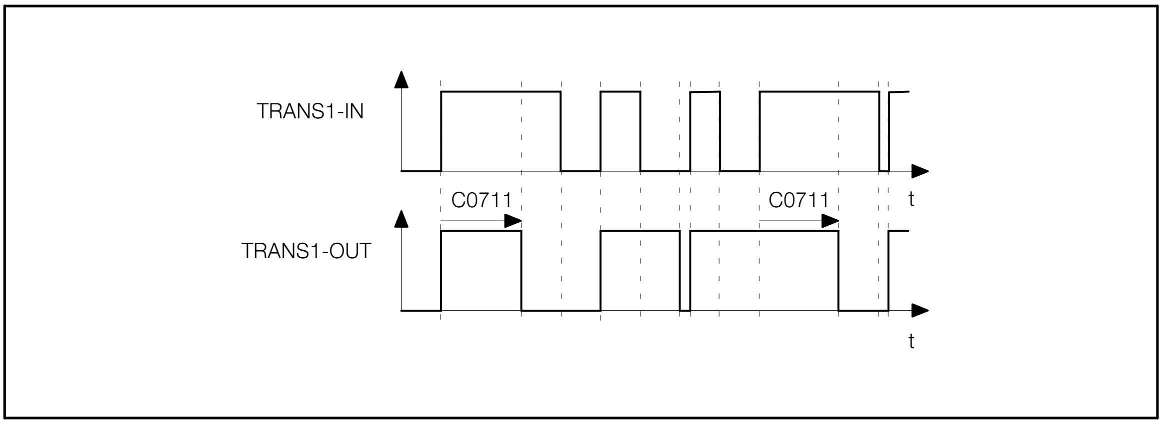


Fig. 3-215 Evaluation of positive edges (TRANS1)

- 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.

3.5.64.2 Evaluate negative edge

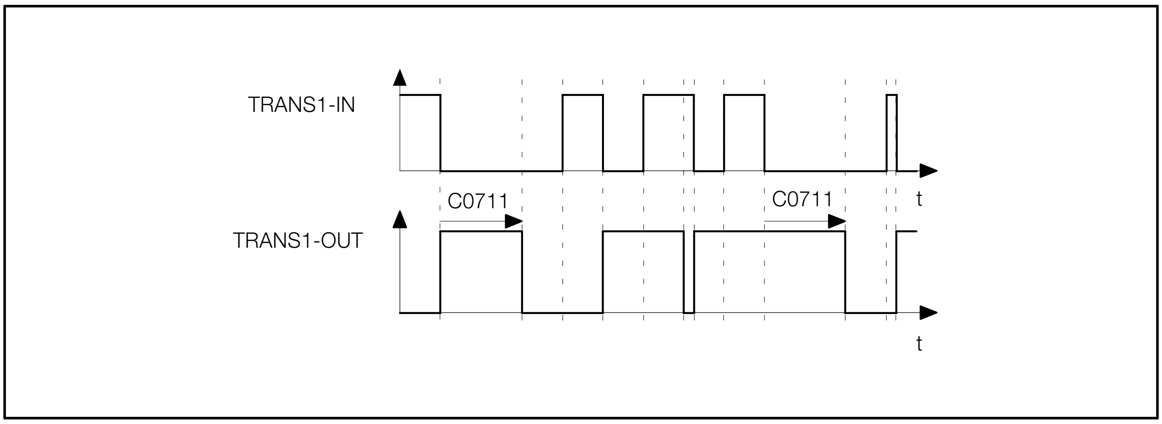


Fig. 3-216 Evaluation of negative edges (TRANS1)

- 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.

3.5.64.3 Evaluate positive or negative edge

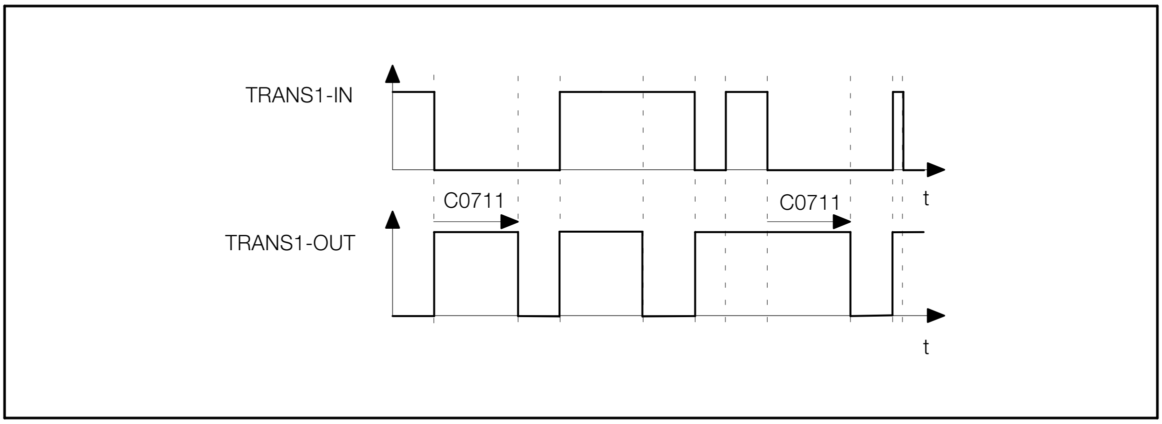


Fig. 3-217 Evaluation of positive and negative edges (TRANS1)

- 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.

3.5.65 Variable table - acceleration (VTACC)

One function block (VTACC) is available.

Purpose

Stores the values for acceleration and deceleration. They serve as acceleration and deceleration ramps in the positioning program.

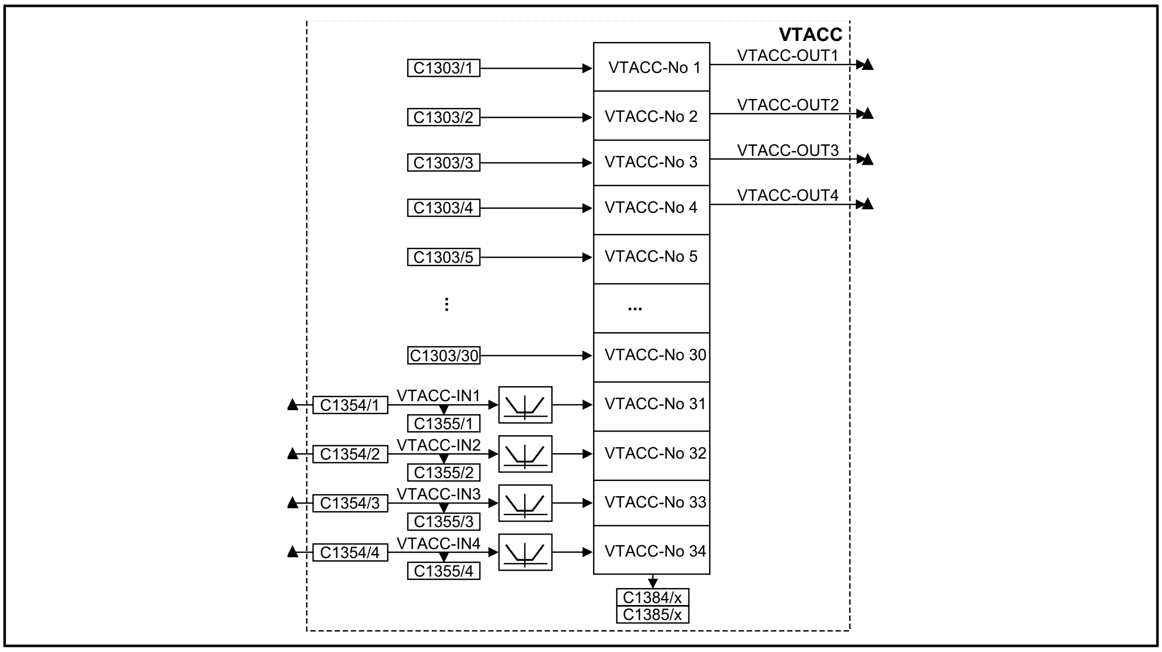


Fig. 3-218 Function block VTACC

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTACC-IN1	ph	C1355/1	dec [inc]	C1354/1	3	• Generates the absolute value for negative values. • When the values are > amax (C1250) the drive moves with amax.
VTACC-IN2	ph	C1355/2	dec [inc]	C1354/2	3	
VTACC-IN3	ph	C1355/3	dec [inc]	C1354/3	3	
VTACC-IN4	ph	C1355/4	dec [inc]	C1354/4	3	
VTACC-OUT1	ph	-	-	-	-	-
VTACC-OUT2	ph	-	-	-	-	-
VTACC-OUT3	ph	-	-	-	-	-
VTACC-OUT4	ph	-	-	-	-	-

Function

A total of 34 table positions is available.

