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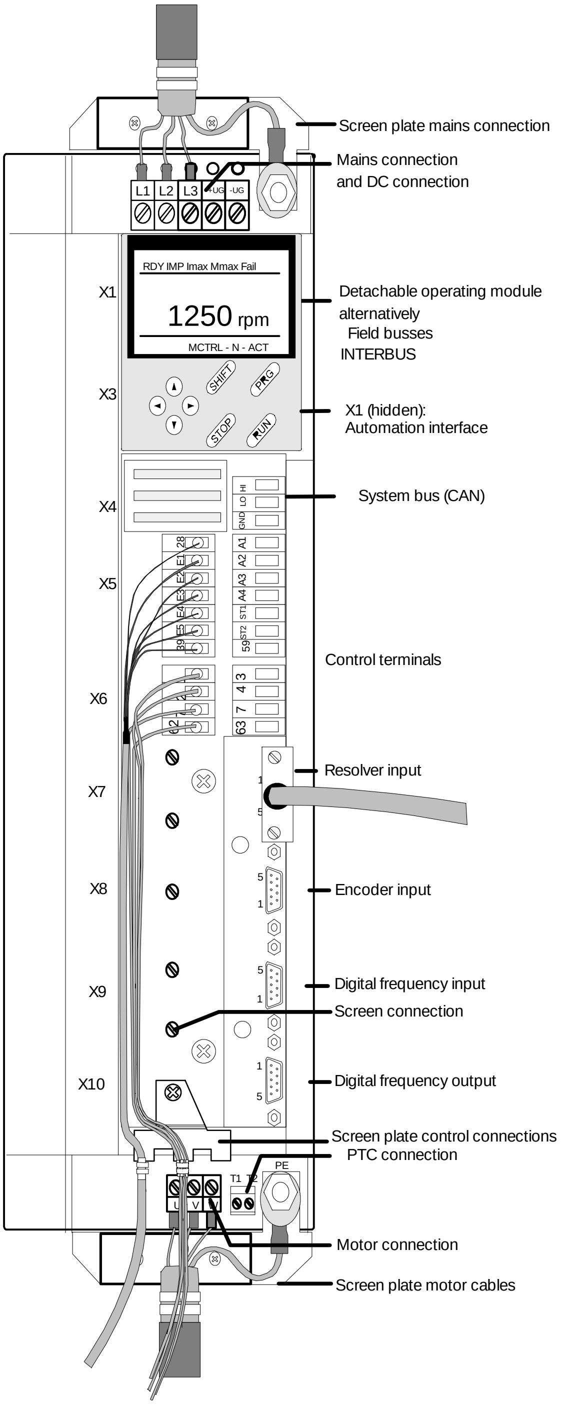
EDS9300U
00411242

Lenze

Manual

Global Drive

9300 Servo position controller


Screen plate mains connection
Mains connection
and DC connection
L1
L2
L3
+UG
-UG
RDY IMP Imax Mmax Fail
1250 rpm
MCTRL - N - ACT
SHIFT
PRG
STOP
RUN
Detachable operating module
alternatively
Field busses
INTERBUS
X1 (hidden):
Automation interface
System bus (CAN)
Control terminals
Resolver input
Encoder input
Digital frequency input
Screen connection
Digital frequency output
Screen plate control connections
PTC connection
T1
T2
PE
Motor connection
Screen plate motor cables
X1
X3
X4
X5
X6
X7
X8
X9
X10

K35.0002

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B	**Technical data**	●	●	●	●	●
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C	**Commissioning** **During operation**		●	●	●	●
	– Manual Oscilloscope function					
D	**Configuration**		D1.1	D2.1	D3.1	D4.1
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F	**DC bus connection of several drives** – Operating Instructions 9340 regenerative power supply	●				
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I	**Accessories and motors**	●				
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M	**Glossary** **Table of keywords**	●	●	●	●	●

Explanation of symbols: ● part of the corresponding Manual

All documentation listed here contains a type designation and a material number at the top left edge.

The features and data specified in your Manual correspond to the controller version at the time of printing (print date: see inside cover of the parts). Lenze strives to keep all information up to the state of the latest controller version. If you should still find differences to your Manual, we kindly ask you to refer to the Operating Instructions included in the scope of supply or to contact your Lenze representative directly.

EDS9300UE-PA
00411233

Lenze

Manual
Part A

Table of contents

Preface and general information

Global Drive

Servo position controller 9300

This documentation is valid for 9300 position controllers as of version:

33.932X	EP	2x	1x		(9321 - 9329)
33.933X	EP	2x	1x		(9330 - 9332)
33.932X	CP	2x	1x	- V003	Cold Plate (9321 - 9328)

Type

Desgin:
E = Enclosure IP20
C = Cold Plate
xK = Cam profiler
xP = Position controller
xR = Register controller
xS = Servo inverter

Hardware level and index

Software level and index

Variant

Explanation

All indications given in these Operating instructions have been selected carefully and comply with the hardware and software described. Nevertheless, deviations cannot be ruled out. We do not take any responsibility or liability for damages which might possibly occur. Required corrections will be made in the following editions.

Version 2.0 09/99

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Contents

1 Preface and general information

1.1 How to use this Manual

- This Manual supplements the Operating Instructions of the servo position controller 93XX.
- It contains the Operating Instructions which were valid when the Manual was printed with additional information on systems engineering, functionality and accessories.
  – In case of doubt, the Operating Instructions attached to the 93XX servo position controller is valid.
- The Manual assists you in selecting and dimensioning the 93XX servo position controller and the accessories to ensure a safe and trouble-free operation. It contains safety information which must be observed.
- The Manual must always be in a complete and perfectly readable state.

1.1.1 Terminology used

Term	In the following text used for
93XX	Any type of servo position controller (types 9321 ... 9332)
Controller	Servo position controller 93XX
Drive system	Drive systems with servo position controllers 93XX and other Lenze drive components

1.1.2 What is new?

Version	Id. No.	Modifications
1.0 12/97	00398839	First edition
2.0 09/99	00411242	Types 9321 to 9324 with 200% overcurrent, new function “Automatic control parameter identification”

1.2 Legal regulations

Labelling	**Nameplate**	**CE-identification**	**Manufacturer**
	Lenze controllers are unambiguously designated by the contents of the nameplate.	Conforms to the EC Low-Voltage Directive	Lenze GmbH & Co KG Postfach 101352 D-31763 Hameln
Application as directed	**Servo position controller 93XX** • must only be operated under the conditions prescribed in these Instructions. • are components – for open and closed loop control of variable speed drives with PM synchronous motors, asynchronous servo motors or asynchronous standard motors. – for installation in a machine – for assembly with other components to form a machine. • are electric units for the installation into control cabinets or similar enclosed operating housing. • comply with the requirements of the Low-Voltage Directive. • are not machines for the purpose of the Machinery Directive. • are not to be used as domestic appliances, but only for industrial purposes. **Drive systems with 93XX servo position controllers** • comply with the EMC Directive if they are installed according to the guidelines of CE-typical drive systems. • can be used – for operation at public and non-public mains – for operation in industrial premises and residential areas. • The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed as inappropriate!**		
Liability	• The information, data, and notes in these instructions met the state of the art at the time of printing. Claims on modifications referring to controllers which have already been supplied cannot be derived from the information, illustrations, and descriptions. • The specifications, processes, and circuitry described in these instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. • The specifications in these Instructions describe the product features without guaranteeing them. • Lenze does not accept any liability for damage and operating interference caused by: – Disregarding the operating instructions – Unauthorized modifications to the controller – operating errors – improper working on and with the controller		
Warranty	• Warranty conditions: see Sales and Delivery Conditions of Lenze GmbH & Co KG. • Warranty claims must be made to Lenze immediately after detecting the deficiency or fault. • The warranty is void in all cases where liability claims cannot be made.		
Disposal	**Material**	**recycle**	**dispose**
	Metal	●	-
	Plastic	●	-
	Assembled PCBs	-	●

1.3 EC directives/Declaration of conformity

1.3.1 What is the purpose of EC directives?

EC directives are issued by the European Council and are intended for the determination of common technical requirements (harmonization) and certification procedures within the European Community. At the moment, there are 21 EC directives of product ranges. The directives are or will be converted to national laws of the member states. A certification issued by one member state is valid automatically without any further approval in all other member states.

The texts of the directive are restricted to the essential requirements. Technical details are or will be determined by European harmonized standards.

1.3.2 What does the CE mark imply?

After a verification, the conformity according to the EC directives is certified by affixing a CE mark. Within the EC there are no commercial barriers for a product with the CE mark.

The attachment of a declaration of conformity is not necessary for most of the directives. Users or customers are therefore not aware which of the 21 EC Directives comply with a certain product and which harmonized standards were considered in the evaluation procedure of conformity.

Controllers with the CE mark exclusively correspond to the Low Voltage Directive. So far, only recommendations were given for the compliance with the EMC regulation. In this case, the user himself has to prove the compliance with the CE directives for the installation of a machine. Lenze has already given proof of the compliance with the CE directives and confirmed this by the declaration of conformity to the EMC CE directive.

1.3.3 EC Low Voltage Directive

(73/23/EEC)

amended by: CE Mark Directive (93/68/EEC)

General

- The Low Voltage Directive is effective for all electrical equipment for use with a rated voltage between 50 V and 1000V V AC and between 75 V and 1500 V DC and with normal ambient conditions. The use of e.g. electrical equipment in explosive atmospheres and electrical parts in passenger and goods lifts are excepted.
- The objective of the Low Voltage Directive is to ensure that only electrical equipment which does not endanger the safety of persons or animals is placed on the market. It should also be designed to conserve material assets.

1.3.3.1 EC Declaration of Conformity ’95

for the purpose of the EC Low Voltage Directive (73/23/EEC)

amended by: CE Mark Directive (93/68/EEC)

The 93XX controllers are developed, designed, and manufactured in compliance with the above mentioned EC directive under the sole responsibility of

Lenze GmbH & Co KG, Postfach 10 13 52, D-31763 Hameln

Considered standards:

Standard	
DIN VDE 0160 5.88 + A1 / 4.89 + A2 / 10.88 EN 50178 Classification VDE 0160 / 11.94	Electronic equipment for use in electrical power installations
DIN VDE 0100	Standards for the erection of power installations
EN 60529	IP Degrees of protection
IEC 249 / 1 10/86, IEC 249 / 2-15 / 12/89	Base material for printed circuits
IEC 326 / 1 10/90, EN 60097 / 9.93	Printed circuits, printed boards
DIN VDE 0110 /1-2 /1/89 /20/ 8/90	Creepage distances and clearances

Hameln, 01 January,1997

(i. V. Langner)
Product Manager

(i. V. Lackhove)
Project Manager

1.3.4 EC Directive Electromagnetic Compatibility

(89/336/EEC)

amended by: First Amendment Directive (92/31/EEC)
CE Mark Directive (93/68/EEC)

General

- The EC Electromagnetic Compatibility Directive is effective for "devices" which may cause electromagnetic interference or the operation of which may be impaired by such interference.
- The aim is to limit the generation of electromagnetic interference such that an operation without interferences of radio and telecommunication systems and other equipment is possible. The devices must also show an appropriate resistance against electromagnetic interference to ensure the application as directed.
- Controllers cannot be operated on their own. Controllers cannot be evaluated on their own in terms of EMC. Only after the integration of the controllers into a drive system, can this system be tested concerning the objectives of the EC EMC Directive and the compliance with the "Law about the Electromagnetic Compatibility of Devices".
- Lenze has evaluated the conformity of controllers on defined drive systems. These evaluated drive systems are called "CE-typical drive system" in the following.

  Therefore, the user of the controllers can
  – either determine the system components and their implementation into a drive system himself and declare the conformity under his own responsibility,
  – or install the drive system according to the CE-typical drive system evaluated by the inverter manufacturer who has already proved the conformity.

Components of the CE typical drive system

System component	Specification
Controller	Controller types 93XX series For the type designation refer to the first cover page
Mains filter A/B	For data and filter assignment see chapter "Ratings"
Motor cable	Screened power cable with tinned E-CU braid with a minimum of 85% optical coverage.
Mains cable between mains filter and controller	As from cable length 300 mm: Screened power cable with tinned E-CU braid with a minimum of 85% optical coverage.
Control cables	Screened signal cable type LIYCY
Motor	Standard three-phase asynchronous motor, servo synchronous motor, servo asynchronous motor Lenze types DXRA, MDXKX or similar

- Controller, RFI filter and mains choke are located on a common mounting plate.
- The system components were wired according to chapter 4 "Electrical Installation".

1.3.4.1 EC Declaration of Conformity '95

in the sense of Electromagnetic Compatibility (89/336/EEC)

amended by: First Amendment Directive (92/31/EEC)
CE Mark Directive (93/68/EEC)

The 93XX controllers are no independent devices in the sense of the law about electromagnetic compatibility (EMVG of 9 Nov., 92 and 1st EMVGÄndG of 30 Aug, 95). The controller can only be evaluated in terms of EMC after it has been implemented into a drive system.

Lenze GmbH & Co KG, Postfach 10 13 52, D-31763 Hameln

declares the conformity of the described "CE-typical drive system" with the 93XX controllers to the above mentioned EC Directive.

The conformity evaluation is based on the working paper of the product standard for drive systems:

IEC 22G-WG4 5/94	EMC product standard including specific test methods for power drive systems

Considered generic standards:

Generic standard	
EN 50081-1 /92	Generic standard for the emission of noise Part 1: Residential area, commercial premises, and small businesses
EN 50081-2 /93 (used in addition to the requirements of IEC 22G)	Generic standard for the emission of noise Part 2: Industrial premises The emission of noise in industrial premises is not limited in IEC 22G.
prEN 50082-2 3/94	Generic standard for noise immunity Part 2: Industrial premises The requirements of noise immunity for residential areas were not considered, since these are less strict.

Considered basic standards for the test of the noise emission:

Basic standard	Test	Limit value
EN 55022 7/92	Radio interference housing and mains Frequency range 0.15 - 1000 MHz	Class B for use in residential areas and commercial premises
EN 55011 7/92 (used in addition to the requirements of IEC 22G)	Radio interference housing and mains Frequency range 0.15 - 1000 MHz The emission of noise in industrial premises is not limited in IEC 22G.	Class A for use in industrial premises
IEC 801-2 /91	Electrostatic discharge on housing and heatsink	Severity 3 6 kV for contact, 8 kV clearance
IEC 1000-4-3	Electromagnetic fields Frequency range 26 - 1000 MHz	Severity 3 10 V/m
ENV 50140 /93	High-frequency field Frequency range 80 - 1000 MHz, 80% amplitude-modulated	Severity 3 10 V/m
	Fixed frequency 900 MHz with 200 Hz, 100 % modulated	10 V/m
IEC 801-4 /88	Fast transients, burst on power terminals	Severity 3 2 kV / 5 kHz
	Burst on bus and control cables	Severity 4 2 kV / 5 kHz
IEC 801-5	Surge test mains cables	Installation class 3

Hameln, 01 January,1997

(i. V. Langner)
Product Manager

(i. V. Lackhove)
Project Manager

1.3.5 EC Machinery Directive

(89/392/EEC)

amended by: First Amendment Directive (91/368/EEC)
Second Amendment Directive (93/44/EEC)
CE Mark Directive (93/68/EEC)

General

For the purpose of the Machinery Directive, "machinery" means an assembly of linked parts or components, at least one of which moves, with the appropriate actuators, control and power circuits, etc., joined together for a specific application, in particular for the processing, treatment, moving or packaging of a material.

1.3.5.1 EC Manufacturer's Declaration

in the sense of the EC Machinery Directive (89/392/EEC)

amended by: First Amendment Directive (91/368/EEC)
Second Amendment Directive (93/44/EEC)
CE Mark Directive (93/68/EEC)

The 93XX controllers are developed, designed, and manufactured under the sole responsibility of

Lenze GmbH & Co KG, Postfach 10 13 52, D-31763 Hameln

Commissioning of the controllers is prohibited until it is proven that the machine where they are to be installed, corresponds to the EC Machinery Directive.

Hameln, 01 January,1997

(i. V. Langner)	(i. V. Lackhove)
Product Manager	Project Manager

2 Safety information

2.1 See Operating Instructions

Safety information

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Lenze

Manual
Part B

Technical data

Installation

Global Drive

Servo position controller 9300

This documentation is valid for 9300 position controllers as of version:

33.932X	EP	2x	1x		(9321 - 9329)
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Type

Desgin:
E = Enclosure IP20
C = Cold Plate
xK = Cam profiler
xP = Position controller
xR = Register controller
xS = Servo inverter

Hardware level and index

Software level and index

Variant

Explanation

All indications given in these Operating instructions have been selected carefully and comply with the hardware and software described. Nevertheless, deviations cannot be ruled out. We do not take any responsibility or liability for damages which might possibly occur. Required corrections will be made in the following editions.

Version 2.0 09/99

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Part B

3 Technical data

3.1 Features

- Single axis in narrow design
  – thus space-saving installation
- Power range: 370 W to 75 kW
  – uniform control module and thus uniform connection for the control cables over the complete power range
- Heat sink can be separated
  – the cooling can be achieved outside the control cabinet (Push-through or ”Cold Plate technique).
- Power connections from the top (supply) or from the bottom (motor)
  – simple connection for multi-axis applications
- Direct connection of resolver or encoder feedback
  – simple connection via prefabricated system cables (accessories)
  – connecting cables can be plugged
- Point-to-point positioning
  – with or without velocity changeover
- Touch probe positioning
- Absolute or relative positioning
- S-ramps.
- Homing according to different modes
- Manual homing.
- Manual positioning.
- Manual positioning with intermediate stop
- Simple programming via PC
- Application configuration for control functions and input/output signals
  – comprehensive function block library
  – high flexibility in the adaptation of the internal control structure to the application
- Integrated automation interface
  – simple extensions of the controller functions
- System bus for the connection of servo inverters and for the extension of input and output terminals
- Approval of standard devices UL 508, File No. 132659 (listed).
- Approval 9371 BB (BAE) UL 508, File No. 132659 (listed).

3.2 General data/application conditions

Field	Values
Vibration resistance	Germanischer Lloyd, general conditions
Permissible moisture	Humidity class F without condensation (average relative humidity 85 %)
Permissible temperature ranges	during transport of the controller: -25 °C … +70 °C during storage of the controller: -25 °C … +55 °C during operation of the controller: 0 °C … +40 °C without power derating +40 °C … +55 °C with power derating (units 9321-9326) +40 °C … +50 °C with power derating (units 9327-9332)
Permissible installation height h	h ≤ 1000 m amsl without power derating 1000 m amsl < h ≤ 4000 m amsl with power derating
Permissible pollution	VDE 0110 part 2 pollution degree 2
Noise emission	Requirements to EN 50081-2, EN 50082-1, IEC 22G-WG4 (Cv) 21 Limit value class A to EN 55011 (industrial premises) with mains filter A Limit value class B to EN 55022 (residential area) with mains filter B and installation in control cabinet
Noise immunity	Limit values maintained using mains filter. Requirements to EN 50082-2, IEC 22G-WG4 (Cv) 21 . **Requirements** – **Standard** – **Severity** Running time – EN61000-4-2 – 3, i.e. 8 kV with air discharge and 6 kV with contact discharge RF interference (enclosure) – EN61000-4-3 – 3, i.e. 10 V/m; 27 to 1000 MHz Burst – EN61000-4-4 – 3/4, i.e. 2 kV/5 kHz Surge (on mains cable) – IEC 1000-4-5 – 3, i.e. 1,2/50 µs, 1 kV phase-phase, 2 kV phase-PE
Insulation strength	Overvoltage category III to VDE 0110
Packaging	to DIN 4180 9321 to 9332: Delivery packaging
Type of protection	IP20 IP41 on the heat-sink side for thermal separation (punching) NEMA 1: Protection against contact
Approvals	CE: Low-Voltage Directive UL508: Industrial Control Equipment UL508C: Power Conversion Equipment

3.3 Rated data

3.3.1 Types 9321 to 9325

	Type	**EVS9321-EP**	**EVS9322-EP**	**EVS9323-EP**	**EVS9324-EP**	**EVS9325-EP**
	Order No.	EVS9321-EP	EVS9322-EP	EVS9323-EP	EVS9324-EP	EVS9325-EP
	Type	**EVS9321-CP**	**EVS9322-CP**	**EVS9323-CP**	**EVS9324-CP**	**EVS9325-CP**
	Order No.	EVS9321-CP	EVS9322-CP	EVS9323-CP	EVS9324-CP	EVS9325-CP
Mains voltage	V_r [V]	320 V ± 0% ≤ V_r ≤ 528 V ± 0% ; 45 Hz … 65 Hz ± 0%				
Alternative DC supply	V_G [V]	460 V ± 0% ≤ V_{DC} ≤ 740 V ± 0%				
Mains current with mains filter Mains current without mains filter	I_r [A]	1.5 2.1	2.5 3.5	3.9 5.5	7.0 -	12.0 16.8
Ratings for operation at a mains: 3 AC / 400V / 50Hz/60Hz						
Motor power (4 pole ASM)	P_r [kW]	0.37	0.75	1.5	3.0	5.5
	P_r [hp]	0.5	1.0	2.0	4.0	7.5
Output power U, V, W (8kHz*)	S_{r8} [kVA]	1.0	1.7	2.7	4.8	9.0
Output power +U_G, -U_G 2)	P_{DC} [kW]	2.0	0.75	2.2	0.75	0
Output current (8 kHz*)	I_{r8} [A]	1.5	2.5	3.9	7.0	13.0
Output current (16 kHz*)	I_{r16} [A]	1.1	1.8	2.9	5.2	9.7
Max. output current (8 kHz*)1)	I_{max8} [A]	2.3	3.8	5.9	10.5	19.5
Max. output current (16 kHz*)1)	I_{max16} [A]	1.7	2.7	4.4	7.8	14.6
Max. standstill current (8 kHz*)	I_{08} [A]	2.3	3.8	5.9	10.5	19.5
Max. standstill current (16 kHz*)	I_{016} [A]	1.7	2.7	4.4	7.8	14.6
Ratings for operation at a mains: 3 AC / 480V / 50Hz/60Hz						
Motor power (4 pole ASM)	P_r [kW]	0.37	0.75	1.5	3.0	5.5
	P_r [hp]	0.5	1.0	2.0	4.0	7.5
Output power U, V, W (8kHz*)	S_{r8} [kVA]	1.2	2.1	3.2	5.8	10.8
Output power +U_G, -U_G 2)	P_{DC} [kW]	2.0	0.75	2.2	0.75	0
Output current (8 kHz*)	I_{r8} [A]	1.5	2.5	3.9	7.0	13.0
Output current (16 kHz*)	I_{r16} [A]	1.1	1.8	2.9	5.2	9.7
Max. output current (8 kHz*)1)	I_{max8} [A]	2.3	3.8	5.9	10.5	19.5
Max. output current (16 kHz*)1)	I_{max16} [A]	1.7	2.7	4.4	7.8	14.6
Max. standstill current (8 kHz*)	I_{08} [A]	2.3	3.8	5.9	10.5	19.5
Max. standstill current (16 kHz*)	I_{016} [A]	1.7	2.7	4.4	7.8	14.6
Motor voltage	V_M [V]	0 - 3 V_{mains}				
Power loss (operation with I_{rx})	P_{loss} [W]	100	110	140	200	260
Power derating	[%/K] [%/m]	40°C < T_{amb} < 55 °C: 2 %/K (not UL approved) 1000 m amsl < h ≤ 4000 m amsl: 5%/1000m				
Weight	m [kg]	3.5	3.5	5.0	5.0	7.5

1) The currents apply to a periodical load cycle with 1 minute overcurrent with the current mentioned here and 2 minutes base load with 75% I_{rx}

2) When operated under rated load, the controller can supply this power additionally.

* Chopper frequency of the inverter (C0018)

3.3.2 Types 9321 to 9324 with 200 % overcurrent

	Type	EVS9321-EP	EVS9322-EP	EVS9323-EP	EVS9324-EP
Ratings for operation at a mains: 3 AC / 400V / 50Hz/60Hz					
Motor power (4 pole ASM)	P_r [kW]	0.37	0.75	1.5	3.0
	P_r [hp]	0.5	1.0	2.0	4.0
Output power U, V, W (8 kHz)	S_{r8} [kVA]	1.0	1.7	2.7	4.8
Output current (8 kHz) 2)	I_{r8} [A]	1.5	2.5	3.9	7.0
Output current (16 kHz) 2)	I_{r16} [A]	1.1	1.8	2.9	5.2
Max. output current (8 kHz)1)	I_{max8}[A]	3.0	5.0	7.8	14.0
Max. output current (16 kHz)1)	I_{max16} [A]	2.2	3.6	5.8	10.4
Max. standstill current (8 kHz)	I_{08} [A]	3.0	5.0	7.8	14.0
Max. standstill current (16 kHz)	I_{016} [A]	2.2	3.6	5.8	10.4
Ratings for operation at a mains: 3 AC / 480V / 50Hz/60Hz					
Motor power (4 pole ASM)	P_r [kW]	0.37	0.75	1.5	3.0
	P_r [hp]	0.5	1.0	2.0	4.0
Output power U, V, W (8 kHz)	S_{r8} [kVA]	1.2	2.1	3.2	5.8
Output current (8 kHz) 2)	I_{r8} [A]	1.5	2.5	3.9	7.0
Output current (16 kHz) 2)	I_{r16} [A]	1.1	1.8	2.9	5.2
Max. output current (8 kHz)1)	I_{max8} [A]	3.0	5.0	7.8	14.0
Max. output current (16 kHz)1)	I_{max16} [A]	2.2	3.6	5.8	10.4
Max. standstill current (8 kHz)	I_{08} [A]	3.0	5.0	7.8	14.0
Max. standstill current (16 kHz)	I_{016} [A]	2.2	3.6	5.8	10.4

1) The currents apply to a periodical load cycle with 10 seconds overcurrent with the current mentioned here and 50 seconds base load with 44 % I_{rx}

Main point for individual situations	Settings under code C0022	Thermal continuous current	Max. current phase	Recovery phase
Continuous power	$I_{max} \leqq$ 150 % I_{rX}	100 % I_{rX}	150 % I_{rX} for 60 s	75 % I_{rX} for 120 s
Peak power	$I_{max} >$ 150 % I_{rX}	70 % I_{rX}	200 % I_{rX} for 10 s	44 % I_{rX} for 50 s

2) The output current INx is only valid for a motor current adjustable under C022 which has not exceeded 150% rated current (nameplate).
If the maximum current is increased to a value higher than this, the continuous current is automatically reduced to 70 % of its original value.

Overcurrent diagram: 🕮 7-268

All other data: 🕮 3-3

Note!

The change to I_{max} > 150 % I_{rX} is only possible when the controller is inhibited.

3.3.3 Types 9326 to 9332

	Type	**EVS9326-EP**	**EVS9327-EP**	**EVS9328-EP**	**EVS9329-EP**	**EVS9330-EP**	**EVS9331-EP**	**EVS9332-EP**
	Order No.	EVS9326-EP	EVS9327-EP	EVS9328-EP	EVS9329-EP	EVS9330-EP	EVS9331-EP	EVS9332-EP
	Type	**EVS9326-CP**	**EVS9327-CP**	**EVS9328-CP**				
	Order No.	EVS9326-CP	EVS9327-CP	EVS9328-CP				
Mains voltage	V_r [V]	$320\ V \pm 0\% \leq V_r \leq 528\ V \pm 0\%$; 45 Hz … 65 Hz ± 0%						
Alternative DC supply	V_G [V]	$460\ V \pm 0\% \leq V_G \leq 740\ V \pm 0\%$						
Mains current with mains filter Mains current without mains filter	I_r [A]	20.5 -	27.0 43.5	44.0 -	53.0 -	78.0 -	100 -	135 -
Ratings for operation at a mains: 3 AC / 400V / 50Hz/60Hz								
Motor power (4 pole ASM)	P_r [kW]	11.0	15.0	22.0	30.0	45.0	55.0	75.0
	P_r [hp]	15.0	20.5	30.0	40.0	60.0	73.5	100.0
Output power UVW (8 kHz*)	S_{r8} [kVA]	16.3	22.2	32.6	40.9	61.6	76.2	100.5
Output power $+U_G$, $-U_{DC}$ 2)	P_{DC} [kW]	0	10	4	0	5	0	0
Output current (8 kHz*) 1)	I_{r8} [A]	23.5	32.0	47.0	59.0	89.0	110.0	145.0
Output current (16 kHz*) 1)	I_{r16} [A]	15.3	20.8	30.6	38.0	58.0	70.0	90.0
Max. output current (8 kHz*)	I_{max8} [A]	35.3	48.0	70.5	88.5	133.5	165.0	217.5
Max. output current (16 kHz*)	I_{max16} [A]	23.0	31.2	45.9	57.0	87.0	105.0	135.0
Max. standstill current (8 kHz*)	I_{08} [A]	23.5	32.0	47.0	52.0	80.0	110.0	126.0
Max. standstill current (16kHz*)	I_{016} [A]	15.3	20.8	30.6	33.0	45.0	70.0	72.0
Ratings for operation at a mains: 3 AC / 480V / 50Hz/60Hz								
Motor power (4 pole ASM)	P_r [kW]	11.0	18.5	30.0	37.0	45.0	55.0	90.0
	P_r [hp]	15.0	25.0	40.0	49.5	60.0	73.5	120.0
Output power UVW (8 kHz*)	S_{r8} [kVA]	18.5	25.0	37.0	46.6	69.8	87.3	104.0
Output power $+U_{DC}$, $-U_{DC}$ 2)	P_{DC} [kW]	0	12	4.8	0	6	0	6
Output current (8 kHz*)	I_{r8} [A]	22.3	30.4	44.7	56.0	84.0	105.0	125.0
Output current (16 kHz*)	I_{r16} [A]	14.5	19.2	28.2	35.0	55.0	65.0	80.0
Max. output current (8 kHz*)1)	I_{max8} [A]	33.5	45.6	67.1	84.0	126.0	157.5	187.5
Max. output current (16 kHz*)1)	I_{max16} [A]	21.8	28.8	42.3	52.5	82.5	97.5	120.0
Max. standstill current (8 kHz*)	I_{08} [A]	22.3	30.4	44.7	49.0	72.0	105.0	111.0
Max. standstill current (16kHz*)	I_{016} [A]	14.5	19.2	28.2	25.0	36.0	58.0	58.0
Motor voltage	V_M [V]	0 - 3 V_{mains}						
Power loss	P_{loss} [W]	360	430	640	810	1100	1470	1960
Power derating	[%/K] [%/K] [%/m]	*9326: at 40 °C < T_{amb} < 55 °C: 2%/K (not UL approved)* *9327 - 9332: at 40 °C < T_{amb} < 50 °C: 2.5%/K (not UL approved)* 1000 m amsl < h ≤ 4000 m amsl: 5%/1000m						
Weight	m [kg]	7.5	12.5	12.5	12.5	36.5	59	59

1) The currents apply to a periodical load cycle with 1 minute overcurrent with the current mentioned here and 2 minutes base load with 75% I_{rx}

2) When operated under rated load, the controller can supply this power additionally.

* Chopper frequency of the inverter (C0018)

3.3.4 Fuses and cable cross-sections

Type	Mains input L1, L2, L3, PE/motor connection U, V, W										Input +UG, -UG		
	Operation without mains filter					Operation with mains filter							
	Fuse		E.l.c.b.	Cable cross-section 2)		Fuse		E.l.c.b.	Cable cross-section 2)		Fuse	Cable cross-section 2)	
	VDE	UL	VDE	mm^2	AWG	VDE	UL	VDE	mm^2	AWG		mm^2	AWG
9321	M 6A	5A	B 6A	1	17	M 6A	5A	B 6A	1	17	6.3A	1	17
9322	M 6A	5A	B 6A	1	17	M 6A	5A	B 6A	1	17	6.3A	1	17
9323	M 10A	10A	B 10A	1.5	15	M 10A	10A	B 10A	1.5	15	8A	1.5	15
9324	-	-	-	-	-	M 10A	10A	B 10A	1.5	15	12A	1.5	15
9325	M 32A	25A	B 32A	6	9	M 20A	20A	B 20A	4	11	20A	4	11
9326	-	-	-	-	-	M 32A	25A	B 32A	6	9	40A	6	9
9327	M 63A	63A	-	16	6	35A	35A	-	10	7	50A	10	7
9328	-	-	-	-	-	50A	50A	-	16	5	80A	16	5
9329	-	-	-	-	-	80A	80A	-	25	3	100A	25	3
9330	-	-	-	-	-	100A	100A	-	50	0	2 * 80A 1)	2 * 16	2 * 5
9331	-	-	-	-	-	125A	125 A	-	70	2/0	2 * 100A 1)	2 * 25	2 * 3
9332	-	-	-	-	-	160A	175 A	-	95	3/0	3 * 80A 1)	3 * 16	3 * 5

1) The DC bus fuses are connected in parallel

2) The valid local regulations must be observed

For operation of the controllers in a UL-approved plant:

- Use only UL-approved fuses and fuse holders:
  – 500 V to 600 V in the mains input (AC)
  – 700 V in DC-bus voltage (DC)
  – The activation characteristic is defined by ”H” or ”K5”.
- Use only UL-approved cables.

Tip!

UL-approved fuses and fuse holders can be obtained from, e.g. Bussmann or Ferraz.

Connection of the motor cables

- The protection of the motor cables is not necessary for functional reasons.
- Refer to the data listed in the table ”Operation with mains filter”.

3.3.5 Mains filter

Type	Rated data (uk ≈ 6%)		Lenze order number	
	Mains current	Inductance	for RFI degree A	for RFI degree B
9321	1.5 A	24 mH	EZN3A2400H002	EZN3B2400H002
9322	2.5 A	15 mH	EZN3A1500H003	EZN3B1500H003
9323	4 A	9 mH	EZN3A0900H004	EZN3B0900H004
9324	7 A	5 mH	EZN3A0500H007	EZN3B0500H007
9325	13 A	3 mH	EZN3A0300H013	EZN3B0300H013
9326	24 A	1.5 mH	EZN3A0150H024	EZN3B0150H024
9327	30 A	1.1 mH	EZN3A0110H030	EZN3B0110H030
9328	42 A	0.8 mH	EZN3A0080H042	EZN3B0080H042
9329	60 A	0.54 mH	EZN3A0055H060	EZN3B0055H060
9330	90 A	0.37 mH	EZN3A0037H090	EZN3B0037H090
9331	150 A	0.22 mH	EZN3A0022H150	EZN3B0022H150
9332	150 A	0.22 mH	EZN3A0022H150	EZN3B0022H150

The mains filters for RFI degree B contain additional RFI suppression components.

3.4 Dimensions

The dimensions of the controllers depend on the mechanical installation. (📖 4-1)

Technical data

4 Installation

4.1 Mechanical installation

4.1.1 Important notes

- Use the controllers as built-in devices only!
- If the cooling air contains pollutants (dust, fluff, grease, aggressive gases):
  – Take suitable preventive measures, e.g. separate air duct, installation of filters, regular cleaning, etc.
- Ensure free space!
  – You can install several controllers next to each other without free space in a control cabinet.
  – Ensure unimpeded ventilation of cooling air and outlet of exhaust air!
  – Allow a free space of 100 mm at the top and at the bottom.
- Do not exceed the permissible ambient temperature during operation. (📖 3-2)
- With continuous oscillations or vibrations:
  – Check whether shock absorbers are necessary.

Possible mounting positions

Vertically on the control cabinet back panel with mains connections at the top:

- with enclosed fixing rails or fixing brackets. (📖 4-2)
- thermally separated with external heat sink
  – Push-through technique(📖 4-3)
  – ”Cold plate technique” (📖 4-6)

4.1.2 Standard assembly with fixing rails or fixing brackets

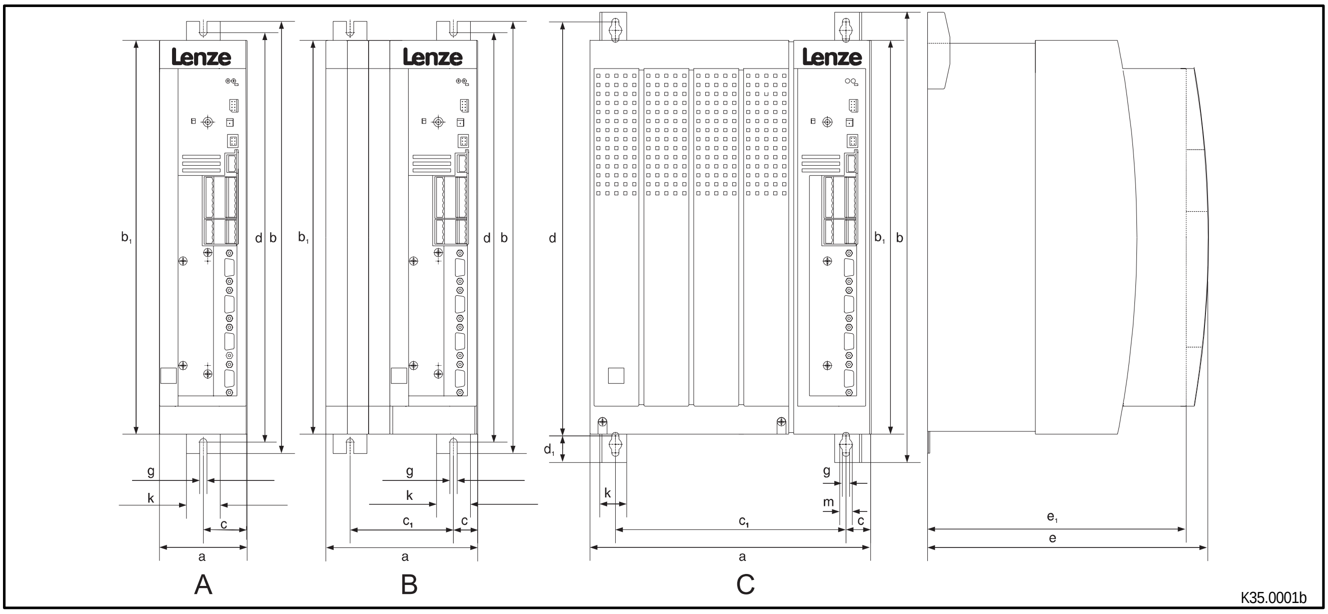


Fig. 4-1 Dimensions for assembly with fixing rails/fixing brackets

Type	Fig.	a	b	b1	c	c1	d	d1	e*	e1	g	k	m
9321, 9322	A	78	384	350	39	-	365	-	250	230	6.5	30	-
9323, 9324	A	97	384	350	48.5	-	365	-	250	230	6.5	30	-
9325, 9326	B	135	384	350	21.5	92	365	-	250	230	6.5	30	-
9327, 9328, 9329	C	250	402	350	22	206	370	24	250	230	6.5	24	11
9330	C	340	672	591	28,5	283	624	38	285	265	11	28	18
9331, 9332	C	450	748.5	680	30.5	389	702	38	285	265	11	28	18

* When using a plug-on fieldbus module:
Observe the free space required for the connection cables

All dimensions in mm

Controllers 9321 to 9326

- Assembly preparation:
  – Take out fixing rail(s) (accessory kit in the box) and mount them on the controller housing

Controllers 9327 to 9332

- Remove cover:
  – Loosen screws (X)
  – Swing cover to the top and detach
  – Take accessory kit out of the interior of the controller
- Assembly preparation:
  – Take out fixing bracket and screws (accessory kit) and mount them on the controller housing

4.1.3 Assembly with thermally separated power stage ("push-through technique")

The heat sink of the controllers 9321 ... 9329 can be mounted outside the control cabinet to reduce the heat generated in the control cabinet. For this, you need an assembly frame with seal (can be ordered from Lenze).

- Distribution of the power loss:
  – Approx. 65% via the separated heat sink (heat sink + blower)
  – Approx. 35 % inside the controller.
- The enclosure of the separated heat sink (heat sink + blower) is IP41.
- The rated data of the controller is still valid.

Preparation for assembly:

1. Lay the halves of the assembly frame into the slot provided on the controller.
2. Push the frame halves together until the ends catch.
3. Slip the seal ring over the heat sink and insert it into the slot provided.

Installation

Dimensions for the types 9321 to 9326

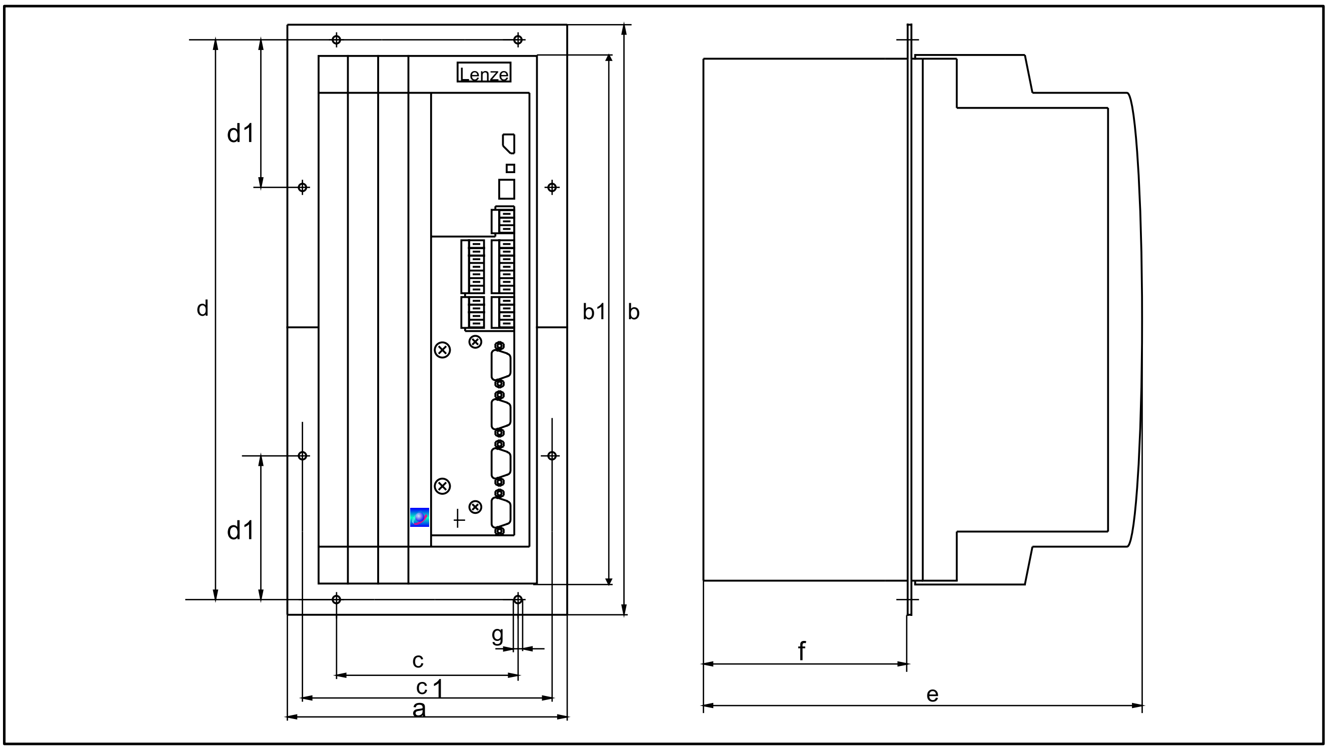


Fig. 4-2 Dimensions for the assembly with thermally separated power stage

Type	a	b	b1	c	c1	d	d1	e*	f	g
9321, 9322	112.5	385.5	350	60	95.5	365.5	105.5	250	92	6.5
9323, 9324	131.5	385.5	350	79	114.5	365.5	105.5	250	92	6.5
9325, 9226	135	385.5	350	117	137.5	365.5	105.5	250	92	6.5

* When using an attachable fieldbus module:
Observe the free space required for the connection cables

All dimensions in mm

Assembly cut-out

Type	Height	Width
9321, 9322	350 ±3	82 ±3
9323, 9324		101 ±3
9325, 9326		139 ±3

Dimensions for the types 9327 to 9329

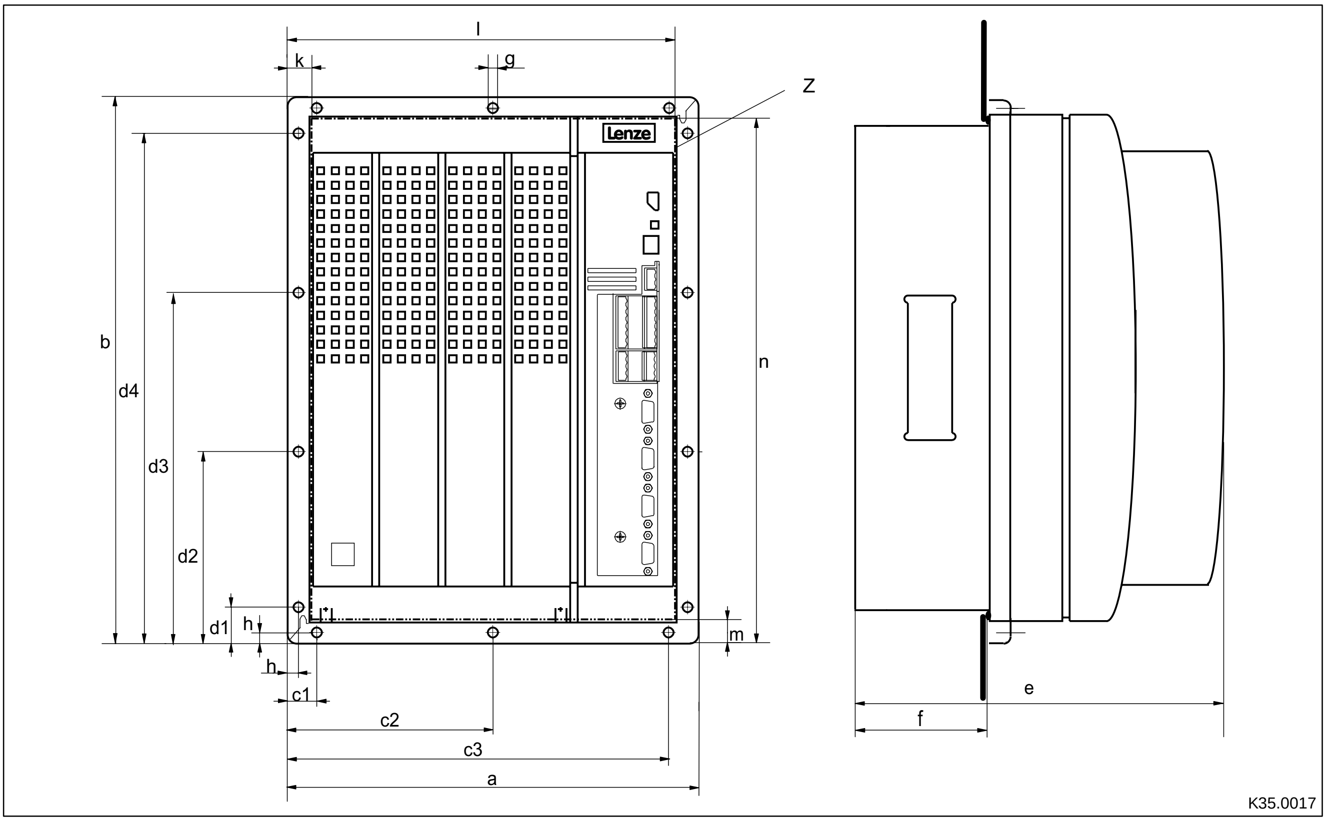


Fig. 4-3 Dimensions for the assembly with thermally separated power stage

Type	a	b	c1	c2	c3	d1	d2	d3	d4	e *)	f	g	h
9327, 9328, 9329	280	379	28	140	252	41	141	238	338	250	90	6	9

Assembly cut-out Z

Type	Height	Width	k	l	m	n
9327, 9328, 9329	338 ±1	238 ±1	20 ±2	259 ±2	20 ±2	359 ±2

* When using an attachable fieldbus module:
Observe the free space required for the connection cables

All dimensions in mm

4.1.4 Assembly of variants

Variant EVS932X-Cx (”Cold plate”)

For installation in a control cabinet with other heat sinks in ”cold plate technique” (x = order designation; more information on the inner cover page).

Dimensions for the types 9321-Cx to 9326-Cx

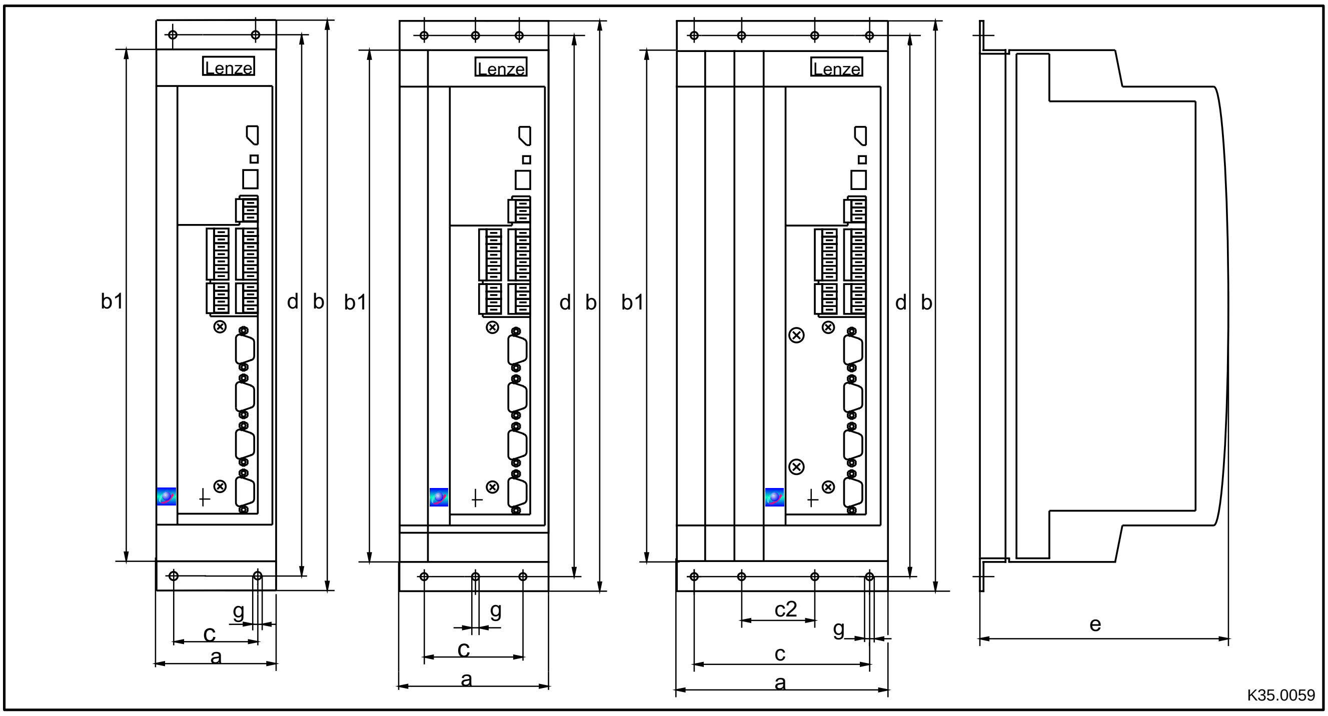


Fig. 4-4 Dimensions for the assembly in ”cold plate technique”

Type	a	b	b1	c	c2	d	e*	g
9321-Cx 9322-Cx	78	381	350	48	-	367	168	6.5
9323-Cx 9324-Cx	97	381	350	67	-	367	168	6.5
9325-Cx 9326-Cx	135	381	350	105	38	367	168	6.5

* When using an attachable fieldbus module: Observe the free space required for the connection cables

All dimensions in mm

Dimensions for the types 9327-Cx and 9328-Cx

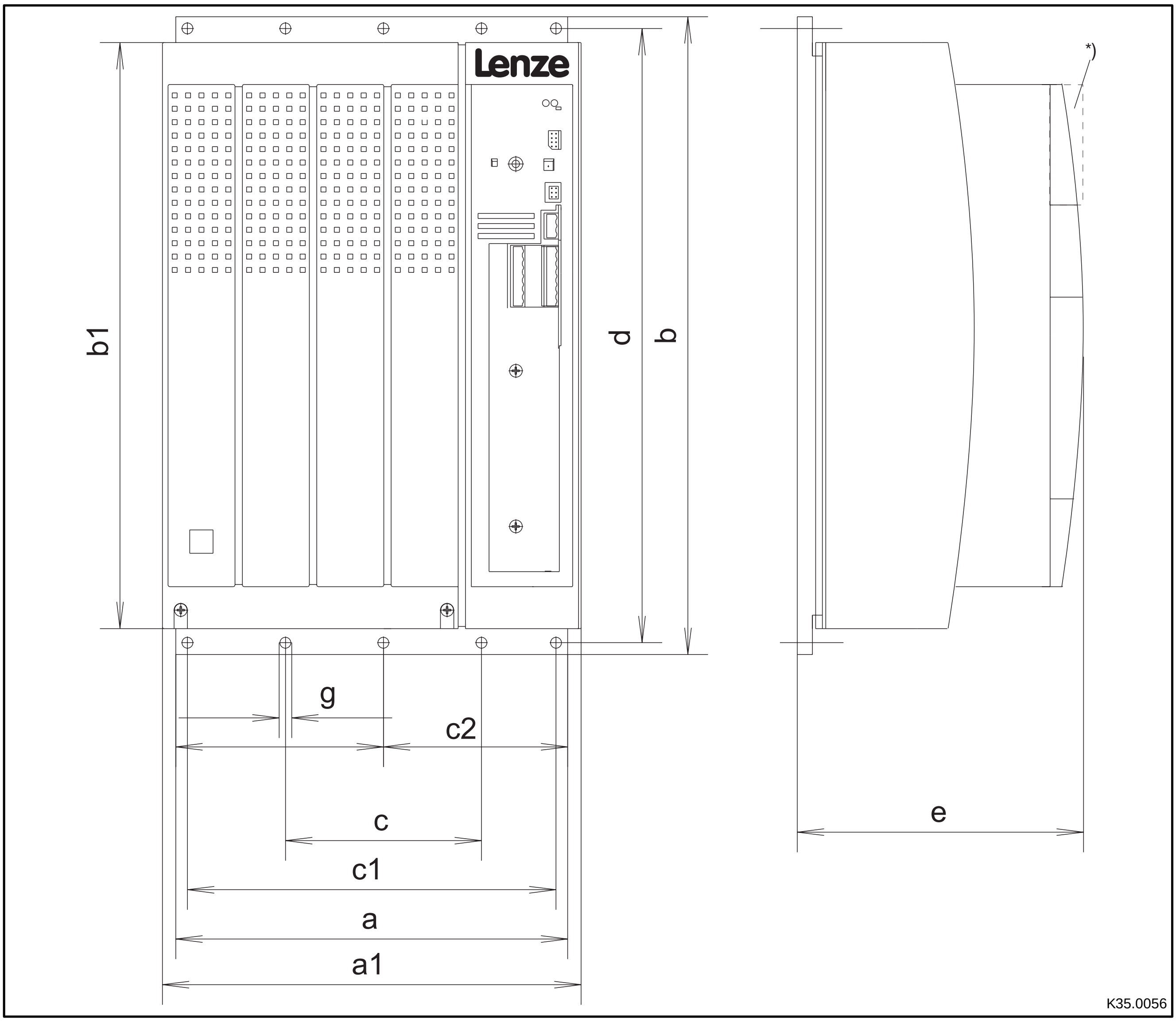


Fig. 4-5 Dimensions for the assembly in "cold plate technique"

Type	a	a1	b	b1	c	c1	c2	d	e*	g
9327-Cx 9328-Cx	234	250	381	350	110	220	117	367	171	6.5

* When using an attachable fieldbus module:
Observe the free space required for the connection cables

All dimensions in mm

Installation

- Observe the following points to comply with the technical data:
  – Ensure sufficient ventilation of the heat sink.
  – The free space behind the control cabinet back panel must be at least 500 mm.
- If several controllers are installed in the control cabinet:
  – Do not install the controllers on top of each other.
- The cooling path must not exceed the thermal resistances stated in the table:

Controller	Cooling path	
Type	Power to be dissipated P_{loss} [W]	$R_{thmax\ heat\ sink}$ [K/W]
9321-Cx	80	0.50
9322-Cx	80	0.50
9323-Cx	100	0.40
9324-Cx	155	0.25
9325-Cx	210	0.19
9326-Cx	360	0.10
9327-Cx	410	0.09
9328-Cx	610	0.06

- The temperature of the cold plate must not exceed +85° C.
- Insertion depth t of the screws into the base plate of the controller:

$$8\ \text{mm} \leq t \leq 10\ \text{mm}$$

- For the bore pattern and surface quality of the heat sink please consult the factory.
- Apply the heat-conductive compound (accessory kit) to the cold plate of the controller.

4.2 Electrical installation

For information about the installation according to EMC, see chapter 4.3. (📖 4-34)

4.2.1 Protection of persons

Danger!
All power terminals carry voltage up to 3 minutes after mains disconnection.

4.2.1.1 Residual-current circuit breakers

Labelling of RCCBs	Meaning
∿	AC-sensitive residual-current circuit breaker (RCCB, type AC)
∿ ⎍	Pulse-current sensitive residual-current circuit breaker (RCCB, type A)
⎓ ∿ ⎍	All-current sensitive residual-current circuit breaker (RCCB, type B)

Definition

In the following text "RCCB" is used for "residual-current circuit breaker".

Protection of persons and animals

DIN VDE 0100 with residual-current operated protective devices (RCCB):
- The controllers are equipped with a mains rectifier. If a short-circuit to frame occurs, a smooth DC residual current can block the activation of the DC sensitive or pulse-current sensitive RCCBs and thus destroy the protective function for all units connected. We therefore recommend:
  - "pulse-current sensitive RCCB" or "all-current RCCB" in systems equipped with controllers with single-phase mains connection (L1/N).
  - "all-current sensitive RCCB" in systems equipped with controllers with three-phase mains connection (L1/L2/L3).

Rated residual current

Please observe the rated residual current for the selection of the RCCB:
- Controller with single-phase mains connection: 30 mA rated residual current
- Controller with three-phase mains connection: 300 mA rated residual current

The RCCB can be activated unintentionally under the following conditions:
- In the event of capacitive leakage currents between the cable screens (especially with wall mounting).
- Simultaneous connection of several inverters to the mains
- If RFI filters are used.

Installation

The RCCB must only be installed between the supplying mains and the controller.

Standards (All-current sentitive RCCB)

All-current sensitive RCCBs are described in the European Standard EN EN 50178 and in the IEC 755.
The EN 50178 has been harmonized and has been effective since October 1997. It replaces the national standard VDE 0160.

4.2.1.2 Insulation

The controllers have an electrical isolation (insulating distance) between the power terminals and the control terminals as well as to the housing:

- Terminals X1 and X5 have a double basic insulation (double insulating distance, safe mains isolation to VDE0160, EN50178). The protection against contact is ensured without any further measures.
- The control inputs and outputs of all controllers are electrically isolated.

Danger!

- Terminals X3, X4, X6, X7, X8, X9, X10 have a single basic insulation (single insulating distance).
- Protection against contact in the event of fault is ensured only by additional measures.
- If an external voltage supply (24V DC) is used, the insulation level of the controller depends on the insulation level of the voltage source.

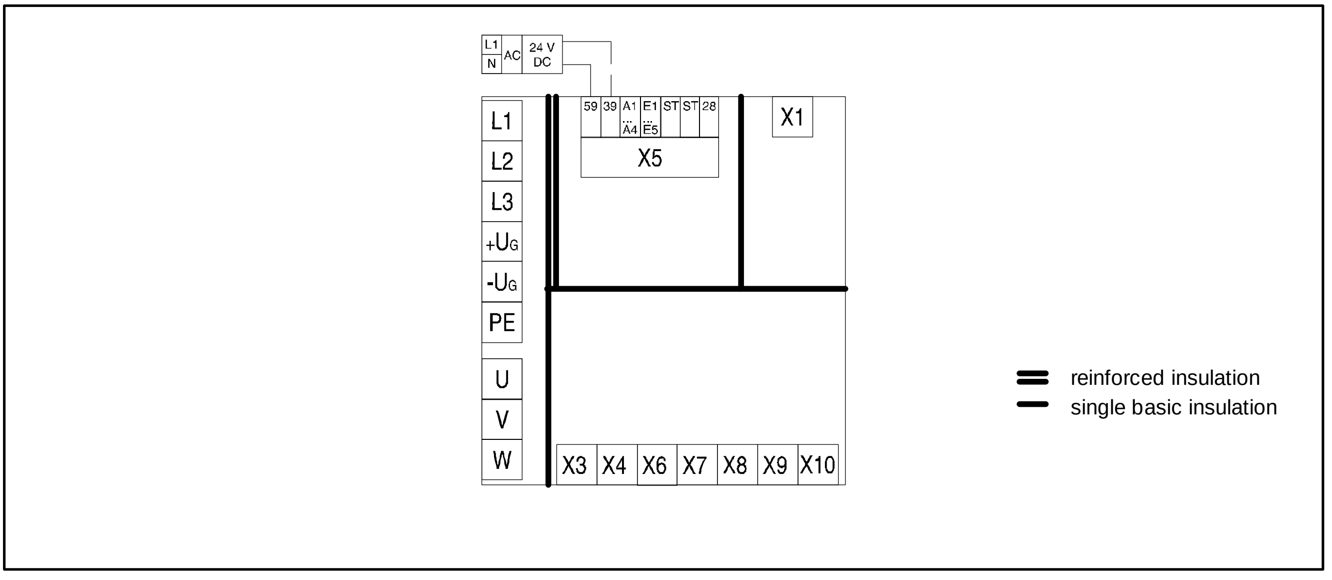


Fig. 4-6 Basic insulation in the controller

4.2.1.3 Replacement of defective fuses

Replace defective fuses with the prescribed type only when no voltage is applied. (📖 3-6)

- For single drives, the controller carries a hazardous voltage up to three minutes after mains disconnection.
- In a DC-bus connection, all controllers must be inhibited and separated from the mains.

4.2.1.4 Mains disconnection

Make a safety disconnection between the controller and the mains only via a contactor at the input side.

- Please observe that all drives connected to the DC bus must be inhibited.

4.2.2 Protection of the controller

Stop!

The controllers contain electrostatically sensitive components.

- Prior to assembly and service operations, the personnel must be free of electrostatic charge:
  – Discharge by touching the PE fixing screw or another grounded metal part in the control cabinet.

- Length of the screws for the connection to the screen cable/screen plate for the types 9327 to 9332: < 12 mm
- Controller protection by means of external fuses. (📖 3-6)
- Protect unused control inputs and outputs with plugs or covers (included in the contents of delivery) for the Sub-D inputs.
- Frequent mains switching can overload the internal switch-on current limitation. For cyclic mains switching, the controller can be switched on every three minutes as a maximum.
- The controllers 9324, 9326, 9328 and 9329 must only be operated with the appropriate mains filters. (📖 3-7)
- In case of condensation, connect the controller to the mains voltage only after the visible humidity has evaporated.

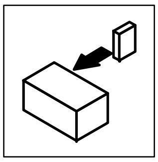
4.2.3 Motor protection

- Complete motor protection according to VDE:
  – By overcurrent relays or temperature monitoring.
  – Required for group drives (motors connected in parallel to a controller)
  – We recommend the use of PTC thermistors or thermostats with PTC characteristic to monitor the motor temperature.

Stop!

As standard Lenze three-phase AC motors are equipped with PTC thermistors. If motors from other manufacturers are used, carry out all steps required for the adaptation to the controller. (📖 4-28)

- When using motors with insulation which is not suitable for inverter operation:
  – Please contact your motor supplier.
  Lenze AC motors are designed for inverter operation.
- With the corresponding parameter setting, the controllers generate field frequencies up to 600 Hz:
  – With motors not suited for the application, dangerous overspeeds may occur and destroy the drive.



4.2.4 Mains types/conditions

Please observe the restrictions for each mains type!

Mains	Operation of the controllers	Notes
With grounded neutral (TT/TN mains)	No restrictions	Observe controller ratings • Mains r.m.s. current: 🕮 3-3
With isolated neutral (IT mains)	Possible, if the controller is protected in the event of an earth fault in the supplying mains. • Possible, if appropriate earth fault detections are available and • the controller is separated from the mains immediately.	Safe operation in the event of an earth fault at the inverter output cannot be guaranteed.
With grounded phase	Operation is only possible with one variant	Contact Lenze
DC-supply via $+U_G/-U_G$	The DC voltage must be symmetrical to PE.	The controller will be destroyed when grounding $+U_G$ or $-U_G$.

4.2.5 Interaction with compensation equipment

- The controllers take up a very low fundamental reactive power from the supplying AC mains. Therefore compensation is not necessary.
- If the controllers are operated at mains with compensation, this equipment must be used with chokes.
  – For this, contact the supplier of the compensation equipment.

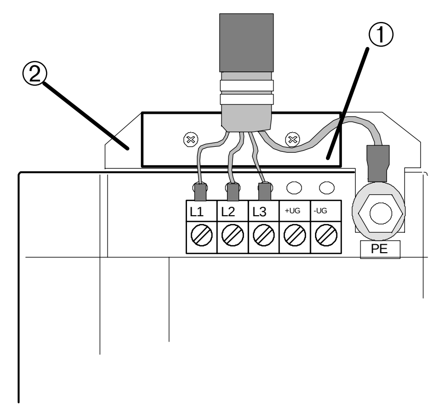
4.2.6 Specification of all cables used

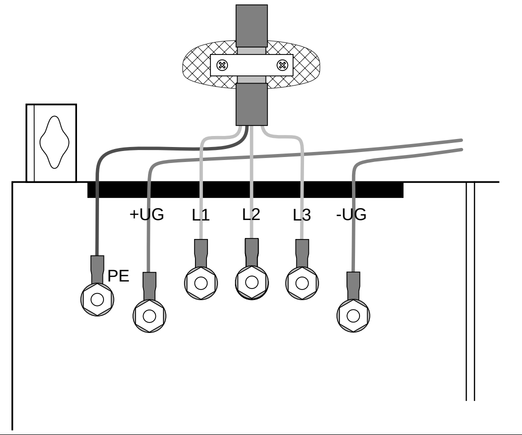
- The cables used must comply with the required approvals of the application site (e. g. UL).
- The prescribed minimum cross-sections of PE conductors must be maintained in all cases. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- The screening quality of a cable is determined by
  – a good screen connection
  – a low screen resistance
  Only use screens with tin-plated or nickel-plated copper braids!
  Screens of steel braid are not suitable.
  – For the overlapping degree of the screen braid:
  A min. of 70 % to 80 % with an overlapping angle of 90°

4.2.7 Power connections

Controller	Preparations for the power connection
9321 ... 9326	• Remove the covers of the power connections: – Unlatch to the front by gentle pressure. – Pull upwards (mains connection) or downwards (motor connection).
9327 ... 9332	• Remove cover: – Loosen screws (X) (see Fig. 4-1). – Swing cover to the top and detach. – Take the accessory kit out of the interior of the controller.

4.2.7.1 Mains connection

<table>
<tr><th>Types 9321 to 9326</th><th>Types 9327 to 9332</th></tr>
<tr><td>


</td><td>


</td></tr>
<tr><td>Correct screen connection with screened cables (required parts in the accessory kit):
• Screw sreen plate ① on fixing bracket ②.
• Fix screen using cable lugs. Do not use as a strain relief!
• To improve the screen connection: Connect screen additionally to the stud next to the power connections.</td><td>Correct screen connection with screened cables:
• Connect the screen with suitable clamp on the conducting control cabinet mounting plate.
• To improve the screen connection: Connect screen additionally to the stud next to the power connections.</td></tr>
</table>

Fig. 4-7 Proposal for mains connection

- Connect the mains cables to the screw terminals L1, L2, L3.
- Connect cables for brake unit (935X), supply module (934X) or further controllers in the DC bus connection to the screw terminals +UG, -UG at the top of the controller.
- Max. permissible cable cross-sections and tightening torques:

Type	Terminals		
	Max. permissible cable cross-sections	**L1, L2, L3, +UG, -UG**	**PE connection**
9321 - 9326	4 mm^2 1)	0.5 ... 0.6 Nm (4.4 ... 5.3 lbin)	3.4 Nm (30 lbin)
9327 - 9329	25 mm^2 2)	4 Nm (35 lbin)	
9330 - 9331	95 mm^2 2)	7 Nm (62 lbin)	
9332	120 mm^2 2)	12 Nm (106.2 lbin)	

1) with pin-end connector: 6 mm^2
with wire crimp cap 4 mm^2
2) with ring cable lug The cross-section is only limited by the cable cut-out in the housing.

Installation

Fuses

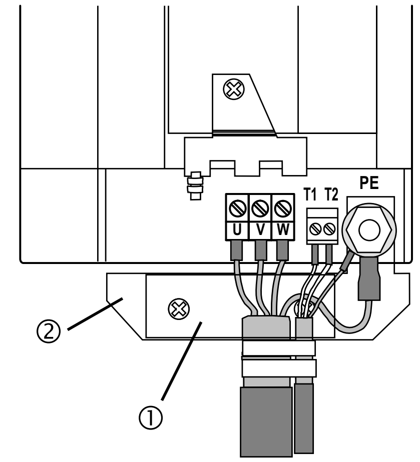
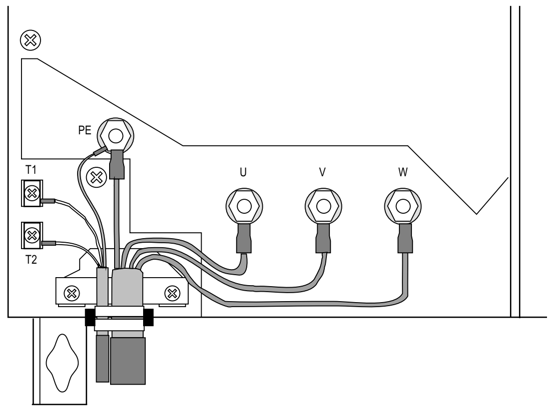
Fuses and cable cross-sections	The specifications in chapter 3.3.4 are recommendations and refer to the application • in control cabinets and machines • installation in the cable duct • max. ambient temperature +40 °C.	📖 3-6
Selection of the cable cross-section	For selection take into account the voltage drop in the event of load application (to DIN 18015 part 1: ≤ 3 %).	
Cable and controller protection on the AC side (L1, L2, L3)	• By means of standard commercial fuses. • Fuses in UL-conform plants must have UL-approval. • The rated voltages of the fuses must be dimensioned according to the mains voltage at the site. The activation characteristic is defined with "H" or "K5".	
Cable and controller protection on the DC side (+UG, -UG)	• By means of recommended DC fuses. • The fuses/fuse holders recommended by Lenze are UL approved.	
For DC group drives or supply using a DC source:	Observe the information given in Part F of the Manual.	
Connection of a brake unit	If the unit is connected to the terminals +UG / -UG, the fuses and cross-sections indicated in chapter 3.3.4 are not valid. These unit-specific data can be obtained from the technical documentation for the brake unit.	
Further information	For cable and controller protection see the chapter "Accessories" in "Planning".	
Further standards	The compliance with other standards (e.g.: VDE 0113, VDE 0289, etc.) remains the responsibility of the user.	

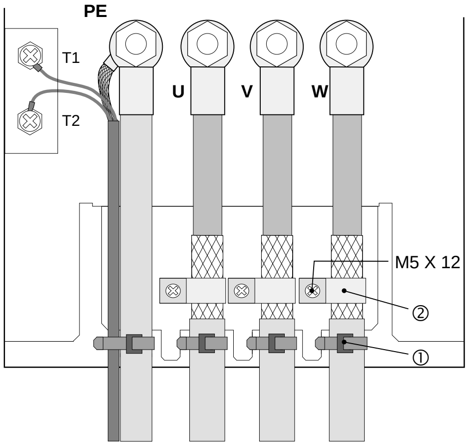
4.2.7.2 Motor connection

For EMC safety reasons, we recommend the use of screened motor cables.

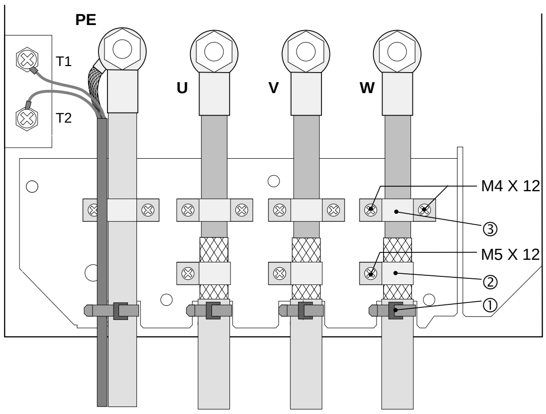
Note!

The screening of the motor cables is only required to comply with existing standards (e. g. VDE 0160, EN 50178).

Types 9321 to 9326	
	Correct screen connection with screened cables (required parts in the accessory kit): • Screw sreen plate ① on fixing bracket ②. • Fix the screen of the motor cable and thermal contact, if necessary. Do not use as a strain relief! • To improve the screen connection: Connect screen additionally to the stud PE next to the motor connections.
Types 9327 to 9329	
	Correct screen connection with screened cables: • Fix the screen of the motor cable and thermal contact, if necessary. Do not use as a strain relief! • To improve the screen connection: Connect screen additionally to the stud PE next to the motor connections.

<table>
<tr><th colspan="2">Types 9330 and 9331</th></tr>
<tr><td>
</td><td>

- Strain relief by using cable binders ①.
- Correct screen connection with screened cables:
  – Apply motor cable screen to the screening plate using clamp and screws M5x12 ②.
  – Connect thermal contact screen to the stud PE next to the motor connections over a large surface.

</td></tr>
<tr><th colspan="2">Type 9332</th></tr>
<tr><td>
</td><td>

- Strain relief by using cable clamps and screws M4x12 ③.
  – Additional strain relief/fixing can be achieved by using cable binders ①.
- Correct screen connection with screened cables:
  – Apply motor cable screen to the screening plate using clamp and screws M5x12 ②.
  – Connect thermal contact screen to the stud PE next to the motor connections over a large surface.

</td></tr>
</table>

Fig. 4-8 Proposal for motor connection

- Observe the max. permissible motor cable length:

	V_r = 400 V (+10%)		V_r = 480 V (+10%)	
Type	f_{chop} = 8 kHz	f_{chop} = 16 kHz	f_{chop} = 8 kHz	f_{chop} = 16 kHz
9321/9322	up to 50 m	up to 45 m	up to 50 m	up to 25 m
9323 - 9332	up to 50 m	up to 50 m	up to 50 m	up to 50 m

- Connect the motor cables to the screw terminals U, V, W.
  – Observe correct pole connection.
  – Max. motor cable length: 50 m.
  – Max. permissible cable cross-sections and tightening torques:

	Max. permissible cable cross-sections		Terminal screw tightening torques			
Type	Power connections	T1, T2	U, V, W	PE connection	Screen/ strain relief	T1, T2
9321 - 9326	4 mm² 1)	1.5 mm²	0.5 ... 0.6 Nm (4.4 ... 5.3 lbin)	3.4 Nm (30 lbin)	-	0.5 ... 0.6 Nm (4.4 ... 5.3 lbin)
9327 - 9329	25 mm² 2)		4 Nm (35 lbin)		-	0.5 ... 0.6 Nm (4.4 ... 5.3 lbin)
9330 - 9331	95 mm² 2)		7 Nm (62 lbin)		3.4 Nm (30 lbin)	
9332	120 mm² 2)		12 Nm (106.2 lbin)		M4: 1.7 Nm (15 lbin) M5: 3.4 Nm (30 lbin)	

1) with pin-end connector: 6 mm²
with wire crimp cap 4 mm²
2) with ring cable lug The cross-section is only limited by the cable cut-out

Note!

Switching on the motor side of the controller is permitted for safety switch-off only (emergency switch-off).

4.2.7.3 Connection of a brake unit

- When connecting a brake unit (brake module with internal brake resistor or brake chopper with external brake resistor) observe the corresponding Operating Instructions in all cases.

Stop!

- Design the circuit so that, if the temperature monitoring of the brake unit is activated,
  – the controllers are inhibited (X5/28 = LOW).
  – the mains is disconnected.
- Examples:
  – Chapter 4.3, “Installation of a CE-typical drive system”. (📖 4-34)
  – Fig. 4-9, “Decentralized supply for DC-bus connection of several drives”. (📖 4-18)

4.2.7.4 DC-bus connection of several drives

Decentralized supply with brake module

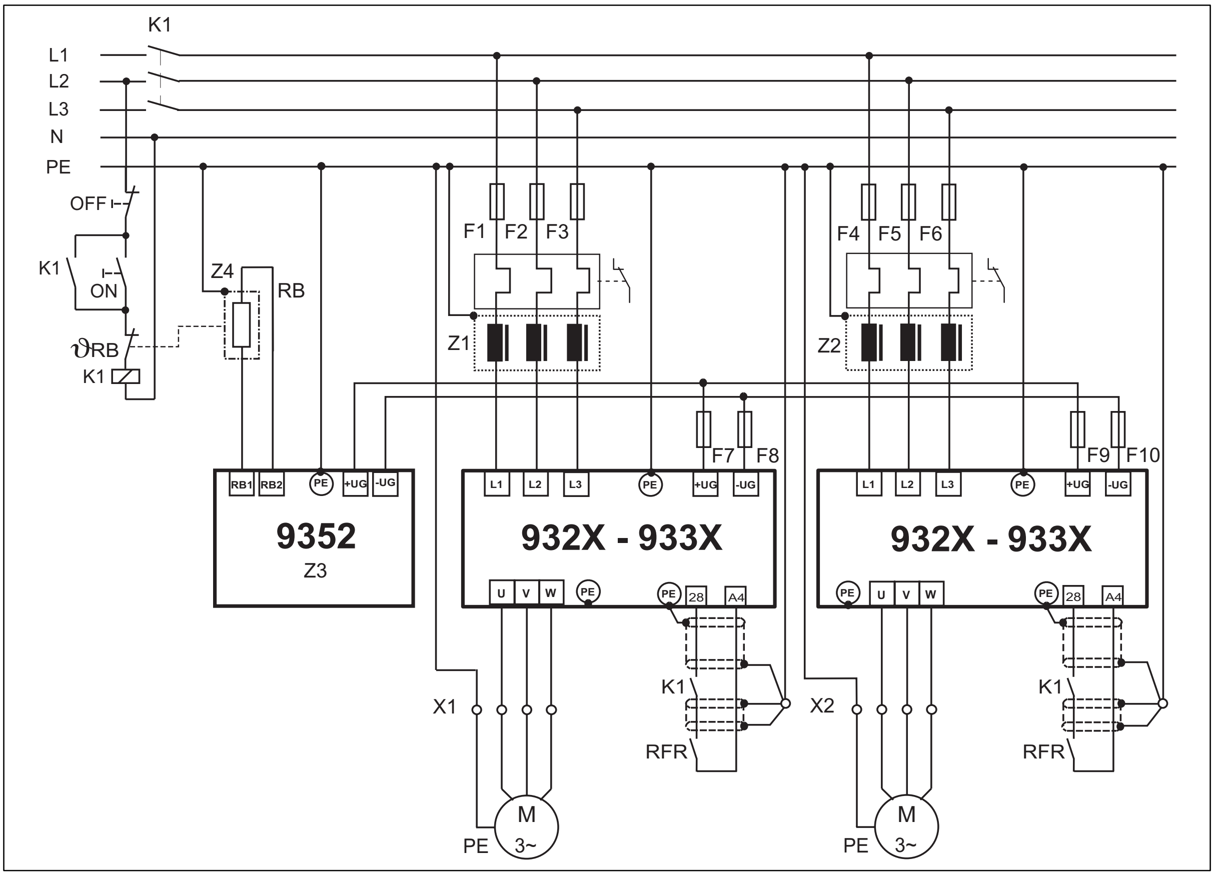


Fig. 4-9 Decentralized supply with DC-bus connection of several drives

Z1, Z2	Mains filter (for selection see Manual, Part F)
Z3	Brake chopper
Z4	Brake resistor (for r.m.s. current monitoring see the Manual, Part F)
F1...F6	Fuses (see chapter 3.3.4 and chapter 4.2.7.1)
F7...F10	DC-bus fuse (see chapter 3.3.4 / 4.2.7.1); fuse holder with/without alarm contact
K1	Main contactor

STOP

Stop!

- Set the DC bus voltage thresholds of controller and brake unit to the same values.
  – Controller using C0173
  – Brake unit with switches S1 and S2
- Use a bimetal relay to monitor the mains supply.

Note!

Observe the information given in Part F of the Manual and the application report “DC-bus connection” for selection of the components.

Central supply with supply module

- Observe the corresponding Operating Instructions for installation of a supply module.

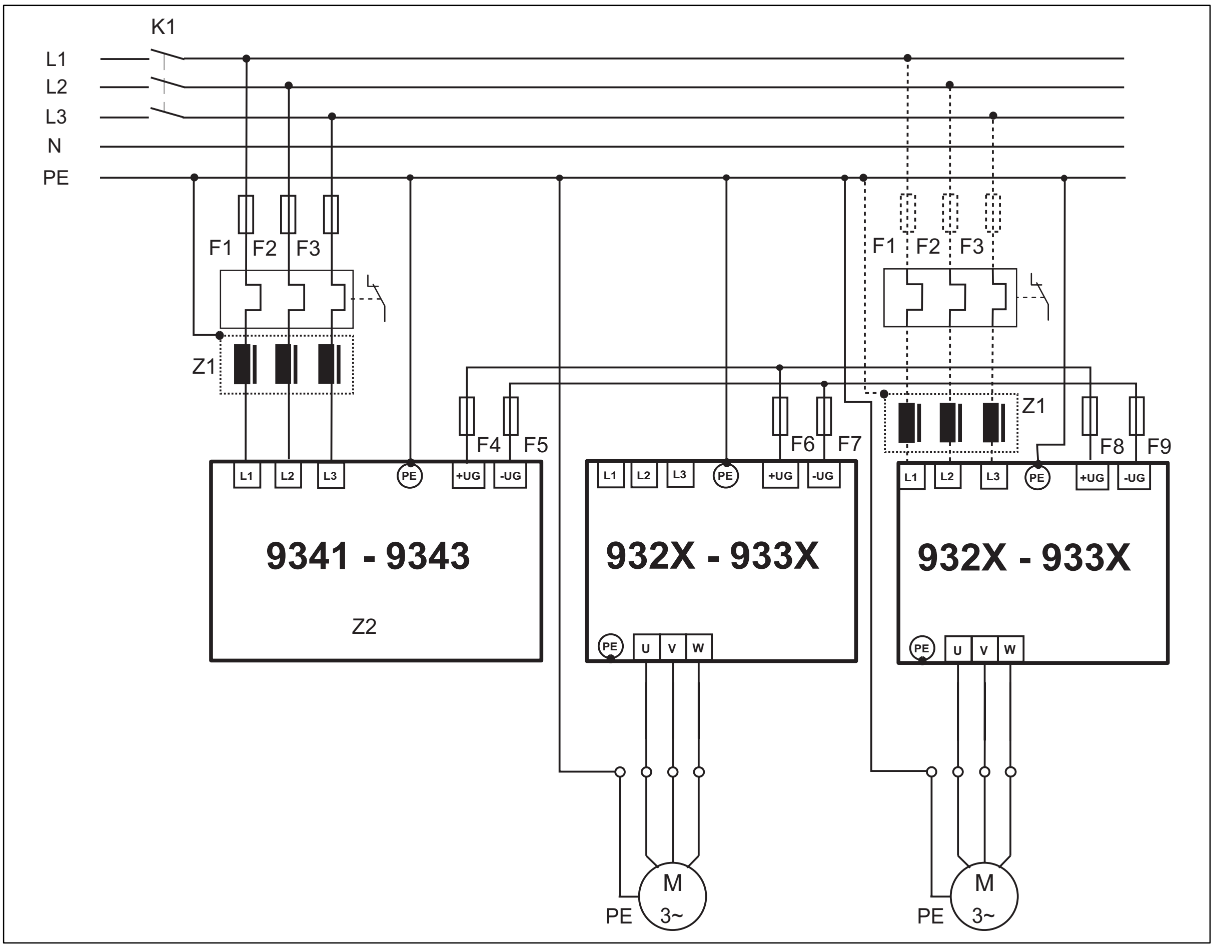


Fig. 4-10	Central supply for DC bus connection of several drives

Z1	Mains filter
Z2	Supply module
F1...F6	Protection, see “Cable protection” (📖 3-6) / “mains connection” (📖 4-13)
F4...F9	DC-bus fuse (see chapter 3.3.4 / 4.2.7.1); fuse holder with/without alarm contact
K1	Main contactor

Note!

If the power supply of the supply module is not high enough, a parallel supply can be installed via the mains input of other controllers (see Manual, Part F). In this event, the controller can only be operated with the assigned mains filters (min. limit value class A).

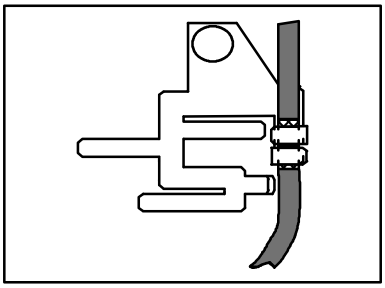
4.2.8 Control connections

4.2.8.1 Control cables

- Connect control cables to the screw terminals:

max. permissible cable cross-section	Screw-tightening torques
1.5 mm^2	0.5 ... 0.6 Nm (4.4 ... 5.3 lbin)

- We recommend a one-side screening of all cables for analog signals to avoid signal distortion.
- Connect the screens of the control cables
  – with the collective screen plate to the front metal surface
    (max screw length 12 mm).



4.2.8.2 Assignment of the control terminals

Protection against inverse polarity

- This protection prevents the wrong connection of the internal control inputs. However, it is possible to overcome the protection against polarity reversal by applying great force causing the controller to be enabled.

Overview

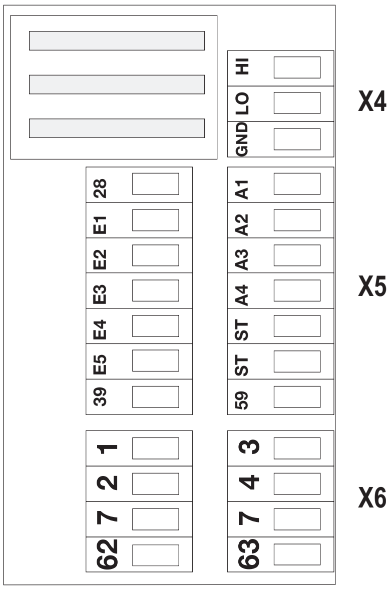
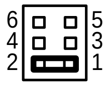
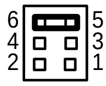


Fig. 4-11 Layout of the control connections on the front of the controller

	Terminal	Use **(Default setting is printed in bold)**		Level	Data
Analog inputs	1, 2	Difference input master voltage **(not assigned)**	 Jumper X3	-10 V to +10 V	Resolution: 5 mV (11 bit + sign)
		Difference input master current **(not assigned)**	 Jumper X3	-20 mA to +20 mA	Resolution: 20 µA (10 bit + sign)
	3, 4	Difference input master voltage **(not assigned)**	Jumper X3 has no effect	-10 V to +10 V	Resolution: 5 mV (11 bit + sign)
Analog outputs	62	Monitor 1 **(Actual speed)**		-10 V to +10 V; max. 2 mA	Resolution: 20 mV (9 bit + sign)
	63	Monitor 2 **(Torque setpoint)**		-10 V to +10 V; max. 2 mA	Resolution: 20 mV (9 bit + sign)
	7	Internal ground, GND		-	-
Digital inputs	28	Controller enable (RFR)		HIGH	LOW: 0 ... +4 V HIGH: +13 ... +30 V Input current at 24 V: 8 mA per input Reading and writing of the inputs: once per ms (average value)
	E1	freely assignable **(limit switch / positioning in negative direction)**		LOW	
	E2	freely assignable **(limit switch / positioning in positive direction)**		LOW	
	E3	freely assignable **Start position program:** **Condition: terminal X5/E5 = HIGH)**		LOW→HIGH edge	
	E4	freely assignable **(Touch probe for homing switch)**		LOW	
	E5	freely assignable **(Program active)** **(TRIP-reset)** **(Reset positioning program)** **(Activate manual positioning / with priority)**		HIGH HIGH→LOW edge LOW LOW	
Digital outputs	A1	freely assignable **(reference known)**		HIGH	LOW: 0 ... +4 V HIGH: +13 ... +30 V Output current: max. 50 mA per output (external resistance at least 480 Ω at 24 V) Updating of the outputs: once per ms
	A2	freely assignable **(Target position reached)**		HIGH	
	A3	freely assignable **(RDY)**		HIGH	
	A4	freely assignable **(PFO1)**		(selectable)	
	39	Ground of the digital inputs and outputs		-	
	59	Supply input of the control module: 24 V external (I > 1A)		-	

Tip!

If necessary, remove plug-on module to change the jumper.

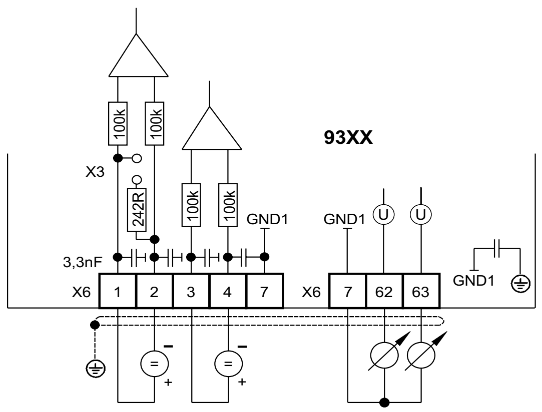
4.2.8.3 Connection diagrams

Connection of analog signals

Analog signals are connected via the 2 x 4-pole terminal block X6.

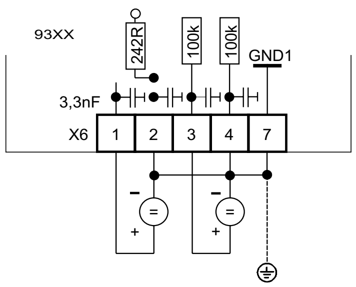
Depending on the use of the analog input, the jumper of X3 must be set accordingly.

Connection for external voltage supply



STOP!

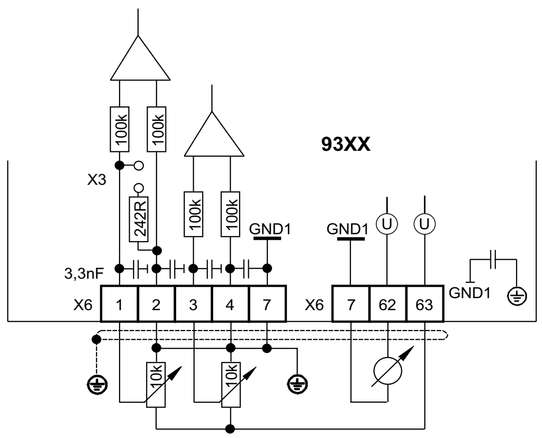
- The maximum permitted voltage difference between an external voltage source and theGND1 (terminal X6/7) of the controller is 10V (common mode).
- The maximum permitted voltage difference between GND1 (terminal X6/7) and the PE of the controller is 50V.



Limit the voltage difference

- by overvoltage clamping components or
- by direct connection of terminal(s) X6/2, X6/4 and X6/7 to GND1 and PE (see figure).

Connection for internal voltage supply



Configuration of the internal voltage supply:

- Set a freely assignable analog output (AOUTx) to HIGH level.
- For instance terminal X6/63: Assign FIXED100% to C0436 (📖 7-13), 10V are thus applied across terminal X6/63.

Note!

Use one of the predefined configurations in C0005 for this application. With C0005 = XX1X (e. g. 1010 for speed control with control via terminals) FIXED 100% is automatically assigned to the output X6/63 (corresponds to 10 V at the output X6/63).

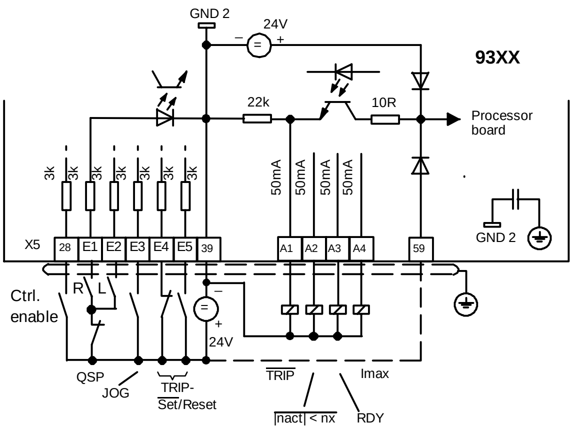
Connection of digital signals

Digital signals are connected via the 2 x 7-pole terminal block X5.

The levels of the digital inputs and outputs are PLC compatible.

Use relays with low-current contacts for switching the signal cables (recommendation: relays with gold contacts).

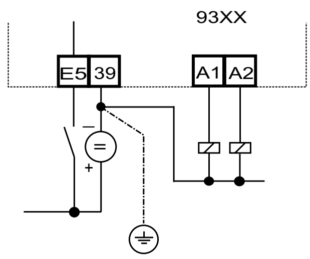
Connection for external voltage supply



The external voltage source supplies the digital inputs and outputs.
- If the external voltage supply is also used as an alternative supply for the control electronics (backup operation in the event of mains failure):
  - – For this, make the connection illustrated as a broken line.
  - – The external voltage source must be able to drive a current > 1 A.

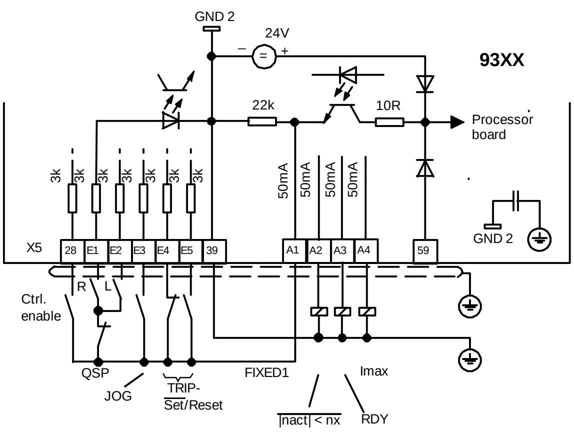
This ensures that all actual values, even after mains disconnection, are still detected and processed.
- Connection of the external voltage source:
  - – Supply voltage at X5/59
  - – External mass at X5/39

STOP!
The voltage difference between GND2 (term. X5/39) and the PE of the controller must not exceed 50 V.



Limit the voltage difference
- by overvoltage clamping components or
- by direct PE connection of terminal 39 (see figure).

Connection for internal voltage supply



Configuration of the internal voltage supply
- Set a freely assignable digital output (DIGOUTx) to HIGH level.
- For instance terminal X5/A1: Assign C0117/1 with FIXED1. 24V are thus applied across terminal X5/A1.

Note!
Use one of the predefined configurations in C0005 for this application. With C0005 = XX1X (e. g. 20010 for absoute positioning; limited travelling range) FIXED1 is automatically assigned to the output X5/A1 (corresponds to 24 V at terminal X5/A1).

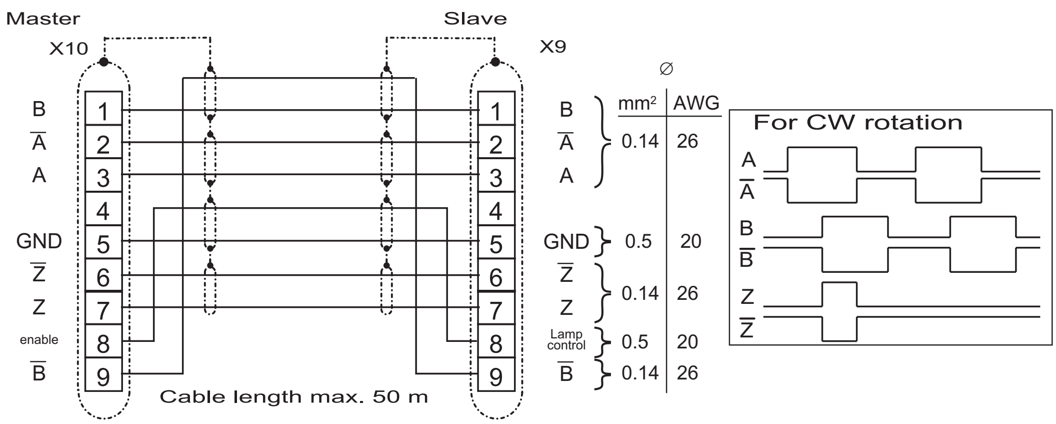
Installation

Digital frequency input (X9) / digital frequency output (X10)

Note!

Use prefabricated Lenze cables for the connection to the digital frequency input (X9) or digital frequency output (X10). Otherwise, use cables with twisted pairs and screened wires (A, $\overline{A}$ / B, $\overline{B}$ / Z, $\overline{Z}$) (see diagram).

Digital frequency output X10	Digital frequency input X9
Features: • Sub-D female connector, 9-pole • Output frequency: 0 - 500 kHz • Current load capacity per channel: max. 20 mA • Two-track with inverse 5 V signals and zero track • X10 has a different basic setting depending on the selected configuration (C0005) – Factory setting: Encoder simulation of the resolver signal • Load capacity: – With parallel connection do not connect more than 3 slaves. • When PIN 8 (EN) shows a LOW level, the master is initialized (e.g. if the mains was disconnected). The slave can thus monitor the master.	Features: • Sub-D male connector, 9-pole • Input frequency: 0 - 500 kHz • Current consumption per channel: max. 6 mA • Two-track with inverse 5 V signals and zero track • Possible input signals: – Incremental encoder with two 5 V complementary signals shifted by 90° (TTL encoder). – Encoder simulation of the master • PIN 8 serves to monitor the cable or the connected controller: – When this PIN shows a LOW level, the SD3 monitoring responds. – If the monitoring is not required, this input can be connected to +5V. • The input is disconnected if C0540 = 0, 1, 2 or 3.



9 pole Sub-D connector — 9 pole Sub-D male connector

Pin assignment X10									Pin assignment X9								
1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
B	A	A	+5 V	GND	Z	Z	EN	B	B	A	A	+5 V	GND	Z	Z	LC	B

STATE-BUS (X5/ST)

The STATE-BUS is a controller-specific bus system for monitoring a DC-bus network:

- Controls all networked drives in a preselected way.
- Up to 20 controllers can be connected.
- Connection of the STATE-BUS cables to terminals X5/ST.

STOP

Stop!

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

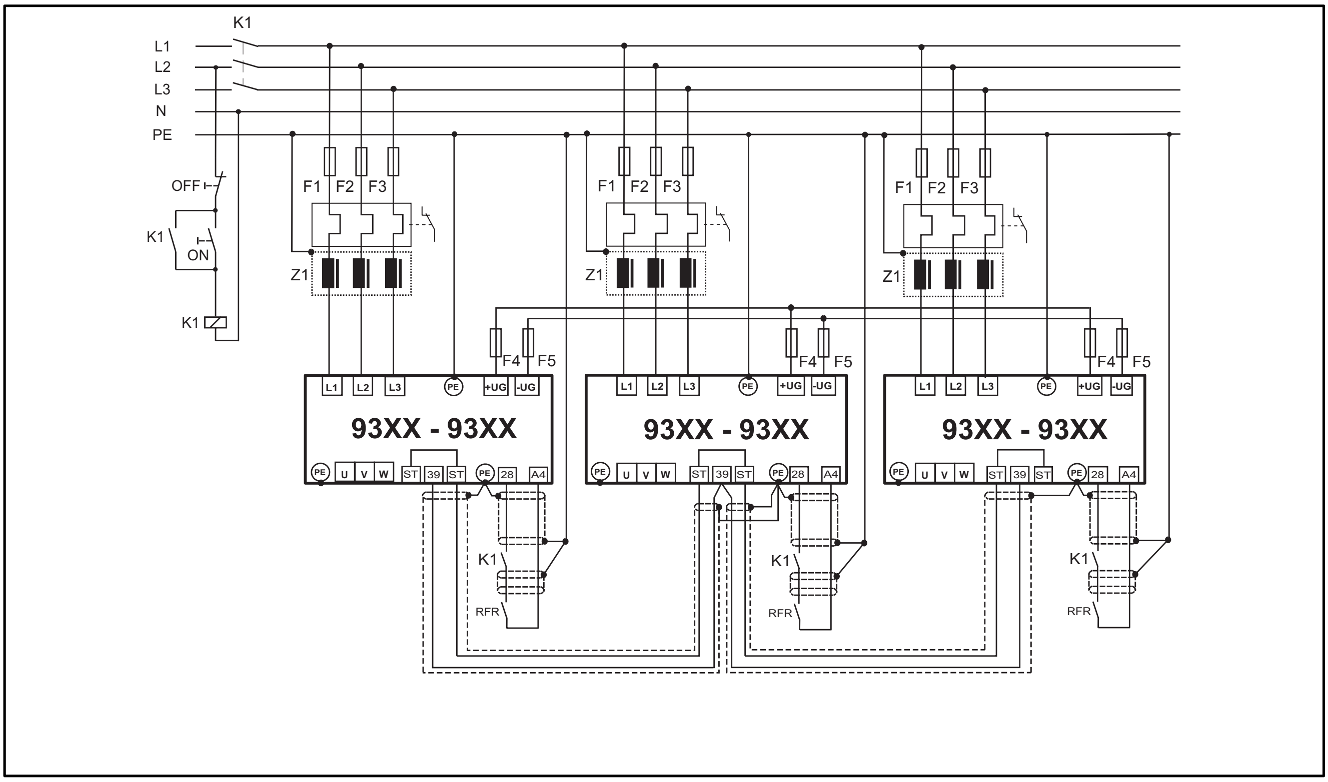


Fig. 4-12 Monitoring of a DC-bus drive network with the STATE-BUS

Z1	Mains filter
F1...F5	Protection, see “Cable protection” (3-6) / “Mains connection” (4-13)
K1	Main contactor

System bus connection (X4)

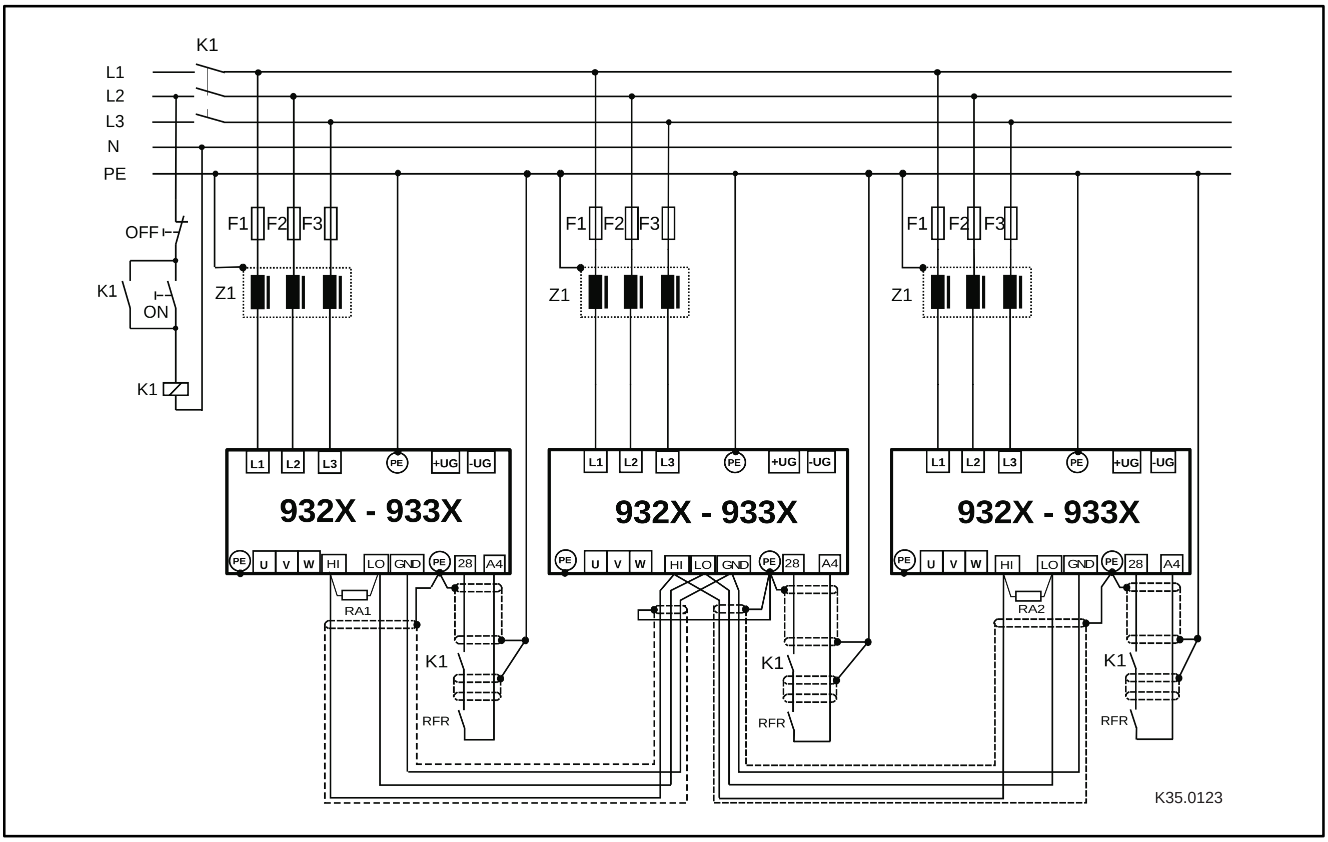


Fig. 4-13 Wiring of the system bus

RA1, RA2 Bus terminating resistors 120 Ω (included in the accessory kit)

- Connection via pluggable screw terminals (double terminals can be used).
- Only connect terminals of the same designation.
- Features of the signal cable:

Total cable length	up to 300 m	300 m to 1000 m
Cable type	LIYCY 2 x 2 x 0.5 mm^2 twisted pair with screening Pair 1: CAN-LOW (LO) and CAN-HIGH (HI) Pair 2: 2*GND	CYPIMF 2 x 2 x 0.5 mm^2 twisted pair with screening Pair 1: CAN-LOW (LO) and CAN-HIGH (HI) Pair 2: 2*GND
Cable resistance	≤ 40 Ω/km	≤ 40 Ω/km
Capacitance per unit length	≤ 130 nF/km	≤ 60 nF/km

- Connection of the bus termination resistors:
  – Connect one resistor 120 Ω to the first and one to the last bus participant.
  – On the 93XX controller the resistor can be screwed directly under the terminals X4/HI and X4/LO.

