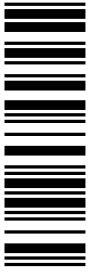
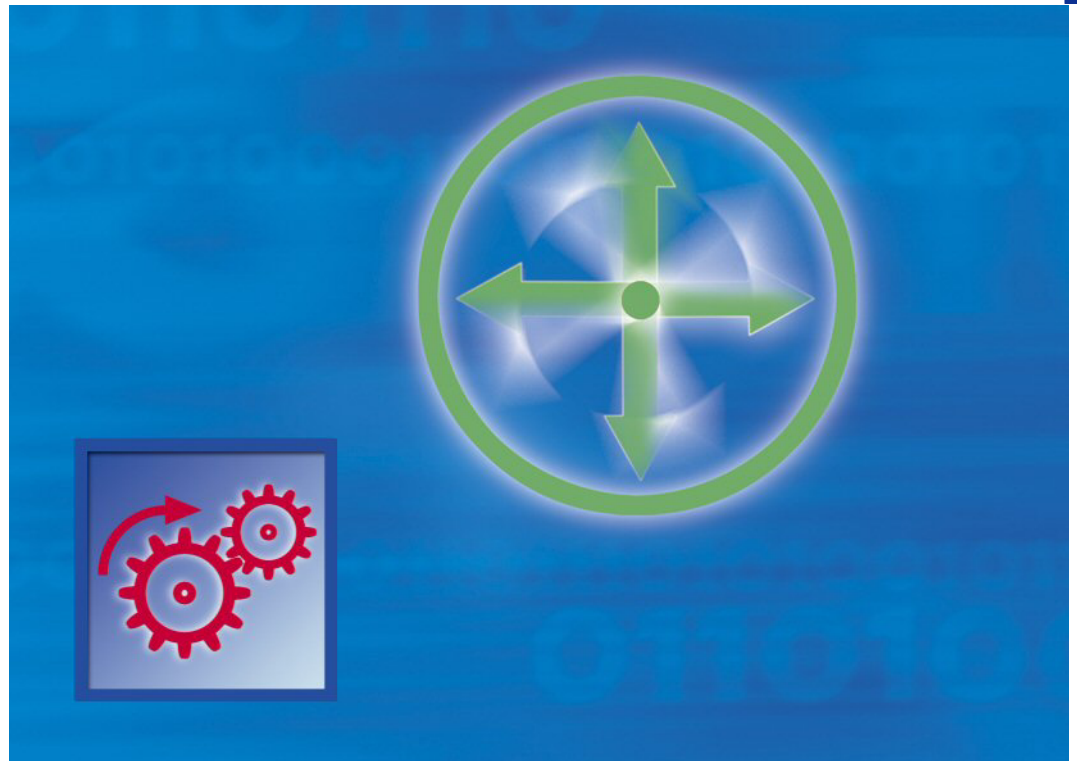


L-force *Runtime Software*



Software Manual

9400



Technology application "electronic gearbox"

Overview of the technical documentation for Servo Drives 9400

Project planning, selecting & ordering

- ☐ 9400 Hardware Manual
- ☒ Catalogue / electronic catalogue (DSC - Drive Solution Catalogue)

Mounting & wiring

- ☒ MA 9400 StateLine/HighLine
- ☒ MA for communication module
- ☒ MA for extension module
- ☒ MA for safety module
- ☒ MA for accessories
- ☒ MA for remote maintenance components

Parameter setting

- ☒ BA keypad
- ☐ SW for Lenze »Engineer« software
- ☐ SW for controller (9400 StateLine/HighLine)
- ☐ SW for regenerative power supply module
- ☐ KHB for communication module
- ☐ SW for extension module
- ☐ SW for safety module
- ☐ SW for Lenze technology application
- ☐ SW 9400 function library

← This documentation

Configuring

- ☐ SW for Lenze »Engineer« software
- ☐ SW for controller (9400 HighLine)
- ☐ KHB for communication module
- ☐ SW for extension module
- ☐ SW for safety module
- ☐ SW for Lenze technology application
- ☐ SW 9400 function library

← This documentation

Commissioning of the drive

- ☒ Commissioning guide
- ☐ SW for controller (9400 StateLine/HighLine)
- ☐ Remote Maintenance Manual

Networking

- ☐ KHB for communication medium used

Legend:

- ☒ Printed documentation
- ☐ Online documentation (PDF/Engineer online help)

Abbreviations used:

- BA Operating Instructions
- KHB Communication Manual
- MA Mounting Instructions
- SW Software Manual

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1 About this documentation

This documentation contains information about the technology application "Electronic gearbox" for the Servo Drives 9400 series.



Note!

This documentation supplements the mounting instructions supplied with the controller, the hardware manual and the software manual for the controller.

The Mounting Instructions contain safety information which must be observed!

The information in this documentation applies to:

Technology application	Appl. ID	Required runtime software licence
Electronic gearbox	100302202	Motion Control HighLevel or higher
Electronic gearbox <i>MotionBus</i>	100302102	Motion Control HighLevel or higher

The technology application can be used with the following controllers:

Product series	Type designation	From hardware version	From software version
9400 Servo Drives	E94AxHExxxx	PD	1.35

Target group

This documentation is directed at qualified personnel according to IEC 364.

Document history

Version			Description
1.0	04/2007	TD05	First edition
1.1	10/2008	TD05	New subchapter " Parameterisable function blocks "
1.2	11/2009	TD05	Error corrections

1.1 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

Type of information	Writing	Examples/notes
Numbers		
Decimal separator	Point	The decimal point is always used. Example: 1234.56
Text		
Program name	» «	The Lenze PC software »Engineer«...
Window pane	<i>Italics</i>	The <i>Message window</i> ... / The <i>Options</i> dialog box...
Control element	Bold	The OK button... / The Copy command... / The Properties tab... / The Name input field...
Sequence of menu commands		If the execution of a function requires several commands, the individual commands are separated by an arrow: Select File→Open to...
Keyboard command	< Bold >	Use < F1 > to open the Online Help. If a command requires a combination of keys, a "+" is placed between the key symbols: Use < Shift >+< ESC > to...
Program listings	Courier	<pre>IF var1 < var2 THEN a = a + 1 END IF</pre>
Keyword	Courier bold	
Hyperlink	<u>Underlined</u>	Optically highlighted reference to another topic. It is activated with a mouse click in this online documentation.
Symbols		
Page reference	 6	Optically highlighted reference to another page. It is activated with a mouse click in this online documentation.
Step-by-step instructions		Step-by-step instructions are indicated by a pictograph.

1.2 Definition of notes used

The following signal words and symbols are used in this documentation to indicate dangers and important information:

Safety instructions

Layout of the safety instructions:



Danger!

(characterises the type and severity of danger)

Note

(describes the danger and gives information about how to prevent dangerous situations)

Pictograph	Signal word	Meaning
	Danger!	Danger of personal injury through dangerous electrical voltage Indicates an impending danger that may lead to death or severe personal injury if the corresponding measures are not taken.
	Danger!	Danger of personal injury through a general source of danger Indicates an impending danger that may lead to death or severe personal injury if the corresponding measures are not taken.
	Stop!	Danger of material damage Indicates a potential danger that may lead to material damage if the corresponding measures are not taken.

Application notes

Pictograph	Signal word	Meaning
	Note!	Important note for trouble-free operation
	Tip!	Useful tip for easy handling
		Reference to another document

2 Brief description

The technology application "Electronic gearbox" serves to implement a synchronism with adjustable stretching ratio between the drives in the system.

- ▶ The ratio can be freely adjusted, the values are input in the form of a fraction (numerator/denominator) with 32 bit resolution.
- ▶ The master value can be specified either by a "Virtual master", or via a bus system or the digital frequency extension module. It is selected from the **Application parameter** tab via the **Master value source** list field (C03052).
- ▶ The master value transmission (high speed stability) is preset. The actual values can be transmitted by the corresponding selection in the list fields **Master value output** (C3054/1, C3054/2, C3197).

Functions

- ▶ Virtual master with inching, handwheel and reduced speed.
- ▶ Master value conditioning (master shaft) with master value scaling, stretch factor and reversal of rotation direction.
- ▶ Virtual clutch with emergency stop and basic speed
- ▶ Trimming function via profile generator.
- ▶ Master value conditioning (machine axis/tool) with setpoint scaling.
- ▶ Additional operating modes for activating the basic drive functions "Homing", "Manual jog (inching)" and "Position override function".
- ▶ Support of the basic drive functions "Quick stop" and "Limiter".
- ▶ Following error monitoring.
- ▶ Optional control of a holding brake.

Application range

- ▶ Slitters
- ▶ Calender drives
- ▶ Line drives
- ▶ Conveying belts
- ▶ Vibrators
- ▶ Roller mills
- ▶ Stretching machines
- ▶ Wire drawing machines

Required license/delivery

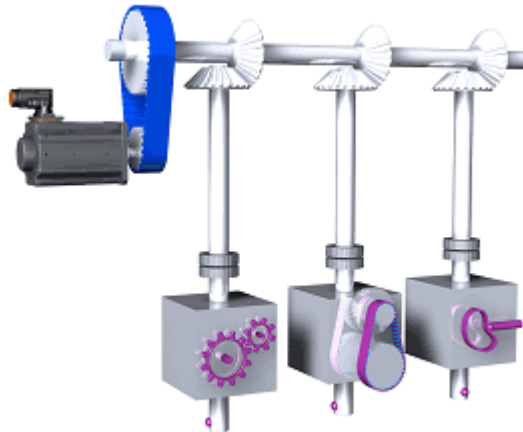
- ▶ License stage Motion Control HighLevel or higher required.
- ▶ The technology application can be selected in the »Engineer« application catalog.

3 Introduction

The following subchapters provide information on the electrical shaft.

3.1 Synchronisation of the drives via a master angle

By coupling the drives via a master angle the positions are firmly allocated to each other like a mechanical shaft.



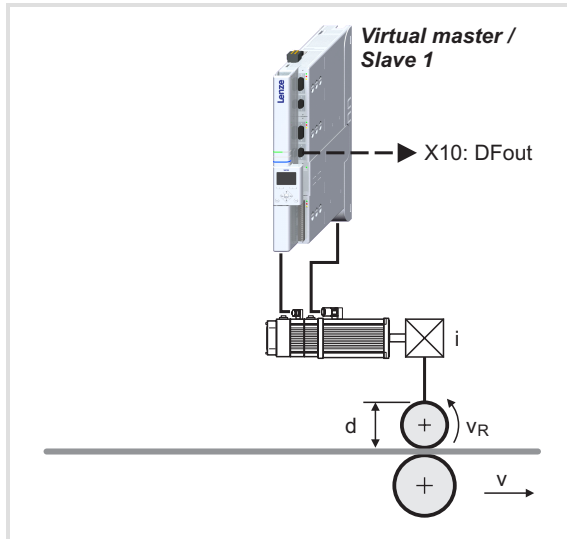
- ▶ A drive with a virtual master or a real master (encoder) is able to create the master angle and transmit this to the other drives which follow this master angle.

Advantages of this type of synchronisation

- ▶ The communication between the drives is very simple. A time-consuming evaluation of the status signals of each drive and the control signals to be generated from it for each single drive is not required.
- ▶ Due to the flexible electronics trimming functions can be carried out very easily. Thus, motion sequences in machines can be easily synchronised and optimised.
- ▶ A variation of the master angle speed changes the number of cycles of the machine. The drives keep the position allocation.

3.2 Virtual master/real master

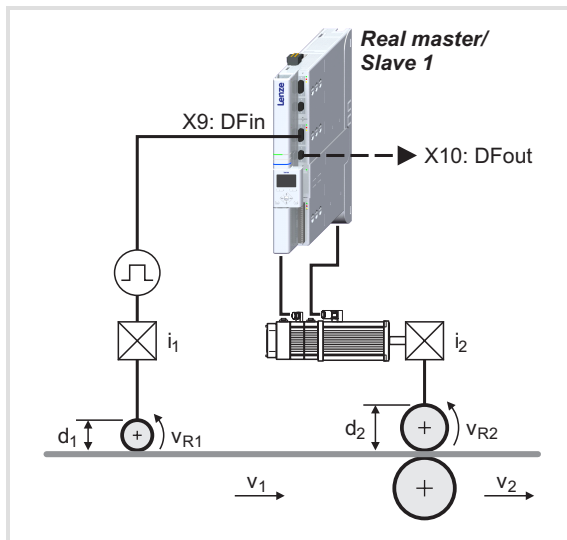
Virtual master



[3-1] Example "Virtual master" (with master value transmission via digital frequency extension module)

- In an interconnection, a drive takes over the task of the (virtual) master and is the first slave drive at the same time.
- The master value created in the TA by the "Virtual master" function is transmitted via a bus system or the digital frequency output to the other slave drives.

Real master



[3-2] Example "Real master" (with master value transmission via digital frequency extension module)

- The master value for a slave drive can be also specified by a real master (e.g. external encoder).
- The master value can be specified e.g. via the digital frequency input of the master frequency extension module or a bus system.
- The master value (possibly conditioned in the TA) by the "Virtual master" function is transmitted via a bus system or the digital frequency output to the other slave drives.

3.3 Transmission of the master angle

The master value/angle can be transmitted via the following transmission media:

- ▶ Digital frequency (simulation of an incremental encoder)
- ▶ System bus (CAN)
- ▶ ETHERNET Powerlink

The transmission medium is selected according to the criteria listed in the below table:

Criterion	Transmission medium		
	Digital frequency	System bus (CAN)	ETHERNET Powerlink
Network structure	Rail or cascade	Rail	Rail or cascade
Master value/master angle transmission	Only relative	Absolute or relative	Absolute or relative
Max. resolution	16 bits/revolution	24 bits/revolution	24 bits/revolution
Cable length	Virtually unlimited, but max. 50 m from drive to drive.	Depends on baud rate, number of nodes and cable cross-section. With a baud rate of 500 kbits/s the total cable length is limited to e.g. 117 metres.	Virtually unlimited, but max. 100 m from drive to drive.
Additional hardware required	Digital frequency extension module (E94AYFLF)	No, interface is already integrated in 9400 HighLine (CAN on board).	ETHERNET Powerlink communication module (E94AYCEP)

* In preparation; at present 16 bits/revolution

3.4 Speed or angular synchronism?

The decision whether to use a speed or angular synchronism mainly refers to the TA "Electronic gearbox".

Angular synchronism

Use the angular synchronism if the material is not able to absorb any force and no remaining positional variation must be available. Please note that a position controller always causes additional trouble in a track since disturbances and reference value variations must be compensated exactly.

Speed synchronism

Use the speed synchronism if the material is able to absorb force which ensures a better concentricity.

3.5 Rail or cascade structure?

Rail structure

All drives obtain the same master value/master angle.

Cascade structure

Each drive obtains its own master value/master angle which is created or merely prepared through the upstream drive.

3.6 Master or actual value transfer?

Master value transmission

The master value transfer results in a much quieter machine running. The mark corrections, superimposed control functions and disturbances of the drive, however, do not affect the system.

Actual value transfer

The actual value transfer results in an uneven machine running. Mark corrections, superimposed control functions and disturbances of the leading drive affect the system.

3.7 Absolute or relative master angle processing?

Absolute master angle processing

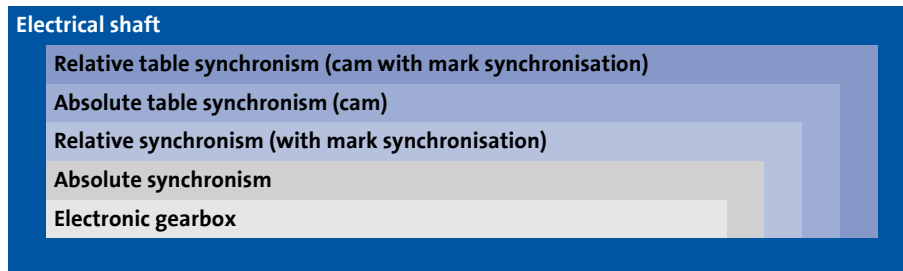
All drives have a common fix reference to each other via the position of the master angle.

Relative master value/master angle processing

Stands for a high-precision transmission of the master value. However, there is no firm reference to the other drives (e.g. in case of a material path each printing roll is synchronised one by one to the print image).

3.8 Functions with synchronisation via the electrical shaft

The functions of the electrical shaft are built on each other and thus are scalable:



Electronic gearbox

The electronic gearbox represents the simplest function in the DC-bus operation via the electrical shaft. The function is suited for e.g. material transport or material processing. A direct synchronism of tools to a material path can be created without direct position reference or for stretching machines with adjustable stretching ratio.

Absolute synchronism

This function is suited for applications with continuously rotating tools (e.g. groove cylinder), which are fed with material in a fixed machine cycle and for which several tools have to be synchronised to each other.

Relative synchronism (with mark synchronisation)

This function is suited for processing continuous material in the form of a material web. Here the tools (e.g. pressure cylinders) are aligned via marks to e.g. print images which are located on the web. There must be no risk of collision. We distinguish between "Relative synchronism with register formation and mark synchronisation" and "Relative synchronism with register control".