- Enter fixed values under C1303.
  - – 30 table positions (VTACC-No1 ... VTACC-No30) are available.
  - – Subcodes (C1303/1 ... C1303/30) define the table position number.
- Enter variable values in VTACC-INx.
  - – 4 table positions (VTACC-No31 ... VTACC-No34) are available.
  - – Signal input via function blocks.
  - – The values must be transmitted to the table positions before the corresponding program set starts and accesses these values.
- C1384 indicates the values (in % of amax) on the table positions.
  - – Select table position (C1384/1 ... C1384/34) with subcode.
- C1385 displays the values (in inc) on the table positions.
  - – Select table position (C1385/1 ... C1385/34) with subcode.
- The conversion from a [units/s^2] to a [inc] is performed according to the formula:

$$a\,[\mathrm{inc}] = a\,[\mathrm{units/s^2}] \cdot \frac{65536\,[\mathrm{inc/r}] \cdot \text{gear nominator} \cdot 16384}{\text{Feed const. }[\mathrm{units/r}] \cdot \text{gear denominator} \cdot 1000000\,[1/\mathrm{s^2}]}$$

Tip!

Entries into the processing table are only required if FB inputs and outputs are used.

3.5.66 Variable table Piece number (VTPCS)

One function block FB (VTPCS) is available.

Purpose

Stores setpoint piece numbers. They are used as comparison values for the piece number function in the program processing.

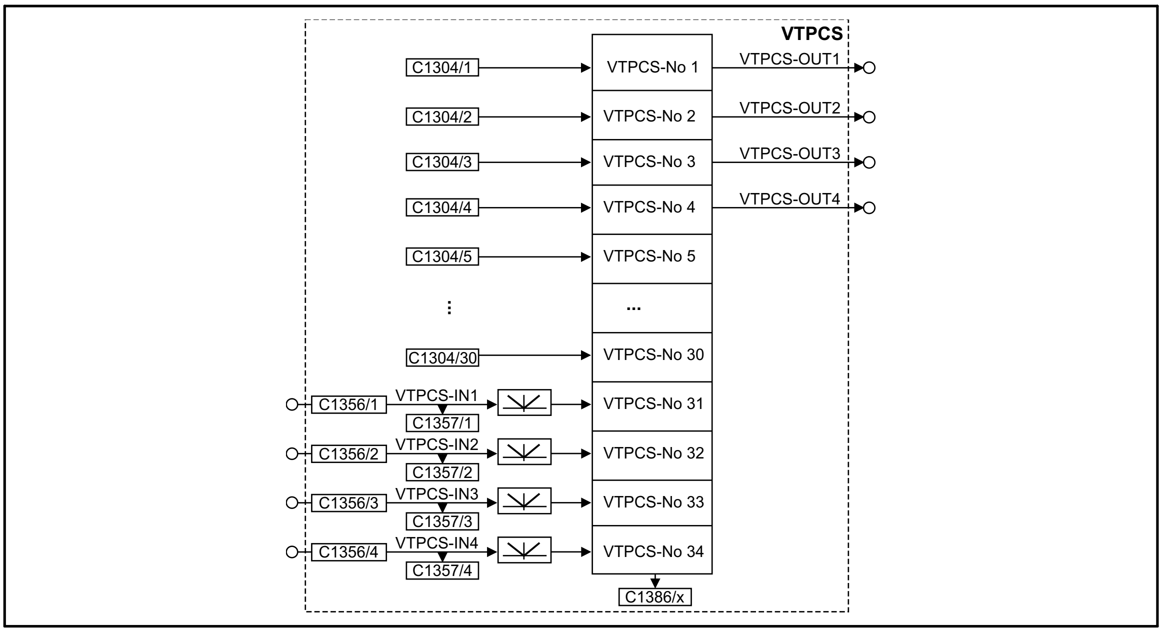


Fig. 3-219 Function block VTPCS

Stop!

If piece numbers >32767 are entered under C1304/1 to C1304/4, the outputs VTPCS-OUT1 ... VTPCS-OUT4 must no longer be used.

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTPCS-IN1	a	C1357/1	dec [inc]	C1356/1	1	• Generates the absolute value for negative values. • Limits the value to 32767.
VTPCS-IN2	a	C1357/2	dec [inc]	C1356/2	1	
VTPCS-IN3	a	C1357/3	dec [inc]	C1356/3	1	
VTPCS-IN4	a	C1357/4	dec [inc]	C1356/4	1	
VTPCS-OUT1	a	-	-	-	-	-
VTPCS-OUT2	a	-	-	-	-	-
VTPCS-OUT3	a	-	-	-	-	-
VTPCS-OUT4	a	-	-	-	-	-

Function

A total of 34 table positions are available.

- Enter fixed values under C1304.
  - 30 table positions (VTPCS-No1 ... VTPCS-No30) are available.
  - Subcodes (C1304/1 ... C1304/30) define the table position number.
- Enter variable values in VTPCS-INx.
  - 4 table positions (VTPCS-No31 ... VTPCS-No34) are available.
  - Signal input via function blocks.
  - The values must be transmitted to the table positions before the corresponding program set starts and accesses these values.
- C1386 displays the values on the table positions.
  - Select table position (C1386/1 ... C1386/34) with subcode.
- For signals with percentage standardization at VTPCS-INx the conversion is performed according the the formula:

$$\text{VTPCS–INx [inc]} = \text{VTPCS–INx [\%]} \cdot \frac{16384\ \text{[inc]}}{100\ \%}$$

Tip!

Entries into the processing table are necessary only if the FB inputs and outputs are used.

3.5.67 Variable table - target position/position values (VTPOS)

One function block (VTPOS) is available.

Purpose

Stores values for target positions (position values): They serve as target positions in the positioning program or comparison values for SP1 and SP2.

