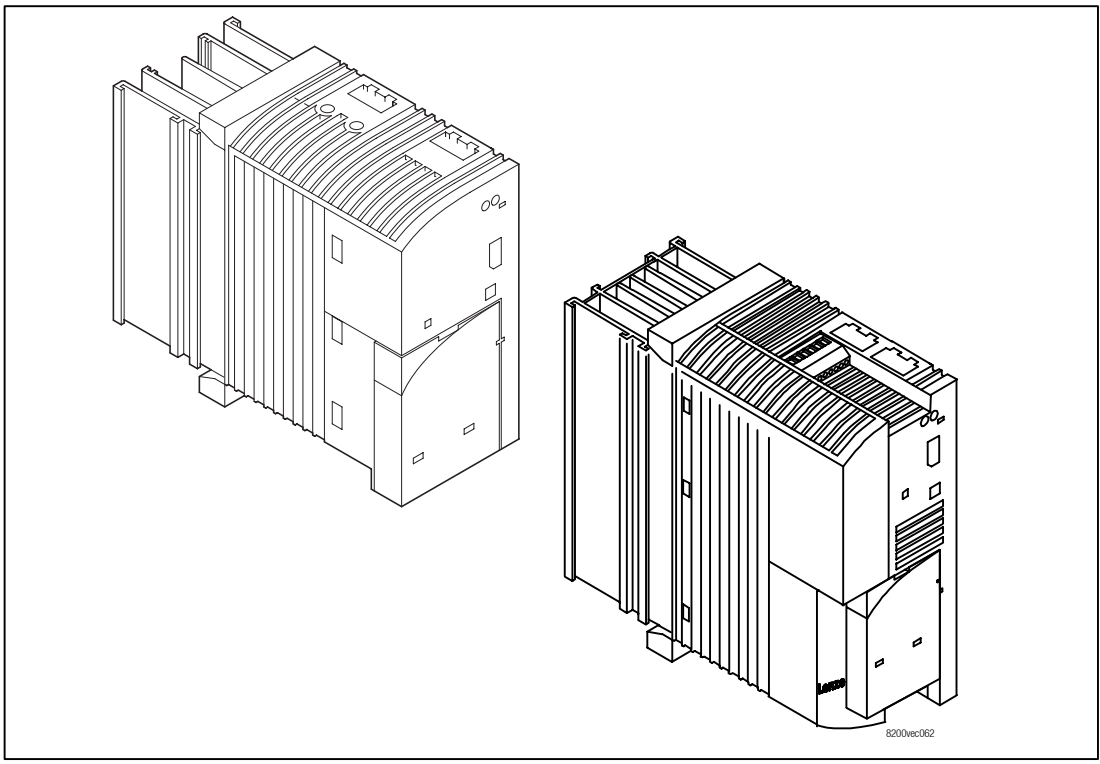
EDB82EV113
00424319

Lenze

Operating Instructions

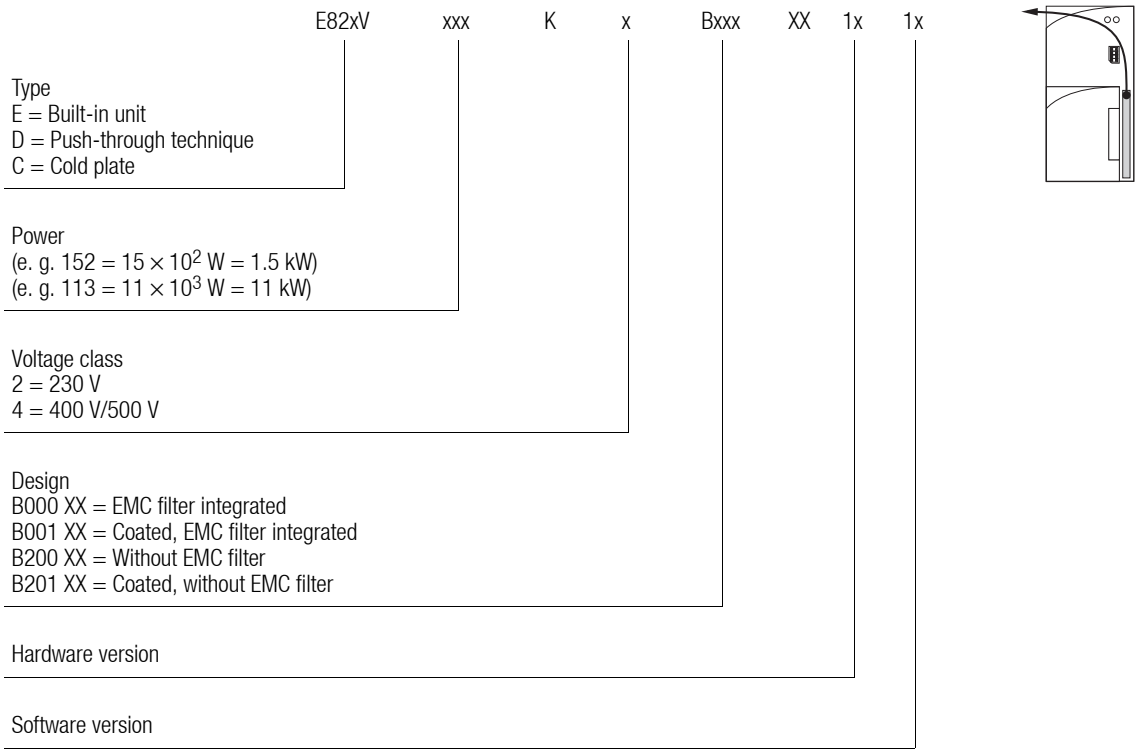


Global Drive

8200 vector frequency inverter

0.25 kW ... 11 kW

This documentation is only valid for 8200 vector frequency inverters as of version:



If 8200 vector frequency inverters are used together with Lenze motors or Lenze geared motors these Instructions only apply together with the Instructions for the corresponding motors or geared motors.

In the event of service, please state the type. The function module can be identified by means of the keypad or PC. In addition, every function module is unambiguously identified by a label (e. g. “STANDARD” for standard I/O).

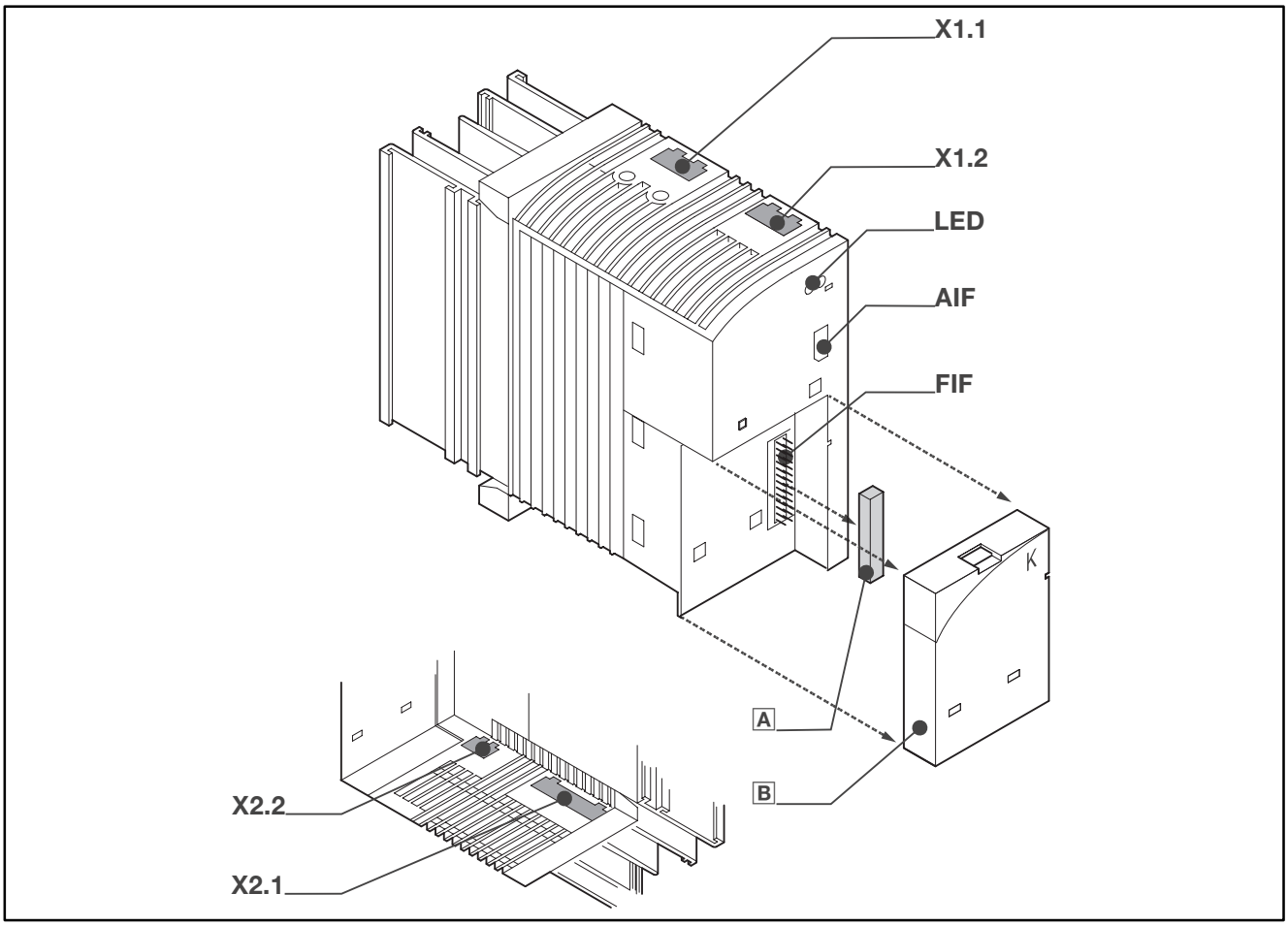
What is new / what has changed ?