Features:

- CAN based with bus protocol according to CANopen (CAL-based Communication Profile DS301)
- Bus expansion:
  – 25 m at max. 1 Mbit/s baud rate
  – up to 1 km with reduced baud rate
- Extremely reliable data transmission (hamming distance = 6)
- Signal level to ISO 11898
- Up to 63 bus devices are possible
- Access to all Lenze parameters
- Master functions integrated into the controller
  – Data exchange possible between controllers without participation of a master system (current ratio control, speed synchronization, etc.)

The following connections of the system bus connection are possible:

- Connection to a decentral terminal extension for digital and analog inputs and outputs
- Connection to a superimposed control (PLC, decentral digital inputs and outputs, keypad)
- Interconnection of several controllers

Automation interface (X1)

The automation interface (X1) is used for the connection of different plug-on modules

- Operating module
- Fieldbus modules
  – RS232, RS485, optical fibre, type 2102 (LECOM-A/B/LI),
  – INTERBUS, type 2111
  – PROFIBUS, type 2131

4.2.9 Motor temperature monitoring

Selection of the feedback system	• Temperature sensor KTY – "Linear" temperature sensor in the motor winding (standard for Lenze motors MDXKX and MDXQX) • Temperature sensor PTC – PTC temperature sensor with defined tripping temperature (see DIN 44081 and DIN 44082) • Thermal contact TKO – Thermostat/normally closed contact
Other monitorings	KTY, PTC and TKO do not offer full protection. To improve the monitoring, Lenze recommends a bimetal relay.
Alternative monitoring	Comparators (CMP1 ... CMP3) monitor and a time element (TRANS1 ... TRANS4) limits the motor current (blocking current) at low speed or if the motor is in standstill. This function can be implemented by interconnecting the corresponding function blocks.
Reactions	Different, depending on the temperature monitoring. 📖 7-266

Stop!

Do not connect an external voltage to the inputs.

	Lenze motors			**Motors of other manufacturers**		
	MDXKX and MDXQX		**with thermal contact**	**with sensor for continuous temperature detection**		**with thermal contact or PTC to DIN 44081/44082**
Connection	• Resolver input X7: – Pin X7/8 = PTC+ Pin X7/9 = PTC- • Encoder input X8: – Pin X8/8 = PTC+ Pin X8/5 = PTC-		Terminals T1/T2 next to the terminals U, V, W	• Resolver input X7: – Pin X7/8 = PTC+ Pin X7/9 = PTC- • Encoder input X8: – Pin X8/8 = PTC+ Pin X8/5 = PTC-		Terminals T1/T2 next to the terminals U, V, W
Fault message	(MONIT-)OH3	(MONIT-)OH7	(MONIT-)OH8	(MONIT-)OH3	(MONIT-)OH7	(MONIT-)OH8
Possible reactions	The corresponding monitoring and thus the following codes are preset under C0086					
	• Trip (C0583 = 0) • OFF (C0583 = 3)	• Warning (C0584 = 2) • OFF (C0584 = 3)	• Trip (C0585 = 0) • Warning (C0585 = 2) • OFF (C0585 = 3)	• Trip (C0583 = 0) • OFF (C0583 = 3)	• Warning (C0584 = 2) • OFF (C0584 = 3)	• Trip (C0585 = 0) • Warning (C0585 = 2) • OFF (C0585 = 3)
Point of release	fixed at 150 ° C	adjustable 45°C ... 150°C (C0121)	fixed, (depending on PTC/thermal contact): PTC: at R_{ϑ} > 1600 Ω	fixed at 150 °C	adjustable 45°C ... 150°C (C0121)	fixed, (depending on PTC/thermal contact): PTC: at R_{ϑ} > 1600 Ω
Notes	• Monitoring is active in the factory setting. • If resolver (X7) and encoder (X8) are operated together: – Connect PTC only to one connector (X7 or X8) – The PTC connection of the other connector remains unconnected • Further information on the connection of the temperature sensor can be obtained from the description of the feedback system.		• Deactivate monitoring via X7 or X8 under C0583=3 and C0584=3 • Connection to DIN 44081 (see also Fig. 4-14).	• We recommend a Ziehl PTC (up to 150 °C): K15301075 or a thermostat. • Input characteristic. 📖 4-29 • Deactivate monitoring via X7 or X8 under C0583=3 and C0584=3		• Deactivate monitoring via X7 or X8 under C0583=3 and C0584=3 • Connection to DIN 44081 (see also Fig. 4-14).

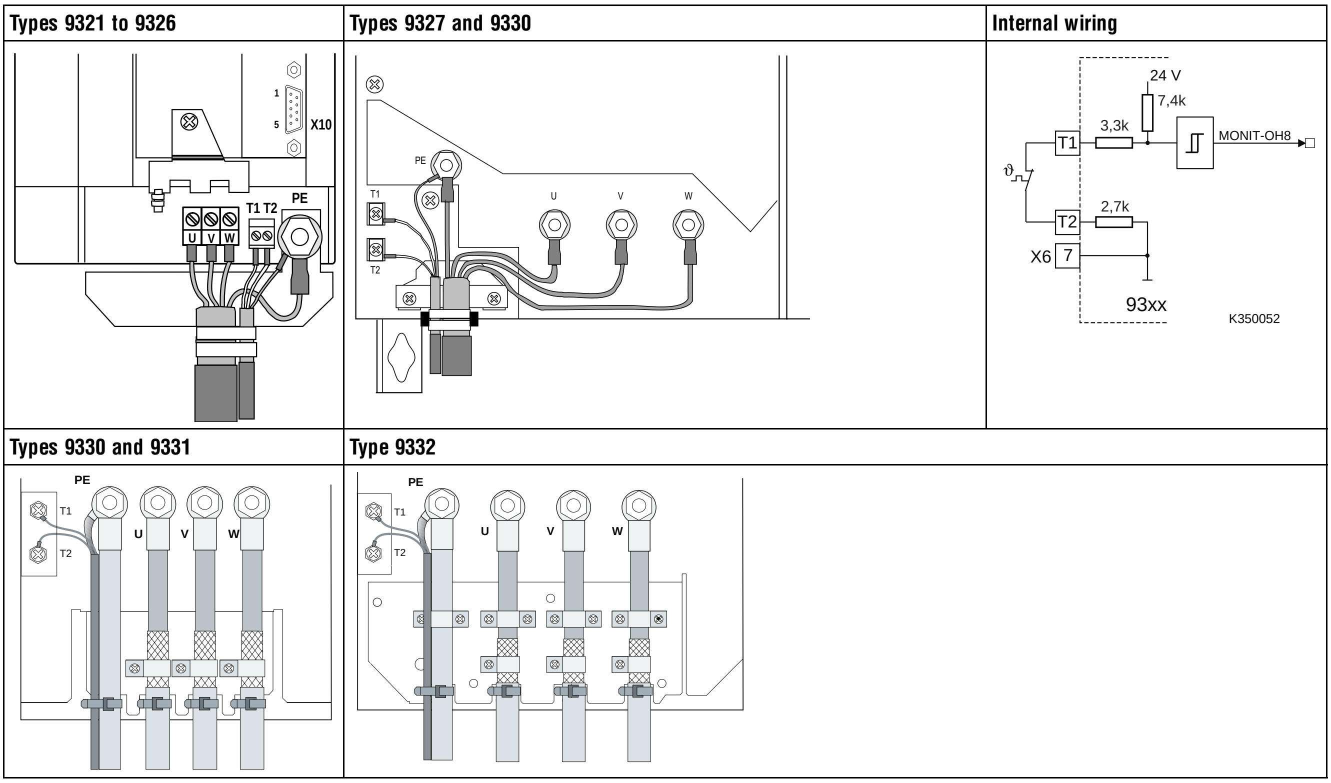
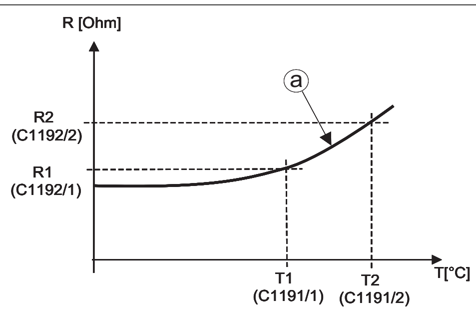


Fig. 4-14 Connection of a thermal sensor to the terminals T1 and T2 and interconnection

Note!

- The prefabricated Lenze system cables for **Lenze servo motors** provide the cable for the temperature feedback. The cables are designed for wiring according to EMC.
- If you use cables of your own:
  – Always lay cables separately from motor cables.

4.2.9.1 User-specific characteristic for a PTC resistor



Code	Subcode	Description
C1190	0 (Control mode 1)	Evaluation of the Lenze standard motor-temperature sensor
	1 (Control mode 2)	Evaluation of a user-specific temperature sensor. The operating level is almost in the linear section (a) of the sensor characteristic. The working area is determined by two vertex. Interpolation takes place between these two points.
C1191	1 (100 °C)	Definition of the temperature vertex assigned to the resistances of the sensor.
	2 (150 °C)	
C1192	1 (1670 Ω)	Definition of sensor resistances
	2 (2225 Ω)	

Example of a sensor characteristic for continuous temperature detection

4.2.10 Feedback systems

Different feedback systems can be connected to the controller:

- Resolver feedback (factory setting)
- Encoder feedback
  – Incremental encoder TTL
  – Sin/cos encoder
  – Sin/cos encoder with serial communication (single turn)
  – Sin/cos encoder with serial communication (multi turn)

Resolver signal or encoder signal can be output for slaves at the digital frequency output X10.

- Connection as shown in the figures:
  – Use twisted pair cables and screened pair cables.
  – Connect the screen at both ends.
  – Use indicated cable cross-sections.
- The feedback system is activated under C0025.

Sensorless control SSC

The sensorless controller (SSC) should not be used for new drive solutions (C0025 = 1).

Instead, use a vector control EVF 9300 or contact Lenze.

Resolver connection (X7)

- In all configurations predefined under C0005, a resolver can be used as feedback system. An adjustment is not necessary.

Note!

Use prefabricated Lenze system cables for resolver connection.

Features:

- 2-pole resolver (V = 10 V, f = 4 kHz)
- Resolver and resolver cable are monitored for open circuit (fault indication Sd2)

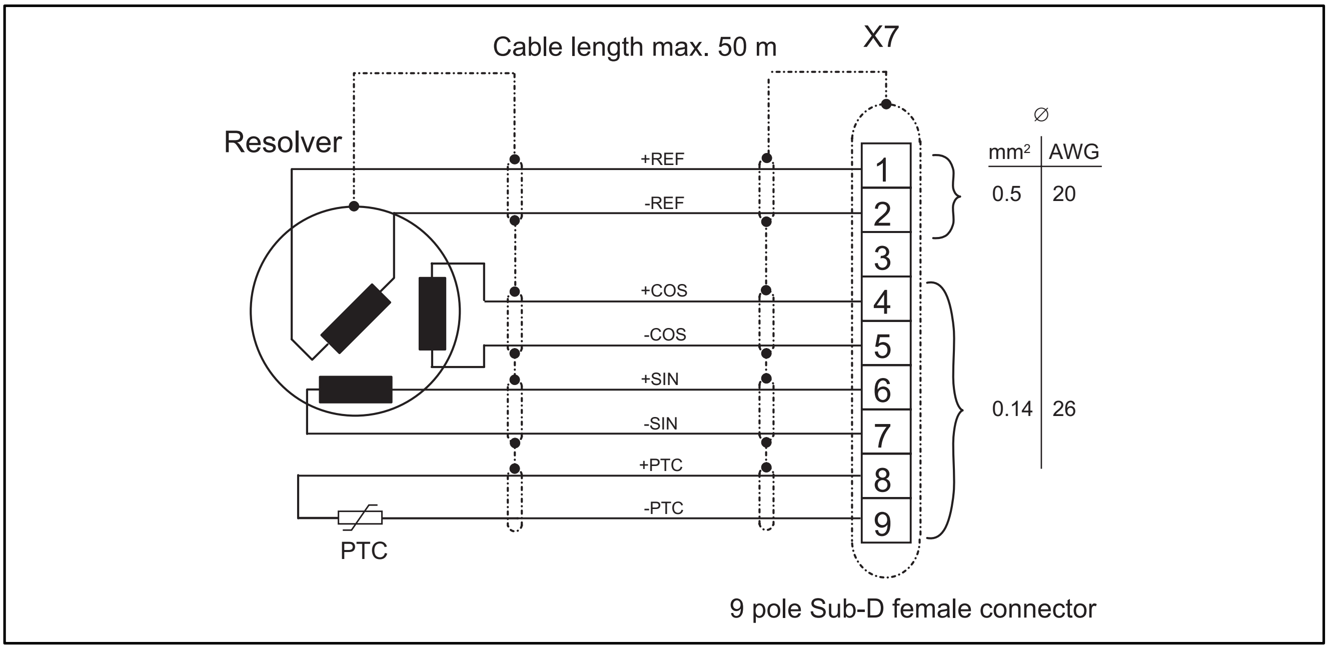


Fig. 4-15 Resolver connection

Assignment of the female connector (X7)									
Pin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Signal	+Ref	-Ref	GND	+COS	-COS	+SIN	-SIN	+PTC (📖 4-28)	-PTC (📖 4-28)

Encoder connection (X8)

An incremental encoder or a sin/cos encoder can be connected to this input.

Note!

Use prefabricated Lenze system cables for encoder connection.

- The encoder supply voltage V_{CC5_E} can be adjusted in the range from 5 V to 8 V under C0421
  – to set the encoder supply
  – to compensate the voltage drop on the encoder cable, if necessary
  $\Delta V \approx 2$ * cable length * resistance/m * $I_{encoder}$

Stop!

Observe the connection voltage of the encoder system used. If C0421 is set too high, the encoder might be destroyed.

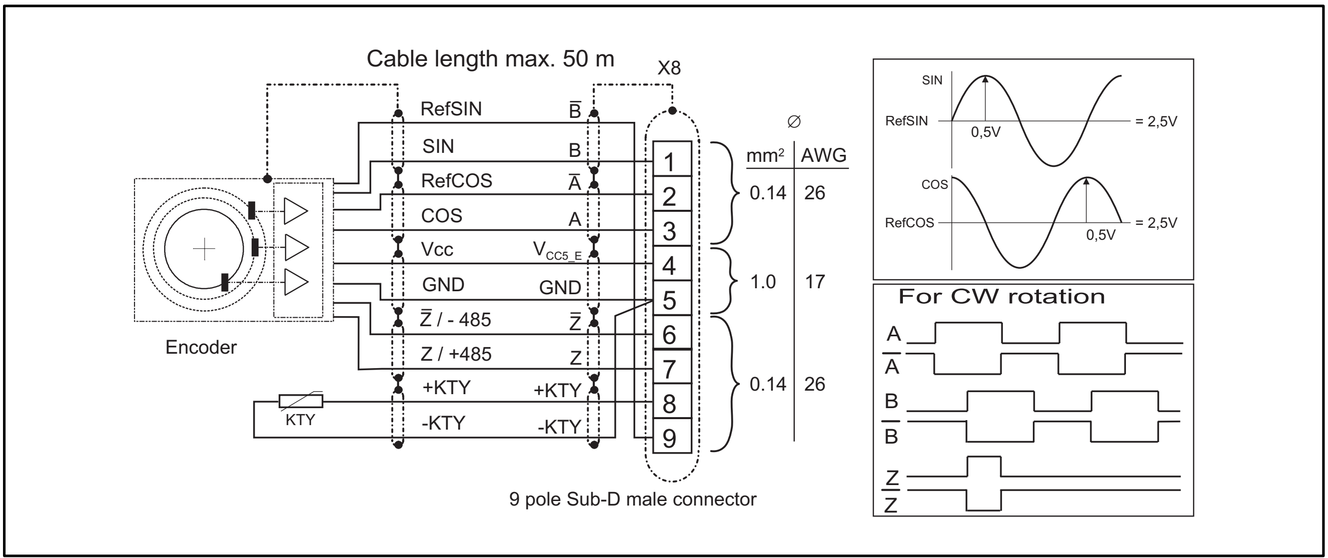


Fig. 4-16 Encoder connection

Incremental encoder

Features:

- Incremental encoders with two 5 V complementary signals shifted by 90 ° (TTL encoder) can be connected.
  – The zero track can be connected (as option).
- 9-pole Sub-D female connector
- Input frequency: 0 - 500 kHz
- Current consumption per channel: 6 mA

Assignment of the male connector (X8)									
Pin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Signal	B	$\overline{A}$	A	V_{CC5_E}	GND (-PTC)	$\overline{Z}$	Z	+PTC (📖 4-28)	$\overline{B}$

Sin/cos encoder

Features:

- The following encoders can be connected
  – sin/cos encoders with a rated voltage from 5 V to 8 V.
  – sin/cos encoders with a communication interface, type Stegmann SCS/M70xxx (The initialization time of the controller is increased to approx. 2 seconds).
- 9-pole Sub-D female connector
- Internal resistance Ri = 221 Ω
- Voltage sine and cosine track: 1 Vss ±0.2 V
- Voltage RefSIN and RefCOS: +2,5 V

Note!

For drives with track indications assign: sine, $\overline{\text{sine}}$ and cosine, $\overline{\text{cosine}}$:
Assign RefSIN with $\overline{\text{sine}}$ and RefCOS with $\overline{\text{cosine}}$.

Assignment of the male connector (X8)									
Pin	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Signal	SIN	RefCOS	COS	V_{CC5_E}	GND (-PTC)	$\overline{Z}$ or -RS485	Z or +RS485	+PTC (📖 4-28)	RefSIN

4.3 Installation of a CE-typical drive system

General notes	• The electromagnetic compatibility of a machine depends on the type of installation and care taken. Please observe: – Assembly – Filters – Screening – Grounding • For diverging installations, the conformity to the CE EMC Directive requires a check of the machine or system regarding the EMC limit values. This is for instance valid for – using unscreened cables – the use of group RFI filters instead of assigned RFI filters – operation without mains filter • **The compliance of the machine application with the EMC Directive is in the responsibility of the user.** – If you observe the following measures, you can assume that the machine will operate without any EMC problems caused by the drive system, and that compliance with the EMC Directive and the EMC law is achieved. – If devices which do not comply with the CE requirement concerning noise immunity EN 50082-2 are operated close to the controller, these devices may be disturbed electromagnetically by the controllers.
Structure	• Connect controller, mains choke, and mains filter to the grounded mounting plate with a wire of as large a cross-section as possible: – Mounting plates with conductive surfaces (zinc-coated, stainless steel) allow permanent contact. – Painted plates are not suitable for the installation in accordance with the EMC. • If you use several mounting plates: – Connect as much surface as possible of the mounting plates (e.g. with copper bands). • Ensure the separation of motor cable and signal or mains cable. • Do not use the same terminal strip for mains input and motor output. • Cable guides as close as possible to the reference potential. Unguided cables have the same effect as aerials.
Filters	• Use mains filters or RFI filters and mains chokes which are assigned to the controller: – RFI filters reduce impermissible high-frequency interference to a permissible value. – Mains chokes reduce low-frequency interferences which depend on the motor cable and its length. – Mains filters combine the functions of mains choke and RFI filter.
Screening	• Connect the screen of the motor cable to the controller – to the screen connection of the controller. – additionally to the mounting plate with a surface as large as possible. – Recommendation: For the connection, use ground clamps on bare metal mounting surfaces. • If contactors, motor-protecting switches or terminals are located in the motor cable: – Connect the screens of the connected cables also to the mounting plate, with a surface as large as possible. • Connect the screen in the motor terminal box or on the motor housing to PE: – Metal glands at the motor terminal box ensure a connection of the screen and the motor housing. • If the mains cable between mains filter and controller is longer than 300mm: – Screen mains cables. – Connect the screen of the mains cable directly to the inverter and to the mains filter and connect it to the mounting plate with as large a surface as possible. • Use of a brake chopper: – Connect the screen of the brake resistor cable directly to the mounting plate, at the brake chopper and the brake resistor with as large a surface as possible. – Connect the screen of the cable between controller and brake chopper directly to the mounting plate, at the inverter and the brake chopper with a surface as large as possible. • Screen the control cables: – Connect both screen ends of the digital control cables. – Connect one screen end of the analog control cables. – Always connect the screens to the screen connection at the controller over the shortest possible distance. • Application of controllers in residential areas: – To limit the radio interference, use an additional screen damping ≥ 10 dB. This is usually achieved by installation in enclosed and grounded control cabinets made of metal.
Grounding	• Ground all metallically conductive components (controller, mains filter, motor filter, mains choke) using suitable cables connected to a central point (PE bar). • Maintain the minimum cross-sections prescribed in the safety regulations: – For EMC, not the cable cross-section is important, but the surface and the contact with a cross-section as large as possible, i.e. large surface.

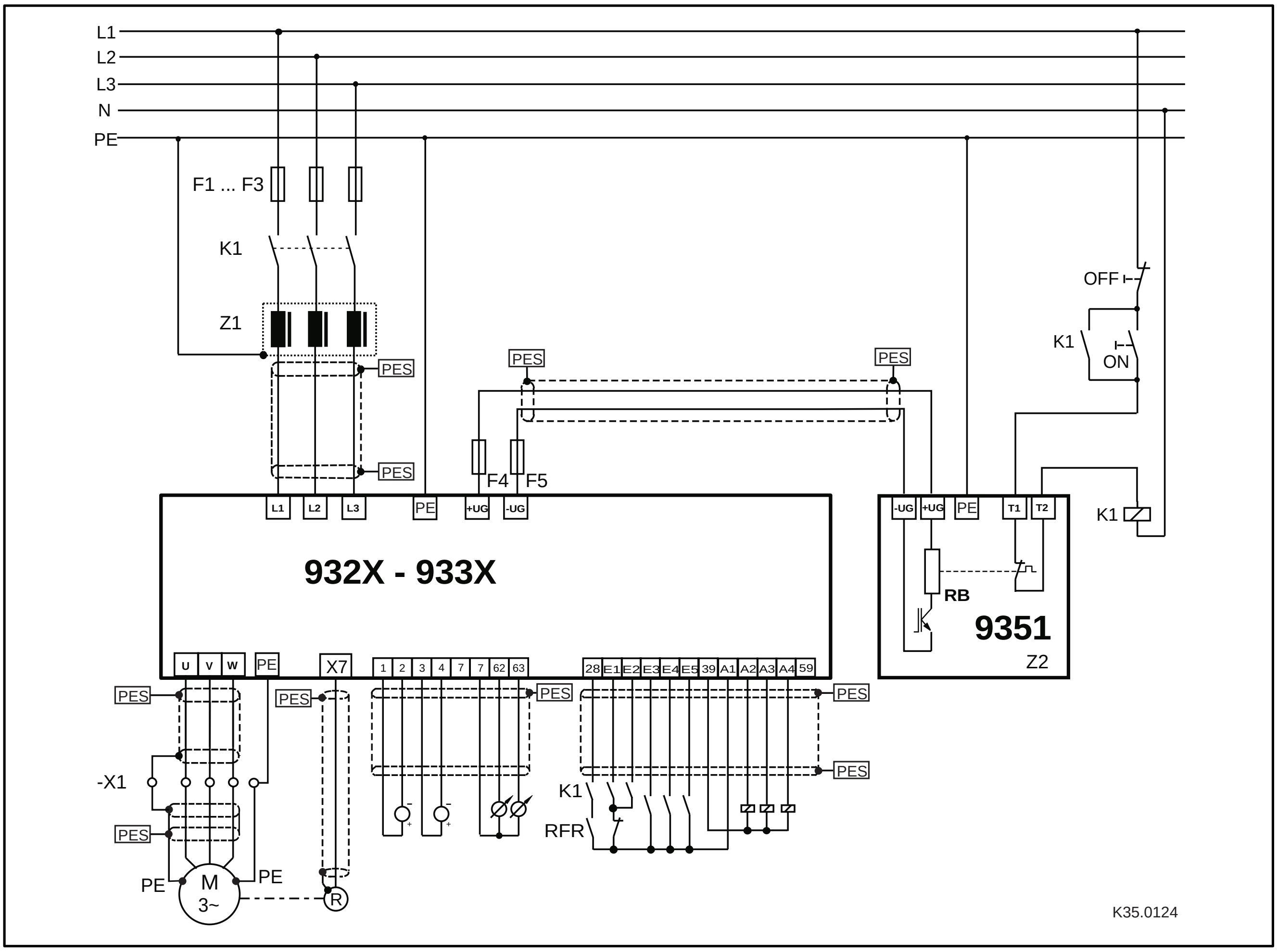


Fig. 4-17	Example for wiring in accordance with the EMC regulations	
	F1...F5	Protection, see “Cable protection” (3-6) / “mains connection” (4-13)
	K1	Mains contactor
	Z1	Mains filter “A” or “B” see Accessories.
	Z2	Brake module, see Accessories.
	-X1	Terminal strip in control cabinet
	PES	RF scree termination by a PE connection with a surface as large as possible (see ”Screening” in this chapter).

Show/Hide Bookmarks

EDS9300UE-PC
00411235

Lenze

Manual
Part C

Commissioning

During operation

Global Drive

Servo position controller 9300

This documentation is valid for 9300 position controllers as of version:

33.932X	EP	2x	1x		(9321 - 9329)
33.933X	EP	2x	1x		(9330 - 9332)
33.932X	CP	2x	1x	- V003	Cold Plate (9321 - 9328)

Type

Desgin:
E = Enclosure IP20
C = Cold Plate
xK = Cam profiler
xP = Position controller
xR = Register controller
xS = Servo inverter

Hardware level and index

Software level and index

Variant

Explanation

Version 2.0 09/99

Contents

Part C

5 Commissioning

5.1 Before switching on

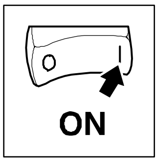
Prior to initial switch-on of the controller, check the wiring for completeness, short-circuit, and earth fault:

- Power connection:
  – Supply via terminals L1, L2 and L3 (direct mains connection) or alternatively via terminals +UG, -UG (DC bus connection, network of drives).
- Motor connection:
  – In-phase connection to the motor (direction of rotation).
- Feedback system (resolver, incremental encoder, ...).
- Control terminals:
  – Controller enable: terminal X5/28 (reference potential: X5/39).
- Cover of the power terminals:
  – Put on cover(s) and fix.
- **Keep to the switch-on sequence!**
- All commissioning steps described in this chapter refer to the default setting.

5.2 Initial switch-on

Tip!

- Use a PC with the Lenze program "Global Drive Control" (GDC) under Windows for commissioning. The convenient menu includes the codes for the most important settings.
- A fieldbus module type 2102 "RS232, RS485, fibre optics" (Lecom A/B) is required to run the GDC.
- GDC and fieldbus module are not included in the scope of supply of the controller.



Commissioning

Commissioning using an example

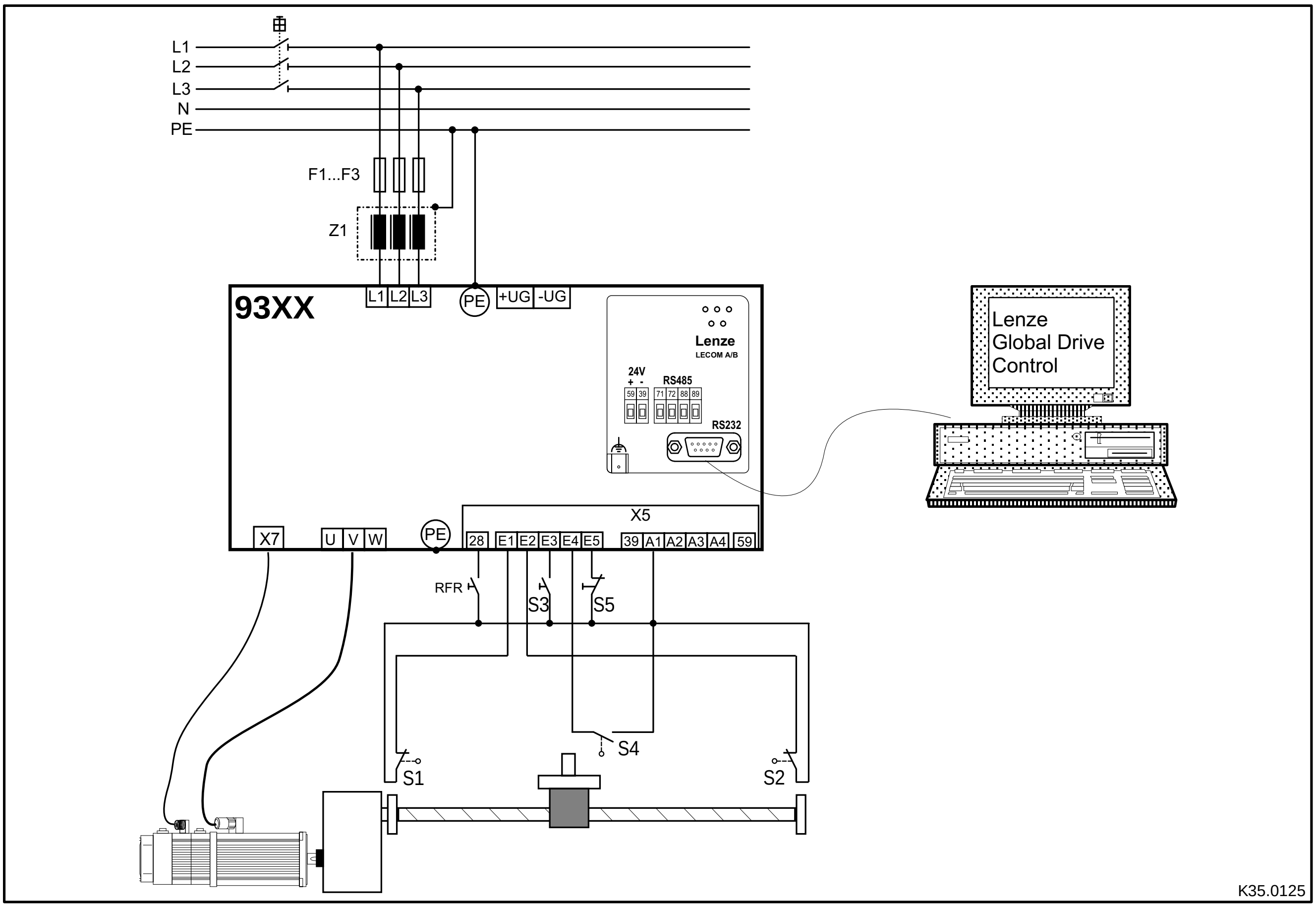
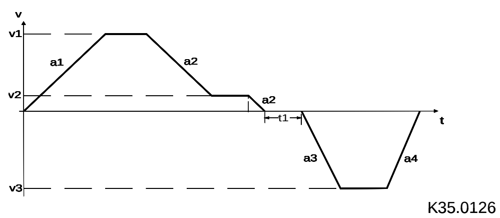


Fig. 5-1 Example of a drive control with default setting

Switch	Function
S1	Limit switch for negative direction of positioning (system protection)
S2	Limit switch for positive direction of positioning (system protection)
S3	Start positioning program
S4	Reference label for homing Tip: Set E4 to HIGH if there is no homing mark.
S5	Change-over from positioning to manual operation

Positioning profile	Name	Function
	a1	Acceleration forwards
	v1	positioning speed forwards
	a2	Deceleration forwards
	v2	Creeping for target approach
	t1	Waiting time (e.g. processing of a workpiece)
	a3	Acceleration backwards
	v3	positioning speed backwards
	a4	Deceleration backwards

ON

The following table lists the procedure for the commissioning of a position control according to the example in Fig. 5-1. A comprehensive description of the commissioning of position controls can be obtained from the following chapters.

Section	**Action**	**Detailed description**
Switch on controller	1. Assign terminal X5/28 (controller enable)to LOW signal. 2. Assign terminals X5/E1 and X5/E2 to HIGH signal (+13...+30V). 3. Assign terminals X5/E3 to X5/E5 to LOW signal. 4. Switch on mains: – The controller is ready for operation after approx.1s (2 s for drives with sine-cosine encoder with serial interface).	5-5
Switch on PC	Start GDC on the PC – Set the communication parameters for online operation in the ”Momentary drive” dialog box. Confirm with ”OK”. – Select the controller in the ”Assign controller description” dialog box. Confirm with ”OK”.	5-5
Generate parameter set	1. Adapt controller to the mains 2. Adapt controller to the motor 3. Enter machine parameters	5-6 5-7 5-8
Manual control	1. Enter parameters for manual positioning or use default setting 2. Enable controller 3. Function test with manual control	5-9 5-10 5-11
Enter parameters for positioning profile	1. Enter positioning data in the ”Programming” dialog box. 2. Connect the X5 terminals in the ”Terminal monitor 93XX (digital)” menu – When the digital terminals X5 are supplied with internal voltage; Assign output X5/A1 with ”FIXED1”. The output on terminal X5/A1 is approx. 24V. **TIP!** For this application, you may use one of the predefined configurations in C0005. C0005 = XXX1X (e.g. 20010 = absolute positioning with control via terminals) assigns FIXED1 automatically to the output X5/A1.	5-13
Control drive	1. Check whether the drive is ready for operation: – When the green LED is flashing: Controller is ready for operation, go on with step 2. – When green LED is off and red LED is flashing: Interference. Before proceeding with commissioning, eliminate the fault. 2. Enable controller – Green LED is illuminated when a HIGH signal (+13...+30V) is assigned and no other source of the controller inhibit is active. 3. For operation with a fieldbus module, additional settings are necessary (see operating instructions of the fieldbus module). The motor now rotates with the provided set-value and the selected direction of rotation.	5-23 8-1

5.3 Commissioning sequence

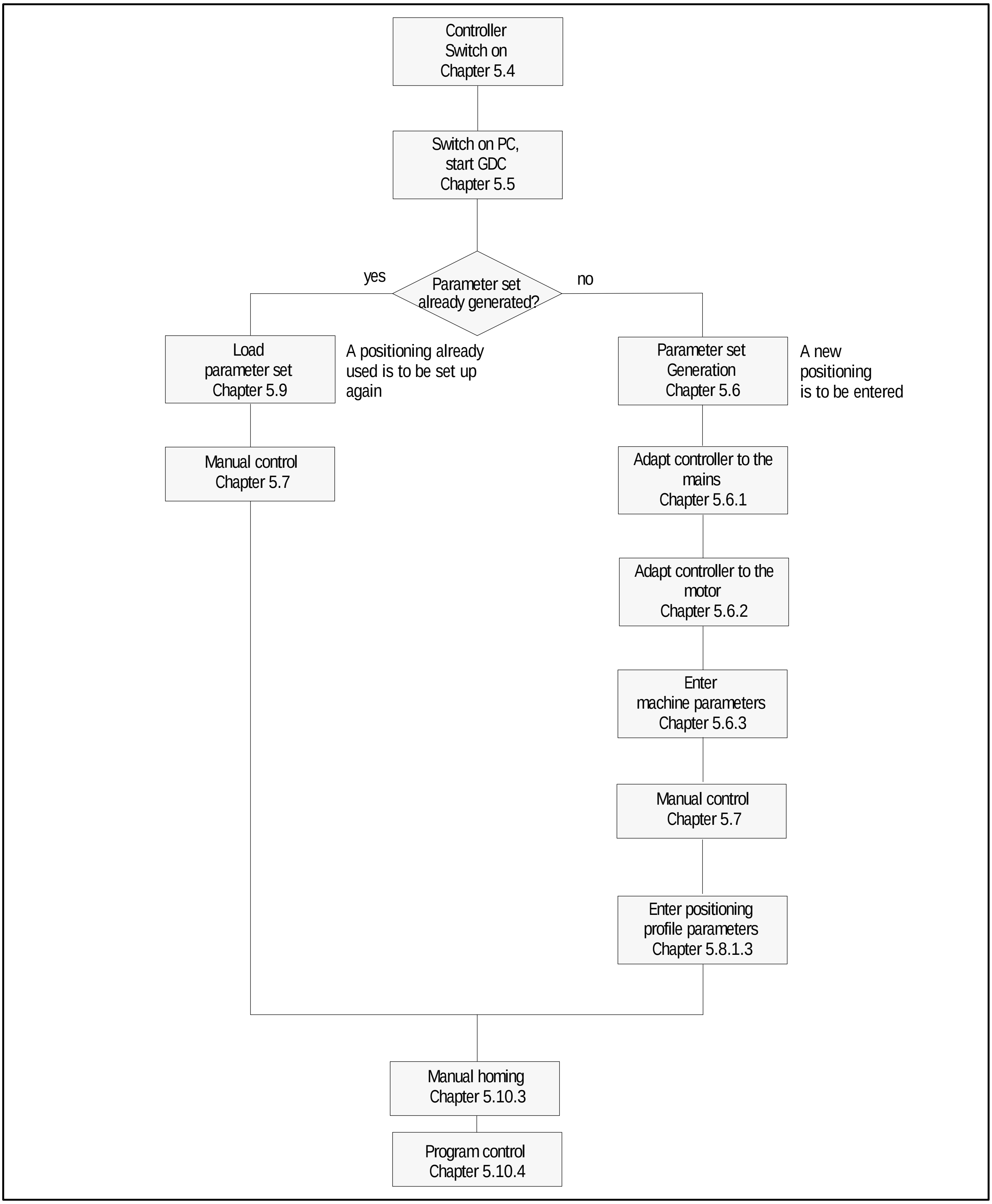


Fig. 5-2 Commissioning sequence

5.4 Switch on the controller

1. Assign LOW level to terminal X5/28 (controller enable).
2. Connect the positioning limit switch to terminals X5/E1 and X5/E2 (📖 4-19)

Note:
If you do not use positioning limit switches, assign the terminals to HIGH level.

3. Assign LOW level to terminals X5/E3 to X5/E5.
4. Switch on mains:
   – The controller is ready for operation after approx.1s
   (2 s for drives with sin/cos encoders with serial interface).
5. Check whether the controller is ready for operation:
   – If the green LED is flashing:
   Controller is ready for operation.
   – When green LED is off and red LED is blinking:
   There is a fault. Before proceeding with commissioning, eliminate the fault. (📖 8-1)
6. For operation with a fieldbus module, additional settings are necessary
   (see Operating Instructions for the fieldbus module used).

5.5 Switch on PC, start GDC

- Switch on PC.
- Start the GDC program under Windows.

When GDC is in ”online operation”

- The ”Find LECOM A/B drives” dialog box is opened.
- Click on ”Find”. GDC will now search for a controller.
- GDC selects the first controller found.
- GDC tests all baud rates which can be set.
- GDC loads the parameter set description for the connected controller.
  – If GDC does not find a parameter set description, you are asked which description you want to load alternatively.
- GDC automatically reads the parameter set from the controller.

When GDC is in ”offline operation”

- You have to select the controller manually.
  – You can change to ”online operation”. GDC automatically selects a controller.
- Open the ”Controller” menu in the menu bar and click on ”Select”. Make your choice for:
  – the desired parameter set description.
  – Baud rate.
  – Controller address.

5.6 Generate parameter set

Warning!

Do not change any controller settings that are not mentioned in this chapter. For more complex positioning tasks consult the Manual.

The instructions for the generation of a parameter set in this Chapter are based on the factory setting.

Proceed systematically when generating a parameter set:

1. Adapt controller to mains conditions.
2. Adapt controller to motor.
3. Enter machine parameters.
4. Enter parameters for manual positioning. (Then carry out a function test.)
5. Enter parameters for positioning profile.

Tip!

Make a positioning profile of your positioning task and, using this drawing, determine as much positioning data as possible. (🕮 5-13)

5.6.1 Adapt controller to the mains

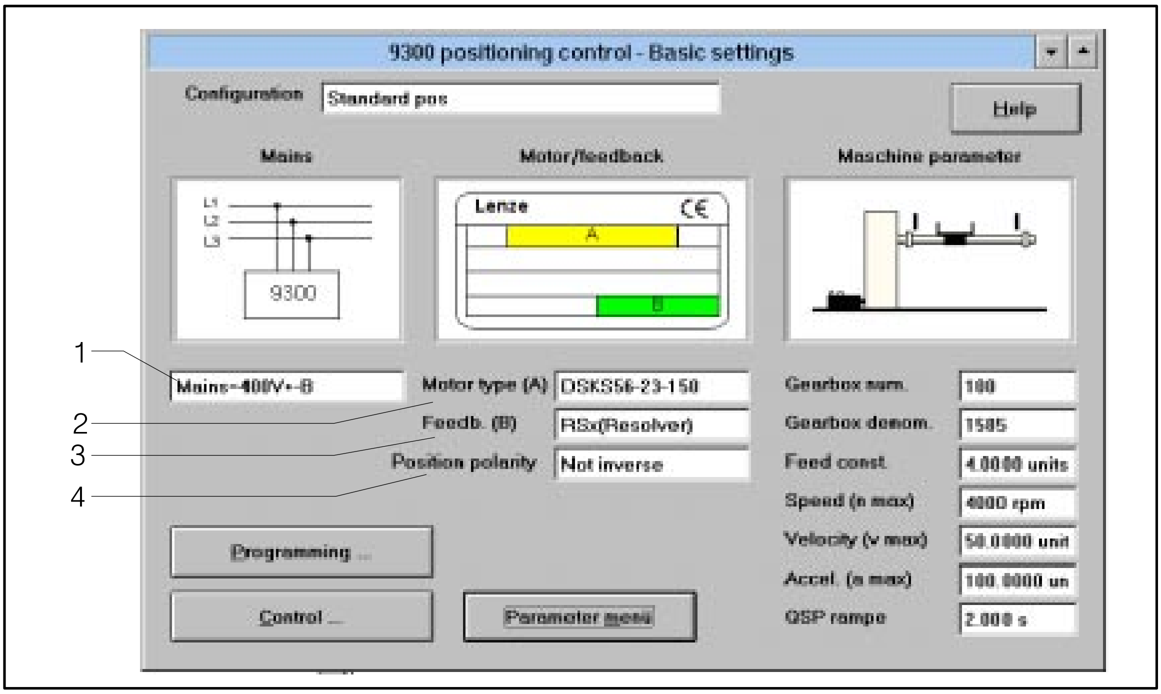


Fig. 5-3 ”Basic settings” dialog box

Field	Command	Function
1	Click on field	Select values for the actual mains and operating conditions.

5.6.2 Adapt controller to the motor

To achieve an optimum speed-torque characteristic for the drive, it is necessary to enter the nameplate data of the connected motor.

When you use a Lenze motor:

Field	Command	Function
2	Click "motor type (A)".	Select connected motor.
3	Click "encoder (B)".	Selected feedback system used.
4	Click on field "position polarity".	Select direction of rotation.

For motors with a resolver, use the eight-digit designation of the motor nameplate "encoder" (as an option).

- For this change to the parameter menu (see button Fig. 5-4) and select the menu "Motor/feedback system".

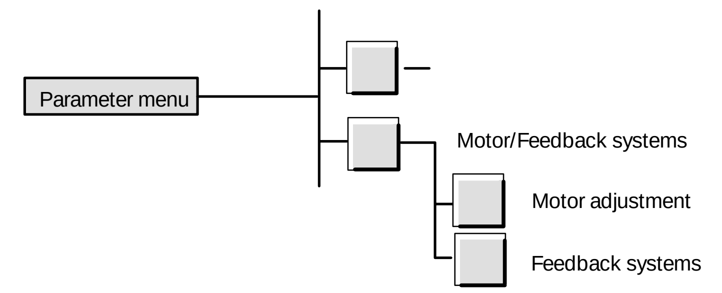


Fig. 5-4 How to find the menus "Motor setting" and "Feedback systems"

In the menu "Feedback systems":

Field	Command	Function
	Select C0416	Resolver fault. Enter value from the motor nameplate
	Select C0003	Save data (C0003 = 1).

If you use a motor other than from Lenze:

Change to the menu "Motor setting" (see Fig. 5-4).

In the menu "Motor setting":

Field	Command	Function
	Select C0086	Select a motor which best matches the motor used. List of the motors available: 7-356 .
	Select C0006	Operating mode of the motor control
	Select C0022	Adapt I_{max} to the maximum motor current.
	Select C0081	Rated motor power
	Select C0084	Stator resistance of the motor (only for very high demands on the control characteristics).
	Select C0085	Stray inductance of the motor (only for very high demands on the control characteristics).
	Select C0087	Rated motor speed
	Select C0088	Rated motor current
	Select C0089	Rated motor frequency
	Select C0090	Rated motor voltage
	Select C0091	Motor cos φ.
	Select C0003	Save data (C0003 = 1).

5.6.3 Enter machine parameters

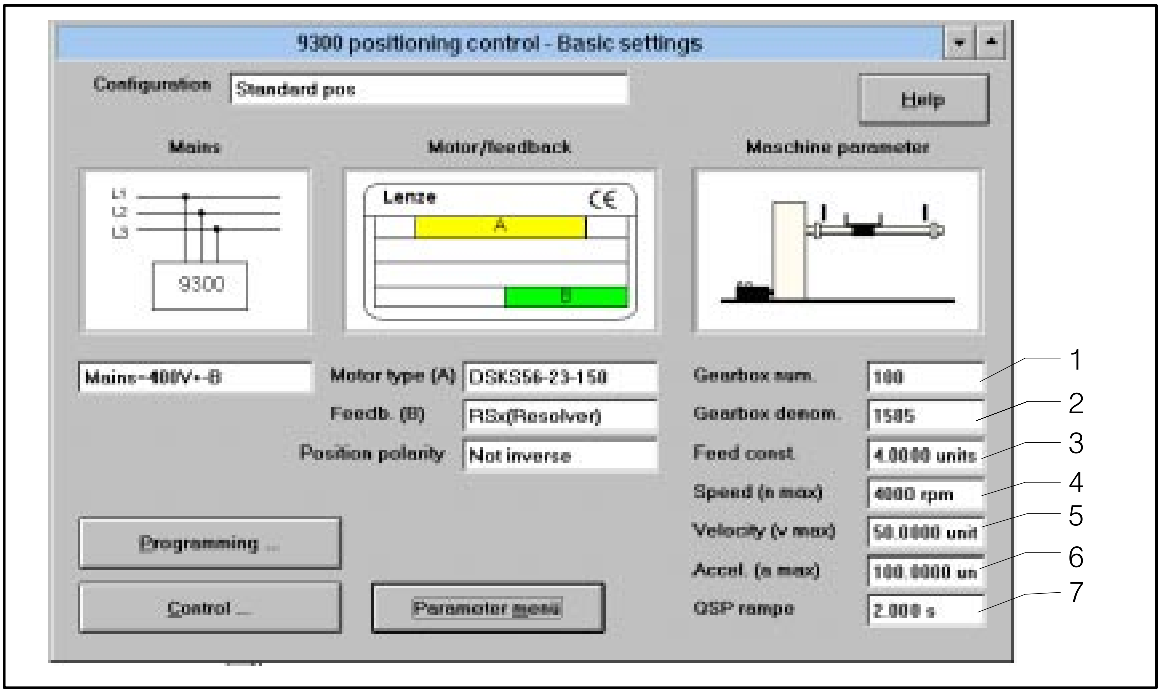


Fig. 5-5 "Base settings" dialog box

Field	Command	Function	
1	Click on field "Gearbox numerator"	Enter denominator for the gearbox ratio.	$i = \frac{n_{motor}}{n_{gearbox\ output}}$
2	Click on field "Gearbox denominator"	Enter numerator for the gearbox ratio.	The value results from the number of units (e. g. mm) being moved forward during one rotation at the gearbox output side.
3	Click on field "Feed constant"	Enter feed of the spindle.	
4	Click on field "Speed (n-max)"	Enter upper speed limit of the motor	
5	Click on field "speed (v-max)"	Enter fastest positioning speed of the machine	
6	Click on field "Acceleration (a-max)"	Maximum permissible acceleration (with interference or during approach to position limit switches a-max cannot be activated).	
7	Click on field "QSP ramp"	Time from release of fault or approach to a position limit switch to machine standstill.	

5.6.4 Parameters for manual positioning

Stop!

Check the parameters for manual positioning. To check the configuration, select small values for acceleration and speed (e.g. factory setting).

The factory setting of the parameters is sufficient for most applications. Enter the settings as follows:

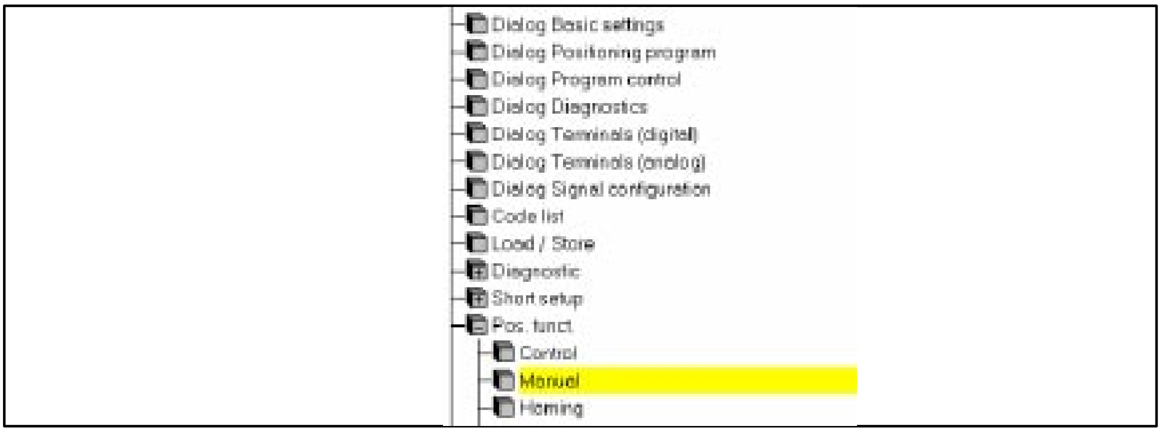


Fig. 5-6 Menu "Manual positioning" in the parameter menu

Step	Command	Function
1	Select "Basic settings" dialog box.	
2	Click on "Parameter menu" button.	Open parameter menu
3	Click on "Positioning functions" menu.	Open "Positioning functions" menu.
4	Click on "Manual positioning" menu.	Open "Manual positioning" menu.
5	Click on C1243. Enter new value.	Manual positioning speed. Factory setting: 5 % of vmax
6	Click on C1252. Enter new value.	Manual positioning acceleration. Factory setting: 10 % of amax
7	Click on C0003.	Save settings
8	Click on "Dialog control" menu.	Open "Control" dialog box.

Commissioning

5.6.5 Controller enable

- The controller is enabled only when all sources of the controller inhibit are reset.
  – When the controller is enabled, the green LED on the controller is illuminated.
- For the display of active sources of a controller inhibit see Chapter "Troubleshooting". (🕮 8-1)

The following table shows the conditions for controller enable:

Source controller inhibit	Controller inhibited	Controller enabled	Note
Terminal X5/28	0 V ... +4 V	+13 V ... +30 V	-
Fault	In case of TRIP In case of Message	TRIP reset	Check, see 🕮 8-1
System bus (CAN)	Transmission of the control information INHIBIT via C0135	Transmission of the control information ENABLE via C0135	🕮 Manual
Field bus module	See operating instructions of the corresponding fieldbus module		-

Tip!

All sources of controller the inhibit act like a series connection of switches, independent of each other.

Stop!

When the internal control structure is changed, another terminal assignment may result.

5.7 Function test with manual control

Test the function with manual control after every new or modified configuration.

Warning!

Provide suitable emergency stops for manual operation so that you will be able to stop the drive in the event of unpredictable movements.

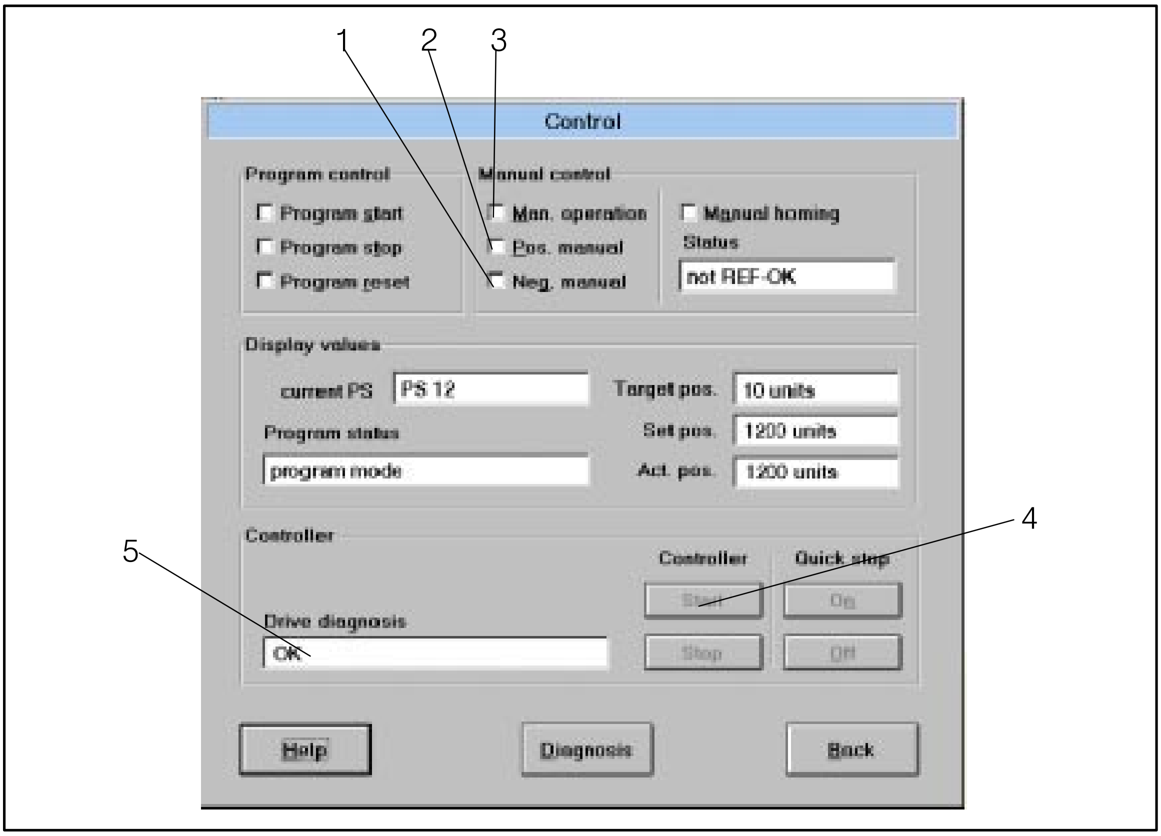


Fig. 5-7 Dialog box "Control"

Field	Command	Function
3	Select "Manual operation"	Manual operation active
5		With drive diagnostics "Ok", "Enable" is possible. 🕮 6-2
4	Controller "Enable"	Enables the controller, if there is no interference.
2	Select "Manual positive"	The drive moves in the positive direction towards the limit switch. • Test positioning limits • Overide positioning limit switch to test its function.
	Reset "Manual positive"	The drive stops.

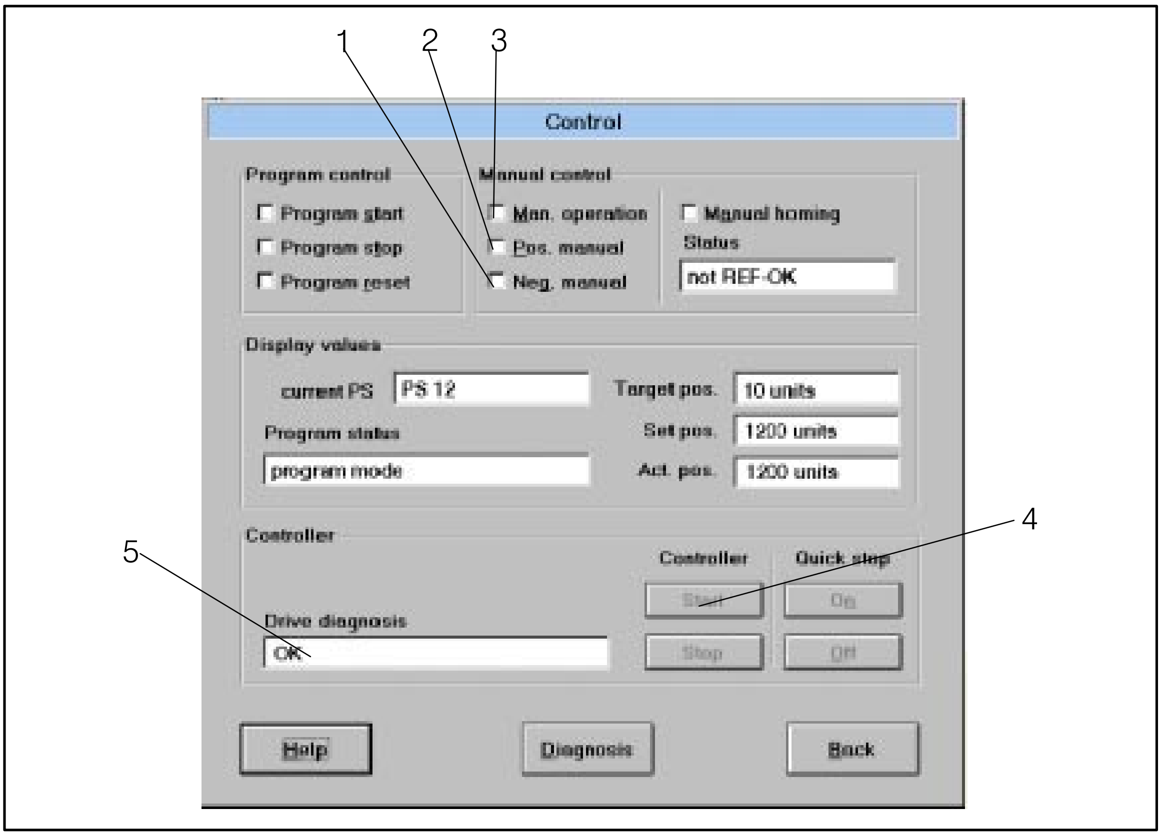


Fig. 5-8 Dialog box ”Control”

Field	Command	Function
1	Select ”Manual negative”	The drive positions in the negative direction towards the limit switch. • Test positioning limits • Overide positioning limit switch to test its function.
	Reset ”Manual negative”	The drive stops.
1, 2	”Manual positive” and ”Manual negative” selected	The drive brakes with a-max down to standstill.

Tip!

- To assign the reverse direction to the function ”Manual positive” and ”Manual negative”, change to the dialog box ”Base settings” and set the field ”Position polarity” to ”inverted”.
- You can quit overridden limit switches only by changing the positioning direction (”Manual positive” or ”Manual negative”).

5.8 Enter positioning profile parameters

5.8.1 Structure of a positioning program

- The positioning program consists of max. 32 program sets (PS).
- The sequence of processing the PS within the positioning program can be freely selected.
- The PS determine the sequence of the positioning. The functions within a PS are processed according to a fixed sequence (see Fig. 5-14). These functions include:
  – Type of positioning (relative or absolute positioning with or without touch probe)
  – Speed profile of the positioning
  – Access to data in the variable tables (VT).
  – Reaction on external events via digital inputs (PFI)
  – Processing of waiting times
  – Repetition of number of pieces
  – Output of control signals via digital outputs (PFO)

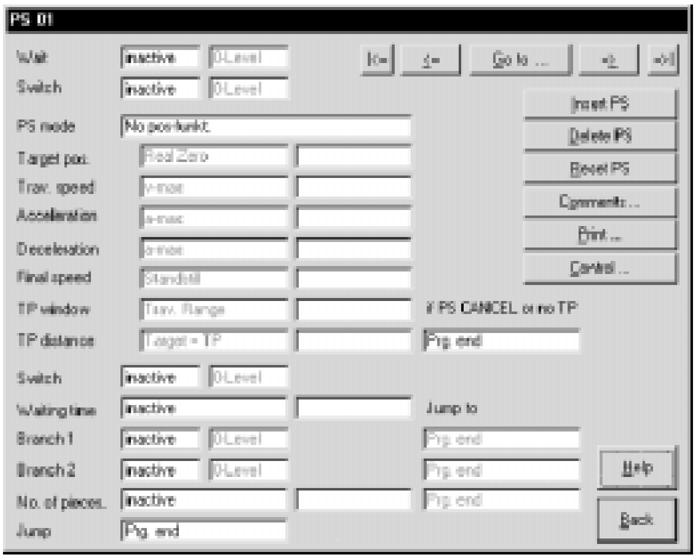


Fig. 5-9 PS input dialog

- The positioning is carried out according to the positioning profile parameters. These parameters are listed in the variable tables (VT). The following VTs are available:
  – VTPOS for the target position
  – VTVEL for the positioning speed and final speed
  – VTACC for the acceleration and deceleration
  – VTPCS for the number of pieces or repeat function
  – VTTIME for the waiting time

5.8.1.1 Tools for editing

For a simple and fast input of parameter data, GDC provides tools for editing. These are explained in the PS templates displayed in the program.

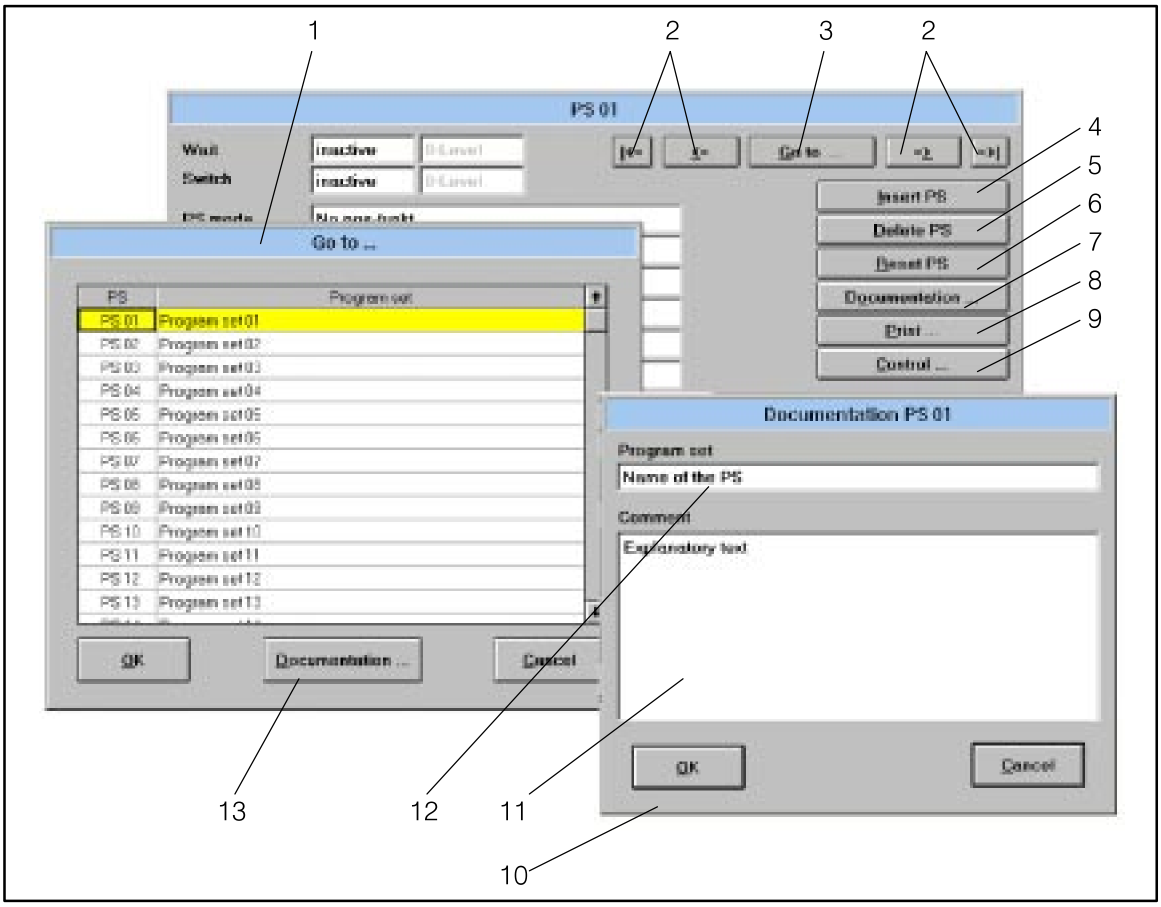


Fig. 5-10 Editing tools for the program sets

Field	Function	Description
1, 3	Selection of a PS	Click on "Go to ..." (3). The dialog box (1) is opened. Select a PS which you want to modify. At the same time you can write notes about the PS. For this, click on "Documentation" (13) (see also 7).
2	Browsing the PS	Select the previous or next PS or jump to the first or last PS.
4	Insert PS	Inserts a new PS at this place and displaces all following PS by one position. The last PS is deleted.
5	Delete PS	Deletes the current PS and displaces all following PS by one position.
6	Reset PS	Resets all parameters of the current PS to factory setting.
7, 10, 11, 12	Write comments on the PS	Documentation of current PS. In the dialog box (10) you can enter a name for the PS (12) and add an explanatory text as comment (11).
8	Print PS	Output of the current or all PS to a printer.
9	Select dialog box "Control".	Direct change to the dialog box "Control", e.g. to test modifications in manual operation. 🕮 5-11

5.8.1.2 Structure of a positioning profile

- Make a positioning profile of your task (e.g. Fig. 5-11, Fig. 5-12)
- For more complex positioning profiles, generate the positioning program with several PS (e.g. for different positioning speeds).

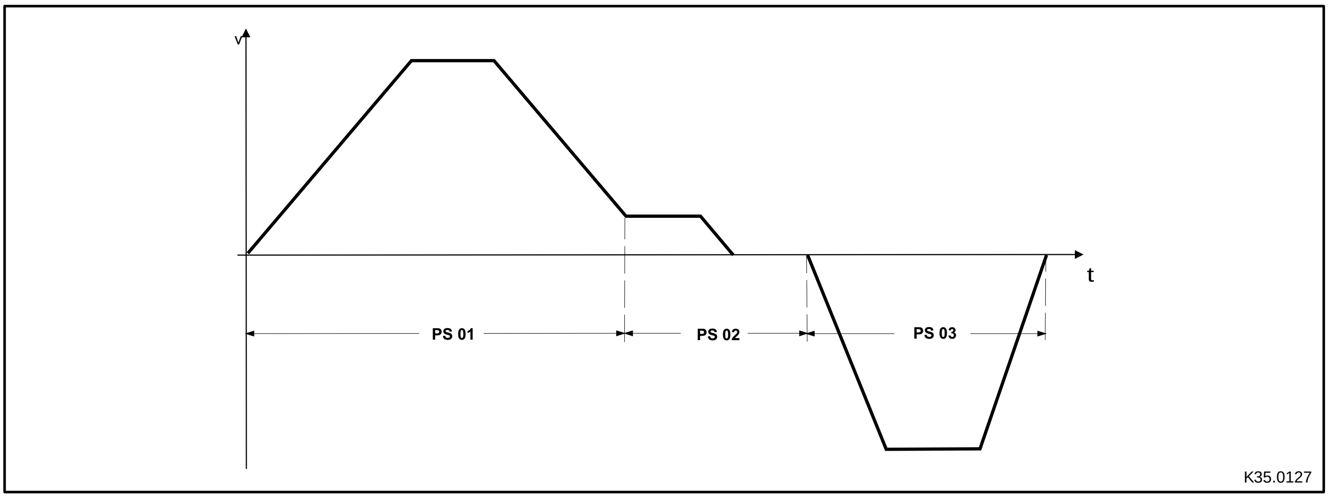


Fig. 5-11 Structure of a positioning profile (example of a point-to-point positioning)

In the example, a total of three program sets are required for the complete input of all parameters. Every PS uses the same input template. The input template is described in the next Chapter.

Program sets

The parameter data for the positioning profile are saved in the program sets.

- Thanks to the template of the program sets.
  – the sequence of the input is determined. (🕮 5-19)
  – complex positionings are divided into individual sections (sets).
- Every program set can be called up again and again without further programming.
- A total of 32 program sets are available.

Commissioning

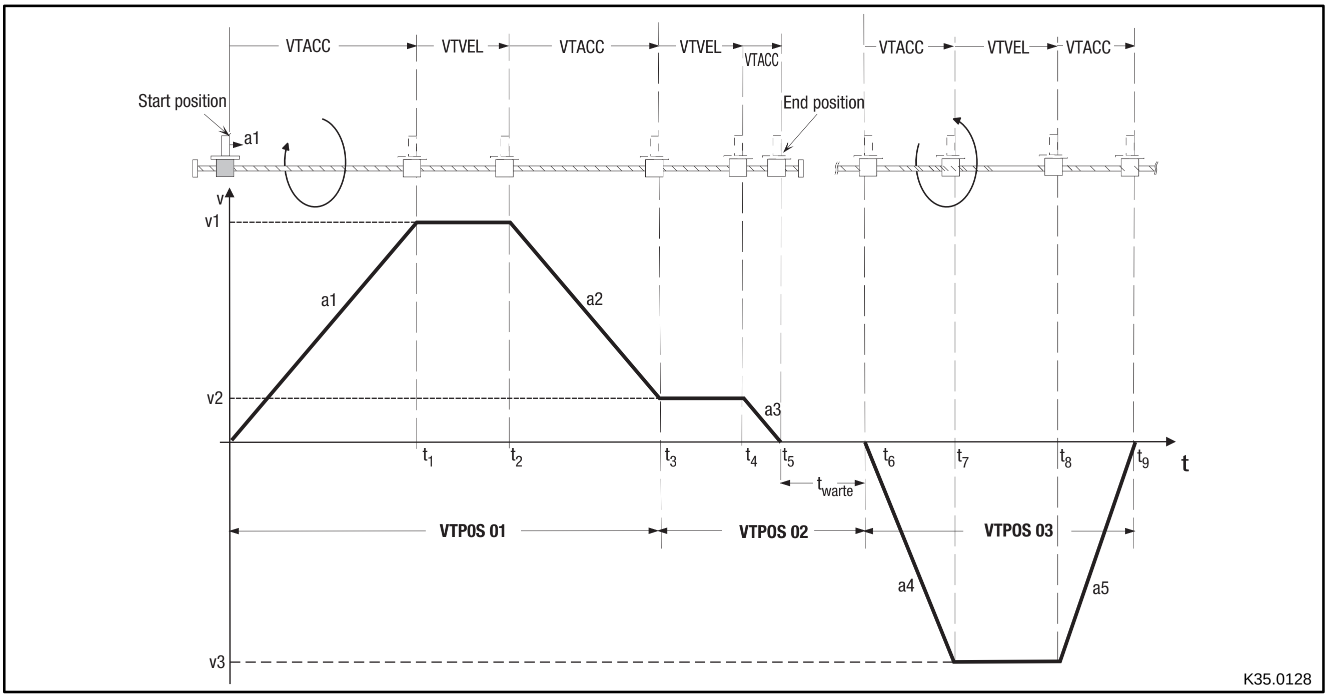


Fig. 5-12 Structure of a positioning profile (example of a point-to-point positioning)

Name	Program set (PS)	Function
a1	PS01	Acceleration forwards
t1	PS01	Time until v1 is reached
v1	PS01	Positioning speed forwards
t2	PS01	Calculated time of braking to reach v2 in t3
a2	PS01	Deceleration 1 forwards
t3	PS01	Start creeping with v2
v2	PS01, PS02	Final speed (PS01), positioning speed (PS02)
t4	PS02	Drive approaches position
a3	PS02	Deceleration 2 forwards
t5	PS02	Position reached, then waiting time (e.g. processing of a workpiece)
t6	PS03	Start backward motion
a4	PS03	Acceleration backwards
t7	PS03	Time until v3 is reached
v3	PS03	positioning speed backwards
t8	PS03	Time until a5 starts (calculated)
a5	PS03	Deceleration backwards
t9	PS03	Time until the start is reached again

Description of the input template

Click on the "Programming" button in the "Basic settings" dialog box.

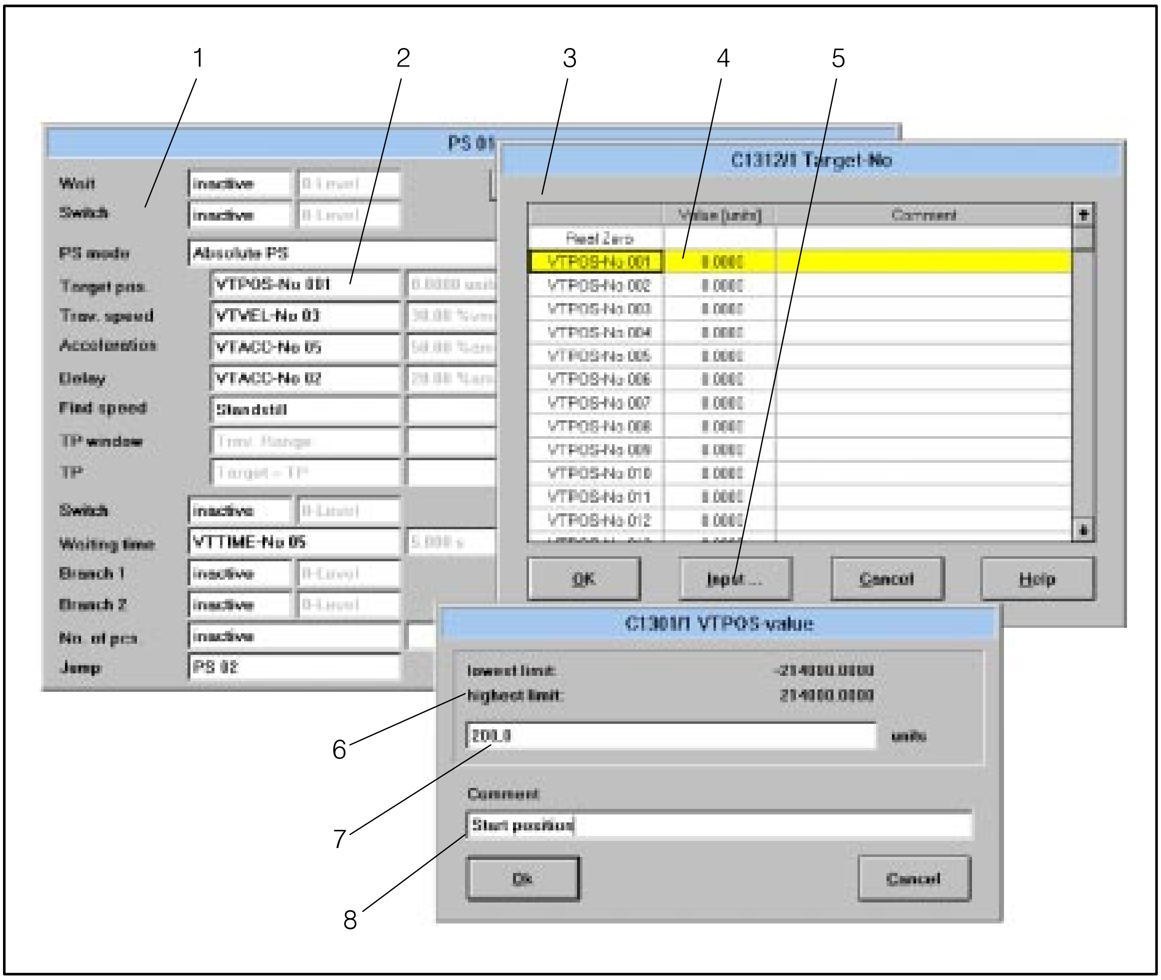


Fig. 5-13 Dialog box for entering the positioning data

Field	Function	Description
1	Dialog box for a program set (PS)	All necessary positioning profile parameters for a PS are entered as well as possible branches to further PS.
2, 3	Parameter field	Click on field. A dialog box (3) for selecting a parameter is opened.
4, 5, 6	Selection field	A parameter is selected. Click on desired parameter. For variable tables (VT) you can describe the table items. For this, click on "Input" (5). A dialog box (6) for entering a parameter is opened.
6	Dialog box	Dialog box for entering a parameter in the variable table
7	Input field	Input of the desired parameter
8	Comment on the parameter	You can write a comment to the parameter, e.g. for which function it is required.

Processing a program set

The following chart shows the processing of a program set (PS).

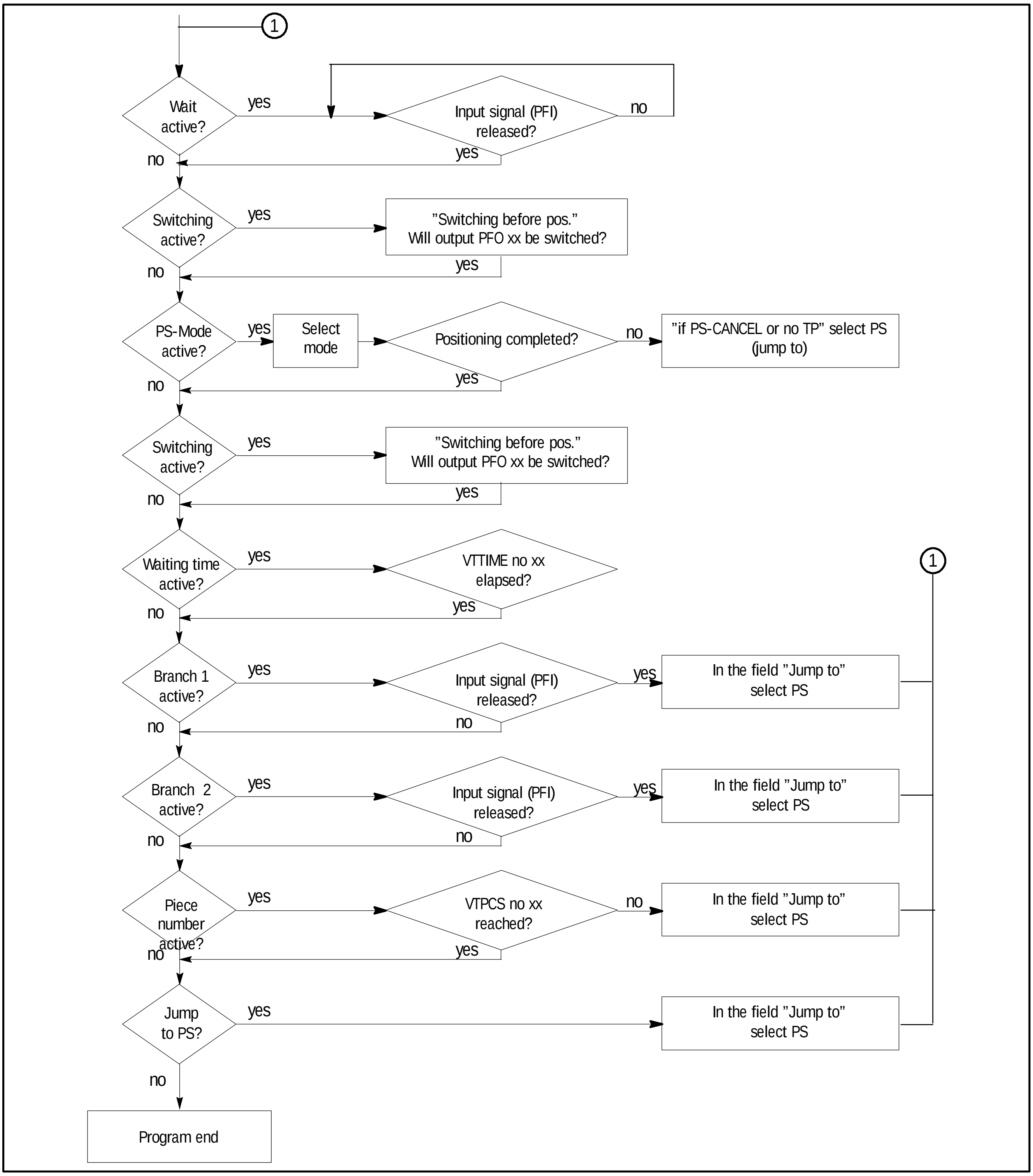


Fig. 5-14 Processing a program set

5.8.1.3 Enter parameters

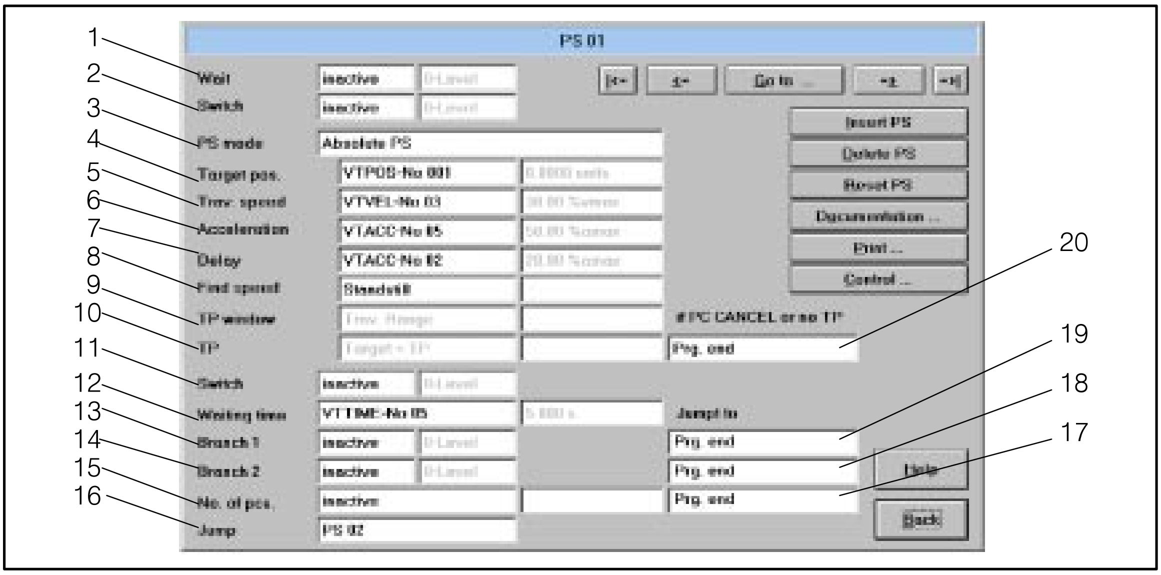


Fig. 5-15 Dialog box for entering the positioning data

Field	Function	Description
1	Inactive or no. of a PFI 0 level or 1 level	Program function input (PFI). A digital input signal via an FB or terminal initiates the processing of the PS.
2	Inactive or no. of a PFO (0 or 1 level)	Program function output (PFO). A digital output signal indicates the state via an FB or via terminal.
3	Type of positioning	e.g. absolute positioning, relative positioning or special function (set reference).
4	Position target of VTPOS	Input of a position target from the variable table VTPOS.
5	Positioning speed from VTVEL	Input of a speed from the variable table VTVEL.
6	Acceleration from VTACC	Input of an acceleration from the variable table VTACC.
7	Deceleration from VTACC	Input of a deceleration from the variable table VTACC.
8	Final speed from VTVEL	Input of a speed from the variable table VIVEL or standstill.
9	TP window from VTPOS	Input of a position value from the variable table VTPOS.
10→20	TP residual distance from VTPOS	Input of a position value from the variable table VTPOS.If there is no touch probe during a touch probe positioning, the program branches/jumps ("if PS CANCEL or no TP") to a PS or program end.
11	Inactive or no. of a PFO (0 or 1 level)	Program function output (PFO). A digital output signal indicates the state via an FB or via terminal.
12	Inactive or time from VTTIME	Input of a waiting time from the variable table VTTIME until the next program function is processed.
13→19	Inactive or no. of a PFI 0 level or 1 level	Program function input (PFI). If a digital input signal is applied during a request (via a FB or a terminal), the program branches ("Jump to") to a PS or to the program end.
14→18	Inactive or no. of a PFI 0 level or 1 level	Program function input (PFI). If a digital input signal is applied during a request (via a FB or a terminal), the program branches ("Jump to") to a PS or to the program end.
15→17	Inactive or number from VTPCS	Input of a set piece number from the variable table VTPCS. As long as the set piece number is not reached, the program branches to a PS or to the program end.
16	Jump to the next PS or program end	Input of a PS or program end to which the program branches after the current PS has been processed.

5.8.2 Save parameter set

The operating menu GDC (see Fig. 5-16) allows you to save a new or modified parameter set:

- Saving on the hard drive of the PC or a diskette by
  ”Write all parameter sets to file”
- Saving in the controller by
  ”Write current parameter set to the controller (F5)”
  – You can save the data as non-volatile with C0003=1 in the ”Parameter set management” menu.

Tip!

Comments can be entered for the parameter set when saving on the hard drive or diskette.

1. Click on ”Drive parameters” in the menu bar of GDC.

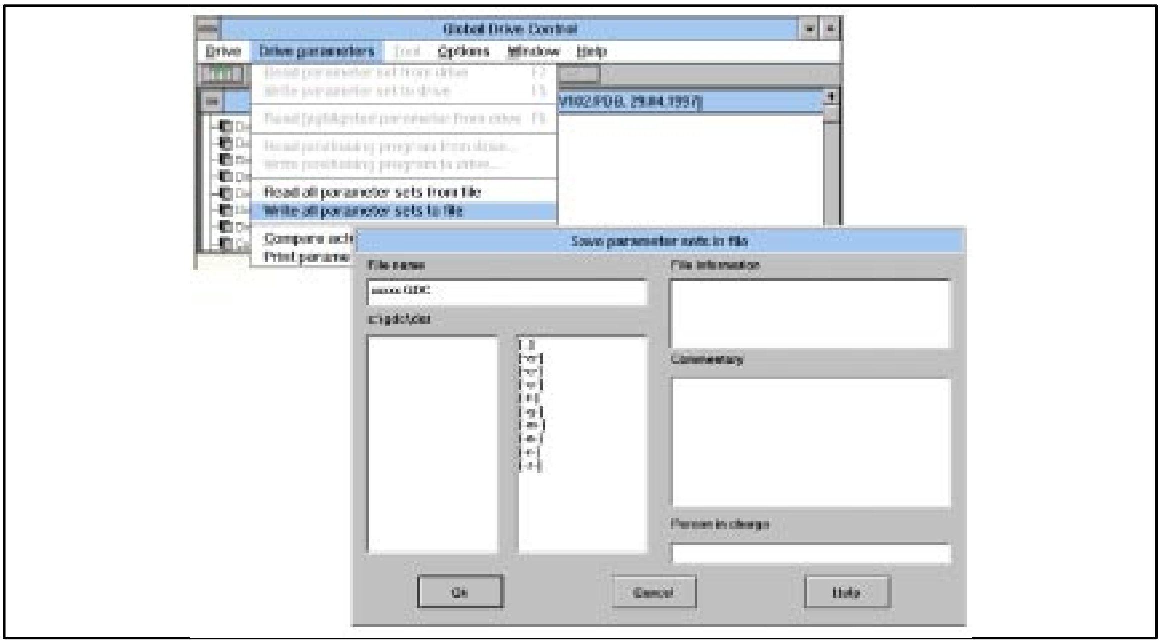


Fig. 5-16 Dialog box ”Write parameter set to file”

2. Select ”Write all parameter sets to file”.
3. Enter the file names and select the disk drive on which you want to save the parameter set.
4. Write a comment on the parameter set in the ”Commentary” field and confirm with ”Ok”.

5.9 Load parameter set

5.9.1 Load parameter set from the PC

The operating menu (Fig. 5-17) allows the loading of a parameter set

- from the hard disk of the PC or a diskette in GDC by ”Read all parameter sets from file”
- from the PC to the drive by ”Write current parameter set to the controller (F5)”

Warning!

- The controller is re-initialized by the parameter set transfer from the PC to the controller:
  – System configurations and terminal assignments may be modified. Ensure, that your wiring and drive configuration correspond to the settings of the parameter set.
- Only use terminal X5/28 or the STOP function of GDC as a source for the controller inhibit. A parameter set transfer is only possible when the controller is inhibited.

1. Insert a diskette with the parameter set into the disk drive of the PC. Click on ”Drive parameters” in the menu bar of GDC.

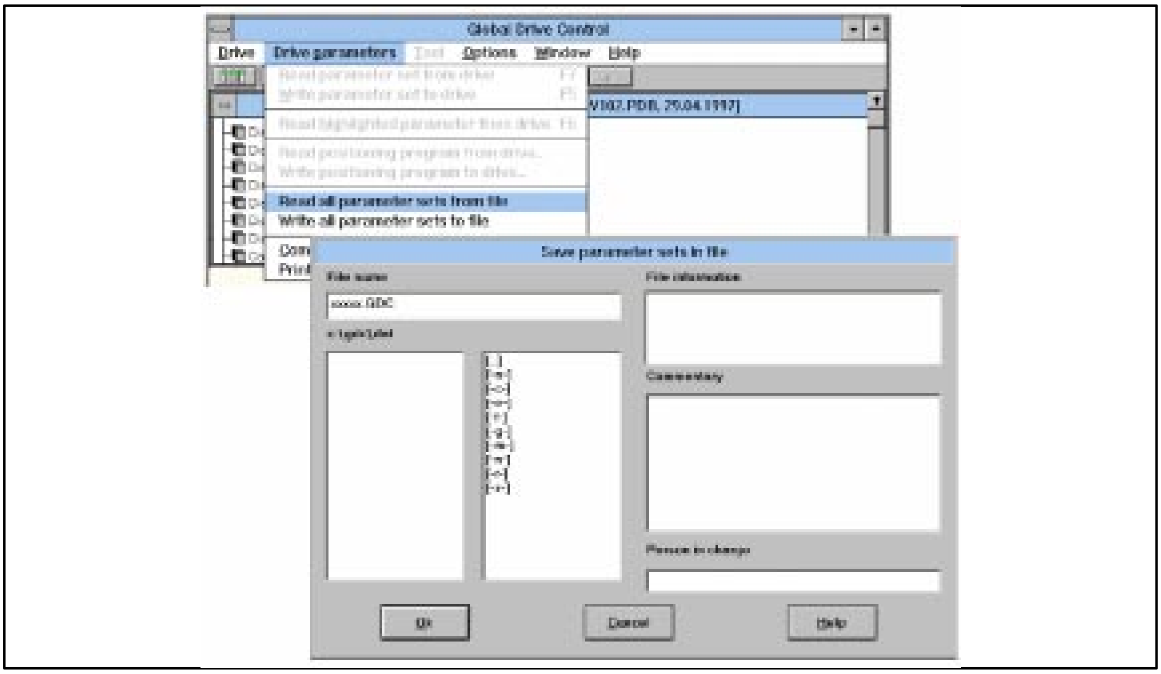


Fig. 5-17 Dialog box ”Read all parameter sets from file”

2. Select ”Read all parameter sets from file”.
3. Select the disk drive and the parameter set which is to be loaded. Confirm with ”OK”.
4. Make sure that your wiring and drive configuration match the settings of the new parameter set.

5.9.2 Load parameter set from the controller

The operating menu (Fig. 5-17) allows the loading of a parameter set

- from the controller to the PC by "Read current parameter set from the controller (F7)"
  – C0002 offers the following options in the menu "Parameter set management":

1. Loading of factory setting (C0002=0)
2. Loading of customer-specific parameter set (C0002=1)

Tip!

The RDY message is not displayed while the parameter set is loaded since the controller cannot be operated then.

5.10 Control drive

5.10.1 Description of the dialog box

- Click on the ”Control” button in the ”Basic settings” dialog box.

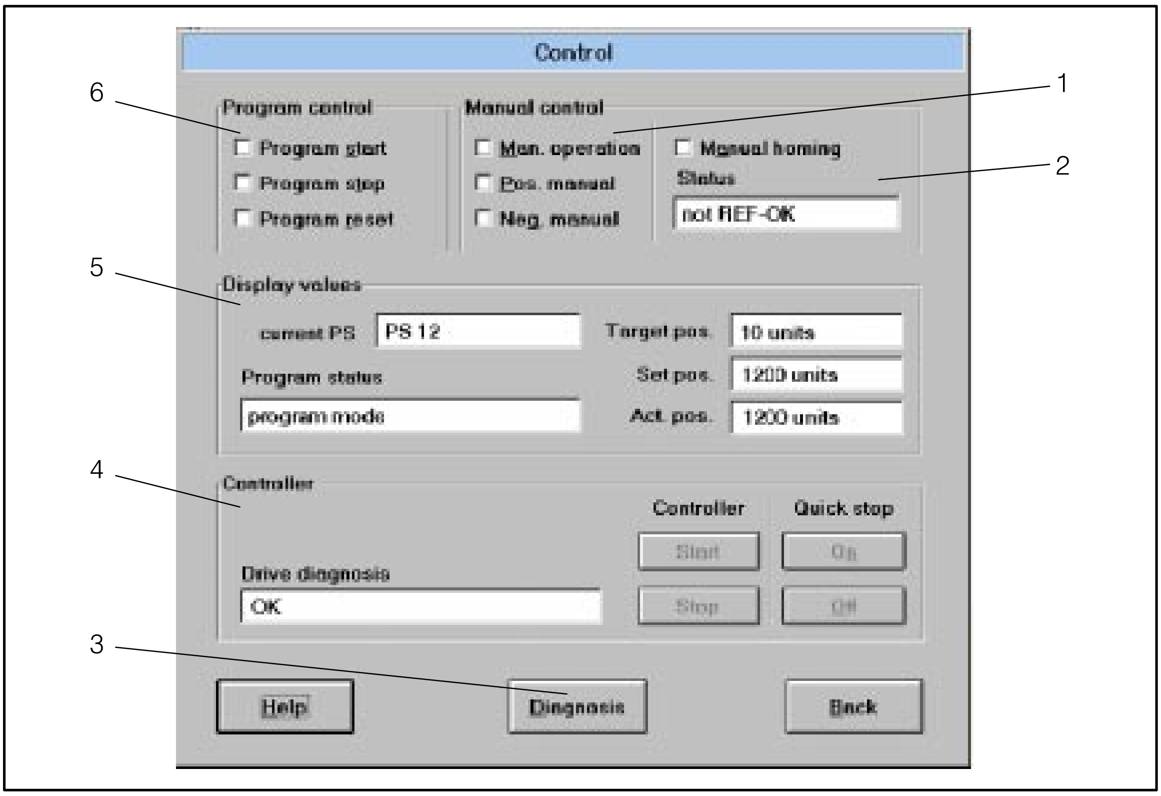


Fig. 5-18 Dialog box ”Control”

Field	Function	Description
1	Manual control	🕮 5-11
2	Manual homing	🕮 5-25
3	Menu ”Diagnostics”	🕮 6-2
4	”Enable”, ”Inhibit” controller and drive diagnostics	🕮 5-10, “Controller enable” 🕮 5-11, “Function test with manual control” 🕮 5-25, “Manual homing” 🕮 5-26, “Program control”
5	Status display	Important values for program control 🕮 5-26
6	Program control	🕮 5-26

5.10.2 Parameters for homing

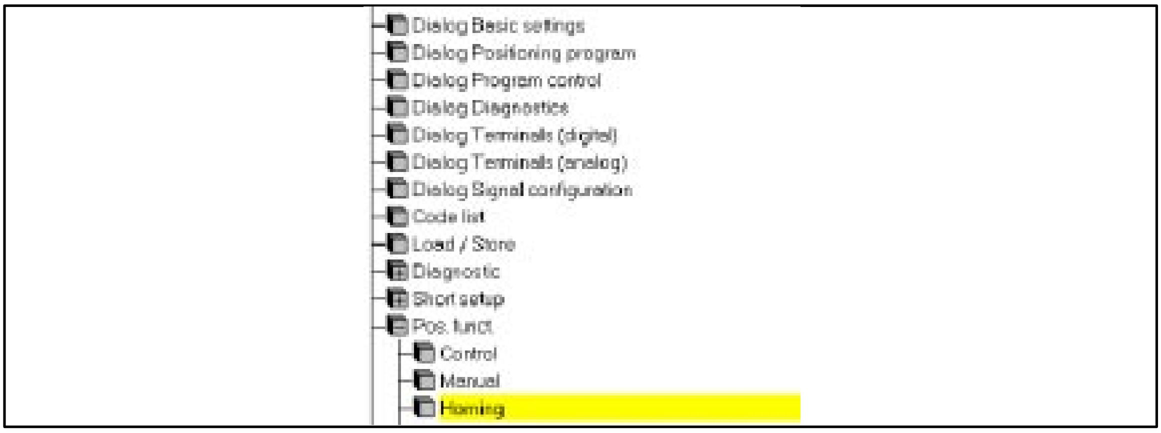


Fig. 5-19 Menu "Homing" in the parameter menu

The factory setting of the parameters is sufficient for most applications. Enter the settings as follows:

Step	Command	Function
1	Select "Basic settings" dialog box.	
2	Click on "Parameter menu" button.	Open parameter menu
3	Click on "Positioning functions" menu.	Open "Positioning functions" menu.
4	Click on "Homing" menu.	Open "Homing" menu.
5	Click on C1242. Enter new value.	Homing speed. Factory setting: 5 % of vmax
6	Click on C1251. Enter new value.	Homing acceleration. Factory setting: 10 % of amax
7	Click on C1213. Select positioning direction. Factory setting: +home Setting: -home	Homing mode • The drive moves in the positive direction towards the limit switch. • The drive positions in the negative direction towards the limit switch.
8	Click on C0003.	Save settings
9	Click on "Dialog control" menu.	Open "Control" dialog box.

5.10.3 Manual homing

The controller can perform all positioning tasks only with a defined reference point (zero point).

- Click on the ”Control” button in the ”Basic settings” dialog box.