Absolute table synchronism (cam)

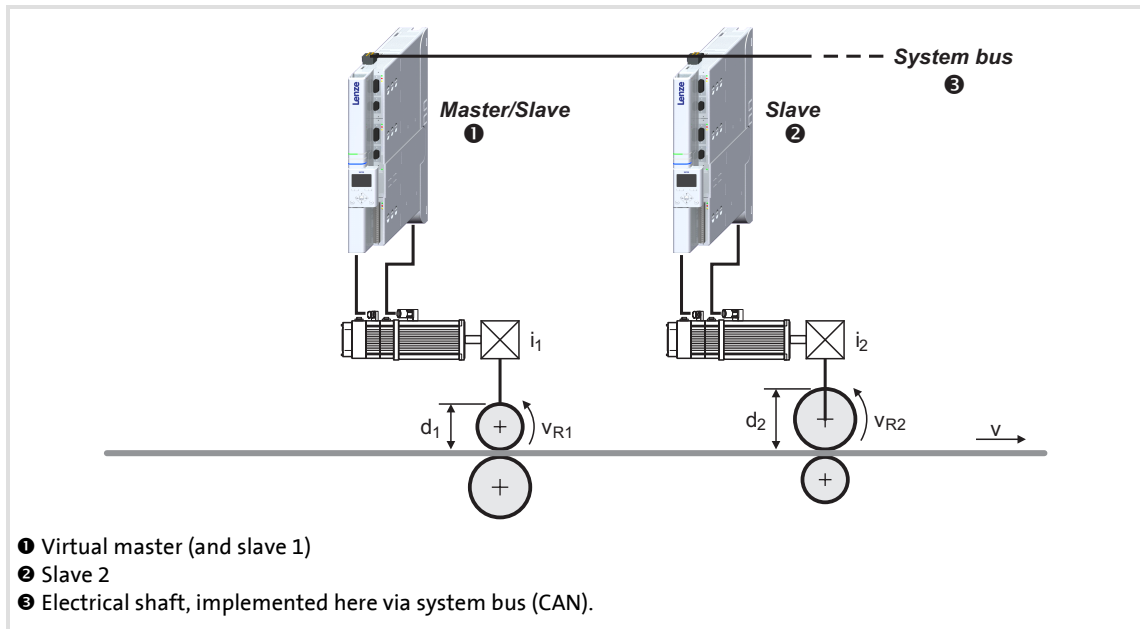
Like "Absolute synchronism", although the tools can also perform a non-linear movement.

Relative table synchronism (with mark synchronisation)

Like "Relative synchronism", although the tools can also perform a non-linear movement.

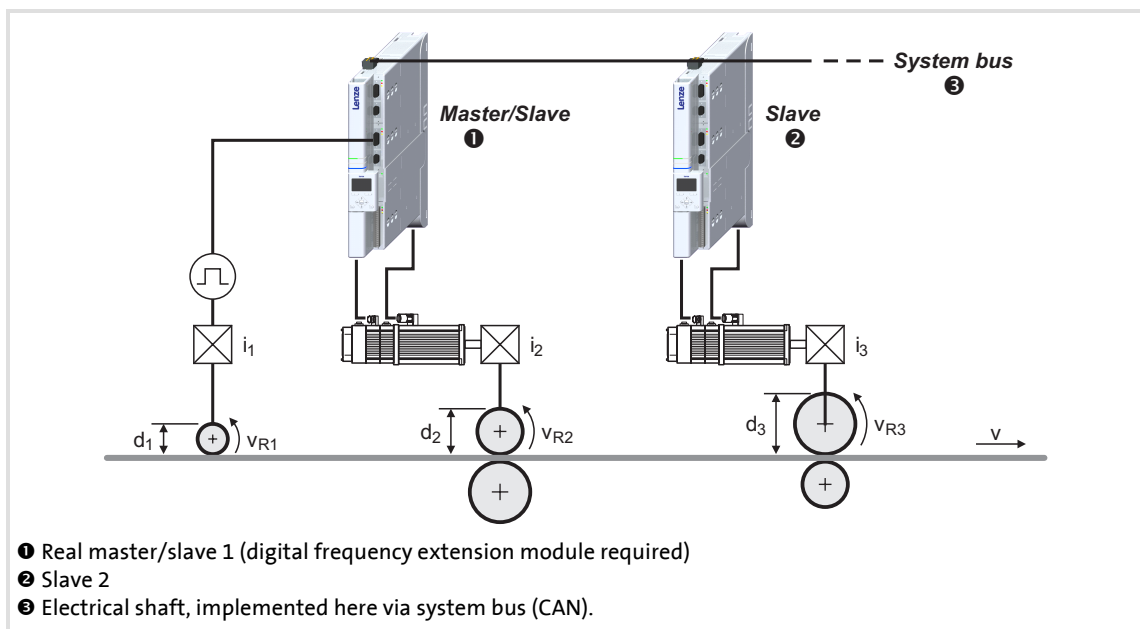
3.9 Application examples

3.9.1 Electronic gearbox with virtual master



[3-3] Electronic gearbox with virtual master (rail)

3.9.2 Electronic gearbox with real master

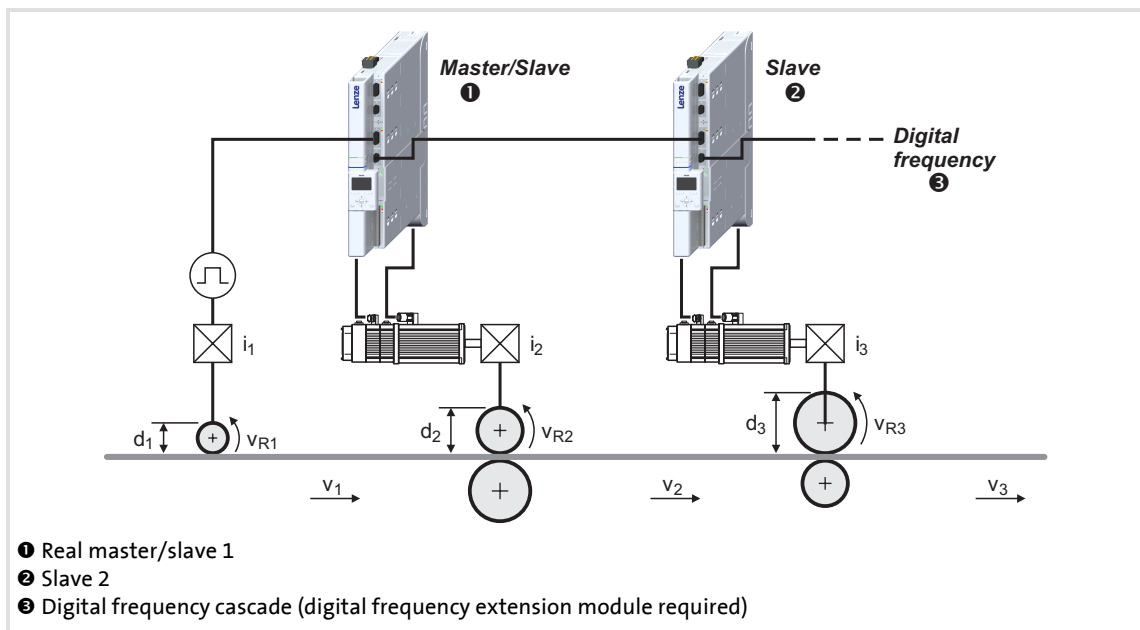


[3-4] Electronic gearbox with real master (rail)

3.9.3 Electronic gearbox as cascade

The technology application "Electronic gearbox" is often operated as cascade since changes of speed/gearbox ratio of an upstream drive also have an effect on the subsequent drive.

- Typical applications are, for instance, stretching machines, wire drawing machines and roller mills.
- There is no position reference between tool and material. However, it may be required to position the tools for maintenance work.
- The master speed is transmitted via the digital frequency or ETHERNET Powerlink.



[3-5] Electronic gearbox with real master (cascade)

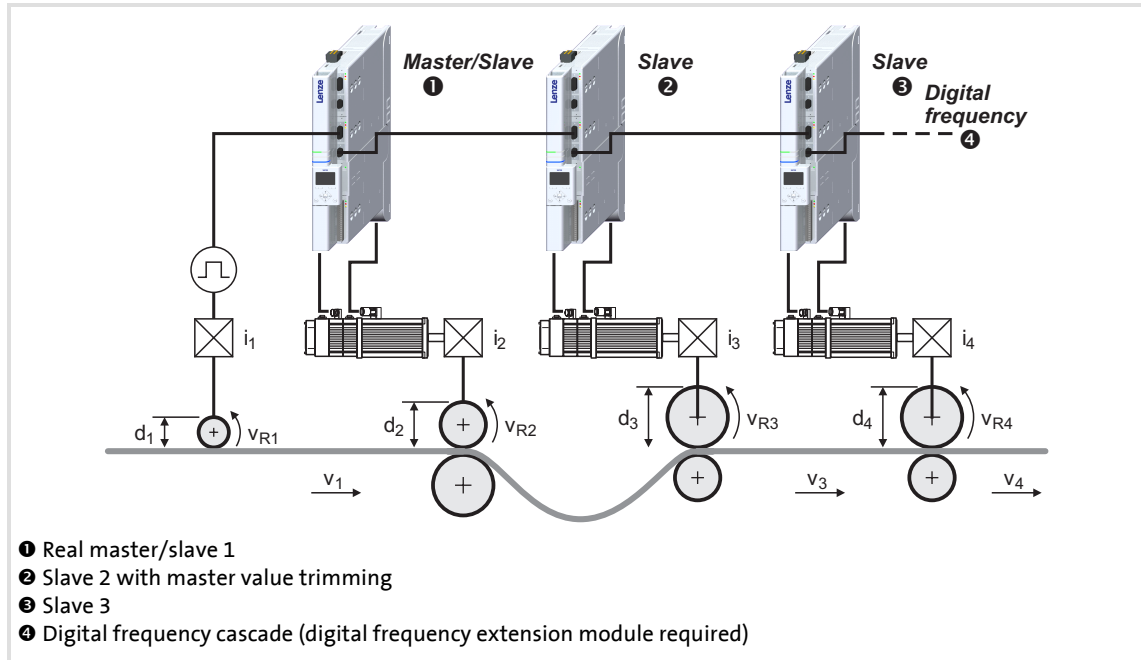
- The following applies to the speed of the web in case of a cascade:

$$v_3 > v_2$$

$$v_3 = v_2 \cdot K$$

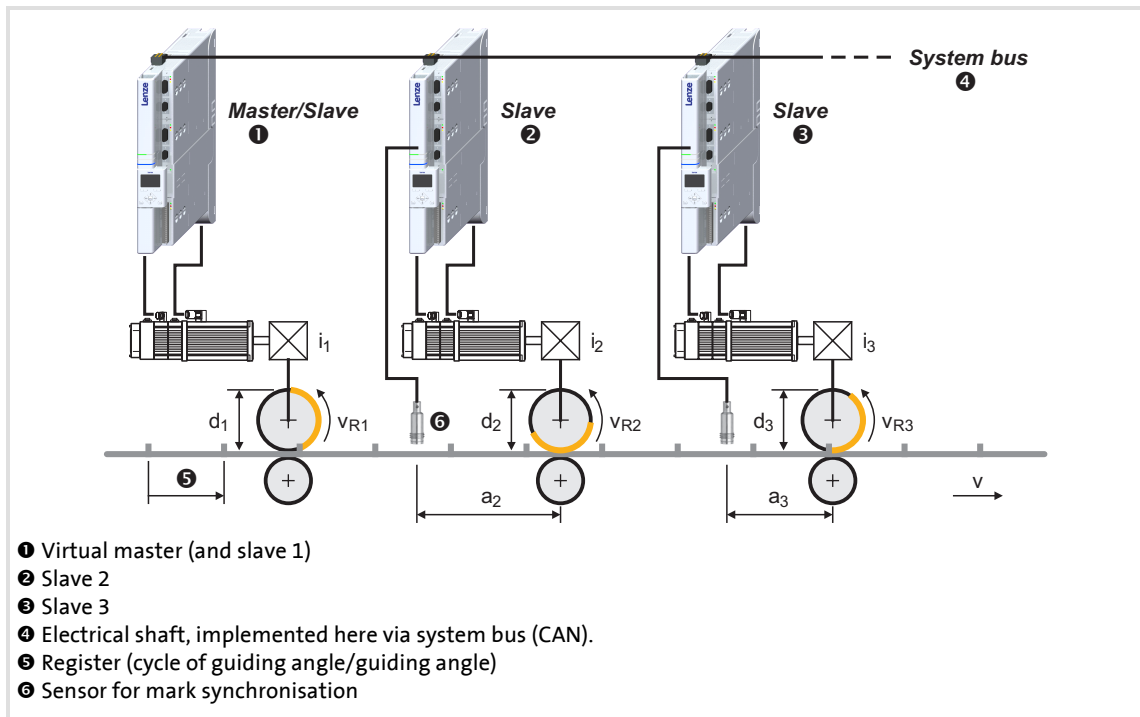
3.9.4 Tighten the web via trimming function with cascade

In case a clearance has developed, the web must be "tightened" again. Only then the machine can be accelerated again via the master. The subsequent slave (cascade structure) must run along in the set ratio. Thus, the trimming function acts directly before or after the stretching factor.



[3-6] Trimming function in case of the electronic gearbox as cascade

3.9.5 Relative synchronism with mark synchronisation and virtual master

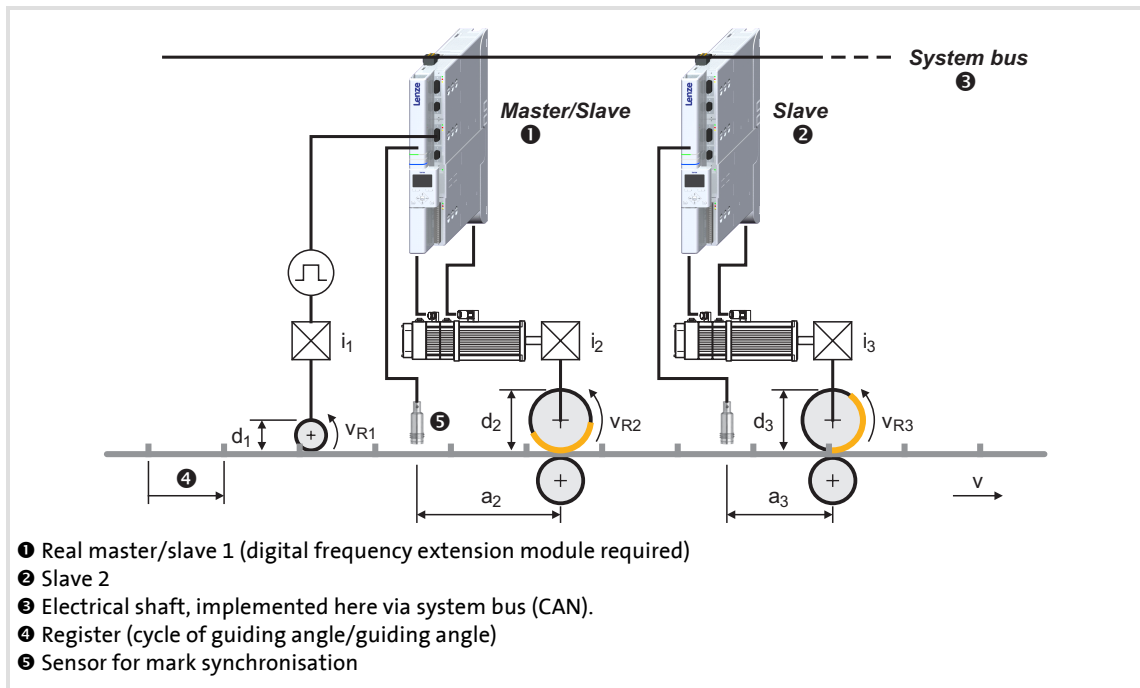


[3-7] Relative synchronism with virtual master (rail)

In case of the relative synchronism with mark synchronisation, there is a position reference between tool and web, which occurs in each register. For this, a slight correction is superimposed to the synchronous motion with regard to the web. Such applications are, for instance, printing machines.

For the mark synchronisation in particular the register 5 (the cycle of the guiding angle) and the distance of the sensor 6 from the home position of the tool (distances a_2 and a_3) are relevant.

3.9.6 Relative synchronism with mark synchronisation and real master



[3-8] Relative synchronism with real master (rail)

4 Short setup



Note!

The electrical shaft can be implemented with a bus system as e.g. system bus (CAN) or Ethernet Powerlink or via digital frequency transmission.

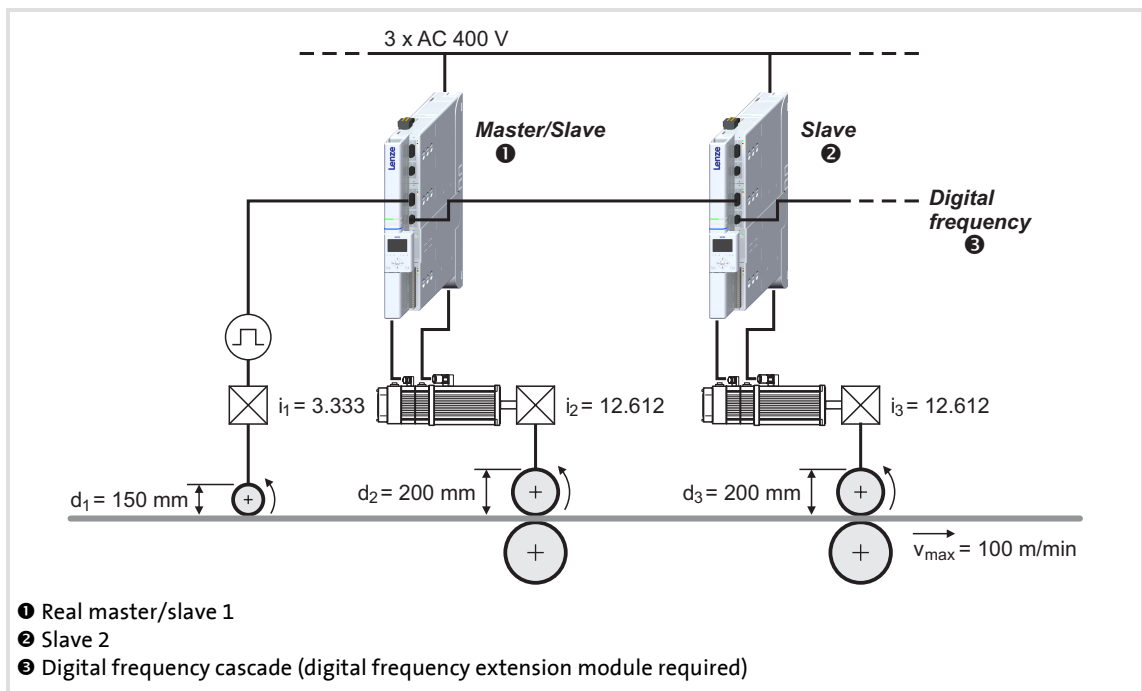
With regard to the configuration of the digital frequency extension module in the controller, two variants of technology applications are available in the »Engineer« application catalog.