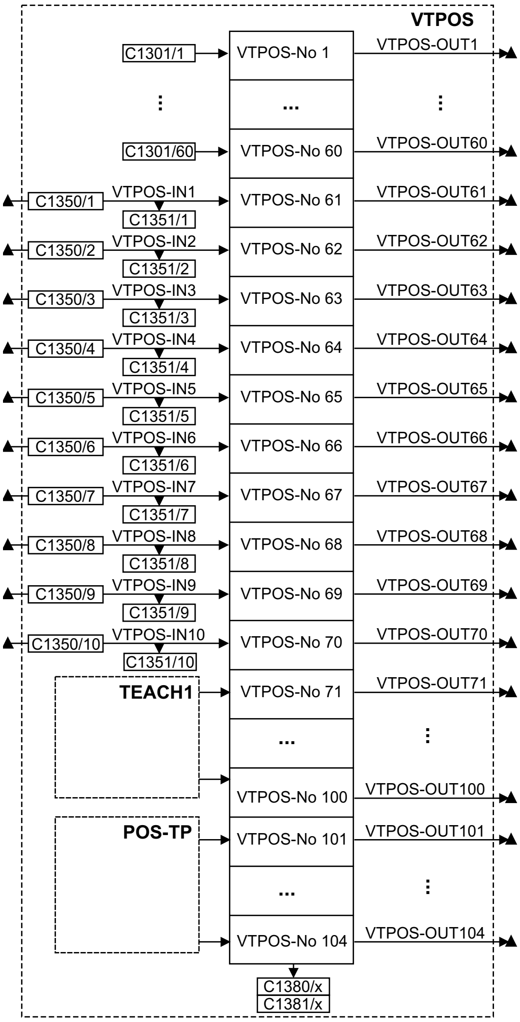


Fig. 3-220 Function block VTPOS

Signal				Source		Note
Name	**Type**	**DIS**	**DIS format**	**CFG**	**List**	
VTPOS-IN1	ph	C1351/1	dec [inc]	C1350/1	3	-
VTPOS-IN2	ph	C1351/2	dec [inc]	C1350/2	3	-
VTPOS-IN3	ph	C1351/3	dec [inc]	C1350/3	3	-
VTPOS-IN4	ph	C1351/4	dec [inc]	C1350/4	3	-
VTPOS-IN5	ph	C1351/5	dec [inc]	C1350/5	3	-
VTPOS-IN6	ph	C1351/6	dec [inc]	C1350/6	3	-
VTPOS-IN7	ph	C1351/7	dec [inc]	C1350/7	3	-
VTPOS-IN8	ph	C1351/8	dec [inc]	C1350/8	3	-
VTPOS-IN9	ph	C1351/8	dec [inc]	C1350/9	3	-
VTPOS-IN10	ph	C1351/10	dec [inc]	C1350/10	3	-
VTPOS-OUT1	ph	-	-	-	-	-
...	...					
VTPOS-OUT104	ph	-	-	-	-	-

Function

A total of 104 table positions are available.

- Enter fixed target position values via C1301/x.
  - 60 table positions (VTPOS-No1 ... VTPOS-No60) are available.
  - Subcodes (C1301/1 ... C1301/60) define the table position number.
- Enter variable target position values via VTPOS-INx.
  - 10 table positions (VTVEL-No61 ... VTVEL-No70) are available.
  - Signal input via function blocks.
  - The target position value must be transmitted to the table positions before the corresponding program set starts and accesses these values.
- Enter target position values of FB TEACH1.
  - 30 table positions (VTPOS-No71 ... VTPOS-No100) are available.
- Enter target position values via touch probe.
  - 4 table positions (VTPOS-No101 ... VTPOS-No104) are available.
- C1380 displays the target position values (in units) on the table positions.
  - Select table position (C1380/1 ... C1380/104) with subcode.
- C1381 displays the target position values (in inc) on the table positions.
  - Select table position (C1381/1 ... C1381/104) with subcode.
- The conversion from target position [units] to target position [inc] is performed according to the formula:

$$\text{Target position [inc]} = \text{Target position [units]} \cdot \frac{65536\ [\text{inc/r}] \cdot \text{gear nominator}}{\text{Feed const. [units/r]} \cdot \text{gear denominator}}$$

Tip!

Entries into the processing table are only required if FB inputs are used.

3.5.68 Variable table Waiting time (VTTIME)

One function block (VTTIME) is available.

Purpose

Store values for waiting times. They are used as delays for the function ”Waiting time” in the positioning program.

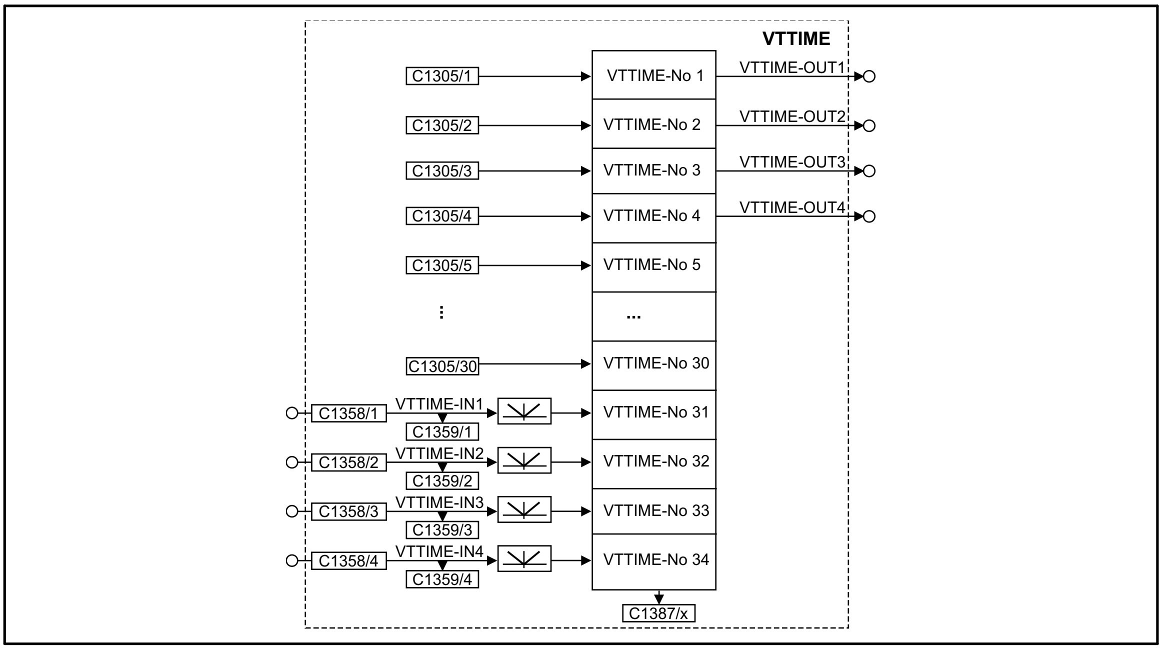


Fig. 3-221 Function block VTTIME

Stop!

If times >32767 ms are entered under C1305/1 to C1305/4 the outputs VTTIME-OUT1 ... VTTIME-OUT4 must no longer be used.

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTTIME-IN1	a	C1359/1	dec [inc]	C1358/1	3	• Generates the absolute value for negative values. • Value = 100 % = 16384 ms • Limits the value to 32767 ms • Display: 1 inc = 1 ms
VTTIME-IN2	a	C1359/2	dec [inc]	C1358/2	3	
VTTIME-IN3	a	C1359/3	dec [inc]	C1358/3	3	
VTTIME-IN4	a	C1359/4	dec [inc]	C1358/4	3	
VTTIME-OUT1	a	-	-	-	-	1 inc = 1 ms
VTTIME-OUT2	a	-	-	-	-	1 inc = 1 ms
VTTIME-OUT3	a	-	-	-	-	1 inc = 1 ms
VTTIME-OUT4	a	-	-	-	-	1 inc = 1 ms

Function

A total of 34 table positions are available.

- Enter fixed time value under C1305.
  - 30 table positions (VTTIME-No1 ... VTTIME-No30) are available.
  - Subcodes (C1305/1 ... C1305/30) define the table position number.
- Enter variable time values under VTTIME-INx.
  - 4 table positions (VTTIME-No31 ... VTTIME-No34) are available.
  - Signal input via function blocks.
  - The time values must be transmitted to the table positions before the program set starts and has access to it.
- C1387 displays the time values on the table positions.
  - Select table position (C1387/1 ... C1387/34) with subcode.

Note!

