EN

F1

CDD3000

Application Manual

Servocontroller system
2.4 A - 170 A

Adaptation of the drive system
to the application

LUST

LUST

Overview of documentation

Before purchase

CDD3000 Catalogue

Selecting and ordering a drive system

With delivery (depending on supply package)

CDD3000 Operation Manual (D)

Quick and easy initial commissioning

Application Manual (F1)

Adaptation of the drive system to the application

User Manual CAN$_{Lust}$ (G1)

Project planning, installation and commissioning of the CDD3000 on the field bus

User Manual CAN$_{open}$ (G2)

Project planning, installation and commissioning of the CDD3000 on the field bus

User Manual PROFIBUS-DP (G3)

Project planning, installation and commissioning of the CDD3000 on the field bus

CDD3000 Application Manual

F1

ID no.: 0931.22 B.2-00

Date: 05/2007

Applicable from firmware version V3.20

Required DRIVEMANAGER at least version V3.50-00

We reserve the right to make technical changes.

LUST

Dear User,

This manual is aimed primarily at you as a **programmer** of drive and automation solutions. It describes how you can adapt your new CDD3000 drive system optimally to your specific application. We assume your drive has been commissioned by means of the first commissioning procedure – if note, you should first refer to the Operation Manual.

Don't be put off by the size of the manual: Only sections 1 to 3 contain essential information with which you need to familiarize yourself. The remaining sections and the Appendix are provided **as reference resources**: (they present the full
scope of functions and flexibility of the software of the CDD3000 in handling a wide variety of drive tasks.) In those sections you can also concentrate on the functions of relevance to your application, e.g. encoder simulation or sinusoidal ramps.

Good luck, and have a nice day!

How to use this Manual

EN

Pictograms

➢ **Important!** Misoperation may damage the drive or cause it to malfunction.

➢ **Danger from electrical tension!**Improper behaviour may endanger human life.

➢ **Danger from rotating parts!**The drive may start running automatically.

➢ **Note:** Useful information

➢ **Reference:** More information in other sections of the Application Manual or additional documents

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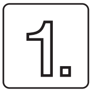
4 Preset solutions

1 Safety

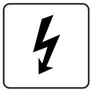
1.1 Measures for your safety

The new CDD3000 servocontrollers are quick and safe to handle. For your own safety and for the safe functioning of your device, please be sure to observe the following points:



Read the Operation Manual first!

- Follow the safety instructions!



Electric drives are dangerous:

- Electrical voltages > 230 V/460 V: Dangerously high voltages may still be present 10 minutes after the power is cut. so always make sure the system is no longer live!
- Rotating parts
- Hot surfaces

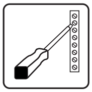
Protection against magnetic and/or electromagnetic fields during installation and operation.

- Persons fitted with heart pacemakers, metallic implants and hearing aids etc. must not be allowed access to the following areas:
  – Areas where drive systems are installed, repaired and operated.
  – Areas where motors are installed, repaired and operated. Motors with permanent magnets pose a particular hazard.

Note: If it is necessary to access such areas, suitability to do so must be determined beforehand by a doctor

Your qualification:

- In order to prevent personal injury and damage to property, only personnel with electrical engineering qualifications may work on the device.
- The said qualified personnel must be familiar with the contents of the Operation Manual (cf. IEC364, DIN VDE0100).
- Knowledge of national accident prevention regulations (e.g. VBG 4 in Germany, regulations laid down by the employers' liability insurance associations) is essential.



During installation observe the following instructions:

- Always comply with the connection conditions and technical specifications.
- Comply with the standards for electrical installations, such as regarding cable cross-section, PE conductor and earth connections.
- Do not touch electronic components and contacts (electrostatic discharge may destroy components).

Pictograms used

The safety instructions detail the following hazard classes.
The hazard class defines the risk posed by failing to comply with the safety notice.

Warning symbols	General explanation	Hazard class to ANSI Z 535
	**Important!** Misoperation may damage the drive or cause it to malfunction.	Serious injury or damage to property may occur.
	**Danger from electrical tension!** Improper conduct may endanger human life.	Death or serious injury will occur.
	**Danger from rotating parts!** Drive may start up automatically.	Death or serious injury will occur.

1.2 Intended use

Drive controllers are components that are intended for installation in stationary electrical systems or machines.

The drive controllers may not be commissioned (i.e. may not be put to their intended use) until it has been established that the machine complies with the provisions of EC Directive 98/37/EC (Machinery Directive); EN 60204 is to be observed.

Commissioning (i.e. putting the device to its intended use) is only permitted in compliance with the EMC Directive (89/336/EEC).

CE — The CDD3000 conforms to the Low Voltage Directive 73/23/ECC.

The harmonized standards of the EN 50178/DIN VDE 0160 series in conjunction with EN 60439-1/ VDE 0660 part 500 and EN 60146/

VDE 0558 are to be applied with regard to the drive controllers.

If the drive controller is used for special applications (e.g. in areas subject to explosion hazard), the required standards and regulations (e.g. EN 50014, “General provisions” and EN 50018 “Pressurized enclosure”) must always be observed.

Repairs may only be carried out by authorized repair workshops. Unauthorized opening and incorrect intervention could lead to death, physical injury or material damage. The warranty provided by LUST would thereby be rendered void.

Note: Deployment of the drive controllers in non-stationary equipment is classed as non-standard ambient conditions, and is permissible only by special agreement.

1.3 Responsibility

Electronic devices are fundamentally not fail-safe. The company setting up and/or operating the machine or plant is itself responsible for ensuring that the drive is rendered safe if the device fails.

EN 60204-1/DIN VDE 0113 “Safety of machines”, in the section on “Electrical equipment of machines”, stipulates safety requirements for electrical controls. They are intended to protect personnel and machinery, and to maintain the function capability of the machine or plant concerned, and must be observed.

An emergency off system does not necessarily have to cut the power supply to the drive. To protect against danger, it may be more beneficial to maintain individual drives in operation or to initiate specific safety sequences. Execution of the emergency off measure is assessed by means of a risk analysis of the machine or plant, including the electrical equipment to DIN EN 1050, and is determined with selection of the circuit category in accordance with DIN EN 954-1 “Safety of machines - Safety-related parts of controls”.

2 Servocontroller CDD3000

Note: This section sets out basic aspects of the device hardware which are essential to understanding and using the Application Manual. For more information on the device hardware refer to the CDD3000 Operation Manual.

2.1 Device and terminal view

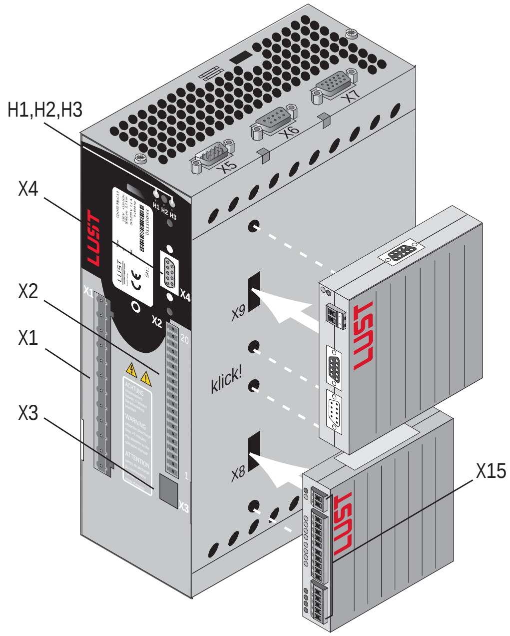


Figure 2.1 Layout, CDD3000

No.	Designation	Function
H1, H2, H3	LEDs	Device status display
X1	Power connection	Mains, motor, braking resistor (L+/RB), DC supply
X2	Control connection	4 digital inputs 3 digital outputs (of which 1 relay) 2 analog inputs
X3	PTC connection	PTC, Klixon evaluation or linear temperature transmitter
X4	RS232 connection	Serial interface for connection of DRIVEMANAGER or KEYPAD KP200XL
X5	Position communication	Encoder simulation/master encoder with TTL level
X6	Resolver connection	Resolver, Hall sender
X7	Encoder connection	Single/multi-turn with SIN/COS signal, SSI or Hiperface interface

Table 2.1 Key to CDD3000 layout

No.	Designation	Function
X8	Option slot 1	e.g. for user module UM8I4O
X9	Option slot 2	e.g. for communication module CM-xxx
X15	Control terminal UM8I4O	I/O expansion

Table 2.1 Key to CDD3000 layout

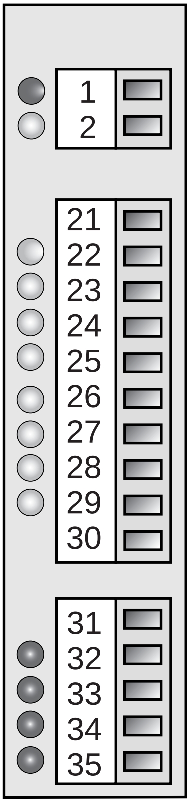
X1	Designation 32.xxx	X1	Designation 34.xxx
U	Motor cable U	U	Motor cable U
V	Motor cable V	V	Motor cable V
W	Motor cable W	W	Motor cable W
⏚	Grounding lead PE	⏚	Grounding lead PE
⏚	Grounding lead PE	⏚	Grounding lead PE
L+	DC-link voltage + /Braking resistor	L+	DC-link voltage + /Braking resistor
RB	Braking resistor	RB	Braking resistor
L-	DC-link voltage -	L-	DC-link voltage -
⏚	Grounding lead PE	⏚	Grounding lead PE
	NC	L3	Mains phase L3
N	Neutral conductor	L2	Mains phase L2
L1	Mains phase L1	L1	Mains phase L1

Table 2.2 Power terminal designation, CDD3000

Note: Be sure to observe device name plate data.

X2	Designation	Function
20	BRK_{OUT}	Brake output
19	BRK_{GND}	Ground for brake output, supply
18	BRK_{VCC}	24 V for brake output, supply
17	OSD02	Relay output (root) 14
16	OSD02	Relay output (NO contact)) 13
15	OSD01	Digital output
14	OSD00	Digital output
13	DGND	Digital ground
12	ISD04	Digital input
11	ISD03	Digital input
10	ISD02	Digital input
9	ISD01	Digital input
8	ISD00	Digital input
7	ENPO	Power stage hardware enable
6	DGND	Digital ground
5	+24V	Auxiliary voltage +24 V
4	ISA01-	Analog reference input 0- 10 V
3	ISA01+	
2	ISA00-	Analog reference input ± 10 V
1	ISA00+	

Table 2.3 Control terminal designation, CDD3000



X15	Designation	Function
1	U_V	24 V DC supply, feed
2	DGND	Digital ground
21	U_V	Auxiliary voltage 24 V DC
22	IED00	Digital input
23	IED01	Digital input
24	IED02	Digital input
25	IED03	Digital input
26	IED04	Digital input
27	IED05	Digital input
28	IED06	Digital input
29	IED07	Digital input
30	DGND	Digital ground
31	DGND	Digital ground
32	OED00	Digital output
33	OED01	Digital output
34	OED02	Digital output
35	OED03	Digital output

Table 2.4 Control terminal designation, UM-8I40

Pin assignment of serial interface X4 9-pin D-Sub socket

X4/Pin	Function
1	+15 V DC for KEYPAD KP200
2	TxD, send data
3	RxD, receive data
4	Do not use
5	GND for +15 V DC of KEYPAD KP200
6	+24 V DC, control pcb power supply
7	Do not use
8	Do not use
9	GND for +24 V DC, control pcb power supply

Table 2.5 Pin assignment X4

Pin assignment X5 Position communication 9-pin D-Sub plug

X5/Pin	Function
1	GND
2	GND
3	R-
4	B -
5	A+
6	5V / 100 mA
7	R+
8	B+
9	A-

Table 2.6 Pin assignment X5

Pin assignment X6 Resolver 9-pin D-Sub socket

X6/Pin	Function
1	SIN+ (S2)
2	SIN- (S4)
3	COS+ (S1)
4	GND
5	PTC
6	REF+ (R1) (8 kHz, approx. 7 V AC)
7	REF- (R2)
8	COS- (S3)
9	PTC

Table 2.7 Pin assignment X6

Pin assignment X7 Encoder connection 15-pin HD D-Sub socket

X7/Pin	Sin/Cos function	SSI function	HIPERFACE function
1	A-	A-	REFCOS
2	A+	A+	COS+
3	V (150 mA)	V (150 mA)	
4		DATA+	Data+ RS485
5		DATA-	Data- RS 485
6	B -	B -	REFSIN
7			Us 7-12 V / 100 mA
8	GND	GND	GND
9	R-		
10	R+		
11	B+	B+	SIN+
12	Sense+	Sense+	Sense+
13	Sense-	Sense-	Sense-
14		CLK+	
15		CLK-	

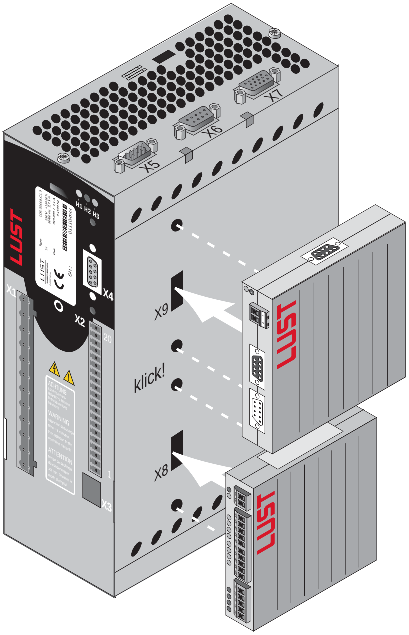
Table 2.8 Pin assignment X7

2.2 Module mounting

The CDD3000 servocontrollers have two option slots to accommodate user and communication modules.

Servocontrollers **up to size BG5** are side mounted. To remove them, press the red release lever on the front and withdraw the module to the side.

Servocontrollers BG1 ... BG5

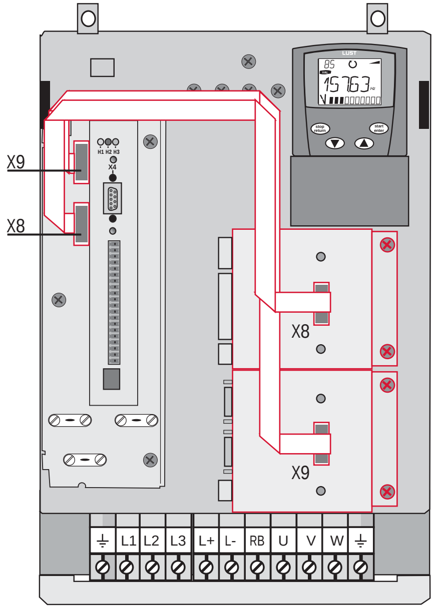


X8 = Option slot 1 for user modules (UM-xxxx)
X9 = Option slot 2 for communication modules (CM-xxxx).

Figure 2.2 Mounting of user/communication modules

For servocontroller **sizes BG6 to BG8** the modules are built-in. For mounting you will require one mounting package MP-CMUM for each module (see Order Catalogue). Each mounting package also includes a ribbon cable to connect X8 to X8 or X9 to X9.

Servocontrollers BG6 ... BG8



The CDD3000 servocontroller has two option slots to accommodate user and communication modules.

Figure 2.3 Mounting of user/communication modules (BG6 to BG8)

Important: Do not plug in/remove modules during operation.

2.3 Ambient conditions

Characteristic		Specification of servocontrollers
Temperature range	in operation	-10 ...45 ° C (BG1 ... BG5) -10 ... 40 °C (BG6 ... BG8) with power reduction to 55 ° C
	in storage	-25 ... +55 °C
	in transit	-25 ... +70 °C
Relative air humidity		15 ... 85 %, condensation not permitted
Mechanical strength to IEC 68-2-6	Vibration	0,075 mm in frequency range 10 ... 57 Hz 1 g in frequency range 57 ... 150 Hz
Protection	Device	IP20 (NEMA 1)
	Cooling method	Cold plate: IP20 Push-through heat sink: IP54 (3 ...15 kW)
Touch protection		VBG 4
Mounting height		up to 1000 m above MSL, above 1000 m above MSL with power reduction 1% per 100 m, max. 2000 m above MSL

Table 2.9 Ambient conditions for the servocontrollers

2.4 Specification of control connections

Servocontroller CDD3000

Des.	No.	Des.	Specification	Isolation
Analog Inputs	1 2	ISA00+ ISA00-	• ISA00: U_{IN} = ± 10 V DC, resolution 12-bit, sampling time 1 ms (special function 125 µs)	
	3 4	ISA01+ ISA01-	• ISA01: U_{IN} = + 10 V DC, resolution 10-bit, sampling time 1 ms • Tolerance: ± 1% of meas. • 24 V digital input, PLC-compatible Switching level Low/High: <4.8 V / > 8 V DC Sampling time 1 ms • R_{IN} = 110 kΩ	
Digital Inputs	8 9 10 11 12	ISD00 ISD01 ISD02 ISD03 ISD04	• ISD00-ISD02: Frequency range < 500 Hz, sampling time 1ms • ISD03-ISD04: Frequency range < 500 kHz, sampling time 1ms (special functions < 2 µs) • PLC-compatible Switching level Low/High: <5 V / > 18 V DC • I_{max} (at 24 V) = 10 mA • R_{IN} = 3 kΩ	Yes
	7	ENPO	• Hardware enable of power stage = High level • Specification as ISD00	Yes
Digital Outputs	14 15	OSD00 OSD01	• Short-circuit-proof with 24V supply from servocontroller • PLC-compatible, sampling time 1 ms • I_{max} = 50 mA, high-side driver • No internal freewheeling diode; provide external protection	Yes

Table 2.10 Specification of control connections

Des.	No.	Des.	Specification	Isolation
Relay output	16 17	OSD02	• Relay, 1 NO contact • 25 V / 1 A AC, usage category AC1 • 30 V / 1 A DC, usage category DC1 • Sampling time 1 ms • Operating delay approx. 10 ms	Yes
voltage supply	5 6, 13	+24 V DGND	• Auxiliary voltage U_V = 24 V DC, short-circuit-proof • Tolerance ±20% • I_{max} = 100 mA (overall, also includes driver currents for outputs OSD0x) • External 24V supply to control electronics in case of power failure possible, Current consumption I_{max} = 1 A	Yes
Motor holding brake	18 19 20	VCC03 GND03 OSD03	• Digital +24 V output, high-active • Short-circuit-proof • Suitable for actuation of a motor holding brake • I_{max} = 2,0 A (current overload causes shut-off) to υ_{Umax}=45°C; reduction of I_{max} at υ_U > 45°C. • I_{min} = 150 mA (I < I_{min} wire break causes shut-off) • Separate voltage supply required: U_{IN} = + 24 V ± 10% I_{IN} = 2.1 A • Also usable as configurable digital output	Yes

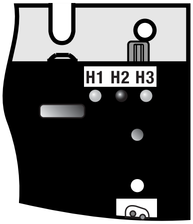
Table 2.10 Specification of control connections

User module UM-8I4O

Des.	Terminal	Specification	floating
Digital input			
+24V DC	X15-21	Auxiliary voltage for IEDxx	
IED00 to IED07	X15-22 to X15-29	• Limit frequency 5 kHz • PLC-compatible • Switching level Low/High: <5 V / > 18 V DC • I_{max} at 24 V = 6 mA • R_{IN} = 4 kΩ • Internal signal delay time ≈ 2µs • Terminal scan cycle = 1ms	Yes
DGND	X15-30	• Digital ground for IEDxx	
OED00 to OED03	X15-32 to X15-35	• Short-circuit proof, I_{kmax} = 1.2 A/OEDxx • PLC-compatible • Current at "1": I_{min} = 5 mA I_{max} = 500 mA • I_{max} in parallel operation = 125 mA • Internal signal delay time ≈ 250 µs • Terminal scan cycle = 1ms • Protection against inductive load • Thermal overload protection • High-side driver	Yes
DGND	X15-31	• Digital ground for OEDxx	
Supply voltage, module feed			
+24V DC	X15-1	• U_V = 24 V DC ±20% • I = 0.6 A • No polarity reversal protection	
DGND	X15-2	• Digital ground	

Table 2.11 Specification of control connections, UM-8I4O

2.5 LEDs



At the top right of the servocontroller there are three status LEDs coloured red (H1), yellow (H2) and green (H3).

Device status	Red LED (H1)	Yellow LED (H2)	Green LED (H3)
Power on	❍	❍	●
Servocontroller ready (ENPO set)	❍	●	●
Control enabled	❍	✳	●
Error	✳ (flash code)	❍	●
Warning (in "ready" condition)	●	●	●
Warning (in "control enabled" condition)	●	✳	●
❍ LED off, ● LED on, ✳ LED flashing			

Table 2.12 Meanings of LEDs

Note: Error messages can be viewed in more detail using the KEYPAD KP200 control unit or the DRIVEMANAGER.

For more information on the error messages see Appendix B.

2.6 Isolation concept

The analog and digital inputs are isolated from each other in order to avoid transient currents and interference over the connected lines. The analog inputs are connected to the potential of the servocontroller processor. The digital inputs and outputs are isolated, thereby keeping interference away from the processor and the analog signal processing.

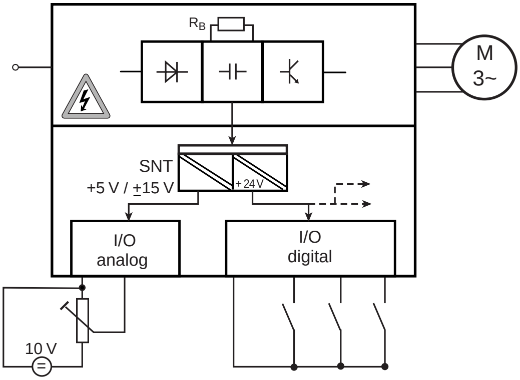


Figure 2.4 Voltage supply to I/Os

When selecting the cable, note that the cables for the analog inputs and outputs must always be shielded. The cable or wire core shield on shielded pairs should cover as large an area as possible in respect of EMC considerations, thereby providing safe discharge of high-frequency interference voltages (skin effect).

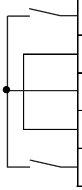
Special case: use of an analog input as a digital input

Use of the device's internal 24 V DC as supply voltage in conjunction with the analog input ISA01 as the digital input requires connection of digital ground and of signals ISA01-. For the reasons mentioned above, this can lead to interference, and demands extra care in selecting and connecting the control cables.

Note: Only analog input ISA01 usable as digital input.

Note: Optionally, the standard inputs and outputs provided can be expanded by an additional eight inputs and four outputs with the user module UM-8I4O.

A bridge is only required when the internal 24 V is used.



X2	Des.	Function
1	ISA00+	Analog reference input ± 10 V
2	ISA00-	Analog reference input ± 10 V
3	ISA01+	Analog reference input 0-10 V
4	ISA01-	Analog reference input 0-10 V
5	+24 V	Auxiliary voltage 24 V,
6	DGND	Digital ground
7	ENPO	Power stage hardware enable

Figure 2.5 Removal of isolation

If more digital inputs and outputs are required than are present on the servocontroller, we recommend using user module UM-8I4O. It ensures safe operation of the CDD3000 servocontroller with no disturbance of the analog signals. Safe operation based on burst immunity to EN 61000-4-4 is not affected by connection of the analog and digital ground. The only effect may be on evaluation of the analog input resulting from interference voltage where long cables are attached to the digital outputs and inputs.

Example: Risk of disturbance

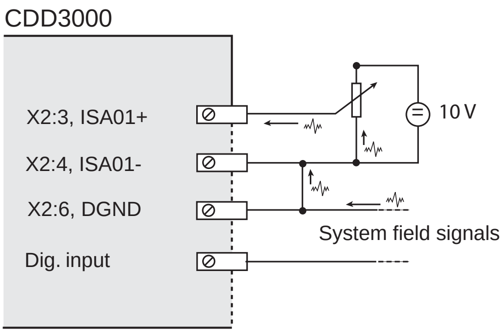


Figure 2.6 Disturbance of the analog input

For more information on the analog and digital inputs, see section 5.1.

2.7 Device software

Loading new device software

Note: This function is available as from hardware version 1.1.

With the DRIVEMANAGER a new device software release (firmware) can be loaded into the Flash-EPROM of the CDD3000.

1. To perform the update, connect the DRIVEMANAGER to the servocontroller.
2. From the Tools menu choose “Load device software (firmware) ...”. The DRIVEMANAGER then guides you through the further work steps. LEDs H2 and H3 are lit steadily during transfer of the firmware. When the transfer is completed successfully, LED H2 goes out provided no ENPO signal is applied.

3 User control structure

Operation variants

The user structure of the CDD3000 is highly flexible, as a result of the various user control variants and wide-ranging parameter-setting facilities.

The user control variant are:

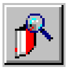
– DRIVEMANAGER PC user software
  The user friendly DRIVEMANAGER user interface (DM) is recommended for complete parameter setting/commissioning of the servocontroller. Parameters are set in user screens or, for the experienced user, by way of the Parameter Editor.

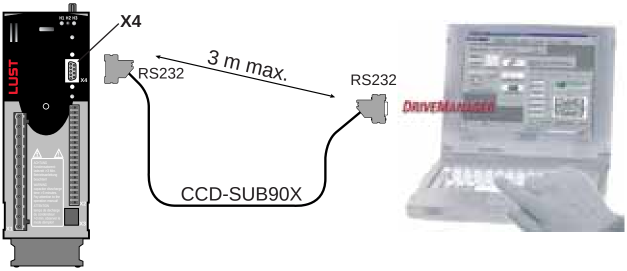
– **KP200 control unit**
  The user-friendly KP200/KP200XL hand-held control unit is intended for parameter changing or for storing/loading data sets on SMARTCARD, for torque and speed control only

– **Field buses**
  – CAN_{Lust}
  – CAN_{open}
  – PROFIBUS

3.1 Operation with DRIVEMANAGER

Connection and startup

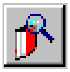
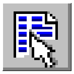
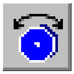
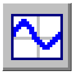
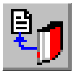
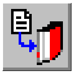
- Connect the interface cable and switch on the power supply to the drive unit.
- When the program starts the DRIVEMANAGER (version 3.x or higher) automatically connects to the attached drive unit.
- If the connection setup does not occur automatically, check the settings in the **Tools > Options** menu and start the connection setup with the icon 

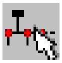
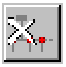


Servocontroller connection to PC/DRIVEMANAGER

The key functions

For more information refer to the DRIVEMANAGER Help.

Icon	Function	Menu
	Connect to device	Communication > Connect > Single device
	Change device settings	Active device > Change settings
	Print parameter data set	Active device > Print settings
	Control drive	Active device > Open-loop control > Basic operation modes, no position references
	Digital scope	Active device >Monitoring > Quickly changing digital scope values
	Save settings from device to file	Active device > Save device settings to
	Load settings from file into device	Active device > Load device settings from

Icon	Function	Menu
	Bus initialization (change settings)	Communication > Bus configuration
	Disconnect from device	Communication > Disconnect
	Compare device settings	Active device > Compare settings

Note: For more information refer to the DRIVEMANAGER. Operation Manual

3.1.1 User screens

DRIVEMANAGER Quick access to CDD3000 setup

or from the menu: Active device >Change settings

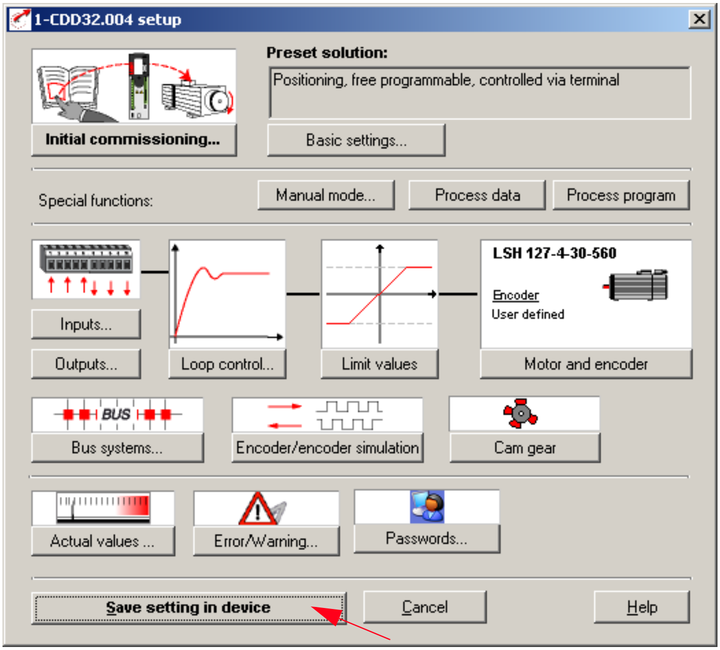


Figure 3.1 Setup in device

On the “CDD3000 setup” screen the servocontroller parameters can be set.

Note: The settings for the various preset solutions **are described in** section 4**.**
The setting options offered by the **software functions** (inputs/outputs, loop control, etc.) are described **in section 5**.

Note: Any changes to the parameters are effected only in the volatile memory, and must be saved subsequently in the device by way of the **“Save setting in device”** button (see arrow). The same effect is achieved by simultaneously pressing the two cursor keys on the KP200 control unit for approx. two seconds while at the menu level (see section 3.3).

Screen operation

For example:

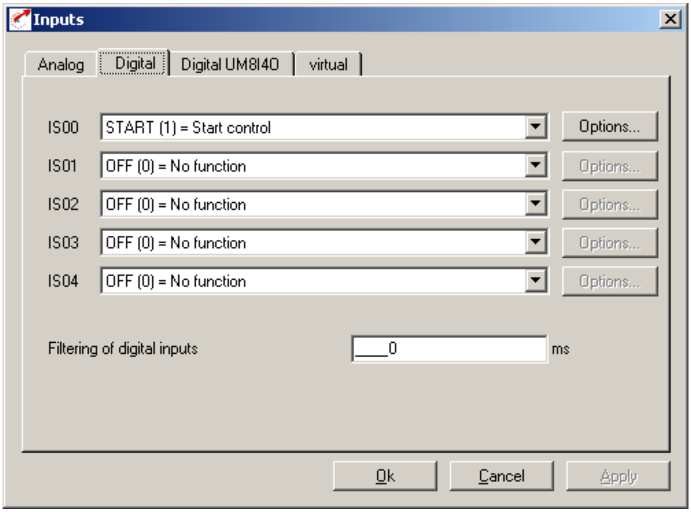


Figure 3.2 Example of screen operation

Functions of buttons:

→ Apply change and close screen

→ Reject change and close screen

→ Apply change (activate) and leave screen open.

→ Optional settings for the relevant function

Explanation of setting

For example:

Start (1) = Start control

Function (max. five characters), Display on KP200

Setting via field bus

Plain text display of function

Help function

In any input dialog box a Help function providing further information on the parameter can be called up by pressing the F1 key.

e.g. Speed control → Actual speed filter screen.

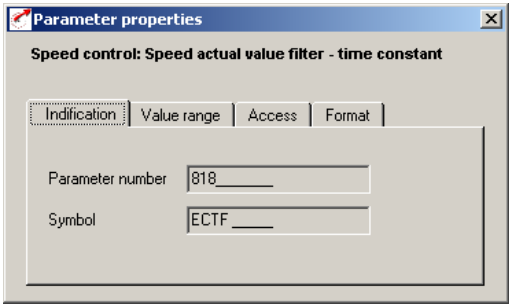


Figure 3.3 Identification

Parameter number	Number of parameter
Abbreviation	Name, max. five characters (displayed in KP200)

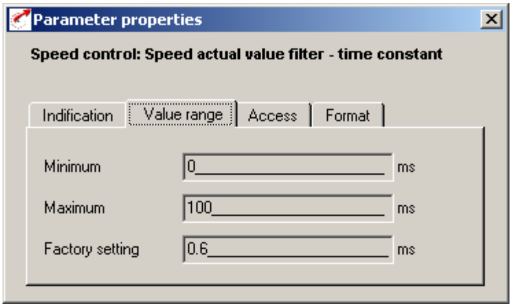


Figure 3.4 Value range

Minimum/Maximum	The value must be within this range (here: between 0 and 32 ms).
Factory setting	After a device reset this value is automatically entered.

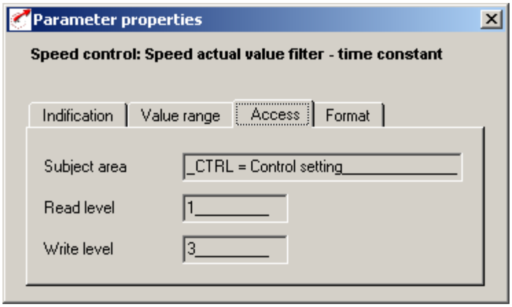


Figure 3.5 Access

Subject area	For ease of handling the individual parameters are grouped into subject areas.
Read level	At this level or above the parameter can be read.
Write level	At this level or above the parameter can be edited.

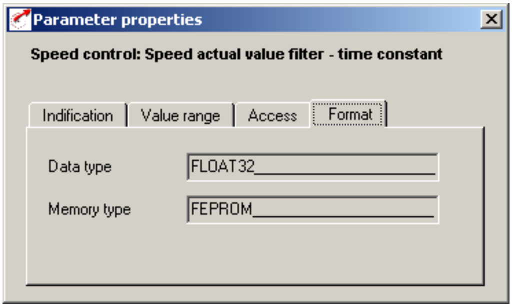


Figure 3.6 Format

For more information on the data and memory types, see “Memory type and data type” on page A-2.

3.1.2 Parameter Editor

Parameter Editor

The Parameter Editor contains all the parameters of the device, divided into subject areas, as on the KP200 control unit. The reason for this is to provide experienced users with access to all the parameters of the device (depending on their user level). Note that changes to individual parameters may possibly not be supported by the preset solution.

Subject areas

For ease of handling the individual parameters are grouped into subject areas (parameter groups).

Parameter

The parameters are changeable variables which are all assigned a factory setting (FS). They have a fixed value range with a minimum and maximum value. The current parameter value is always displayed.

Menu: Tools – Parameter Editor

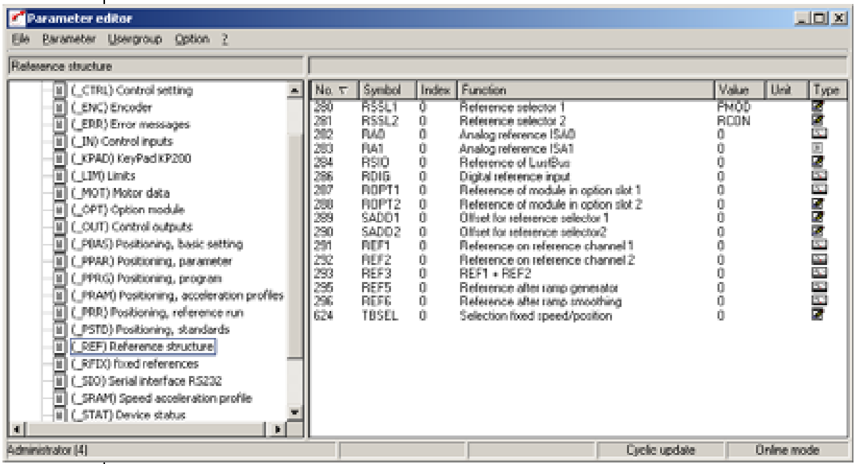


Figure 3.7 Parameter Editor

3.1.3 User levels

By means of the parameters the inverter module can be fully adapted to the application task. In addition there are parameters for the internal variables of the inverter module which, for the sake of general operating safety, are protected against user access.

The user level is set when the DRIVEMANAGER is started, but can be changed at any time subsequently (“Tools” menu - “Select new user level”). The number of editable and displayable parameters changes depending on the user level. The higher the user level the greater the number of accessible parameters. In contrast, users are presented with a more concise range of those parameters which are really required, allowing them to find their specific solution more rapidly. Consequently, choosing as low a user level as possible makes operation significantly easier.

Note: The user levels protect against unauthorized access. Consequently, to protect the parameter setting of the inverter module parameter 01_MODE, in subject area “_KPAD”, should always be reset to the lowest user level after adaptation.

Target group	Comments	User level 01-MODE	Password in FS [1)]
Layman	No access permission, for status monitoring only • No parameter setting • Display of basic parameters	1	/
Beginner	With basic knowledge for minimal operation • Expanded basic parameters editable • Expanded parameter display	2	/
Advanced	For commissioning and field bus connection • Parameter setting for standard applications • Expanded parameter display	3	/
Expert	With control engineering skills • All control parameters editable • Expanded parameter display	4	/
Other	For system integrators	5	/

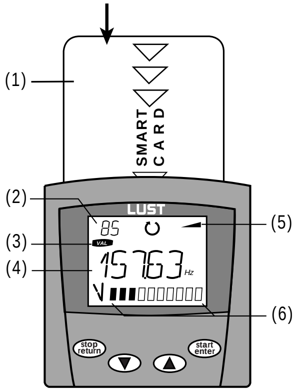
[1)] FS = Factory setting

Table 3.1 Setting user levels

3.2 Operation with KEYPAD KP200XL

Overview - KEYPAD KP200XL

The KEYPAD can be plugged directly into slot X4 of the servocontroller.



(1) SMARTCARD chipcard to save and transfer settings

(2) 3-digit display, e.g. for parameter number

(3) Current menu

(4) 5-digit display for parameter name and value

(5) Acceleration or braking ramp active

(6) Bar graph display, 10-character

start enter	Call up menu branches or parameters; Save changes; Start in “Control drive” mode
stop return	Quit menu branches; Cancel changes; Stop in “Control drive” mode
▲	Select menu, subject area or parameter; Increase setting
▼	Select menu, subject area or parameter; Reduce setting

Figure 3.8 Operating and display elements of the KEYPAD KP200

Menu structure

The KEYPAD KP200XL has a user-friendly menu structure which is identical to that of the KP100 for the SMARTDRIVE VF1000 frequency inverters and MASTERCONTROL MC6000/ MC7000 servocontrollers.

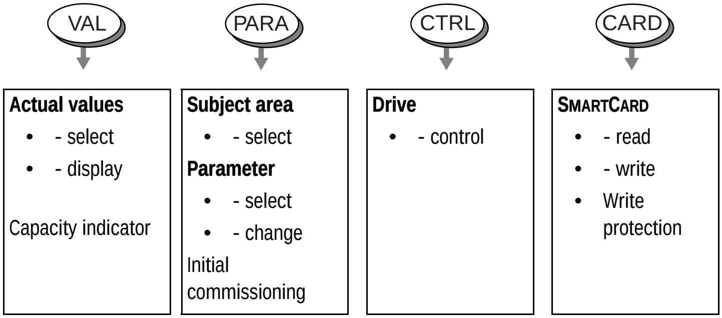
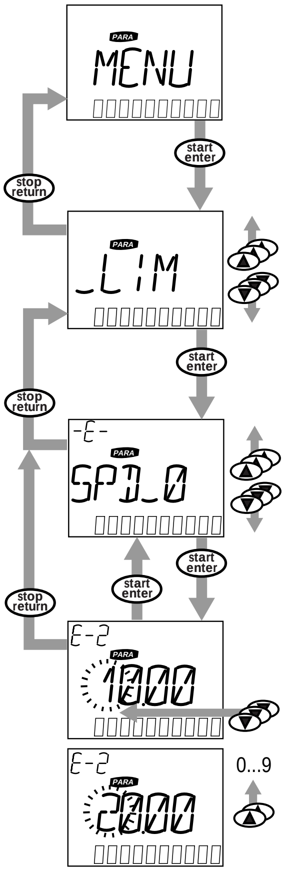


Figure 3.9 Functions of the menus

Example parameter setting (PARA menu)

- The parameters in the PARA menu are grouped into subject areas according to their functions, in order to provide a clearer overview.
- Only the parameters to which the current user level permits access can be changed.



1. Select PARA menu.

2. Select desired subject area with cursor keys and confirm with **Start/Enter**.

3. Select desired parameter with cursor keys (pay attention to user level).

4. The current value is displayed, with the last character flashing. Switch to the next character using the **down** key. Use the **up** key to change the flashing character. The fifth character at the extreme left indicates the preceding sign: (–) = minus.

The last character can be entered as an exponent.

Save new value with **Start/Enter** or cancel (without saving) with **Stop/Return.**

Note: The KEYPAD KP200XL Operation Manual gives more information on changing user level.

Read from/write to SMARTCARD:

- In this menu servocontroller settings can be saved to the SMARTCARD and transferred to other servocontrollers.
- In every storage operation, **all** parameters are always saved to the SMARTCARD. For read operations, either all parameters or only parameters for motor setup (per read operation) can be read-in.

CARD menu

Note: It is not possible to use the Card menu or save data on the SMARTCARD for position controlled operation modes!

Function	Meaning
READ > ALL	Read all parameters from SMARTCARD
READ > DRIVE	Read in partial data set (motor data only)
WRITE	Store all parameters on the SMARTCARD
LOCK	Write-protect the SMARTCARD
UNLOCK	Cancel the write protection

Table 3.2 CARD menu

Note: For more information on operation with the KEYPAD refer to the KEYPAD KP200XL Operation Manual.

3.3 Saving the settings

Saving the settings in the device

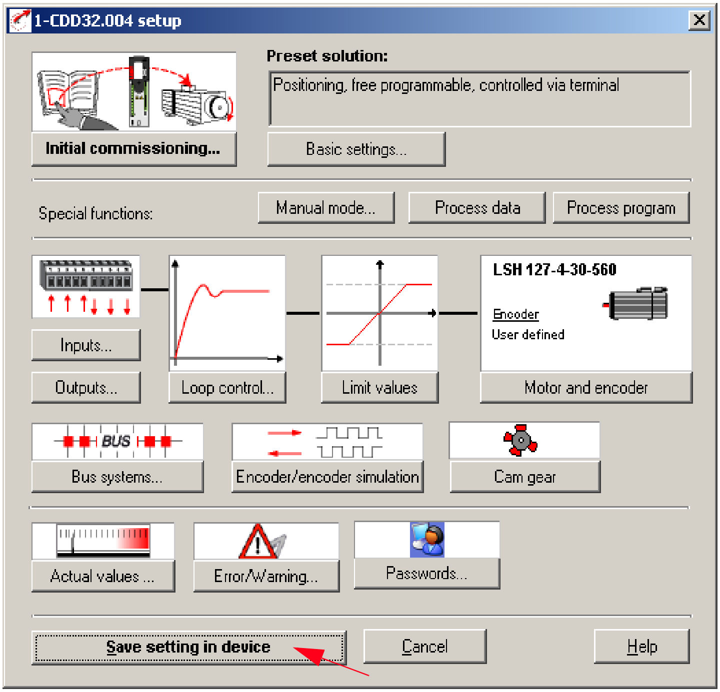


Figure 3.10 Saving the settings in the device

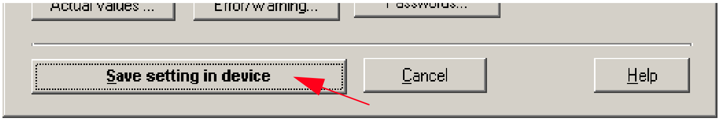
Note: Any changes to the parameters are effected only in the volatile memory, and must be saved subsequently in the device by way of the “Save setting in device” button (see arrow). The same effect is achieved by simultaneously pressing the two cursor keys on the KP200 control unit for approx. two seconds while at the menu level (see Figure 3.12).

Saving the settings in the device

Any changes which are to be stored permanently in the device must be saved by way of the *CDD3000 setup* screen.

DRIVEMANAGER
CDD3000 setup

or:
Active device >Change settings



The changes made can also be saved to a file.

Saving the settings to a file

DRIVEMANAGER
CDD3000 setup

or:
Active device >Save device settings to >file

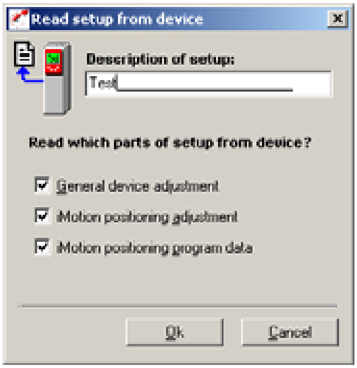


Figure 3.11 Saving the setting

Depending on the preset solution, the CDD3000 has a range of data sets which together form the device configuration.

Save ...	With KEYPAD TO SMARTCARD	With DRIVEMANAGER to file
Device data (="Settings") (device settings and motor data)	Yes	yes (*.00D), (*.00T), (*.00X)
Process data (variables, flags and table position of sequence control)	No	yes (*.01D), (*.01T), (*.01X)
Process programs	No	yes (*.prg)

Table 3.3 Saving the setting

Choose the file name (e.g. mydata). Then the data sets are selected depending on the preset solution. All files are saved under the chosen file names (e.g. mydata) with the appropriate extension (*.00D). The device data can be assigned a description prior to saving.

Saving setting with KEYPAD

The changes made can also be saved in the device using the KEYPAD. Switch to the Level menu by pressing the **stop/return** key repeatedly, then press and hold down the **up** and **down** cursor keys simultaneously for about three seconds. The save operation takes around six seconds.

1. Select menu.

2. Press and hold both cursor keys until “SAVE” appears (approx. 3 sec.)

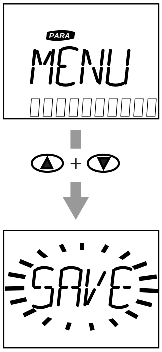
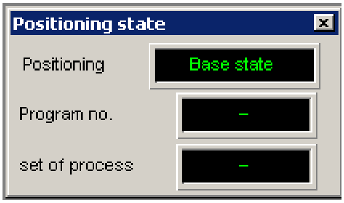


Figure 3.12 Saving with KP200XL

3.4 Device status

CDD3000 status positioning

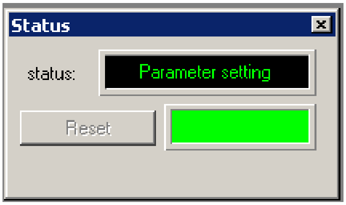
The “View” menu offers information on the device status.



This screen shows the status of positioning (basic setting or automatic mode) and indicates which sequence program (number xx) and which line of the sequence program (Nxxx) is currently being run.

The current line number of the sequence program can also be recorded with the digital scope.

CDD3000 status



The device status and any error messages are displayed here. An error can be reset with the “Reset” button.

• Power cut to electronics	CDD supplied with 24 V, no DC link voltage present
• Switch-on inhibit	Power stage enable ENPO not set
• Ready for start	ENPO set
• Control enabled	Loop control active current applied to motor
• Quick stop active	Emergency stop executed at max. torque
• Error	Device in error state (with indication of error)
• Flux build-up	Magnetic flux is built up in the motor
• Parameter setting	Parameters are changed

CDD3000 reference and actual values

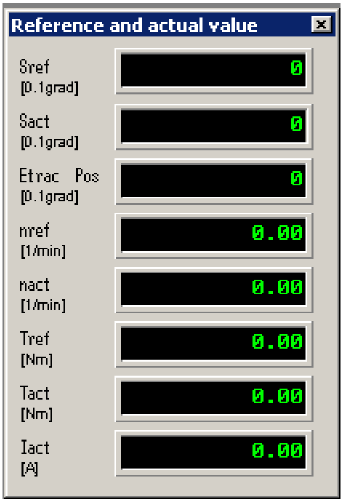


Figure 3.13 CDD3000 reference and actual values

- **$R_{eference}$** = Position reference value in the unit set under Standardization
- **A_{ctual}** = Actual position value in the unit set under Standardization
- **delta_s** = Tracking error in the unit set under Standardization
- **N_{ref}** = Speed reference value in revolutions per minute
- **N_{act}** = Actual speed value in revolutions per minute
- **M_{ref}** = Torque reference value in Newtonmeters
- **M_{act}** = Actual torque value in Newtonmeters
- **I_{act}** = Effective current value in Amperes

CDD3000 inputs and outputs

Figure 3.14 CDD3000 inputs and outputs IO and FCT

All analog and digital inputs and outputs are shown here. Either with their label (e.g. IS00), or with their function (e.g. AUTO = PosModautomatic mode). The options are toggled with the “IO” or “Fct” button

3.5 Commissioning

Commissioning procedure:

1. Initial commissioning based on Operation Manual:

The precondition is initial commissioning with the aid of the Operation Manual.
The user manual only covers adaptation of the software functions.

↓

If the settings from the initial commissioning based on the Operation Manual are not adequate for your application:

2. Selection of optimum preset solution

The preset solutions record the typical applications of the positioning controllers.

The data set which best covers the specific application is selected.

↓

3. Custom adaptation of the preset solution to the application

The preset solution serve as the starting point for application-oriented adaptation. Other function adaptations are made to the parameters in the function-oriented subject areas. Save your settings in the device!

↓

4. Checking the set application solution

To preserve the safety of personnel and machinery, the application solution should only be checked at low speed. Make sure the direction of rotation is correct. In case of emergency the drive power stage can be disabled, and the drive stopped, by removing the ENPO signal.

↓

5. Concluding commissioning

When you have successfully completed commissioning, save your settings (using the SMARTCARD or DRIVEMANAGER) and store the data set in the device.

↓

4 Preset solutions

4.1 Selecting preset solutions

With the DRIVEMANAGER the desired preset solution can be selected, and its parameters set, quickly and easily in the course of first commissioning.

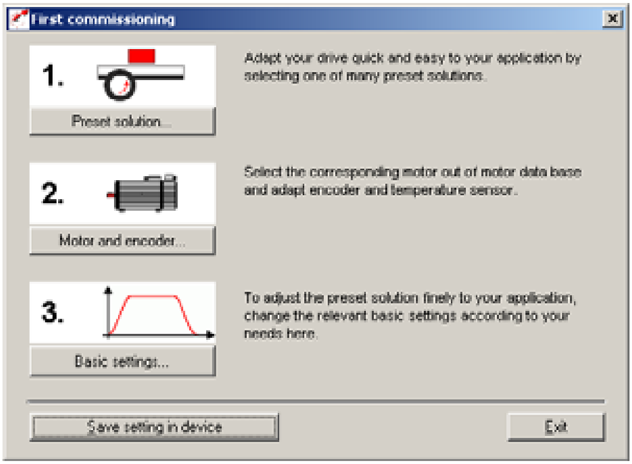


Figure 4.1 Selection of preset solutions in the DRIVEMANAGER

Preset solutions

The preset solution is selected according to the type of drive task. A preset solution is a presetting of the drive controller which can subsequently be adapted to the application.

For more information on first commissioning refer to the CDD3000 Operation Manual.

The CDD3000 servocontroller provides a wide range of preset solutions, each described briefly in the DRIVEMANAGER. The application preset by a preset solution can optionally be controlled via the control terminals (T = Terminal) or over a field bus (B = Bus).

Bus	Abbreviation	Control mode, reference	Control via ...	Comments
0	OFF	User-defined	User-defined	
1	TCT_1	Torque control, 10 V	Terminal	
2	SCT_1	Speed control, external position control	Terminal	Reference via ± 10 V (8 kHz)
3	SCT_2	Speed control, 10 V	Terminal	Reference via ± 10 V (1 kHz)
4	SCB_2	Speed control, 10 V	Field bus	
5	SCT_3	Speed control, fixed speeds	Terminal	Selection via dig. Inputs
6	SCB_3	Speed control, fixed speeds	Field bus	Selection via dig. Inputs
7	SCT_4	Speed control, pulse input	Terminal	Master encoder X5
8	SCB_4	Speed control, pulse input	Field bus	Master encoder X5
9	SCB_5	Speed control, field bus	Field bus	
10	PCB_2	Positioning, field bus	Field bus	
11	PCT_3	Positioning, fixed position	Terminal	Selection via dig. Inputs
12	PCB_3	Positioning, fixed position	Field bus	Selection via dig. Inputs
13	PCT_4	Positioning	Terminal	Free programmable sequence program
14	PCB_4	Positioning	Field bus	Free programmable sequence program

Table 3.4 Preset solutions

For more information on first commissioning refer to the CDD3000 Operation Manual.

Torque control, ±10 V reference (TCT_1)

This operation mode is suitable for tractive force control. The internal speed controller remains active and limits the speed (safety function). Control is via the control terminal.

Speed control with external position control (SCT_1)

This operation mode is suitable for moving multiple axes three-dimensionally with an external path control or to approach any desired positions at different velocities. In this mode the servocontroller is coupled directly to a controller (PLC) which executes the position control and computes the position references. The PLC delivers a differential ±10 V reference, which is processed by the servocontroller at a sampling rate of 8 kHz (125 µs). The high sampling rate ensures a low level of tracking error in the position control loop. Control is via the control terminal.

Speed control, ±10 V reference (SCT_2, SCB_2)

This operation mode is suitable for rotational drives in which the axle is driven at varying speeds. To this end, the servocontroller converts the differential ±10 V reference input into a motor speed. The acceleration profile is programmable. Control is optionally via the control terminal (SCT_2) or the field bus (SCB_2).

Speed control, fixed speeds (SCT_3, SCB_3)

This operation mode is suitable for traction or lifting drives in which the axle is driven at up to 8 pre-programmed speeds. The acceleration profile is programmable. Control is optionally via the control terminal (SCT_3) or the field bus (SCB_3).

Speed control, pulse input (SCT_4, SCB_4)

This operation mode is suitable for tracking a master axle in speed synchronous mode or to convert the frequency signal of a stepper motor control into a rotation speed. Actuation is via signals with RS422 (X5) or HTL level (X2-ISD03, ISD04). The acceleration profile is programmable. Control is optionally via the control terminal (SCT_4) or the field bus (SCB_4).

Speed control, reference and control via field bus (SCB_5)

This preset solution is suitable where the speed reference input is via a field bus in addition to the parameter setting and control of the controller. The acceleration profile is programmable.
All digital outputs can be set via the field bus. The status of the digital inputs can be read.

Electronic Gearing functionality is available in operation modes PCT4... and PCB4... .

---

1 2 3 4 5 A EN

Positioning via field bus (PCB_2)

This operation mode is suitable to specify a positioning set comprising of the target position, velocity and accelerations via the field bus, and to control the sequencing. The positioning profile is generated in the servocontroller and the positioning status is made available to the field bus. Various homing mode types integrated into the CDD3000 can be selected via the field bus.

Positioning, fixed positions (PCT_3, PCB_3)

This operation mode is suitable for approaching a maximum of 31 pre-programmed positions or for positioning of a specific positioning route. The parameterizable positioning sets each comprise a target position, mode (absolute-relative), velocity, and the accelerations. Various homing mode types integrated into the CDD3000 can be selected. Control is optionally via the control terminal (PCT_3) or the field bus (PCB_3).

Positioning, free programmable (PCT_4, PCB_4)

This operation mode is suitable for inserting the controller into a customized positioning process or to integrate a sequence control into the servocontroller. To this end, the CDD3000 has a highly flexible positioning and sequence control with a simple and easily understood programming language. It permits time optimized or jerk limited absolute or relative positioning. Other functions, such as various homing mode types integrated into the CDD3000 and an indexing table positioning function, are available. Control is optionally via the control terminal (PCT_4) or the field bus (PCB_4).

4.1.1 Reference structure

The reference structure is adjusted to the application by the selection of the preset solution such that no adaptation is required for most applications.

There is one reference structure for speed-controlled mode see Figure 4.3 and one for the position-controlled mode see Figure 4.2

BUS	SETTING	MEANING
0	RCON	Reference constant 0
1	RA0	Reference of analog input 0
2	RA1	Reference of analog input 1
3	RSIO	Reference of serial interface RS232
4	RDIG	Reference of master encoder input X5
5	ROPT1	Reference of option module at slot 1
6	ROPT2	Reference of option module at slot 2
7	RFIX	Reference of fixed value 1-8
8	PTAB	Reference of driving set table 0-31
9	PMOD	Reference of sequence program

Table 3.5 Settings for parameters 280_RSSL1/ 281_RSSL2 and 289_SADD1/290_SADD2

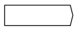
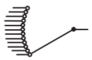
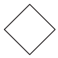
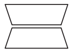
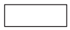
Symbol	Meaning
	Reference source (input), in some cases with second characteristic set
	Reference selector (switch)
	Parameter
	Interim reference values (for display only)
	Limitation of reference value
	Mathematical influence

Table 3.6 Symbols used

Principle of reference input (position control)

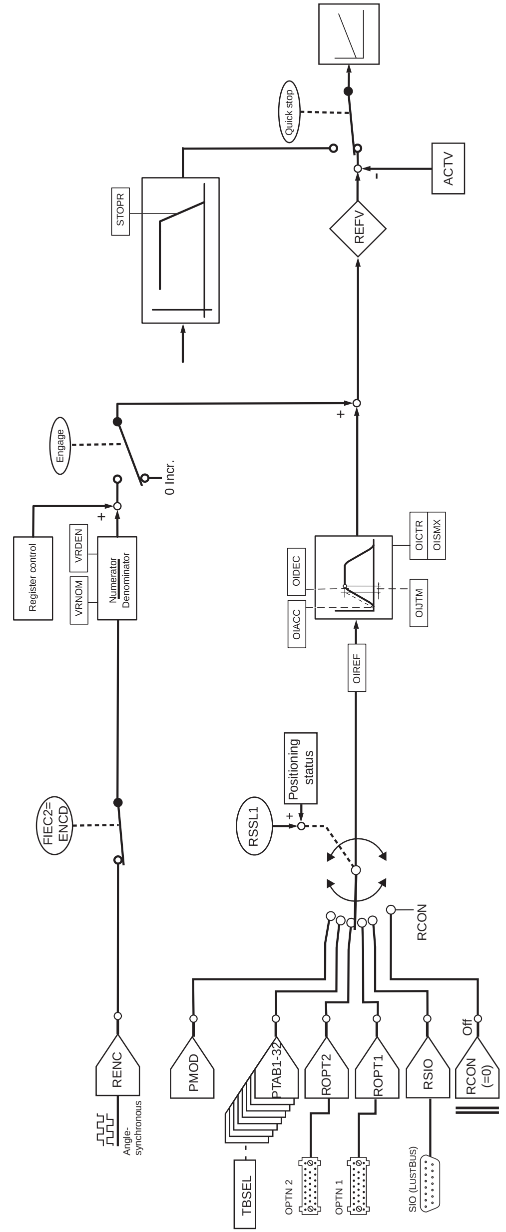


Figure 4.2 Principle of reference input (position control)

Principle of reference input (speed/torque control):

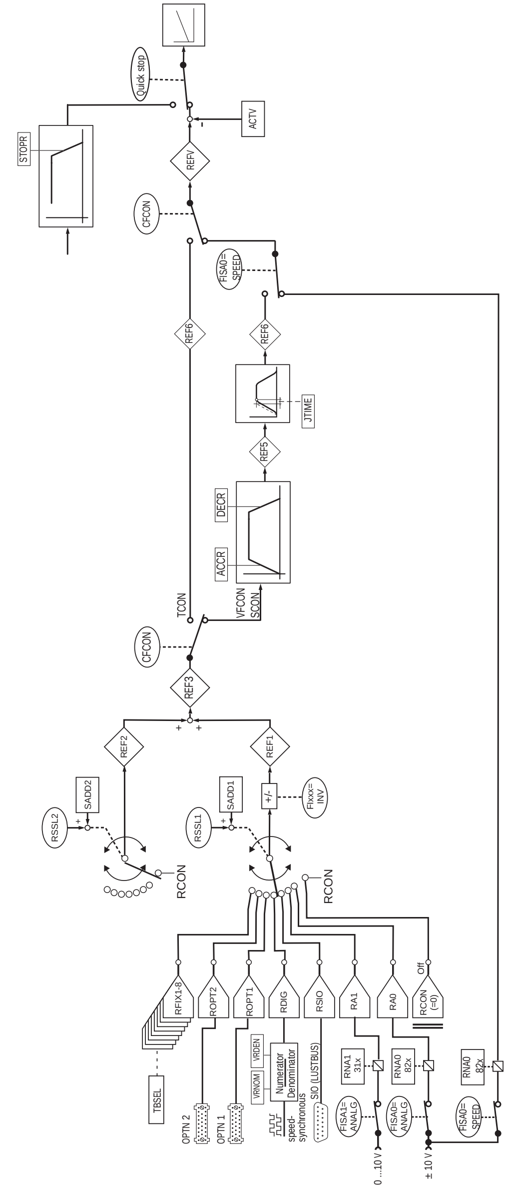


Figure 4.3 Principle of reference input (speed/torque control)

4.2 Torque control (TCT_1)

Possible applications:

Tractive force control

Functionality:

- Scaleable analog reference (±10 V, 12-bit resolution)
- Parameterizable speed limit
- Control of drive via I/O

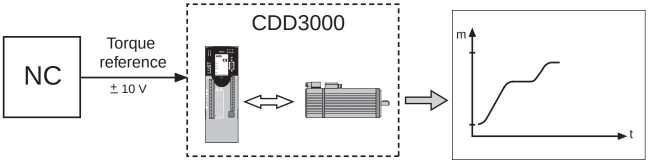


Figure 4.4 Torque control with ±10 V reference input

4.2.1 Making basic settings

Reference tab

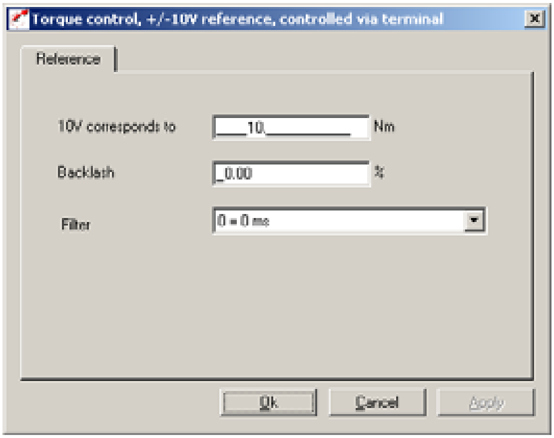


Figure 4.5 Reference tab

DM	Meaning	Value range	Unit	Parameter
10 V corresponds to	Standardization for analog input	± 32768	Nm	822_RNA0 (_IN)
Backlash	Backlash function for fault isolation at zero	0 - 90	%	192_IADB0 (_IN)
Filter	Filter for analog channel ISA00	0-64 Bus: 0 - 6	ms	188_IADB0 (_IN)

Table 4.1 Reference - basic settings

For more information on the analog inputs, see section 5.1.1.