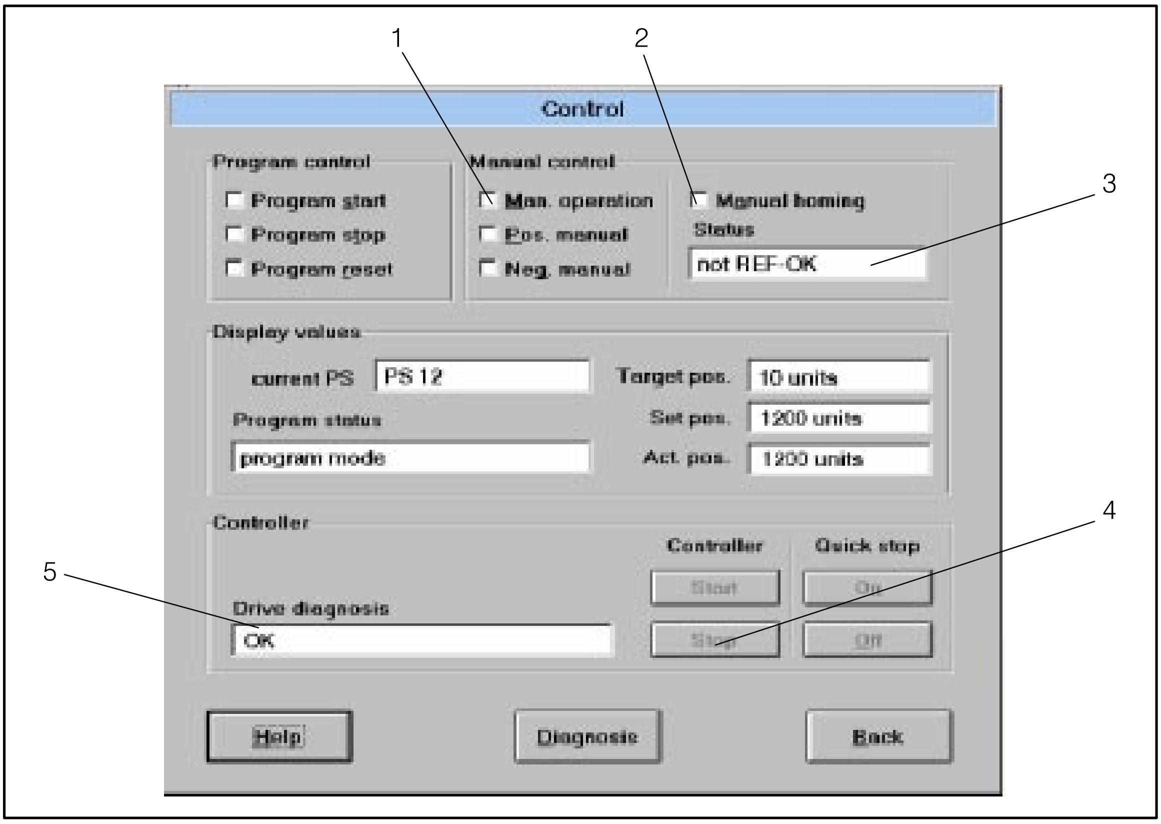


Fig. 5-20 Dialog box ”Control”

Field	Command	Function
1	Select ”Manual operation”	Manual operation active
5		With drive diagnostics ”Ok”, ”Enable” is possible. 🕮 6-2
4	Controller ”Enable”	Enables the controller, if there is no interference.
2	Select ”Manual homing”.	The drive uses the reference parameters for positioning. 🕮 5-24
	Reset ”Manual homing”.	The drive stops.
	Override the reference switch.	The drive positions until the next zero position of the rotor and brakes to standstill. This position is now defined to be the reference point for all position values.
3		Status display ”Reference Ok” is displayed after successful reference homing.
		Terminal X5/A4 = HIGH

5.10.4 Program control

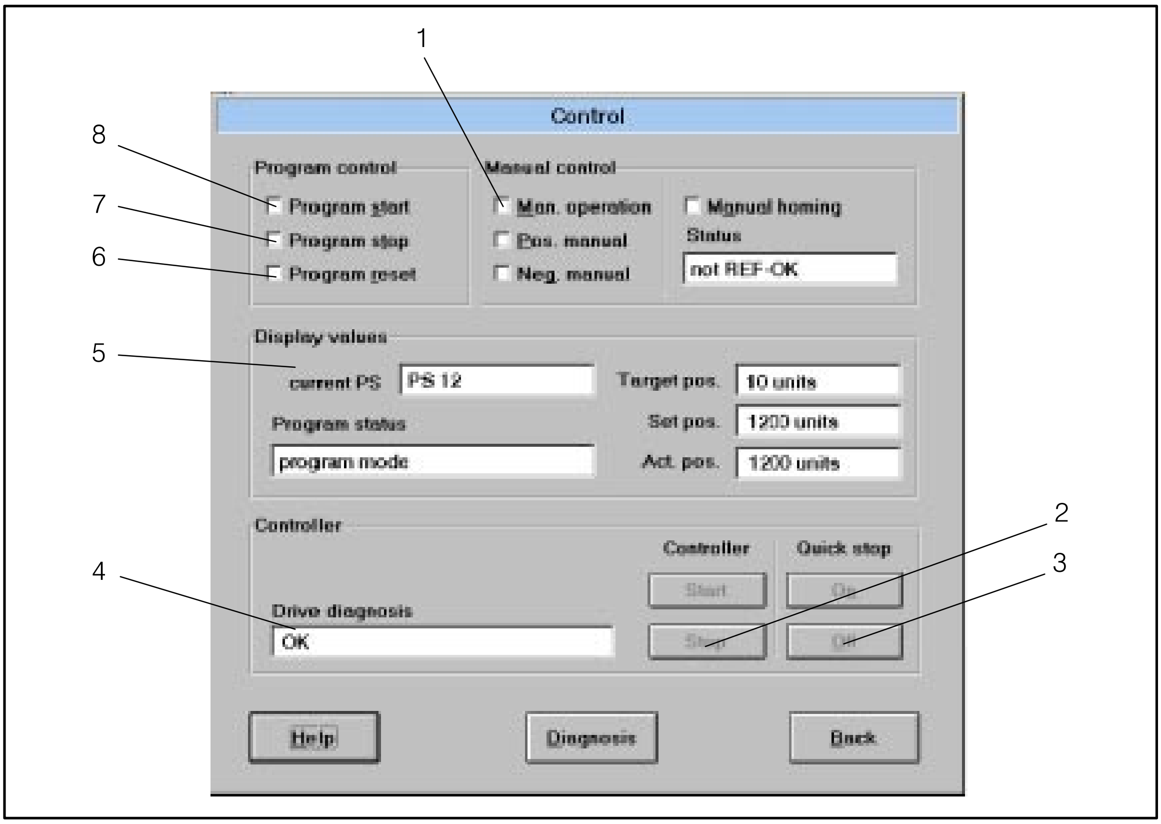


Fig. 5-21 Dialog box ”Control”

Field	Command	Function
	Activate program operation	For factory setting • Switch terminal X5/E5 = HIGH.
1	Reset ”Manual operation”.	Manual operation switched off.
4		With drive diagnostics ”Ok”, ”Enable” is possible. 🕮 6-2
2	Controller ”Enable”	Enables the controller, if there is no interference.
8	Select ”Program start”.	The drive moves according to the loaded positioning profile.
	Reset ”Program start” and select again.	The program restarts, or is continued after an interruption (”Program stop”).
5		Display of the current position and the current program state.
7	Select ”Program stop”.	The program interrupts, the drive stops.
	Reset ”Program stop”.	The program can be continued with ”Program start”.
6	Select ”Program reset”.	The program interrupts, the drive stops. Resets the piece counter and all PFO. 🕮 5-13
6	Reset ”Program reset”.	Loads the first PS with which the program is to start. The program can be restarted with ”Program start”.

5.11 Automatic control parameter identification

With the function “Automatic control parameter identification”

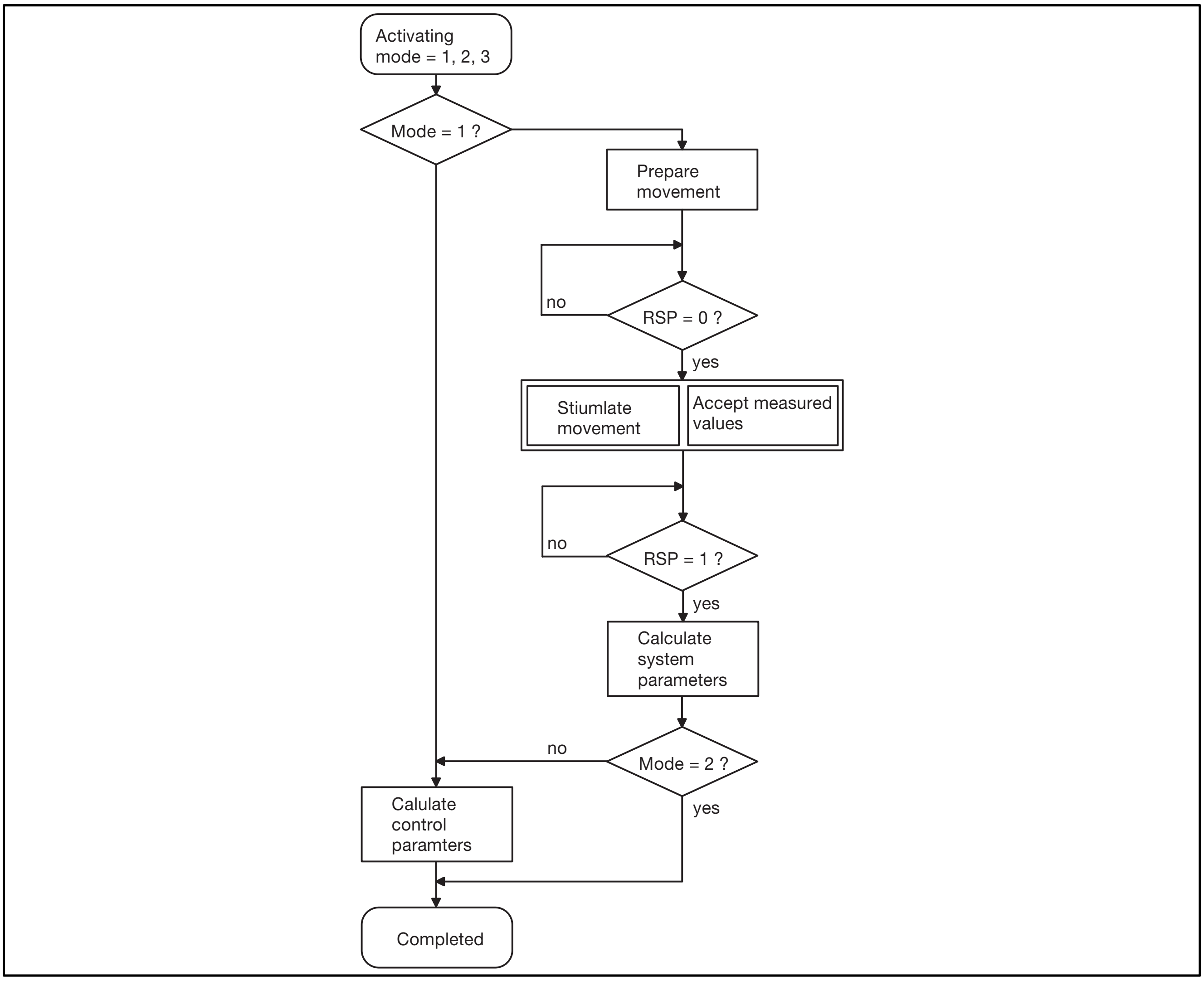
- mechanical distance parameters are identified by a short motion run and
- an automatic adjustment of the speed and position encoder based on the parameters identified or selected.

STOP

Stop!

- An identification can only be carried out if the drive is not exposed to external torques. In the event of pulled loads (or similar) a motion cannot be activated through the function!
- Release the brake (if mounted) before executing this function.
- Ensure the following to keep the number of revolutions:
  – Brake resistor or regenerative power supply and
  – constant moment of inertia.
- If the values differ too much from default setting of codes C1182 - C1185, deviations in the identification of distance parameters and thus controller setting may occur.
- The motion to be carried out by the function must be set in a way that even the slowest rotating element of the controller train is still moving significantly.

5.11.1 Procedure



The function is activated through mode (C1180). Inhibit the controller (Ctrl. inhibit) and stop the drive. Otherwise the function will not be executed and the status (C1181) with the corresponding error code will be set. If the function is activated again, the error will be reset, and initialization and the corresponding function will restart. Enter 0 to reset the function.

Calculation of control parameters (mode = 1)

This function only calculates control parameters.

Identification/identification and calculation of control parameters (mode = 2/3)

The function "Identification" or "Identification and calculation of control parameters" activates drive motion. Reset controller inhibit (Ctrl. inhibit) to enable the motion after the function has been activated. After the motion is completed, the controller must be inhibited again to end the function.

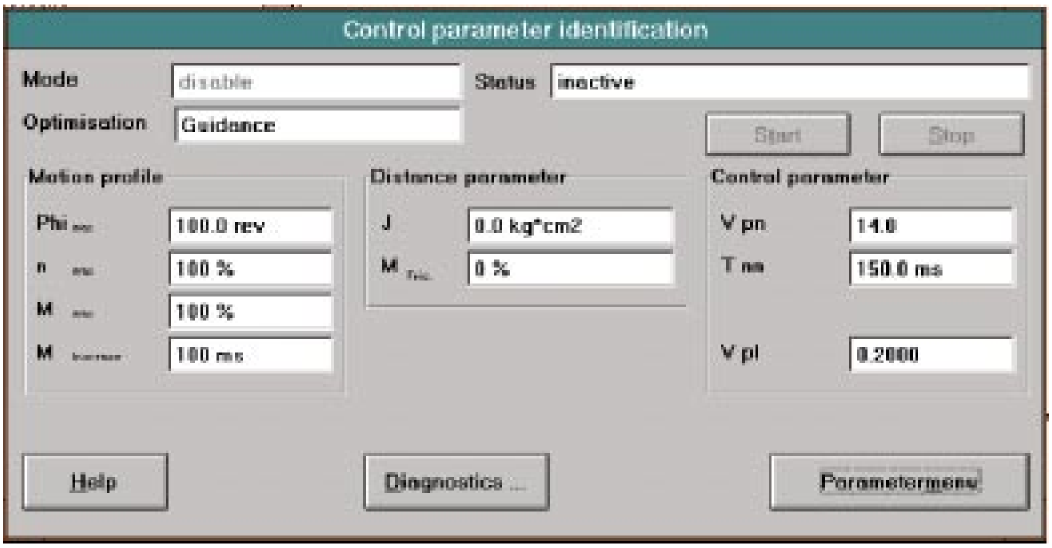


Fig. 5-22 Dialog box "Control parameter identification"

5.11.2 Troubleshooting

If an error occurs during parameter identification, the status (C1181) helps to detect the error.

Status (C1181)	**Cause**	**Remedy**
2	Control parameter calculation not possible	Check whether distance parameters are set reasonably (C1187/C1188).
3	Too few scanning points.	Change motion conditions (C1182-C1185), i. e. increase torque, increase number of revolutions, increase speed, reduce torque rise time.
4	Reference torque too low	• Increase Imax (C0022) • Check maximum torque (C0057)
5	Speed at start $\neq$ 0	Stop drive and reactivate function
6	Controller inhibit during motion	Repeat identification
7	Minimum brake torque not reached Torque ramp too flat or maximum torque too low	Change motion conditions (C1182-C1185), i. e. increase torque, increase number of revolutions, increase speed, reduce torque rise time.
8	Time overflow	Select higher torque or shorter torque rise time
9	Blocking	Release brake, check motor cable, eliminate blocking

Commissioning

6 During operation

6.1 Status indications

6.1.1 On the 9371 BB keypad

Status messages on the keypad		
Display	**on**	**off**
RDY	Ready for operation	Initializing or fault
IMP	Power outputs inhibited	Power outputs enabled
FAIL	Active fault (TRIP, fail-QSP, message or warning)	No fault
I_{MAX}	Motor current setpoint ≥ C0022	Motor current setpoint < C0022
M_{MAX}	Speed controller within its limitation. Drive is torque controlled.	Speed-controlled drive

6.1.2 In Global Drive Control

1. Click the "Control" button in the "Basic settings" dialog box.
2. Click the "Diagnostic" button in the "Control" dialog box.

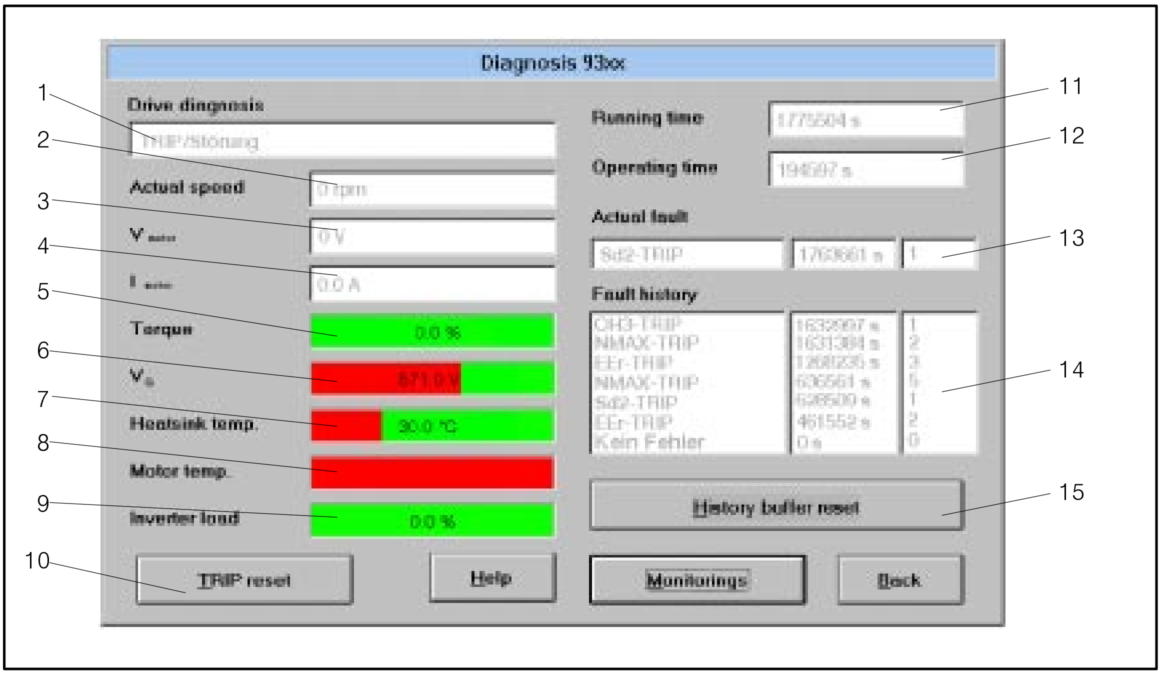


Fig. 6-1 Dialog box "Diagnostics 9300"

1	Type of fault
2	Actual speed
3	Actual motor voltage
4	Actual motor current
5	Motor torque
6	DC-bus voltage
7	Heat sink temperature
8	Motor temperature
9	Controller load
10	Reset fault
11	Time when the supply voltage was applied
12	Time when the controller was enabled
13	Actual fault with time and frequency of the fault. 🕮 8-3
14	Fault history with time and frequency of the fault. 🕮 8-3
15	Reset history buffer. 🕮 8-4

6.2 Information on operation

Please observe the following notes for controller operation:

Stop!

- Cyclic connection and disconnection of the supply voltage at L1, L2, L3 or $+U_{DC}$, $-U_G$ mgiht overload the internal input current limit:
  – Allow at least 3 minutes between disconnection and reconnection.

- During mains switching (L1,L2,L3) it is not important whether further controllers are supplied via the DC bus.

6.2.1 Switching on the motor side

- Switching on the motor side of the inverter is permissible for emergency switch-off.
- Please note:
  – Switching while a controller is enabled may cause the fault indication ”0Cx” (short-circuit/earth fault in operating case x).
  – For long motor cables and operation of controllers with smaller output power, leakage currents through interfering cable capacitances may cause the fault indication ”OCx”.
  – Switching equipment on the motor side must be dimensioned for DC voltages (V_{DC} max = 800 V).

6.2.2 Controller protection by current derating

Valid for the types 9326 to 9332.

For field frequencies < 5 Hz the controller automatically derates the maximum permissible output current.

- For operation with chopping frequency = 8 KHz (C0018=1, optimum power):
  – The current limit is derated according to the heat sink temperature (see Fig. 6-2).
- For operation with chopping frequency = 16 KHz (C0018=2, optimum noise):
  – The current limit is always derated to $I_{r16} = I_{016}$.
- For operation with automatic changeover of the chopping frequency (C0018=0):
  – Below the threshold, the controller operates with 16 kHz (optimum noise). The function of the current limitation follows the characteristic ”Imax 16 KHz” (see Fig. 6-2).
  – If the machine requires a higher torque, for example for acceleration, the controller automatically switches to 8 kHz (optimum power). The function of the current limitation follows the characteristic ”Imax 8 KHz” (see Fig. 6-2).

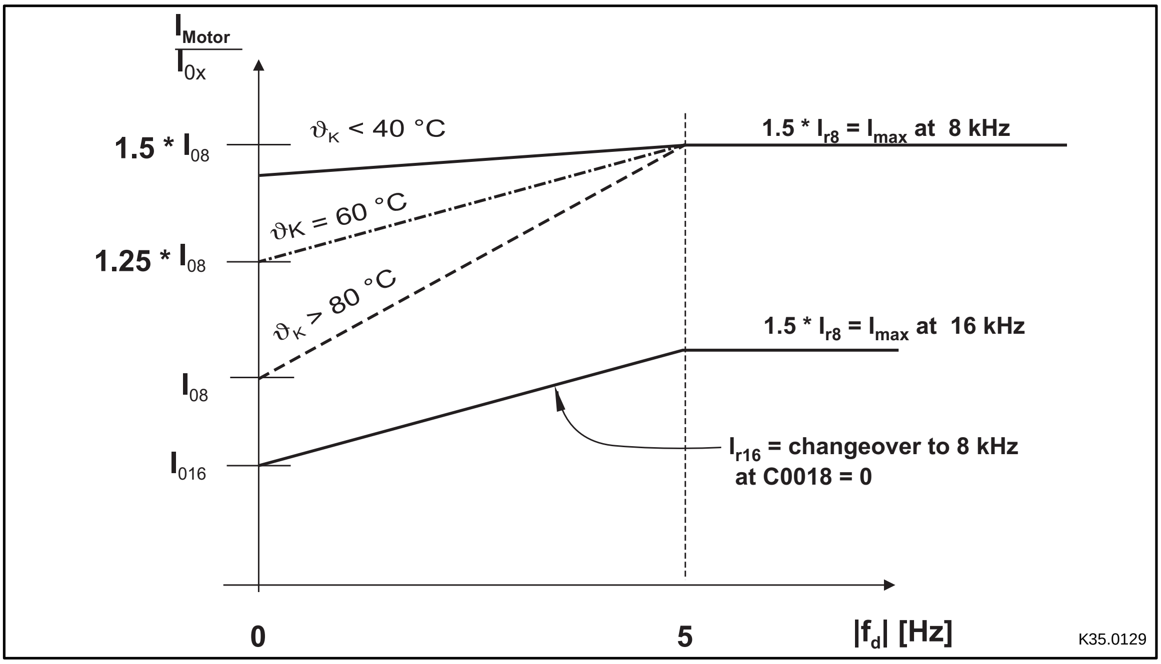


Fig. 6-2 Current derating function for types 9326 to 9332

ϑ_K	Heat sink temperature
I_{rx}	Rated current at U, V, W depends on the chopper frequency
f_d	Field frequency at output U, V, W
I_{0x}	Max. standstill current at field frequency = 0 Hz

See also chapter “Rated data”. 🕮 3-3

EDS9300UE-PD2.1
00415627

Lenze

Manual
Part D2.1

Configuration

Global Drive

Servo position controller 9300

This documentation is valid for 9300 position controllers as of version:

Type	Design	Hardware version and index	Software level and index	Variant	Explanation
33.932X	EP	2x	2x		(9321 - 9329)
33.933X	EP	2x	2x		(9330 - 9332)
33.932X	CP	2x	2x	- V003	Cold Plate (9321 - 9328)

Type

Desgin:
E = Enclosure IP20
C = Cold Plate
xK = Cam profiler
xP = Position controller
xR = Register controller
xS = Servo inverter

Hardware version and index

Software level and index

Variant

Explanation

Version 2.0 05/00 - TD27

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7 Configuration

Every practical application demands certain application-specific configurations (programs).

For this, function blocks are available which can be connected for the corresponding application. The function blocks are linked via codes. (🕮 7-4)

7.1 Predefined configurations

Basic configurations are already defined for standard applications of the controller. These basic configurations can be selected via code C0005. The signal flow charts for the most important basic configurations are listed in the appendix.

7.1.1 Working with predefined configurations

To adapt predefined configurations to your application, proceed as follows:

1. Select basic configuration under C0005.
2. Select operating mode under C0005. (🕮 7-299)
3. Configure different signal flow charts, if necessary:
   – Integrate or remove function blocks. (🕮 7-4)
   – Set parameters for function blocks. (🕮 7-5)
   – Change terminal configuration.

Note!

If the signal flow for the basic configuration is changed, e.g. by adding function blocks, C0005 is set to ”0”. The message ”COMMON” is displayed.

If only the assignment of the control inputs and outputs is changed, C0005 remains the same. Under code C0464 an identification is displayed.

7.2 Operating modes

Determine the operating mode, the interface you want to use for parameter setting or control of the controller, by choosing an operating module.

7.2.1 Parameter setting

Parameters can be set with one of the following modules:

- Communication module
  – 2102 (LECOM A/B/LI)
  – 2111 (INTERBUS)
  – 2131 (PROFIBUS)
  – 2133 (PROFIBUS)
- PC system bus module
  – 2173

7.2.2 Control

Control via terminals (X5 and X6), via the fieldbus module at X1 or via the system bus (X4). Mixed modes are also possible.

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

7.2.3 Configuration with Global Drive Control

With the PC program Global Drive Control (GDC) LENZE offers

- an easy to understand,
- well structured,
- convenient

tool for the configuration of your specific drive task.

Function block library

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

Signal configuration

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

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

Terminal assignment

Freely assignable terminals can be configured using two dialog boxes:

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

7.3 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.

7.3.1 Signal types

Every function block has inputs and outputs for connection with corresponding signal types for each function:

- Quasi analog signals
  – Symbol: ○
  – Unit: %
  – Designation: a
  – Value range: + 16384 = + 100%
  – Resolution: 16 bit
- Digital signals
  – Symbol: □
  – Unit: binary, with HIGH or LOW level
  – Designation: d
  – Resolution: 1 bit
- Speed signals
  – Symbol: △
  – Unit: rpm
  – Abbreviation: phd
  – Resolution: 16 bit
- Phase signals
  – Symbol: ▲
  – Unit: inc
  – Designation: ph
  – Value range: 1 rev. = 65536 inc
  – Resolution: 32 Bit

The signal type of the output and input must be the same for a proper connection. Thus, the analog output signal of one function block can only be connected to the analog input signal of the other function block. If two different signal types are connected, the connection will be rejected.

7.3.2 Elements of a function block

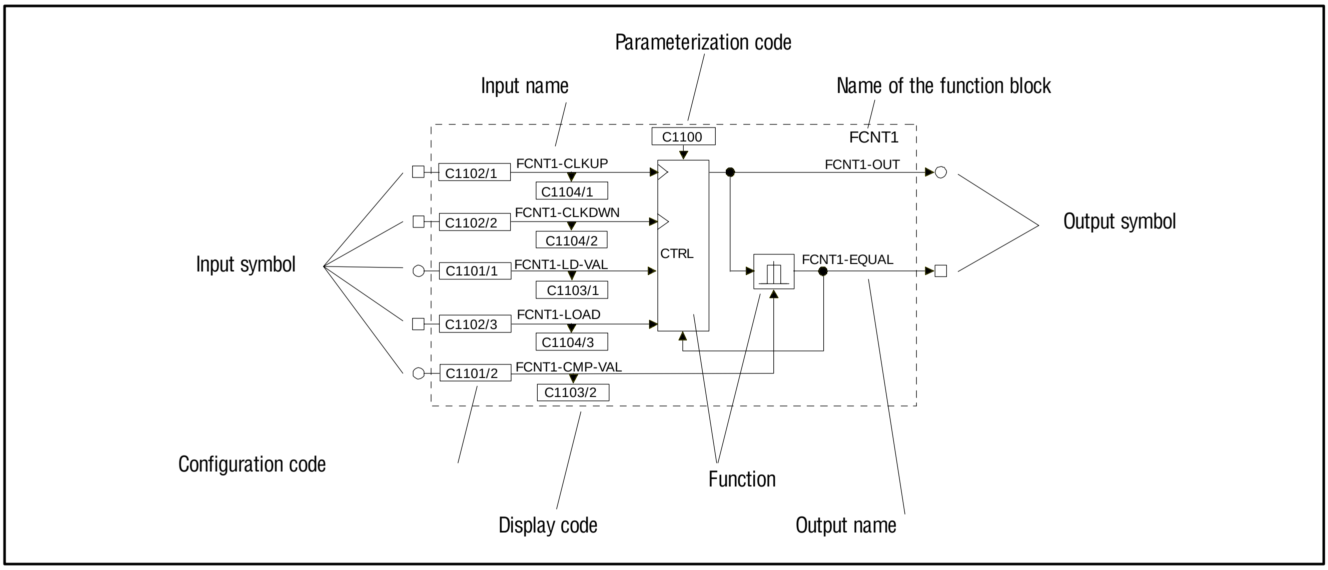


Fig. 7-1 Structure of an FB using the example of FCNT1

Name of the FB

Identifies the FB clearly. The name of the FB is followed by a number distinguishing the function of the FB.

A selection number defines every FB. The input of the selection number into the processing table is always required for the calculation of the FB. (🕮 7-10). The selection numbers are listed in selection list 5. (🕮7-358) .

Example:

(FCNT1, see Fig. 7-1)

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

Input symbol

Designates the signal type which is allowed as a source for each input. (🕮 7-4)

Tip!

Inputs which are not linked cannot be configured.

Name of the input

Consists of the FB name and a designation. The designations of the inputs are followed by a number distinguishing the functions of the input.

Configuration code

Configures the input with a signal source (e.g. terminal signal, control code, output of a FB, 0). Inputs with identical codes are distinguished by the attached subcode (Cxxxx/1). These codes are configured by their subcodes.

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

Display code

Displays the current input value. Inputs with identical codes are distinguished by the subcode.The subcode is attached to the code (Cxxxx/1). These codes are displayed via their subcodes.

Display codes cannot be processed.

Function

Represents the mathematical function as a block diagram (see Fig. 7-1).

Parameterization code

Adaptation of the function or the behaviour to the application.The possible settings are explained and shown in the text and/or the line diagram.

Output symbol

Designates the signal type. Connections with inputs of the same signal type are possible. (📖 7-4)

Every output is defined by a selection number. The selection numbers are divided into selection lists (1 ... 4) according to the different signal types. (📖7-358)

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

Example:

(FCNT1, see Fig. 7-1)

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

Tip!

Outputs, which are not linked, cannot be configured.

Name of the output

Consists of the FB name and a designation. Outputs with the same function are distinguished by a number behind their designation.

7.3.3 Connection of function blocks

General rules

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

Stop!

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

Tip!

Lenze offers a net-list generator for the visualization of existing connections (see accessories: PC program GDC). (📖 13-4)

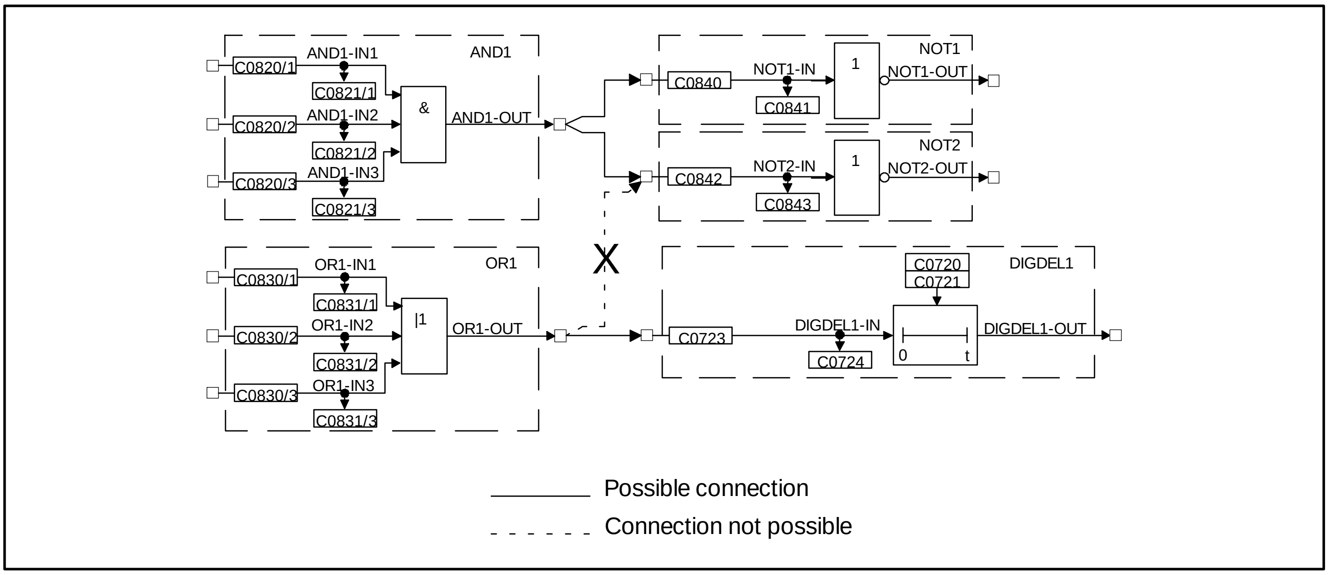


Fig. 7-2 Correct connection of function blocks

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. FIXED 0, FIXED 1, FIXED 0%, ...).
6. Repeat 1. to 5. until the desired configuration is set.
7. Save modified configuration in the desired parameter set.

Example

- Condition:
  – Factory 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.

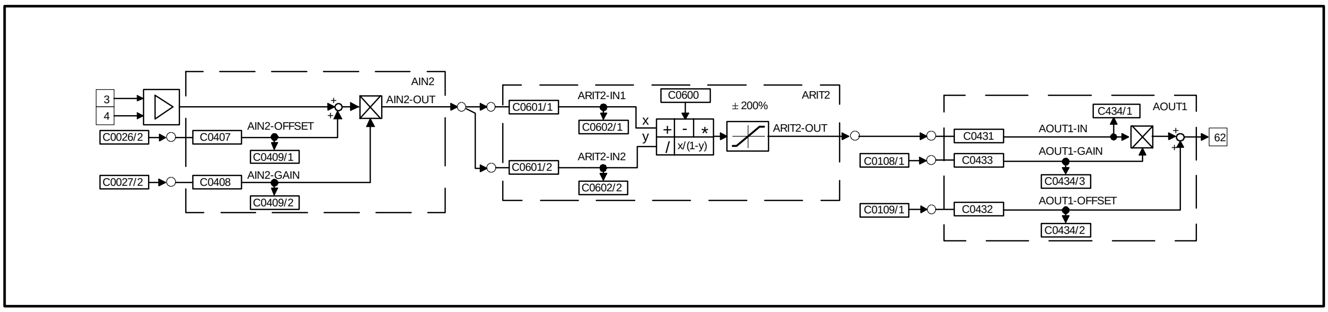


Fig. 7-3 Example of a simple configuration

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 some unwanted signal connections.
- Example:
  – In the factory setting of the basic configuration C0005 = 1000 (speed control), ASW1-IN1 and AIN2-OUT are connected.
  – This connection is not automatically removed by the settings described above! If you do not want this connection, it must be removed.

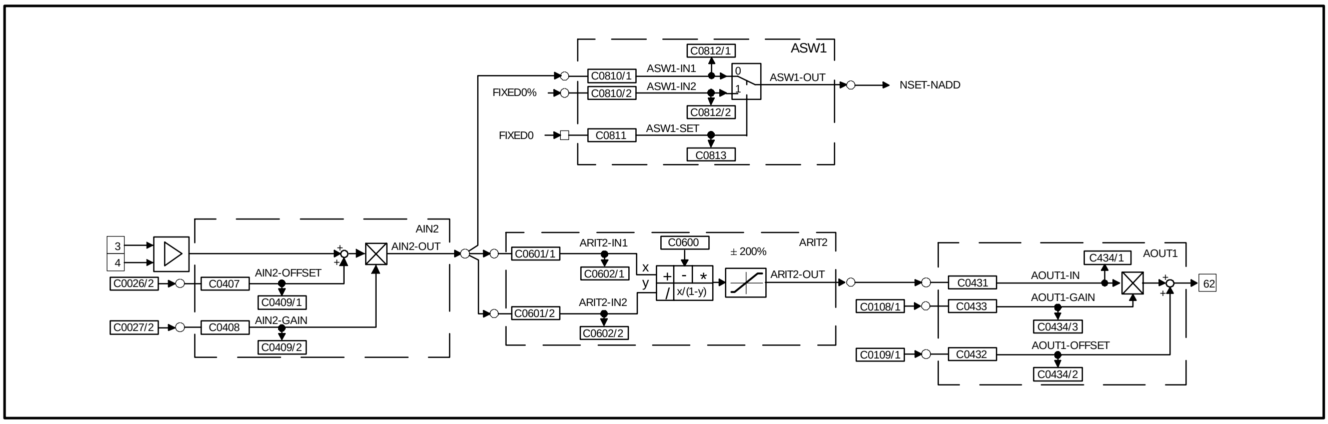


Fig. 7-4 Remove connections in a configuration

Now, the connection is removed.

6. Remove connection between ASW1-IN1 and AIN2-OUT:
   – Select C0810/1 using ▲ or ▼.
   – Change to the parameter level using PRG.
   – Select the constant FIXED0% (selection number 1000) using ▲ or ▼.
   – Confirm using SH + PRG
   – Change to the code level again using PRG.
7. 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.

7.3.4 Entries into the processing table

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

Several aspects must be observed:

The number of FBs to be processed is limited

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

Entry sequence into the FBs

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

Example:

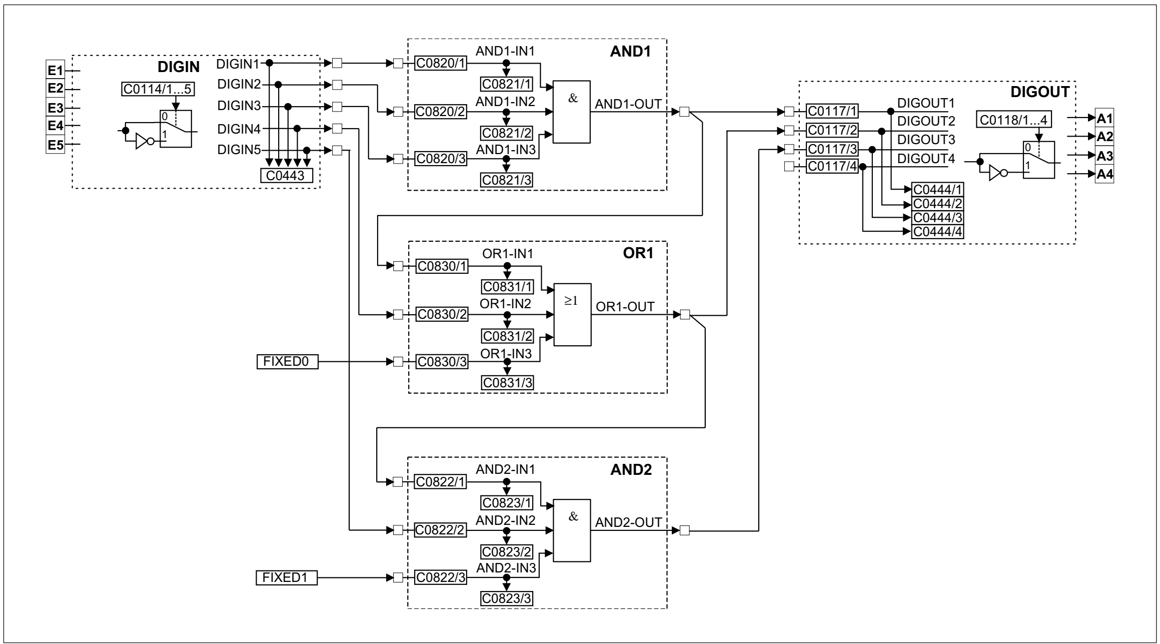


Fig. 7-5 Example of a configuration

Structure of the processing table for the configuration example Fig. 7-5:

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

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

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

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

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

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

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

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

Frequent faults in the configuration

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

Configuration

7.3.4.1 Signal configuration with Global-Drive-Control

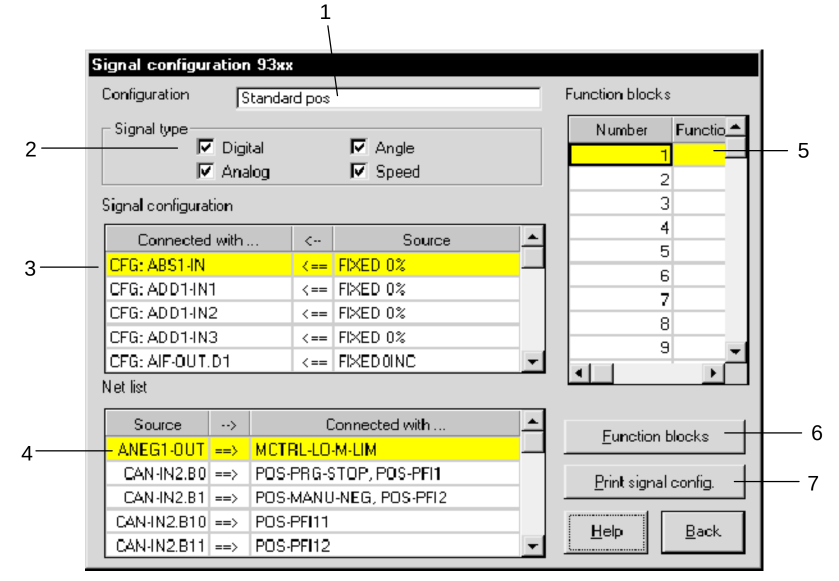


Fig. 7-6 Dialog box “Signal configuration of servo position controller 9300”

Field	Command	Function
	Initiate parameter menu	
	Open menu “Dialog signal configuration”.	
1	Click “Configuration”.	All signal configurations available are displayed in a window. • Select the signal configuration required and confirm with “OK”.
2	Highlight the option for “Signal type” required.	Fields 4 and 5 only list the signal types available for the corresponding option.
3	Click an entry in “Signal link”.	All signal sources available for the FB input selected are displayed in a window. • Select the signal source required and confirm with “OK”.
4	Click the entry under “Network list”.	The corresponding FB and its links are displayed in a window.
5	Click “Edit FB”.	All FBs available are displayed in a window. • Select the required FB and confirm with “Accept”.
6	Click “Function blocks”.	All FBs available are displayed in a window.
7	Click “Print signal config.”.	Output of the current signal configuration to the printer.

Entry sequence for FBs

FBs must not be entered directly one after the other into the processing table. However, the easiest sequence is the one following the signal flow chart. All positions must be assigned.

7.4 Terminal assignment

If the signal configuration under C0005 is changed, the assignment of all inputs and outputs with their corresponding default assignment is overwritten. If necessary, you have to adapt the function assignment to your wiring.

- The digital inputs are linked by the FB DIGIN. (🕮 7-179)
- The digital outputs are linked by the FB DIGOUT. (🕮 7-180)
- The analog inputs are linked by the FB AIN. (🕮 7-94)
- The analog outputs are linked by the FB AOUT. (🕮 7-100)

STOP

Stop!

If you link an FB input with a signal source, the already existing links are maintained. Remove links which are not required. (🕮 7-9)

7.4.1 Freely assignable digital inputs

Five freely assignable inputs are available (X5/E1 ... X5/E5). The signals are conditioned and linked with other FBs by FB DIGIN. (🕮 7-179)

Display links:

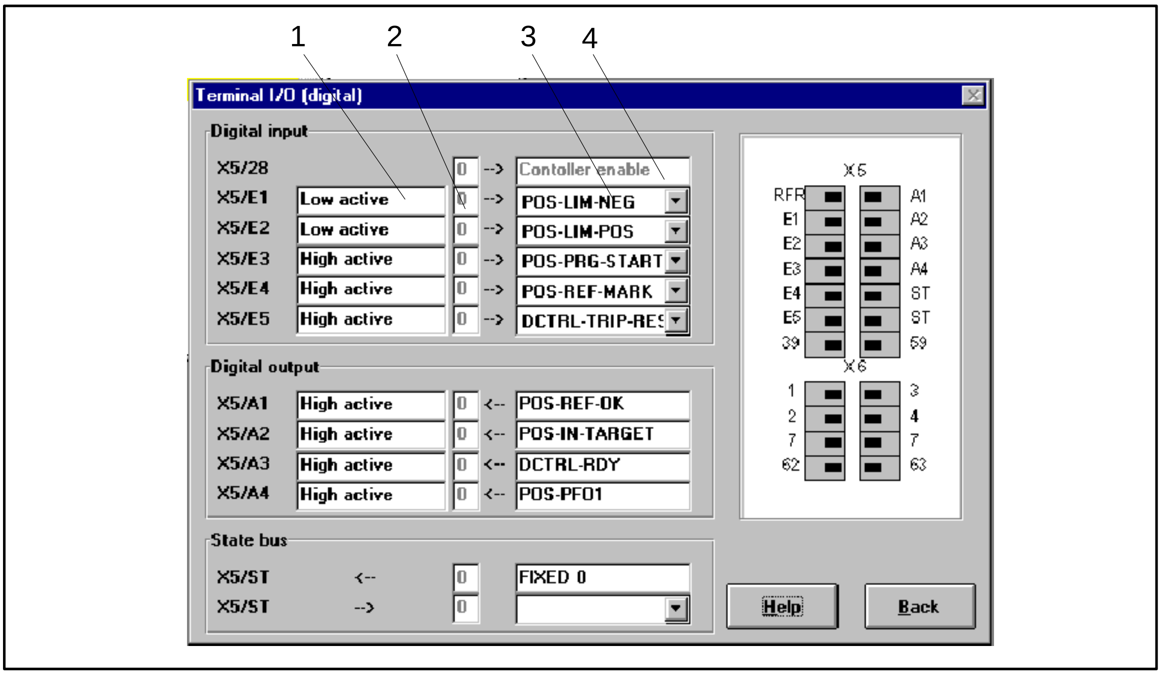


Fig. 7-7 Dialog box “Terminal monitor 93xx (digital)”

Field	Command	Function
	Initiate parameter menu	
	Click on “Dialog terminal monitor 93xx (digital)” menu.	
1	Click on field.	Select signal level on which the input X5/E1 has to react.
2		Displays whether the input is triggered with a HIGH (1) or LOW (0) edge.

Field	Command	Function
3	Click on field.	A window displays the existing links for the input X5/E1.
4		Input X5/28 is assigned with controller enable. Cannot be modified.

The display of the links of the terminals X5/E2 ... X5/E5 is done in the same way.

Tip!

In the “Dialog signal configuration” menu you can carry out all links to the FB DIGIN. (📖 7-12)
Field 3 (in Fig. 7-7 for terminal X5/E1) shows these links.

7.4.2 Freely assignable digital outputs

Four freely assignable digital outputs are available (X5/A1 ... X5/A4). The signals are conditioned and linked with other FBs by FB DIGOUT. (📖 7-180)

Change assignment:

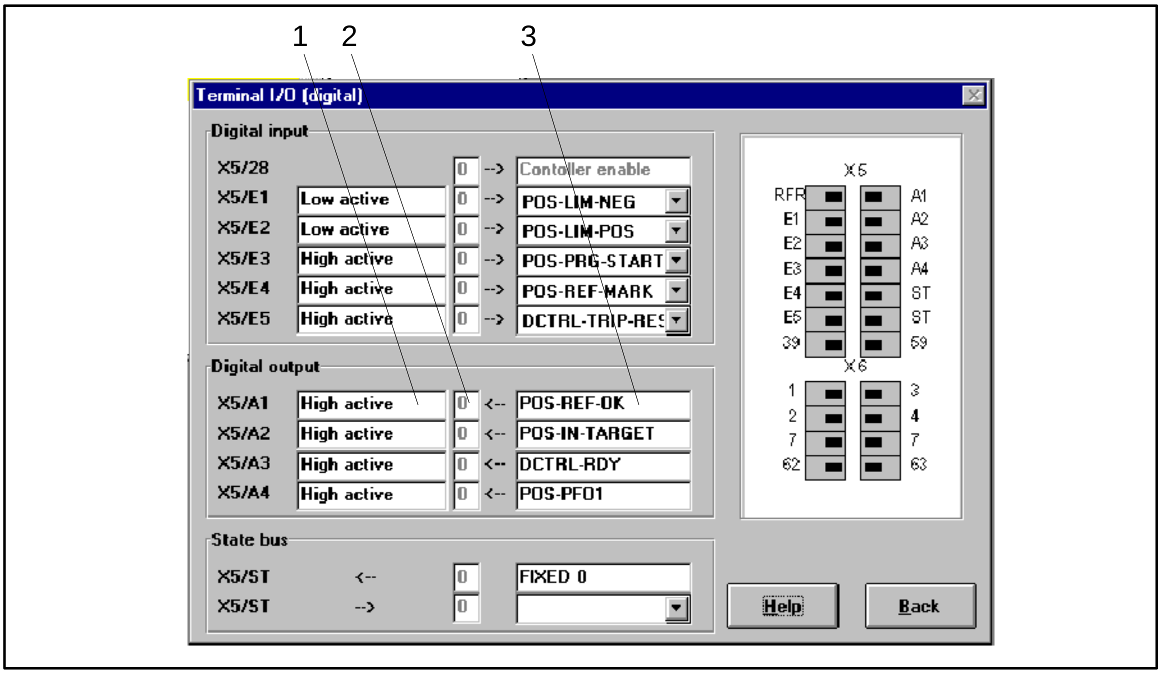


Fig. 7-8 Dialog box “Terminal monitor 93xx (digital)”

Field	Command	Function
	Initiate parameter menu	
	Click on “Dialog terminal monitor 93xx (digital)” menu.	
1	Click on field.	Select signal level on which the output X5/A1 has to switch when it is triggered.
2		Displays whether the output is triggered with a HIGH (1) or LOW (0) edge.
3	Click on field.	A window displays all available links of the output X5/A1. • Select link.

The assignment of the terminals X5/A2 ... X5/A4 is changed in the same way.

7.4.3 Input and outputof the STATE-BUS

Configure input and output of the FB STATE-BUS. (📖 7-245)

Change assignment:

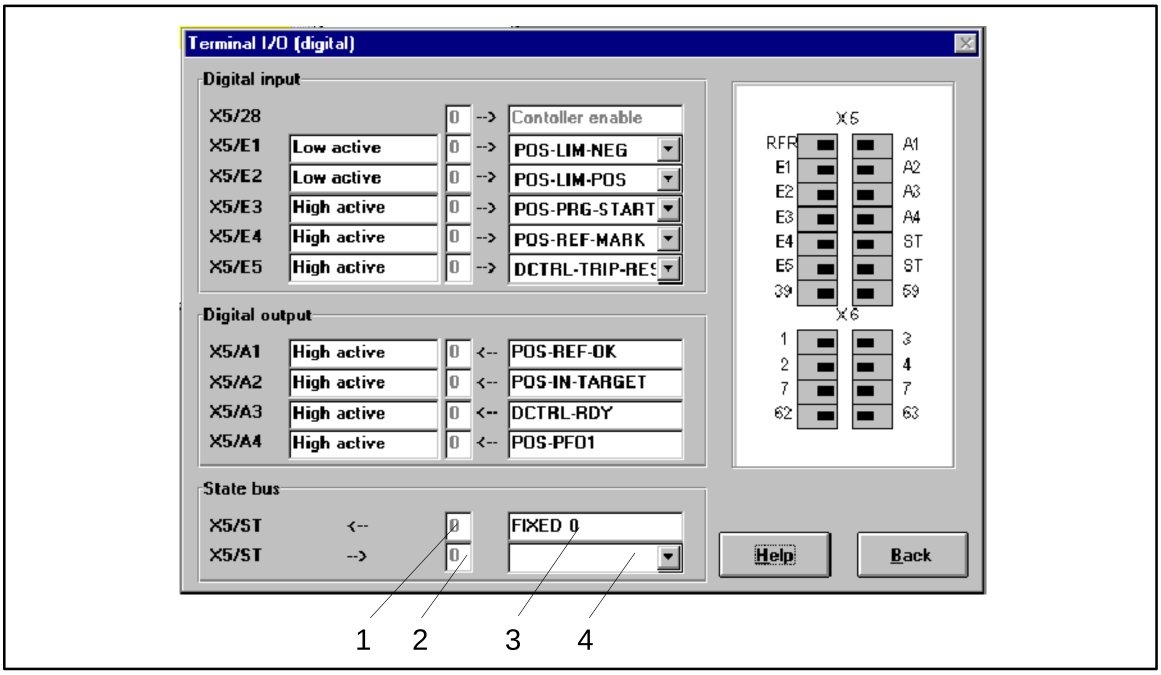


Fig. 7-9 Dialog box “Terminal monitor 93xx (digital)”

Field	Command	Function
	Initiate parameter menu	
	Click on “Dialog terminal monitor 93xx (digital)” menu.	
1		Displays whether the output X5/ST is triggered with HIGH (1) or LOW (0) edge.
2		Displays whether the input X5/ST is triggered with a HIGH (1) or LOW (0) edge.
3	Click on field.	A window displays the available links by means of which the outgoing bus signal is to be output at terminal X5/ST. • Select link.
4	Click on field.	A window displays the existing links by means of which the incoming bus signal is to be processed. • Select link.

Tip!

In the “Dialog signal configuration” menu all links to the FB STATE-BUS can be carried out. (📖 7-12)

Field 4 displays these links.

7.4.4 Freely assignable analog inputs

Two freely assignable analog inputs are available (X6/1,2 and X6/3,4). The signals are conditioned and linked with other FBs by FB AIN. (📖 7-94)

Display links:

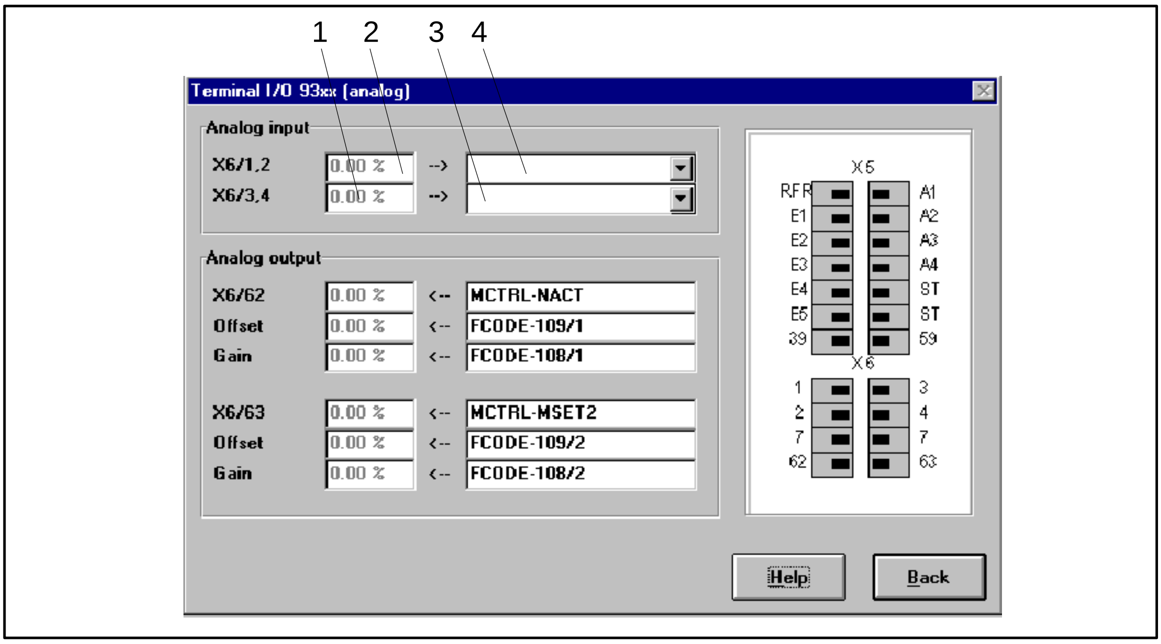


Fig. 7-10 Dialog box “Terminal monitor 93xx (analog)”

Field	Command	Function
	Initiate parameter menu	
	Click on “Dialog terminal monitor 93xx (analog)” menu.	
1		Displays the input value at terminal X6/1,2.
2		Displays the input value at terminal X6/3,4.
3	Click on field.	A window displays the existing links for the input X6/1,2.
4	Click on field.	A window displays the existing links for the input X6/3,4.

Tip!

In the “Dialog signal configuration” menu you can carry out all links to the FB AIN. (📖 7-12)
Field 1 or field 2 diplays these links.

7.4.5 Freely assignable analog outputs

Two freely assignable analog outputs are available (X6/62 and X6/63). The signals are conditioned and linked with other FBs by FB AOUT. (📖 7-100)

Change assignment:

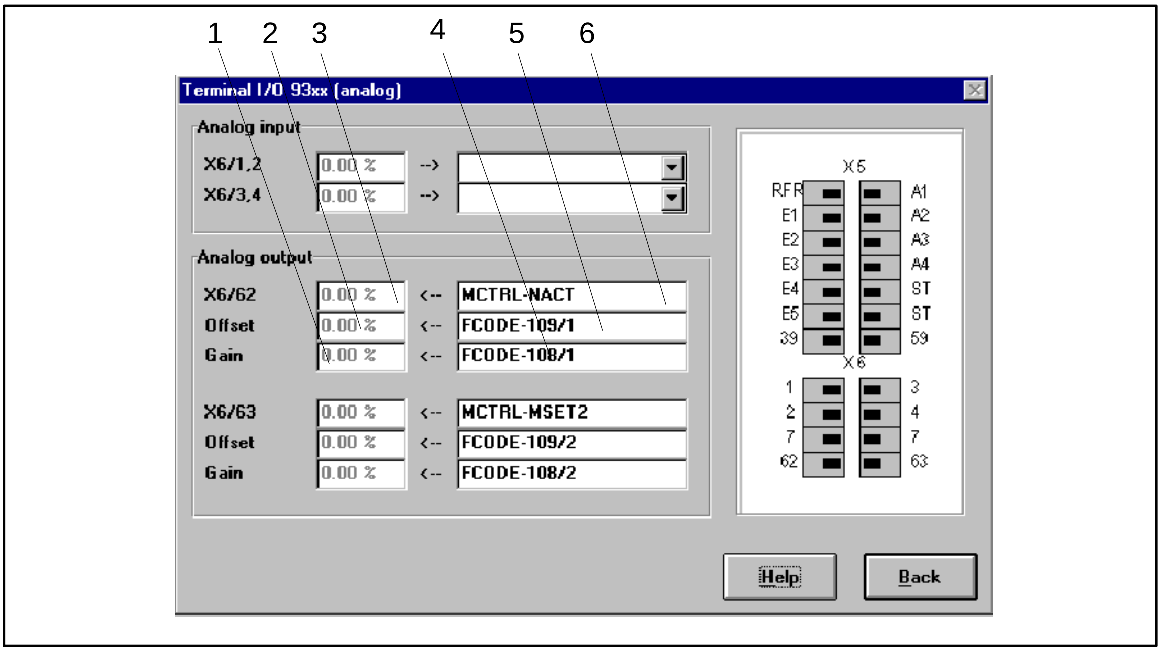


Fig. 7-11 Dialog box “Terminal monitor 93xx (analog)”

Field	Command	Function
	Initiate parameter menu	
	Click on “Dialog terminal monitor 93xx (analog)” menu.	
1		Displays the value of the gain signal.
2		Displays the value of the offset signal.
3		Displays the output value at terminal X6/62.
4	Click on field.	A window displays the available links for the evaluation of the signal with a gain. • Select link.
5	Click on field.	A window displays the available links for the evaluation of the signal with an offset. • Select link.
6	Click on field.	A window displays all available links of the output X6/62. • Select link.

The assignment of terminal X6/63 is changed in the same way.

7.5 Description of the function blocks

Function blocks

Function block	Description		CPU time [ms]	used in basic configuration C0005						
				1000	20000	22000	26000			
ABS1	Absolute value generator	7-87	4							
ADD1	Addition block	7-88	8							
AIF-IN	Fieldbus	7-89	60							
AIF-OUT	Fieldbus	7-92	56	●						
AIN1	Analog input X6/1, X6/2	7-94	10	●						
AIN2	Analog input X6/3, X6/4		28	●						
AND1	Logic AND, block1	7-96	6							
AND2	Logic AND, block2									
AND3	Logic AND, block3									
AND4	Logic AND, block4									
AND5	Logic AND, block5									
ANEG1	Analog inverter 1	7-99	3	●	●	●	●			
ANEG2	Analog inverter 2									
AOUT1	Analog output X6/62	7-100	12	●	●	●	●			
AOUT2	Analog output X6/63			●	●	●	●			
ARIT1	Arithmetic block 1	7-102	11							
ARIT2	Arithmetic block 2									
ARITPH1	32-bit arithmetic block	7-104	15							
ARITPH2	32-bit arithmetic block 2									
ARITPH3	32-bit arithmetic block 3									
ARITPH4	32-bit arithmetic block 4									
ARITPH5	32-bit arithmetic block 5									
ARITPH6	32-bit arithmetic block 6									
ASW1	Analog changeover 1	7-107	4	●						
ASW2	Analog changeover 2									
ASW3	Analog changeover 3									
ASW4	Analog changeover 4									
BCD1	BCD decade switch 1	7-109	30							
BCD2	BCD decade switch 2									
BCD3	BCD decade switch 3									
BRK	Trigger holding brake	7-119	15							
CAN-IN1	System bus	7-123	-							
CAN-IN2	System bus									
CAN-IN3	System bus									
CAN-OUT1	System bus	7-130	56	●	●	●				
CAN-OUT2	System bus			●	●	●				
CAN-OUT3	System bus			●	●	●				
CMP1	Comparator 1	7-134	15	●						
CMP2	Comparator 2									
CMP3	Comparator 3		15							
CMPPH1	Comparator 1	7-138	20							
CMPPH2	Comparator 2									
CMPPH3	Comparator 3									
CONV1	Conversion analog signals	7-143	8							
CONV2	Conversion analog signals									
CONV3	Conversion speed signals to analog signals									
CONV4	Conversion speed signals to analog signals									
CONV5	Conversion analog signals to speed signals									
CONVAD1	Analog digital converter 1	7-145	4							
CONVAD2	Analog digital converter 2									

Function block	Description		CPU time [ms]	used in basic configuration C0005						
				1000	20000	22000	26000			
CONVAPH1	Analog long converter 1	🕮 7-147	31							
CONVAPH2	Analog long converter 2									
CONVAPH3	Analog long converter 3									
CONVDA1	Digital analog converter 1	🕮 7-149	38							
CONVDA2	Digital analog converter 2									
CONVDA3	Digital analog converter 3									
CONVPHA1	Long analog converter 1	🕮 7-152	6							
CONVPHA2	Long analog converter 2									
CONVPHA3	Long analog converter 3									
CONVPHPH2	Long long converter 2	🕮 7-154	80				●			
CURVE1	Characteristic function	🕮 7-155	15			●				
DB1	Dead band	🕮 7-158	7							
DCTRL	Device control	🕮 7-159	-							
DFIN	Digital frequency input	🕮 7-162	5	●						
DFOUT	Digital frequency output	🕮 7-165	35	●	●	●	●			
DFRFG1	Digital frequency ramp generator	🕮 7-169	40							
DFSET	Digital frequency processing	🕮 7-173	85							
DIGDEL1	Binary delay element 1	🕮 7-176	9							
DIGDEL2	Binary delay element 2									
DIGIN	Input terminals X5/E10 X5/E5	🕮 7-179	-							
DIGOUT	Output terminals X5/A10 X5/A4	🕮 7-180	-							
DISA	Free analog display code	🕮 7-181	1							
DISPH	Free long display code	🕮 7-183	1							
DT1	Differential element	🕮 7-184	12							
FCNT1	Free piece counter, block 1	🕮 7-185	11							
FCNT2	Free piece counter, block 2									
FCNT3	Free piece counter, block 3									
FDO	Free digital outputs	🕮 7-189	-							
FEVAN1	Free analog input variable	🕮 7-191	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	🕮 7-197	9							
FLIP1	D-flipflop 1	🕮 7-199	6							
FLIP2	D-flipflop 2									
LIM1	Limiter	🕮 7-201	5							
MCTRL	Servo control	🕮 7-202	-							
MPOT1	Motor potentiometer	🕮 7-209	20							
NOT1	Logic NOT, block1	🕮 7-211	4		●	●	●			
NOT2	Logic NOT, block2						●			
NOT3	Logic NOT, block3						●			
NOT4	Logic NOT, block4									
NOT5	Logic NOT, block5									
NSET	Speed setpoint conditioning	🕮 7-213	70	●						
OR1	Logic OR, block1	🕮 7-218	6				●			
OR2	Logic OR, block2						●			
OR3	Logic OR, block3									
OR4	Logic OR, block4									
OR5	Logic OR, block5									
OSZ	Oscilloscope function	🕮 7-221	70							
PCTRL1	Process controller	🕮 7-225	58							

Function block library

Function block	Description		CPU time [ms]	used in basic configuration C0005						
				1000	20000	22000	26000			
PHDIV1	Conversion	🕮 7-228	8							
PHINT1	Phase integrator	🕮 7-229	7							
POS	Position control	🕮 7-22	330		●	●	●			
PT1-1	1st order delay element	🕮 7-231	8							
R/L/Q	QSP / setpoint inversion	🕮 7-232	8	●						
RFG1	Ramp generator	🕮 7-233	16							
S&H1	Sample and Hold	🕮 7-235	4							
SELPH1	Long-value selection, block 1	🕮 7-236	6							
SELPH2	Long-value selection, block 2									
SP1	Switching points, block 1	🕮 7-238	80			●				
SP2	Switching points, block 2		130							
STAT	Output of digital status signals	🕮 7-244	-							
STATE-BUS	Control of a drive network	🕮 7-245	-							
SYNC1	Multi-axis positioning	🕮 7-246	37				●			
TEACH1	Teach in programming	🕮 7-253	10			●				
TRANS1	Binary edge evaluation	🕮 7-255	7				●			
TRANS2	Binary edge evaluation									
VTACC	Variable table Acceleration	🕮 7-257	20							
VTPCS	Variable table Piece number	🕮 7-259	12							
VTPOS	Variable table Target Position (position value)	🕮 7-261	45							
VTTIME	Variable table Waiting time	🕮 7-263	12							
VTVEL	Variable table speed	🕮 7-265	18							

Table of free codes

Code	Description	CPU time [ms]							
FCODE 17	Free control codes	-							
FCODE 26/1									
FCODE 26/2									
FCODE 27/1									
FCODE 27/2									
FCODE 32									
FCODE 37									
FCODE 108/1									
FCODE 108/2									
FCODE 109/1									
FCODE 109/2									
FCODE 141									
FCODE 250									
FCODE 470/1									
FCODE 470/2									
FCODE 470/3									
FCODE 470/4									
FCODE 471									
FCODE 472/1									
FCODE 472/2									
FCODE 472/3									
FCODE 472/4									
FCODE 472/5									
FCODE 472/6									
FCODE 472/7									

Code	Description	CPU time [ms]							
FCODE 472/8									
FCODE 472/9									
FCODE 472/10									
FCODE 472/11									
FCODE 472/12									
FCODE 472/13									
FCODE 472/14									
FCODE 472/15									
FCODE 472/16									
FCODE 472/17									
“FCODE 472/18									
FCODE 472/19									
FCODE 472/20									
FCODE 473/1									
FCODE 473/2									
FCODE 473/3									
FCODE 473/4									
FCODE 473/5									
FCODE 473/6									
FCODE 473/7									
FCODE 473/8									
FCODE 473/9									
FCODE 473/10									
FCODE 474/1									
FCODE 474/2									
FCODE 475/1									
FCODE 475/2									
FCODE 1211									

7.6 Position control (POS)

Purpose

The FB position control is the heart of the servo position controller 9300. It controls the positioning in the controller.

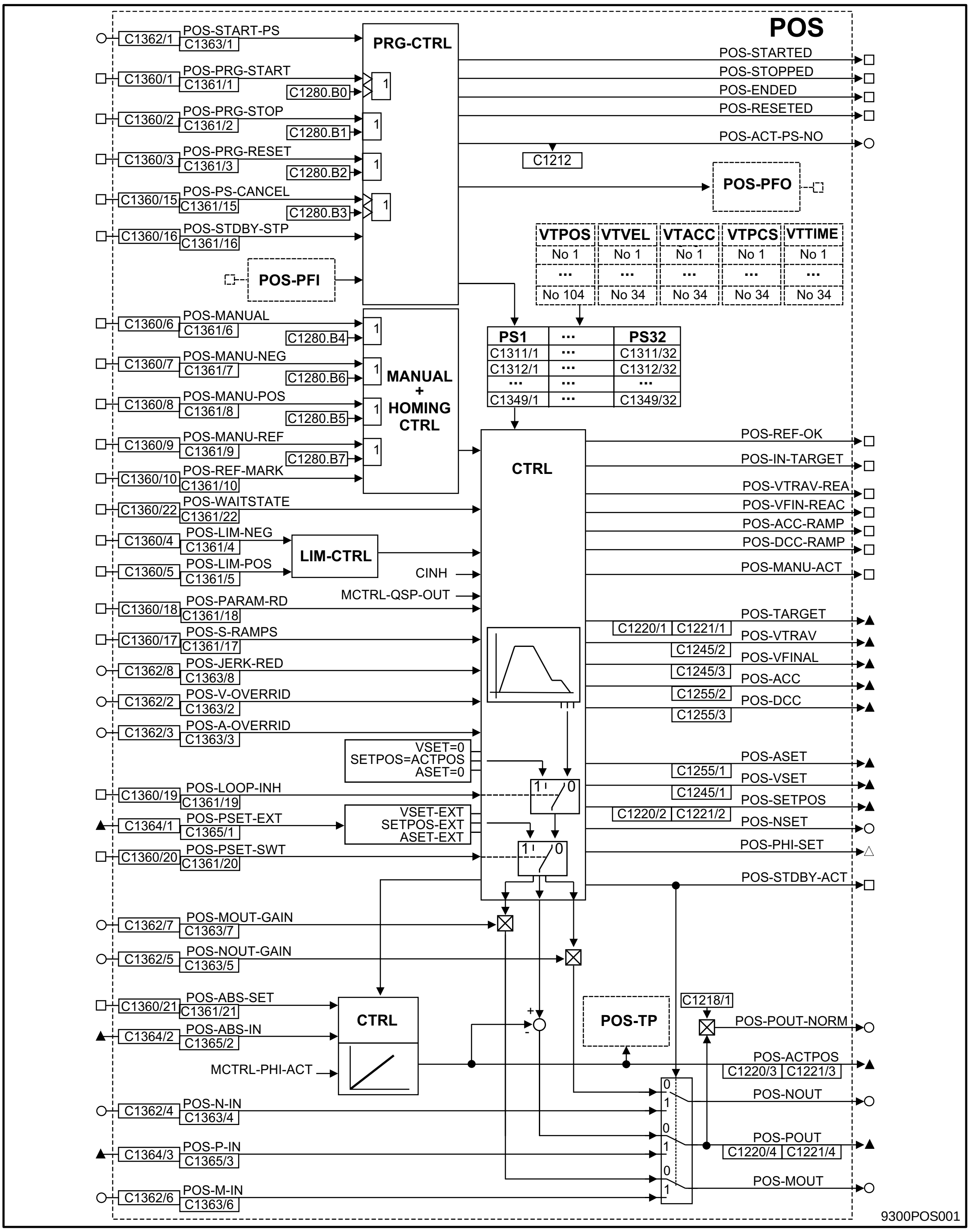


Fig. 7-12 Function block POS

Signal				Source		Note
Name	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” 7-59)
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” 7-40)
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-ACC	ph	C1255/2	dec [inc]	-	-	Deceleration, absolute value for current PS; for normalization see formula 3.
POS-ACC-RAMP	d	-	-	-	-	HIGH = drive accelerates
POS-ACT-PS-NO	a	C1212	dec [inc]	-	-	Current program set
POS-ACTPOS	ph	C1220/3 C1221/3	dec [units] dec [inc]	-	-	Actual position value; for normalization see formula 1
POS-ASET	ph	C1255/1	dec [inc]	-	-	Current acceleration/deceleration setpoint, for normalization see formula 3.
POS-DCC	ph	C1255/3	dec [inc]	-	-	Deceleration in current program set (positive display); for normalization see formula 3
POS-DCC-RAMP	d	-	-	-	-	HIGH = drive decelerates
POS-ENDED	d	-	-	-	-	Position status display HIGH = Program end reached. Current program set No.=0 (POS-ACT-PS-NO). (see “program control” 7-65)
POS-IN-TARGET	d	-	bin	-	-	HIGH = Position setpoint has reached position target, positioning is completed, the following function of the PS will be processed. LOW = Positioning is running or has been cancelled through POS-PS-CANCEL. POS-IN-TARGET remains LOW, until POS-WAITESTATE = HIGH. 7-60
POS-JERK-REG	a	1363/8	dec [%]	C1362/8	1	Reduces the jolt of a S profile, or prolongs the jolt time (Tr) (see “S-shaped ramps” 7-57). Note: will be evaluated as value.
POS-LIM-NEG	d	C1361/4	bin	C1360/4	2	HIGH = negative end of travel switch approached. (see “Travel limits” 7-42)
POS-LIM-POS	d	C1361/5	bin	C1360/5	2	HIGH = positive traversing range switch approached. (see “Travel limits” 7-42)
POS-LOOP-INH	d	C1361/19	bin	C1360/19	2	HIGH = Closed-loop circuit 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 (7-75)
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 moves in negative direction with v_manual (C1243). Acceleration with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID. LOW = Drive stopped with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have an influence. Note: POS-MANU-REF has priority. If -NEG and -POS are controlled at the same time, the drive stops. (see “manual mode” 7-62)
POS-MANU-POS	d	C1361/8	bin	C1360/8	2	like POS-MANU-NEG, but in positive direction (see “manual mode” 7-62)
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” 7-64)
POS-MANUAL	d	C1361/6	bin	C1360/6	2	Changeover Manual/program operation HIGH = Manual operation, current program will be interrupted, if necessary. Drive will be braked to standstill with the a-manual (C1252) incl. the influence of POS-A-OVERRIDE. LOW = Program mode (see “manual mode” 7-62)
POS-MOUT	a	-	-	-	-	Actual torque precontrol value after influence from POS-MOUT-GAIN. Normalization: 100% equals a-max (C1250).

Function block library

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-MOUT-GAIN	a	C1363/7	dec [%]	C1362/7	1	Reduces speed torque precontrol. The polarity of the input signal will be taken into consideration.
POS-N-IN	a	C1363/4	dec [%]	C1362/4	1	External speed setpoint, effective in stand-by operation (📖 7-75)
POS-NOUT	a	-	-	-	-	Current speed setpoint for n-controller after influence from POS-NOUT-GAIN. Normalization: 100% equals nmax (C0011).
POS-NOUT-GAIN	a	C1363/5	dec [%]	C1362/5	1	Reduces speed speed precontrol. The polarity of the input signal will be taken into consideration.
POS-NSET	a	-	-	-	-	Actual speed setpoint (profile generator output), normalization: 100% equals Nmax (C0011).
POS-P-IN	ph	C1365/3	dec [inc]	C1364/3	3	Externally calculated following error, effective in stand-by operation (📖 7-75)
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: position target, traversing speed, acceleration, deceleration, final speed, V-OVERRID, A-OVERRID, POS-S-RAMPS. Note: Not effective in stand-by operation ("Stand-By operation" see 📖 7-75)
POS-PHI-SET	phd	-	-	-	-	Application "Virtual master": Phase difference signal for selecting the position setpoint through pulse train output or system bus (CAN). (see "Virtual master" 📖 7-61)
POS-POUT	ph	-	-	-	-	Contouring error for phase controller
POS-POUT-NORM	d	-	dec [%]			Normalized analog contouring error output. The current contouring error POS-POUT will be output additionally in the following normalization: 100% equals second contouring error tolerance (C1218/2). Tip: for monitoring the dynamic drive response.
POS-PRG-RESET	d	C1361/3	bin	C1360/3	2	HIGH= Interrupts the program and sets "Program end". Piece counter and PFOs will be reset. Touch probe inputs used by the program will be "disabled" and stand-by operation interrupted. The drive will be stopped with a-max (C1250) (no influence of POS-A-OVERRID). (see "program control" 📖 7-65)
POS-PRG-START	d	C1361/1	bin	C1360/1	2	Start of the program. LOW-HIGH signal = Start at the beginning (POS-START-PS) or proceeding from the position before the program had been interrupted. The program will be continued till "Program end" even if POS-PRG-START is reset. If POS-PRG-START = HIGH at the program end, the program will be processed again from its beginning. (see "program control" 📖 7-65)
POS-PRG-STOP	d	C1361/2	bin	C1360/2	2	HIGH = Program and positioning will be interrupted. The drive will be stopped with the current delay of the PS (no influence of POS-A-OVERRID). LOW = Program will be continued. Positioning will be continued with the current profile parameters of the PS. (see "program control" 📖 7-65)
POS-PS-CANCEL	d	C1361/15	bin	C1360/15	2	Cancel PS and continue program from another point. LOW-HIGH signal = Stops current PS. 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). (see "program control" 📖 7-65)
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/home position known
POS-RESETED	d	-	-	-	-	Position status display HIGH = Position program in status "Prg-Reset" (see "program control" 📖 7-65)
POS-S-RAMPS	d	C1361/17	bin	C1361/17	2	HIGH level = S-profile active (see "S-shaped ramps" 📖 7-57)
POS-SETPOS	ph	C1220/2 C1221/2	dec [units] dec [inc]	-	-	Current position setpoint; for normalization see formula 1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-START-PS	a	C1363/1	dec [inc]	C1362/1	1	Start program set No. of program set (PS) which is used to start the program. In the standard configurations (see C0005) in connection 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" 🕮 7-65)
POS-STDBY-ACT	d	-	-	-	-	HIGH = Stand-by mode active. (see "Stand-by operation" 🕮 7-75)
POS-STDBY-STP	d	C1361/16	bin	C1360/16	2	HIGH = stops stand-by operation if "STDBY" is selected in POS mode (C1311 = 30). Otherwise no function. (see "Stand-by operation" 🕮 7-75)
POS-STOPPED	d	-	-	-	-	Position status display HIGH = Program and drive have been stopped or drive is being stopped (see "program control" 🕮 7-65)
POS-TARGET	ph	C1220/1 C1221/1	dec [units] dec [inc]	-	-	Current position target in real measuring system; for normalization 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" 🕮 7-59)
POS-VFIN-REAC	d	-	-	-	-	HIGH = current traversing speed reached
POS-VFINAL	ph	C1245/3	dec [inc]	-	-	Acceleration, absolute value for current PS, for normalization see formula 3.
POS-VSET	ph	C1245/1	dec [inc]	-	-	Current speed setpoint; for normalization see formula 2
POS-VTRAV	ph	C1245/2	dec [inc]	-	-	Final speed, absolute value for current PS, for normalization 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 PS is delayed to wait until the possibly occurring contouring 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" 🕮 7-60)

Formulae for the scaling of signals (see above table, row "notes"):

Formula 1: position

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

Formula 2: Velocity (VEL)

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

Formula 3: Acceleration/deceleration (ACC/DCC)

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

Function block library

Function

7.6.1 Measurements

Absolute measurements

An absolute position target is a defined point on the traversing path referring to a zero. The target position is approached independently of the current position.

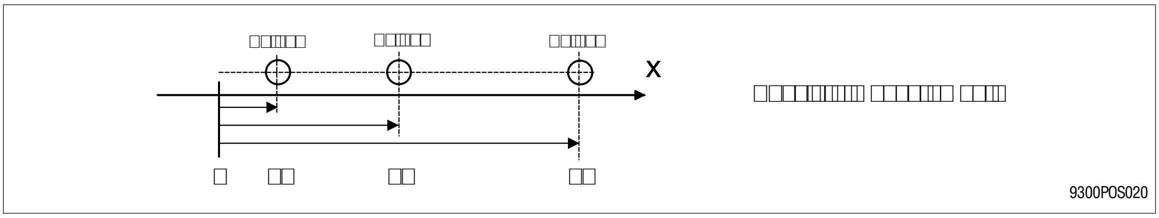


Fig. 7-13 Absolute measurements

Relative measurements

The relative measurement corresponds to incremental measurements. The new target refers to the previous previous target.

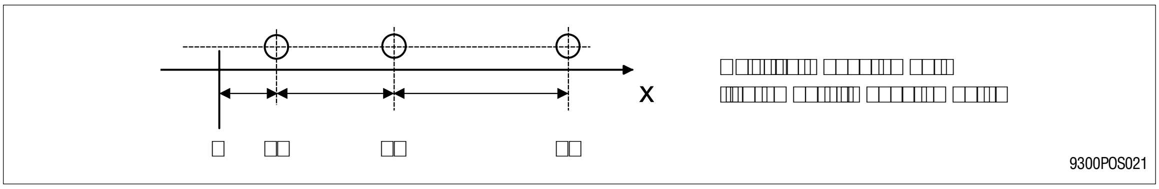


Fig. 7-14 Relative measurements

Mixed measurements

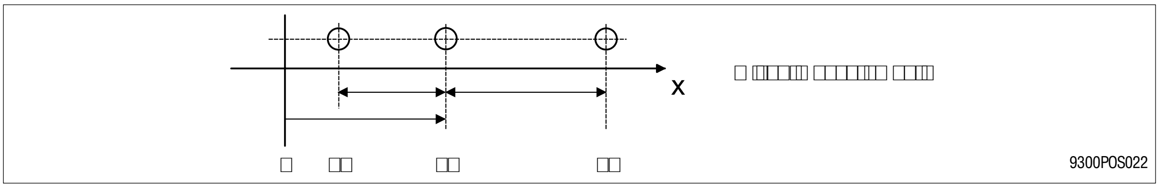


Fig. 7-15 Mixed measurements

7.6.2 Machine parameters

Example

Purpose

- The physical unit (e.g.: mm, m, degree) for a “unit” is defined by entering the machine parameters (see Part C, chapter 5.6.1). .

Function

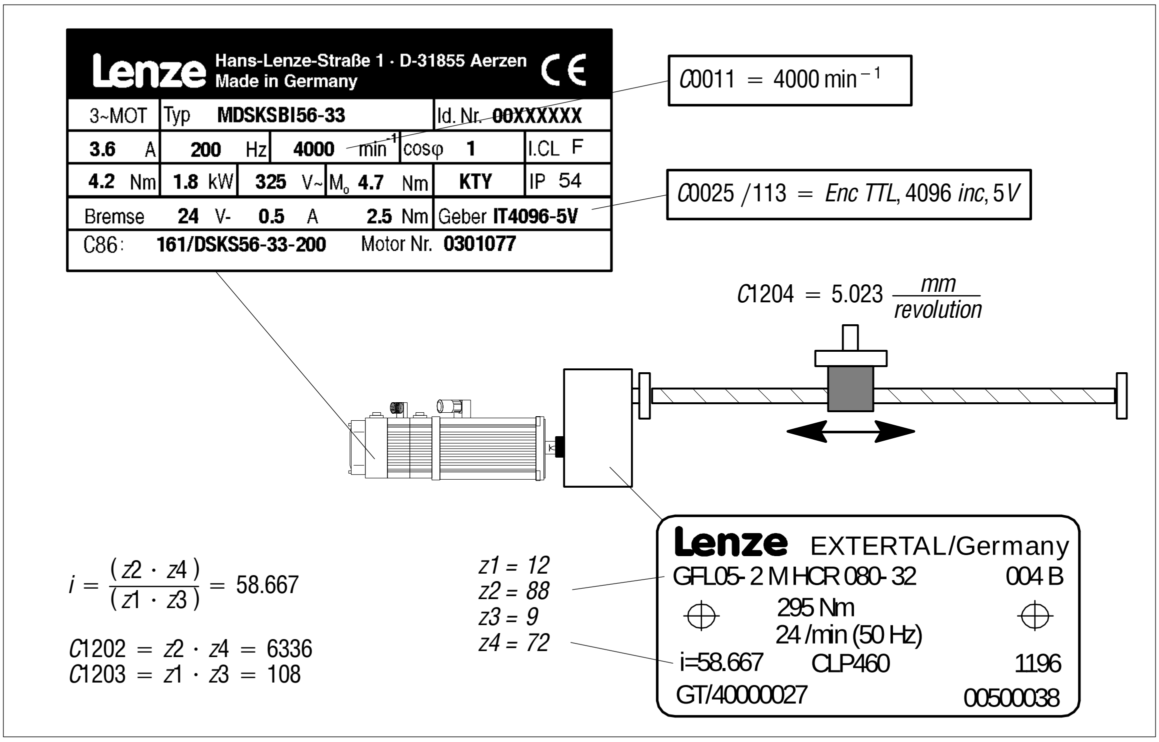
- Input of the gear ratio under C1202 and C1203, according to the nameplate data of the gearbox.
- Input of the feed constant under C1204. Enter the number of units (e.g.: mm) to be fed during one revolution at the gearbox output side.
- Input of the maximum motor speed (n_{max}) under C0011. Limitation mainly to protect the motor.
- Input of the maximum velocity (v_{max}) under C1240. Limitation mainly for the entire machine. The velocity should not be higher than reachable with maximum motor speed. Reference for the velocity in variable table VTVEL.

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

- Input of maximum acceleration$_{max}$) under C1250. Reference for the acceleration in variable table VTACC.

Application example

For positioning a spindle feed unit is driven through a gearbox. The machine works with an incremental encoder, instead of the standard resolver, as feedback system. The incremantal encoder is mounted to the motor and operates with 4096 pulses/rev. The gearbox ratio is i = 32 ($n_{motor}/n_{spindle}$). The spindle pitch is h = 10 mm. The data input should be in mm (1 mm = 1 unit).



Settings:

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

7.6.2.1 Position encoder to material

Purpose

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

Function

- The feedback is ensured by a separate position encoder (C0490) at the material web. Because of $n_{position\ encoder} \varnothing n_{motor}$ there is a gear ratio between position encoder and motor.
  - The speed is fed back through an encoder mounted to the motor shaft (C0495).
  - For defining the dimension of an “unit” (e.g. mm, cm), machine parameters are entered as if the position encoder was mounted to the motor shaft.
- The gear ratio between position encoder and motor is adjusted by means of the “Encoder gear factor” (C1207/1, C1207/2).

$$\frac{C1207/1}{C1207/2} = \frac{n_{Motor}}{n_{Encoder}}$$

- The counting of the actual position value (GDC monitor, C1220/3) must show positive values when the motor rotates in CW direction.

  If this is not the case, the

1. actual position value can be inverted by exchanging the encoder tracks.
   - When using the inversion, the position control circuit must be switched off (MCTRL-PHI-ON = 0) when activating the QSP function (MCTRL-QSP-OUT = 1). The drive is then decelerated to standstill along the QSP ramp.
2. counting direction of the position encoder must be inverted through the actual value polarity (C1208).
   - The inversion of the counting direction through actual value polarity (C1208) is not considered when executing the QSP function, therefore a positive feedback of the position control circuit occurs when activating the QSP function or FAIL QSP.
     The drive could accelerate in an uncontrolled mode to its speed limit n_{max} !

Stop!

If the ratio between position encoder and motor shaft is increased, the position resolution (incr/unit) will be reduced.
This can have a negative effect on the stability of the control circuit.

Example:
Assume a position encoder with 14 increments. With quadruple evaluation there are 4096 incr available internally.
The angle of twist at the motor shaft per encoder increment is:
Encoder on motor shaft:

$$\frac{360°}{4096\ incr} = 0,0879° = 0° 5,3'$$

Ratio of the position encoder i = 128:

$$0,0879° \times 128 = 11,25° = 11° 15'$$

The motor must thus rotate 115to compensate the offset of one increment. A further increase of the ratio would result in an increasing “compensation” of the motor.

Continuous slip of a friction wheel on the material web (= position encoder drive) leads to a faulty actual position value. A possibly occurring web break accelerates the drive to a very high speed because of 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 parameter but:

C1207/1	Position encoder gearbox factor, numerator	32	Numerator according to motor speed
C1207/2	Position encoder gearbox factor, denominator	1	Denominator according to encoder speed
C1208	Polarity actual position	-0-: not inverse -1-: inverse	If "inverse" is selected, observe the QSP function notes.

7.6.3 Positioning modes (C1210)

You can select the following positioning modes under C1210:

- Relative positioning (🕮 7-32)
- Absolute positioning (🕮 7-34)
- Absolute positioning with saving (🕮 7-35)

7.6.3.1 Relative positioning

Purpose

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

Function

- Set positioning mode (C1210) = 1.
- The positioning of absolute target positions is not possible. A fault is displayed (P07).
- The setpoint positions and actual positions are reset prior to a new positioning.
  – The current contouring error is maintained (POS-SETPOS = 0, POS-ACTPOS = current contouring error).
- The position limit values (C1223, C1224) determine the maximum feed length in the corresponding direction.

Tip!

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

- Homing is not necessary. However, it can be carried out to set the machine to a defined position.

Rounding error

When the mechanical elements are designed without special preparations, the distance traversed of a defined target position may result in a non-integer number of increments (e.g. 1554.4). The internal calculation only uses the integer 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 result e.g. in a drifting of holding positions of a conveyor belt. Therefore ensure that all position targets (distances traversed) can be displayed without decimal digits of increments (see position resolution).

Position resolution

- Display under code C1205.
  Display of the number of increments using which the user-defined "units" are resolved.
- 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/units (position resolution)

Formula:

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

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

A difference of 0.4 inc results from every feed.

Tip!

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

7.6.3.2 Absolute positioning

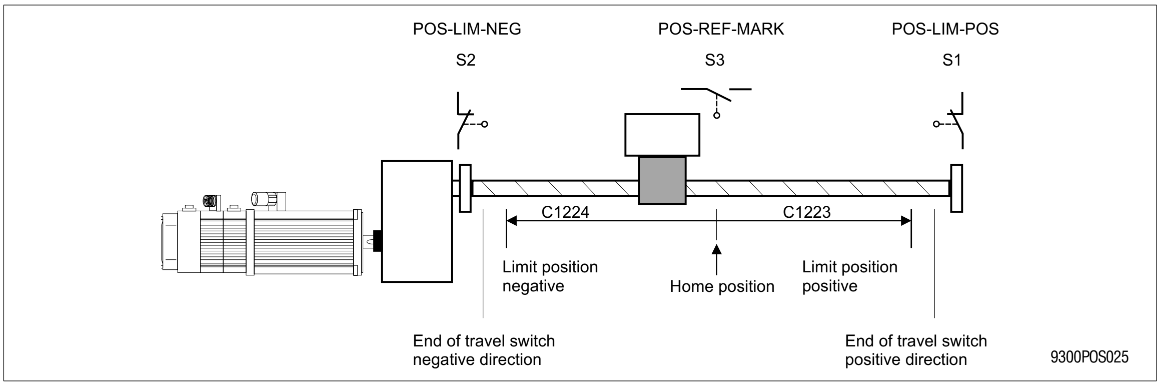


Fig. 7-16 Example of a machine with finite traversing range

Purpose

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

Function

- Set positioning mode (C1210) = 0 (default setting)
- The drive must be set to home position before positioning can be started (output POS-REF-OK = 1, homing status C1284 = “REF-OK”). The home position for the measuring systems is determined by homing. (🕮 7-44)
- There are two measuring systems in absolute positioning:
  - the machine measuring system and
  - the real measuring system.
- The end of travel switches are located in front of the mechanical stops. They prevent the drive from touching the stops.
- Adjustable position limit values (C1223, C1224) ensure that the end of travel switches are not approached during operation. A target position out of the limit position is not approached. In this case, a fault (P04, P05) would indicate this (see Part E, chapter 8.3).

7.6.3.3 Absolute positioning with saving

Purpose

Homing is not necessary after mains switching.

Function

- Resolver or absolute value encoder ST at X8 required as position feedback system.
- Set positioning mode (C1210) = 2 (absolute positioning with saving).
- The actual position value (POS-ACTPOS) is automatically saved when switching off the mains and restored when switching the mains on again.
  – The motor should not rotate more than max. +/- half a revolution when being switched off.
- The status “Home position known” will be set automatically. Output POS-REF-OK = 1 and homing status C1284 = “REF-OK”.
- All other function are identical with absolute positioning in chapter 7.6.3.2.

7.6.4 Measuring systems

Purpose

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

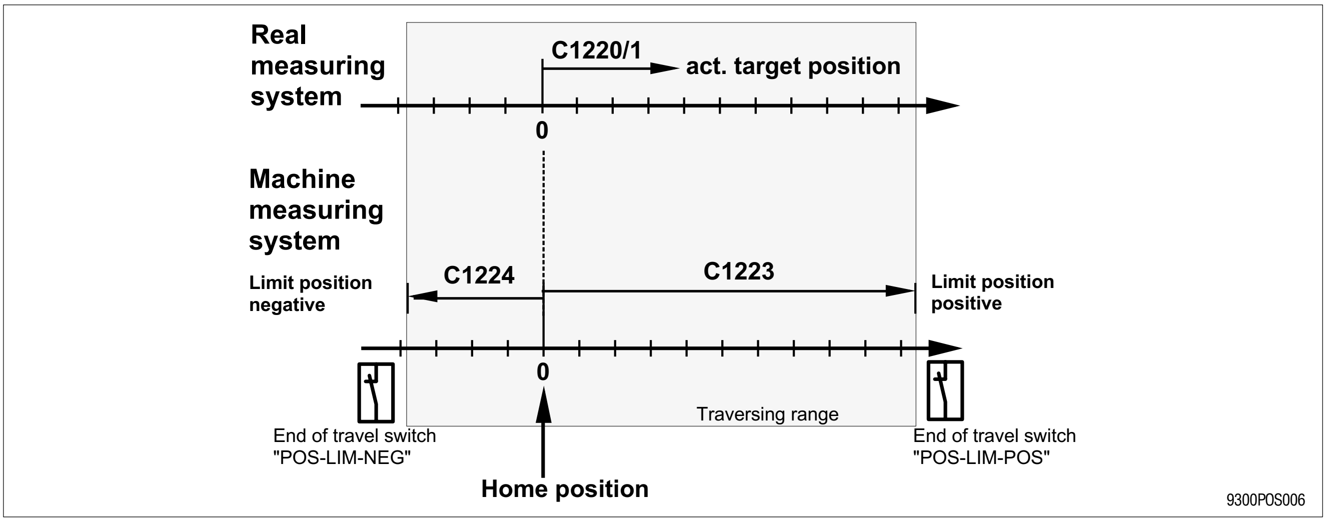


Fig. 7-17 Measuring systems for absolute positioning in default setting (C1225=0, C1227=0)

In default setting the home position = machine zero = real zero (📖 7-36) .

Home position

- The home position is the reference for the “connection” of the measuring systems with the machine.
- Is detected through “Homing”.

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 home position.
- The home position is detected for “homing” or “set home position” and, usually, not shifted later. (📖 7-44) .

Real measuring system

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

7.6.4.1 Measuring systems and zero point shifting

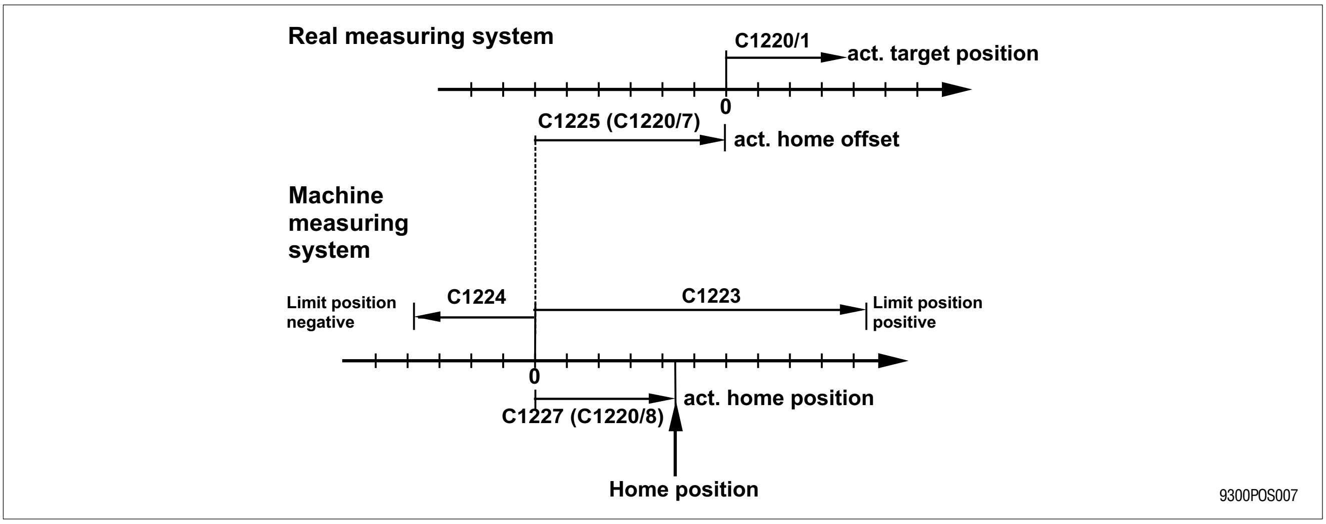


Fig. 7-18 Measuring systems for absolute positioning and zero point shifting

Shifting of machine zero

Purpose

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

Function

- The machine zero is shifted - compared to the home position - under C1227. The reference position is set at the home position, i.e. machine zero is in negative direction when the reference position is positive.
- The reference position (C1227) will only be accepted as "actual reference position" when being in "homing" or "Set home position" mode.
- The effective "actual reference position" is indicated under C1220/8 and C1221/8.

Shifting of real zero

Purpose

- The position targets are to refer to the front edge of the workpiece. I.e. the real measuring system must be moved.

Function

- Real zero can be shifted - compared to machine zero - using the reference offset (C1225). The entry of a positive value results in a movement of the real zero in positive direction.
- The reference offset is effective directly after entry. The position setpoint (POS-SETPOS) and the actual position value (POS-ACTPOS) change according to the reference offset, since their reference (real zero) has changed.
- 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".

7.6.4.2 Measuring systems for absolute value encoders

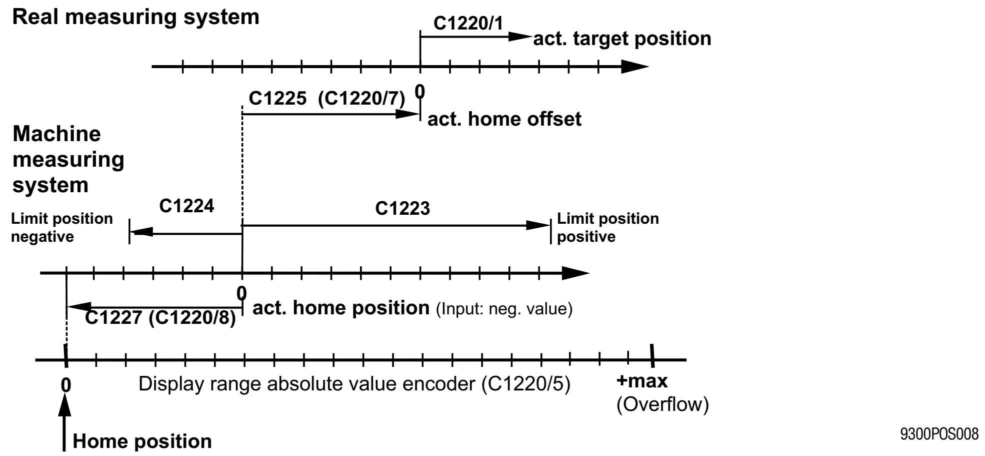


Fig. 7-19 Measuring systems with absolute value encoders

With absolute value encoders, measurement systems and their references refer to the same conditions than with absolute positioning. The only difference is the definition of the home position.

Encoder zero is defined as home position.

- 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”.
- Initialization
  – After switch on the “actual home position” is initialized with the “home position” (C1227). “Actual home offset” (C1220/7, C1221/7) is set equal to the input value “home offset” (C1225).
- During operation
  – C1227 will not be accepted directly for “actual home position”. In program operation acceptance can be initialized by the function “Acceptance of home position (C1227)” (setting under PS mode (C1311) = 16).
- Set homing value
  – The program function “Set home position” enables the machine zero to be set in the actual position. For this, the “actual home position” is set to the negative value of the actual position value (POS-ACTPOS). Transfer the value under C1220/8 to C1227 and save it under C0003 to ensure that the setting is available after mains switching. The “actual home offset” (C1220/7) is set equal to the input value “home offset” (C1225) when setting the home position.

The following functions **not** be executed when using positioning with absolute value encoder:
– Homing in program operation,
– manual homing
– Prg. fct. “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.
- The overflow is at 65536 incr/rev * 4096 rev = 268.435.456 incr. (Display: C1221/5)

7.6.5 Absolute value encoder

7.6.5.1 Absolute value encoder via encoder connection X8

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).

Function

- Connection of sine/cosine absolute value encoders with communication interface, type Stegmann SCS/M70xxx, to encoder input X8 (see Operating Instructions).
- Feedback with absolute value encoders is set under “Feedback system position” (C0490): C0490 = 4 (absolute MT, MT = multi-turn).
- The absolute value encoder must be mounted in a position where the encoder zero is outside the traversing range. Otherwise an overflow would occur. The overflow would result in a wrong actual position.
- A value overflow is not noticeable during operation. Positionings beyond the overflow point are possible.
- The machine zero is moved in the traversing range by means of the home position to enable reasonable position limit values and monitoring of the traversing range (see “Measuring systems with absolute value encoders”).

Tip!

- Absolute value encoders have a finite range, e. g.: 4096 increments. Within this range, they can also be moved when being switched off; they still provide the correct absolute position value after mains reconnection.
- It must be ensured that the encoder zero is outside the traversing range. The fine tuning is then made through the home position. This tuning is made only for commissioning or mechanical changes.

7.6.5.2 Absolute value encoder though system bus (CAN)

Purpose

- Use of absolute value encoders with CAN interface.

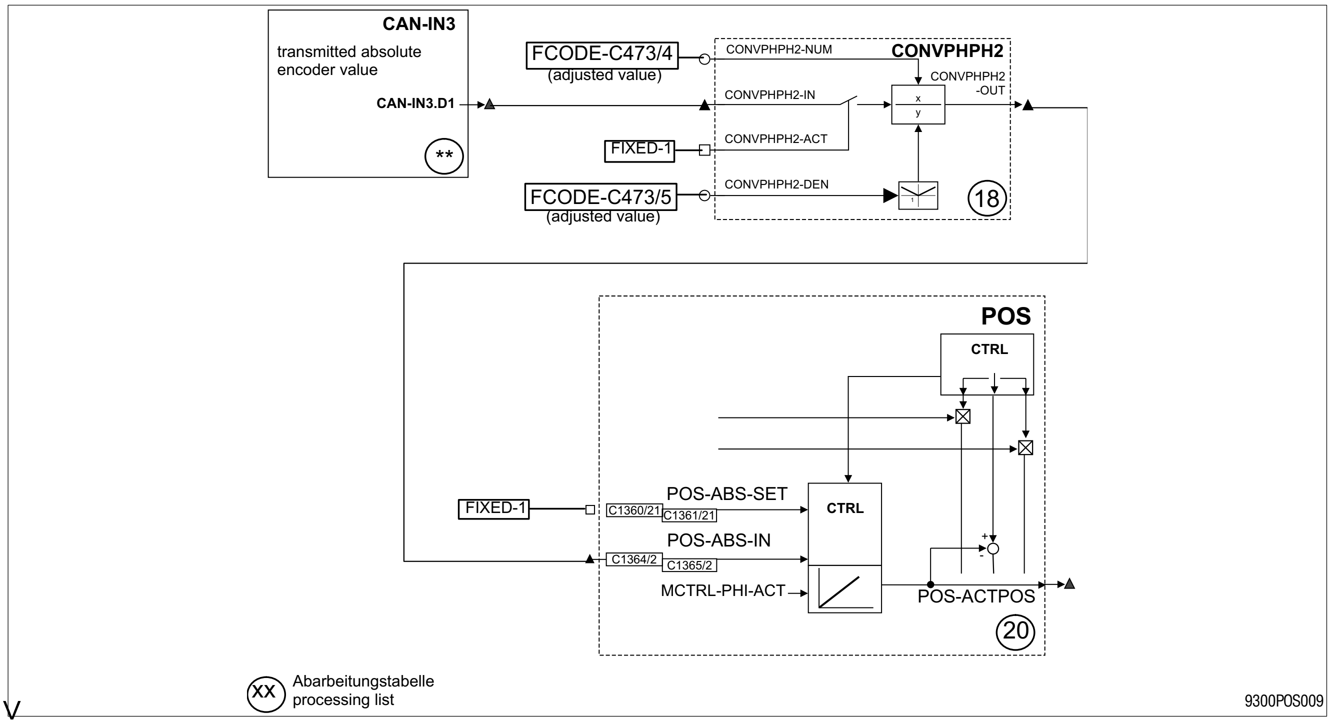


Fig. 7-20 Absolute value encoder though system bus (CAN)

Function

- All absolute value encoders with a CAN interface to specification “CAL DS-301” (CAN open) can be used.
- CAN parameters, especially CAN baud rate, CAN identifier and cycle time must be adjusted accordingly. CAN parameters set 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 position resolution of 65536 inc/rev using the function block CONVPHPH2. The adaptation factor is entered via the free codes C473/4 and C473/5.