Material No.	Edition	Important	Contents
408400	1.0□05/99□TD02	1st edition	
424319	2.0□10/01□TD02	2nd edition	Chapter 3 “Technical data”: Additionally listed are 3 ... 11 kW Chapter 4 “Mechanical installation”: New mounting possibilities Chapter 4 “Electrical installation”: Additional EMC information Chapter 5 “Commissioning”: Step by step commissioning Chapter 10 “Network of several drives”: Mains chokes, fuses, assignments Chapter 12 “Accessories”: Additional accessories and update All chapters: Revised

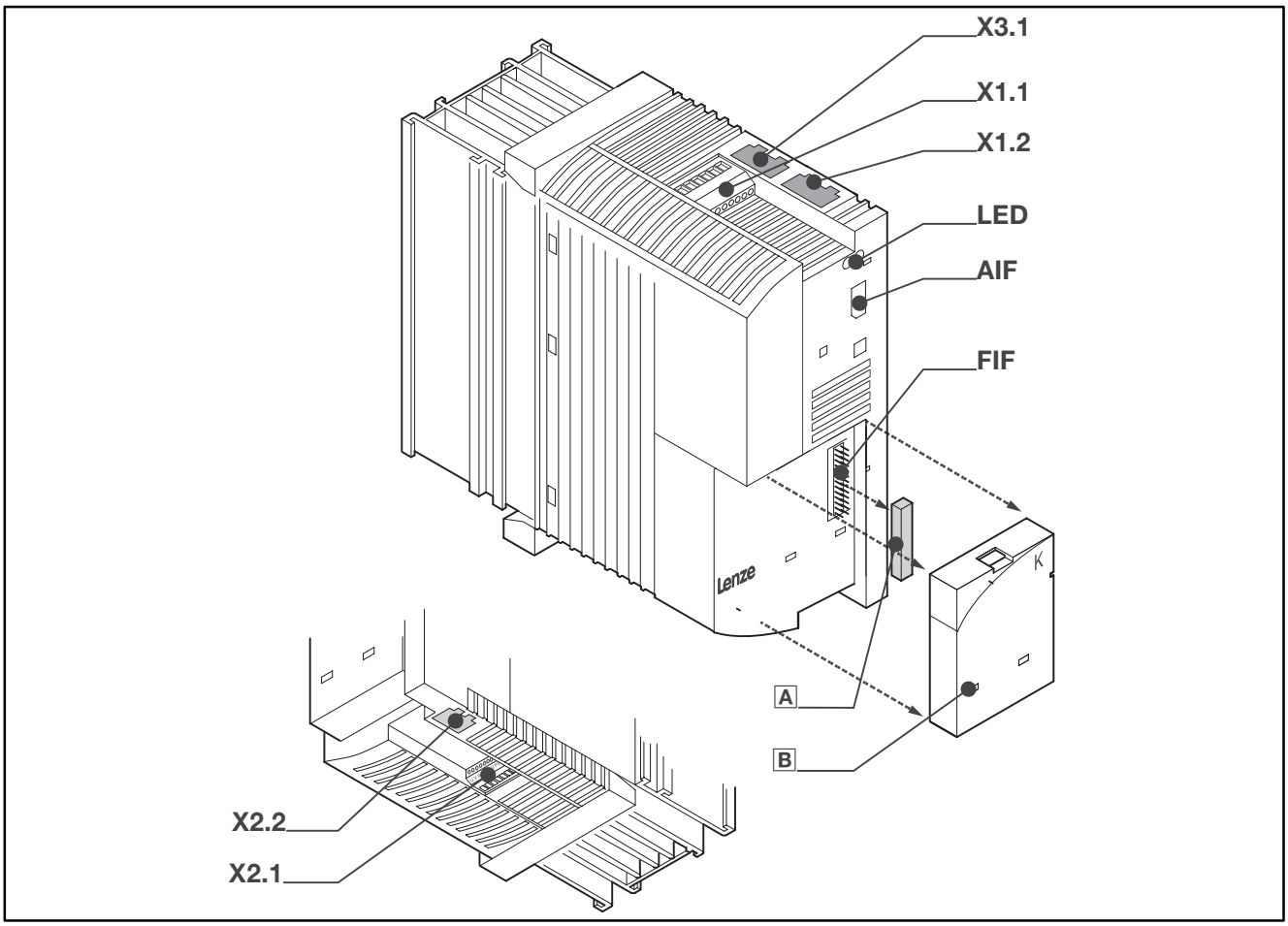
Version 2.0 10/2001

System overview

8200 vector frequency inverters 0.25 ... 2.2 kW



8200 vector frequency inverters 3 ... 11 kW



Position	Description	Function
X1.1	Terminal X1.1	Mains connection and DC supply
X1.2	Terminal X1.2	Relay output
X2.1	Terminal X2.1	Motor connection and connection of an external brake resistor
X2.2	Terminal X2.2	Connection of motor temperature monitoring (thermal NC contact or PTC)
X3.1	Terminal X3.1 only active with 8200 vector 3 ... 11 kW, variant "Safe hold" E82EVxxxKxBx4x	Input for safety switch-off and feedback contact
LED	2 LEDs (red, green)	Status display
AIF	AIF interface (automation interface)	Plug-in station for communication modules Keypad E82ZBC Fieldbus modules type 21XX, e. g. INTERBUS 2111, PROFIBUS-DP 2133, ...
FIF	FIF interface (function interface)	Plug-in station for function modules Standard I/O E82ZAFS Application I/O E82ZAFA [1)] Fieldbus function modules type E82ZAFX, e. g. INTERBUS E82ZAFI, PROFIBUS-DP E82ZAFP, ...
A	FIF cover	Must be mounted for operation without function module
B	Blind cover	Protection cover

[1)] **Please observe:**	**Application I/O**	**8200 vector frequency inverters**	
		up to E82EV ... Vx04	**as of E82EV ... Vx11**
The application I/O is compatible with the following software version of the 8200 vector frequency inverter:	**E82 ... XXVB01**	✓	—
	E82 ... XXVC10	—	✓

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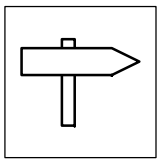

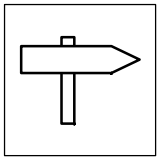

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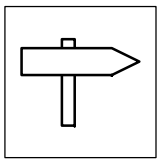

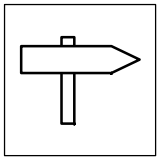

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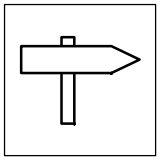

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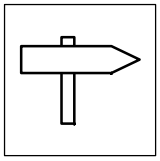

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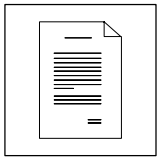


1 Preface and general information

1.1 The 8200 vector frequency inverter

The main task of 8200 vector frequency inverters is the electronic speed adjustment of three-phase AC motors. Together with a Lenze geared motor or a Lenze three-phase AC motor the 8200 vectors forms an electronic variable-speed drive and provides excellent drive features. Different combination possibilities of frequency inverters and application-specific modules, which can be connected via two interfaces, ensure high flexibility.