4.2.2 Setting function parameters

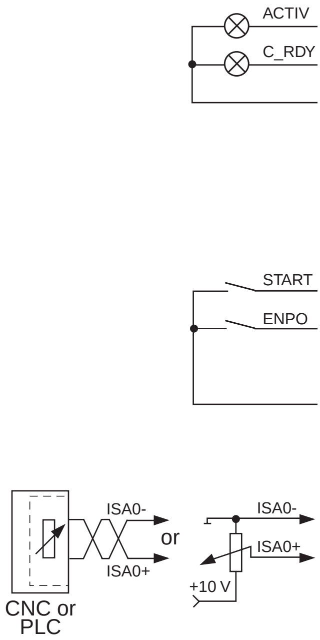
Once the preset solution, its basic setting and the motor data have been set, general function parameter settings can also be made.

- **Limit values** (e.g. max. torque and max. speed), see section 5.4.1.
- **Inputs/outputs** (e.g. “Reference reached” message), see section 5.1/5.2.
- **Brake actuation**, see section 5.1.2.
- Parameterizable **encoder simulation**, see section 5.9.1.

Note: In contrast to the basic settings, these functions are **independent** of the preset solution.

1
2
3
4
5
A
EN

4.2.3 Terminal assignment



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Loop control active
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Not assigned
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Start loop control
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Differential analog reference -
1	ISA00+	Differential analog reference +

Figure 4.6 Terminal assignment for torque control, ±10 V reference, control via terminal

4.3 Speed control with external position control (SCT_1)

Possible applications:

- Operation in path control or external position controller (e.g. PLC)

Functionality:

- Scaleable analog reference (±10 V, 12-bit resolution)
- Minimum tracking error owing to reference sampling rate of 125 µs
- Parameterizable encoder simulation
- Control of drive via I/O

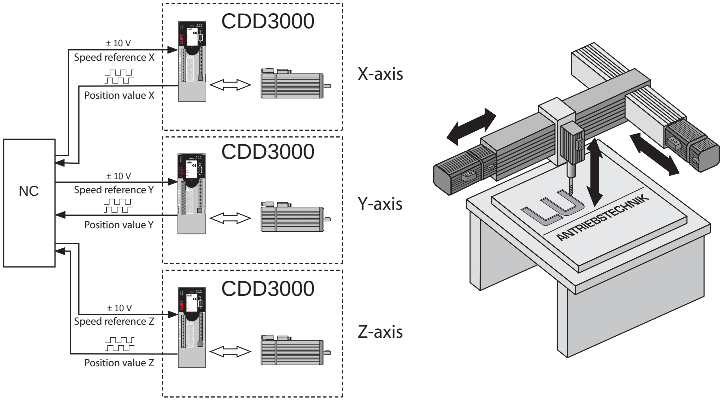


Figure 4.7 Example of a 3-axis path control

This preset solution is suitable

- for three-dimensional shifting of several different axes with an external path control.
- for approaching any positions at different speeds.

Explanatory notes:

- Only one encoder is required for torque, speed and position control. This saves on additional encoders and cabling.
- Resolution of analog inputs: ISA0 12-bit, ISA1 10-bit
- Sampling cycle, analog input ISA0: 8 kHz (125 µs)
- Short sampling cycles of the control loops, resulting in a high control quality of the drive:
  Torque control: 16 kHz
  speed control: 8 kHz

Control structure:

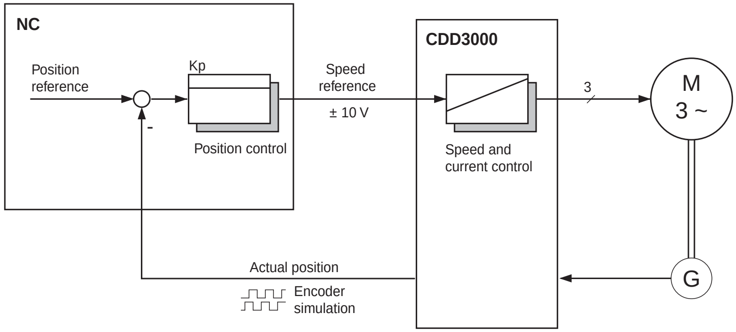


Figure 4.8 Block diagram of control structure

In this operation mode the functions of the reference structure (speed ramps, reference switchover, smoothing time, reference inversion, ...) are ineffective.

4.3.1 Making basic settings

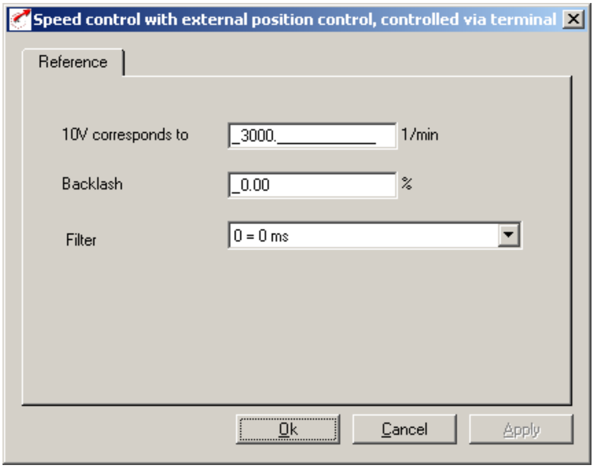


Figure 4.9 Reference tab

DM	Meaning	Value range	Unit	Parameter
10 V corresponds to	Standardization for analog input	± 32768	Nm	822_RNA0 (_IN)
Backlash	Backlash function for fault isolation at zero	0 - 90	%	192_IADB0 (_IN)
Filter	Filter for analog channel ISA00	0-64 Bus: 0 - 6	ms	188_IADB0 (_IN)

Table 4.2 Reference - basic settings

For more information on the analog inputs, see section 5.1.1.

4.3.2 Setting function parameters

Once the preset solution, its basic setting and the motor data have been set, general function parameter settings can also be made.

- **Limit values** (e.g. max. torque and max. speed), see section 5.4.1.
- **Inputs/outputs** (e.g. “Reference reached” message), see section 5.1/5.2.
- **Brake actuation**, see section 5.1.2.
- Parameterizable **encoder simulation**, see section 5.9.1.

Note: In contrast to the basic settings, these functions are **independent** of the preset solution.

4.3.3 Terminal assignment

X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Loop control active
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Not assigned
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Start loop control
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Differential analog reference -
1	ISA00+	Differential analog reference +

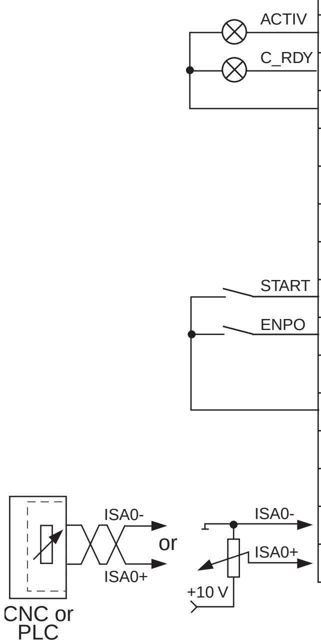


Figure 4.10 Terminal assignment for speed control with external position control, control via terminal

4.4 Speed control with ±10 V reference input (SCT_2, SCB_2)

Possible applications:

– Rotational drive, main spindle drive

Functionality:

– Scaleable analog reference (10 V, 12-bit resolution)
– Programmable time optimized acceleration profile
– Limit switch evaluation
– Control of drive via I/O (SCT_2)
– Control of drive via field bus (SCB_2)

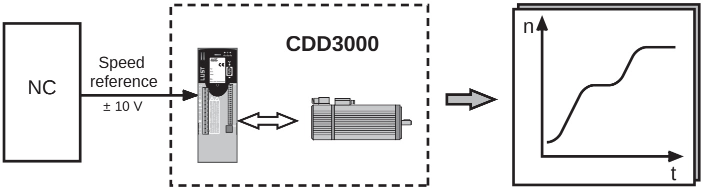


Figure 4.11 Speed control with ± 10 V reference input

Note: This preset solution is suitable for operation of the drive axle at different speeds without use of an external position control loop. If you wish to use an external position controller, we recommend the “speed control with external position control” preset solution, because in it the sampling time of the analog input is shorter, so the control result is better. The disadvantage is that the reference structure is bypassed and so is no longer usable.

4.4.1 Making basic settings

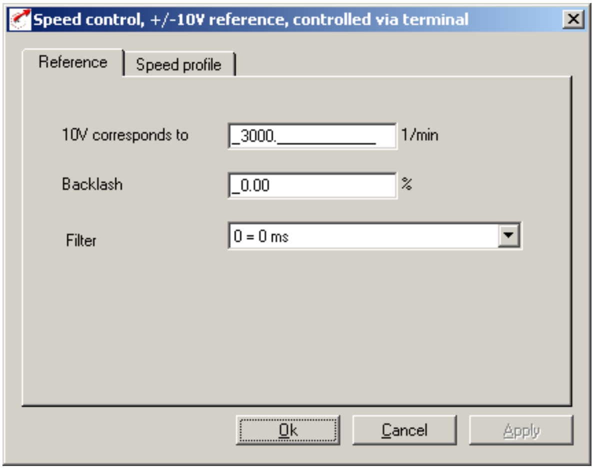


Figure 4.12 Reference tab

DM	Meaning	Value range	Unit	Parameter
10 V corresponds to	Standardization for analog input	± 32768	rpm	822_RNA0 (_IN)
Backlash	Backlash function for fault isolation at zero	0 - 90	%	192_IADB0 (_IN)
Filter	Filter for analog channel ISA00	0-64 Bus: 0 - 6	ms	188_IADB0 (_IN)

Table 4.3 Reference - basic settings

Speed Profile tab

Basic settings...

Speed profile

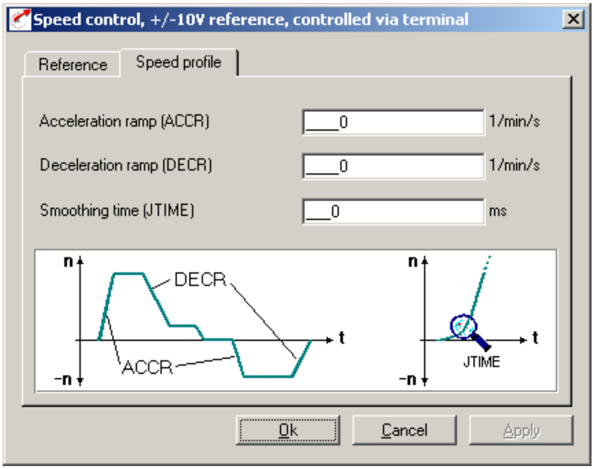


Figure 4.13 Speed Profile parameter screen

DM	Meaning	Value range	Unit	Parameter
Acceleration ramp	Ramp generator for acceleration. Setting 0 means acceleration at max. torque.	0 - 65535	rpm/s	52_ACCR (_SRAM)
Deceleration ramp	Ramp generator for deceleration. Setting 0 means deceleration at max. torque.	0 - 65535	rpm/s	102_DECR (_SRAM)
Smoothing time	The run-up and run-down time increases by the smoothing time. **Attention:**Does not work with quick-stop!	0 - 2000	ms	560-JTIME (_SRAM)

Table 4.4 Basic setting - Speed profile

Note: The entire ramp generator can be deactivated by setting the acceleration **or** deceleration ramp parameter to 0 – that is, acceleration and deceleration at preset maximum torque.

Jerk limitation with smoothing time JTIME

This jerk limitation function delivers the following benefits:

- The mechanism is left heavily vibrated
- Material fatigue due to load changes is reduced
- A mechanism with play is subject to less deflection

Note: A quick stop (emergency stop) is always made without jerk limitation.

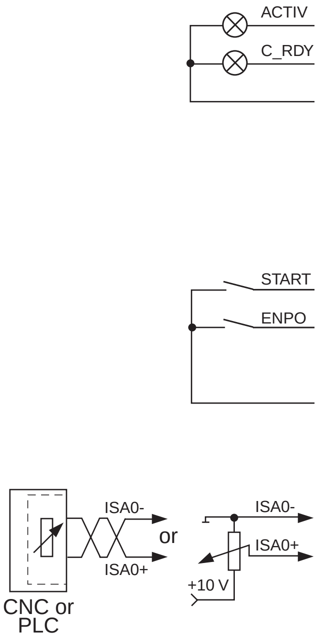
4.4.2 Setting function parameters

Once the preset solution, its basic setting and the motor data have been set, general function parameter settings can also be made.

- **Limit values** (e.g. max. torque and max. speed), see section 5.4.1.
- **Inputs/outputs** (e.g. “Reference reached” message), see section 5.1/5.2.
- **Brake actuation**, see section 5.1.2.
- Parameterizable **encoder simulation**, see section 5.9.1.
- **Torque reduction** (SCALE function), see section 5.1.1.

Note: In contrast to the basic settings, these functions are **independent** of the preset solution.

4.4.3 Terminal assignment

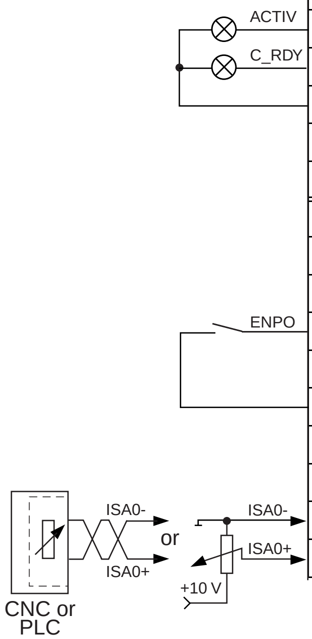


X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Loop control active
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Not assigned
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Start loop control
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Differential analog reference -
1	ISA00+	Differential analog reference +

Figure 4.14 Terminal assignment for speed control, ±10 V reference, control via terminal

4.4.4 Control via field bus

Note: For the preset solution SCB_2 the "EASYDRIVE Basic" bus setup should be used, retaining analog input ISA0 as the reference source.



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Loop control active
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Not assigned
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Differential analog reference -
3	ISA01+	Differential analog reference +
2	ISA00-	Differential analog reference -
1	ISA00+	Differential analog reference +

Figure 4.15 Terminal assignment for speed control, ± 10 V reference, control via field bus

For more information refer to the user manual of the relevant field bus system.

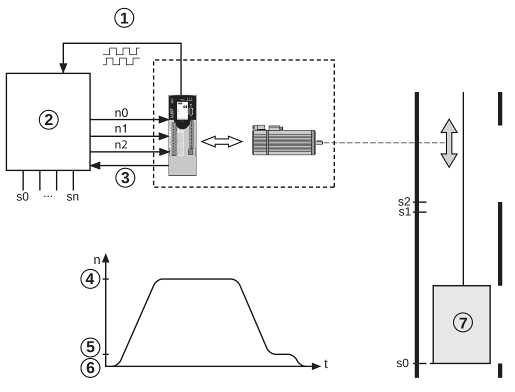
4.5 Speed control with fixed speeds (SCT_3, SCB_3)

Possible applications:

– Traction or lifting drive

Functionality:

– Eight speeds
– Programmable time optimized acceleration profile
– Limit switch evaluation
– Control of drive via I/O (SCT_3)
– Control of drive via field bus (SCB_3)



1 Encoder simulation
2 Control
3 Reference reached
4 Speed 2
5 Speed 1
6 Speed 0
6 Speed 0

Figure 4.16 Example of a lifting drive with quick/slow jog positioning.

The controller uses the encoder simulation to determine the position of the cabin.

4.5.1 Making basic settings

Speed Profile tab

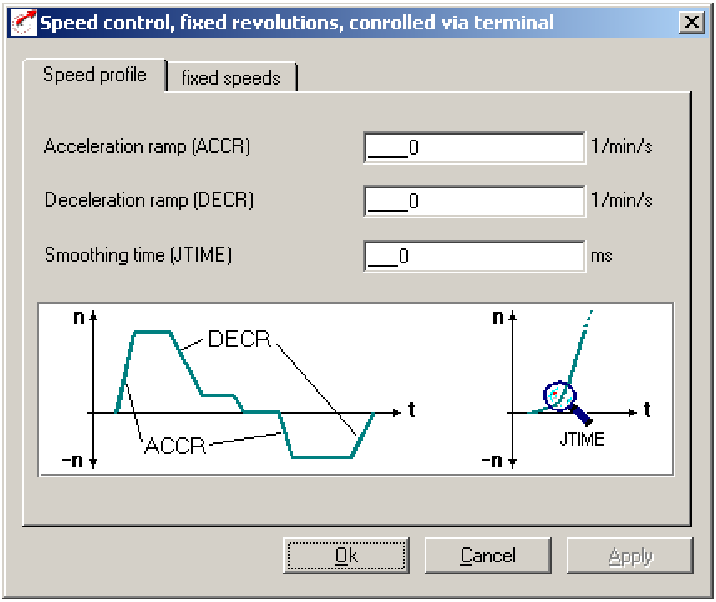


Figure 4.17 Speed Profile tab

DM	Meaning	Value range	Unit	Parameter
Acceleration ramp	Ramp generator for acceleration. Setting 0 means acceleration at max. torque.	0 - 65535	rpm/s	52_ACCR (_SRAM)
Deceleration ramp	Ramp generator for deceleration. Setting 0 means deceleration at max. torque.	0 - 65535	rpm/s	102_DECR (_SRAM)
Smoothing time	The run-up and run-down time increases by the smoothing time. **Attention:**Does not work with quick-stop!	0 - 2000	ms	560-JTIME (_SRAM)

Table 4.5 Basic setting - Speed profile

Note: The entire ramp generator can be deactivated by setting the acceleration **or** deceleration ramp parameter to 0 – that is, acceleration and deceleration at preset maximum torque.

Jerk limitation with smoothing time JTIME

This jerk limitation function delivers the following benefits:

- The mechanism is left heavily vibrated
- Material fatigue due to load changes is reduced
- A mechanism with play is subject to less deflection

Note: A quick stop (emergency stop) is always made without jerk limitation.

Fixed Speeds tab

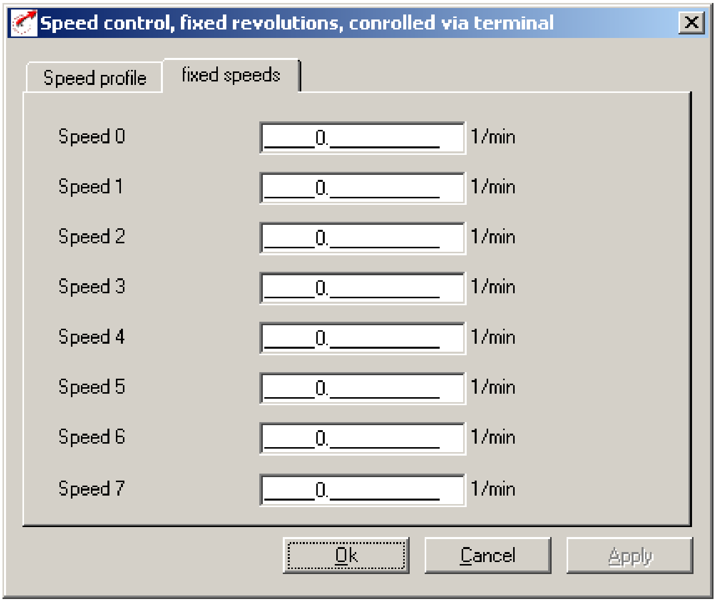


Figure 4.18 Fixed Speeds tab

Here the fixed speed references 1 - 8 are set which can be selected via digital inputs TB0 to TB2.

DM	Meaning	Value range	Unit	Parameter
Speed 0	Fixed speed 1	± 32764	rpm	270_RFIX1 (_RFIX)
Speed 1	Fixed speed 2	± 32764	rpm	271_RFIX2 (_RFIX)
Speed 2	Fixed speed 3	± 32764	rpm	272_RFIX3 (_RFIX)
Speed 3	Fixed speed 4	± 32764	rpm	273_RFIX4 (_RFIX)
Speed 4	Fixed speed 5	± 32764	rpm	274_RFIX5 (_RFIX)
Speed 5	Fixed speed 6	± 32764	rpm	275_RFIX6 (_RFIX)
Speed 6	Fixed speed 7	± 32764	rpm	276_RFIX7 (_RFIX)
Speed 7	Fixed speed 8	± 32764	rpm	277_RFIX8 (_RFIX)

Table 4.6 Fixed speeds - basic settings

Note: Inputs TB0 to TB2 are BCD coded.

Coding of fixed speeds with digital inputs TB0 to TB2

TB0	TB1	TB2	
0	0	0	Speed 0
1	0	0	Speed 1
0	1	0	Speed 2
1	1	0	Speed 3
0	0	1	Speed 4
1	0	1	Speed 5
0	1	1	Speed 6
1	1	1	Speed 7

Table 4.7 Fixed speeds

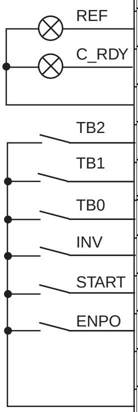
4.5.2 Setting function parameters

Once the preset solution, its basic setting and the motor data have been set, general function parameter settings can also be made.

- **Limit values** (e.g. max. torque and max. speed), see section 5.4.1.
- **Inputs/outputs** (e.g. “Reference reached” message), see section 5.1/5.2.
- **Brake actuation**, see section 5.1.2.
- Parameterizable **encoder simulation**, see section 5.9.1.
- **Torque reduction** (SCALE function), see section 5.1.1.

Note: In contrast to the basic settings, these functions are **independent** of the preset solution.

4.5.3 Terminal assignment

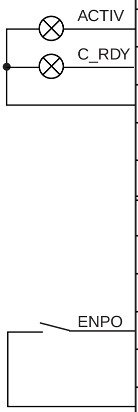


X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Reference reached
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Table index 2
11	ISD03	Table index 1
10	ISD02	Table index 0
9	ISD01	Reverse direction
8	ISD00	Start loop control
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

Figure 4.19 Terminal assignment for speed control, fixed speeds, control via terminal

4.5.4 Control via field bus

Note: For the preset solution SCB_3 the "EASYDRIVE Basic" bus setup should be used.



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Loop control active
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Not assigned
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Not assigned
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

Figure 4.20 Terminal assignment for speed control, fixed speeds, control via field bus

For more information refer to the user manual of the relevant field bus system.

4.6 Speed control via pulse input (SCT_4, SCB_4)

Possible applications:

- Speed synchronism (slave axle)
- Speed controlled operation on stepper motor control

Functionality:

- Speed reference via parameterizable master encoder input (TTL/HTL level)
- Reference as incremental encoder or pulse/direction signals
- Programmable time optimized acceleration profile
- Limit switch evaluation
- Control of drive via I/O (SCT_4)
- Control of drive via field bus (SCB_4)

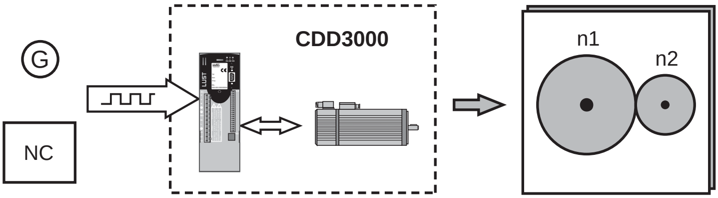


Figure 4.21 Speed control via pulse input

This preset solution is suitable

- where the CDD3000 has to track the precise speed of a master axle.
- where the CDD3000 has to convert the frequency signal of a controller into a rotation speed.

Structure of reference processing

The following diagram shows the structure of reference processing:

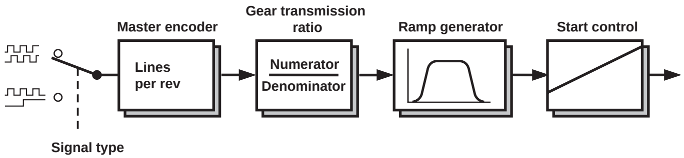


Figure 4.22 Structure of reference processing

Note: Since no position controller is involved, the angle positions of the master and slave axles drift apart. During the acceleration and braking phases the drift is dependent on the preset ramps and torque limits.
If you need angle synchronism, use preset solution PCB4... or PTC4... .

Mode of actuation

The master encoder input X5 permits incremental reference input for loop control. The reference generator is either the encoder simulation of another CDD3000 servocontroller, a standard commercially available incremental encoder or a stepper motor controller.

The signal shape corresponds either to the A/B incremental encoder signals or to pulse direction signals.

For more information on the master encoder input, see section 5.9.

4.6.1 Making basic settings

Speed control via pulse input:Master Encoder tab

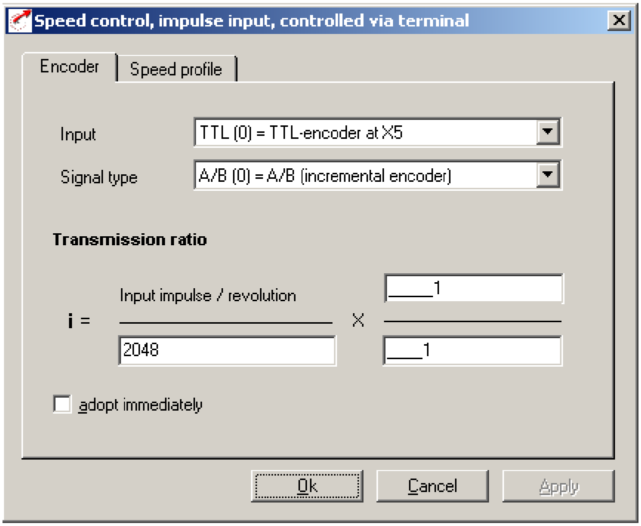


Figure 4.23 Master Encoder tab

Type of encoder	Resolver			Optical encoder		
Encoder at X5 Number of pole pairs	R1 p=1	R2 p=2	R8 p=3	G1	G2,G3, G5, G6, G7	G8
Resolution of encoder evaluation [1)] Increments per revolution Degrees	2^{14} 0.022°	2 x 2^{14} 0.011°	3 x 2^{14} 0.0073°	2^{25} 0.000011°	2^{25} 0.000011°	2^{12} 0.088°
Encoder simulation at X5 Standard pulses per revolution Zero pulses per revolution	1024* 1	2048* 2	3072* 3	2048 1	2048 0 (!)	1024 1
	*Adjustable from p x 128 to p x 4096					

[1)] Higher resolutions in encoder evaluation result in higher speed resolutions and thus smoother running of the drive. The resolution of the position controller is 16 bits, regardless of the encoder type used.

Table 4.8 Master encoder - basic settings

Example 1:
Speed synchronism

The master axle has a rotary encoder with 10.000 increments and a mechanical gear with a transmission ratio of 15.

The slave axle has a mechanical gear with a transmission ratio of 5.

On the gear output side the slave drive is to run half as fast as the master.

Solution:

- Signal type = Incremental encoder signals
- Lines per revolution master encoder is selected as 4096.
- Thus for the transmission ratio:

$$\frac{\text{Numerator}}{\text{Denominator}} = \frac{\text{Selected lines per rev Master encoder}}{\text{Lines per rev Master encoder}} \cdot \frac{\text{Gear transmission ratio Slave}}{\text{Gear transmission ratio Master}} \cdot \frac{\text{Speed Slave}}{\text{Speed Master}}$$

$$\frac{\text{Numerator}}{\text{Denominator}} = \frac{4096}{10000} \cdot \frac{5}{15} \cdot \frac{1}{2} = \frac{128}{625} \cdot \frac{1}{15} = \frac{128}{1875}$$

- $\frac{4096}{10000}$: Correction encoder
- $\frac{5}{15}$: Correction mechanical gearing
- $\frac{1}{2}$: Speed ratio $\frac{\text{Master}}{\text{Slave}}$

For more information on the master encoder input, see section 5.9.

Speed Profile tab

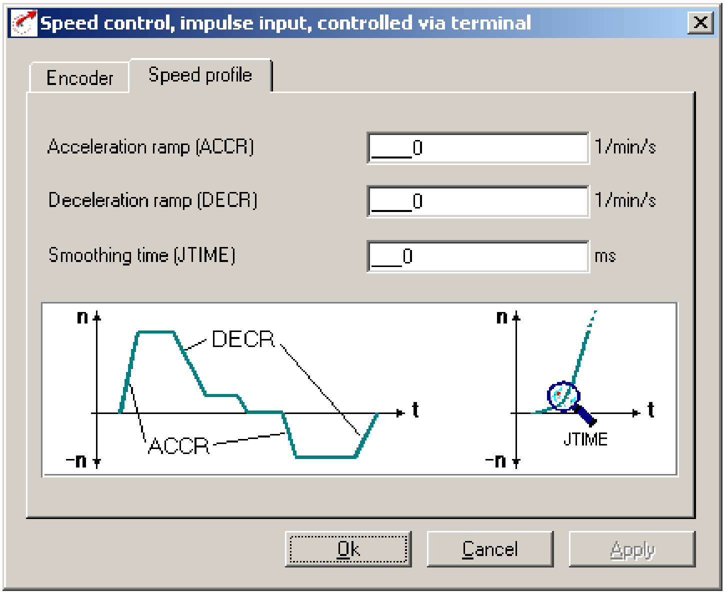


Figure 4.24 Speed Profile tab

DM	Meaning	Value range	Unit	Parameter
Acceleration ramp	Ramp generator for acceleration. Setting 0 means acceleration at max. torque.	0 - 65535	rpm/s	52_ACCR (_SRAM)
Deceleration ramp	Ramp generator for deceleration. Setting 0 means deceleration at max. torque.	0 - 65535	rpm/s	102_DECR (_SRAM)
Smoothing time	The run-up and run-down time increases by the smoothing time. **Attention:**Does not work with quick-stop!	0 - 2000	ms	560-JTIME (_SRAM)

Table 4.9 Basic setting - Speed profile

Note: The entire ramp generator can be deactivated by setting the acceleration **or** deceleration ramp parameter to 0 – that is, acceleration and deceleration at preset maximum torque.

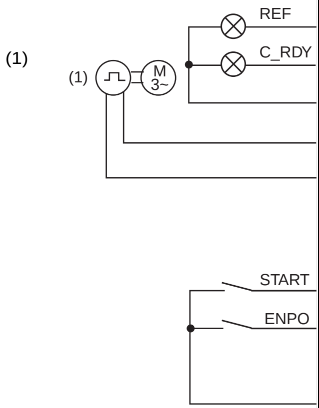
4.6.2 Setting function parameters

Once the preset solution, its basic setting and the motor data have been set, general function parameter settings can also be made.

- **Limit values** (e.g. max. torque and max. speed), see section 5.4.1.
- **Inputs/outputs** (e.g. “Reference reached” message), see section 5.1/5.2.
- **Brake actuation**, see section 5.1.2.
- Parameterizable **encoder simulation**, see section 5.9.1.
- **Torque reduction** (SCALE function), see section 5.1.1.

Note: In contrast to the basic settings, these functions are **independent** of the preset solution.

4.6.3 Terminal assignment



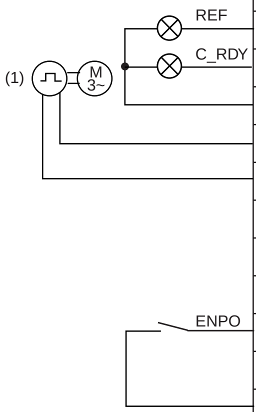
X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Reference reached
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Encoder track B
11	ISD03	Encoder track A
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Start loop control
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

(1) Optional HTL master encoder, depending on “Input” parameter on Master Encoder tab.

Figure 4.25 Terminal assignment for speed control, pulse input, control via terminal

4.6.4 Control via field bus

Note: For the preset solution SCB_4 the "EasyDrive Basic" bus setup should be used.



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Reference reached
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Encoder track B
11	ISD03	Encoder track A
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Not assigned
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

(1) Optional HTL master encoder, depending on "Input" parameter on Master Encoder tab.

Figure 4.26 Terminal assignment for speed control, pulse input, control via field bus

For more information refer to the user manual of the relevant field bus system.

4.7 Speed control, reference and Control via field bus (SCB_5)

Possible applications:

– Speed control in multiple applications

Functionality:

– Speed reference input via field bus
– Four preset control modes (Drivecom, LUST-EasyDrive)
– Programmable time optimized acceleration profile
– Direct field bus access to I/O of drive controller
– Control and parameter setting of drive via field bus

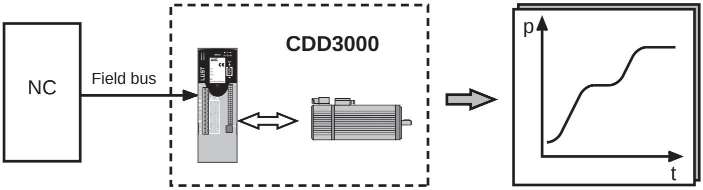


Figure 4.27 Speed control, reference and control via field bus

4.7.1 Making basic settings

Speed Profile tab

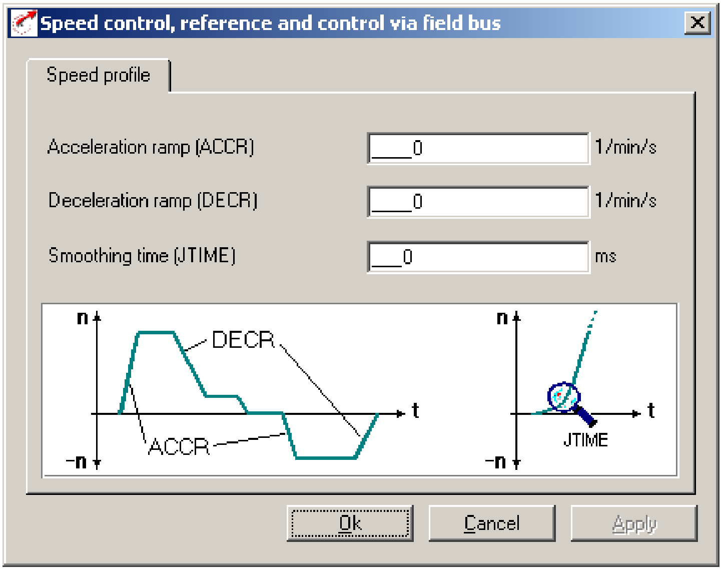


Figure 4.28 Speed Profile tab

DM	Meaning	Value range	Unit	Parameter
Acceleration ramp	Ramp generator for acceleration. Setting 0 means acceleration at max. torque.	0 - 65535	rpm/s	52_ACCR (_SRAM)
Deceleration ramp	Ramp generator for deceleration. Setting 0 means deceleration at max. torque.	0 - 65535	rpm/s	102_DECR (_SRAM)
Smoothing time	The run-up and run-down time increases by the smoothing time. **Attention:**Does not work with quick-stop!	0 - 2000	ms	560-JTIME (_SRAM)

Table 4.10 Basic setting - Speed profile

Note: The entire ramp generator can be deactivated by setting the acceleration **or** deceleration ramp parameter to 0 – that is, acceleration and deceleration at preset maximum torque.

4.7.2 Setting function parameters

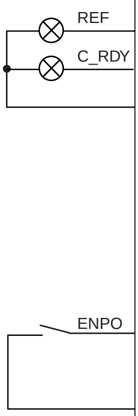
Once the preset solution, its basic setting and the motor data have been set, general function parameter settings can also be made.

- **Limit values** (e.g. max. torque and max. speed), see section 5.4.1.
- **Inputs/outputs** (e.g. “Reference reached” message), see section 5.1/5.2.
- **Brake actuation**, see section 5.1.2.
- Parameterizable **encoder simulation**, see section 5.9.1.

Note: In contrast to the basic settings, these functions are **independent** of the preset solution.

4.7.3 Terminal assignment

Note: For the preset solution SCB_5 the “EasyDrive Basic” bus setup should be used.



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Reference reached
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Not assigned
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Not assigned
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

Figure 4.29 Terminal assignment for speed control, reference and control via field bus

For more information refer to the user manual of the relevant field bus system.

4.8 Positioning, reference and Control via field bus (PCB_2)

Possible applications:

– Multi-axis positioning system

Functionality

– Position reference via field bus
– Parameterizable time optimized driving profile
– User-definable travel units
– Eleven homing mode types
– Jog/manual mode
– Control and parameter setting of drive via field bus

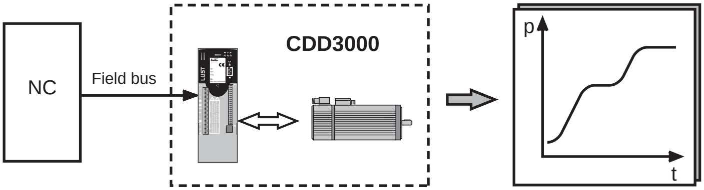


Figure 4.30 Positioning, reference and control via field bus

4.8.1 Making basic settings

Driving Profile tab

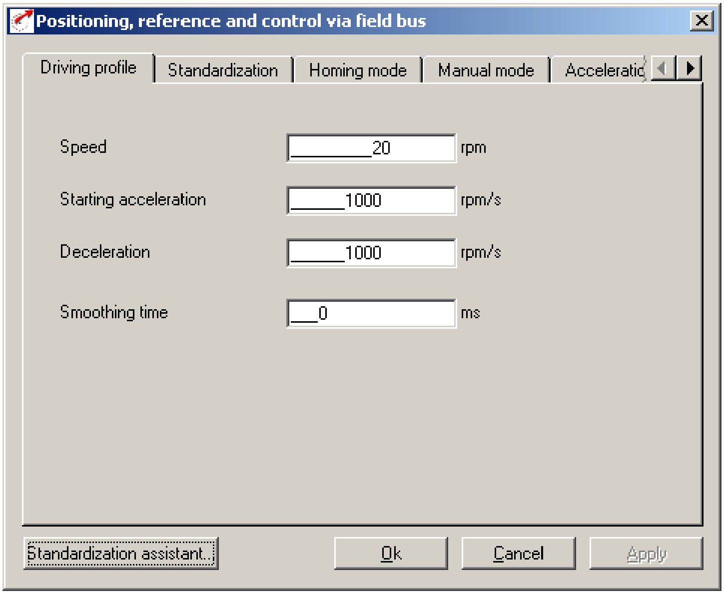


Figure 4.31 Driving Profile tab

In this screen the velocity and acceleration of the positioning set is specified in base units.

DM	Meaning	Value range	Unit	Parameter
Velocity	Velocity of positioning set	± 2147483647 (± 32768 revolutions)	Customer unit defined on the Standardization tab	552_POSMX (_PRAM)
Startup acceleration	Startup acceleration of positioning set in positive and negative direction	1 - 2147483647		553_POACC (_PRAM)
Braking acceleration	Braking acceleration of positioning set in positive and negative direction	1 - 2147483647		554_PODEC (_PRAM)
Smoothing time	The smoothing time (sinusoidal ramps) extends the braking process (positive+negative) and limits jerking.	0 - 2000	ms	560_JTIME (_SRAM)

Table 4.11 Driving profile - basic settings

Standardization tab

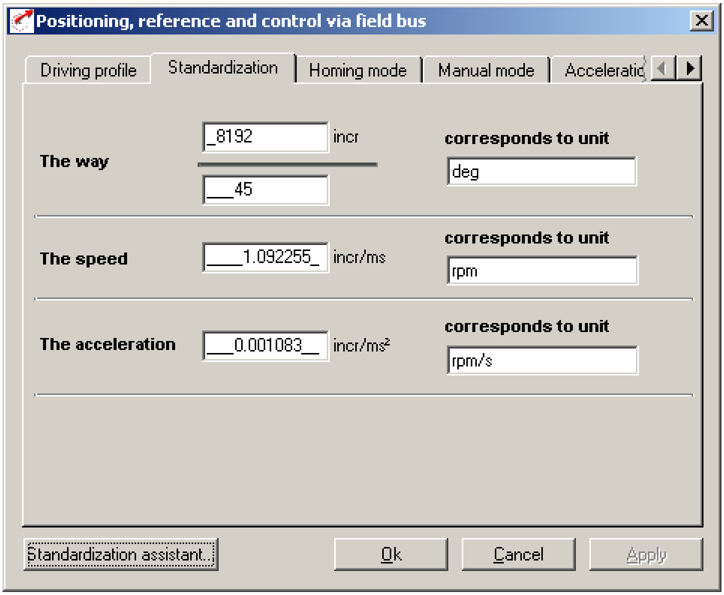


Figure 4.32 Standardization tab

In this screen you can enter the customer units for the travel ('way'), the velocity and the acceleration.

DM	Meaning	Value range	Unit	Parameter
The way Numerator	Travel standardization numerator	1 - 65535	Increments	700_POWGZ (_PSTD)
The way Denominator	Travel standardization denominator	1 - 65535	travel units	701_POWGN (_PSTD)
The velocity	Velocity standardization	0 - 32764	increments / ms	711_POAVE (_PSTD)
The acceleration	Acceleration standardization	0 - 3600	increments / ms²	712_POABE (_PSTD)
corresponds to unit	Scaled customer unit for travel, velocity and acceleration of positioning.	/	/	766_POWUN 767_POSUN 768_POAUN (_PSTD)

Table 4.12 Standardization - basic settings

Note: Select the units with which you want to program the positions, velocities and accelerations. If you specify degrees as the unit, for example, the smallest division is 1 degree. The standardization factors for the travel ('way') must be integers. For the velocity and acceleration decimal places are accepted. Therefore rounding errors may occur for the velocity or acceleration.

Example: Parameter-setting in degrees required

➪ Reference 360° = 1 motor revolution

➪ Configuration $\frac{\text{Numerator}}{\text{Denominator}} = \frac{65536\ \text{incr.}}{360^\circ} = \frac{8192}{45}$

For notes on the standardization assistant, see section 4.10.2.

For more information and examples, see section 4.10.10 preset solution “Positioning, free programmable”.

1
2
3
4
5
A
EN

Homing Mode tab

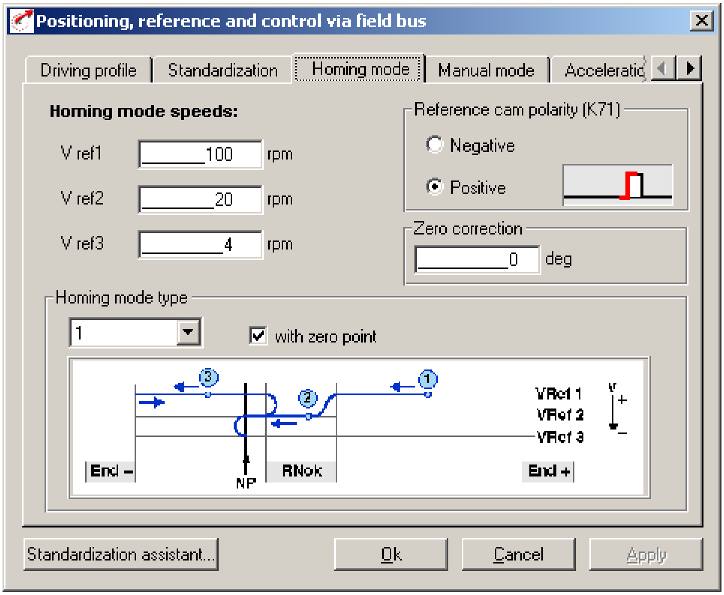


Figure 4.33 Homing Mode tab

In this screen you can set the background conditions for homing.

DM	Meaning	Value range	Unit	Parameter
Reference cam polarity	Defines whether the reference cam operates as a normally closed or normally open contact.	Positive = normally open (0) Negative = normally closed (1)	/	723_PORPO (_PRR)
Reference velocities	Defines the positioning velocities during homing.	0 - 2147483647	Customer unit defined on the Standardization tab	724_POVR1 725_POVR2 726_POVR3 (_PRR)
Homing mode type	Defines the positioning curve during homing.	0 ... 10	/	722_PORTY (_PRR)
Zero correction	Offset value for actual position after homing. Shift of machine zero relative to reference point.	± 2147483647	Customer unit defined on the Standardization tab	717_PONKR (_PRR)
Zero search	The homing run can only be made to the reference cam, even ignoring the zero pulse of the encoder.	OFF (0) ON (1)	/	792_POZP (_PRR)

Table 4.13 Homing mode - basic settings

Homing mode

The object of the homing mode is to establish an absolute position reference (referred to the entire axle), and it must usually be executed once after power-up, because normal encoders (except multi-turn) only register the position within one revolution.

Example: Homing mode type 0

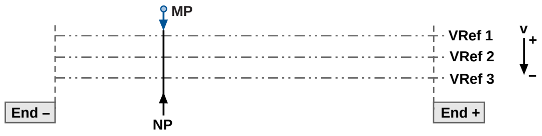


Figure 4.34 Homing mode type 0. The current actual position is set as the reference point. No homing run is carried out. Example: Conveyor belt.

Example: Homing mode type 1

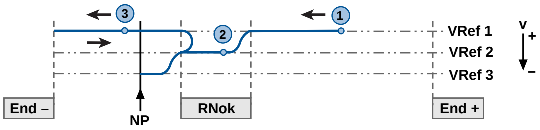


Figure 4.35 Homing mode type 1. The reference cam is between the two hardware limit switches. The zero pulse to be evaluated is the first one after exiting the cam in negative direction.

For more information see section 4.11.2 “Making basic settings”.

Jog Mode tab

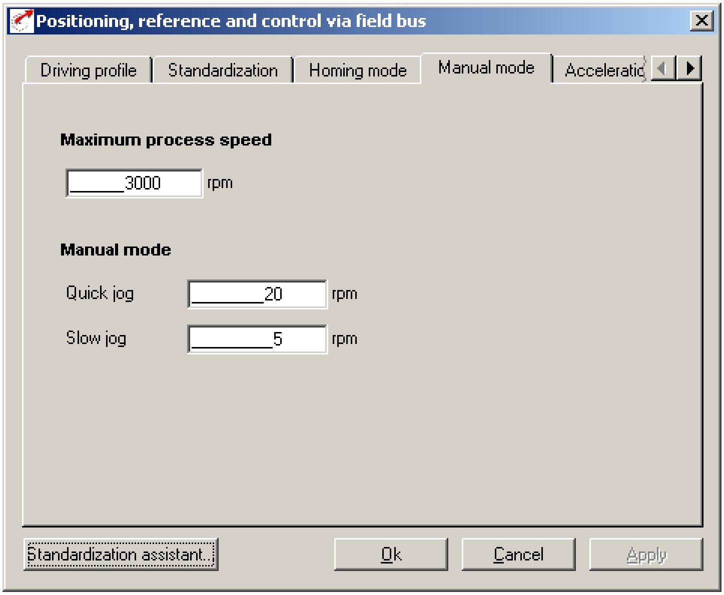


Figure 4.36 Jog Mode tab

In this screen you specify the maximum positioning velocity and the velocities of jog mode (manual mode) in customer units.

DM	Meaning	Value range	Unit	Parameter
Maximum process speed	The positioning control is limited to this value. Asynchronous machines can be operated up to rated speed (no field weakening range).	1 - 2147483647	Customer unit defined on Standardization tab	704_POVMX (_PBAS)
Quick jog	Velocity of quick jog (via digital input or in Manual menu). Quick jog is activated by additionally actuating the second jog input while in slow jog mode.	1 - 2147483647	Customer unit defined on Standardization tab	715_POEGW (_PBAS)
Slow jog	Velocity of slow jog (via digital input or in Manual menu).	1 - 2147483647	Customer unit defined on Standardization tab	716_POSGW (_PBAS)

Table 4.14 Jog mode - basic settings

Acceleration Profile tab

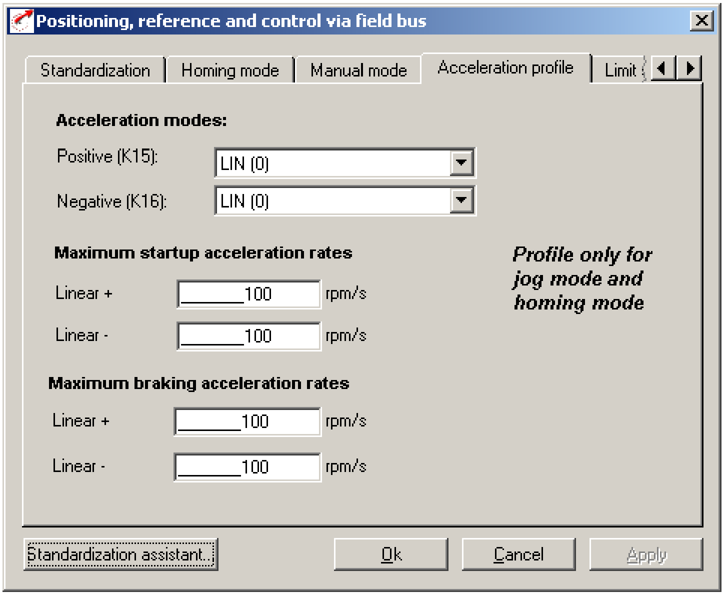


Figure 4.37 Acceleration Profile tab

In this screen the maximum accelerations and the acceleration mode are entered.

DM	Meaning	Value range	Unit	Parameter
Acceleration modes Positive direction, Negative direction	Choose between linear and sinusoidal ramps. The sinusoidal ramps are created by limiting the change over time of the acceleration, the jerk. In sinusoidal acceleration the target position is reached later by the amount of the smoothing time.	Lin (0) SIN² (1)	/	705_POBEP 706_POBEN (_PRAM)
Maximum Startup acceleration Linear +, Linear –	Linear + determines the maximum permissible acceleration on startup in positive direction, linear – in negative direction.	1 - 2147483647	Customer unit defined on the Standardization tab	707_POLAP 708_POLAN (_PRAM)
Maximum Braking acceleration Linear +, Linear –	Linear + determines the maximum permissible acceleration on braking in positive direction, linear – in negative direction.	1 - 2147483647	Customer unit defined on the Standardization tab	709_POBLP 710_POBLN (_PRAM)

Table 4.15 Acceleration profile - basic settings

Note: This acceleration profile applies only to homing mode and jog mode.
In automatic mode the acceleration preset on the Driving Profile tab applies.

Limit switch tab

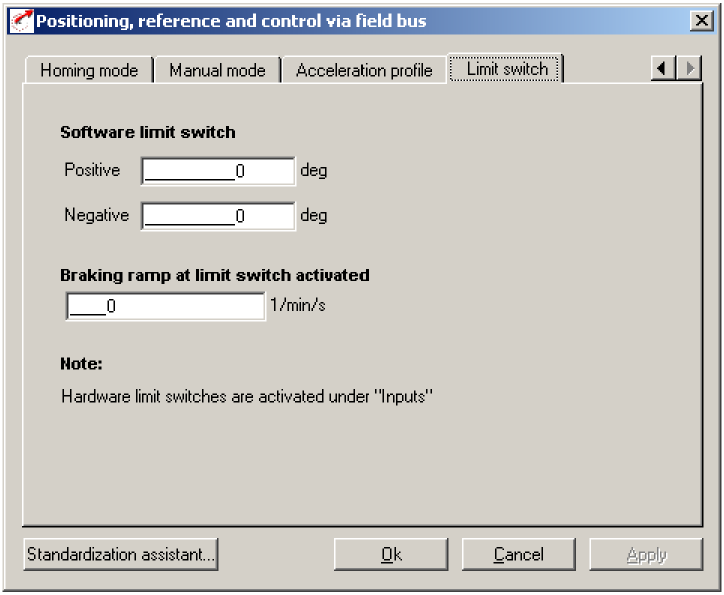


Figure 4.38 Limit switch tab

DM	Meaning	Value range	Unit	Parameter
Software limit switch positive	Software limit switch in positive axle direction	± 2147483648	Customer unit defined on the Standardization tab	718_POSWP (_PBAS)
Software limit switch negative	Software limit switch in negative axle direction	± 2147483648	Customer unit defined on the Standardization tab	719_POSWN (_PBAS)
Braking ramp	Braking ramp in effect when the software limit switch is active	0 - 65535	rpm/s	496_STOPR (_SRAM)

Table 4.16 Limit switch - basic settings

With the software limit switches the travel range can be limited (referred to the machine zero; see Homing Mode tab). Their parameters should be set before those of the hardware limit switches – that is: first the respective software limit switch, then the hardware switch, and then the mechanical end stop. When a software limit switch is reached, braking is applied by the adjustable braking ramp and an error message is sent. If both parameters are set = 0, no monitoring is carried out. Before and during the homing run the software limit switches are not monitored.

4.8.2 Setting function parameters

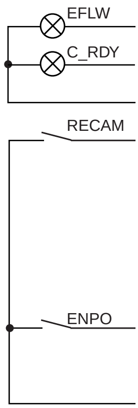
Once the preset solution, its basic setting and the motor data have been set, general function parameter settings can also be made.

- **Limit values** (e.g. max. torque and max. speed), see section 5.4.1.
- **Inputs/outputs** (e.g. “Reference reached” message), see section 5.1/5.2.
- **Brake actuation**, see section 5.1.2.
- Parameterizable **encoder simulation**, see section 5.9.1.
- **Torque reduction** (SCALE function), see section 5.1.1.
- **Limit switch evaluation**, see section 5.1.2

Note: In contrast to the basic settings, these functions are **independent** of the preset solution.

4.8.3 Terminal assignment

Note: With the preset solution PCB_2 use the “EASYDRIVE DirectPOS” bus setup.



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	No tracking error
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Reference cam
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Not assigned
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

Figure 4.39 Terminal assignment for positioning, reference and control via field bus

Note: For more information refer to the user manual of the relevant field bus system.

4.9 Positioning with fixed positions (PCT_3, PCB_3)

Possible applications:

- Positioning with external sequence control

Functionality:

- 31 positioning sets
- Parameterizable time optimized driving profile
- User-defined travel units
- Eleven homing mode types
- Jog/manual mode
- Control of drive via I/O

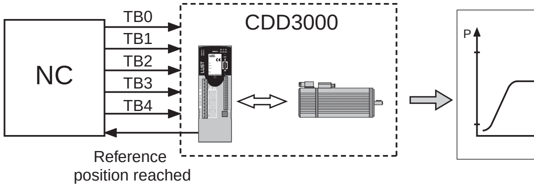


Figure 4.40 Positioning with fixed position, control via terminal

Reference processing is presented in more detail in the following diagram:

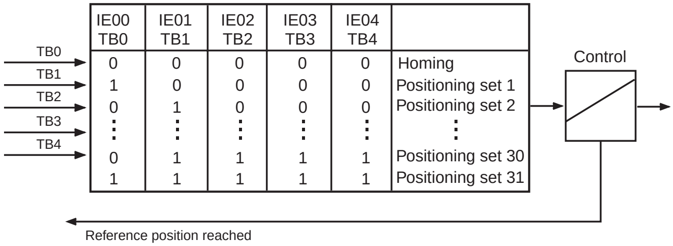


Figure 4.41 Reference processing

4.9.1 Making basic settings

Basic settings...

Position Table tab

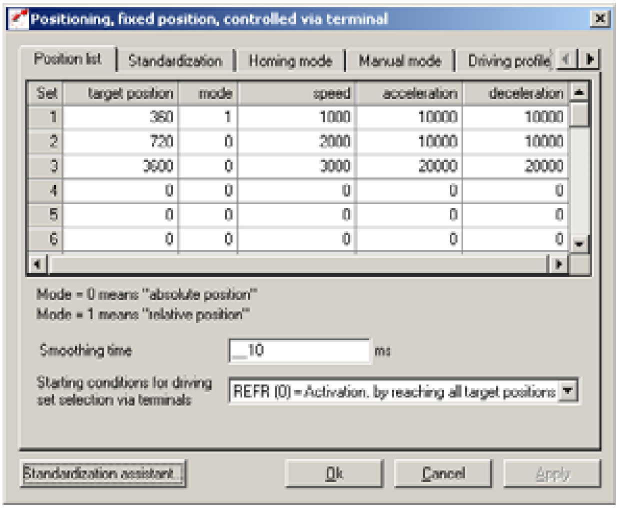


Figure 4.42 Position Table tab

By making entries in the “table”, up to a maximum of 31 positioning sets can be programmed. The positioning set number at the same time corresponds to the binary code which must be applied to control inputs TB0 to TB4 to select the set.

Note: Inputs TB0 to TB4 are BCD coded.

DM	Meaning	Value range	Unit	Parameter
Smoothing time	Jerk limitation is activated if “sinusoidal ramps” are set on the Driving Profile tab.	0 - 2000	ms	560_JTIME (_SRAM)
Start condition for driving set selection via terminal	There are two start conditions for activating the positioning sets: 1. Activate when target position reached (REFR). With the Low-High edge at the enable table position input (TBEN) the binary code applied at inputs TB0...TB4 is read in, the corresponding entry in the table is worked through and positioning is started. If a further Low-High edge occurs at the TBEN input during positioning, it is buffered. When the target position is reached the buffer is emptied, the binary code applied at inputs TB0...TB4 is read in, the corresponding entry in the table is worked through and the new positioning is started. As a result, a new positioning job is not started until the target position of the preceding job has been reached. The buffer is erased with “ENPO” or “Start control”. Tip: The buffer can also be emptied by sending a positioning job to the same target position. 2. Activate immediately (directly) (DIR). With the High edge at the “enable table position” input the binary code applied at inputs TB0 ... TB4 is read in and executed directly – that is, any positioning still in progress is aborted.	REFR (0) DIR (1)	/	770_POTBS (_PBAS)

Table 4.17 Position table - basic settings

A positioning set comprises:

DM	Meaning	Unit	Example	Parameter
- Target position	Target position of the positioning set. In relative positioning the preceding sign determines the direction of rotation (pos. = ↻ , neg. = ↺).	Unit set on the "Standardization" tab. Base unit is increments (65536 per revolution).	$\frac{65536}{360} = \frac{8192}{45}$ corresponds to unit: degrees	555_PDPOS (_PSET)
- Mode	Mode of positioning (absolute or relative)	absolute → 0 relative → 1		556_PDMOD (_PSET)
- Velocity	Process speed for this positioning set	The unit set on the "Standardization" tab. Base unit is "increments per ms".	1.092225 increments/ms^2 corresponds to the unit rpm	557_PDSPD (_PSET)
- Startup acceleration	Maximum acceleration on startup for this positioning set	The unit set on the "Standardization" tab. Base unit is "increments per ms^2".	0.001083 increments/ms^2 corresponds to the unit rpm/sec	558_PDALL (_PSET)
- Braking acceleration	Maximum (negative) acceleration on braking for this positioning set	The unit set on the "Standardization" tab. Base unit is "increments per ms^2".	0.001083 increments/ms^2 corresponds to the unit rpm/sec	559_PDDEL (_PSET)

Table 4.18 Positioning sets

Standardization tab

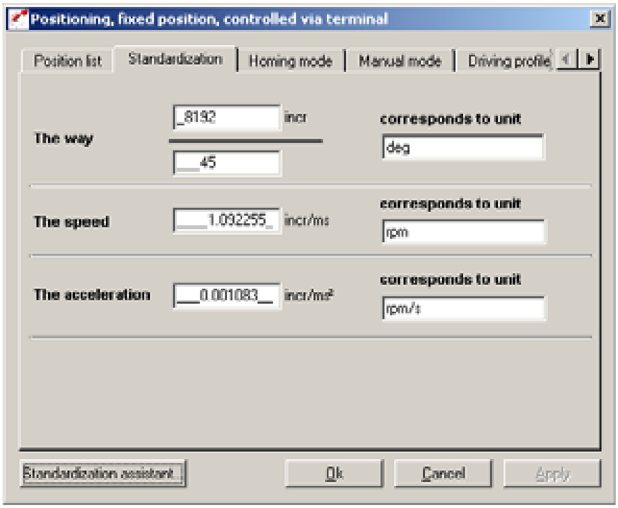


Figure 4.43 Standardization tab

In this screen you can enter the customer units for the travel ('way'), the velocity and the acceleration.