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	AMeas = 8 inc/mm

Position resolution of the measuring system referring to the motor side	$Ax_{meas} = \frac{(A_{meas} \cdot d \cdot \pi)}{i} = \frac{(8\ inc/mm \cdot 50\ mm \cdot 3,14)}{30}$ $Ax_{meas} = 41.87\ inc/rev$

internal position resolution (fix)	$A_{internal}$ = 65536 inc/rev

Adapation factor for CONVPHPH2	$\frac{C0473/4}{C0473/5} = \frac{A_{intern}}{Ax_{meas}} = \frac{65536 inc/rev}{41.87 inc/rev}$ $\frac{C0473/4}{C0473/5} = \frac{1565}{1}$

- 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 initialization (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!

7.6.6 Positioning limits

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

- the end-of-travel switches (hardware setting),
- the limit positions (software setting).

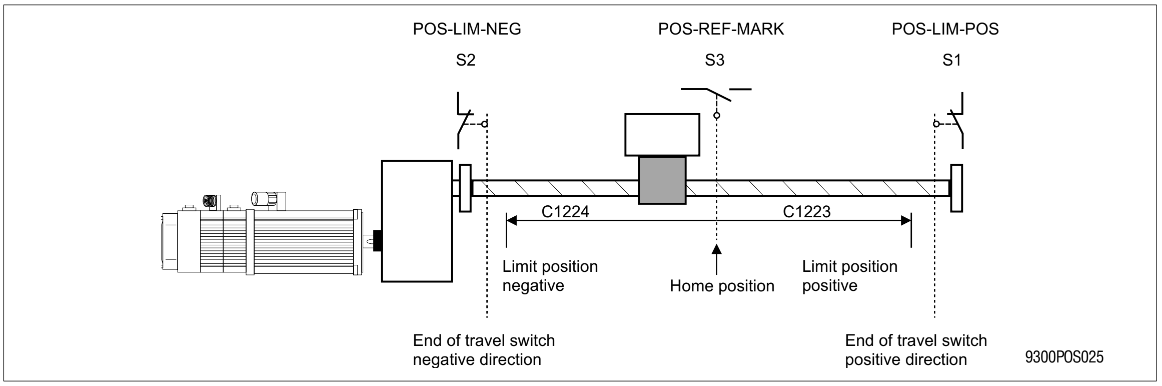


Fig. 7-21 Example for positioning limits

7.6.6.1 End of travel switch

- The end of travel switches are connected via the digital input terminals E1 and E2.
- In the default setting, E1 and E2 are configured for the function block inputs POS-LIM-POS and POS-LIM-NEG and are LOW active (protected against open circuit).
- An end of travel switch activates error message P01 or P02 under the following circumstances (see also Part E, (📖 8-6)):
  - 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 an 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 end of travel switches should be mounted in positions that provide enough braking distance for the drive in the event of a failure.

7.6.6.2 Position limit values (C1223, C1224)

- Position limit values (C1223, C1224) define the permissible traversing range of the drive.
- The reference point for the position limit values is always machine zero. Therefore, a move of the real zero does not result in a move of the position limit values referring to the traversing range limits. (📖 7-36) .
- An error message (P04, P05) will be set if the position limit values are exceeded. The drive brakes to standstill using the function “FAIL-QSP (default setting); the ramp time “QSP-Tif” can be adjusted under C0105.
- In the event of an 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 limit value
C1224	Pos.limit-	-214000.0000 ... 0.0000 [units]	Negativ position limit value

Tip!

- The settings should not allow that the end of travel limit switches are reached during operation.
- If the position limit values are set higher than allowed by the internal range, the warning "P18-internal limitation" will be activated (see Part E, (📖 8-6)). The limit values are automatically limited to the range internally possible. 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 limit values under C1220/10 and C1220/11 in [units] and C1221/10 and C1221/11 in [incr.].

7.6.7 Homing

Determination of the mechanical home position for measuring systems.

After homing, the drive is in a defined position.

Functions

- Homing (📖 7-44)
- Homing end (📖 7-45)
- Homing status (📖 7-46)
- Homing modes (📖 7-47) ff.
- Second homing speed (📖 7-54)
- Set homing value (📖 7-54)

7.6.7.1 Homing

Purpose

- Homing for finding the home position

Function

- Selection of a sequence suitable for homing (📖 7-47) .
- Setting of the homing speed under C1242
  – Setting of a second homing speed under C1241 (as necessary) (📖 7-54)
- Setting of the homing acceleration under C1251
- Definition of the homing end point under C1209.
- Execution of homing in
  – manual operation using “Manual homing” (📖 7-62) .
  – program operation. (Selection under C1311/x=3, program set mode)

Homing procedure

- The homing status POS-REF-OK is reset (see (📖 7-46)) and the current reference offset initialized using the value entered under C1225.
- Homing is started and carried out according to the mode selected under C1213.
- When the home position is found, the reference position (C1227) will be set here and the reference offset (C1225) will be added. The position indications now refer to real zero (see Fig. 7-18).
- The homing status POS-REF-OK is set.

7.6.7.2 Homing end

Purpose

- Determination of the point where the drive is going to stop after homing.

Selection of the homing limit (C1209)

- C1209 = 0 (default setting):
  Drive remains on the **Home position** (zero pulse/zero position/touch probe) or goes back.
- C1209 = 1:
  Drive remains on **real zero** . The additional distance is determined by the reference offset and the reference position.
- C1209 = 61:
  Drive remains on position target **VTPOS-NO-60** (parameter C1301/60). The additional distance is determined by the reference offset, reference position and position target.
- C1209 = 71:
  Drive remains on position target **VTPOS-NO-70** (function block input). The additional distance is determined by the reference offset, reference position and position target.
- C1209 = 101:
  Drive remains on position target **VTPOS-NO-100** (teach-in value). The additional distance is determined by the reference offset, reference position and position target.

Tip!

When the drive must not reverse during homing:

- Select real zero as homing limit (C1209) and
- enter reference offset.

Thus, the braking distance after homing is always long enough.

7.6.7.3 Homing status

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

The homing status “Reference known” shows when the measuring systems have a defined reference to the machine. For absolute positioning (📖 7-34) or (📖 7-35) positioning is only possible after a defined reference has been created.

The output POS-REF-OK is set by

- 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
- Description of the following codes:
  – C0011 (Nmax)
  – C0490 (Feedback system for position encoder)
  Note:
  Please consider that the codes C0490 and C0025 influence each other. A later change of one of these codes overwrites the other one.
  – 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 error occur:
  – NMAX (Limit speed of C0596)
  – P12 (Encoder limit exceeded)
  – SD2 (Resolver error), if resolver is 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.

7.6.7.4 Homing mode 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 home position via homing switch

Mode 0: Traversing direction to end of travel switch positive

Set C1213 = 0.

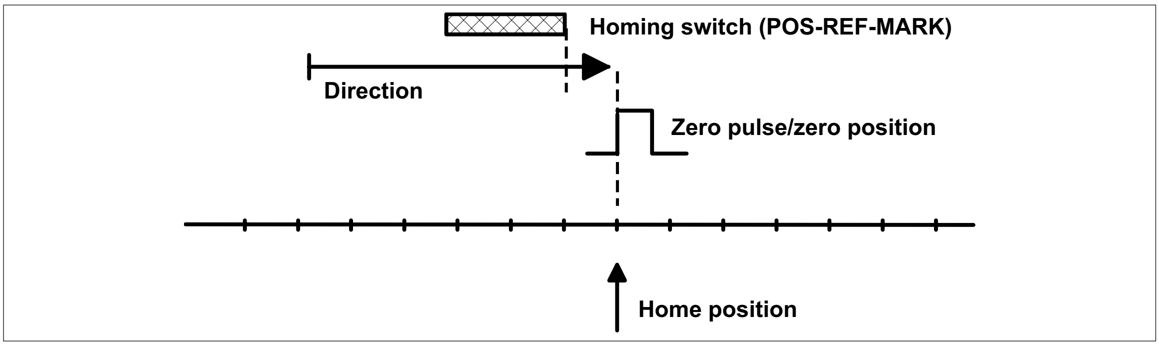


Fig. 7-22 Move to home position via homing switch

Function procedure

- Move to the home position with homing speed (C1242) towards positive end of travel switch overriding the homing switch.
- The home position 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: Positioning direction to negative end of travel switch

Set C1213 = 1.

Function procedure

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

7.6.7.5 Homing mode 2 and 3

Purpose

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

Approach end of travel switch, reverse and move to home position via homing switch

Mode 2: Positioning direction to positive end of travel switch

Set C1213 = 2.

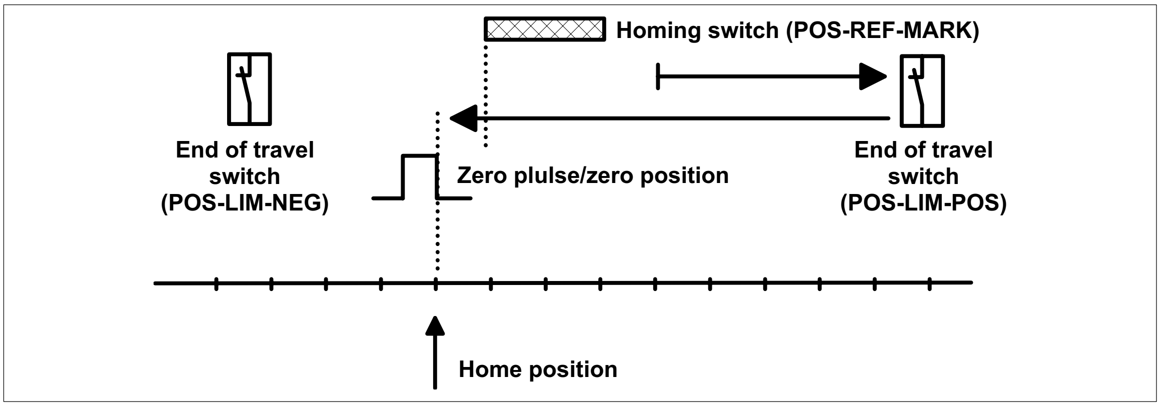


Fig. 7-23 Move to POS-LIM-POS, reverse, move to home position via POS-REF-MARK

Function procedure

- Move to positive end of travel switch with homing speed C1242.
- Reverse and move to home position with homing speed C1242, overriding the homing switch. In this case, no fault (P02) is displayed!
- The home position 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 switch before homing, it is reversed immediately.

Mode 3: Positioning direction to negative end of travel switch

Set C1213 = 3.

Function procedure

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

7.6.7.6 Homing mode 4 and 5

Purpose

- Simple homing in all positioning modes (C1210 = 0, 1, 2).
- The homing switch (POS-REF-MARK) will not be overrun.
- The homing switch must be in direction of the movement.

Move to homing switch, reverse and move to home position

Mode 4: Positioning direction to positive end of travel switch

Set C1213 = 4.

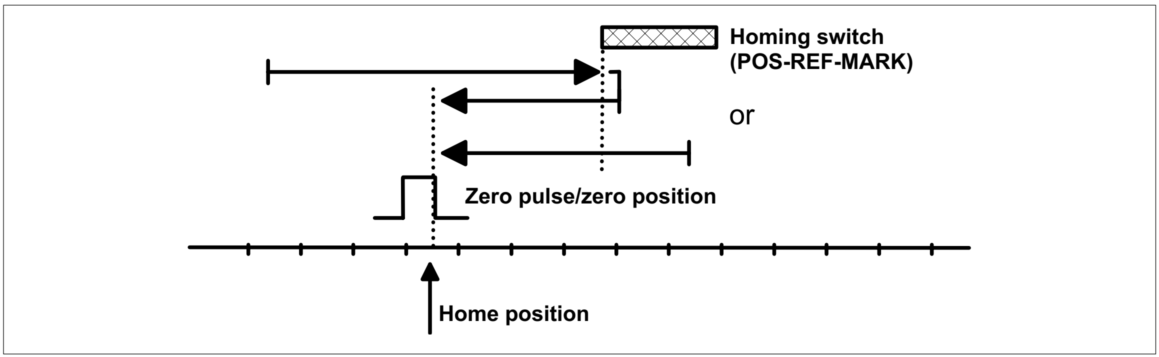


Fig. 7-24 Move to POS-REF-MARK, reverse and move to home position

Function procedure

- Move towards positive end of travel switch with homing speed C1242 up to homing switch.
- Reverse and move to home position.
- The home position is at the first zero pulse / zero position of the position encoder after leaving the homing switch.
- If the drive is already on the end of travel switch before homing, it is reversed immediately.

Mode 5: Positioning direction to negative end of travel switch

Set C1213 = 5.

Function procedure

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

7.6.7.7 Homing mode 6 and 7

Purpose

- Homing in all positioning modes (C1210 = 0, 1, 2).
- Use of the touch probe, if zero pulse cannot be reproduced at the same position because of the mechanical set-up.
  Zero pulse can also be mechanically shifted after a motor replacement.
- The homing switch (POS-REF-MARK) must be in direction of the movement.

Approach TP signal via homing switch

Mode 6: Positioning direction to positive end of travel switch

Set C1213 = 6.

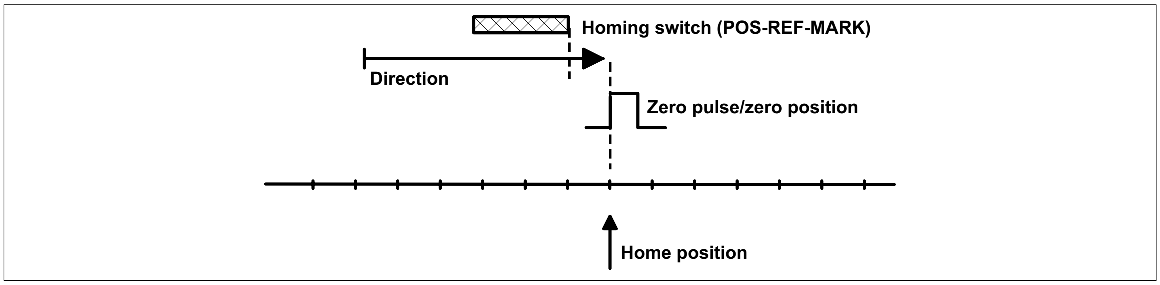


Fig. 7-25 Move to TP signal via POS-REF-MARK

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 (LENZE recommendation).
- Select signal of the TP input via C1215.
  - – C1215 = 0 ≙ LOW-HIGH signal.
  - – C1215 = 1 ≙ HIGH-LOW signal.

Function procedure

- Move to the home position with homing speed (C1242) towards positive end of travel switch overriding the homing switch.
- The home position is determined by the TP signal after leaving the homing switch. Previous TP signals are ignored.
- The drive can be on the homing switch before homing.

Mode 7: Positioning direction to negative end of travel switch

Set C1213 = 7.

Function procedure

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

7.6.7.8 Homing mode 8 and 9

Purpose

- Homing in all positioning modes (C1210 = 0, 1, 2).
- Use of the touch probe, if zero pulse cannot be reproduced at the same position because of the mechanical set-up.
  Zero pulse can also be mechanically shifted after a motor replacement.
- The touch probe must be in direction of the movement.

Move to TP signal

Mode 8: Positioning direction to positive end of travel switch

Set C1213 = 8.

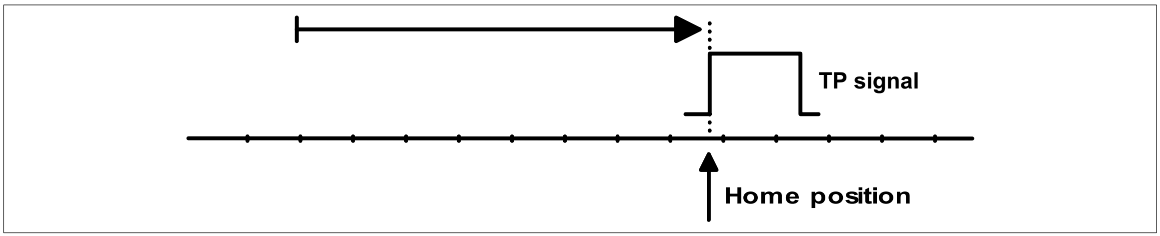


Fig. 7-26 Move to TP signal

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 (LENZE recommendation).
- Select signal of the TP input via C1215/x.
  – C1215/x = 0 ≙ LOW-HIGH signal.
  – C1215/x = 1 ≙ HIGH-LOW signal.

Function procedure

- Move to the TP signal with homing speed (C1242) towards positive end of travel switch.
- The first TP signal determines the home position.

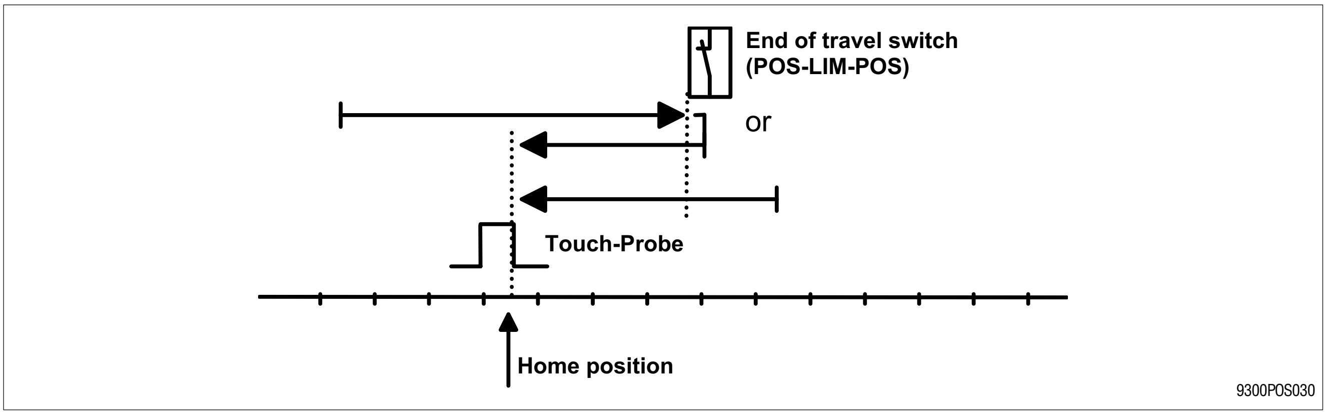
Mode 9: Positioning direction to negative end of travel switch

Set C1213 = 9.

Function procedure

- As "Positioning direction to positive end of travel switch", but the drive moves towards the negative end of travel switch.

7.6.7.9 Homing mode 10 and 11



Purpose

- Homing in absolute positioning mode (C1210 = 0, 2).
- Use of the touch probe, if zero pulse cannot be reproduced at the same position because of the mechanical set-up.
  Zero pulse can also be mechanically shifted after a motor replacement.
- The touch probe must be in direction of the movement.

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

Move to POS-LIM-POS in positive direction, reverse and home to TP. TP can also be the negative edge of the POS-LIM-POS.

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

The fault P02 is not displayed!

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

Move to POS-LIM-NEG in negative direction, reverse and home to TP. TP can also be the negative edge of the POS-LIM-NEG.

Otherwise identical with mode 10

Tip!

The limit switch (POS-LIM-xxx) can be used as touch probe (POS-REF-MARK) at the same time to save initiators. The TP input is selected under C1214.

In default setting the limit switches are LOW active, therefore select a rising signal for TP (C1215/x = 0). The drive should not stop on the home position directly after homing because the end of travel limit switches might be activated. Set the homing end point (C1209) accordingly.

7.6.7.10 Second homing speed

Second homing speed

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

Homing procedure with activated second homing speed:

Mode 0, 1:

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

Mode 2, 3:

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

Mode 4, 5:

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

Mode 6, 7:

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

Mode 8, 9:

Only with first speed to home position via TP.

Mode 10, 11:

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

7.6.7.11 Set homing value

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 home position.

7.6.8 Traversing profile generator and setpoints

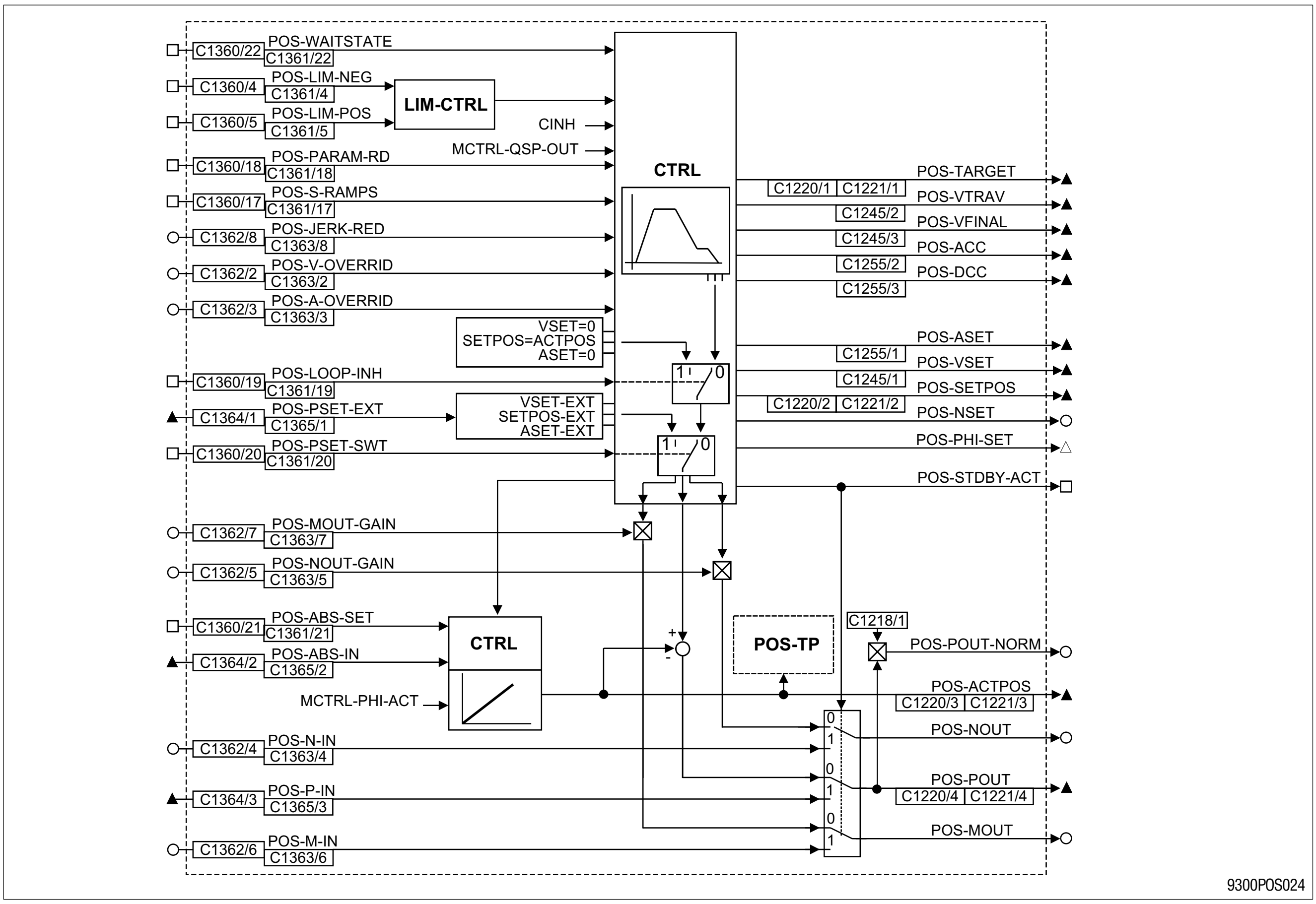


Fig. 7-27 Part of the function block POS

Purpose

- The traversing profile generator of the function block POS generates a speed profile with the corresponding setpoints for:
  - the position setpoint (POS-SETPOS),
  - the speed precontrol value (POS-NOUT) and
  - the torque precontrol value (POS-MOUT).
- The traversing profile is generated under consideration of the traversing profile parameter selected:
  - Position target (VTPOS),
  - Traversing speed (VTVEL)
  - Acceleration (VTACC)
  - Deceleration (VTACC)
  - Final speed (VTVEL).
- Traversing profile parameters are always read at the beginning of a positioning and remain unchanged for the whole positioning process. The Override inputs (POS-V-OVERRID, POS-A-OVERRID) are taken into account.
  Value in the variable table VTxxx can be changed for the oncoming positioning while still working on the first positioning.
- Traversing profile parameters can be changed via input POS-PARAM-RD even during a positioning process.

Function

- Linear ramps (L profile) (📖 7-56)
- S ramps (S profile) (📖 7-57)
- Override (POS-V-OVERRID, POS-A-OVERRID) (📖 7-59)
- New traversing profile parameters during positioning (POS-PARAM-RD) (📖 7-55)
- Influence of precontrol values (POS-NOUT-GAIN, POS-MOUT-GAIN) (📖 7-59)
- Target window (POS-WAITSTATE) (📖 7-60)
- Virtual master (POS-PHI-SET) (📖 7-61)

7.6.8.1 Linear ramps (L profile)

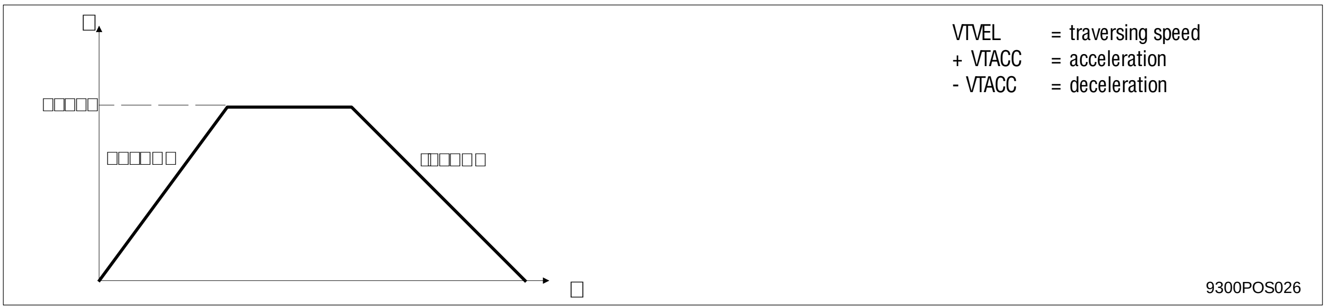


Fig. 7-28 Linear ramps (L profile)

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

7.6.8.2 S ramps (S profile)

Purpose

- Less wear of drive components because of a reduction of the jolt during acceleration

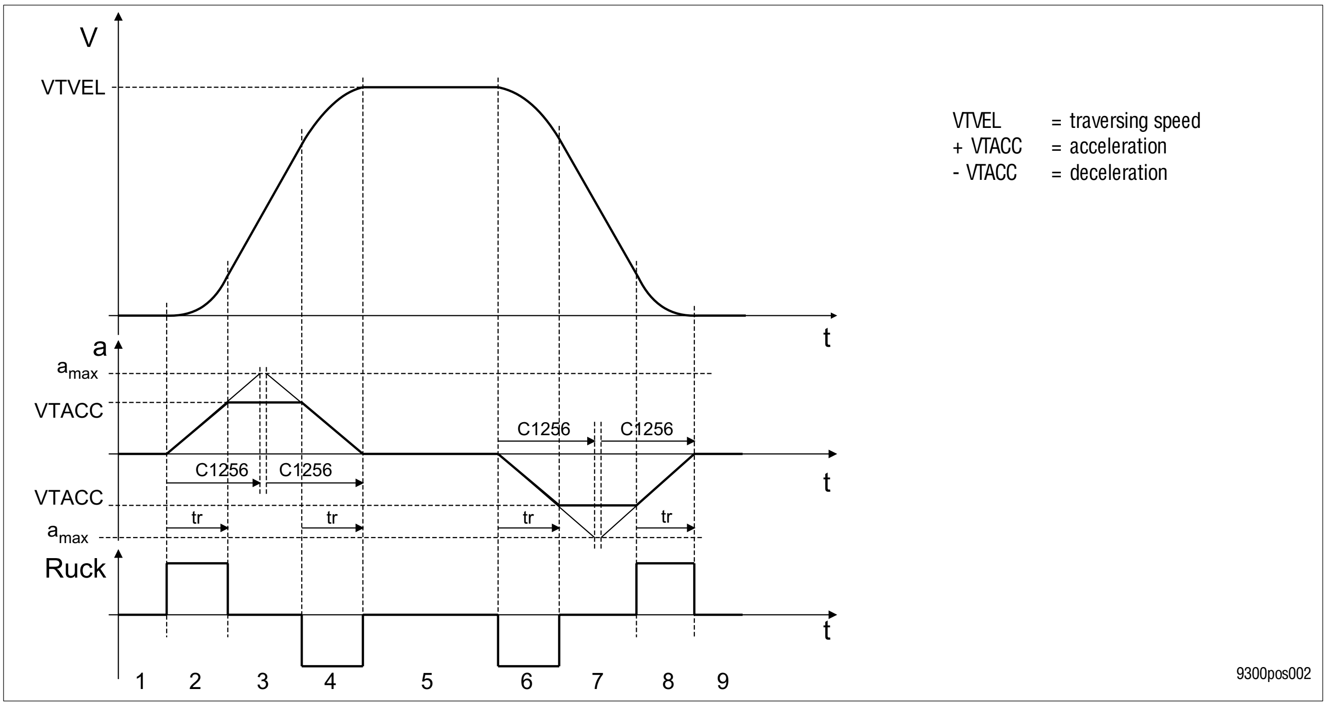


Fig. 7-29 S ramps (S profile)

1. Standstill
2. Deceleration with adjusted jolt
3. Acceleration with VTACC
4. Reduce acceleration with adjusted jolt
5. Traversing with VTVEL
6. Deceleration with adjusted jolt
7. Deceleration with VTACC
8. Reduce deceleration with adjusted jolt
9. Drive in target position

- The S-profile is used for soft acceleration and deceleration starts. The entered acceleration is reached only after the jolt time has elapsed.
  – A slower acceleration always leads to a longer positioning time - compared to the time-optimized L profile.
  – Jolt time (T_r) adjustable under C1256.
  T_r corresponds to the time required until reaching the max. acceleration a-max.
  The effective jolt time tr is reduced according to the actual acceleration a:

$$t_r = T_r \times \frac{a}{a_{max}} \rightarrow t_r = C1256 \times \frac{VTACC \times C1250}{C1250} \rightarrow t_r = C1256 \times VTACC$$

  – Jolt reduction or prolongation of the jolt time ($t_{r(RED)}$) can be implemented through input “POS-JERK-RED” (default setting 100%).

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

- The S profile must be selected before the positioning has been started.
- S profile is activated as follows:
  Assign 1-signal to input “POS-S-RAMPS”, e.g. assign FIXED1 directly or switch FCODE-471.B1 = 1 (default setting).
- Use “POS-PARAM-RD” to switch from one profile to the other, even during positioning.
  When changing from L profile to S profile during acceleration/deceleration, the S profile still starts with acceleration 0. The procedured is thus prolonged accordingly.

Tip!

- The jolt remains unchanged when the acceleration is changed.
  – The position target will be overrun (e.g. with TP positioning or override) if the target position with these parameters cannot be reached. The drive then changes its direction of rotation and goes to its 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.
- With the S profile, the delay is set automatically equal to the acceleration in PS. Delay entries are not considered.
- In manual operation (POS-MANU-ACT = 1) and homing, stopping is always carried out with L profile!

7.6.8.3 Override

Purpose

- Dynamically changing profile parameters (speed and acceleration).
  Example: Set traversing speed in dependence 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 detected before every positioning process. During positioning use input POS-PARAM-RD (see chapter 7.6.8.4)
  – 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 orverride values are effective, negative values will be evaluated as zero.

7.6.8.4 New traversing profile parameter during positioning

Purpose

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

Function

- LOW-HIGH signal at POS-PARAM-RD accepts new profile parameters from the variable tables VT, even during positioning.
  Profile parameters: Position target, traversing speed, acceleration, deceleration, final speed, V-override, A-override, POS-S-RAMPS (limited).
  – With constant HIGH level: new profile parameters are accepted every 10 ms.

Note: Not effective in stand-by operation.

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

Purpose

- Reduction of the influence of precontrols 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 position target.

7.6.8.6 Target window (POS-WAITSTATE)

Purpose

- The program is continued only once the target position is reached.

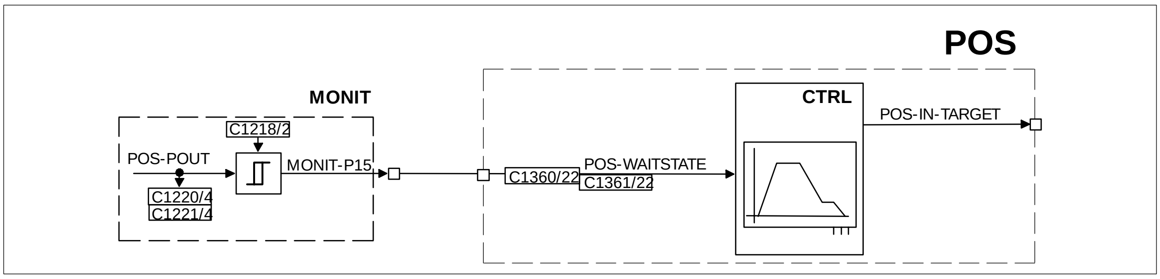


Fig. 7-30 Connect output MONIT-P15 with input POS-WAITSTATE

Function

Output	Level	Description
POS-WAITSTATE	HIGH	POS-IN-TARGET is not yet set because the positioning is still in process. The functions of the next PS are not yet executed.
	LOW	Continuation of the program: The program is continued only once the difference between acutal value and setpoint is compensated such that the difference is within the permissible contouring error tolerance. Under code C1218/2 you can enter a contouring error with less tolerance.
MONIT-P15	HIGH	Display when the momentary contouring error is higher than the target window.
		The output MONIT-P15 will be switched even if the second contouring error monitoring is switched off.

Tip!

Very dynamic accelerations can cause such a large control difference that the setpoint reaches the target position before the actual value. If the program was continued immediately, faults would occur, resulting in negative effects to subsequent processes.

The solution of these types of tasks is to delay the program continuation (POS-WAITSTATE = HIGH) until the actual value of the drive is actually in the target position. This target position is entered as a very small window via code C1218/2 contouring error tolerance). To continue the program, this control difference between setpoint and actual value (called contouring error) must be smaller than this window to be defined before.

7.6.8.7 Virtual master (POS-PHI-SET)

Purpose

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

Function

- Definition "Virtual master":
  The "master" drive itself and the "slave" drives are positioned via the phase difference output (POS-PHI-SET).
  The drives do not show any feedback to each other or any time delay in positioning, unlike the situation when the slave drives are connected 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 chopped drives:
    The dynamic response can be improved by an additional speed precontrol.

Tip!

A system bus connection (CAN) requires controller synchronization; otherwise traversing information can be lost. Use the function block SYNC to implement the synchronization in the slave drives. The "CAN-Sync telegram" needs to be generated in the master drive.

7.6.9 Manual operation

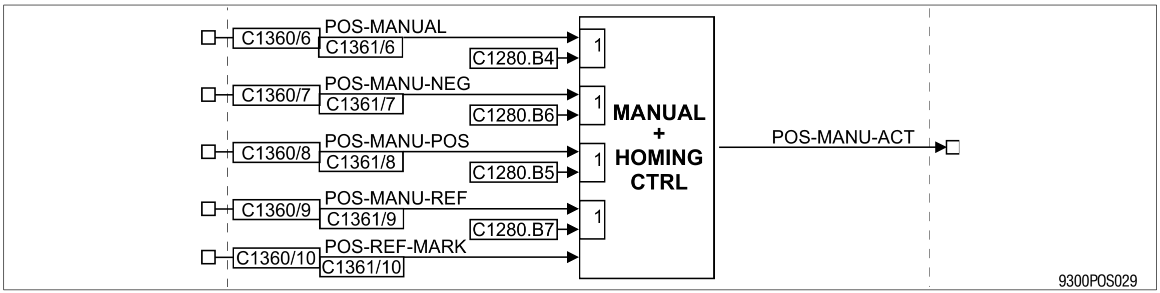


Fig. 7-31 Manual control (part of the function block POS)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-MANUAL	d	C1361/6	bin	C1360/6	2	Changeover Manual/program operation HIGH = Manual operation, current program will be interrupted, if necessary. Drive will be braked to standstill with the a-manual (C1252) incl. the influence of POS-A-OVERRIDE. LOW = Program operation
POS-MANU-NEG	d	C1361/7	bin	C1360/7	2	HIGH = Drive moves in negative direction with v_manual (C1243). Acceleration with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID. LOW = Drive stopped with a-manual (C1252). The override inputs POS-V-OVERRID and POS-A-OVERRID have an influence. Note: POS-MANU-REF has priority. If -NEG and -POS are controlled at the same time, 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 manual homing)
POS-REF-MARK	d	C1361/10	bin	C1360/10	2	Home position 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 positioning without intermediate stop (🕮 7-63)
- Manual positioning with intermediate stop (🕮 7-64)
- Manual homing (🕮 7-64)

7.6.9.1 Manual positioning

- Set manual positioning mode to “Manual positioning without intermediate stop” (C1260 = 0)
- Activate manual operation:
  POS-MANUAL = HIGH and/or
  C1280/B4 = 1 (“Manual positioning” in GDC dialog “Control”)
- Manual positioning in positive direction:
  POS-MANU-POS = HIGH and/or
  C1280/B5 = 1 (“Manual positive” in GDC dialog “Control”).
- Manual positioning in negative direction:
  POS-MANU-NEG = HIGH and/or
  C1280/B6 = 1 (“Manual negative” in GDC dialog “Control”).
- 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 end of travel switch is reached. The error messages P01 and P02 will be activated.

Tip!

- In manual operation, assigned end of travel switches can be left again in direction of the traversing range. The fault must have been reset before.
- In manual operation, the drive always stop along linear ramps (L profile).

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

1. The drive must be enabled (DCTRL-INH =0),
2. The QSP function must not be activated (MCTRL-QSP-OUT=0),
3. Manual homing must not be activated:
   POS-MANU-REF = LOW and
   C1280/B7 = 0 (“Manual homing” in GDC dialog “Control”),
4. only one direction can be preselected.
   When both directions, positive and negative, are activated at the same time, the drive will be braked to standstill.

7.6.9.2 Manual positioning with intermediate stop

Purpose

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

Activating this function

- Set manual positioning mode to “Manual positioning with intermediate stop” (C1260 = 1)
- The mode is activated as explained under Manual Positioning (see above).,
- Intermediate stop positions are defined by selecting position targets from the variable table VTPOS. Up to 16 position targets can be selected under C2161/1 to C1261/16. (GDC menu: “Positioning functions/manual positioning”)
- The drive moves to the next target position and stops there. For further movement, the control signal for Manual Positive or Manual Negative must be reset and set again. The drive brakes immediately to standstill when the control signal is reset before the next target position is reached.

7.6.9.3 Manual homing

Purpose

Example: Homing during commissioning (Part C, (🕮 5-1))

Activating this function

- The homing parameters set apply to manual homing (🕮 7-44)
- Activate manual operation
  – POS-MANUAL = HIGH
  and/or
  C1280/B4 = 1 (“Manual positioning” in the GDC dialog “Control”), if none of the manual functions is activated, the drive will brake to standstill.
- Start manual homing
  – POS-MANU-REF = LOW / HIGH signal
  or
  C1280/B7 = 0 / 1 signal (“Manual homing” in GDC dialog “Control”).
  The signal for manual homing must be available until homing is over, otherwise the process will be interrupted.
  Every homing restart requires a new signal.

Tip!

The following conditions must be fulfilled for manual homing:

1. The drive must be enabled (DCTRL-INH =0).
2. The QSP function must not be activated (MCTRL-QSP-OUT=0).

Manual homing has priority of manual positioning, that means the signals for manual positioning have no effect when manual homing is signalled by one of the control signals.

7.6.10 Program operation

Purpose

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

Function

- Program control (📖 7-65)
- Variable tables (VT) (📖 7-69)
- Program sets (PS) (📖 7-70)

7.6.10.1 Program control

Purpose

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

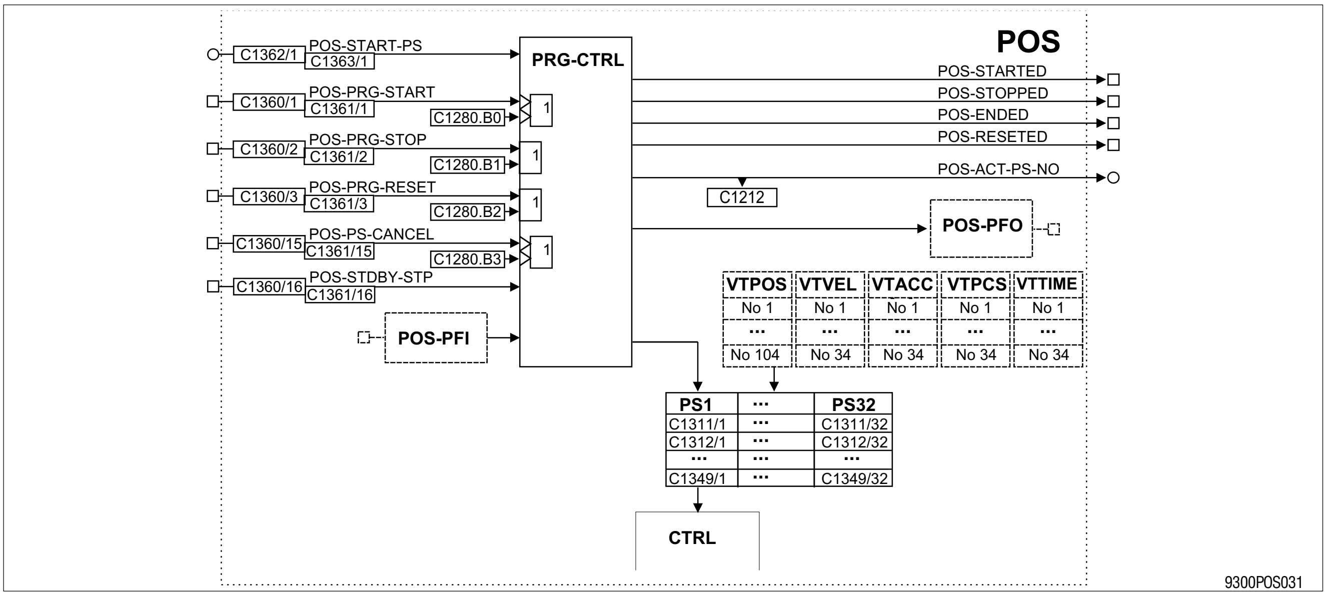


Fig. 7-32 Section from the function block POS: Functionality of PS, VT, PFI and PFO

Start program

- The program start is determined by the FB input "POS-START-PS". In standard configuration this input is connected to C1211.
- Start of the positioning program by
  - LOW-HIGH signal at POS-PRG-START or
  - C1280.B0 = 0 / 1 signal ("Program start" in GDC dialog "Control").

Tip!

- The program is also continued until the "Program end" when the program is started and immediately reset.
- If the start signal is still applied at "program end", the program will be restarted automatically.
- POS-PRG-START requires a new signal after the program has been interrupted (e.g. by controller inhibit) or a fault message.
  The program is then continued from the same point (status display: C1283=15).

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

The controller is enabled when

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)

Stop program

- POS-PRG-STOP = HIGH or C1280.B1 = 1 ("Program stop" in GDC dialog "Control").
  – The signal "Program stop" interrupts the program and positioning. The drive will be stopped with the current delay of the PS (no influence of POS-A-OVERRID).
- POS-PRG-STOP = LOW **and** C1280.B1 = 0 ("Program stop" in GDC dialog "Control").
  – The program will continue from the same position when the signal "Program stop" is LOW. Positioning will be continued with the current profile parameters of the PS.

Reset program

- POS-PRG-RESET = HIGH or C1280.B2 = 0 ("Program reset" in 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 program reset is also accepted when the controller is inhibited. It will be saved then. The program reset will not be carried out before the controller is enabled (see notes under Start Program).

Cancel current PS

- 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).
  – Afterwards, the program will be continued with the PS selected under C1333 (JMP-TP-PS).

7.6.10.2 Status of the program control

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

Update conditions of the status outputs “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)
- – program operation is active (POS-MANUAL=0, C1280.B4=0)

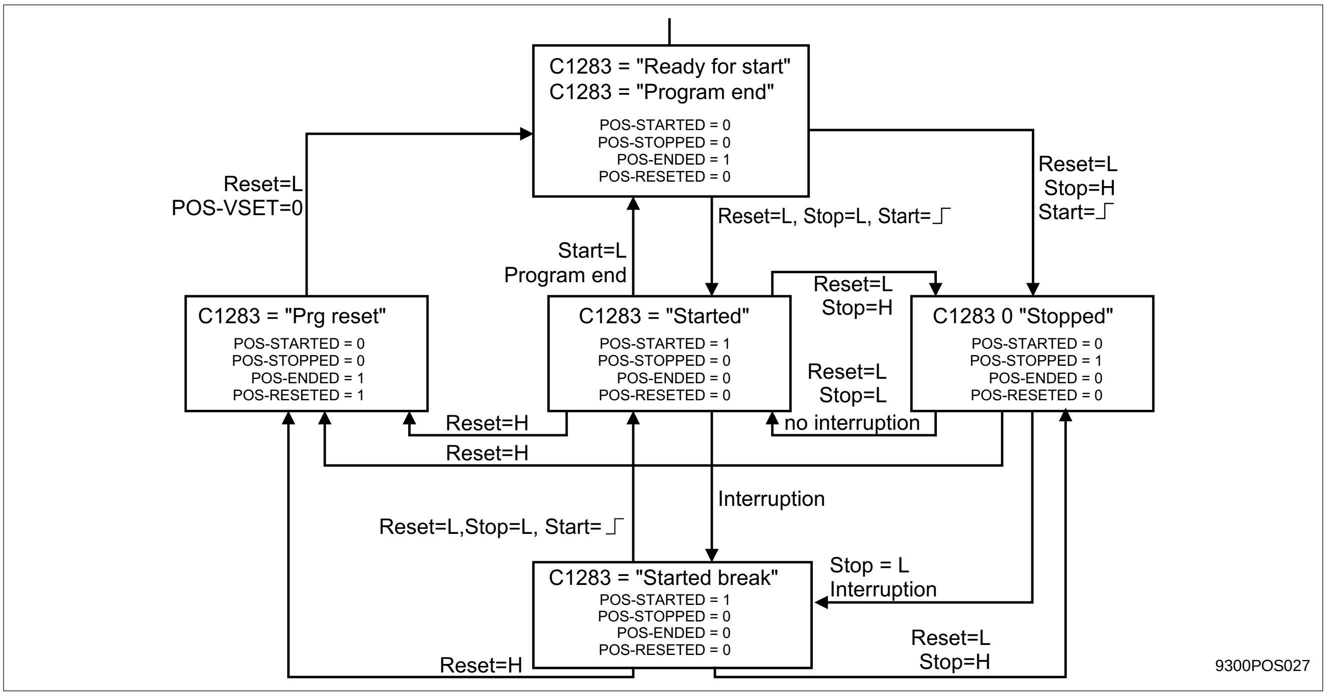


Fig. 7-33 Status machine of program control

“Ready to start”

- Program control is ready for start but not started yet.
- Output POS-ENDED = HIGH
- Positioning status (C1283) = “Ready for start”
- Actual PS No. (POS-ACT-PS-NO) = 0 (program end)

“Started”

- Program has been started, the positioning program is running.
- Output POS-STARTED = HIGH,
- Positioning status (C1283) = “Started”,
  or “Started-rem”, if C1280.B0 = 1 (GDC control),
  or “Started-dig”, if input POS-PRG-START = HIGH.

“Started-break”

- Program had been started but was interrupted by controller inhibit, QSP, TRIP, mains failure, Fail-QSP or manual positioning. A new start signal is required to continue the program.
- Output POS-STARTED = HIGH,
- positioning status (C1283) = “Started break”,

Tip!

- “Started” and “Started break” can only be defined through the positioning status (C1283).
- Bei aktiviertem Stand-by-Betrieb kann “Started-break” cannot be found when the stand-by operation is activated!
- Because of mains failure, the drive may not be in the indicated position, although the message POS-IN-TARGET was indicated.

“Stopped”

- Program and drive stopped, or drive will be stopped.
- 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”

- Program cancelled and drive 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,
- actual PS No. (POS-ACT-PS-NO) = 0 (program end)

7.6.11 Variable tables (VT)

Five variable tables comprise the profile parameters determining the positioning.

- C1301: VTPOS (📖 7-261)
  – 104 variables for position values
- C1302: VTVEL (📖 7-265)
  – 34 variables for speeds
- C1303: VTACC (📖 7-257)
  – 34 variables for acceleration / deceleration
- C1304: VTTIME (📖 7-263)
  – 34 variables for waiting time
- C1305: VTPCS (📖 7-259)
  – 34 Variables for piece numbers

7.6.12 Program sets (PS)

Function

- PS mode
- Point to point positioning
- Point-to-point positioning with changeover of velocity
- Touch probe positioning
- Stand-by mode
- 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. “Repetition function - No. of pieces
- Prg. fct. “Jump to next PS”

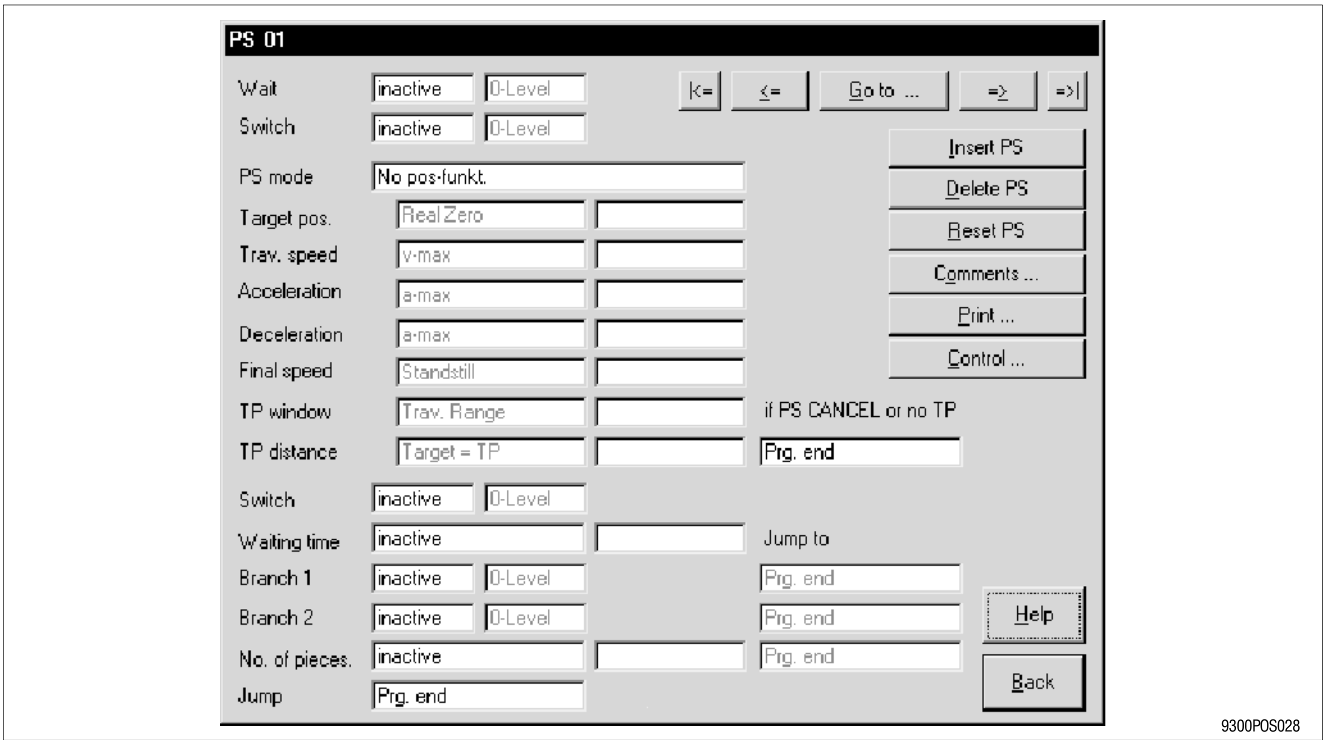


Fig. 7-34 Screenshot: GDC input: Dialog “Programming)

7.6.12.1 PS mode

Purpose

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

Function

- GDC input: Dialog “Programming”
- 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 home position (C1227)
30	Stand-by mode, cancel with STDBY-STP
31	Stand-by mode, cancel with TP E01 and traversing of the residual distance
32	Stand-by mode, cancel with TP E02 and traversing of the residual distance
33	Stand-by mode, cancel with TP E03 and traversing of the residual distance
34	Stand-by mode, cancel with TP E04 and traversing of the residual distance

7.6.12.2 Point-to-point positioning

Purpose

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

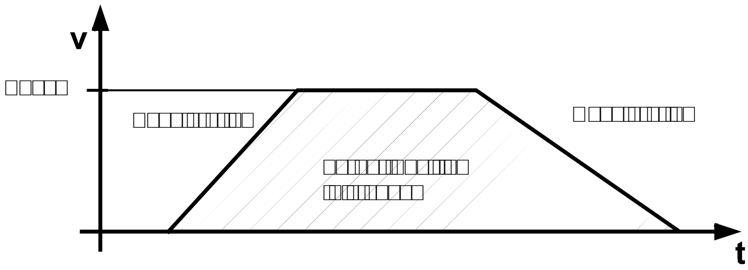


Fig. 7-35 Point-to-point positioning

Function

- PS mode (C1311): Select “Absolute PS” or “Relative PS”.
- The traversing profile is generated according to the parameters selected (see also traversing profile generator).
- The traversing 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”.

7.6.12.3 Point-to-point positioning with changeover of velocity

Purpose

- Changeover of velocity between two positionings without stopping.

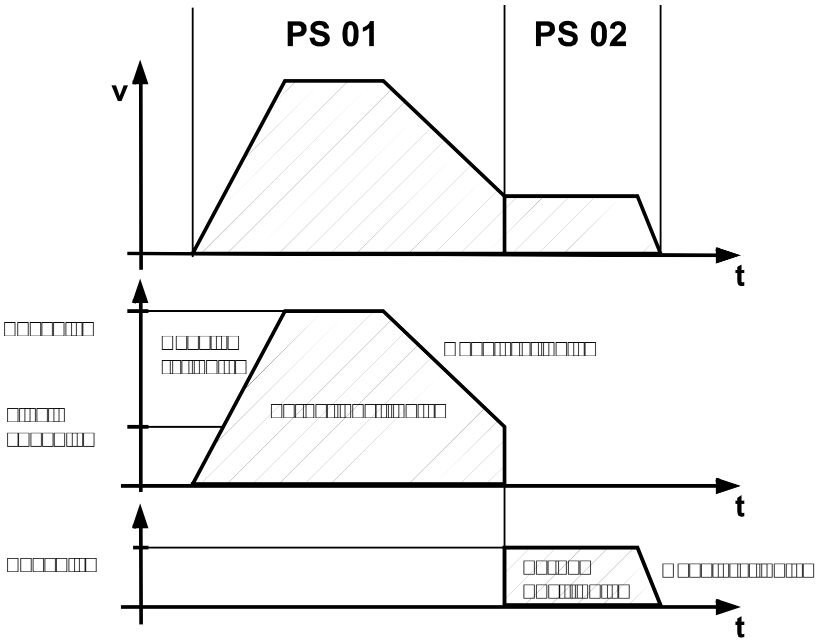


Fig. 7-36 Point-to-point positioning with changeover of velocity

Function

- PS mode (C1311): Select “Absolute PS” or “Relative PS”.
- The traversing profiles of two subsequent positionings are set like in point-to-point positioning except that one final speed is unequal 0. The final speed is reached when the position target is reached. 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 decelerates to standstill.

7.6.12.4 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 at the same place.

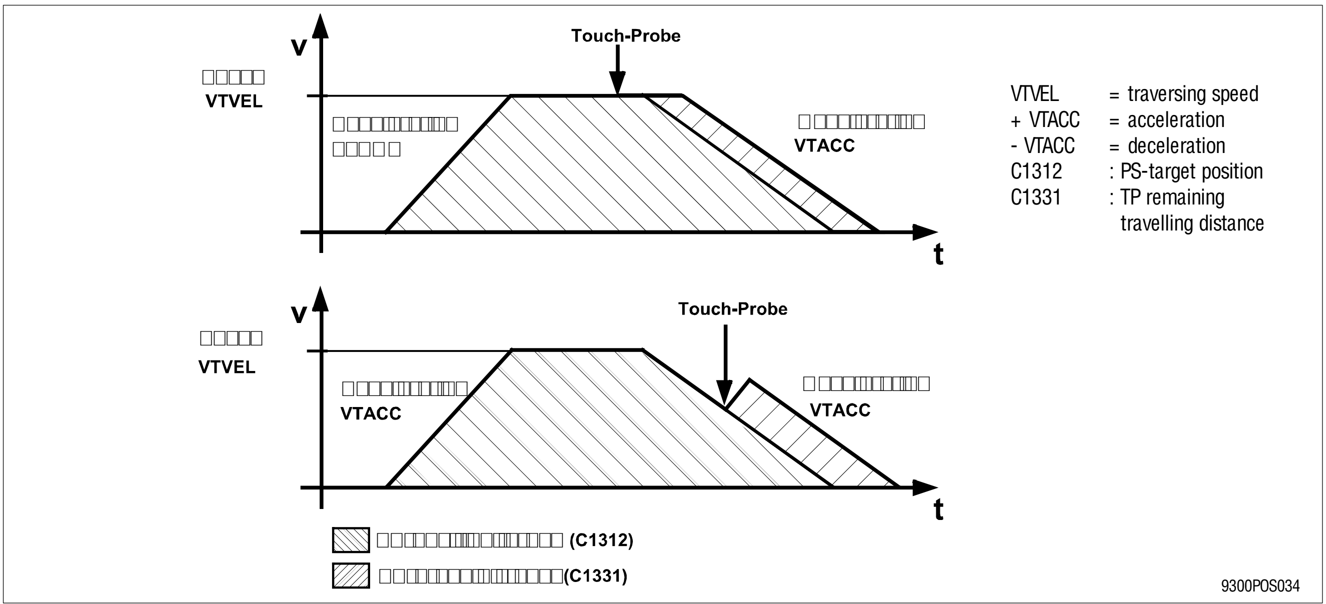


Fig. 7-37 Speed profile of a TP positioning

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 touch probe inputs possible (terminals E1 ... E4) is enabled during positioning.
- If TP occurs, the actual position value is saved as PT position and the position target of the current positioning is changed. The new position target is calculated from the TP position + TP remaining travelling distance (1331/x). A positive TP travelling distance moves the new position target in traversing direction. A negative TP travelling distance can lead to drive reversing.
- The actual position value saving via TP is interrupt-controlled and has a very short reaction time.
  - Rising signal at terminal: < 0.010 ms
- - Falling signal at terminal: < 0.100 ms
- The TP input can be enabled for the entire TP positioning or for parts of it. Position target, TP remaining travelling distance and TP window determine the restricted area (see figure 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”.

7.6.12.5 Stand-by mode

Purpose

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

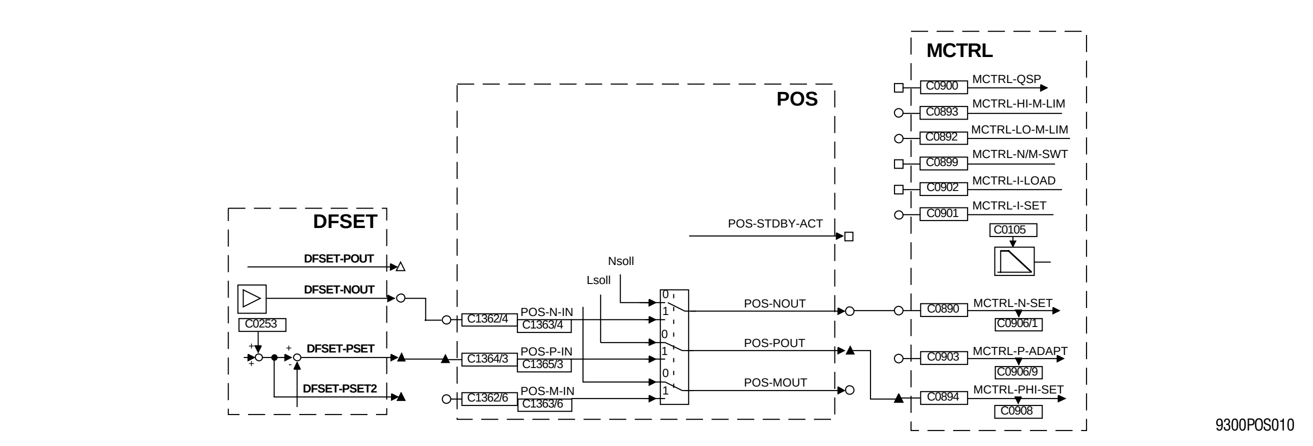


Fig. 7-38 Stand-by operation with selection through pulse train input

Function

- Stand-by operation is only possible in manual operation.
- PS mode (C1311): Select 30...34 (stand-by operation and signal source for abort).
- In PS stand-by operation is carried out instead of positioning. As long as stand-by operation is active (POS-STDBY-ACT = HIGH), “Positioning or special function” in PS are not completed. The following PS functions are only processed when the stand-by operation is over.
- After having started the stand-by operation, the drive be accelerated or decelerated to the external speed setpoint at POS-N-IN. The following profile parameters of the PS apply. When reaching the speed the external inputs (POS-N-IN, POS-P-IN) will be used. From now on the position setpoint (POS-SETPOS) equals the actual position value (POS-ACTPOS).
- The contouring error monitoring of the positioning (P14, P15) is not active in stand-by operation.

Cancel stand-by operation

- Cancellation through FB input “POS-STDBY-STP”:
  E. g.: Linkage to a digital control signal through a fieldbus or a function block interconnection. The stand-by operation will be cancelled and the drive will be reset to positioning when POS-STDBY-STP = HIGH. The positioning accelerates/decelerate the drive to the selected final speed of the PS using the profile parameters. The following PS functions will only be processed when the final speed has been reached.
- Cancellation through touch-probe signal at terminal X5/E1...X5/4:
  E. g.: For accurate positioning over a mark signal after operation with pulse train input. A TP input has been enabled during stand-by operation. The stand-by operation will be cancelled and the drive will be reset to positioning when a TP signal occurs. A positioning action (remaining TP travelling distance) that starts from the TP position, follows. 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 end of travel switch is active (fault P01, P02).
- Monitoring of the position limit value is active (fault P04, P05).
- Endless operation is possible with relative positioning (1210 = 1). The position values (POS-SETPOS and POS-ACTPOS) are reset to 0 when reaching half of the position limit value; the current contouring error remains the same (no jolting).

Tip!

The stand-by mode is completed, if

- program reset has been carried out (see program control)
- manual operation has been activated (see manual operation).

An interrupt of the program does not affect the stand-by operation (see program control).

Profile parameters and override inputs are **not** read through the function POS-PARAM-RD during stand-by operation.

7.6.12.6 Set position value

Purpose

- Shifting of the real measuring system during program processing

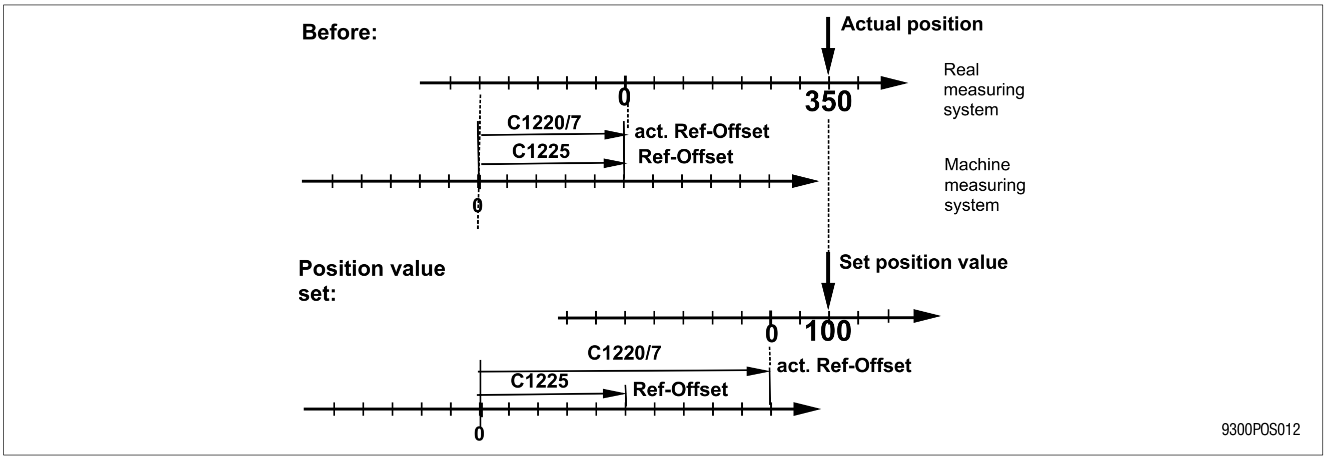


Fig. 7-39 Set position value

Function

- Selection of the function "Set position value" in PS under PS mode (C1311=5).
- The position setpoint (POS-SETPOS) is set to the position target selected in the PS.
- The actual position value (POS-ACTPOS) is set in order to keep the actual contouring error (no jerk).
- Setting of the position value shifts the real zero; the actual reference offset (C1220/7) is changed. The actual reference offset does not correspond to the input value under C1225.
- Real zero can be moved withing position limits (C1223, C1224). When exceeding these limits, error message "P08" (actual offset above limits) will be set.

7.6.12.7 Prg. fct. “Wait for input”

Purpose

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

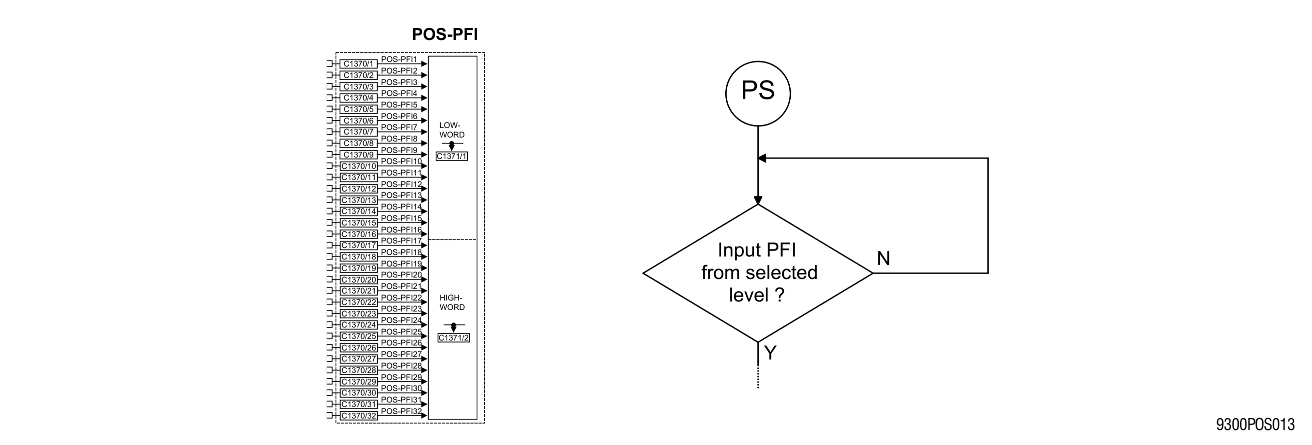


Fig. 7-40 Scheme - Wait for input

Function

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

7.6.12.8 Prg. fct. “Switch output before positioning”

Purpose

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

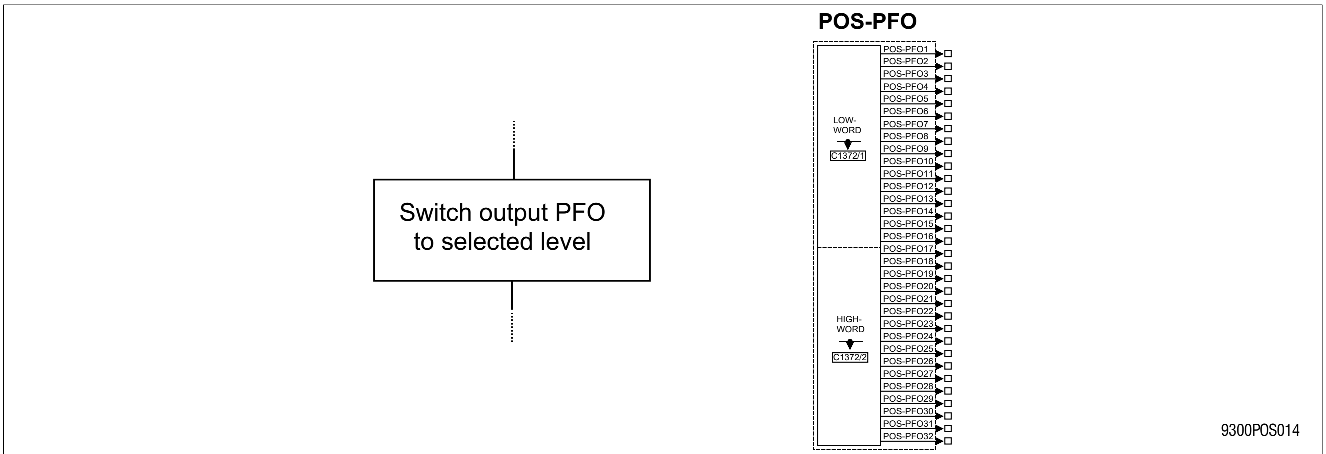


Fig. 7-41 Scheme - Switch output

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: Dialog “Programming”
- Default setting: not active

7.6.12.9 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: Dialog “Programming”
- 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 the positioning has not taken place or the position target has been reached in the same cycle. For remedy reset the output in one of the following PS. The output will then be switched for at leat one cycle.

7.6.12.10 Prg. fct. “Waiting time”

Purpose

Continue program only after waiting time is over.

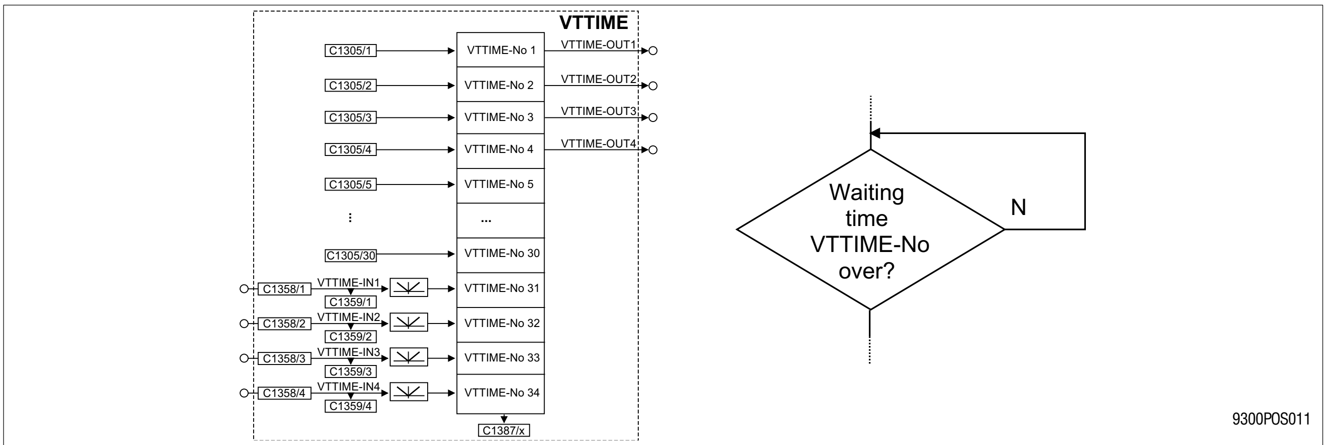


Fig. 7-42 Scheme - Waiting time

Function

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

7.6.12.11 Prg. fct. “Branch 1”

Purpose

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

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

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

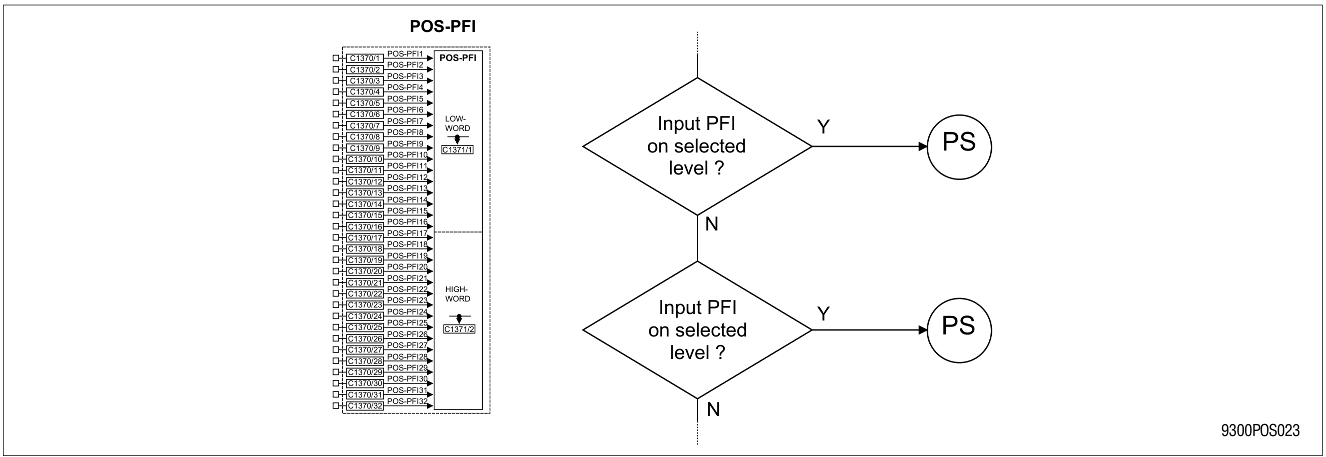


Fig. 7-43 Scheme - Branch 1 and 2

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: Dialog “Programming”
- Default setting: not active

7.6.12.12 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: Dialog “Programming”
- Default setting: not active

7.6.12.13 Prg. fct. “Repetition function - No. of pieces

Purpose

- Repeated repetition of the same PS or PS sequence.

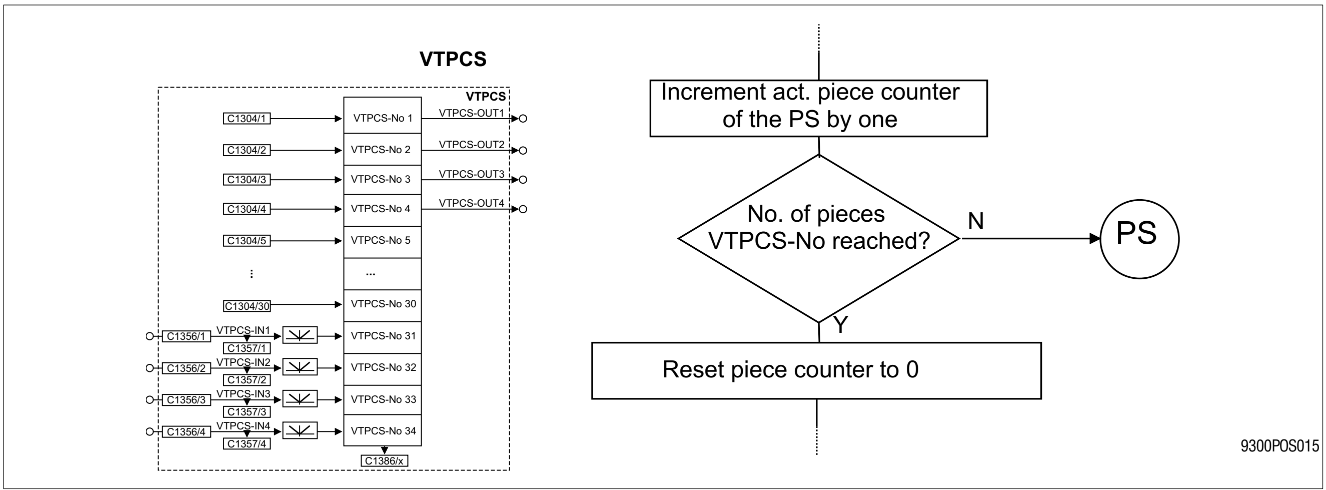


Fig. 7-44 Scheme - No. of pieces - Repetition function

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.
- Every PS has its own piece counter. C1299/x indicates the current count.
- With every PS cycle the corresponding piece counter count 1 (starting from 0). Afterwards the setpoint and actual values are compared and branched accordingly if the no. of pieces has not been reached.
  When the no. of pieces is reached, the piece counter is reset for the cycle and the no. of piece repetition function is over.
- “Program reset” resets all piece counters.
- GDC input: Dialog “Programming”
- Default setting: not active

7.6.12.14 Prg. fct. “Jump to next PS”

Purpose

- Link several PS in one program.

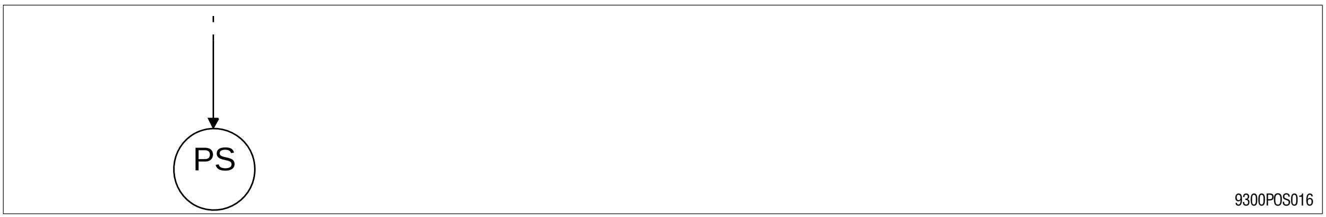


Fig. 7-45 Scheme - Jump to next PS

Function

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

7.6.13 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-target for positioning or, for instance, for length calculation with arithmetic function blocks.

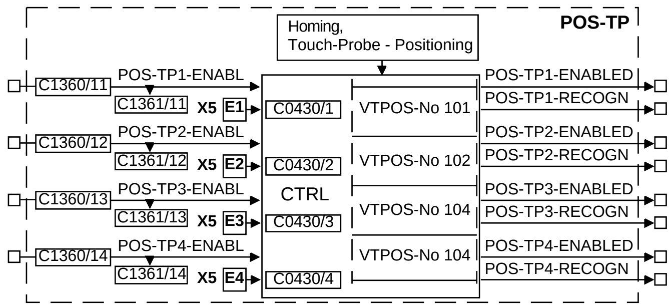


Fig. 7-46 Table inputs, outputs

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 enable of the TP input
POS-TP1-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E1
POS-TP2-ENABLED	d	-	-	-	-	Indicates the enable of the TP input
POS-TP2-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E2
POS-TP3-ENABLED	d	-	-	-	-	Indicates the enable of the TP input
POS-TP3-RECOGN	d	-	-	-	-	TP signal detected at terminal X5/E3
POS-TP4-ENABLED	d	-	-	-	-	Indicates the enable 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 explicitely transfer it to the processing.

7.6.14 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.

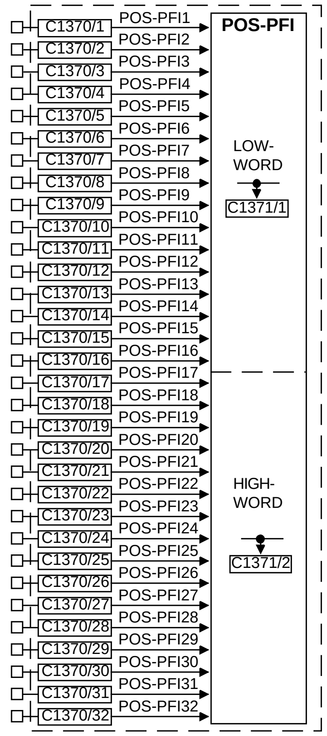


Fig. 7-47 POS-PFI, Program Function Inputs

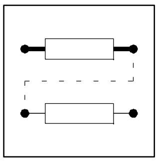
Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
POS-PFI1	d	-	-	C1370/1	2	-
...	d	-	-	...	2	-
POS-PFI32	d	-	-	C1370/32	2	-
LOW-WORD	-	C1371/1	hex	-	-	-
HIGH-WORD	-	C1371/2	hex	-	-	-

Function

- The PFI are evaluated during PS processing through the following program functions:
  "Wait for input",
  "Branch 1" and
  "Branch 2".
- 32 PFI available.
- PFI can be linked to any number of digital signal sources. (For instance, digital input terminals (DIGIN), fieldbus control signals (AIF-IN) 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 explicitely transfer it to the processing.



7.6.15 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.

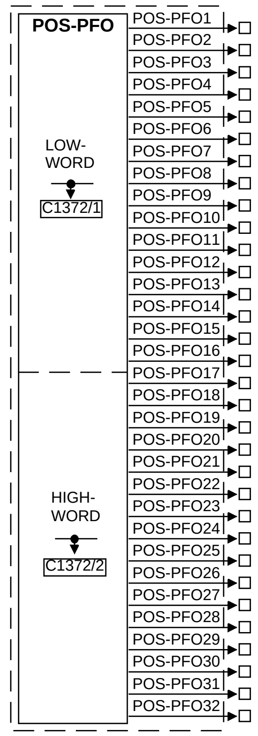


Fig. 7-48 POS-PFO, Program Function Outputs

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 evaluated 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 explicitely transfer it to the processing.

7.6.16 Absolute value generator (ABS)

Purpose

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

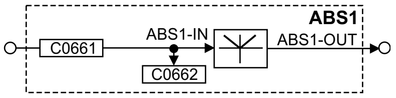


Fig. 7-49 Absolute value generator (ABS1)

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

Function

The absolute value of the input signal is generated.

7.6.17 Addition block (ADD)

Purpose

Adds or subtracts "analog" signals depending on the input used.

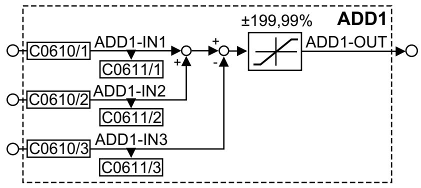


Fig. 7-50 Addition block (ADD1)

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.
- The result of the subtraction is then limited to ±199.99 %.

7.6.18 Automation interface (AIF-IN)

Purpose

Interface for input signals from the connected field bus module (e.g. INTERBUS-S, PROFIBUS-DP) for setpoints and actual values as binary, analog or phase information.Please observe the corresponding Operating Instructions of the connected fieldbus module.

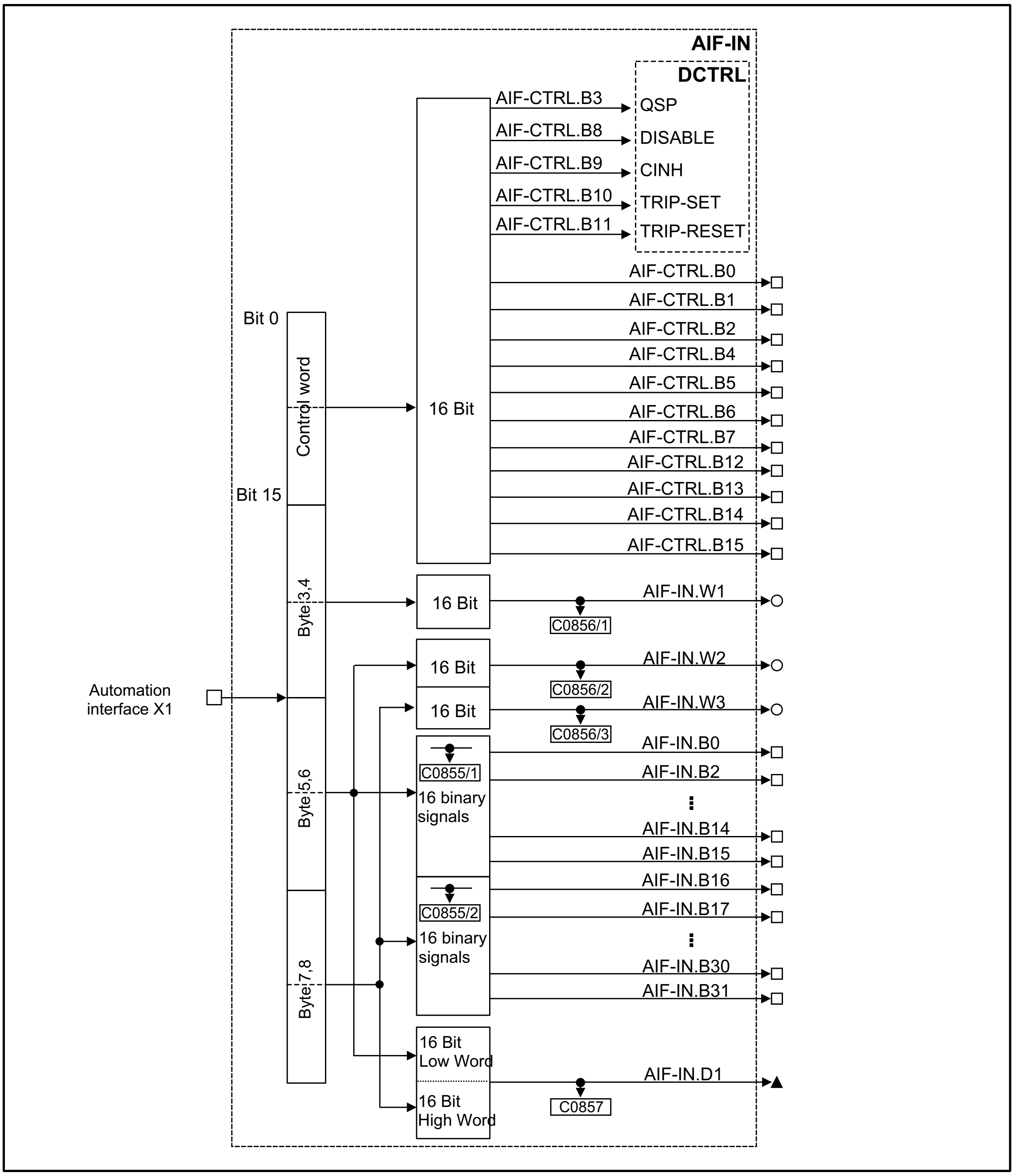


Fig. 7-51 Automation interface (AIF-IN)

Function block library

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 revolution
AIF-IN.D2	ph	C1197	dec [inc]	-	-	-	65536 = 1 revolution
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 to the function block DCTRL where they are linked to other 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

The meaning of these user data can be selected among different signal types. Depending on the requirement, these data can be evaluated as up to 2 analog signals, 32 digital signals or one phase signal.Mixed forms are also possible.

7.6.19 Automation interface (AIF-OUT)

Purpose

Interface for output signals from the connected field bus module (e.g. INTERBUS-S, PROFIBUS-DP) for setpoints and actual values as binary, analog or phase information.Please observe the corresponding Operating Instructions of the connected fieldbus module.

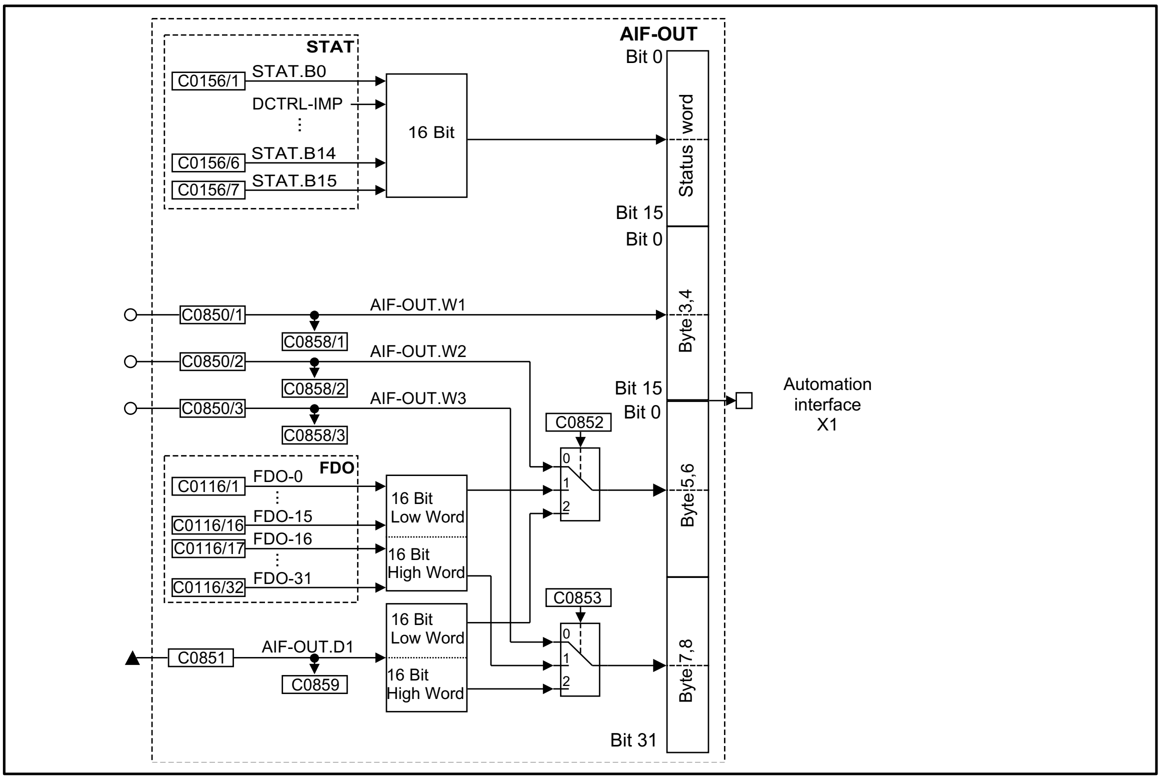


Fig. 7-52 Automation interface (AIF-OUT)

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 revolution = 65536
AIF-OUT.D2	ph	C1196	abs [inc]	C1195	4	1000	1 revolution = 65536

Function

The input signals of this function block are copied to the 8 byte user data of the AIF object and laid on the connected 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 of the function block STAT is mapped. Some of the bits are freely assignable (see description function block STAT in chapter 7.6.74)

Byte 3 and 4

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

Byte 5 and 6

- C0852 = 0
  – The analog signal at AIF-OUT.W2 is output on byte 5 and 6.
- C0852 = 1
  – Bits 0 ... 15 of FDO are output.
- C0852 = 2
  – The LOW WORD from 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
  – 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 on byte 5 and 6.
  – For this, C0852 is set to 2. The phase signal at C0851 is output on byte 5 and 6.
- For the digital signals, only the bits 16 ... 31 (byte 7 and 8) are available (byte 5 and 6 are assigned):
  – For this, C0853 is set to 1. Bit 16 ... 31 (FDO) are output on byte 7 and 8.

7.6.20 Analog input via terminal 1,2/3,4 (AIN)

Purpose

This FB is the interface for analog signals as

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

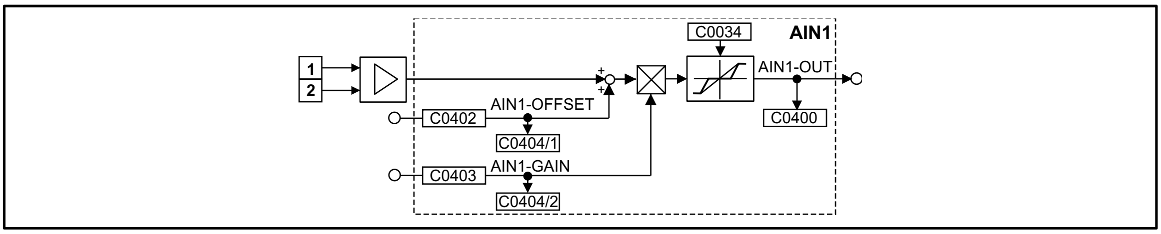


Fig. 7-53 Analog input via terminal 1,2 (AIN1)

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	-	-	-	-	-	-

Special feature of input terminals 1,2

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

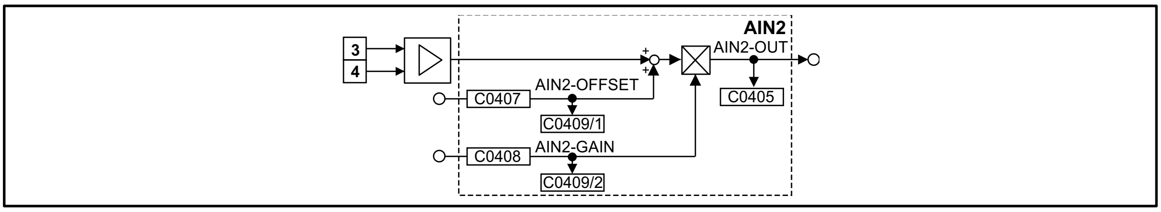


Fig. 7-54 Analog input via terminal 3, 4 (AIN2)

Special feature of AIN2

- The signal is read cyclically every 250 ms .

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	-	-	-	-	-	-

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 with the value which is applied at input AINx-GAIN.
- The signal is then limited to ±200%.
- The signal is output at AINx-OUT.

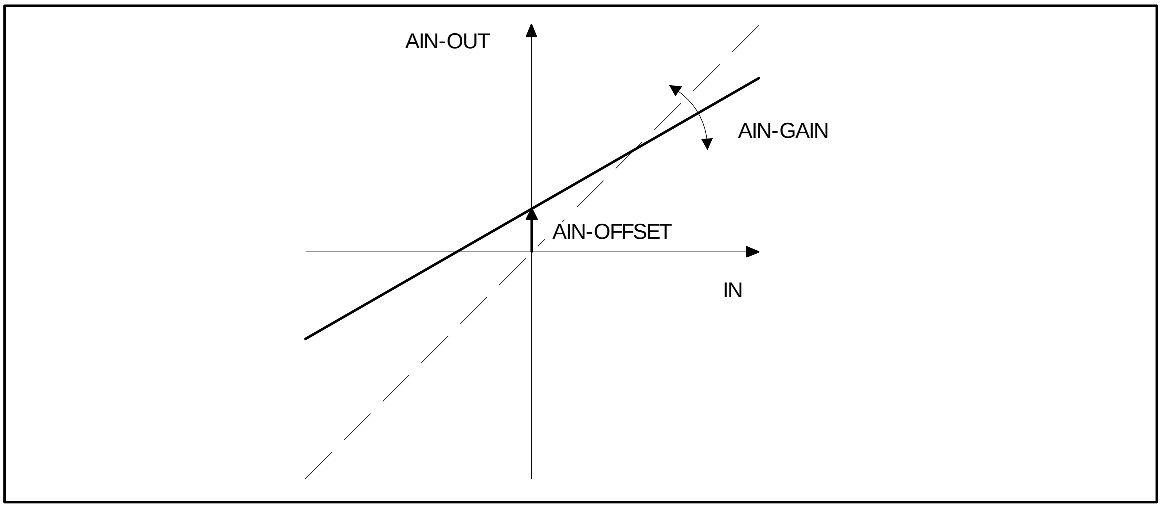


Fig. 7-55 Offset and gain of the analog input

7.6.21 AND link (AND)

Purpose

This function is used to link digital signals as an AND function. These operations can be used for the control of functions or the generation of status information.

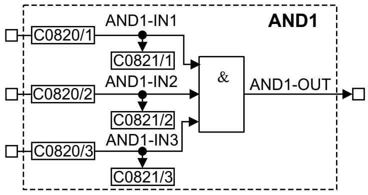


Fig. 7-56 AND function (AND1)

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	-	-	-	-	-	-

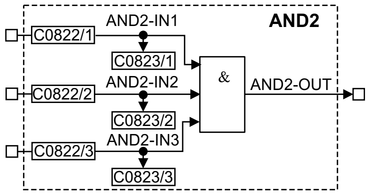


Fig. 7-57 AND function (AND2)

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	-	-	-	-	-	-

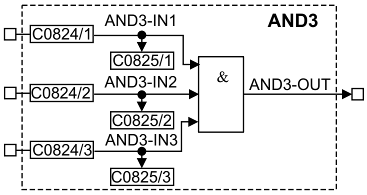


Fig. 7-58 AND function (AND3)

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	-	-	-	-	-	-

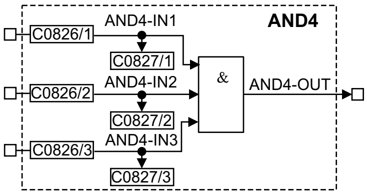


Fig. 7-59 AND function (AND4)

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	-	-	-	-	-	-

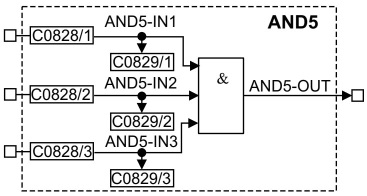


Fig. 7-60 AND function (AND5)

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.

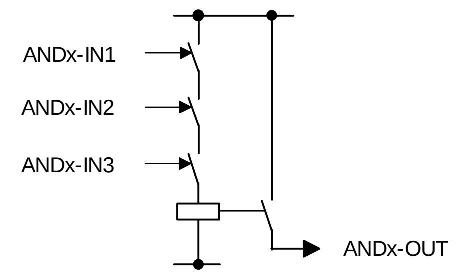


Fig. 7-61 AND function as a series connection of normally-open contacts

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.

7.6.22 Inverter (ANEG)

Purpose

This FB inverts the sign of an analog signal.

Two inverters are available:

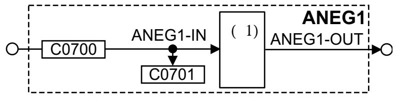


Fig. 7-62 Inverter (ANEG1)

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

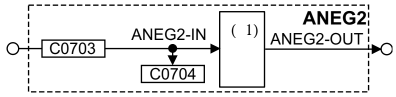


Fig. 7-63 Inverter (ANEG2)

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 with -1 and then output again.

7.6.23 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.

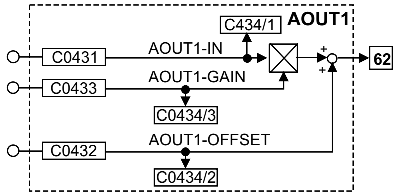


Fig. 7-64 Analog output via terminal X6/62 (AOUT1)

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	-

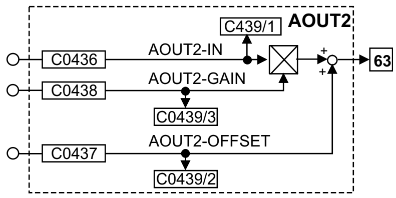


Fig. 7-65 Analog output via terminal X6/63 (AOUT2)

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 with 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 limited again 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

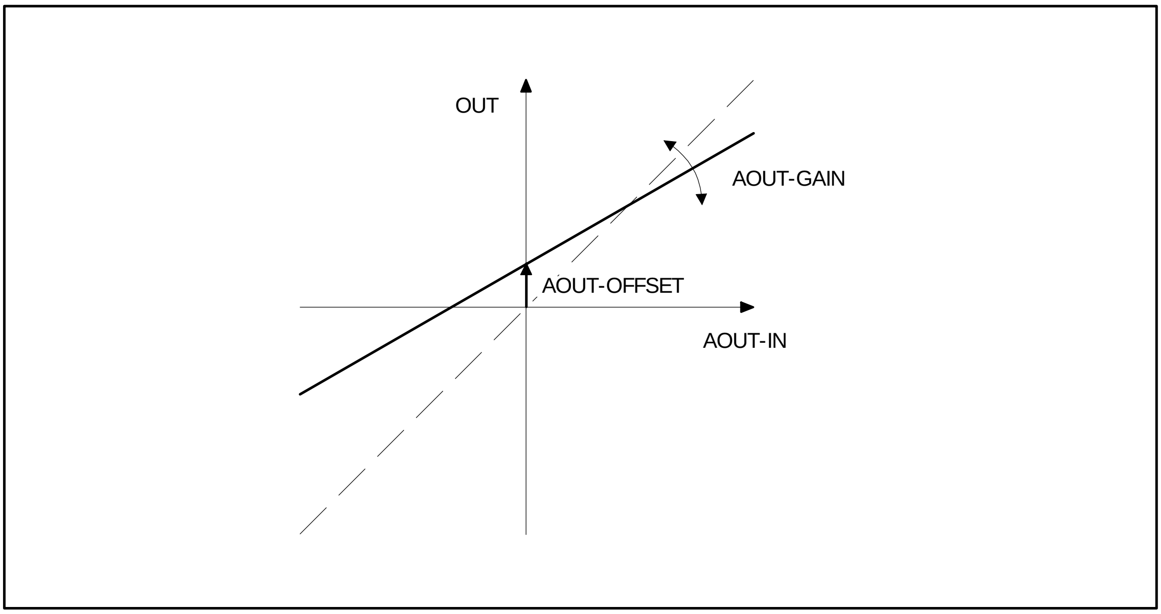


Fig. 7-66 Offset and gain of the analog output

7.6.24 Arithmetic block (ARIT)

Purpose

Logic operation of two ”analog” signals.