- In the TA variant "Electronic gearbox" the configuration of a digital frequency extension module is expected. Therefore, the TA can provide the function of the electrical shaft either via digital frequency transmission and via a bus system.
- In the TA variant "Electronic gearbox *MotionBus*" the configuration of a digital frequency extension module is not included and corresponding interfaces are not available in the TA. Thus the function of the electrical shaft with this TA can only be provided via a bus system.

4.1 Application example

In the application example used for short setup, the technology application "Electronic gearbox" is operated as cascade since changes of speed/gearbox ratio of an upstream drive also have an effect on the subsequent drive.

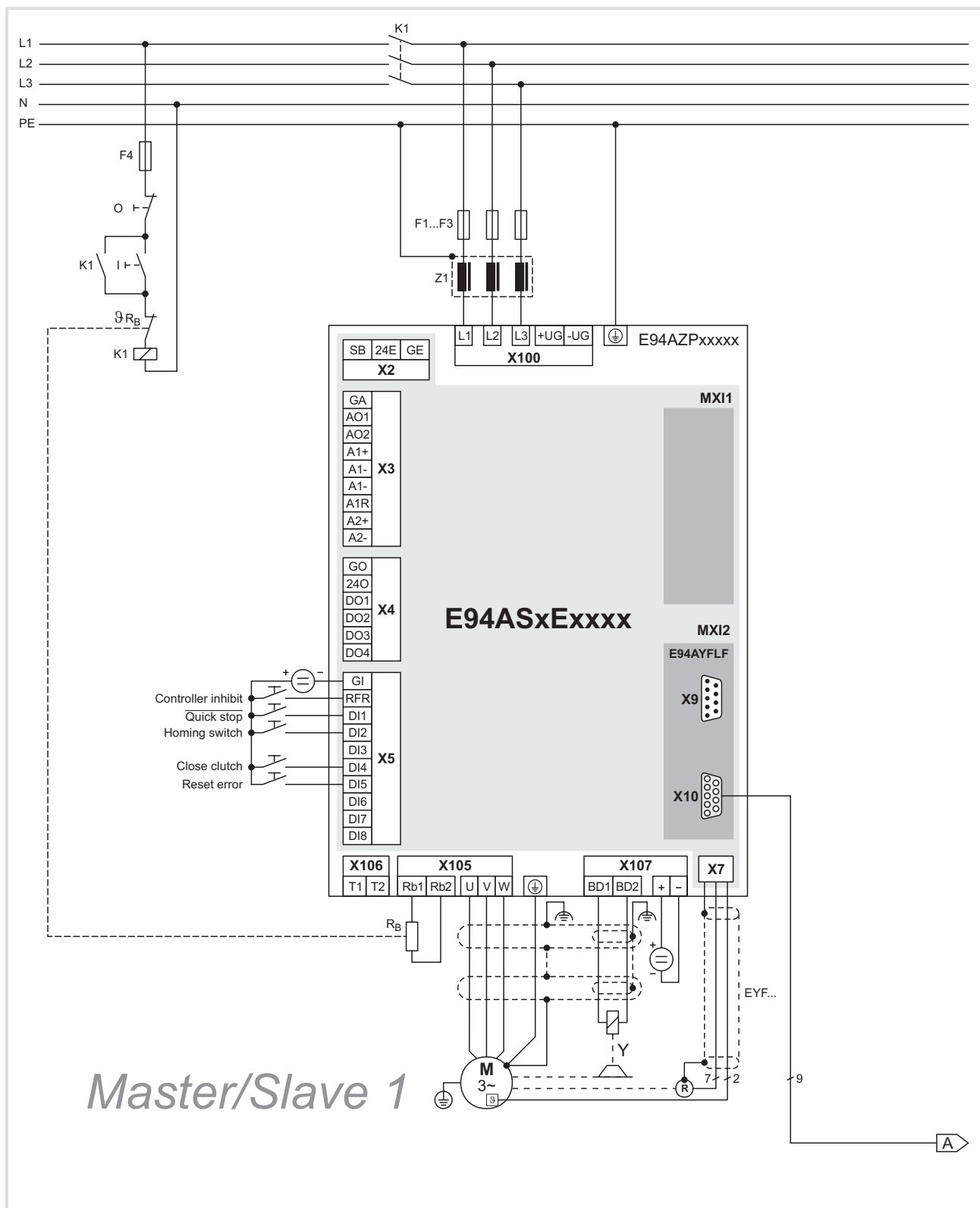
- Typical applications are, for instance, stretching machines, wire drawing machines and roller mills.
- There is no position reference between tool and material. However, it may be required to position the tools for maintenance work.
- The master speed is transmitted via the digital frequency (digital frequency extension module required).

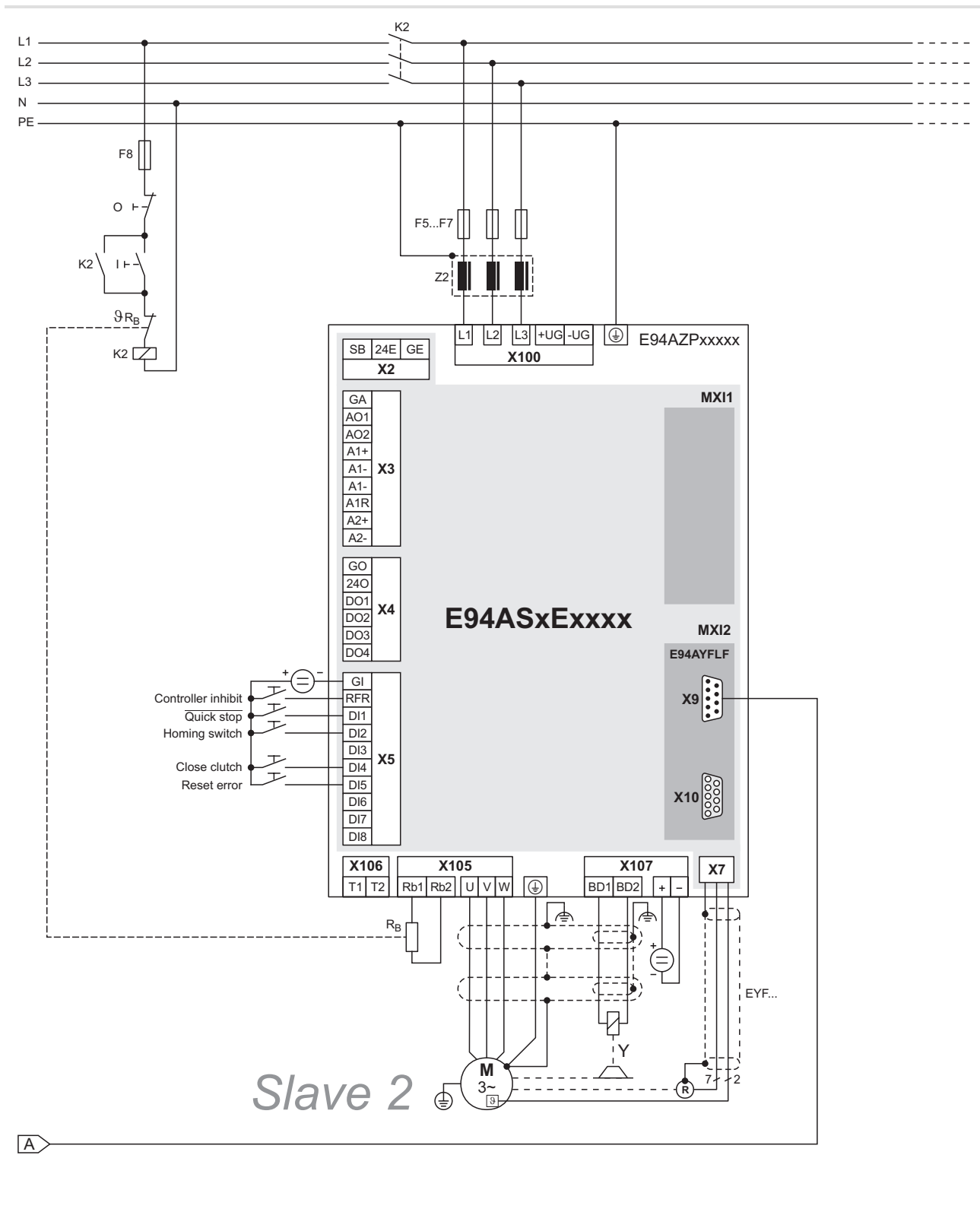


[4-1] Schematic diagram

Component	Technical data
Controller 1 & 2	9400 SingleDrive HighLine with brake module
Motor 1 & 2	MDFKA-090-22, 60
	Type: Asynchronous servo motor
	Connection: Y
	Power factor: 0.8
	Rated current: 8.5 A
	Rated frequency: 60 Hz
	Rated power: 3.8 kW
	Rated speed: 1680 rpm
	Rated voltage: 390 V
Gearbox i_1	Gearbox factor: 3.333 (resulting number of teeth: 10/3)
Gearbox i_2, i_3	Gearbox factor: 12.612

4.2 Connection diagram





[4-3] Connection diagram slave 2

9400 Technology applications | Electronic gearbox

Short setup

Connection diagram

Designation	Component
E94ASxExxx	9400 Single Drive servo axis module
E94AZPxxxxx	Mounting backplane
E94AYFLF	Digital frequency extension module (in module slot MXI1)
K1, K2	Mains contactor
F1 ... F8	Fuses
Z1, Z2	Mains filter/RFI filter (option)
	HF-shield termination through large-surface connection to functional earth
EYF...	System cable for resolver feedback
R	Resolver
R _B	Brake resistor
Y	Motor holding brake (at optional motor brake control)

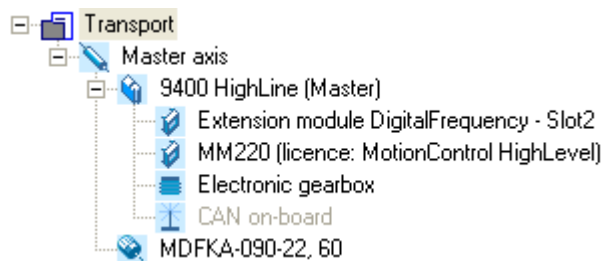
4.3 Step 1: Creating a project

**Tip!**

Since the components of the master and slave axis are identical in the application example, you can use the *copy&paste* function to create the project in the »Engineer«:

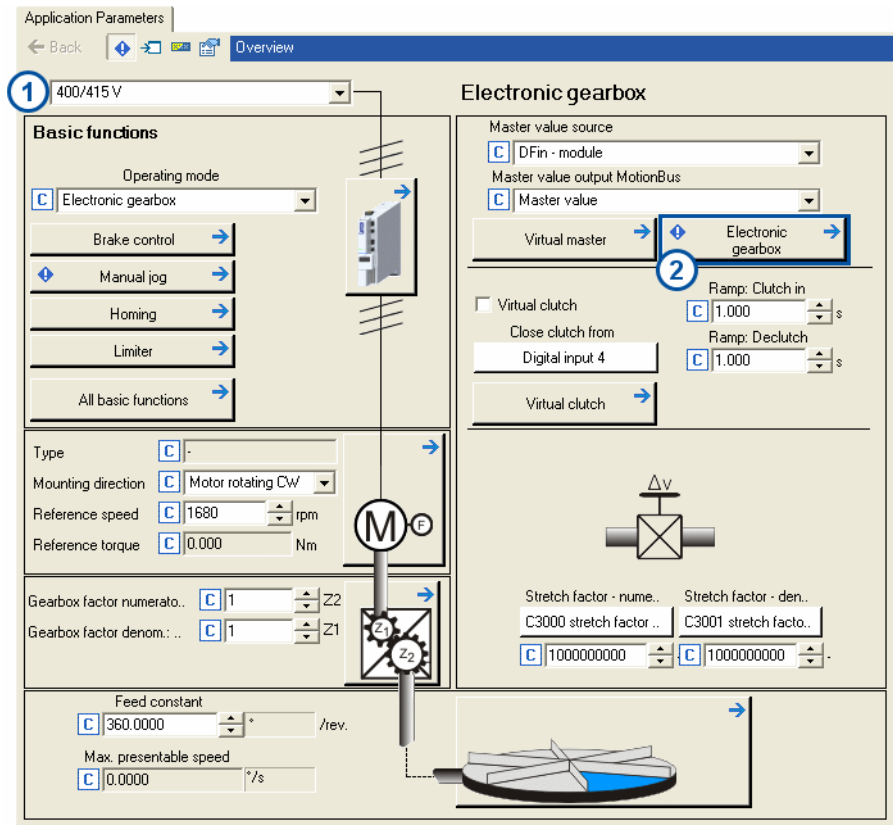
- In the first step, only insert the master drive axis.
- Then, parameterise the technology application "Electronic gearbox" for the master drive.
- When the required settings have been made, copy the master axis in the project view, paste it, and rename it.

1. Start »Engineer«.
2. Go to *Start-up wizard* and select the option "New project (empty)" and enter a name for the project in a next step.
3.  Insert the axis for the master drive.
 - Add the corresponding components to the axis (controller, motor, digital frequency extension module).
 - Select the application "Electronic gearbox" for the controller. (Do not select "Electronic gearbox *MotionBus*" because the digital frequency extension module is only supported by the variant without *MotionBus*.)
 - Example *project view* in the »Engineer«:



4.4 Step 2: Parameterising the application

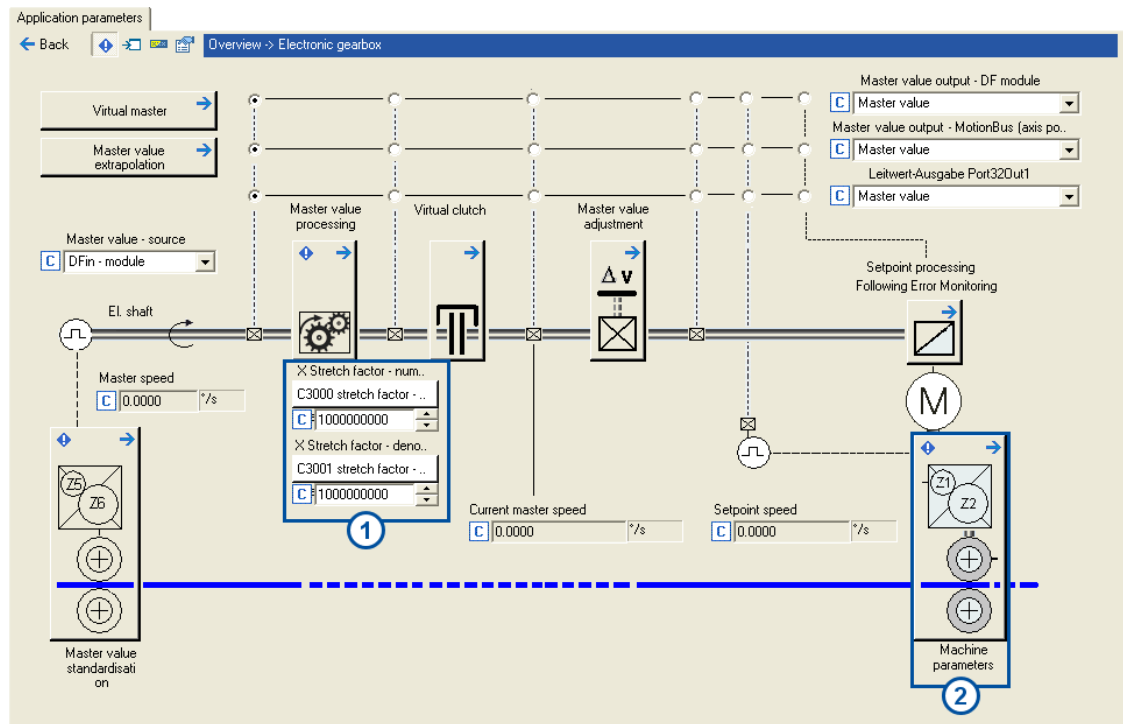
For parameterising the application in the »Engineer«, use the **Application parameters** tab which will be displayed by default when selecting the controller in the *project view*:



1. Select the mains voltage (C00173).
2. Click **Electronic gearbox** to change to the dialog level *Overview* → *Electronic gearbox* for further parameter setting.

Electronic gearbox

Go to dialog: [Overview](#)
[Electronic gearbox](#)



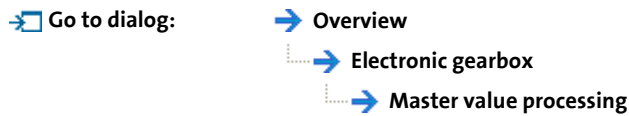
1. Select the synchronism ratio between master and slave drive:
 - Stretch factor numerator (C03000)
 - Stretch factor denominator (C03001)
2. Click **Machine parameters** to change to the dialog level *Overview* → *Electronic gearbox* → *Machine parameters*.