DM	Meaning	Value range	Unit	Parameter
The way Numerator	Travel standardization numerator	1 - 65535	Increments	700_POWGZ (_PSTD)
The way Denominator	Travel standardization denominator	1 - 65535	travel units	701_POWGN (_PSTD)
The velocity	Velocity standardization	0 - 32764	increments[ms]	702_POAVE (_PSTD)
The acceleration	Acceleration standardization	0 - 3600	increments[ms²]	703_POABE (_PSTD)
corresponds to unit	Scaled customer unit for travel, velocity and acceleration of positioning	/	/	766_POWUN 767_POSUN 768_POAUN (_PSTD)

Table 4.19 Standardization - basic settings

Note: Select the units with which you want to program the positions, velocities and accelerations. If you specify degrees as the unit, for example, the smallest division is 1 degree. The standardization factors for the travel ('way') must be integers. For the velocity and acceleration decimal places are accepted. Therefore rounding errors may occur for the velocity or acceleration.

Example: Parameter-setting in degrees required

➪ Reference 360° = 1 motor revolution

➪ Configuration $\frac{\text{Numerator}}{\text{Denominator}} = \frac{65536\ \text{incr.}}{360^\circ} = \frac{8192}{45}$

For notes on the standardization assistant, see section 4.10.2.

For more information and examples, see section 4.11.10, preset solution “Positioning, free programmable”.

Homing Mode tab

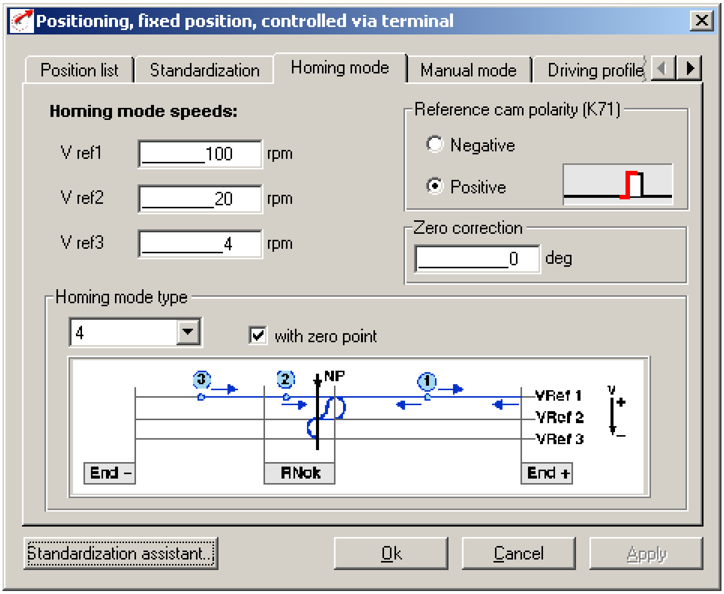


Figure 4.44 Homing Mode tab

In this screen you can set the background conditions for homing.

DM	Meaning	Value range	Unit	Parameter
Reference cam polarity	Defines whether the reference cam operates as a normally closed or normally open contact.	Positive = normally open (0) Negative = normally closed (1)	/	723_PORPO (_PRR)
Reference velocities	Defines the positioning velocities during homing.	0 - 2147483647	Customer unit defined on Standardization tab	724_POVR1 725_POVR2 726_POVR3 (_PRR)
Homing mode type	Defines the positioning curve during homing.	0 ... 10	/	722_PORTY (_PRR)
Zero correction	Offset value for actual position after homing. Shift of machine zero relative to reference point.	± 2147483647	Customer unit defined on Standardization tab	717_PONKR (_PRR)
Zero search	The homing run can only be made to the reference cam, even ignoring the zero pulse of the encoder.	OFF (0) ON (1)	/	792_POZP (_PRR)

Table 4.20 Homing mode - basic settings

Homing mode

The object of the homing mode is to establish an absolute position reference (referred to the entire axle), and it must usually be executed once after power-up, because normal encoders (except multi-turn) only register the position within one revolution.

Example: Homing mode type 0

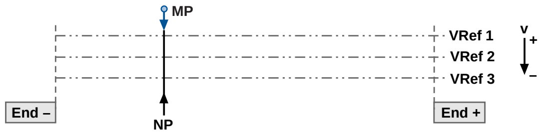


Figure 4.45 Homing mode type 0. The current actual position is set as the reference point. No homing run is carried out. Example: Conveyor belt.

Example: Homing mode type 1

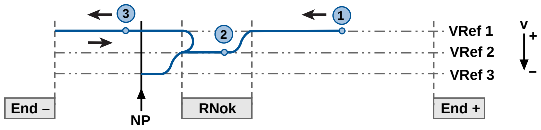
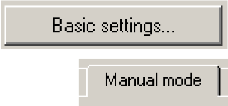


Figure 4.46 Homing mode type 1. The reference cam is between the two hardware limit switches. The zero pulse to be evaluated is the first one after exiting the cam in negative direction.

For more information see section 4.11.2 “Making basic settings”.



Jog Mode tab

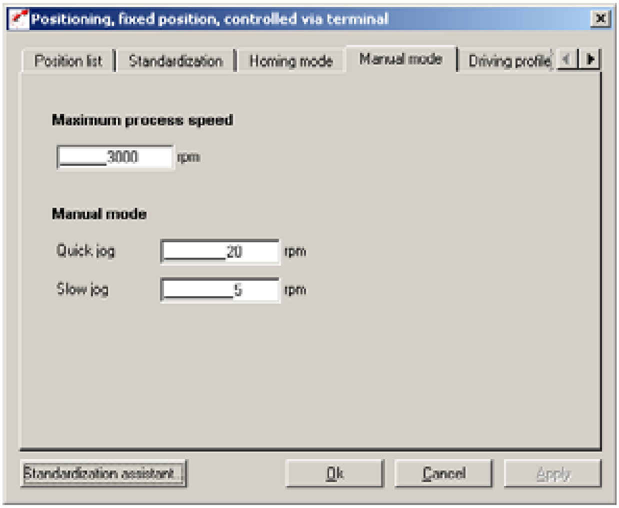


Figure 4.47 Jog Mode tab

In this screen you specify the maximum positioning velocity and the velocities of jog mode (manual mode) in customer units.

DM	Meaning	Value range	Unit	Parameter
Maximum process speed	The positioning control is limited to this value. Asynchronous machines can be operated up to rated speed (no field weakening range).	1 - 2147483647	Customer unit defined on Standardization tab	704_POVMX (_PBAS)
Quick jog	Velocity of quick jog (via digital input or in Manual menu). Quick jog is activated by additionally actuating the second jog input while in slow jog mode.	1 - 2147483647	Customer unit defined on Standardization tab	715_POEGW (_PBAS)
Slow jog	Velocity of slow jog (via digital input or in Manual menu).	1 - 2147483647	Customer unit defined on Standardization tab	716_POSGW (_PBAS)

Table 4.21 Jog mode - basic settings

Driving Profile tab

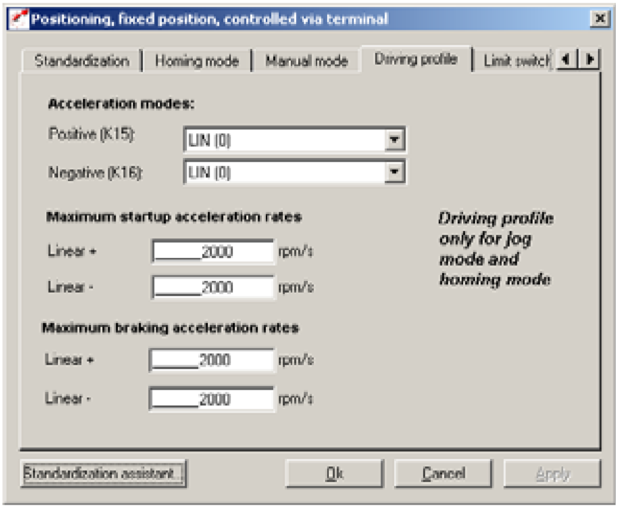


Figure 4.48 Driving Profile tab

Here you define the mode of acceleration and the maximum accelerations (startup and braking, negative and positive).

DM	Meaning	Value range	Unit	Parameter
Acceleration modes in positive direction, negative direction	Choose between linear and sinusoidal ramps. The sinusoidal ramps are created by limiting the change over time of the acceleration, the jerk. In sinusoidal acceleration the target position is reached later by the amount of the smoothing time.	Lin (0) SIN² (1)	/	705_POBEP 706_POBEN (_PRAM)
Maximum startup acceleration rate Linear + Linear –	Linear+ determines the maximum permissible acceleration on startup in positive direction, linear– in negative direction.	1-2147483647	Customer unit defined on the Standardization tab	707_POLAP 708_POLAN (_PRAM)
Maximum braking acceleration rate Linear + Linear –	Linear+ determines the maximum permissible acceleration on braking in positive direction, linear– in negative direction.	1-2147483647	Customer unit defined on the Standardization tab	709_POBLP 710_POBLN (_PRAM)

Table 4.22 Driving profile - basic settings

Note: This acceleration profile applies only to homing mode and jog mode.
In automatic mode the acceleration preset on the Driving Profile tab applies.

Basic settings...

Limit switch

Limit switch tab

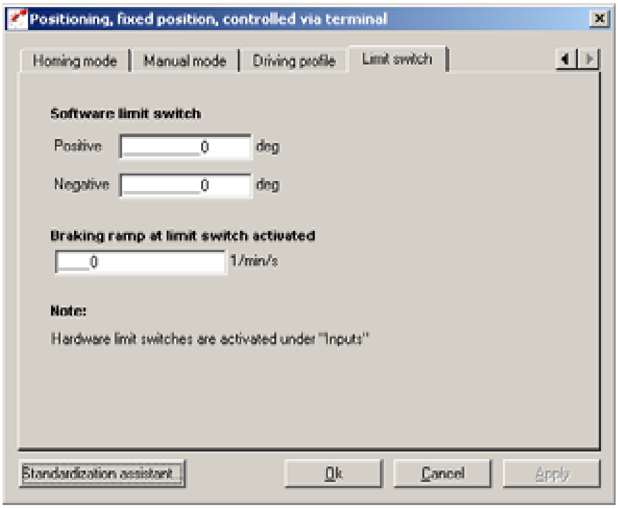


Figure 4.49 Limit switch tab

DM	Meaning	Value range	Unit	Parameter
Software limit switch positive	Software limit switch in positive axle direction	± 2147483648	Customer unit defined on the Standardization tab	718_POSWP (_PBAS)
Software limit switch negative	Software limit switch in negative axle direction	± 2147483648	Customer unit defined on the Standardization tab	719_POSWN
Braking ramp	Braking ramp in effect when the software limit switch is active	0 - 65535	rpm/s	496_STOPR (_SRAM)

Table 4.23 Limit switch - basic settings

With the software limit switches the travel range can be limited (referred to the machine zero; see Homing Mode tab). Their parameters should be set before those of the hardware limit switches – that is: first the respective software limit switch, then the hardware switch, and then the mechanical end stop. When a software limit switch is reached, braking is applied by the adjustable braking ramp and an error message is sent. If both parameters are set = 0, no monitoring is carried out. Before and during the homing run the software limit switches are not monitored.

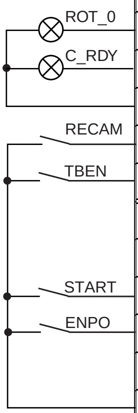
4.9.2 Setting function parameters

Once the preset solution, its basic setting and the motor data have been set, general function parameter settings can also be made.

- **Limit values** (e.g. max. torque and max. speed), see section 5.4.1.
- **Inputs/outputs** (e.g. “Reference reached” message), see section 5.1/5.2.
- **Brake actuation**, see section 5.1.2.
- Parameterizable **encoder simulation**, see section 5.9.1.
- **Torque reduction** (SCALE function), see section 5.1.1.
- **Limit switch evaluation**, see section 5.1.2

Note: In contrast to the basic settings, these functions are **independent** of the preset solution.

4.9.3 Terminal assignment

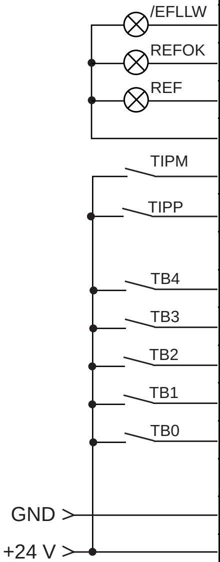


X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Standstill
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Reference cam
11	ISD03	Enable table position
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Start loop control
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

Figure 4.50 Terminal assignment 1/2 for positioning with fixed positions, control via terminal

Note: In the basic configuration (without user module) only 4 positions ($2^2 = 4$) are possible. For terminal expansion user module UM8I40 is additionally required.

Terminal expansion UM8140:

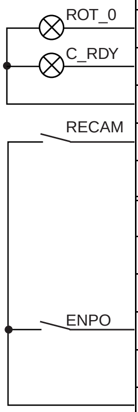


X15	Des.	Function
35	OED03	Not assigned
34	OED02	No tracking error
33	OED01	Reference point defined
32	OED00	Reference reached
31	DGND	Digital ground
29	IED07	Jog mode, negative direction
28	IED06	Jog mode, positive direction
27	IED05	Not assigned
26	IED04	Speed or position table index 4
25	IED03	Speed or position table index 3
24	IED02	Speed or position table index 2
23	IED01	Speed or position table index 1
22	IED00	Speed or position table index 0
2	DGND	Digital ground
1	U_V	24 V DC supply, feed

Figure 4.51 Terminal assignment 2/2 for positioning, fixed positions, control via terminal

4.9.4 Control via field bus

Note: For the preset solution PCB_3 the "EASYDRIVE TablePos" bus setup should be used.



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Standstill
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Reference cam
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Not assigned
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

Figure 4.52 Terminal assignment for positioning, field positions, control via field bus

For more information refer to the user manual of the relevant field bus system.

4.9.5 Activation

Activation is via the inputs: ENPO, START control, (enable table position) and inputs TB0 to TB4 (position table index 0 to 4) and optionally TIPP/ TIPM (jog range in positive and negative direction of rotation).

Step	Action	Comment
1	With inputs “ENPO” and “START control” the power stage is enabled.	The motor shaft is position controlled.
2	With the “Enable table position” input and TB0 to TB4 = 0 V, (i.e. positioning set 0) a homing run can then be carried out.	The matching homing mode type is set on the “Homing mode” tab **beforehand**. After a reinitialization (power-on), a homing run must first be carried out before a positioning set can be requested.
3	Then with the “Enable table position” input the binary code applied at inputs TB0 to TB4 (= positioning set) can be executed.	There are two start conditions for activating the positioning sets. Activate when all target positions reached or ... Activate immediately (directly) See “Position Table” tab.
4	Optionally, inputs TIPP/TIPM can be used to move in positive and negative direction in jog mode.	An ongoing positioning operation of a positioning set has priority, i.e. is run first. Only when it is done can jog mode be started.

Table 4.24 Activation

Example of a positioning operation with fixed positions

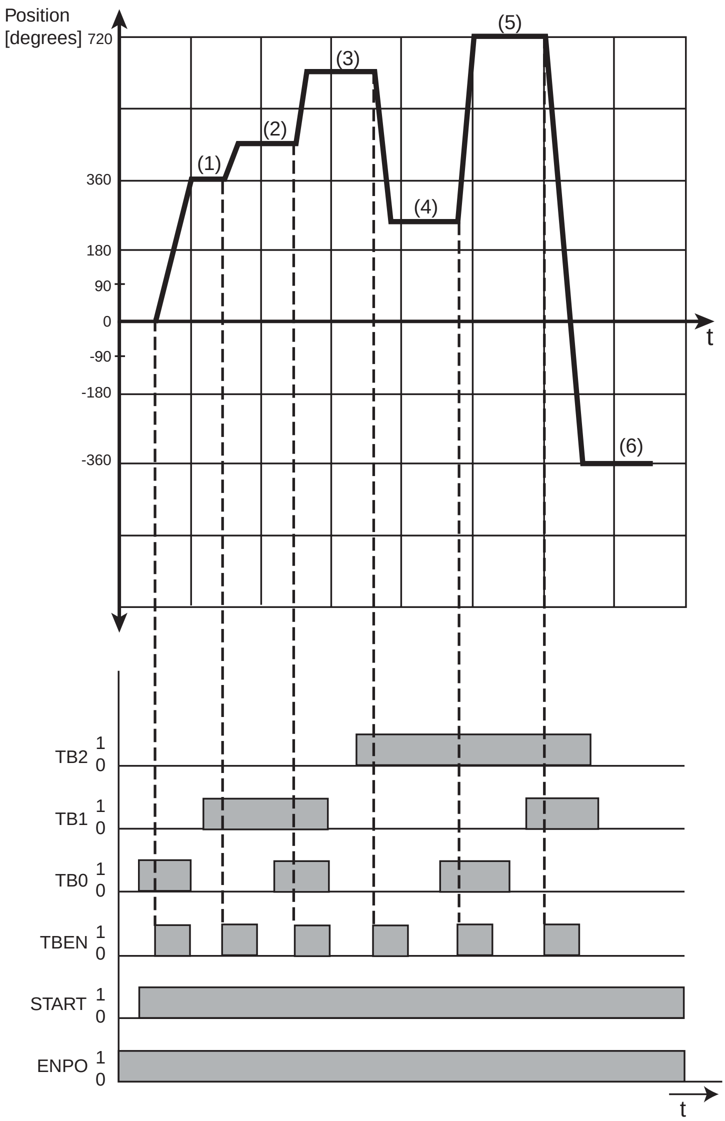


Figure 4.53 Example of positioning with fixed positions

Input on Position Table tab for example

Set no.	Target position [degrees]	Mode	Velocity [rpm]	Startup acceleration [rpm/sec]	Braking acceleration [rpm/sec]
1	360	absolute	1000	1000	1000
2	90	relative	2000	1000	1000
3	180	relative	2000	1000	1000
4	-360	relative	3000	2000	2000
5	720	absolute	3000	2000	2000
6	-360	absolute	3000	2000	2000

Table 4.25 Input on Position Table tab for example

Input on Standardization tab for example

(using standardization assistant)

- The way $\frac{65536}{360} = \frac{8192}{45}$ corresponds to unit: degrees
- The velocity 1,0922 incr./ms corresponds to the unit rpm
- The acceleration 0.001803 incr/ms^2 corresponds to the unit rpm/sec.
- The start condition is: Activate when old target position reached (REFR).

Note: See also Figure 4.43 on Page 4-57

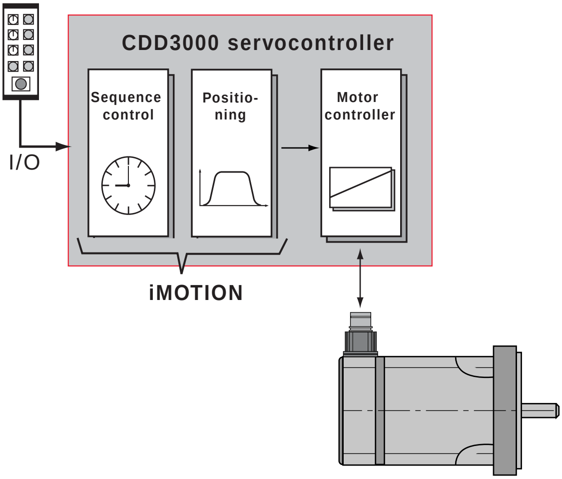
4.10 Positioning free programmable (iMotion) (PCT_4, PCB_4)

Possible applications:

- Single axle positioning system
- sequence control

Functionality:

- Individually programmable positioning sequences
- Parameterizable time optimized driving profile
- User-definable travel units
- Eleven homing mode types
- Indexing table positioning
- Jog/manual mode
- Control of drive via I/O (PCT_4)
- Control of drive via field bus (PCB_4)



1
2
3
4
5
A
EN

4.10.1 Overview of functions

Positioning controller CDD3000

The CDD3000 servocontroller has an integrated single-axle positioning and sequence control. This results in major advantages over the conventional split between a servocontroller with torque and speed control and a separate, higher-level positioning and sequence control.

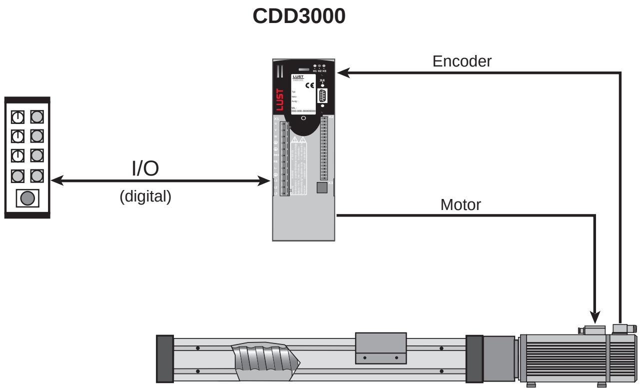


Figure 4.54 Layout of a positioning system

Properties of the CDD3000 positioning controller

- Reduced wiring based on integrated positioning control
- Single-axle, slim design
- Same termination technique throughout the power range
- Standalone operation
- Optimum tuning of positioning control with direct access to the servocontroller system variables
- Digital position reference input in 250 µs cycle, synchronous with speed control, resulting in higher quality of positioning
- Standard resolution 16 bits (65536 increments) per revolution
- Resolution of position controller internally 20 bits
- 9 different types of homing run

Programming offers the following facilities

- Simple, easy-to-understand programming language
- High degree of flexibility in writing sequence programs
- 100 process programs with up to 700 program sets
- Absolute and relative positioning, endless travel (e.g. conveyor belts)
- Time-optimized or non-bucking positioning (linear or sinusoidal ramps)
- Variables, timers, numerators and flags can be used and simple programmable logic control functions can be simulated

Areas of application

Based on its high degree of flexibility and programming, the single-axle position controller can provide high-precision positioning and time/path-optimized speed profiles in many different applications.

Common areas of application are:

➢ Handling equipment (parts positioning, mounting, sorting, palletizing, etc.)

➢ Pressing

➢ Feed drives, stop positioning

➢ Indexing tables

➢ Special machines, e.g. for cutting to length and metering

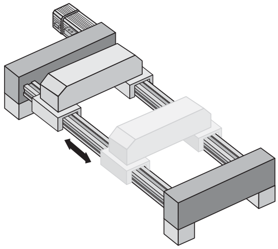


Figure 4.55 Linear drive

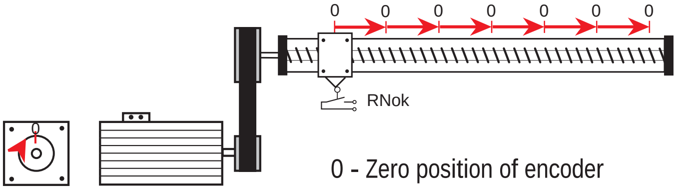
Submodes of the position controller

In the **Positioning, free programmable** preset solution there are the following submodes:

1. Manual mode
   Precondition: Input IS01 “AUTO” = Low level
   - Setup mode: Positioning and control commands are transmitted from the PC via the serial interface and executed directly by the servocontroller (with Manual button).
   - Jog mode: The axle can be positioned in slow or quick jog mode. This can also be activated from the **Manual** menu orby way of two inputs (“Jog+” or “Jog–” function).

2. Automatic mode
   - The positioning control works through the selected process program. Automatic mode is selected by way of the input IS01 “AUTO” = High level.
3. Homing mode

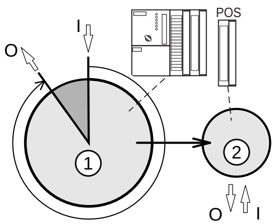
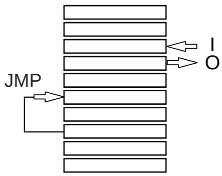
- In manual and in automatic mode
- In the homing run the axle runs until the reference cam (mechanical, inductive or capacitive proximity switch) is detected at the input IE04 “Reference cam” and a zero position of the encoder is reached.
- The object of the homing mode is to establish an absolute position reference (referred to the entire axle), and it must usually be executed once after power-up, because normal encoders only register the position within one revolution.



Exceptions: Infinite moving axles (e.g. conveyor belts, indexing tables) which require no absolute position reference over multiple revolutions or use of multi-turn encoders which can register the position over a large number of revolutions (type G3, G6-Multiturn).

Time response of the position controller

For greater clarity: The comparison with the programmable logic control shows the different mode of functioning and the differing time response.

Comparison:	PLC	CDD3000
Principle of function	Fixed cycle: Read inputs, run through complete program, set outputs 	Sequence is determined by program. Next command is usually only executed when the preceding one has been completed (e.g. target position reached). 
Programming	with Instruction List, Ladder Diagram or Function Block Diagram; flags indicate the current status	Similar to BASIC programming language with step commands and subroutines
Processing speed	typically 0.5 ms/ 1 K instructions (e.g. S7-300)	1 ms / command, so-called “set-to-set execution time” (for simple commands the same time is reserved as for complex positioning commands)
Response time to an input	depending on length of PLC cycle, typically approx. 10 to 20 ms (exception: interrupt input)	depending on program length (e.g. 1 ms, if input is polled in next set)
Sampling time of the position control	Typically 1 to 5 with PLC with positioning card (without fine interpolation), speed input analog via ±10 V	250 µs position control, speed input digital

①- PLC cycle; ② - positioning core

Table 4.26 Time response of the positioning controller

Accuracy and time response

The data determine the achievable positioning accuracy of the drive and the time sequence of a program in advance. This delivers information, for example, as to how long a signal must be applied to an input as a minimum, or how long it takes until an output is set.

Correct time sequencing of a process program must always be checked!

Accuracy and time response			
Position resolution on the motor shaft	16	Bit	= 360°/65,536 increments
Positioning accuracy on the motor shaft [1)]	≤ ± 0,5’ ≤ ± 10’	angle minutes	Optical encoders (sin/cos) Resolver
Set-to-set execution time	1	ms	
Read inputs / Set outputs	1	ms	
Positioning commands GO (program editing is immediately resumed)	1	ms	
Positioning commands GOW (program editing is resumed only when the target position is reached)	2	ms	plus positioning time
Read status	1 - 2	ms	
Change acceleration values in the program (SET K15 ... K24)	1	ms	
Time between selection of automatic mode and subsequent start command	≥ 20	ms	

1) Also consider the inaccuracies which may additionally result from the mechanism (torsion and slack).

Table 4.27 Accuracy and time response

4.10.2 Making basic settings

Standardization tab

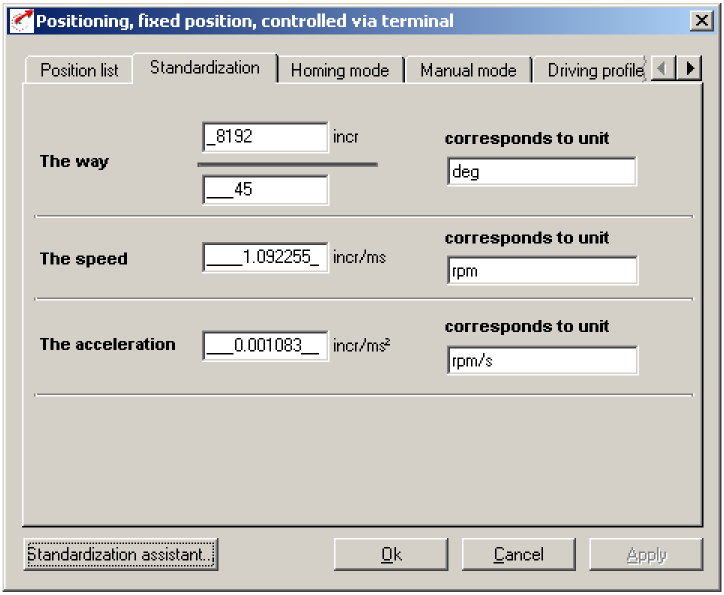


Figure 4.56 Standardization tab, indexing table setting

In this screen the customer units for the travel ('way'), the velocity and the acceleration are entered.

DM	Meaning	Value range	Unit	Parameter
The way Numerator	Travel standardization numerator	1 - 65535	Increments	700_POWGZ (_PSTD)
The way Denominator	Travel standardization denominator	1 - 65535	way units	701_POWGN (_PSTD)
The velocity	Velocity standardization	1 - 65535	Increments / ms	702_POAVE (_PSTD)
The acceleration	Acceleration standardization	1 - 3600	increments / ms²	703_POABE (_PSTD)

Table 4.28 Standardization - basic settings

DM	Meaning	Value range	Unit	Parameter
corresponds to unit	Standardized customer unit for travel ('way'), velocity and acceleration of positioning	/	/	766_POWUN 767_POSUN 768_POAUN (_PSTD)
Indexing table application	Within a revolution of the indexing table travel optimized positioning is carried out	OFF (0) ON (1)	/	763_PORTA (_PBAS)
Number of angle units per revolution		1 - 2146483647	Increments/ revolution	764_PONAR (_PBAS)

Table 4.28 Standardization - basic settings

Note: Select the units with which you want to program the positions, velocities and accelerations. If you specify degrees as the unit, for example, the smallest division is 1 degree. The standardization factors for the travel ('way') must be integers. For the velocity and acceleration decimal places are accepted. Consequently, no rounding errors can occur for the travel.

Example: Parameter-setting in degrees required

➪ Reference 360° = 1 motor revolution

➪ Configuration $\frac{\text{Numerator}}{\text{Denominator}} = \frac{65536 \text{ incr.}}{360^{\circ}} = \frac{8192}{45}$

For more information and examples, see section 4.10.10 “Calculation aids”.

Standardization assistant

Step	Action	Comment
1	Selection of unit for travel ('way') / position.	see Figure 4.57 (incr/ µm/ mm/ deg/ min)
2	Enter the mechanical reference data of your application here.	**Example**: 360° corresponds to a load revolution on gear output side; transmission ratio i = 4 **Result**: With reference 180° for a relative positioning operation the gear on the output side is run half a revolution, on the motor side two revolutions.
3	Selection of a unit for velocity and acceleration.	see Figure 4.58
4	Click on the “Check and Apply” button to calculate the corresponding standardization values and enter them automatically on the Standardization tab.	**Note**: Changing the calculated standardization values subsequently will alter the reference to the selected unit.
(5)	If the application is an indexing table, and travel optimized positioning is required, choose “Indexing table application”.	Enter the number of travel ('way') units for one revolution of the indexing table.

Table 4.29 Standardization assistant

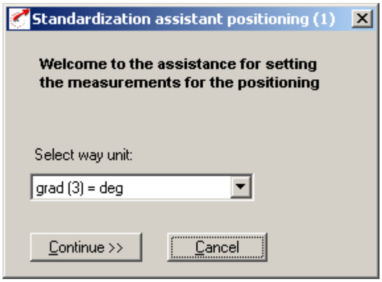


Figure 4.57 Standardization assistant, positioning (1)

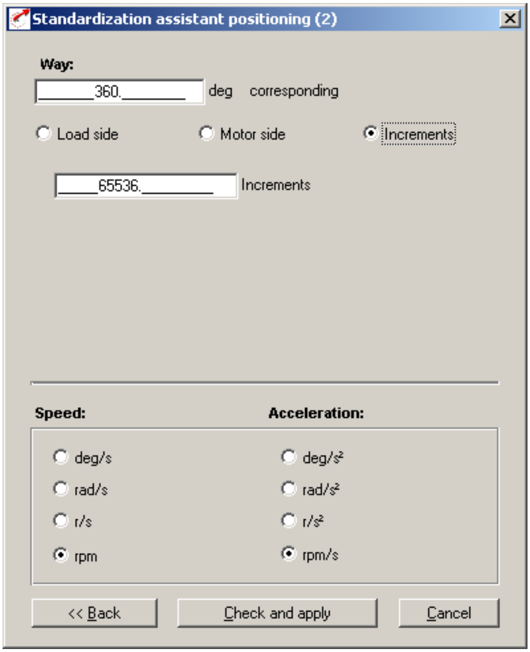


Figure 4.58 Standardization assistant, positioning (2)

Figure 4.59 Standardization assistant, indexing table setup

Speeds tab

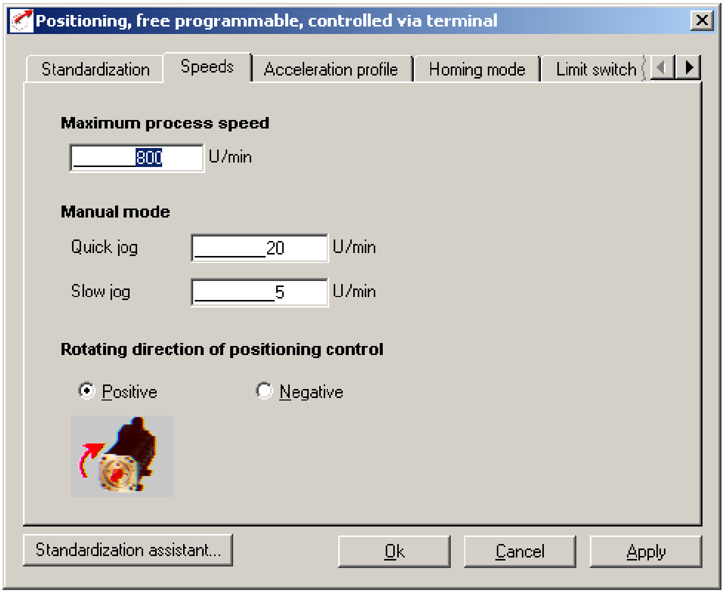


Figure 4.60 Speeds tab

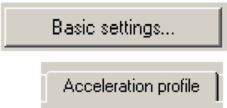
Here you specify the maximum positioning velocity and the velocities of jog mode (manual mode) as well as the direction of rotation of the positioning control.

DM	Meaning	Value range	Unit	Parameter
Maximum process speed	The positioning control is limited to this value. Asynchronous machines can be operated up to rated speed (no field weakening range). (Value is limited by speed controller - see Limitations tab)	1 - 2147483647	Customer unit defined on Standardization tab	704_POVMX (_PBAS)
Quick jog	Velocity of quick jog (via digital input or in Manual menu). Quick jog is activated by additionally actuating the second jog input while in slow jog mode.	1 - 2147483647	Customer unit defined on Standardization tab	715_POEGW (_PBAS)
Slow jog	Velocity of slow jog (via digital input or in Manual menu).	1 - 2147483647	Customer unit defined on Standardization tab	716_POSGW (_PBAS)
Direction of rotation (preceding sign) of positioning control		NEG (0) POS (1)	/	721_POSIG (_PSTD)

Table 4.30 Velocities - basic settings

Note: Referred to the motor means positive direction of rotation clockwise, looking onto the motor shaft (A-side bearing plate).

Acceleration Profile tab



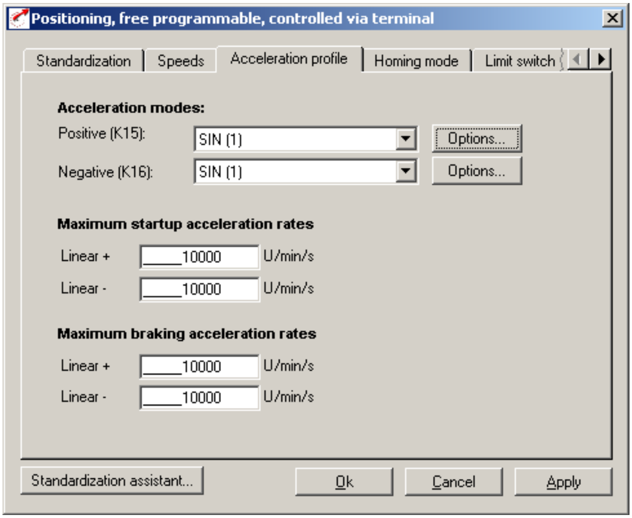


Figure 4.61 Acceleration Profile tab

In this screen the maximum accelerations and the acceleration mode are specified.

DM	Meaning	Value range	Unit	Parameter
Acceleration modes in positive direction, negative direction	Choose between linear and sinusoidal ramps. The sinusoidal ramps are created by limiting the change over time of the acceleration, the jerk. In sinusoidal acceleration the target position is reached later by the amount of the smoothing time.	LIN (0) SIN (1)	/	705_POBEP 706_POBEN (_PRAM)
Options Acceleration mode	Smoothing time of sinusoidal ramp	0 - 2000	ms	560_JTIME (SRAM)
Maximum startup acceleration rate Linear +, Linear –	Linear+ determines the maximum permissible acceleration on startup in positive direction, linear– in negative direction.	1 to 2147483647	Customer unit defined on Standardization tab	707_POLAP 708_POLAN (_PRAM)
Maximum braking acceleration rate Linear +, Linear –	Linear+ determines the maximum permissible acceleration on braking in positive direction, linear– in negative direction.	1 to 2147483647	Customer unit defined on Standardization tab	709_POBLP 710_POBLN (_PRAM)

Table 4.31 Acceleration profile - basic settings

Homing mode

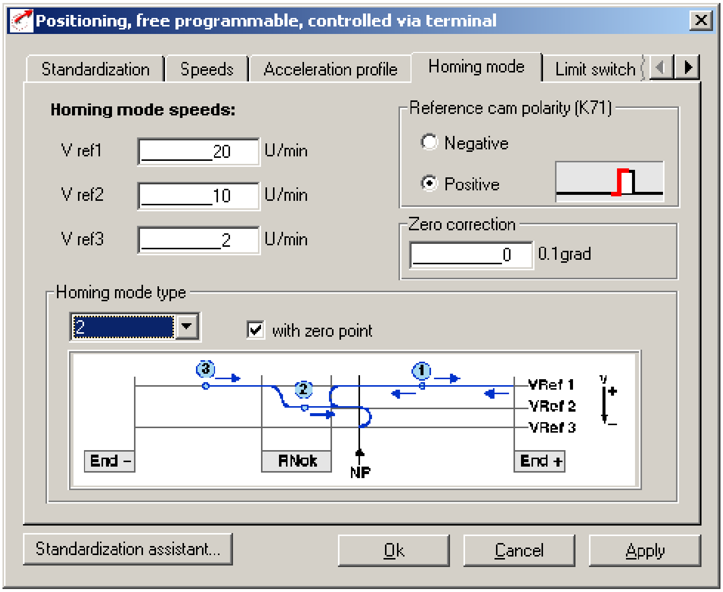


Figure 4.62 Homing Mode tab

In this screen the background conditions for homing are set.

DM	Meaning	Value range	Unit	Parameter
Reference cam polarity	Defines whether the reference cam operates as a normally closed or normally open contact	Positive = normally open Negative = normally closed	/	723_PORPO (_PRR)
Reference velocities	Defines the positioning velocities during homing.	0 - 2147483647	Customer unit defined on Standardization tab	724_POVR1 725_POVR2 726_POVR3 (_PRR)
Homing mode type	Defines the positioning curve during homing.	0 - 9	/	722_PORTY (_PRR)
Zero correction	Offset value for actual position after homing. Shift of machine zero relative to reference point.	± 2147483647	Customer unit defined on Standardization tab	717_PONKR (_PRR)
Zero search	The homing run can only be made to the reference cam, even ignoring the zero pulse of the encoder.	OFF (0) ON (1)	/	792_POZP (_PRR)

Table 4.32 Homing mode - basic settings

The object of the homing mode is to establish an absolute position reference (referred to the entire axle), and it must usually be executed once after power-up, because normal encoders (except multi-turn) only register the position within one revolution.

Device firmware versions V1.x support only homing mode with a reference cam connected to digital input ISD04. This means a reference cam must also be connected in conjunction with direct drives or in indexing table applications.

As from device firmware V2.35 the following variants are additionally supported:

Multi-turn encoder

For absolute encoders, homing mode type 9 should be set.
At controller start-up the encoder position and the zero point correction is taken as the actual position.

No further homing run is required!
The setting is only transferred after power-off!

Setting:
717 PONKR zero point correction
722 PORTY homing mode type 9

Further information on the G7 encoder siehe Kapitel 5.5.3

Virtual reference cam
If a homing run is started with no digital input to the reference cam configured, after 5 seconds the rising edge of a virtual cam, and after a further 5 seconds its falling edge is simulated, thereby automatically searching for the encoder zero. The time for simulation of the cam can be set by means of the variable POVAR Index 99 (corresponds to the variable H99 in the iMotion program) in a range of 0-5000 ms.

Example: Homing mode type 2

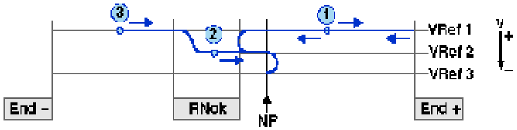


Figure 4.63 Homing mode type 2: The reference cam is between the two hardware limit switches; the first zero pulse after exiting the cam in positive direction is evaluated see Table 4.33

Example: Homing mode type 4

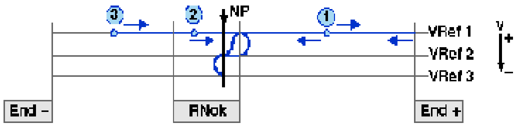


Figure 4.64 Homing mode type 4: The reference cam is between the two hardware limit switches; the first zero pulse after reaching the cam in negative direction is evaluated see Table 4.33

Example: Homing mode type 6

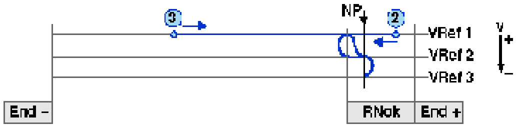


Figure 4.65 Homing mode type 6: The reference cam is flush to the positive hardware limit switch; the first zero pulse after reaching the cam in positive direction is evaluated see Table 4.33

Example: Homing mode type 8

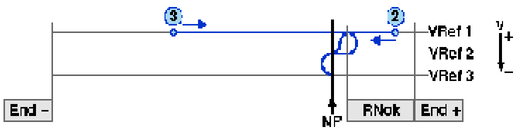


Figure 4.66 Homing mode type 8: The reference cam is flush to the positive hardware limit switch; the first zero pulse after exiting the cam in negative direction is evaluated see Table 4.33

Key to "Homing mode type" diagram:

Possible starting positions:

①	Between reference cam and positive limit switch
②	On reference cam
③	Between reference cam and negative limit switch

Abbreviations used:

End –	Negative hardware limit switch
End +	Positive hardware limit switch
RNok	Reference cam
ZP	Zero pulse of encoder
VRef 1	First (highest) ref.velocity
VRef 2	Second (middle) ref.velocity
VRef 3	Third (lowest) ref.velocity
MP	Machine zero

Note: For more information on the zero pulse of the respective encoders, see section 5.9.1.

Homing mode type

Select the homing mode type matching your layout:

Type 0:	No homing run is carried out. Instead, the current position is read-in and set equal to the zero correction (also via command SET 0). For multi-turn encoders, use type 9
Type 1:	Reference cam: between the two limit switches; evaluation of first ZP after Zero pulse: exiting cam in negative direction
Type 2:	Reference cam: between the two limit switches; evaluation of first ZP after Zero pulse: exiting cam in positive direction
Type 3:	Reference cam: between the two limit switches; evaluation of first ZP after Zero pulse: reaching cam in positive direction
Type 4:	Reference cam: between the two limit switches; evaluation of first ZP after Zero pulse: reaching cam in negative direction
Type 5:	Reference cam: flush to negative limit switch; evaluation of first ZP after Zero pulse: reaching cam in negative direction
Type 6:	Reference cam: flush to positive limit switch; evaluation of first ZP after Zero pulse: reaching cam in positive direction
Type 7:	Reference cam: flush to negative limit switch; evaluation of first ZP after Zero pulse: exiting cam in positive direction
Type 8:	Reference cam: flush to positive limit switch; evaluation of first ZP after Zero pulse: exiting cam in negative direction
Type 9	Applies only to absolute encoders. No homing run is carried out. Instead of this, at start-up the current position is read and offset with the zero point correction.

Table 4.33 Homing mode types

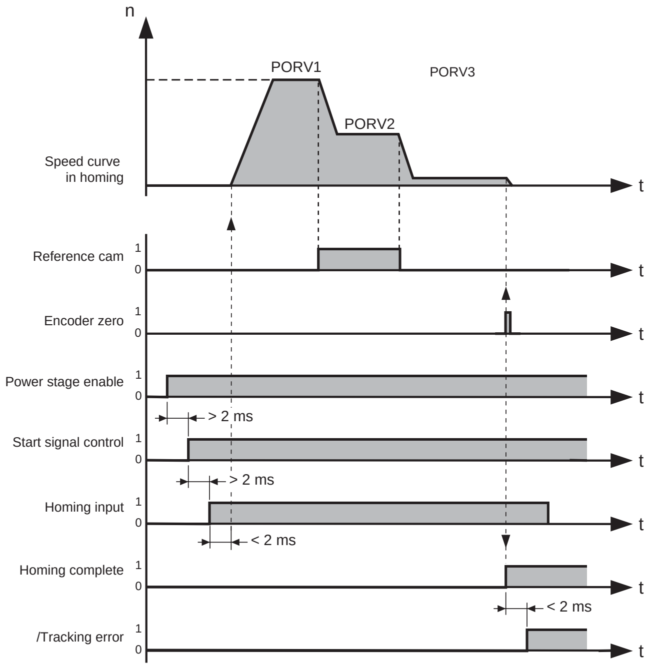
Zero search

The homing run can only be made to the reference cam, even ignoring the zero pulse of the encoder (for this, clear the “With zero search” checkbox).

Note: During the homing run the software limit switches are not monitored. If a hardware limit switch is tripped, the direction is reversed.

Note: "Homing mode completed" output
On encoders with zero pulse (G1/resolvers) the signal is set when the zero pulse is reached.

Time response of homing mode



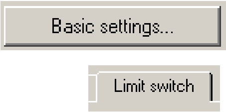
PORV1 = Speed 1 in homing mode
PORV2 = Speed 2 in homing mode
PORV3 = Speed 3 in homing mode

Figure 4.67 Signal characteristics in homing mode

For the homing run:

1. the power stage must be enabled (ENPO input),
2. the control must be started (axles now holds its position under position control),
3. homing mode must be started by a 24 V level at the "Go" input.

The homing speeds V1 to V3 can be chosen at will.



Limit switch tab

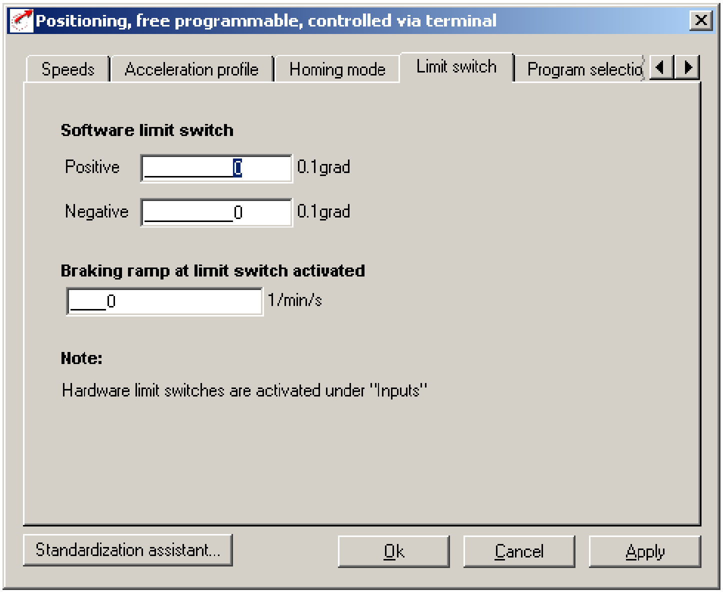


Figure 4.68 Limit switch tab

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DM	Meaning	Value range	Unit	Parameter
Software limit switches Positive	Software limit switch in positive axle direction	± 2147483648	Customer unit defined on the Standardization tab	718_POSWP (_PBAS)
Software limit switches Negative	Software limit switch in negative axle direction	± 2147483648	Customer unit defined on the Standardization tab	719_POSWN (_PBAS)
Braking ramp	Braking ramp in effect when the software limit switch is active	0 - 65535	rpm/s	496_STOPR (_SRAM)

Table 4.34 Limit switch - basic settings

With the software limit switches the travel range can be limited (referred to the machine zero; see Homing Mode tab). Their parameters should be set before those of the hardware limit switches - that is: first the respective software limit switch, then the hardware switch, and then the mechanical end stop. If the target position resulting from a positioning command is outside these limits, the positioning operation is not carried out and an error message is transmitted. When a software limit switch is reached, braking is applied by the adjustable braking ramp and an error message is sent. If both parameters are set = 0, no monitoring is carried out. During the homing run the software limit switches are not monitored.

Program Selection tab

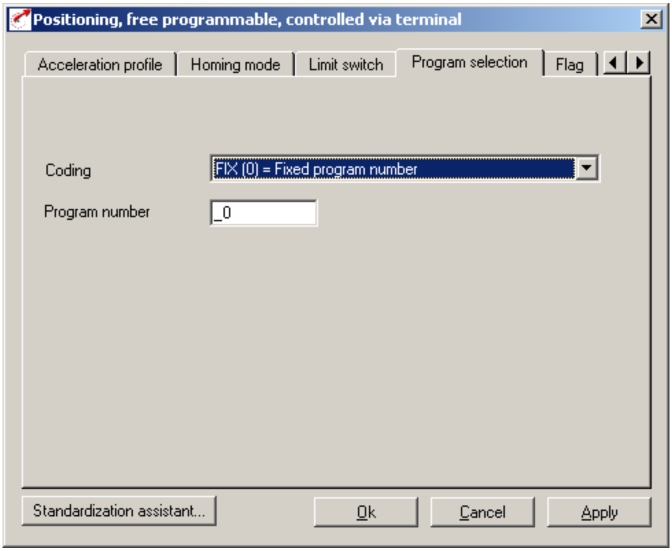


Figure 4.69 Program Selection tab

In this screen the coding of the program selection is specified.

DM	Meaning	Value range	Unit	Parameter
Coding	Definition of how the sequence program is selected.	see table 4.36	/	735_POPKD (_PBAS)
Program number	With coding = FIX (0) active program	see table 4.36	/	734_POQPN (_PBAS)

Table 4.35 Program selection - basic settings

Coding

Bus	Setting	Function	Inputs max.	Programs
0	FIX	Fixed program number	/	0 ... 99
1	NOCOD	One input per program	8	0 ... 7
2	BIN	Binary coded	7[1)]	0 ... 99
3	BCD	BCD coded	8[1)]	0 ... 99

1) The error "Selected program not available (E-POS216)" occurs if no valid BCD combination is applied.

Table 4.36 Program selection coding

Note: The user can choose which of the stored programs to start. The selection is made in automatic mode. Following selection, the program is launched with a High edge at the start input.
Factory setting: Always start program P00.

Flag tab

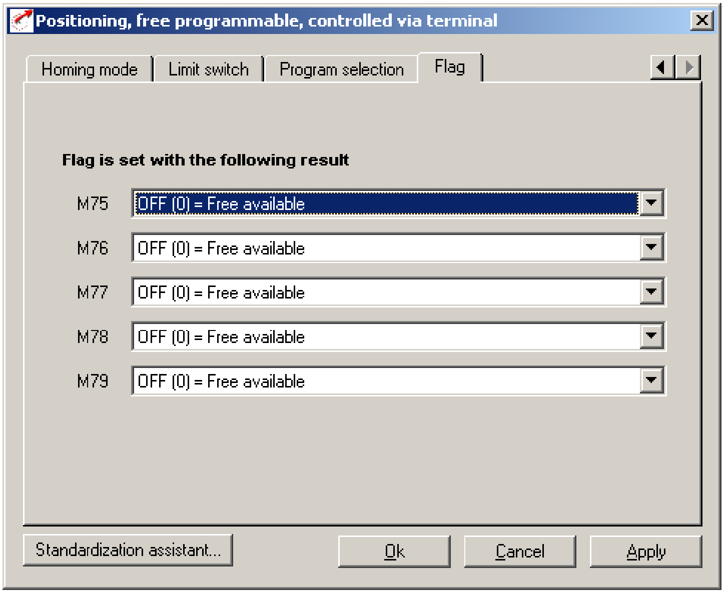


Figure 4.70 Flag tab

Here the event controlled flags are set which can be polled in the sequence program (positioning, free programmable).

DM	Meaning	Value range	Unit	Parameter
M75	Function selector flag M75	see Table 4.38	-	775_FSM75 (_PPAR)
M76	Function selector flag M76	see Table 4.38	-	776_FSM76 (_PPAR)
M77	Function selector flag M77	see Table 4.38	-	777_FSM77 (_PPAR)
M78	Function selector flag M78	see Table 4.38	-	778_FSM78 (_PPAR)
M79	Function selector flag M79	see Table 4.38	-	779_FSM79 (_PPAR)

Table 4.37 Flag - basic settings

Flags M75 to M79 can be assigned various items of information:

Bus	Parameter	Function
0	OFF	Freely usable
1	ACTIVE	Control in function
2	REFOK	Homing mode completed
3	ROT_R	Clockwise rotation
4	ROT_L	Anti-clockwise rotation
5	ROT_0	Standstill
6	REF	Reference reached
7	PABRE	Positioning absolute =0/ relative =1
8	PMODE	Positioning pos.mode =0/velocity mode =1
9	LIMIT	Reference limitation initiated
10	SCAVM	Speed threshold reached
11	TCAVM	Torque threshold reached
12	WARN	Warning
13	ERR	Error
14	ERRW	Warning or error
15	EFLW	Tracking error
16	STOP	Quick stop
17	UV	Undervoltage in DC link
18	PSTP	Positioning stopped (collective message from WARN, ERR, EFLW, STOP, UV)
19	OS00	Digital output OS00 (standard)
20	OS01	Digital output OS01 (standard)
21	OS02	Digital output OS02 (standard)
22	OS03	Digital output OS03 (standard)
23	OV0	Digital output OV0 (virtual)
24	OV1	Digital output OV1 (virtual)
25	OE00	Digital output OS00 (expanded)
26	OE01	Digital output OS00 (expanded)
27	OE02	Digital output OS00 (expanded)
28	OE03	Digital output OS00 (expanded)
29	ACCP	Profile generator in acceleration phase
30	VMAX	Reference generator has reached maximum speed.
31	MOGEN	Motor motorized/regenerative
32	WI2TD	Warning threshold I x I x T device exceeded (parameter 339_WLITD)
33	WI2TM	Warning threshold I x I x T motor exceeded (parameter 338_WLITM)

Table 4.38 Flags event table

Note: For more information on the various functions of the flags, see section 5.2.1 “Digital outputs”.

4.10.3 Special functions of the preset solution

1. Positioning data

The process data can be displayed with the “Process data” button.

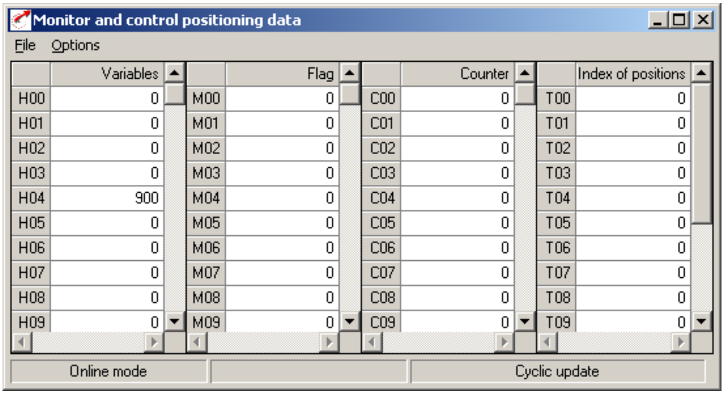


Figure 4.71 Positioning data

The positioning data include:

- 100 variables H00 .. H99 integer: ±2.147.483.647
- 100 flags M00 .. M99 0 or 1
- 100 numerators C00 .. C99 integer 0 - 65535
- 16 table positions T00 .. T15 integer: ±2.147.483.647
- **Variables**
  Under Variables position, velocity, numerator and timer values can be stored which are used in the sequence program. The use of variables is particularly beneficial where the value is used multiply.
- **Flags**
  Flags retain their value (0 or 1) until they are overwritten with a new one. As a result, flags set in one program can be scanned by another one (or a subroutine).

Note: Positioning data also retain their value following a power-off, provided they were saved beforehand in the Flash-Eprom with a command (SET Para [150] =1 or SAVE) or with the “Save device setting” button. The save operation takes about 6 seconds, and must not be interrupted (such as by a power-off), otherwise the entire device setup will be inconsistent and the device will not work.

Note: After power-up all flags are set to 0. Flags are set in the program by means of set commands (Set Mxx = 1); they are scanned by step commands or subroutine calls.

- **Numerator**
  Numerators are 16-bit “variables” which can be incremented and decremented in the program sequence.
- **Table positions**
  The positioning controller can store a table with 31 position values. The table positions can store values for positions and positioning travel distances.

In the sequence program you can choose the “GOT...” commands to position to table values. For this, a maximum of 5 inputs are programmed with the “Table index” function. The table index determines which line in the table (1 ... 31) is used for positioning. The position values can be set in the program (SET_command) or entered using the Process data Editor.

Note: After power-up, all table positions are set to the values stored in the Flash-Eprom. (Data must be saved!).

2. Process program / Program editor

The Program Editor is launched with the “Process program” button.

Clicking the button in the main window opens up the following edit screen:

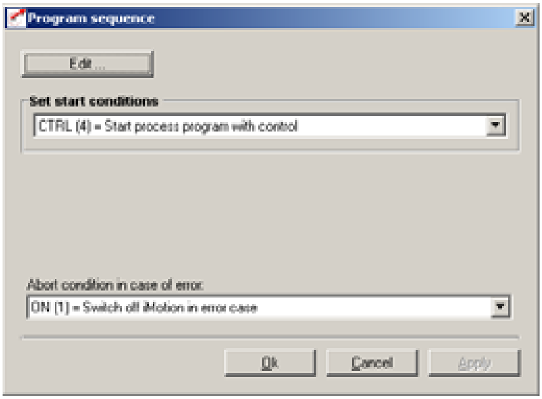
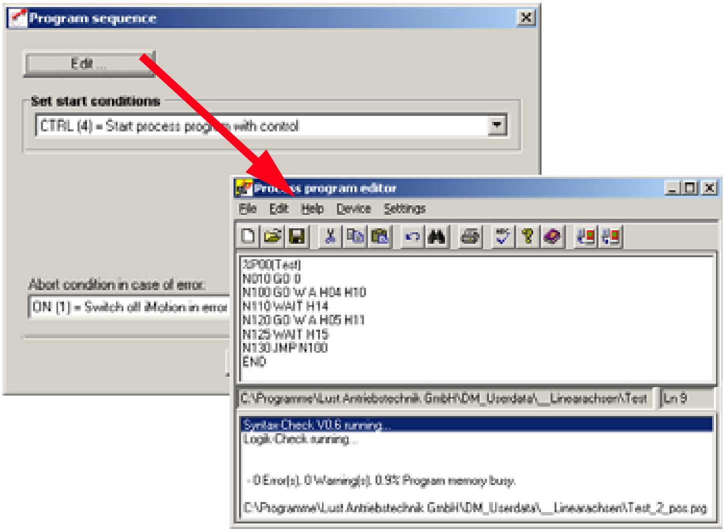


Figure 4.72 Program Editor

DM	Meaning	Value range	Unit	Parameter
Define start condition	Define start condition for sequence program	see Table 4.40		771_POSCT (_PPRG)
Abort condition in case of error	Define whether the sequence program is stopped in the event of an error	OFF (0) / ON (1)		773_POERR (_PPRG)

Table 4.39 Start conditions - basic setting

Clicking the Edit button opens the Program Editor.



The Program Editor is used to create and edit sequence programs. With regard to creating sequence programs also refer to section 4.11.9 - Program examples.