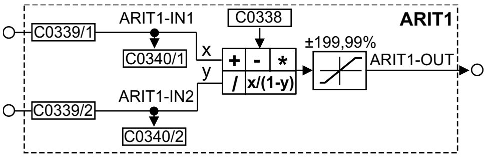


Fig. 7-67 Arithmetic block (ARIT1)

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 %

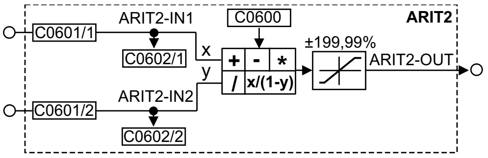


Fig. 7-68 Arithmetic block (ARIT2)

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 selected (example for ARIT1):

- C0338 = 0
  – Output = ARIT1-IN1
  – ARIT1-IN2 is not processed
- C0338 = 1
  – Output = ARIT1-IN1 + ARIT1-IN2
  – Example: 100% = 50% + 50%
- C0338 = 2
  – Output = ARIT1-IN1 - ARIT1-IN2
  – Example: 50% = 100% - 50%
- C0338 = 3
  – Output = ARIT1-IN1 * ARIT1-IN2
  – Example: 100% = 100% * 100%

- C0338 = 4
  – Output = ARIT1-IN1 / |ARIT1-IN2|
  – Example: 1% = 100% / 100%
- C0338 = 5
  – Output = ARIT1-IN1 / (100% - ARIT1-IN2)
  – Example: 200% = 100% /(100% - 50%)

7.6.25 Arithmetic block (ARITPH)

Purpose

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

ARITPH1

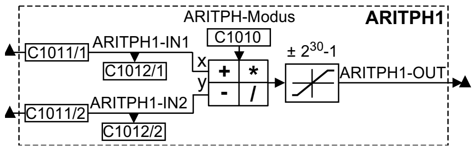


Fig. 7-69 Function block ARITPH1

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

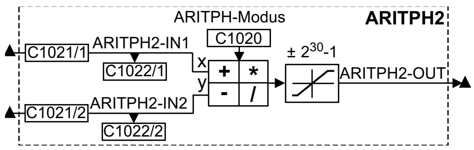


Fig. 7-70 Function block ARITPH2

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

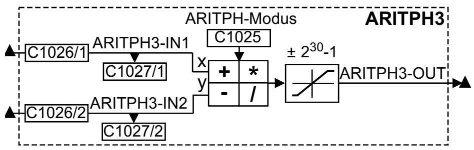


Fig. 7-71 Function block ARITPH3

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

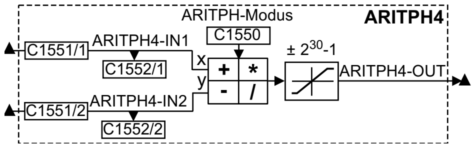


Fig. 7-72 Function block ARITPH4

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

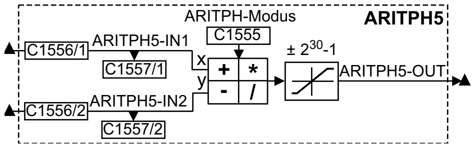


Fig. 7-73 Function block ARITPH5

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

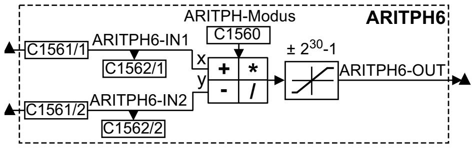


Fig. 7-74 Function block ARITPH6

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 the code ARITPH mode.
- The function block limits the result (see table)

Code	Subcode	Arithmetic function	Limitation	
ARITPH1: C1010 ARITPH2: C1020 ARITPH3: C1025 ARITPH4: C1550 ARITPH5: C1555 ARITPH6: C1560	0	OUT = IN1	2^{30} -1	
	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)
	11	OUT = IN1 + IN2	without	with overflow
	12	OUT = IN1 - IN2	without	with overflow
	13	OUT = IN1 * IN2	2^{31}	
	14	OUT = IN1 / IN2	2^{30} -1	(remainder not considered)
	21	OUT = IN1 + IN2	no limit	no limit
	22	OUT = IN1 - IN2	no limit	no limit

- The calculation is performed cyclically in the control program.

7.6.26 Changeover switch for analog signals (ASW)

Purpose

This FB changes between two analog signals.

Therefore, it is possible to change e.g. during winding between an initial diameter and a calculated diameter.

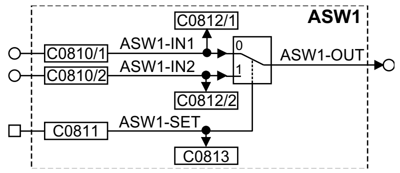


Fig. 7-75 Changeover switch for analog signals (ASW1)

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	-	-	-	-	-	-

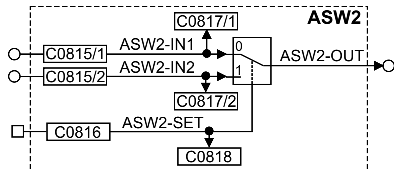


Fig. 7-76 Changeover switch for analog signals (ASW2)

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	-	-	-	-	-	-

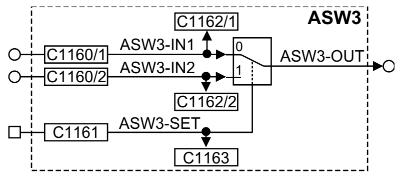


Fig. 7-77 Changeover switch for analog signals (ASW3)

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

Function block library

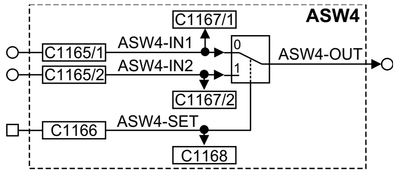


Fig. 7-78 Changeover switch for analog signals (ASW4)

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 a 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.

7.6.27 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

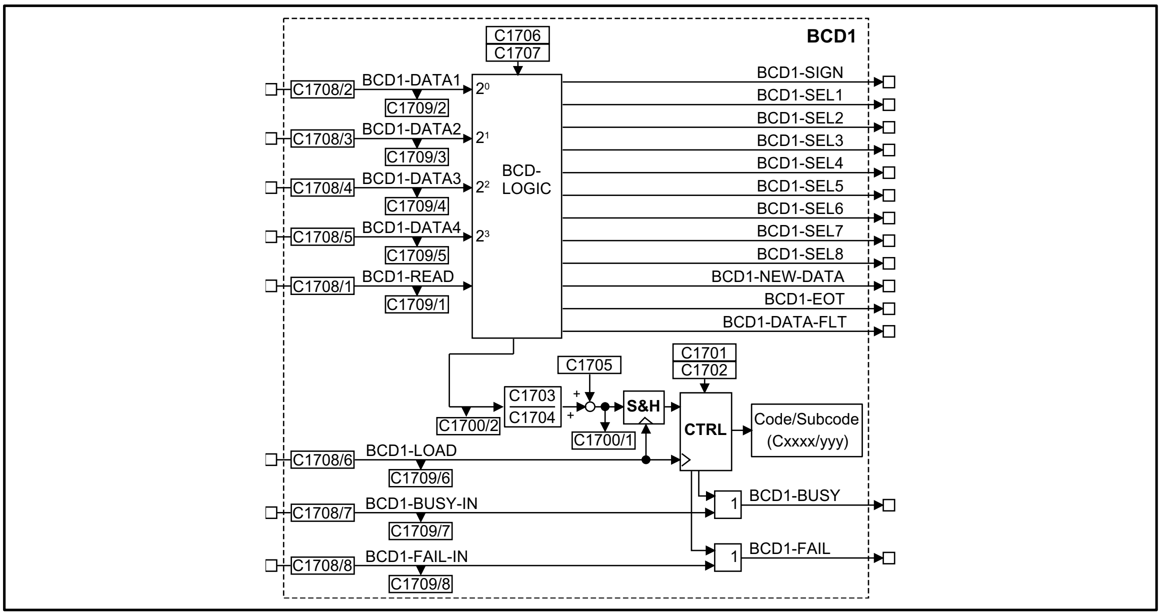


Fig. 7-79 Function block BCD1

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	Generate a collective busy signal
BCD1-FAIL-IN	d	C1709/8	bin	C1708/8	2	Generate 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" recognized.

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
BCD1-DATA-FLT	d	-	-	-	-	HIGH = BCD error (see chapter 7.6.27.1).
BCD1-BUSY	d	-	-	-	-	HIGH = Data are being transmitted to code.
BCD1-FAIL	d	-	-	-	-	HIGH = Data transmission to code is faulty.

BCD2

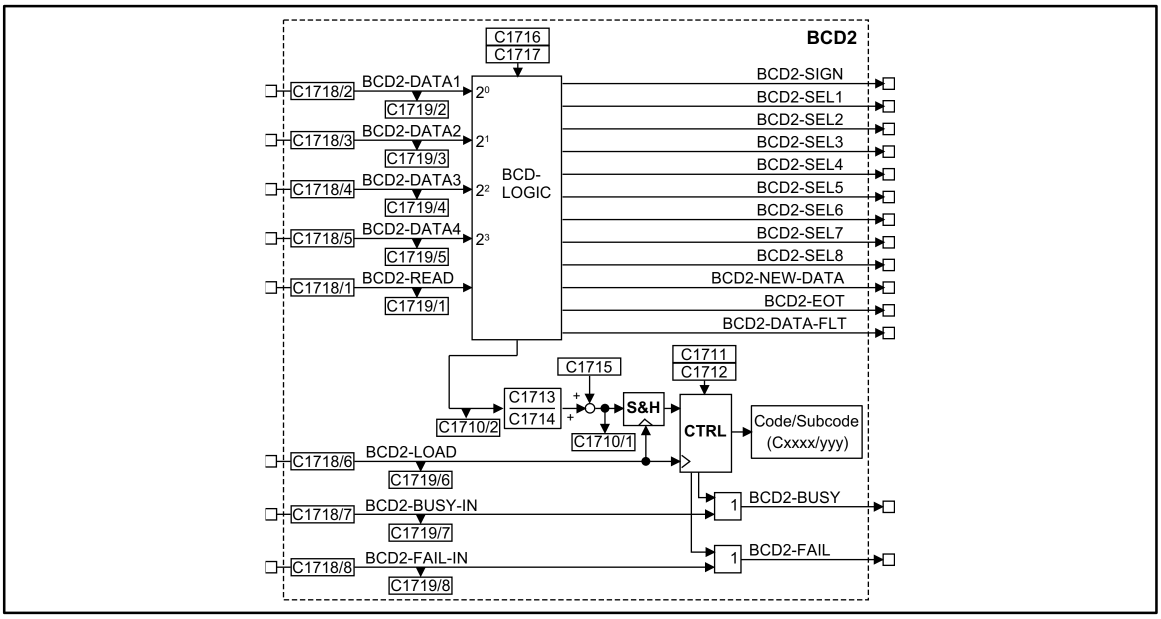


Fig. 7-80 Function block BCD2

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	Generate a collective busy signal
BCD2-FAIL-IN	d	C1719/8	bin	C1718/8	2	Generate 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.

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
BCD2-EOT	d	-	-	-	-	HIGH = all BCDs read or "CANCEL" recognized.
BCD2-DATA-FLT	d	-	-	-	-	HIGH = BCD error (see chapter 7.6.27.1).
BCD2-BUSY	d	-	-	-	-	HIGH = Data are being transmitted to code.
BCD2-FAIL	d	-	-	-	-	HIGH = Data transmission to code is faulty.

BCD3

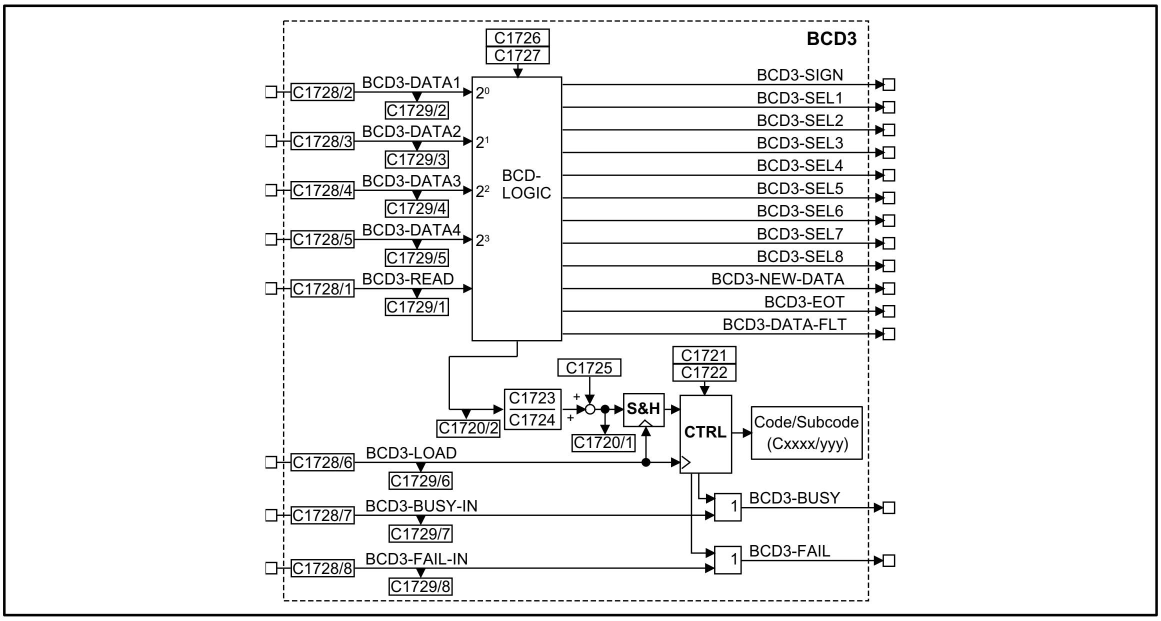


Fig. 7-81 Function block BCD3

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	Generate a collective busy signal
BCD3-FAIL-IN	d	C1729/8	bin	C1728/8	2	Generate 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.

Function block library

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
BCD3-NEW-DATA	d	-	-	-	-	HIGH = BCD accepted, transmit next BCD.
BCD3-EOT	d	-	-	-	-	HIGH = all BCDs read or ”CANCEL” recognized.
BCD3-DATA-FLT	d	-	-	-	-	HIGH = BCD error (see chapter 7.6.27.1).
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

7.6.27.1 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		

7.6.27.2 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 7.6.27.1).
BCDx-FAIL	HIGH	If • the permissible value range for the target code is exceeded or • BCDx-DATA-FLT = HIGH has occurred before.

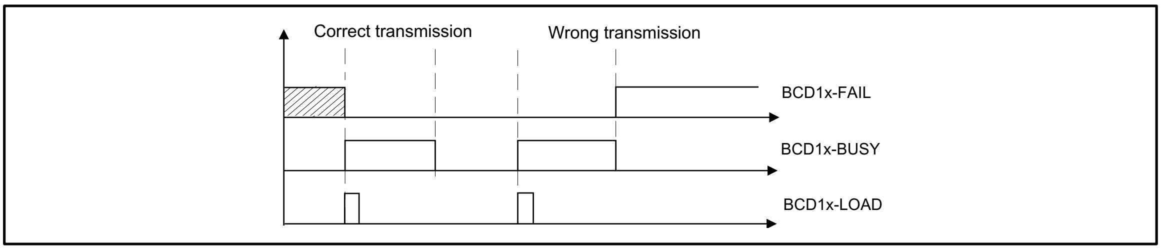


Fig. 7-82 Signal shape for FB BCD1 for the transmission to the target code

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 ofthe target code see FB FEVAN. (📖 7-191)

7.6.27.3 "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.

7.6.27.4 "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.	-	-

7.6.27.5 BCD decade switch

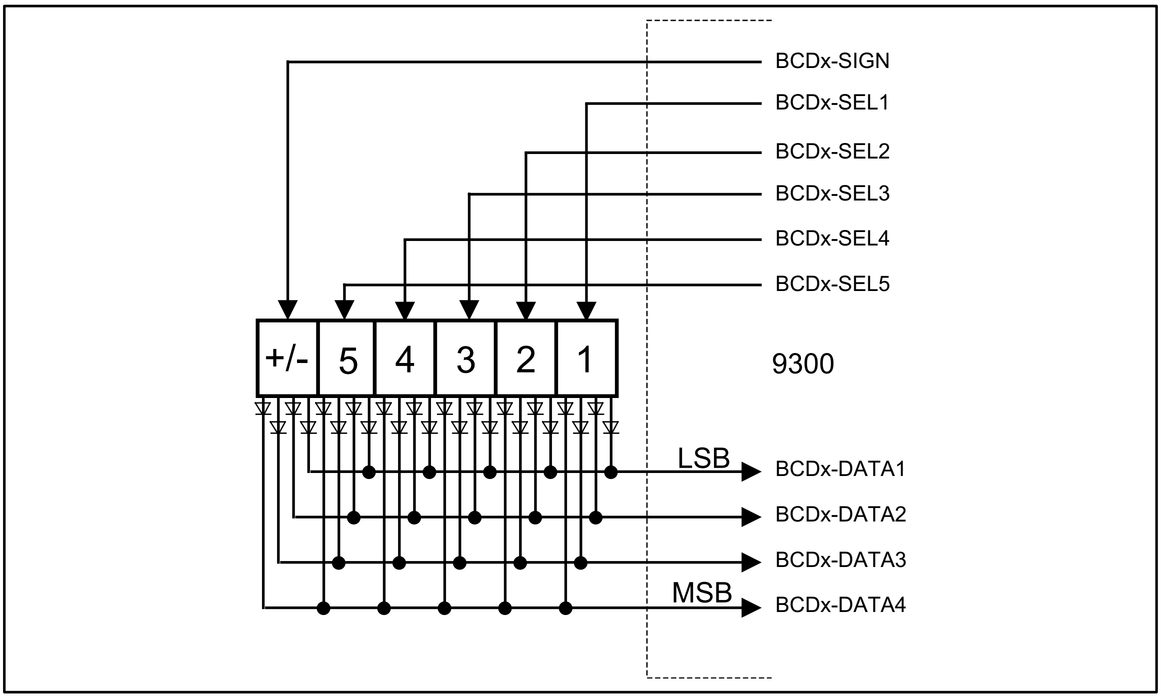


Fig. 7-83 Connection of a BCD decade switch

- 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 the BCD data to BCDx-DATA1 ... BCDx-DATA4.
BCDx-LOAD	LOW-HIGH edge	Writes BCD data to the target code.

7.6.27.6 Complete BCD reading

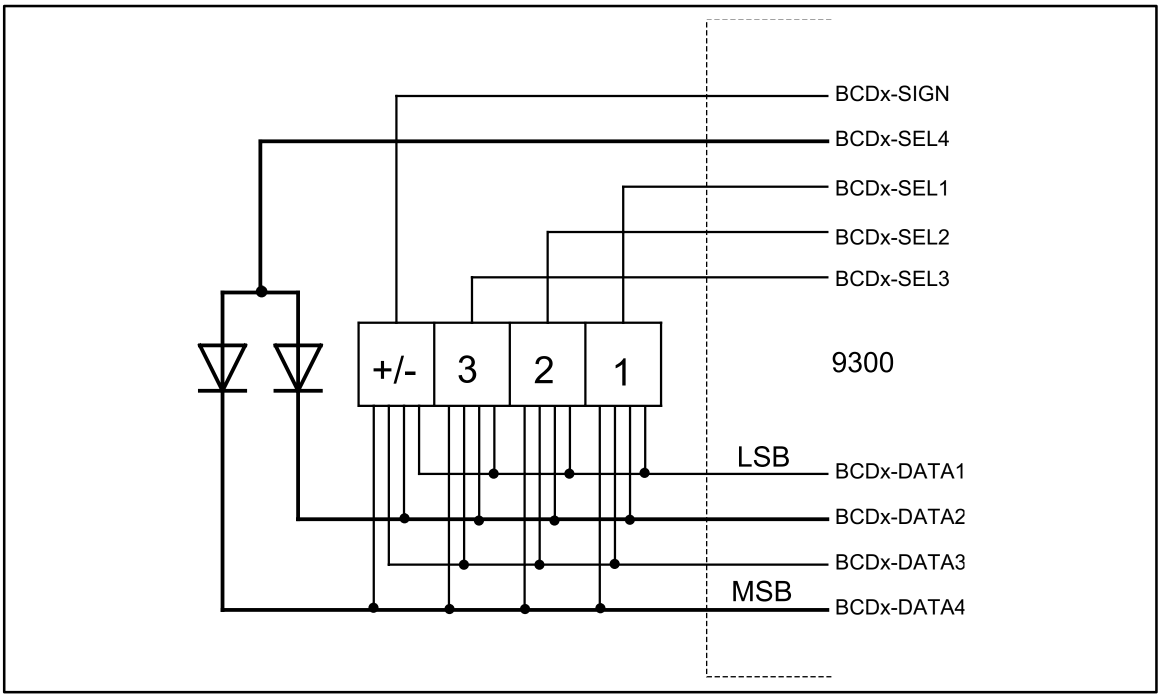


Fig. 7-84 Cancel after the 3rd absolute value digit (diode circuit)

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 "CANCEL" is transmitted after a read BCD. Reading is stopped with the identification of "CANCEL".
- The least significant bit (LSB) is to be assigned with "CANCEL", 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).

7.6.27.7 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 of the individual BCDs.This setting may be necessary if a bus system is used for the transmission 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.

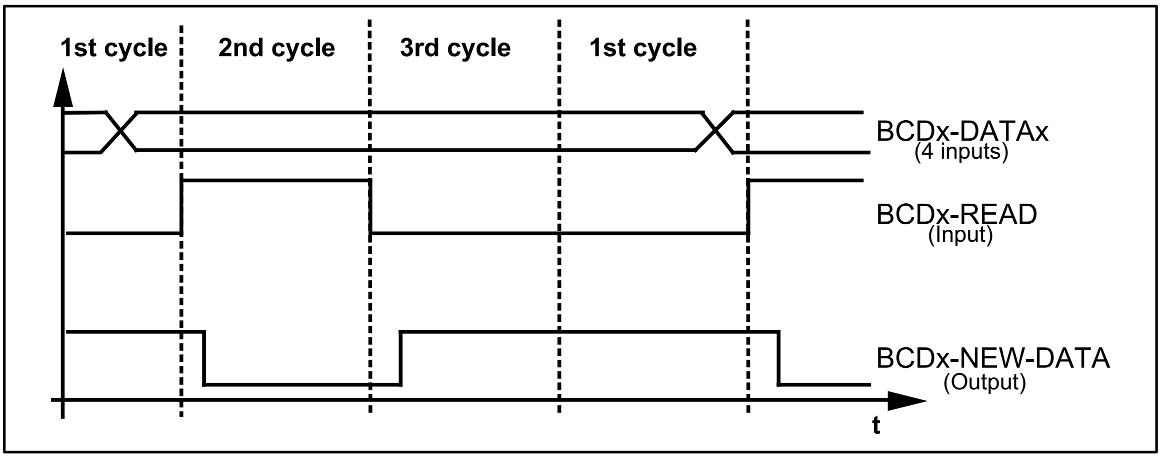


Fig. 7-85 Sequence of handshaking

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		Generate 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.

7.6.28 Holding brake (BRK)

Danger!

The exclusive triggering of the holding brake via the function block BRK is not permissible!

The conversion is done according to the formula: **safe** triggering of the holding brake requires a second mode of switch-off in addition. There is the risk of severe personal injury and danger to material assets without a second mode of switch-off!

Purpose

The FB is used to trigger a holding brake.

Possible applications:

- Hoists
- Traversing drives
- Active loads

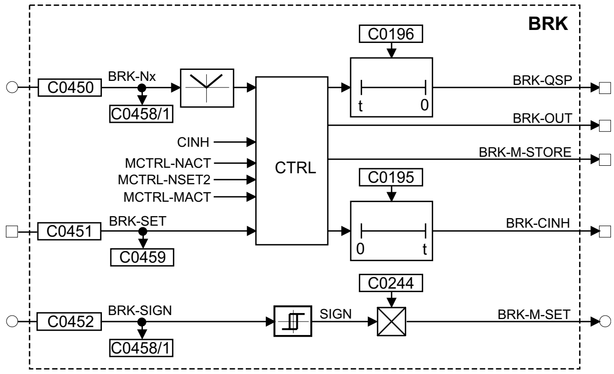


Fig. 7-86 Holding brake (BRK)

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 can output the signal "close brake". The signal source for this input can be a control code, a fixed value or any other analog output of a FB.
BRK-SIGN	a	C0458/2	dec [%]	C0452	1	1000	Direction of the torque with which the drive has to build a torque against the brake. The signal source for this input can be a control code, a fixed value or any other analog output of a FB.
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 engaging time
BRK-T-RELEASE	a	-	dec	C0196	-	0.0	Brake opening time

Function

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

7.6.28.1 Close brake

Purpose

A HIGH signal at the BRK-SET input activates the function. The BRK-QSP output changes to HIGH at the same time. This signal can be used to decelerate the drive to zero speed via a deceleration ramp.

Function

If the setpoint speed falls below the speed set at the BRK-Nx input, the BRK-OUT output is set to HIGH. To obtain protection against open circuit, this signal must be inverted at the output (e.g. under C0118).

When the BRK-OUT is set, a time element is triggered. After the time set under C0195 has elapsed, the BRK-RSP output is set. Using this output, for instance, the controller inhibit (inside the controller) can be set. In general, the brake -close time is set here. This is necessary because the brake does not engage immediately after the activation of the BRK-OUT signal and thus the drive does not provide a holding torque for the time set.

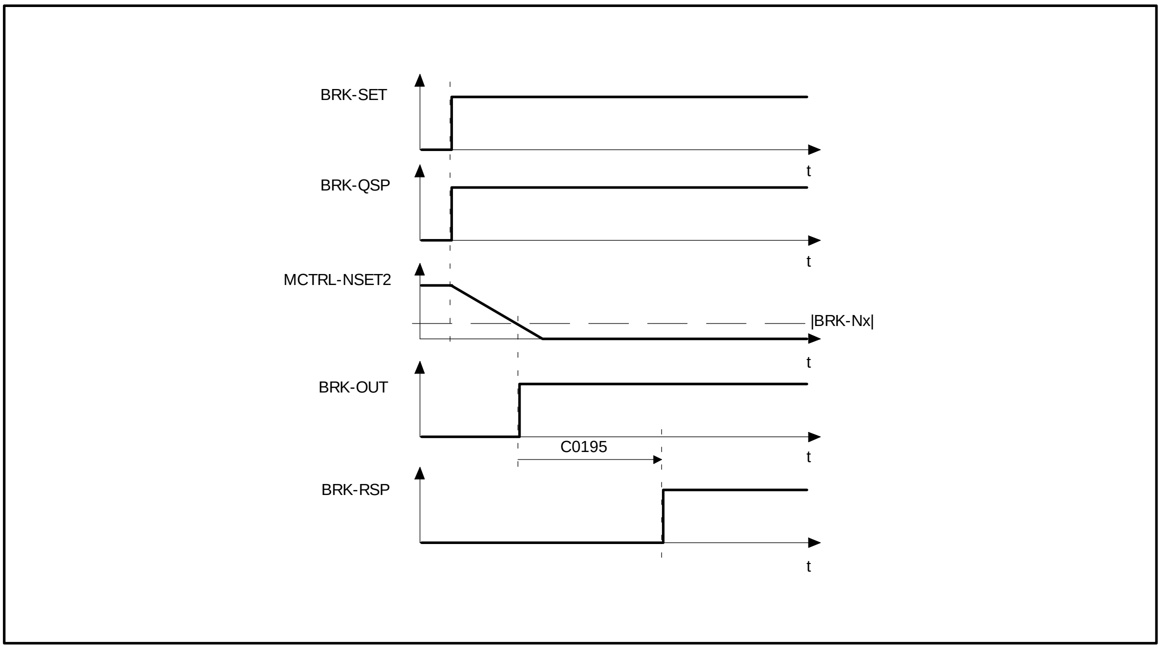


Fig. 7-87 Signal sequence when the brake is closed

7.6.28.2 Open the brake

Purpose

The LOW signal at the BRK-SET input sets the BRK-CINH immediately to LOW. The BRK-M-STORE output is set to HIGH at the same time. This signal initiates the generation of a defined brake torque against the brake. The drive thus takes up the torque while the brake opens. The signal is reset only after the time set under C0196 has 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. With this signal, the setpoint integrator can be enabled after the brake-open time has elapsed, for instance.

Note

If an actual speed larger than the value at BRK-Nx is detected before the brake-open time (C0196) has elapsed, the BRK-QSP and BRK-M-STORE signals are immediately reset. The drive can immediately operate speed- or phase controlled. If the BRK-QSP output acts on the QSP control word, the drive synchronizes to the actual speed and follows its setpoint.

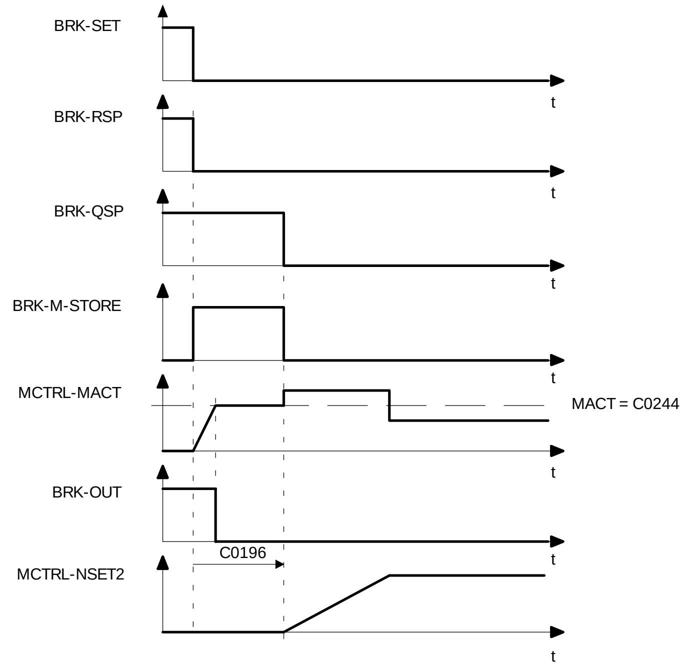


Fig. 7-88 Signal sequence when the brake is opened (released)

7.6.28.3 Setting controller inhibit

Purpose

Controller inhibit can be set e.g. in case of an interference (LU, OU, 0).

Function

When controller inhibit (CINH) is set, the BRK-OUT signal is immediately set to HIGH. The drive is then braked by its mechanical brake.

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

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

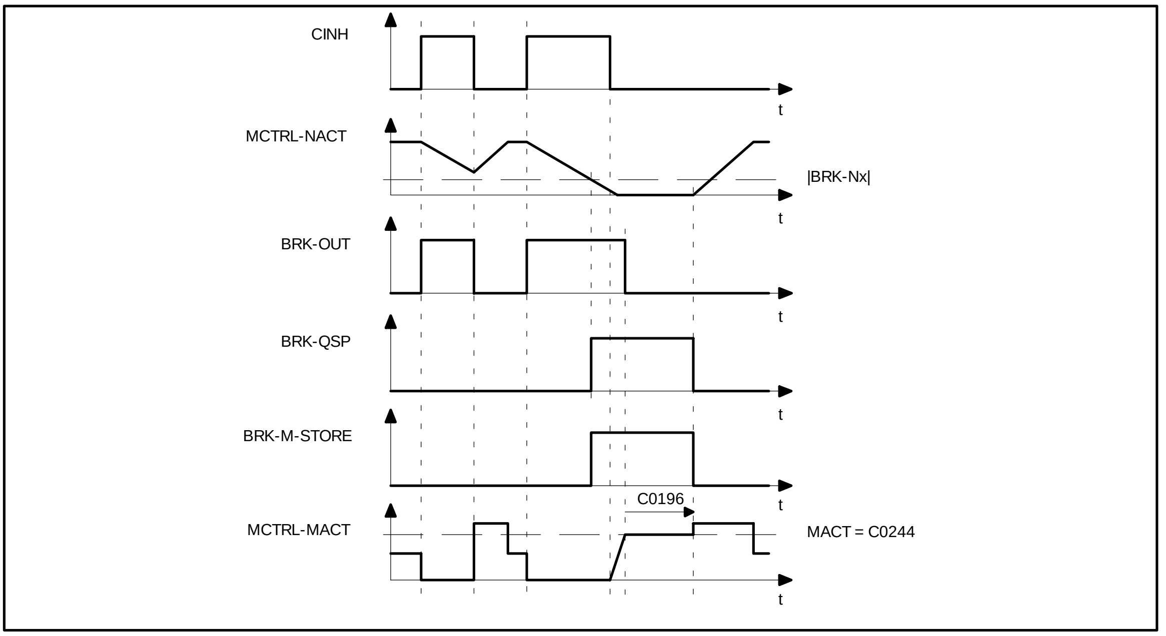


Fig. 7-89 Control brake by CINH

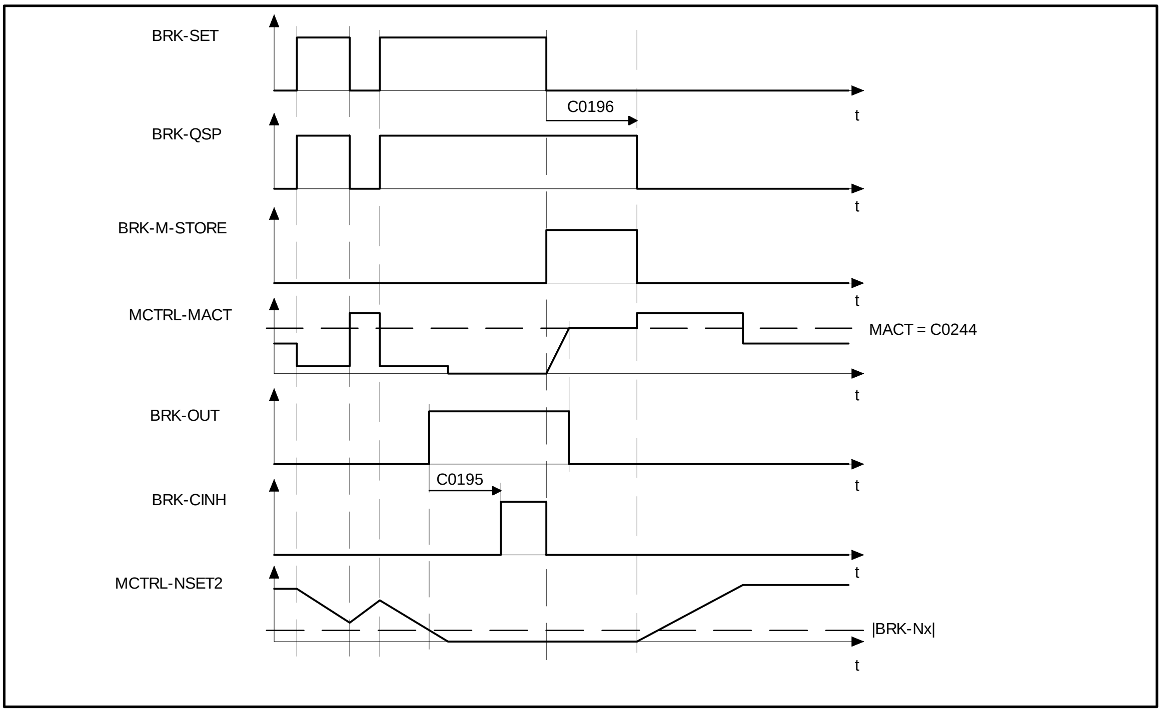


Fig. 7-90 Switching cycle when braking

7.6.29 System bus (CAN-IN)

Purpose

Interface for input signals from the system bus for setpoints and actual values as binary, analog, or phase information.

CAN-IN1

The process data object CAN-IN1 is provided for the cyclic transmission of process data and the communication with higher-level master.

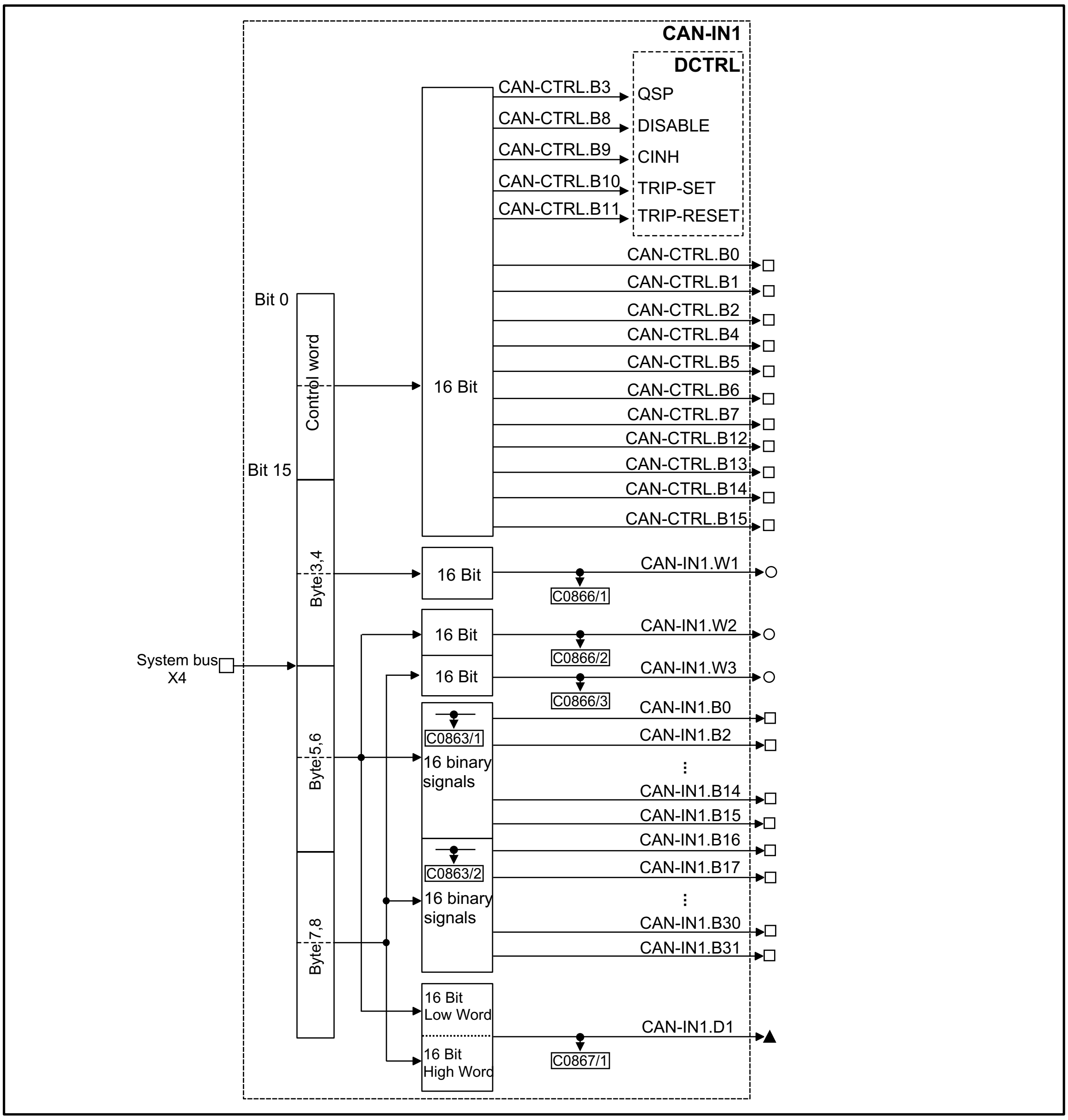


Fig. 7-91 System bus (CAN-IN1)

Function block library

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CAN-CTRL.B0	d	C0136/2	bin	-	-	-	
CAN-CTRL.B1	d	C0136/2	bin	-	-	-	
CAN-CTRL.B2	d	C0136/2	bin	-	-	-	
CAN-CTRL.B4	d	C0136/2	bin	-	-	-	
CAN-CTRL.B5	d	C0136/2	bin	-	-	-	
CAN-CTRL.B6	d	C0136/2	bin	-	-	-	
CAN-CTRL.B7	d	C0136/2	bin	-	-	-	
CAN-CTRL.B12	d	C0136/2	bin	-	-	-	
CAN-CTRL.B13	d	C0136/2	bin	-	-	-	
CAN-CTRL.B14	d	C0136/2	bin	-	-	-	
CAN-CTRL.B15	d	C0136/2	bin	-	-	-	
CAN-IN1.W1	a	C0866/1	dec [%]	-	-	-	+16384 = +100 %
CAN-IN1.W2	a	C0866/2	dec [%]	-	-	-	+16384 = +100 %
CAN-IN1.W3	a	C0866/3	dec [%]	-	-	-	+16384 = +100 %
CAN-IN1.D1	ph	C0867/1	dec [inc]	-	-	-	65536 = 1 revolution
CAN-IN1.B0	d	C0863/1	hex	-	-	-	
CAN-IN1.B1	d	C0863/1	hex	-	-	-	
CAN-IN1.B2	d	C0863/1	hex	-	-	-	
CAN-IN1.B3	d	C0863/1	hex	-	-	-	
CAN-IN1.B4	d	C0863/1	hex	-	-	-	
CAN-IN1.B5	d	C0863/1	hex	-	-	-	
CAN-IN1.B6	d	C0863/1	hex	-	-	-	
CAN-IN1.B7	d	C0863/1	hex	-	-	-	
CAN-IN1.B8	d	C0863/1	hex	-	-	-	
CAN-IN1.B9	d	C0863/1	hex	-	-	-	
CAN-IN1.B10	d	C0863/1	hex	-	-	-	
CAN-IN1.B11	d	C0863/1	hex	-	-	-	
CAN-IN1.B12	d	C0863/1	hex	-	-	-	
CAN-IN1.B13	d	C0863/1	hex	-	-	-	
CAN-IN1.B14	d	C0863/1	hex	-	-	-	
CAN-IN1.B15	d	C0863/1	hex	-	-	-	
CAN-IN1.B16	d	C0863/2	hex	-	-	-	
CAN-IN1.B17	d	C0863/2	hex	-	-	-	
CAN-IN1.B18	d	C0863/2	hex	-	-	-	
CAN-IN1.B19	d	C0863/2	hex	-	-	-	
CAN-IN1.B20	d	C0863/2	hex	-	-	-	
CAN-IN1.B21	d	C0863/2	hex	-	-	-	
CAN-IN1.B22	d	C0863/2	hex	-	-	-	
CAN-IN1.B23	d	C0863/2	hex	-	-	-	
CAN-IN1.B24	d	C0863/2	hex	-	-	-	
CAN-IN1.B25	d	C0863/2	hex	-	-	-	
CAN-IN1.B26	d	C0863/2	hex	-	-	-	
CAN-IN1.B27	d	C0863/2	hex	-	-	-	
CAN-IN1.B28	d	C0863/2	hex	-	-	-	
CAN-IN1.B29	d	C0863/2	hex	-	-	-	
CAN-IN1.B30	d	C0863/2	hex	-	-	-	
CAN-IN1.B31	d	C0863/2	hex	-	-	-	

Function

The input signals of the 8 byte user data of this CAN 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 to the function block DCTRL, where they are linked to other signals. The other 11 bits can be used to control further function blocks.

Byte 3 and 4

form the signal to CAN-IN1.W1.

Byte 5, 6, 7 and 8

The meaning of these user data can be selected among different signal types. Depending on the requirement, these data can be evaluated as up to 2 analog signals, 32 digital signals or one phase signal.Mixed forms are also possible.

CAN-IN2

The process data object CAN-IN2 is provided for the event-driven transmission of process data and for communication among the controllers. However, decentralized inputs can also be evaluated.

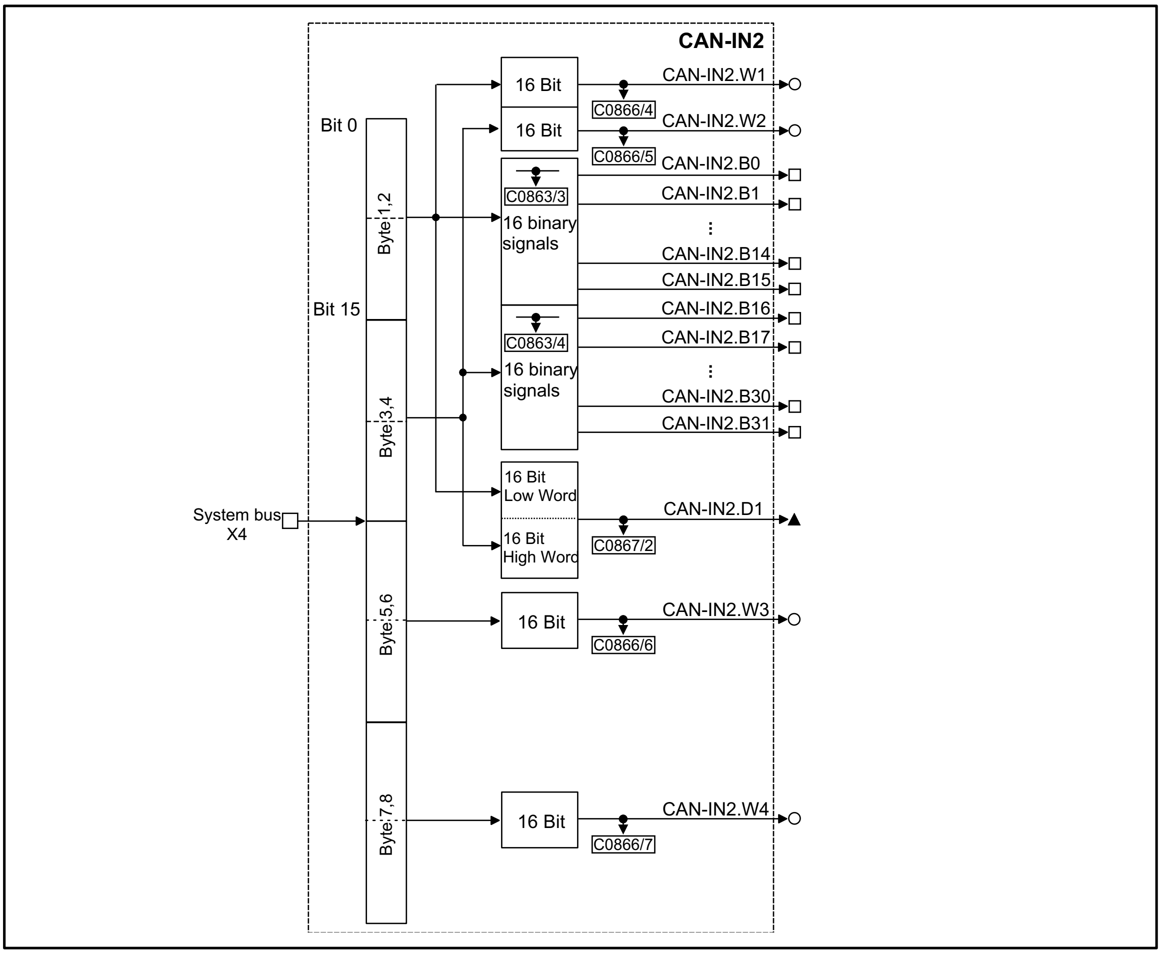


Fig. 7-92 System bus (CAN-IN2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CAN-IN2.W1	a	C0866/4	dec [%]	-	-	-	+16384 = +100 %
CAN-IN2.W2	a	C0866/5	dec [%]	-	-	-	+16384 = +100 %

Function block library

Name	Type	DIS	DIS format	CFG	List	Lenze	
CAN-IN2.W3	a	C0866/6	dec [%]	-	-	-	+16384 = +100 %
CAN-IN2.W4	a	C0866/7	dec [%]	-	-	-	+16384 = +100 %
CAN-IN2.D1	ph	C0867/2	dec [inc]	-	-	-	65536 = 1 revolution
CAN-IN2.B0	d	C0863/3	hex	-	-	-	
CAN-IN2.B1	d	C0863/3	hex	-	-	-	
CAN-IN2.B2	d	C0863/3	hex	-	-	-	
CAN-IN2.B3	d	C0863/3	hex	-	-	-	
CAN-IN2.B4	d	C0863/3	hex	-	-	-	
CAN-IN2.B5	d	C0863/3	hex	-	-	-	
CAN-IN2.B6	d	C0863/3	hex	-	-	-	
CAN-IN2.B7	d	C0863/3	hex	-	-	-	
CAN-IN2.B8	d	C0863/3	hex	-	-	-	
CAN-IN2.B9	d	C0863/3	hex	-	-	-	
CAN-IN2.B10	d	C0863/3	hex	-	-	-	
CAN-IN2.B11	d	C0863/3	hex	-	-	-	
CAN-IN2.B12	d	C0863/3	hex	-	-	-	
CAN-IN2.B13	d	C0863/3	hex	-	-	-	
CAN-IN2.B14	d	C0863/3	hex	-	-	-	
CAN-IN2.B15	d	C0863/3	hex	-	-	-	
CAN-IN2.B16	d	C0863/4	hex	-	-	-	
CAN-IN2.B17	d	C0863/4	hex	-	-	-	
CAN-IN2.B18	d	C0863/4	hex	-	-	-	
CAN-IN2.B19	d	C0863/4	hex	-	-	-	
CAN-IN2.B20	d	C0863/4	hex	-	-	-	
CAN-IN2.B21	d	C0863/4	hex	-	-	-	
CAN-IN2.B22	d	C0863/4	hex	-	-	-	
CAN-IN2.B23	d	C0863/4	hex	-	-	-	
CAN-IN2.B24	d	C0863/4	hex	-	-	-	
CAN-IN2.B25	d	C0863/4	hex	-	-	-	
CAN-IN2.B26	d	C0863/4	hex	-	-	-	
CAN-IN2.B27	d	C0863/4	hex	-	-	-	
CAN-IN2.B28	d	C0863/4	hex	-	-	-	
CAN-IN2.B29	d	C0863/4	hex	-	-	-	
CAN-IN2.B30	d	C0863/4	hex	-	-	-	
CAN-IN2.B31	d	C0863/4	hex	-	-	-	

Function

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

Byte 1, 2, 3 and 4

The meaning of these user data can be selected among different signal types. Depending on the requirement, these data can be evaluated as up to 2 analog signals, 32 digital signals or one phase signal.Mixed forms are also possible.

Byte 5 and 6

form the signal to CAN-IN2.W3.

Byte 7 and 8

form the signal to CAN-IN2.W4.

CAN-IN3

The process data object CAN-IN3 is provided for the event-driven transmission of process data and for communication among the controllers. However, decentralized inputs can also be evaluated.

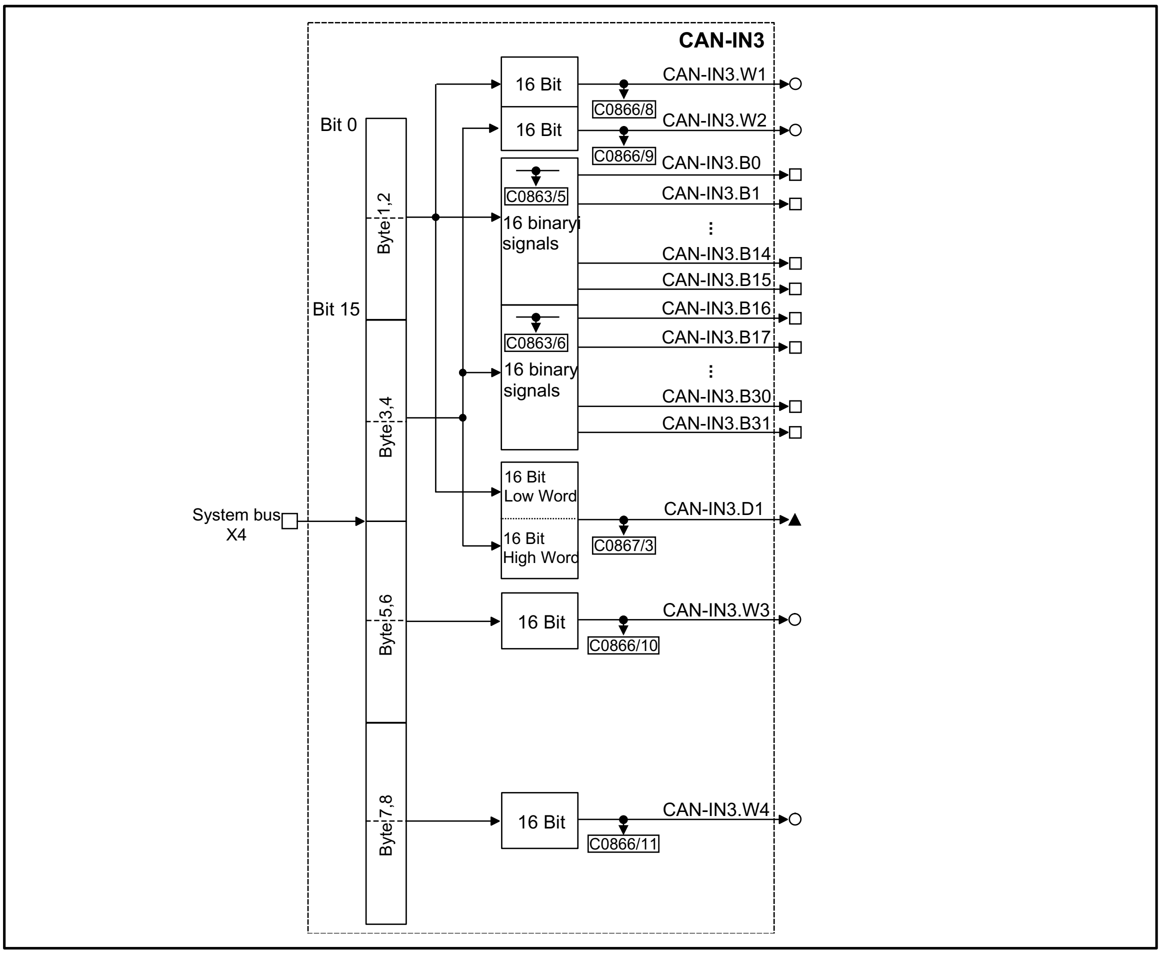


Fig. 7-93 System bus (CAN-IN3)

Function block library

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CAN-IN3.W1	a	C0866/8	dec [%]	-	-	-	+16384 = +100 %
CAN-IN3.W2	a	C0866/9	dec [%]	-	-	-	+16384 = +100 %
CAN-IN3.W3	a	C0866/10	dec [%]	-	-	-	+16384 = +100 %
CAN-IN3.W4	a	C0866/11	dec [%]	-	-	-	+16384 = +100 %
CAN-IN3.D1	ph	C0867/3	dec [inc]	-	-	-	65536 = 1 revolution
CAN-IN3.B0	d	C0863/5	hex	-	-	-	
CAN-IN3.B1	d	C0863/5	hex	-	-	-	
CAN-IN3.B2	d	C0863/5	hex	-	-	-	
CAN-IN3.B3	d	C0863/5	hex	-	-	-	
CAN-IN3.B4	d	C0863/5	hex	-	-	-	
CAN-IN3.B5	d	C0863/5	hex	-	-	-	
CAN-IN3.B6	d	C0863/5	hex	-	-	-	
CAN-IN3.B7	d	C0863/5	hex	-	-	-	
CAN-IN3.B8	d	C0863/5	hex	-	-	-	
CAN-IN3.B9	d	C0863/5	hex	-	-	-	
CAN-IN3.B10	d	C0863/5	hex	-	-	-	
CAN-IN3.B11	d	C0863/5	hex	-	-	-	
CAN-IN3.B12	d	C0863/5	hex	-	-	-	
CAN-IN3.B13	d	C0863/5	hex	-	-	-	
CAN-IN3.B14	d	C0863/5	hex	-	-	-	
CAN-IN3.B15	d	C0863/5	hex	-	-	-	
CAN-IN3.B16	d	C0863/6	hex	-	-	-	
CAN-IN3.B17	d	C0863/6	hex	-	-	-	
CAN-IN3.B18	d	C0863/6	hex	-	-	-	
CAN-IN3.B19	d	C0863/6	hex	-	-	-	
CAN-IN3.B20	d	C0863/6	hex	-	-	-	
CAN-IN3.B21	d	C0863/6	hex	-	-	-	
CAN-IN3.B22	d	C0863/6	hex	-	-	-	
CAN-IN3.B23	d	C0863/6	hex	-	-	-	
CAN-IN3.B24	d	C0863/6	hex	-	-	-	
CAN-IN3.B25	d	C0863/6	hex	-	-	-	
CAN-IN3.B26	d	C0863/6	hex	-	-	-	
CAN-IN3.B27	d	C0863/6	hex	-	-	-	
CAN-IN3.B28	d	C0863/6	hex	-	-	-	
CAN-IN3.B29	d	C0863/6	hex	-	-	-	
CAN-IN3.B30	d	C0863/6	hex	-	-	-	
CAN-IN3.B31	d	C0863/6	hex	-	-	-	

Function

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

Byte 1, 2, 3 and 4

The meaning of these user data can be selected among different signal types. Depending on the requirement, these data can be evaluated as up to 2 analog signals, 32 digital signals or one phase signal.Mixed forms are also possible.

Byte 5 and 6

form the signal to CAN-IN3.W3.

Byte 7 and 8

form the signal to CAN-IN3.W4.

7.6.30 System bus (CAN-OUT)

Purpose

Interface for output signals from the system bus for setpoints and actual values as binary, analog, or phase information. (📖 7-123)

CAN-OUT1

The process data object CAN-OUT1 is provided for the cyclic transmission of process data and the communication with a superimposed master.

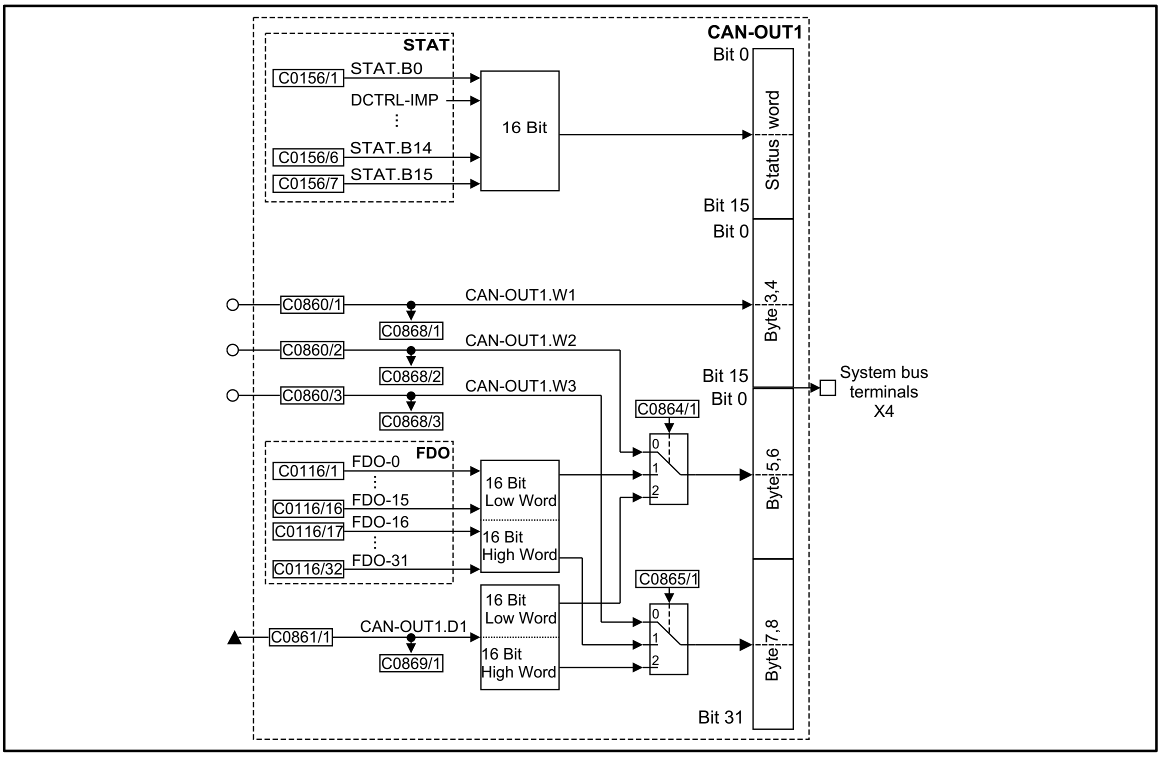


Fig. 7-94 System bus (CAN-OUT1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CAN-OUT1.W1	a	C0868/1	dec [%]	C0860/1	1	1000	+100 % = +16384
CAN-OUT1.W2	a	C0868/2	dec [%]	C0860/2	1	1000	+100 % = +16384
CAN-OUT1.W3	a	C0868/3	dec [%]	C0860/3	1	1000	+100 % = +16384
CAN-OUT1.D1	ph	C0869/1	dec [inc]	C0861/1	4	1000	1 revolution = 65536

Function

The input signals of this function block are copied to the 8 byte user data of CAN object 1 and laid on the system bus. The meaning of the user data can be determined very easily with C0864/1 and C0865/1 and the corresponding configuration code (CFG).

Byte 1 and 2

Here, the status word of the function block STAT is mapped. (📖 7-244)
Some of the bits are freely assignable.

Byte 3 and 4

Here, the analog signal configured at the input CAN-OUT1.W1 is mapped.

Byte 5, 6, 7 and 8

The meaning of these user data can be selected among different signal types. Depending on the requirement, up to two analog signals, 32 digital signals of the function block FDO or a phase signal can be selected.Mixed forms are also possible.

Example:

16 digital signals and one analog signal are to be output.

The digital signals are output by the function block FDO. The bits 16 to 31 are to be output. For this, set C0865/1 = 1. These bits are output on byte 7 and 8.

This means that the analog signal is lead via CAN-OUT1.W2. For this, set C0864/1 = 0. These bits are output on byte 5 and 6. An analog signal source is assigned to the input under configuration code C0860/2.

CAN-OUT2

The process data object CAN-OUT2 is provided for the event-driven transmission of process data and for communication among the controllers. Decentralized outputs can also be accessed.

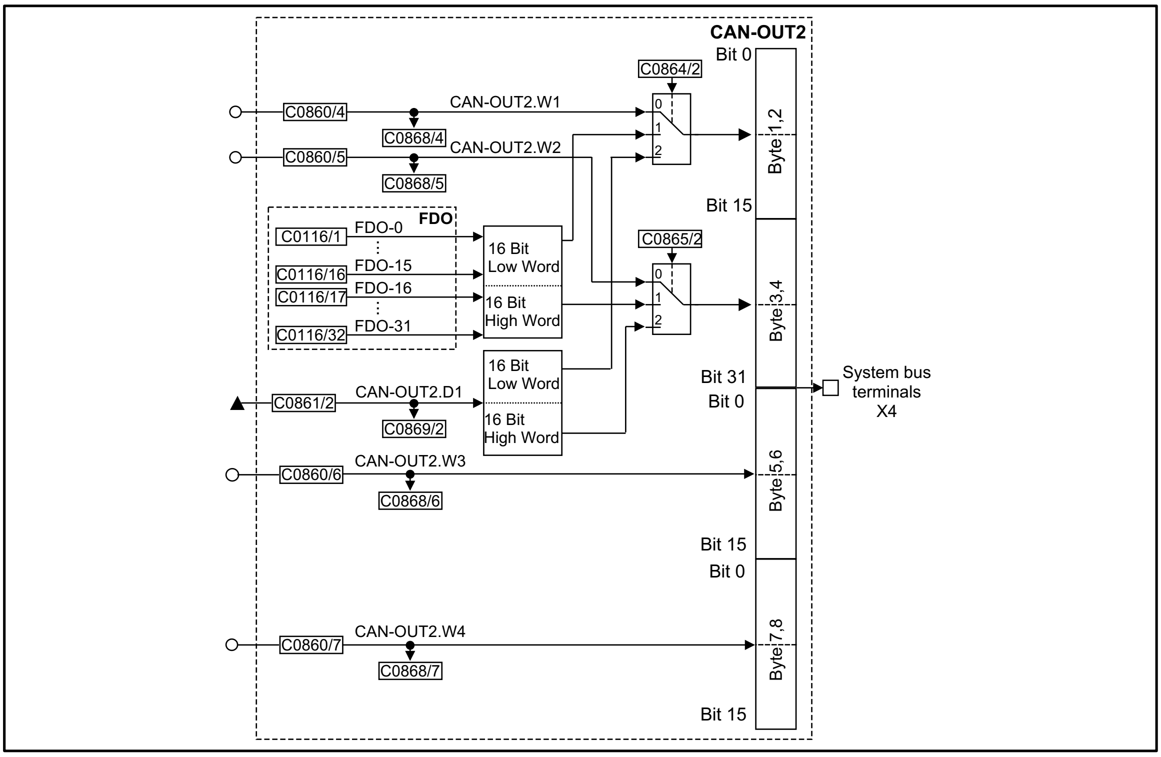


Fig. 7-95 System bus (CAN-OUT2)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CAN-OUT2.W1	a	C0868/4	dec [%]	C0860/4	1	1000	+100 % = +16384
CAN-OUT2.W2	a	C0868/5	dec [%]	C0860/5	1	1000	+100 % = +16384
CAN-OUT2.W3	a	C0868/6	dec [%]	C0860/6	1	1000	+100 % = +16384
CAN-OUT2.W4	a	C0868/7	dec [%]	C0860/7	1	1000	+100 % = +16384
CAN-OUT2.D1	ph	C0869/2	dec [inc]	C0861/2	4	1000	1 revolution = 65536

Function

The input signals of this function block are copied to the 8 byte user data of CAN object 2 and laid on the system bus. The meaning of the user data can be determined very easily with C0864/2 and C0865/2 and the corresponding configuration code (CFG).

Byte 1, 2, 3 and 4

The meaning of these user data can be selected among different signal types. Depending on the requirement, up to two analog signals, 32 digital signals of the function block FDO or a phase signal can be selected.Mixed forms are also possible.

Byte 5 and 6

Here, the analog signal configured at the input CAN-OUT2.W3 is mapped.

Byte 7 and 8

Here, the analog signal configured at the input CAN-OUT2.W4 is mapped.

CAN-OUT3

The process data object CAN-OUT3 is provided for the event-driven transmission of process data and for communication among the controllers. Decentralized outputs can also be accessed.

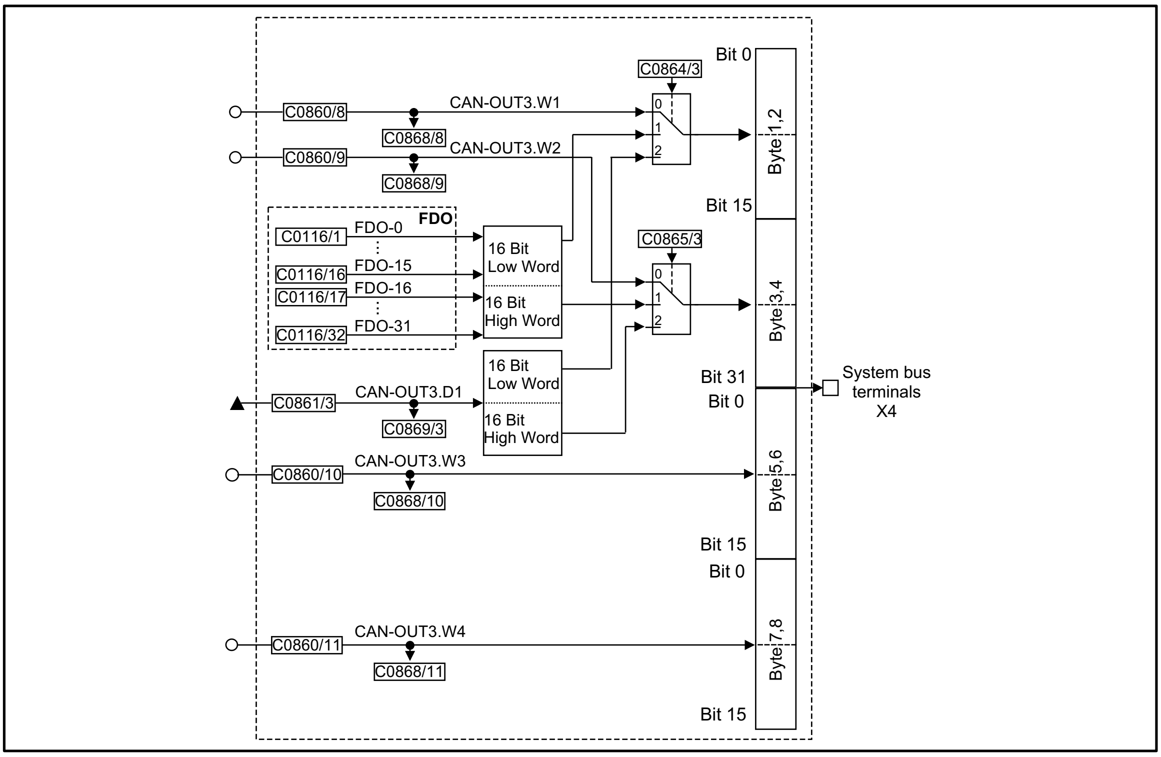


Fig. 7-96 System bus (CAN-OUT3)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
CAN-OUT3.W1	a	C0868/8	dec [%]	C0860/8	1	1000	+100 % = +16384
CAN-OUT3.W2	a	C0868/9	dec [%]	C0860/9	1	1000	+100 % = +16384
CAN-OUT3.W3	a	C0868/10	dec [%]	C0860/10	1	1000	+100 % = +16384
CAN-OUT3.W4	a	C0868/11	dec [%]	C0860/11	1	1000	+100 % = +16384
CAN-OUT3.D1	ph	C0869/3	dec [inc]	C0861/3	4	1000	1 revolution = 65536

Function

The input signals of this function block are copied to the 8 byte user data of CAN object 3 and laid on the system bus. The meaning of the user data can be determined very easily with C0864/3 and C0865/3 and the corresponding configuration code (CFG).

Byte 1, 2, 3 and 4

The meaning of these user data can be selected among different signal types. Depending on the requirement, up to two analog signals, 32 digital signals of the function block FDO or a phase signal can be selected.Mixed forms are also possible.

Byte 5 and 6

Here, the analog signal configured at the input CAN-OUT3.W3 is mapped.

Byte 7 and 8

Here, the analog signal configured at the input CAN-OUT3.W4 is mapped.

7.6.31 Comparator (CMP)

Purpose

These function blocks are used to compare two analog signals with each other.

Two comparators are available. They can be used to implement threshold switches:

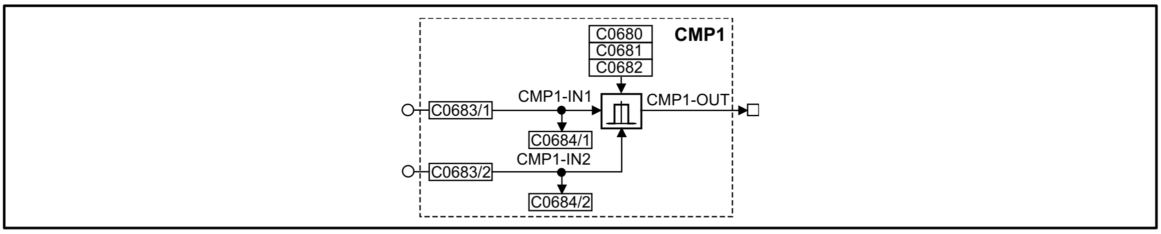


Fig. 7-97 Comparator (CMP1)

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	-	-	-	-	-	-

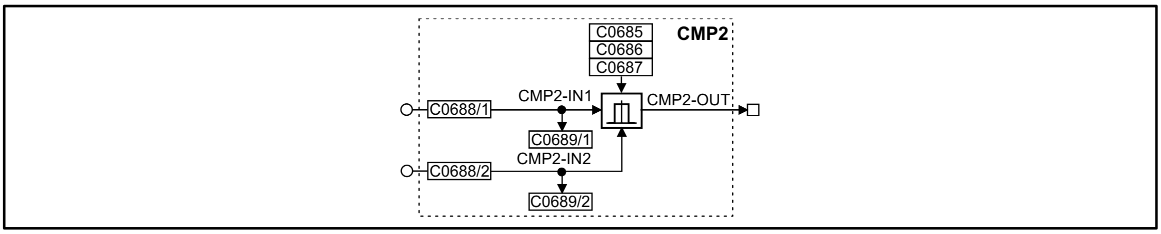


Fig. 7-98 Comparator (CMP2)

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	-	-	-	-	-	-

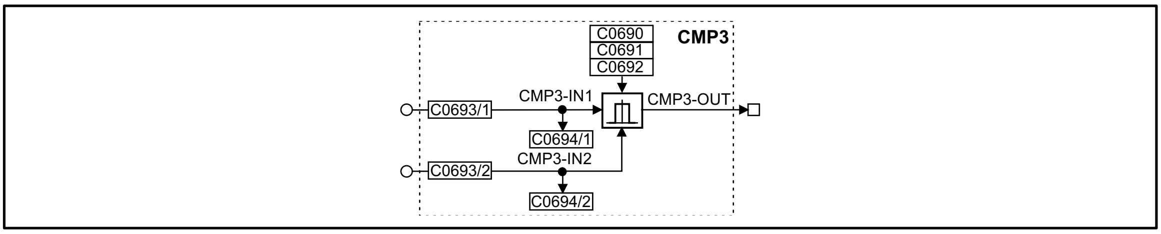


Fig. 7-99 Comparator (CMP3)

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 is an example for CMP1 and is also suitable for CMP2 and CMP3.

The function of these function blocks can be set under code C0680 (CMP1). The following comparator functions 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|

7.6.31.1 Function 1: CMP1-IN1 = CMP1-IN2

This function is used to find out whether two signals are identical.

- Under code C0682 you can set the window of equality.
- Under code C0681 a hysteresis can be set if the input signals are not stable and therefore the output oscillates.

The exact function can be obtained from the line diagram.

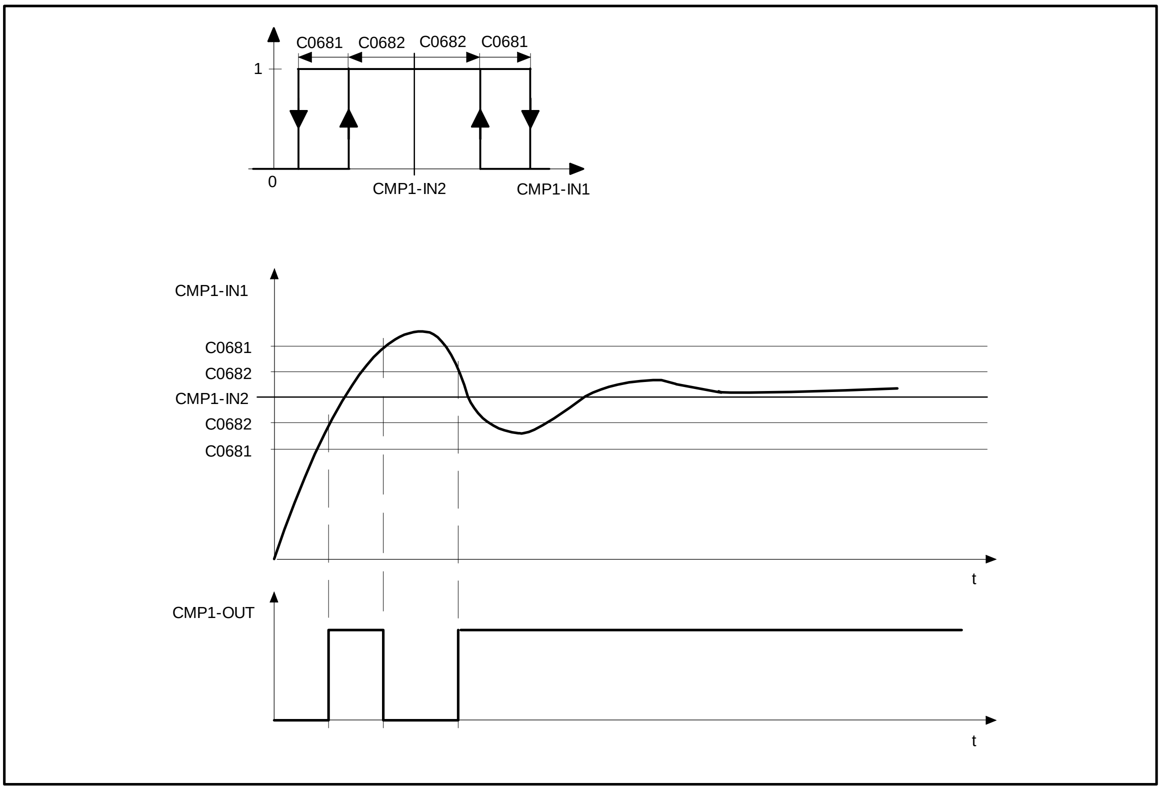


Fig. 7-100 Equality of signals (CMP1-IN1 = CMP1-IN2)

Example:

This function is used to obtain the comparison "Actual speed is equal to setpoint speed ($n_{act} = n_{set}$)".

7.6.31.2 Function 2: CMP1-IN1 > CMP1-IN2

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

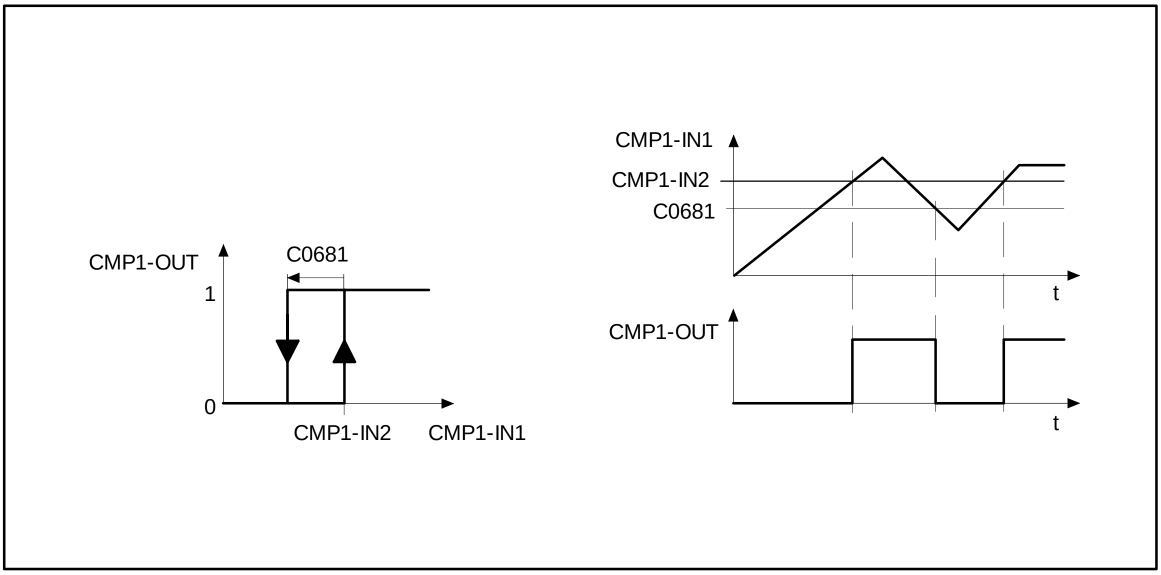


Fig. 7-101 Exceeding signal values (CMP1-IN1 > CMP1-IN2)

Example:

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

7.6.31.3 Function 3: CMP1-IN1 < CMP1-IN2

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

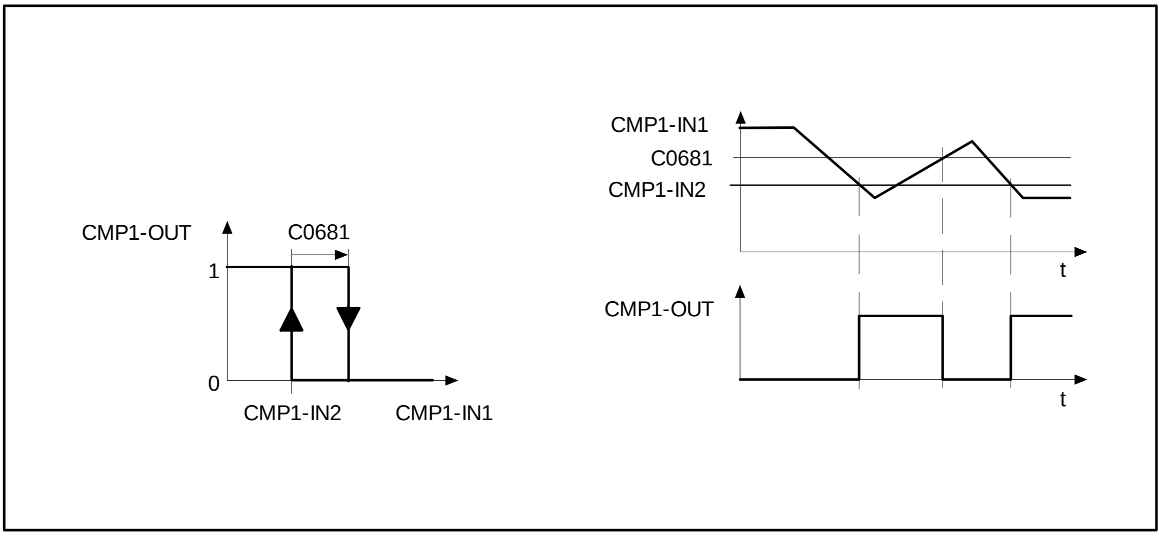


Fig. 7-102 A value falls below signal values (CMP1-IN1 < CMP1-IN2)

Example:

This function is used to obtain the comparison "Actual speed is lower than a limit value ($n_{act} > n_x$)" for one direction of rotation.

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

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

Example:

This function is used to obtain the comparison "$n_{act} = 0$".

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

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

Example:

This function is used to obtain the comparison "$|n_{act}| > |n_x|$" independently of the direction of rotation.

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

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

Example:

This function is used to obtain the comparison "$|n_{act}| < |n_x|$" independently of the direction of rotation.

7.6.32 Long comparator (CMPPH)

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

Purpose

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

CMPPH1

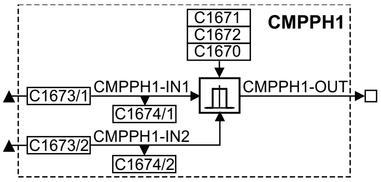


Fig. 7-103 Function block CMPPH1

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

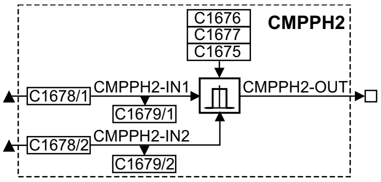


Fig. 7-104 Function block CMPPH2

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

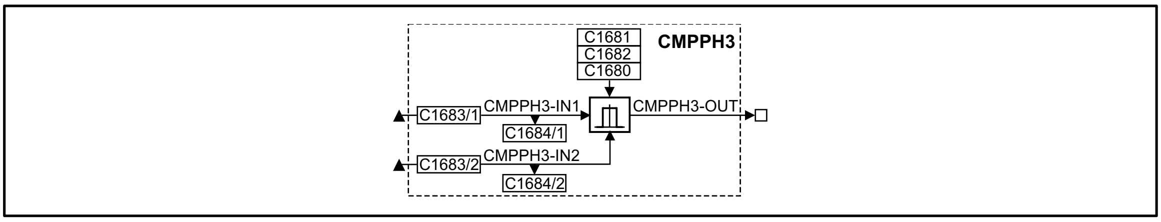


Fig. 7-105 Function block CMPPH3

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|

7.6.32.1 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.

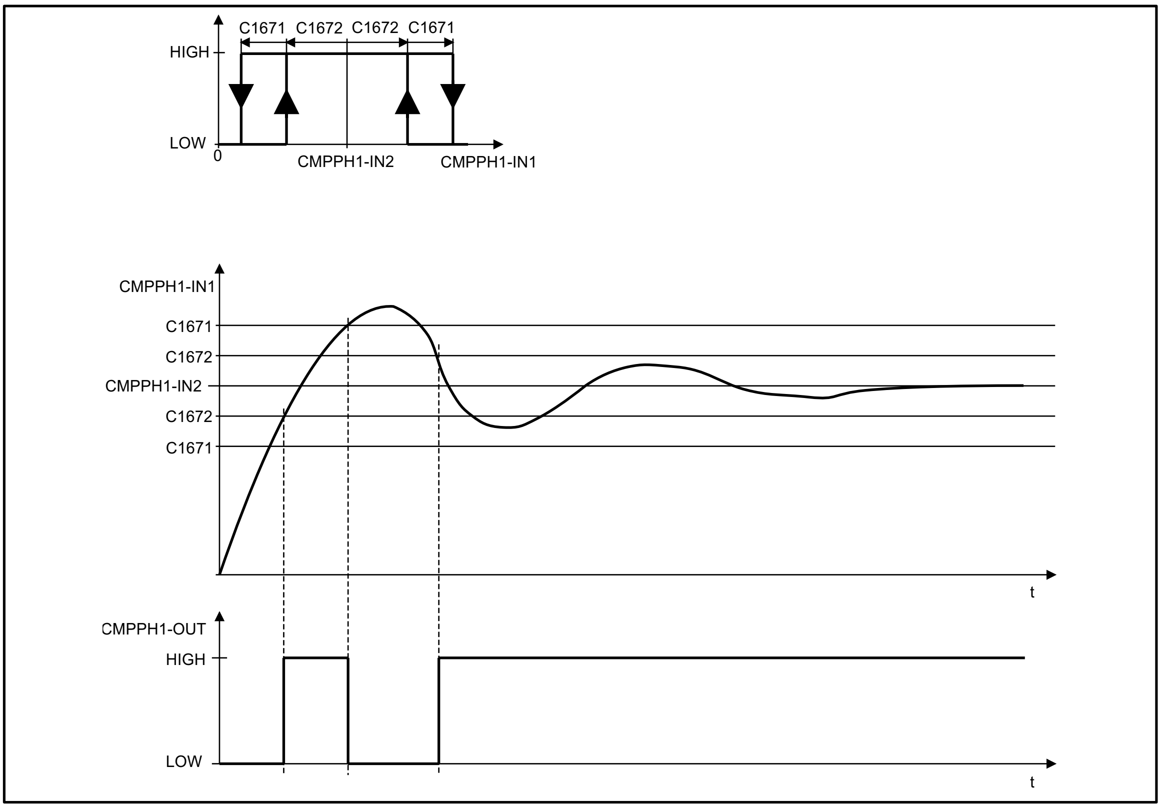


Fig. 7-106 Equality of signals (CMPPH1-IN1 = CMPPH1-IN2)

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

7.6.32.2 Function 2: CMPPH1-IN1 > CMPPH1-IN2

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

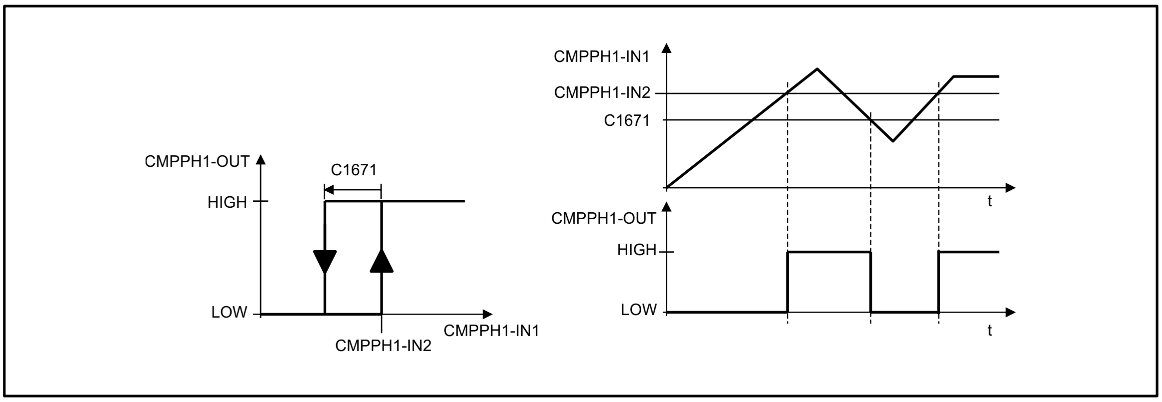


Fig. 7-107 Exceeding signal values (CMPPH1-IN1 > CMPPH1-IN2)

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

7.6.32.3 Function 3: CMPPH1-IN1 < CMPPH1-IN2

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

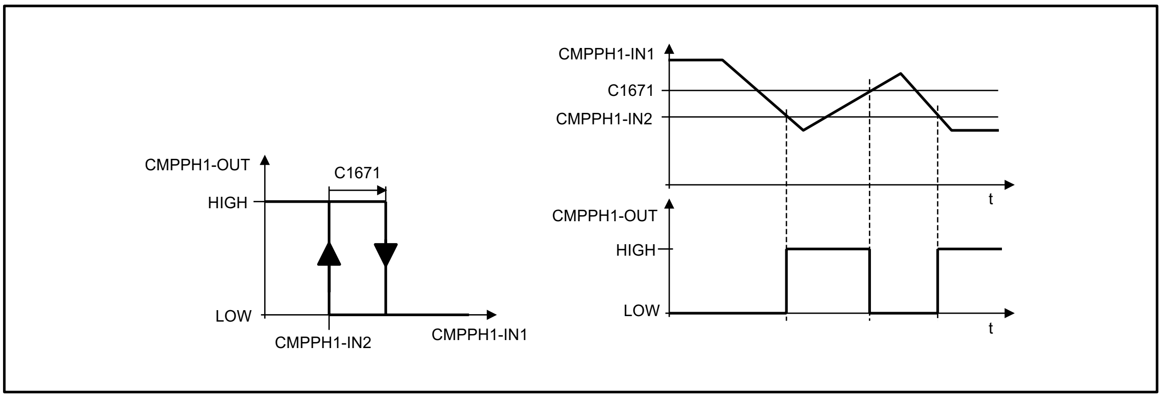


Fig. 7-108 Falling below signal values (CMPPH1-IN1 < CMPPH1-IN2)

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

7.6.32.4 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 "$ph_{act.} = 0$".

7.6.32.5 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 "$|ph_{act.}| > |ph_x|$".

7.6.32.6 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 "$|ph_{act.}| < |ph_x|$".

7.6.33 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

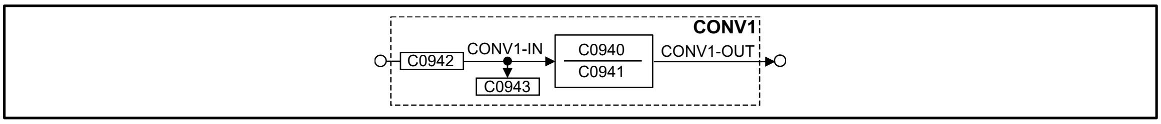


Fig. 7-109 Function block CONV1

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:

$$\text{CONV1–OUT} = \text{CONV1–IN} \cdot \frac{\text{C0940}}{\text{C0941}}$$

Example:

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

CONV2

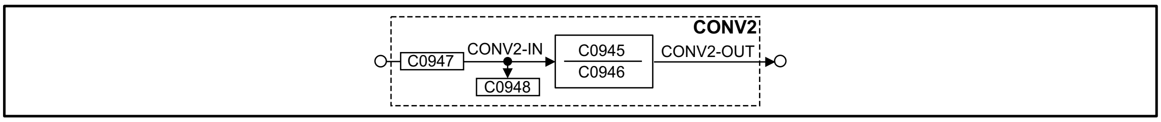


Fig. 7-110 Function block CONV2

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:

$$\text{CONV2–OUT} = \text{CONV2–IN} \cdot \frac{\text{C0945}}{\text{C0946}}$$

CONV3

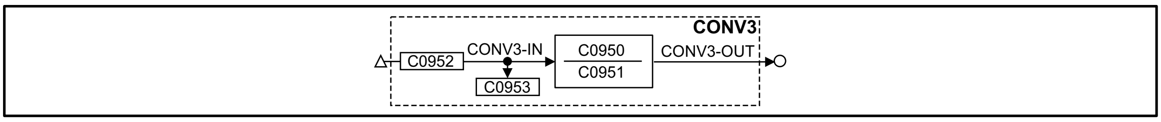


Fig. 7-111 Function block CONV3

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

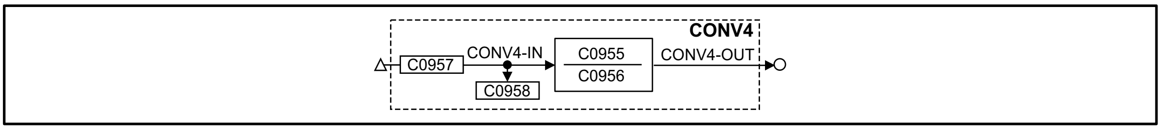


Fig. 7-112 Function block CONV4

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

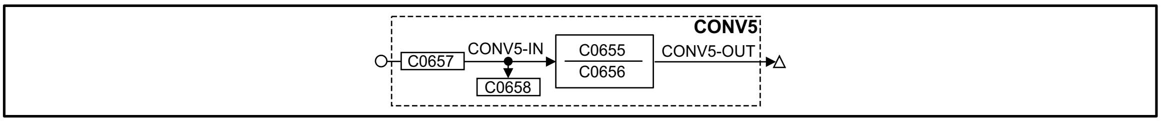


Fig. 7-113 Function block CONV5

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.

The conversion is done according to the formula:

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

7.6.34 Analog-digital converter (CONVAD)

Conversion of an analog value to individual digital signals.

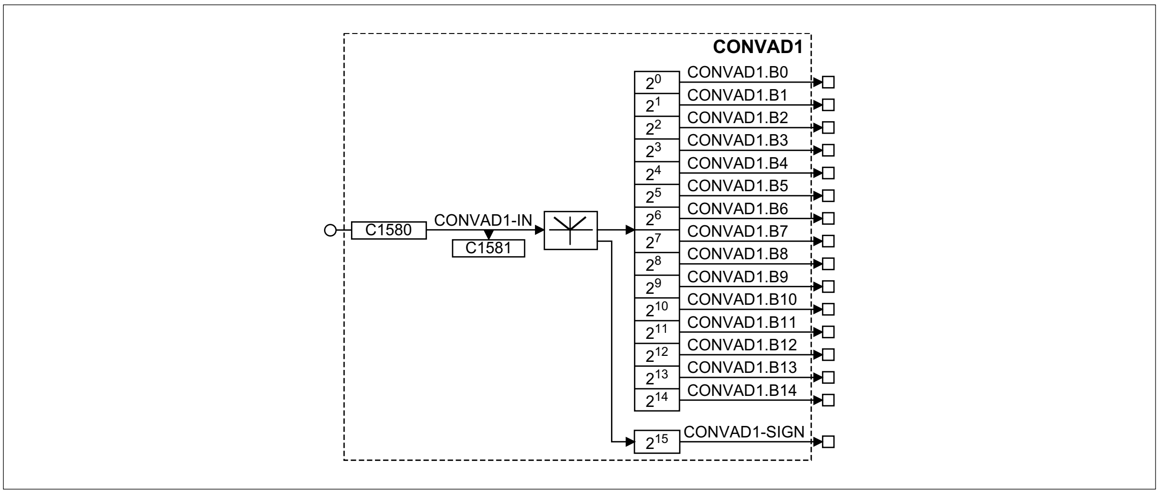


Fig. 7-114 Analog-digital-converter (CONVAD1)

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

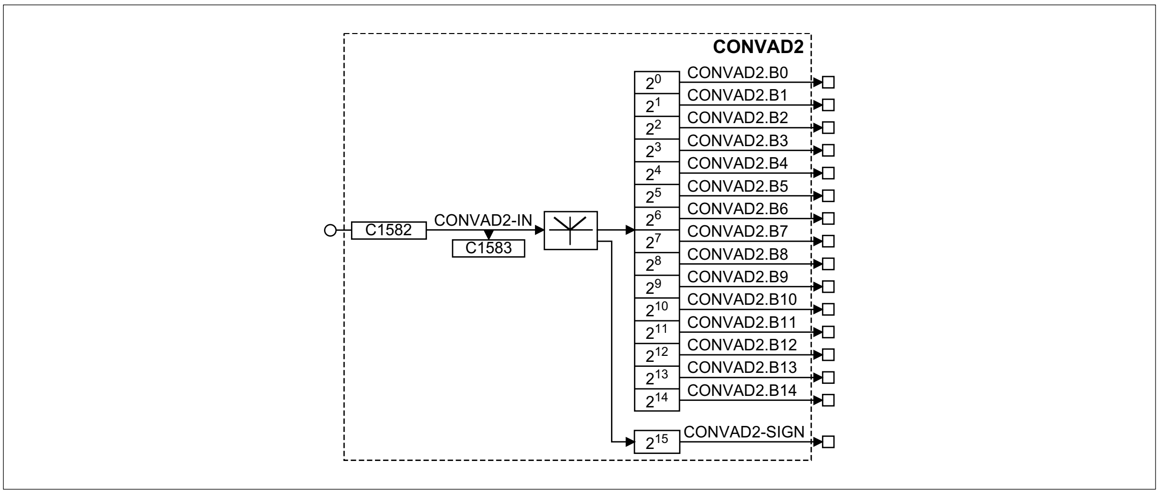


Fig. 7-115 Analog-digital-converter (CONVAD2)

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

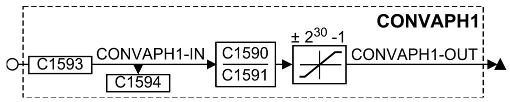
Function

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

7.6.35 Analog-Long converter (CONVAPH)

Conversion of an analog value to a phase signal.

CONVAPH1



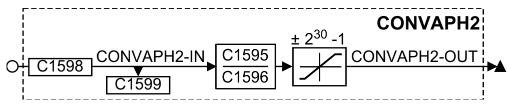
Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH1-IN	a	C1594	dec	C1593	1	-
CONVAPH1-OUT	ph	-	-	-	-	Limits to $\pm 2^{30}-1$

Function

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

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

CONVAPH2

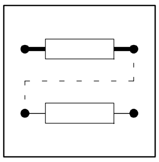


Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVAPH2-IN	a	C1599	dec	C1598	1	-
CONVAPH2-OUT	ph	-	-	-	-	Limits to $\pm 2^{30}-1$

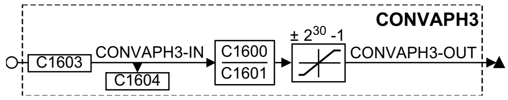
Function

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

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



CONVAPH3



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

Function

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

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

7.6.36 Digital-analog converter (CONVDA)

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

Purpose

Conversion of individual digital signals to an analog value.

CONVDA1

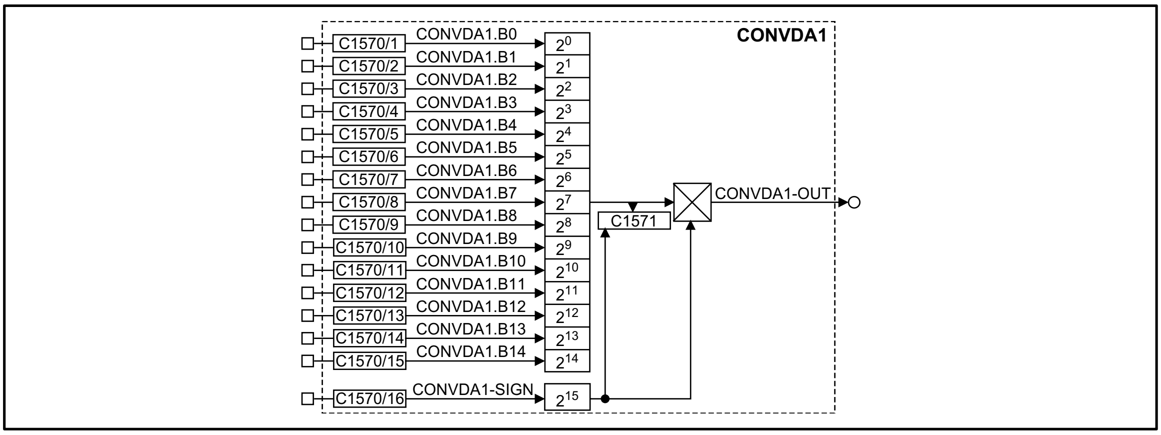


Fig. 7-116 Function block CONVDA1

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 ≙ negative sign LOW ≙ positive sign
CONVDA1-OUT	a	-	-	-	-	-
-	-	C1571	hex	-	-	Indicates the result

CONVDA2

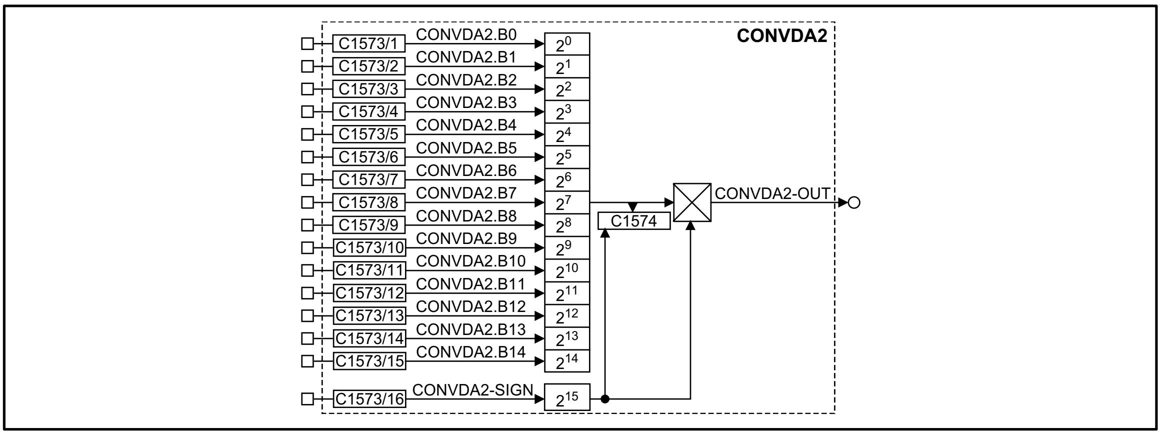


Fig. 7-117 Function block CONVDA2

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 ≙ negative sign LOW ≙ positive sign
CONVDA2-OUT	a	-	-	-	-	-
-	-	C1574	hex	-	-	Indicates the result

CONVDA3

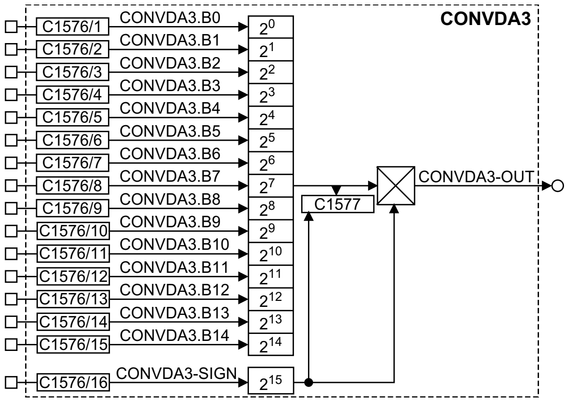


Fig. 7-118 Function block CONVDA3

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 ≙ negative sign LOW ≙ 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

7.6.37 Long-Analog converter (CONVPHA)

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

Purpose

Conversion of a phase signal to an analog value.