Machine parameters



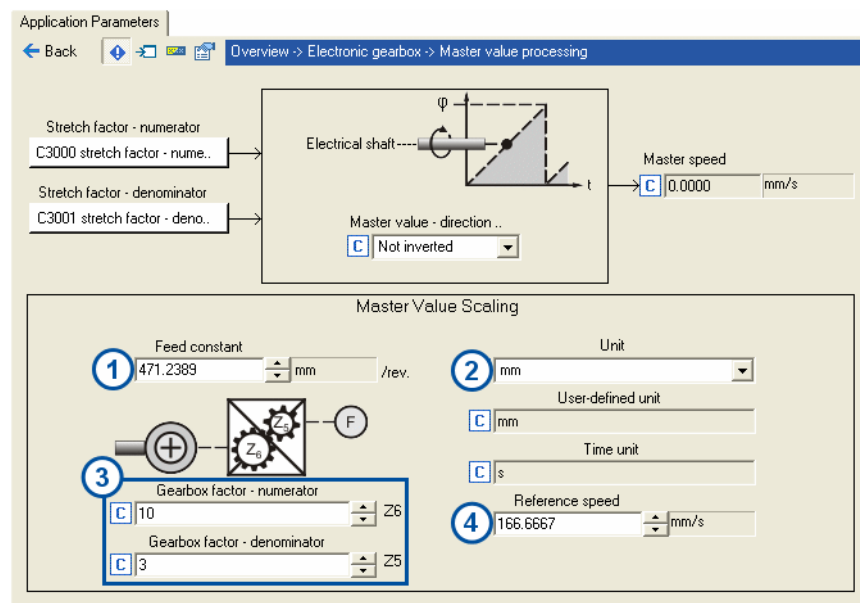
1. Set gearbox ratio for the motor in the form of a quotient (numerator and denominator): $i_2 = 12.612 = 12612/1000$
 - Numerator (C02520) = 12612
 - Denominator (C02521) = 1000
2. Set the same gearbox ratio for the encoder on the load side:
 - Numerator (C02522) = 12612
 - Denominator (C02523) = 1000
3. Set feed constant (C02524).
 - The feed constant corresponds to the motion of the machine at one revolution of the gearbox output shaft.
 - For the conveyor drive: $V_k = d_2 \cdot \pi = 628,3185 \text{ mm}$
4. Set the selection "mm" as unit (C02525).
 - This parameter is used to define the real unit of the machine for the selection of physical values (e. g. speeds, accelerations and decelerations).
5. Click **Back** to go back to the *Electronic gearbox* dialog level.
6. In the *Electronic gearbox* dialog level, click **Master value processing** to change to the *Master value processing* dialog level.

Master value processing



Note!

All controllers in the network must have the same master value processing settings!



1. Set feed constant (C03932).
 - For the master value: $V_k = d_1 \cdot \pi = 471.2389 \text{ mm}$
2. Set the selection "mm" as path unit (C03933).
3. Set the gearbox ratio for the master value as a quotient (numerator and denominator):
 - $i_1 = 3.333 = 10/3$
 - Numerator (C03930) = 10
 - Denominator (C03931) = 3
4. Set the max. machine speed as reference speed (C03941):
 - $v_{\max} = 100 \text{ m/min} = 166.6667 \text{ mm/s}$



Tip!

For operation with a virtual master the following setting of the gearbox ratio is recommended to achieve a good resolution of the guiding angle/master value:

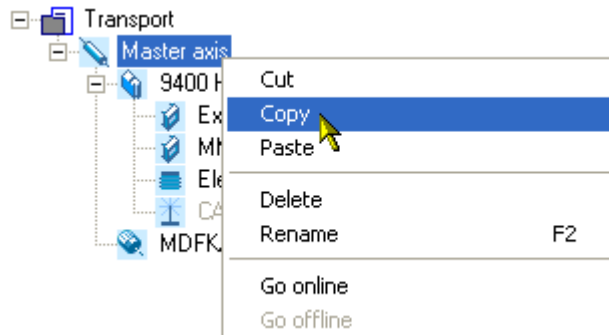
- Numerator (C03930) = 100
- Denominator (C03931) = 1

4.5 Step 3: Adding a slave axis to the project

Use the *copy&paste* function in the *project view* for not having to enter all settings for the slave axis once again:

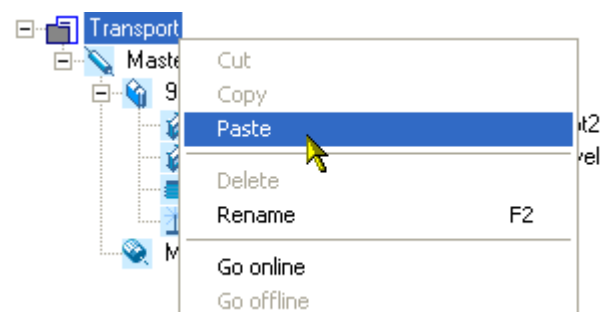
1. Copy the master axis in the *project view*.

- For this, select the master axis, open the *context menu* (right mouse button), and click **Copy**:



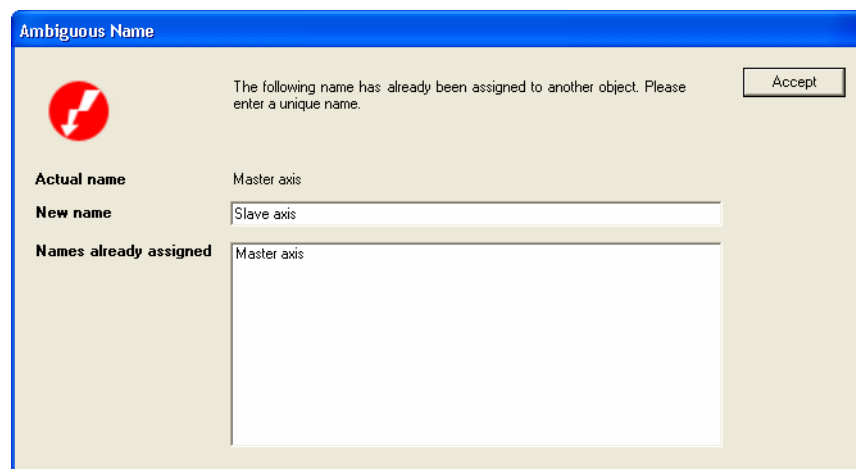
2. Paste the copy of the master axis into the *project view*.

- For this, select the topmost project element, open the *context menu* (right mouse button), and click **Paste**:



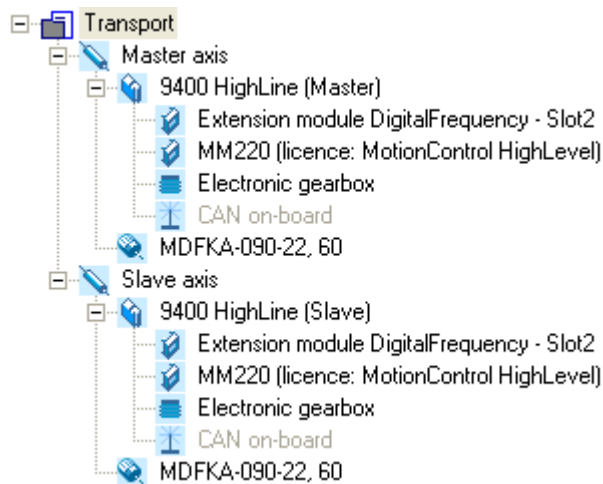
3. Rename the copy of the axis pasted.

- All axes in the *project view* must have an unambiguous name. This is why the following dialog box in which you are asked to rename the axis (e.g. "slave axis") appears automatically after pasting:



4. Rename the copy of the controller.

- The *Ambiguous name* dialog box appears once again for the copied controller because all controllers must have an unambiguous name in the *project view*.
- Enter e.g. "9400 HighLine (slave)" as controller name.
- Example *project view* in the »Engineer«:



4.6 Step 4: Transferring applications to the controllers



Note!

The transferred application is always stored in the first application memory location in the memory module of the controller.

The preinstalled technology applications on the following memory locations are still available.

1.  Update devices.
 - Set the checkmark in the control field **Recreate all**.
 - Click **Create** to start the compiling process.
2.  Go online and transfer the applications to the controllers.

4.7 Step 5: Controlling applications via terminals

Terminal assignment

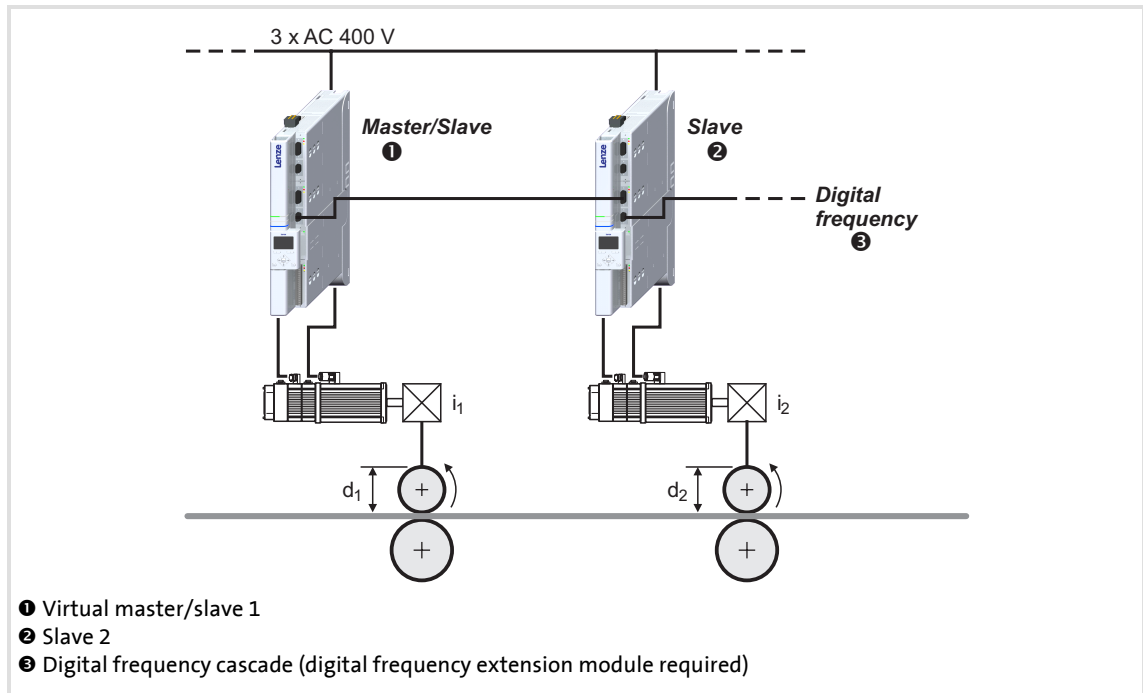
Terminal		Assignment (Lenze setting)
X5	RFR	Controller enable
	DI1	Quick stop - If DI1 is set to LOW level, the drive is decelerated to standstill within the deceleration time set for the quick stop function independent of the setpoint selection. - If the quick stop function is deactivated, the drive is led to the selected setpoint again via the set acceleration time.
	DI2	Connection of reference switch
	DI3	-
	DI4	Close clutch
	DI5	Reset error By means of a LOW-HIGH edge an existing error status can be reset if the cause of the fault is removed.
	DI6	-
	DI7	-
	DI8	-

Procedure

1. Enable controller: Set digital input RFR to HIGH level.
2. Deactivate quick stop: Set digital input DI1 to HIGH level.

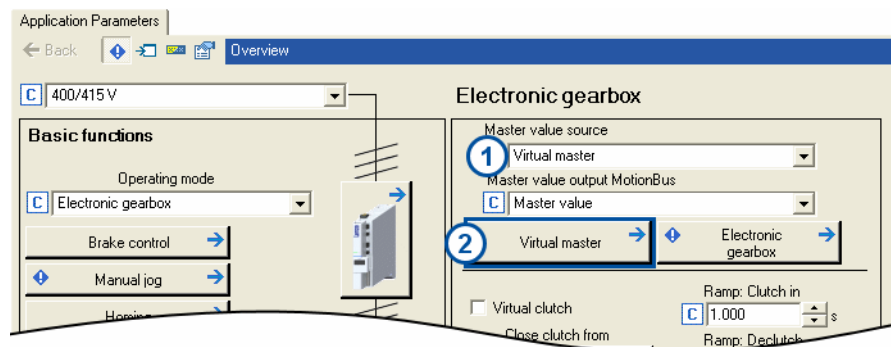
4.8 Using the "Virtual master" function

Instead of a real master, you can also use a "virtual master" for operating the electronic gearbox. In this case, one drive in the network acts both as a (virtual) master and the first slave drive. The master value generated by the "Virtual master" function in the TA is transferred to the other slave drives via the digital frequency output:



[4-4] Schematic diagram

Based on the previously described short setup, the following additional settings have to be made for the master drive for using the "Virtual master" function:



1. Select "Virtual master" as master value source (C03052) in the *Overview* dialog level.
2. Click **Virtual master** to change to the dialog level *Overview* → *Virtual master*.

- Go to dialog: [Overview](#)
[Virtual master](#)

Application parameters

Back Overview -> Virtual master

VMas - STOP1 of master sh. FALSE

1 Activate master function from TRUE

VMas - positive inching from C3017 pos. inching - master

VMas - negative inching from C3018 neg. inching - master

2 VMas - start continuous operation Digital input 8

VMas - 2nd master speed fr. FALSE

4 VMaster handwheel 0 unit/t

VMaster: Operating mode Continuous operation

Master speed 1 500.0000 °/s

Master speed 2 0.1000 °/s

Status 0

Speed at output 0.0000 °/s

Ramp: Inching 0.010 s

3 Ramp: Continuous operation 1.000 s

Ramp: Stop 1.000 s

Positive inching: Speed 50.0000 °/s

Negative inching: Speed 25.0000 °/s

Reference speed 166.6667 °/s

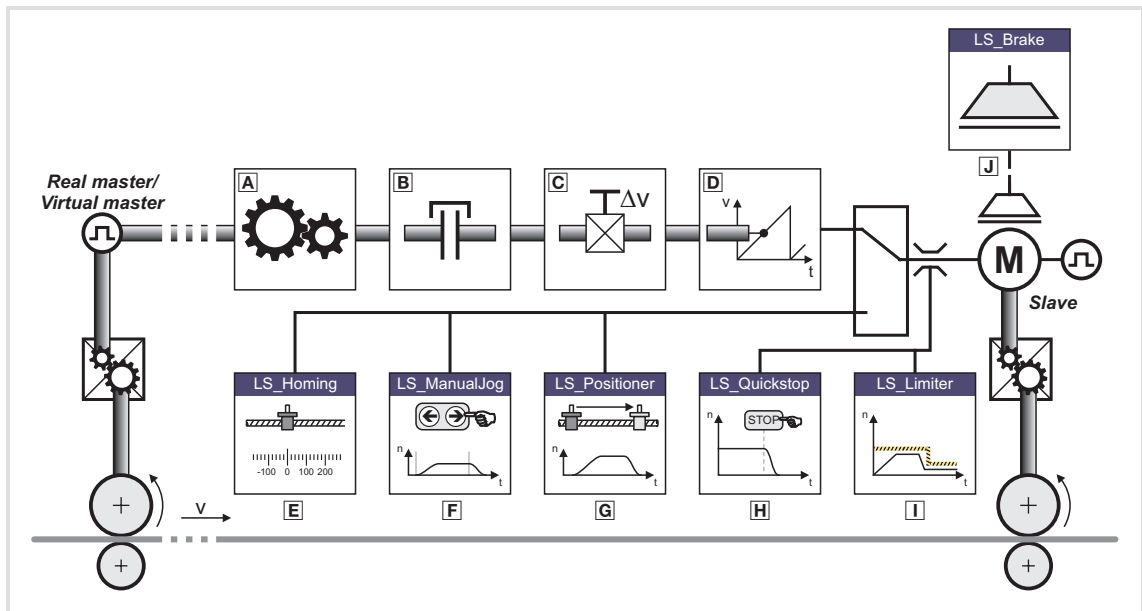
V_{Master} / V_{Jog}

tf[s]

- Set control input **Activate master function** to TRUE.
 - For this, click the white button, go to the *I/O configuration for...* dialog box in the **Constants** tab and activate **TRUE**.
- Assign control input **VMas - start continuous operation** e.g. to digital input DI8.
 - For this, click the white button, go to the *I/O configuration for...* dialog box in the **Digital input terminals** tab and activate **Digital input 8**.
- Select Ramp: Continuous operation (C03570/2).
- Select Master speed 1 (C03568/1).