Entries into the processing table are necessary only if the FB inputs and outputs are used.

3.5.69 Variable table - speed (VTVEL)

One function block (VTVEL) is available.

Purpose

Stores values for traversing and final speeds. They serve as setpoint speeds in the positioning program.

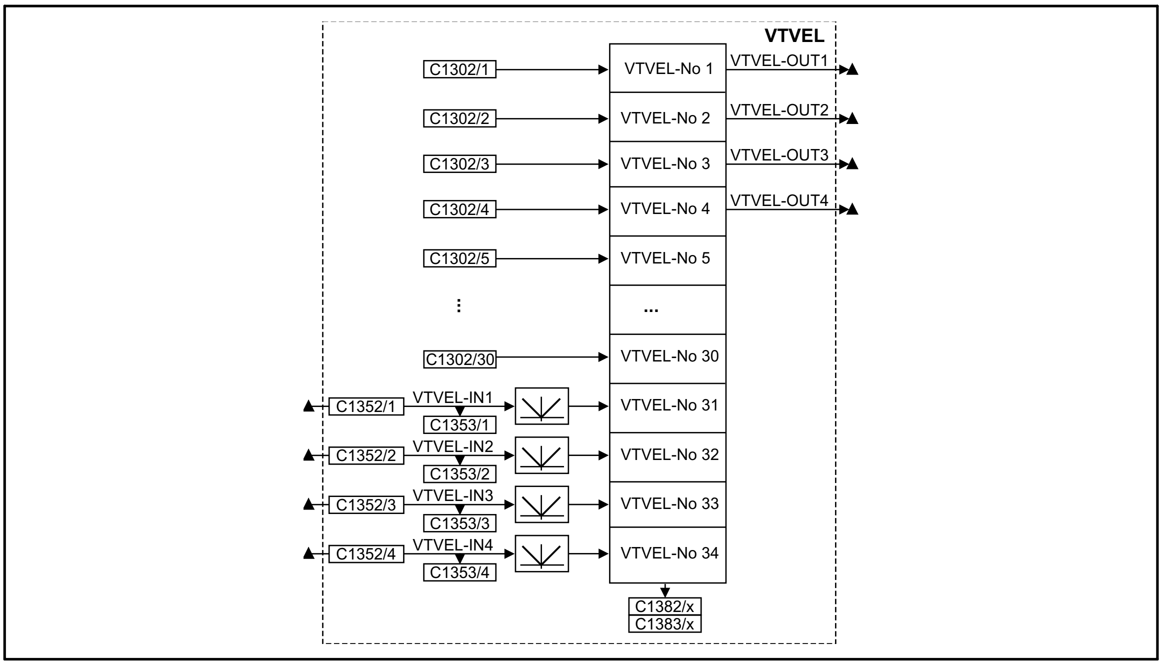


Fig. 3-222 Function block VTVEL

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
VTVEL-IN1	ph	C1353/1	dec [inc]	C1352/1	3	• Generates the absolute value for negative values. • When the values exceed vmax (C1240) the drive moves with vmax.
VTVEL-IN2	ph	C1353/2	dec [inc]	C1352/2	3	
VTVEL-IN3	ph	C1353/3	dec [inc]	C1352/3	3	
VTVEL-IN4	ph	C1353/4	dec [inc]	C1352/4	3	
VTVEL-OUT1	ph	-	-	-	-	-
VTVEL-OUT2	ph	-	-	-	-	-
VTVEL-OUT3	ph	-	-	-	-	-
VTVEL-OUT4	ph	-	-	-	-	-

Function

A total of 34 table positions is available.

- Enter fixed setpoints under C1302.
  - 30 table positions (VTVEL-No1 ... VTVEL-No30) are available.
  - Subcodes (C1302/1 ... C1302/30) define the table position number.
- Enter variable setpoints under VTVEL-INx.
  - Four table positions (VTVEL-No31 ... VTVEL-No34) are available.
  - Signal input via function blocks.
  - The setpoints must be transmitted to the table positions before the program set starts and has access to it.
- C1382 indicates the setpoints (in % of vmax) on the table positions.
  - Select table position (C1382/1 ... C1382/34) with subcode.
- C1383 displays the setpoints (in inc) on the table positions.
  - Select table position (C1383/1 ... C1383/34) with subcode.
- The conversion from v [units/s] to v [inc] is performed according to the formula:

$$v\,[\text{inc}] = v\,[\text{units/s}] \cdot \frac{65536\,[\text{inc/r}] \cdot \text{gear nominator} \cdot 16384}{\text{Feed const. }[\text{units/r}] \cdot \text{gear denominator} \cdot 1000\,[1/\text{s}]}$$

Tip!

Entries into the processing table are only required if FB inputs and outputs are used.

4 Application examples

Contents

4.1 Example 1: Dosing system

The "Dosing system" application example describes different filling stations of a packaging machine. The containers of these machine parts are to be filled using the least amount of space or the shortest possible time. It is also important that the exact amount is supplied via the feed screw. Two 9300 servo position controllers with power-optimised servo motors are used as drive components.

The 9300 servo position controller contains functions which could previously only be offered by a higher-level control (e.g. PLC). Positioning tasks which are similar to this example can easily be achieved at minimum expense using this controller.