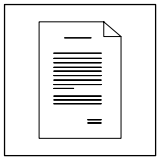
Additional features like compact design and high functionality make the 8200 vector frequency inverter the ideal solution for almost every application, e.g. in HVAC technology, material handling, and automation.

1.2 About these Operating Instructions ...

- These Operating Instructions are intended for all persons who install, set-up and adjust the 8200 vector frequency inverter.
- A chapter informs entirely about a subject:
  – You therefore only have to read the chapter you are interested in at the moment.
  – The Table of Contents and Index help you to find all information about a certain topic.
- These Instructions are meant as addition to the Mounting Instructions which are part of the delivery package:
  – The features and funtions are described in detail.
  – Examples describe how to set the parameters for typical applications.
  – In case of doubt, the Mounting Instructions delivered together with the 8200 vector frequency inverter apply.
- The Mounting Instructions do not inform about the use together with Lenze geared motors and Lenze motors. The most important data are listed on the nameplates. If necessary, Operating Instructions can always be ordered from Lenze.

1.3 Terminology used

Term	In the following text used for
Controller	Any frequency inverter, servo inverter or DC controller
vector	8200 vector frequency inverters
Drive	Lenze controller in combination with a geared motor, a three-phase AC motor or other Lenze drive components.
AIF	**O**utomation**I**nter**F** ace: Interface for a communication module.
FIF	**F** unction**I**nter**F** ace: Interface for a function module.
Cxxxx/y	Subcode y of code Cxxxx (e.g. C0410/3 = subcode 3 of code C0410)
Xk/y	Terminal y on terminal strip Xk (e. g. X3/28 = terminal 28 on terminal strip X3)
🕮 xx-yyy	Cross reference to a page



1.4 Legal regulations

Labelling	**Nameplate**	**CE-identification**	**Manufacturer**
	Lenze controllers are unambiguously designated by the contents of the nameplate.	Conforms to the EC Low Voltage Directive	Lenze GmbH & Co KG Postfach 101352 D-31763 Hameln
Application as directed	**8200 vector frequency inverters and accessories** • must only be operated under the conditions prescribed in these Operating Instructions. • are components – for open and closed loop control of variable speed drives with asynchronous standard motors, reluctance motors, PM synchronous motors with asynchronous damping cage. – for installation into a machine – used for assembly together with other components to form a machine. • comply with the requirements of the EC Low-Voltage Directive. • are not machines for the purpose of the EC Machinery Directive. • are not to be used as domestic appliances, but only for industrial purposes. **Drives with 8200 vector frequency inverters** • meet the EC Electromagnetic Compatibility Directive if they are installed according to the guidelines of CE-typical drive systems. • can be used – for operation at public and non-public mains – for operation in industrial premises and residential areas. • The user is responsible for the compliance of his application with the EC directives. **Any other use shall be deemed inappropriate!**		
Liability	• The information, data and notes in these Operating Instructions met the state of the art at the time of printing. Claims referring to drive systems which have already been supplied cannot be derived from the information, illustrations, and descriptions given in these Operating Instructions. • The specifications, processes, and circuitry described in these instructions are for guidance only and must be adapted to your own specific application. Lenze does not take responsibility for the suitability of the process and circuit proposals. • The specifications in these Instructions describe the product features without guaranteeing them. • Lenze does not accept any liability for damage and operating interference caused by: – Disregarding these Operating Instructions – Unauthorized modifications to the controller – Operating errors – Improper working on and with the controller		
Warranty	• Warranty conditions: see Sales and Delivery Conditions of Lenze GmbH & Co KG. • Warranty claims must be made immediately after detecting defects or faults. • The warranty is void in all cases where liability claims cannot be made.		
Disposal	**Material**	**recycle**	**dispose**
	Metal	•	-
	Plastic	•	-
	Printed-board assemblies	-	•

2 Safety information

2.1 General safety and application notes for Lenze controllers

(according to Low-Voltage Directive 73/23/EEC)

1. General

Lenze controllers (frequency inverters, servo inverter, DC controllers) can carry a voltage or parts of the controllers can rotate during operation. Surfaces can be hot.
If the required cover is removed, the controllers are used inappropriately or installed or operated incorrectly, severe damage to persons or material assets can occur.
For more information please see the documentation.
All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel (IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and national regulations for the prevention of accidents must be observed).
According to this basic safety information qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.

2. Intended use

Drive controllers are components which are designed for the installation into electrical systems or machinery. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000-3-2. The documentation contains information about the compliance of the limit values to EN 61000-3-2.
When installing controllers into machines, commissioning of the drive controllers (i.e. the starting of operation as directed) is prohibited until it is proven that the machine corresponds to the regulations of the EC Directive 98/37/EG (Machinery Directive); EN 60204 (VDE 0113) must be observed.
Commissioning (i.e. starting of operation as directed) is only allowed when there is compliance with the EMC Directive (89/336/EEC).
The drive controllers meet the requirements of the Low-Voltage Directive 73/23/EEC. The harmonised standards EN 50178/DIN VDE 0160 apply to the controllers.
The technical data as well as the connection conditions can be obtained from the nameplate and the documentation. The instructions given must be strictly observed.
Warning: Controllers are products with restricted availability according to EN 61800-3. These products can cause interferences in residential premises. If controllers are used in residential premises, corresponding measures are required.

3. Transport, storage

The notes on transport, storage and appropriate handling must be observed.
Climatic conditions according to EN 50178 apply.

4. Installation

The controllers must be installed and cooled according to the regulations given in the corresponding Instructions.
Ensure careful handling and avoid mechanical overload. Do not bend any components and do not change the insulation distances during transport and storage. Electronic components and contacts must not be touched.
Controllers contain electrostatically sensitive components which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this could mean hazards for your health!

5. Electrical connection

When working on live controllers, the valid national regulations for the prevention of accidents (e. g. VBG 4) must be observed.
The electrical installation must be carried out in compliance with the corresponding regulations (e.g. cable cross-sections, fuses, PE connection). Additional notes and information can be obtained from the corresponding Instructions.
The Instructions contain notes concerning wiring according to EMC regulations (shielding, earthing, filters and cable routing). These notes must also be observed when using CE-marked controllers. The compliance with limit values required by the EMC legislation is the responsibility of the manufacturer of the machine or system.

6. Operation

If necessary, systems including controllers must be equipped with additional monitoring and protection devices according to the applying safety regulations (e.g. regulation for technical equipment, regulation for the prevention of accidents). The controller can be adapted to your application. Please observe the corresponding information given in the Instructions.
After a controller has been disconnected from the voltage supply, all live components and power connections must not be touched immediately because capacitors can still be charged. Please observe the corresponding stickers on the controller.
All protection covers and doors must be shut during operation.
Note for UL-approved systems with integrated controllers: UL warnings are notes which only apply to UL systems. The Instructions give UL-related information.

7. Safe standstill

The variant V004 of 9300 and 9300 vector, and the variant Bx4x of 8200 vector controllers support the function "Safe standstill", protection against unexpected start, according to the requirements of Annex I No. 1.2.7 of the EC Directive "Machinery" 98/37/EG, DIN EN 954-1 category 3 and DIN EN 1037. Please observe the notes on the function "Safe standstill" given in the corresponding Instructions.

8. Maintenance and service

Please observe the Instructions given by the manufacturer,

and the product-specific safety and application notes in these Instructions.

2.2 Residual hazards

Protection of persons	• Before working on the controller check that no voltage is applied to the power terminals, the relay output and the pins of the FIF interface. – because the power terminals U, V, W, BR1, BR2 and the pins of the FIF interface remain live for at least 3 minutes after mains switch-off. – because the power terminals L1, L2, L3; U, V, W, +UG, -UG, BR1, BR2 and the pins of the FIF interface remain live when the motor is stopped. – because the relay outputs K11, K12, K14 can remain live when the controller is disconnected from the mains. • If you use the function “Selection of the direction of rotation”, which is not protected against open-wire, via the digital signal DCTRL1-CW/CCW (C0007 = -0- ... -13-, C0410/3 ≠ 255): – The drive can reverse the direction of rotation in the event of a control-voltage failure or an open circuit. • If you use the function ”Flying-restart circuit” (C0142 = -2-, -3-) with machines with a low moment of inertia and a minimum friction: – The motor can start for a short time or reverse the direction of rotation for a short time after controller enable while the motor is at standstill. • The heatsink of the controller has an operating temperature of > 80 °C: – Direct skin contact results in burnings.
Controller protection	• All pluggable connection terminals must only be connected or disconnected when no voltage is applied! • **Cyclic** connection and disconnection of the controller supply voltage with L1, L2, L3 can exceed the input current limit: – Allow at least 3 minutes between disconnection and reconnection. • Depending on the controller settings, the connected motor can be overheated: – For instance, longer DC-braking operations. – Longer operation of self-ventilated motors at low speed.
Overspeeds	• Drives can reach dangerous overspeeds (e.g. setting of inappropriately high field frequencies): – The controllers do not offer any protection against these operating conditions. For this, use additional components.