CONVPHA1

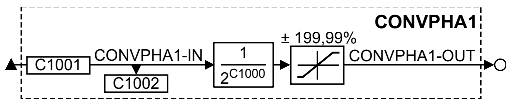


Fig. 7-119 Function block CONVPHA1

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA1-IN	ph	C1002	dec [inc]	C1001	3	-
CONVPHA1-OUT	a	-	-	-	-	Limits 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

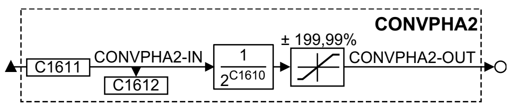


Fig. 7-120 Function block CONVPHA2

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA2-IN	ph	C1612	dec [inc]	C1611	3	-
CONVPHA2-OUT	a	-	-	-	-	Limits 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

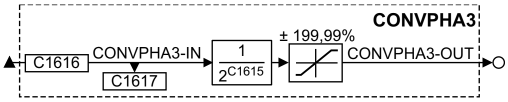


Fig. 7-121 Function block CONVPHA3

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
CONVPHA3-IN	ph	C1617	dec [inc]	C1616	3	-
CONVPHA3-OUT	a	-	-	-	-	Limits to +199,99 %

Function

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

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

7.6.38 Phase conversion (CONVPHPH)

Purpose

Conversion of a phase signal with dynamic fracture.

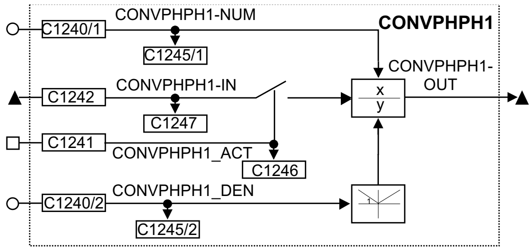


Fig. 7-122 Phase conversion (CONVPHPH1)

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

Function

Caution!

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

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

7.6.39 Characteristic function (CURVE)

Purpose

Conversion of an analog signal into a characteristic.

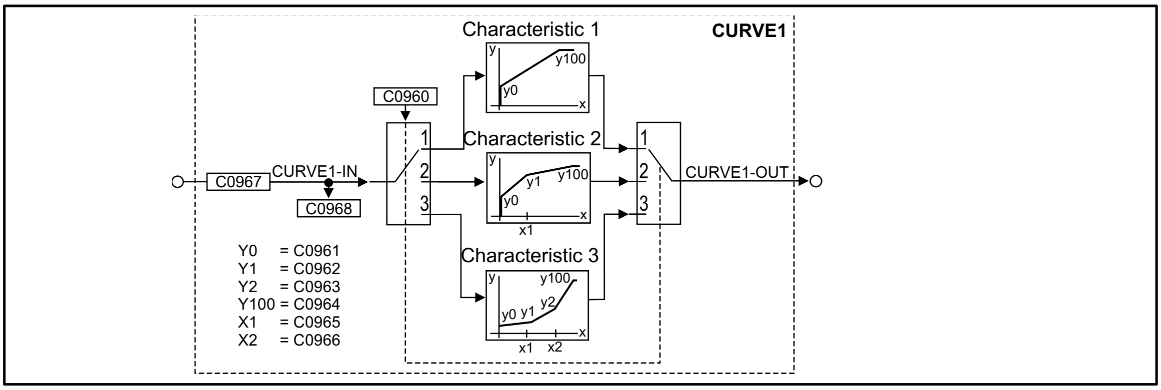


Fig. 7-123 Characteristic function (CURVE1)

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

Scope of functions

Under C0960, you can select the function:

- Characteristic with two co-ordinates
- Characteristic with three co-ordinates
- Characteristic with four co-ordinates

The codes for entering the co-ordinates can be obtained from the line diagrams.

A linear interpolation is carried out between the co-ordinates.

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

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

or

- Connect limiter (LIM) before or after the CURVE function block

7.6.39.1 Characteristic with two co-ordinates

Set C0960 = 1.

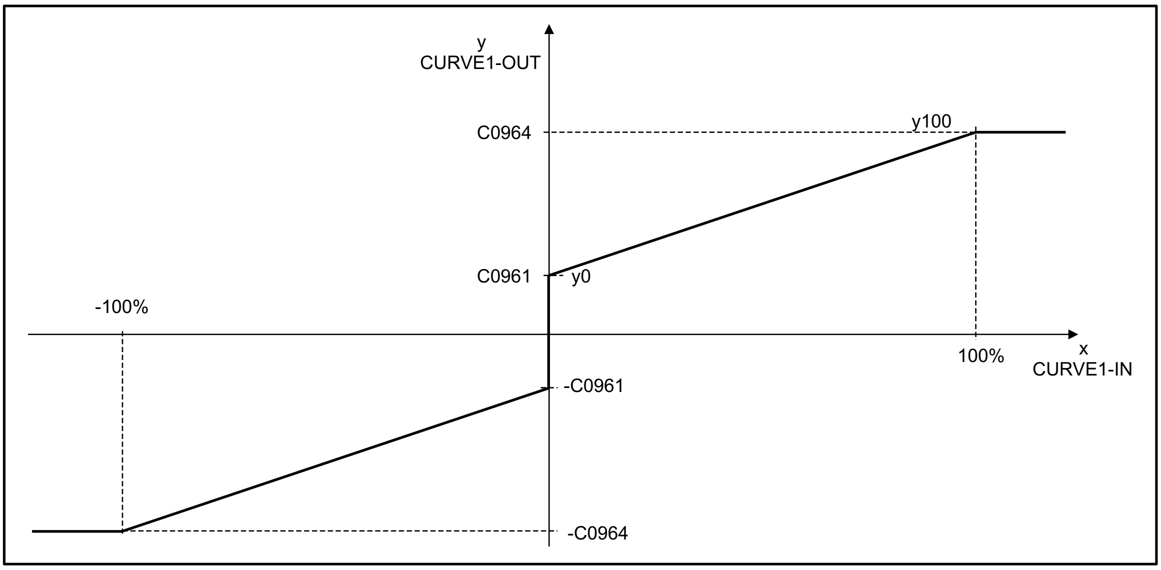


Fig. 7-124 Line diagram with 2 co-ordinates

7.6.39.2 Characteristic with three co-ordinates

Set C0960 = 2.

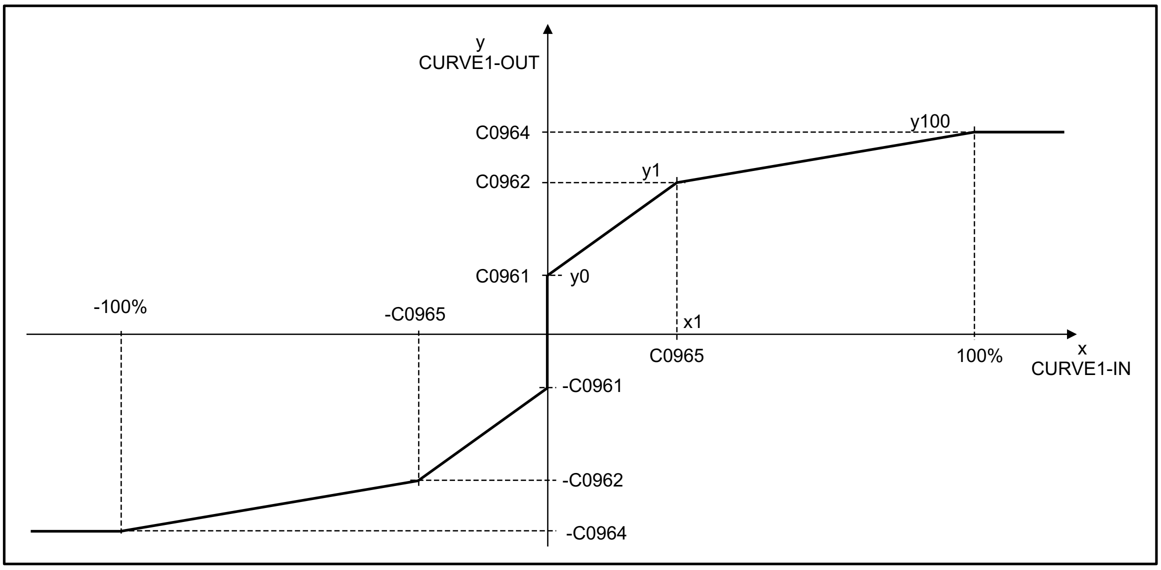


Fig. 7-125 Line diagram with three co-ordinates

7.6.39.3 Characteristic with four co-ordinates

Set C0960 = 3.

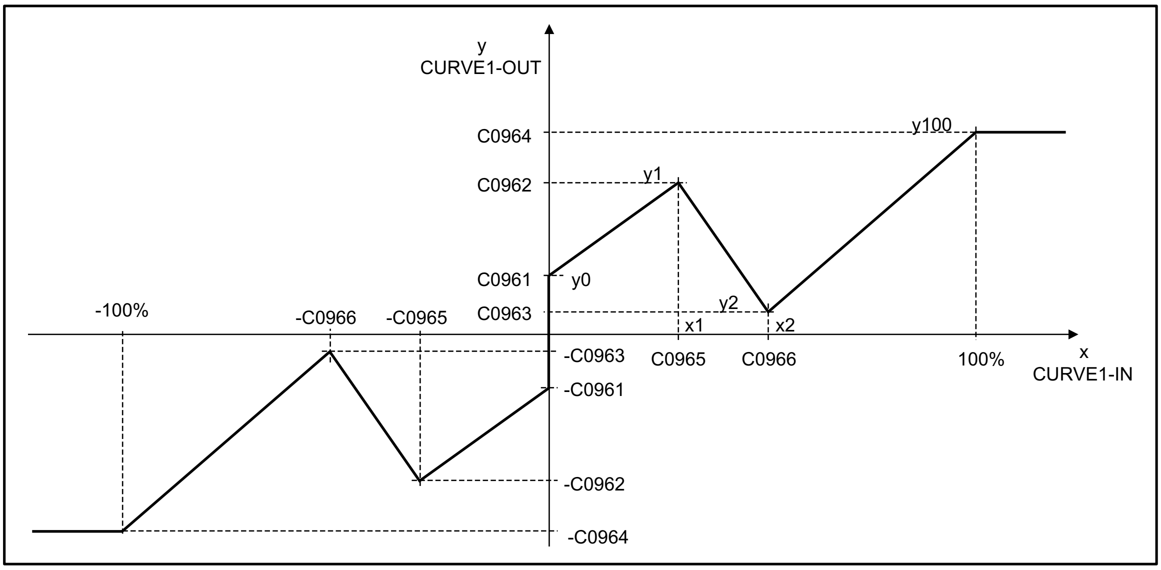


Fig. 7-126 Line diagram characteristic with four co-ordinates

7.6.40 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.

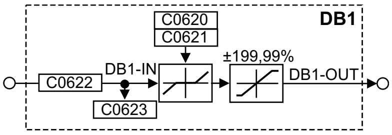


Fig. 7-127 Dead band element (DB1)

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 parameterized under C0621.
- The gain is set under C0620.

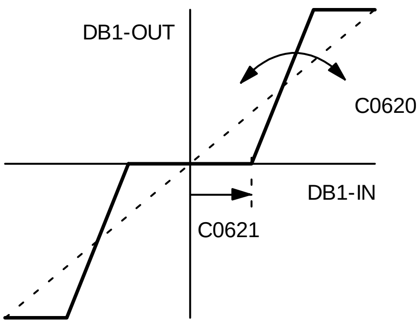


Fig. 7-128 Dead band and gain

7.6.41 Control of the controller (DCTRL)

Purpose

Controls the controllers to specified states (e.g. trip, trip reset, quick stop or controller inhibit).

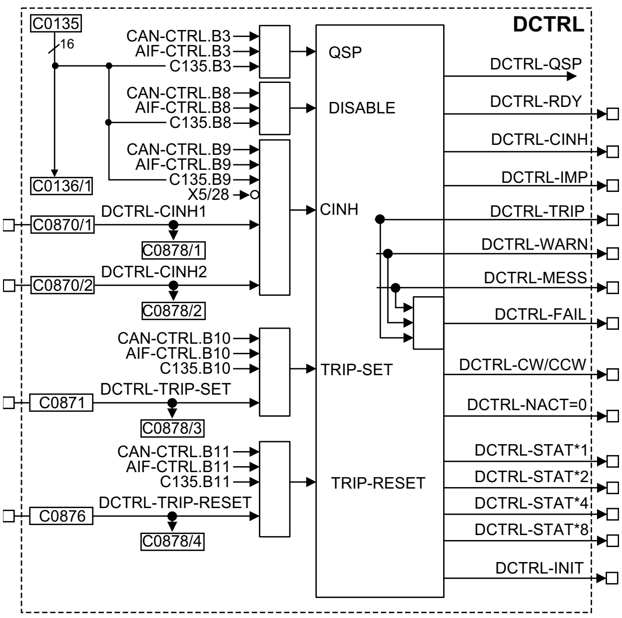


Fig. 7-129 Control of the controller (DCTRL)

Signal				Source			Note
Name	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 = fault indication EEr
DCTRL-TRIPRESET	d	C0878/4	bin	C0876	2	55	LOW-HIGH signal = Trip reset
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 = Active fault
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

7.6.41.1 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 displays the control word C0135

7.6.41.2 Operation inhibited (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 displays the control word C0135

7.6.41.3 Controller inhibit (CINH)

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

- The function can be controlled by six 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
  – Free inputs DCTRL-CINH1 and DCTRL-CINH2
- All inputs are linked by an OR-operation.
- C0136/1 displays the control word C0135

7.6.41.4 TRIP-SET

The drive is controlled into the state 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 displays the control word C0135

7.6.41.5 TRIP-RESET

Resets an active trip, after the cause of fault is reset. If the cause of fault is still active, there is no reaction.

- 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.
- The function can only be performed by a LOW-HIGH edge of the signal resulting from the OR operation.
- C0136/1 displays the control word C0135

Tip!

If one of the inputs is set to HIGH, no LOW-HIGH edge can occur at the resulting signal.

7.6.41.6 Controller state

The state is binary coded in the outputs DCTRL-STAT*x.

STAT*8	STAT*4	STAT*2	STAT*1	Action of the controller
0	0	0	0	Initialization after connection of the supply voltage
0	0	0	1	Lock mode, Protection against restart active C0142
0	0	1	1	Drive is in controller inhibit mode
0	1	1	0	Controller enabled
0	1	1	1	The release of a monitoring function resulted in a ”message”
1	0	0	0	The release of a monitoring function resulted in a ”trip”
1	0	1	0	The release of a monitoring function resulted in a ”FAIL-QSP”

7.6.42 Digital frequency input (DFIN)

Purpose

Conversion and standardization of a power pulse current at the digital frequency input X9 into a speed and phase setpoint. The transmission of a digital frequency is very precise (without offset and gain errors).

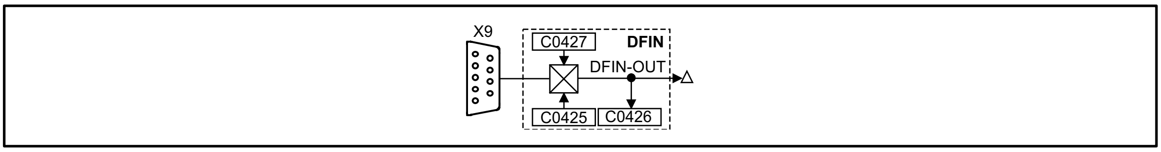


Fig. 7-130 Digital frequency input (DFIN)

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

Function

- The input X9 is dimensioned for signals with TTL level (see chapter 4.2.8 digital frequency input X9).
- Adapt the controller to the connected encoder or controller, in the event of pulse train cascade or pulse train bus under C0425.
- The input of a zero track is optional.
- The evaluation of the following input signals is possible under C0427:

C0427 = 0

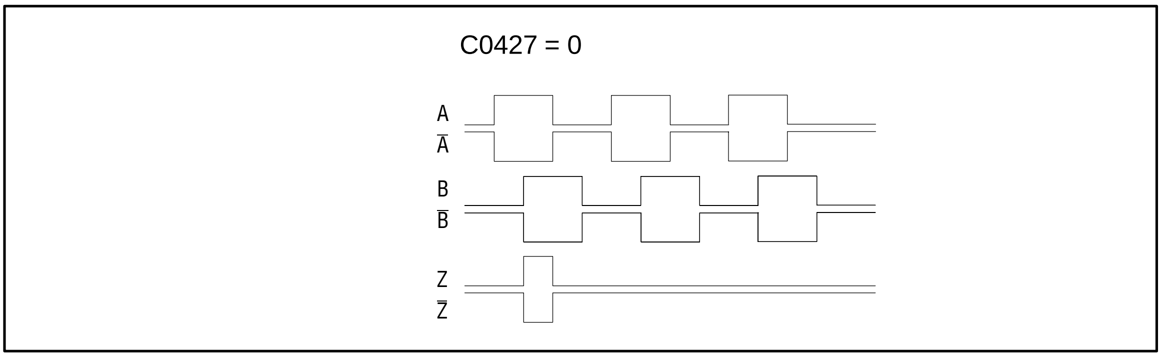


Fig. 7-131 Signal sequence with phase shift (CW rotation)

- CW rotation
  – Track A is leading track B by 905 (positive value at DFIN-OUT).
- CCW rotation
  – Track A is lagging behind track B by 905 (negative value at DFIN-OUT).

C0427 = 1

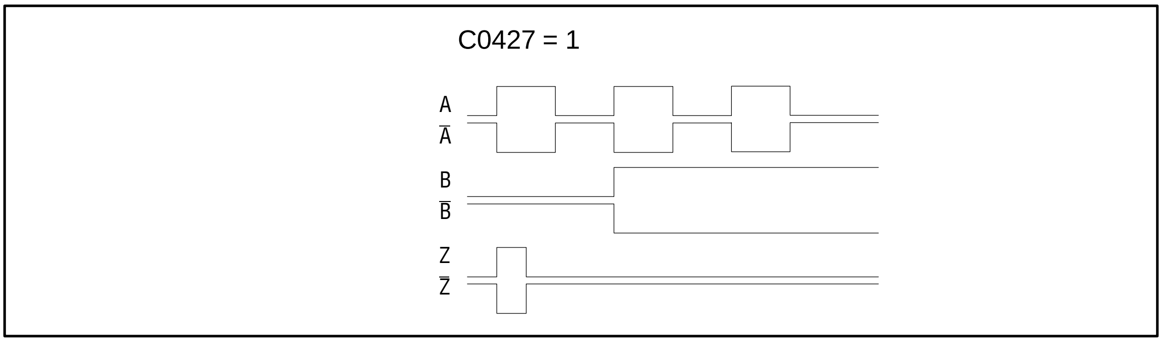


Fig. 7-132 Control of the direction of rotation by track B

- 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

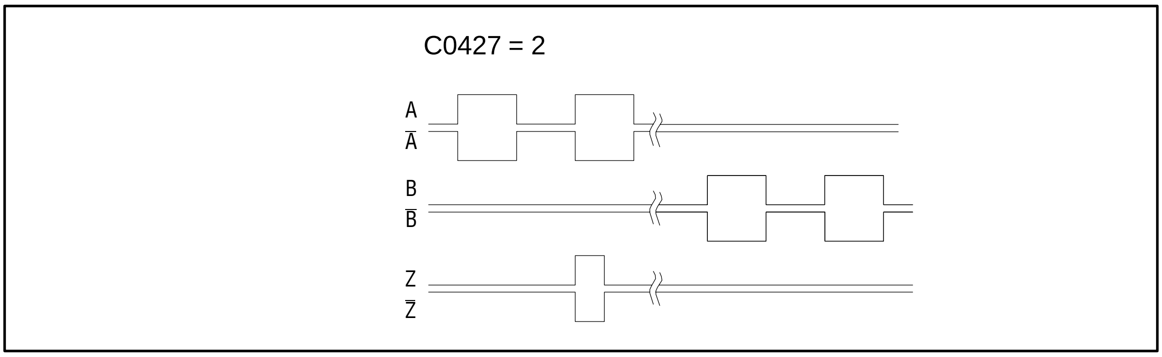


Fig. 7-133 Control of speed and direction of rotation via track A or track B

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

Transmission function

$$\text{DFIN-OUT [rpm]} = \text{f [Hz]} \cdot \frac{60}{\text{Increments\_from\_C0425}}$$

Example:

Input frequency = 200 kHz

C0425 = 3 (≙ of an increment of 2048 inc/rev)

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

Signal adaptation

Finer resolutions than the squaring can be achieved 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:

$$CONV3 - OUT\,[\%] = f\,[Hz] \cdot \frac{0,4}{Increments\_from\_C0425} \cdot \frac{C0950}{C0951}$$

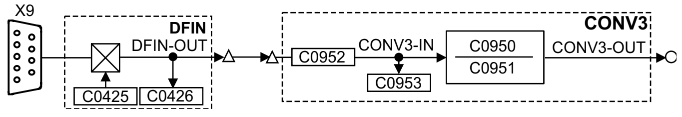


Fig. 7-134 Digital frequency input (DFIN) with connected converter

Stop!

When C0540 = 0, 1, 2, 3 and feedback system C0025 > 10, you must no longer use the digital frequency input X9.

7.6.43 Digital frequency output (DFOUT)

Purpose

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

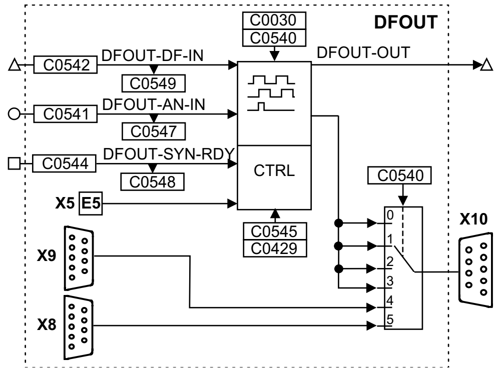


Fig. 7-135 Digital frequency output (DFOUT)

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

7.6.43.1 Output signals on X10

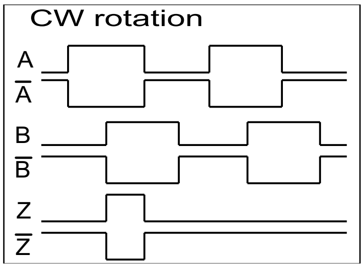


Fig. 7-136 Signal sequence for CW rotation (definition)

- The output signal corresponds to the simulation of an incremental encoder:
  - Track A, track B and the zero track (if necessary) as well as the corresponding inverted tracks are output with tracks shifted by 90 degree.
  - The levels are TTL compatible.
- The signal sequence in the diagram occurs if the input values are positive (CW rotation).
- If the input values are negative (CCW rotation), track B leads track A by 9055 .
- The zero pulse is output according to the function set under C0540.
- C0030 is used to set the encoder constant of the encoder simulation.
- The function of the digital frequency output X10 is determined via C0540.

Stop!

C0540 = 0 to C0540 = 3 cannot be set if the connection to the digital frequency input DFIN X9 is made and C0025 > 10 was selected.

[C0540]	Signal at X10
0	DFOUT-AN-IN is output at X10; external input of the zero track is possible
1	DFOUT-DF-IN is output at X10; external input of the zero track is possible
2	Encoder simulation of the resolver with zero track in resolver zero track (mechanical assembly to 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 amplified electrically and is output directly (C0030 is without function)
5	The signal at input X8 is amplified electrically and is output directly (C0030 is without function)

7.6.43.2 Output of an analog signal

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

Transmission function

$$f\,[\mathrm{Hz}] = \mathrm{DFOUT-AN-IN}\,[\%] \cdot \frac{\text{Increments from C0030}}{100} \cdot \frac{\mathrm{C0011}}{60}$$

Example:

DFOUT-AN-IN = 50 %

C0030 = 3, this corresponds to 2048 inc/rev.

C0011 = 3000 rpm

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

Generate zero pulse

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

- Set input DFOUT-SYN-RDY = HIGH.
- A LOW-HIGH edge at terminal X5/E5 generates the zero pulse 360° later.
  – Then, a zero pulse is generated every 3605according to C0030.
- The zero pulse can be shifted by +3605under C0545 (65536 inc = 360°).

7.6.43.3 Output of a speed signal

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

Transmission function

$$f\,[\mathrm{Hz}] = \mathrm{DFOUT-DF-IN}\,[\mathrm{rpm}] \cdot \frac{\text{Increments from C0030}}{60}$$

Example:

DFOUT-DF-IN = 3000 rpm

C0030 = 3, this corresponds to 2048 inc/rev.

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

Generate zero pulse

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

- Set input DFOUT-SYN-RDY = HIGH.
- A LOW-HIGH edge at terminal X5/E5 generates the zero pulse 360° later.
  – Then, a zero pulse is generated every 3605according to C0030.
- The zero pulse can be shifted by +3605under C0545 (65536 inc = 360°).

7.6.43.4 Encoder simulation of the resolver

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

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

Generate zero pulse in resolver zero position (C0540 = 2)

The output of the zero pulse referring to the motor depends on how the resolver is attached to the motor.

- The zero pulse can be shifted by +3605 under C0545 (65536 inc = 360°).

Generate zero pulse externally (C0540 = 3)

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

- Set input DFOUT-SYN-RDY to HIGH.
- A LOW-HIGH edge at terminal X5/E5 generates the zero pulse 360° later.
  – Then, a zero pulse is generated every 3605 according to C0030.
- The zero pulse can be shifted by +3605 under C0545 (65536 inc = 360°).

7.6.43.5 Direct output of X8 (C0540 = 4)

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

7.6.43.6 Direct output of X9 (C0540 = 5)

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

7.6.44 Digital frequency ramp generator (DFRFG)

Purpose

Synchronization of the drive (motor shaft) on a digital frequency (phase input). Then, the drive performs a phase-synchronous run to the digital frequency.

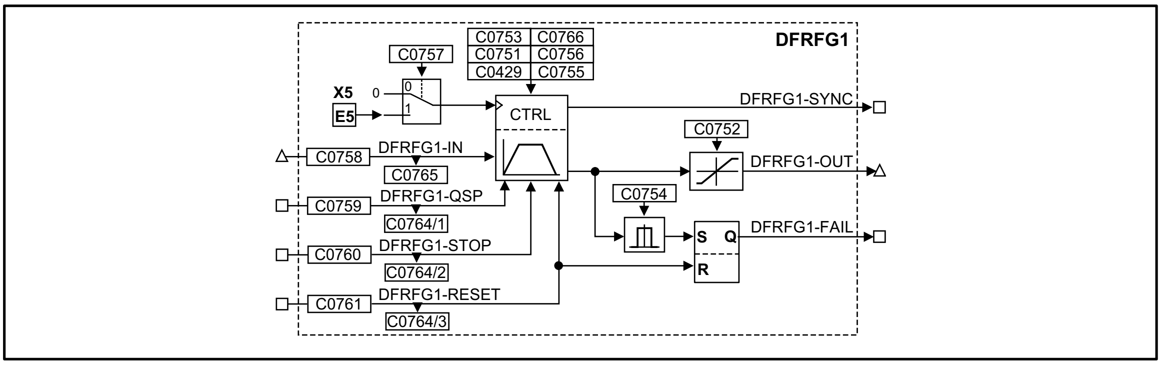


Fig. 7-137 Digital frequency ramp generator (DFRFG1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
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 generator stop
- RESET
- Detect phase difference
- Start via touch probe initiator (terminal X5/E5)
- Correction of the touch probe initiator (terminal X5/E5)

7.6.44.1 Profile generator

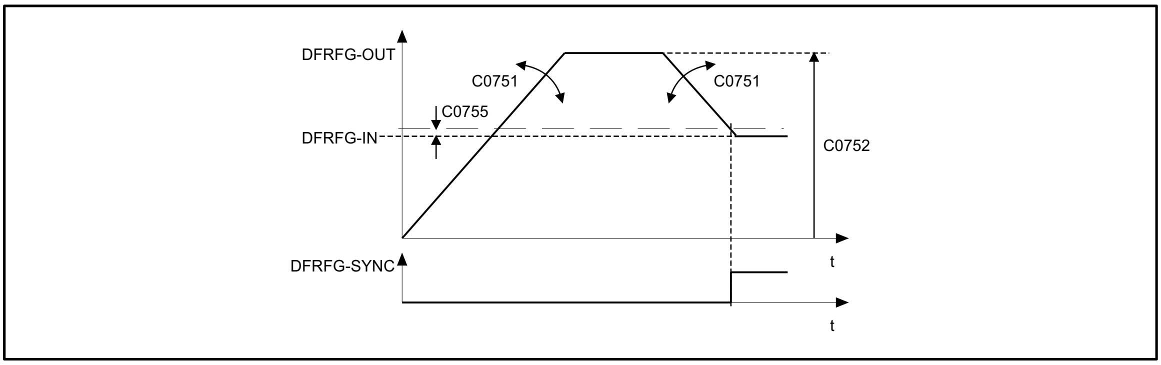


Fig. 7-138 Synchronize on DFRFG

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

- Set acceleration and deceleration under C0751.
- Set max. speed under C0752.
- If the distance and the speed reach their setpoints, the output switches DFRFG1-SYNC=HIGH. At the same time, the FB switches the profile generator inactive.
- Set changeover point under C0755.

Stop!

Do not operate the drive at the torque limit M_{max}, I_{max}.

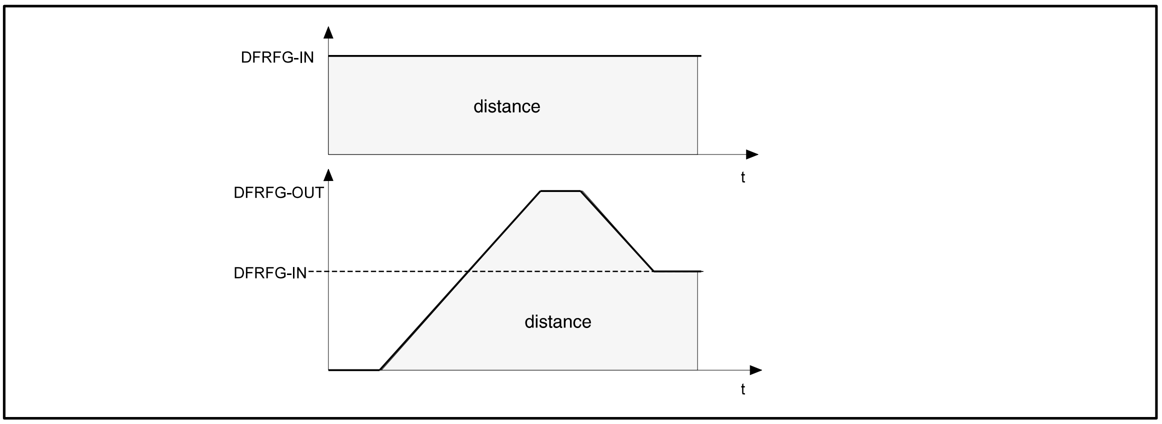


Fig. 7-139 Speed-time diagram DFRFG

The number of increments at DFRFG-IN (master drive) provide the target.The target can be represented as a distance.In the speed-time diagram, the distance covered (phase) is shown as the area under the speed profile. When synchronization is reached, master and slave have covered the same distance (phase).

7.6.44.2 Quick stop

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

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

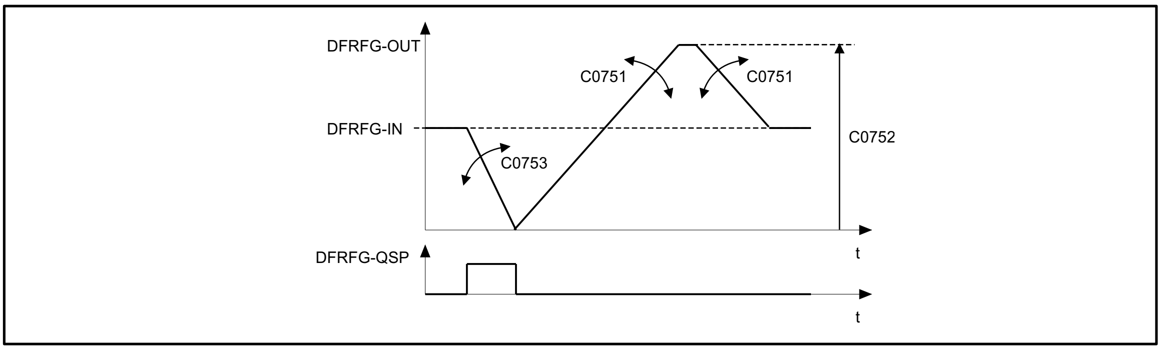


Fig. 7-140 Quick stop DFRFG

7.6.44.3 Ramp 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 of the setpoint phase via the profile generator after reset of the stop request.

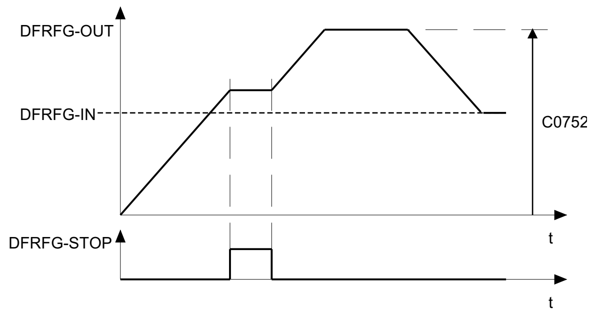


Fig. 7-141 Ramp generator stop

7.6.44.4 RESET

DFRFG-RESET = HIGH:

- Resets the setpoint phase which is internally added
- Activates the profile generator
- HIGH-LOW edge at DFRFG-RESET: Detection of the setpoint phase

7.6.44.5 Detect phase difference

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

- Set limit value of the monitoring under 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).

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

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.
  – Touch probe signals are otherwise ignored .
- A LOW-HIGH edge at terminal X5/E5 starts the procedure:

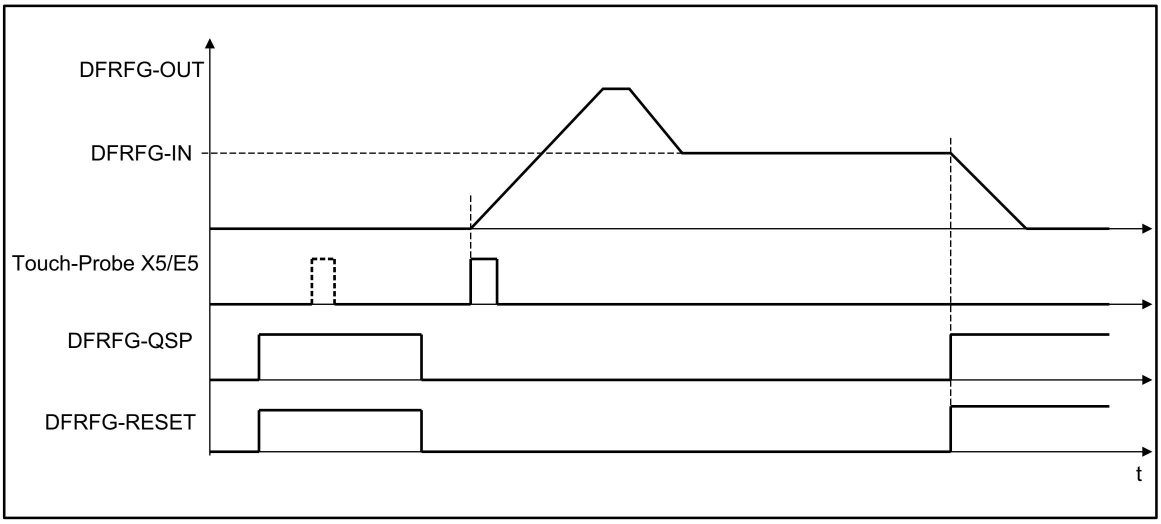


Fig. 7-142 Starting via touch probe initiator (terminal X5/E5)

Stop!

In the default setting, terminal X5/E5 has another function.

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

Delays during activation of the initiator cause a speed-dependent phase offset (e.g. during positioning, synchronizing).

- Set correction value for the phase offset under C0429.
- Formula for the correction value at C0429

  Correction value at C0429 = 16384 · correction value

- Please obtain the correction value from the data sheet of the initiator, or contact the manufacturer.

7.6.44.8 Set offset

The offset can be set under code C0756 (see chapter; Code list). 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 generator. The lead of the master from the moment of starting or the resulting distance/phase difference is taken up during the acceleration.

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

Tip!

When the offset is large and the input speeds are low, the drive may reverse. To avoid this, you can select a direction of rotation for the output under C0766.

7.6.45 Digital frequency processing (DFSET)

Purpose

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

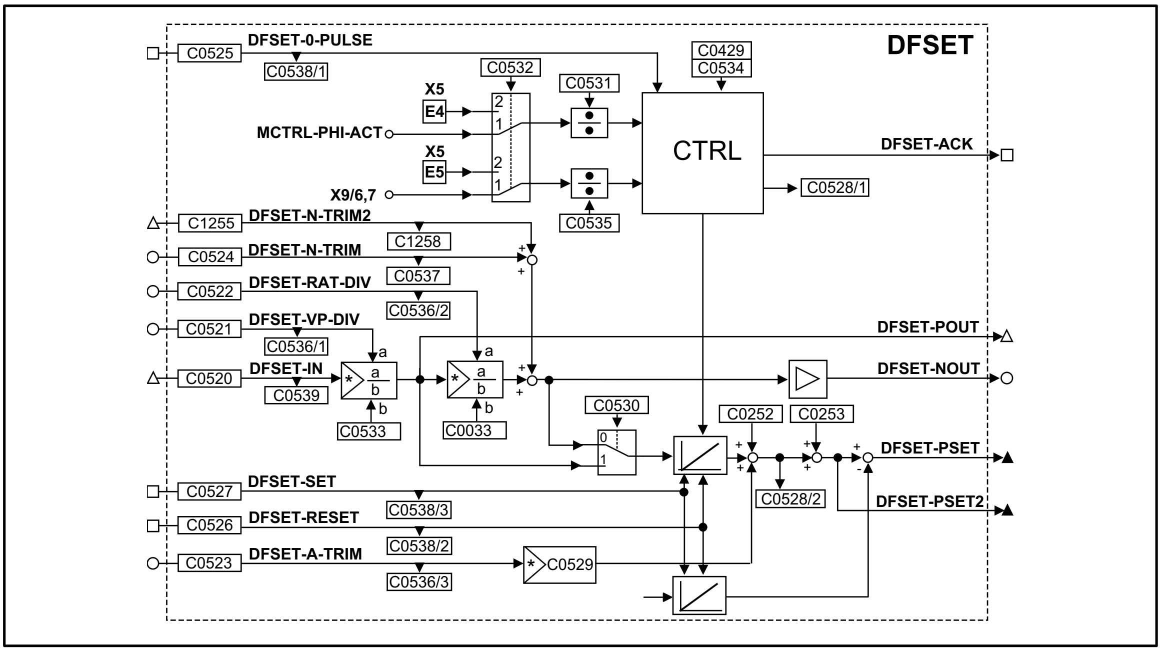


Fig. 7-143 Digital frequency processing (DFSET)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
DFSET-IN	phd	C0539	dec [rpm]	C0520	4	Speed/Phase 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 stretch factor 100 % = 16384 inc
DFSET-RAT-DIV	a	C0536//2	dec	C0522	1	Numerator gearbox factor 100 % = 16384 inc
DFSET-0-PULSE	d	C0538/1	bin	C0525	2	HIGH = Enabling of zero pulse synchronizing
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 = momentary 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/Phase setpoint
DFSET-PSET	ph	-	-	-	-	Contouring error for phase controller
DFSET-PSET2	ph	-	-	-	-	Phase setpoint 65536 inc = 1 revolution
DFSET-ACK	d	-	-	-	-	HIGH = Synchronizing is performed

Function

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

7.6.45.1 Setpoint conditioning with stretch and gearbox factor

Stretch factor

Defines the ratio between the drive and the setpoint.

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

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

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

7.6.45.2 Processing of correction values

Speed trimming

This is used to add correction values, e.g. by a superimposed closed-loop control. This allows acceleration or deceleration of the drive.

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

Phase trimming

Adds a setpoint at DFSET-A-TRIM to the setpoint phase. This changes the rotor position to the setpoint with the number of increments provided (drive leading or lagging). The phase trimming is performed within a range of ±32767 increments (≙ ±1/2 revolution). The source can be any analog signal.

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

Phase offset

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

Speed-proportional phase setting

Leading or lagging of the phase with rising speed.

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

7.6.45.3 Synchronizing on zero track or touch probe

The synchronization is selected under C0532.

- C0532 = 1, zero 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).

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

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

$$\text{Correction value at C0429} = 16384 \cdot \text{Correction value}$$

- Please obtain the values from the data sheet of the initiator or contact the manufacturer.

STOP

Stop!

When the synchronization via terminals X5/E4 and X5/E5 (C0532 = 2) is activated, make sure that no other control signals are taken from these terminals. If the configuration is changed under C0005, the terminals are assigned to a basic setting.

Synchronization mode

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

C0534	Synchronization mode	Note
0	inactive	function inactive
1	continuous synchronization with correction in the shortest possible way	
2	continuous synchronization with correction in the shortest possible way	after a LOW-HIGH signal to DFSET-0-pulse, the zero track is synchronized once
10	single synchronization, a phase deviation is corrected in the shortest possible way	after a LOW-HIGH signal to DFSET-0-pulse, the zero track is synchronized once
11	single synchronization, a phase deviation is corrected in CW direction	after a LOW-HIGH signal to DFSET-0-pulse, the zero track is synchronized once
12	single synchronization, a phase deviation is corrected in CCW direction	after a LOW-HIGH signal to DFSET-0-pulse, the zero track is synchronized once
13	single synchronization, a phase difference is determined between setpoint pulse and actual pulse and is corrected to the corresponding direction of rotation according to the sign	after a LOW-HIGH signal to DFSET-0-pulse, the zero track is synchronized once

7.6.46 Delay elements (DIGDEL)

Purpose

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

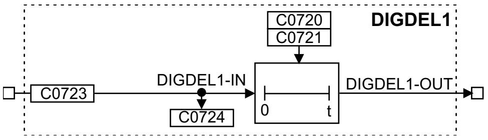


Fig. 7-144 Delay element (DIGDEL1)

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

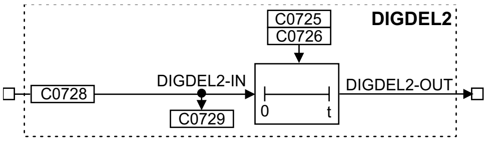


Fig. 7-145 Delay element (DIGDEL2)

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
- dropout delay
- general delay

7.6.46.1 On-delay

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

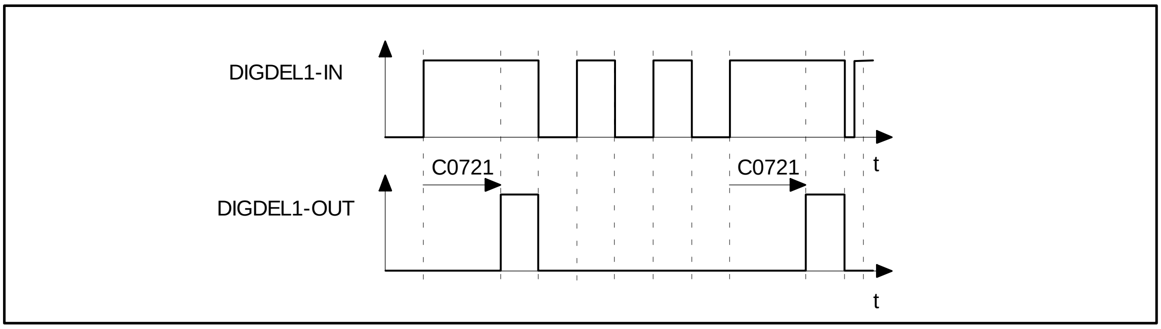


Fig. 7-146 On-delay (DIGDEL1)

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.

7.6.46.2 Dropout delay

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

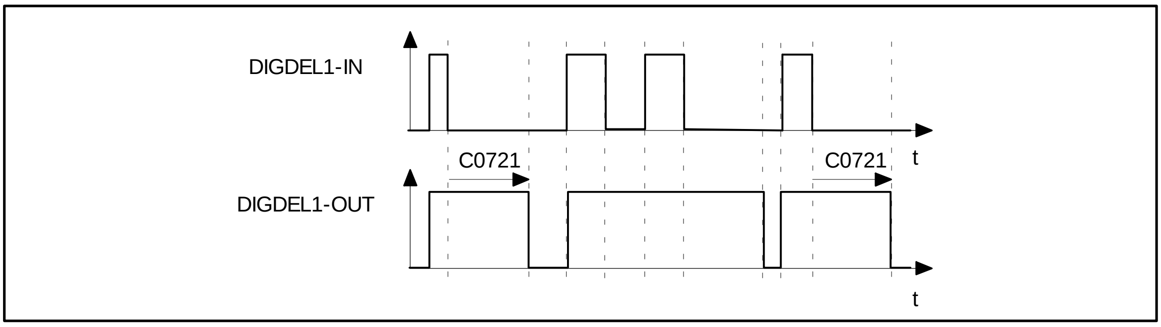


Fig. 7-147 Dropout delay (DIGDEL1)

- 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.

7.6.46.3 General delay

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

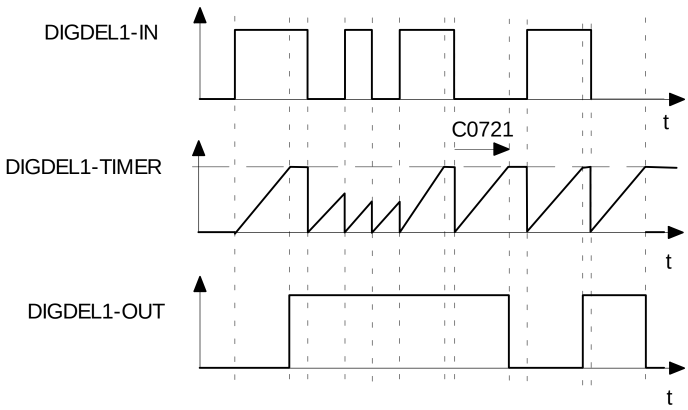


Fig. 7-148 General delay

- 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.

7.6.47 Freely assignable digital inputs (DIGIN)

Purpose

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

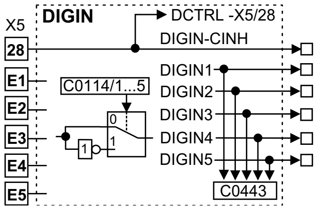


Fig. 7-149 Freely assignable digital inputs (DIGIN)

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)

7.6.48 Freely assignable digital outputs (DIGOUT)

Purpose

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

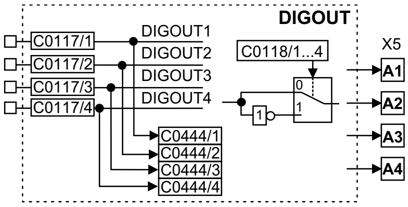


Fig. 7-150 Freely assignable digital outputs (DIGOUT)

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)

7.6.49 Free analog display code (DISA)

One function block (DISA) is available.

Purpose

Display analog values in the following formats:

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

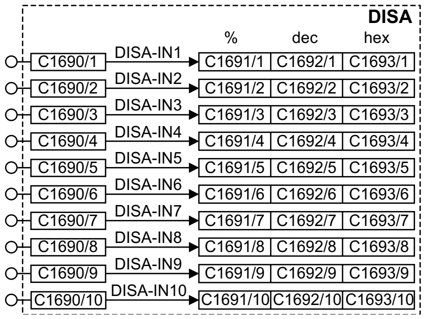


Fig. 7-151 Function block DISA

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			

Function block library

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			

7.6.50 Free long display code (DISPH)

One function block (DISPH) is available.

Purpose

Display long values.

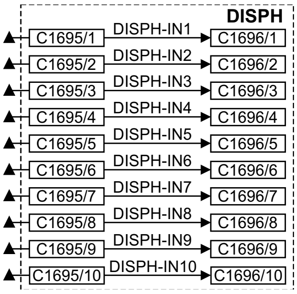


Fig. 7-152 Function block DISPH

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	-

7.6.51 First order derivative-action element (DT1)

Purpose

Derivative action of signals

For instance, used for the speed injection (dv/dt).

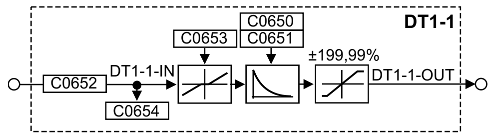


Fig. 7-153 First order derivative-action element (DT1-1)

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.

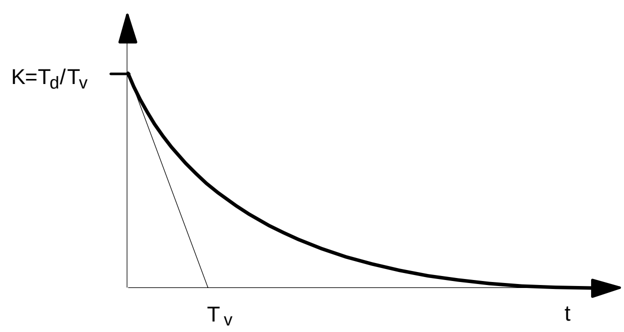


Fig. 7-154 Delay time T_v of the first order derivative-action element

7.6.52 Free piece counter (FCNT)

Purpose

Digital up/down counter.

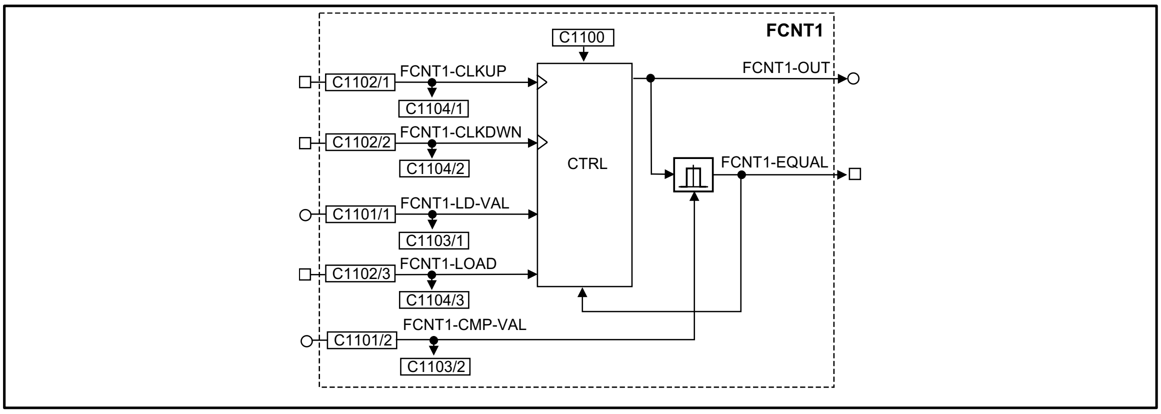


Fig. 7-155 Free piece counter (FCNT1)

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	Start value
FCNT1-LOAD	d	C1104/3	bin	C1102/3	2	• HIGH = Accept start 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

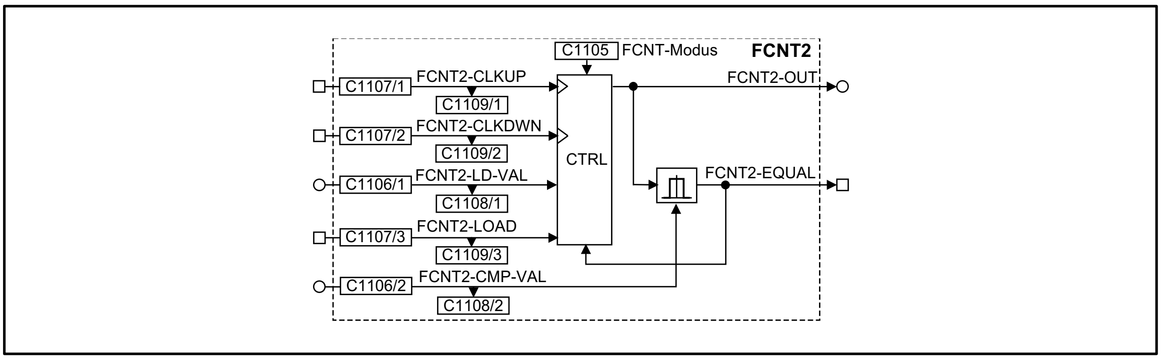


Fig. 7-156 Free piece counter (FCNT2)

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

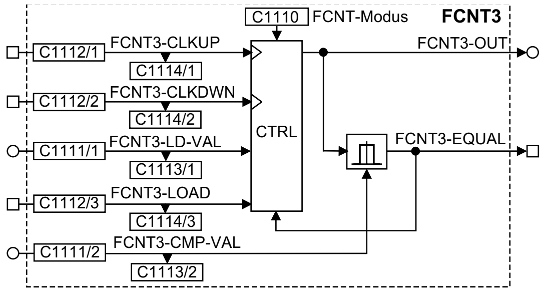


Fig. 7-157 Free piece counter (FCNT3)

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

- For | counter | ≥ | FCNT1-CMP-VAL | (comparison value):
  – For 1 ms FCNT1-EQUAL = HIGH
  – Resets the counter to the start value (FCNT1-LD-VAL)

Tip!

If the signal is to be set for a longer time, e.g. when the output is requested by a PLC, you can extend the signal with the TRANS function block.

C1100 = 2

- For | counter | = | FCNT1-CMP-VAL | (comparison value):
  – The counter stops
- FCNT1-LOAD = HIGH resets the counter to the start value (FCNT1-LD-VAL)

7.6.53 Free codes (FCODE)

2 x 16 free codes are available:
FCODE1476/1-16 and FCODE1477/1-16

Purpose

Input of length-related setpoints in physical units

Function

FCODE1476/1 -16

Input in [m_units]. (Measuring system of the master value)

FCODE1477/1 -16

Input in [s_units]. (Measuring system of the curve drive)

STOP

Stop!

The codes for the determination of the scaling factors (gearbox factors, feeding factors) affect the conversion of the units in incremental values.

Master units: C1303/1; C1303/2; C1304

Slave units: C1305/1; C1305/2; C1306

7.6.54 Free digital outputs (FDO)

Purpose

This function block is used to switch digital signals via C0151, via the function block AIF-OUT and via the function block CAN-OUT, to the connected fieldbus systems.

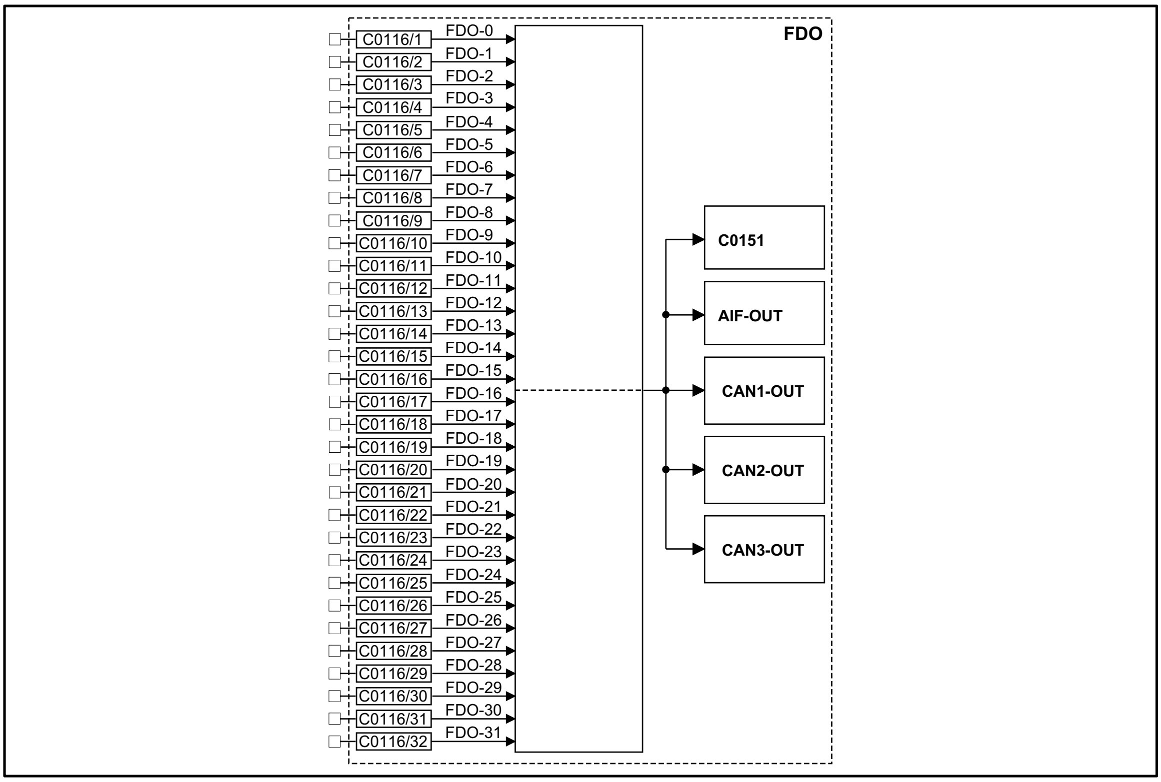


Fig. 7-158 Free digital outputs (FDO)

Function block library

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.

7.6.55 Freely assignable input variables (FEVAN)

Purpose

Transfer of analog signals to any code. At the same time, the FB converts the signal to the data format of the target code.

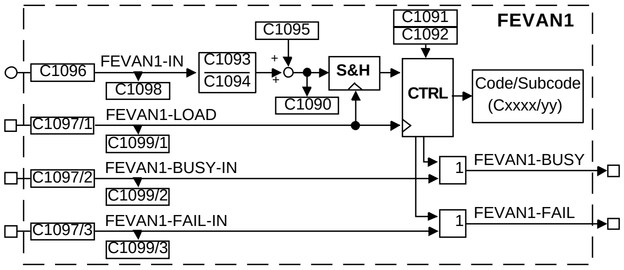


Fig. 7-159 Freely assignable input variables (FEVAN1)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN1-IN	a	C1098	dec	C1096	1	Input value
FEVAN1-LOAD	d	C1099	bin	C1097	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN1-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN1-FAIL	d	-	-	-	-	• HIGH = transmission failed – A LOW-HIGH edge at FEFAN1-LOAD switches FEFAN1-FAIL = LOW.
-	-	C1090	-	-	-	Display of the converted signal

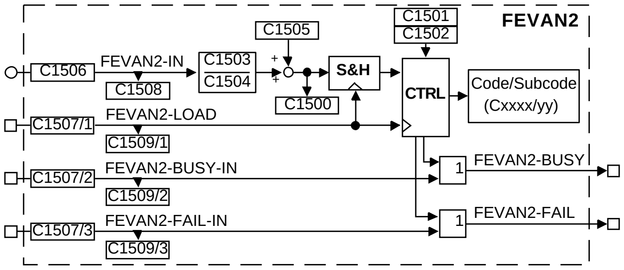


Fig. 7-160 Freely assignable input variables (FEVAN2)

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
FEVAN2-IN	a	C1508	dec	C1506	1	Input value
FEVAN2-LOAD	d	C1509	bin	C1507	2	A LOW-HIGH edge transmits the converted signal to the target code.
FEVAN2-BUSY	d	-	-	-	-	HIGH = transmitting
FEVAN2-FAIL	d	-	-	-	-	• HIGH = transmission failed – A LOW-HIGH edge at FEFAN2-LOAD switches FEFAN2-FAIL = LOW.
-	-	C1500	-	-	-	Display of the converted signal

Function block library

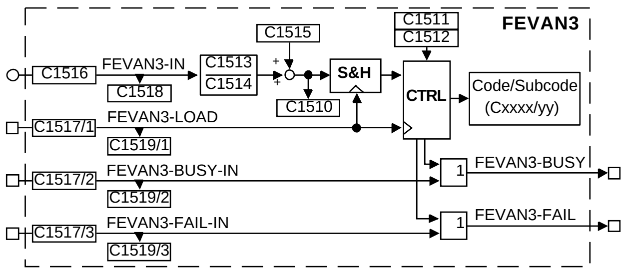


Fig. 7-161 Freely assignable input variables (FEVAN3)

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

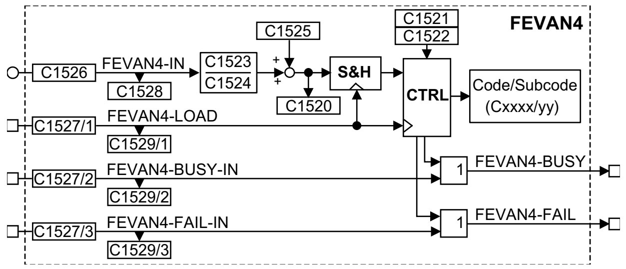


Fig. 7-162 Freely assignable input variables (FEVAN4)

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	LOW-HIGH edge
FEVAN4-BUSY-IN	d	C1529/2	bin	C1527/2	2	HIGH = transmitting Set signals from external
FEVAN4-FAIL-IN	d	C1529/3	bin	C1527/3	2	High = transmission failed
FEVAN4-BUSY	d	-	-	-	-	transmitting
FEVAN4-FAIL	d	-	-	-	-	Transmission failed
-	-	C1520	-	-	-	Display of the converted signal

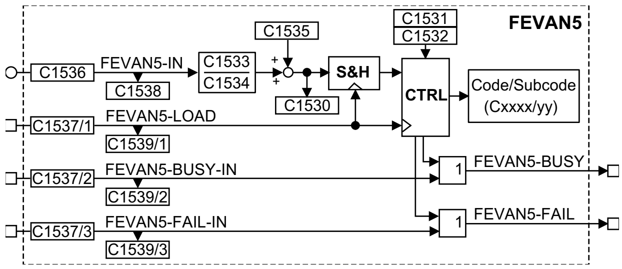


Fig. 7-163 Freely assignable input variables (FEVAN5)

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	LOW-HIGH edge
FEVAN5-BUSY-IN	d	C1539/2	bin	C1537/2	2	HIGH = transmitting Set signals from external
FEVAN5-FAIL-IN	d	C1539/3	bin	C1537/3	2	High = transmission failed
FEVAN5-BUSY	d	-	-	-	-	transmitting
FEVAN5-FAIL	d	-	-	-	-	Transmission failed
-	-	C1530	-	-	-	Display of the converted signal

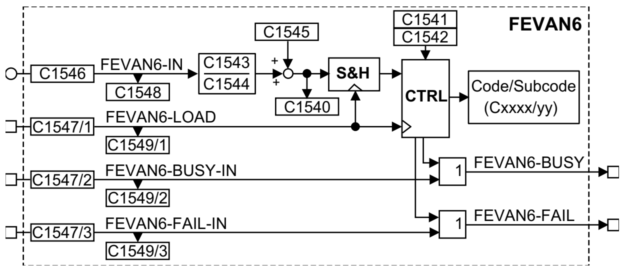


Fig. 7-164 Freely assignable input variables (FEVAN6)

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	LOW-HIGH edge
FEVAN6-BUSY-IN	d	C1549/2	bin	C1547/2	2	HIGH = transmitting Set signals from external
FEVAN6-FAIL-IN	d	C1549/3	bin	C1547/3	2	High = transmission failed
FEVAN6-BUSY	d	-	-	-	-	transmitting
FEVAN6-FAIL	d	-	-	-	-	Transmission failed
-	-	C1540	-	-	-	Display of the converted signal

Function block library

Function

- Conversion of the read data via:
  – Numerator, denominator
  – Offset
- Selection of a target code for the data read.

Codes for the conversion of the data read and for the selection of the target code:

Function block	Numerator	Denominator	Offset	Selection of the target code		
				Code	Subcode	Examples
FEVAN1	C1093	C1094	C1095	C1091	C1092	
FEVAN2	C1503	C1504	C1505	C1501	C1502	

Data transmission

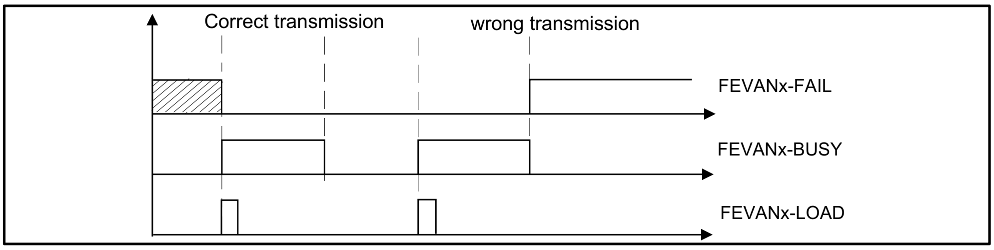


Fig. 7-165 Signal flow

Transmission errors can occur, if:

- the target code is not available
- the target subcode is not available
- the transmitted data are out of the target code limits
- the target code is inhibited since it can only be written if the controller is inhibited.Set controller inhibit (see code table).

Cyclic data transmission

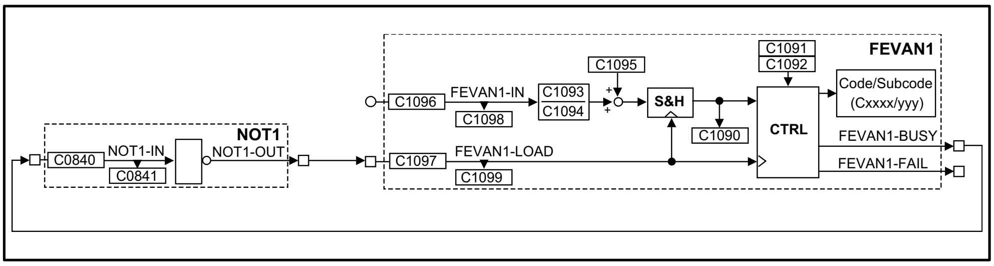


Fig. 7-166 Example for a cycle data transmission to a target code

Conversion

In the example, the conversion is performed at FB FEVAN1.

- The data format of the target code is important for the conversion (see attribute table, chapter 7.11).
- Adapt input signal to the data format of the target code:
  – C1093 (numerator)
  – C1094 (denominator).
- C1094 also fixes the decimal code of the target code:
  – Set C1094 corresponding to the existing decimal codes of the target code. The number of decimal codes can be obtained from the code table.
  – 0.0001 ≙ no decimal codes
  – 0.001 ≙ one decimal code
  – 0.01 ≙ decimal codes
  – 0.1 ≙ three decimal codes
  – 1 ≙ four decimal codes
- For target codes with percentage standardization, the formula for the conversion must include a scaling factor (see example 1).

Example 1 (only for FIX32 format with percentage scaling):

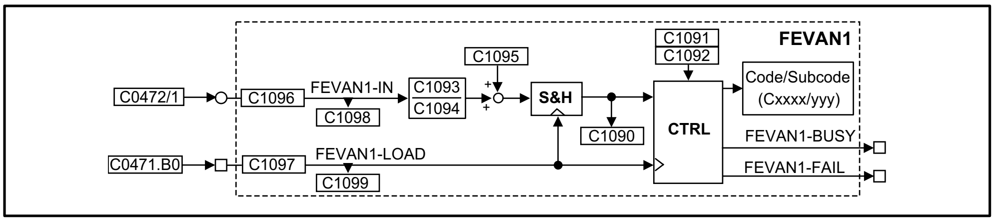


Fig. 7-167 Example of a circuit for FIX32 format with percentage scaling

Task:

- C0472/1 = 1.05 %. Write this value to C0141.

Configuration:

- Connect FEVAN1-IN (C1096) to FCODE-472/1 (19521).
- Connect FEVAN1-LOAD (C1097/1) to FCODE-471.B0 (19521).

Parameterization:

- Set C1091 = 141 (≙ C0141)
- Set C1092=0 (no subcode)
- C1093 = calculate numerator
- Set C1094 = 0.01 (two decimal places)
- Set C1095 = 0 (no offset)

Calculation:

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

Scaling factor   Scaling factor

Control:

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

Example with target C1093:

$$1,05\,\% \cdot 10000 \cdot \frac{100}{16384} \cdot C1094 \cdot \frac{1}{1,05\,\%} = C1093 = 0.6103$$

Setpoint in C0141   FEVAN1-IN

Display:

- C0141 = 1.00 %

Example 2 (only for FIX32 format scaling):

Task:

- C0473/1 = 1000. Write this value to C0011.

Configuration:

- Connect FEVAN1-IN (C1096) to FCODE-473/1 (19551).
- Connect FEVAN1-LOAD (C1097/1) to FCODE-471.B0 (19521).

Parameterization:

- Set C1091 = 11 (≙ C0011)
- Set C1092=0 (no subcode)
- Set C1093 = 1.0
- Set C1094 = 0.0001 (no decimal place)
- Set C1095 = 0 (no offset)

The source code has no unit. The standardization factor is omitted.

Calculation:

$$\text{FEVAN1–IN} \cdot \frac{1}{10000} \cdot \frac{\text{C1093}}{\text{C1094}} + \text{C1095} = \text{C0011 [rpm]}$$

Scaling factor

$$1000 \cdot \frac{1}{10000} \cdot \frac{1,0}{0.0001} + 0 = 1000\ \text{rpm}$$

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 according to the following formula:

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

7.6.56 Fixed setpoints (FIXSET)

Purpose

This function block is used to program a maximum of 15 fixed setpoints and to call them via digital terminals or control codes.

The fixed setpoints can be used e.g. for:

- Different dancer set positions when a dancer position control is used or
- Different stretch ratios (gearbox factor) when a speed ratio control with digital frequency coupling is used

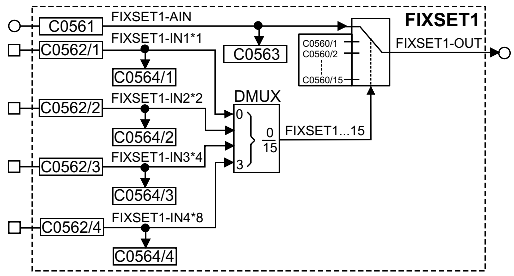


Fig. 7-168 Fixed setpoint (FIXSET1)

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 at all selection inputs FIXSET-INx.
FIXSET1-IN1*1	d	C0564/1	bin	C0562/1	2	1000	The number of inputs to be assigned depends on the number of required FIXSET setpoints.
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 output of the FB can be used as a setpoint source (signal source) for another FB (e.g. process controller, arithmetic block, etc.). The parameterization and handling is the same as for JOG, but it is independent of JOG (see function block NSET).

- Parameterization of the fixed setpoints
  – The individual fixed setpoints are parameterized by the subcodes of C0560.
- Output of the selected fixed setpoint:
  – If the binary inputs are triggered with a HIGH signal, a fixed setpoint from the table is switched to the output.
- Range:
  – The values for the fixed setpoints range from -200% to +200%.

7.6.56.1 Enable of the FIXSET1 setpoints

Number of required fixed setpoints	Number of the inputs to be assigned
1	at least 1
1 ... 3	at least 2
4 ... 7	at least 3
8 ... 15	4

Decoding table of the binary input signals:

Output signal FIXSET1-OUT =	1st input FIXSET1-IN1	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

7.6.57 Flipflop (FLIP)

Purpose

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

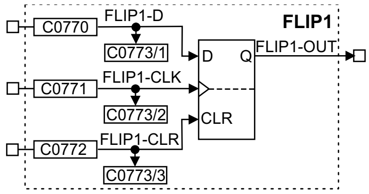


Fig. 7-169 Flipflop (FLIP1)

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	-	-	-	-	-	-

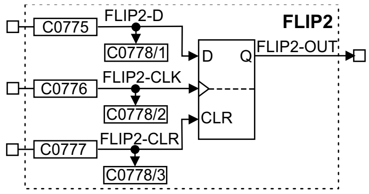


Fig. 7-170 Flipflop (FLIP2)

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	-	-	-	-	-	-

Function

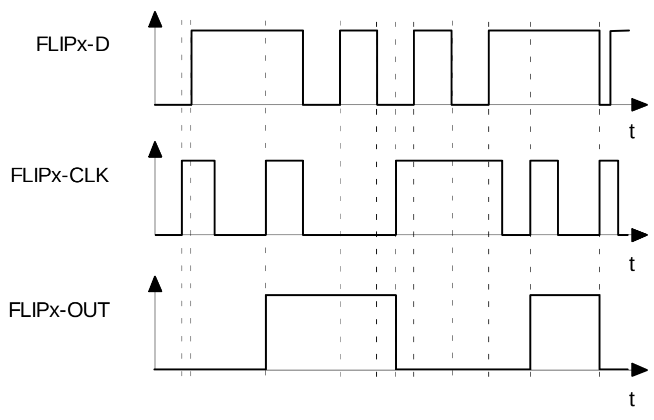


Fig. 7-171 Sequence of a flipflop

- 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 a LOW level and maintained until this input is applied to 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 applied to a HIGH level.

7.6.58 Limiter (LIM)

Purpose

This FB is used to limit signals to ranges which can be set.

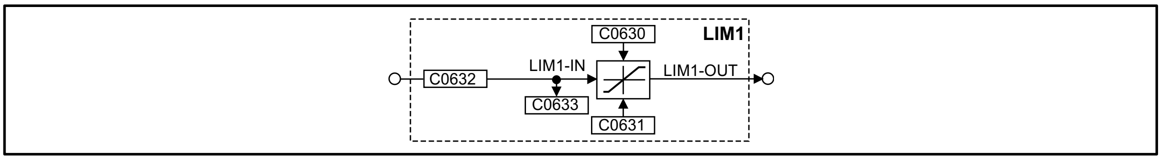


Fig. 7-172 Limiter (LIM1)

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).

7.6.59 Internal motor control (MCTRL)

Purpose

This function block consists of the control of the driving machine, including phase controller, speed controller and motor control.

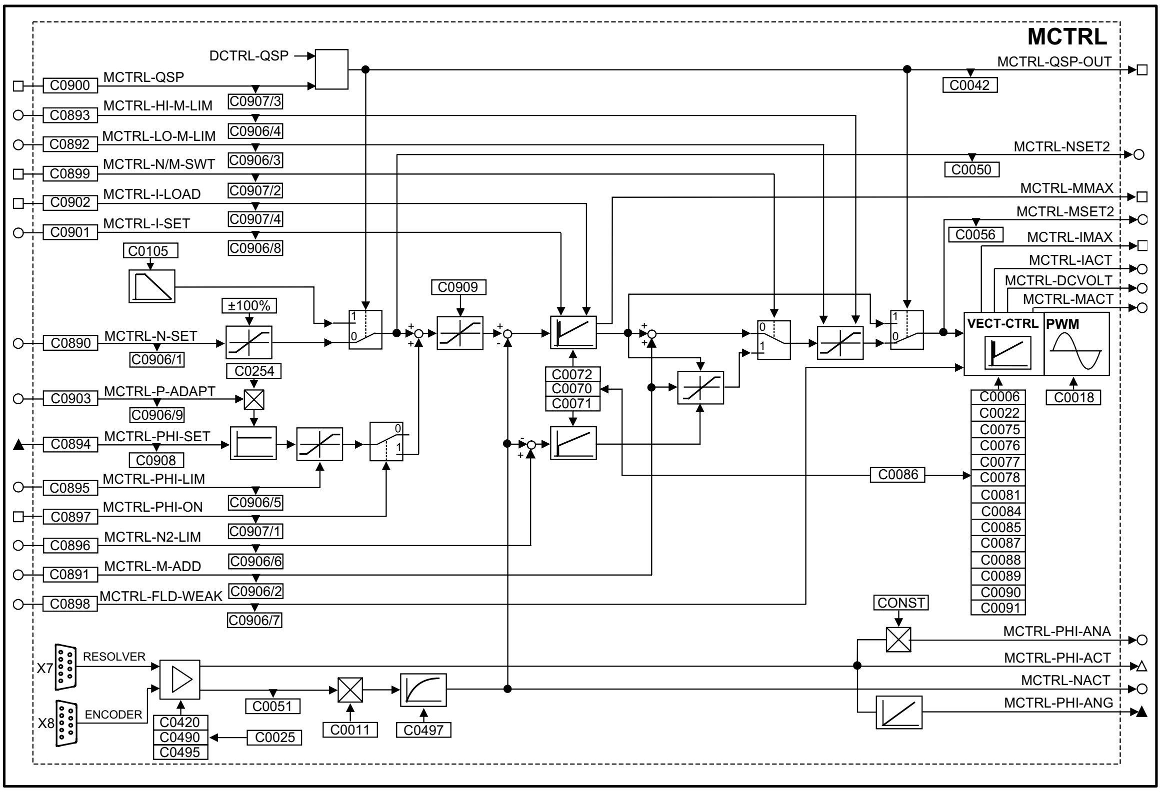


Fig. 7-173 Internal motor control (MCTRL)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
MCTRL-PHI-SET	ph	C0908	dec [inc]	C0894	3	1000	Input phase controller for difference between set and actual phase
MCTRL-N-SET	a	C0906/1	dec [%]	C0890	1	5050	Input speed setpoint
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 limit in % of C0057
MCTRL-HI-MLIM	a	C0906/4	dec [%]	C0893	1	19523	Upper torque limit in % of C0057
MCTRL-PHI-LIM	a	C0906/5	dec [%]	C0895	1	1006	Influence of the phase controller in % of nmax C0011
MCTRL-N2-LIM	a	C0906/6	dec [%]	C0896	1	1000	Lower speed limit for speed limit
MCTRL-FLDWEAK	a	C0906/7	dec [%]	C0898	1	1006	Motor excitation
MCTRL-I-SET	a	C0906/8	dec [%]	C0901	1	1006	Input to set the I-component of the speed controller
MCTRL-P-ADAPT	a	C0906/9	dec [%]	C0903	1	1006	Influence in % on VP of C0254; the absolute value (without sign) is processed
MCTRL-PHI-ON	d	C0907/1	bin	C0897	2	1000	HIGH = Activate phase controller
MCTRL-N/M-SWT	d	C0907/2	bin	C0899	2	1000	LOW = speed control active HIGH = torque control active
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-PHI-ACT	phd	-	-	-	-	-	
MCTRL-PHI-ANG	ph	-	-	-	-	-	65536 inc = one revolution
MCTRL-NACT	a	-	-	-	-	-	in % of nmax (C0011)
MCTRL-PHI-ANA	a	-	-	-	-	-	Actual phase as analog signal 90 degree = 100%
MCTRL-MACT	a	-	-	-	-	-	in % of Mmax (C0057)
MCTRL-MSET2	a	-	-	-	-	-	in % of Mmax (C0057)
MCTRL-NSET2	a	-	-	-	-	-	in % of nmax (C0011)
MCTRL-DCVOLT	a	-	-	-	-	-	100% = 1000V
MCTRL-QSP-OUT	d	-	-	-	-	-	HIGH = Drive performs QSP
MCTRL-MMAX	d	-	-	-	-	-	HIGH = Speed controller operates within its limit
MCTRL-IMAX	d	-	-	-	-	-	HIGH = Drive operates at its current limit C0022
MCTRL-IACT	a	-	-	-	-	-	-

Function

- Current controller
- Torque limit
- Additional torque setpoint
- Speed controller
- Torque control with speed limit
- Limit for speed setpoint
- Phase controller
- Quick stop QSP
- Field weakening
- Chopping frequency change-over

7.6.59.1 Current controller

Adapt current controller under C0075 (proportional gain) and C0076 (adjustment time) to the connected machine.

Tip!

Set a suitable motor from the motor selection list under C0086. (📖 7-380)
This automatically sets the parameters of the current controller correctly.

7.6.59.2 Additional torque setpoint

Depending on the triggering of the input MCTRL-IN/M-SWT, the input MCTRL-M-ADD serves as a torque setpoint or an additional torque setpoint. The additional torque setpoint can be used, for example for friction compensation or for speed injection (dv/dt).

- With MCTRL-N/M-SWT = LOW the speed control is active.
  – MCTRL-M-ADD is added to the output of the n-controller.
  – the limits set by the torque limit MCTRL-LO-M-LIM and MCTRL-HI-M-LIM cannot be exceeded.
- With MCTRL-N/M-SWT = HIGH the torque control is active.
  – MCTRL-M-ADD acts as a torque setpoint.
  – The n-controllers have a monitoring function.
- The torque setpoint is provided in [%] of the maximum torque (see code C0057).
  – negative values mean a torque with CCW rotation of the motor.
  – positive values mean a torque with CW rotation of the motor

7.6.59.3 Torque limiting

An external torque limit can be set by the inputs MCTRL-LO-M-LIM and MCTRL-HI-M-LIM. This means that different torques can be set 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 limiting is deactivated.

Stop!

Only set positive values in MCTRL-HI-M-LIM and negative values in MCTRL-LO-M-LIM, otherwise the speed controller may lose control.The drive may accelerate accidentally.

7.6.59.4 Speed controller

The speed controller is designed as an ideal PID - controller.

Parameter setting

When a motor from the table in chapter 5.2 is selected under C0086, the parameters are set so that only very few adjustments to the application are necessary, if any.

- For parameter setting of the proportional gain Vp under C0070
  – Enter approx. 50 % setpoint speed
  – Increase C0070, until the drive becomes instable (observe motor noises).
  – Reduce C0070, until the drive becomes stable again.
  – Reduce C0070 to approx. 50 %
- For parameter setting of the adjustment time Tn under C0071.
  – Reduce C0071, until the drive becomes instable (observe motor noises).
  – Increase C0071, until the drive becomes stable again.
  – Set C0071 to approx. twice the value.
- For parameter setting of the difference gain Td under C0072.
  – Increase C0072 during operation until an optimum control behaviour is achieved.

Signal limiting

When the drive outputs the maximum torque, the speed controller is at its limit.

- The drive cannot follow the speed setpoint.
- This state is shown by MCTRL-MMAX = HIGH.

Set 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 the input MCTRL-I-SET as its integral component.
  – The value at the input MCTRL-I-SET acts as a torque setpoint for the motor control.
- MCTRL-I-LOAD = LOW
  – Function switched off.

7.6.59.5 Torque control with speed limiting

This function is activated by MCTRL-N/M-SWT = HIGH. For the speed limit, a second speed controller (auxiliary speed controller) is connected.

- MCTRL-M-ADD acts as a bipolar torque setpoint.
- n-controller 1 generates the upper speed limit.
  – The upper speed limit is provided in [%] at the input MCTRL-N-SET by nmax C0011 (positive sign for CW rotation).
  – The upper speed limit should only be used for CW rotation.
- n-controller 2 (auxiliary controller) generates the lower speed limit.
  – The lower speed limit is provided in [%] at the input MCTRL-N2-LIM by nmax C0011 (negative sign for CCW rotation).
  – The lower speed limit should only be used for CCW rotation.

7.6.59.6 Limiting of setpoint speed

The speed setpoint in the input MCTRL-N-SET is limited to + 100% of nmax (C0011).

A limit of the direction of rotation for the speed setpoint can be set under C0909.

7.6.59.7 Phase controller

The phase controller is required to achieve phase synchronization and driftfree standstill.

Tip!

Select a configuration with digital frequency coupling under C0005. This allows an automatic connection of all important signals. On this basis, you can optimize the system.

Activate phase controller

1. Configure a signal source under C0894, which provides the phase difference between set and actual phase (see ”digital frequency - configurations under C0005”).
2. Enter a value > 0 at the input MCTRL-PHI-LIM.
3. Trigger the input MCTRL-PHI-ON with HIGH (e.g. FIXED1).
4. Set the gain of the phase controller C0254 > 0 (see chapter 7.6.59.4)
   – Before setting C0254, select a P-gain C0070 for the n-controller as high as possible.
   – During operation, increase C0254, until the drive shows the desired control behaviour.

Phase controller influence

The output of the phase controller is added to the speed setpoint.

- If the actual phase is lagging, the drive is accelerated
- If the actual phase is leading, the drive is decelerated, until the desired phase synchronization is achieved.

The influence of the phase controller consists of:

- Phase difference multiplied by the P-gain C0254
- Additional influence via analog signal at MCTRL-P-ADAPT
- Limit of the phase controller output to + MCTRL-PHI-LIM

Limitation of the phase controller output

This limits the maximum speed-up of the drive in the event of large phase differences.

7.6.59.8 Quickstop QSP

The quick stop function is used to stop the drive independently of the setpoint input, within a time to be set.

The quick stop function is active,

- if the input MCTRL-QSP is triggered with HIGH.
- if the controller is triggered through the control words (DCTRL).

Function:

- If torque control is selected, this will be deactivated. The drive is controlled by the speed controller.
- The speed decelerates with the deceleration rate set under C0105 to zero speed.
- The torque limits MCTRL-LO-M-LIM and MCTRL-HI-M-LIM are deactivated.
- The phase 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 cannot supply the maximum torque.

7.6.59.9 Field weakening

The field weakening does not have to be set if the motor type was set under under C0086. All necessary settings are done automatically. The motor is operated in the field weakening, if:

- the output voltage of the controller exceeds the rated motor voltage set under C0090.
- the controller can no longer increase the output voltage with increasing speed, due to the mains voltage or DC bus voltage.

Manual field weakening

A manual field weakening is possible via the input MCTRL-FLD-WEAK. For a maximum excitation, this input must be triggered with +100% (e.g.FIXED100%).

STOP

Stop!

The available torque is reduced by the field weakening.

7.6.59.10 Chopping frequency change-over

The chopping frequency of the inverter can be selected:

- 8 kHz fixed, for operation with optimum power (C0018 = 1)
  – maximum power output of the controller, but with audible pulse operation
- 16 kHz fixed, for operation with optimum noise (C0018 = 2)
  – inaudible pulse operation of the controller,but with reduced power (torque)
- automatic change-over between operation with optimum power and optimum noise (C0018 = 0)

Automatic chopping frequency change-over

The automatic chopping frequency change-over can be used if the drive is to be operated with optimum noise, but the torque available in this mode is not sufficient for accelerations.

Condition M = f(I)	Function
$M < M_{r16}$ (I_{r16})	Controller operates with 16 kHz (optimum noise)
M_{r16} (I_{r16}) $< M < M_{r8}$ (I_{r8})	Controller changes to 8 kHz (optimum power)
$M > M_{max8}$ (I_{max8})	Controller operates with 8 kHz in its current limit

7.6.60 Motor potentiometer (MPOT)

Purpose

The FB replaces a hardware motor potentiometer.

The motor potentiometer is used as an alternative setpoint source which is triggered by two terminals.

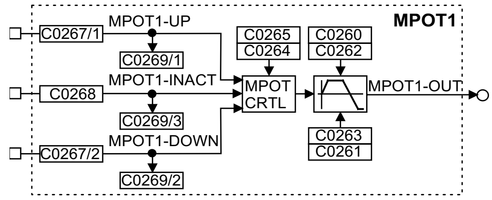


Fig. 7-174 Motor potentiometer (MPOT1)

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.
- MPOT1-DOWN = HIGH
  – The motor potentiometer approaches its lower limit.
- MPOT1-UP = LOW and MPOT1-DOWN = LOW or
  MPOT1-UP = HIGH and MPOT1-DOWN = HIGH:
  – The motor potentiometer does not change its output signal.

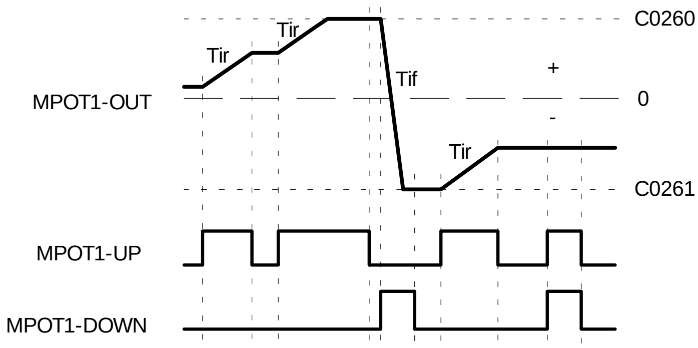


Fig. 7-175 Control signals of the motor potentiometer

Another digital input (MPOT1-INACT) exists apart from the two digital inputs MPOT1-UP and MPOT1-DOWN. The motor potentiometer function can be activated or deactivated with the input MPOT1-INACT. Logic 1 at this input activates 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. Under C0264, you can set the following functions:

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 its lower limit (C0261) with the corresponding deceleration time
3	The motor potentiometer immediately changes its output to 0%. (important for emergency stop function)
4	The motor potentiometer immediately changes its output to the lower limit (C02619
5	The motor potentiometer approaches its upper limit (C0260) with the corresponding acceleration time

If the motor potentiometer is activated (input MPOT1-INACT = 0), the subsequent function depends on

- the momentary output signal,
- the set limits of the MPOT
- the control signals UP and DOWN.

If the output value is out of the limits, the MPOT approaches the next limt 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 limits, the output follows the selected control function UP, DOWN or no action.

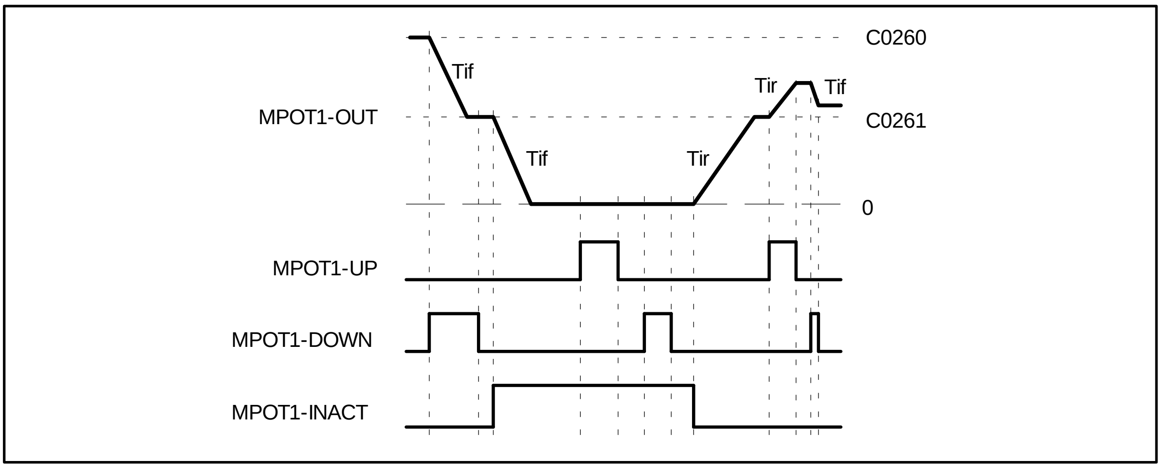


Fig. 7-176 Deactivation of the motor pot via the input MPOT1-INACT

Initialization

With this function, the output value MPOT can be saved non-volatile in the internal memory of the device. The values is saved automatically if this function was selected under the code. The values is then restored to the MPOT after mains connection.

You can activate other initialization functions under C0265 (see code table).

If the initialization is completed, the MPOT follows the applied control function.

7.6.61 Logic NOT (NOT)

Purpose

Logic inversion of digital signals. The inversion can be used for the control of functions or the generation of status information.

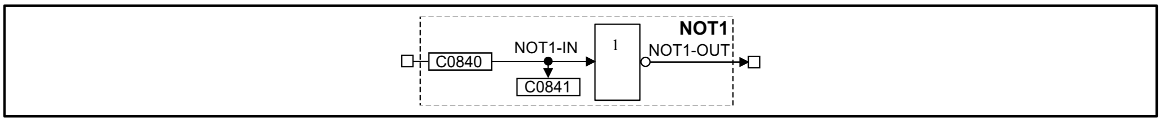


Fig. 7-177 Logic NOT

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

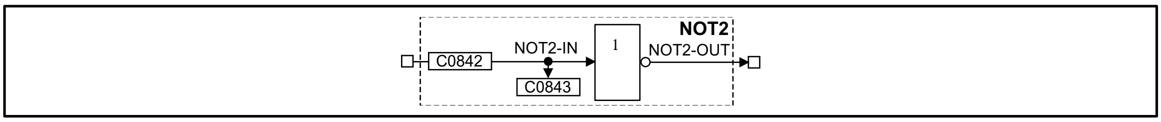


Fig. 7-178 Logic NOT (NOT2)

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

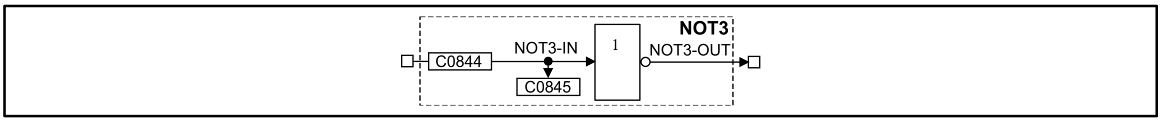


Fig. 7-179 Logic NOT (NOT3)

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

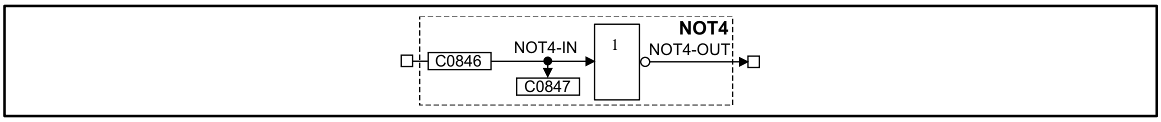


Fig. 7-180 Logic NOT (NOT4)

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

Function block library

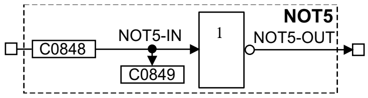


Fig. 7-181 Logic NOT (NOT5)

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 a normally-open contact to a normally-closed contact in a control with contactors.

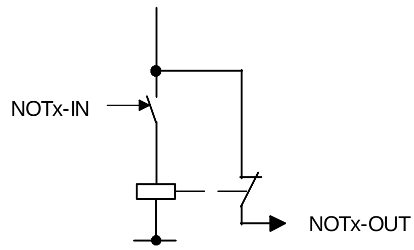


Fig. 7-182 Function of NOT as a change from a normally-open to a normally-closed contact

7.6.62 Conditioning of the setpoint speed (NSET)

Purpose

This FB conditions the

- main setpoint speed and
- and additional setpoint (or other signals)

for the subsequent control structure via ramp generator or fixed speeds.

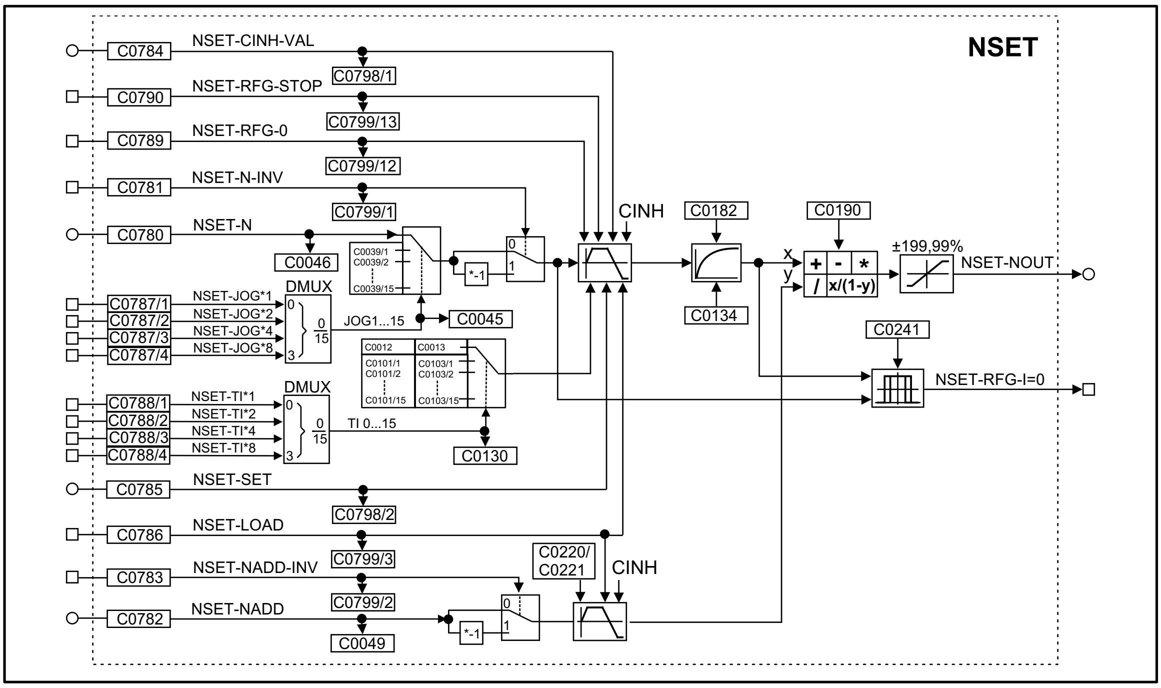


Fig. 7-183 Conditioning of the setpoint speed (NSET)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
NSET-N	a	C0046	dec [%]	C0780	1	50	Provided for main setpoint; other signals are permissible
NSET-NADD	a	C0047	dec [%]	C0782	1	5650	Provided for additional setpoint; other signals are permissible
NSET-JOG*1	d	C0799/4	bin	C0787/1	2	53	Selection and control of overriding "fixed setpoints" for the main setpoint
NSET-JOG*2	d	C0799/5	bin	C0787/2	2	1000	
NSET-JOG*4	d	C0799/6	bin	C0787/3	2	1000	
NSET-JOG*8	d	C0799/7	bin	C0787/4	2	1000	
NSET-TI*1	d	C0799/8	bin	C0788/1	2	1000	Selection and control of alternative "fixed setpoints" for the main setpoint
NSET-TI*2	d	C0799/9	bin	C0788/2	2	1000	
NSET-TI*4	d	C0799/10	bin	C0788/3	2	1000	
NSET-TI*8	d	C0799/11	bin	C0788/4	2	1000	
NSET-N-INV	d	C0799/1	bin	C0781	2	10251	Control of the signal inversion for the main setpoint
NSET-NADD-INV	d	C0799/2	bin	C0783	2	1000	Control of the signal inversion for the additional setpoint
NSET-RFG-0	d	C0799/12	bin	C0789	2	1000	The main setpoint integrator is led to zero via the momentary T_i times
NSET-RFG-STOP	d	C0799/13	bin	C0790	2	1000	Holding (freezing) of the main setpoint integrator to its momentary value
NSET-CINH-VAL	a	C0798/1	dec [%]	C0784	1	5001	The signal is generated which the main setpoint integrator is to be accepted when the controller is inhibited
NSET-SET	a	C0798/2	dec [%]	C0785	1	5000	The signal is generated which the main setpoint integrator is to be accepted when the NSET-LOAD input is set
NSET-LOAD	d	C0799/3	bin	C0786	2	5001	Control of the two ramp generators in special situations e.g. QSP
NSET-OUT	a	-	-	-	-	-	-
NSET-RFG-I=0	d	-	-	-	-	-	-

Function

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

7.6.62.1 Main setpoint channel

- The signals in the main setpoint channel are limited to the range of ±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 switches the input to inactive. The following signal conditioning uses the JOG value instead.

7.6.62.2 JOG setpoints

- These are fixed values which are saved 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 the enabling of the JOG values (calling from the memory) is carried out according to the following table:

Output signal	1st input NSET-JOG*1	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

- If all inputs are assigned with 0, the input NSET-N is active.
- The number of inputs which you must assign, depends on the number of the required JOG setpoints. A maximum of four inputs and thus 15 possibilities can be selected. The digital signal source is assigned under C0787 and the corresponding subcode.

Number of the required JOG setpoints	Number of the inputs to be assigned
1	at least 1
1 ... 3	at least 2
4 ... 7	at least 3
8 ... 15	4

Function block library

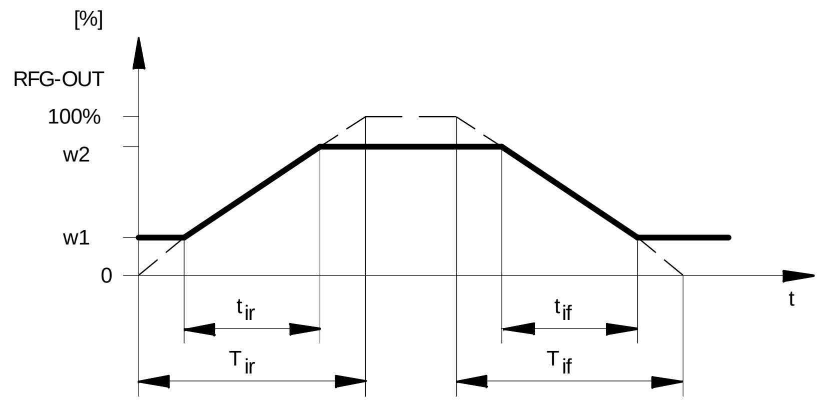
7.6.62.3 Setpoint inversion

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 a HIGH signal.

Ramp generator for the main setpoint

The setpoint is then led via a ramp generator with linear characterisitc. Setpoint step-changes are thus transformed into a ramp.



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

Fig. 7-184 Acceleration and deceleration times of the ramp generator

- The ramps can be adjusted separately for acceleration and deceleration.
  - – 16 acceleration and deceleration times can be switched active via the inputs NSET-TI*x (for table and function see JOG setpoints; they are decoded according to the signal graphic).
  - – The T_i times can only be activated in pairs.
- The controller inhibit (CINH) is set, the ramp generator accepts the value which was applied at 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 generator is stopped. Changes at the input of the ramp generator have no effect on the output.
- NSET-RFG-0 = HIGH
  - – The ramp generator decelerates to zero along its deceleration ramp.
- It is also possible to load the ramp 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 the input NSET-SET is accepted by the ramp generator and provided at 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 ouput of RFG is frozen
0	0	1	0	RFG decelerates to zero along the set deceleration ramp
0	0	1	1	
0	1	0	0	RFG accepts the value applied at the input NSET-SET and provides it to its output
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	RFG accepts the value applied at the input NSET-CINH-VAL and provides it to its output
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

7.6.62.4 S ramp

A PT1 element is connected to the linear ramp generator. This arrangement implements an S ramp for an almost jerk-free acceleration and deceleration.

- The PT1 element is connected and disconnected by C0134.
- The time constant is set under C0182.

7.6.62.5 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 under C0190 (see table below).

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 %)

7.6.62.6 Additional setpoint

- An additional setpoint (e.g. a correction signal) can be linked to the main setpoint via the input NSET-NADD.
- The input signal can be inverted via the input NSET-NADD-INV, before it has an effect on the ramp generator. The ramp generator has a linear characteristic with one acceleration and one deceleration time.
- When NSET-LOAD = HIGH the ramp generator is set to zero and held there without considering the T_i times. The same applies when controller inhibit is set.

7.6.63 OR operation (OR)

Purpose

Logic OR operation of digital signals. The operations can be used for the control of functions or the generation of status information.