5 Parameter setting & configuration

5.1 Basic signal flow



[5-1] Signal flow of the TA "Electronic gearbox" (schematic diagram)

Functions in the operating mode "Electronic gearbox"

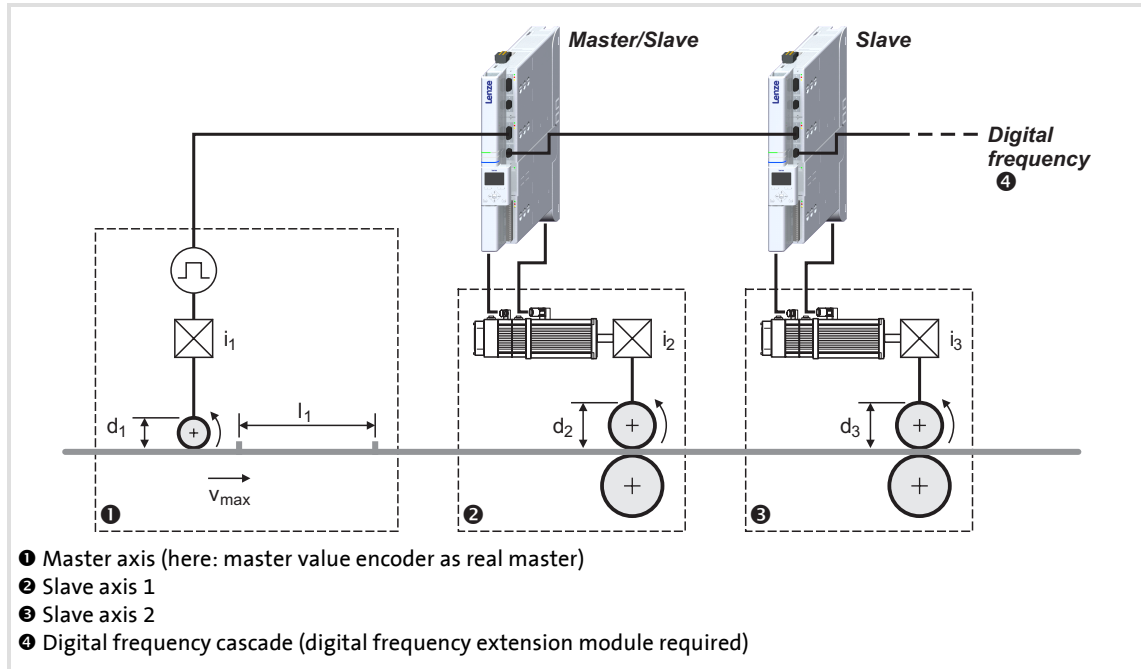
- A** Master value processing with stretch factor
- B** Virtual clutch
- C** Master value trimming
- D** Setpoint conditioning

Basic drive functions

- E** Homing
- F** Manual jog (inching)
- G** Position override function
- H** Quick stop
- I** Limiter (optional)
- J** Brake control (optional)

5.2 Machine parameters

The following schematic diagram shows the relevant global data (machine parameters) for the interconnection via the electrical shaft:



[5-2] Schematic diagram of the most important machine parameters

Symbol	Description
i_1	Gearbox ratio of master value encoder
d_1	Diameter of the master roll
l_1	Master value cycle (if available)
v_{max}	Maximum speed
i_2, i_3	Gearbox ratio of the slave axes
d_2, d_3	Diameter of the slave rolls

Detailed information for setting the machine parameters can be obtained from the following subchapters.

5.2.1 Master axis (master shaft)

For scaling and imaging the master value in the application, the machine parameters of the higher-level drive (master shaft) must be set.



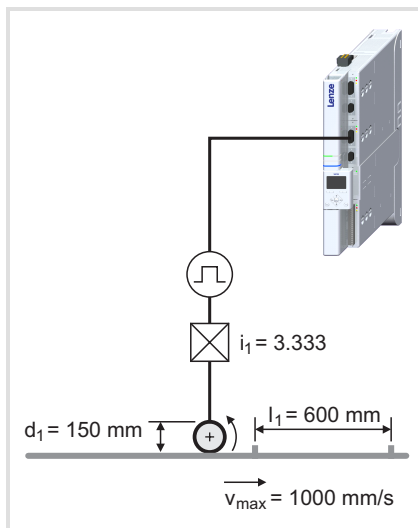
Note!

When setting (scaling) the electrical shaft, ensure that the ratio and encoder constants are identical for all drives in the system. The reference to the scaling of the master drive is sensible.

► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Electronic gearbox* → *Master value processing*

Parameter		Lenze setting	
		Value	Unit
C03930	Gearbox ratio - numerator	1	
C03931	Gearbox ratio - denominator	1	
C03932	Feed constant	360.0000	unit/revolution
C03933	Path units	User-defined	
C03934	User-defined path unit	°	
C03938	Cycle	360.0000	unit
C03941	Reference speed	500.0000	unit/t

Example of determining the machine parameters for the master axis



1. Set gearbox ratio for the master value in the form of a quotient (numerator and denominator):
 $i_1 = 3.333 = 10/3$
 - Numerator (C03930) = 10
 - Denominator (C03931) = 3
2. Set feed constant (C03932).
 - For the master value: $V_k = d_1 \cdot \pi = 471.2389 \text{ mm}$
3. Set the selection "mm" as path unit (C03933).
4. As reference speed (C03941) set the max. machine speed $v_{\max} = "1000 \text{ mm/s}"$.



Tip!

Setting the cycle (C03938) only is required if the selection "Modulo" is set as traversing range (C02528).

For operation with a virtual master the following setting of the gearbox ratio is recommended to achieve a good resolution of the guiding angle/master value:

- Numerator (C03930) = 100
- Denominator (C03931) = 1

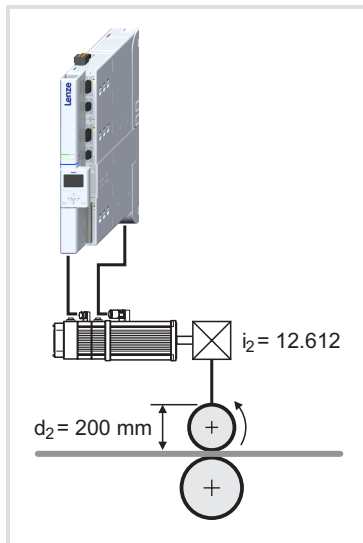
5.2.2 Slave axis (machine axis)

Among other things, the following machine parameters describe the motor end of the mechanics used.

► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Electronic gearbox* → *Machine parameter*

Parameter		Lenze setting	
		Value	Unit
C00173	Mains voltage	400/415	V
C00174	Undervoltage (LU) threshold	285	V
C00600	Resp. to DC bus overvoltage	Trouble	
C02520	Gearbox factor numerator: Motor	1	
C02521	Gearbox factor denom: Motor	1	
C02527	Motor mounting direction	Motor rotating CW	
C02570	Position control structure	Position control	
C02522	Gearbox factor num.: Pos. enc.	1	
C02523	Gearbox factor denom.: Pos. enc.	1	
C02529	Mounting direction of position encoder	Encoder rotating CW	
Description of the mechanics (load, tool)			
C02528	Traversing range	Modulo	
C02524	Feed constant	360.0000	unit
C02525	Unit	°	
C02526	User-defined unit	°	
C02533	Time unit	s	
C00273/1	Motor moment of inertia	Motor-dependent	kg cm ²
C00273/2	Load moment of inertia	0.00	kg cm ²

Example of determining the machine parameters for the slave axis



1. Set gearbox ratio for the motor in the form of a quotient (numerator and denominator): $i_2 = 12.612 = 12612/1000$
 - Numerator (C02520) = 12612
 - Denominator (C02521) = 1000
2. Set the same gearbox ratio for the position encoder:
 - Numerator (C02522) = 12612
 - Denominator (C02523) = 1000
3. Set feed constant (C02524).
 - For the conveyor drive: $V_k = d_2 * \pi = 628,3185 \text{ mm}$
4. Set the selection "mm" as unit (C02525).

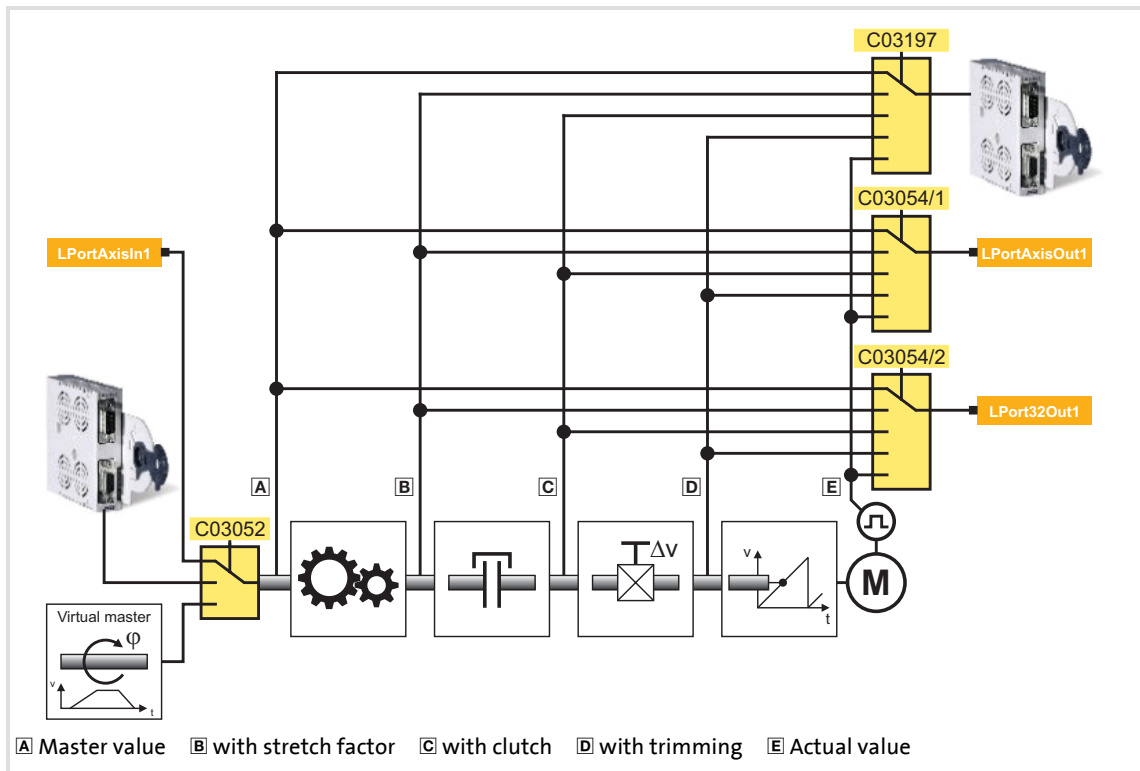


Tip!

The feed constant corresponds to the movement on the machine side when the gearbox output shaft carries out one revolution (for selection as angle = 360°).

When the unit is set, the real unit of the machine for the selection of physical values (e. g. speeds, accelerations and decelerations) is defined.

5.3 Selection of master value source and output



[5-3] Signal flow for selecting the master value source and the master values to be output

Master value source

The master values can be either selected by a "Virtual master", via a bus system or the digital frequency extension module. ▶ [Transmission of the master angle](#) (12)

- ▶ They can be selected on the **Application parameters** tab via the **Master value source** list field or via C03052.

Master value output

The master value to be output (A ... E) is selected individually for the three possible communication channels:

- ▶ List field **Master value output DF module** (C03197):
Selection of the master value output for the digital frequency module.
- ▶ List field **Master value output MotionBus** (C03054/1):
Selection of the master value output for horizontal communication.
- ▶ List field **Master value output LPort32Out1** (C03054/2):
Selection of the master value output for vertical communication.

5.3.1 Master value source: Virtual master

If the "Virtual master" is selected as master value source, the master value is created in the TA and transmitted via a bus system or the digital frequency output to the other slave drives.

► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Virtual master*

Parameter		Lenze setting	
		Value	Unit
C03565	Operating mode	Continuous operation	
C03568/1	Master speed 1	500.0000	unit/t
C03568/2	Master speed 2	0.1000	unit/t
C03569/1	Speed inching right	50.0000	unit/t
C03569/2	Speed inching left	25.0000	unit/t
C03570/1	Inching ramp	0.010	s
C03570/2	Continuous operation ramp	1.000	s
C03570/3	Stop ramp	1.000	s

Control/setpoint inputs of the function		Signal configuration
Lenze setting	Control/setpoint input	(Multiplexer parameters)
FALSE	→ VMas master shaft STOP1	C03058/1
C03016	→ Activate master function	C03058/3
C03017	→ VMas inching positive	C03058/4
C03018	→ VMas inching negative	C03058/5
FALSE	→ VMas start continuous operation	C03058/7
FALSE	→ VMas 2. master speed	C03058/8
0	→ VMaster handwheel	C03056

► Configuration: Tab **FB editor** → FB [VirtualMaster](#)

5.3.2 Master value source: Digital frequency input

To use the digital frequency input as master value source, the controller must be provided with digital frequency extension module (E94AYFLF).

To ensure the integration of the extension module in the application, the TA "Electronic gearbox" must be used as technology application.



Note!

The technology application "Electronic gearbox" *MotionBus* which can also be selected in the application catalog does not contain any interfaces to the digital frequency extension module.

5.3.3 Master value source: Bus system

When the master value is selected via a bus system as e.g. system bus (CAN) it is possible to first extrapolate the received position information to compensate higher bus transmission cycles.

- Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Electronic gearbox* → *Master value extrapolation*

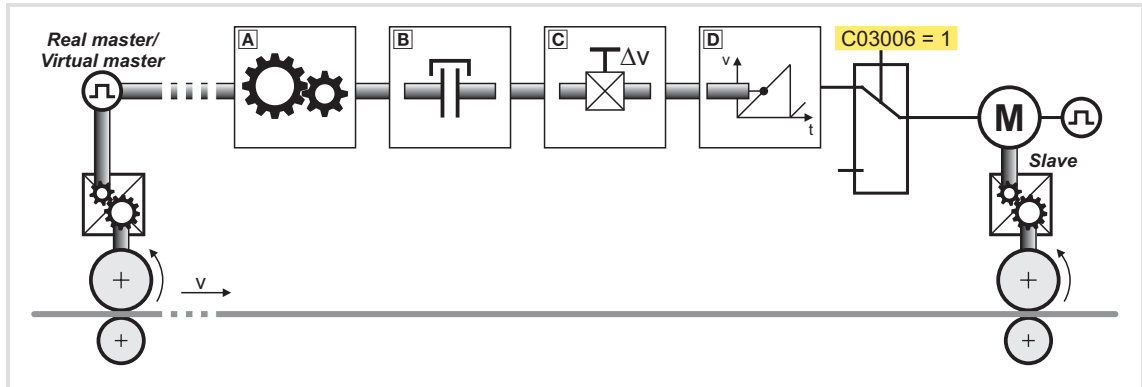
Parameter		Lenze setting	
		Value	Unit
C03550	Number of extrapolation cycles	1	

Control inputs of the function		Signal configuration
Lenze setting	Control input	(Multiplexer parameters)
TRUE	→ Activate extrapolation	C03058/9

- Configuration: Tab **FB editor** → FB [MotionBusIn](#)

5.4 Operating mode "Electronic gearbox"

In the "Electronic gearbox" (C03006 = "1") operating mode the drive follows the master value of the electrical shaft if the clutch is engaged.



[5-4] "Electronic gearbox" operating mode (schematic diagram)

Functions in the operating mode "Electronic gearbox"

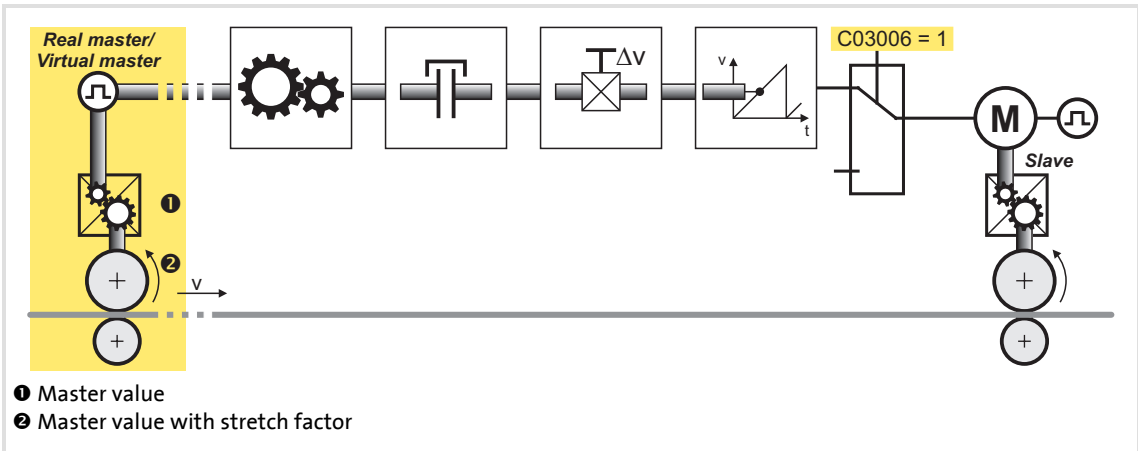
- A** Master value processing
- B** Virtual clutch
- C** Master value trimming
- D** Setpoint conditioning



Tip!

A description of the different functions for conditioning the master value can be found in the following subchapters.