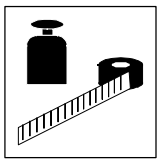
2.3 Layout of the safety instructions

All safety instructions given in these Operating Instructions have the same layout:

Signal word (characterises the severity of danger)

Note (describes the danger and gives information how to avoid it)

	Icons used		Signal words	
Warning of danger to persons		Warning of hazardous electrical voltage	**Danger!**	Warns of **impending danger**. Consequences if disregarded: Death or severe injuries
		Warning of a general danger	**Warning!**	Warns of **potential, very hazardous situation**. Possible consequences if disregarded: Death or severe injuries
			Caution!	Warns of **potential, hazardous situations**. Possible consequences if disregarded: Light or minor injuries
Warning of damage to material			**Stop!**	Warns of **potential damage to material**. Possible consequences if disregarded: Damage of the controller/drive system or its environment
Other notes			**Tip!**	Designates a general, useful note. If you observe it, handling of the controller/drive system is made easier.



3 Technical data

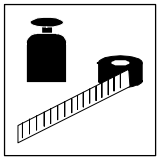
3.1 General data/application conditions

Standards and application conditions			
Conformity		CE	Low-Voltage Directive (73/23/EEC)
Approvals		UL 508C	Underwriter Laboratories (File-No. E132659) Power Conversion Equipment
			0.25 ... 2.2 kW: as of version E82EVxxxKxBxxxXX 1F 14
			3 ... 11 kW: as of version E82EVxxxKxBxxxXX VA 14
Max. permissible motor cable length (without additional output filters)	shielded	50 m	For compliance with EMC regulations and rated mains voltage and a chopper frequency of 8 kHz, the permissible cable lengths can change
	unshielded	100 m	
Vibration resistance		Acceleration resistance up to 0.7g (Germanischer Lloyd, general conditions)	
Climatic conditions		Class 3K3 to EN 50178 (without condensation, average relative humidity 85 %)	
Degree of pollution		VDE 0110 part 2 pollution degree 2	
Packaging (DIN 4180)		Dust packaging	
Permissible temperature range	Transport	-25 °C...+70 °C	
	storage	-25 °C...+60 °C	
	operation	-10 °C...+55 °C	reduce the rated output current by 2.5%/°C above +40 °C
Permissible installation height		0 ... 4000 m amsl	reduce the rated output current by 5%/1000 m above 1000 m amsl
Mounting positions		vertical	
Free space	above/below	≥100 mm	
	to the sides	connection possible without allowing gap	
DC group drives		possible, except for E82EV251K2B and E82EV371K2B	

General technical data			
EMC	Compliance with EN 61800-3/A11		
Noise emission	Compliance with limit value classes A and B to EN 55011		
	E82EVxxxKxB00x	without additional measures [1]	
	E82EVxxxKxB20x	only by means of external filters	
Noise immunity	Requirement to EN 61800-3 incl. A11		
	Requirements	**Standard**	**Severities**
	ESD	EN 61000-4-2	3, i.e. 8 kV with air discharge, 6 kV with contact discharge
	high frequency in cables	EN 61000-4-6	150 kHz ... 80 MHz, 10 V/m 80 % AM (1kHz)
	RF interference (enclosure)	EN 61000-4-3	80 MHz ... 1000 MHz, 10 V/m 80 % AM (1kHz)
	Burst	EN 61000-4-4	3/4, i. e. 2 kV/5 kHz
	Surge (Surge on mains cable)	EN 61000-4-5	3, d. h. 1.2/50 µs, 1 kV phase-phase, 2 kV phase-PE
Insulation strength	Overvoltage category III acc. to VDE 0110		
Discharge current to PE (to EN 50178)	> 3.5 mA		
Type of protection	IP20		
Protection measure against	Short circuit, earth fault (earth-fault protected during operation, limited earth-fault protection during power up), motor stalling, motor overtemperature (input for PTC or thermal contact, I^2t monitoring)		
Insulation of control circuits	Safe mains isolation: Double/reinforced insulation to EN 50178		
Operation in public supply networks (Limitation of harmonic currents according to EN 61000-3-2)	Total power connected to the mains	Compliance with the requirements [2]	
	< 0.5 kW	With mains choke	
	0.5 kW ... 1 kW	with active filter (in preparation)	
	> 1 kW	without additional measures	

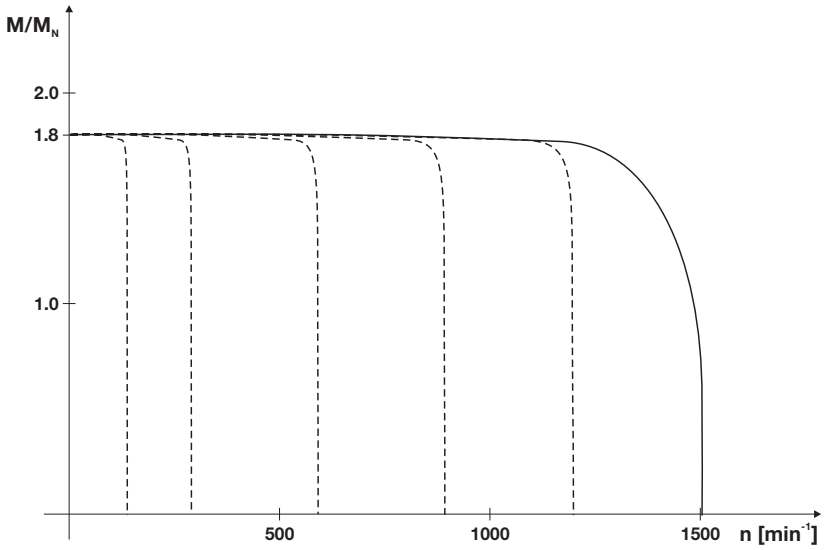
1) Limit value class B: depending on type

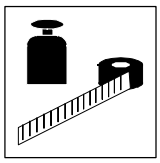
2) The additional measures described only ensure that the controllers meet the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the compliance with the regulations of the machine!



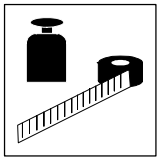
Technical data

General data / application conditions

Control			
Control types		V/f characteristic control (linear/square-law), vector control, troque selection	
Chopper frequency		2 kHz, 4 kHz, 8 kHz, 16 kHz optional	
Torque characteristic	Maximum torque	1.8 x M_r for 60s	if rated motor power = rated controller power
	Setting range	1 : 10	over the speed range of 3 ... 50 Hz, accuracy < 8 %
	Torque-speed characteristic		
Sensorless speed control	Minimum output frequency	1.0 Hz (0 ... M_r)	
	Setting range	1 : 50	Ref. to 50 Hz and M_r
	Accuracy	± 0.5 %	over the speed range 3 ... 50 Hz
	Smooth running	± 0.1 Hz	
Output frequency	Field	- 480 Hz ... + 480 Hz	
	Absolute resolution	0.02 Hz	
	Normalised resolution	Parameter data: 0.01 %, process data: 0.006 % (= 2^{14})	
Digital setpoint selection	Accuracy	± 0.005 Hz (= ±100 ppm)	
Analog setpoint selection	Linearity	± 0.5 %	Signal level: 5 V or 10 V
	Temperature sensitivity	+ 0.3 %	0 ... 60 °C
	Offset	± 0 %	