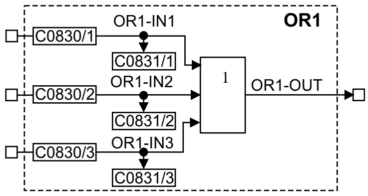


Fig. 7-185 OR operation

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	-	-	-	-	-	-

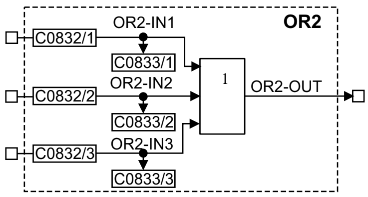


Fig. 7-186 OR operation (OR2)

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	-	-	-	-	-	-

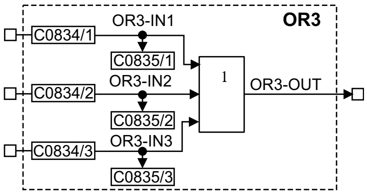


Fig. 7-187 OR operation (OR3)

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	-	-	-	-	-	-

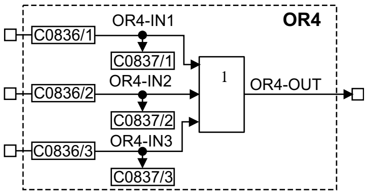


Fig. 7-188 OR operation (OR4)

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	-	-	-	-	-	-

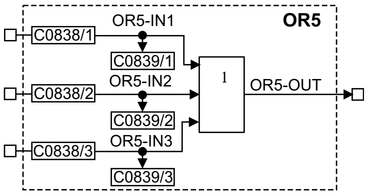


Fig. 7-189 OR operation (OR5)

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 block library

Function

ORx-IN1	ORx-IN2	ORx-IN3	ORx-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 parallel connection of normally-open contacts in a contactor control.

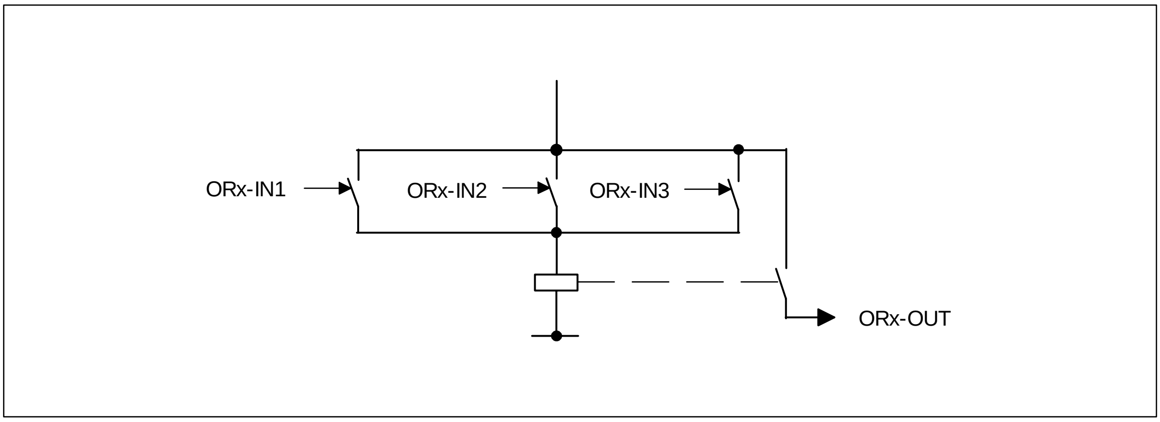


Fig. 7-190 Function of the OR operation as a parallel connection of normally-open contacts

Tip!

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

7.6.64 Oscillоscope function (OSZ)

Purpose

Detection of any measurement variables (e.g. setpoint speed, actual speed, torque, etc.) . They are visualized in Global Drive Control.

Supports the controller commissioning and trouble-shooting.

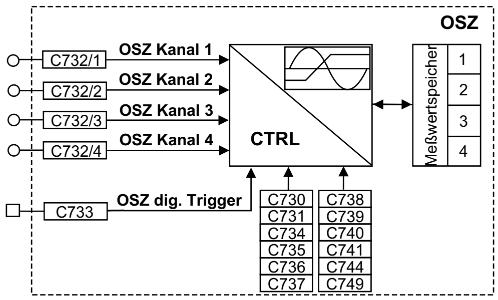


Fig. 7-191 Oscilloscope function (OSZ)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
OSZ CHANNEL 1	a	-	-	C0732/1	1	-	-
OSZ CHANNEL 2	a	-	-	C0732/2	1	-	-
OSZ CHANNEL 3	a	-	-	C0732/3	1	-	-
OSZ CHANNEL 4	a	-	-	C0732/4	1	-	-
OSZ-DIG-TRIGGER	d	-	-	C0733/1	2	-	-

Function

The FB consists of three units:

- Trigger check
  – Monitoring of the digital trigger source for a valid trigger result
- Processing of the measured signal
  – Linking the measurement inputs
  – Calculation of the time
  – Monitoring of the analog trigger source for a valid trigger result
- Memory of the measured values
  – Scaling of the ring buffer memory
  – Filing of the measured data in the ring buffer memory
  – Saving of measured points for the reconstruction of the graphic

Description of the functions

Function	Code	Choice	Description
OSZ mode			Controls the measurement in the controller
	C0730	1	• Starts the recording of the measured values
		0	• Cancels a current measurement
OSZ status			Displays five different operating states
	C0731	1	• Measurement completed – The memory of the measured values is completely filled with data. The measured values can be called by the PC.
		2	• Measurement active – A measurement was started with C0730 = 1. The FB waits for a valid trigger result.
		3	• Trigger recognized – The FB has recognized a valid trigger result. Depending on the trigger delay, the saving of the measured data is not yet completed. It is completed automatically with the entry of the last memory unit.
		4	• Measurement cancelled – Cancelling of the current recording of the measured values (C0730 = 0). The memory of the measured values has been filled with data. The data can be called by the PC.
		5	• Read memory – A memory of the measured data is currently read. No setting is possible in this operating state.
Configuration OSZ channel 1 ... 4	C0732/1 to C0732/4		• Links the measurement channels of the FB with the signals of the process environment – Assignment of four measurement channels with any analog signals is possible. Enter the corresponding signal number in C0732/1 ... C0732/4. – Always start linking with channel 1, then channel 2 and so on. Unused channels are automatically assigned with the signal FIXED 0%.
Configuration OSZ trigger	C0733/1		Links the digital trigger input with a digital signal of the process environment – The trigger input can be assigned with any digital signal. Enter the corresponding signal number in C0733/1.
Trigger source			Determines the trigger source
	C0734	1	The source is one of the four measurement channels C0734/1 ... C0734/4
		0	The source is the digital trigger input (C0733/1)
Trigger level	C0735	-32767 ... 32767	• Determines the trigger level which the triggering releases when the threshold is exceeded. – The trigger level is monitored only when the triggering is done on one of the four channels. – The trigger level is not effective with digital triggering.
Trigger edge			Determines the trigger edge which causes the release of the triggering. • Triggering on analog input channel – With a LOW-HIGH trigger edge, the analog trigger signal must exceed a defined trigger level to release the triggering. – With a HIGH-LOW trigger edge, the analog trigger signal must fall below a defined trigger level to release the triggering. • Triggering on digital trigger input – With a LOW-HIGH trigger edge the digital trigger signal must change from LOW to HIGH to release the triggering. – With a HIGH-LOW trigger edge the digital trigger signal must change from HIGH to LOW to release the triggering. Fig. 7-192displays the triggering of an analog signal with positive edge.
	C0736	1	– HIGH-LOW trigger edge
		0	LOW-HIGH trigger edge

Function	Code	Choice	Description
Trigger delay			The trigger delay determines when the saving of the measured values is started, referring to the trigger time.
	C0737	-100.0 % ... 0 %	• Negative trigger delay (pre-triggering) – Defines a percentage of the complete memory content. This part of the memory content is filled with measured values **before** the triggering (see Fig. 7-193).
		0 % ... 999.9 %	• Positive trigger delay (post triggering) – Defines a percentage of the complete memory content. The measured values are saved **after** the triggering. The delay is defined by the part of this memory content (Fig. 7-192).
Scanning period	C0738	1 ms ... 10 min	• Setting the scanning period – The scanning period is the time between two measurements – The measurements are carried at the same time for all channels (e.g. a value is measured at the channel 1 at the same time as a value at channel 2, 3, or 4. – The scanning period can be set in steps of 1, 2 and 5.
Number of channels	C0739		Number of channels used for measurements
Read memory			The code is necessary if the GDC is not used for visualization.
	C0740/1	0 ... 16383	• Determines the start for the reading of the memory and thus enables the deliberate access to a memory block. – To read the memory part by part (e.g. read only the measured values of a channel or reading with reduced memory size), the start can be shifted.
	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 the data
Information on 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 byte)
	C0741/3		Data size of the measured values (1 byte / 2 bytes)
	C0741/4		Number of the available measurement channels (1 ... 4)
Memory size	C0744	0 ... 6	Set memory size 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) – Change of the memory size from 512 ... 8192 measured values / step – An optimum adaptation of the memory size to the corresponding task reduces the data transmission time.
Information on saving			Information on saving the measured values in the memory The FB saves the data in a ring format. For the reconstruction of the signal sequence, the following three "graphic points" are marked.
	C0749/1		Measured value no. of the time of cancelling
	C0749/2		Measured value no. of the time of triggering
	C0749/3		Measured values no. of the time of completion

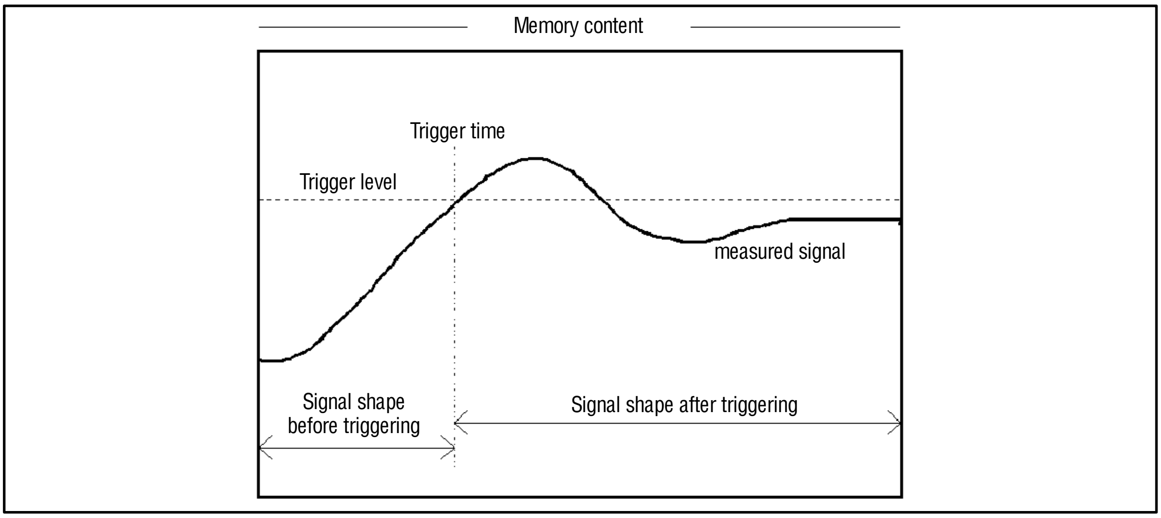


Fig. 7-192 Example: Trigger level and trigger delay with approx. -30 % post triggering

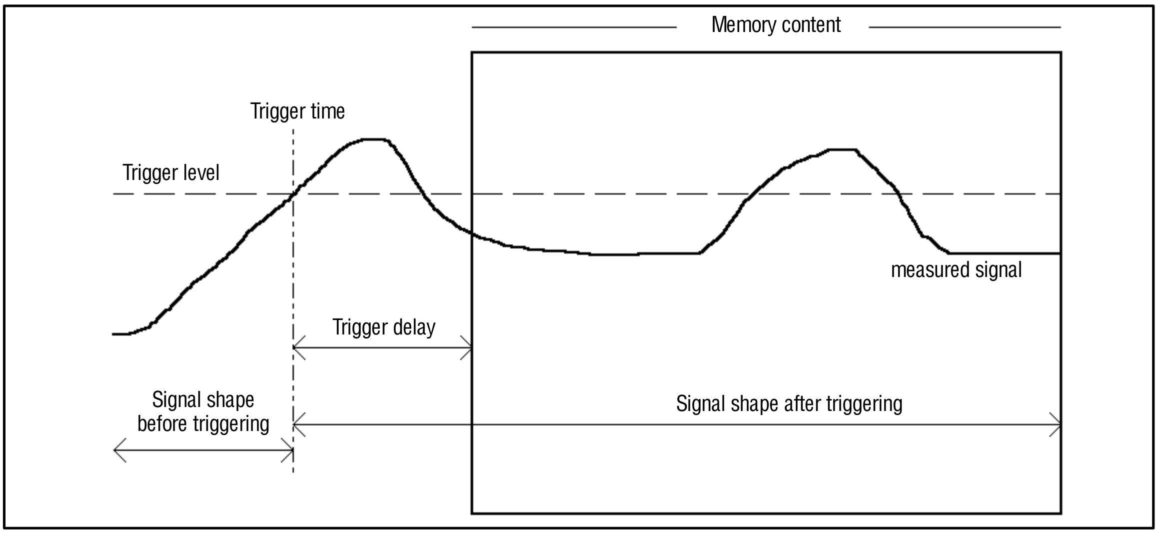


Fig. 7-193 Example: Trigger level and trigger delay with approx. -30% pre-triggering

7.6.65 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 is according to the ideal PID algorithm, but it can also be changed over to a PI or P characteristic.

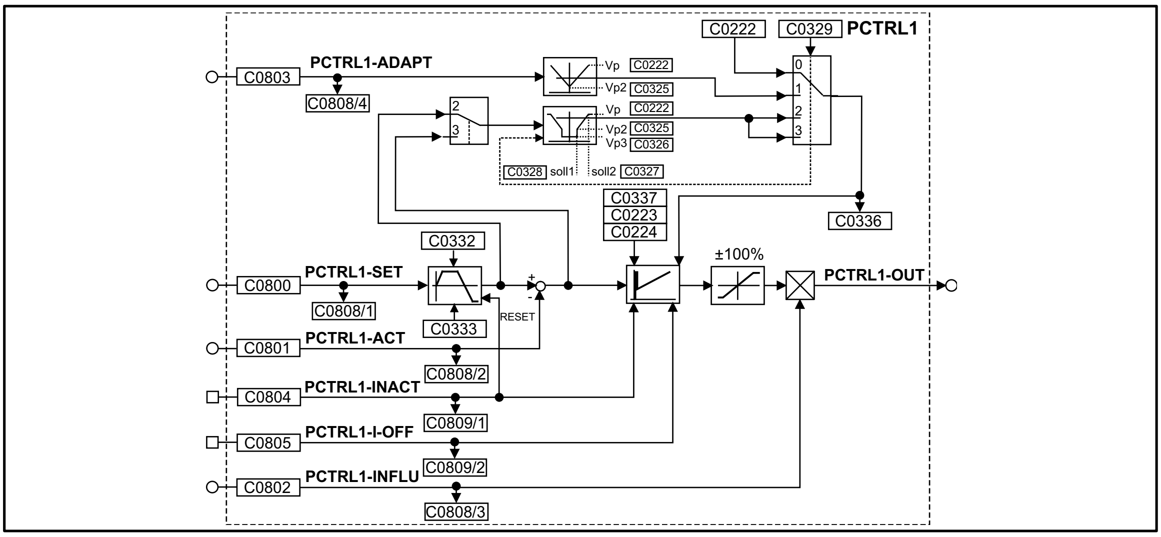


Fig. 7-194 Process controller (PCTRL1)

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 of step-change signals can be decelerated via the ramp 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).

7.6.65.1 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 switched off the I-component
  – PCTRL-I-OFF = LOW switches on the I-component
- The adjustment time is parameterized via C0223.
- The P-gain can be set in different ways. The function for the provision of 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 shape 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 is valid if the input value = 0 %.

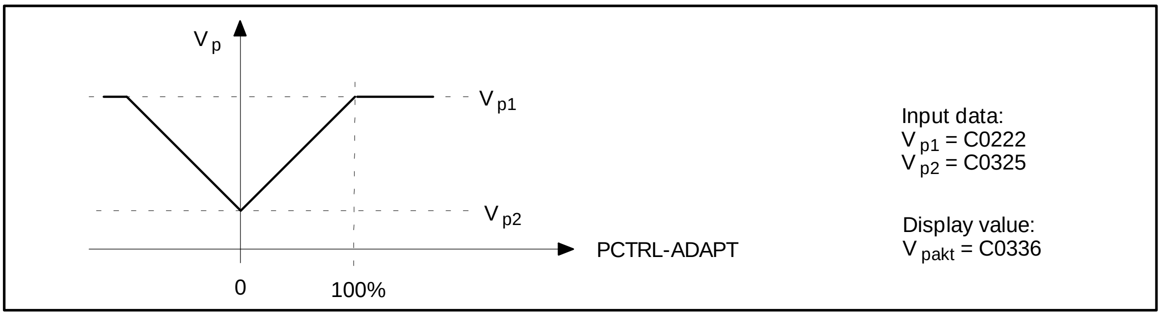


Fig. 7-195 Input of the P-gain via PCTRL-ADAPT input

  – C0329 = 2
  The P-gain is derived from the process setpoint PCTRL-SET. The setpoint is obtained after the ramp generator and calculated via the characteristic with three coordinates.

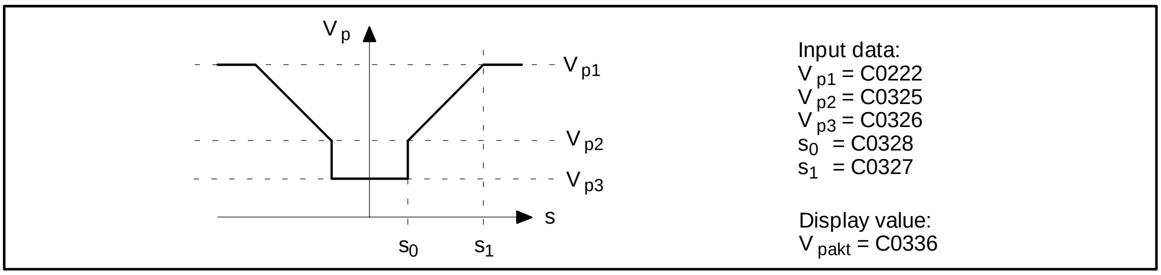
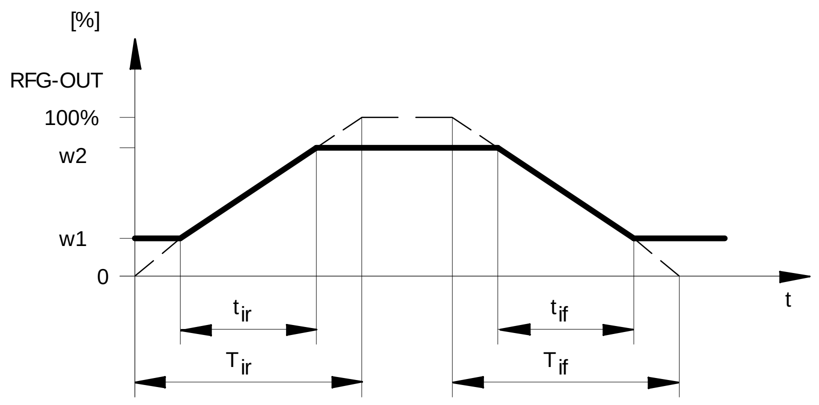


Fig. 7-196 Input of the P-gain derived from the PCTRL-SET process setpoint

  – C0329 = 3
  The input of the P-gain is derived from the control difference and led by the characteristic generation as C0329 = 2.

7.6.65.2 Ramp generator

The setpoint PCTRL-SET is led by a ramp 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. 7-197 Acceleration and deceleration times of the ramp 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 generator is immediately set to zero.

7.6.65.3 Value range of the output signal

- The process controller operates bipolar in the default setting.
  - The output value is limited to +100 %.
- The function can be set unipolar under C0337.
  - The output value is limited to 0 ... +100 %.

7.6.65.4 Evaluation of the output signal

- The output signal can be evaluated after the limitation block via PCTRL-INFLU.
  - The process controller can be used or suppressed with this evaluation.
  - The calcuation is done according to the following formula:
    100 % (PCTRL-OUT) = 100 % * 100 % (PCTRL-INFLU).

7.6.65.5 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 generator is set to zero.

7.6.66 Signal adaptation for phase signals (PHDIV)

Purpose

Division or multiplication of phase signals as a power of two.

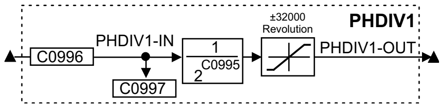


Fig. 7-198 Signal adaptation for phase signals (PHDIV1)

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
PHDIV1-IN	ph	C0997	dec [inc]	C0996	3	1000	
PHDIV1-OUT	ph	-	-	-	-	-	65536 inc = one encoder revolution

Function

- Arithmetic function:

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

  – positive values in C0995 result in a division
  – negative values in C0995 result in a multiplication
- The output value is limited to ±32000 encoder revolutions.
  – If the limit is exceeded, the output is kept at the limit value.

7.6.67 Phase integrator (PHINT)

Purpose

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

PHINT3 can recognize a relative distance.

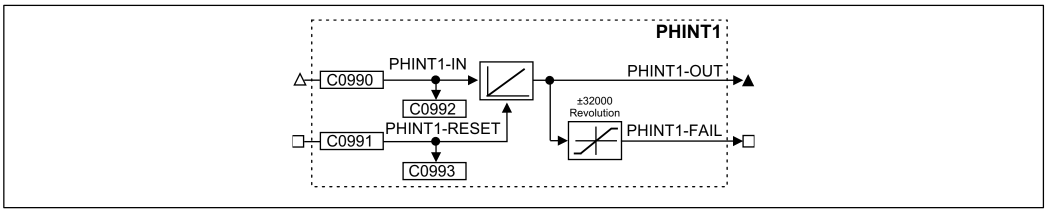


Fig. 7-199 Phase integrator (PHINT1)

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

7.6.67.1 Constant input value

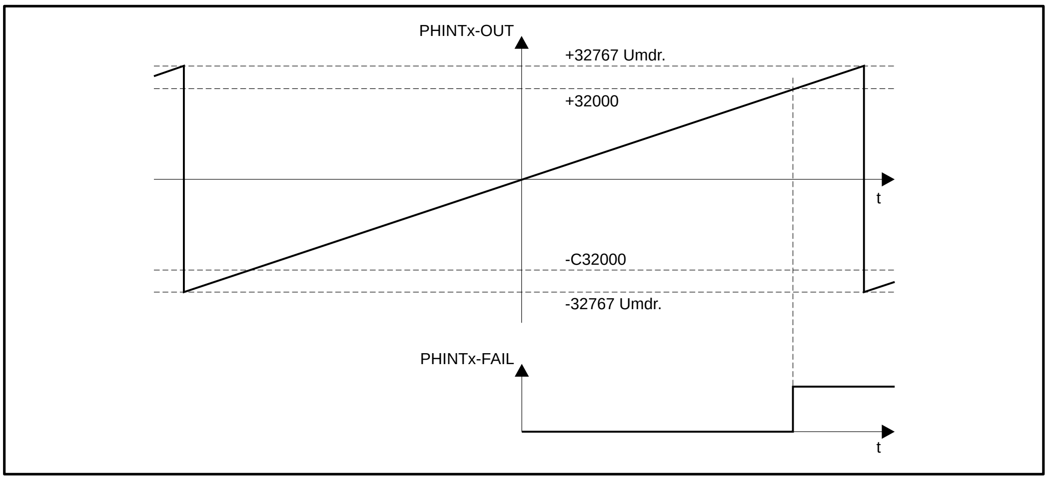


Fig. 7-200 Function of PHINTx with constant input value

- 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 ($\triangleq$ +2147483647 inc)
  – an overflow results. The counting is continued at the value -32768.
  – PHINTx-FAIL switches to HIGH when the value $\geq$ +32000 is reached
- If the count falls below the value of -32768 encoder revolutions ($\triangleq$ -2147483648 inc)
  – an overflow results. The counting starts at the value +32767.
  – PHINTx-FAIL switches to HIGH when the value $\leq$ -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.

7.6.67.2 Scaling of PHINTx-OUT

Mathematic description of PHINTx-OUT:

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

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:

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

7.6.68 First order delay element (PT1)

Purpose

Filter and delay analog signals.

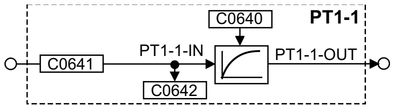


Fig. 7-201 First order delay element (PT1-1)

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 T is set under C0640.
- The proportional value is fixed at K = 1.

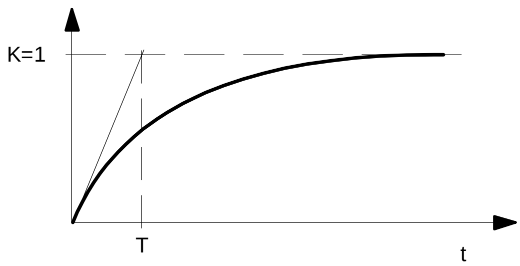


Fig. 7-202 Delay T of the first-order delay element

7.6.69 CW-CCW-QSP link (R/L/Q)

Purpose

The FB links the input of the direction of rotation and the QSP function with a protection against open circuit.

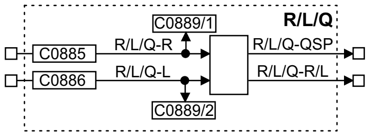


Fig. 7-203 CW-CCW-QSP link (R/L/Q)

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 connected 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 table results, only if the inputs were set to LOW once:

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, both outputs still have their previously output value.

7.6.70 Ramp generator (RFG)

Purpose

The ramp generator limits the rise of signals.

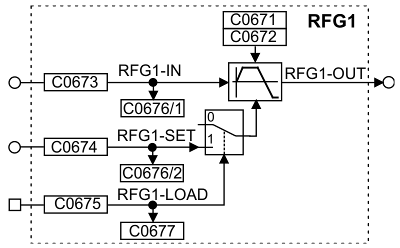


Fig. 7-204 Ramp generator (RFG1)

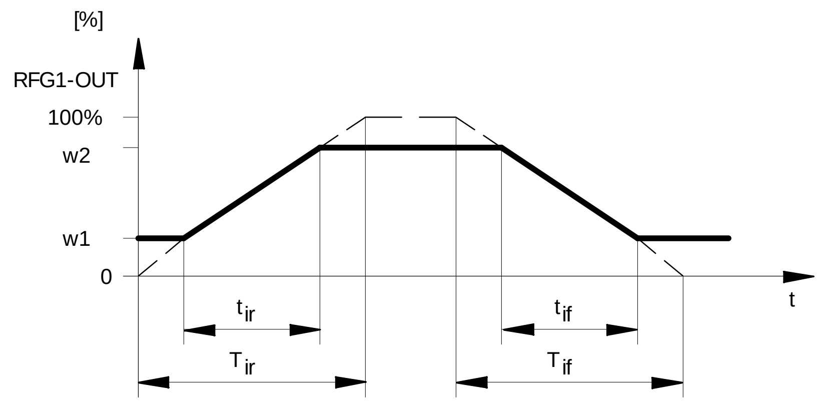
Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
RFG1-IN	a	C0676/1	dec [%]	C0673	1	1000	-
RFG1-SET	a	C0676/2	dec [%]	C0674	1	1000	-
RFG1-LOAD	d	C0677	-	C0675	2	1000	-
RFG1-OUT	a	-	-	-	-	-	-

Function

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

7.6.70.1 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. 7-205 Acceleration and deceleration times of the ramp generator

Here, t_{ir} and t_{if} are the desired times for the change between w_1 and w2. The calculated times T_{ir} and T_{if} can be set under C0671 and C0672.

7.6.70.2 Loading of the ramp generator

The ramp generator can be initialized 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 generator accelerates from this value to its input value via the set T_i times.

7.6.71 Sample and hold function (S&H)

Purpose

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

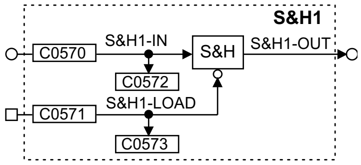


Fig. 7-206 Sample and hold function (S&H1)

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 to LOW level when disconnecting the supply voltage (mains, DC bus or terminal 59).
- Keep S&H1-LOAD to LOW level when connecting the supply voltage (mains, DC bus or terminal 59).

7.6.72 Long value selection (SELPH)

Two FBs are available (SELPH1, SELPH2).

Purpose

Select one long-value from nine long-values and switch to the output.

SELPH1

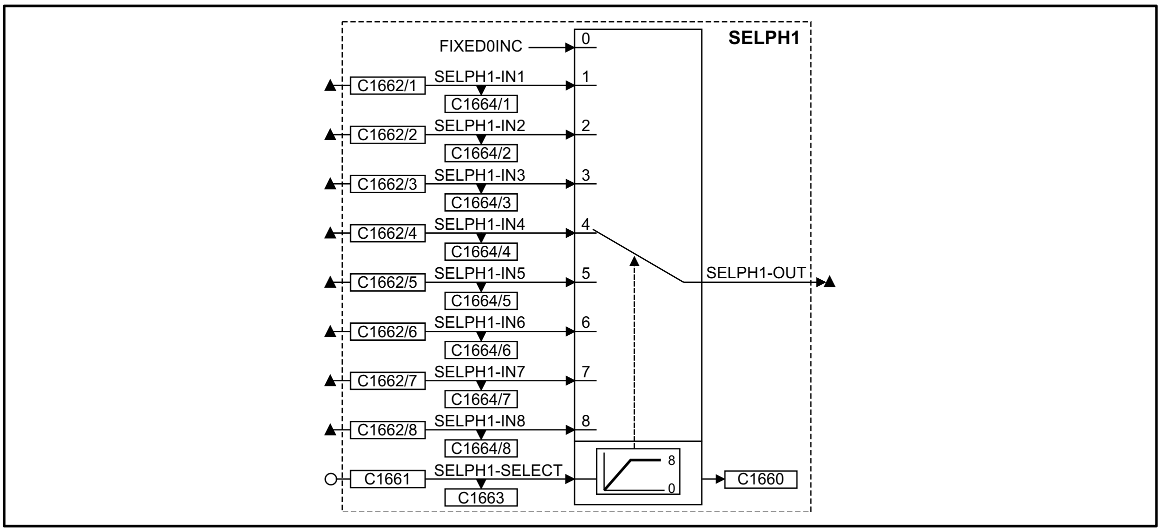


Fig. 7-207 Function block SELPH1

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

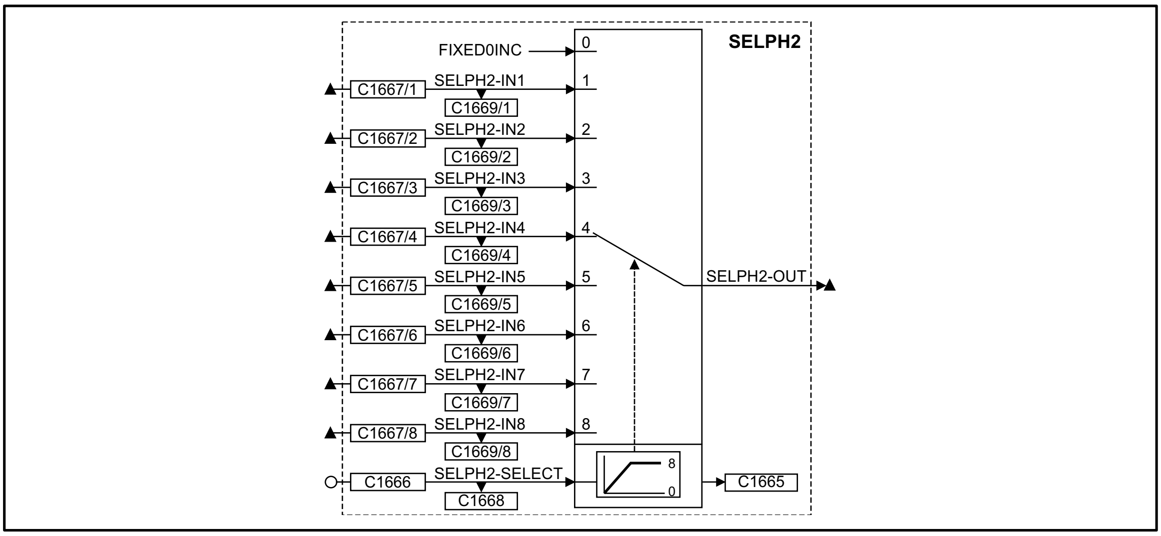


Fig. 7-208 Function block SELPH2

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 before SELPHx-SELECT.

7.6.73 Switching points (SP)

Two FBs (SP1, SP2) are available.

Purpose

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

SP1

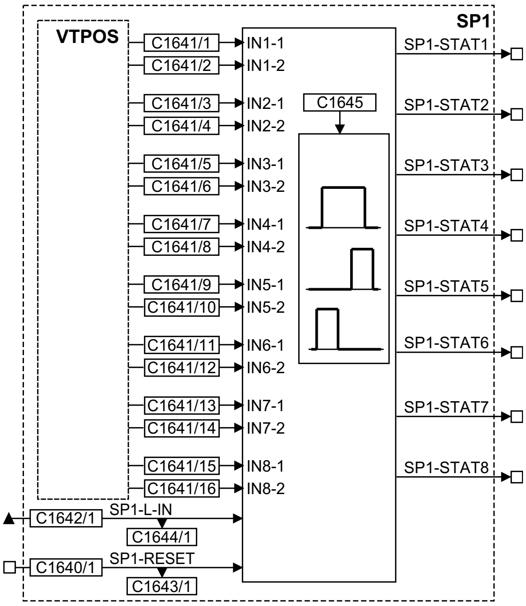


Fig. 7-209 Function block SP1

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

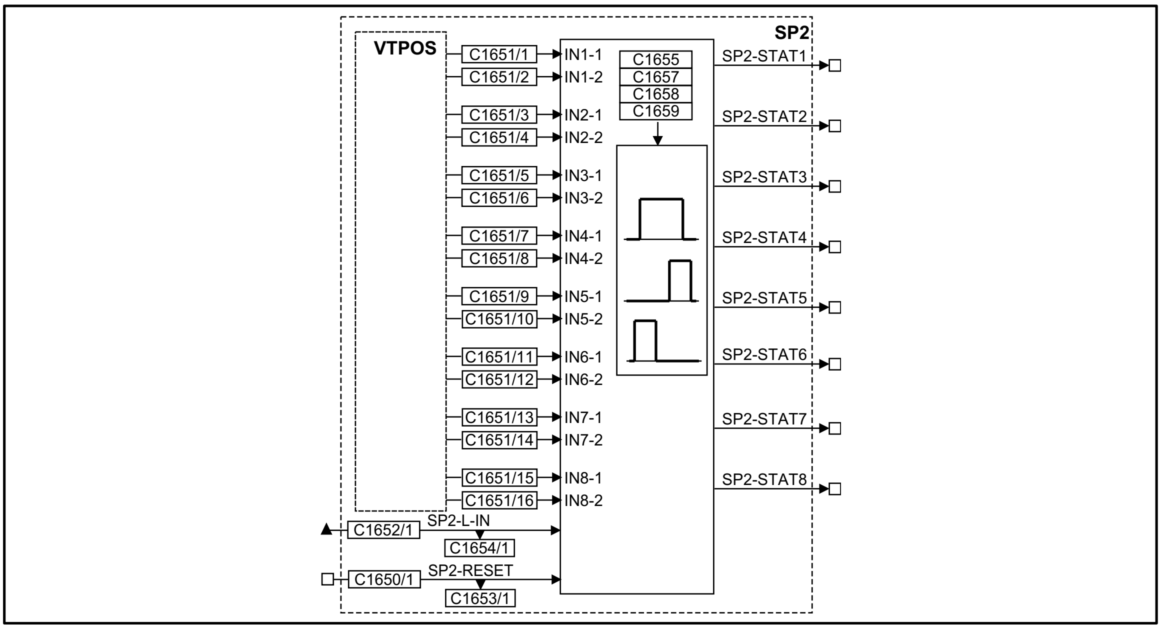


Fig. 7-210 Function block SP2

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

7.6.73.1 Switching points

- The switching points can be set in two ways:
  – Mode 1: Start and end point
  – Mode 2: Center 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 center 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. 7-209):

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. 7-210):

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)

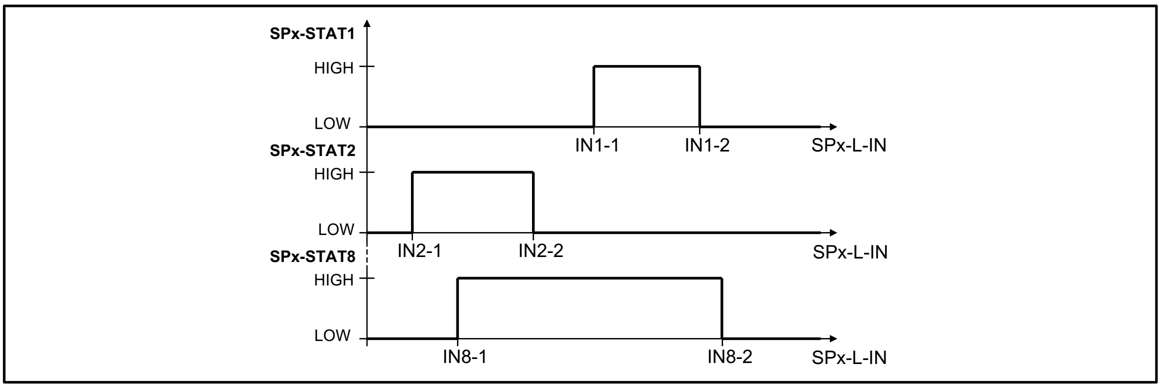


Fig. 7-211 Switch-on and switch-off points for SPx-STAT1, SPx-STAT2 and SPx-STAT8

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

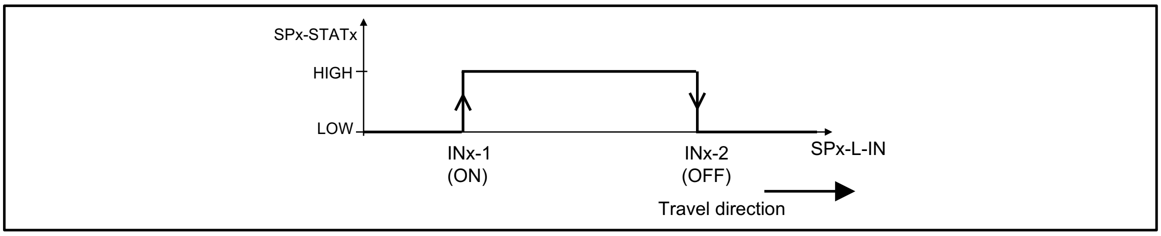


Fig. 7-212 Definition of a switch-on and switch-off position according to the travel direction

Mode 2: Center point with switching range

C1645 = set 1 (SP1)

C1655 = set 1 (SP2)

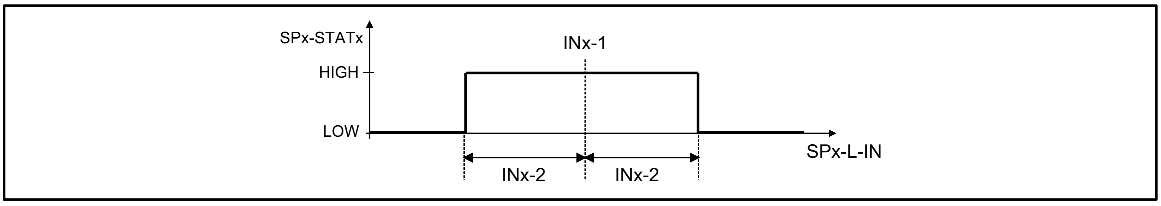


Fig. 7-213 Center point with switching range

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

7.6.73.2 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.

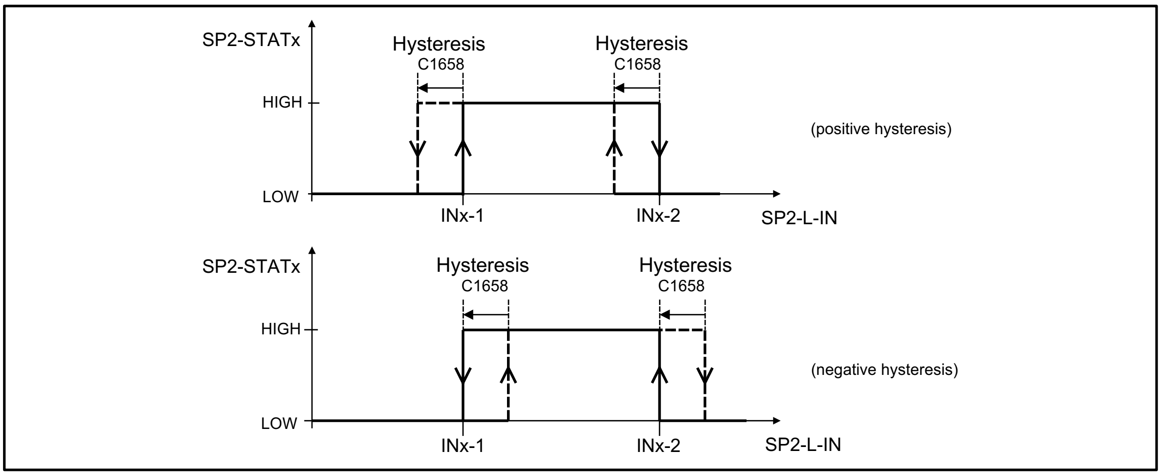


Fig. 7-214 Hysteresis for positive and negative values

7.6.73.3 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

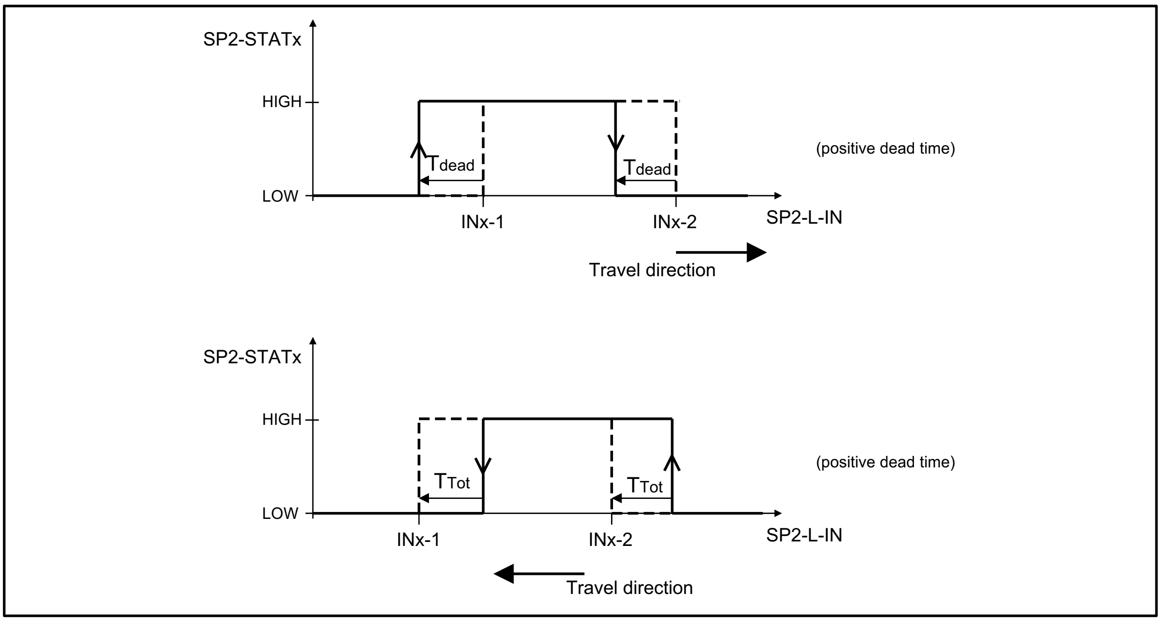


Fig. 7-215 Function of the positive dead time with different travel directions

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

Negative dead time

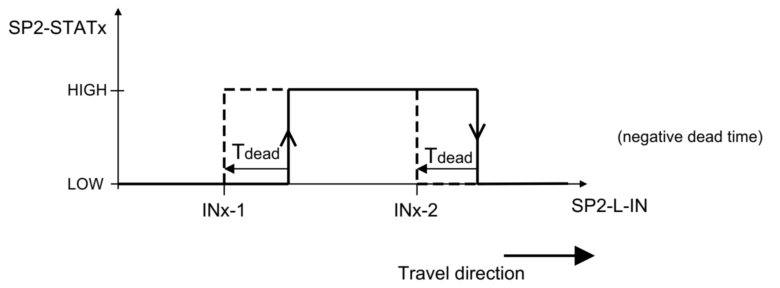


Fig. 7-216 Function of the negative dead time

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

7.6.73.4 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.

7.6.74 Output of digital status signals (STAT)

Purpose

The FB evaluates digital signals of the function blocks and the status of the controller and passes them on to C0150 and to the FB AIF-OUT and CAN-OUT1.

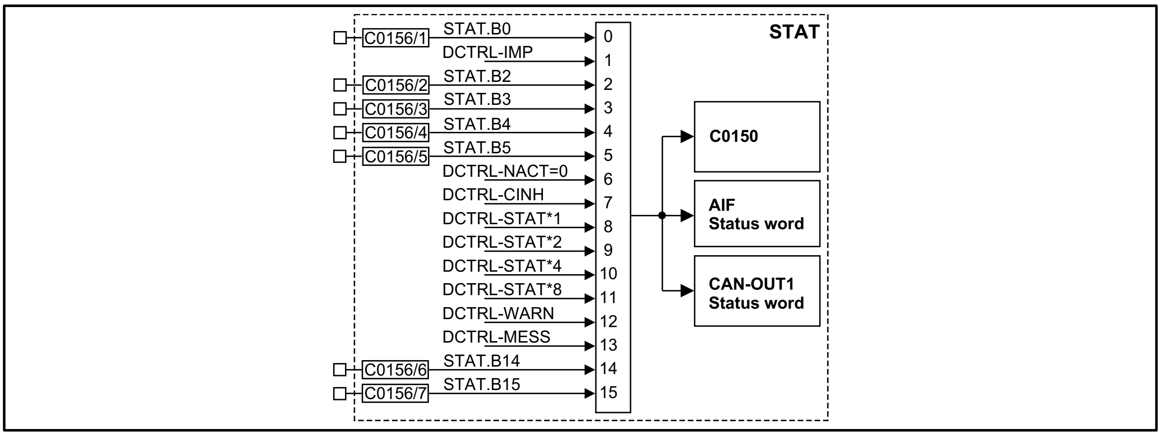


Fig. 7-217 Output of digital status signals (STAT)

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 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 Statuswort is transferred to code C0150 and to the function blocks AIF-OUT, CAN-OUT1, CAN-OUT2, and CAN-OUT1.
- The inputs with the name DCTRL-xxxx are directly accepted from the function block DCTRL. (🕮 7-159)

7.6.75 Control of a drive network (STATE-BUS)

Purpose

The FB controls the controllers to specified states (e.g. trip, trip reset, quick stop or controller inhibit).

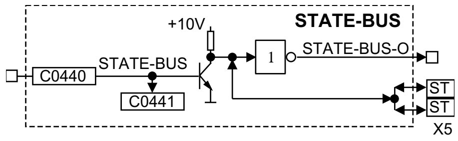


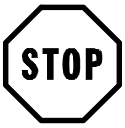
Fig. 7-218 Control of a function block STATE-BUS

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
STATE-BUS	d	C0441	bin	C0440	2	1000	
STATE-BUS-O	d	-	-	-	-	-	
TERMINA 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 (multimaster ability).

- Every connected controller can set these terminals to LOW signal.
- All connected controllers evaluate the signal level at these terminals and control the function blocks which are internally configured.
- Up to 20 controllers can be connected.



Stop!

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

7.6.76 Multi-axis synchronization (SYNC)

Purpose

Synchronizes the control program cycle of the drives with the cycle of a higher-level control.

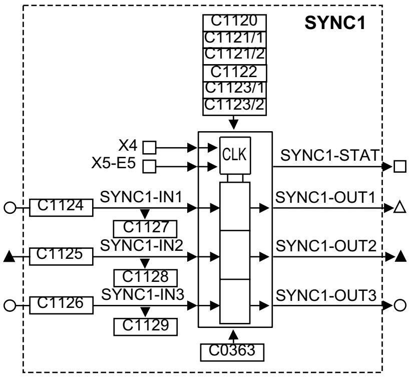


Fig. 7-219 Multi-axis synchronization (SYNC1)

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 completion of the synchronization SYNC1-STAT switches to HIGH. If the synchronization is quit, SYNC1-STAT switches to LOW.
SYNC1-OUT1	phd	-	-	-	-	-	-
SYNC1-OUT2	ph	-	-	-	-	-	-
SYNC1-OUT3	a	-	-	-	-	-	-

Function

- Possible axis synchronizations
- Cycle times
- Phase shift
- Synchronization window for synchronization via terminal (SYNC WINDOW)
- Correction value of phase controller (SYNC CORRECT)
- Fault indications
- Configuration examples
- Standardization

7.6.76.1 Possible axis synchronizations

Operating mode

Code	Value	Function
C1120	0	FB without function. Switches the data at the inputs directly to the outputs.
	1	CAN Sync active Synchronizes the controllers to the sync telegram of the system bus.
	2	Terminal Sync active Synchronizes the controllers to the sync signal of terminal X5/E5.

Synchronization time

After the mains connection and the initialization time of the controller, the FB SYNC1 also requires a synchronization time.

The synchronization time depends on

- the baud rate of the system bus (CAN-SYNC),
- the start time (input 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 synchronization via system bus (CAN)

The system bus (CAN) transmits the sync telegram as well as the process signals.

Application examples:

- Input of cyclic, synchronized position setpoint information, e.g. multi-axis control via the system bus (CAN).

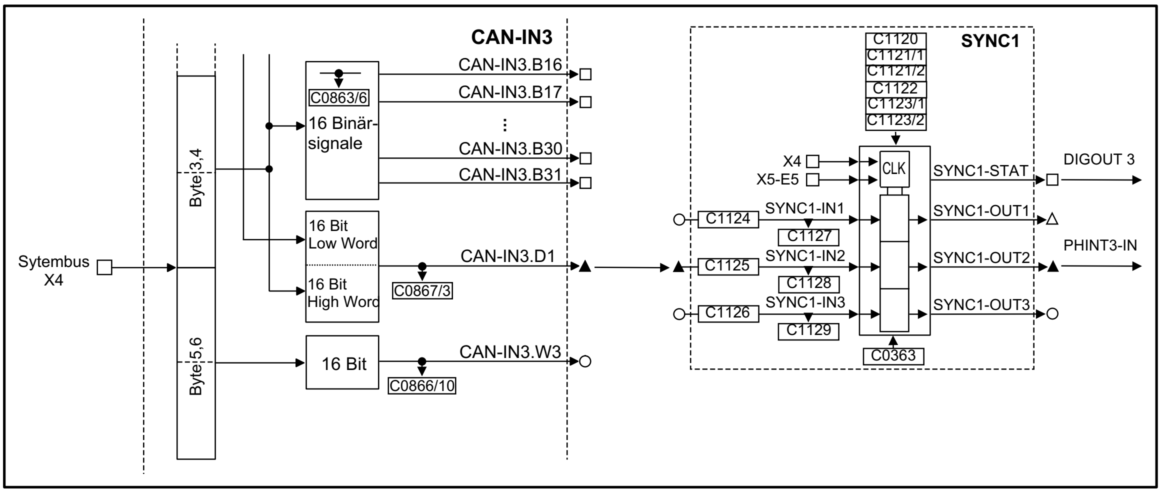


Fig. 7-220 Example for a link of the FB SYNC1

Axis synchronization via terminal control (X5/E5)

There are two different transmission channels for the sync signal and the process signal.

- The process signals are connected via a freely selectable input channel (e.g. AIF interface, DF input).
- The sync signal is sent via terminal X5/E5.

Application examples:

- Input of cyclic, synchronized position setpoint information for multi-axis positioning via different bus systems (e.g. Interbus).
- Synchronization of internal processing cycles of the FB to higher-level process controls.

7.6.76.2 Cycle times

Sync cycle time (SYNC CYCLE)

The master (e.g. PLC) sends ther 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 provided cycle time (1121/1).

The cycle time is entered in integer numbers (1 ms, 2 ms, 3 ms, ...).

1) Designation for the synchronization via system bus (CAN)

2) Designation for the synchronization via terminal

Code	Value	Function
C1121/1	1 ... 13 ms	Definition of the cycle time of the sync telegram (sync signal). A parameterization is required only for the slave. • C1120 = 1 (CAN sync) – Time between two sync telegrams of the master. Adapt the time to the master SYNC. C0362 displays the time (CAN sync cycle) for the slave. Set the value in C1121/1 smaller than the value in C0362. • C1120 = 2 (terminal SYNC) – Time between two sync signals of the master to X5/E5. Adapt the time to the master SYNC.Set the value in C1121/1 ≥ cycle time of the master.

Interpolation cycle time (INTPOL. CYCLE)

The FB interpolates the input signals (C1124, C1125, C1126) between the sync telegrams and sync signals and transmits them to the corresponding output. This means that an optimized signal shape with regard to the internal processing cycle is achieved (e.g. reduction of signal step changes in the output variables when using long 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 independently of the sync cycle. – Select the parameterization of C1121/2 according to the cycle of the process value input.

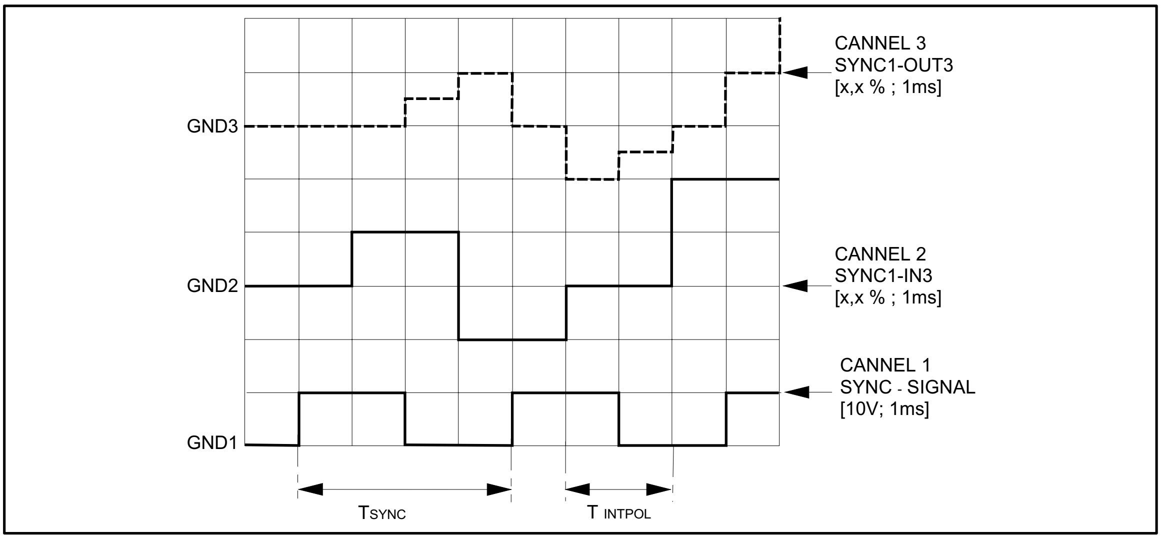


Fig. 7-221 Example of an interpolation

See Fig. 7-221:

An analog value at SYNC1-IN3 is output as an interpolated value SYNC1-OUT3.

- Sync cycle (C1121/1) = 4 ms
- Interpolation cycle (C1121/2) = process cycle = 2 ms
- Phase shift (C1123/1) = 0 ms

7.6.76.3 Phase shift

Phase shift for the synchronization via system bus (SYNC TIME)

Code	Value	Function
C1122	0 ...10.000 μs	• C1120 = 1 – Phase shift between the sync telegram and the start of the internal control program. – The parameters are set automatically depending on the parameterization of the system bus (CAN). • C1120 = 2 – C1122 has no effect

Phase shift for the synchronization via terminal (PHASE SHIFT)

Code	Value	Function
C1123/1	-1.000 ms bis +1.000 ms	• C1120 = 1 – C1123/1 has no effect • C1120 = 2 – Phase shift between the sync signal and the start of the internal control program (e.g. to compensate the effects of signal run times / dead times for the sync signal of the individual slaves).

7.6.76.4 Time window for the synchronization via terminal

Code	Value	Function
C1123/2	0 ... 1.000 ms	• C1120 = 1 – C1123/2 has no effect • C1120 = 2 – Definition of a "time window" for the LOW-HIGH edges of the sync signal at the slave (defined under C1121/1). – If the sync signal sent by the master is within this "time window", SYNC1-STAT switches to HIGH.

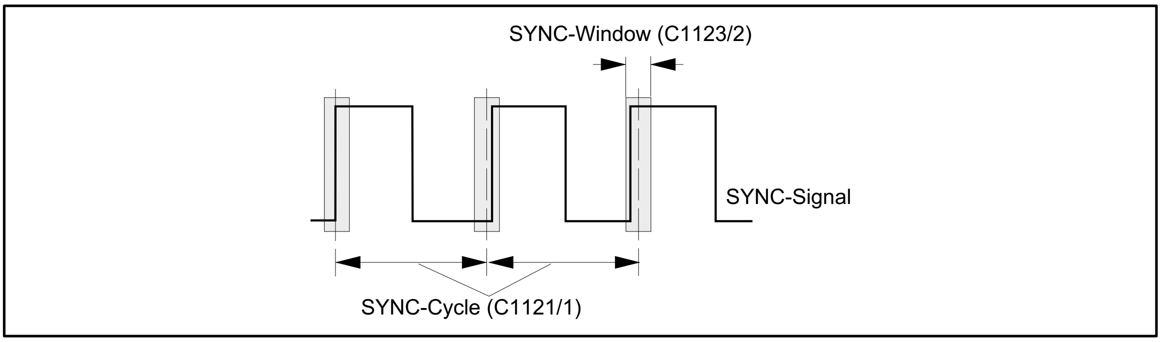


Fig. 7-222 "Time window" for the LOW-HIGH edges of the sync signal

Tip!

A jitter up to ±200 ms on the LOW-HIGH edges of the sync signal is permissible. The size of the jitter affects the parameterization of the "time window".

7.6.76.5 Correction value 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 derived automatically from internal parameters of the system bus (CAN). • C1120 = 2 – Optimizing the rise time of the phase controller depending on the frequency of the sync signal. – Increase the value when the frequency of the sync signal is reduced. – A stable signal at SYNC1-STAT is an indicator for an optimal parameterization.

7.6.76.6 Fault indications

Fault indications for the synchronization via system bus

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronized state (SYNC1-STAT = LOW)	Enable controller only after SYNC1-STAT = HIGH
	The time between two sync telegrams is faulty	C0362 displays the period between two sync telegrams. • Set the time in C1121/1 to the time in C0362. • Adapt the time of the sync telegram from the master

Fault indications for the synchronization via terminal

Fault	Cause	Remedy
P16	Controller was enabled in an unsynchronized state (SYNC1-STAT = LOW)	Enable controller only after SYNC1-STAT = HIGH
	No sync signal	Connect sync signal to terminal X5/E5
	The period of the sync signal is not a multiple of 1 ms	Adapt period
	Sync window too small	Adapt C1123/2 to the ratios

7.6.76.7 Configuration examples

Configuration example CAN-SYNC

Maintain the following sequence during the commissioning:

Step	Where	Operation
1.	-	Commission controller and system bus without FB SYNC1
2.	-	Inhibit controller
3.	CAN master	Define telegram sequence 1. Send new setpoint to all slaves 2. Send SYNC telegram 3. All slaves must respond
4.	CAN slaves	Enter FB SYNC1 in the first position of the processing table
5.		Parameterize 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 slaves	FB SYNC1 (CAN SYNC-CYCLE) • Request cycle time of the SYNC telegram from the master under C0362
9.		FB SYNC1 (SYNC CYCLE) • Set C1121 according to the time of the sync telegrams from the control • Set C1121 ≥ C0362
10.		Parameterize the monitoring function P16 under C1290
11.		Connect output signals of SYNC1 to the desired inputs of the corresponding FB
12.		Via FB DIGOUT • detect signal from SYNC1-STAT
13.		When SYNC1-STAT = HIGH, enable controller

Configuration example TERMINAL-SYNC

Maintain the following sequence during the commissioning:

Step	Where	Operation
1.	-	Commission controller without FB SYNC1
2.	-	Inhibit controller
3.	Slaves	Enter FB SYNC1 in the first position of the processing table
4.		Apply sync signal at terminal X5/E5
5.		Parameterize 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.	Slaves	FB SYNC1 (SYNC CYCLE) • Parameterize the sync cycle time of the sending source under C1121
9.		Parameterize the monitoring function P16 under C1290
10.		Connect output signals of SYNC1 to the desired inputs of the corresponding FB
11.		Via FB DIGOUT • provide signal from SYNC1-STAT
12.		FB SYNC1 (SYNC WINDOW) • Enter the optimum size of the "time window" under C1123/2 • If the sync signal jitters strongly, increase the "time window"
13.		When SYNC1-STAT = HIGH, enable controller

7.6.76.8 Scaling

The signal at input SYNC1-IN1 is transmitted in a scaled form to SYNC1-OUT1

Formula for the scaling:

$$\text{SYNC1-OUT1 [rpm]} = \text{SYNC1-IN1 [inc]} \cdot \frac{1875\ \text{rpm}}{2048\ \text{inc}}$$

The inputs SYNC1-IN2 and SYNC1-IN3 are not scaled. The FB transmits the data unevaluated to SYNC1-OUT2 or SYNC1-OUT3.

7.6.77 Teach-in programming (TEACH)

A function block (TEACH1) is available.

Purpose

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

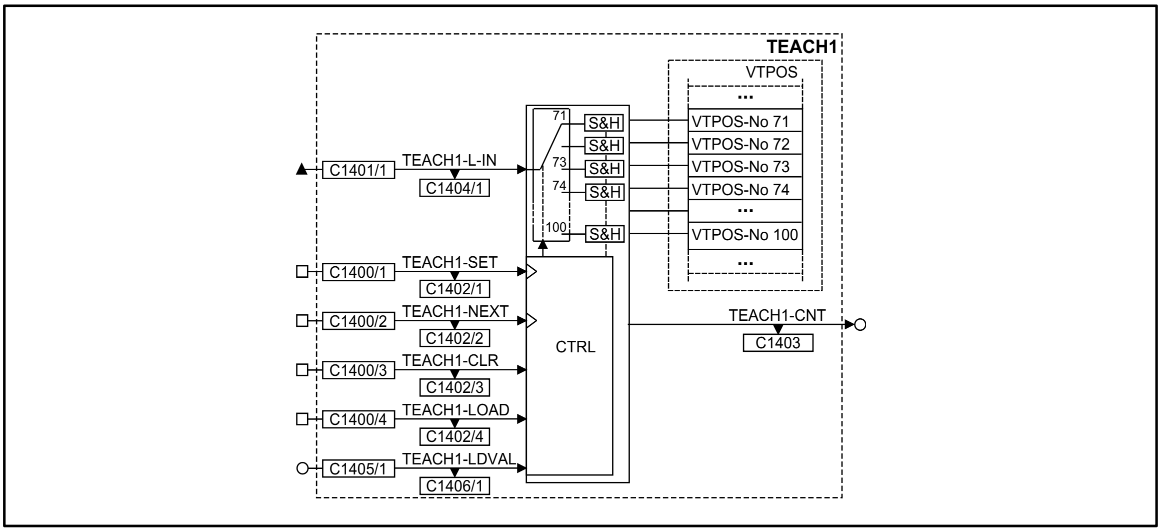


Fig. 7-223 Function block TEACH1

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 followig priority is valid:
  – TEACH1-CLR (1)
  – TEACH1-LOAD (2)
  – TEACH1-NEXT (3)
  – TEACH1-SET (4)

Note !
Save the target positions permanently using C0003.

7.6.78 Edge evaluation (TRANS)

Purpose

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

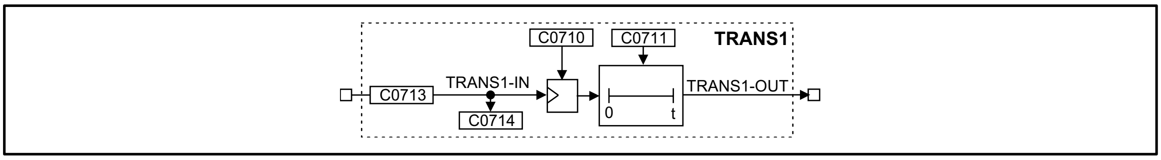


Fig. 7-224 Edge evaluation (TRANS1)

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

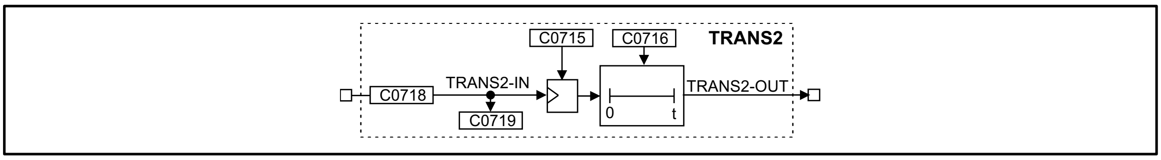


Fig. 7-225 Edge evaluation (TRANS2)

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 on different events. The following functions can be selected under code C0710 or C0716:

- Positive edge
- Negative edge
- Positive or negative edge

7.6.78.1 Evaluate positive edge

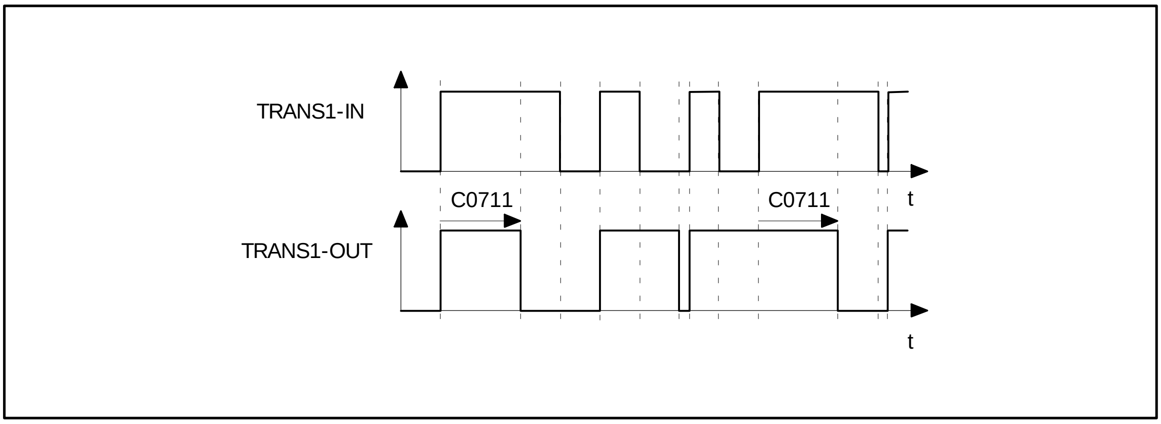


Fig. 7-226 Evaluation of positive edges (TRANS1)

- 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.

7.6.78.2 Evaluate negative edge

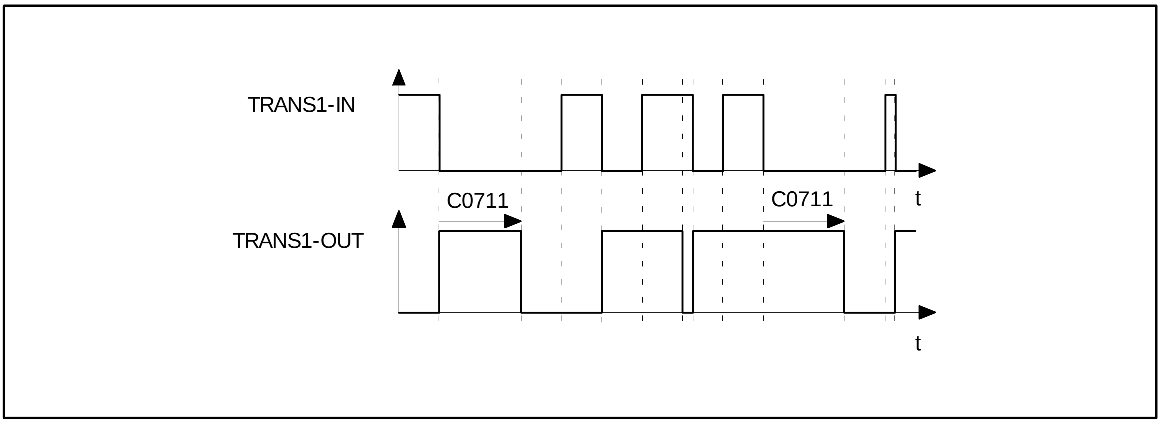


Fig. 7-227 Evaluation of negative edges (TRANS1)

- 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.

7.6.78.3 Evaluate positive or negative edge

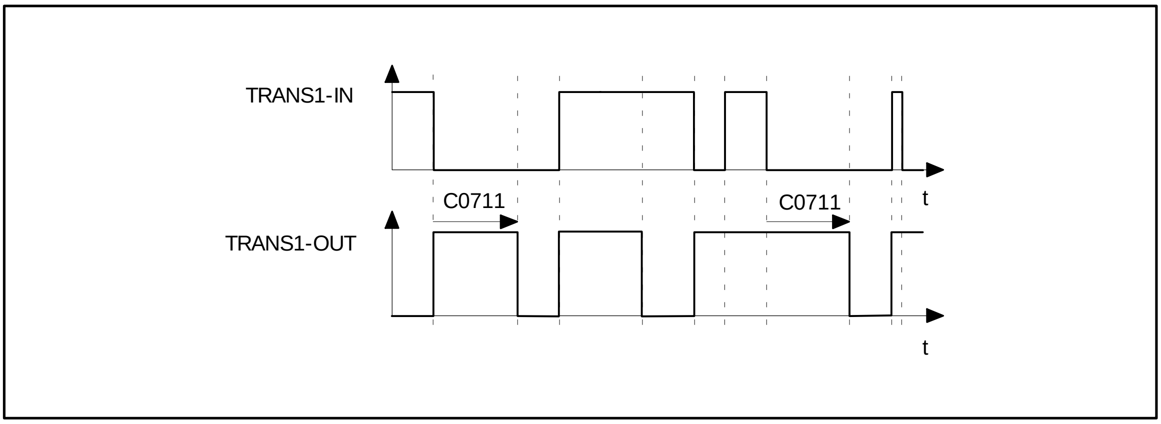


Fig. 7-228 Evaluation of positive and negative edges (TRANS1)

- 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.

7.6.79 Variable table acceleration (VTACC)

One function block (VTACC) is available.

Purpose

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

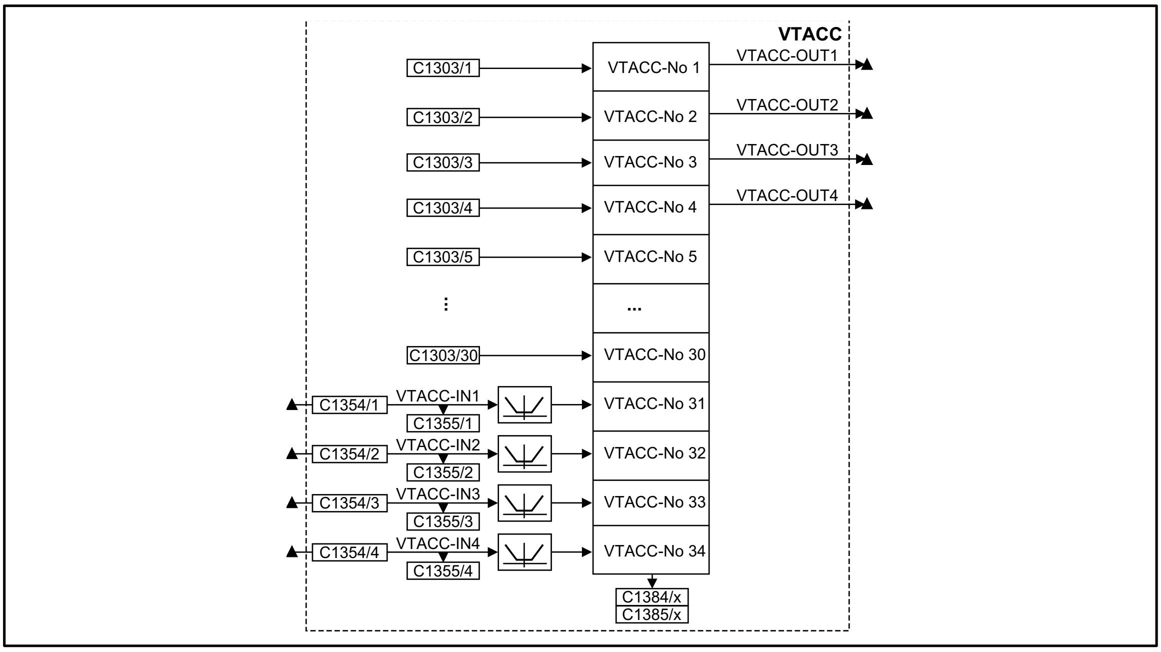


Fig. 7-229 Function block VTACC

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 moses 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 are 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:

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

Tip!

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

7.6.80 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.

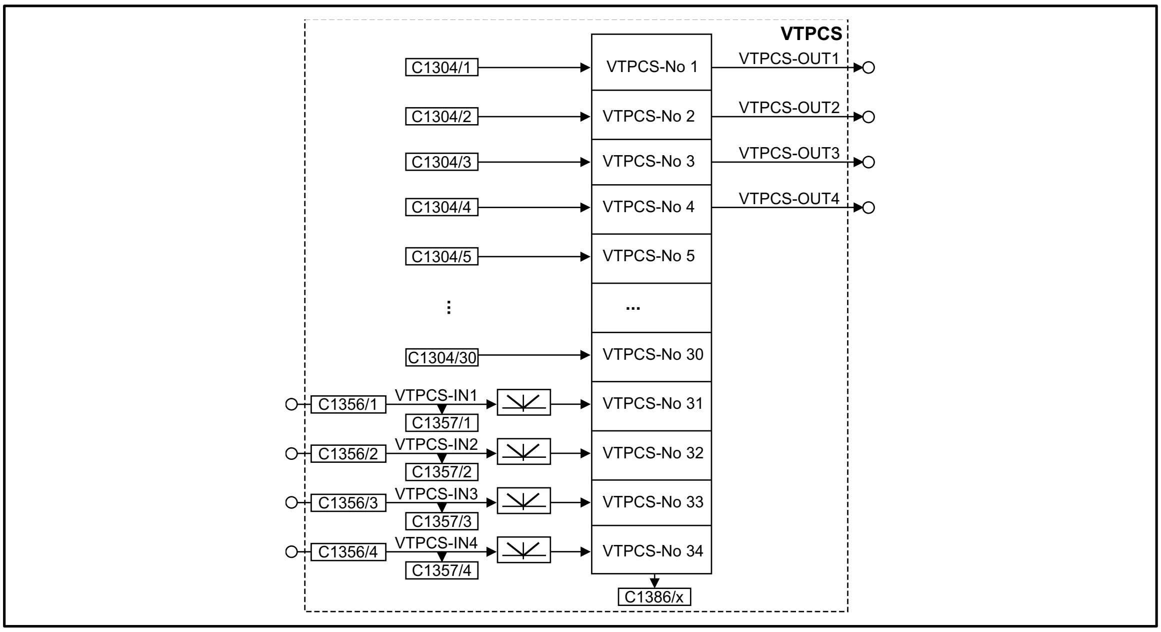


Fig. 7-230 Function block VTPCS

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.

7.6.81 Variable table Target Positition/Position Values (VTPOS)

One function block (VTPOS) is available.

Purpose

Save values for target position (position values). They are used as target positions in the positioning program or as comparison values for SP1 and SP2.

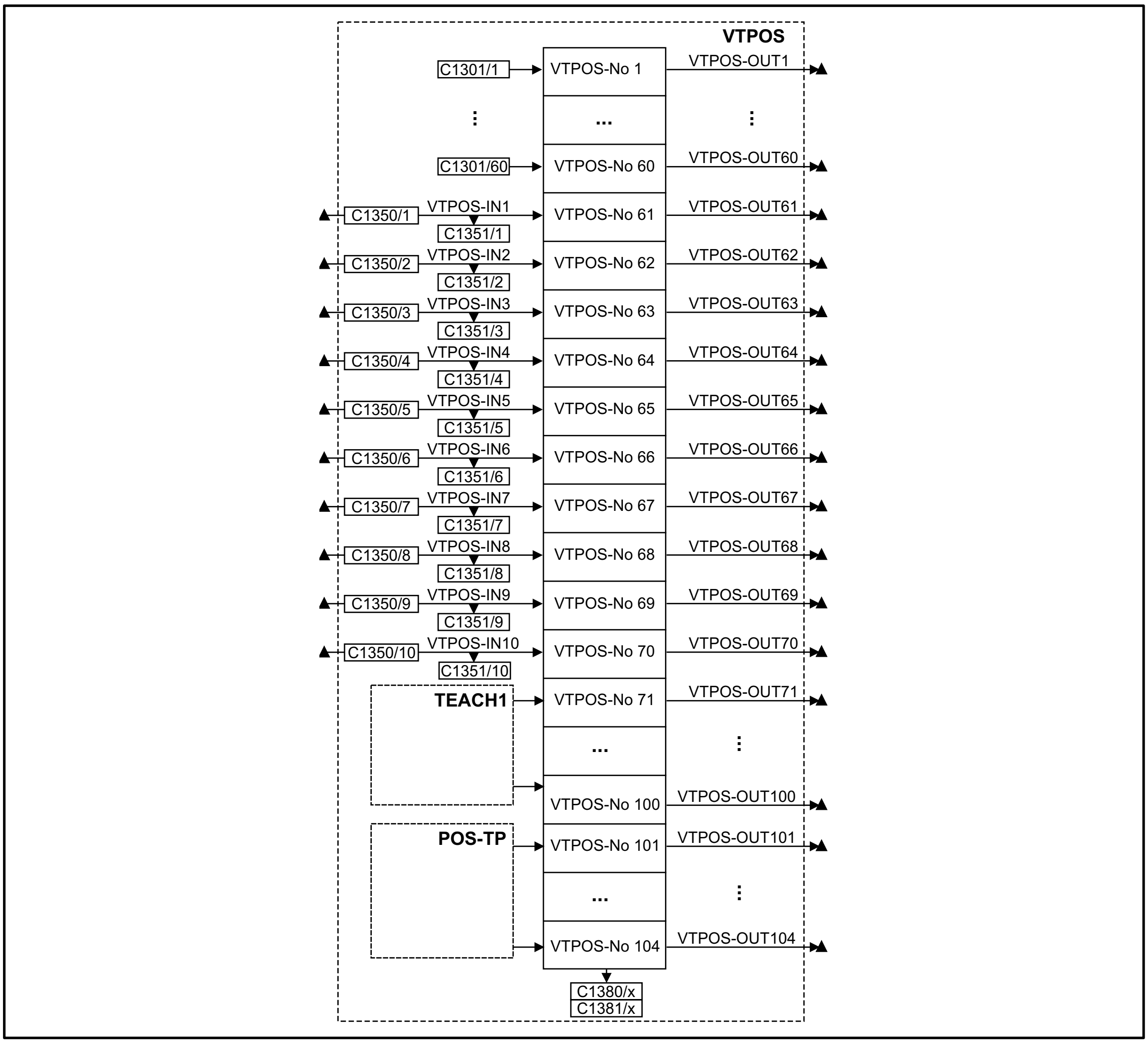


Fig. 7-231 Function block VTPOS

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	-

Function block library

Signal				Source		Note
Name	Type	DIS	DIS format	CFG	List	
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 position target values via VTPOS-INx.
  - 10 table positions (VTVEL-No61 ... VTVEL-No70) are available.
  - Signal input via function blocks.
  - The position target 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 position target [units] to position target [inc] is performed according to the formula:

$$\text{Position} - \text{Target [inc]} = \text{Position} - \text{Target [units]} \cdot \frac{65536\ [\text{inc}/\text{r}] \cdot \text{gear nominator}}{\text{Feed constant [units/r]} \cdot \text{gear denominator}}$$

Tip!

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

7.6.82 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.

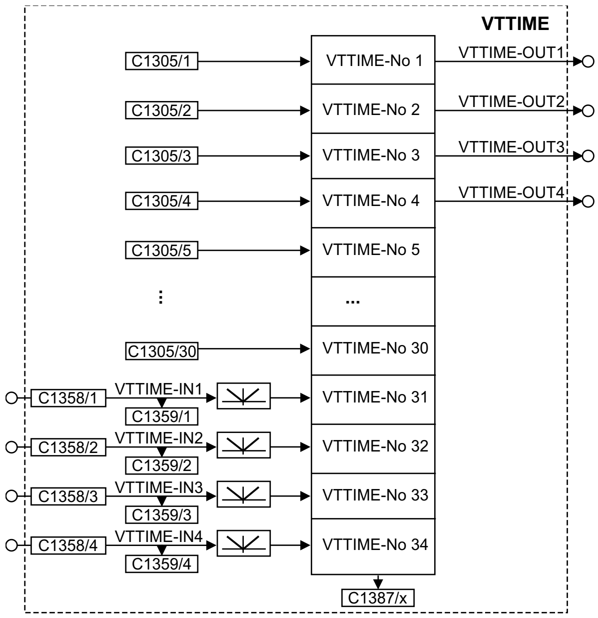


Fig. 7-232 Function block VTTIME

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.

7.6.83 Variable table Speed (VTVEL)

One function block (VTVEL) is available.

Purpose

Stores values for positioning and final speeds. They are used as setpoint speeds in the positioning program.

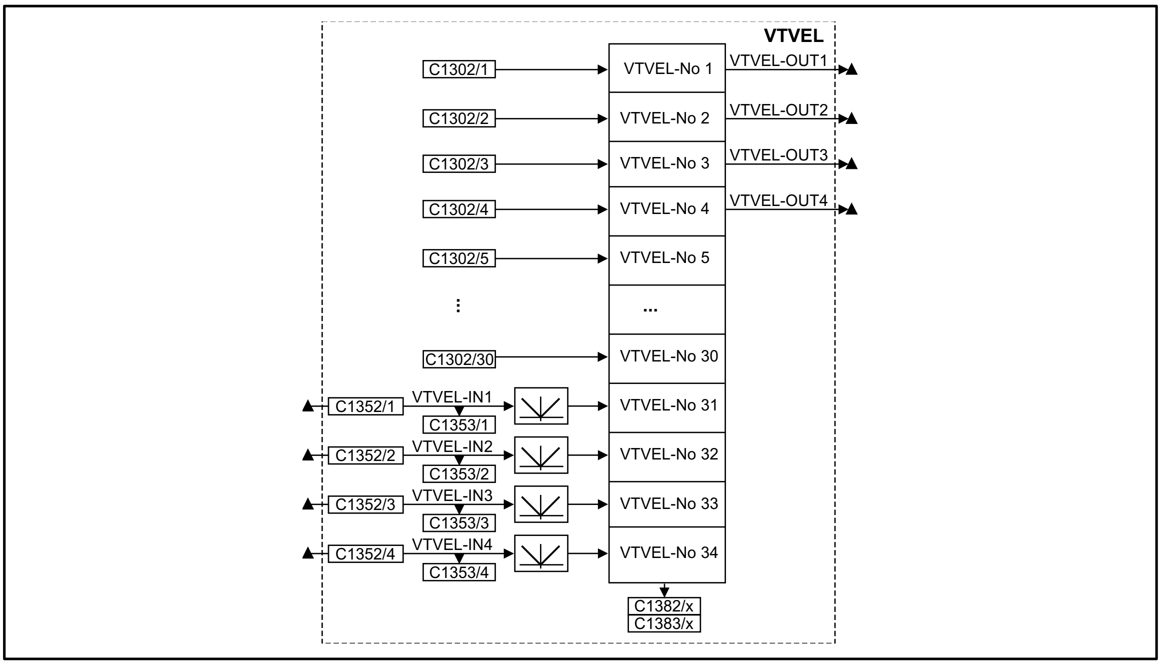


Fig. 7-233 Function block VTVEL

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 are 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:

$$v\,[inc] = v\,[units/s] \cdot \frac{65536\,[inc/r] \cdot \text{gear nominator} \cdot 16384}{\text{Feed constant}\,[units/r] \cdot \text{gear denominator} \cdot 1000000\,[1/s]}$$

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

7.7 Monitoring

Various monitoring functions protect the drive from impermissible operating conditions. (📖 7-269).

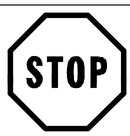
If a monitoring function is activated,

- a reaction to protect the drive will be activated (configuration (📖 7-268)).
- a digital output is set, if it is assigned to the corresponding reaction.
- the fault indication is entered at the first position in the history buffer. (📖 8-3)

7.7.1 Reactions

According to the interferences one or several of the following reactions are possible via the monitoring function:

- TRIP (highest priority)
- Message
- FAIL-QSP
- Warning
- Off

Reaction	Effects on drive or controller		Danger notes
TRIP	• Switches the power outputs U, V, W to a high resistance until TRIP is reset • The drive is idling (no control!). • After TRIP reset the drive accelerates to its setpoint along the set ramps. (📖 8-10)		
Message	• Switches the power outputs U, V, W to a high resistance as long as the message is active.		 The drive restarts automatically if the message is removed.
	• Short-term message ≤ 0.5 s	The drive is idling (no control!) as long as the message is active If the message is removed, the drive accelerates to its setpoint with maximum torque.	
	• Long-term message > 0.5 s	The drive is idling (because of internal controller inhibit!) as long as the message is active. If necessary, restart positioning program.	
FAIL-QSP	Brakes the drive to standstill via the QSP ramp via code C0105. • The time for the QSP ramp is set in the "Basic settings" dialog box. • Default setting of FAIL-QSP: (📖 8-6)		
Warning	• Only display of the operating fault • The drive operates under control.		 Since these reactions have no effect on the drive behaviour, the drive may be destroyed.
Off	• No reaction to operating faults!Monitoring is deactivated.		

7.7.2 Set reactions

1. Click on the "Parameter menu" button in the "Basic settings" dialog box.
2. Open the "Dialog Diagnostics" menu by a double-click.

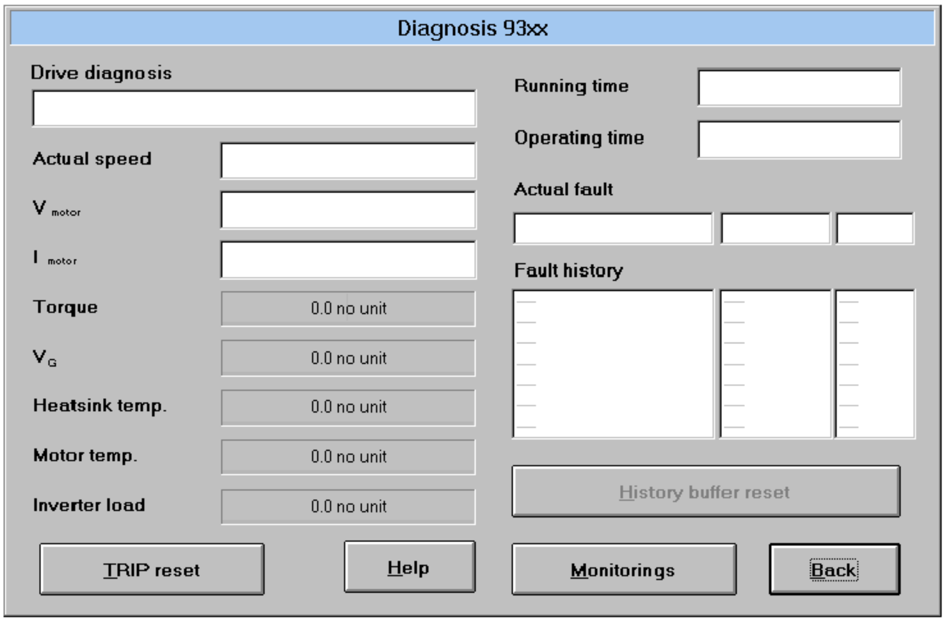


Fig. 7-234 Dialog box "Diagnostic 9300"

3. Click the button "Monitorings...".

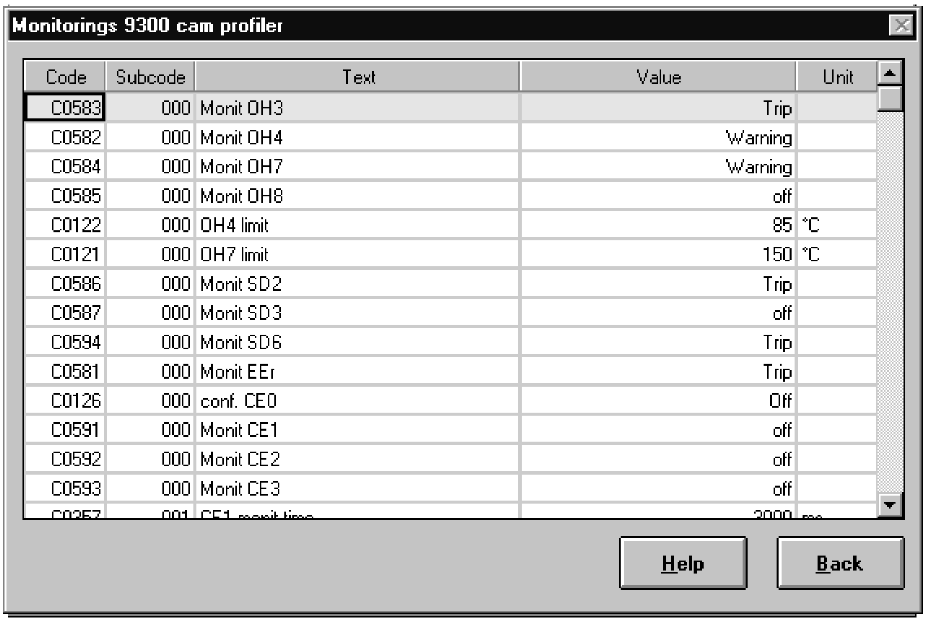


Fig. 7-235 "Monitoring configuration 93xx" dialog box

4. Click on the required monitoring function.
5. Select the possible or permitted reaction and confirm it with "OK".

An overview of the monitoring functions and the settings can be obtained from the following chapter.

7.7.3 Monitoring functions

Overview of the fault sources detected by the controller, and the corresponding reactions

Display	Meaning	TRIP	Meldung	Warning	FAIL-QSP	off	Code	Notes
CCr	System error	●	-	-	-	-	-	Part E, 📖 8-6
CE0	Communication error (AIF)	✓	-	✓	-	●	C0126	
CE1	Communication error at the process data input object CAN-IN1 (time monitoring can be set under C0357/1)	✓	-	✓	-	●	C0591	
CE2	Communication error at the process data input object CAN-IN2 (time monitoring can be set under C0357/2)	✓	-	✓	-	●	C0592	
CE3	Communication error at the process data input object CAN-IN3 (time monitoring can be set under C0357/3)	✓	-	✓	-	●	C0593	
CE4	BUS-OFF state (many communication errors occurred)	✓	-	✓	-	●	C0595	
EEr	External monitoring	●	✓	✓	✓	✓	C0581	📖 7-270
H05, H07	Internal error	●	-	-	-	-	-	Part E, 📖 8-6
H10	Sensor fault heatsink temperature	●	-	-	-	✓	C0588	
H11	Sensor fault: internal temperature	●	-	-	-	✓		
LP1	Motor phase failure detection (function block must be entered in C0465)	✓	-	✓	-	●	C0597	📖 7-270
LU	Undervoltage	-	●	-	-	-	-	📖 7-271
NMAX	Maximum speed exceeded (C0596)	●	-	-	-	-	-	📖 7-272
OC1	Short circuit	●	-	-	-	-	-	📖 7-273
OC2	Earth fault	●	-	-	-	-	-	📖 7-273
OC5	I x t overload	●	-	-	-	-	-	📖 7-274
OH	Heatsink temperature 1 (max. permissible, fixed)	●	-	-	-	-	-	📖 7-274
OH3	Motor temperature 1 (max. permissible, fixed)	●	-	-	-	✓	C0583	📖 7-275
OH4	Heatsink temperature 2 (adjustable; C0122)	-	-	●	-	✓	C0582	📖 7-276
OH7	Motor temperature 2 (can be set; code: C0121)	-	-	●	-	✓	C0584	📖 7-276
OH8	Motor temperature (fixed) via inputs T1/T2	✓	-	✓*	-	●	C0585	📖 7-277
OU	Overvoltage in the DC bus	-	●	-	-	-	-	📖 7-277
P01	Limit switch negative = LOW	✓	-	-	●	-	C1285/1	Part E, 📖 8-6
P02	Limit switch positive = LOW	✓	-	-	●	-	C1285/2	
P03	Contouring error - digital frequency > C0255	✓	-	●	-	✓	C0589	📖 7-278
P04	Position limit exceeded in negative direction	✓	-	-	●	-	C1285/3	Part E, 📖 8-6
P05	Position limit exceeded in positive direction	✓	-	-	●	-	C1285/4	
P06	No reference	✓	-	-	●	-	C1287/1	
P07	Parameter set mode absolute	✓	-	-	●	-	C1291/1	
P08	Actual offset out of range	✓	-	-	●	-	C1291/2	
P09	Impermissible programming	✓	-	-	●	-	C1291/3	
P12	Encoder range exceeded	✓	-	-	●	-	C1288/1	
P13	Phase overflow	●	-	✓	-	✓	C0590	📖 7-279
P14	1st contouring error POS > C1218/1	✓	-	✓	●	✓	C1286/1	Part E, 📖 8-6
P15	2nd contouring error POS > C1218/2	✓	-	✓	✓	●	C1286/2	
P16	Sync error	✓	-	✓	●	✓	C1290/1	
P17	TP control error	✓	-	✓	●	✓	C1289/1	
P18	Internal limitation	✓	-	●	✓	✓	C1289/2	
PEr	Program error	●	-	-	-	-	-	
PI	Fault during initialization	●	-	-	-	-	-	
PR0	General fault in parameter sets	●	-	-	-	-	-	📖 7-280
PR1	Fault in parameter set 1	●	-	-	-	-	-	📖 7-280
Sd2	Resolver fault	●	-	✓*	-	✓	C0586	📖 7-281
Sd3	Encoder fault at X9 PIN 8	✓	-	✓*	-	●	C0587	📖 7-282

Display	Meaning	TRIP	Meldung	Warning	FAIL-QSP	off	Code	Notes
Sd5	Encoder fault at X6/1 X6/2 (C0034 = 1)	✓	-	✓	-	●	C0598	Part E, 📖 8-6
Sd6	Sensor fault: motor temperature (X7 or X8)	●	-	✓	-	✓	C0594	
Sd7	Fault in the absolute value encoder at X8	✓	-	-	-	●	C0025	

Configuration

- ● Default setting
- ✓ possible
- \- not possible
- ✓* possible, but the drive can be destroyed if the fault is not removed immediately.

7.7.3.1 External error EEr

Purpose

Process monitoring

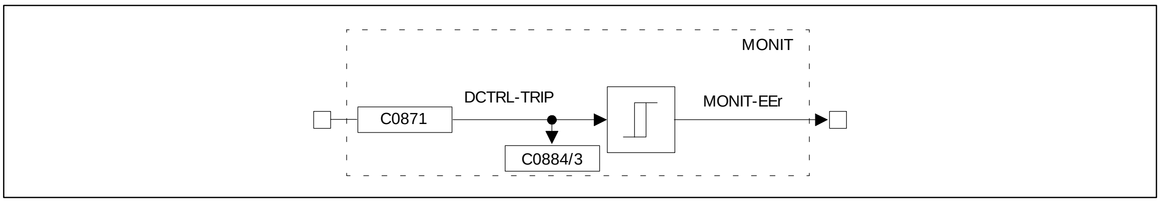


Fig. 7-236 External error EEr

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DCTRL-TRIP	d	C0884/3	bin	C0871	2	54	-
MONIT-EEr	d	-	-	-	-	-	-

Function

The signal EEr is obtained from the signal at the input DCTRL-TRIP-SET (level evaluation). With default setting, this signal is obtained from terminal X5/E4 . Here, external encoders can be connected which control the controller in the desired direction.

Any other binary signal source can also be used.

Features:

- LECOM no.: 91, 1091, 2091
- Reaction: TRIP, MESSAGE, WARNING or OFF

7.7.3.2 Monitoring for failure of a motor phase LP1

Purpose

Motor protection

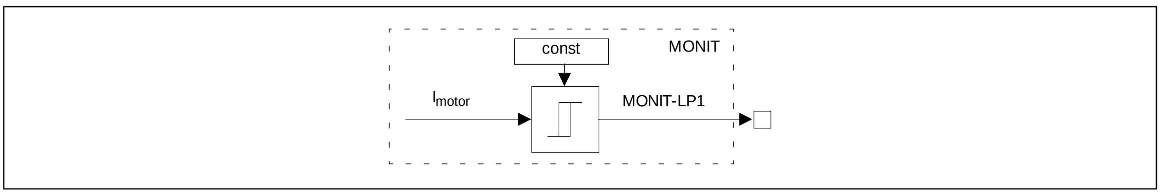


Fig. 7-237 Monitoring for failure of a motor phase LP1

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
I_{MOTOR}	-	-	-	-	-	-	-
MONIT-LP1	d	-	-	-	-	-	-

Function

This monitoring reacts if a power interrupt in a phase of the motor connection is recognized.

Tip!

This can also be an interrupt in the motor winding.

Features:

- LECOM no.: 32
- Reaction: TRIP (cannot be modified)

7.7.3.3 Low voltage LU

Purpose

DC bus monitoring, controller protection.

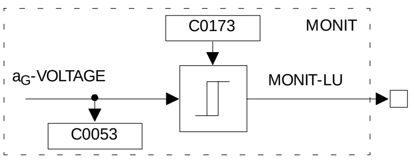


Fig. 7-238 Low voltage LU

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
A_G-VOLTAGE	-	C0053	dec	-	-	-	cannot be reassigned
MONIT-LU	d	-	-	-	-	-	-

Mains voltage range	Selection number (C0173)	Switch-off threshold LU	Switch-on threshold LU
< 400 V	0	285 V	430 V
400 V	1	285 V	430 V
400 0 460 V	2	328 V	473 V
480 V without brake chopper	3	342 V	487 V
Operation with brake chopper (up to 480 V)	4	342 V	487 V

Function

The monitoring indicates a message if the DC bus voltage (terminals $+U_G$ and $-U_G$) falls below the threshold (switch-off threshold) LU) set under code C0173.

The message is reset if the switch-off threshold LU is exceeded again.

The switch-off threshold LU determines the voltage level of the DC bus voltage, where the pulse inhibit is activated.

The selection number is also effective for the overvoltage monitoring (OU).

Adapt the setting of the codes to the available mains voltage (also for operation via $+U_G/-U_G$ terminals). When the controller is operated in a network of drives, all controllers must have the same setting.

If the LU message is applied for more than 3seconds or if the mains is connected, this is entered into the history buffer. This can be the case if the control module is supplied externally by terminals X5/39 and X5/59 and the mains is switched off.

If the signal is reset (mains is reconnected) this is not entered in the history buffer, but only deleted (this is not a fault, but a controller state).

If the low voltage messages appear only for less than 3 seconds this is interpreted as an interference (e.g. mains fault) and entered into the history buffer. In this case, the history buffer is continued.

Features:

- LECOM no.: 1030
- Reaction: MESSAGE (cannot be modified)

7.7.3.4 Plant speed monitoring N_{Max}

Purpose

Process monitoring

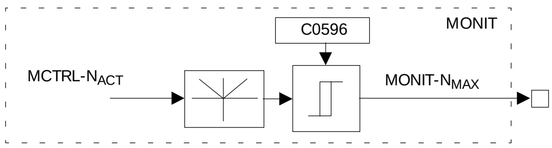


Fig. 7-239 Plant speed monitoring N_{Max}

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
$MCTRL\text{-}N_{ACT}$	-	-	-	-	-	-	cannot be reassigned
$MONIT\text{-}N_{MAX}$	d	-	-	-	-	-	-

Function

A maximum plant speed can be entered under code C0596, independent of the direction of rotation. The monitoring is released, if:

- the actual speed exceeds the limit C0596
- the actual speed exceeds the double value of (n_{max}).

Stop!

- For active loads (e.g. hoists) make sure that no torque is applied at the drive. Special, plant-specific measures are required.
- If the actual speed encoder fails, it is not ensured that this monitoring reacts.

Features:

- LECOM no.: 200
- Reaction: TRIP (cannot be modified)

7.7.3.5 Monitoring for short-circuit OC1

Purpose

Controller protection

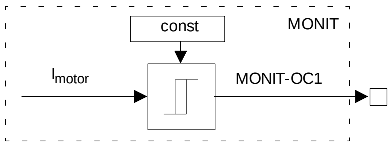


Fig. 7-240 Monitoring for short-circuit OC1

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
I_{MOTOR}	-	-	-	-	-	-	-
MONIT-OC1	d	-	-	-	-	-	-

Function

This monitoring reacts when the motor phases are short-circuited. It can also be a short-circuit of the windings in the machine.

This monitoring however, also reacts during mains connection, if there is an earth fault.

When the monitoring reacts, the controller must be disconnected from the mains and the short-circuit must be eliminated.

Features:

- LECOM no.: 11
- Reaction: TRIP (cannot be modified)

7.7.3.6 Monitoring for earth fault OC2

Purpose

Controller protection

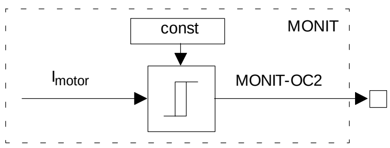


Fig. 7-241 Monitoring for earth fault OC2

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
I_{MOTOR}	-	-	-	-	-	-	-
MONIT-OC2	d	-	-	-	-	-	-

Function

The controllers of the 93XX series are equipped with an earth fault detection as a standard.

When the monitoring reacts, the controller must be disconnected from the mains and the earth fault must be eliminated.