5 different conditions for starting the sequence program can be defined:

Setting	Start sequence program
STD (0)	Via two digital inputs. With a positive edge at input “GO (28) = Start homing mode/sequence” the sequence program is started, provided input “AUTO (29) = Automatic mode” has first been set. If “Automatic mode” is not selected, homing mode is started with the “GO” input. If the drive is controlled over a field bus, the “GO” and “AUTO” control bits need to be set accordingly over the bus.
TERM(1)	Via one digital input. With a positive edge at input “AUTO (29) = Automatic mode” the sequence program is started directly. Input “GO (28) = Start homing mode/sequence” is not used in this setting. A required homing run must be called up from the sequence program.
PARA (2)	Via parameter. “772-POSTC-Start sequence control/homing mode on startup with parameter”. Parameter “772-POSTC” has the following settings. OFF (0) = Sequence program OFF STAPR (1) = Starting sequence program STAHO (2) = Starting homing
AUTO (3)	Automatically on device startup. After power-on the sequence program is started. No other inputs to activate the sequence program are necessary. Under the “AUTO” start condition it should be noted that when sequence control is active no program can be loaded into the servocontroller. So if the program is being modified, a different start condition should be selected by way of the parameter setting.
CTRL (4)	With start of control. Attention: If control is stopped because of a device error, the sequence program is also stopped. When control is restarted the sequence program is also restarted. In addition to the start conditions, by the “error response” setting in parameter 773_POERR the system can be configured so that the sequence program is terminated in the event of an error.

Table 4.40 Start conditions

The „jog“ function is permitted only in the start condition STD (0).

Functions of the Program Editor

- Administer programs (create, open, save to file and transfer to servocontroller)
- Search and replace, copy and paste based on the Windows^{TM} standard
- Syntax check (Check! menu) and compiler
  - The command set is described in section 4.10.8.
  - The program structure is described in section 4.10.9.
  - For examples of process programs, see section 4.10.10.

Note:

- During transfer to the servocontroller (File_Save_To servo menu) the servocontroller must not be in “Automatic” mode.
- The editor is not case-sensitive.
- Set blanks between the set number, command and operand (not tabulators).
- Comments are backed up only on saving to hard disk or floppy. They are not transferred into the axle, so as to save memory capacity in the position controller.

Delete program

A sequence program in the servocontroller is deleted by overwriting it with a new one with the same number.

Delete program in field bus operation.

In operation over a field bus, the old program must be deleted first:

%CL Pyy   yy = program number 0 .. 99

Note: For more information refer to the manual for the relevant field bus system.

Manual mode is launched with the "Manual" button.

3. Manual mode / Jog mode

- **Jog mode**

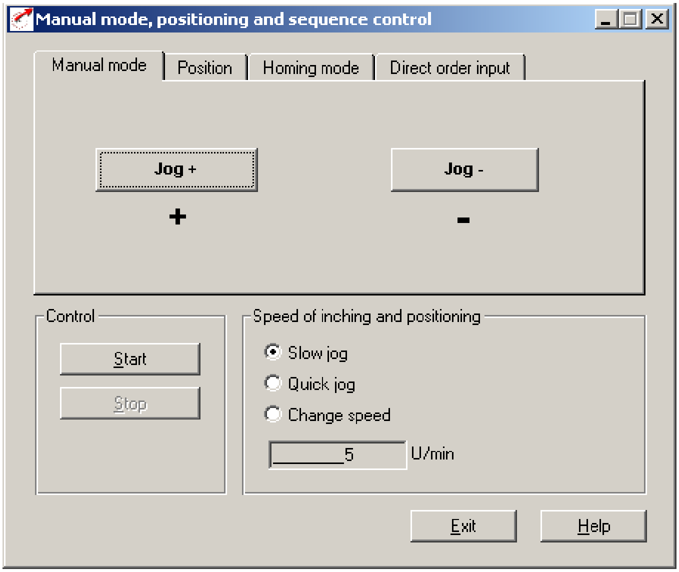


Figure 4.73 Manual mode

Note: Positioning and sequence control manual mode works in the following preset solutions:
- Positioning, reference and control via field bus (PCB_2)
- Positioning, fixed positions (PCT_3/PCB_3)
- Positioning, free programmable (PCT_4/PCB_4)

By pressing the "Jog+" and "Jog–" buttons the axle can be moved at the programmed jog speed (slow, quick) or at a freely selectable speed.

- **Positioning**

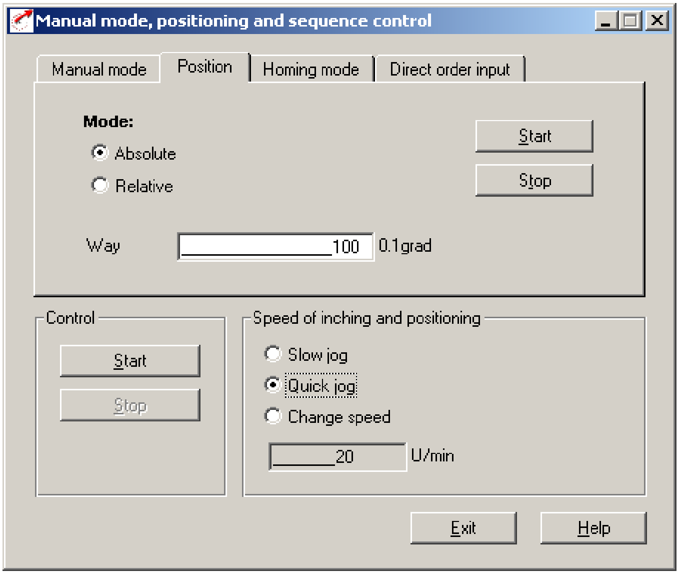


Figure 4.74 Position tab

Here a position (absolute or relative) can be set which is approached automatically at the programmed jog speed when you choose the “Start” button. The “Stop” button stops an ongoing movement.

- **Homing mode**

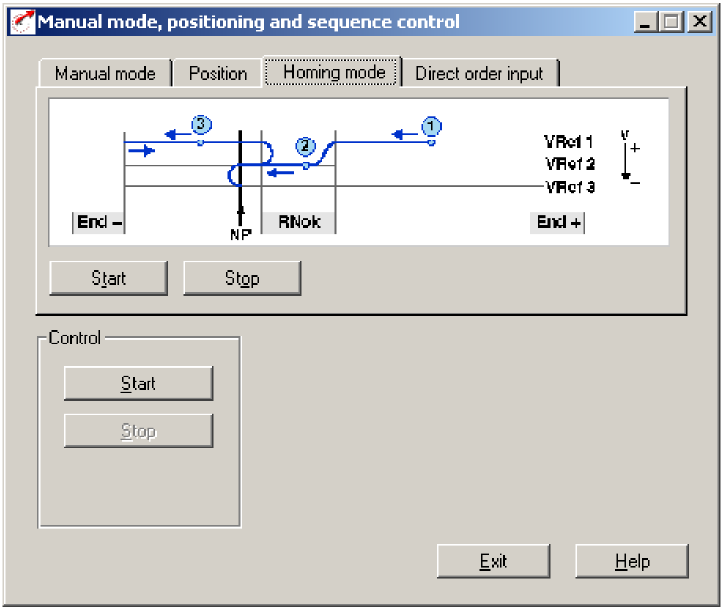


Figure 4.75 Homing Mode tab

Choose the “Start” button to request a homing run. This homing run can be stopped by choosing the “Stop” button or by deactivating the power stage enable ENPO. The homing run conditions (type, velocity, etc.) must be set on the “Homing mode” tab (Basic settings) **beforehand**.

- **Direct order input**

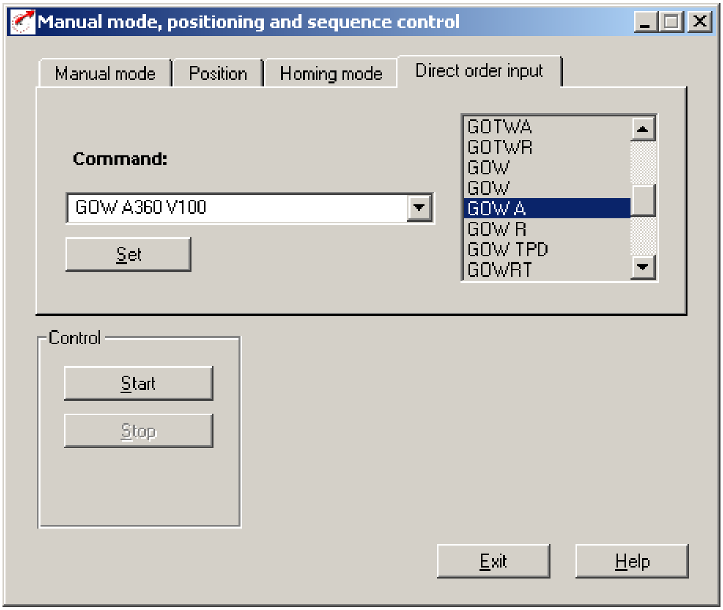
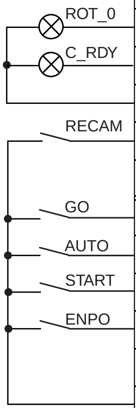


Figure 4.76 Direct Order Input tab

Here a command can be entered directly for execution when the “Set” button is clicked.

For more information on the commands, see section 4.10.7 “Command set”.

4.10.4 Terminal assignment



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Standstill (energized)
14	OSD00	Controller ready
13	DGND	Digital ground
12	ISD04	Reference cam
11	ISD03	Not assigned
10	ISD02	START homing run / sequence
9	ISD01	Automatic mode
8	ISD00	START control
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

Figure 4.77 Terminal assignment for positioning, free programmable, control via terminal

Note: The following description applies where the sequence control start condition is set to STD(0) – see section 4.10.3.

4.10.5 Activation

With High level at the “ENPO” and “START control” inputs (observe time delay ≥ 2 ms!) the servocontroller switches to “Loop control active”, i.e. the motor shaft is position controlled.

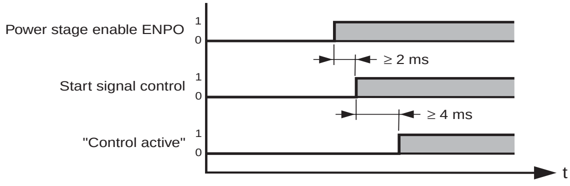


Figure 4.78 Timing of “START control” activation

With the High signal at the “AUTO” input, automatic mode is selected and with the “GO” input the selected program is launched (see “Program Selection” tab).

Manual mode/jog mode (setup mode) is selected by a low level at the “AUTO” input. If the high level is canceled during motion, the axle is immediately stopped and automatic mode is aborted. In the event of a program abort by deselection of Automatic, the program can no longer be resumed, but must be restarted.

In manual mode (Automatic = low level) a homing run is carried out if a low/high edge change occurs at the “GO” input.

The “GO” signal can be cancelled after 20 ms (start pulse).

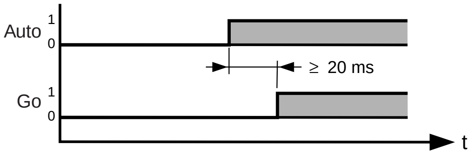
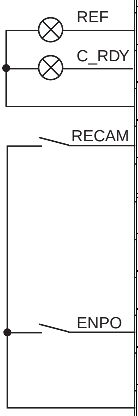


Figure 4.79 Timing of “Go” activation

Note: This actuation applieswhere the sequence control start condition is set to STD (0) – see section 4.10.3. Where the start condition is CTRL (4) the sequence program starts automatically with the control (input: START control = 1).

4.10.6 Control via field bus

Note: For the preset solution PCB_2 the "EASYDRIVE PosMod" bus setup should be used.



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Reference reached
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Reference cam
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Not assigned
7	ENPO	Hardware enable of power stage
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Not assigned
1	ISA00+	Not assigned

Figure 4.80 Terminal assignment for positioning, free programmable, control via field bus

For more information refer to the user manual of the relevant field bus system.

4.10.7 Command set

Programming of the position controller is line-oriented and is similar to the BASIC programming language. This reduces the time spent learning the scope of commands. Another advantage is that the programs are also readable for users without detailed knowledge of the command set.

The command set is divided into the following categories:

- Step commands / subroutine calls
- Set commands
- Positioning commands
- Wait commands

The execution time for commands is generally 1 ms. Exceptions are specified.

Command set overview

Com-mand	Operand 1	Operand 2	Comments
Step commands / Subroutine calls			
JMP	Ny/END/Pyy		Unconditional step / subroutine call
	(IP < > x, Hxx)	Ny/END/Pyy 1)	Actual position
	(SP < = > x, Hxx)	Ny/END/Pyy 1)	Reference position
	(PW = 0/1)	Ny/END/Pyy 1)	Actual position in position window (PW=1)
	(ST = 0/1)	Ny/END/Pyy	Reference position = target position (ST=1)3
	(Ippi = 0/1)	Ny/END/Pyy	Status of input
	(Mxx = 0/1)	Ny/END/Pyy	Status of flag
	(M[Cxx] = 0/1)	Ny/END/Pyy	Status of flag (indexed)
	(Cxx < = > d)	Ny/END/Pyy	Numerator status
	(Hxx < = > z, Hyy)	Ny/END/Pyy	Quantity of variable
	(H[Cxx] < = > z, Hyy)	Ny/END/Pyy	Quantity of variable (indexed)
	(Zxx < > d, = 0)	Ny/END/Pyy	Timer status
	(PARA[n] < = > z)	Ny/END/Pyy	Quantity of a parameter
	(TPx = 0/1)	Ny/END/Pxx	Status of touchprobe
	(OVNORMSUM = x/ Hxx)	OVNORMSUM	Read-in and compare mean value of both analog values. OVNORMSUM = (OV1 + OV2) / 2. Only where the function selectors of both analog inputs are set to OVR1 and OVR2!
Set commands			
SET	Oppi = 0/1, Mxx		Set output directly or with flag
	Oppi = (A | & B)		Set output via logic link (A, B = Ippi or Mxx; | = OR (ASCII 124) ; & = AND)
	Mxx = 0/1, Myy, -Myy		Set flag; invert
	M[Cxx] =0/1, Myy, -Myy		Set flag (indexed); invert
	Mxx = (A | & B)		Set flag via logic link (A = Ippi; B = Ippi or Mxx; | = OR (ASCII 124) ; & = AND)
	Hxx = z, Hyy, H[Cyy], Cyy, PARA[n], FPARA[n, xx]		Set variable
	H[Cxx] = z, Hyy, H[Cyy], Cyy, PARA[n], FPARA[n, xx]		Set variable (indexed)
	Hxx + - * : z, Hyy		Calculate variable
	H[Cxx] + - * : z, Hyy		Calculate variable (indexed)

1) Execution time = 2 ms
2) Execution time dependent on parameters

indexed = dependent on a numerator status

Table 4.41 Command set overview

Com-mand	Operand 1	Operand 2	Comments
	Hxx = IP, SP, OV		Set variable
	H[Cxx] = IP, SP, OV		Set variable (indexed)
	Hxx = Txx		Set variable with table position
	H[Cxx] = Txx		Set variable with table position (indexed)
	Hxx = TPx		Set variable with touchprobe (trigger position)
	H[Cxx] = TPx		Set variable with touchprobe (trigger position) (indexed)
	Cxx = d, Hyy, Cyy		Set numerator
	Cxx + - b, Hyy		Increment/decrement numerator
	Cxx = Ipp		Set numerator with input port
	Txx = x, Hxx, IP, SP		Set table position
	Zxx = d, Hxx		Set timer
	OV = 0/1		Set override (OV=1: activate)
	0		Adopt current position as reference point
	K15, K16 = 0/1, Hxx		Set acceleration mode (0=linear, 1=$\sin^2$) (K15= positive, K16= negative direction)
	K17...K24 = p, Hxx		Set maximum acceleration value (p=1...100%),
	PARA[n] 2) = z, Hyy, H[Cyy]		Set parameter (indexed)
	FPARA [n, xx] 2) =z, Hyy, H[Cyy]		Set field parameter (indexed)
	TPx = G1F0, G1F1		Activate touchprobe (G1 = position encoder (fixed)), (F0 = positive edge), (F1 = negative edge, TPx=TP3, TP4
	Hxx/H[Cxx] = EGEARSPEED		Read-out master encoder velocity in unit incr/ms
	Hxx/H[Cxx] = EGEARINC		Read-out master encoder increments
	EAGERINC = x/Hxx/H[Cxx]		Set master encoder increments
	Hxx/H[Cxx] = IN/SN		Read-out actual or reference speeds in rpm
	Hxx/H[Cxx] = FPARA[Hxx/x, Hxx/y] or gen.		Read field parameters
	FPARA[x/Hxx/H[Cxx], y/Hxx/Hxx[Cxx]] = z/Hxx/H[Cxx]		Write gen. field parameters

1) Execution time = 2 ms

2) Execution time dependent on parameters

indexed = dependent on a numerator status

Table 4.41 Command set overview

Com-mand	Operand 1	Operand 2	Comments
	Hxx/H[Cxx] = OV1		Adopts A/D-converted value of analog input ISA0 into variable. Value range -10 to +10V = -2047 to +2047. Only with function selector setting OVR1 for analog input ISA0
	Hxx/H[Cxx] = OV2		Adopts A/D-converted value of analog input ISA1 into variable. Value range 0 to +10V = 0 to +1023. Only with function selector setting OVR2 for analog input ISA1
	Hxx/H[Cxx] = OVNORMSUM		Read-in mean value of both analog values OVNORMSUM = (OV1 + OV2) / 2 - Only where the function selectors of both analog inputs are set to OVR1 and OVR2!
Positioning commands			
GO	Ax, A Hxx	Vy, Hyy	Absolute position, velocity (with resumption)
	Rx, R Hxx	Vy, Hyy	Relative travel, velocity (with resum.)
GOTA	Vy, Hyy		Position from table, velocity (with resum.)
GOTR	Vy, Hyy		Travel from table, velocity (with resum.)
GOW	Ax, A Hxx	Vy, Hyy 1)	Absolute position, velocity (without resum.)
	Rx, R Hxx	Vy, Hyy 1)	Relative travel, velocity (without resum.)
GOTWA	Vy, Hyy 1)		Position from table, velocity (without resum.)
GOTWR	Vy, Hyy 1)		Travel from table, velocity (without resum.)
GO	0		Carry out homing run (programmed type)
GO	V + - y		Infinite moving (direct)
	V Hxx		Infinite moving (via variable)
GOSYN	0/1		Activate electronic gearing (1) or deactivate (0)
GORT	x, Hxx	Vy, Hyy	Indexing table: Position, velocity (travel optimized, with continuation)
GOWRT	x, Hxx	Vy, Hyy 1)	Indexing table: Position, velocity (travel optimized, without continuation)

1) Execution time = 2 ms
2) Execution time dependent on parameters

indexed = dependent on a numerator status

Table 4.41 Command set overview

Command	Operand 1	Operand 2	Comments
GOTRT	Vy, Hyy		Indexing table: Position from table, velocity (travel optimized, with continuation)
GOWTRT	Vy, Hyy [1]		Indexing table: Position from table, velocity (travel optimized, without continuation)
GORD TP_3 - TP_4	x,Hxx	Vy, Hyy	Compare variation in difference between TP_3 and TP_4 for input
GOWRD TP_3- TP_4	x,Hxx	Vy,Hyy	Compare variation in difference between TP_3 and TP_4 for input (not continued)
GOATPx	x,Hxx	Vy,Hyy	Trigger position (Touchprobe) velocity
GOWATPx	x,Hxx	Vy,Hyy	Trigger position (Touchprobe) velocity
STOP	B		Brake with prog. acceleration and parameterized smoothing
	M		Brake with max. acceleration always without smoothing, even when configured
	0		As STOP M, additionally control shut-off
Wait commands and saving			
WAIT	b, Hxx		Waiting time in ms (1...65535)
	PW		Wait until actual position is in position window
	ST		Wait until reference position = target position
	(Ippi = 0/1)		Wait until input = 0/1
	TPx		Wait until trigger position (Touchprobe) has been saved (triggered)
SAVE			Back up device setup from RAM to Flash-EPROM Execution time approx. 6 s

1) Execution time = 2 ms
2) Execution time dependent on parameters

indexed = dependent on a numerator status

Table 4.41 Command set overview

1 2 3 4 5 A

EN

Key

Parameter	Meaning	Value range	Resolution
Cxx	Numerator index	00 ... 99	
Hxx, Hyy	Variables index	00 ... 99	
Kxx	Machine parameters	00 ... 99	
Mxx, Myy	Flag index	00 ... 99	
Ny	Set number	000 ... 999	
PARA[n]	Parameter number n	000 ... 999	
FPARA [n, xx]	Field parameter number n / field parameter index xx	000 ... 999 / 0 ... 255	
Pmm	Mask (hexadecimal)	00 ... FF Hex	(8 bits)
Pyy	Program number	00 ... 99	
Txx	Table position	00 ... 15	
Zxx	Timer index	00 ... 07	
x	Holding value	(0 ... 2047)	
TPx	Touchprobe (trigger position)	3,4	
a	Value of a flag	0 / 1	
b	Value (auxiliary variable for loading/calculating)	1 ... 65535	(16 bits)
d	Status of a numerator	0 ... 65535	(16 bits)
d	Status of a timer	0 ... 4.294.967.295 [ms]	(32 bits)
x, y, z	Numerical value (position, velocity, variables or table position)	-2.147.483.648 ... +2.147.483.647	(32 bits, with preceding sign)

Table 4.42 Key to Table 4.41

1. Step commands and subroutine calls (JMP)

- Unconditional step commands/subroutine calls are always executed (unconditionally).
- Conditional step commands/subroutine calls are only executed when the specified condition is met. The condition for execution of the command is given in brackets (...).
- The step destination is given as a set number, the end of the program, or a program number:

Jump to set with number y= 0 ... 999	JMP (...) Ny
Jump to end of program	JMP (...) END
Call program/subroutine with number yy= 00 ... 99	JMP (...) Pyy

Subroutines

A subroutine (UP) is handled in the same way as a standalone program. The total number of programs and subroutines is 100 (P00 ... P99).

When the subroutine has been run through the program is resumed with the set which follows the call. The maximum nesting depth for subroutines is 10. If this number is exceeded, an error message is delivered and the current program is aborted.

Unconditional step commands/ subroutine calls

These commands are not linked to any preconditions (axle position, status of internal program variables) and consequently are executed immediately and unconditionally.

JMP Ny	Jump to set with number y
JMP END	Jump to end of program
JMP Pyy	Call subroutine with number yy

Conditional step commands/ subroutine calls

Conditional step commands/subroutine calls are linked to a specific condition, given in brackets. If the condition is met, the step is executed to the specified set number, to the end of the program, or to the subroutine as appropriate. If the condition is not met, the program is resumed with the following set.

Note: The execution of a conditional step can be linked to one of the following conditions.

Actual position

Exceed:

Direct:	JMP (IP>x) Ny/END/Pyy
Via variable:	JMP (IP>Hxx) Ny/END/Pyy

Undershoot:

Direct:	JMP (IP<x) Ny/END/Pyy
Via variable:	JMP (IP<Hxx) Ny/END/Pyy

x	=	Comparative position [travel unit]	
Hxx	=	Variables index	(00 ... 99)
Ny	=	Set number	(000 ... 999)

Execution time: 1ms

Reference position

Reach:

Direct:	JMP (SP=x) Ny/END/Pyy
Via variable:	JMP (SP=Hxx) Ny/END/Pyy

Exceed:

Direct:	JMP (SP>x) Ny/END/Pyy
Via variable:	JMP (SP>Hxx) Ny/END/Pyy

Undershoot:

Direct:	JMP (SP<x) Ny/END/Pyy
Via variable:	JMP (SP<Hxx) Ny/END/Pyy

x	=	Comparative position [travel unit]	
Hxx	=	Variables index	(00 ... 99)
Ny	=	Set number	(000 ... 999)

Execution time: 1 ms

Axle status

PW reached:	JMP (PW = 1) Ny/END/Pyy	Actual position in position window [1)]
PW not reached:	JMP (PW = 0) Ny/END/Pyy	Actual pos. not in position window

Axle stopped:	JMP (ST = 1) Ny/END/Pyy	Reference position = target position 2)
Axle moving:	JMP (ST = 0) Ny/END/Pyy	Reference position ¼ of target position
Ny =	Set number	(000 ... 999)

1) Positioning complete, “Axle in position” output is set

2) Positioning arithmetically complete

Status of a digital input

Status = 0: JMP (Ippi = 0) Ny/END/Pyy
Status = 1: JMP (Ippi = 1) Ny/END/Pyy

Ippi	=	Inputs	(IE00 ... IE07)
Ny	=	Set number	(000 ... 999)

Status of a logical flag

Direct: JMP (Mxx = 0) Ny/END/Pyy
JMP (Mxx = 1) Ny/END/Pyy

Indexed: JMP (M[Cxx] = 0) Ny/END/Pyy
JMP (M[Cxx] = 1) Ny/END/Pyy

Cxx	=	Numerator index	(00 ... 99)
Mxx	=	Flag index	(00 ... 99)
Ny	=	Set number	(000 ... 999)

Status of a numerator

Compare: JMP (Cxx = d) Ny/END/Pyy
Exceed: JMP (Cxx > d) Ny/END/Pyy
Undershoot: JMP (Cxx < d) Ny/END/Pyy

d	=	Comparative numerator status	(0...65535)
Cxx	=	Numerator index	(00 ... 99)
Ny	=	Set number	(000 ... 999)

Mean value of both analog inputs

JMP(OVNORMSUM = x/Hxx) Ny/END/Pyy

Compare: JMP(OVNORMSUM = x/Hxx) Ny/END/Pyy

x	=	Comparison value	(0...2047)
Hxx	=	Variables index	(00 ... 99)
Ny	=	Set number	(000 ... 999)
Pyy	=	Subroutine index	(00 ... 99)

OVNORMSUM forms the mean of both analog values OVNORMSUM = (OV1 + OV2) / 2, wherein OV1 and OV2 have the value range 0 ... 10V corresponds to 0 ... 2047.

Only where the function selectors of both analog inputs are set to FISA0 = OVR1 and FISA1 = OVR2!

Quantity of a variable (direct comparison)

Compare:
Direct: JMP (Hxx = z) Ny/END/Pyy
Indexed: JMP (H[Cxx] = z) Ny/END/Pyy

Exceed:

Direct: JMP (Hxx > z) Ny/END/Pyy
Indexed: JMP (H[Cxx] > z) Ny/END/Pyy

Undershoot:

Direct: JMP (Hxx < z) Ny/END/Pyy
Indexed: JMP (H[Cxx] < z) Ny/END/Pyy

z	=	Variable value	(± 2.147.483.647)
Cxx	=	Numerator index	(00 ... 99)
Hxx	=	Variables index	(00 ... 99)
Ny	=	Set number	(000 ... 999)

Quantity of a variable (comparison with second variable)

Compare:

Direct: JMP (Hxx = Hyy) Ny/END/Pyy
Indexed: JMP (H[Cxx] = Hyy) Ny/END/Pyy

Exceed:

Direct: JMP (Hxx > Hyy) Ny/END/Pyy
Indexed: JMP (H[Cxx] > Hyy) Ny/END/Pyy

Undershoot:

Direct:	JMP (Hxx < Hyy) Ny/END/Pyy
Indexed:	JMP (H[Cxx] < Hyy) Ny/END/Pyy

Cxx	=	Numerator index	(00 ... 99)
Hxx, Hyy	=	Variables index	(00 ... 99)
Ny	=	Set number	(000 ... 999)

Status of a timer

Compare:	JMP (Zxx = 0) Ny/END/Pyy	Timer expired? *)
Exceed:	JMP (Zxx > d) Ny/END/Pyy	
Undershoot:	JMP (Zxx < d) Ny/END/Pyy	

d	=	Comparative timer status	(0...65535)
Ny	=	Set number	(000 ... 999)
Zxx	=	Timer index	(00 ... 09)

Note: It is only possible to scan for equal time when the timer has expired (i.e. “= 0”), as there is no guarantee that a specific interim state (“=d”) is reached at the point of scanning.

Quantity of a parameter

Compare:

Direct:	JMP (PARA[n] = z) Ny/END/Pyy
Indexed:	JMP (PARA[Cxx] = z) Ny/END/Pyy

Exceed:

Direct:	JMP (PARA[n] > z) Ny/END/Pyy
Indexed:	JMP (PARA[Cxx] > z) Ny/END/Pyy

Undershoot:

Direct:	JMP (PARA[n] < z) Ny/END/Pyy
Indexed:	JMP (PARA[Cxx] < z) Ny/END/Pyy

z	=	Variable value	(± 2.147.483.647)
Cxx	=	Numerator index	(00 ... 99)
PARA[n]	=	Parameter number	(000 ... 999)
Ny	=	Set number	(000 ... 999)

Note: Parameters of data type FLOAT32 and STRING cannot be used (see Appendix - Parameter overview).
For others, appropriate conversions are required.

e.g. INT32Q16	- after reading divide by 65536
	- before writing multiply by 65536 multiply
FIXPOINT16	- standardization to 0.05 - read: divide by 20 - write: multiply by 20

2. Set commands (SET)

Using the set commands, a wide variety of operations can be performed in the process programs:

- Setting of outputs (direct, via mask, via logic links, ...)
- Setting of flags (direct, indexed, via logic links, ...)
- Load, calculate variables ...
- Load, increment, decrement numerator
- Set and start timer
- Set table positions
- Activate and deactivate override
- Change acceleration parameters

Set digital output

Direct: SET Oppi = 0
SET Oppi = 1

Via flag: SET Oppi = Myy

via logic link:

OR:
SET Oppi = (Ippi I Iqqk) logic link between two inputs
SET Oppi = (Ippi I Myy) logic link between input and flag
SET Oppi = (Mxx I Myy) logic link between two flags

AND:
SET Oppi = (Ippi & Iqqk) logic link between two inputs
SET Oppi = (Ippi & Myy) logic link between input and flag
SET Oppi = (Mxx & Myy) logic link between two flags

Mxx, Myy	= Flag index	(00 ... 99)
Pmm	= Screen for output	(00 ... FF Hex)
Cxx	= Numerator index	(00 ... 99)
Ippi, Iqqk	= Inputs	(ISxx, IExx)
Oppi	= Outputs	(OSxx, OExx)

The character “I” is the ASCII character number 124. It is produced by pressing <ALT> and simultaneously keying in “124” on the number pad.

Set logical flag

Direct:	SET Mxx = 0 SET Mxx = 1
Indexed:	SET M[Cxx] = 0 SET M[Cxx] = 1

Via 2nd flag:

Direct:	SET Mxx = Myy SET Mxx = -Myy invert flag
Indexed:	SET M[Cxx] = Myy SET M[Cxx] = -Myy invert flag

Via logic link:

OR:

Direct:	SET Mxx = (Ippi | Iqqk) logic link between two inputs SET Mxx = (Ippi | Myy) logic link between input and flag
indexed:	SET M[Cxx] = (Ippi | Iqqk) logic link between two inputs SET M[Cxx] = (Ippi | Myy) logic link between input and flag

AND:

Direct:	SET Mxx = (Ippi & Iqqk) logic link between two inputs SET Mxx = (Ippi & Myy) logic link between input and flag
Indexed:	SET M[Cxx] = (Ippi & Iqqk) logic link between two inputs SET M[Cxx] = (Ippi & Myy) logic link between input and flag

Cxx	= Numerator index	(00...99)
Mxx, Myy	= Flag index	(00...99)
Ippi, Iqqk	= Inputs	(IE00 ... IE07 = connector X15)

The character “I” is the ASCII character number 124. It is produced by pressing <ALT> and simultaneously keying in “124” on the number pad.

Set variable		
	Direct:	SET Hxx = z
	Indexed:	SET H[Cxx] = z

with 2nd variable:

Direct:	SET Hxx = Hyy
Indexed:	SET H[Cxx] = Hyy

with 2nd indexed variable:

Direct:	SET Hxx = H[Cyy]
Indexed:	SET H[Cxx] = H[Cyy]

with numerator status:

Direct:	SET Hxx = Cyy
Indexed:	SET H[Cxx] = Cyy

with value of parameter:

Direct:	SET Hxx = PARA[n]
Indexed:	SET H[Cxx] = PARA[n]

with value of field parameter:

Direct:	SET Hxx = FPARA[n, xx]
Indexed:	SET H[Cxx] = FPARA[n, xx]

Via calculation - direct: [2)]

Addition	SET Hxx +z	
Subtraction	SET Hxx -z	
Multiplication	SET Hxx *z	
Division	SET Hxx :z	$z \neq 0$ [1)]

via calculation - indexed: [2)]

Addition	SET H[Cxx] +z	
Subtraction	SET H[Cxx] -z	
Multiplication	SET H[Cxx] *z	
Division	SET H[Cxx] :z	$z \neq 0$ [1)]

Calculation via second variable - direct: [2)]

Addition	SET Hxx + Hyy
Subtraction	SET Hxx - Hyy
Multiplication	SET Hxx * Hyy
Division	SET Hxx : Hyy Hyy ≠ 0 [1)]

Calculation via second variable - indexed: [2)]

Addition	SET H[Cxx] + Hyy
Subtraction	SET H[Cxx] - Hyy
Multiplication	SET H[Cxx] * Hyy
Division	SET H[Cxx] : Hyy Hyy ≠ 0 [1)]

With actual position:

Direct:	SET Hxx = IP
Indexed	SET H[Cxx] = IP

With reference position:

Direct:	SET Hxx = SP
Indexed:	SET H[Cxx] = SP

With override value:

Direct:	SET Hxx = OV
Indexed:	SET H[Cxx] = OV

With table position:

Direct:	SET Hxx = Txx
Indexed:	SET H[Cxx] = Txx

z	= Variable value	(± 2.147.483.647)
Cxx, Cyy	= Numerator index	(00 ... 99)
Hxx, Hyy	= Variables index	(00 ... 99)
Txx	= Table index	(00 ... 15)

1) z or Hyy = 0 is not permitted (division by 0)! (triggers error message).

2) In these operations it must be ensured that no overranging occurs.

Set numerator

Direct:	SET Cxx = d
With variable:	SET Cxx = Hyy
With numerator:	SET Cxx = Cyy

Increment/decrement numerator:

SET Cxx + d
SET Cxx - d

Increment/decrement numerator via variable:

SET Cxx + Hyy
SET Cxx - Hyy

d	= Numerator value	(0 ... 65535)
b	= Auxiliary variable for add./subtr.	(1 ... 65535)
Cxx, Cyy	= Numerator index	(00 ... 99)
Hyy	= Variables index	(00 ... 99)

Set table position

Direct:	SET Txx = z
Indexed:	SET T[Cxx] = z

Direct:

With variable:	SET Txx = Hyy
Actual position:	SET Txx = IP
With ref.pos.:	SET Txx = SP

indexed:

With variable:	SET T[Cxx] = Hyy
With actual position:	SET T[Cxx] = IP
With ref.pos.:	SET T[Cxx] = SP

z	= Value of table position	(±2.147.483.647)
Cxx	= Numerator index	(00 ... 99)
Hyy	= Variables index	(00 ... 99)
Txx	= Index of table position	(00 ... 15)

Set parameter

With constant: SET PARA[n] = z
With variable: SET PARA[n] = Hxx
With indexed variable: SET PARA[n] = H[Cxx]

z	= Value of parameter	(±2.147.483.647)
Cxx	= Numerator index	(00 ... 99)
Hxx	= Variables index	(00 ... 99)
PARA[n]	= Parameter number	(000 ... 999)

Example: Scaling of torque limit (parameter 139-SCALE)

SET PARA[139] = 100 ➔ 100% of value*
SET PARA[139] = 10 ➔ 10% of value*

* The percentage of SCALE refers to the maximum value of the torque entered in parameter 353-TCMMX (Limit Values tab).

Set field parameter

With constant: SET FPARA(n,xx) = z
With variable: SET FPARA(n,xx) = Hxx
With indexed variable: SET FPARA(n,xx) = H(Cxx)

z	= Value of parameter (±2147483647)
Cxx	= Numerator index (00..99)
Hxx	= Variables index (00..99)
FPARA(n,xx)	= Field parameter number, field parameter index (00..99, 00..99)

Note: Parameters of data type FLOAT32 and STRING cannot be used (see Appendix - Parameter overview).
For others, appropriate conversions are required.

e.g. INT32Q16 - after reading divide by 65536

- before writing multiply by 65536 multiply

FIXPOINT16 - standardization to 0.05
- read: divide by 20
- write: multiply by 20

Adopt reference point

In execution of this command the current actual position is set to the value of the zero correction:

SET 0

Set and start timer

After loading a timer with a value the value is automatically decreased by one every millisecond until eventually the value 0 is reached.

Direct: SET Zxx = d
With variable: SET Zxx = Hyy

d	= Timer value	(0 ... 4.294.967.295 [ms])
Hyy	= Variables index	(00 ... 99)
Zxx	= Timer index	(00 ... 07)

Activate or deactivate override

When override is active, in all positioning operations the programmed velocities are offset against the override passed by the servocontroller (0 ... 150%).

When override is inactive, movement is always at the programmed velocity (corresponding to override = 100%).

Activate: SET OV = 1
Deactivate: SET OV = 0

Acceleration mode	Adopt a modified override value
linear	immediately during positioning
sin^2	on next positioning command

Change acceleration mode

The acceleration mode (Acceleration Profile tab) can be changed at a standstill by means of the following set commands (execution time: 1 ms):

Acceleration mode for positive direction:

	SET K15 = 0/1	(0 = linear; 1 = sin^2)
With variable:	SET K15 = Hxx	(Hxx = 0/1)

Acceleration mode for negative direction:

	SET K16 = 0/1	(0 = linear; 1 = sin^2)
With variable:	SET K16 = Hxx	(Hxx = 0/1)

Change of acceleration maximum values

The values entered on the **Ramps** tab are maximums which can be set in the program to a value between 1 and 100% of the maximum value (cf. section 5.5). The change only takes effect when the axle comes to a standstill on the next positioning command.

Execution time: 1 ms (program is only resumed after calculation).

Direct: SET Kxx = p
With variable: SET Kxx = Hxx

P	= Percentage value of acceleration	(0 ... 100%)
Kxx	= Number of parameter	(17 ... 24)
Hxx	= Variables index	(00 ... 99)

Kxx	Function	Parameter
K17	Startup acceleration rate in positive direction	707_POLAP (_PRAM)
K18	Startup acceleration rate in negative direction	708_POLAN (_PRAM)
K19	Braking acceleration rate in positive direction	709_POBLP (_PRAM)
K20	Braking acceleration rate in negative direction	710_POBLN (_PRAM)

Table 4.43 (Maximum values) Standardization of acceleration

Example: Set linear startup acceleration rate in positive direction to 50 %.

SET K17 = 50

Analog values

Command	Operand 1	Comments
SET	Hxx/H[Cxx] = OV1	Adopts A/D-converted value of analog input ISA0 into variable. Value range -10 to +10V = -2047 to +2047. Only with function selector setting OVR1 for analog input ISA0
	Hxx/H[Cxx] = OV2	Adopts A/D-converted value of analog input ISA1 into variable. Value range 0 to +10V = 0 to +1023. Only with function selector setting OVR2 for analog input ISA1
	Hxx/H[Cxx] = OVNORMSUM	Read-in sum of analog values. OVNORM-SUM = (OV1 + OV2)/2, wherein OV1 and OV2 have the value range 0 ... 10 V corresponds to 0 ...2047. Only where the function selectors of both analog inputs are set to FISA0 = OVR1 and FISA1 = OVR2!

Hxx = Variables index (0 ... 99)
Cxx = Numerator index (0 ... 99)

1
2
3
4
5
A
EN

3. Positioning commands (GO)

With these commands you can move the driven positioning axle. There are three basic methods of moving the axle:

- **Absolute positioning**: Move to a specific position **(GO A ..)**
- **Relative positioning**: Move a specific distance **(GO R ...)**
- **Synchronism**: Electronic gearing (**GOSYN**)

Positioning with or without program resumption

- with program resumption (GO ...)

  If such a command is given in a program, when the axle starts up the program is immediately resumed with the following set. In this way several commands can be processed in parallel.

  If the command is passed during an ongoing positioning operation, the axle moves at the changed speed to the new target position. The new command is immediately executed; that is, the position from the original command is no longer approached!
- without program resumption (GOW ...)

  In these commands the following set is only processed when the actual position has reached the position window. As long as the axle is not in the position window - e.g. because of a tracking error – the program is not resumed.

  The “W” is an abbreviation for “Wait”, GOW = “Go and Wait”.

Positioning with resumption

Position or travel direct / velocity direct

Absolute: GO Ax Vy
Relative: GO Rx Vy

Position or travel direct / velocity via variable

Absolute: GO Ax Hyy
Relative: GO Rx Hyy

Position or travel via variable / velocity direct

Absolute: GO A Hxx Vy
Relative: GO R Hxx Vy

Position or travel via variable / velocity via variable

Absolute: GO A Hxx Hyy
Relative: GO R Hxx Hyy

Position or travel via table / velocity direct

Absolute: GOTA Vy
Relative: GOTR Vy

Position or travel via table / velocity via variable

Absolute: GOTA Hyy
Relative: GOTR Hyy

Ax	= Absolute position [travel unit]
Rx	= Positioning travel [travel unit]
Hxx	= Index of variables with position value
Hyy	= Index of variables with velocity
Vy	= Velocity value [velocity unit]

Positioning without resumption

Position or travel direct / velocity direct

Absolute: GOW Ax Vy
Relative: GOW Rx Vy

Position or travel direct / velocity via variable

Absolute: GOW Ax Hyy
Relative: GOW Rx Hyy

Position or travel via variable / velocity direct

Absolute: GOW A Hxx Vy
Relative: GOW R Hxx Vy

Position or travel via variable / velocity via variable

Absolute: GOW A Hxx Hyy
Relative: GOW R Hxx Hyy

Position or travel via table / velocity via variable

Absolute: GOTWA Hyy
Relative: GOTWR Hyy

Ax	= Absolute position [travel unit]
Rx	= Positioning travel [travel unit]
Hxx	= Index of variables with position value
Hyy	= Index of variables with velocity
Vy	= Velocity value [velocity unit]

Homing mode

The homing run is carried out using the defined homing mode type (K70) and the associated velocities (K72 ... K74).

If this command is sent in a program, the following set only takes effect when the homing run is completed. This command can only be cancelled by selecting manual mode IS00 = 0.

GO 0

Infinite moving

Direct:	GO V+y	positive direction
	GO V-y	negative direction

Via variable: GO V Hxx

Hxx = Index of variables with velocity value

The preceding sign of the value in Hxx determines the direction.

y = Velocity value [velocity unit]

Synchronism (electronic gearing)

In synchronous running the CDD3000 converts the incoming square pulses of a master encoder directly into a position reference and moves to that position under position control.

Activate synchronism:

GOSYN 1

Deactivate synchronism:

GOSYN 0

After activation of synchronism by the GOSYN 1 command, the sequence program is immediately resumed with the next set.

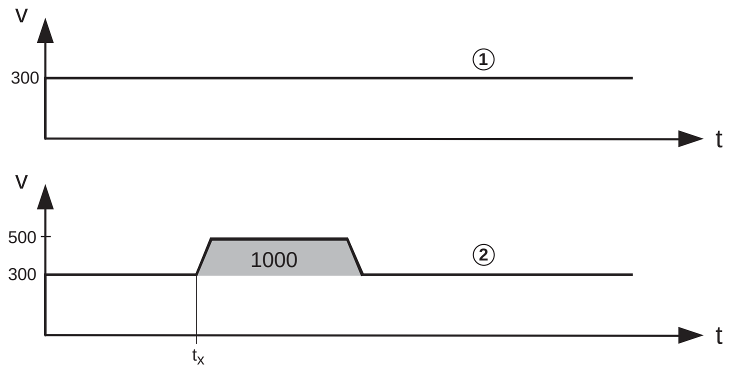
Master encoder

Command	Operand 1	Comments
SET	Hxx/H[Cxx] = EGEARSPEED	Read-out master encoder velocity in unit incr/ms. Regardless of whether engaged or disengaged
	Hxx/H[Cxx] = EGEARINC	Read-out master encoder increments (Incr.). Regardless of whether engaged or disengaged
	EGEARING = x/hxx/H[Cxx]	Set master encoder increments. Regardless of whether engaged or disengaged

Hxx = Variables index (0 ... 99)
Cxx = Numerator index (0 ... 99)
x = Comparison value (±2147483647)

Note: Synchronism is activated hard, without limiting the dynamic of the axle by ramps. Gentle coupling into a rotating master axle is not possible.

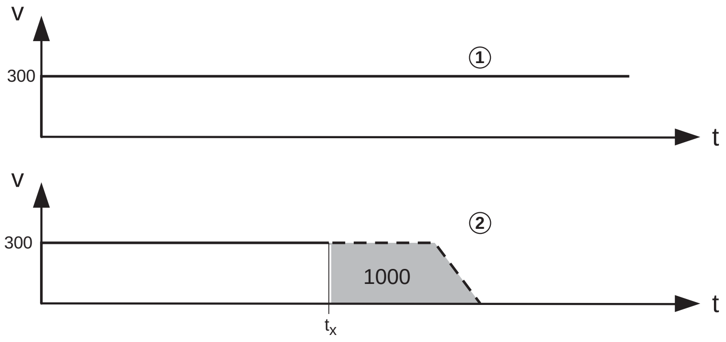
A GOR command (relative positioning) during synchronism results in an overlaid positioning.



(1) Master axle
(2) Slave axle

Figure 4.81 Relative positioning during synchronism. t_x= time of command GO R1000 V200

A GOA command (absolute positioning) during synchronism aborts the synchronism, the axle keeps running at the current process speed and carries out the requested absolute positioning, observing the preset ramps.



(1) Master axle
(2) Slave axle

Figure 4.82 *Absolute positioning during synchronism.* t_x*= time of command GO A1000 V200*

Owing to the syntax, a velocity (here: V200) must always be selected. It is ignored during positioning, however.

The **master encoder, numerator and denominator** parameters specify how many pulses are required for a motor revolution or to cover a certain distance (see “Master encoder/Encoder simulation” user screen).

Example: Synchronism in a printing machine

A CDD3000 as the master axle has an encoder simulation with 3072 increments and a mechanical gear with a transmission ratio of 15. A CDD3000 as the slave axle has a mechanical gear with a transmission ratio of 5.

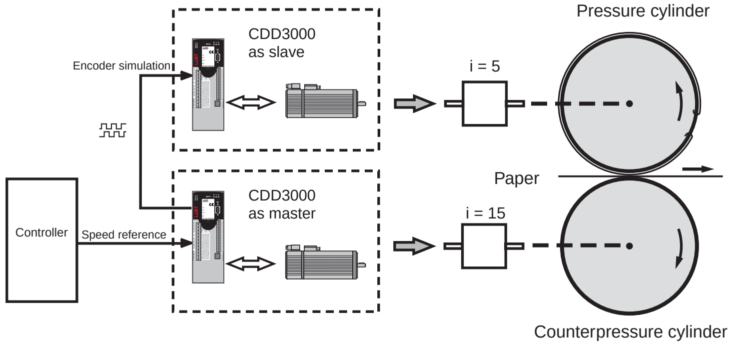


Figure 4.83 Example of a printing machine

The CDD3000 which drives the counterpressure cylinder works as the master. Its encoder simulation serves as the position reference for the CDD3000 which follows as the slave and drives the pressure cylinder. As a result, the movements of the counterpressure and pressure cylinders are synchronized.

Travel optimized positioning of an indexing table

The target position is specified in absolute terms and the positioning controller moves the axle in the direction in which the travel is shortest.

Note: This mode of positioning requires the indexing table application to have been selected on the “Standardization” tab.

Positioning with resumption (travel optimized)

Position direct / velocity direct
GORT x Vy

Position direct / velocity via variable
GORT x Hyy

Position via variable / velocity direct
GORT Hxx Vy

Position via variable / velocity via variable
GORT Hxx Hyy

Position via table / velocity direct
GOTRT Vy

Position via table / velocity via variable
GOTRT Hyy

Note: Standard positioning commands such as GO A Hxx Hyy can still be used. They do not operate in the absolute position system of the indexing table, however – no travel optimized response.

Positioning without resumption (travel optimized)

Position direct / velocity direct
GOWRT x Vy

Position direct / velocity via variable
GOWRT x Hyy

Position via variable / velocity direct
GOWRT Hxx Vy

Position via variable / velocity via variable
GOWRT Hxx Hyy

Position via table / velocity direct
GOWTRT Vy

Position via table / velocity via variable
GOWTRT Hyy

x	= Absolute position [travel unit]
Hxx	= Index of variables with position value
Hyy	= Index of variables with velocity
Vy	= Velocity value [velocity unit]

Braking

For normal braking with the programmed acceleration (parameters K15 to K24):

STOP B

For fast braking (e.g. emergency braking) with maximum acceleration (linear as per K19 or K20, including when sinusoidal acceleration mode is selected):

STOP M

Braking and shut-off of position control

Fast braking (velocity reference = 0) followed by position control shut-off (e.g. to set parameters for servocontroller):

STOP 0

When using STOP 0 in the sequence program: The power stage is automatically reactivated when automatic mode is terminated; that is, when manual mode (IS01) is selected.

Shutting off the control cuts power to the motor. This is not so easily permitted in all applications (e.g. lifting applications). **The user must ensure that the system is not damaged and no personal injury occurs!**

Restart position control by:

STOP B or
STOP M

Touchprobe commands

The CDD3000 has two fast touchprobe inputs (also termed Interrupt inputs) with which the current actual position can be stored and reused in the sequence program for:

Examples:

1. Trigger positioning with touchprobe (cutting to length)

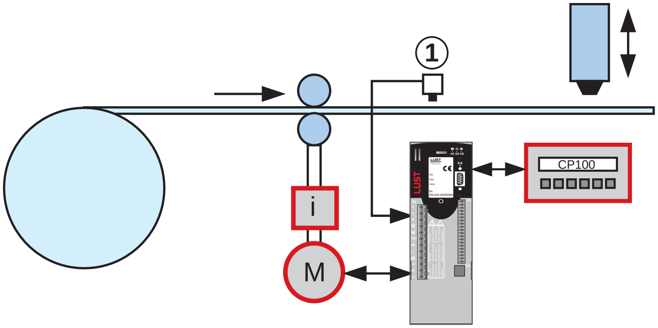


Figure 4.84 Trigger-specific advance. (1) Mark sensor

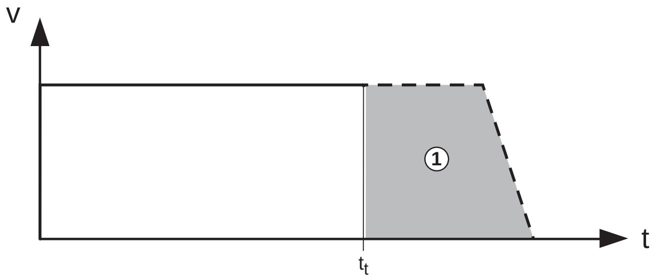


Figure 4.85 Trigger positioning. t_t = Trigger time. (1) Positioning travel

- The axle runs with a positioning command; synchronism is inactive.
- Touchprobe is activated (SET TP4 G1 F0)
- Wait for touchprobe signal (WAIT TP4).
- The trigger signal comes on the digital input IS04 and triggers saving of the actual position.
- The command GOA TP4 11 V30 interrupts the preceding positioning command. The new target position is TP4 + 11. It is approached maintaining the velocity 30 and incorporating the preset ramps.
- If no trigger signal has arrived when the command GO TP1R x Vy is being processed, and as a result no actual position is saved, an error is triggered and the sequence program aborts.

Example program:

```
%P00(TP Cutting to length)
N010 SET 0;                 current position:=0
N020 GO V30;                positioning job: constant velocity
N030 SET TP4 G1 F0;         activating touchprobe 4 (input IS04,
                            rising edge)
N040 WAIT TP4;              waiting for trigger: Touchprobe 4
N100 GOA TP4 11 V30;        positioning job:(trigger position
                            TP4 + 11), (velocity 30)
N110 WAIT ST;               waiting for standstill
                            (standstill window: 411-SPD_0)
N120 SET OS02=1;            activating OS02: cutting
N130 JMP N020;              go back
END
```

2. Mark synchronization

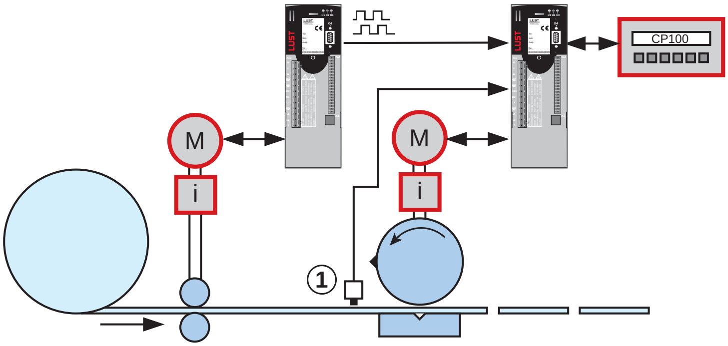


Figure 4.86 Mark synchronization

```
Example program:
%P00(mark synchronization)
N004 SET 0;                  current position:=0
N005 GOSYN1;                 engage electronic gearing
N010 SET TP3=0;              position of touchprobe 3 = 0
N020 SET TP4 G1 F0;          activating touchprobe 4 (input IS04,
                             rising edge)
N040 WAIT TP4;               waiting for trigger: Touchprobe 4
N100 GO R D TP3-TP4 20 V30;positioning job (TP3 - TP4 + 20),
                             (velocity 30)
N410 JMP N020;               go back
END
```

3. Synchronization of conveyor belts

This mode of positioning can be used, for example, to synchronize two conveyor belts which are both subject to slip.

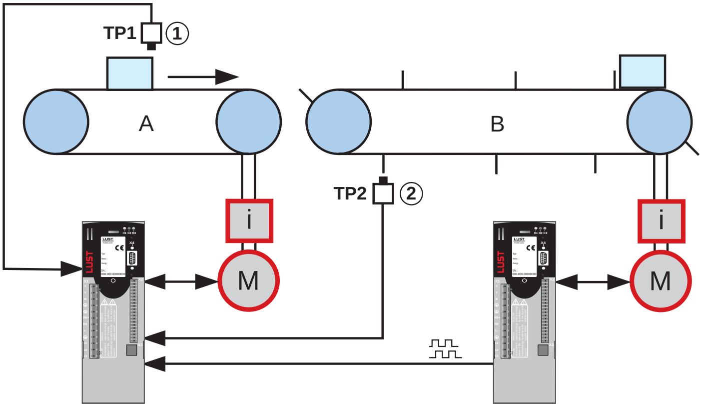


Figure 4.87 Synchronization of conveyor belts (1) Mark sensor, (2) Fan sensor

The master CDD3000 is operated in speed-controlled mode and passes its encoder simuation on to the slave CDD3000. On the slave, synchronism is active. It stores the actual positions of both touchprobes. The difference TP4 - TP3 should be x. If it is not, it is adjusted by a relative positioning of belt A.
Relative positioning travel = x - (TP4 - TP3)

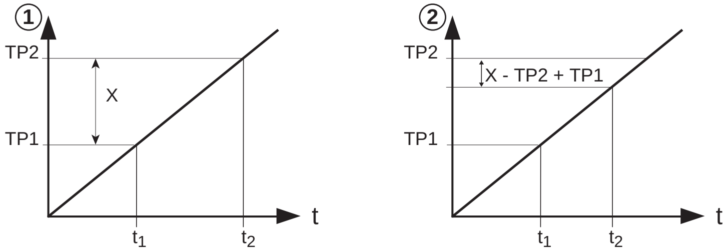


Figure 4.88 (1): Optimum time of arrival for both touchprobes.
(2): Touchprobe 2 arrives too early

The command GORD TP3-TP4 20 V30 shifts the synchronous position of belt A and thus restores the specified reference state.

```
%P00 (Slip compensation)
N010 SET 0;                  current position:=0
N020 GOSYN1;                 engage electronic gearing
N030 SET TP4 G1 F0;          activating touchprobe 4 (input IS04,
                             rising edge)
N040 SET TP3 G1 F0;          activating touchprobe 4 (input IS03,
                             rising edge)
N050 WAIT TP4;               waiting for trigger: Touchprobe 4
N050 WAIT TP3;               waiting for trigger: Touchprobe 3
N100 GO R D TP3-TP4 20 V30;positioning job (TP3 - TP4 + 20),
                             (velocity 30)
N110 JMP N030
END
```

4. Transmitting touchprobe position via CAN

As soon as a touchprobe position has been stored in parameter (793-TPPOS) it can be transmitted via a TX-PDO.

For this the digital input IS03 or IS04 must be entered as an event for transmision in parameters (148-TXEV1; 149-TXEV2; 628-TXEV3; 629-TXEV4). In the corresponding TX-PDOs index 3 of the parameter (793-TPPOS) is mapped for touchprobe 3 and index 4 for touchprobe 4. With the state change of the touchprobe input the assigned TX-PDO is sent.

4. Wait commands and saving

Time

With these commands you can implement a delay by a specific time in milliseconds. When this time expires the program is resumed with the next set.

Direct: WAIT b
Via variable: WAIT Hxx

b = Waiting time in [ms] (1 ... 65535)
Hxx = Index of variables with waiting time

Axle status

The program is resumed when the following condition is met.

PW reached: WAIT PW Actual position in position window 1)

Axle stopped: WAIT ST Reference position = target position 2)

1) Positioning complete, "Axle in position" output is set

2) Positioning arithmetically complete

Input status

The program is only resumed when the relevant input shows the expected status (High or Low level).
WAIT (Ippi = 0)
WAIT (Ippi = 1)

Ippi = Input (IE00 ... IE07, ISD00 ... ISD04)

Saving

The backing-up of the sequence program (and parameters and process data) to the Flash-EPROM can also be triggered by the program itself. The backup operation can only be performed with the axle at a standstill, otherwise error 35 "Impermissible command during axle movement" will be signaled. It takes approx. 6 seconds until the next command is executed.

Direct: SAVE via parameter SET PARA [150] = 1

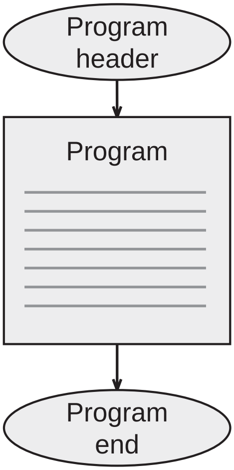
This command can also be used to back up the files without a PC, for example for a teach-in operation (adoption of table positions).

Important: The complete save operation takes about 5 seconds. If the device is switched off during that time, the save operation is interrupted and the device has an inconsistent paramter set. At the next power-on the error E-EEP will be signalled. The device parameters must then be reset.

4.10.8 Sequence programs

Program structure

A program is divided into a header, the actual program part, and the program end.



The **program header** comprises one line containing the program number and, usually, a program name. The name may consist of a maximum of 20 characters.

```
%Pyy (name)
e.g. : %P00 (test program)
```

The lines of the actual **program part** are designated program sets. The maximum number of sets which can be stored in the servocontroller is limited to 700 (in the range N0 ... N999).

Each program set consists of a line number, the command and one to two operands:

```
N050 WAIT ST
```

If you want to insert a commentary, separate it off by means of a semicolon:

```
N050 WAIT ST    ; wait for axle to stop
```

At the **end of the program** the following line (without line number) always comes:

```
END
```

Note:

- It is recommended to number the program sets in steps of ten (N010, N020, ...), to enable additional lines to be added more easily.
- Set blanks between the set number, command and operand (not tabulators).

From one program (main program = HP) other programs (subroutines = UP) can also be called up. The maximum nesting depth for subroutines is 10. Subroutines are structured and treated just the same as main programs.

The main advantages of using subroutines lie in:

- the clearly laid-out program structure and
- the swapping-out of multiply required program parts.

4.10.9 Program examples

The numerical values for travel, velocity and acceleration relate to the programming units defined on the Standardizationtab.

Example 1: First commissioning

(example pre-installed after DRIVEMANAGER setup)

Task: Two positions are to be approached dependent on the digital control input ISD03:

```
%P00 (Commissioning)
```

Important: All the following default values require a resolution of 1 below the standardizations! When the program starts a homing run is always executed according to the type selected under Settings. So first check the functioning of the reference cam.

```
;initialization of variables
N010 SET H10=5000;          process speed in inc/1ms
N020 SET H11=655360;        absolute position 1 in inc. = 10 motor
                            revolutions
N030 SET H12=0;             absolute position 2 in inc.
N040 SET H20=100;           waiting time between positioning
                            operations in ms

N100 GO 0;                  trigger homing mode
N110 WAIT (IS03=1);         wait until input IS03=1
N120 GO W A H11 H10;        approach pos. 1 from variable H11
N130 WAIT H20;              waiting time
N140 WAIT (IS03=0);         wait until input IS03=0
N150 GO W A H12 H10;        approach pos. 2 from variable H12
N160 WAIT H20;              waiting time
N200 JMP N110;              close endless loop
END
```

Example 2: Approaching positions absolutely

The four positions are to be approached absolutely at velocity v=50 and the program is then to wait 1 s in each case. For the movement back to the starting position three times the velocity is to be applied.