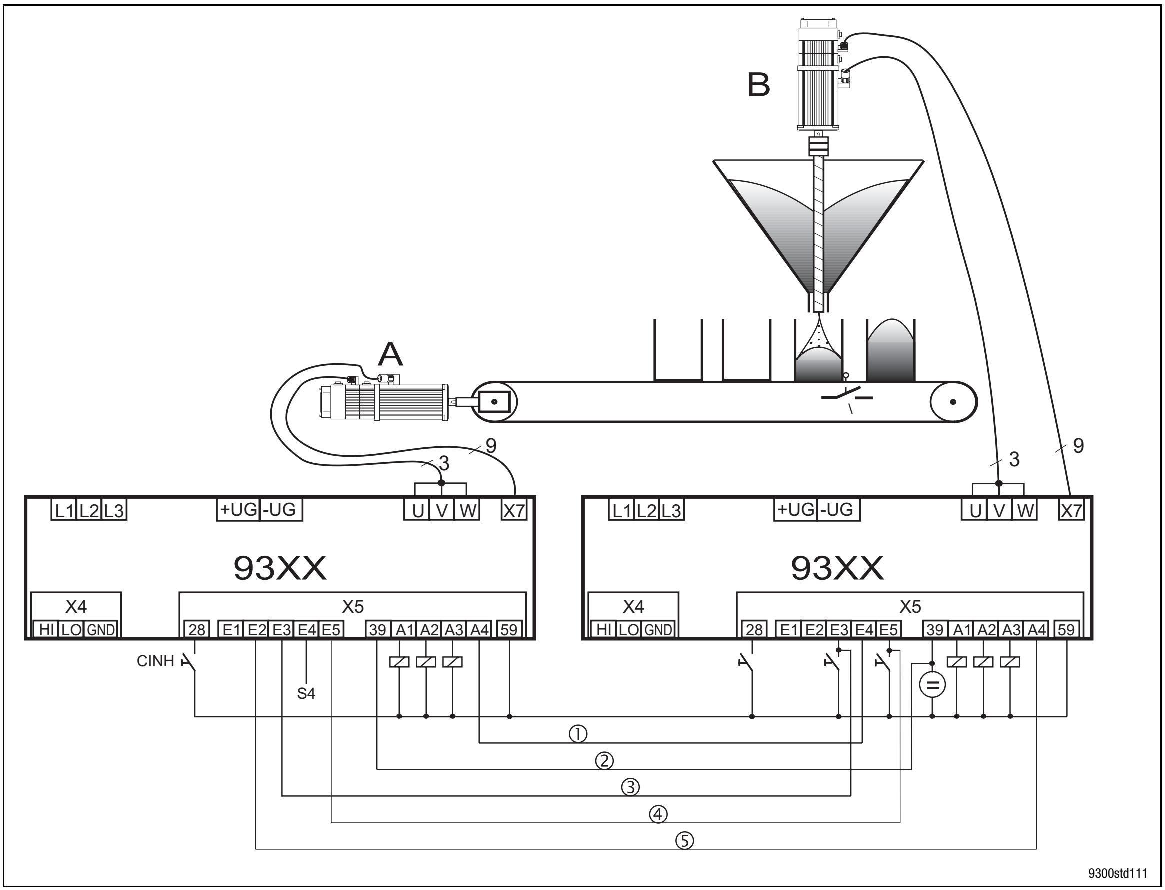
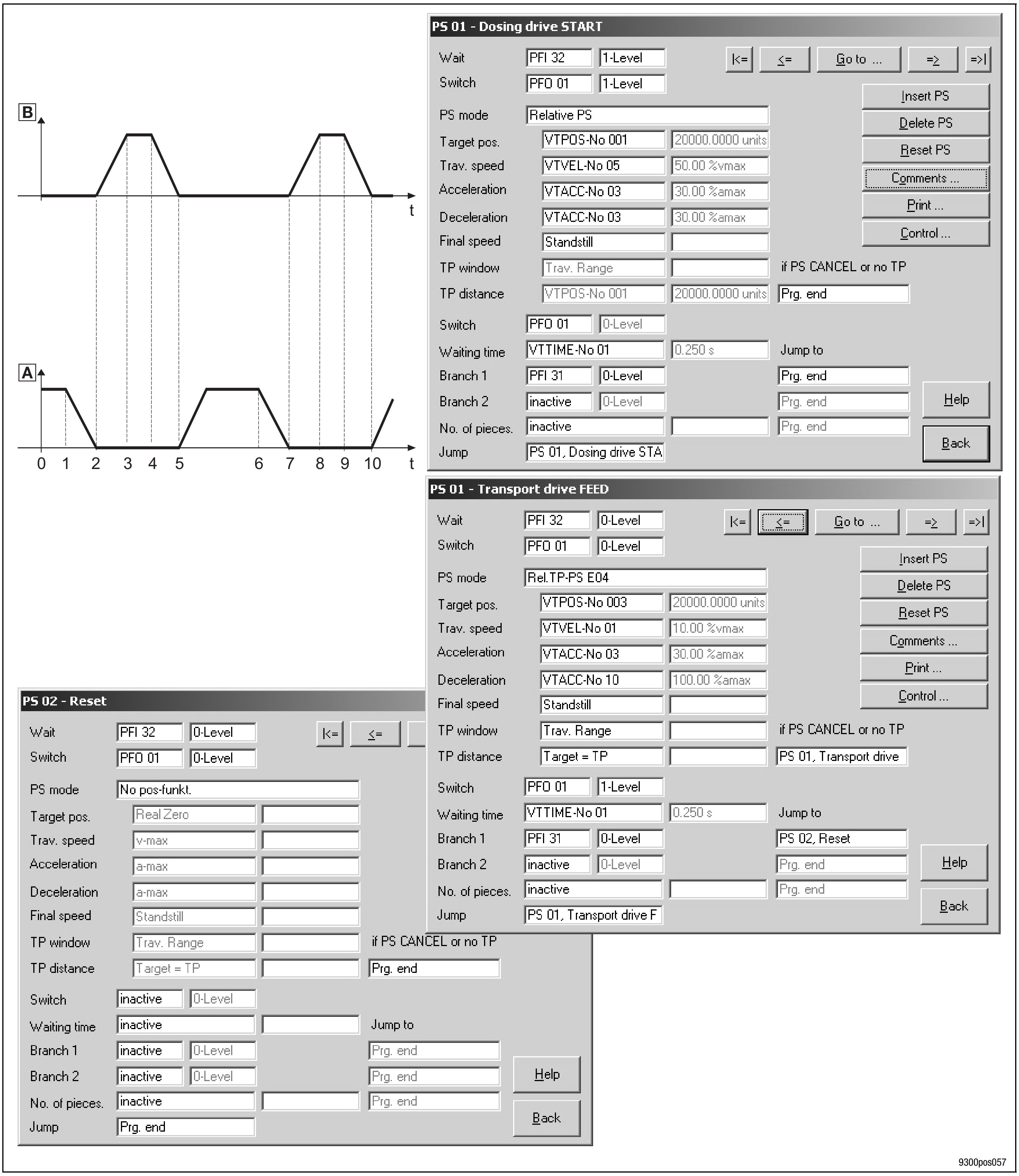


Fig. 4-1 Example of a relative positioning

Drive	Input	Function	Connection cable
A	E1	Not assigned	
	E2	Handshake: start feed	⑤
	E3	Start program	③
	E4	Touch probe initiator (S4) for the detection of the container position	
	E5	Changeover of manual / program mode	
B	E1	Not used	
	E2	Not used	
	E3	Start program	③
	E4	Handshake: start dosing	①
	E5	Changeover of manual / program mode	④
	39	Reference potential	②



PS 01 - Dosing drive START

Wait	PFI 32	1-Level	
Switch	PFO 01	1-Level	
PS mode	Relative PS		
Target pos.	VTPOS-No 001	20000.0000 units	
Trav. speed	VTVEL-No 05	50.00 %vmax	
Acceleration	VTACC-No 03	30.00 %amax	
Deceleration	VTACC-No 03	30.00 %amax	
Final speed	Standstill		
TP window	Trav. Range		if PS CANCEL or no TP
TP distance	VTPOS-No 001	20000.0000 units	Prg. end
Switch	PFO 01	0-Level	
Waiting time	VTTIME-No 01	0.250 s	Jump to
Branch 1	PFI 31	0-Level	Prg. end
Branch 2	inactive	0-Level	Prg. end
No. of pieces.	inactive		Prg. end
Jump	PS 01, Dosing drive STA		

PS 01 - Transport drive FEED

Wait	PFI 32	0-Level	
Switch	PFO 01	0-Level	
PS mode	Rel.TP-PS E04		
Target pos.	VTPOS-No 003	20000.0000 units	
Trav. speed	VTVEL-No 01	10.00 %vmax	
Acceleration	VTACC-No 03	30.00 %amax	
Deceleration	VTACC-No 10	100.00 %amax	
Final speed	Standstill		
TP window	Trav. Range		if PS CANCEL or no TP
TP distance	Target = TP		PS 01, Transport drive
Switch	PFO 01	1-Level	
Waiting time	VTTIME-No 01	0.250 s	Jump to
Branch 1	PFI 31	0-Level	PS 02, Reset
Branch 2	inactive	0-Level	Prg. end
No. of pieces.	inactive		Prg. end
Jump	PS 01, Transport drive F		

PS 02 - Reset

Wait	PFI 32	0-Level	
Switch	PFO 01	0-Level	
PS mode	No pos-funkt.		
Target pos.	Real Zero		
Trav. speed	v-max		
Acceleration	a-max		
Deceleration	a-max		
Final speed	Standstill		
TP window	Trav. Range		if PS CANCEL or no TP
TP distance	Target = TP		Prg. end
Switch	inactive	0-Level	
Waiting time	inactive		Jump to
Branch 1	inactive	0-Level	Prg. end
Branch 2	inactive	0-Level	Prg. end
No. of pieces.	inactive		Prg. end
Jump	Prg. end		

Fig. 4-2 Travel profiles and entry via the dialog boxes in GDC

Travel profiles	
Time	**Description**
1, 6	Container has almost reached the target position • Brake feed
2, 7	Container in target position • Start filling (observe dead time)
5, 10	Filling completed • Start feed, filled container leaves positioning sensor, empty container is positioned

Dosing drive B		
PS	**Time**	**Description**
01	0 - 2	Waiting for input POS-PFI 32, signal at X5/E4 (H level). The feed drive starts the dosing drive if the container is positioned.
	2 - 5	Filling according to program set parameters
	5	Start feed (drive A): switch POS-PFO1, X5/A4; L level • Jump to program set 1 (PS01)

Transport drive FEED A		
PS	**Time**	**Description**
01	2 - 5	Wait for input POS-PFI = 0 level
	5 - 6	Feed until TP(E4) responds
	6 - 7	Cover residual path and stop
	7	Start dosing drive PFO 01 = H: A4 = High, then jump to PS01
02	Is required to complete the program.	