5.4.1 Master value processing



[5-5] "Master value processing" function in the signal flow (schematic diagram)

► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Electronic gearbox*

Parameter		Lenze setting	
		Value	Unit
C03957	Master value	-	unit/t
C03000	Stretch factor - numerator	1000000000	
C03001	Stretch factor - denominator	1000000000	
C03673	Master value with stretch factor	-	unit/t

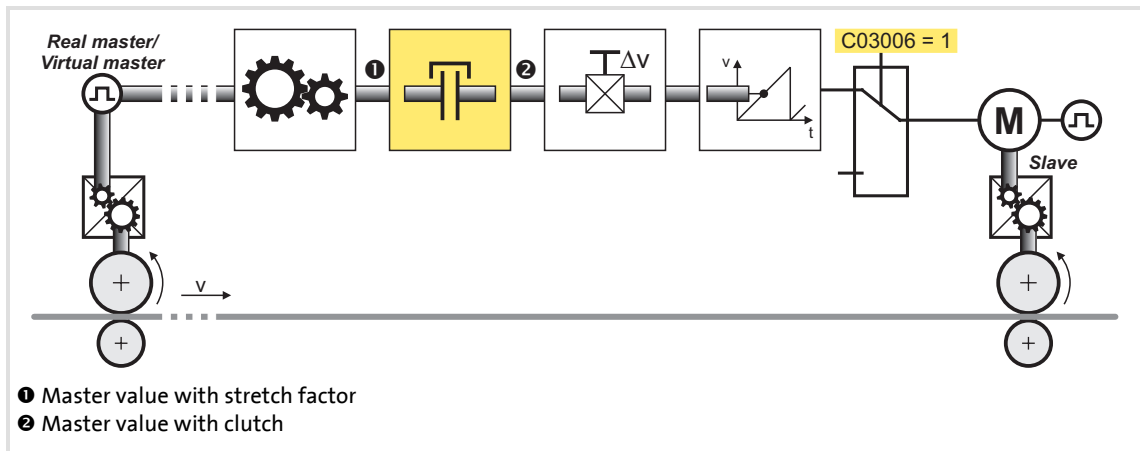
► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Electronic gearbox* → *Master value processing*

Parameter		Lenze setting	
		Value	Unit
C03025	Master value - direction of rotation	Not inverted	

Setpoint inputs of the function		Signal configuration
Lenze setting	Setpoint input	(Multiplexer parameters)
C03000	→ Stretch factor - numerator	C03050/1
C03001	→ Stretch factor - denominator	C03050/2

► Configuration: Tab **FB editor** → FB *GearElectricalShaft*

5.4.2 Virtual clutch



[5-6] Function "Virtual clutch" in the signal flow (schematic diagram)

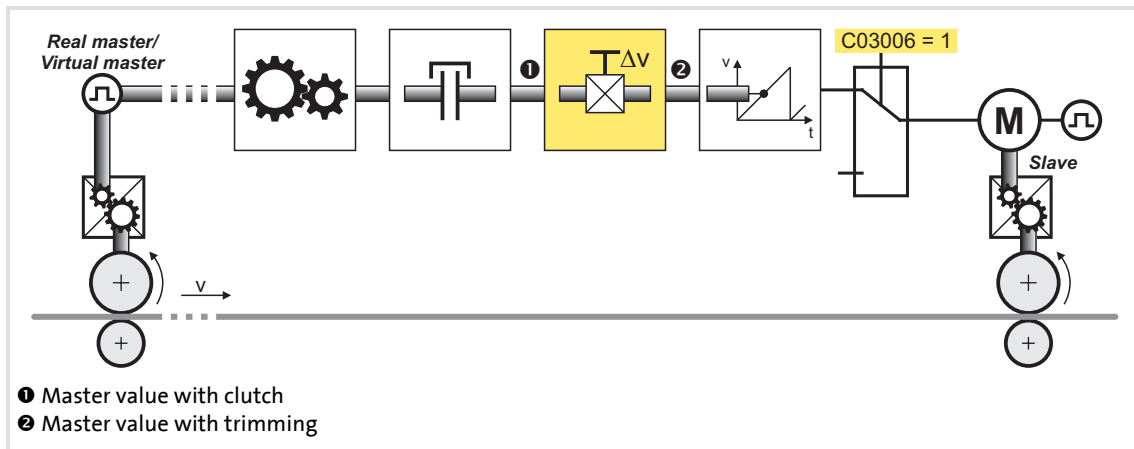
► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Electronic gearbox* → *Virtual clutch*

Parameter		Lenze setting	
		Value	Unit
C03673	Master value with stretch factor	-	unit/t
C03021	Activate clutch	Deactivated	
C03665/1	Clutch in ramp	1.000	s
C03665/2	Decoupling ramp	1.000	s
C03665/3	Stop ramp	1.000	s
C03668	Jerk limitation	1.000	s
C03674	Master value with clutch	-	unit/t

Control inputs of the function		Signal configuration (Multiplexer parameters)
Lenze setting	Control input	
DigIn 4	→ Close clutch	C03058/13
FALSE	→ Clutch - positive opening operation	C03058/14

► Configuration: Tab **FB editor** → FB [ClutchElectricalShaft](#)

5.4.3 Master value trimming



[5-7] "Master value trimming" function in the signal flow (schematic diagram)

This function serves to adjust the master value.

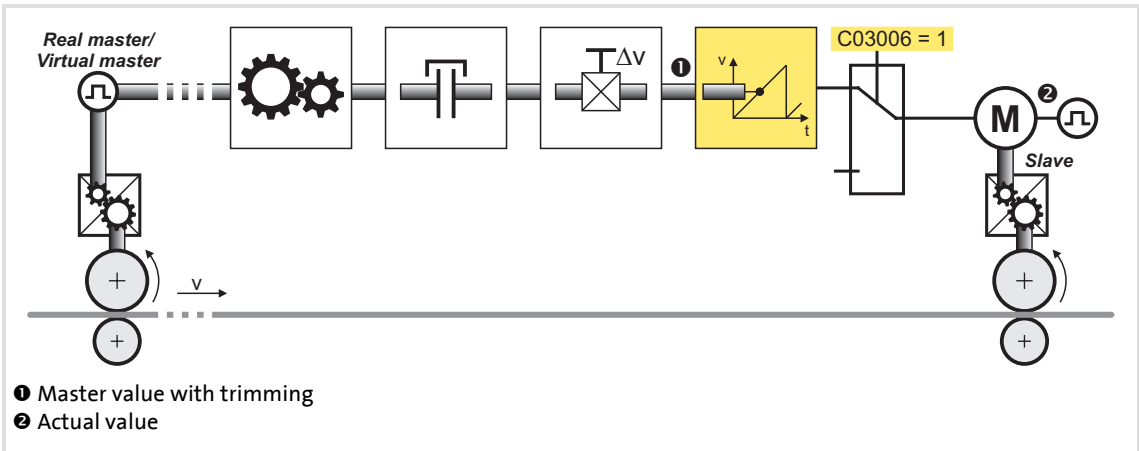
► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Electronic gearbox* → *Master value trimming*

Parameter		Lenze setting	
		Value	Unit
C03674	Master value with clutch	-	unit/t
C03026	Activate trimming	Deactivated	
C03027	Positive trimming	Inactive	
C03028	Negative trimming	Inactive	
C03685	Positive speed	400.0000	unit/t
C03686	Negative speed	-200.0000	unit/t
C03687	Acceleration ramp	1.000	s
C03688	Deceleration ramp	1.000	s
C03689	Disable ramp	1.000	s
C03690	Master value with trimming	-	unit/t

Control inputs of the function		Signal configuration (Multiplexer parameters)
Lenze setting	Control input	
C03026	→ Activate trimming	C03058/16
C03027	→ Positive trimming	C03058/18
C03028	→ Negative trimming	C03058/19

► Configuration: Tab **FB editor** → FB [Trimming](#)

5.4.4 Setpoint conditioning



[5-8] "Setpoint conditioning" function in the signal flow (schematic diagram)

This function is used for speed ratio between the master shaft and the machine axis.

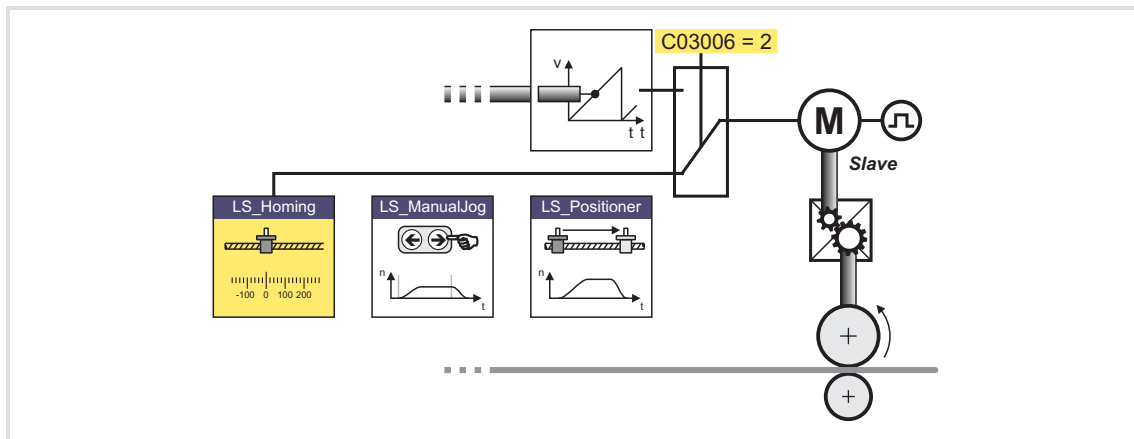
► Parameter setting: Tab **All parameters** → Category *Electronic gearbox* → *ConvertElShaftMotor*

Parameter		Lenze setting	
		Value	Unit
C03715	Operating mode	Unit coupling	
C03717/1	Reference variable X	1.0000	
C03717/2	Reference variable Y	1.0000	

► Configuration: Tab **FB editor** → FB [ConvertElShaftMotor](#)

5.5 "Homing" mode

In the "Homing" mode (C03006 = "2") the drive is decoupled from the electrical shaft and the basic function "Homing" is enabled:



[5-9] "Homing" mode (schematic diagram)

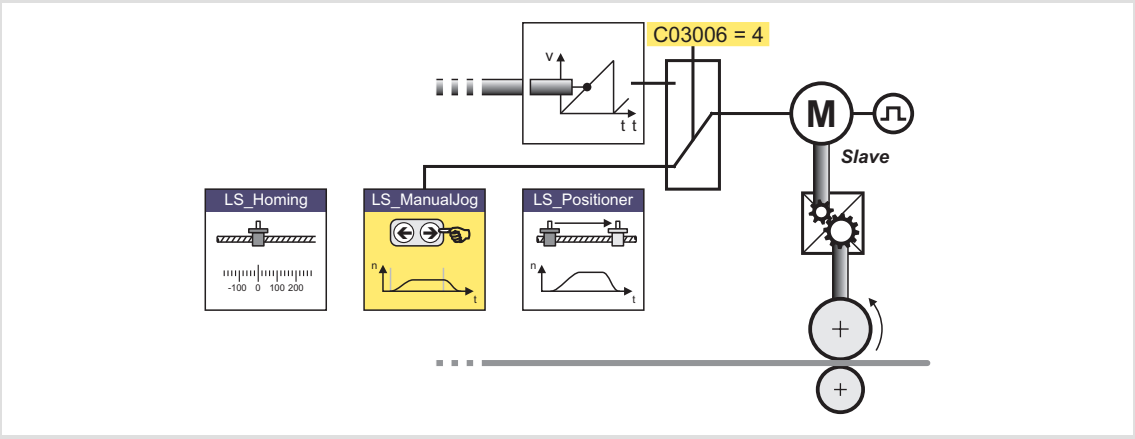
► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Homing*

Parameter		Lenze setting	
		Value	Unit
C02528	Traversing range	Modulo	
C02640	Homing mode	Set home pos. directly	
C02642	Home position	0.0000	unit
C02643	Homing: Target position	0.0000	unit
C02644	Homing: Speed 1	360.0000	unit/s
C02645	Homing: Acceleration 1	720.0000	unit/s ²
C02646	Homing: Speed 2	0.0000	unit/s
C02647	Homing: Acceleration 2	360.0000	unit/s ²
C02648	Homing: S-ramp time	100	ms
C02649	Homing: Torque limit	10.00	%
C02650	Homing: Blocking time	1.000	s
C02652	Ref. pos. after mains switching	Delete	
C02653	Max. rot. ang. aft. mns. swtch.	180	°
C03011	Set home position	Inactive	
C03012	Home position	100.0000	unit

Control inputs of the function		Signal configuration
Lenze setting	Control input	(Multiplexer parameters)
FALSE	→ Start homing	C03160/2
DigIn 2	→ Home mark	C03160/3
C03011	→ Set home position	C03160/4
C03012	→ Home position	C03163
FALSE	→ Reset home position	C03160/5

5.6 "Manual jog" mode

In the "Manual jog" mode (C03006 = "4") the drive is decoupled from the electrical shaft and the basic function "Manual jog" is enabled:



[5-10] "Manual jog" mode (schematic diagram)

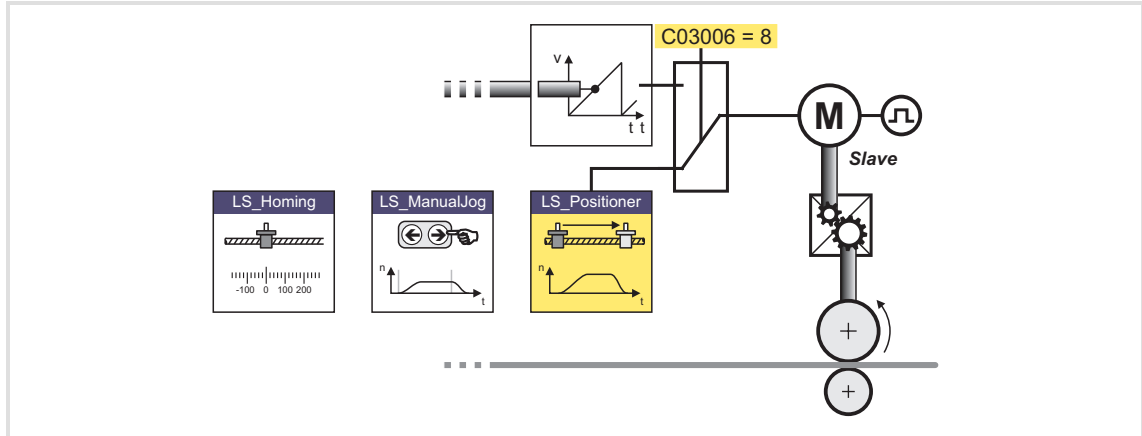
► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Manual jog*

Parameter		Lenze setting	
		Value	Unit
C02620	Manual jog: Speed 1	360.0000	unit/s
C02621	Manual jog: Speed 2	720.0000	unit/s
C02622	Manual jog: Acceleration	360.0000	unit/s ²
C02623	Manual jog: Deceleration	1440.0000	unit/s ²
C02624	Manual jog: S-ramp time	0.100	s
C03007	Positive manual jog	Inactive	
C03008	Negative manual jog	Inactive	

Control inputs of the function		Signal configuration
Lenze setting	Control input	(Multiplexer parameters)
C03007	→ Activate positive manual jog	C03155/2
C03008	→ Activate negative manual jog	C03155/3
FALSE	→ Activate 2. speed	C03155/4
FALSE	→ Retract limit switch	C03155/5

5.7 "Positioning" mode

In the "Positioning" mode (C03006 = "8") the drive is decoupled from the electrical shaft and the basic function "Positioning" is enabled:



[5-11] "Positioning" mode (schematic diagram)

► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *All basic functions* → *Positioning*

Parameter		Lenze setting	
		Value	Unit
C00070	Speed controller gain	0.00700	Nm/rpm
C00071	Reset time - speed controller	10.0	ms
C00072	D component of speed controller	0.00	ms
C02570	Position control structure	Phase control	
C02554	Integral-action time of position controller	60.000	s
C02553	Position controller gain	20.00	1/s
C03040	Positioning - profile no.	0	
C03041	Positioning - teach profile no.	0	

Control/setpoint inputs of the function		Signal configuration (Multiplexer parameters)
Lenze setting	Control/setpoint input	
FALSE	→ Start positioning step	C03185/2
FALSE	→ Abort positioning step	C03187/3
FALSE	→ Restart positioning step	C03185/4
FALSE	→ Activate override	C03185/5
100 %	→ Speed override	C03186/1
100 %	→ Acceleration override	C03186/2
FALSE	→ Inhibit touch probe evaluation	C03185/6
FALSE	→ Teach position	C03185/7

Profile data record management

For the profile data record management the FB **L_PosProfileTable** is used. This FB serves to file and manage up to four (travel) profiles and to "teach" target positions.

- ▶ A profile describes a motion request which can be implemented by the SB **LS_Positioner** into a rotary motion.
- ▶ A profile is described via the following profile parameters: Mode (type of positioning), position, speed, acceleration, deceleration, S-ramp time, TP sequence profile and TP selection.
- ▶ The data of the profile parameters is directly input in the assigned codes:

Profile parameters	Unit	Profile no. 1	Profile no. 2	Profile no. 3	Profile no. 4
Positioning mode	-	C03970/1	C03970/2	C03970/3	C03970/4
Position	unit	Set position	C03971/2	C03971/3	C03971/4
Speed	unit/t	C03972/1	C03972/2	C03972/3	C03972/4
Acceleration	unit/t ²	C03973/1	C03973/2	C03973/3	C03973/4
Deceleration	unit/t ²	C03974/1	C03974/2	C03974/3	C03974/4
S-ramp time	s	C03975/1	C03975/2	C03975/3	C03975/4
TP sequence profile	-	C03976/1	C03976/2	C03976/3	C03976/4
TP selection	-	C03977/1	C03977/2	C03977/3	C03977/4



Note!

For profile no. 1 the set position of the tool which belongs to the master position is always used as target position.

- Application: Returning the tool e.g. from a maintenance position to the network.

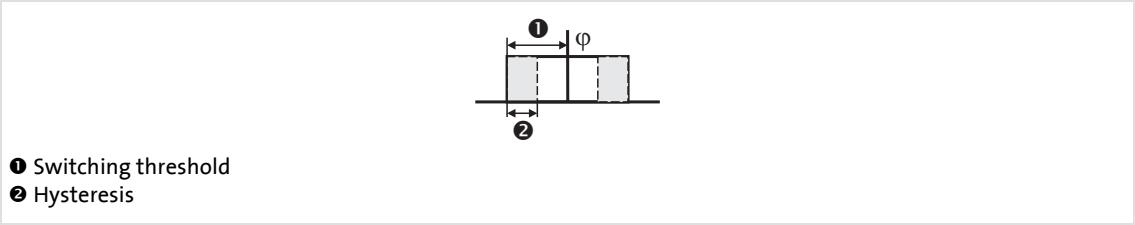
"Teach" position

When the control input "Teach position" is set to TRUE, the current tool position is saved in the profile the number of which is set in C03041. After the control input is reset to FALSE the position saved last is maintained in the profile.