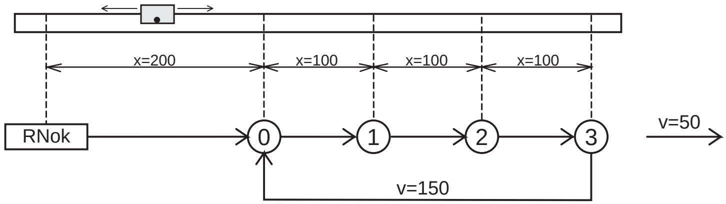


Figure 4.89 Approaching positions

Positions and velocities are specified directly as values; the acceleration is set according to the machine parameters.

```
%P01   (example 1)
N010   GO 0;                homing mode 1)
N030   GO A200 V50;         approach starting position

N040   WAIT ST;             wait for axle to
                            stop
N050   WAIT 1000;           wait 1 s
N060   GOW A300 V50;        approach position 1
                            and wait for axle to
                            stop
N070   WAIT 1000;
N080   GOW A400 V50;        position 2
N090   WAIT 1000;
N100   GOW A500 V50;        position 3
N110   WAIT 1000;
N120   GOW A200 V150;       back to starting
                            position
N130   JMP N050;
END
```

1) Wait command is not necessary, as program is only resumed on completion of homing run

Example 3: Relative positioning

In example 2 the axle is always advanced by the same distance, so a solution involving relative positioning is appropriate. A numerator contains the latest position at any point.

```
%P02    (example  2)
N010    GO 0;                   homing mode
N030    GOW A200 V50;           approach starting position
                                and wait
N040    SET C00=0;              set numerator =0
N050    WAIT 1000;
N060    GOW R100 V50;           approach next position

N070    SET C00+1;              run position counter

N080    WAIT 1000;
N090    JMP (C00<3) N060;       position 3 not
                                yet reached
N100    GOW A200 V150;          back to starting
                                position
N110    JMP N040
END
```

The solution is even more simple and elegant if the numerator is omitted and the comparison is made with the reference position (SP):

```
%P02    (example  2)
N010    GO 0;                   homing mode
N030    GOW A200 V50;           approach starting position
                                and wait
N040    WAIT 1000;
N050    GOW R100 V50;           approach next position

N060    WAIT 1000;
N070    JMP (SP<500) N050;      position 3 not
                                yet reached 1)
N080    GOW A200 V150;          back to starting
                                position
N090    JMP N040
END
```

1)The comparison is made with the reference position because a comparison against the actual position is problematical. The condition is not met if this precise increment is not attained.

Example 4:
Modular programming, actuation via field bus

Task: Over field bus various functions, such as homing mode, absolute positioning and relative positioning, are requested by setting flags and processed autonomously by the axle. The parameters of the individual functions are preset by way of variables.

```
%P00 (example 4)
; sequence program for activation via bus system by access to
;variables (728-POVAR) and flags (729-POMER)

; variables used:
; H50  Home position [increments]
; H51  Absolute position [increments]
; H52  Velocity for absolute positioning [increments/1ms]
; H61  Relative position [increments]
; H62  Velocity for relative positioning [increments/1ms]
; H70  Velocity for jog mode [increments/1ms]

;initialization
N105 SET OV=0;             0 = disable override
N110 SET M80=0;            initialize flag
N111 SET M81=0
N112 SET M82=0
N113 SET M83=0
N114 SET M84=0
N115 SET M85=0

N150 JMP(M80=1)P01;        branch to subroutine 1 (find home)
N160 JMP(M81=1)P02;        branch to subroutine 2 (GO Home)
N170 JMP(M82=1)P03;        branch to subroutine 3 (absolute
                           position)
N180 JMP (M83=1) P04;      branch to subroutine 4 (relative
                           position)
N190 JMP (M84=1) P05;      branch to subroutine 5 (jog)
N200 JMP (M85=1) P06;      branch to subroutine 6 (stop)
N300 JMP N150;             go back
END

%P01 (find home)
N010 WAIT ST
N020 GO 0                  homing mode
N030 SET M80=0             reset start flag
END

%P02 (go home)
N010 WAIT ST
N020 GO A H50 H52;         approach zero
N030 JMP (M85=1) P06;      stop axle
N040 JMP (ST=0) N030
N050 SET M81=0             reset start flag
ND

%P03 (absolute pos.)
N010 WAIT ST
N020 GO A H51 H52;         positioning
N030 JMP (M85=1) P06;      stop axle
N040 JMP (ST=0) N030
N050 SET M82=0;
END
```

```
%P04 (relative pos.)
N010 WAIT ST
N020 GO R H61 H62;          positioning
N030 JMP (M85=1) P06;       stop axle
N040 JMP (ST=0) N030
N050 SET M83=0;             reset start flag
END

%P05 (jog)
N010 STOP B;                stop axle
N020 WAIT ST;               wait for axle to stop
N030 GO V H70;              jog
N040 SET M84=0;             reset start flag
END

%P06 (Stop)
N010 STOP B;                stop axle
N020 WAIT ST;               wait for axle to stop
N030 SET M85=0;             reset start flag
END
```

Example 5:
Application-specific sequence of a homing run

Regardless of the selectable homing mode types, a custom sequence program can also be used for reference.

Here a homing run is shown which eliminates the need for sensors and the axle is referenced by approaching a hardware stop.

In this it should be noted that, when approaching block, the torque set under Limits is exerted by the drive. This homing run is not reproducible to an increment's accuracy.

In the example a homing movement in negative direction is executed.

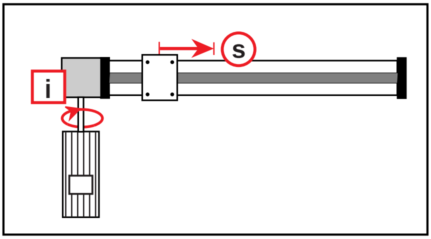
```
%P01 (homing mode)
N010 SET H10=-100;          init homing mode speed
N011 SET H12=20;            clearance travel

N020 SET PARA[805]=50;      write parameter 805-SCALE=50%,
                            ; reduce torque limitation to 50%
N025 SET 0;                 adopt current position as reference
                            position

N030 GO V H10;              infinite positioning with
                            velocity H10
N031 WAIT 300;              wait for axle to move
N035 SET H11=IP;            copy current actual position
                            to variable
N040 WAIT 50;               waiting time
N050 JMP (IP<H11) N035;     check whether actual position
                            continues to rise, blockage not yet
                            reached

N060 STOP B;                blockage reached, stop axle
N070 GO W R H12 H10;        clear axle by distance H12 with
                            velocity H10

N080 SET 0;                 set final reference position
N090 SET OS01=1;            set output for completed
                            homing mode
N095 SET M99=1;             set flag for completed
                            homing mode
N100 SET PARA[805]=100;     reset torque
                            to 100%
END
```

4.10.10 Calculation aids

Example for determining the standardization factors for travel, velocity and acceleration

To be able to specify the positions of a linear application in a unit of length, for example, the position controller must be told the context. This is done on the **Units** tab.

Example: Linear axle with toothed belt drive



Motor:	1 U_{motor} ⇔ 65536 increments (applies regardless of motor and encoder type)
Gearing:	i = 4
Linear transmission:	1 U_{axle} ⇔ 192 mm

In one motor revolution the carriage covers

$$s = \frac{\text{Pinion circumference}}{\text{Gear transmission ratio}} = \frac{192\,mm}{(i = 4)} = 48\,mm$$

.

The following translations are required:

	Desired programming unit	Internal unit
Travel:	mm	Incr.
Velocity:	m/min	Incr./ ms
Acceleration:	m/s²	Incr./ ms²

Travel resolution

General rule:

$$\text{Programming unit} = \frac{\text{Numerator}}{\text{Denominator}} \cdot \text{Incr.}$$

Here:

$$1U = 48mm = 65536\,\text{Incr.}$$

Example - requirement is default in programming unit mm:

$$1\text{ mm} = \frac{65536}{48}\ \text{Incr.}$$

The ratio of numerator to denominator should be chosen as small as possible. Reduction produces the following:

$$\frac{\text{Numerator}}{\text{Denominator}} = \frac{65536/16}{46/16} = \frac{4096}{3}$$

Result:

$$\text{Numerator} = 4096 \quad \text{Denominator} = 3$$

➢ The positions can then be specified in mm, i.e. entered on the "Standardization" tab.

Velocity resolution

General rule:

$$\text{Programming unit} = \text{Velocity} \cdot \frac{\text{Incr.}}{\text{ms}} \qquad \text{where: } 1mm = \frac{65536\,\text{Incr.}}{48}$$

Example – requirement is input in of desired unit 0.01 m/s:

$$\frac{10mm}{s} = \frac{10 \cdot \frac{65536\,\text{Incr.}}{48}}{s}$$

Convert time units into ms (1 s = 1000 · 1 ms):

$$\frac{10mm}{s} = \frac{10 \cdot 65536\,\text{Incr.}}{48 \cdot (1000 \cdot 1ms)}$$

The internal unit is isolated, the factor represents the velocity standardization factor.

$$\frac{10mm}{s} = \underbrace{\frac{10 \cdot 65536}{48 \cdot 1000}} \cdot \frac{\text{Incr.}}{1ms}$$

Result: Velocity = 13.653

➢ The velocity can then be entered on the "Standardization" tab in 0.01 m/s.

Acceleration resolution

General rule:

$$\text{Programming unit} = \text{Accel.} \cdot \frac{\text{Incr.}}{\text{ms}}$$

Example - requirement is default in unit 0.1 m/s²:
Convert time units into (5 ms)²
(1 s² = 200 · 5 ms · 200 · 5 ms):

$$\frac{100\text{mm}}{\text{s}^2} = \frac{100 \cdot 65536\text{Incr.}}{48 \cdot (1000 \cdot 1\text{ms})(1000 \cdot 1\text{ms})}$$

The internal unit is isolated, the factor represents the acceleration standardization factor.

$$\frac{100\text{mm}}{\text{s}^2} = \underbrace{\frac{100 \cdot 65536}{48 \cdot 1000 \cdot 1000}} \cdot \frac{\text{Incr.}}{\text{ms}^2}$$

Result: Acceleration = 0.137

The acceleration can then be entered on the “Standardization” tab in 0.1 m/s².

Notes on use of linear encoder systems:

The CDD3000 drive system always makes a fixed link between the connected encoder system and the motor. The important factor is that the drive system scales all encoder systems to 16 bits per motor revolution. That means, regardless of the preset lines per revolution and resolution of the position encoder, one motor revolution is always represented as 65536 increments.

In drive systems in which the encoder is mounted on the shaft of a rotating motor, the only information required for this is how many increments or sin/cos oscillations per revolution occur. Internally, and when standardization to increments, this value is then automatically scaled to 65536 increments per motor revolution.

In rotational drive systems in which a second encoder system is deployed for position control, the following points need to be considered:

A resolver is always used as the first encoder, attached to the motor shaft accordingly.

A rotary encoder or a linear encoder system can be used as the second encoder.

To enable the position control to work correctly, the correlation between the preset lines per motor revolution and the actual number of increments per motor revolution must be set.

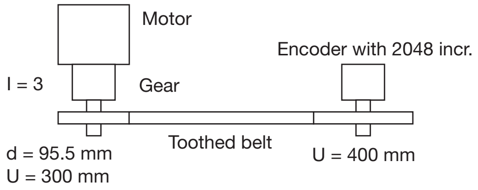
The lines per motor revolution are adjustable in the range from 1 to 8190 increments. How many increments per motor revolution are actually counted depends on the mechanical design of the application.

It is always advantageous if the preset lines per revolution match the actual lines per revolution as closely as possible. The better the match, the better will be the quality of speed pre-control.

The actual mechanical correlations should then be taken into account in standardization of the units for travel, velocity and acceleration.

The following two examples are provided to aid understanding:

1. Example: Optical encoder



Encoder configuration:

Lines per motor revolution = 2048 *300mm / 400mm / 3 = 512 incr. on encoder

The CDD3000 servocontroller automatically represents this internally as 2^{16} increments = 65536 incr.

Standardization of units:

Travel: Ratio incr. / travel unit -> 1 revolution on motor = 100mm advance -> 65536 incr.

1.1 Travel standardization configuration

65536 incr. correspond to 100mm advance

1.2 Velocity configuration

Desired unit mm/s

Internal unit is always incr./ms

-> Incr./ms = k * mm/s k = Incr./ms * s/mm

k = Incr./ms * 1000ms/65536 Incr. Representation without unit

k = 1.526

1.3 Acceleration configuration

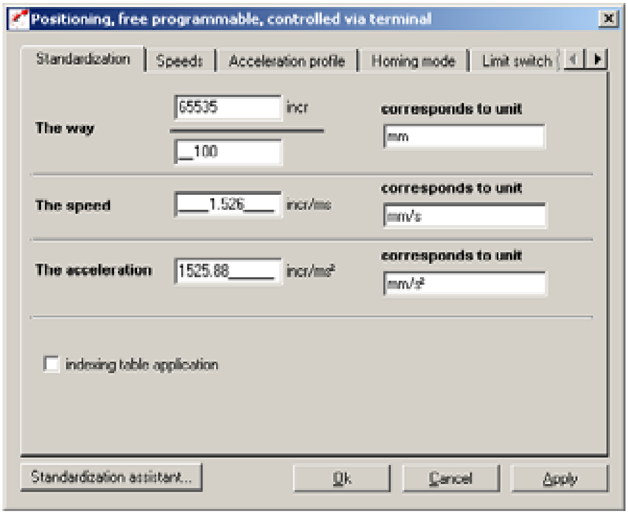
Desired unit mm/s²

Internal unit is always incr./ms²

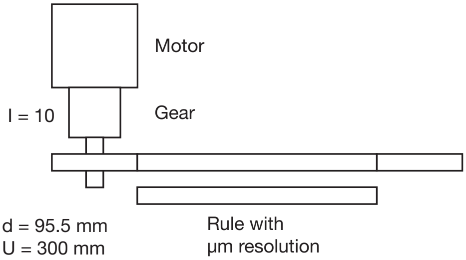
-> Incr./ms² = x * mm/s² x = Incr./ms² * s²/mm

x = Incr./ms² * (1000ms)²/65536 Incr. Representation without unit

x = 1525.88



2. Example: Linear scale



Encoder configuration:

Lines per motor revolution = 30mm -> 30000µm

Maximum configurable number of lines = 8190 inkr. ! This must be allowed for in travel standardization.

The CDD3000 servocontroller represents one motor revolution internally as 2^{16} increments = 65536 incr.

Standardization of units:

Travel: Ratio incr. / travel unit -> 1 revolution on motor = 30000 µm advance -> 65536 incr.

2.1 Travel standardization configuration

Correction for difference between preset number of lines and increments actually delivered by encoder:

65536 incr. * 30000 / 8190 = 240058 incr. corresponding to 30000 µm

Abbreviate fraction to representable parameter values:

240058 / 30000 = 16556 / 2069 corresponding to best possible adaptation with low rounding error

2.2 Velocity configuration

Desired unit mm/s

Internal unit is always incr./ms

-> Incr./ms = k * mm/s k = Incr./ms * s/mm

k = Incr./ms * 1000 ms/240058 incr. Representation without unit

k = 0.0042

2.3 Acceleration configuration

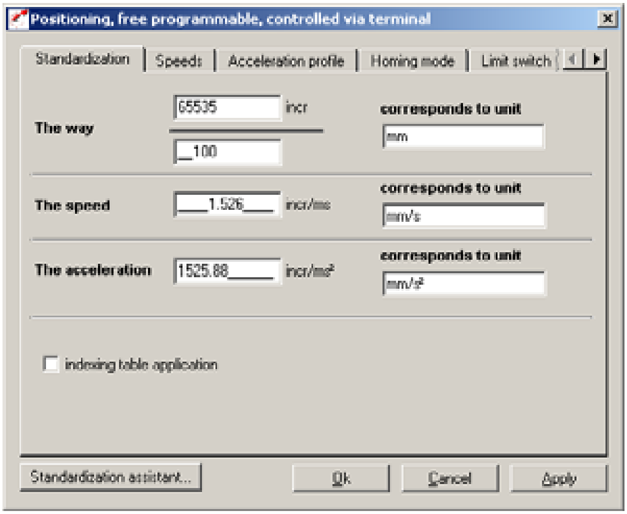
Desired unit mm/s²

Internal unit is always incr./ms²

-> $Incr./ms^2 = x * mm/s^2$ $x = Incr./ms^2 * s^2/mm$

$x = Incr./ms^2 * (1000ms)^2/240058$ incr.   Representation without unit

$x = 4.166$



5 Software functions

5.1 Inputs

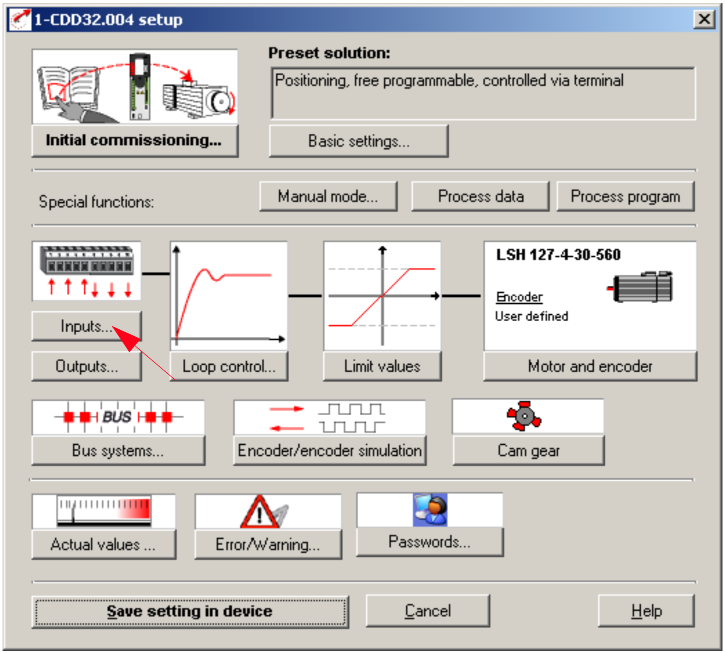


Figure 5.1 User screen: Inputs

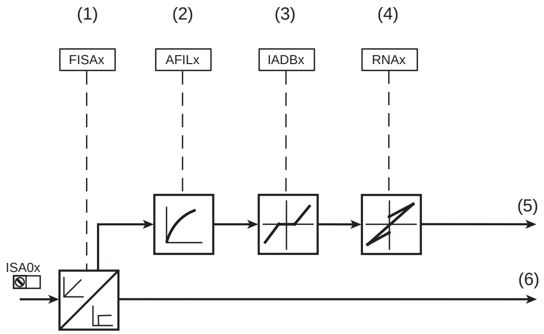
The CDD3000 servocontroller includes:

- Two analog inputs (ISA0, ISA1)
- Six digital inputs (ENPO, IS00 to IS04)
- Two virtual (digital) inputs (FIF0, FIF1)
- Optionally a further eight digital inputs (IE00 to IE 07).

Each input of the servocontroller has a parameter which assigns it a function. These parameters are termed function selectors, and are located together with the respective input options in the “Inputs” setup screen in the DRIVEMANAGER (from V 3.0), see 5.1.

5.1.1 Analog inputs

Function	Effect
• Definition of the internal processing of the analog input signals	• Conditioning and filtering of the analog reference input or use as a digital input



(1) Analog reference input or use as a digital input
(2) Input filter for fault isolation from 0 to 64 ms
(3) Backlash function for fault isolation around zero
(4) Standardization of the analog input
(5) Analog value
(6) Digital value
x Number of the input (0/1)

Figure 5.2 Function block for adaptation of the analog inputs

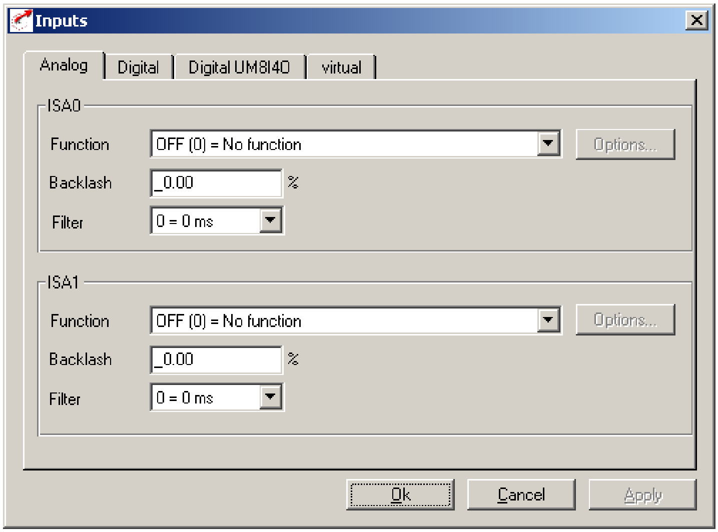


Figure 5.3 Analog Inputs tab

DM	Meaning	Value range	Unit	Parameter
Function	Assignment of a function for the relevant analog input	see table “Settings of analog inputs”	/	180_FISA0 181_FISA1 (_IN)
Backlash	Backlash function for fault isolation around zero. See figures 5.4 and 5.5	0 - 90	%	192_IADB0 193_IADB1 (_IN)
Filter	Input filter for fault isolation	0 - 64 see 5.2	ms	188_AFIL0 189_AFIL1

Table 5.1 Analog inputs - basic settings

Configuration options, ISA0 (10 V):

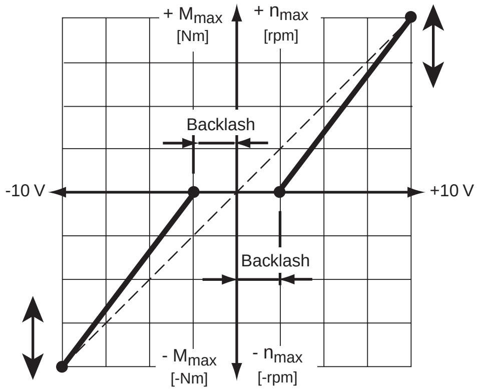


Figure 5.4 Configuration options, ISA0

Configuration options, ISA1 (0 - 10 V):

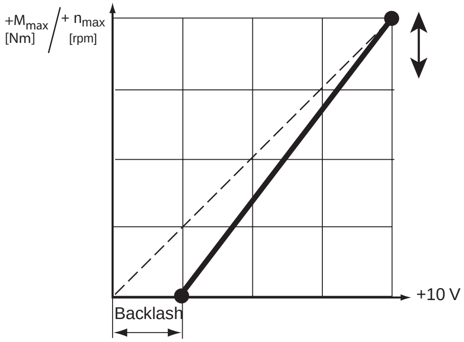


Figure 5.5 Configuration options, ISA1

Filter setting:

Setting	Filter:
0	0 ms
1	2 ms
2	4 ms
3	8 ms
4	16 ms
5	32 ms
6	64 ms

Table 5.2 Filter time constants, analog inputs

Settings of the CDD3000 analog inputs

Bus	KP/DM	Function	IS00	IS01	IS02	IS03	IS04	ISA00	ISA01	IF00	IF01	IE00-07
45	ANALG	Analog reference input: ISA0 = ±10 V and ISA1 = 0 to 10 V	-	-	-	-	-	X	✔	-	-	-
46	SPEED	Direct input for analog speed references ±10 V: Sampling cycle 8 kHz	-	-	-	-	-	✔	-	-	-	-
47	GEARR	No function	-	-	-	-	-	✔	-	-	-	-
48	SCALE	Torque scaling 0-100%	-	-	-	-	-	-	✔	-	-	-
49	OVR1	Analog input ISA00 usable in sequence program	-	-	-	-	-	✔	-	-	-	-
50	OVR2	Analog input ISA00 usable in sequence program	-	-	-	-	-	✔	✔	-	-	-
51	TORQUE	quick torque reference channel	-	-	-		-	✔	-	-	-	-

✔: Input usable
X: Factory setting
- Input not usable

Table 5.3 Settings of the CDD3000 analog inputs

Note: The analog inputs can also be assigned digital functions.
- Functions of the digital inputs, see section 5.1.2
- Isolation of analog and digital inputs, see section 2.6.

Functions/options of the CDD3000 analog inputs

(45) ANALG

Preset solution: Torque/speed control, ±10 V reference.

Analog reference input for speed or torque references, sampling cycle 1 kHz (1 ms)

Resolution, ISA0 (±10 V): 12-bit
ISA1 (0 to 10 V): 10-bit

That is to say: 1 bit corresponds to approx. 4.88 mV or at 3000 rpm approx. 1.465 rpm (ISA0).

(46) SPEED

Preset solution: Speed control with external position control

Direct input for analog references bypassing the reference structure, sampling cycle 8 kHz (125 µs); applies only to ISA0.

Option for setting ANALG and SPEED

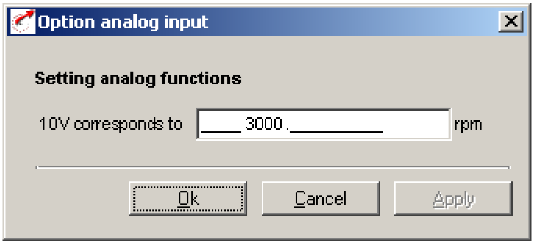
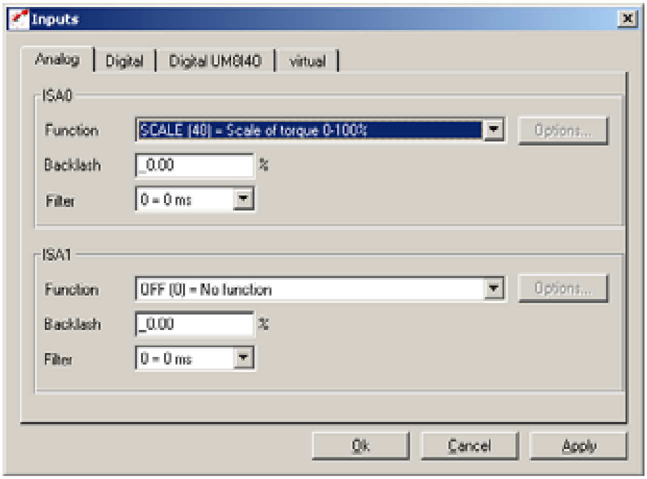


Figure 5.6 Standardization of the analog inputs

(47) No function

(48) SCALE

Torque limitation (online) 0-100% of the preset maximum torque (tab: Limit values and tolerances)



Important: Also effective for emergency stop/quick stop!

Note: In operation via field bus in parameter 805_SCALE the maximum torque (0 ... 100%) can be written as a number value (no analog signal sent).

---

(49) / (50) OVR1 and OVR2

Preset solution: Positioning, free programmable

Override – evaluation of analog inputs

Channels ISA0 and ISA1 are usable in the sequence program.
There are 2 functions which can be used in parallel:

1. Override velocity standardization
   The velocity override is entered via analog channel ISA1, provided ISA1 = OVR2 is set. The unipolar analog value 0 to 10 V corresponds to a percentage velocity change of 0 - 150%. This value is written in display parameter POOVR (format: usign8) and to the variable OV, which is generally usable in the sequence program.
   The override function must be explicitly activated in the sequence program with the command SET OV = 1.
2. Use of both analog inputs in the sequence program
   The analog inputs ISA0 and ISA1 are each usable in the sequence program, provided ISA0 = OVR1 and ISA1 = OVR2 are set. The analog values are written to the corresponding variables (format: usign8) OV1 (-10 V to +10 V = 800 - 7FF Hex) and OV2 (0 V to +10 V = 0 – 3FF Hex).

Note: For more information on use of the override function in the I-MOTION sequence program, see section 4.10.7 “Command set”

---

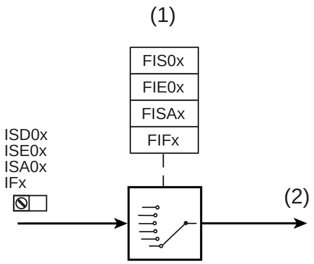
(51) Torque
quick torque reference channel

The TORQUE (51) setting can be selected only at the analog input ISA00. Since this setting relates to the control structure, the sampling cycle of the torque reference is set either to 8 kHz (125 µs) or to 16 kHz (62,5 µs), depending on the power stage switching frequency.

Important: For this function, backlash and filter time are deactivated.

5.1.2 Digital inputs

Function	Effect
• The function selectors determine the function of the digital inputs.	• Free function assignment of the digital inputs



(1)Selection of function of digital input
(2)Digital value

Figure 5.7 Function block for adaptation of the digital inputs

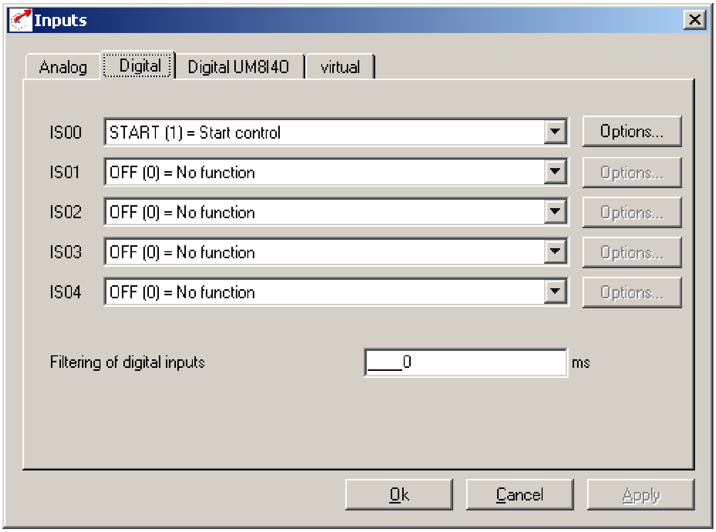


Figure 5.8 Digital Inputs tab

DM	Meaning	Value range	Unit	Parameter
IS00	Function selector Standard input ISD00	see Table 5.5	/	210_FIS00 (_IN)
IS01	Function selector Standard input ISD01	see Table 5.5	/	211_FIS01 (_IN)
IS02	Function selector Standard input ISD02	see Table 5.5	/	212_FIS02 (_IN)
IS03	Function selector Standard input ISD03	see Table 5.5	/	213_FIS03 (_IN)
IS04	Function selector Standard input ISD04	see Table 5.5	/	214_FIS04 (_IN)

Table 5.4 Digital inputs - basic settings

Settings of the CDD3000 digital inputs:

Bus	KP/DM	Function	IS00	IS01	IS02	IS03	IS04	IF00	IF01	IE00-07
0	OFF	Input off	✔	✔	X	X	X	X	X	X
1	START	Start control	X	✔	✔	✔	✔	✔	✔	✔
2	INV	Reference is inverted, i.e. direction reversed	✔	X	✔	✔	✔	✔	✔	✔
3	/STOP	/Quick stop: Stop ramp is executed. Attention: Signal is Low-Active	✔	✔	✔	✔	✔	✔	✔	✔
4	ADD1	Offset for reference selector 1 (RSSL1): Reference selector is advanced by the value in parameter 289 SADD1.	✔	✔	✔	✔	✔	✔	✔	✔
5	ADD2	Offset for reference selector 2 (RSSL2): Reference selector is advanced by the value in parameter 290 SADD2.	✔	✔	✔	✔	✔	✔	✔	✔
6	TB0	Speed and position table, index 0 binary driving set selection in positioning with fixed positions, bit 0	✔	✔	✔	✔	✔	✔	✔	✔
7	TB1	Speed and position table, index 1	✔	✔	✔	✔	✔	✔	✔	✔
8	TB2	Speed and position table, index 2	✔	✔	✔	✔	✔	✔	✔	✔
9	TB3	Speed and position table, index 3	✔	✔	✔	✔	✔	✔	✔	✔
10	TB4	Speed and position table, index 4	✔	✔	✔	✔	✔	✔	✔	✔
11	PGM0	Selection of sequence program, index 0	✔	✔	✔	✔	✔	✔	✔	✔
12	PGM1	Selection of sequence program, index 1	✔	✔	✔	✔	✔	✔	✔	✔
13	PGM2	Selection of sequence program, index 2	✔	✔	✔	✔	✔	✔	✔	✔
14	PGM3	Selection of sequence program, index 3	✔	✔	✔	✔	✔	✔	✔	✔
15	PGM4	Selection of sequence program, index 4	✔	✔	✔	✔	✔	✔	✔	✔
16	PGM5	Selection of sequence program, index 5	✔	✔	✔	✔	✔	✔	✔	✔
17	PGM6	Selection of sequence program, index 6	✔	✔	✔	✔	✔	✔	✔	✔
18	PGM7	Selection of sequence program, index 7	✔	✔	✔	✔	✔	✔	✔	✔

✔: Input usable
X: Factory setting
- Input not usable

Table 5.5 Settings of the CDD3000 digital inputs

Bus	KP/DM	Function	IS00	IS01	IS02	IS03	IS04	IF00	IF01	IE00-07
19	OMRUN	No function	✔	✔	✔	✔	✔	✔	✔	✔
20	/LCW	Limit switch evaluation right: Can be released in manual mode at left. Attention: Low-Active	✔	✔	✔	✔	✔	-	-	✔
21	/ LCCW	Limit switch evaluation left: Can be released in manual mode at right. Attention: Low-Active	✔	✔	✔	✔	✔	-	-	✔
22	E-EXT	External error: Error messages from external devices produce an error message with response as defined in parameter 524 R-EXT.	✔	✔	✔	✔	✔	-	-	✔
23	TIPP	Jog, positive direction: In manual mode the axle can be moved at slow or quick jog speed.	✔	✔	✔	✔	✔	-	-	✔
24	TIPM	Jog, negative direction: In manual mode the axle can be moved at slow or quick jog speed.	✔	✔	✔	✔	✔	-	-	✔
25	RCUP	No function	✔	✔	✔	✔	✔	-	-	✔
26	RCDN	No function	✔	✔	✔	✔	✔	-	-	✔
27	TBEN	Enable table position: Transfer the binary code and run the relevant driving set	✔	✔	✔	✔	✔	-	-	✔
28	GO	Start homing mode/sequence: Positioning, free programmable: Start the sequence program or in manual mode start homing	✔	✔	✔	✔	✔			✔
29	AUTO	Automatic mode: Positioning, free programmable	✔	✔	✔	✔	✔	-	-	✔
30	FEHLD	Feed hold: The ongoing positioning operation is interrupted and resumed following resetting.	✔	✔	✔	✔	✔	-	-	✔
31	RIHLD	Update: The sequence program is interrupted and the ongoing positioning operation is completed.	✔	✔	✔	✔	✔	-	-	✔
32	OPTN1	Usable by module at slot 1	✔	✔	✔	✔	✔	-	-	✔
33	OPTN2	Usable by module at slot 2	✔	✔	✔	✔	✔	-	-	✔
34	POMOD	Digital input usable in sequence program in positioning, free programmable	✔	✔	✔	✔	✔	-	-	✔
35	RSERR	Reset error: Error messages are reset if the error is no longer present.	✔	✔	✔	✔	✔	-	-	✔
36	ENCAM	Activate cam gear function	✔	✔	✔	✔	✔	-	-	✔
37	USER0	Input can be used by modified software	✔	✔	✔	✔	✔	-	-	✔
38	USER1	Input can be used by modified software	✔	✔	✔	✔	✔	-	-	✔
39	/NPG1	Encoder simulation with G1 encoder: Output of (simulated) zero pulse suppression	✔	✔	✔	✔	✔	-	-	✔

✔: Input usable
X: Factory setting
- Input not usable

Table 5.5 Settings of the CDD3000 digital inputs

Bus	KP/DM	Function	IS00	IS01	IS02	IS03	IS04	IF00	IF01	IE00-07
40	LREG	Activate position controller in speed control	✔	✔	✔	✔	✔	-	-	✔
41	ENC	HTL master encoder: Input for evaluation of a 24 V pulse generator with lines per revolution 2^n (n = 5 to 14)	-	-	-	✔	✔	-	-	-
42	RECAM	Evaluation of a reference cam for zero determination in positioning	-	-	-	-	✔	-	-	-
43	TP3	Touchprobe of input ISD03 active	-	-	-	✔	-✔	-	-	-
44	TP4	Touchprobe of input ISD04 active	-	-	-	-	✔	-	-	-

✔: Input usable
X: Factory setting
- Input not usable

Table 5.5 Settings of the CDD3000 digital inputs

Functions/options of the CDD3000 digital inputs

(0) OFF

Input is without function/disabled.
High level at this input is without effect.

(1) START

Start control with preset reference (condition: Input ENPO at high level)

Option for setting START

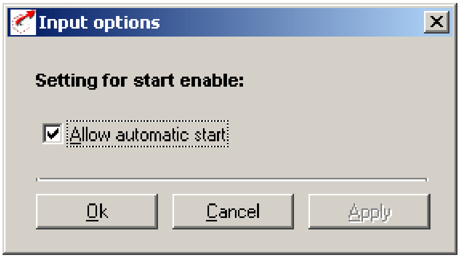


Figure 5.9 Option: Autostart

Automatic start (Autostart)

Loop control is automatically activated after power-up (including after short-time power failure) when START signal is connected. A positive edge is not required.

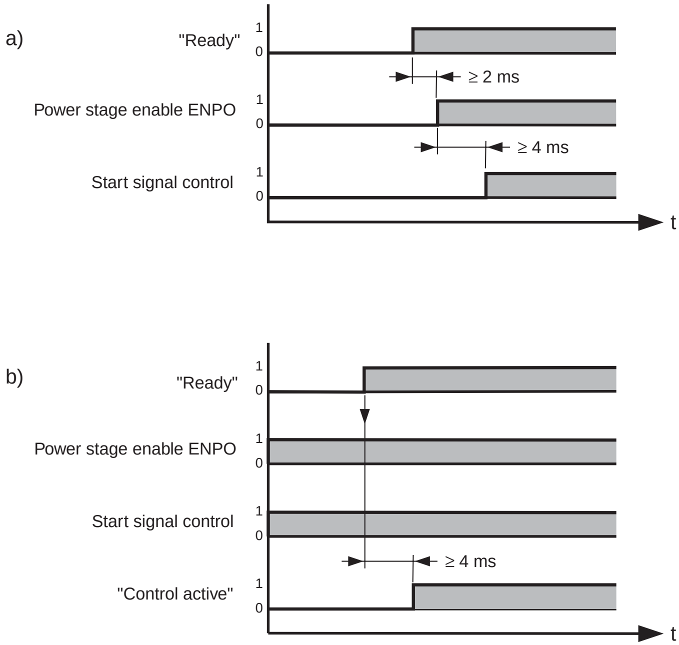


Figure 5.10 (Switch-on a) without autostart and b) with autostart

Note: Between power-up and “ready” the device is initialized, which takes several seconds (typically > 4 seconds).
To conserve digital inputs, a virtual input (IF00 or IF01) can be used for the autostart.

(2) INV

The applied reference value is inverted, i.e. the direction of rotation is reversed.

(3) /STOP

This input (Low-Active) triggers an emergency stop (quick stop); that is, the drive is braked to a standstill as fast as possible with the preset stop ramp, and held at that speed (response time: 1 ms).

Reset: Reset input /**STOP** and **START**.

Option **885_QSOPC** Quick stop /> control transition [only possible in speed control]

Important: The input ENPO (controller enable) must remain set during the quick stop condition, otherwise the motor may rotate freely or spin out of true.

(4) ADD1

Offset for reference selector 1. Reference selector 1 is advanced by the value in parameter 289 SADD1 (**S**elector **Add**ition). It is used to switch between various reference sources.

Example: Reference selector (280 RSSL1) set to FA0, i.e. analog input 0 (±10V).

Parameter SADD1 has the value 1.

With High level at input ADD1, RSSL1 is switched from FA0 to FA1.

From then on analog input 1 is active, and the reference value of input 0 is ignored.

(5) ADD2

As ADD1, offset for reference selector 2.

For more information on the reference structure see section 4.1.

(6) ... (10) TBO to TB4

1. Binary fixed speed selection from speed table for “speed control with fixed speeds”.
2. Binary driving set selection from position table for “positioning with fixed positions”.

The set number of the fixed speed/positioning set corresponds to the binary code applied at control inputs TB0 to TB4.

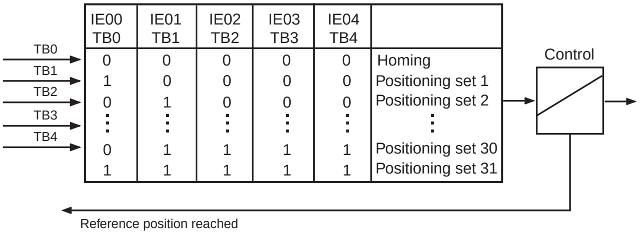


Figure 5.11 Reference processing: Positioning, fixed positions

(11) ... (18) PGM0 to PGM7

Program selection for “positioning, free programmable”:

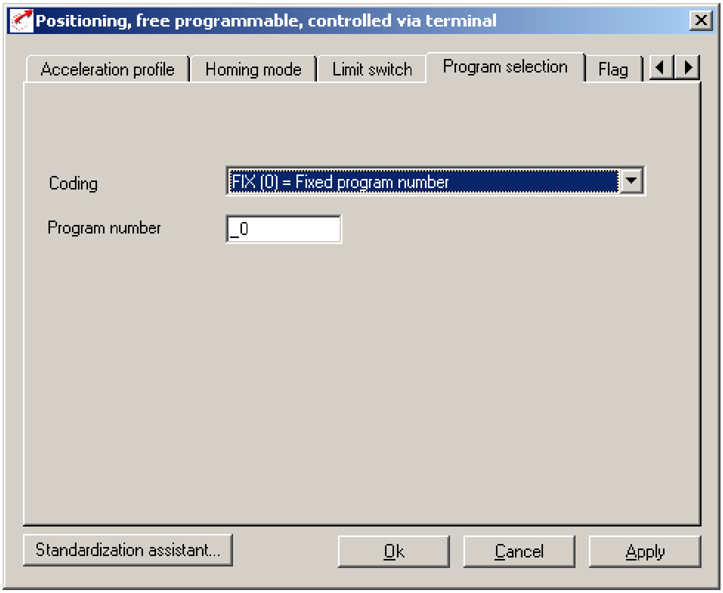


Figure 5.12 Program Selection tab

If the code on the Program Selection tab is set to “NOCOD, BIN or BCD”, the combination on inputs PGM0 to PGM7 for selection between various process programs applies.

(19) No function

(20) / (21) /LCW and /LCCW

The input evaluates a hardware limit switch (Low-Active) in positive (/LCW) or negative (/LCCW-) direction of the axle.

If a limit switch is tripped, the axle movement is immediately stopped with the maximum linear braking acceleration (Ramps tab).

If a limit switch has been tripped, the axle can be released in manual mode in the other direction (jog via inputs or DRIVEMANAGER). During the homing run the function of the limit switches is to reverse direction.

(22) E-EXT

By way of this input the position controller can be told that another device is in an error state. Response: Stop axle and display E-EXT.

(23) / (24) TIPP and TIPM

In manual mode the axle can be positioned by way of these inputs at the speeds set under the “Velocities” tab for slow and quick jog. In addition, these inputs can be used by the program in automatic mode.

Example: To move the axle in positive direction in slow jog mode, the 'TIPP' input is operated.

If the second input (TIPM') is then activated, the axle moves in quick jog mode.

(25) / (26) No function

(27) TBEN

In the “positioning with fixed positions” preset solution, with this input the binary code = positioning set connected to control inputs TB0 to TB4 is adopted and executed.
(see section 4.9 Positioning with fixed positions).

(29) GO

In automatic mode the selected program is started by way of this input (where the sequence program start condition is STD (0)).

In manual mode (AUTO = low level) a homing run is carried out if a low/ high edge change occurs at the GO start input.

The Go signal can be cancelled after 10 ms (start pulse).

(29) AUTO

With the low/high edge change at the AUTO input automatic mode is selected and with input GO the selected program is started (see Program selection PGMx).

Manual mode (jog mode, setup mode) is selected by a low level at the AUTO input.

If the high level is cancelled during motion, the axle is immediately stopped and automatic mode is aborted.

In the event of a program abort by deselection of Automatic, the program can no longer be resumed, only restarted. If resumption of the program is required, it is advisable to use the FEHLD (Feed hold) or RIHLD (Update) input.

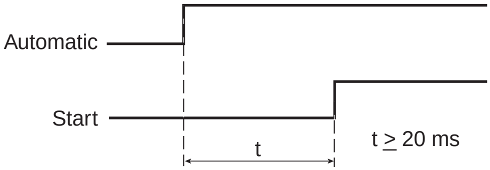


Figure 5.13 Timing AUTO

(30) FEHLD

Feed hold is the prerequisite for all axle movements; that is, the axle can only be positioned when the high level is applied at this input (provided this function has been assigned to an input).

An ongoing positioning operation is aborted with the high/low edge at the FEHLD input, with the programmed braking ramp. With the low/high edge processing is resumed with the next program set.

(31) RIHLD

The update enable permits the editing of individual sets of a program (provided this function has been assigned to an input).

When this signal is removed (low level) the program is interrupted, but any ongoing positioning operation is terminated.

When the signal (high level) is reapplied, the program is automatically resumed at the point where the interruption occurred.

(32) OPTN1

The input is usable by the module at option slot 1.

(33) OPTN2

The input is usable by the module at option slot 2.

(34) POMOD

Positioning, free programmable:
This input is usable in the sequence program, i.e. it can be polled and processed further in the current program.

(35) RSERR

With this input an error can be reset (when the cause has been eliminated).

(36) ENCAM

This input activates the “Cam gear” function.

(37) ... (38) USER0 and USER1

These inputs can be used by special software.

(39) /NPG1 Encoder simulation G1

With this input the “simulated” zero pulses can be suppressed.

(40) LREG

This input activates the position controller in addition to the active speed controller (position reference is current position, which is held).

(41) ENC

Encoder connection for A or B track of a HTL (24 V) master encoder.

Differential signals cannot be evaluated.

Usable as master encoder in:

- Speed control with reference via pulse input
- Electronic gearing as function of sequence program

(42) RECAM

Positioning, free programmable:

The input IS04 is intended for connection of a reference cam and so is equipped with a special hardware. Evaluation of the reference cam for sero pulse definition only.

(43) / (44) TP3 and TP4

Positioning, free programmable:
The CDD3000 has 2 fast Touchprobe inputs with which the current actual position can be stored and reused in the program, e.g. for dynamic measurement or for print mark synchronization.

If Touchprobe 3 is activated, on the next rising edge at input ISD03 (Touchprobe TP4 = ISD04) the current actual position is stored.

5.1.3 Digital inputs User module UM8I40 (optional)

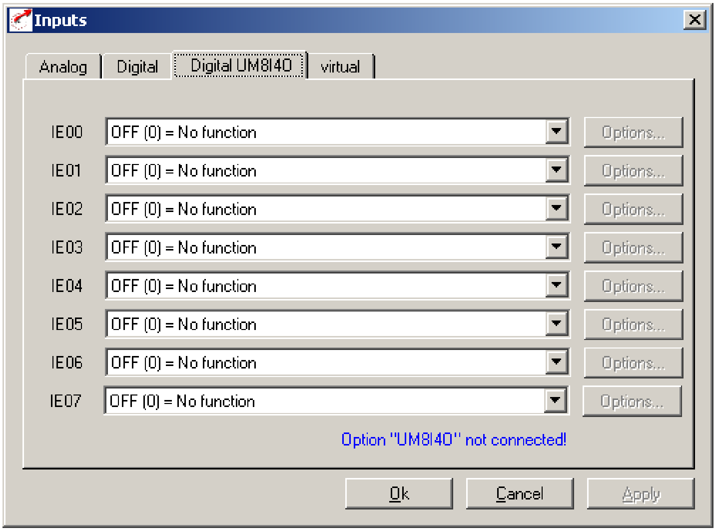


Figure 5.14 Digital Inputs UM8I40 tab

The servocontroller can optionally be equipped with a UM8I40 user module (terminal expansion), providing eight additional digital inputs (and four digital outputs).

DM	Meaning	Value range	Unit	Parameter
IE00	Function selector external input IE00	see Table 5.5	/	214_FIE00 (_IN)
IE01	Function selector external input IE01	see Table 5.5	/	215_FIE01 (_IN)
IE02	Function selector external input IE02	see Table 5.5	/	216_FIE02 (_IN)
IE03	Function selector external input IE03	see Table 5.5	/	217_FIE03 (_IN)
IE04	Function selector external input IE04	see Table 5.5	/	218_FIE04 (_IN)
IE05	Function selector external input IE05	see Table 5.5	/	219_FIE05 (_IN)
IE06	Function selector external input IE06	see Table 5.5	/	220_FIE06 (_IN)
IE07	Function selector external input IE07	see Table 5.5	/	221_FIE07 (_IN)

Table 5.6 Digital inputs UM8I40 - basic settings

Function of external digital inputs, see section 5.1.2 “Digital inputs”.

Note: When the option module is not plugged in (present), the functions can be selected by the status always remains Low (0).

5.1.4 Virtual (digital) inputs

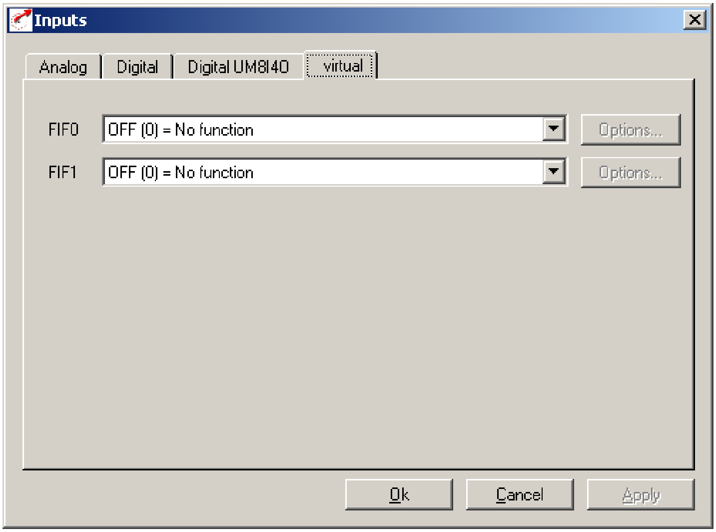


Figure 5.15 Virtual Inputs tab

The CDD3000 servocontroller provides two virtual inputs with the fixed value 1 (High level). They can be used instead of a permanently active switch (e.g. for the “Autostart” function (controller enable)).

DM	Meaning	Value range	Unit	Parameter
FIF0	Function selector virtual fixed input 0	see Table 5.5	/	222_FIF00 (_IN)
FIF1	Function selector virtual fixed input 1	see Table 5.5	/	223_FIF01 (_IN)

Table 5.7 Virtual inputs - basic settings

Function of virtual inputs, see section 5.1.2 “Digital inputs”.

5.2 Outputs

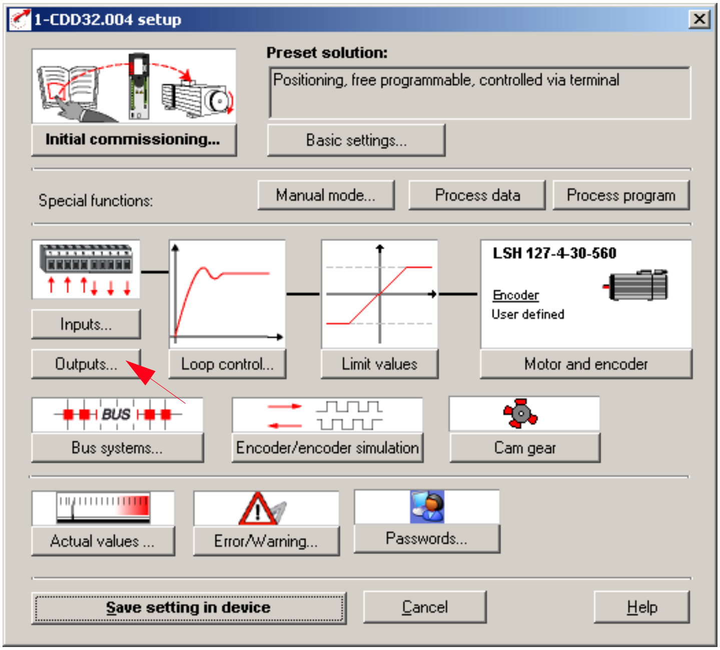


Figure 5.16 Outputs user screen

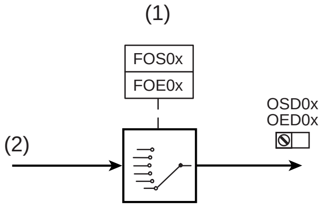
The CDD3000 servocontroller includes:

- two digital standard outputs (OS00, OS01), one relay output (OS02) and one output for control of a holding brake (OS03)
- two virtual digital outputs (OV00, OV01)

Each output of the servocontroller has a parameter which assigns it a function. These parameters are termed function selectors, and are located together with the respective additional output options in the “Outputs” setup screen in the DRIVEMANAGER (from V 3.0), see Figure 5.16.

5.2.1 Digital outputs

Function	Effect
• The function selectors determine the function of the digital outputs.	• Free function assignment of all digital outputs



(1) Selection of function of digital output

(2) Digital value

Figure 5.17 Function block for adaptation of the digital outputs

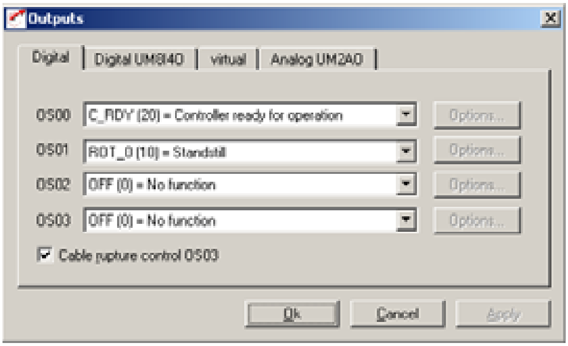


Figure 5.18 Digital Outputs tab

DM	Meaning	Value range	Unit	Parameter
OS00	Function selector Standard output OSD00	See table 5.9	-	240_FOS00 (_OUT)
OS01	Function selector Standard output OSD01	See table 5.9	-	241_FOS01 (_OUT)
OS02	Function selector Standard output OSD02	See table 5.9	-	242_FOS02 (_OUT)
OS03	Function selector Standard output OSD03	See table 5.9	-	247_FOS03 (_OUT)

Table 5.8 Digital outputs - basic settings

Settings of the CDD3000 digital outputs

Bus	KP/DM	Function	OS00	OS01	OS02	OS03	OV00-01	OE00-03
0	OFF	Output off	✔	✔	X	X	X	X
1	ERR	Collective error message	✔	✔	✔	✔	✔	✔
2	WARN	Collective warning message	✔	✔	✔	✔	✔	✔
3	ERRW	Collective warning or error message	✔	✔	✔	✔	✔	✔
4	/ERR	Collective error message negated	✔	✔	✔	✔	✔	✔
5	/WARN	Collective warning message negated	✔	✔	✔	✔	✔	✔
6	/ERRW	Collective warning or error message negated	X	✔	✔	✔	✔	✔
7	ACTIVE	Loop control in function (power stage is active), current applied to motor	✔	X	✔	✔	✔	✔
8	ROT_R	Clockwise rotation	✔	✔	✔	✔	✔	✔
9	ROT_L	Anti-clockwise rotation	✔	✔	✔	✔	✔	✔
10	ROT_0	Motor standstill (power stage is active)	✔	✔	✔	✔	✔	✔
11	LIMIT	Reference limitation active	✔	✔	✔	✔	✔	✔
12	REF	Reference reached	✔	✔	✔	✔	✔	✔
13	SIO	Usable by serial interface RS232	✔	✔	✔	✔	✔	✔
14	OPTN1	Usable by slot 1 (communications module)	✔	✔	✔	✔	-	-
15	OPTN2	Usable by slot 2 (communications module)	✔	✔	✔	✔	-	-
16	POMOD	Usable in sequence program (positioning, free programmable)	✔	✔	✔	✔	✔	✔
17	/EFLW	No tracking error (positioning, free programmable)	✔	✔	✔	✔	✔	✔
18	BRAKE	Holding brake function	✔	✔	✔	✔	✔	✔
19	S_RDY	Device initialized	✔	✔	✔	✔	✔	✔
20	C_RDY	Device ready	✔	✔	✔	✔	✔	✔
21	SCAVM	Speed threshold reached	✔	✔	✔	✔	✔	✔

✔: Input usable
X: Factory setting
- Input not usable

Table 5.9 Settings of the CDD3000 digital outputs

Bus	KP/DM	Function	OS00	OS01	OS02	OS03	OV00-01	OE00-03
22	TCAVM	Torque threshold reached	✔	✔	✔	✔	✔	✔
23	REFOK	Reference point defined (positioning, free programmable)	✔	✔	✔	✔	✔	✔
24	PRRDY	End sequence program (positioning, free programmable)	✔	✔	✔	✔	✔	✔
25	CCOUT	Activated by cam gear	✔	✔	✔	✔	✔	✔
26	USER0	Reserved for modified software	✔	✔	✔	✔	✔	✔
27	USER1	Reserved for modified software	✔	✔	✔	✔	✔	✔
28	USER2	Reserved for modified software	✔	✔	✔	✔	✔	✔
29	USER3	Reserved for modified software	✔	✔	✔	✔	✔	✔
30	T_RDY	Technology ready	✔	✔	✔	✔	✔	✔

✔: Input usable
X: Factory setting
- Input not usable

Table 5.9 Settings of the CDD3000 digital outputs

Functions/options of the CDD3000 digital outputs

(1) OFF

Output is off.

High level: No function

Low level: No function

(1) ERR

Collective error message

High-Pegel: Device in error state. The error must be eliminated and acknowledged for operation to be restarted.

Low level: No error

(2) WARN

Collective warning message

High level: Warning active, device still ready

Low level: No warning

(3) ERRW

Collective warning or error message

High level: Warning active or device in error state

Low level: No warning and no error

(4) /ERR

Collective error message negated (low-active), wire break proof output

High level: No error

Low level: Device in error state. The error must be eliminated and acknowledged for operation to be restarted.

(5) /WARN

Collective warning message negated (low-active), wire break proof output

High level: No warning

Low level: Parameterizable warning limit exceeded, device still ready

(6) /ERRW

Collective warning or error message negated (low-active), wire break proof output

High level: No warning and no error

Low level: Parameterizable warning limit exceeded or device in error state

(7) ACTIVE

Loop control in function, power stage is active

High level: Power stage active

Low level: Power stage not active, no current applied to motor

(8) ROT_R

Clockwise rotation

High level:	Motor shaft rotating clockwise (outside standstill window)
Low level:	no clockwise rotation

(9) ROT_L

Anti-clockwise rotation

High level:	Motor shaft rotating anti-clockwise (outside standstill window)
Low level:	No anti-clockwise rotation

(10) ROT_0

Motor standstill (see section 5.4.2 Tolerances)

High level:	Motor speed in standstill window
Low level:	Motor speed outside standstill window

Note: The messages (8) ROT_R, (9) ROT_L and (10) ROT_0 are filtered with the time set under ECTF (actual speed filter).

---

(11) LIMIT

Reference limitation active

High level:	The internally processed reference value exceeds the reference limit and is restricted to the limit value
Low level:	Reference is not limited

1 2 3 4 5 A EN

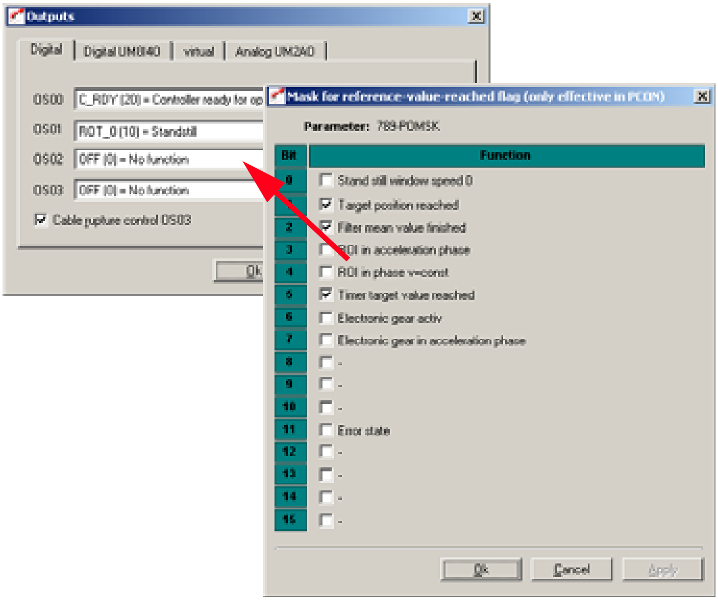
(12) REF

Reference reached (see section 5.4.2 Tolerances)

High level: The specified reference is reached

Low level: Reference not reached

Option 789_POMSK Masking of 'reference reached' status flag



Note: This function is only operative in position control

(13) SIO

Usable by serial interface RS232 (X4)

Output can be set via the serial interface by the LustBus control word

High level: Output set

Low level: Output not set

(14) OPTN1

Usable by slot 1 (communications module)

(15) OPTN2

Usable by slot 2 (communications module)

(16) POMOD

Preset solution positioning, free programmable:
Output can be set/reset by sequence program.