Basis: Basic configuration 20200

Terminal assignment					
Inputs	Function 1	Function 2	Function 3	**Outputs**	Function
X5/E1	Manual jog in negative direction			X5/A1	Reference known
X5/E2	Manual jog in positive direction			X5/A2	Setpoint position reached
X5/E3	Program start	PS function (PFI 31)		X5/A3	Ready for operation
X5/E4	Homing switch	PS function (PFI 31)		X5/A4	PS function (POS-PF01)
X5/E5	Trip reset	Program reset	Manual jog		

Assignment of CAN1			
Inputs	Function	**Outputs** **CAN-OUT1.**	Function
		W1	Actual speed value
		D1	Actual position
CAN status word (bit 0.... bit15) 1: Pulse inhibit 2: Reference known 4: M_{max} (low active) 5: Target position reached 6: n_actual = 0 7: Controller inhibit CINH 12: Fault warning 13: Fault message 14: Fault quick stop 15: Ready for operation			

Assignment of CAN2					
Inputs **CAN-IN2.**	Function 1	Function 2	Function 3	**Outputs** **CAN-OUT2.**	Function
B0	PS function (POS-PFI1)	Program stop		B0	Trip
B1	PS function	Program reset		B1	Program completed
B2	PS function	Program start	Manual jog off	B2	Traversing speed reached (acceleration completed)
B3	PS function	Start homing / manual		B3	PS function (POS-PF04)
B4	PS function	End of stand-by		B4	PS function
B5	PS function	New travel profile parameters		B5	PS function
B6	PS function	No position control		B6	PS function
B7	PS function	Cancel PS		B7	PS function
B8 - B28	PS function			B8 - B28	PS function
B29	PS function (POS-PFI30)			B29	PS function
B30	PS function			B30	PS function
B31	PS function			B31	PS function (POS-PF032)

Assignment of CAN3			
Input	Function	**Output**	Function
CAN-IN2.D1			

Special functions			
Input	Function	**Output**	Function
C0471.B1	Activate S-profiles		

4.2 Example 2: Spray nozzle control

The combination of the spray nozzle control and the positioning of the workpiece are required for printing machines and painting equipment. Previously a cam controller was used. However, mechanical inaccuracies and wear often led to bad results. The absolute positioning in the 9300 servo position controllers and open control structure enables the nozzle control to be provided with the corresponding messages. They can be read via a fieldbus or (as shown in the example) output via the terminals.

The spray nozzle control in Fig. 4-3 is an example of absolute positioning, which replaces former applications with mechanical cam groups.
These applications do not require mechanical limit switches or initiators that were used to be necessary to detect the position. Using the evaluation electronics of the 9300 servo position controller, the position information of the fed part is determined and positioned.

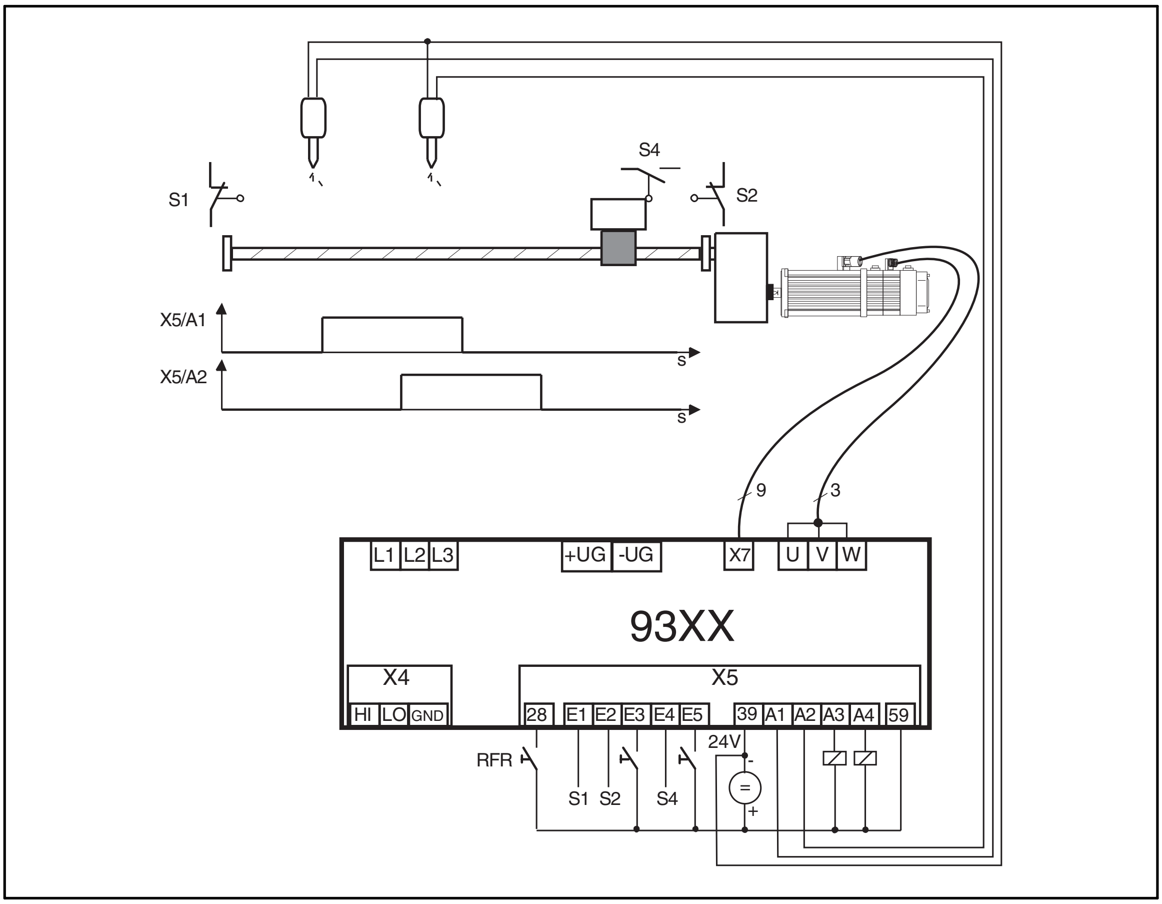


Fig. 4-3 Example of an absolute positioning with the 'SP1' function block (position switch points)

Input	Function
E1	Limit switch (S1) negative direction
E2	Limit switch (S2) positive direction
E3	Start program
E4	Homing switch (S4)
E5	Changeover manual jog / program mode

Basis: Basic configuration 22000

Terminal assignment					
Inputs	Function 1	Function 2	Function 3	**Outputs**	Function
X5/E1	Limit switch negative traversing direction	External setpoint off		X5/A1	Reference known
X5/E2	Limit switch positive traversing direction	External setpoint off		X5/A2	Setpoint position reached
X5/E3	Program start	PS function		X5/A3	Ready for operation
X5/E4	Homing switch	PS function		X5/A4	PS function (POS-PFO1)
X5/E5	Trip reset	Program reset	Manual jog		