Inputs and outputs		
Analog inputs/outputs	With standard I/O	1 input, optionally bipolar 1 output
	With application I/O	2 inputs, optionally bipolar 2 outputs
Digital inputs/outputs	With standard I/O	4 inputs, optionally 1 frequency input single-track 0 ... 10 kHz; 1 input for controller inhibit 1 output
	With application I/O	6 inputs, optionally 1 frequency input single track/two tracks 0 ... 100 kHz; 1 input for controller inhibit 2 outputs, 1 frequency output 50 Hz ... 10 kHz
Cycle times	Digital inputs	1 msec
	Digital outputs	4 ms
	Analog inputs	2 msec
	Analog outputs	4 ms (smoothing time: τ = 10 ms)
Relay output		Converter, AC 250 V/3 A, DC 24 V/2 A ... 240 V/0,22 A
Operation in generator mode (internally monitored)		Integrated brake transistor External brake resistors: (11-4)



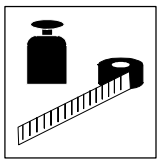
3.2 Rated data for a mains voltage of 230 V

3.2.1 Operation with rated power (normal operation)

Typical motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**0.25**	**0.37**
		P_r [hp]	0.34	0.5
8200 vector type		EMC filter integrated	**E82EV251K2B**	**E82EV371K2B**
		Without EMC filter	**E82EV251K2B200**	**E82EV371K2B200**
Mains voltage		V_{mains} [V]	1/N/PE AC 180 V - 0 % ... 264 V + 0 % ; 45 Hz - 0 % ... 65 Hz + 0 %	
Alternative DC supply		V_{DC} [V]	not possible	
Data for operation with 1/N/PE AC 230 V				
Rated mains current [4]		I_{mains} [A]	3.4	5.0
Output power U, V, W		**S_{r8} [kVA]**	**0.68**	**1.0**
Output power $+U_G$, $-U_G$ [2]		P_{DC} [kW]	DC bus operation not possible	
Rated output current at chopper frequency	2 kHz	I_{r24} [A] [5]	1.7	2.4
	4 kHz			
	8 kHz	**I_{r8} [A]**	**1.7**	**2.4**
	16 kHz	I_{r16} [A]	1.1	1.6
Max. permissible output current for 60 s at chopper frequency [1]	2 kHz	I_{max24} [A]	2.5	3.6
	4 kHz			
	8 kHz	**I_{max8} [A]**	**2.5**	**3.6**
	16 kHz	I_{max16} [A]	1.7	2.3
Output voltage		V_M [V]	3~ 0 ... V_{mains} / 0 ... 480 Hz	
Power loss (operation with I_{r8})		P_{loss} [W]	30	40
Dimensions		H x W x D [mm]	120 x 60 x 140	
Weight		m [kg]	0.8	0.8

Technical data

Rated data at 230 V mains voltage



Typical motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**0.55**		**0.75**		**1.5**		**2.2**	
		P_r [hp]	0.75		1.0		2.0		3.0	
8200 vector type		EMC filter integrated	**E82EV551K2B**		**E82EV751K2B**		**E82EV152K2B**		**E82EV222K2B**	
		Without EMC filter	**E82EV551K2B200**		**E82EV751K2B200**		**E82EV152K2B200**		**E82EV222K2B200**	
Mains voltage		V_{mains} [V]	1/N/PE AC 180 V - 0 % ... 264 V + 0 % ; 45 Hz - 0 % ... 65 Hz + 0 % 3/PE AC 100 V - 0 % ... 264 V + 0 % ; 45 Hz - 0 % ... 65 Hz + 0 %							
Alternative DC supply		V_{DC} [V]	DC 140 V - 0 % ... 370 V + 0 %							
Data for operation with 1/N/PE (3/PE) AC 230 V			1/N/PE	3/PE	1/N/PE	3/PE	1/N/PE	3/PE	1/N/PE [3]	3/PE
Rated mains current [4]		I_{mains} [A]	6.0	3.9	9.0	5.2	15.0	9.1	18.0	12.4
Output power U, V, W		**S_{r8} [kVA]**	**1.2**		**1.6**		**2.8**		**3.8**	
Output power $+U_G$, $-U_G$ [2]		P_{DC} [kW]	-	0.3	-	0.1	-	1.1	-	0.4
Rated output current at chopper frequency	2 kHz	I_{r24} [A] [5]	3.0		4.0		7.0		9.5	
	4 kHz									
	8 kHz	**I_{r8} [A]**	**3.0**		**4.0**		**7.0**		**9.5**	
	16 kHz	I_{r16} [A]	2.0		2.6		4.6		6.2	
Max. permissible output current for 60 s at chopper frequency [1]	2 kHz	I_{max24} [A]	4.5		6.0		10.5		14.2	
	4 kHz									
	8 kHz	**I_{max8} [A]**	**4.5**		**6.0**		**10.5**		**14.2**	
	16 kHz	I_{max16} [A]	2.9		3.9		6.9		9.3	
Output voltage		V_M [V]	3~ 0 ... V_{mains} / 0 ... 480 Hz							
Power loss (operation with I_{r8})		P_{loss} [W]	50		60		100		130	
Dimensions		H x W x D [mm]	180 x 60 x 140				240 x 60 x 140			
Weight		m [kg]	1.2				1.6			

Printed in bold = Data for operation at 8 kHz copper frequency (Lenze setting)

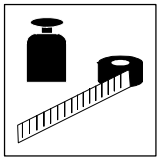
1) Currents for periodic load change: 1 min overcurrent with I_{max} and 2 min basic load with 75 % I_{rx}

2) For operation with power-adapted motors additional power to be taken from the DC bus

3) Operation only with mains choke

4) In operation with mains choke the rated current is reduced by approx. 30 %

5) With different application conditions for other types possible: Operation with increased rated output current and the same load change (📖 3-7)



Technical data

Rated data at 230 V mains voltage

Typical motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**3.0**	**4.0**	**5.5**	**7.5**
		P_r [hp]	4.1	5.4	7.5	10.2
8200 vector type		EMC filter integrated	**E82EV302K2B**	**E82EV402K2B**	**E82EV552K2B**	**E82EV752K2B** 3)
		Without EMC filter	**E82EV302K2B200**	**E82EV402K2B200**	**E82EV552K2B200**	**E82EV752K2B200** 3)
Mains voltage		V_{mains} [V]	3/PE AC 100 V - 0 % ... 264 V + 0 % ; 45 Hz - 0 % ... 65 Hz + 0 %			
Alternative DC supply		V_{DC} [V]	DC 140 V - 0 % ... 370 V + 0 %			
Data for operation with 3/PE AC 230 V						
Rated mains current 4)		I_{mains} [A]	15.6	21.3	29.3	28.0
Output power U, V, W		**S_{r8} [kVA]**	**4.8**	**6.6**	**9.0**	**11,4**
Output power $+U_G$, $-U_G$ 2)		P_{DC} [kW]	0.9	0.8	1.1	0
Rated output current at chopper frequency	2 kHz	I_{r24} [A] 5)	12.0	19.8	22.5	28.6
	4 kHz					
	8 kHz	**I_{r8} [A]**	**12.0**	**16.5**	**22.5**	**28.6**
	16 kHz	I_{r16} [A]	7.8	10.7	14.6	18.6
Max. permissible output current for 60 s at chopper frequency 1)	2 kHz	I_{max24} [A]	18.0	24.8	33.8	42.9
	4 kHz					
	8 kHz	**I_{max8} [A]**	**18.0**	**24.8**	**33.8**	**42.9**
	16 kHz	I_{max16} [A]	11.7	16.1	21.9	27.9
Output voltage		V_M [V]	3~ 0 ... V_{mains} / 0 ... 480 Hz			
Power loss (operation with I_{r8})		P_{loss} [W]	150	190	250	320
Dimensions		H x W x D [mm]	240 x 100 140		240 x 125 x 140	
Weight		m [kg]	2.9		3.6	

Printed in bold = Data for operation at 8 kHz copper frequency (Lenze setting)

1) Currents for periodic load change: 1 min overcurrent with I_{max} and 2 min basic load with 75 % I_{rx}

2) For operation with power-adapted motors additional power to be taken from the DC bus

3) Operation only with mains choke

4) In operation with mains choke the rated current is reduced by approx. 30 %

5) With different application conditions for other types possible: Operation with increased rated output current and the same load change (📖 3-7)

Fuses and cable cross-section (operation with rated power)