5.8 Following error monitoring

In the Lenze setting the following error monitoring is active.

- Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Electronic gearbox* → *Following error monitoring*

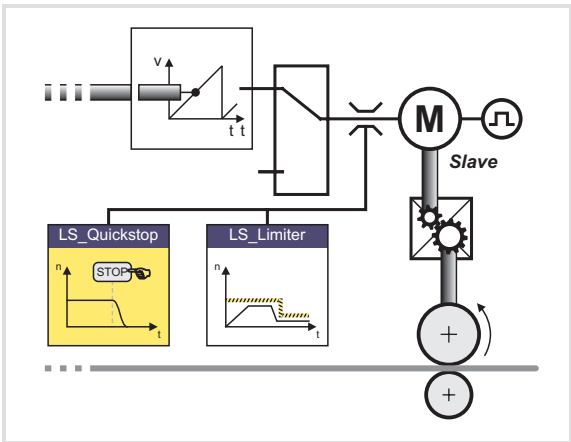


Parameter		Lenze setting	
		Value	Unit
C03911	Switching threshold	1.0000	unit
C03916	Hysteresis	0.5000	unit

Control inputs of the function		Signal configuration
Lenze setting	Control input	(Multiplexer parameters)
TRUE	→ Activate following error monitoring	C03058/21

- Configuration: Tab **FB editor** → FB [MonitFollowError](#)

5.9 Quick stop



[5-12] Basic function "Quick stop" (schematic diagram)

The basic function "Quick stop" brakes the drive to standstill within the deceleration time set for the quick stop function after a corresponding request independent of the setpoint selection.

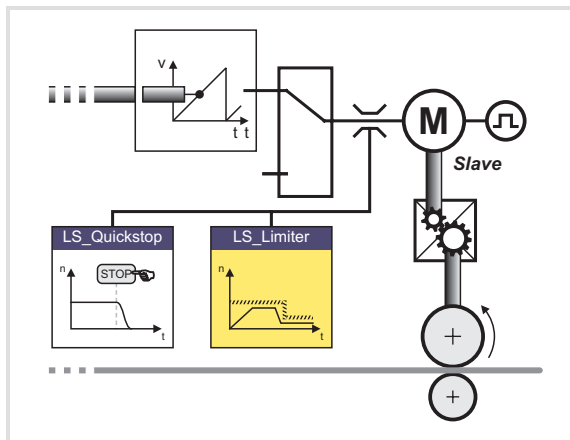
If the quick stop function is deactivated, the drive is led to the selected setpoint again via the set acceleration time.

- ▶ The quick stop function can be activated as follows in the Lenze setting:
 - By setting the digital input DI1 to LOW level.
 - By a master control via the port *LPortControl1*:
By setting bit 2 of the bit-coded control word 1.
- ▶ Parameter setting: Tab **Application parameters** → dialog level *Overview* → *All basic functions* → *Quick stop*

Parameter		Lenze setting	
		Value	Unit
C00105	Quick stop deceleration time	0.000	s
C00106	Quick stop S-ramp time	0.00	%
C00107	Reference for quick stop deceleration time	Motor reference speed (C00011)	

Control inputs of the function		Signal configuration
Lenze setting	Control input	(Multiplexer parameters)
DIGIN 1	→ Activate quick stop 1	C03135/1
Control word 1 bit 02	→ Activate quick stop 2	C03135/2
FALSE	→ Activate quick stop 3	C03135/3

5.10 Limiter



The basic function "Limiter" monitors the travel range limits via limit switches and parameterised software limit positions and can lead the drive to defined limit ranges when being asked accordingly by the safety module.

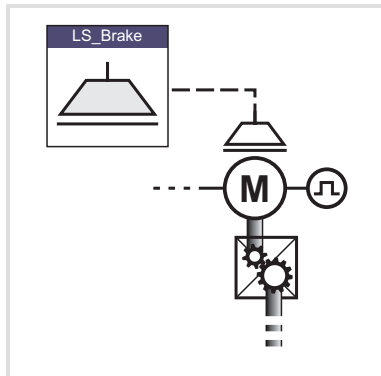
[5-13] Basic function "Limiter" (schematic diagram)

► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Limiter*

Parameter		Lenze setting	
		Value	Unit
Limit values			
C02707	Permissible direction of rot.	Positive and negative	
C02700	Software limit positions are active	Deactivated	
C02701/1	Positive software limit position	0.0000	unit
C02701/2	Negative software limit position	0.0000	unit
Only for homing, positioning and manual jog			
C02702	Limitations are active	Deactivated	
C02703	Max. speed	3600.0000	unit/s
C02705	Max. acceleration	3600.0000	unit/s ²
C02706	Min. S-ramp time	100	ms
Limited speed 1 ... 4 (only for homing, positioning, and manual jog)			
C02708/1	Limited speed 1	3600.0000	unit/s
C02710/1	Delay lim. speed 1	0.0100	unit/s ²
C02711/1	S-ramp time lim. speed 1	100	ms
C02708/2	Limited speed 2	7200.0000	unit/s
C02710/2	Delay lim. speed 2	0.0100	unit/s ²
C02711/2	S-ramp time lim. speed 2	100	ms
C02708/3	Limited speed 3	14400.0000	unit/s
C02710/3	Delay lim. speed 3	0.0100	unit/s ²
C02711/3	S-ramp time lim. speed 3	100	ms
C02708/4	Limited speed 4	28800.0000	unit/s
C02710/4	Delay lim. speed 4	0.0100	unit/s ²
C02711/4	S-ramp time lim. speed 4	100	ms
For manual jog only			
C02713	Max. dist. manual jog	360.0000	unit

Control inputs of the function		Signal configuration
Lenze setting	Control input	(Multiplexer parameters)
FALSE	→ Positive limit switch	C03150/1
FALSE	→ Negative limit switch	C03150/2

5.11 Brake control



The basic function "Brake control" serves to the wear free control and monitoring of a holding brake.

In the simplest case, an optionally available brake module is used.

Alternatively the holding brake can also be controlled and monitored via the digital inputs/outputs.

[5-14] Basic function "Brake control" (schematic diagram)



Note!

In the Lenze setting the brake control is switched off to reach a safe status after mains connection.

► Parameter setting: Tab **Application parameters** → dialog level *Overview* → *Brake control*

Parameter		Lenze setting	
		Value	Unit
C02580	Operating mode of brake	Brake control off	
C02581	Brake activation threshold	50	rpm
C02582	Brake resp. to pulse inhibit	Activate the brake immediately	
C02583	Status input monitoring	Not active	
C02585	Brake control polarity	Not inverted	
C02586	Starting torque 1	0.00	Nm
C02587	Starting torque 2	0.00	Nm
C02588	Source of starting torque	Starting torque 1/2	
C02589	Brake closing time	100	ms
C02590	Brake opening time	100	ms
C02591	Waiting time - status monitoring	100	ms
C02593	Waiting time - brake activation	0.000	s
C02594	Test torque	0.00	Nm
C02595	Permissible angle of rotation	5	°
C02596	Grinding speed	100	rpm
C02597	Accel./decel. time - grinding	1.000	s
C02598	Grinding ON time	0.5	s
C02599	Grinding OFF time	0.5	s

Control/setpoint inputs of the function		Signal configuration
Lenze setting	Control/setpoint input	(Multiplexer parameters)
FALSE	→ Release brake	C03165/1
FALSE	→ Activate starting torque 2	C03165/2
FALSE	→ Keep open brake at standstill	C03165/3
FALSE	→ Brake status signal	C03165/4
FALSE	→ Activate brake test	C03165/5
FALSE	→ Grind brake	C03165/6
0 %	→ Additional torque	C03166

5.12 Signal configuration

5.12.1 Drive and motor interface

If required, the preset signal configuration of the control and setpoint inputs of the drive and motor interface can be easily reconfigured per parameter setting of the assigned multiplexer parameters.

Drive interface

Signal (Lenze setting)	Control input	Signal configuration
FALSE	→ Set controller inhibit	C03130/1
DIGIN 5	→ Reset error 1	C03130/2
Control word 1 bit 07	→ Reset error 2	C03130/3
FALSE	→ Reset error 3	C03130/4
FALSE	→ Set error	C03130/5
Control word 1 bit 00	→ Switch on drive	C03130/6

Motor interface

Signal (Lenze setting)	Setpoint input	Signal configuration
100 %	→ Position controller adaptation	C03141/1
100 %	→ Phase controller adaptation	C03141/2
100 %	→ Adaptation of speed controller	C03141/3
100 %	→ Upper torque limit value	C03141/4
-100 %	→ Lower torque limit value	C03141/5
100 %	→ Flux setpoint	C03141/6
100 %	→ Mass inertia	C03141/7

5.12.2 Output ports

If required, the preset signal configuration of the output ports can be easily reconfigured per parameter setting of the assigned multiplexer parameters.

Output port "LPortAxisOut1"

The output port **LPortAxisOut1** is intended for the connection with a following axis.

Signal (Lenze setting)	Output port	Signal configuration
Axis status word		
• Application-specific signals can be supplemented.		
FALSE	→ Axis status word bit 00	C03120/1
FALSE	→ Axis status word bit 01	C03120/2
FALSE	→ Axis status word bit 02	C03120/3
FALSE	→ Axis status word bit 03	C03120/4
FALSE	→ Axis status word bit 04	C03120/5
FALSE	→ Axis status word bit 05	C03120/6
FALSE	→ Axis status word bit 06	C03120/7
FALSE	→ Axis status word bit 07	C03120/8
FALSE	→ Axis status word bit 08	C03120/9
FALSE	→ Axis status word bit 09	C03120/10
FALSE	→ Axis status word bit 10	C03120/11
FALSE	→ Axis status word bit 11	C03120/12
FALSE	→ Axis status word bit 12	C03120/13
FALSE	→ Axis status word bit 13	C03120/14
FALSE	→ Axis status word bit 14	C03120/15
FALSE	→ Axis status word bit 15	C03120/16
Setpoints for horizontal communication		
0 %	→ Axis-Port Out 1	C03124/1
Master value (Position in [increments])	→ Axis-Port Out 2	C03054/1

Output port "LPortStatus1"

The output port **LPortStatus1** is intended for the connection with a higher-level control.

Signal (Lenze setting)	Output port	Signal configuration
Status word 1		
Drive ready	→ Status word 1 bit 00	C03121/1
FALSE	→ Status word 1 bit 01	C03121/2
Drive is ready to start	→ Status word 1 bit 02	C03121/3
Error is active	→ Status word 1 bit 03	C03121/4
FALSE	→ Status word 1 bit 04	C03121/5
Quick stop is active	→ Status word 1 bit 05	C03121/6
Switch-on inhibit is active	→ Status word 1 bit 06	C03121/7
Warning is active	→ Status word 1 bit 07	C03121/8
FALSE	→ Status word 1 bit 08	C03121/9
FALSE	→ Status word 1 bit 09	C03121/10
FALSE	→ Status word 1 bit 10	C03121/11
Drive in the limitation	→ Status word 1 bit 11	C03121/12
Homing complete	→ Status word 1 bit 12	C03121/13
Home position available	→ Status word 1 bit 13	C03121/14
FALSE	→ Status word 1 bit 14	C03121/15
FALSE	→ Status word 1 bit 15	C03121/16

Output port "LPortStatus2"

The output port **LPortStatus2** is intended for the connection with a higher-level control.

Signal (Lenze setting)	Output port	Signal configuration
Status word 2		
Virtual master is active	→ Status word 2 bit 00	C03122/1
Clutch is disengaged	→ Status word 2 bit 01	C03122/2
Trimming is active	→ Status word 2 bit 02	C03122/3
FALSE	→ Status word 2 bit 03	C03122/4
FALSE	→ Status word 2 bit 04	C03122/5
FALSE	→ Status word 2 bit 05	C03122/6
FALSE	→ Status word 2 bit 06	C03122/7
FALSE	→ Status word 2 bit 07	C03122/8
FALSE	→ Status word 2 bit 08	C03122/9
FALSE	→ Status word 2 bit 09	C03122/10
FALSE	→ Status word 2 bit 10	C03122/11
FALSE	→ Status word 2 bit 11	C03122/12
FALSE	→ Status word 2 bit 12	C03122/13
FALSE	→ Status word 2 bit 13	C03122/14
FALSE	→ Status word 2 bit 14	C03122/15
FALSE	→ Status word 2 bit 15	C03122/16

5.14 Application error messages

For the output of application-specific error messages an FB instance *ApplicationError* of the function block **L_DevApplErr** is available in the network.

- ▶ Via the 8 boolean inputs up to 8 different application error messages with parameterisable module ID, error ID and error response can be activated by the application.
- ▶ The first four inputs can be connected to the multiplexer parameters with the desired tripping signals. The next four inputs are firmly connected to the tripping signals of the application.

Error message	Error ID	Error response
1 Free (configurable via C03060/1)	8001	No response
2 Free (configurable via C03060/2)	8002	Error
3 Free (configurable via C03060/3)	8003	Error
4 Free (configurable via C03060/4)	8004	Error
5 Following error	8005	Warning
6 Drive cannot follow	8006	Warning
7 Drive system interrupted	8007	Quick stop by trouble
8 External fault in drive system	8008	Quick stop by trouble

▶ Parameter setting: Tab **All parameters**

Parameter	Lenze setting
C05900 Module ID	999
C05901/1...8 Error ID 1 ... 8	See table above
C05902/1...8 Error response 1 ... 8	See table above

Control inputs of the function		Signal configuration (Multiplexer parameters)
Lenze setting	Control input	
FALSE	→ Application fault 1	C03060/1
FALSE	→ Application fault 2	C03060/2
FALSE	→ Application fault 3	C03060/3
FALSE	→ Application fault 4	C03060/4

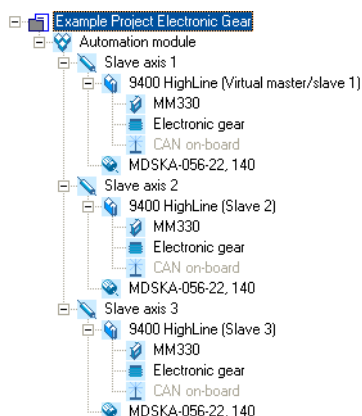
5.15 Master value transmission via system bus (CAN)

In the application example described in the chapter "[Short setup](#)", the master speed is transmitted via the digital frequency. (20)

The following instructions describe step by step the proceeding for commissioning the electrical shaft via the system bus (CAN).

Create project view

1. Start »Engineer«.
2. Go to *Start-up wizard* and select the option "New project (empty)" and enter a name for the project in a next step.
3.  Insert system module.
4.  Enter axes for master and slave(s).
 - Add the corresponding components (controller, motor, extension module) to the axes.
 - Select for each controller the application "Electronic gearbox".
 - Example *project view* in the »Engineer«:



Parameterise the virtual master

1. Go to the *Project view* and select the controller  which is to take over the part of the "Virtual master" in the network.
2. Go to the **Application parameters** tab and select the entry "Virtual master" in the list field **Master value source** (C03052).
3. Click **Electronic gearbox** to change to the dialog level *Overview* → *Electronic gearbox*.
4. Click **Master value processing** to change to the dialog level *Overview* → *Electronic gearbox* → *Master value processing*.
 - Parameterise gearbox ratio, feed constant, cycle, path unit, and reference speed for the master value.

5. Click **Back** to change to the previous dialog level.
6. Click **virtual master** to change to the dialog level *Overview* → *Electronic gearbox* → *Virtual master*.
 - Parameterise desired operating mode, speed and ramps.

Parameterising slave(s)

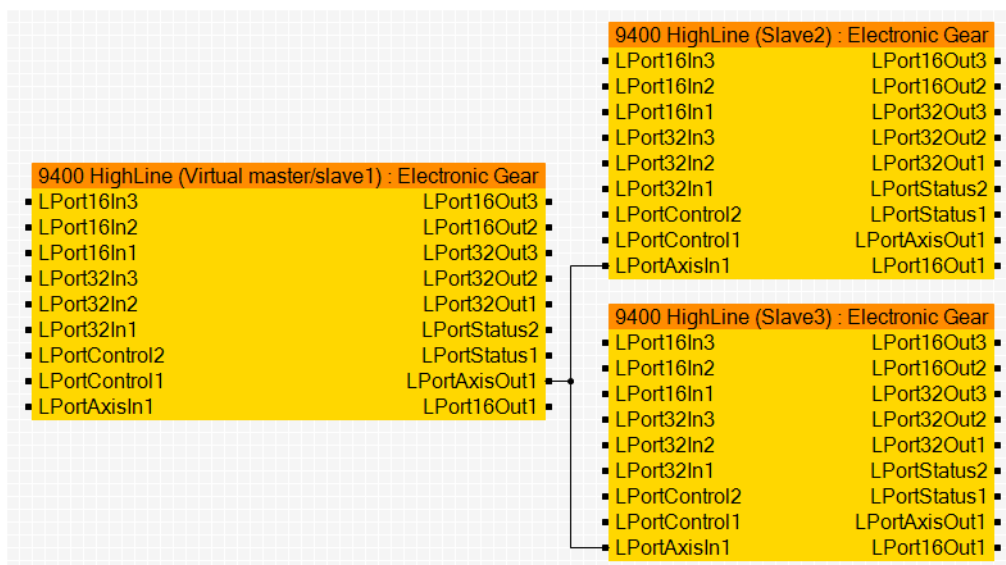
1. Go to *Project view* and select the first slave controller .
2. Go to the **Application parameters** tab and select the entry "Virtual master in the list field **Virtual master** (C03052).
3. Make the same settings for all other slave controllers.