Assignment of CAN1			
Inputs	Function	**Outputs CAN-OUT1.**	Function
		W1	Actual speed value
		D1	Actual position
		CAN status word (bit 0.... bit15) 1: Pulse inhibit 2: Reference known 4: M_{max} (low active) 5: Target position reached 6: n_act = 0 7: Controller inhibit CINH 12: Fault warning 13: Fault message 14: Fault quick stop 15: Ready for operation	

Assignment of CAN2					
Inputs CAN-IN2.	Function 1	Function 2	Function 3	**Outputs CAN-OUT2.**	Function
B0	PS function (POS-PFI1)	Program stop		B0	Trip
B1	PS function	Program reset		B1	Program completed
B2	PS function	Program start	Manual jog off	B2	Traversing speed reached (acceleration completed)
B3	PS function			B3	PS function (POS-PFO4)
B4	PS function			B4	PS function
B5	PS function			B5	PS function
B6	PS function			B6	PS function (POS-PFO7)
B7	PS function	Cancel PS		B7	Position switch point 1
B8 - B14	PS function			B8 - B14	Position switch point 2 - 8
B15 - B17	PS function			B15 - B17	Touch probe recognised at X5/E1 - X5/E3
B18	PS function			B18	Touch probe enabled at X5/E4
B19	PS function			B19	PS function (POS-PFO20)
B20 - B28	PS function			B20 - B28	PS function
B29	PS function (POS-PFI30)			B29	PS function
B30				B30	PS function
B31				B31	PS function (POS-PFO32)

Adaptation to the example by extending the basic configuration

Please establish the following connections:

DIGOUT 1 (terminal X5/A1	<->	SP1-STAT1
DIGOUT 2 (terminal X5/A2	<->	SP1-STAT2

Please observe:

- Description of the function block SP1
- GDC mask (if the program is used)
- Operating Instructions/Manual: Chapter ’Commissioning’

4.3 Example 3: Path control

Path control is an interesting solution for warehousing and complex transport tasks. These motion sequences often require complicated and expensive control systems.Thanks to the different function blocks, such as AND, OR, NOR elements, the servo position controller is able to perform a variety of functions and features.

For a multi-axis application, the individual stations can be linked e.g. via the InterBus fieldbus. A higher-level control is required in these cases.

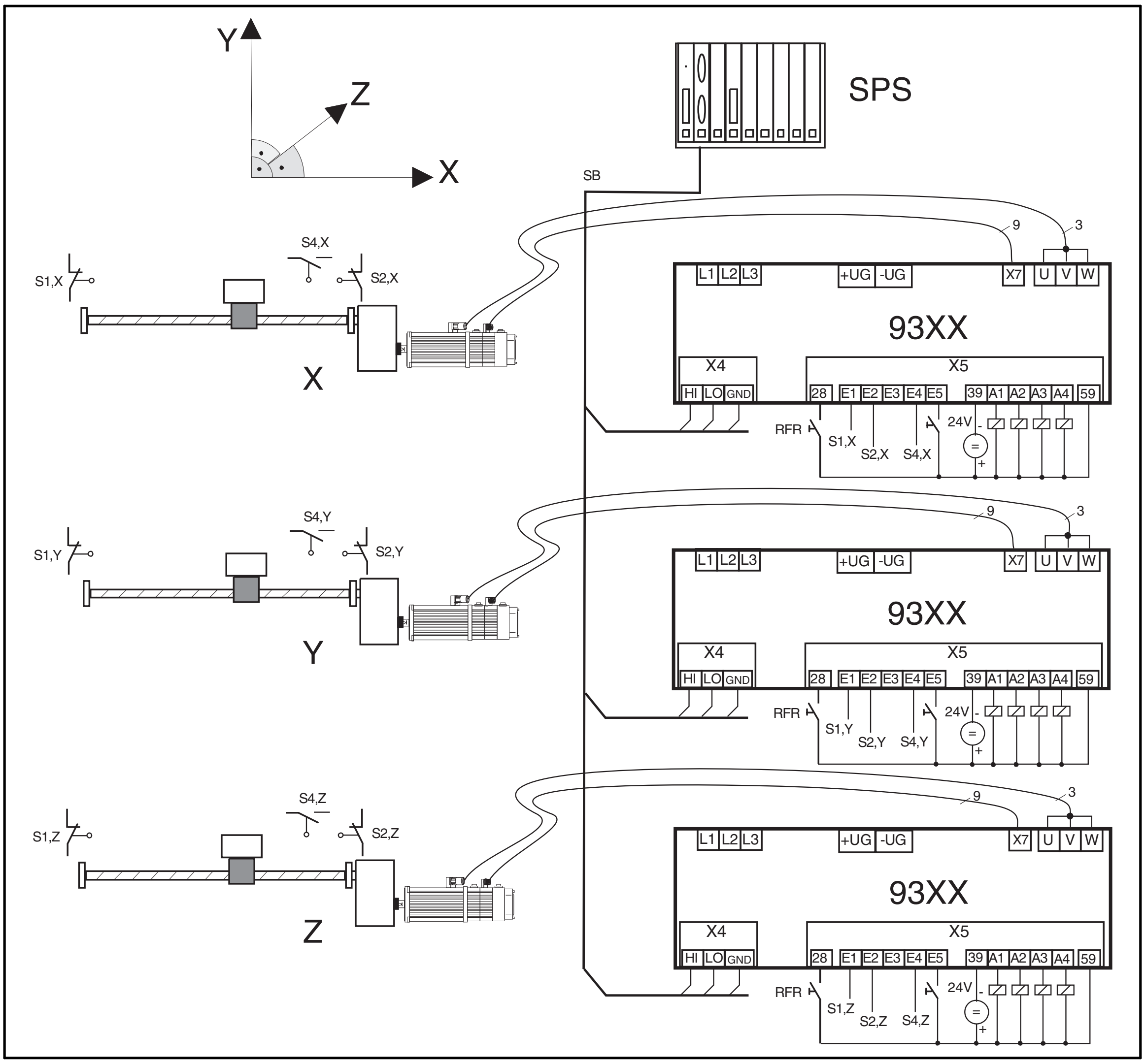


Fig. 4-4 Example of a multi-axis positioning

Input	Function
E1	Limit switch (S1X, S1Y, S1Z) negative traversing direction
E2	Limit switch (S2X, S2Y, S2Z) positive traversing direction
E3	Not assigned
E4	Reference switch (S4X, S4Y, S4Z)
E5	Changeover manual jog / program mode

Abbreviations	Meaning
PLC	Programmable logic controller
SB	System bus (CAN)

Basis: Basic configuration 26000

Terminal assignment					
Inputs	Function 1	Function 2	Function 3	**Outputs**	Function
X5/E1	Negative manual jog	External setpoint off		X5/A1	Synchronisation status
X5/E2	Positive manual jog	External setpoint off		X5/A2	Following error 1
X5/E3	Program start	Actual position = external setpoint	PS function	X5/A3	Ready for operation
X5/E4	Homing switch	PS function		X5/A4	Reference known
X5/E5	Trip reset				

Assignment of CAN1			
Inputs	Function	**Outputs CAN-OUT1.**	Function
		W1	Actual speed value
		D1	Actual position
		CAN status word (bit 0.... bit15) 1: Pulse inhibit 2: Reference known 4: M_{max} (low active) 5: Target position reached 6: n_act = 0 7: Controller inhibit CINH 12: Fault warning 13: Fault message 14: Fault quick stop 15: Ready for operation	