			Operation without mains choke					**Operating with mains choke**					
			Installation to EN 60204-1			Installation to UL 1)		Installation to EN 60204-1			Installation to UL 1)		
8200 vector Type	[kW]	**Mains**	Fuse	E.l.c.b.	L1, L2, L3, PE [mm^2]	Fuse	L1, L2, L3, PE [AWG]	Fuse	E.l.c.b.	L1, L2, L3, PE [mm^2]	Fuse	L1, L2, L3, PE [AWG]	**FI**
E82EV251K2B	0.25	1/N/PE AC 2/PE AC 180 ... 264 V; 45 ... 65 Hz	M10 A	C10 A	1.5	10 A	16	M10 A	C10 A	1.5	10 A	16	≥ 30 mA 2)
E82EV371K2B	0.37		M10 A	C10 A	1.5	10 A	16	M10 A	C10 A	1.5	10 A	16	
E82EV551K2B	0.55		M10 A	B10 A	1.5	10 A	16	M10 A	B10 A	1.5	10 A	16	
E82EV751K2B	0.75		M16 A	B16 A	2.5	15 A	14	M10 A	B10 A	1.5	10 A	16	
E82EV152K2B	1.5		M20 A	B20 A	2 x 1.5	20 A	2 x 16	M16 A	B16 A	2 x 1.5	15 A	2 x 16	
E82EV222K2B	2.2		Operation only with mains choke					M20 A	B20 A	2 x 1.5	20 A	2 x 16	
E82EV551K2B	0.55	3/PE AC 100 ... 264 V; 45 ... 65 Hz	M6 A	B6 A	1	5 A	18	M6 A	B6 A	1	5 A	18	≥ 30 mA 3)
E82EV751K2B	0.75		M10 A	B10 A	1.5	10 A	16	M6 A	B6 A	1	5 A	18	
E82EV152K2B	1.5		M16 A	B16 A	2.5	15 A	14	M10 A	B10 A	1.5	10 A	16	
E82EV222K2B	2.2		M16 A	B16 A	2.5	15 A	14	M10 A	B10 A	1.5	10 A	16	
E82EV302K2B	3.0		M20 A	B20 A	4	20 A	12	M16 A	B16 A	2.5	15 A	14	≥ 300 mA 4)
E82EV402K2B	4.0		M25 A	B25 A	4	25 A	10	M20 A	B20 A	4	20 A	12	
E82EV552K2B	5.5		M35 A	-	6 4)	35 A	8	M25 A	B25 A	4	25 A	10	≥ 30 mA 5)
E82EV752K2B	7.5		Operation only with mains choke					M35 A	-	6 6)	35 A	8	

1) Use UL-approved cables, fuses and fuse holders only.
UL fuse: 240 V voltage, tripping characteristic "H" or "K5"

2) Pulse-current or universal-current sensitive earth leakage circuit breaker

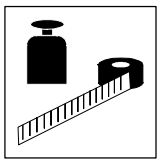
3) All-current sensitive e.l.c.b.

4) All-current sensitive e.l.c.b. for use with E82EVxxxK2B00x

5) All-current sensitive e.l.c.b. for use with E82EVxxxK2B20x

6) Flexible cable can only be connected using pin end connectors.

Observe national and regional regulations (e. g. VDE 0113, EN 60204)



3.2.2 Operation with increased rated power

Under the application conditions described here the controller can be operated in continuous operation with a motor of higher performance. The overload capacity is reduced to 120 %.

- Typical applications:
  - Pums with square-law load characteristic
  - Fans
- Operation permitted only
  - in the mains voltage areas stated
  - with 2 or 4 kHz chopper frequency
  - with the fused, cable cross sections and mains chokes required

Maximum motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**0.37**	**0.75**		**1.1**		**2.2**	
		P_r [hp]	0.5	1.0		1.5		3.0	
8200 vector type		EMC filter integrated	**E82EV251K2B**	**E82EV551K2B**		**E82EV751K2B** 3)		**E82EV152K2B**	
		Without EMC filter	**E82EV251K2B200**	**E82EV551K2B200**		**E82EV751K2B200** 3)		**E82EV152K2B200**	
Mains voltage		V_{mains} [V]	1/N/PE AC 180 V - 0 % ... 264 V + 0 % ; 45 Hz - 0 % ... 65 Hz + 0 % 3/PE AC 100 V - 0 % ... 264 V + 0 % ; 45 Hz - 0 % ... 65 Hz + 0 %						
Alternative DC supply		V_{DC} [V]	not possible	DC 140 V - 0 % ... 370 V + 0 %					
Data for operation with 1/N/PE (3 PE) AC 230 V			1/N/PE	1/N/PE	3/PE	1/N/PE	3/PE	1/N/PE	3/PE
Rated mains current 4)		I_{mains} [A]	4.1	7.2	4.2	9.0	4.4	18.0	10.4
Output power U, V, W		S_{r24} [kVA]	0.8	1.4		1.9		3.3	
Output power $+U_G$, $-U_G$ 2)		P_{DC} [kW]	DC bus operation not possible	0.1		0		0.4	
Rated output current at chopper frequency	2 kHz	I_{r24} [A]	2.0	3.6		4.8		8.4	
	4 kHz								
Max. permissible output current for 60 s at chopper frequency 1)	2 kHz	I_{max24} [A]	2.5	4.5		6.0		10.5	
	4 kHz								
Output voltage		V_M [V]	3~ 0 ... V_{mains} / 0 ... 480 Hz						
Power loss (operation with I_{r24})		P_{loss} [W]	30	50		60		100	
Dimensions		H x W x D [mm]	120 x 60 x 140	180 x 60 x 140				240 x 60 x 140	
Weight		m [kg]	0.8	1.2				1.6	

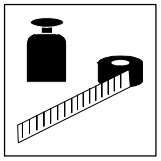
Maximum motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**4.0**	**7.5**
		P_r [hp]	5.4	10.2
8200 vector type		EMC filter integrated	**E82EV302K2B**	**E82EV552K2B** 3)
		Without EMC filter	**E82EV302K2B200**	**E82EV552K2B200** 3)
Mains voltage		V_{mains} [V]	3/PE AC 100 V - 0 % ... 264 V + 0 % ; 45 Hz - 0 % ... 65 Hz + 0 %	
Alternative DC supply		V_{DC} [V]	DC 140 V - 0 % ... 370 V + 0 %	
Data for operation with 3/PE AC 230 V				
Rated mains current 4)		I_{mains} [A]	18.7	25.2
Output power U, V, W		S_{r24} [kVA]	5.7	10.8
Output power $+U_G$, $-U_G$ 2)		P_{DC} [kW]	0	0
Rated output current at chopper frequency	2 kHz	I_{r24} [A]	14.4	27.0
	4 kHz			
Max. permissible output current for 60 s at chopper frequency 1)	2 kHz	I_{max24} [A]	18.0	33.8
	4 kHz			
Output voltage		V_M [V]	3~ 0 ... V_{mains} / 0 ... 480 Hz	
Power loss (operation with I_{r24})		P_{loss} [W]	150	250
Dimensions		H x W x D [mm]	240 x 100 140	240 x 125 x 140
Weight		m [kg]	2.9	3.6

1) Currents for periodic load change: 1 min overcurrent with I_{max} and 2 min basic load with 75 % I_{rx}

2) For operation with power-adapted motors additional power to be taken from the DC bus

3) Operation only with mains choke

4) In operation with mains choke the rated current is reduced by approx. 30 %



Technical data

Rated data at 230 V mains voltage

Fuses and cable cross-sections (operation with increased rated power)

			Operation without mains choke					Operating with mains choke					
			Installation to EN 60204-1			Installation to UL [1]		Installation to EN 60204-1			Installation to UL [1]		
8200 vector		**Mains**	Fuse	E.l.c.b.	L1, L2, L3, PE	Fuse	L1, L2, L3, PE	Fuse	E.l.c.b.	L1, L2, L3, PE	Fuse	L1, L2, L3, PE	**FI**
Type	[kW]				[mm²]		[AWG]			[mm²]		[AWG]	
E82EV251K2B	0.25	1/N/PE AC 180 ... 264 V; 45 ... 65 Hz	M10 A	C10 A	1.5	10 A	16	M10 A	C10 A	1.5	10 A	16	≥ 30 mA [2]
E82EV551K2B	0.55		M10 A	B10 A	1.5	10 A	16	M10 A	B10 A	1.5	10 A	16	
E82EV751K2B	0.75		Operation only with mains choke					M10 A	B10 A	1.5	10 A	16	
E82EV152K2B	1.5		M20 A	B20 A	2 x 1.5	20 A	2 x 16	M16 A	B16 A	2 x 1.5	15 A	2 x 16	
E82EV551K2B	0.55	3/PE AC 100 ... 264 V; 45 ... 65 Hz	M6 A	B6 A	1.5	5 A	16	M6 A	B6 A	1	5 A	18	≥ 30 mA [3]
E82EV751K2B	0.75		Operation only with mains choke					M10 A	B10 A	1.5	10 A	16	
E82EV152K2B	1.5		M16 A	B16 A	2.5	15 A	14	M10 A	B10 A	1.5	10 A	16	
E82EV302K2B	3.0		M25 A	B25 A	4	25 A	10	M20 A	B20 A	4	20 A	12	≥ 300 mA [4]
E82EV552K2B	5.5		Operation only with mains choke					M32 A	B32 A	6 [6]	35 A	8	≥ 30 mA [5]

1) Use UL-approved cables, fuses and fuse holders only.
UL fuse: 240 V voltage, tripping characteristic "H" or "K5"

2) Pulse-current or universal-current sensitive earth leakage circuit breaker

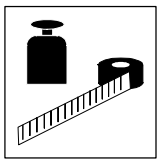
3) All-current sensitive e.l.c.b.