Establish network

1. Go to *Project view* and select the system module .
2.  Insert network.
 - Go to the dialog box *Insert network* to select the entry "System bus (CAN) from the list field.
 - The checkmark in the control field **Insert and configure node** must be set so that a machine application is inserted in the *Project view* together with the network.
3. On the **Node** tab for the inserted network:
 - Set node addresses for the controllers according to the DIP switch setting of the CAN address of the memory module.
 - Go to *Context menu* for the master controller (right mouse button) and select the command **Set as master**.
4. On the **Synchronisation** tab for the inserted network:
 - Select the master controller as sync source in the list field **Node**.
 - Select all slave controllers as sync receivers by setting the checkmark in the first column **Appl..**

Connect ports in the machine application

1. Go to *Project view* and select the machine application  which has been inserted automatically with the insertion of the network.
2. Go to the **Connections** tab and connect the output port *LPortAxisOut1* of the master controller with the input port *LPortAxisIn1* of all slave controllers.



Compile the project

1. Go to *Project view* and select the system module .
2.  Update devices.
 - Set the checkmark in the control field **Recreate all**.
 - Click **Create** to start the compiling process.

Optimise bus load

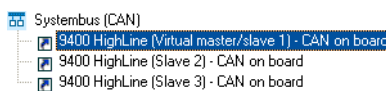
To ensure that the bus load will not be too high, the transmission time for the master controller can be set to a value > 1 ms. Then, the same time must be set in the slave controllers for the master value extrapolation.



Note!

This setting is only possible after the compiling process is completed since only then the process data objects are defined for the data exchange among the devices.

1. Go to *Project view* below the network and select the master controller.



2. Go to the **Process data objects** tab and set a transmission time > 1 ms (e.g. 5 ms) for the process data object.

3. Go to *Project view* and select the first slave controller .
4. Go to the **Application parameters** and change to the dialog level *Electronic gearbox* → *Electronic gearbox* → *Master value extrapolation*.
5. Set the number of extrapolation cycles to the same value than the transmission time set before.
 - This means: In case of a transmission time of 5 ms set for the master set the number of extrapolation cycles for the slave to the value "5".
6. Make the same settings for all other slave controllers.

Transmit applications to the controller

1.  Go online.
2.  Download applications in the controller.



Note!

The downloaded application is basically stored in the first application memory location of the controller.

The preinstalled technology applications on the following memory locations are still available.

3. Confirm  Dialog box *Save parameter set* with **Yes, all devices**.
4. Confirm  Dialog box *Start application* with **Yes, all devices**.
5. Confirm  Dialog box *Enable controller* with **Yes, all devices**.
6. Control applications via terminals or network.

5.16 Parameterisable function blocks

This subchapter lists all relevant parameterisable function blocks of the technology application and the corresponding parameters in alphabetical order.

5.16.1 ApplicationError

Is an instance of	Function			
L_DevApplErr	Error handling ▶ Application error messages (📖 63)			

Parameter	Possible settings			Information
C05900	980		999	Module ID Initialisation: 999
C05901/1...8	0		65535	Error ID Initialisation: 8001 ... 8008
C05902/1...8				Error response
	0	None		
	1	Fault		
	2	Trouble		
	3	Quick stop by trouble		
	4	Warning locked		
	5	Warning		
	6	Information		

5.16.2 ClutchElectricalShaft

Is an instance of	Function
L_LdClutchV	► Virtual clutch (46)

Parameter	Possible settings			Information
C03665/1	0.010	s	130.000	Clutch in ramp - Acceleration ramp for synchronising to <i>dnSpeedIn_s</i>. - Initialisation: 1.000 s
C03665/2	0.010	s	130.000	Decoupling ramp - Deceleration ramp for synchronising to <i>dnSetSpeed_s</i>. - Initialisation: 1.000 s
C03665/3	0.010	s	130.000	Ramp for positive opening operation - Deceleration ramp for positive opening operation. - Initialisation: 1.000 s
C03666	Character string			Speed unit Read only
C03667	-214748.3647	unit/t	214748.3647	Reference speed - Read only - Reference value for selecting speeds.
C03668	0.010	s	130.000	S-ramp time - For limiting the jerk - Initialisation: 1.000 s
C03670	-2147483647		2147483647	State Display of the bit-coded output signal <i>dnState</i>.
C03672	-214748.3647	unit	214748.3647	Setpoint speed after decoupling - Read only - Is generated from the speed signal <i>dnSetSpeed_s</i>.
C03673	-214748.3647	unit	214748.3647	Speed at the input - Read only - Is generated from the speed signal <i>dnSpeedIn_s</i>.
C03674	-214748.3647	unit	214748.3647	Speed at the output - Read only - Is generated from the speed signal <i>dnSpeedOut_s</i>.

5.16.3 ConvertElShaftMotor

Is an instance of	Function
L_LdConvAxisV	Transformation ratio of speed between two axes. ▶ Setpoint conditioning (□ 48)

Parameter	Possible settings			Information
C03715				Coupling of measuring systems X and Y
	0	Coupling via feed constants		Lenze setting
	1	Coupling via cycles		
	2	Free coupling		
C03716/1	0	unit	214748.3647	Cycle X • Read only
C03716/2	0	unit	214748.3647	Cycle Y • Read only
C03717/1	0.0000		214748.3647	Coupling factor X • Initialisation: 1.0000
C03717/2	0.0000		214748.3647	Coupling factor Y • Initialisation: 1.0000
C03718/1	Character string			User-defined unit X • Read only
C03718/2	Character string			User-defined unit Y • Read only
C03720/1	-214748.3647	unit/t	214748.3647	Speed X at the input • Read only • Is generated from the speed signal <i>dnSpeedIn_s</i> .
C03720/2	-214748.3647	unit/t	214748.3647	Speed Y at the output • Read only • Is generated from the speed signal <i>dnSpeedOut_s</i> .
C03724	-2147483647		2147483647	State • Display of the bit-coded output signal <i>dnState</i> .

5.16.4 ElectricalShaftData

Is an instance of	Function
L_SdSetAxisData	Mapping of the machine parameters of the higher-level drive (master shaft). ► Master axis (master shaft) (38)

Parameter	Possible settings			Information
C03930	1		2147483647	Gearbox ratio - numerator • Initialisation: 1
C03931	1		2147483647	Gearbox ratio - denominator • Initialisation: 1
C03932	0.0001	Unit/incr.	214748.3647	Feed constant • Initialisation: 360 units/incr.
C03933				Path unit
	0	User-defined		Selection in C03934
	1	Inc		
	2	µm		
	3	mm		
	4	m		
	5	inch		
	6	yard		
	7	°		Lenze setting
C03934	Character string, max. 8 characters			User-defined path unit
C03935	At present, the unit of the time base is permanently set to "s" and cannot be changed!			Time unit
C03938	0.0000	unit	214748.3647	Cycle • Initialisation: 360 units
C03939	10	Bit	24	Resolution of encoder revolution • Initialisation: 16 bits
C03941	-214748.3647	unit/t	214748.3647	Reference speed • Initialisation: 214748.3647 units/t
C03942				Traversing range
	0	Unlimited		
	1	Limited		
	2	Modulo		Lenze setting
C03948	-2147483.647		2147483.647	Resulting gearbox factor • Read only
C03949	-214748.3647	Incr.	214748.3647	Resolution of application unit • Read only

5.16.5 FollowError_Hysteresis

Is an instance of	Function			
L_SdSetPosition	Conversion of the following error hysteresis selected in the real units of the machine via C03916 into a position in [increments]. ▶ Following error monitoring (📖 53)			

Parameter	Possible settings			Information
C03916	-214000.0000	unit	214000.0000	Position value Initialisation: 0.5000 units
C03917	Character string			Position unit Read only
C03918	-2147483647		2147483647	State Read only

5.16.6 FollowError_Limit

Is an instance of	Function			
L_SdSetPosition	Conversion of the following error limit selected in the real units of the machine via C03911 into a position in [increments]. ▶ Following error monitoring (📖 53)			

Parameter	Possible settings			Information
C03911	-214000.0000	unit	214000.0000	Position value Initialisation: 1.0000 units
C03912	Character string			Position unit Read only
C03913	-2147483647		2147483647	State Read only

5.16.7 HomingSetPosition

Is an instance of	Function			
L_SdSetPosition	Conversion of the home position selected in the real units of the machine via C03012 into a position in [increments]. ▶ "Homing" mode ( 49)			

Parameter	Possible settings			Information
C03012	-214000.0000	unit	214000.0000	Position value Initialisation: 100.0000 units
C03013	Character string			Position unit Read only
C03014	-2147483647		2147483647	State Read only

5.16.8 L_PosProfileTable1

Is an instance of	Function
L_PosProfileTable	Storage and management of up to four travel profiles for the "positioning" mode. ▶ "Positioning" mode (51)

Parameter	Possible settings			Information
C03970/1...4 (subcode 1 ... 4 ≡ profile no. 1 ... 4)	1	Absolute		Positioning mode For absolute positioning, the home position must be known.
	2	Absolute TP		
	5	Relative		
	6	Relative TP		
	7	Speed		
	8	Speed TP		
	11	Absolute CW		
	12	Absolute CW TP		
	13	Absolute CCW		
	14	Absolute CCW TP		
	15	Absolute ShortestWay		
	16	Absolute ShortestWay TP		
	C03971/1...4 (subcode 1 ... 4 ≡ profile no. 1 ... 4)	-214748.3647	unit	
C03972/1...4 (subcode 1 ... 4 ≡ profile no. 1 ... 4)	-214748.3647	unit/t	214748.3647	Speed
C03973/1...4 (subcode 1 ... 4 ≡ profile no. 1 ... 4)	0.0000	unit/t ²	214748.3647	Acceleration
C03974/1...4 (subcode 1 ... 4 ≡ profile no. 1 ... 4)	0.0000	unit/t ²	214748.3647	Deceleration
C03975/1...4 (subcode 1 ... 4 ≡ profile no. 1 ... 4)	0.0000	s	214748.3647	S-ramp time
C03976/1...4 (subcode 1 ... 4 ≡ profile no. 1 ... 4)				TP sequence profile Sequence profile for touch probe residual path positioning.
	0	No residual path positioning		
	1	Profile no. 1		
	...	...		
	4	Profile no. 4		

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Parameter setting & configuration

Parameterisable function blocks

Parameter	Possible settings			Information
C03977/1...4 (subcode 1 ... 4 ≡ profile no. 1 ... 4)	Value is bit-coded:			Touch probe configuration The touch probe channels to be used are selected by setting the corresponding bits to "1".
	Bit 0	TP channel 1, rising edge		Digital input 1
	Bit 1	TP channel 1, falling edge		
	Bit 2	TP channel 2, rising edge		Digital input 2
	Bit 3	TP channel 2, falling edge		
	Bit 4	TP channel 3, rising edge		Digital input 3
	Bit 5	TP channel 3, falling edge		
	Bit 6	TP channel 4, rising edge		Digital input 4
	Bit 7	TP channel 4, falling edge		
	Bit 8	TP channel 5, rising edge		Digital input 5
	Bit 9	TP channel 5, falling edge		
	Bit 10	TP channel 6, rising edge		Digital input 6
	Bit 11	TP channel 6, falling edge		
	Bit 12	TP channel 7, rising edge		Digital input 7
	Bit 13	TP channel 7, falling edge		
	Bit 14	TP channel 8, rising edge		Digital input 8
	Bit 15	TP channel 8, falling edge		
	Bit 16	TP channel 9		Motor encoder zero pulse
	Bit 18	TP channel 10		Load encoder zero pulse
	Bit 20	TP channel 11		DFIN zero pulse
	Bit 22	TP channel 12		DFOUT zero pulse
	C03978			
071		The position applied at the input <i>dnTeachPos_p</i> is saved in the profile selected via the input <i>dwTeachProfileNumber</i> .		
C03979/1	Character string			Position unit Read only
C03979/2	Character string			Speed unit Read only
C03979/3	Character string			Acceleration unit Read only
C03980/1	-214748.3647	unit	214748.3647	External target position Display of input signal <i>dnExtPos_p</i> in real unit of the machine.
C03980/2	-214748.3647	unit	214748.3647	Teach position Display of input signal <i>dnTeachPos_p</i> in real unit of the machine.
C03981/1	0		4	Selected profile Display of input signal <i>dwProfileNumber</i>.
C03981/2	0		4	Selected teach profile Display of input signal <i>dwTeachProfileNumber</i>.

Parameter	Possible settings	Information
C03983		DIS:bPosTeach
	0 FALSE	• Display of input signal <i>bPosTeach</i> .
	1 TRUE	
C03984		DIS:bBusy
	0 Profile parameters are available.	• Display of output signal <i>bBusy</i> .
	1 Conversion active, no access to profile parameters at the moment.	
C03985	-2147483647 2147483647	State • Display of the bit-coded output signal <i>dnState</i> .

5.16.9 MonitFollowError

Is an instance of	Function
L_LdMonitFollowError	► Following error monitoring (53)

Parameter	Possible settings	Information
C03960	-214748.3647 unit 214748.3647	Following error at the input • Display of input signal <i>dnFollowErrorIn_p</i> in real unit of the machine.
C03961	Character string	Position unit • Read only
C03963		Following error out of tolerance • Read only
	FALSE Following error smaller than set switching threshold	
	TRUE Following error larger than set switching threshold	
C03964		Following error monitoring activated • Read only
	FALSE Deactivated	
	TRUE Activated	

5.16.10 MotionBusIn

Is an instance of	Function			
L_LdExtrapolate	Optional extrapolation of the position information received via a bus system in order to compensate for larger bus transmission cycles. ▶ Master value source: Bus system (📖 43)			

Parameter	Possible settings			Information
C03550	1		127	Number of extrapolation cycles Initialisation: 1
C03551/1	Character string			Position unit Read only
C03551/2	Character string			Speed unit Read only
C03557	-214748.3647	unit/t	214748.3647	Speed at the output - Read only - Is generated from the speed signal <i>dnSpeedOut_s</i>.
C03558	-214748.3647	unit	214748.3647	Position at the output Display of output signal <i>dnPosOut_p</i> in real unit of the machine.
C03559				Extrapolation cycles > selected value Read only
	0	No (OK)		
	1	Yes (error)		

5.16.11 Trimming

Is an instance of	Function
L_LdMPot	► Master value trimming (47)

Parameter	Possible settings			Information
C03685	-214000.0000	unit/t	214000.0000	Positive speed • Initialisation: 400.0000 units/t
C03686	-214000.0000	unit/t	214000.0000	Negative speed • Initialisation: -200.0000 units/t
C03687	0.001	s	130.000	Acceleration ramp • Initialisation: 1.000 s
C03688	0.001	s	130.000	Deceleration ramp • Initialisation: 1.000 s
C03689	0.001	s	130.000	Ramp for motor potentiometer off • Initialisation: 1.000 s
C03690	-214748.3647	unit	214748.3647	Speed at the output • Read only • Is generated from the speed signal <i>dnSpeedOut_s</i> .
C03691	Character string			Speed unit • Read only
C03692	-214748.3647	unit/t	214748.3647	Reference speed • Read only • Reference value for selecting speeds.

5.16.12 VirtualMaster

Is an instance of	Function
L_LdVirtualMaster	"Virtual master" ▶ Master value source: Virtual master (42)

Parameter	Possible settings			Information
C03565				Virtual master operating mode
	0	Continuous operation		Lenze setting
	1	Inching		
	2	Handwheel function		
C03566	Character string			Speed unit Read only
C03567	-214748.3647	unit/t	214748.3647	Reference speed - Read only - Reference value for selecting speeds.
C03568/1	-214000.0000	unit/t	214000.0000	Master speed 1 Initialisation: 1.0000 units/t
C03568/2	-214000.0000	unit/t	214000.0000	Master speed 2 Initialisation: 1.0000 units/t
C03569/1	0.0000	unit/t	214000.0000	Manual speed CW rotation Initialisation: 1.0000 units/t
C03569/2	0.0000	unit/t	214000.0000	Manual speed CCW rotation Initialisation: 1.0000 units/t
C03570/1	0.010	s	130.000	Ramp for manual jog Initialisation: 1.000 s
C03570/2	0.010	s	130.000	Ramp for continuous operation/ single cycle Initialisation: 1.000 s
C03570/3	0.010	s	130.000	Stop ramp Initialisation: 1.000 s
C03579	-2147483647		2147483647	State Display of the bit-coded output signal <i>dnState</i>.
C03582	-214748.3647	unit	214748.3647	Speed at the output - Read only - Is generated from the speed signal <i>dnSpeedOut_s</i>.
C03583	-214748.3647	unit	214748.3647	External master speed at the input - Read only - Is generated from the speed signal <i>dnExtMaster_s</i>.



Your opinion is important to us

These instructions were created to the best of our knowledge and belief to give you the best possible support for handling our product.

If you have suggestions for improvement, please e-mail us to:

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Thank you for your support.

Your Lenze documentation team



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Lenze Automation GmbH
Grünstraße 36
D-40667 Meerbusch
Germany



+49 (0)21 32 / 99 04-0



+49 (0)21 32 / 7 21 90



Lenze@Lenze.de



www.Lenze.com

Service Lenze Service GmbH
Breslauer Straße 3
D-32699 Extertal
Germany



00 80 00 / 24 4 68 77 (24 h helpline)



+49 (0)51 54 / 82-11 12



Service@Lenze.de

EDS94TA10030xxxx ■ 13277848 ■ EN 1.2 ■ TD05

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