Assignment of CAN2					
Inputs CAN-IN2.	Function 1	Function 2	Function 3	**Outputs CAN-OUT2.**	Function
B0	PS function (POS-PFI1)	Program stop		B0	Trip
B1	PS function	Program reset		B1	Program completed
B2	PS function	Program start	Manual jog off	B2	Traversing speed reached
B3	PS function			B3	PS function (POS-PFO4)
B4	PS function			B4	PS function
B5	PS function			B5	PS function
B6	PS function			B6	PS function
B7	PS function	Cancel PS		B7	PS function
B8 - B29	PS function			B8 - B29	PS function
B30				B30	PS function
B31				B31	PS function (POS-PFO32)

Assignment of CAN3			
Input CAN-IN2.	Function	**Outputs**	Function
D1			

Adaptation to the example by extending the basic configuration

Please establish the following connections:

POS-MANU-NEG	<->	CAN-IN2.B9
POS-MANU-POS	<->	CAN-IN2.B10B1
OR1-IN1	<->	FIXED0
OR1-IN2	<->	FIXED0
POS-LIM-NEG	<->	DIGIN1
POS-LIM-POS	<->	DIGIN2
POS-MANUAL	<->	CAN-IN2.B11
POS-LOOP-INH	<->	CAN-IN2.B4
POS-ABS-SET	<->	CAN-IN2.B4
POS-PSET-SWT	<->	NOT2-OUT
NOT2-IN	<->	CAN-IN2.B11

Function of the ’Path control’ after changing the configuration

Input	**Level**	**Function**	
CAN-IN2.B4	HIGH	Switch off position control circuit	Accept position setpoint as actual position
CAN-IN2.B9	HIGH	Manual operation in negative traversing direction	
CAN-IN2.B10	HIGH	Manual operation in positive traversing direction	
CAN-IN2.B11	HIGH	Activate manual operation	

4.3.1 Commissioning of the path control

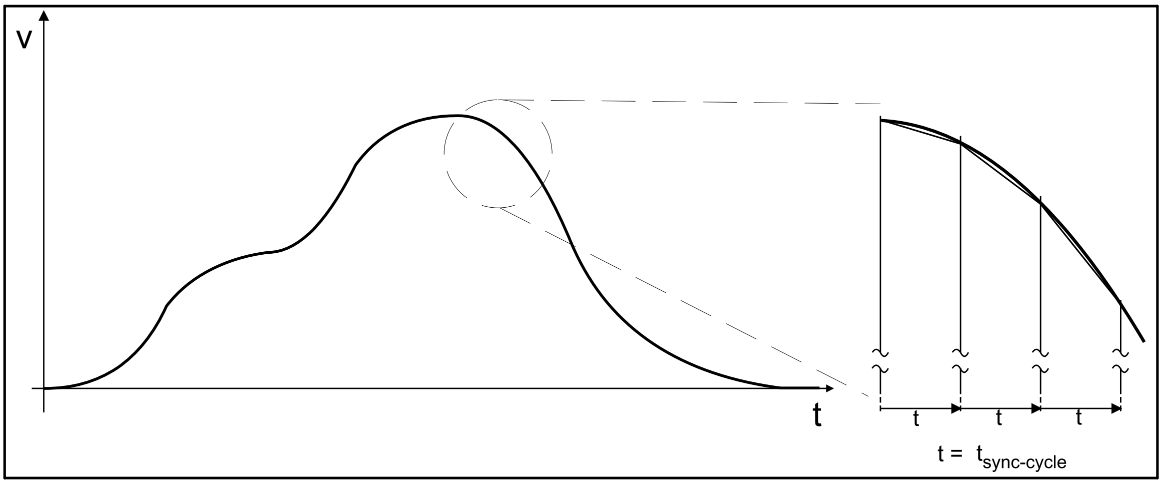


Fig. 4-5 Example of a travel profile

How to commission the system bus (CAN)

- Control: slave 1 (drive X)
  - Node addresses: C0350 = 1
  - Position setpoint on bytes 1 to 4 (see description CAN-IN3)
  - CAN-IN3 identifier = 385
  - Baud rate: C0351 → Adapt to control
    Reset mode: C0358 = 1
    Sync mode: C1120 = 1
    Sync cycle: C1121 → According to the time interval between the sync telegram and the control
  - Actual value = set setpoint (following error = 0)
    CAN-IN2.B4 = 1 (afterwards set CAN-IN2.B4 = 0)
- Control: slave 2 (drive Y)
  Node addresses 0350 = 2
  - CAN-IN3 identifier = 386
  - As slave 1
- Control: slave 3 (drive Z)
  Node addresses C0350 = 3
  - CAN-IN3 identifier = 387 (otherwise as slave 1)

- Telegram sequence
  - – Send new position setpoint to slave 1, slave 2 and slave 3
  - – Send sync telegram
  - – All slaves reply with CAN-OUT1

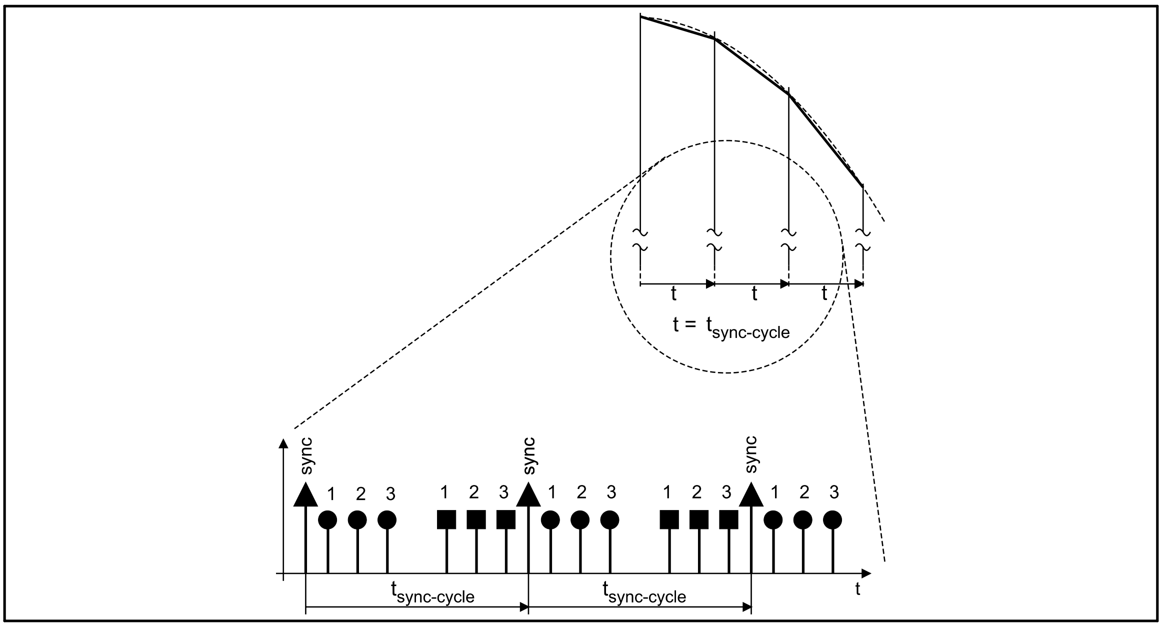


Fig. 1 Sequence of communication between master and slaves

Character	Explanation
●	Response of the controller (CAN-IN1)
■	Send setpoint position (from the master) to the controller
1	Slave 1
2	Slave2
3	Slave 3

Input of the target position by an external control (here: PLC)

- The setpoint position is determined by cyclic set phase increments ($t_{sync-cycle}$) in increments of milliseconds (± 150µs).
  The input must be crystal-precise in the long term.
- The POS function block calculates the speed and the acceleration.
- Inputs in v_{max} (C1240) and a_{max} (C1250) have no effect.
- This means that speed profiles are possible in any form (e.g. cams).
- Activation by POSD-PSET-SWT = HIGH (e.g. FIXED1)

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

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