(17) /EFLW

Control mode – positioning: No tracking error (low-active), wire break proof execution (see section 5.4.3)

High level:	No tracking error
Low level:	A tracking error has occurred, i.e. the distance between the reference and actual positions is too large.

(18) BRAKE

Holding brake function:

A holding brake built into the motor (option) offers protection against unwanted movement of the motor shaft when power is cut to the controller. It also offers the possibility in the event of an error to brake the axle down to a standstill and hold it there, even without loop control.

Options ...

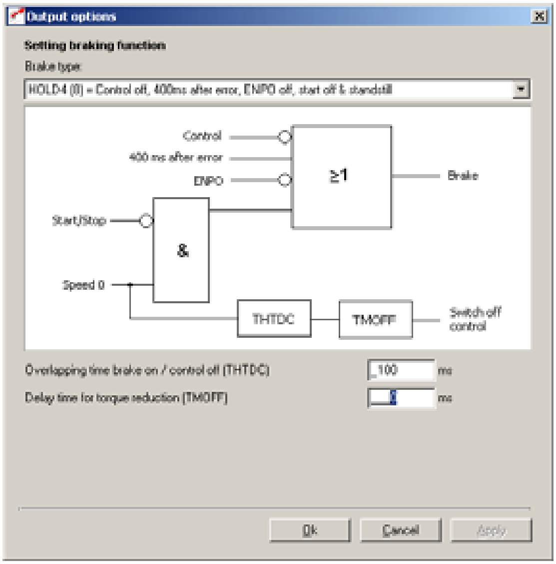


Figure 5.19 Setting of brake function

Nine different 'brake type' options (SPD0 to HOLD6) are available for actuation of the brake. They regulate engagement of the brake in case of error and when the control is switched on and off.

For details of which parameters are relevant in the respective brake types to set the functionality refer to the following table.

Brake types:

Bus	Setting	The brake engages on ...	Parameters used							
			THTDC	TMOFF	TMON	TREF	LCQFA	ERRAC	QSOPC	SELDC
0	SPD_0	Standstill and control off								
1	ERR_1	Standstill and in case of error								
2	ERR_2	Standstill and in case of error. After no more than 400 ms								
3	ERR_3	Error								
4	HOLD	Control off								
5	HOLD1	Standstill or in case of error, THTDC	✔	✔				✔	✔	✔
6	HOLD2	Standstill or standstill and in case of error, after no more than 400 ms THTDC	✔	✔				✔	✔	✔
7	HOLD3	Control off, error, ENPO off, start off and standstill	✔	✔				✔	✔	✔
8	HOLD4	Control off, 400 ms after error, ENPO off, start off and standstill	✔	✔				✔	✔	✔
9	HOLD5	Only logical in speed control: Control off, 400 ms after error, ENPO off, start off and standstill control	✔	✔	✔	✔	✔	✔	✔	✔
10	HOLD6	Brake remains closed during commutation finding. Control off, 400 ms after error, ENPO off, start off and standstill	✔	✔				✔	✔	✔

Table 5.10 Brake types

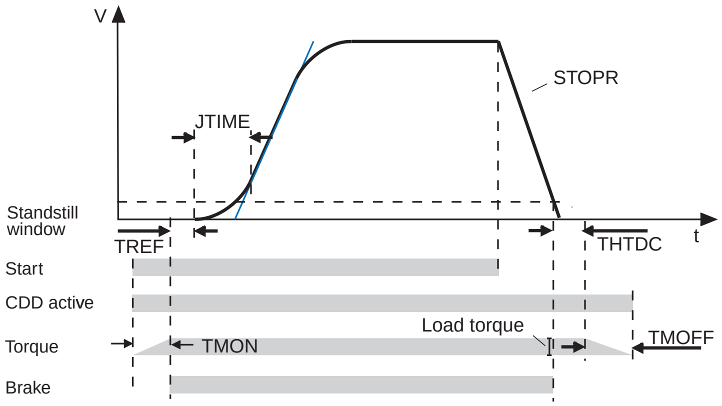


Figure 5.20 Speed profile, brake function

Brake type parameters used:

THTDC

Overlapping time brake on / control off:

The control is shut off after motor standstill and when a defined time elapses

TMOFF

Timer torque reduction:
The current torque is reduced in linear mode within the specified time to zero

TMON

Timer torque build-up:
The torque used in the last movement is stored and increased in linear mode within the specified time from zero.
(Only relevant for HOLD5)

TREF

Speed control delay time until reference enable:
The existing speed reference is delayed for the time TREF. After expiry of the timer TMON and after the control start, the torque is increased linearly to the torque reference needed in the last movement

LCQFA

Load torque compensation: Scaling for pre-control of current For acceleration (lifting) or braking (lowering) the active torque is increased (lifting) or reduced (lowering) by the scaling factor.

(Default 0%, i.e. function deactivated)

QSOPC

After a quick stop has been executed, this function (QSOPC = -2) allows the brake ramp that is still active to be cancelled and the controller restarted.
The function can be triggered only by activation or deactivation of the start signal or the start bit in bus operation (START).
It is not effective if the quick stop is triggered by the function STOP (bus) or /STOP (terminal)
The setting is effective only for Hold1 to Hold6!

SELDC

Switches off the power stage if the speed reference = 0 or the speed actual value = 0
SELDC = ACTV:
The power stage will be switched off as soon as the speed actual value = 0 and the time THTDC has expired.

SELDC = REFV:
The power stage will be switched off as soon as the speed reference = 0 and the time THTDC has expired.
The setting is effective only for Hold1 to Hold6!

ERRAC

Switches off the power stage if certain quite specific error reactions occur
ERRAC = ON: (factory setting)
If an error occurs for which the error reaction is set to STOP or LOCKS, the controller switches itself off automatically after the motor has come to a standstill and the time THTDC has expired.

ERRAC = OFF:
Even after the motor has come to a standstill the controller remains active until one of the following conditions is satisfied:

- Acknowledgement of the error message
- The digital input „START“ is cancelled (control location term)
- The „START“ BIT 0 in the control word is set to LOW (control location option)

If however **during the braking process, i.e. when the standstill window has not yet been reached**, one of the following conditions is triggered:

- Acknowledgement of the error message
- The digital input „START“ is cancelled (control location term)
- The „START“ BIT 0 in the control word is set to LOW (control location option)

the power stage will be switched off immediately,
irrespective of the setting of the parameter ERRAC.

Brake types

SPD_0

The brake engages:
- at standstill
- when control is shut off
(further parameters: none)

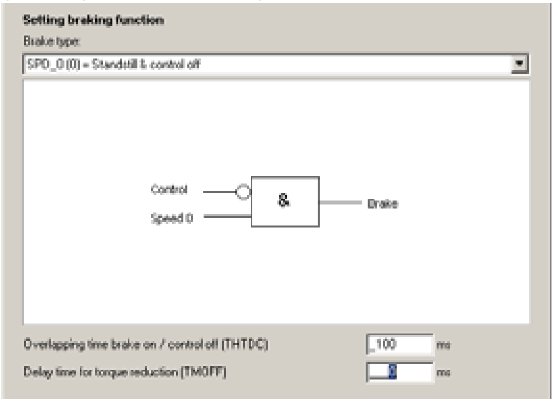


Figure 5.21 SPD_0

ERR_1

The brake engages:
- in case of error immediately
- at standstill
(further parameters: none)

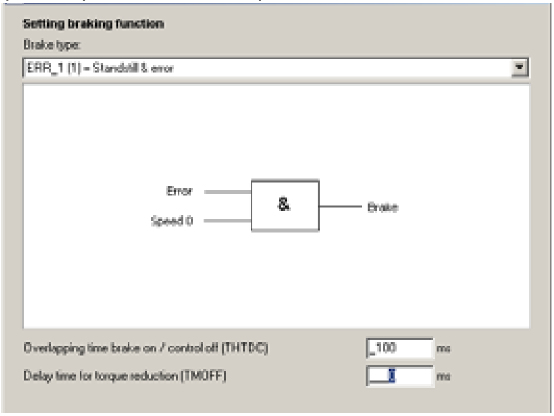


Figure 5.22 ERR_1

ERR_2

The brake engages:
- in case of error at standstill or
- no more than 400 ms after the error occurred
(further parameters: none)

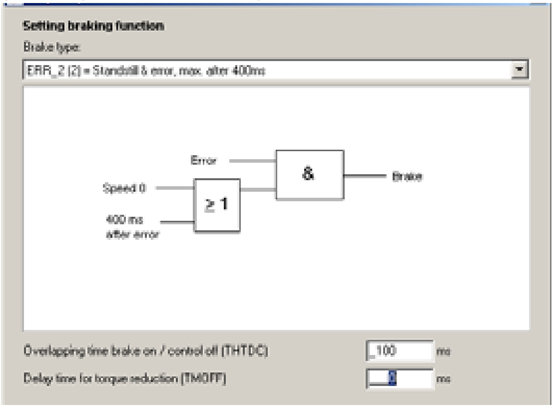


Figure 5.23 ERR_2

ERR_3

The brake engages:
- in case of error immediately
(further parameters: none)

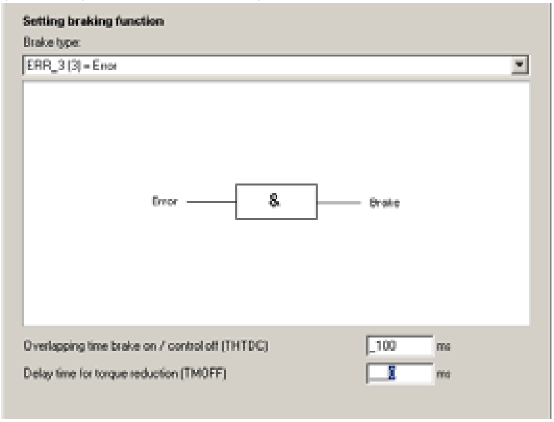


Figure 5.24 ERR_3

HOLD
The brake engages:
- when control is shut off
(further parameters: none)

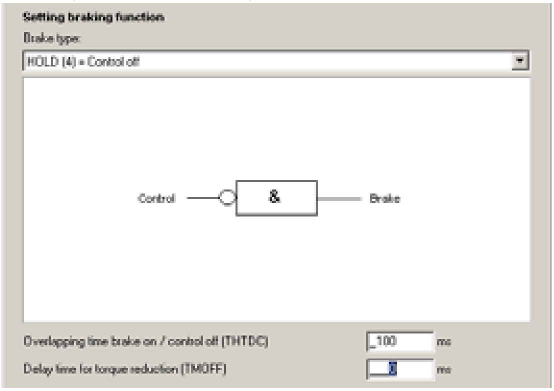
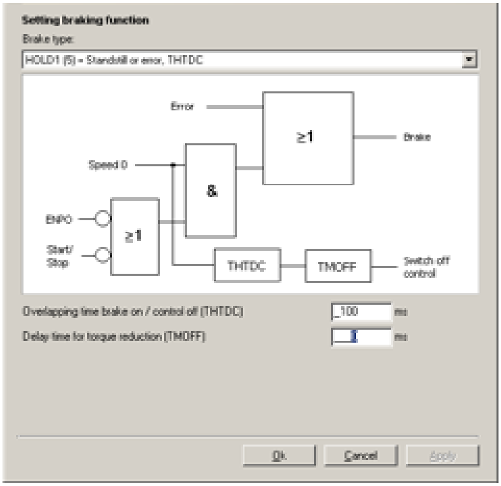


Figure 5.25 HOLD

HOLD1

The brake engages:
- in case of error
- when the control is off at standstill



Further parameters:

Overlapping time brake on / control off **467-THTDC** [ms]

Delay time for torque reduction **867-TMOFF** [ms]

HOLD2

The brake engages:
- after control off, when standstill reached
- in case of error at standstill or no more than 400 ms after the error occurred.

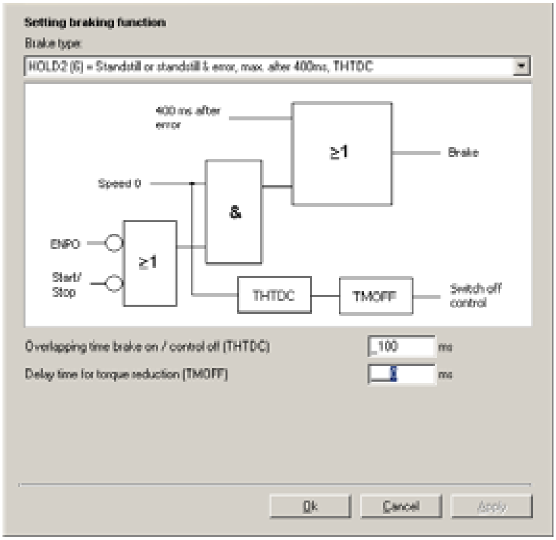


Figure 5.26 HOLD2

Further parameters:

Overlapping time brake on / control off **467-THTDC** [ms]

Delay time for torque reduction **867-TMOFF** [ms]

HOLD3

The brake engages:
- after control off, when standstill reached
- in case of error immediately
- on cancellation of ENPO

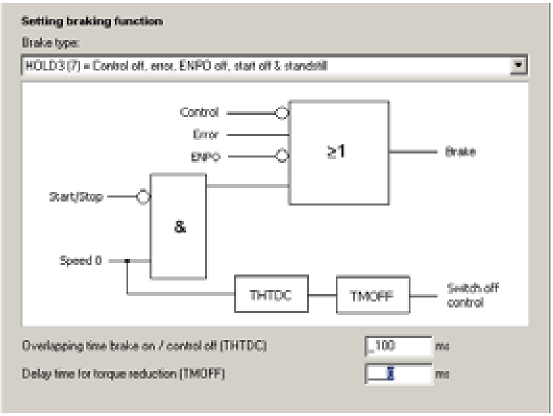


Figure 5.27 HOLD3

Further parameters:

Overlapping time brake on / control off **467-THTDC** [ms]

Delay time for torque reduction **867-TMOFF** [ms]

HOLD4

The brake engages:
- after control off, when standstill reached
- in case of error when standstill window is reached after braking ramp executed, but no more than 400 ms after error occurred
- on cancellation of ENPO

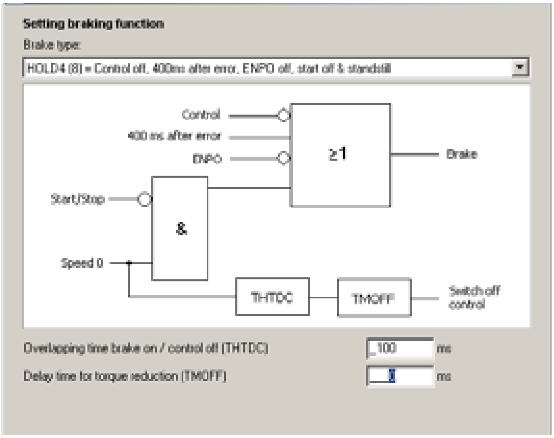


Figure 5.28 HOLD4

Further parameters:

Overlapping time brake on / control off **467-THTDC** [ms]

Delay time for torque reduction **867-TMOFF** [ms]

HOLD5

The brake engages:
- after control off, when standstill reached
- in case of error when standstill window is reached after braking ramp executed, but no more than 400 ms after error occurred
- on cancellation of ENPO

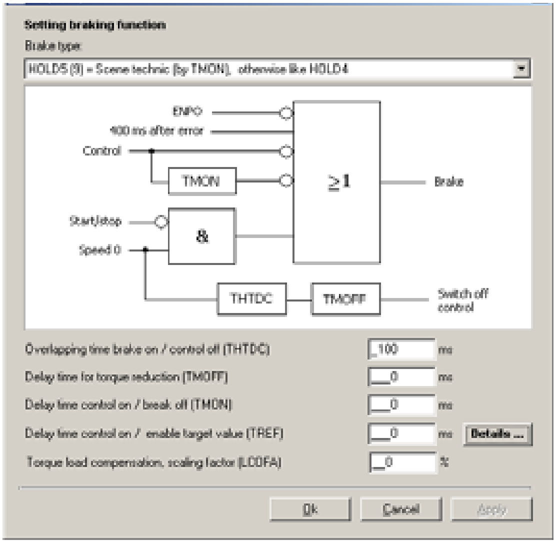


Figure 5.29 HOLD5

Further parameters:

Overlapping time brake on / control off **467-THTDC** [ms]

Delay time for torque reduction **867-TMOFF** [ms]

Delay time control on/ brake off **865-TMON** [ms]

Delay time control active/apply reference **866-TRef** [ms]

Scaling for pre-control of current/load torque compensation **878-LCQFA** [%]

HOLD6

The brake engages:
- after control off, when standstill reached
- in case of error when standstill window is reached after braking ramp executed, but no more than 400 ms after error occurred
- on cancellation of ENPO
- brake remains closed during commutation finding

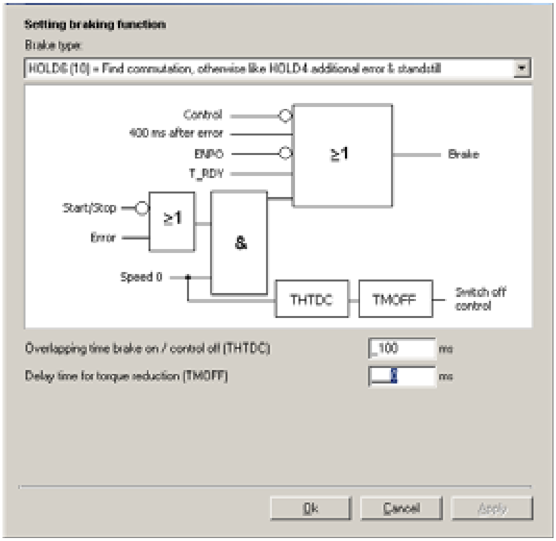


Figure 5.30 HOLD6

Further parameters:

Overlapping time brake on / control off **467-THTDC** [ms]

Delay time for torque reduction **867-TMOFF** [ms]

Note: The holding brake is not designed as a service brake, i.e. as a matter of principle actuation and release is effected at standstill or in case of error.

Important: In setting HOLD1 and ERR3 the brake engages immediately in case of error (regardless of motor speed). This “breakdown braking” may shorten the service life of the holding brake.

(19) S_RDY

S_RDY is cancelled prior to a control initialization. When the initialization is complete S_RDY is reset.

Device initialized

High level: Device is initialized after power-on, i.e. capable of communication and activation (ENPO and START not required)

Low level: Device not initialized

(20) C_RDY

Device ready

High level: Device is ready, i.e. input ENPO set and no error (START not required)

Low level: Device not ready

(21) SCVAM

Speed threshold reached

Options ...

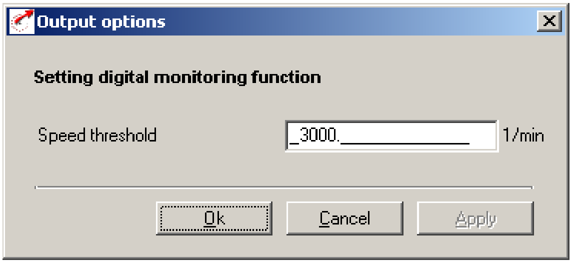


Figure 5.31 Speed threshold

High level: When speed threshold reached (e.g. 3000 rpm)

Low level: Speed threshold not reached

(22) TCAVM

Torque threshold reached

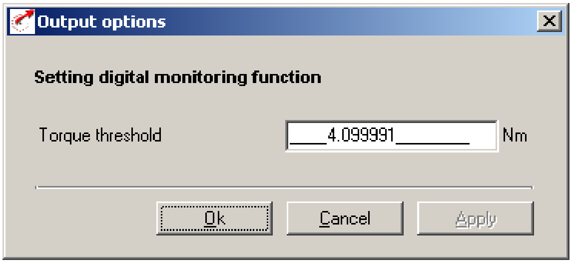


Figure 5.32 Torque threshold

High level: When torque threshold exceeded (e.g. 4.1 Nm)

Low level: Torque threshold not reached

(23) REFOK

Control mode - positioning:
Homing mode completed (see section 4.10.2)

High level: The homing run is completed and the zero has been found.

Low level: No reference point (machine zero) defined

(24) PRRDY

Preset solution positioning, free programmable
End sequence program

High level: The sequence program has not yet started or is already completed and has reached the instruction END.

Low level: Sequence program not at end

(25) CCOUT (see section 5.10 Cam gear)

Activated by cam gear

(26) ... (29) USERx (0 –4)

Setting reserved for modified software

(30) T_RDY

Loop control in function, power stage is active, commutation finding completed

High level: Power stage active; commutation completed

Low level: Power stage not active or power stage active and commutation finding being executed.

5.2.2 Digital outputs, user module UM8I40

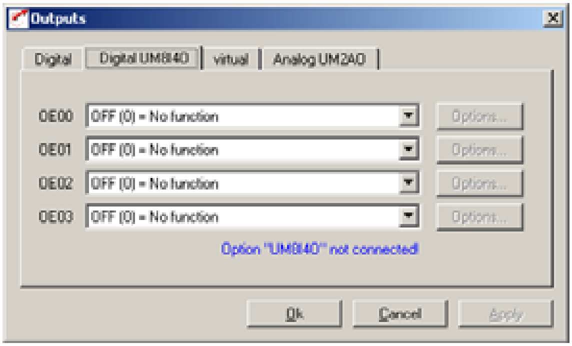


Figure 5.33 Digital Outputs UM8I40 tab

The servocontroller can optionally be equipped with a UM8I40 user module (terminal expansion), providing eight additional digital inputs (and four digital outputs).

DM	Meaning	Value range	Unit	Parameter
OE00	Function selector external output OED00	See table 5.9	-	243_FOE00 (_OUT)
OE01	Function selector external output OED01	See table 5.9	-	244_FOE01 (_OUT)
OE02	Function selector external output OED02	See table 5.9	-	245_FOE02 (_OUT)
OE03	Function selector external output OED03	See table 5.9	-	246_FOE03 (_OUT)

Table 5.11 Digital outputs UM8I40 - basic settings

Function of external digital outputs, see section 5.2.1 “Digital outputs”.

Note: When the option module is not plugged in (present), the functions can be selected by the status always remains Low (0).

5.2.3 Virtual (digital) outputs

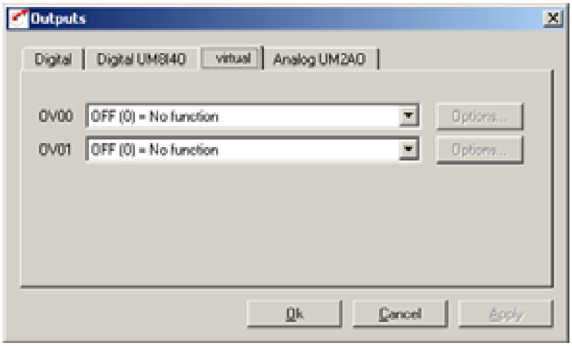


Figure 5.34 Virtual Outputs tab

The servocontroller provides two virtual (digital) outputs, which can be used for event control via CAN bus.

DM	Meaning	Value range	Unit	Parameter
OV00	Function selector virtual output OV00	See table 5.9	-	248_FOV00 (_OUT)
OV01	Function selector virtual output OV01	See table 5.9	-	249_FOV01 (_OUT)

Table 5.12 Virtual outputs - basic settings

Functions of virtual outputs, see section 5.2.1 “Digital outputs”.

5.3 Loop control

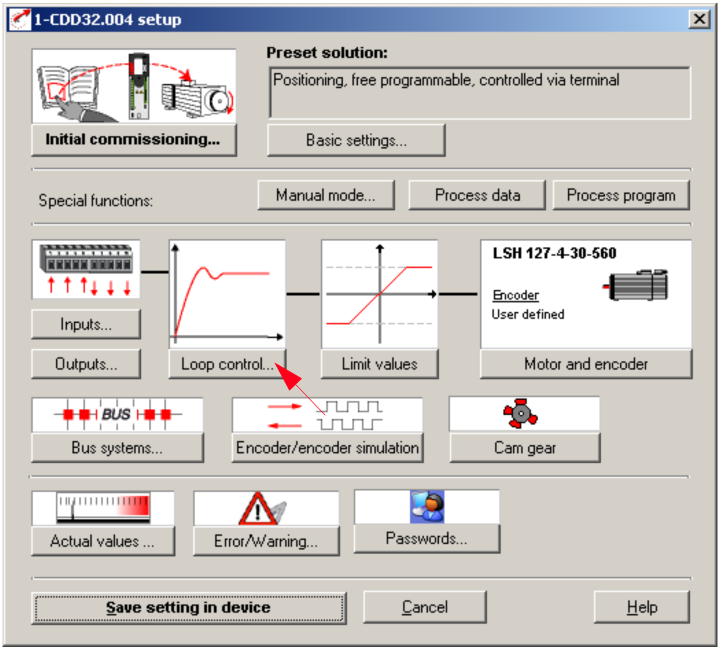


Figure 5.35 User screen: Loop control

In the “Loop control” screen all loop control settings and refinements are entered.

5.3.1 Loop control software

The CDD3000 servocontroller works on the principle of field oriented regulation. Field orientation means injecting a current into the motor at the point at which the field is largest.

This means the injected current is converted optimally into torque. An optimum machine usage is achieved with optimum dynamic and low loss. This results in a very high efficiency.

The digitally regulated drive is suitable for all applications in which the following properties are key:

- Constant speed (synchronism)
- Positional accuracy (absolute and repeatable)
- Dynamics
- Const. Torque
- Disturbance adjustment

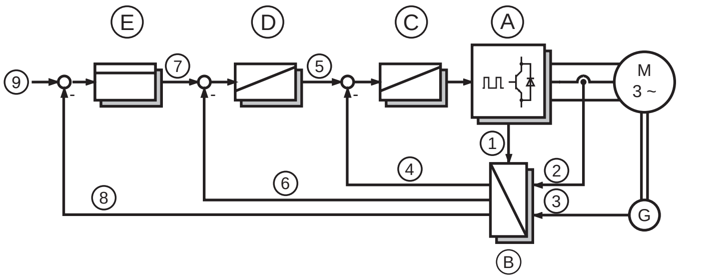
Note: Synchronous and asynchronous machines can be controlled. Direct drives/linear motors (ironless/iron-core) can be controlled.

The CDD3000 servocontroller can be operated in three control modes:

- Torque control (TCON)
- Speed control (SCON)
- Position control (PCON)

Note: The control mode is set by selection of a preset solution, see section 4.1

It has three control loops which are overlaid onto each other (see diagram). Depending on the preset solution, the respective underlaid control loops are active, e.g. in speed control only the speed and torque controllers. The speed reference (7) is then delivered directly by the reference input, the position controller (E) is isolated and without function.



The pre-control structure for speed and torque is not shown!

A)Modulator and power stage	3)Current recording
B)Processing of actual values	4)Actual torque
C)Torque controller	5)Torque reference
D)Speed controller	6)Actual speed
E)Position controller	7)Speed reference
1)Voltage recording	8)Actual position
2)Current recording	9)Position reference

Figure 5.36 Control structure

The parameters of the control loop are located in the Parameter Editor in the "Control setting" subject area (_CTRL). The torque and speed controllers are executed as Pi-controllers, the position controller as a P-controller. The gain (P-component) and the lag time (I-component) of the individual controllers is programmable in the respective subject area.

In the user screen the settings are entered on the "Loop control" and "Extended" tabs.

5.3.2 Speed control / Position control

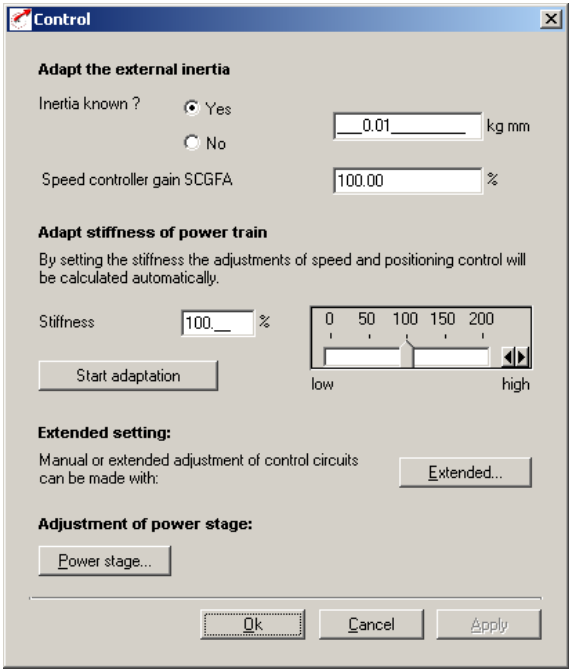


Figure 5.37 Control tab

DM	Meaning	Value range	Unit	Parameter
SCGFA	Scaling factor: PI controller gain Speed controller	0 - 999,95	%	811_SCGFA (_CTRL)
SCDSC	Dimensioning Speed controller, desired dynamics	0 - 200	%	46_SCDSC (_SCD)
SCJ	Total moment of inertia of system with motor	0-1000	kg/m²	817_SCJ (_SCD)

Table 5.13 Control - basic settings

Adaptation to the external moment of inertia

Setting the control loops

It may be necessary, depending on application:

- to enter the known moment of inertia directly, or
- to adapt the speed controller gain (SCGFA in %).

Adaptation to the stiffness of the drive train

This can be done in two ways: Either the control loop parameters can be set directly (see “Extended setting”) or the adjustment can be made using a wizard.
In the assistant the stiffness can be specified in percent, and by way of the “Start adaptation...” button the settings are calculated and entered.
A setting <100% produces a “soft” controller setup (e.g. for a toothed belt drive) and a setting >100% means a “hard” controller setup for a hard mechanism (with low play and elasticity).

Note: The torque controller is set by attuning the motor data see section 5.5 “Motor and encoder”) optimally to the respective motor.
You can make a manual or advanced setting of the control loops using the **Extended ...** button.

Power stage setting

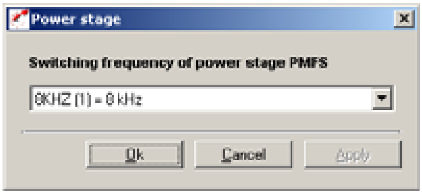


Figure 5.38 Power Stage tab

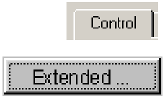
DM	Meaning	Value range	Unit	Parameter
Switching frequency	Switching frequency of power stage / modulator	4/8/16 BUS: 0-2	kHz	690_PMFS (_CONF)

Table 5.14

Table 5.15 Power stage - basic settings

Note: The higher the switching frequency,

- the lower will be the output power of the servocontroller (derating of output current)
- the smoother the motor runs at high speeds
- the less noise there will be



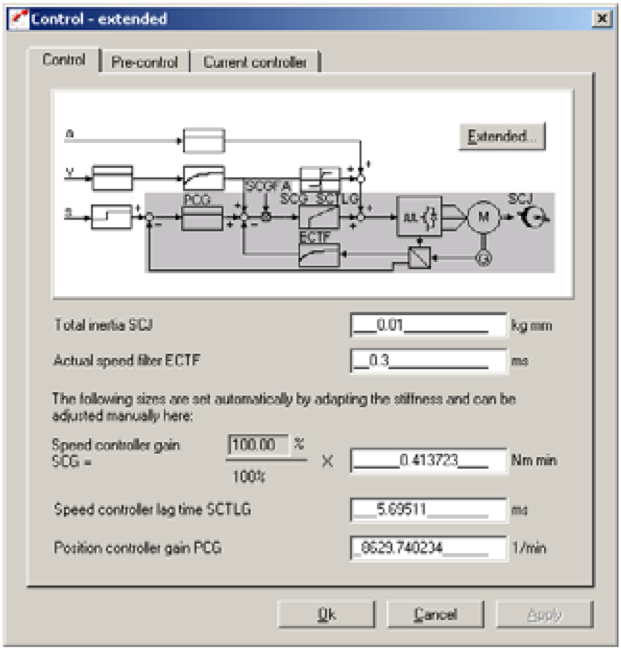


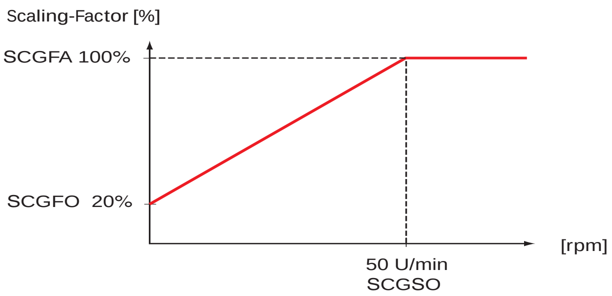
Figure 5.39 Control - Extended tab

In this screen the speed and position controllers can be adapted to the application by setting the controller and filter parameters directly. Basic control engineering skills are essential for this.

DM	Meaning	Value range	Unit	Parameter
Total inertia	Moment of inertia complete, i.e. of the clutch, the gearing where appropriate, the system and the motor.	0 - 1000	kgm^2	817_SCJ (_SCD)
Actual speed filter	Actual value filter to filter out any disturbance to the feedback. The less the ECTF, the more rigid will be the axle.	0 - 32	ms	818_ECTF (_CTRL)
Speed controller gain	Adaptation of the P-gain of the speed controller. The higher the gain, the more rigid will be the axle.	0-100000000	Nm min	810_SCG (_CTRL)
Speed controller lag time	Adaptation of the I-component of the speed controller, with the lag time SCTLG. The less the SCTLG, the more rigid will be the axle.	1 - 2000	ms	812_SCTLG (_CTRL)
Reduction of SCG at low speeds	**Weighting** of the speed controller gain reduction in percent	0-100	%	837_SCGFO (_CTRL)
prevents „buzzing“ or cogging (especially effective for TTL encoders).	**Weighting** of the speed controller gain reduction in rpm	0-200	rpm	839_SCGSO (CTRL)
Position controller gain	Adaptation of the P-gain of the position controller. The higher PCG is set, the more rigid will be the drive and the fewer tracking errors there will be during positioning. If PCG is set too high, it will cause overshoot at the target position or even control instabilities.	1 - 32000	rpm	460_PCG (_CTRL)

Table 5.16 Extended control - basic settings

Note: All parameters of the extended setup can be edited online (with the power stage active).
A detailed picture of the loop control structure with pre-control can be viewed by clicking the Zoom button.



Speed controller gain reduction at low speeds

Pre-control

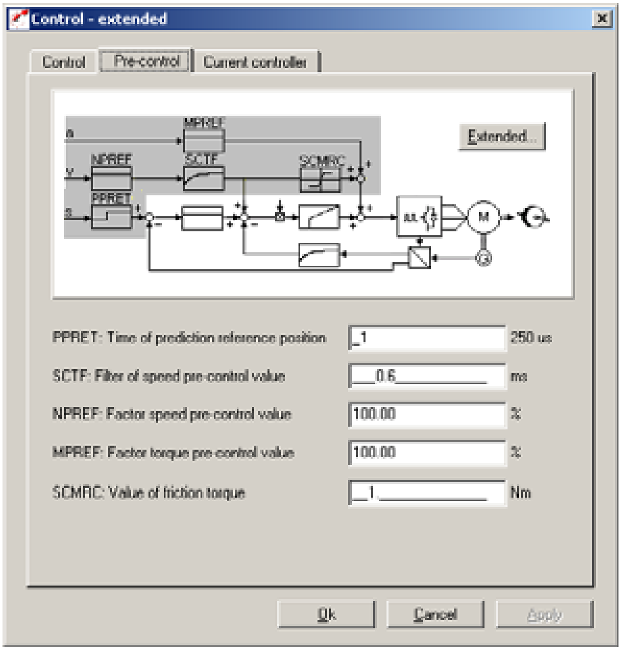


Figure 5.40 Pre-control

The object of pre-control is to compensate for the time constants of the speed and torque control loops.

To this end, the CDD3000 calculates the pre-control signal for the speed by differentation of the position reference and the pre-control signal for the acceleration by a second differentation. The torque is calculated by multiplying the acceleration by the moment of inertia.

For the pre-control to work optimally, it is predictive. This means that the torque controller receives its reference before the speed controller, and the speed controller receives its reference before the position controller.

DM	Meaning	Value range	Unit	Parameter
Time of prediction	Time shift (in 250 µsec increments) of torque reference relative to position controller. Default: 1 - 2	0-20	250 µsec	459_PPRET (_CTRL)
Filter of speed pre-control value	The speed pre-control value filter prevents the position controller and speed controller from working against each other. Default: SCTF = 2 x ECTF	0-1000	ms	816_SCTF (_CTRL)
Factor speed pre-control value	Level of speed pre-control Default: 100%	0 - 999,95	%	463_NPREF (_CTRL)
Factor torque pre-control value	Level of torque pre-control (can be checked with digital scope): Actual torque / torque: Partial reference 3 Default: 100%	0-999,95	%	464_MPREF (_CTRL)
Value of friction torque	Pre-control for friction torque	0-500	Nm	897_SCMRC (_SCD)

Table 5.17 Setting pre-control

Note: The level of the pre-control values depends on the preset moment of inertia (see: “Adaptation to the external moment of inertia”).
The smoothing time also affects the pre-control. At smoothing times longer than 30 ms the pre-control is inactive.

Current controller

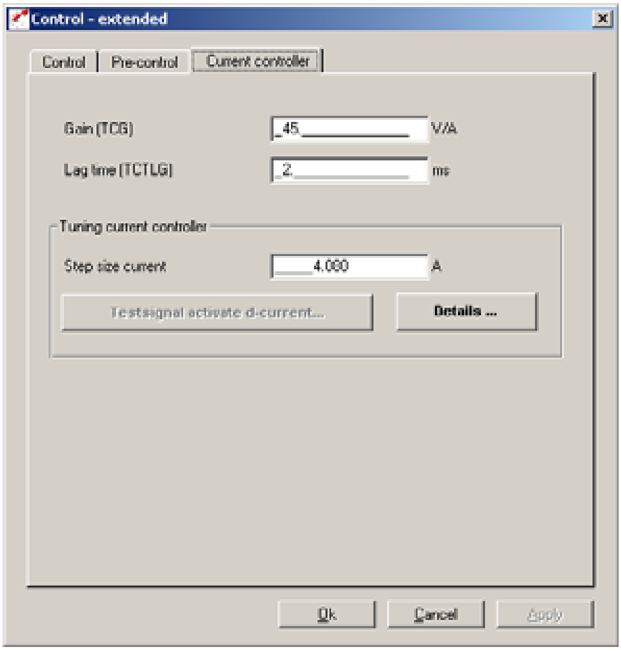


Figure 5.41 Current controller

In this screen the current controller parameters can be set directly. Basic control engineering skills are essential for this.

DM	Meaning	Value range	Unit	Parameter
Gain	Adaptation of the P-gain of the current controller.	0-426	V/A	800_TCG (_CTRL)
Lag time	Adaptation of the I-component of the current controller, with the lag time	0-50	ms	802_TCTLG (_CTRL)

Table 5.18 Setting the current controller

Current controller tuning:

Here a step response can be recorded directly (precondition: ENPO = High). The recommended stepwidth is the rated current of the motor. Clicking the **Apply d-current test signal** button opens an image directly with the digital scope.

Note: For this test the CDD3000 must be in a speed-controlled operation mode. Otherwise the motor may move.
The step is made in 2 stages. The first, smaller, step aligns the motor shaft; the second step is used for optimization. The level of the second step should not be selected too large, to prevent the voltage reference from going to the limit (small signal response required). The scope is started automatically.
Aim of optimization: The current controller acting time should be < 2 ms and the overshoot < 10 %.
Precondition: Input ENPO is active

5.4 Limit values

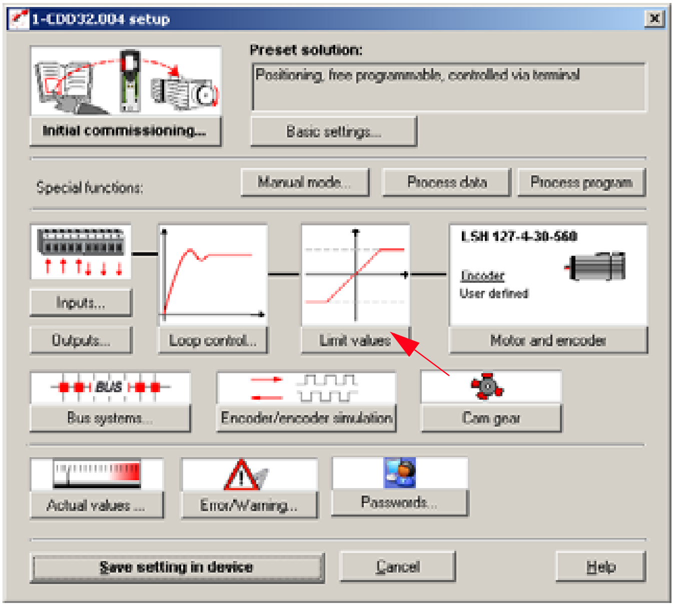


Figure 5.42 User screen: Limit values and tolerances

In the “Limit values” screen the application-specific limit values and tolerances, such as the maximum speed, can be set.

5.4.1 Limit values

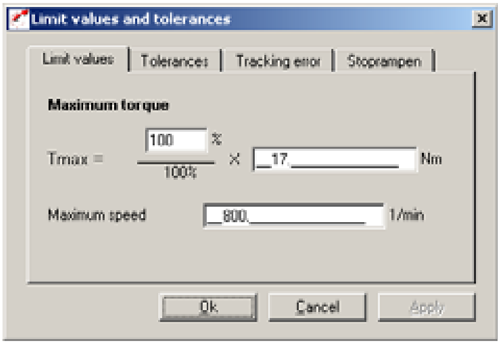


Figure 5.43 Limit Values tab

DM	Meaning	Value range	Unit	Parameter
Maximum torque	The maximum motor torque can be limited to a fixed value. The limitation acts both in positive and in negative direction. If the maximum torque is chosen too high, it is automatically limited and a warning is delivered. The corrected value must be stored secure against mains power failure.	0 to 100	%	805_SCALE (_LIM)
	The value range depends on the maximum torque of the motor and on the maximum output current of the servocontroller. For applications in which the max. torque has to be adjusted dynamically in operation, the torque reduction function (SCALE) is provided, see section 5.1.1 “Analog inputs”.	0 - 5000	Nm	803_TCMMX (_LIM)
Maximum speed	The maximum speed of the drive can be limited to protect the machine. The limitation acts both in positive and in negative direction.	0 to 30000	rpm	813_SCSMX (_LIM)
Limit frequency for limitation of the I_{max} below a rotating field frequency< 5 Hz (from firmware > V 3.20) **Application: when error message E-OLM5 is triggered!**	**Current limitation ON:** The parameter 518 ILIM5 (unit Hz) allows the current to be restricted to a permitted range when the rotating field frequency> 5 Hz. If the frequency exceeds 5 Hz, the current is increased as a ramp to I_{max}. **Current limitation OFF:** Current limitation is deactivated if parameter 518 ILIM5 is set to < 5 Hz. Below the 5 Hz limit only the rated current is available. If within this range more current is demanded, the error E-OLM5 is triggered. I_{max} depends on the power stage switching frequency.	0 to 50	Hz	518_ILIM5
	Current limitation ON Current limitation OFF			

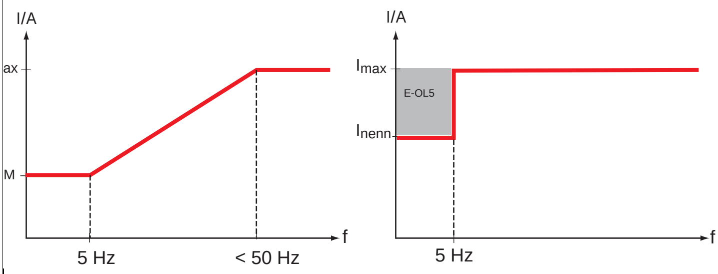
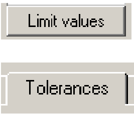


Table 5.19 Limit values - basic settings

5.4.2 Tolerances



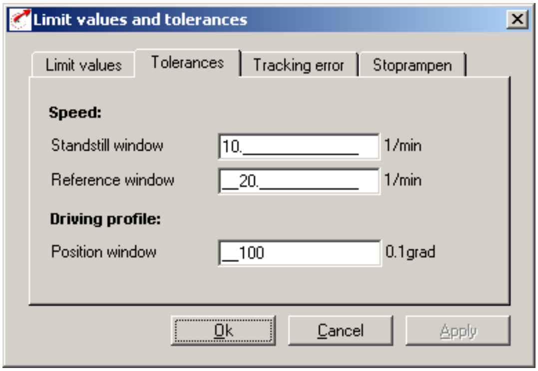


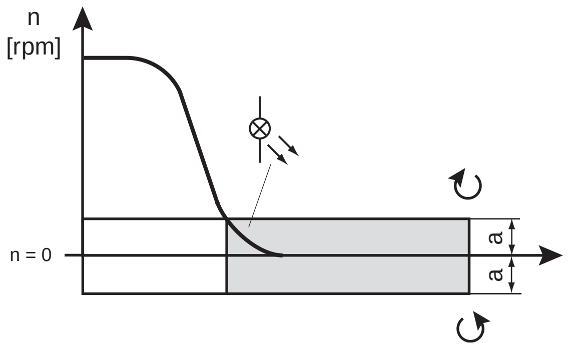
Figure 5.44 Tolerances tab

DM	Meaning	Value range	Unit	Parameter
Standstill window	Window for the “Speed=0” message (at the digital output/ field bus): When current is applied to the motor and the actual speed is less than the “standstill window” parameter, a 24 V level is connected to the “Standstill” output. With the message “Motor rotating anti-clockwise” (ROT_L) the motor must be outside the standstill window and be rotating anti-clockwise. The same applies to the “Motor rotating clockwise” message (ROT_R).	0,02 - 20	rpm	411_SPD_0 (_LIM)
Reference window	Message box: “Reference reached” (at the digital output/ field bus). If the difference between the reference and actual speeds (or reference and actual torque in torque control mode) is less than the “reference window” parameter, a 24 V level is connected to the “reference reached” output.	0 - 1000 0 - 5	rpm / Nm	232_REF_R (_OUT)
Position window	Message box: “Position reached” in the sequence program	1 - 65535	Increments / Customer unit	720_POWIN (_PBAS)

Table 5.20 Tolerances - basic settings

Standstill window

Message box: “Speed=0”

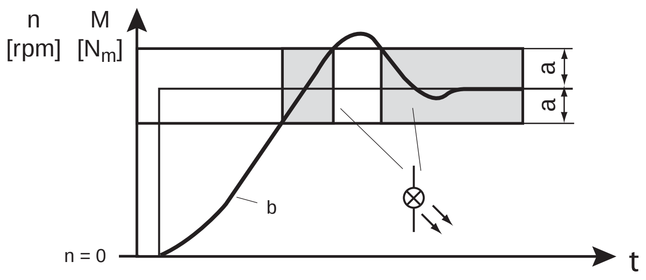


a Standstill window

Figure 5.45 Standstill window

Reference window

Message box: “Reference reached”



a Reference window
b Actual speed

Figure 5.46 Reference window

5.4.3 Tracking error

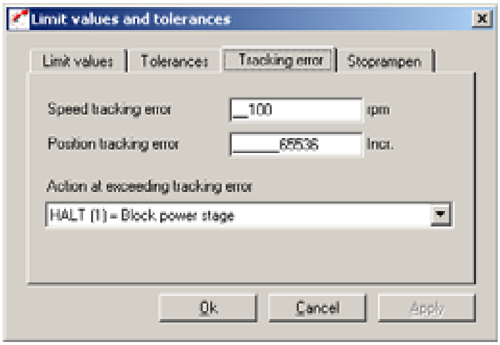


Figure 5.47 Tracking Error tab

DM	Meaning	Value range	Unit	Parameter
Speed tracking error	If the difference between the reference and actual speeds is greater than this value, a 0 V level is connected to the "/Tracking error" output and the following response is triggered:	0 - 12000	rpm	899_SDIF (_LIM)
Position tracking error	If the difference between the reference and actual positions is greater than this value, a 0 V level is connected to the "/Tracking error" output and the following response is triggered:	2.147.483.648 (=32.768 rev.)	Increm ents	462_PDMX (_CTRL)
Action at exceeding tracking error	0 = Only warning 1 = Signal error and disable power stage 2 = Signal error, quick-stop and wait for cancellation of start signal	0 to 2	-	539_R-FLW (_ERR)

Table 5.21 Tracking error - basic settings

Note: In speed tracking error monitoring for 0 rpm, monitoring is deactivated (logical when recording step responses).

5.4.4 Stop ramps

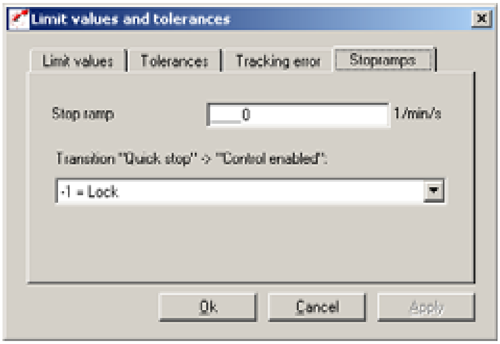


Figure 5.48 Stop Ramps tab

DM	Meaning	Value range	Unit	Parameter
Stop ramp	The stop ramp is activated when the start signal is removed and in case of error shutdown (depending on response, see ERROR/ WARNING). Setting 0 means braking at the preset max. torque.	0 to 65536	rpm/s	496_STOPR (_SRAM)
Transition	Quick stop => Control enabled (only possible in speed control) (see also page 5-39)	-1 = Disable -2 = Enable	/	685_QSOPC (_CONF)
Activation of „Disabling the power stage“ (advantage-ous for hoist applications)	ACTV: Power stage is disabled if the **actual speed = 0** REFV: Power stage is disabled if the **refe-rence speed = 0** (see also page 5-39)	-ACTV REFV	/	497 SELDC (_OUT)

Table 5.22 Stop ramp - basic setting

5.5 Motor and encoder

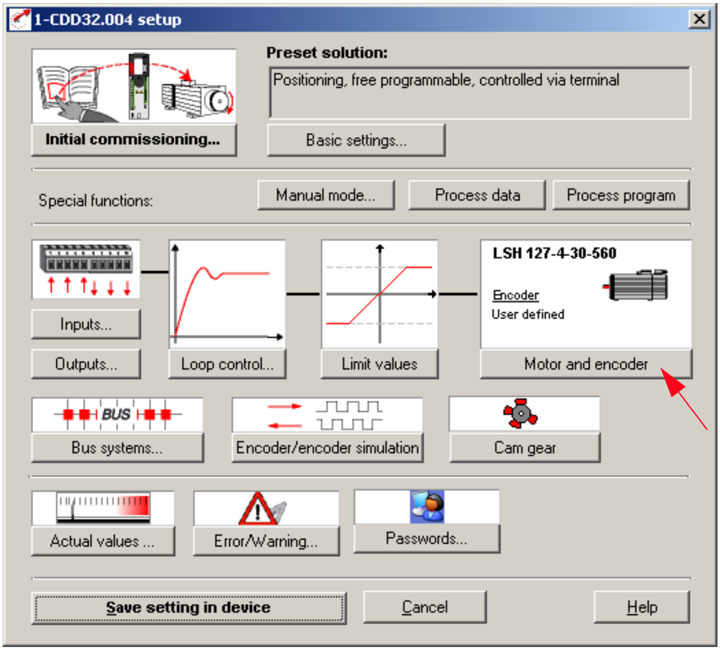


Figure 5.49 User screen: Motor and encoder setup

In the “Motor and encoder setup” screen the matching motor data set can be loaded and the encoder type set.

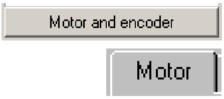
Procedure for setting up a motor:

- Load motor data
- Set motor protection (temperature monitoring and I^2xt protection)
- Set encoder (resolver/optical encoder)
- If necessary, set commutation finding (synchronous motor/linear motor without absolute encoder).

For more information on the motor database refer to the CDD3000 Operation Manual.

Important: Parameters of the “Motor and encoder” subject area may only be changed by qualified personnel. An incorrect setting may cause the motor to start up unintentionally (“run away”).

5.5.1 Motor



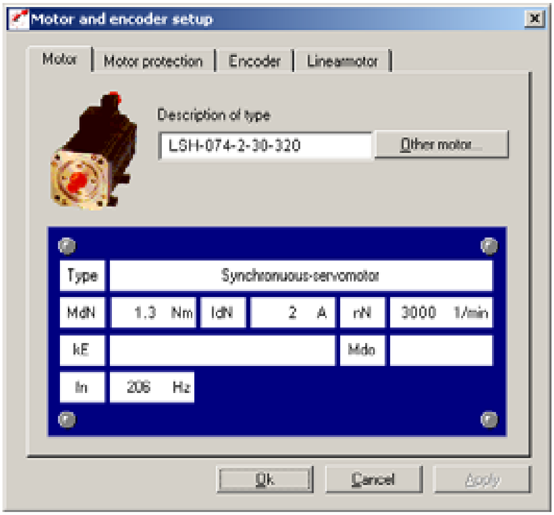


Figure 5.50 Motor tab

A database is available containing the settings for all LUST servomotors. Using the correct motor data set ensures

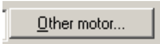
- that the electrical parameters of the motor are correctly set,
- that the motor protection (“Motor protection” tab) is correctly set and
- that the control circuits of the drive are preset.

The torque controller is set up optimally, so no further adjustments are necessary.

Note: The setting of the speed controller is based on the assumption that the machine moment of inertia reduced onto the motor shaft is equal to the motor moment of inertia.
The position controller is designed for a flexible coupling of the mechanism.

Changing motor in the DRIVEMANAGER

A different motor can be loaded from the database of the DRIVEMANAGER.



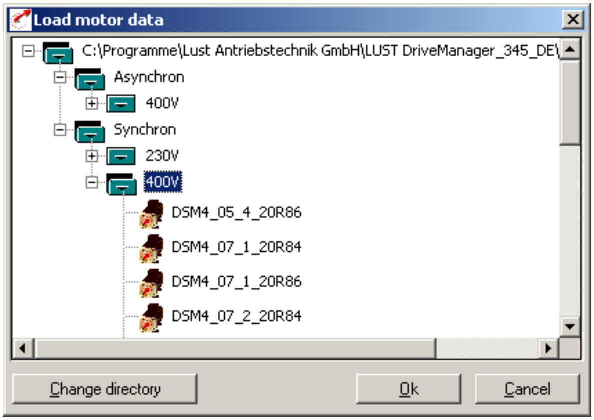


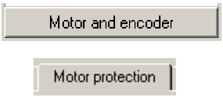
Figure 5.51 Changing motor

Click on the “Other motor” button on the “Motor” tab to select the right motor from your installed database. The motor type is indicated on its name plate.

If the motor data set is supplied on a data carrier (floppy disk, CD-ROM), it can be loaded directly by clicking on the “Change directory” button.

Note: If you are using a motor which is not in the database, “LUST Antriebstechnik GmbH” corporation offers custom data sets as a special service. Please consult your project engineer on this.

5.5.2 Motor protection



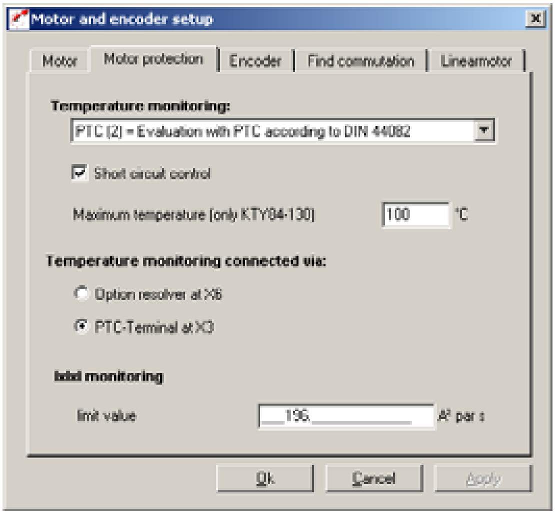


Figure 5.52 Motor Protection tab

In this screen the matching motor temperature sensor (PTC) and temperature-dependent switches and an I²xt monitor can be set to protect the motor.

DM	Meaning	Value range	Unit	Parameter
Temperature monitoring	Type of temperature sensor	see table 5.20		330_MOPTC (_MOT)
Temperature monitoring connected via:	Selection of terminal: X3 = PTC terminals X6 = D-Sub connector, resolver	X3 (0) X6 (1)		337_MOPC (_MOT)
Maximum temperature	Maximum temperature of the motor in KTY84 evaluation through to shutdown E-OTM	10 - 250	°C	334_MOTMX (_MOT)
Short-circuit control	Short-circuit monitoring on PTC input	OFF (0) ON (1)		329_PTCSC (_MOT)
Ixlxt monitoring	The I^2xt monitor protects the motor over the entire speed adjustment range. The value is only available for motors from the motor database.	0 - 237262	A^2 sec.	854_MOI2T (_MOT)

Table 5.23 Motor protection - basic settings

The servocontroller shuts off the motor with an error message:

- E-OTM, if the motor temperature exceeds a programmable limit value (limit value programmable in KTY 84).
- E-OLM if the up-integrated current/time value exceeds the required motor-dependent limit value for a specific time. This function replaces a motor circuit-breaker.

Temperature monitoring settings

Bus	KP/DM	Function
0	OFF	Monitoring off
1	KTY	Linear PTC (KTY 84, yellow)
2	PTC	Threshold PTC (to DIN 44082)
3	TSS	Klixon (temperature switch as break contact)

Table 5.24 Temperature monitoring settings

Note: The linear PTC evaluation is adapted to a KTY84 with yellow tolerance marking, i.e. 100 °C is within the tolerance band 970 to 1030 Ω.
In KTY84 evaluation the current motor temperature is displayed in the “Actual values – Temperatures” screen. The shutdown temperature is adjustable from 10 - 250 °C.
The resistance of the PTC at the nominal response temperatures has a value >3 KΩ (cf. DIN 41081/41082).

IxIxT monitor settings:

If the effective value of the current exceeds the value iMOCNM*root2 (parameter 158-MOCNM), up-integration is performed with ieff². If the current pointer length falls below the value iMOCNM*root2, down-integration is performed with (iMOCNM - ieff)² until the integrator reaches the value zero. To suppress the current spikes occurring due to normal current ripple, ieff² is filtered with a P-T1 element.

The setting “0” for parameter 854-MOI2T deactivates the I²xt monitoring.

Warning threshold for the I² x t monitoring

Motor protection:
Parameter 338 WLITM = Warning threshold for the I² x t monitoring as a percentage of the shut-down limit (unit in [%])

Device protection:
Parameter 339 WLITD = Warning threshold for the I² x t monitoring as a percentage of the shut-down limit (unit in [%])

Reaching the warning threshold is indicated by the function selectors of flags 75-79 (see Imotion program).

Assignment of flag information siehe Tabelle 4.41

Note: The values of the I²t monitor can also be recorded with the digital scope:
Shut-off limit (effective value):
Motor protection: Max. value of I2t integrator
(corresponding to parameter 854-MOI2T)
Integrator value (effective value):
Motor protection: I2t integrator actual value

The value MOI2T is calculated from Id0 (effective value of standstill current) and the overload factor A, and the time T, as per:

MOI2T = (A * Ido)^2 * T

5.5.3 Encoder

As from firmware version V2.35, the CDD3000 drive system is capable of working with single and dual encoder systems. The factory setting is by default always preset for operation with one encoder system, mounted on the motor shaft.

In configuration of the drive system during first commissioning the encoder evaluation parameters are set in the following steps:

Step 1: Select single or dual encoder system

In the Drivemanager “Motor and encoder” screen select the “Encoder” tab and highlight the relevant system.