Features:

- LECOM no.: 12
- Reaction: TRIP (cannot be modified)

Possible earth fault causes:

- Short-circuit to frame of the machine
- Short-circuit of a phase to the screen
- Short-circuit of a phase to PE

7.7.3.7 Fault message (OC5)

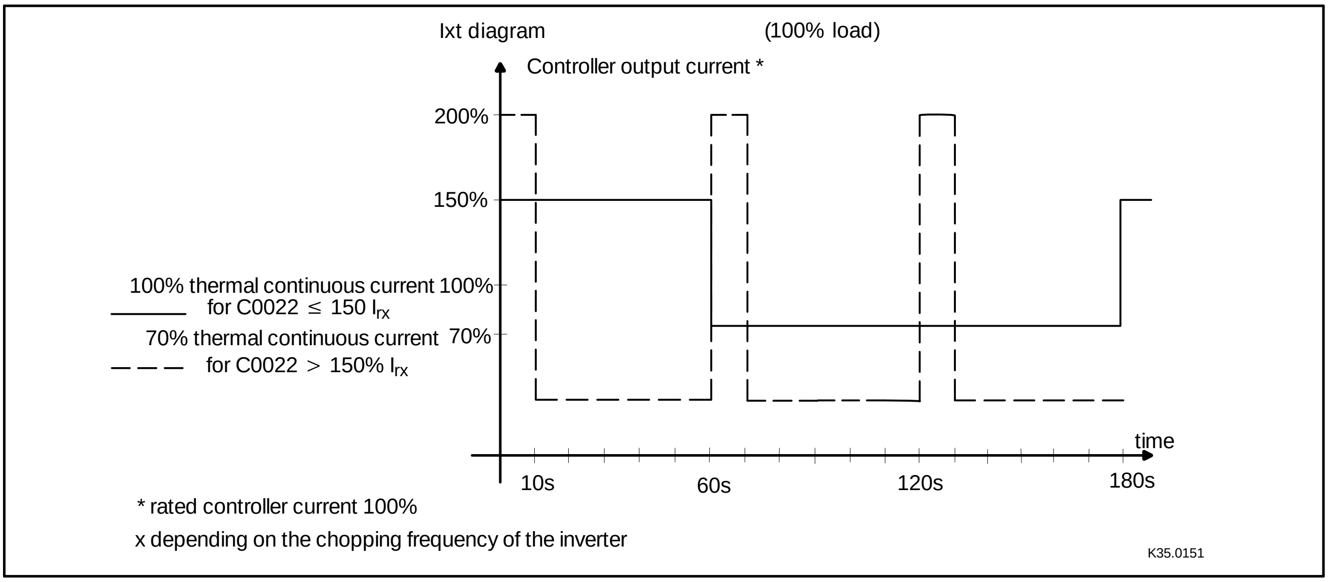


Fig. 7-242 Max. permitted overcurrent depending on the time

7.7.3.8 Heatsink monitoring OH (fixed)

Purpose

Controller protection

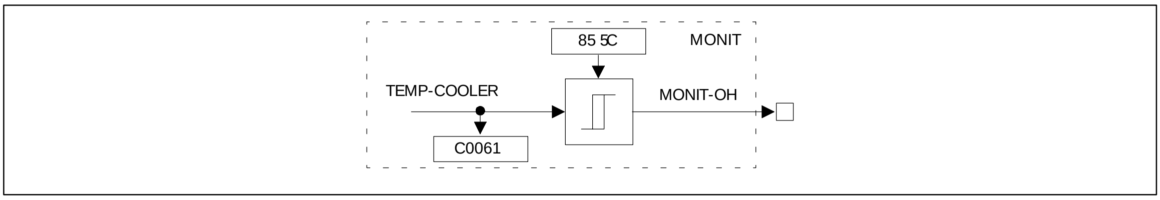


Fig. 7-243 Heatsink monitoring OH

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TEMP-COOLER	-	C0061	dec	-	-	-	cannot be reassigned
MONIT-OH	d	-	-	-	-	-	-

Function

The signal OH is derived from a comparator with hysteresis. The switch-off threshold is 855C and is fixed. The hysteresis is also fixed and amounts to 5K, i.e. the reclosing point is 805C.

Features:

- LECOM no.: 50
- Reaction: TRIP (cannot be modified)

Tripping can have the following causes:

- The ambient temperature is too high.
  Remedy:
  – Install a blower into the switch cabinet.
- The controller is overloaded in its arithmetic mean, i.e. overload and recovery phase exceed 100 %.
  Remedy:
  – Reduce overload phase
  – Use more powerful controller

7.7.3.9 Motor temperature monitoring OH3 (fixed)

Purpose

Protects the motor from overheat

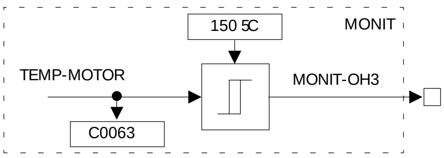


Fig. 7-244 Motor temperature monitoring OH3 with fixed threshold

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TEMP-MOTOR	-	C0063	dec	-	-	-	-
MONIT-OH3	d	-	-	-	-	-	-

Function

The signal OH3 is derived from a comparator with hysteresis. The switch-off threshold is 150 5C and is fixed. The hysteresis is also fixed and amounts to 15 K (i.e. the reclosing temperature is 135 5C. This monitoring is only effective for the thermal sensor specified by Lenze as it is included in the standard Lenze servo motor. The Sub-D connectors X7 or X8 serve as inputs.

STOP

Stop!

Only one of the inputs can be used. The other input must not be assigned (must remain open). This monitoring is activated by default setting. This means that the monitoring reacts if no Lenze servo motor is used.

Features:

- LECOM no.: 53
- Reaction: TRIP or OFF

7.7.3.10 Heatsink monitoring OH4 (adjustable)

Purpose

Controller protection

This monitoring is designed as a warning before the disconnection of the controller via the OH-TRIP.

Thus, the process can be influenced to avoid a switch-off of the controller at an inconvenient time.

For example, blowers which would cause an inacceptable noise in continuous operation, can also be triggered.

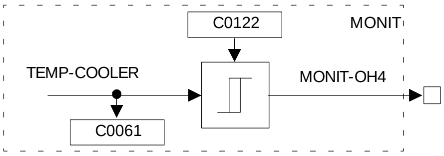


Fig. 7-245 Heatsink monitoring OH4 with adjustable threshold

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TEMP-COOLER	-	C0061	dec	-	-	-	cannot be reassigned
MONIT-OH4	d	-	-	-	-	-	-

Function

The signalOH4 is derived from a comparator with hysteresis.The threshold can be set under code C0122. The hysteresis is fixed and amounts to 5 K. The signal is thus reset below a threshold of 5 K.

Features:

- LECOM no.: 2054
- Reaction: WARNING or OFF

7.7.3.11 Motor temperature monitoring OH7 (adjustable)

Purpose

Process monitoring

This monitoring is designed as a warning before the disconnection via the OH3-TRIP.

Thus, the process can be influenced to avoid a switch-off of the motor at an inconvenient time.

For example, blowers which would cause an inacceptable noise in continuous operation, can also be triggered.

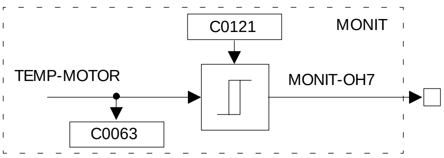


Fig. 7-246 Motor temperature monitoring OH7 with adjustable threshold

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
TEMP-MOTOR	-	C0063	dec	-	-	-	-
MONIT-OH7	d	-	-	-	-	-	-

Function

The signal OH7 is derived from a comparator with hysteresis.

Here, the same conditions apply as for the OH3 monitoring, since here the same inputs are used.

The threshold is set under code C0121. The hysteresis is fixed and amounts to 15 K. The signal is thus reset below a threshold of 15 K.

Features:

- LECOM no.: 2057
- Reaction: WARNING or OFF

7.7.3.12 Motor temperature monitoring OH8

Purpose

Motor protection

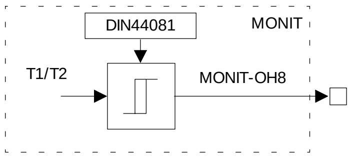


Fig. 7-247 Motor temperature monitoring OH8

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
T1/T2	-	-	-	-	-	-	-
MONIT-OH8	d	-	-	-	-	-	-

Function

The signal OH8 is derived from the digital signal via the terminals T1, T2 next to the power terminals UVW. The threshold and the hysteresis depend on the encoder system (DIN 44081) (see Chapter 4.2.9).

STOP

Stop!

When using this input as a motor protection: If the monitoring is set to WARNING or OFF, the motor can be destroyed in case of further overload.

Features:

- LECOM no.: 58, 2058
- Reaction: TRIP, WARNING or OFF

7.7.3.13 Overvoltage OU

Purpose

DC bus protection. Controller protection

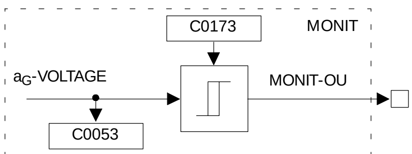


Fig. 7-248 Overvoltage OU

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
A_G-VOLTAGE	-	C0053	dec	-	-	-	-
MONIT-OU	d	-	-	-	-	-	-

Mains voltage range	Selection number (C0173)	Switch-off threshold OU	Switch-on threshold OU
< 400 V	0	770 V	755 V
400 V	1	770 V	755 V
400 0 460 V	2	770 V	755 V
480 V without brake chopper	3	770 V	755 V
Operation with brake chopper (up to 480 V)	4	800 V	785 V

Function

The monitoring indicates a message if the DC bus voltage (terminals $+U_G$and $-U_G$) exceeds the threshold (switch-off threshold OU) set under code C0173.

The message is reset if the voltage falls below the switch-off threshold OU again.

The table above shows the setting of the switching thresholds according to the selection number.

The switch-off threshold OU determines the voltage level of the DC bus voltage, where the pulse inhibit is activated.

The selection number is also effective for the low voltage monitoring (LU).

Features:

- LECOM no.: 1020
- Reaction: MESSAGE (cannot be modified)

A frequent overvoltage message indicates an incorrect dimensioning of the drive. This means that the brake energy is too high.

Remedy:

- Use supply module 934X or
- use (additional) brake choppers type 935X

When several controllers are operated simultaneously, an operation as DC bus connection may be useful.

Here, the generated brake energy of one drive can serve as drive energy for another drive.

The mains connections only supply the energy difference.

7.7.3.14 Contouring error P03

Purpose

Process monitoring

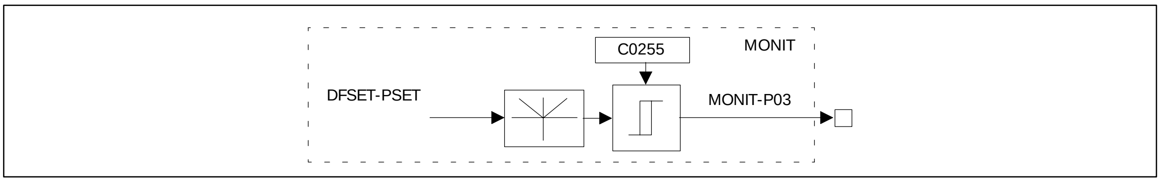


Fig. 7-249 Contouring error P03

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DFSET-PSET	-	-	-	-	-	-	-
MONIT-P03	d	-	-	-	-	-	-

Function

The monitoring reacts if the drive is not able to follow its set phase, because e.g.

- the centrifugal mass is too large for the set acceleration or deceleration time

or

- the torque limit is reached (load torque > drive torque)

Remedy:

- Unload drive

or

- increase torque limit at the servo controller (if the power limits of the controller are not yet achieved)

The monitoring is derived from the phase difference of set-value integrator minus actual phase integrator. The comparison value (contouring error limit C0255) can be set by a code. Homing points are only lost if a TRIP reaction was set.

Features:

- to monitor the process
- LECOM no.: 153, 2153
- Reaction: TRIP, WARNING or OFF

7.7.3.15 Phase controller overflow P13

Purpose

Process monitoring

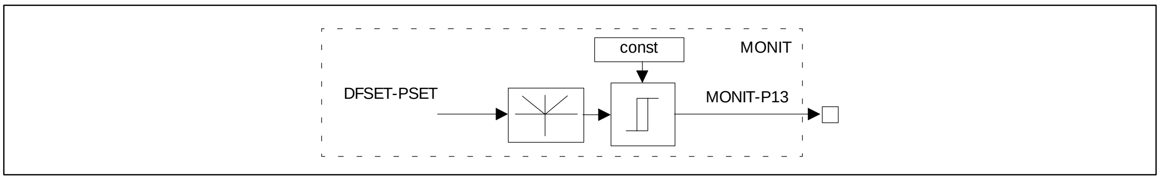


Fig. 7-250 Phase controller overflow P13

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
DFSET-PSET	-	-	-	-	-	-	-
MONIT-P13	d	-	-	-	-	-	-

Function

If this monitoring reacts, the phase deviation which can be represented internally, is exceeded. Homing points are lost.

When the monitoring is switched off, the homing points are also lost.

Features:

- LECOM no.: 163
- Reaction: TRIP or OFF

7.7.3.16 Parameter error PRO

Purpose

Controller protection

Function

Function of LECOM no. 79 (PI)

Some parameters are used for internal calculation of further data for the servo controllers. The monitoring reacts if incorrect values are recognized internally due to this calculation.

The cause may be:

Data of a powerful controller were transmitted to a less powerful controller, e.g. the settings of the motors do not match with the controller.

In this case, please contact Lenze. The values of the codes C0300 and C0301 should be communicated to Lenze.

Function of LECOM no. 75 (PR0)

This indication is displayed if the stored parameters do not match with the loaded software version. In this case, the factory setting is loaded automatically. To acknowledge the PR0, all parameter sets must be saved again manually (C0003). Only after the values have been saved, the indication can be acknowledged.

Stop!

It is not sufficient to save only one parameter again.

Features:

- LECOM
  – No.: 79 (PI)
  – No.: 75 (PR0)
- Reaction: TRIP (cannot be modified)

7.7.3.17 Parameter set error PR1, PR2, PR3, PR4

Purpose

Controller protection

Function

During load, each of the parameter sets is checked if it is complete and correct. If a difference should be recognized, the controller changes to the TRIP state. The incorrect parameter set is displayed (C0168; PR1 = parameter set1 etc.).

At the same time, the default setting is loaded, but not saved (after TRIP-RESET the controller operates with the default settings, until the setting is changed).

The cause can be a transmission error during the transmission of parameter sets to the controller.

Remedy:

The corresponding parameter set must be reset or transmitted to the controller again.

This interference can also be caused by an interrupt of the transmission of parameter sets by the operating unit (e.g. by an early disconnection of the operating unit).

Features:

- LECOM
  – No.: 72 (PR1)
  – No.: 73 (PR2)
  – No.: 77 (PR3)
  – No.: 78 (PR4)
- Reaction: TRIP (cannot be modified)

7.7.3.18 Resolver monitoring for wire breakage Sd2

Purpose

Motor protection

Monitors the cable and the resolver for wire breakage.

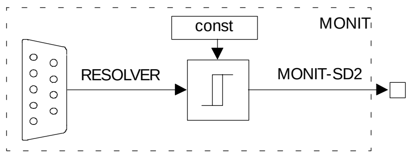


Fig. 7-251 Resolver monitoring for wire breakage Sd2

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
RESOLVER	-	-	-	-	-	-	-
MONIT-SD2	d	-	-	-	-	-	-

Function

Warning!

During commissioning this monitoring should not be switched off, since the machine may reach very high speeds (potential destruction of the motor and the driven machine) in case of fault (e.g. system cables disconnected or incorrectly bolted). The same applies if this monitoring is changed to WARNING. The possibility of disconnection should only be used if the monitoring reacts without obvious reasons (very long cables, strong noises of other devices).

This monitoring is activated automatically if the resolver is selected as actual speed encoder (C0025).

This monitoring is deactivated automatically if another actual speed encoder is selected.

Stop!

If there is a fault in the actual speed detection, it is not ensured that the monitoring reacts to overspeed NMAX.

Features:

- LECOM no.: 82, 2082

- Reaction: TRIP, WARNING or OFF

7.7.3.19 Dig-Set monitoring Sd3

Purpose

Process monitoring

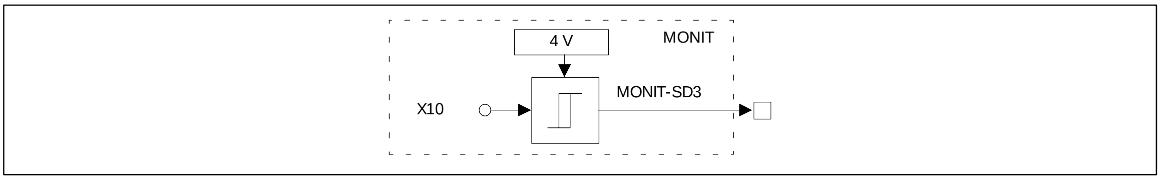


Fig. 7-252 Dig-Set monitoring Sd3

Signal				Source			Note
Name	Type	DIS	DIS format	CFG	List	Lenze	
X10	-	-	-	-	-	-	-
MONIT-SD3	d	-	-	-	-	-	-

Function

The monitoringSd3 reacts if pin 8 at the digital frequency input X9 is not supplied. Therefore, an interrupt of the digital frequency coupling can be displayed.

Features:

- LECOM no.: 83, 2083
- Reaction: TRIP, WARNING or OFF

7.8 Parameter setting

- The parameter setting of the controller is used to adapt the drive to your applications.
- The complete parameter set is organized in codes which are consecutively numbered and begin with "C" (see "Code table", (📖 7-299)).
- Save the parameter set for your application.
  – One parameter set is available.
  – The parameter sets are factory-set when delivered.

Ways of parameter setting

There are two ways of changing parameters:

- With a superimposed host (PC or PLC) via fieldbus modules and operating programs.
- With the keypad (for slight changes of the parameter set).

Stop!
Cam profile specific functions cannot be changed via the keypad!

Therefore, the following pages describe how to change parameters with the operating program Global Drive Control.

Except of the cam-specific functions, the controller can also be parameterized using the keypad. In the following you will find the corresponding description:

Structure of a parameter set

The 9371BB keypad and the PC programs Global Dirve Control and LEMOC2 have menu levels which help you to find the required codes:

- Main menu
  – contains submenus
  – contains the complete code list
- Submenus
  – contain the codes which are assigned to them

Codes consist of:

- Code level
  – Codes without subcodes contain one parameter
  – Codes with subcodes contain several parameters
- Parameter level/operating level
  There are 4 different parameter types:
  – Absolute values of a physical variable
    (e. g. 400 V, 10 s)
  – Relative values of unit variables
    (e. g. 50 % setpoint)
  – Numbers for certain states
    (e. g. 0 = controller inhibited, 1 = controller enabled)
  – Display values
    These values can only be displayed but not changed.
    (E. g. act. value of the motor current under C0054)

You can modify absolute and relative values in discrete steps.

List of selection menus

9371BB keypad		**Global Drive Control or LEMOC2**	
Main menu	**Submenu**	**Main menu**	**Submenu**
USER menu		USER menu	
Code list		Code list	
Load / Store		Parameter-set management	
Diagnostics		Diagnostics	
	Actual info		Actual operation
	History		History
Short set-up		Short set-up	
	Speed mode		Speed operation
	Torque mode		Torque operation
	DF master		Digital frequency - master
	DF slave bus		Digital frequency - slave line
	DF slave cas		Digital frequency - slave cascade
	User menu CFG		Configuration user menu
Main FB		Main function blocks	
	NSET		NSET: Speed preprocessing
	NSET-JOG		NSET-JOG: JOG values
	NSET-RAMP1		NSET-RAMP1: Standard RFG
	MCTRL		MCTRL: Motor control
	DFSET		DFSET: Dig. frequency processing
	DCTRL		DCTRL: Device control
Terminal I/O		Terminal I/O	
	AIN1 X6.1/2		Analog input 1 X6.1/2
	AIN2 X6.3/4		Analog input 2 X6.3/4
	AOUT1 X6 62		Analog output 1 X6/62
	AOUT2 X6 63		Analog output 2 X6/63
	DIGIN		Digital inputs
	DIGOUT		Digital outputs
	DFIN		Digital frequency input
	DFOUT		Digital frequency output
	State bus		State bus
Controller		Controller setting	
	Speed		Speed
	Current		Current/torque
	Phase		Phase
Motor/feedb.		Motor/feedback system	
	Motor adj		Motor adjustment
	Feedback		Feedback systems
Monitoring		Monitorings	

9371BB keypad		Global Drive Control or LEMOC2	
Main menu	**Submenu**	**Main menu**	**Submenu**
LECOM/AIF		LECOM/AIF interface	
	LECOM-A/B		LECOM-A/B
	AIF interface		AIF-data interface
	Status word		Status word
System bus		System bus	
	Management		CAN management
	CAN-IN1		CAN-IN1 Input block 1
	CAN-OUT1		CAN-OUT1 Ouput block 1
	CAN-IN2		CAN-IN2 Input block 2
	CAN-OUT2		CAN-OUT2 Output block 2
	CAN-IN3		CAN-IN3 Input block 3
	CAN-OUT3		CAN-OUT3 Output block 3
	Status word		Status word
	FDO		FDO: Free digital outputs
	Diagnostics		Diagnostics
FB config		FB configuration	
Func. blocks		Function blocks	
	ABS		ABS: Absolute value
	ADD		ADD Addition
	AIF-OUT		AIF-OUT Data interface
	AIN1		AIN1 Analog input 1 (term. 1/2
	AIN2		AIN2 Analog input 2 (term. 3/4
	AND1		AND1 Logic AND
	AND2		AND2 Logic AND
	AND3		AND3 Logic AND
	AND4		AND4 Logic AND
	AND5		AND5 Logic AND
	AND6		AND6 Logic AND
	AND7		AND6 Logic AND
	ANEG1		ANEG1 Analog negation
	ANEG2		ANEG2 Analog negation
	AOUT1		AOUT1 Analog output term. 62
	AOUT2		AOUT2 Analog output term. 63
	ARIT1		ARIT1 Arithmetics
	ARIT2		ARIT2 Arithmetics
	ARITPH1		ARITPH1 32 bit arithmetics
	ASW1		ASW1 Analog switch
	ASW2		ASW2 Analog switch
	ASW3		ASW3 Analog switch
	ASW4		ASW4 Analog switch
	BRK		BRK Brake logic
	CAN-OUT1		CAN-OUT1 Output block 1
	CAN-OUT2		CAN-OUT2 Output block 2
	CAN-OUT3		CAN-OUT3 Output block 3

Configuration

9371BB keypad		Global Drive Control or LEMOC2	
Main menu	Submenu	Main menu	Submenu
	CFG-FB		CFG FB configuration
	CMP1		CMP1 Analog comparator
	CMP2		CMP2 Analog comparator
	CMP3		CMP3 Analog comparator
	CONV1		CONV1 Converter
	CONV2		CONV2 Converter
	CONV3		CONV3 Converter
	CONV4		CONV4 Converter
	CONV5		CONV5 Converter
	CONV6		CONV6 Converter
	CONVPHA1		CONVPHA1 32 bit converter
	CONVPHPH1		CONVPHPH1 32 bit converter
	CONVPP1		CONVPP1 32 bit / 16 bit converter
	DB		DB Analog deadband
	DCTRL		DCTRL Device control
	DFIN		DFIN Digital frequency input
	DFOUT		DFOUT Digital frequency output
	DFRFG		DFRFG Dig. frequency ramp function generator
	DFSET		DFSET Dig. frequency processing
	DIGDEL1		DIGDEL1 Digital delay
	DIGDEL2		DIGDEL2 Dig. delay
	DIGIN		DIGIN Digital input E1 - E5
	DIGOUT		DIGOUT Digital output A1 - A4
	DT1		DT1 Differentiator element
	FCNT1		FCNT1 Piece counter
	FDO		FDO Free digital outputs
	FEVAN1		FEVAN1 Free analog input variable
	FEVAN2		FEVAN2 Free analog input variable
	FIXSET		FIXSET Fixed setpoints
	FLIP1		FLIP1 Flip-Flop
	FLIP2		FLIP2 Flip-Flop
	LIM		LIM Limiter
	GEARCOMP		GEARCOMP Gear compensation
	MCTRL		MCTRL Motor control
	MFAIL		MFAIL Mains failure detection
	MPOT		MPOT Motor potentiometer
	NOT1		NOT1 Logic NOT
	NOT2		NOT2 Logic NOT
	NOT3		NOT3 Logic NOT
	NOT4		NOT4 Logic NOT
	NOT5		NOT5 Logic NOT
	NSET		NSET Speed preprocessing
	NSET-JOG		NSET-JOG JOG values
	NSET-RAMP1		NSET-RAMP1 Standard RFG
	OR1		OR1 Logic OR
	OR2		OR2 Logic OR
	OR3		OR3 Logic OR
	OR4		OR4 Logic OR
	OR5		OR5 Logic OR

9371BB keypad		Global Drive Control or LEMOC2		
Main menu	**Submenu**	**Main menu**	**Submenu**	
	PCTRL		PCTRL	Process controller
	PHADD1		PHADD1	32 bit addition element
	PHCMP1		PHCMP1	Phase comparator
	PHCMP2		PHCMP2	Phase comparator
	PHCMP3		PHCMP3	Phase comparator
	PHDIFF1		PHDIFF1	32 bit setpoint/act. value comparison
	PHDIV1		PHDIV1	Phase division
	PHINT1		PHINT1	Phase integrator
	PHINT2		PHINT2	Phase integrator
	PHINT3		PHINT3	Phase integrator
	PT1		PT1	Delay element
	R/L/Q		R/L/Q	CW/CCW/QSP
	REF		REF	Homing
	RFG		RFG	Ramp function generator
	SRFG1		SRFG1	S-shape ramp function generator
	STORE1		STORE1	Store phase, E5
	STORE2		STORE2	Store phase, E4
	SYNC1		SYNC1	Control program synchronization
	TRANS1		TRANS1	Transition evaluation
	TRANS2		TRANS2	Transition evaluation
	TRANS3		TRANS3	Transition evaluation
	TRANS4		TRANS4	Transition evaluation
FCODE		Free codes		
Identify		Identification		
	Drive		Controller	
	Op keypad		LECOM	

7.8.1 Parameter setting in GDC

7.8.1.1 Change parameters

The parameter setting is explained by means of the following example:

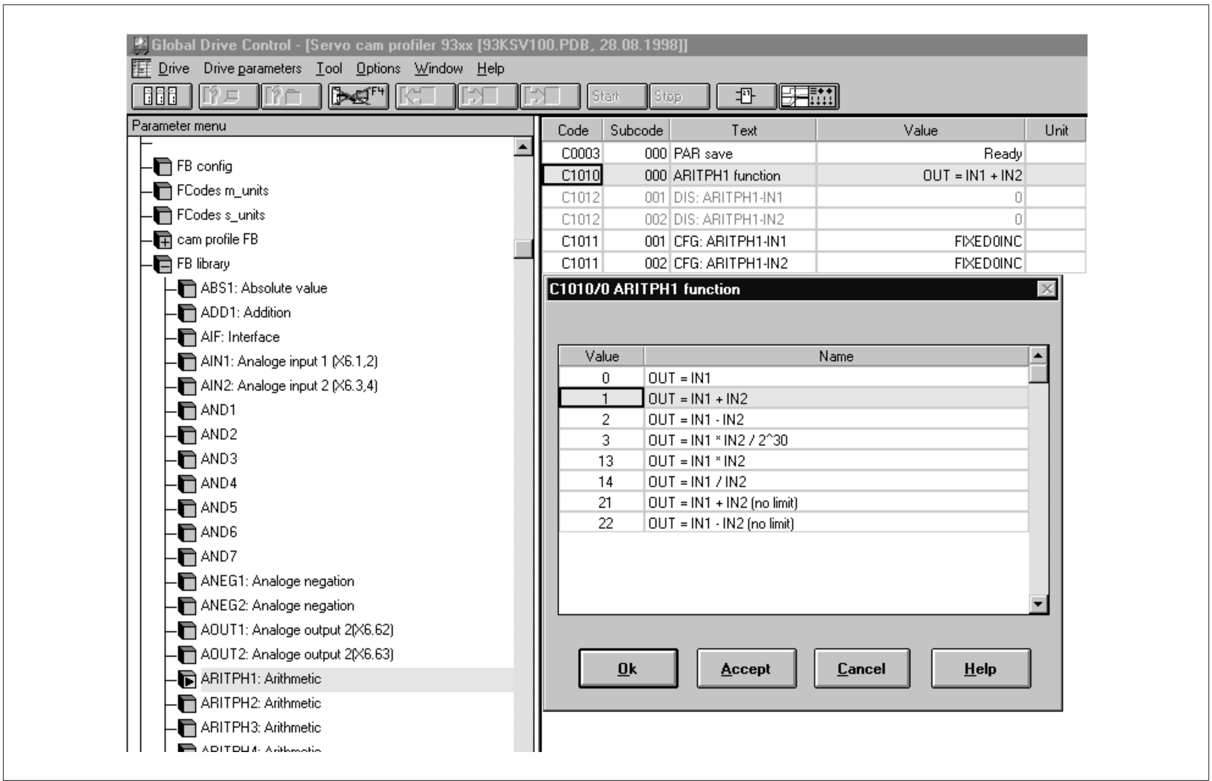


Fig. 7-253 Parameter setting for the FB “ARITPH1: Arithmetic operation with phase signals”

Step	Command	Function
	Initiate parameter menu	
	Open menu “Function blocks”.	Displays all FB menus.
3.	Example: Open menu “ARITPH1”.	Opens the parameter table for FB ARITPH1.
4.	Example: Click C1010 “ARITPH1 function”.	All available functions are displayed. • Select the function which is to be carried out by the FB. Confirm with “OK”.
5.	Click C0003 “Save parameter set”.	Saves the parameter set to avoid that all settings will be lost if the mains is switched off. All available parameter sets are displayed. • Select ”PSet 1”. Confirm with “OK”.

Note!

Save the changed parameter set in a file on your hard disk of your PC or a diskette. You can use it for future applications or other controllers.

7.8.1.2 Parameter set transfer

Warning!

The controller is being new initialized because of the parameter set transfer from the PC to the controller: System configuration and terminal assignments can have changed!

- Ensure that your wiring and drive configuration correspond to the settings of the parameter set.
- Only use terminal X5/28 or the STOP function of GDC as source for the controller inhibit.

A parameter set transfer is only possible when the controller is inhibited.

With the PC program Global Drive Control complete parameter sets can be transferred from one controller to another.

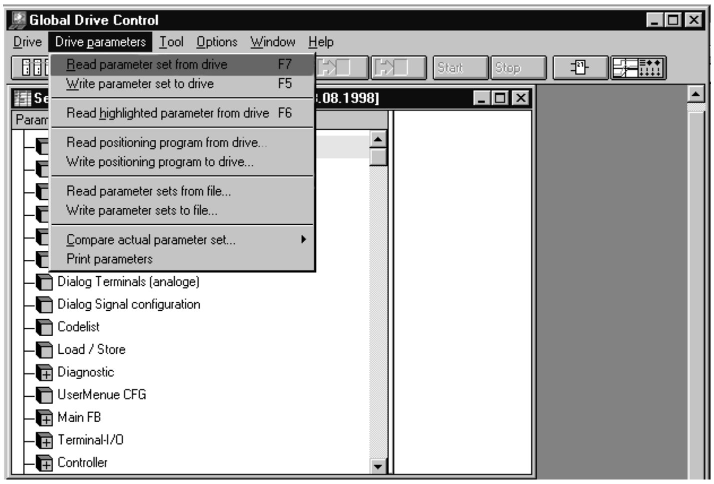


Fig. 7-254 Dialog box "Read parameter set from file"

Step	Command	Function
	At the PC of the first controller (source):	
	Select the entry "Read the actual parameter set from the controller" from the menu "Control parameters".	Loads the actual parameter set from the first controller in the PC. C0002 provides the following possibilities: • Loading of factory setting (C0002=0) • Loading of customer-specific parameter set (C0002=1)
	Select the entry "Write all parameter sets to file" from the menu "Control parameters".	Saves the parameter sets in a file on a hard disk or another data medium. • Saves the parameter sets on a diskette.
3.		• Insert the diskette into the PC's drive of the second controller.
	At the PC of the second controller (target):	
4.	Select the entry "Read all parameter sets from file" from the menu "Control parameters".	Loads the parameter sets from a file on a hard disk or another data medium. • Loads the parameter sets of the first controller from a diskette.
5.	Select the entry "Write actual parameter set to controller" from the menu "Control parameters".	Transfers the actual parameter set from the PC to the second controller. • In the menu "Parameter set management" the data can be saved so that they are protected against mains failure with C0003=1.
6.		Check, whether the wiring and the drive configuration correspond to the settings of the new parameter set.
7.		Deactivate the controller inhibit (terminal X5/28=HIGH).

7.8.2 Parameter change using the keypad

7.8.2.1 Keypad

(Order number: EMZ9371BB)

The keypad can be connected or disconnected from X1 during operation.

After the keypad has been connected to the controller it is initialized. The keypad is ready for operation when "GLOBAL DRIVE READY" is indicated.

Front view

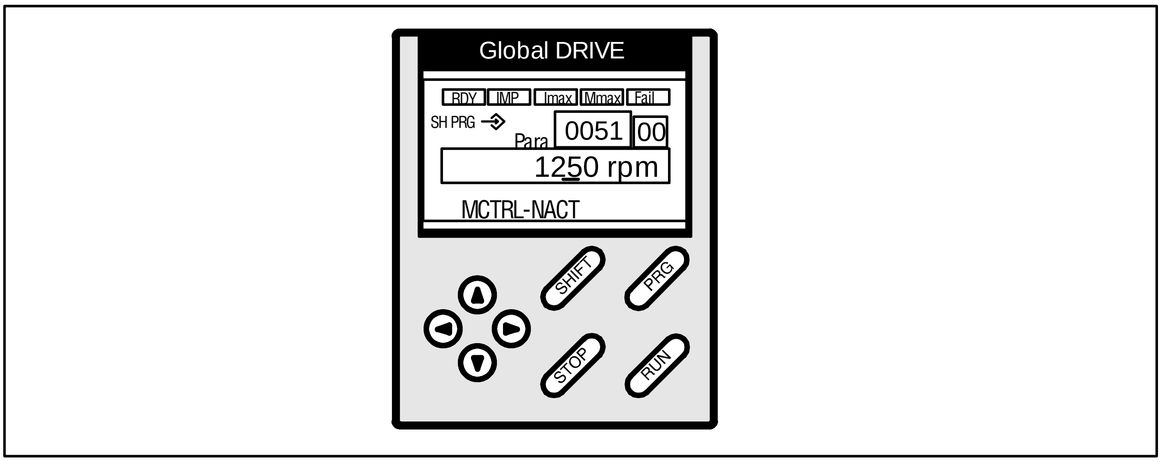


Fig. 7-255 The keypad

LCD

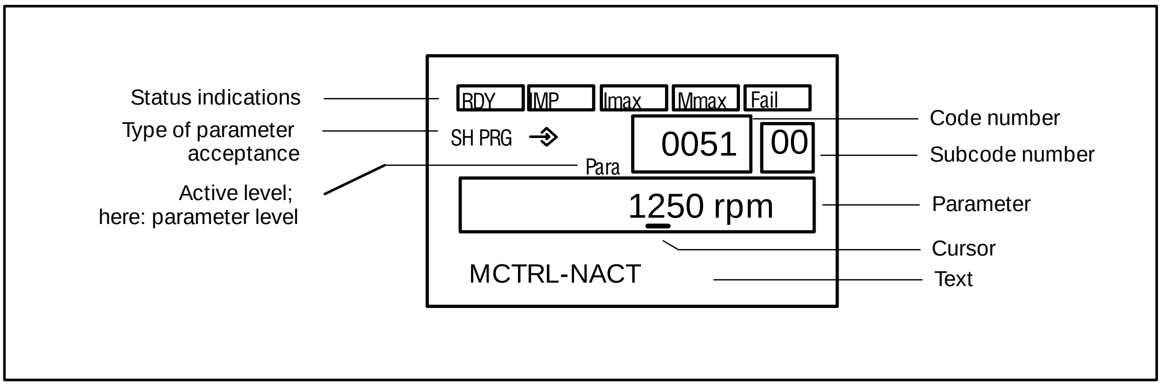


Fig. 7-256 LCD display on the keypad

Segments and status messages of the LCD display:

Segment	Explanation
Code number	Four-digit code number
Subcode number	Two-digit subcode number
Parameter	Parameter value with up to twelve digits
Text	Text with max. 13 characters; Operating level: Status information from C0183 or content of C0004
SH PRG ➔	SH PRG ➔ : Parameter acceptance by pressing SHIFT + PRG (OFFLINE)
	SH PRG: Parameter acceptance with SHIFT + PRG when the controller is inhibited (OFFLINE)
	➔ : Parameter is directly accepted by the controller (ONLINE)
	Empty: Parameter cannot be changed
Active level	Menu = Menu level, Code = Code level, Para = Parameter level, Nothing displayed = Operating level

Status messages of the keypad		
Display	**on**	**off**
RDY	Ready for operation	Initialization or fault
IMP	Power outputs inhibited	Power outputs enabled
FAIL	Active fault	No fault
I_{MAX}	Motor current setpoint ≥ C0022	Motor current setpoint < C0022
M_{MAX}	Speed controller 1 within limitation. Drive is torque controlled.	Drive is speed controlled.

Key functions

"SHIFT + " means:

1. Press SHIFT and remain pressing it.
2. Press another key indicated.

Keys	Function		
	Menu level	**Code level**	**Parameter level/operating level**
PRG	-	Change between code, parameter and operating level	
SHIFT + PRG	-	-	Parameter acceptance (depends on parameter and menu)
▲	Next higher menu point	Next higher code number	Increase indicated number
SHIFT + ▲	Quickly to next higher menu point	Quickly increase code number	Quickly increase displayed number
▼	Next lower menu point	Next lower code number	Decrease displayed number
SHIFT + ▼	Quickly to next lower menu point	Quickly decrease code number	Quickly decrease displayed number
◄	Next higher menu level	Jump to menu level	Cursor left
►	Next lower menu level (submenus) or code level	-	Cursor right
RUN	Void STOP-key function		
STOP	Inhibit controller: Quick stop, ctrl. inhibit or switched off C0469 Trip reset: If a TRIP occurs and the STOP key is pressed (independently of C0469) Press RUN afterwards. The LED in the STOP-key indicates its status. • LED on: STOP-key pressed • LED off: RUN-key pressed		

Operating level

Change from the prameter level to the operating level by pressing PRG.

- The operating level indicates additional status information or displays the additional display value determined under C0004 (presetting: act. speed C0051).
  – In the USER menu the first line indicates the first code of the USER menu.
- The additional information is indicated according to the following priority list:

Priority	Display	Meaning
1	GLOBAL DRIVE INIT	Initialization or communication fault between keypad and controller
2	XXX - TRIP	Active TRIP (contents of C0168/1)
3	XXX - MESSAGE	Active message (contents of C0168/1)
4	Special controller status:	
		Switch-on inhibit
5	Source for controller inhibit (at the same time value of C0004 is displayed):	
	STP1	Terminal X5/28
	STP3	Keypad or LECOM A/B/LI
	STP4	InterBus-S or Profibus
	STP5	System bus (CAN)
	STP6	C0040
6	Source for quick stop:	
	QSP-term-Ext	Input MCTRL-QSP at function block MCTRL is at HIGH signal (factory setting: assigned to terminals X5/E1 and X5/E2)
	QSP-C0135	Keypad or LECOM A/B/LI
	QSP-AIF	InterBus-S or Profibus
	QSP-CAN	System bus (CAN)
7	XXX - WARNING	Active warning (contents of C0168/1)
8	xxxx	Value of C0004

User menu

In practical use it might be necessary to change certain codes more than once.

Under C0517 it is therefore possible to install a user menu with max. 32 codes which are to be changed most frequently.

- The number before the comma is the code number.
- The number after the comma stands for the subcode.
- Code-subcode combinations must only occur once.

7.8.2.2 Change parameters

Note!

The changed parameter set must be saved if the changes are to remain valid after mains switch-off (see chapter 7.8.2.3).

Basic procedure

1. Use the arrow keys to change from the menus ▲, ▼, ◀ or ▶ to the code level. ”Code” is displayed.
2. With ▲ or ▼ code or subcode can be selected.
3. Change to the parameter level using PRG. ”Para” is displayed.
4. With ◀ or ▶ the cursor (small, black bar) can be moved under the digit to be changed.
5. With ▲ or ▼ change digit.
6. If necessary, repeat 4. and 5. to change other digits.
7. Accept parameters. The LCD next to the parameter indicates how the controller accepts the changed parameter:

Display next to the parameter	Controller has accepted the new value
➾	immediately, during the change
SH+ PRG ➾	after having pressed SH+ PRG. Acknowledgement: ok is displayed
SH+ PRG	Press STOP to inhibit the controller. Press SHIFT + PRG. Acknowledgement: ok is displayed Press RUN to enable the controller.

8. Change to the code level by 2 * PRG. ”Code” is displayed.

7.8.2.3 Save parameter set

Save the parameters to ensure that the settings will not be lost after mains switch-off.

- Up to 4 different parameter sets can be created, if this is required by, for instance, a machine, which processes different materials or works in different operating states (set-up operation, ”stand by”, etc.).
- If you need only one parameter set, save the changes permanently under parameter set 1, since the controller loads this parameter set automatically after every switch on.

Procedure

1. Use the arrow keys to change from the menus to the code level.
   ”Code” is displayed.
2. With ▲ or ▼ select C0003.
3. Change to the parameter level using PRG.
   ”Para” is displayed.
4. With ▲ or ▼ set parameter to 1 (also during operation).
   Note: If the parameter set is to be saved in a different location, select 2, 3 or 4 instead of 1.
5. Press SHIFT + PRG.
   ”OK” is displayed for approx. 1 s.
   Your settings are now saved permanently under parameter set 1 (or 2, 3 or 4).

7.8.2.4 Load parameter set

(only possible with controller inhibit)

Warning!

- After loading of a new parameter set the controller will be initialized again and behaves as if the mains was switched on:
  – System configurations and terminal assignment can be changed. Ensure, that your wiring and drive configuration correspond to the settings of the parameter set.
- Only use terminal X5/28 as source for the controller inhibit! Otherwise, the drive can start in an uncontrolled way when changing to another parameter set.

Note!

The RDY message is not displayed while the parameter set is loaded, since the controller cannot be operated then.

Mains connection

The controller loads parameter set 1 automatically.

Keypad

1. X5/28 = LOW
2. With ▲ or ▼ select C0002.
3. Change to the parameter level using PRG.
4. With ▲ or ▼ select required parameter set.
5. Press SHIFT + PRG.
   ”OK” is displayed. Loading is over as soon as ”OK” is off.
6. Enable the controller with X5/28 = HIGH.

Terminal control

It is possible to change to other parameter sets using, for instance, the digital inputs X5/E1 0 X5/E5.

After mains switch-on the controller reads parameter set 1. After that the terminals are evaluated and the selected parameter set is loaded. A LOW-HIGH signal at input DCTRL-PAR-LOAD (”Load parameter set”) is not required.

- In each parameter set one or two digital inputs must be assigned to ”Select parameter set”:
  – Determine the source(s) for ”Select parameter set” under C0880. The signal names are: DCTRL-PAR*1 and DCTRL-PAR*2.
- In each parameter set one digital input must be assigned to ”Load parameter set”:
  – Determine the source for ”Load parameter set” under C0881. The signal name is: DCTRL-PAR-LOAD.
- These inputs must be assigned identically for all parameter sets to be used.

- The controller reads the terminals assigned to ”Select parameter” as binary code. The input DCTRL-PAR*1 is the first input, the input DCTRL-PAR*2 is the second input. Input (e.g. E1 = 1st input, E2 = 2nd input).
  – The signal must be constantly assigned to the terminals for at least 10 ms to ensure that the parameter set to be loaded is correct.
  – Terminal signals for the selection of parameter sets:

	1st input (DCTRL-PAR*1)	2nd input (DCTRL-PAR*2)
Parameter set 1	LOW	LOW
Parameter set 2	HIGH	LOW
Parameter set 3	LOW	HIGH
Parameter set 4	HIGH	HIGH

- A LOW-HIGH signal at the input ”Load parameter set” DCTRL-PAR-LOAD switches to the new parameter set.

Procedure:

1. Control digital inputs which are assigned to the function ”Select parameter set”.
2. Inhibit the controller with X5/28 = LOW.
3. Activate a LOW-HIGH signal at the input ”Load parameter set”.
4. After loading:
   – C0002 indicates the number of the loaded parameter set.
   – RDY is on.
5. Enable the controller with X5/28 = HIGH.

7.8.2.5 Parameter set transfer

(only possible with controller inhibit)

Warning!

- After loading of a new parameter set the controller will be initialized again and behaves as if the mains was switched on:
  – System configurations and terminal assignment can be changed. Ensure, that your wiring and drive configuration correspond to the settings of the parameter set.
- Only use terminal X5/28 as source for the controller inhibit! Otherwise, the drive can start in an uncontrolled way when changing to another parameter set.

Use the keypad to transfer complete parameter sets from one controller (e.g. controller 1) to another controller (e.g. controller 2).

When copying from the controller to the keypad all parameter sets are copied and saved in the keypad.

Procedure:

1. Plug the keypad in controller 1.
2. Inhibit the controller with X5/28 = LOW.
3. Save the last changes in the corresponding parameter set under C0003.
4. Use the arrow keys to change from the menus to the code level.
   ”Code” is displayed.
5. With ▲ or ▼ select C0003.

6. Change to the parameter level using PRG.
   "Para" is displayed.
7. Select parameter 11.
8. Press SHIFT + PRG.
   RDY is off. BUSY is displayed.
   All parameter sets are copied to the keypad. Copying is completed when BUSY is off (after approx. one minute).

Stop!

Do not plug out the keypad before BUSY is off. Otherwise, TRIP "PRX" will be indicated.

9. Enable the controller with X5/28 = HIGH.
10. Plug the keypad in controller 2.
11. Inhibit the controller 2 with X5/28 = LOW.
12. Use the arrow keys to change from the menus to the code level.
    "Code" is displayed.
13. With ▲ or ▼ select C0002.
14. Change to the parameter level using PRG.
    "Para" is displayed.
15. Select parameter 20 to copy all parameter sets from the keypad to the controller 2 **and** to save them.
16. Press SHIFT + PRG.
    RDY is off. BUSY is displayed.
    All parameter sets are copied to controller 2 and saved. Copying and saving is completed when BUSY is off.
17. Enable the controller with X5/28 = HIGH.

Note!

It is also possible to copy single parameter sets from the keypad to the controller 2:

- For this, use parameters 11, 12, 13, or 14 instead of parameter 20 to copy the parameter sets 1, 2, 3, or 4 to the the controller 2.15.
- The copied parameter sets must be saved if the changes are to remain valid after mains switch-off (see chapter 7.8.2.3).

7.8.2.6 Password protection

Code	LCD	Possible settings		IMPORTANT
		Lenze	Selection	
C0094	Password	0	0 {1} 9999	Password • Parameter access protection for the operating module. When the password is activated, only the codes of the user menus can be accessed. For further selection possibilities see C0096
[C0096]				Extended password protection for bus systems with activated password (C0094). • All codes in the user menu can be accessed.
1	AIF protect.	0	0 No password protection	
2	CAN protect.	0	1 Read protection	
			2 Write protection	
			3 Read/Write protection	

You can restrict the code access via the operating module using the password protection in C0094.

- Reading C0094 using the operating module:
  – C0094 = 0: password protection is not activated.
  – C0094 = 9999: password protection is activated.
- Activate password protection:
  – Enter four-digit number in C0094.
  – Confirm using SH + PRG.
- Deactivate password protection:
  – Enter four-digit number again.
  – All other inputs are refused.

Effect

- Working with the operating module:
  – The codes listed in the USER menu can still be read and changed.
  – All other codes are no longer displayed.
- Working with the fieldbus:
  – It is possible to extend the protection for codes via the fieldbus under C0096/1 (AIF) and C0096/2 (CAN).

7.8.3 Display functions

Act. value display

The actual values can be read under the following codes:

Code	Meaning
C0051	Absolute act. speed value [rpm]
C0052	Absolute motor voltage [V]
C0053	Absolute DC-bus voltage [V]
C0054	Absolute motor current [A]
C0060	Rotor position [inc/rev]
C0061	Heat sink temperature [5C]
C0063	Absolute motor temperature [5C] Display only if the KTY (PTC) is connected via X7 or X8.
C0064	Controller load capacity [%]

Identification

- Read under C0099 which software version is used by the controller.
- C0093 indicates the controller type.

Configuration

EDS9300UE-PE
00411238

Lenze

Manual
Part E

Troubleshooting and fault elimination

Maintenance

Global Drive

Servo position controller 9300

This documentation is valid for 9300 position controllers as of version:

33.932X	EP	2x	1x		(9321 - 9329)
33.933X	EP	2x	1x		(9330 - 9332)
33.932X	CP	2x	1x	- V003	Cold Plate (9321 - 9328)

Type

Desgin:
E = Enclosure IP20
C = Cold Plate
xK = Cam profiler
xP = Position controller
xR = Register controller
xS = Servo inverter

Hardware level and index

Software level and index

Variant

Explanation

Version 2.0 09/99

Contents

Part E

8 Troubleshooting and fault elimination

- Operational faults are indicated immediately via the display elements or the status information (📖 8-1, chapter “Troubleshooting”).
- Faults can be analysed using
  – the history bufferr (📖 8-3)
  – and the list “Fault messages”. (📖 8-6)
- The list “Fault messages” gives information on how to eliminate faults. (📖 8-6)

8.1 Troubleshooting

Display on the controller

Two LEDs on the front of the controller indicate the controller status.

LED green	LED red	Cause	Check
■	□	Controller enabled; no fault	
★	□	Controller inhibit, switch-on inhibit	C0183; or C0168/1
□	★	Fail	C0168/1
■	★	Warning, fail-QSP	C0168/1

■ : on □ : off ★ : blinking

Display in Global Drive Control

- Open the ”Dialog Diagnosis” menu in the parameter menu by a double click.

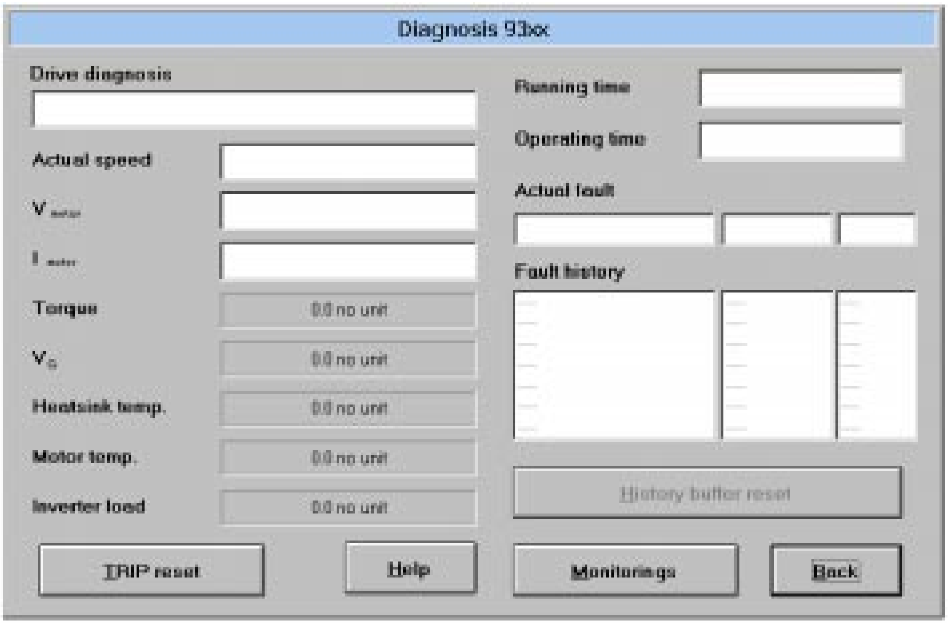


Fig. 8-1 Dialog box ”Diagnostics 9300”

- The dialog box ”Diagnosis 9300” indicates the controller status.

Troubleshooting and fault elimination

Display on the operating module

In the display status indications show the controller status.

Display	Controller status	Check
RDY	Controller ready for operation, controller can be inhibited	C0183, C0168/1
IMP	Pulses at the power stage inhibited	C0183, C0168/1
I_{max}	Max. current reached	
M_{max}	Max. torque reached	
Fail	Fault through TRIP, message, fail-QSP or warning	C0183, C0168/1

Display via the LECOM status word C0150

Bit	Meaning	
0	FREE 0	freely linkable
1	IMP (pulse inhibit)	0 = enable pulses for power stage 1 = inhibit pulses for power stage
2	FREE 2	freely linkable
3	FREE 3	freely linkable
4	FREE 4	freely linkable
5	FREE 5	freely linkable
6	f_d = 0 (act. speed = 0)	0 = n <> 0 1 = n = 0
7	Ctrl. inhibit (controller inhibit)	0 = no controller inhibit 1 = controller inhibit
8-11	Controller status	0 = controller initialization 1 = switch-on inhibited 3 = operation inhibited (controller inhibit) 6 = operation enabled 7 = message active 8 = fault active 9 = power off A = fail-QSP
12	Warning	0 = no warning 1 = warning
13	Message	0 = no message 1 = message
14	FREE 14	freely linkable
15	FREE 15	freely linkable

8.2 Fault analysis with the history buffer

- The history buffer is used to trace faults.
- Fault messages are stored in the history buffer in the order of their occurrence.
- Open the "Dialog Diagnosis" menu in the parameter menu by a double click.

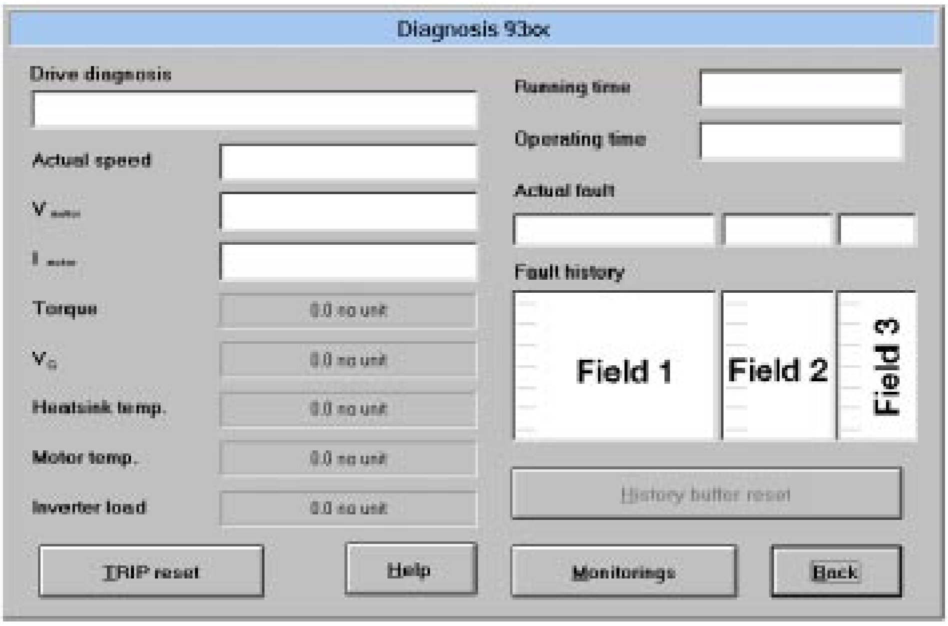


Fig. 8-2 Dialog box "Diagnostics 9300"

8.2.1 Structure of the history buffer

- The history buffer provides 8 memory locations. The fields under "fault history" show the memory locations 2 to 7.
- The fields under "Actual fault" show memory location 1. It contains information on the active fault.
  – The first memory location is written only after the elimination or acknowledgement of the active fault. This entry eliminates the last fault from the history buffer so that it can no longer be read.
- The history buffer provides three information units for every fault occurred. The fields under "Actual fault" and "Fault history" have the following meaning:
  – **Field 1:** Fault recognition and reaction
  – **Field 2:** Instant of fault
  – **Field 3:** Frequency of fault

Troubleshooting and fault elimination

The following table shows the assignment of information and codes.

Codes and information to be retrieved				Memory location
C0168	C0169	C0170	Subcode	
Fault recognition and reaction	Time of the last occurrence	Frequency of the immediately following occurrence	1	Active fault
			2	History buffer location 1
			3	History buffer location 2
			4	History buffer location 3
			5	History buffer location 4
			6	History buffer location 5
			7	History buffer location 6
			8	History buffer location 7

8.2.2 Working with the history buffer

- Open the ”Dialog Diagnostics” menu in the parameter menu by a double click.

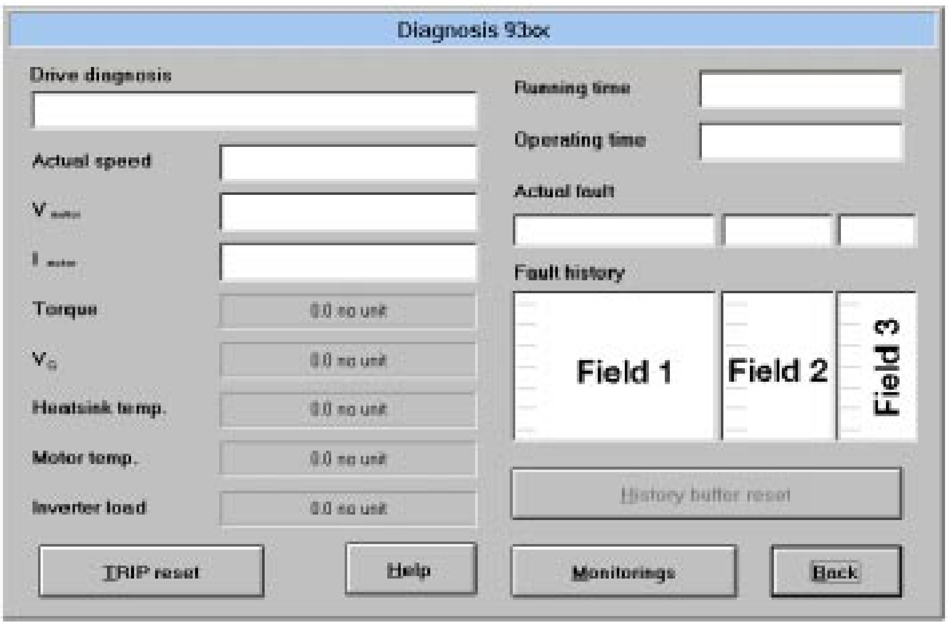


Fig. 8-3 Dialog box ”Diagnostics 9300”

Fault recognition and reaction (field 1)

- Contains the fault recognition for every memory location and the reaction to the fault.
  – e.g. ”OH3 TRIP”
  – With a fieldbus, the faults are indicated by a fault number. (🕮 8-6, column 2)

Please note:

- For faults occuring at the same time with different reactions:
  – Only the fault of which the reaction has highest priority is input in the memory (priority = TRIP → message → FAIL-QSP → warning).
- For faults occuring at the same time and with the same reaction (e.g. 2 messages):
  – Only the fault which occurred first is entered.

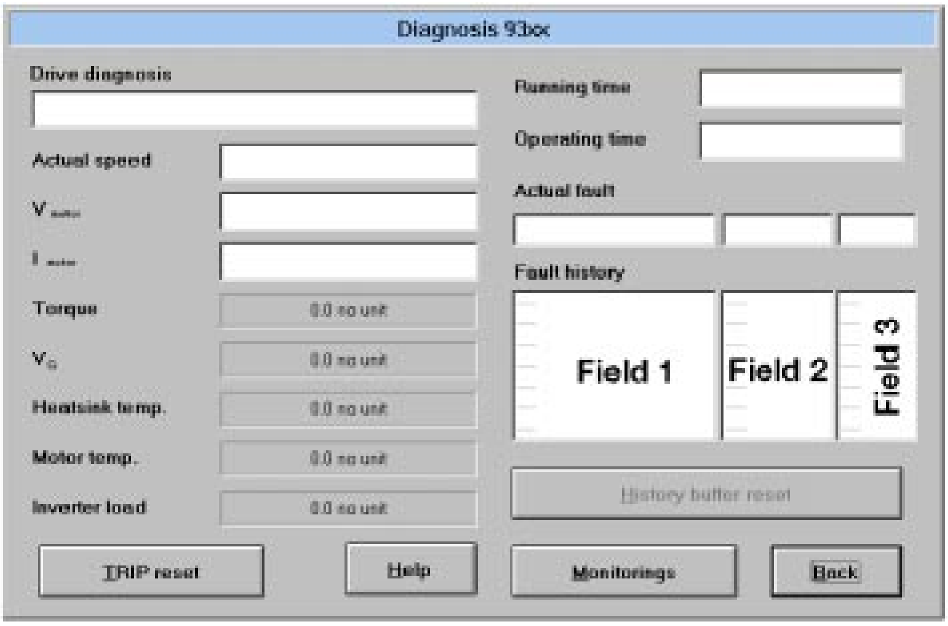


Fig. 8-4 Dialog box "Diagnostics 9300"

Time (field 2)

- Contains the times when the faults occurred
  - – e.g. "1234567 s"
  - – Reference time is the mains switch-on time (see Fig. 8-4, field top right).

Please note:

- If a fault is immediately followed by another several times, only the time of the last occurrence is stored.

Frequency (field 3)

- Contains the frequency of a fault immediately followed by the same fault. The time of the last occurrence is stored.

Reset fault

- Click on the "TRIP reset" button.

Delete history buffer

- This function is possible only when no fault is active.
- Click on the "fault memory reset" button".

8.3 Fault messages

Note!

If the fault indication is requested by a fieldbus, the fault indication is represented by a fault number (C0168/x). See column 2 and the footnote at the end of this table.

Display	Fault No.[2)]	Fault	Cause	Remedy
---	---	No fault	-	-
CCr	71	System fault	Strong interference on control cables	Screen the control cables
			Ground or earth loops in the wiring	PE wiring. 4-34
CDE	220	Data error	Attempt to accept faulty data	New data transfer
	2221	Data error warning	The check sum of the transferred data is not correct.	New data transfer and check
CE0	61	Communication error	Interference during transmission of control commands via automation interface X1	Plug in automation module firmly, bolt down, if necessary
CE1	62	Communication error at the process data input object CAN_IN_1	CAN_IN_1 object receives faulty data or communication is interrupted	• Check cable at X4 • Check transmitter • Increase monitoring time under C0357/1 if necessary
CE2	63	Communication error at the process data input object CAN_IN_2	CAN_IN_2 object receives faulty data or communication is interrupted	• Check cable at X4 • Check transmitter • Increase monitoring time under C0357/2 if necessary
CE3	64	Communication error at the process data input object CAN_IN_3	CAN_IN_3 object receives faulty data or communication is interrupted	• Check cable at X4 • Check transmitter • Increase monitoring time under C0357/3 if necessary
CE4	65	BUS-OFF state	Controller has received too many incorrect telegrams by system bus X4 and has disconnected from the bus	• Check wiring • Check bus terminator (if any) • Check screen contact of the cables • Check PE connection • Check bus load: • Reduce baud rate (observe cable length)
EEr	91	External fault (TRIP-Set)	A digital input assigned to the TRIP-Set function has been activated	Check external encoder
H05	105	Internal fault		Contact Lenze
H07	107	Incorrect power stage	During initialization of the controller, an incorrect power stage was detected	Contact Lenze
H10	110	Sensor fault heat sink temperature	Sensor of the heat sink temperature detection indicates undefined values	Contact Lenze
H11	111	Sensor fault indoor temperature	Sensor of indoor temperature detection indicates undefined values	Contact Lenze
LP1	32	Motor phase failure	A current-carrying motor phase has failed	• Check motor • Check supply cables
			The current limit is set too low	Set a higher current limit under C0599
			This monitoring is not suitable for: • Synchronous servo motors • Field frequencies > 480 Hz	Deactivate monitoring with C0597= 3
LU	30	Undervoltage	DC bus voltage is smaller than the value fixed under C0173	• Check mains voltage • Check supply cable
r_{MAX}	200	Max. speed exceeded (C0596)	Active load (e.g. for hoists) too high Drive is not speed-controlled, torque excessively limited.	Check drive dimensioning. Increase torque limit if necessary.

Display	Fault No.[2]	Fault	Cause	Remedy
OC1	11	Short-circuit	Short-circuit	Find out cause of short-circuit; check cable.
			Excessive capacitive charging current of the motor cable.	Use motor cable which is shorter or of lower capacitance.
OC2	12	Earth fault	One of the motor phases has earth contact.	• Check motor • Check supply cables
			Excessive capacitive charging current of the motor cable.	Use motor cable which is shorter or of lower capacitance.
OC5	15	I x t overload	Frequent and too long acceleration with overcurrent Continuous overload with I_{motor} > 1.05 x $I_{rx.}$	Check drive dimensioning.
OH	50	Heat sink temperature is higher than the value set in the controller	Ambient temperature T_{amb} > 40 °C or 50 °C.	• Allow controller to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heat sink very dirty.	Clean heat sink
			Incorrect mounting position.	Change mounting position.
OH3 [1]	53	Heat sink temperature is higher than the value set in the controller	Motor too hot because of excessive current or frequent and too long acceleration	Check drive dimensioning.
			No PTC connected.	Connect PTC or switch-off monitoring (C0583=3).
OH4	54	Heat sink temperature is higher than the value set under C0122.	Ambient temperature T_{amb} > 40 °C or 50 °C.	• Allow controller to cool and ensure better ventilation. • Check ambient temperature in the control cabinet.
			Heat sink very dirty.	Clean heat sink
			Incorrect mounting position.	Change mounting position.
			Value set under C0122 was too low.	Enter higher value.
OH7 [1]	57	Motor temperature is higher than the value set under C0121.	Motor too hot because of excessive current or frequent and too long acceleration	Check drive dimensioning.
			No PTC connected.	Connect PTC or switch-off monitoring (C0584=3).
			Value set under C0121 was too low.	Enter higher value.
OH8	58	PTC at terminals T1, T2 indicates motor overheat.	Motor too hot because of excessive current or frequent and too long acceleration	Check drive dimensioning.
			Terminals T1, T2 are not assigned.	Connect PTC or thermostat or switch off monitoring (C0585=3).
OU	20	Overvoltage	Excessive brake energy (DC bus voltage higher than set under C0173).	Use brake module or regenerative power supply module.
P01	151	Limit switch negative	Negative limit switch was reached.	• Control drive in positive direction. • Check terminal connection X5/E2.
P02	152	Positive limit switch	Positive limit switch was reached.	• Control drive in negative direction. • Check terminal connection X5/E1.
P03	153	Contouring error	Phase difference between set and actual position is larger than the contouring error limit set under C0255.	• Extend contouring error limit under C0255 • Switch off the monitoring if necessary (C0589 = 3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive dimensioning.
P04	154	Negative position limit	Negative position limit (C1224) was not reached.	Find out why the value was not reached (e.g. "incorrect" position targets, set function position value) and adjust the negative position limit (C1224) if necessary.
P05	155	Positive position limit	Positive position limit (C1223) was exceeded.	Find out why the value was exceeded (e.g. "incorrect" position targets, set function position value) and adjust the positive position limit (C1223) if necessary.
P06	156	No reference	The homing point is unknown. For absolute positioning no homing was performed before the first positioning.	Perform one of the following functions and restart: • Manual homing. • Start homing in the program. • Set reference.

Troubleshooting and fault elimination

Display	Fault No.2)	Fault	Cause	Remedy
P07	157	PS absolute mode instead of relative mode.	An absolute PS (C1311) was performed during relative positioning (position mode C1210).	Perform one of the following functions and restart: • Change from absolute PS to relative PS. • Change position mode.
P08	158	Actual offset out of range.	Actual home offset (C1226) out of position limits. Fault of the program function "Set position value".	Adjust position limits if necessary, or check whether program function "Set position value" is to be applied.
P09	159	Impermissible programming	Impermissible programming	Check position program: • After a PS with final speed a PS with positioning has to follow; waiting for input is not permissible.
P12	162	Encoder range	The range of the absolute encoder was exceeded.	• Return drive by manual positioning. • Check position limits and adjustment of the encoder. • The absolute encoder has to be dimensioned and mounted such that its range is not exceeded over the complete positioning range.
P13	163	Phase overflow	• Phase controller limit reached • Drive cannot follow the digital frequency (I_{max} limit).	• Enable drive • Check drive dimensioning
P14	164	1st contouring error	The drive cannot follow the setpoint. Contouring error is higher than limit value in C1218/1.	• Increase current limit C0022 (observe max. motor current). • Reduce acceleration. • Check drive dimensioning. • Increase limit value under C1218.
P15	165	2nd contouring error.	The drive cannot follow the setpoint. Contouring error is higher than limit value in C1218/2.	• Increase current limit C0022 (observe max. motor current). • Reduce acceleration. • Check drive dimensioning. • Increase limit value under C1218.
P16	166	Transmission error of a synch telegram on the system bus.	Sync telegram from master (PLC) is out of time pattern.*	Set C1121 (Sync cycle) to the transmission cycle of the master (PLC).
			Sync telegram of master (PLC) is not received.*	• Check communication channel. • Check baud rate, controller address.
			Controller enable (RFR) too soon.	Enable controller with delay. The required delay depends on the time between the synch telegrams.
			* C0362 indicates the time between 2 sync telegrams (C0362 = 0, communication interrupted).	
P17	167	TP control error	Simultaneous use of the TP input by different function blocks (e.g. FB DFSET and POS). A conflict occurs.	Configure another TP input for FB POS (not possible for DFSET) or switch off monitoring under C0580.
P18	168	Internal limitation	Input of extremely high or low machine parameters.	Check machine parameters.
P21	171	Contouring error RC	Phase difference between set and actual position is larger than the contouring error limit set under C1328.	Extend contouring error limit with C1328. If necessary, switch-off the monitoring (C1329=3).
			Drive cannot follow the digital frequency (I_{max} limit).	Check drive selection.
PEr	74	Program interference	A fault in the program was detected.	Send controller with data (on diskette) to Lenze.
PI	79	Initializing error	• A fault was detected during transfer of parameter set between the controllers • Parameter set does not match controller.	Correct parameter set.
PR0 PR1	75 72	Parameter set error	Fault when loading a parameter set. CAUTION: The factory setting loaded automatically.	• Set the required parameters and store them under C0003. • For PR0 the supply voltage must be switched off additionally.

Display	Fault No.[2]	Fault	Cause	Remedy
Sd2	82	Resolver fault	Resolver cable interrupted.	• Check the resolver cable for open circuit • Check resolver • Or switch off monitoring (C0586 = 3).
Sd3	83	Encoder fault at X9/8	Cable interrupted.	Check cable for open circuit.
			Input X9 PIN 8 not assigned.	Assign input X9 PIN 8 with 5V or switch off monitoring (C0587 = 3).
Sd5	85	Master current source defective	Master current at X6/1 X6/2 < 2mA.	• Check cable for open circuit. • Check master current source.
Sd6	86	Sensor fault	Encoder of the motor temperature detection at X7 or X8 indicates indefinite values.	Check supply cable for firm connection. Switch off monitoring with C0594 = 3 if necessary.
Sd7	87	Encoder fault	Absolute encoder with RS485 interface does not transmit data.	Check supply cable. Check encoder. Check voltage supply C0421. No Stegmann encoder connected.

1) Temperature detection via resolver or incremental encoder.

2) Displayed value = {fault no.} + 0 ≙ TRIP
= {fault no.} + 1000 ≙ Message
= {fault no.} + 2000 ≙ Warning
= {fault no.} + 2000 ≙ FAIL-QSP

8.4 Reset of fault messages

TRIP

- After eliminating the fault, the pulse inhibit is only reset after acknowledgement of TRIP.
- Acknowledge TRIP by:
  - – Global Drive Control: Click the button ”TRIP reset” in the dialog box ”Diagnostics 9300”.
    (📖 8-4, “Working with the history buffer”)
  - – Keypad 9371 BB:
    Press STOP key. Then press RUN to enable the controller again.
  - – Fieldbus module: Set C0043 = 0
  - – Control word C0135
  - – Terminal X5/E5
  - – Control word AIF
  - – Control word system bus (CAN)

Note!
If a TRIP source is still active, TRIP cannot be reset.

Message

- After eliminating the fault, the pulse inhibit is reset automatically.

Warning!
After eliminating the fault, the drive starts automatically.

FAIL-QSP

- After eliminating the fault, the pulse inhibit is only reset after acknowledgement of TRIP.
- Acknowledge TRIP by:
  - – Global Drive Control: Click the button ”TRIP reset” in the dialog box ”Diagnostics 9300”.
    (📖 8-4, “Working with the history buffer”)
  - – Keypad 9371 BB:
    Press STOP key. Then press RUN to enable the controller again.
  - – Fieldbus module: Set C0043 = 0
  - – Control word C0135
  - – Terminal X5/E5
  - – Control word AIF
  - – Control word system bus (CAN)

Note!
If a TRIP source is still active, TRIP cannot be reset.

Warning

- After eliminating the fault, the warning is reset automatically.

9 Maintenance

- The controller is free of maintenance if the prescribed conditions of operation are observed. (📖 3-2)
- If the ambient air is polluted, the air vents of the controller may be obstructed. Therefore, check the air vents periodically (depending on the degree of pollution approx. every four weeks):

Free the obstructed air vents using a vacuum cleaner.

Stop!

Do not use sharp or pointed tools such as knives or screwdrivers to clean the air vents.

Maintenance

EDS9300UE-PK
00411239

Lenze

Manual
Part K

Selection help

Application examples

Global Drive

Servo position controller 9300

This documentation is valid for 9300 position controllers as of version:

33.932X	EP	2x	1x		(9321 - 9329)
33.933X	EP	2x	1x		(9330 - 9332)
33.932X	CP	2x	1x	- V003	Cold Plate (9321 - 9328)

Type

Desgin:
E = Enclosure IP20
C = Cold Plate
xK = Cam profiler
xP = Position controller
xR = Register controller
xS = Servo inverter

Hardware level and index

Software level and index

Variant

Explanation

Version 2.0 09/99

Contents

Part K

15 Application examples

15.1 Example 1: Dosing

The dosing application example describes different filling stations of a packing 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 optimized servo motors are used here as drive components.

The 9300 servo position controller contains functions which could previously only be offered by a superimposed control (e.g. PLC). Positioning tasks which are similar to this example, can easily be achieved with a minimum expenditure using this controller.

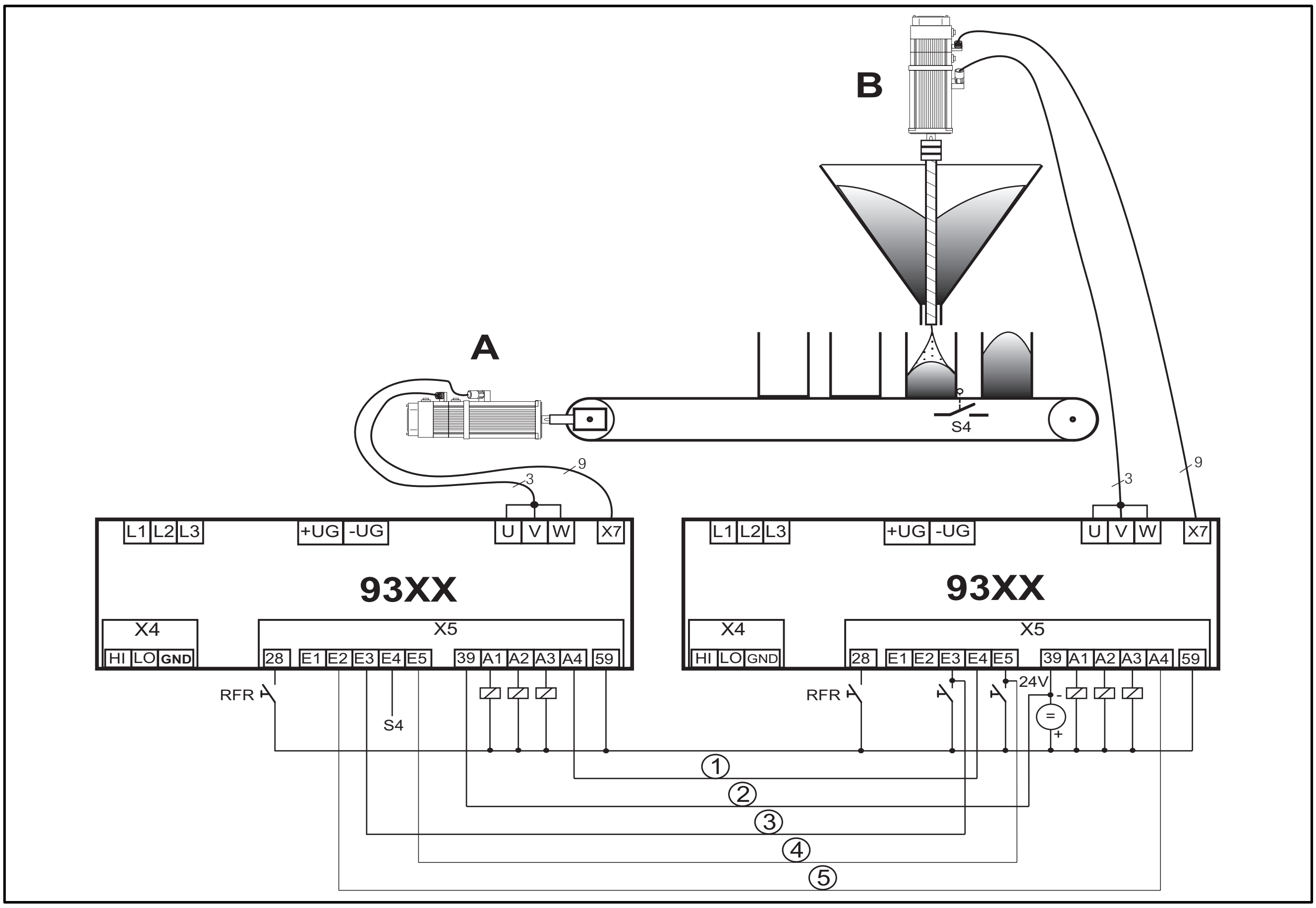


Fig. 15-1 Example of a relative positioning

Drive	Input	Function	Connecting cable
O	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	Change-over of manual / program mode	
B	E1	not used	
	E2	not used	
	E3	Start program	③
	E4	Handshake: start dosing	①
	E5	Change-over of manual / program mode	④
	39	Reference potential	②

Application examples

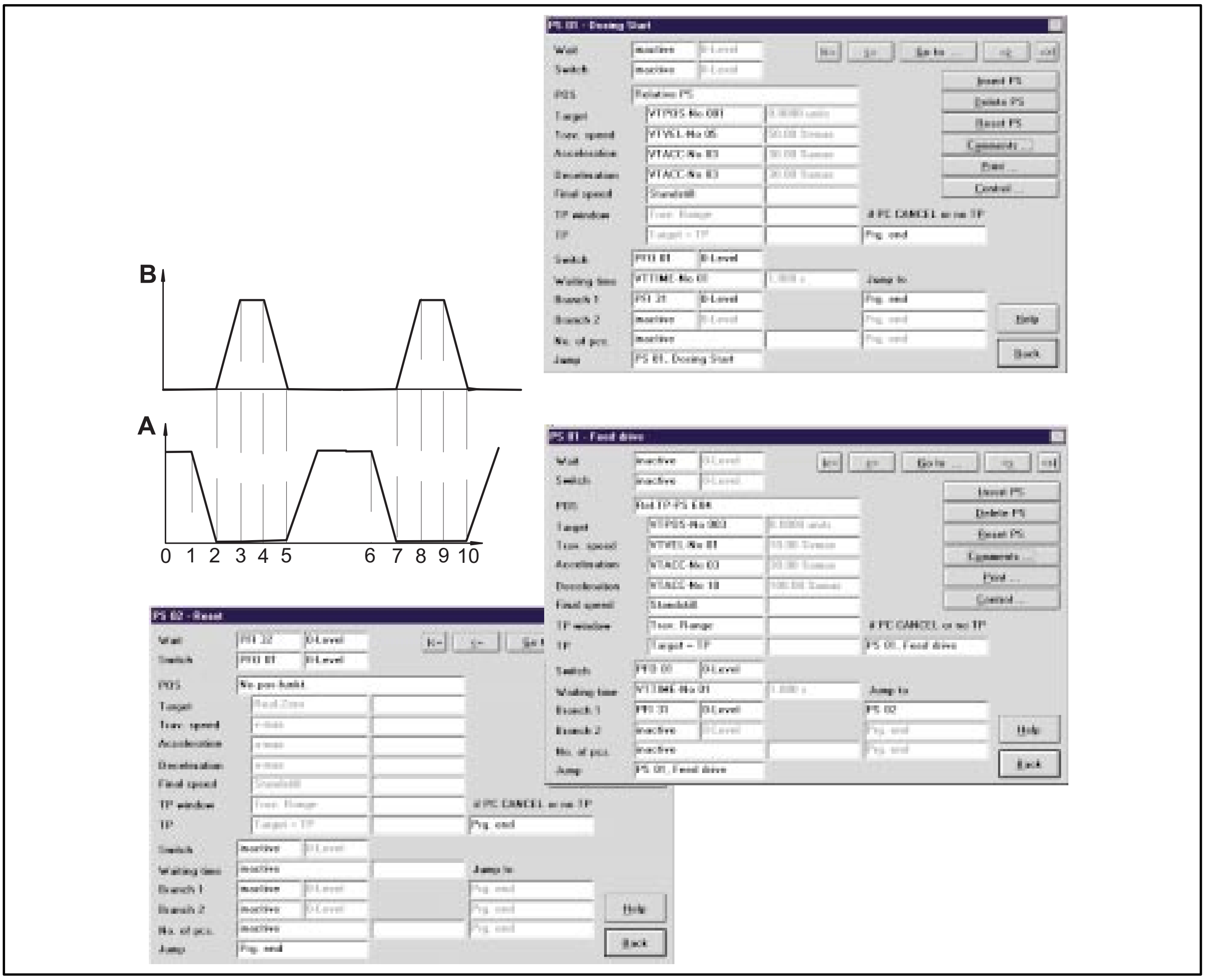


Fig. 15-2 Positioning profiles and input via the dialog boxes in GDC

Positioning profiles	
Time	**Description**
1, 6	Container immediately before target position • Brake feed
2, 7	Container in target position • Start filling (observe deadtime)
5, 10	Filling completed • Start feed, filled container leaves position sensor, empty container is positioned

Dosing drive B		
PS	**Time**	**Description**
01	0 - 2	Wait 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) reacts
	6 - 7	Cover final distance and stop
	7	Start dosing drive PFO 01 = H: A4 = High, then jump to PS01
02	is required to complete the program.	

Application examples

Basis: Basic configuration 20200

Terminal assignment					
Inputs	Function 1	Function 2	Function 3	**Outputs**	Function
X5/E1	Manual homing in negative direction			X5/A1	Reference known
X5/E2	Manual positioning in positive direction			X5/A2	Setpoint position reached
X5/E3	Program start	PS function (PFI 31)		X5/A3	Ready for operation
X5/E4	Home position switch	PS function (PFI 31)		X5/A4	PS function (POS-PFO1)
X5/E5	Trip reset	Program reset	Manual positioning		

Assignment of CAN1			
Inputs	Function	**Outputs CAN-OUT1.**	Function
		W1	Actual speed
		D1	Actual position

CAN status word (bit 0.... bit15)
1: Pulse inhibit — 2: Reference known
4: M_{max} (lowaktiv) — 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 positioning off	B2	Positioning speed reached (acceleration completed)
B3	PS function	Start homing / manual		B3	PS function (POS-PFO4)
B4	PS function	End of stand-by		B4	PS function
B5	PS function	New positioning 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-PFO32)

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

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

15.2 Example 2: Spray jet control

The combination of the spray jet 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 resulted in worse results. The absolute positioning in the 9300 servo position controllers and open control structure enables the jet control to have corresponding messages. They can be read via a fieldbus or (as in the example) output via the terminals.

The spray jet control in Fig. 15-3 is an example of absolute positioning, which replaces former applications with mechanical cam controllers.
These applications do not require mechanical limit switches or initiators which used to be necesary 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.

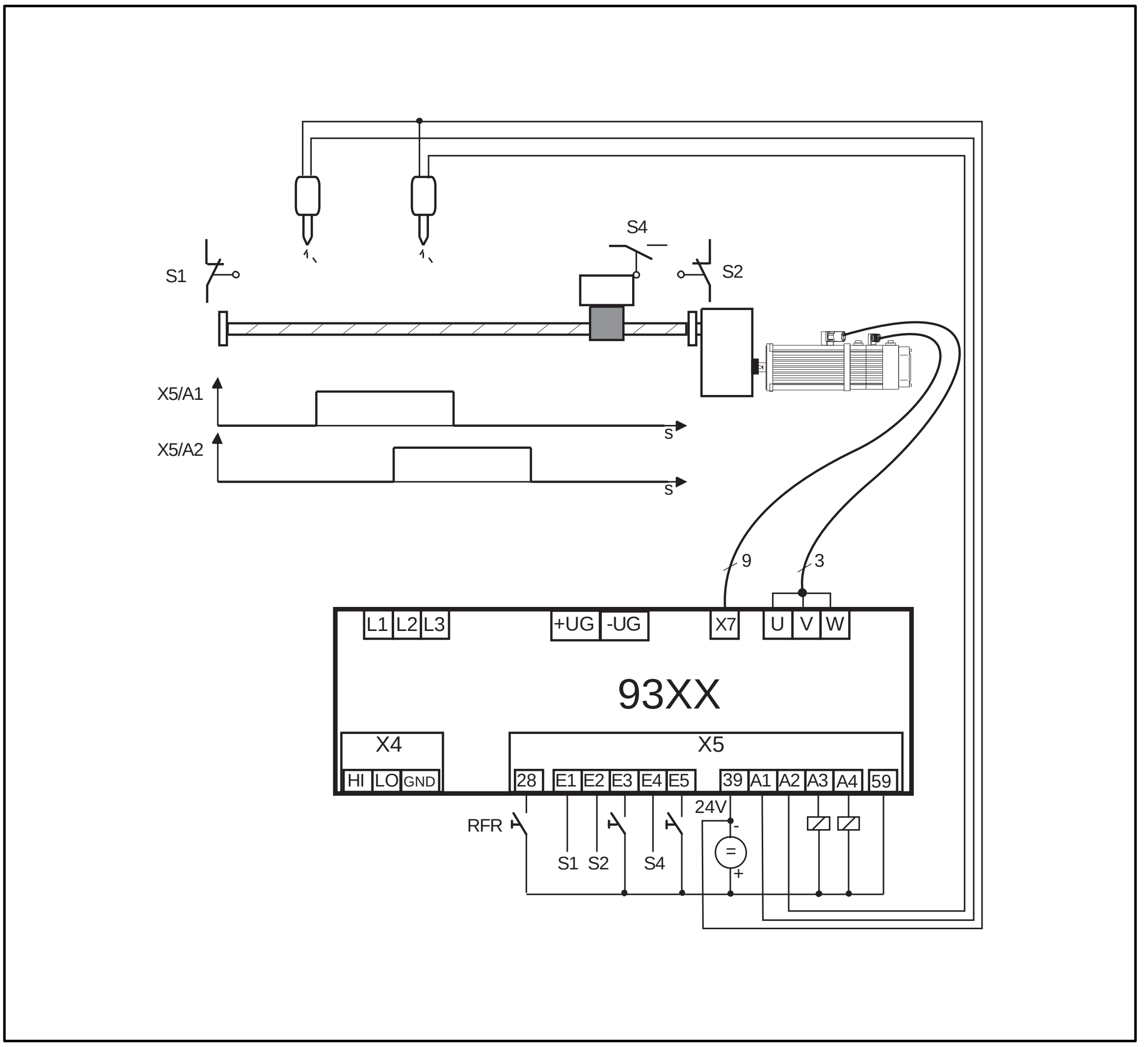


Fig. 15-3 Example of an absolute positioning with the function block 'SP1' (slow-down points)

Input	Function
E1	Limit switch (S1) negative direction
E2	Limit switch (S2) positive direction
E3	Start program
E4	Homing switch (S4)
E5	Change-over manual positioning / program mode

Application examples

Basis: Basic configuration 22000

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

Assignment of CAN1			
Inputs	Function	**Outputs CAN-OUT1.**	Function
		W1	Actual speed
		D1	Actual position
		CAN status word (bit 0.... bit15) 1: Pulse inhibit 4: M_{max} (lowaktiv) 6: n_act = 0 12: Fault warning 14: Fault quick stop	2: Reference known 5: Target position reached 7: Controller inhibit CINH 13: Fault message 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 positioning off	B2	Positioning 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	Slow-down point 1
B8 - B14	PS function			B8 - B14	Slow-down point 2 - 8
B15 - B17	PS function			B15 - B17	Touch Probe on X5/E1 - X5/E3 recognized
B18	PS function			B18	Touch Probe on X5/E4 released
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'

15.3 Example 3: Contouring control

Contouring controls are interesting for warehousing and complex transport functions. These motions often require complicated and expensive controls. 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 superimposed control is necessary in these cases.

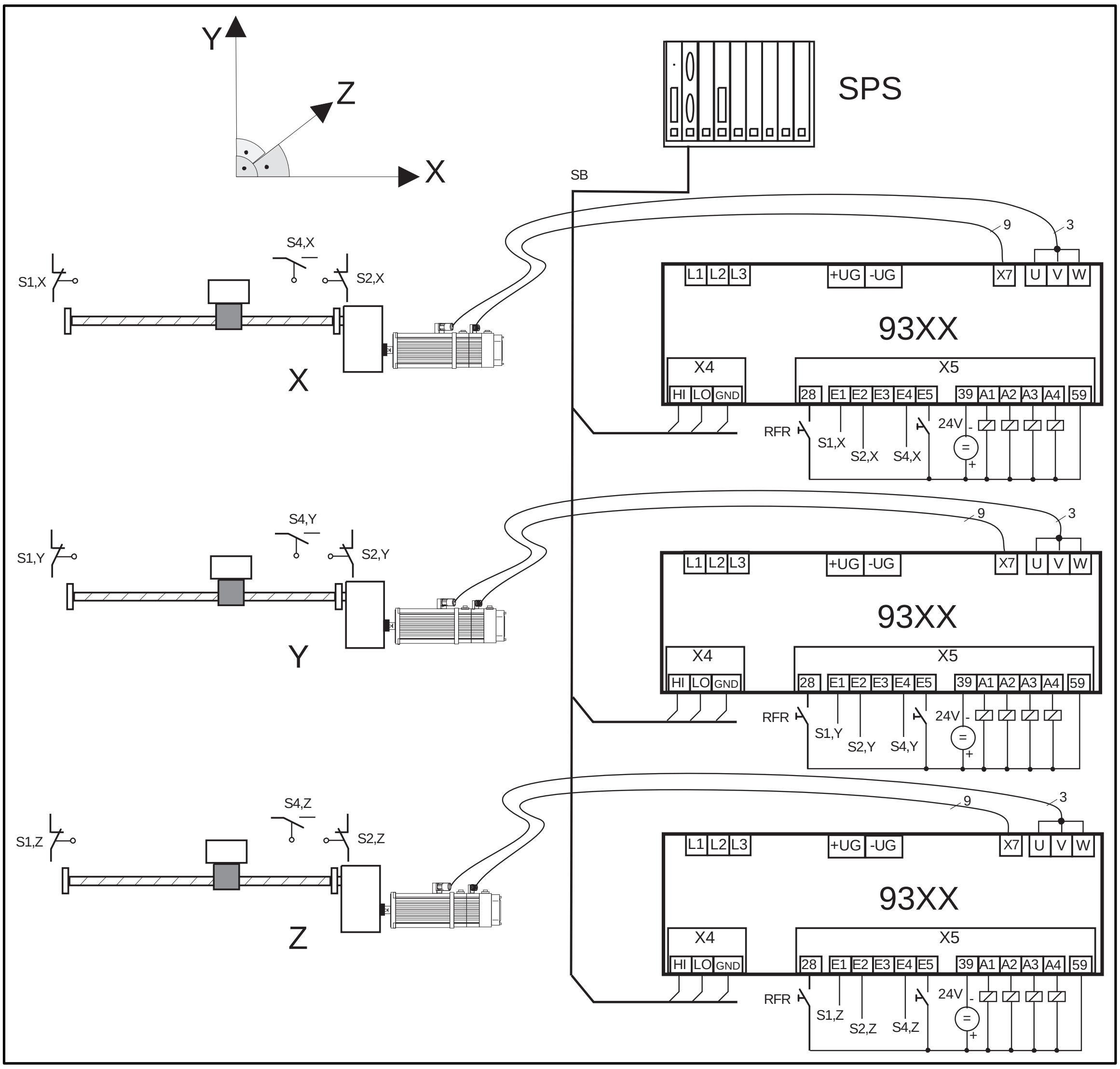


Fig. 15-4 Example of a multi-axis positioning
(SPS = PLC)

Input	Function
E1	Limit switch (S1X, S1Y, S1Z) negative direction
E2	Limit switch (S2X, S2Y, S2Z) positive direction
E3	Not assigned
E4	Reference switch (S4X, S4Y, S4Z)
E5	Change-over manual positioning / 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 positioning	external setpoint off		X5/A1	Synchronization status
X5/E2	Positive manual positioning	external setpoint off		X5/A2	Contouring error 1
X5/E3	Program start	Actual position = external setpoint	PS function	X5/A3	Ready for operation
X5/E4	Home position switch	PS function		X5/A4	Reference known
X5/E5	Trip reset				

Assignment of CAN1			
Inputs	Function	**Outputs CAN-OUT1.**	Function
		W1	Actual speed
		D1	Actual position
		CAN status word (bit 0.... bit15) 0: Synchronization status 1: Pulse inhibit 4: M_{max} (lowaktiv) 6: n_act = 0 12: Fault warning 14: Fault quick stop	 2: Reference known 5: Target position reached 7: Controller inhibit CINH 13: Fault message 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 positioning off	B2	Positioning 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 'Contouring 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 direction	
CAN-IN2.B10	HIGH	Manual operation in positive direction	
CAN-IN2.B11	HIGH	Activate manual operation	

15.3.1 Commissioning of the contouring control

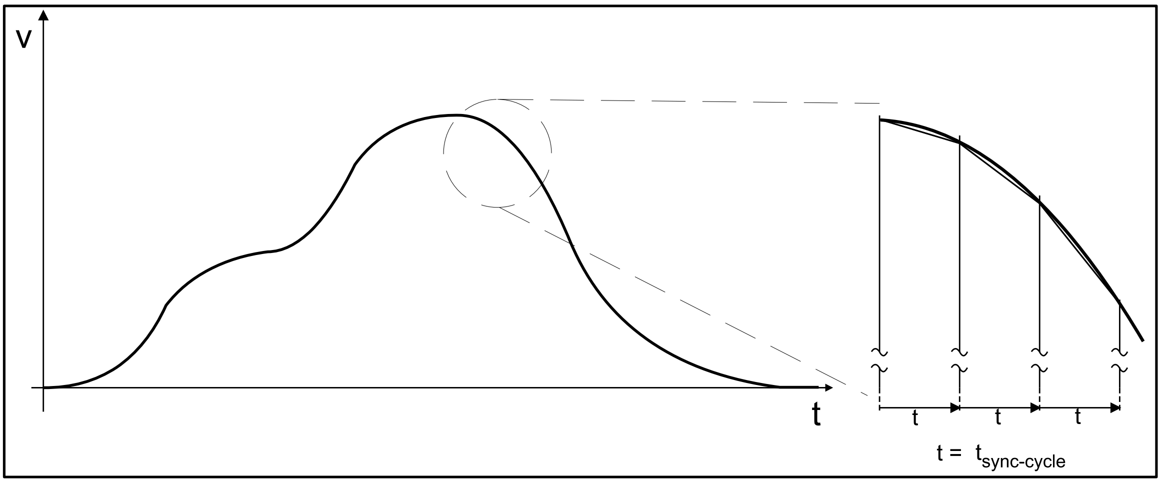


Fig. 15-5 Example of a positioning profile

How to commission the system bus (CAN)

- Control: slave 1 (drive X)
  - – Node addresses: C0350 = 1
  - – Position setpoint on byte 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 of the sync telegram from the control
  - – Actual value = set setpoint (contouring error = 0)
    CAN-IN2.B4 = 1 (afterwards set CAN-IN2.B4 = 0 again)
- Control: slave 2 (drive Y)
  Node addresses C0350 = 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

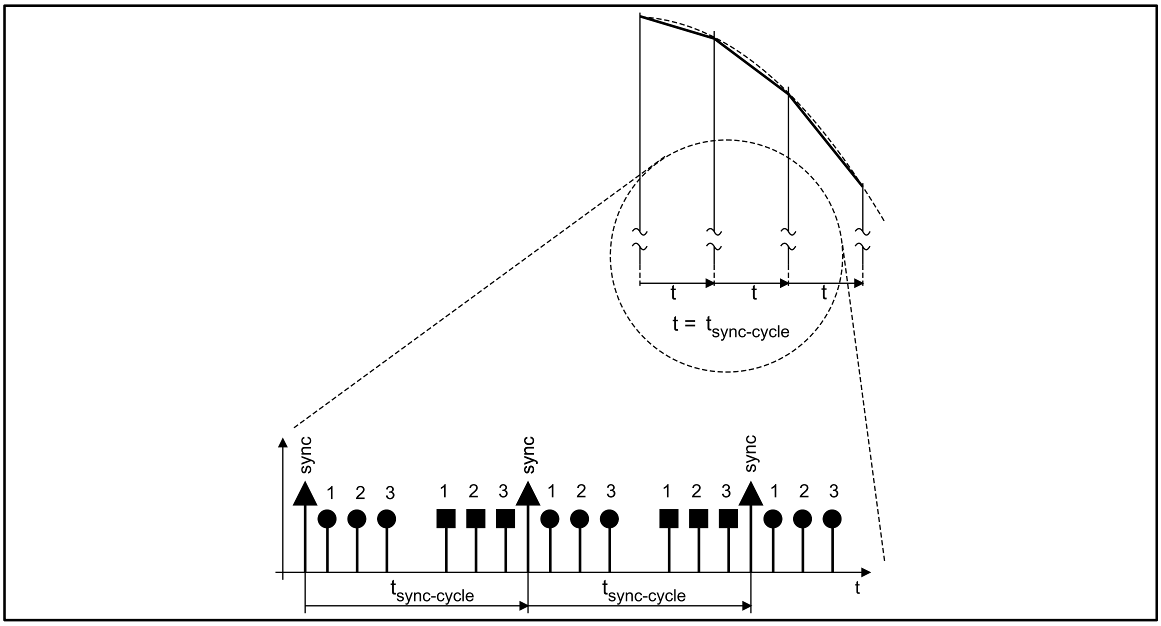


Fig. 1 Sequence of communication between master and slaves

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

Application examples

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 quartz-precise in the long-term mean.
- 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)

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EDS9300UE-PL
00411240

Lenze

Manual
Part L

Signal-flow charts

Global Drive

Servo position controller 9300

This documentation is valid for 9300 position controllers as of version:

33.932X	EP	2x	1x		(9321 - 9329)
33.933X	EP	2x	1x		(9330 - 9332)
33.932X	CP	2x	1x	- V003	Cold Plate (9321 - 9328)

Type

Desgin:
E = Enclosure IP20
C = Cold Plate
xK = Cam profiler
xP = Position controller
xR = Register controller
xS = Servo inverter

Hardware level and index

Software level and index

Variant

Explanation

Version 2.0 09/99

Contents

Part L

16 Signal flow charts

The following signal flow charts show the basic configurations of the 9300 servo position controller:

- 1000
  – Simple speed control via analog inputs for short set-up.
- 20000
  – Absolute positioning via home position.
- 22000
  – Absolute positioning with slow-down points (cam controller) and teach function (reading positions and entry into variable tables)
- 26000
  – External contouring control to prepare for a multi-axis positioning. Phase setpoint input via system bus.

Signal-flow charts

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EDS9300UE-PM
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Manual
Part M

Glossary

Table of keywords

Global Drive
Servo position controller 9300

This documentation is valid for 9300 position controllers as of version:

33.932X	EP	2x	1x		(9321 - 9329)
33.933X	EP	2x	1x		(9330 - 9332)
33.932X	CP	2x	1x	- V003	Cold Plate (9321 - 9328)

Type

Desgin:
E = Enclosure IP20
C = Cold Plate
xK = Cam profiler
xP = Position controller
xR = Register controller
xS = Servo inverter

Hardware level and index

Software level and index

Variant

Explanation

All indications given in these Operating instructions have been selected carefully and comply with the hardware and software described. Nevertheless, deviations cannot be ruled out. We do not take any responsibility or liability for damages which might possibly occur. Required corrections will be made in the following editions.

Version 2.0 09/99

Contents

Part M

17 Glossary

Term	Meaning
AIF	Automation interface (X1)
CAN	Controller Area Network
CE	Communauté Européenne (English: European Community)
Code	For entry and display (access) of parameter values. Variable addressing according to the format "code/subcode" (Cxxxx/xx). All variables can be addressed via the code digits.
Contouring error	Deviation between momentary position setpoint and actual position. Display for a momentary contouring error under C0908.
Contouring error monitoring	Monitors the momentary contouring error if the contouring error tolerance is exceeded and releases a fault indication, if necessary.
Contouring error tolerance	If the contouring error reaches a defined contouring error tolerance, a fault indication is released.
Ctrl. enable	Controller enable
Ctrl. inhibit	Controller inhibit (= $\overline{\text{Controller enable}}$)
FB	Function block
Fieldbus	For data exchange between higher-level control and positioning control, e.g. INTERBUS or PROFIBUS.
FPDA	Freely programmable digital output
FPDE	Freely programmable digital input
GDC	Global Drive Control (PC program for Lenze controllers - Windows)
INTERBUS	Industrial communication standard to DIN E19258
JOG	JOG speed or input for JOG speed
KTY	"Linear" temperature sensor in the motor winding
LECOM	Lenze Communication
LEMOC2	PC program for Lenze controllers - DOS
LU	Undervoltage
Master	A master is for instance a PLC or PC.
OU	Overvoltage
PC	Personal Computer
PLC	Programmable logic controller
PM	Permanent magnet
Process data	For instance, setpoints and actual value which are to be exchanged as quickly as possible. Usually, this applies to smaller data amounts which are transmitted cyclically. With PORFIBUS these data are transmitted via the logic process data channel.
PROFIBUS	Communication standard DIN 19245, consisting of three parts
PTC	PTC thermistor with defined tripping temperature
QSP	Quick stop
RFG	Ramp function generator
Slave	Bus participant that must wait for the master's request to send data. Controllers are slaves.
SSC	Sensorless speed control
SSI	Synchronous serial interface
Target position	The target which is to be approached by means of a defined traversing profile.
TKO	Thermal contact / normally closed contact

Glossary

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A

B

C

abc

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P

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