4) All-current sensitive e.l.c.b. for use with E82EVxxxK2B00x

5) All-current sensitive e.l.c.b. for use with E82EVxxxK2B20x

6) Flexible cable can only be connected using pin end connectors.

Observe national and regional regulations (e. g. VDE 0113, EN 60204)

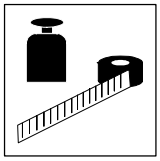


3.3 Rated data for a mains voltage of 400/500 V

3.3.1 Operation with rated power (normal operation)

Typical motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**0.55**		**0.75**		**1.5**		**2.2**	
		P_r [hp]	0.75		1.0		2.0		3.0	
8200 vector type		EMC filter integrated	**E82EV551K4B**		**E82EV751K4B**		**E82EV152K4B**		**E82EV222K4B**	
		Without EMC filter	**E82EV551K4B200**		**E82EV751K4B200**		**E82EV152K4B200**		**E82EV222K4B200**	
Mains voltage		V_{mains} [V]	3/PE AC 320 V - 0 % ... 550 V + 0 % ; 45 Hz - 0 % ... 65Hz + 0 %							
Alternative DC supply		V_{DC} [V]	DC 450 V - 0 % ... 775 V + 0 %							
Data for operation with 3/PE AC			400 V	500 V	400 V	500 V	400 V	500 V	400 V	500 V
Rated mains current [4]		I_{mains} [A]	2.5	2.0	3.3	2.6	5.5	4.4	7.3	5.8
Output power U, V, W		**S_{r8} [kVA]**	**1.3**		**1.7**		**2.7**		**3.9**	
Output power $+U_G$, $-U_G$ [2]		P_{DC} [kW]	0.3		0.1		1.1		0.4	
Rated output current at chopper frequency	2 kHz / 4 kHz	I_{r24} [A] [5]	1.8	1.4	2.4	1.9	4.7	3.1	5.6	4.5
	8 kHz	**I_{r8} [A]**	**1.8**	**1.4**	**2.4**	**1.9**	**3.9**	**3.1**	**5.6**	**4.5**
	16 kHz	I_{r16} [A]	1.2	0.9	1.6	1.2	2.5	2.0	3.6	2.9
Max. permissible output current for 60 s at chopper frequency [1]	2 kHz / 4 kHz	I_{max24} [A]	2.7	2.7	3.6	3.6	5.9	5.9	8.4	8.4
	8 kHz	**I_{max8} [A]**	**2.7**	**2.7**	**3.6**	**3.6**	**5.9**	**5.9**	**8.4**	**8.4**
	16 kHz	I_{max16} [A]	1.8	1.35	2,4	1.85	3.8	3.0	5.5	4.4
Output voltage		V_M [V]	3~ 0 ... V_{mains} / 0 ... 480 Hz							
Power loss (operation with I_{r8})		P_{loss} [W]	50		60		100		130	
Dimensions		H x W x D [mm]	180 x 60 x 140				240 x 60 x 140			
Weight		m [kg]	1.2				1.6			

Typical motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**3.0**		**4.0**		**5.5**		**7.5**		**11**	
		P_r [hp]	4.1		5.4		7.5		10.2		15	
8200 vector type		EMC filter integrated	**E82EV302K4B**		**E82EV402K4B**		**E82EV552K4B**		**E82EV752K4B**		**E82EV113K4B** [3]	
		Without EMC filter	**E82EV302K4B200**		**E82EV402K4B200**		**E82EV552K4B200**		**E82EV752K4B200**		**E82EV113K4B200** [3]	
Mains voltage		V_{mains} [V]	3/PE AC 320 V - 0 % ... 550 V + 0 % ; 45 Hz - 0 % ... 65Hz + 0 %									
Alternative DC supply		V_{DC} [V]	DC 450 V - 0 % ... 775 V + 0 %5									
Data for operation with 3/PE AC			400 V	500 V	400 V	500 V	400 V	500 V	400 V	500 V	400 V	500 V
Rated mains current [4]		I_{mains} [A]	9.0	7.2	12,3	9.8	16.8	13.4	21.5	17.2	21.0	16.8
Output power U, V, W		**S_{r8} [kVA]**	**5.1**		**6.6**		**9.0**		**11.4**		**16.3**	
Output power $+U_G$, $-U_G$ [2]		P_{DC} [kW]	1.7		0.8		1.1		1.5		0	
Rated output current at chopper frequency	2 kHz / 4 kHz	I_{r24} [A] [5]	7.3	5.8	9.5	7.6	13.0	10.4	16.5	13.2	23.5	18.8
	8 kHz	**I_{r8} [A]**	**7.3**	**5.8**	**9.5**	**7.6**	**13.0**	**10.4**	**16.5**	**13.2**	**23.5**	**18.8**
	16 kHz	I_{r16} [A]	4.7	3.8	6.1	4.9	8.4	6.8	10.7	8.6	13.0	12.2
Max. permissible output current for 60 s at chopper frequency [1]	2 kHz / 4 kHz	I_{max24} [A]	11.0	11.0	14.2	14.2	19.5	19.5	24.8	24.8	35.3	35.3
	8 kHz	**I_{max8} [A]**	**11.0**	**11.0**	**14.2**	**14.2**	**19.5**	**19.5**	**24.8**	**24.8**	**35.3**	**35.3**
	16 kHz	I_{max16} [A]	7.0	5.7	9.1	7.9	12.6	10.0	16.0	12.9	19.5	18.3
Output voltage		V_M [V]	3~ 0 ... V_{mains} / 0 ... 480 Hz									
Power loss (operation with I_{r8})		P_{loss} [W]	145		180		230		300		410	



Technical data

Rated data at 400/500 V mains voltage

Typical motor power Three-phase AC asynchronous motor (4 pole)	**P_r [kW]**	**3.0**	**4.0**	**5.5**	**7.5**	**11**
	P_r [hp]	4.1	5.4	7.5	10.2	15
8200 vector type	EMC filter integrated	**E82EV302K4B**	**E82EV402K4B**	**E82EV552K4B**	**E82EV752K4B**	**E82EV113K4B** 3)
	Without EMC filter	**E82EV302K4B200**	**E82EV402K4B200**	**E82EV552K4B200**	**E82EV752K4B200**	**E82EV113K4B200** 3)
Dimensions	H x W x D [mm]	240 x 100 140			240 x 125 x 140	
Weight	m [kg]	2.9			3.6	

Printed in bold = Data for operation at 8 kHz copper frequency (Lenze setting)

1) Currents for periodic load change: 1 min overcurrent with I_{max} and 2 min basic load with 75 % I_{rx}

2) For operation with power-adapted motors additional power to be taken from the DC bus

3) Operation only with mains choke

4) In operation with mains choke the rated current is reduced by approx. 30 %

5) With different application conditions for other types possible: Operation with increased rated output current and the same load change (📖 3-11)

Fuses and cable cross-section (operation with rated power)