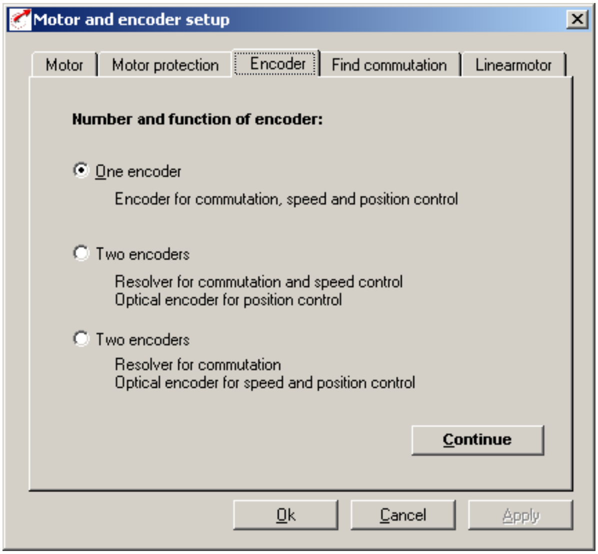


Figure 5.53 “Encoder” tab

Single-encoder system:

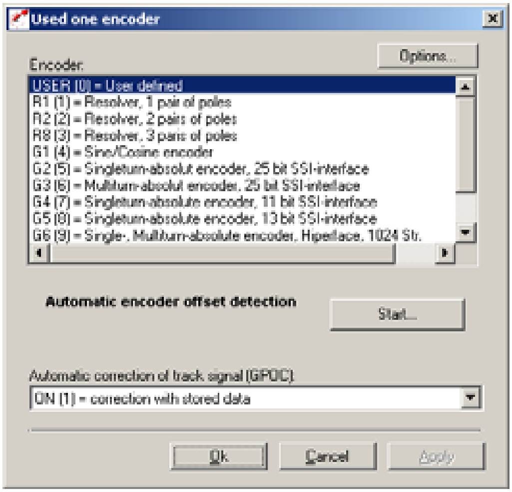


Figure 5.54 Encoder configuration

The rotary encoder connected to the motor is set up on the “Encoder” tab. Resolvers are designated by the parameter Rx, encoders by the parameter Gx. The encoder used is entered on the motor name plate.

DM	Meaning	Value range	Unit	Parameter
Encoder	Assistance parameter for setting the encoder type	see table 5.22	/	430_ECTYP (_ENC)
Automatic correction of track signal	OFF (0) = off ON (1) = correction with stored values Adapt (2) = correction (online) active	0 - 2	/	675_ECCON (_ENC)
Automatic encoder offset detection	The encoder offset can be automatically calculated in two ways (absolute encoder only): By default with freely alignable shaft and for braked direct drives. Precondition: Input ENPO set			

Table 5.25

Table 5.26 Encoder - basic setting

Note: To set the lines per revolution:
The factory default setting of the lines per revolution for encoder G1 is 2048. To set any desired lines per revolution in the range 1- 8190 the encoder is configured as “USER - user-defined”.

Automatic correction of track signal

Both resolver and Sin/Cos incremental encoders exhibit systematic errors which are reflected in the measured position and the speed calculated from it. Dominant errors of the encoders in this context are gain and phase errors, as well as offset components of the track signals.

To this end, LUST developed Gain Phase Offset Correction (GPOC). This patented procedure weights the amplitude of the complex pointer described by the track signals by special correlation methods. The dominant errors can thereby be determined very precisely, with no interference from other encoder errors, and then corrected.

System balancing

For system balancing the following procedure is suggested:

- Run the motor at constant speed (e.g. with control window in DRIVEMANAGER) / for resolvers approx. 1000 to 3000 rpm; for optical encoders approx. 1 to 5 rpm.
- Switch to **ADAPT** and wait about 1-3 minutes for the compensation algorithms to reach their steady state.
- Switch to **ON** to enable the calculated values to be used.
- Apply setting (and save secure against mains power failure).

Note: Checking performance possible using digital scope: Recording of actual speeds/track signals before and after GPOC.

Encoder types

Bus	Type	Designation
0	User	Encoder type not corresponding to Rx and Gx
1	R1	Resolver 1 pole pair
2	R2	Resolver 2 pole pairs
3	R8	Resolver 3 pole pairs
4	G1	Sin/Cos 2048 lines zero pulse
5	G2	Sin/Cos 2048 lines single-turn SSi 25 bits
6	G3	Sin/Cos 2048 lines multi-turn SSi 25 bits
7	G4	Sin/Cos 2048 lines single-turn SSi 11 bits
8	G5	Sin/Cos 2048 lines single-turn SSi 13 bits
9	G6	Sin/Cos 1024 lines single- or multi-turn Hiperface
10	G7	Sin/Cos 512 lines single- or multi-turn Hiperface
11	G8	TTL encoder 1024 lines
12	G9	Sin/Cos encoder with special Hiperface protocol
13	G10	Sin/cos, single or multiturn EnDat 2.1

Table 5.27 Encoder types

Important: Encoder types G1 and G8 can only be used with a synchronous motor in conjunction with the “Find commutation” function, as for loop-controlled operation of a synchronous motor the rotor position on activation of control must be known. If this rule is ignored the motor may “race”. In conjunction with asynchronous motors this restriction does not apply.

Note: Note on connection of a TTL encoder:
In drive systems with one encoder, the TTL encoder preset as a G8 type is connected to connector **X5**. This results in the restriction that the “Encoder simulation” and “Master encoder” functions are not available simultaneously.
Connecting a TTL encoder to connector X5 requires differential signals of the encoder according to RS422.
In drive systems with two encoders, the encoder for commutation finding and speed control is always the resolver. One of the Gx types is selected as the master encoder. This master encoder is always connected to connector X7, even in the case of a TTL encoder.

Options (USER setting)

If the encoder type differs from the possible presets (Rx to Gx), it can be set manually.

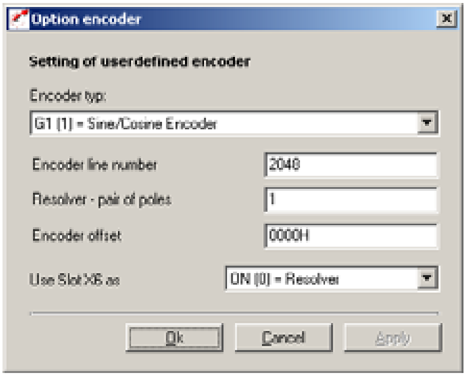


Figure 5.55 Encoder options

DM	Meaning	Value range	Unit	Parameter
Encoder type	Freely selectable encoder type in case of deviation from preset	see table 5.24	-	431_CFENC (_ENC)
Encoder line number	Lines per revolution of the connected optical encoder	1 -65535	Lines per revolution	432_ECLNC (_ENC)
Resolver - pair of poles	Number of pole pairs of the connected resolver (only effective with setting R)	1 - 7	Pole pairs	433_ECNPP (_ENC)
Encoder offset	Correction value for the mechanical installation position of the encoder	0 - FFFF	Hex	434_ECOFF (_ENC)
Use slot X6 as	For Hall sender evaluation on the resolver input the excitation can be shut off.	OFF (0) Hall sender ON (1)Resolver	/	435_RESON (_SYS)

Table 5.28 Encoder options - basic settings

1
2
3
4
5
A

EN

Bus	Type	Designation
0	R	Resolver
1	G1	Sine/cosine encoder
2	G2	Single-turn absolute value encoder, 25 bits SSI interface
3	G3	Multi-turn absolute value encoder, 25 bits SSI interface
4	G4	Single-turn absolute value encoder, 11 bits SSI interface
5	G5	Single-turn absolute value encoder, 13 bits SSI interface
6	G6	Single/multi-turn/absolute value encoder, Hiperface
7	G7	Single/multi-turn/absolute value encoder, Hiperface
8	G8	TTL encoder
9	G9	TR encoder with reduced Hiperface protocol
10	G10	Sin/cos, single or multiturn EnDat 2.1

Table 5.29

Table 5.30 Encoder type user-defined

Electronic nameplate (G7 encoder)

When the drive controller is switched on a check of the motor type is performed (parameter MOENP = 1-254). If a variation from the default data is found, an error message is triggered. In this case the nameplate must be read again.
Setting:
Parameter MOENP = 0
Parameter CFENC = G7
If MOENP = 255 no comparison of the motor type is performed.

Important: When the electronic nameplate is read again, a comparison is performed between the customer's setting and the factory setting data.

Encoder type (10) EnDat 2.1
Function:
Support of sin-cos encoders with EnDat 2.1 format
Setting:
431 CFENC encoder type = ED21
450 CF2EC encoder type for speed and position control = ED21
Screen „Motor and encoder“
[user-defined] / [options]

Note: The CDD3000 can evaluate optical encoders with any number of lines per motor revolution between 1 and 65535.

Dual-encoder system:

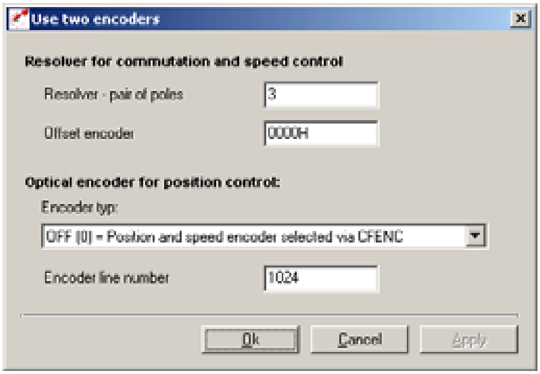
The CDD3000 servocontroller can evaluate two encoders simultaneously (one resolver and one optical encoder).

This enables a “higher-level position control” to be effected, meaning an optical encoder can be attached directly to the process to compensate for mechanical inadequacies (slack/elongation...).

For this there are two setting options.

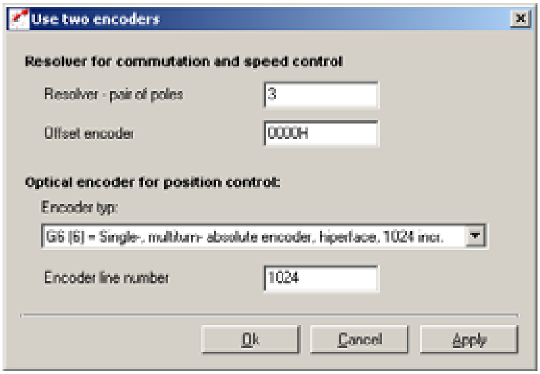
Option A:

The resolver is responsible for commutation and speed control, and the optical encoder is only used for position control.



Option B:

The resolver is only responsible for commutation and the speed and position control are implemented with the optical encoder.



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DM	Meaning	Value range	Unit	Parameter
Resolver - pair of poles	Number of pole pairs of the connected resolver (only effective with setting Rx)	1-7	Pole pairs	433_ECNPP (_ENC)
Offset Encoder	Correction value for the mechanical installation position of the encoder	0-FFFF	Hex	434_ECOFF (_ENC)
Encoder type	Optical encoder type for position control and, where appropriate, speed control	see table 5.24		450_CF2EC (_ENC)
Encoder line number	Lines per motor revolution of the connected optical encoder	1-65535	Lines per revolution	432_ECLNC (_ENC)

Table 5.31

Table 5.32 Basic setting - two encoders

Note: Note: Changes to the encoder configurations can only be made offline. The system must then be re-initialized. Please note the information regarding standardization of the units of the quantities in position-controlled mode in section 4.10

Note: **Wire break detection using two encoders**
In the event of a wire breakage on one of the two encoders an error shutdown will be performed.
No distinction is made as to which encoder has suffered the wire breakage!

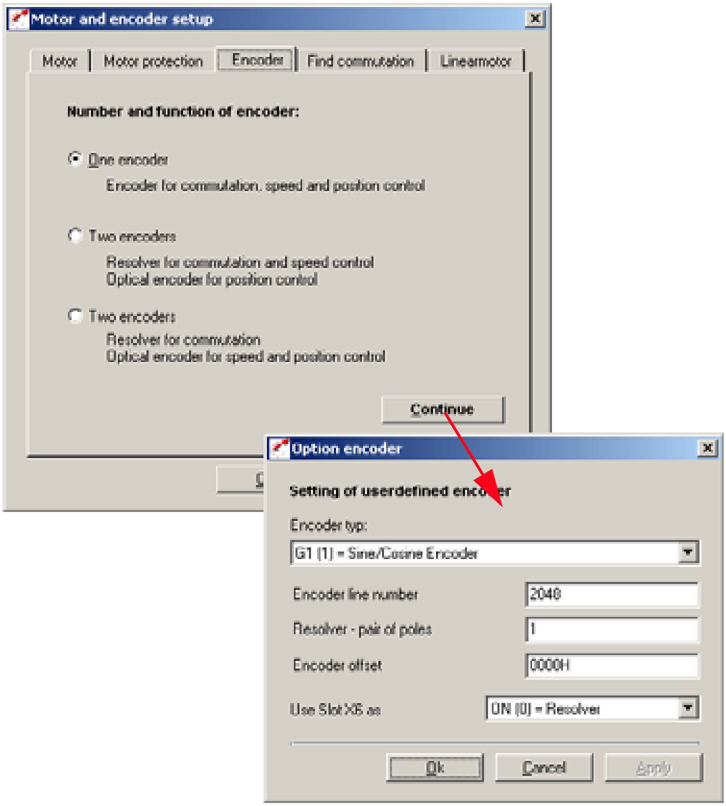
Note: If you want to forward the position information to the higher-level controller at a higher resolution, select the „1-to-1“ setting. You can then configure the selected lines per revolution in 2^n increments from 32 to 65536 (resolver: px 32 to px 65536).

5.5.4 Find commutation

If a synchronous motor is connected to an encoder which has no absolute link to the pole pitch of the motor, after powering up the controller a commutation finding must be performed.

Commutation finding is performed in operation one time after switching on the mains voltage, at the first start enable. It can be forced during commissioning by altering a parameter which causes a full control initialization (e.g. changing find commutation parameters/control mode, etc.).

For this, the encoder G1 (Sine/Cosine encoder without position reference) or USER (user-defined) is set on the Encoder tab.



Then on the Find Commutation tab the method to be applied and its parameters can be set.

A total of five methods are available:

1. Find commutation IENCC (1) via motion

An easily parameterized method in which, however the rotor moves by as much as half a revolution, or half a pole pitch unit (where p = 1).

2. Find commutation LHMES (2) with braked machine

The machine must be blocked by a suitable brake during commutation finding. The occurring torques and forces may reach the machine's rated torque/rated force.

3. Not implemented

4. Find commutation IECON (4) with minimized movement

Here, too the rotor must be able to move, though appropriate parameter-setting can reduce the rotor movement to just a few degrees per mm.

5. Find commutation HALL1 (5) with Hall senders 120 degrees

Hall sender evaluation of two **120 degrees** offset sensors: The sensors deliver analog output signals which are read-in on the resolver input.

6. Find commutation HALL2 (6) with Hall senders 90 degrees

Hall sender evaluation of two **90 degrees** offset sensors: The sensors deliver analog output signals which are read-in on the resolver input.

Important: Parameters of the “Find commutation” subject area may only be changed by qualified personnel. If they are set incorrectly the motor may start up in an uncontrolled manner.

Note: Activation of speed tracking error monitoring is recommended (see section 5.4.3). This monitor reliably prevents the motor from racing (e.g. if the commutation finding is inadequately configured/executed).

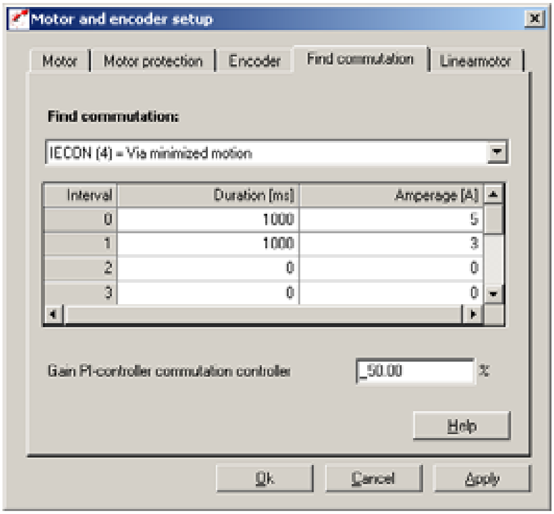


Figure 5.56 Find Commutation tab

The settings are made in the combo box according to the chosen method.

Note: The preset current ratings are amplitude variables (peak values).
As a general rule the commutation finding process should be recorded with the digital scope of the DRIVEMANAGER, in order to obtain a precise picture of the process.
For more information and help on using the Find Commutation function consult your project engineer.

DM	Meaning	Value range	Unit	Parameter
Find commutation	Methods of commutation finding	OFF (0) HALL2 (6)		886_IESEL (_CTRL)
Interval **0/1**: Duration [0] Duration [1] Amperage [0] Amperage [1]	Find commutation with (min.) rotor movement: Duration of 2nd interval Duration of 1st interval Amperage (current rating) of 2nd interval Amperage (current rating) of 1st interval	 65535 see note 1. 0-300 0-300	 ms ms A A	 884_IENCT [_CTRL) 884_IENCT [_CTRL] 885_IENCC [_CTRL] 885_IENCC [CTRL]
Interval **2/4**: Duration [2] Duration [4] Amperage [2] Amperage [4]	Find commutation with braked machine: Test signal period Number of oscillations for 2nd measurement Test signal amplitude Offset for 2nd measurement	 see note 2. see note 3. 0-300 0-300	 ms ms A A	 884_IENCT [_CTRL) 884_IENCT [_CTRL] 885_IENCC [_CTRL] 885_IENCC [CTRL]
Gain commutation controller	Parameter to optimize movement (see description of method)	0-999,95	%	807_KCGFA (_CTRL)

Table 5.33 Find commutation - basic setting

Note:

1. (see interval duration)
   The total duration of both intervals must not exceed 8100 ms.
2. The period should be between 2 ms (=> 500 Hz) and 10 ms (=> 100 Hz).
3. The number of oscillations must be in the range 5....50.

Methods of commutation finding

OFF (0) = off

There is no commutation finding.

Find commutation IENCC (1) via motion

Principal of method:

In this method a direct current is applied to the motor in two orthogonal directions. This aligns the rotor (maximum 0.5 magnetic pitch).

Area of application:

The encoder offset (commutation angle) can be set without major parameter configuration.

Precondition:

It is not possible to set a time above 8s. If the rotor is then not yet at rest, a different method must be selected.

Important: The motor may be moved jerkily during commutation finding. The coupled mechanism must be designed to cope with this.

Important: If the axle is blocked, i.e. the rotor is unable to align itself freely, the methods will not work properly. As a result, the commutation angle will be incorrectly defined and the motor may run down in an uncontrolled manner.

Parameter setting:

Parameters for two intervals in which a direct current is applied are set in terms of duration and current rating. The parameters are set on the “Find commutation” tab from the “Motor and encoder” menu.

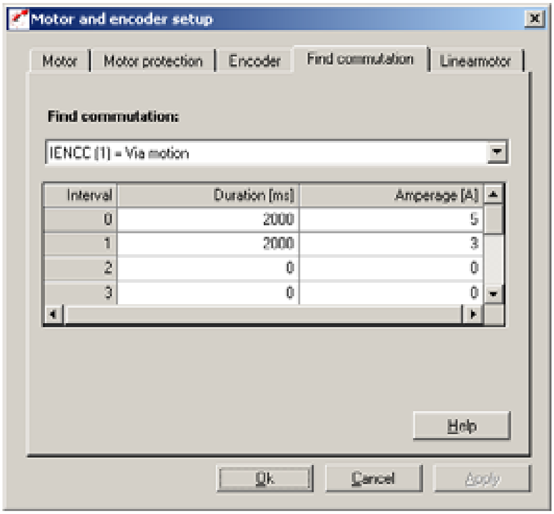


Figure 5.57 Find Commutation tab - via motion

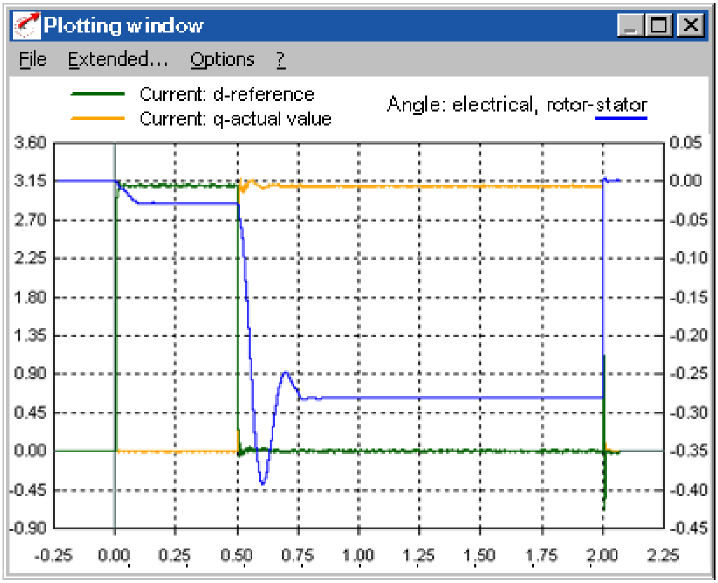
First the interval configured in field [1] is applied, then the one set in field [0]. The durations should be selected such that the rotor is at rest at the end of the second interval (field [0]). The recommended amperage is the motor rated current.

Note: Inexperienced users should always select the motor rated current (amplitude) as the amperage and the maximum time of 2 x 4s as the duration.

Checking the parameter settings:

As a check, the commutation process can be recorded using the DriveManager. For this the current variables on the Alpha and Beta axis and the electrical rotor/stator angle are plotted.

In the plot shown the rotor is at rest at the end of each of the two periods at t = 0.5 s and t = 2 s. respectively



Find commutation LHMES (2) with braked machine

This method is suitable for commutation finding with a braked rotor.

Principal of method:

Saturation effects in the stator inductance are evaluated. For this two test signals are applied. The first determines the position of the rotor axle, the second its orientation.

Area of application:

To determine the rotor angle with a braked rotor or in motors with very high inertia.

Precondition:

The rotor must be braked effectively, so that the motor does not move even when the rated current is applied.

Precondition:

The stator of the machine must be iron-core.

Parameter setting:

The test signals are a sinusoidal current which can be defined in terms of amplitude and period duration, and for the second measurement also in terms of direct component and number of periods. These settings are made on the “Find commutation” tab from the “Motor and encoder” menu.

In field 2 the period durations (e.g. 3 ms => 333Hz test signal frequency) and the amplitude (e.g. 1A) are entered.

The number of periods for the second measurement can be set in field 4 under Duration; the direct component is entered under Amperage.

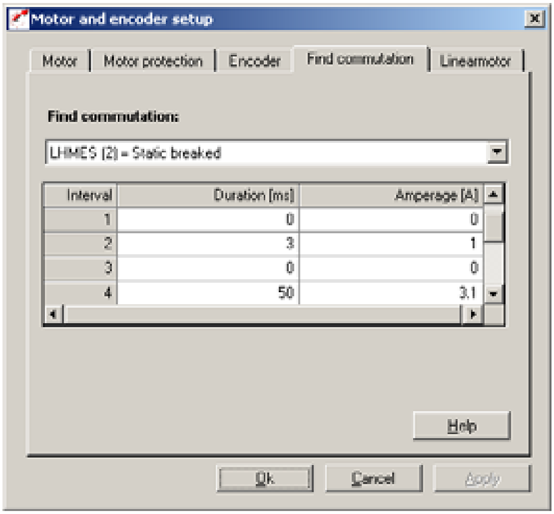


Figure 5.58 Find Commutation tab - with braked machine

Setting parameters for a test signal: Frequency 333 Hz; amplitude 1A; duration 50 periods; direct component 3.1 A

With a test signal frequency of 333 Hz and an amplitude of an order of one quarter of the rated current or 1A, evaluation of 50 oscillations and a direct component in the amount of the rated current, good results are produced in most cases.

Checking the parameter settings:

The inductances determined are stored in field parameter 835_SC_V2 (_SCD).

The field parameter [12] corresponds to the mean inductance, and should match the stator inductance specified on the data sheet.

Parameters [3] and [4] specify the inductance under the influence of saturation, and should be 5% to 10% apart. If these values are too close together, the controller will abort with the error message E-ENC 137. In this case the current must be increased in field 4.

Find commutation IECON (4) with minimized movement

Please consult us if you wish to use this method of minimizing the alignment movement.

Important: The speed controller must be preset. If the speed controller has not yet been set up, a different commutation method should first be selected, such as with movement, IENCC (1).

Note: The default setting for interval 1 is 1000 ms and rated current (amplitude) of the motor.
The default setting for interval 0 is 2000 ms and twice the rated current (amplitude).
The default setting for the PI controller: commutation controller gain is 50 %.

Find commutation HALL1 (5) with Hall senders

Hall sender evaluation of two **120 degrees** offset sensors:

The sensors deliver analog output signals which are read-in on the resolver input (X6). Then the commutation angle is determined from the two track signals by means of an arc-tangent operation.

The accuracy of the calculated encoder offset depends on the properties of the evaluated magnetic field, the quality of the sensor signals and the downstream evaluation electronics.

Note: The resolver excitation must be shut off (see section 5.5.3).
The cabling of the Hall sender must be checked to ensure that the direction of movement/rotation matches that of the second encoder system and that of the motor. This can be checked with the digital scope in the DM: Resolver track A/B (CFENC must be set to R1.)
The offset of the encoder (Hall sender), i.e. the mechanical correction value of the fitting position, must be determined one time.

Find commutation HALL2 (6) with Hall senders

Hall sender evaluation of two **90 degrees** offset sensors: Otherwise treated as HALL1 (5).

5.5.5 Linear motors

On the “Linear motor” tab the motor data can be calculated from the rating plate/data sheet data.

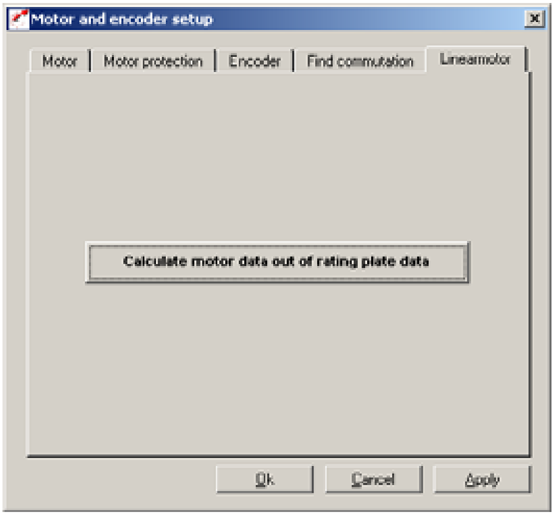


Figure 5.59 Linear Motor tab

The “Calculate motor data” screen translates the data sheet data of the linear motor into rotational quantities.

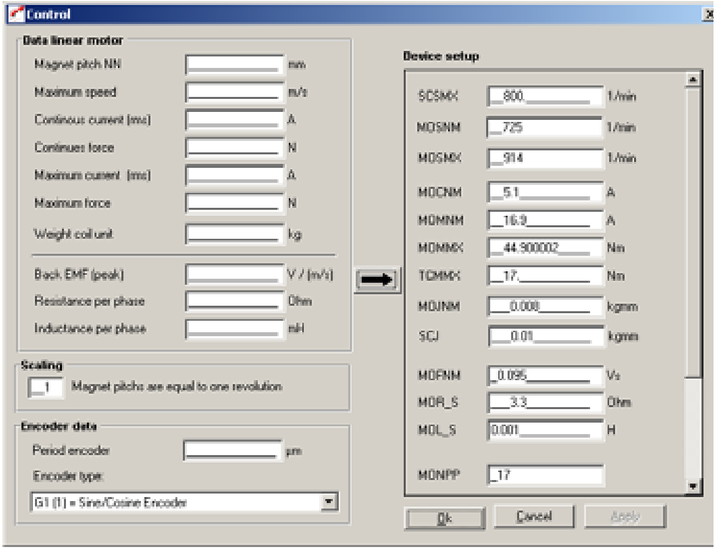


Figure 5.60 Calculation of motor data

Scaling section: If the lines per revolution of the encoder or the maximum velocity is problematic, one pole pair may correspond to multiple revolutions (MONPP ≠ 1).

Note: For details of the further procedure in creating data sets for linear motors please consult your project engineer.

5.6 Actual values

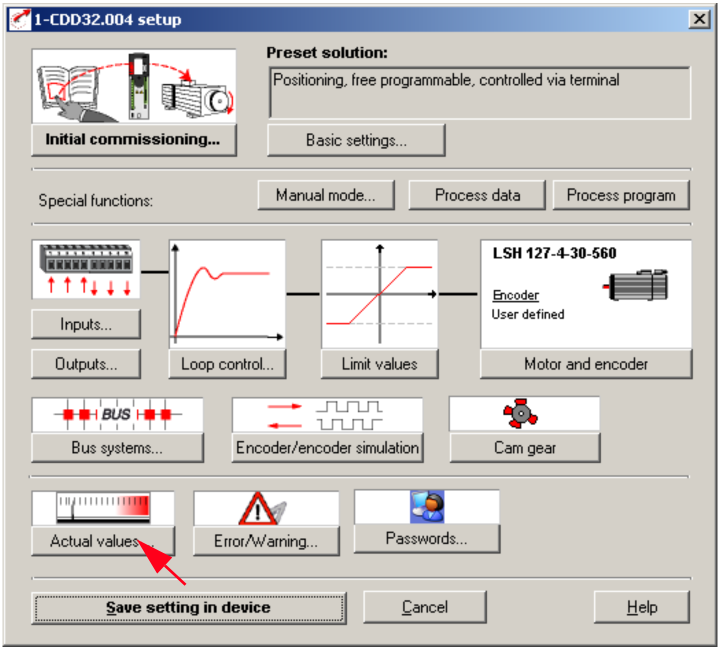
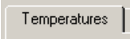


Figure 5.61 User screen: Actual values

In the “Actual values” screen all the values necessary for diagnosis and monitoring can be called up.

5.6.1 Temperatures



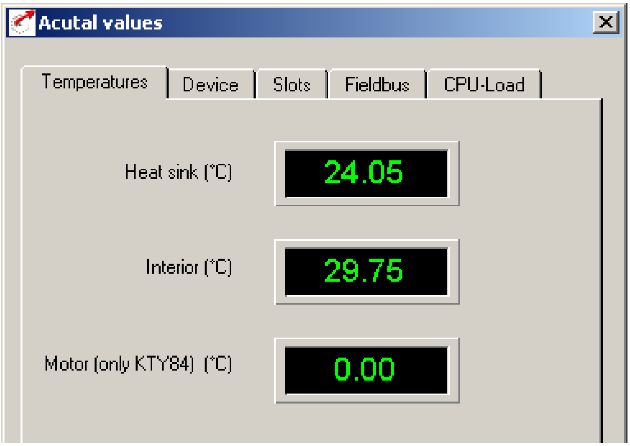


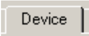
Figure 5.62 Temperatures tab

DM	Meaning	Value range	Unit	Parameter
Heat sink	Current heat sink temperature, measured in module of power stage. Overheating shut-off (E-OTM) at 85 °C.	0 - 150,00	°C	427_TEMP (_VAL)
Interior	Current interior temperature, measured on the control pcb.	0 - 150,00	°C	425_DTEMP (_VAL)
Motor	Current motor temperature, measured in the motor winding (only with KTY 84/yellow).	0 - 250,00	°C	407_MTEMP (_VAL)

Table 5.34 Temperatures - basic settings

Note: The service life of the electronic components (electrolytic capacitor, power stage transistors, ...) will be reduced considerably in continuous operation at an interior temperature above 65 °C.

5.6.2 Device data



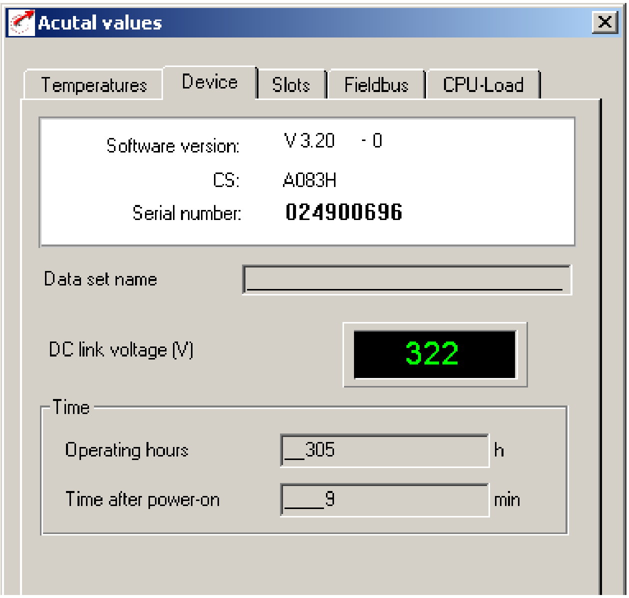
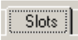


Figure 5.63 Device tab

DM	Meaning	Value range	Unit	Parameter
Software version	Current firmware version in device Example: Standard software V2.35 Modified V200.40	0 - 999,95	/	92_REV (_STAT)
CS	Checksum of firmware in device	0000-FFFF Hex	/	115_CSXOR _STAT)
Serial number	Serial number of device	/	/	127_S_NR (_STAT)
Data set name	Name of the current parameter set in the device	max. 27 characters	/	889_NAMDS (_CONF)
DC-link voltage	Current voltage in the servocontroller DC link. $U_{zk} = \text{Voltage} \cdot \sqrt{2}$	Single-phase typically 325 V Three-phase typically 565 V	V DC V DC	405_DCV (_VAL)
Operating hours	Operating hours of the device	0 - 65535	hrs	87_TOP (_VAL)
Time after power-on	Time after power-on of device	0 - 65535	min	TSYS_86 (_VAL)

Table 5.35 Device - basic settings

5.6.3 Slots



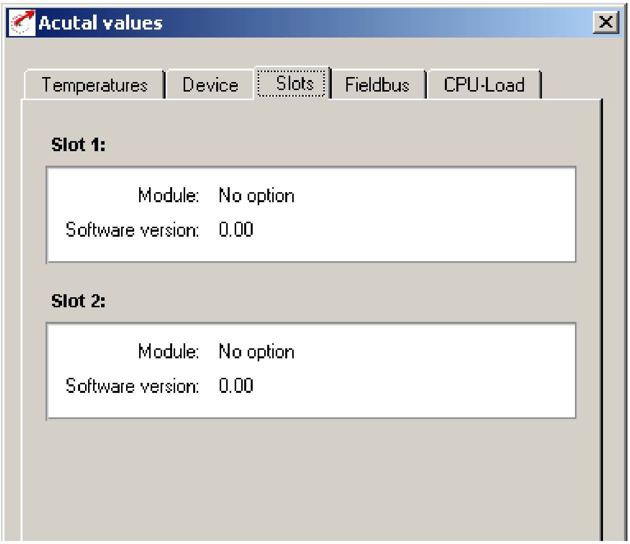


Figure 5.64 Slots tab

DM	Meaning	Value range	Unit	Parameter
Slot: 1 module	Assignment of option module in slot 1	see Table 5.33	/	579_OPTN1(_OPT)
Slot 1: Software version	Software version of option module in slot 1	0 - 999,95	/	576_OP1RV(_OPT)
Slot 2: Module	Assignment of option module in slot 1	see Table 5.33	/	578_OPTN2(_OPT)
Slot 2: Software version	Software version of option module in slot 1	0 - 999,95	/	577_OP2RV(_OPT)

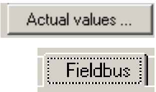
Table 5.36 Slots - basic settings

Possible modules:

Bus	Type	Designation
0	NONE	No option
1	LCAN	CAN_{Lust} (CM-CAN1)
2	COPEN	CAN_{open} (CM-CAN2)
3	PROFI	ProfibusDP (CM-DPV1)
4	I01	I/O module (UM-8I40)
5	2AOUT	Analog output (UM-2AO)

Table 5.37 Option modules

5.6.4 Field bus



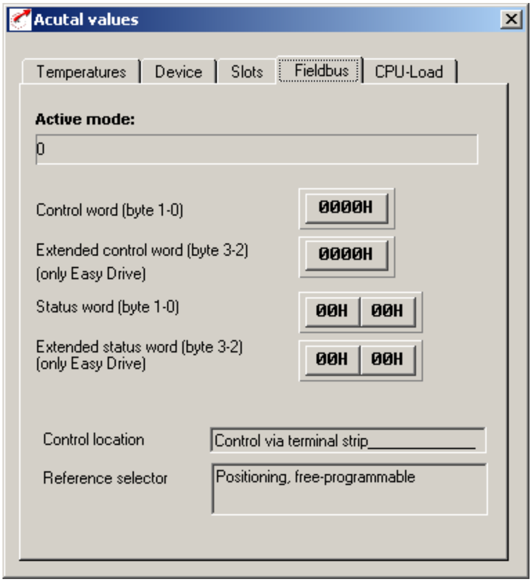


Figure 5.65 Field Bus tab

DM	Meaning	Value range	Unit	Parameter
Active mode	Configuration of actuation via CAN	0-7	/	492_CACNF (_CAN)
Network status	Status of the CAN network (operational, preoperational, prepared)	1 = operational 2 = preoperational 3 = prepared	/	
Control word	Control word of Rx-Pdo (byte 0,1)	/	/	573_CACTR (_OPT)
Status word	Status word of Rx-Pdo (byte 2,3)	/	/	572_CASTA (_OPT)
Extended control word	Extended control word of Rx-Pdo (byte 2.3)	/	/	
Control location	Source of control commands (independent of reference source)	See “Reference structure” section	/	260_TERM (_CONF)
Reference selector	Source of reference input (independent of control location)	See “Reference structure” section 4.1.1	/	280_RSSL1 (_REF)

Table 5.38 Field bus - basic settings

5.7 Error messages

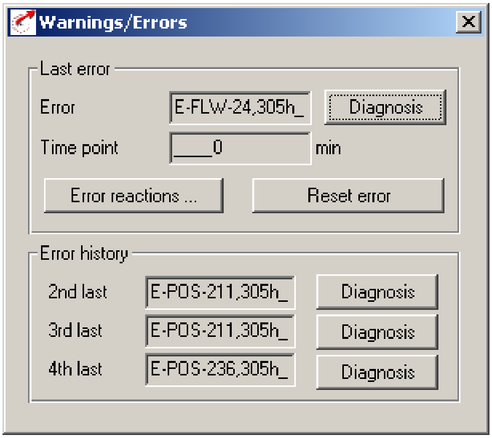


Figure 5.66 Warnings/Errors tab

In Figure 5.66 the last errors to occur are displayed, with an indication of the time and reset possibility.

DM	Meaning	Value range	Unit	Parameter
Error	Last errors to occur. Example: E-OTM-1, 1H Error E-OTM, error location 1, point in time in hours	see Appendix B (Troubleshooting)	/	95_ERR1 (_ERR)
Time point	Time between power-on and last error	0 - 65535	minute s	94_TERR (_ERR)
2nd last	Last-but-one error	see Appendix B (Troubleshooting)	/	96_ERR2 (_ERR)
3rd last	Last-but-two error	see Appendix B (Troubleshooting)	/	97_ERR3 (_ERR)
4th last	Last-but-three error	see Appendix B (Troubleshooting)	/	98_ERR4 (_ERR)

Table 5.39 Error messages - basic settings

Diagnosis

Plain-text display of the error message / more information on the error location.

Reset error

Acknowledge error and set device to normal condition (ready).

Error reactions

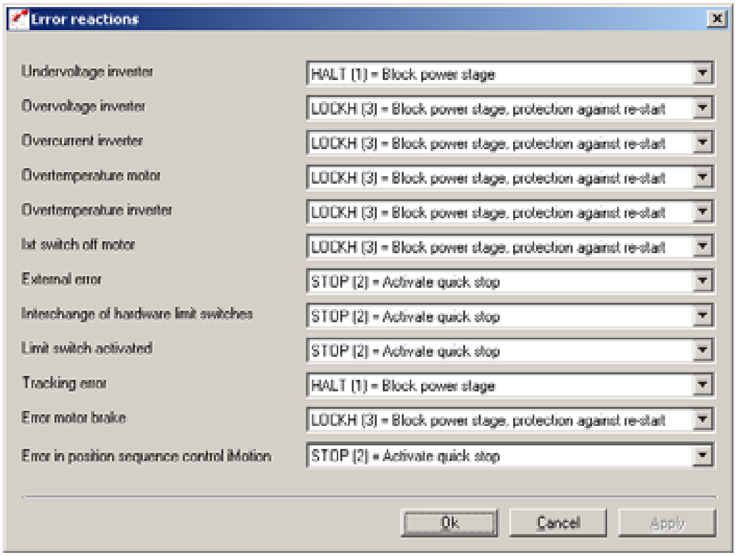


Figure 5.67 Error reactions

The following error reactions can be programmed depending on the error:	
(0) WARN	No error reaction (only warning)
(1) STOP	Block power stage
(2) STOP	Activate quick stop
(3) LOCKH	Block power stage, protection against re-start
(4) LOCKS	Activate quick stop, protection against re-start
(5) RESET	Block power stage, re-start by power-off

Table 5.40

For more information on error messages and their rectification, refer to Appendix B.

5.8 Bus systems

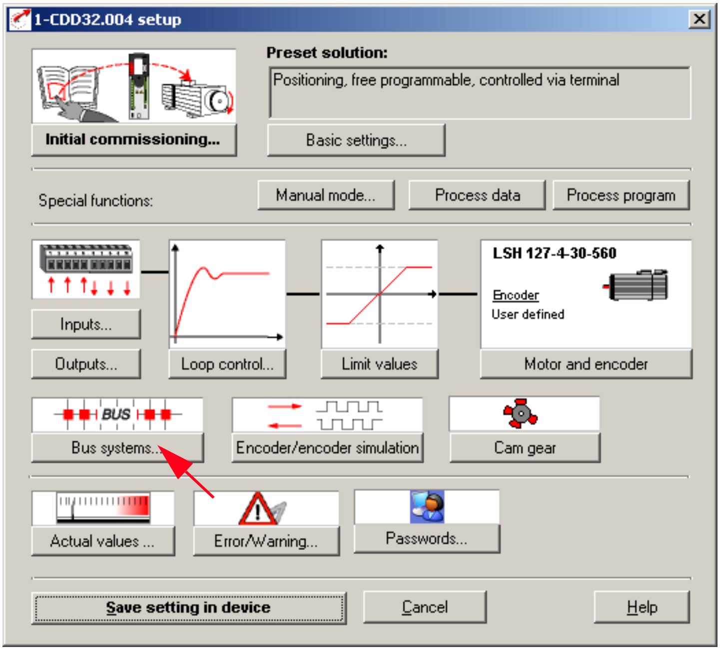


Figure 5.68 User screen: Bus systems

In the “Bus systems” screen all the settings relevant to the “CAN-Lust”, “CAN-OPEN” and “PROFIBUS” bus systems are entered.

For more information on the bus systems refer to the documentation accompanying the relevant bus system.

5.8.1 PROFIBUS

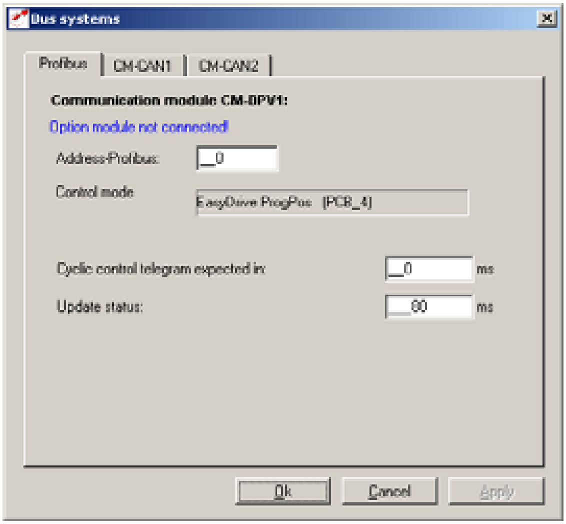


Figure 5.69 PROFIBUS tab

DM	Meaning	Value range	Unit	Parameter
Address-Profibus	Device address With setting 0 HW address coding is active on the module.	0 - 99	/	571_CLADR (_OPT)
Cyclic control telegram expected in	Watchdog monitoring, control log	0 - 255	ms	574_CAWDG (_OPT)
Update status	Sampling time of status report via bus	0 - 32000	ms	575_CASCY (_OPT)

Table 5.41 Profibus - basic settings

For more information refer to the user manual “CM-DPV1”.

5.8.2 CANLust

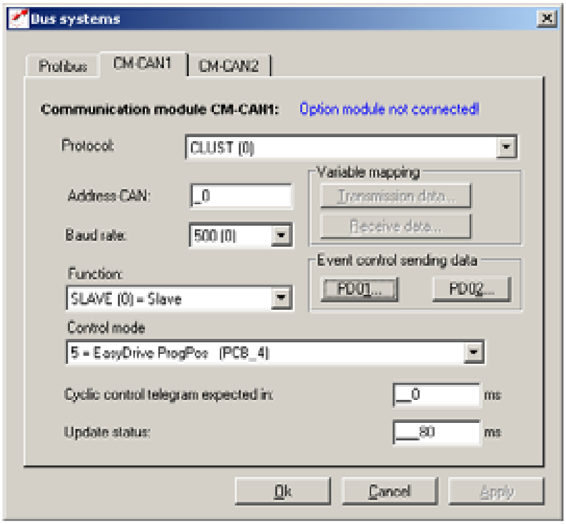


Figure 5.70 CAN_{Lust} tab

DM	Meaning	Value range	Unit	Parameter
Protocol	Protocol used	CLUST (0) COPEN (1)	/	654_PRSEL (_OPT)
Address-CAN	CANLust device address With setting 0 HW address coding is active on the module.	0 - 99	/	571_CLADR (_OPT)
CAN baud rate	CANLust Baud rate	25 - 500 Bus: 5 - 0	kbit/ sec	489_CLBDR (_OPT)
Function	Not active	Slave (0) / Master (1)		570_CAMOD (_OPT)
Control mode	Changes the open loop control mode via the bus system. This means that the content of the control and status information is automatically adapted to the selected “preset solution”. No subsequent changes are permitted.	(see Table 5.38)	/	492_CACNF (_OPT)
Cyclic control telegram expected in	Watchdog monitoring, control log	0 - 255	ms	574_CAWDG (_OPT)
Update status	Sampling time of status report via bus	0 - 32000	ms	575_CASCY (_OPT)

Table 5.42 CAN_{Lust} - basic settings

Control mode / reference transfer

Bus	DM
0	Not used
1	Drivecom, 16 bits reference, actual
2	Drivecom, 32 bits reference, actual
3	Drivecom, 32 bits reference, 2 x 16 bits actual
4	EasyDrive Basic
5	EasyDrive ProgPos (PCB_4)
6	EasyDrive TabPos (PCB_3)
7	EasyDrive DirectPos (PCB_2)
8	EasyDrive Synchron (PCB_1)

Table 5.43 Control mode / reference transfer

For more information refer to the user manual “CM-CAN1”.

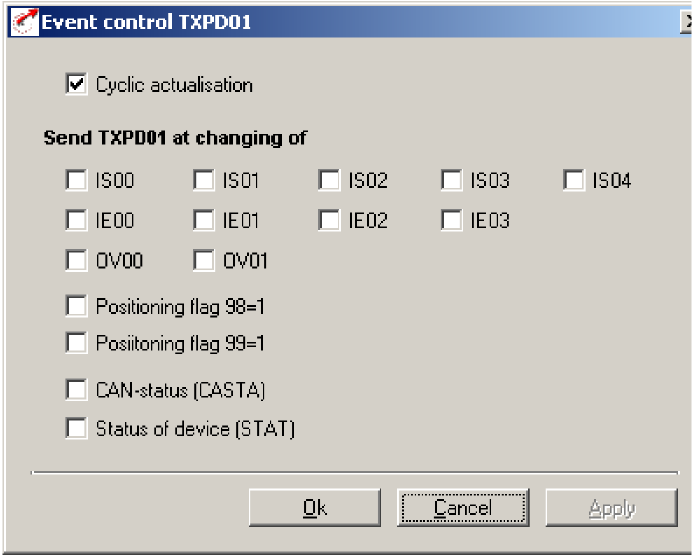
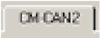


Figure 5.71 Event control TxPD01

5.8.3 CANopen



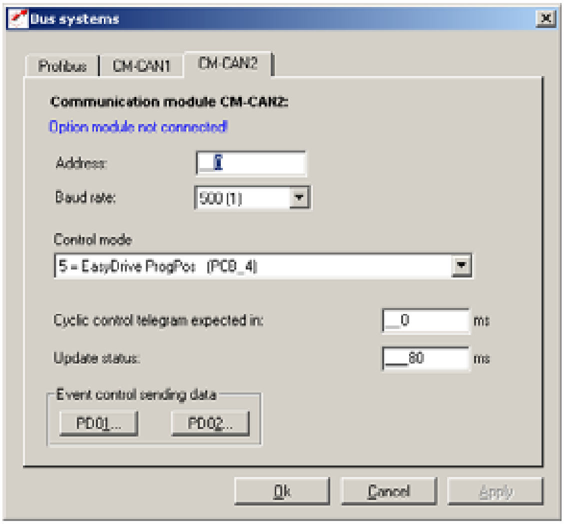


Figure 5.72 CANopen tab

DM	Meaning	Value range	Unit	Parameter
Address-CAN	CAN device address With setting 0 HW address coding is active on the module.	0 - 99		571_CLADR (_OPT)
CAN baud rate	CAN Baud rate	25 - 500 Bus: 5 - 0	kbit/ sec	489_CLBDR (_OPT)
Control mode	Changes the open loop control mode via the bus system. This means that the content of the control and status information is automatically adapted to the selected “preset solution”. No subsequent changes are permitted.	(see Table 5.38)	/	492_CACNF (_OPT)
Cyclic control telegram expected in	Watchdog monitoring, control log	0 - 255	ms	574_CAWDG (_OPT)
Update status	Sampling time of status report via bus	0 - 32000	ms	575_CASCY (_OPT)

Table 5.44 CANopen - basic settings

For more information refer to the user manual “CM-CAN2”.

5.9 Master encoder/ Encoder simulation

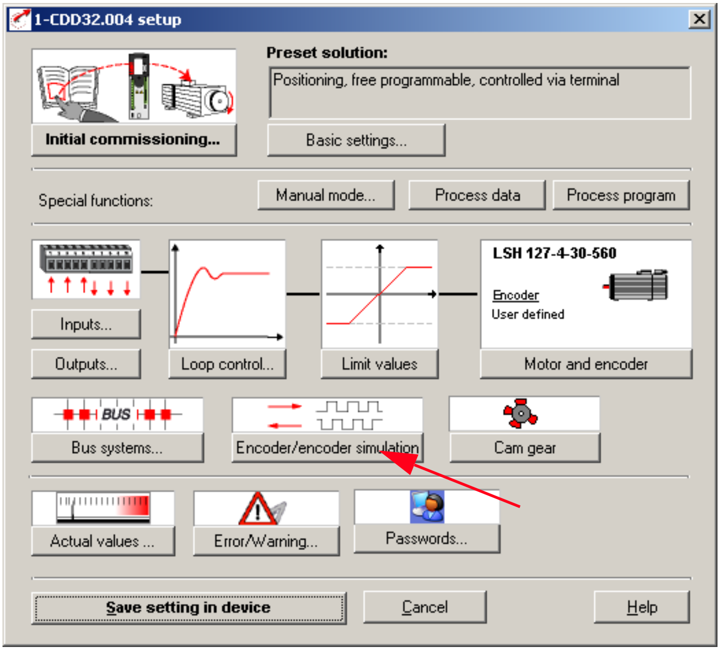


Figure 5.73 User screen: Encoder/Encoder simulation

In the “Encoder/Encoder simulation” screen all the settings for operation with a master encoder ('Conducting encoder') and/or use of encoder simulation are entered.

5.9.1 Encoder simulation

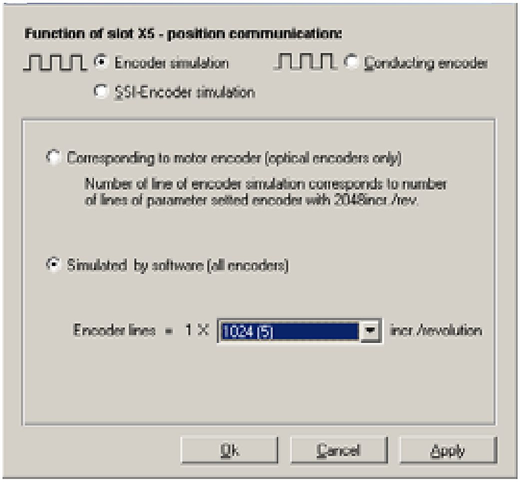


Figure 5.74 Encoder Simulation tab

Encoder simulation connector X5

To forward the signals of the configured position encoder directly "1-to-1", select the first setting. The servocontroller converts the signals of a Sin/ Cos encoder into TTL square signals and forwards them on interface X5. This setting only makes sense for optical encoders (G1 to G8).

If you want to forward the position information to the higher-level controller at a higher resolution, select the "1-to-1" setting. You can then configure the selected lines per revolution in 2^n increments from 32 to 65536 (resolver: px 32 to px 65536).

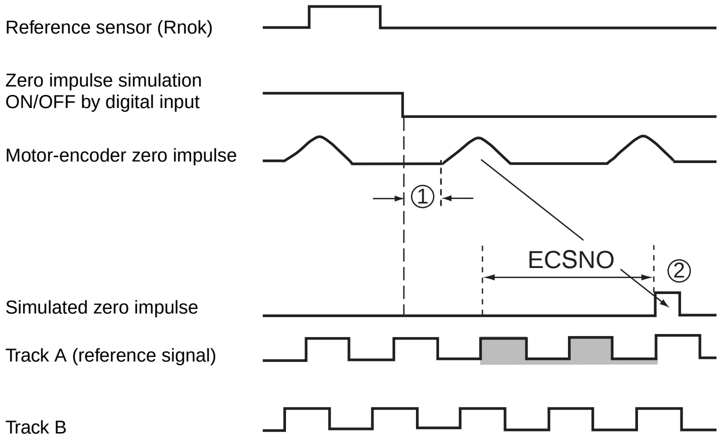
Note: Please note that conversion of the lines per revolution by software entails a small amount of dead time in outputting the position. This setting is typically selected when using a resolver.
The 500 kHz limit frequency of the output must be observed particularly with high numbers of lines per revolution.

Outputs the zero impulses in the setting „1 to n (only for optical encoders)“

Function description

If the motor-encoder system zero impulse is simulated in the software, it should always be output at the same position.
To resolve the software-related problem of the delay time, when the simulated zero impulse is output it should always be offset by the number of TTL periods set in parameter 488 ECSNO. It is essential that the offset is in the correct direction of rotation.

Time diagram:



1) t > 500 µs (ensured by the controller)
2) first zero impulse

Figure 5.75 Time diagram

Parameterisation and setting

Parameter 488 ECSNO: = zero impulse output delay by an integer number of TTL signal periods (track A, track B)
(default setting: 5 periods, example below: 2 periods;
Setting range: -8191 to +8192)

FISxx := NP_SYNC = LOW => simulation ON

– FISxx := NP_SYNC = HIGH => simulation OFF

The direction of rotation when passing through the zero impulse must be specified to the servo controller by means of the preceding sign of the parameter ECSNO

– parameterised as:
– 488 ECSNO positive: = clockwise rotation (cw, default)
– 488 ECSNO negative: = counter clockwise

If the parameter ECSNO is too small or the direction of rotation assigned the wrong preceding sign, no simulated zero impulse will be output.

DM	Meaning	Value range	Unit	Parameter
Encoder lines	The output lines per revolution is adjustable with resolvers in 2^n increments (n=5...16), i.e. 32 to max. 65536 lines. When using the “1-to-1” setting the output lines per revolution corresponds to that of the connected encoder. In the case of encoder types G2 to G7 a zero pulse is outputted directly after system startup. As a result no machine link can be made.	32 (0) to 65536(11) Bus: 0 - 11	Increments/ revolution	471_ECSLN (_SYNC)

Table 5.45 Encoder simulation - basic settings

Encoder simulation forms incremental encoder-compatible pulses from the position of the rotary encoder connected to the motor. Accordingly, pulses are delivered in two 90° offset signals A and B as well as a zero pulse R.

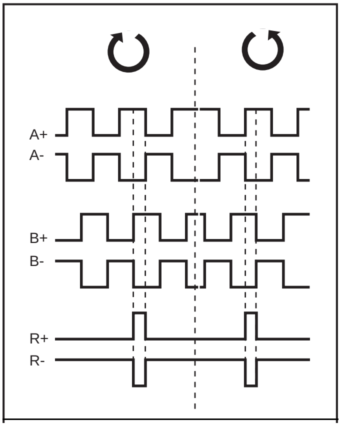
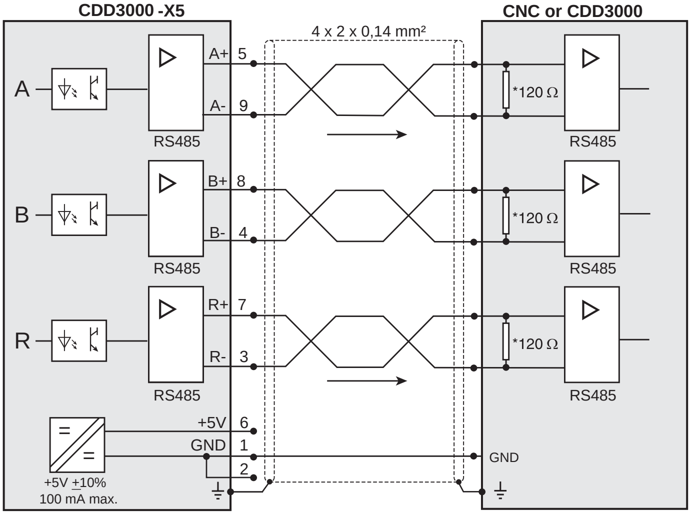


Figure 5.76 Encoder simulation signals looking onto the motor shaft (at left when motor rotating clockwise)

Note: If the signal jitters too much or has excessive noise, it can be filtered independently of the actual speed filter ECTF with parameter 429_ECSTF (_SYNC) (factory setting 1 ms).

.



* The wave terminating resistor is not included in the CDD3000.
It must be connected externally.

Figure 5.77 Encoder simulation connection and signal description

Technical data relating to resolution

Type of encoder	Resolver			Optical encoder		
Encoder at X5 Number of pole pairs	R1 p = 1	R2 p = 2	R8 p = 3	G1 -	G2, G3, G5 G6/G7	G8
Resolution of encoder evaluation [1)]: Increments per revolution Degrees	2^{14} 0,022°	2^{15} 0,011°	$3x2^{14}$ 0,0073°	2^{25} 0,000011°		2^{12} 0,088°
Encoder simulation at X5: Standard pulses per revolution	1024	2048	3072	2048	2048	1024
	(adjustable from p x 32 to p x 65536)			(setting from 32 to 65536)	(setting from 32 to 65536)	(setting from 32 to 65536)
Zero pulses per revolution	1	2	3	1	1 [2)]	1

1) Higher resolutions in encoder evaluation result in higher speed resolutions and thus smoother running of the drive.
The resolution of the position controller is 16 bits, regardless of the encoder type used.

2) The zero pulse has no machine link.

Table 5.46 Encoder simulation technical data

For more information on the hardware and on the electrical specification refer to the Operation Manual.

Example: $f = \frac{3000rpm \cdot 2048pulses}{60rpms} = 102,4kHz$.

Note: The controller connected to the encoder simulation must be able to process its output frequencies. The maximum output frequency is 500 KHz (depending on the cables used: length / type / capacitance ....)

5.9.2 Master encoder

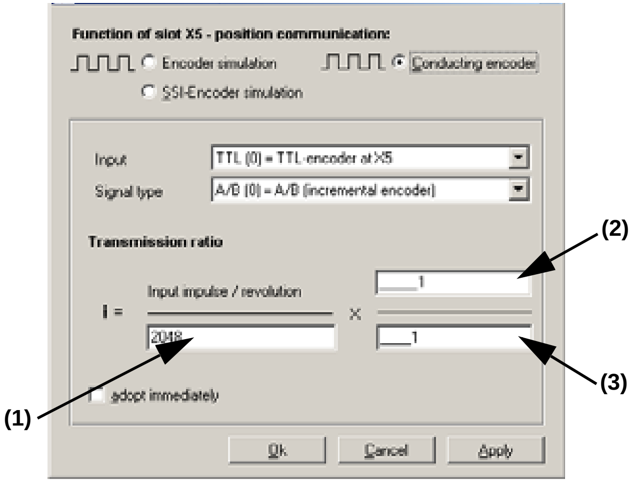


Figure 5.78 Master Encoder tab

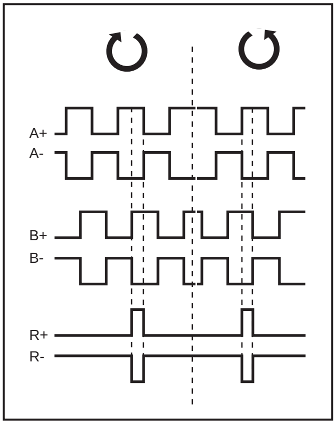
DM	Meaning	Value range	Unit	Parameter
Input	Signal source for TTL master encoder at X5 or HTL master encoder (only A and B track) at X2	(0) TTL - (1) HTL	/	473_EC2TP (_SYNC)
Signal type	Shape of input signals	(0) A/B (1) A/DIR	/	475_RSTEP (_SYNC)
Transmission ratio input impulses/revolution (1)	Lines per revolution of master encoder	2^n n = 5 - 13 (32 - 8192)	Lines/ revolution	474_EC2LN (_SYNC)
Transmission ratio numerator (2)	Transmission ratio: Numerator	-65535 ... +65536	/	480_VRN0M (_SYNC)
Transmission ratio denominator (3)	Transmission ratio: Denominator	0 ... 65536	/	481_VRDEN (_SYNC)
adopt immediately	Synchronized application of transmission ratio (after change in user screen)	(0) OFF (1) ON	/	485_VRSET (SYNC)

Table 5.47 Master encoder - basic settings

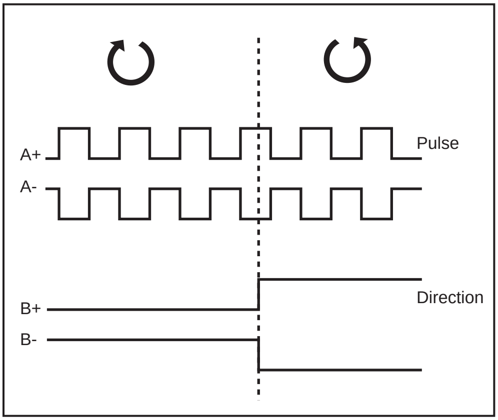
TTL master encoder

The master encoder input X5 permits incremental reference input for loop control. The reference generator is either the encoder simulation of another CDD3000 servocontroller, a standard commercially available incremental encoder or a stepper motor controller. The signal shape corresponds either to

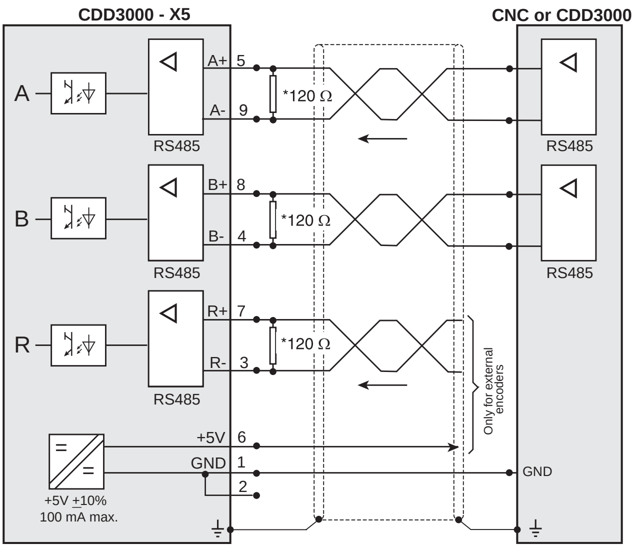
- **A/Bincremental encoder signals** or



- **pulse direction signals** when a stepper motor controller is connected.



Parameters to evaluate the signals can be set for signal type, lines per revolution and transmission ratio.

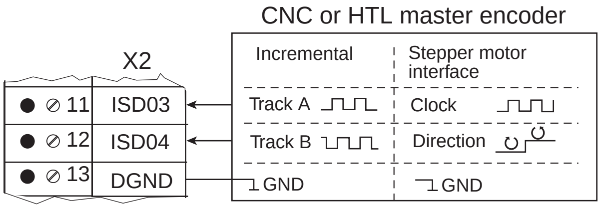


* The wave terminating resistor must be connected externally for the CDD3000.

Figure 5.79 Master encoder input connection and signal description

HTL master encoder

A master encoder with HTL level (24V) can alternatively be connected via control terminal X2. Digital inputs ISD03 and ISD04 are used for this.



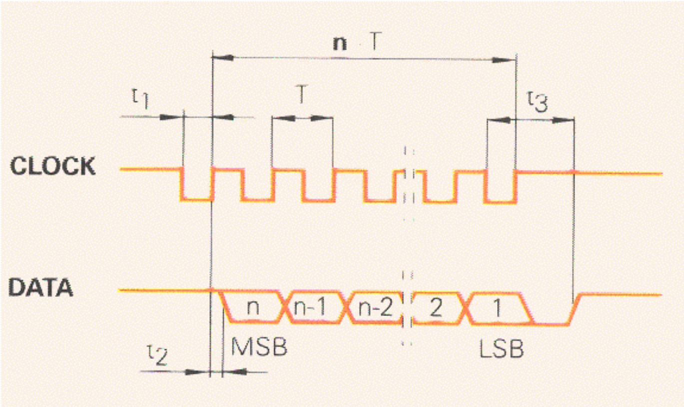
You will find the specification of the digital inputs of control terminal X2 in section 2.4 “Specification of control connections”.

Note: When a HTL master encoder is in use, both the encoder simulation and the master encoder input at X5 are inactive. In order to maintain the switching times and the edge steepness of the encoder, the cable length dependent on the sampling rate and the supply voltage must not be exceeded. Therefore please refer to the manufacturer's data sheet.

5.9.3 Encoder simulation via SSI

As an alternative to TTL encoder simulation, encoder simulation via SSI can be configured. The absolute position is communicated via the SSI interface. The CDD3000 simulates an SSI encoder, thereby assuming the Slave function in SSI communications.

Communication to the SSI standard for single-turn and multi-turn encoders (as also supported by Heidenhain encoders) utilizes an additional clock pulse before the actual SSI transmission to transmit the data of the current absolute position to the shift register.



The CDD responds to the clock pulse generated by the SSI Master with the absolute position. A range of different protocol formats can be selected.

The parameters relevant for SSI communication are set on the tab.

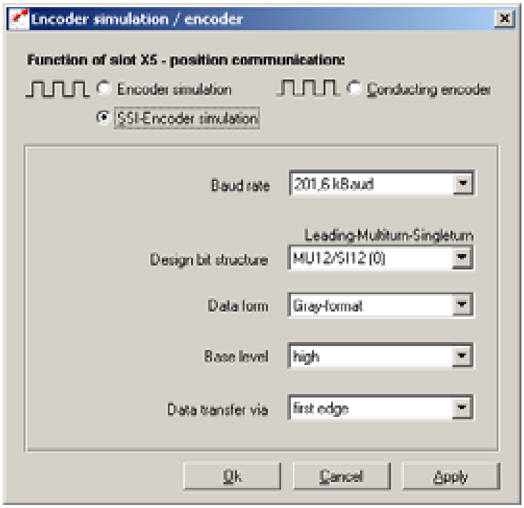
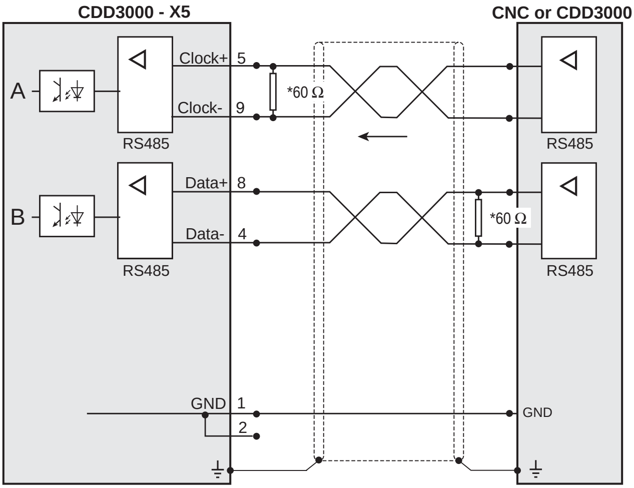


Figure 5.80 SSI Encoder Simulation tab

DM	Meaning	Value range	Bit no. = Value	Parameter
Design bit structure	Number of data bits / number of clock pulses 12 multi-turn + 12 single-turn / 25 clock pulses 8 multi-turn + 16 single-turn / 25 clock pulses 10 multi-turn + 20 single-turn / 31 clock pulses 12 multi-turn + 13 single-turn / 26 clock pulses 10 multi-turn + 13 single-turn / 24 clock pulses The data is always transferred with the MSB first (Heidenhain compatible)	0:=MU12/SI12 (default) 1:=MU8/SI16 2:=MU10/SI20 3:=ENC25-bit (Heidenhain) 4:=ENC23-bit		888_SSIFO (_SYNC)
Baud rate	SSI transfer rate	201.6 KBaud 500 KBaud 1.042 MBaud 1,560 MBaud	0-1:=00 0-1:=01 0-1:=10 0-1:=11	889_SSICO (_SYNC)
Base level		Low High	2:=0 2:=1	889_SSICO (_SYNC)
Data transfer	Shift first edge of clock pulse, read-in on second (default) Read-in first edge of clock pulse, shift on second (default)		3:=0 3:=1	889_SSICO (_SYNC)
Data form		Binary format (default) Gray format	4:=0 4:=1	889_SSICO (_SYNC)

Table 5.48 SSI encoder simulation - settings



* The wave terminating resistor must be connected externally for the CDD3000.

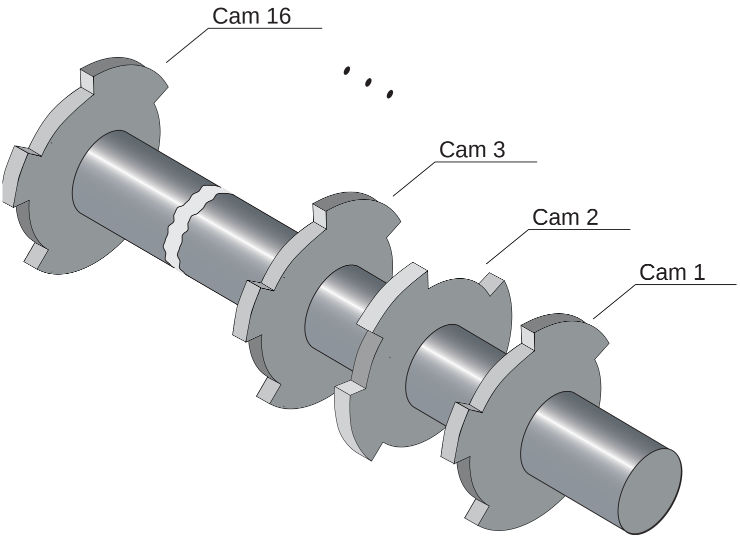
Figure 5.81 SSI encoder simulation connection and signal description

5.10 Cam gear

Software cam gears today offer the possibility to replace expensive mechanical cam gears virtually entirely and at low cost. This enables simple parameter-setting and intuitive functionality with short commissioning times.

The cam gear implemented in the postioning controller can most easily be described as a roller with radially raised curves (cams) along the roller axis. 16 cams with their start and end position referred to the roller diameter (cycle) can be arranged at will on the roller. Each cam is assigned an action register which triggers the corresponding actions when the cam is reached. This state can be signalled to a higher-level controller, for example, by setting a flag CMx. The CMx flag status can be transmitted via outputs or over the field bus.

The cam status can also be utilized by writing a Mxx flag in the “iMotion” sequence control.



The cam gear is started and processed when a number of cams not equal to zero is specified.

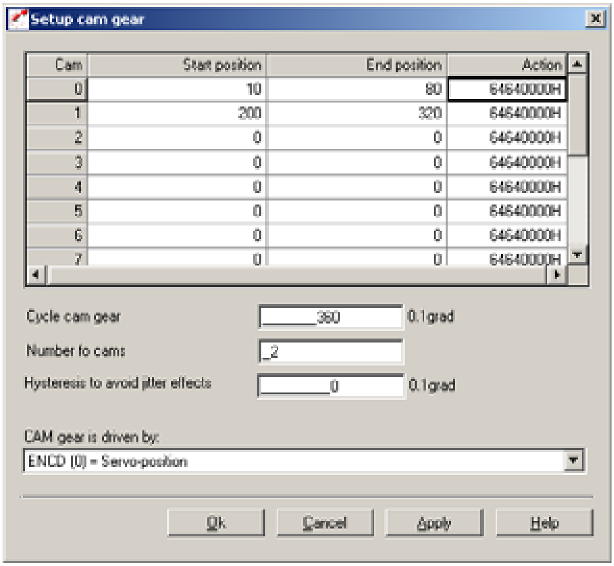


Figure 5.82 Cam gear setup

DM	Meaning	Value range	FS	Parameter
Start position	The cam positions can be specified in any sequence, but logically they must always be within the cycle. No check of this condition is carried out!	0 ... 2147483647	0	663_CSTAP (_CAM)
End position		0 ... 2147483647	0	664_CENDP (_CAM)
Action	Set switching points, set PLC flag.	00000000H ... FFFFFFFFH	FFFF0000H	665_CACTN (_CAM)
Cycle cam gear	When the defined cycle has ended it restarts. The cycle is specified in user-specific units (positioning). If no unit is specified, the calculation is made in increments (speed-controlled). In this, 65536 increments correspond to one revolution of the motor shaft.	0 ... 2147483647	0	648_CCCYC (_IN)
Number of cams	Only the defined number of cams is evaluated. If the defined number is zero, the cam gear is not processed.	0 ... 15	0	662_CCNUM (_IN)
Hysteresis to avoid jitter effects	The cam length should logically be selected greater than the hysteresis.	0 ... 2147483647	0	666_CCHYS (_IN)
Cam gear is driven by	Here the position reference source driving the cam is set. The following settings are possible: “ENCD [0] = Cam gear cycle referred to position encoder”:= The cycle of the cam gear is determined by the current position of the position controller. “EGEAR [1] = Cam gear cycle referred to master encoder”:= The cycle of the cam gear is determined by the external master encoder.	ENCD ... EGEAR	ENCD	639_CCENC (_CAM)

Table 5.49 Cam gear setup

Synchronization of the cam gear

- With a positive edge on the input configured to “ENCAM (36) Start cam gear” or a positive edge of flag 75 in the iMotion sequence program, the cam gear is synchronized to the current position. With this positive edge the cycle of the cam gear is restarted (the cycle is set to zero).

Stopping the cam gear via iMotion or field bus:

- If the number of cams (parameter “662-CCNUM-Number of cams used”) is set to zero, the cam gear is stopped.
- With a negative edge on the input configured to “ENCAM (36) Start cam gear” processing of the cam gear is stopped.
- If the cam gear was started not via a digital input, but via a positive edge of flag 75, a negative edge of flag 75 terminates processing of the cam gear.

Sending CAN telegrams

- The cam gear itself sends no CAN telegrams. By setting flag 98, flag 99, virtual output OV00 and virtual output OV01, a CAN event handling mechanism is produced. See also: Defining the action of a cam

Defining the action of a cam:

- When you double-click in the Action column of the Cam Gear setup screen the following dialog box opens up:

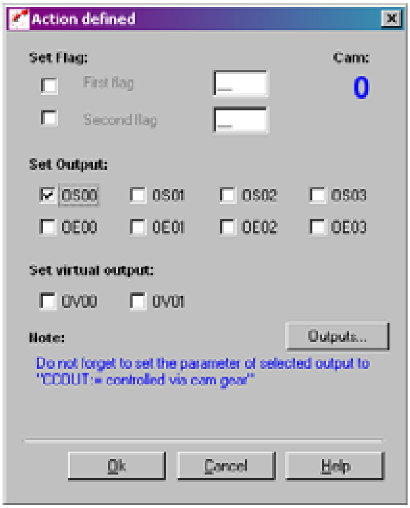


Figure 5.83 Defining the action of a cam

- To set a flag for the iMotion program, select the “First flag” or “Second flag” and enter a number between 0 and 99.
- To set one or more outputs with a cam active, select the relevant output by clicking on it.
- Note that the selected output must be assigned to the cam gear (e.g.: OS03 = CCOUT (25)). The output is assigned in the Outputs screen.

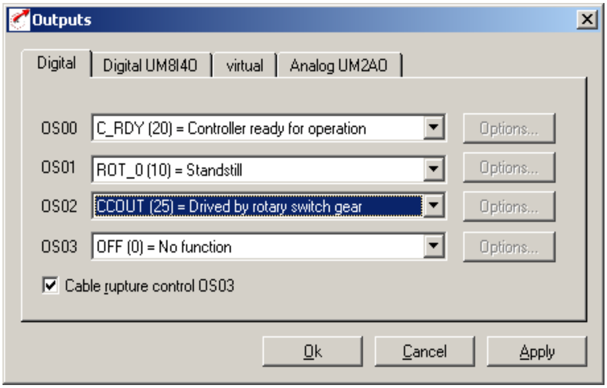


Figure 5.84 Defining the function of the digital outputs

Appendix A Overview of parameters

The following parameter overview contains all the parameters up to user level 01-MODE = 4 in the factory setting, in software version 3.20.

Abbreviations:

R	Read level (LE), indicates the user level (01 -MODE) as from which the parameter is **displayed**.
W	Write level (SE), indicates the user level (01 -MODE) as from which the parameter can be **edited**.
G	Dependent on device

Memory and data types:

Memory types:

RAM C V	RAM control variable
RAM A V	RAM actual value
FEPROM	Flash-EPROM, retained after power-off

Data types:

USIGN8	Integer, unsigned
USIGN16	Integer, unsigned
USIGN32	Integer, unsigned
INT8	Integer, signed
INT16	Integer, signed
INT32	Integer, signed
INT32Q16	32-bit number with standardization 1/65536, i.e. the Low word indicates the number of decimal places.
FIXPOINT16	Fixed point number with standardization 1/20, i.e. increment size 0.05
FLOAT32	32-bit floating point number in IEEE format
ERR-STRUC	Error number (1 byte), error location (1 byte), error time (2 bytes)
STRING	ASCII characters, max. 100 bytes in bus operation incl. Zero terminator

Note: The DRIVEMANAGER has a user-friendly print function which you can use at any time to print off your latest parameter list.

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
(_CONF) Device configuration									
7	AUTO		Auto-Start	OFF		2	2	USIGN8	FEPROM
89	NAMDS		Designation of parameter setting (max. 27 characters)			1	2	STRING	FEPROM
150	SAVE		Back-up device setup	READY		2	2	USIGN8	RAM_CV
152	ASTER		Current application data set (ADS)	SCT_2		1	2	USIGN8	FEPROM
260	CLSEL		Control location selector	TERM		4	4	USIGN8	FEPROM
300	CFCON		Control mode	SCON		4	4	USIGN8	FEPROM
690	PMFS		Power stage, switching frequency	8KHZ		3	4	USIGN8	FEPROM
(_CAM) Electronic cam gear									
640	CCEVS		Event selector for cam gear	00000000H		4	4	USIGN32	FEPROM
641	CCEPM	U		OFF		1	4	USIGN8	FEPROM
642	CCOVR			00H		4	4	USIGN8	FEPROM
643	CCPOS	incr		0		4	4	INT32	FEPROM
644	CCACT			00H		4	4	USIGN8	FEPROM
645	CCORN			FF00FF00H		4	4	USIGN32	RAM_CV
646	CCLPO			0		4	7	USIGN8	RAM_AV
647	CCNOM			0		4	4	USIGN8	FEPROM
648	CCCYC			0		4	4	INT32	FEPROM
649	CCCFG			CYCLE		4	4	USIGN8	FEPROM
650	CCFRM	incr		0		4	4	USIGN16	FEPROM
(_CTRL) Control setting									
460	PCG	rpm	Position control: P-controller gain	4.000		1	3	FLOAT32	FEPROM
462	PDMX	incr	Position control: Maximum tracking error	65536		3	3	INT32	FEPROM
800	TCG	V/A	Torque control: PI controller gain	32.445.202		4	4	FLOAT32	FEPROM
802	TCTLG	ms	Torque control: PI controller lag time	2		4	4	FLOAT32	FEPROM
810	SCG	Nm min	Speed control: PI controller gain	0.035		4	4	FLOAT32	FEPROM

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
811	SCGFA		Speed control: PI controller gain scaling factor	100.00		1	3	FIXPT16	FEPROM
812	SCTLG	ms	Speed control: PI controller lag time	21		1	3	FLOAT32	FEPROM
816	SCTF	ms	Speed control: Reference input variable filter time constant	0		1	4	FLOAT32	FEPROM
818	ECTF	ms	Speed control: Actual speed filter time constant	0.6		1	3	FLOAT32	FEPROM
(_ENC) Encoder									
430	ECTYP		Assistance parameters for setting the encoder type	R1		3	3	USIGN8	FEPROM
431	CFENC		Encoder type	R		3	3	USIGN8	FEPROM
432	ECLNC		Encoder, incremental encoder lines per revolution	2048		3	3	USIGN16	FEPROM
433	ECNPP		Encoder, number of resolver pole pairs	1		3	3	USIGN8	FEPROM
434	ECOFF		Encoder, offset	0000H		4	4	USIGN16	FEPROM
450	CF2EC		Encoder type for speed and position con-troller	OFF		4	4	USIGN8	FEPTROM
675	ECCON		Encoder, correction of track signals, mode	OFF		4	4	USIGN8	FEPROM
(_ERR) Error messages									
74	ERES		Reset device errors	STOP		4	4	USIGN8	RAM_CV
94	TERR	min	Time between power-on and last error	0		1	7	USIGN16	RAM_AV
95	ERR1		Last error	- 0.0h		1	7	ERR_STRUC	FEPROM
96	ERR2		Second-last error	- 0.0h		2	7	ERR_STRUC	FEPROM
97	ERR3		Third-last error	- 0.0h		2	7	ERR_STRUC	FEPROM
98	ERR4		Fourth-last error	- 0.0h		2	7	ERR_STRUC	FEPROM
423	ERPAR		Faulty parameter in self-test	0		4	15	USIGN16	RAM_AV
524	R-EXT		Response to external error message	STOP		4	4	USIGN8	FEPROM
539	R-FLW		Response to tracking error	WARN		2	3	USIGN8	FEPROM
(_IN) Control inputs									

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
180	FISA0		Function selector analog standard input ISA00	ANALG		1	2	USIGN8	FEPROM
181	FISA1		Function selector analog standard input ISA01	OFF		1	2	USIGN8	FEPROM
188	AFIL0		Filter for analog channel ISA00	0		4	4	USIGN8	FEPROM
189	AFIL1		Filter for analog channel ISA01	0		4	4	USIGN8	FEPROM
192	IADB0		Backlash range ISA00	0.00		4	4	FIXPT16	FEPROM
193	IADB1		Backlash range ISA01	0.00		4	4	FIXPT16	FEPROM
210	FIS00		Function selector standard input ISD00	START		1	2	USIGN8	FEPROM
211	FIS01		Function selector standard input ISD01	OFF		1	2	USIGN8	FEPROM
212	FIS02		Function selector standard input 2	OFF		1	2	USIGN8	FEPROM
213	FIS03		Function selector standard input ISD03	OFF		1	2	USIGN8	FEPROM
214	FIE00		Function selector external input IED00	OFF		1	2	USIGN8	FEPROM
215	FIE01		Function selector external input IED01	OFF		1	2	USIGN8	FEPROM
216	FIE02		Function selector external input IED02	OFF		1	2	USIGN8	FEPROM
217	FIE03		Function selector external input IED03	OFF		1	2	USIGN8	FEPROM
218	FIE04		Function selector external input IED04	OFF		1	2	USIGN8	FEPROM
219	FIE05		Function selector external input IED05	OFF		1	2	USIGN8	FEPROM
220	FIE06		Function selector external input IED06	OFF		1	2	USIGN8	FEPROM
221	FIE07		Function selector external input IED07	OFF		1	2	USIGN8	FEPROM
222	FIF00		Function selector virtual fixed input 0	OFF		1	2	USIGN8	FEPROM
223	FIF01		Function selector virtual fixed input 1	OFF		1	2	USIGN8	FEPROM
224	FIS04		Function selector standard input ISD04	OFF		1	2	USIGN8	FEPROM
311	RNA1	Nm	Maximum value ISA1 at +10V for torque control	10		3	3	INT32Q16	FEPROM
312	RNA1	rpm	Maximum value ISA1 at +10V for speed control	3000		3	3	INT32Q16	FEPROM

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
821	RNA0	Nm	Maximum value ISA0 at +10V for torque control	10		3	3	INT32Q16	FEPROM
822	RNA0	rpm	Maximum value ISA0 at +10V for speed control	3000		3	3	INT32Q16	FEPROM
(_KPAD) KeyPad KP200									
1	MODE		User level of KP200	1		1	1	USIGN8	RAM_CV
360	DISP		Parameter for continuous actual value display of KP200	400		2	2	USIGN16	FEPROM
361	BARG		Parameter for bar graph display of KP200	170		2	2	USIGN16	FEPROM
362	PSW2		Password for user level 2 of KP200	0		2	2	USIGN16	FEPROM
363	PSW3		Password for user level 3 of KP200	0		3	3	USIGN16	FEPROM
364	PSW4		Password for user level 4 of KP200	0		4	4	USIGN16	FEPROM
367	PSWCT		Password for Control menu of KP200	0		3	3	USIGN16	FEPROM
368	PNUM		Parameter number display of KP200 on/off	ON		4	4	USIGN8	FEPROM
369	CTLFA		Multiplier of incremental value in CTRL menu (KP200)	10000		4	4	USIGN16	FEPROM
(_LIM) Limitations									
410	SPD0H	rpm	rpm Hysteresis, standstill recognition	0		1	2	INT32Q16	FEPROM
411	SPD_0	rpm	rpm Speed limit value 0	10		1	2	INT32Q16	FEPROM
518	ILIM5	Hz	Limitation of Imax at f > 5 Hz	0		4	4	FLOAT32	FEPROM
803	TCMMX	Nm	Limitation: Maximum torque	2		1	3	FLOAT32	FEPROM
805	SCALE		Limitation: Torque scaling factor	100		4	4	USIGN8	RAM_CV
813	SCSMX	rpm	Limitation: Maximum speed	3000		1	3	FLOAT32	FEPROM
(_MOT) Motor data									
153	CFMOT		Motor type	PS		4	5	USIGN8	FEPROM
157	MOSNM	rpm	Motor speed, nominal value	3000		1	5	USIGN16	FEPROM
158	MOCNM	A	Motor current, nominal value	1		1	5	FLOAT32	FEPROM

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
160	MOJNM	kgmm	Motor moment of inertia	0.00074		4	5	FLOAT32	FEPROM
330	MOPTC		Type of PTC evaluation	OFF		2	3	USIGN8	FEPROM
334	MOTMX		Maximum motor temperature	150		4	4	USIGN16	FEPROM
337	MOPCO		Motor PTC Selection of connection	X3		4	5	USIGN8	FEPROM
453	MOENP		Motor type on the electronic nameplate	255		4	4	USUGN8	FEPROM
840	MOFN M	Vs	Motor parameter: Rated flux	0.207139		4	5	FLOAT32	FEPROM
842	MOR_S	Ohm	Motor parameter: Stator resistance	1.875		4	5	FLOAT32	FEPROM
843	MOR_R	Ohm	Motor parameter: Rotor resistance	2		4	5	FLOAT32	FEPROM
844	MONPP		Motor parameter: Number of pole pairs	3		4	5	USIGN8	FEPROM
850	MOL_M	H	Motor parameter: Magnetizing inductance	0.0058		4	5	FLOAT32	FEPROM
851	MOL_S	H	Motor parameter: Leakage inductance ASM/Stator inductance SM	0.0058		4	5	FLOAT32	FEPROM
852	MOMN M	Nm	Motor torque, nominal value	1		1	5	FLOAT32	FEPROM
853	MOMM X	Nm	Motor torque, maximum value	2		1	5	FLOAT32	FEPROM
854	MOI2T		i^2xt limitation of motor	0		4	4	FLOAT32	FEPROM
856	MOSMX	rpm	Motor speed, maximum value	3000		1	5	USIGN16	FEPROM
857	MOTYP		Motor type			1	4	STRING	FEPROM
(_OPT) Option modules									
148	TXEV1		Event to send 1st status identifier	0001H		4	4	USIGN16	FEPROM
149	TXEV2		Event to send 2nd status identifier	0000H		4	4	USIGN16	FEPROM
489	CLBDR		CANlust baud rate	500		3	3	USIGN8	FEPROM
492	CACNF		CANlust reference transfer mode	4		4	4	USIGN8	FEPROM
570	CAMOD		Function selection option module CANlust	SLAVE		4	4	USIGN8	FEPROM
571	CLADR		CANlust device address	0		4	4	USIGN8	FEPROM
572	CASTA		CAN bus status word	0000H		4	15	USIGN16	RAM_AV
573	CACTR		CAN bus control word	0000H		4	4	USIGN16	RAM_CV
574	CAWDG		CAN bus watchdog time (0 = OFF)	0		3	3	USIGN8	FEPROM
575	CASCY	ms	Sampling time for status message	80		3	3	USIGN16	FEPROM
576	OP1RV		Software version option module slot 1	0.00		3	7	FIXPT16	RAM_AV
577	OP2RV		Software version option module slot 2	0.00		3	7	FIXPT16	RAM_AV

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
578	OPTN2		Assignment of option module slot 2	NONE		4	15	USIGN8	RAM_AV
579	OPTN1		Assignment of option module slot 1	NONE		4	15	USIGN8	RAM_AV
580	COADR		CANopen device address	0		4	4	USIGN8	FEPROM
581	COBDR		CANopen baud rate	500		3	3	USIGN8	FEPROM
582	PBADR		Profibus DP device address	0		4	4	USIGN8	FEPROM
583	IOEXT		States of external I/Os	0000H		1	15	USIGN16	RAM_AV
584	TXMAP		Mapping parameter for status identifier 2	00000000H		4	4	USIGN32	FEPROM
585	RXMAP		Mapping parameter for control identifier 2	00000000H		4	4	USIGN32	FEPROM
586	TXMPC		Number of mapped send parameters	0		4	4	USIGN8	FEPROM
587	RXMPC		Number of mapped receive parameters	0		4	4	USIGN8	FEPROM
(_OUT) Control outputs									
203	OAFI0		Filter constant for analog output OSD00	4		3	3	USIGN8	FEPROM
205	FOA0		Analog selector for digital output OSD00	SPEED		1	2	USIGN8	FEPROM
206	OA0MN		Lower frequency limit for analog output channel 0	0		3	3	INT16	FEPROM
207	OA0MX		Upper frequency limit for analog output channel 0	100		3	3	INT16	FEPROM
231	REF_R	Nm	Reference-reached window for torque control	1		1	2	INT32Q16	FEPROM
232	REF_R	rpm	Reference-reached window for speed control	20		1	2	INT32Q16	FEPROM
233	REF_R	incr	Reference-reached window for position control	100		1	2	USIGN32	FEPROM
240	FOS00		Function selector standard output OSD00	C_RDY		1	2	USIGN8	FEPROM
241	FOS01		Function selector standard output OSD01	ACTIVE		1	2	USIGN8	FEPROM
242	FOS02		Function selector standard output OSD02	OFF		1	2	USIGN8	FEPROM
243	FOE00		Function selector external output OED00	OFF		1	2	USIGN8	FEPROM
244	FOE01		Function selector external output OED01	OFF		1	2	USIGN8	FEPROM

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
245	FOE02		Function selector external output OED02	OFF		1	2	USIGN8	FEPROM
246	FOE03		Function selector external output OED03	OFF		1	2	USIGN8	FEPROM
247	FOS03		Function selector standard output OSD03	OFF		1	2	USIGN8	FEPROM
248	FOV00		Function selector virtual output OV00	OFF		1	2	USIGN8	FEPROM
249	FOV01		Function selector virtual output OV01	OFF		1	2	USIGN8	FEPROM
424	ERRAC		At error reactions STOP and LOCKS: Power stage siwtched off at standstill	ON		2	2	USIGN8	FEPROM
465	BRAKE		Actuation mode for motor brake	HOLD2		1	2	USIGN8	FEPROM
467	THTDC	ms	Time between engagement of brake and shut-off of control	100		1	2	USIGN16	FEPROM
497	SELDC		Stop the power stage after quick stop	ACTV		1	2	USIGN8	FEPROM
804	TCAVM	Nm	Threshold value for actual torque value monitoring	4.099.991		3	3	INT32Q16	FEPROM
814	SCAVM	rpm	Threshold value for actual speed monitoring	3000		3	3	INT32Q16	FEPROM
(_PBAS) Positioning, basic setting									
704	POVMX		Maximum achievable process speed	16384		4	4	USIGN32	FEPROM
715	POEGW		Quick jog speed	20		4	4	USIGN32	FEPROM
716	POSGW		Slow jog speed	5		4	4	USIGN32	FEPROM
718	POSWP		Positive software limit switch	0		4	4	INT32	FEPROM
719	POSWN		Negative software limit switch	0		4	4	INT32	FEPROM
720	POWIN		Reference-reached window	100		4	4	USIGN16	FEPROM
734	POQPN		Source of program number	0		4	4	USIGN8	FEPROM
735	POPKD		Coding of program number	FIX		4	4	USIGN8	FEPROM
761	POTPO		Polarity of Touchprobe	POS		4	4	USIGN8	FEPROM
762	POTNP		Polarity of zero pulse probe	POS		4	4	USIGN8	FEPROM
763	PORTA		Indexing table application	OFF		4	4	USIGN8	FEPROM
764	PONAR		Number of angle units per revolution	1		4	4	INT32	FEPROM
765	POTPT	ms	Timeout of "target position reached" monitor	500		4	4	USIGN16	FEPROM
770	POTBS		Start condition for driving set selection via terminal	REFR		4	4	USIGN8	FEPROM
788	POWIT	ms	Time in reference-reached window until display	0		4	4	USIGN16	FEPROM

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
(_PPAR) Positioning, parameters									
727	POTAB		Position table	0		4	4	INT32	FEPROM
728	POVAR		Variables	0		4	4	INT32	FEPROM
729	POMER		Flags	0		4	4	USIGN8	FEPROM
730	POZAH		Numerator	0		4	4	USIGN16	RAM_CV
745	POAPO		Current program set number of active process program	0		4	4	USIGN16	RAM_CV
775	FSM75		Function selector flag M75	OFF		1	2	USIGN8	FEPROM
776	FSM76		Function selector flag M76	OFF		1	2	USIGN8	FEPROM
777	FSM77		Function selector flag M77	OFF		1	2	USIGN8	FEPROM
778	FSM78		Function selector flag M78	OFF		1	2	USIGN8	FEPROM
779	FSM79		Function selector flag M79	OFF		1	2	USIGN8	FEPROM
(PPRAG) Positioning, program									
744	POAPR		Number of active process program	0		4	7	USIGN8	RAM_AV
746	POENA		Enable positioning software	OFF		4	4	USIGN8	FEPROM
751	POCMD		Direct command input in manual mode			4	4	STRING	RAM_CV
758	POTKD		Coding of table index	BIN		4	4	USIGN8	FEPROM
759	POQTI		Source of table index	0		4	4	USIGN8	RAM_CV
(_PRAM) Positioning, acceleration profiles									
552	POSMX		Velocity for reference input via SIO, fixed pos., bus	20		4	4	INT32	FEPROM
553	POACC		Startup acceleration for reference input via SIO, fixed pos., bus	10		4	4	USIGN32	FEPROM
554	PODEC		Braking acceleration for reference input via SIO, fixed pos., bus	10		4	4	USIGN32	FEPROM
561	OIREF	incr	Target position of online interpolator	0		4	4	INT32	RAM_CV
562	OISMX	incr/ms	Max. process speed of online interpolator	1092		4	4	INT32Q16	RAM_CV
563	OIACC	incr/mss	Max. linear startup acceleration of online interpolator	4		4	4	INT32Q16	RAM_CV
564	OIDEC	incr/mss	Max. linear braking acceleration of online interpolator	4		4	4	INT32Q16	RAM_CV
565	OIJTM	ms	Smoothing time of online interpolator	0		4	4	USIGN16	RAM_CV
566	OICTR		Control/status word of online interpolator	0000H		4	4	USIGN16	RAM_CV
705	POBEP		Acceleration mode in positive direction	LIN		4	4	USIGN8	FEPROM
706	POBEN		Acceleration mode in negative direction	LIN		4	4	USIGN8	FEPROM

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
707	POLAP		Startup acceleration rate in positive direction	10		4	4	USIGN32	FEPROM
708	POLAN		Startup acceleration rate in negative direction	10		4	4	USIGN32	FEPROM
709	POBLP		Braking acceleration rate in positive direction	10		4	4	USIGN32	FEPROM
710	POBLN		Braking acceleration rate in negative direction	10		4	4	USIGN32	FEPROM
(_PRR) Positioning, homing									
717	PONKR		Zero correction	0		4	4	INT32	FEPROM
722	PORTY		Homing mode type	1		4	4	USIGN8	FEPROM
723	PORPO		Polarity of reference cam	POS		4	4	USIGN8	FEPROM
724	PORV1		Homing speed 1	100		4	4	USIGN32	FEPROM
725	PORV2		Homing speed 2	20		4	4	USIGN32	FEPROM
726	PORV3		Homing speed 3	4		4	4	USIGN32	FEPROM
792	POZP		Zero search	ON		2	2	USIGN8	FEPROM
(_PSRD) PosMod standardizations									
700	POWGZ		Travel standardization numerator	1		4	4	USIGN32	FEPROM
701	POWGN		Travel standardization denominator	1		4	4	USIGN32	FEPROM
711	POAVE		Velocity standardization	1		4	4	INT32Q16	FEPROM
712	POABE		Acceleration standardization	1		4	4	INT32Q16	FEPROM
721	POSIG		Preceding sign of direction of rotation	POS		4	4	USIGN8	FEPROM
766	POWUN		Standardized unit for positioning travel of PosMod			4	4	STRING	FEPROM
767	POSUN		Standardized unit for velocity of PosMod			4	4	STRING	FEPROM
768	POAUN		Standardized unit for acceleration of PosMod			4	4	STRING	FEPROM
819	NAUNS		Standardization assistant: Dimension unit: travel	incr		2	2	USIGN8	FEPROM
823	NAUNV		Standardization assistant: Dimension unit: velocity	incr/s		2	2	USIGN8	FEPROM
824	NAUNA		Standardization assistant: Dimension unit: acceleration	incr/s/s		2	2	USIGN8	FEPROM
825	NAZS		Standardization assistant: Travel standardization numerator	65536		2	2	FLOAT32	FEPROM
826	NANS		Standardization assistant: Travel standardization denominator	65536		2	2	FLOAT32	FEPROM
827	NABAS		Standardization assistant: Reference page	incr		2	2	USIGN8	FEPROM

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
828	NARND	U	Standardization assistant: Revolutions of load or motor	1		2	2	FLOAT32	FEPROM
829	NAGZ1		Standardization assistant: Transmission ratio, drive	1		2	2	USIGN32	FEPROM
855	NAGZ2		Standardization assistant: Transmission ratio, output	1		2	2	USIGN32	FEPROM
858	NART		Standardization assistant: Indexing table travel	1		2	2	FLOAT32	FEPROM
(_REF) Reference structure									
280	RSSL1		Reference selector 1	RA0		4	4	USIGN8	FEPROM
281	RSSL2		Reference selector 2	RCON		4	4	USIGN8	FEPROM
282	RA0		Analog reference ISA0	0		4	15	INT32Q16	RAM_AV
283	RA1		Analog reference ISA1	0		4	15	INT32Q16	RAM_CV
284	RSIO		Reference of LustBus	0		4	4	INT32Q16	RAM_CV
286	RDIG		Digital reference input	0		4	15	INT32Q16	RAM_AV
287	ROPT1		Reference value of option slot 1	0		4	6	INT32Q16	RAM_AV
288	ROPT2		Reference value of option slot 2	0		4	6	INT32Q16	RAM_CV
289	SADD1		Offset for reference selector 1	0		1	1	USIGN8	FEPROM
290	SADD2		Offset for reference selector 2	0		1	1	USIGN8	FEPROM
291	REF1		Reference of reference selector 1	0		4	15	INT32Q16	RAM_AV
292	REF2		Reference of reference selector 2	0		4	15	INT32Q16	RAM_AV
293	REF3		REF1 + REF2	0		4	15	INT32Q16	RAM_AV
295	REF5		Reference after ramp generator	0		4	15	INT32Q16	RAM_AV
296	REF6		Reference after smoothing	0		4	15	INT32Q16	RAM_AV
624	TBSEL		Selection fixed speed/position	0		3	3	USIGN8	RAM_CV
(_RFIX) Fixed reference values									
270	RFIX1	rpm	Fixed speed 1	0		3	3	INT32Q16	FEPROM
271	RFIX2	rpm	Fixed speed 2	0		3	3	INT32Q16	FEPROM
272	RFIX3	rpm	Fixed speed 3	0		3	3	INT32Q16	FEPROM
273	RFIX4	rpm	Fixed speed 4	0		3	3	INT32Q16	FEPROM
274	RFIX5	rpm	Fixed speed 5	0		3	3	INT32Q16	FEPROM
275	RFIX6	rpm	Fixed speed 6	0		3	3	INT32Q16	FEPROM
276	RFIX7	rpm	Fixed speed 7	0		3	3	INT32Q16	FEPROM
277	RFIX8	rpm	Fixed speed 8	0		3	3	INT32Q16	FEPROM
(_SIO) Serial interface RS232									

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
81	SBAUD	1/s	LustBus transfer rate	57600		4	4	USIGN8	FEPROM
82	SADDR		LustBus device address	1		4	4	USIGN8	FEPROM
83	SDMMY		LustBus dummy parameter	0		4	4	USIGN8	RAM_CV
84	SWDGT	s	LustBus watchdog time setting	0.00		4	4	FIXPT16	FEPROM
85	SERR		LustBus error status word	00H		4	4	USIGN8	RAM_AV
494	SCTL2		Control word to set ext. outputs via SIO	0		4	4	USIGN16	RAM_CV
551	SCTL1		Control word of serial interface	0		4	4	USIGN16	RAM_CV
(_SRAM) Speed acceleration rate profile									
52	ACCR	rpm/s	Speed control: Acceleration ramp	0		1	2	USIGN16	FEPROM
102	DECR	rpm/s	Speed control: Deceleration ramp	0		1	2	USIGN16	FEPROM
496	STOPR	rpm/s	Stop ramp	0		1	2	USIGN16	FEPROM
560	JTIME	ms	Speed control: Smoothing time of sinusoidal ramp	0		1	2	USIGN16	FEPROM
(_STAT) Device status									
90	SREV		Base standard version of modified software	1		4	7	FIXPT16	RAM_CV
92	REV		Software version	3		1	7	FIXPT16	FEPROM
106	CRIDX		Revision index as suffix to version number	97		4	7	USIGN8	RAM_CV
127	S_NR		Serial number of device			3	7	STRING	FEPROM
130	NAME		Symbolic device name			1	6	STRING	FEPROM
390	TYPE		Device type	30000		1	15	USIGN16	RAM_AV
394	A_NR		Article number of device			3	7	STRING	FEPROM
757	POSTI		Status information of positioning and sequence control	0		4	7	INT16	RAM_AV
(_SYNC) Synchronous functions									
470	FIEC2		Position communication (X5): Function selector	ECSIM		3	3	USIGN8	FEPROM
471	ECSLN		Encoder simulation: Lines per revolution	1024		3	3	USIGN8	FEPROM

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
473	EC2TP		Master encoder: Signal level	TTL		3	3	USIGN8	FEPROM
474	EC2LN		Master encoder: Lines per revolution	2048		4	4	USIGN16	FEPROM
475	RSTEP		Master encoder: Signal type	A/B		3	3	USIGN8	FEPROM
476	RSDIR		Master encoder: Direction selection where RSTEP=A/DIR	NORM		3	3	USIGN8	FEPROM
477	VRAEN		Master encoder: Activation transmission ratio via ISA00	OFF		3	3	USIGN8	FEPROM
478	VRSMN		Master encoder: Analog transmission ratio at -10V	1		3	3	USIGN16	FEPROM
479	VRSMX		Master encoder: Analog transmission ratio at +10V	2		3	3	USIGN16	FEPROM
480	VRNOM		Master encoder: Numerator of transmission ratio	1		3	3	INT32	FEPROM
481	VRDEN		Master encoder: Denominator of transmission ratio	1		3	3	USIGN32	FEPROM
482	RCDE	U		0		3	3	INT32Q16	FEPROM
483	RCEM	U		1		3	3	INT32Q16	FEPROM
484	RCO	U		0		3	3	INT32Q16	FEPROM
485	VRSET		Synchronous application of transmission ratio	OFF		4	4	USIGN8	RAM_CV
(_SYS) System setup									
4	PROG		Reset device to factory setting	2		4	4	USIGN16	FEPROM
15	PLRDY		Activate control initialization	OFF		4	4	USIGN8	RAM_CV
151	ASTPR		Original application data set	SCT_2		1	4	USIGN8	FEPROM
392	CFHSW		Hardware status word of system	0000H		4	15	USIGN16	RAM_AV
393	CFSSW		Control structure status word of system	0000H		4	15	USIGN16	RAM_AV
399	NORMS		De-standardization values for Drive Manager	0		1	15	FLOAT32	RAM_AV
403	STAT		Status word of system	0000H		4	15	USIGN16	RAM_AV
495	IOSTA			0000H		1	15	USIGN16	RAM_AV
670	ECCOA		Encoder track A, offset correction	0		4	6	INT32	FEPROM
671	ECCOB		Encoder track B, offset correction	0		4	6	INT32	FEPROM
672	ECCAA		Encoder track A, amplitude correction factor	1073741824		4	6	INT32	FEPROM
673	ECCAB		Encoder track B, amplitude correction factor	1073741824		4	6	INT32	FEPROM

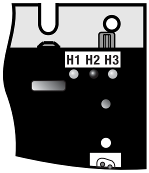
No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
674	ECCPH		Encoder tracks A and B, phase correction factor	0		4	6	INT32	FEPROM
(_XXX) SC-Drives (in preparation)									
817	SCJ	kgmm	SCD, overall moment of inertia of system with motor	0		4	4	FLOAT32	FEPROM
(_PSET) Positioning, fixed positions									
555	PDPOS		Driving sets: Target position	0		4	4	INT32	FEPROM
556	PDMOD		Driving sets: Mode (Absolute, Relative)	0		4	4	USIGN8	FEPROM
557	PDSPD		Driving sets: Velocity	0		4	4	INT32	FEPROM
558	PDACC		Driving sets: Startup acceleration	0		4	4	USIGN32	FEPROM
559	PDDEC		Driving sets: Braking acceleration	0		4	4	USIGN32	FEPROM
(_MENU) Menu control, KP200									
8	GROUP		Subject area of KP200	_KPAD		1	1	USIGN8	RAM_CV
(_VAL) Actual value									
5	SVSLD		Progress indicator for data backup in FLASH memory	0		1	15	USIGN8	RAM_AV
75	CURNT	A	Effective value of phase current	0		1	15	INT32Q16	RAM_AV
76	TORQE	Nm	Torque	0		1	15	INT32Q16	RAM_AV
77	SPEED	rpm	Actual speed	0		1	15	INT32Q16	RAM_AV
78	POS		Position	0		1	7	INT32Q16	RAM_AV
79	DPOS			0		3	7	INT32Q16	RAM_AV
86	TSYS	min	System time after power-up	0		3	15	USIGN16	RAM_AV
87	TOP	h	Operating hours meter	20		3	7	USIGN16	FEPROM
400	ACTV		Current actual value	0		1	15	INT32Q16	RAM_AV
405	DCV	V	DC-link voltage	0.00		1	15	FIXPT16	RAM_AV
406	REFV		Current reference value	0		1	15	INT32Q16	RAM_AV
407	MTEMP		Motor temperature in KTY84 evaluation	0.00		1	15	FIXPT16	RAM_AV
416	ISA0	V	Filtered input value ISA0	0		2	15	INT32Q16	RAM_AV

No.	Name	Unit	Function	Factory set.	Editable online	R	W	Data type	Memory type
417	ISA1	V	Filtered input value ISA1	0		2	15	INT32Q16	RAM_AV
425	DTEMP		Interior temperature	0.00		1	15	FIXPT16	RAM_AV
427	TEMP		Heat sink temperature	0.00		1	15	FIXPT16	RAM_AV
739	PORTP		Indexing table position within the preset angle units	0		4	7	INT32	RAM_AV
753	POOVR		Override	0		4	7	USIGN8	RAM_AV
754	POAIP		Current actual position in travel units	0		4	7	INT32	RAM_AV
755	POASP		Current reference position in travel units	0		4	7	INT32	RAM_AV
756	POADP		Current tracking error in travel units	0		4	7	INT32	RAM_AV

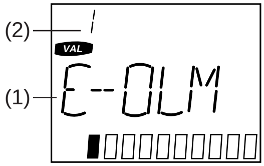
Appendix B Troubleshooting

Errors in operation are signalled as follows:

- CDD3000: Red LED (H1) flashes (flash code see Table A.2



- DRIVEMANAGER Possible causes of the error and measures to remedy it are displayed in a window.
- KEYPAD KP200: The display is backlit in red and indicates the error (1) and an error location number (2). The error location number provides detailed localization of the cause of the error.



Error reaction

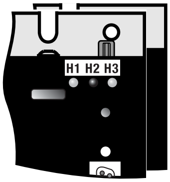
When an error occurs the servocontroller responds with a specific function sequence. This is allocated to a corresponding **reaction number**.

Reaction no.	Function
0	Signal error only, no further reaction (warning).
1	Signal error and disable power stage.
2	Signal error, quick-stop and wait for cancellation of start signal.
3	Signal error, disable power stage and secure against restarting 1).
4	Signal error, quick-stop, wait for cancellation of start signal and secure against restarting 1).
5	Signal error, disable power stage and wait for error reset; error reset only possible by complete cutting of power.

1) Only relevant with programmed autostart function.

Table A.1 Error reaction

LEDs



At the top right of the servocontroller there are three status LEDs coloured red (H1), yellow (H2) and green (H3).

Device status	Red LED (H1)	Yellow LED (H2)	Green LED (H3)
Power on	❍	❍	●
Servocontroller ready (ENPO set)	❍	●	●
Control enabled	❍	✳	●
Error	✳ (flash code)	❍	●
Warning (in "ready" condition)	●	●	●
Warning (in "control enabled" condition)	●	✳	●

❍ LED off, ● LED on, ✳ LED flashing

Table A.2 Meanings of LEDs

Error messages

If an error occurs in operation it is indicated by a flash code from LED H1 (red) on the servocontroller. If a KP200 is connected the KP200 indicates the error type as an abbreviation. When the DRIVEMANAGER is active the error is additionally reported in plain text.

Flash code of red LED H1	Display KEYPAD	Reaction No.	Explanation	Cause/Remedy
1x	Various messages	0-5	see Table A.4	
2x	E-OFF	1	Undervoltage shut-off	Check power supply. Also occurs briefly in response to normal power-off.
3x	E-OC	3	Current overload shut-off	Short-circuit, ground fault: Check cabling of connections, check motor coil, check neutral conductor and grounding (see also section 3, Installation). Device setup not correct: Check parameters of control circuits. Check ramp setting.
4x	E-OV	3	Voltage overload shut-off	Voltage overload from mains: Check mains voltage. Restart device. Voltage overload resulting from feedback from motor (regenerative operation): Slow down braking ramps. If not possible, use a braking resistor.
5x	E-OLM	3	Motor protection shut-off	Motor overloaded (after I x t monitoring): Slow down process cycle rate if possible. Check motor dimensioning.
6x	E-OLI	3	Device protection shut-off	Device overloaded: Check dimensioning. Possibly use a larger device.
7x	E-OTM	3	Motor temperature too high	Motor PTC correctly connected? Motor PTC evaluation correctly set? Motor overloaded? Allow motor to cool down. Check dimensioning.
8x	E-OTI	3	Overheating in servocontroller	Ambient temperature too high: Improve ventilation in switch cabinet. Load too high during driving/braking: Check dimensioning. Possibly use a braking resistor.

Table A.3 Error messages/flash code

Bus	DM/KP	Error location no.	Meaning	Comment
0			No error	
1	E-CPU	0	Processor faulty or wrong software version	1
2	E-OFF	1	Undervoltage in DC link (≤ 212/425 V), also applied on normal power-off.	
3	E-OC	19	Max. permissible output current exceeded (software shut-off)	
3	E-OC	34	Current overload shut-off of servo resulting from fast Ixt, effective to 5 Hz output frequency	
3	E-OC	35	Short-circuit detected during self-test	
3	E-OC	41	Max. permissible output current exceeded (hardware shut-off)	
4	E-OV	1	Overvoltage in DC link	
5	E-OLM	1	Current overload shut-off: IxIxt monitoring of motor, dependent on parameter MOI2T	
6	E-OLI	1	Current overload shut-off: Ixt monitoring of servo	
7	E-OTM	1	Motor overheating	
8	E-OTI	31	Servo heat sink overheating	
8	E-OTI	32	Servo interior overheating	
9	E-PLS	9	Plausibility check detected invalid parameter or program sequence	1
10	E-PAR	0	Invalid parameter setting	
10	E-PAR	7	Value range infringement of a parameter setting detected. Parameter ERPAR contains number of incorrect parameter	1
10	E-PAR	8	After reinitialization of the parameter list in the device startup phase an invalid parameter value was found. Parameter ERPAR contains the number of this parameter.	1
10	E-PAR	9	Error initializing a parameter with its permanent memory value. Parameter ERPAR contains the number of the parameter.	1
10	E-PAR	13	The combination of function selector settings for one of the analog inputs and the reference selector are mutually contradictory.	1
10	E-PAR	16	Error initializing factors for analog output to digital outputs.	1
10	E-PAR	48	Error initializing a variable	
10	E-PAR	101	Setting of number of resolver pole pairs not possible	1
11	E-FLT		Global error in floating point calculation	1

Note:
1 = If this error is repeated please contact your local Service Partner
2 = See description of field bus (user manual)

Table A.4 Error messages

Bus	DM/KP	Error location no.	Meaning	Comment
12	E-PWR	6	No power stage, or power stage unknown: No valid power stage ID detected	1
12	E-PWR	8	No power stage, or power stage unknown: No valid power stage ID detected	1
13	E-EXT	1	Error request received via digital input with function E-EXT	
14	E-USR	1	Error executing a customer-specific software function	
15	E-OP1		Error in option module at slot 1 (X8), further information in user manual	2
16	E-OP2		Error in option module at slot 2 (X9), further information in user manual	2
18	E-SIO	11	SIO watchdog tripped (LustBus)	
19	E-EEP		Error accessing EEPROM	1
21	E-SC	20	Error in auto-tuning	
25	E-HWE	47	Hardware limit switches interchanged	
26	E-OL5	1	I x t shut-off below 5 Hz to protect power stage	
30	E-ENC	1	Encoder wire break detection	
30	E-ENC	123	Hiperface: Communication error signalled by encoder	
30	E-ENC	124	Hiperface: Communication error signalled by dSMC	
30	E-ENC	125	Hiperface: Unknown encoder type	
30	E-ENC	126	Hiperface: Error signalled by encoder (but communication is OK)	
30	E-ENC	127	Hiperface: Communication parameters not found	
30	E-ENC	131	Error in commutation finding	
31	E-TIM		Runtime monitor error	1
32	E-FLW	1	Position tracking error	
32	E-FLW	24	Speed tracking error	
33	E-WDG	11	Watchdog for RS232 (LustBus) triggered	
34	E-VEC		Initialization error	1
35	E-BRK	1	Monitoring unit for brake output (OSD03) signals error	
36	E-POS	210	Pos. hardware limit switch approached	
36	E-POS	211	Neg. hardware limit switch approached	
36	E-POS	212	Pos. software limit switch approached	
36	E-POS	213	Neg. software limit switch approached	

Note:
1 = If this error is repeated please contact your local Service Partner
2 = See description of field bus (user manual)

Table A.4 Error messages

Bus	DM/KP	Error location no.	Meaning	Comment
36	E-POS	214	Positioning job with no defined reference point	
36	E-POS	215	Error accessing optional hardware	
36	E-POS	216	Selected program not available	
36	E-POS	217	Jump to non-existent record number	
36	E-POS	218	Called subroutine not available	
36	E-POS	219	Position outside positioning range	
36	E-POS	220	Division by zero	
36	E-POS	221	Max. subroutine nesting depth exceeded	
36	E-POS	223	Target position not reached	
36	E-POS	224	No feed hold (only positioning commands)	
36	E-POS	225	Selection (Auto/Homing/Jog) not permitted	
36	E-POS	226	**ProgPos**: Index overflow in indexed addressing, **TabPos**: Table index faulty (1<=Index<=31)	
36	E-POS	232	Error reading a parameter in sequence program	
36	E-POS	233	Error writing a parameter in sequence program	
36	E-POS	234	Error executing a positioning command with positioning travel by Touchprobe	
36	E-POS	235	Impermissible command in this status	
36	E-POS	236	Hardware limit switches interchanged	
37	E-FLH		Error in data flash memory	1
38	E-HW	45	Hardware limit switch left (all control modes)	
38	E-HW	46	Hardware limit switch right (all control modes)	
39	E-HWE	47	Hardware limit switches interchanged (all control modes)	
40	E-WRN	59	Torque limit (TCMMX) automatically limited	
40	E-WRN	60	Cycle time of status report via field bus too short	
40	E-WRN	61	Position reference / travel standardization outside value range	
40	E-WRN	62	Speed limit (SCSMX) automatically limited	
40	E-WRN	63	Position reference / velocity or acceleration standardization outside value range	
40	E-WRN	64	Power failure detected	
40	E-WRN	101	Encoder wire break detected (offline), no encoder connected	
40	E-WRN	179	Overflow of error counter in CAN controller	

Note:
1 = If this error is repeated please contact your local Service Partner
2 = See description of field bus (user manual)

Table A.4 Error messages

Helpline

If you have any technical queries about project planning or commissioning of the drive device, please contact our Helpline.

You can reach us:

Mon.-Thur.:	8 a.m. - 4.30 p.m.	Tel. +49 6441/966-180
Fri.:	8 a.m. - 4 p.m.	Tel. + 49 6441/966-180
E-mail:	helpline@lust-tec.de	
Fax:	+49 6441/966-137	

Service repairs

If you need further assistance, our specialists at the LUST Service Center will be glad to help.

You can reach us:

Mon.-Thur.:	8 a.m. - 4.30 p.m.	Tel. +49 6441/966-171
Fri.:	8 a.m. - 4 p.m.	Tel. + 49 6441/966-171
E-mail:	service@lust-tec.de	
Fax:	+49 6441/966-211	

Resetting errors (after eliminating the cause)

Resetting errors with reaction number 1 to 4:

- In control via terminals: rising edge at **input ENPO** (Attention: control is shut off!) or:

  with input Ixxx, to which the function FIxxx = RSERR (Reset Error) is assigned.
- In control via KEYPAD: press **stop/return** key on KEYPAD for approx. 3 seconds
- In control via DRIVEMANAGER: click on “Reset error” button.
- In control via field bus: set “Reset error” bit in bus control word.

Starting the drive after an error

- Cancel start signal and reapply it.
- With programmed auto-start function:
  - In error reactions 1 and 2 the drive automatically restarts when the error is reset.
  - In error reactions 3 and 4 the drive does not restart until the start signal has been withdrawn and re-sent.

Resetting errors with reaction number 5:

Errors with reaction number 5 are serious device errors. They can only be reset by switching all supply voltages (mains, possibly 24V) off and back on again.

Errors in power switching

Error	Cause	Remedy
Power on. Servocontroller shows no reaction (LEDs off).	If switching is too frequent, the device protects itself by means of high-resistance isolation from the system.	After a rest phase of a few minutes the device is ready to start once again.

User errors in KEYPAD operation

Error	Cause	Remedy
ATT1	Parameter cannot be changed at current user level or is not editable.	Select user level 1-MODE higher.
ATT2	Motor must not be controlled via the CTRL menu.	Cancel start signal from a different control location.
ATT3	Motor must not be controlled via the CTRL menu because of error state.	Reset error.
ATT4	New parameter value impermissible	Change value.
ATT5	New parameter value too high	Reduce value.
ATT6	New parameter value too low	Increase value.
ATT7	Card must not be read in current state.	Reset start signal.
ERROR	Invalid password	Enter correct password.

Table A.5 KEYPAD user errors

User errors in SMARTCARD operation

Error	Meaning	Remedy
ERR91	SMARTCARD write-protected	Use different SMARTCARD
ERR92	Error in plausibility check	
ERR93	SMARTCARD not readable, wrong servocontroller type	
ERR94	SMARTCARD not readable, parameter not compatible	
ERR96	Connection to SMARTCARD broken	
ERR97	SMARTCARD DATA invalid (checksum)	
ERR98	Insufficient memory on SMARTCARD	
ERR99	Selected area not present on SMARTCARD, no parameters transferred from SMARTCARD	

Table A.6 SMARTCARD errors

Note: KEYPAD user errors can be reset with **Start/Enter**.
SMARTCARD user errors can be reset with **Stop/Return**.

Appendix C Index

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