			Operation without mains choke					**Operating with mains choke**					
			Installation to EN 60204-1			Installation to UL 1)		Installation to EN 60204-1			Installation to UL 1)		
8200 vector Type	[kW]	**Mains**	Fuse	E.l.c.b.	L1, L2, L3, PE [mm²]	Fuse	L1, L2, L3, PE [AWG]	Fuse	E.l.c.b.	L1, L2, L3, PE [mm²]	Fuse	L1, L2, L3, PE [AWG]	**FI**
E82EV551K4B	0.55	3/PE AC 320 ... 550 V; 45 ... 65 Hz	M6 A	B6 A	1	5 A	18	M6 A	B6 A	1	5 A	18	≥ 300 mA 2) ≥ 30 mA 3)
E82EV751K4B	0.75		M6 A	B6 A	1	5 A	18	M6 A	B6 A	1	5 A	18	
E82EV152K4B	1.5		M10 A	B10 A	1.5	10 A	16	M10 A	B10 A	1.5	10 A	16	
E82EV222K4B	2.2		M10 A	B10 A	1.5	10 A	16	M10 A	B10 A	1.5	10 A	16	
E82EV302K4B	3.0		M16 A	B16 A	2.5	15 A	14	M10 A	B10 A	1.5	10 A	16	
E82EV402K4B	4.0		M16 A	B16 A	2.5	15 A	14	M16 A	B16 A	2.5	15 A	14	
E82EV552K4B	5.5		M25 A	B25 A	4	20 A	12	M20 A	B20 A	4	20 A	12	
E82EV752K4B	7.5		M32 A	B32 A	6 4)	25 A	10	M20 A	B20 A	4	20 A	12	
E82EV113K4B	11.0		Operation only with mains choke					M32 A	B32 A	6 4)	25 A	10	

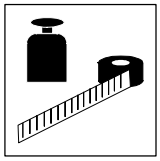
1) Use UL-approved cables, fuses and fuse holders only.
UL fuse: 500 ... 600 V voltage, tripping characteristic "H" or "K5"

2) All-current sensitive e.l.c.b. for the use with E82EVxxxK4B00x

3) All-current sensitive e.l.c.b. for the use with E82EVxxxK4B20x

4) Flexible cable can only be connected using pin end connectors.

Observe national and regional regulations (e. g. VDE 0113, EN 60204)



3.3.2 Operation with increased rated power

Under the application conditions described here the controller can be operated in continuous operation with a motor of higher performance. The overload capacity is reduced to 120 %.

- Typical applications:
  - Pums with square-law load characteristic
  - Fans
- Operation permitted only
  - in the mains voltage areas stated
  - with 2 or 4 kHz chopper frequency
  - with the fused, cable cross sections and mains chokes required

Maximum motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**0.75**	**1.1**	**3.0**
		P_r [hp]	1.0	1.5	4.0
8200 vector type		EMC filter integrated	**E82EV551K4B**	**E82EV751K4B** 3)	**E82EV222K4B** 3)
		Without EMC filter	**E82EV551K4B200**	**E82EV751K4B200** 3)	**E82EV222K4B200** 3)
Mains voltage		V_{mains} [V]	3/PE AC 320 V - 0 % ... 440 V + 0 % ; 45 Hz - 0 % ... 65Hz + 0 %		
Alternative DC supply		V_{DC} [V]	DC 450 V - 0 % ... 620 V + 0 %		
Data for operation with 3/PE AC			400 V	400 V	400 V
Rated mains current 4)		I_{mains} [A]	2.9	2.8	6.1
Output power U, V, W		S_{r24} [kVA]	1.5	2.0	4.6
Output power $+U_G$, $-U_G$ 2)		P_{DC} [kW]	0.1	0	0
Rated output current at chopper frequency	2 kHz / 4 kHz	I_{r24} [A]	2.2	2.9	6.7
Max. permissible output current for 60 s at chopper frequency 1)	2 kHz / 4 kHz	I_{max24} [A]	2.7	3.6	8.4
Output voltage		V_M [V]	3~ 0 ... U_{mains} / 0 ... 480 Hz		
Power loss (operation with I_{r8})		P_{loss} [W]	50	60	130
Dimensions		H x W x D [mm]	180 x 60 x 140		240 x 60 x 140
Weight		m [kg]	1.2		1.6

Maximum motor power Three-phase AC asynchronous motor (4 pole)		**P_r [kW]**	**4.0**	**5.5**	**11**
		P_r [hp]	5.4	7.5	15
8200 vector type		EMC filter integrated	**E82EV302K4B**	**E82EV402K4B** 3)	**E82EV752K4B** 3)
		Without EMC filter	**E82EV302K4B200**	**E82EV402K4B200** 3)	**E82EV752K4B200** 3)
Mains voltage		V_{mains} [V]	3/PE AC 320 V - 0 % ... 440 V + 0 % ; 45 Hz - 0 % ... 65Hz + 0 %		
Alternative DC supply		V_{DC} [V]	DC 450 V - 0 % ... 620 V + 0 %5		
Data for operation with 3/PE AC			400 V	400 V	400 V
Rated mains current 4)		I_{mains} [A]	10.8	10.6	18.0
Output power U, V, W		S_{r24} [kVA]	6.0	7.9	13.7
Output power $+U_G$, $-U_G$ 2)		P_{DC} [kW]	0.7	0	0
Rated output current at chopper frequency	2 kHz / 4 kHz	I_{r24} [A]	8.7	11.4	19.8
Max. permissible output current for 60 s at chopper frequency 1)	2 kHz / 4 kHz	I_{max24} [A]	11.0	14.2	24.8
Output voltage		V_M [V]	3~ 0 ... V_{mains} / 0 ... 480 Hz		
Power loss (operation with I_{r8})		P_{loss} [W]	145	180	300
Dimensions		H x W x D [mm]	240 x 100 140		240 x 125 x 140
Weight		m [kg]	2.9		3.6

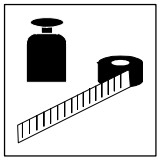
Printed in bold = Data for operation at 8 kHz copper frequency (Lenze setting)

1) Currents for periodic load change: 1 min overcurrent with I_{max} and 2 min basic load with 75 % I_{rx}

2) For operation with power-adapted motors additional power to be taken from the DC bus

3) Operation only with mains choke

4) In operation with mains choke the rated current is reduced by approx. 30 %



Technical data

Rated data at 400/500 V mains voltage

Fuses and cable cross-sections (operation with increased rated power)

			Operation without mains choke					Operating with mains choke					
			Installation to EN 60204-1			Installation to UL [1]		Installation to EN 60204-1			Installation to UL [1]		
8200 vector		**Mains**	Fuse	E.l.c.b.	L1, L2, L3, PE	Fuse	L1, L2, L3, PE	Fuse	E.l.c.b.	L1, L2, L3, PE	Fuse	L1, L2, L3, PE	**FI**
Type	[kW]				[mm²]		[AWG]			[mm²]		[AWG]	
E82EV551K4B	0.55	3/PE AC 320 ... 440 V; 45 ... 65 Hz	M6 A	B6 A	1	5 A	18	M6 A	B6 A	1	5 A	18	≥ 300 mA [2] ≥ 30 mA [3]
E82EV751K4B	0.75		Operation only with mains choke					M6 A	B6 A	1	5 A	18	
E82EV222K4B	2.2		Operation only with mains choke					M10 A	B10 A	1.5	10 A	16	
E82EV302K4B	3.0		M16 A	B16 A	2.5	15 A	14	M10 A	B10 A	1.5	10 A	16	
E82EV402K4B	4.0		Operation only with mains choke					M16 A	B16 A	2.5	15 A	14	
E82EV752K4B	7.5		Operation only with mains choke					M25 A	B25 A	4	25 A	10	

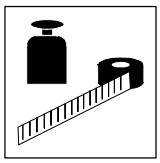
[1] Use UL-approved cables, fuses and fuse holders only.
UL fuse: 500 ... 600 V voltage, tripping characteristic "H" or "K5"

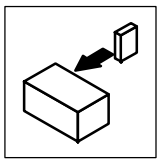
[2] All-current sensitive e.l.c.b. for the use with E82EVxxxK4B00x

[3] All-current sensitive e.l.c.b. for the use with E82EVxxxK4B20x

[4] Flexible cable can only be connected using pin end connectors.

Observe national and regional regulations (e. g. VDE 0113, EN 60204)



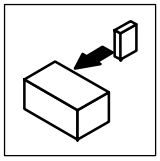


4 Installation

4.1 Mechanical installation

4.1.1 Important notes

- 8200 vector frequency inverters should only be used as built-in units
- If the cooling air contain pollutants (dust, fluff, grease, aggressive gases) ensure suitable measures to protect the inverter (e.g. filters, regular cleaning, etc.)
- Free space:
  – You can mount several inverters next to each other without allowing free space in between them.
  – Ensure unimpeded ventilation of cooling air and outlet of exhaust air.
  – Allow a free space of 100 mm above and below the inverter.
- With continuous vibrations and shocks: Use shock absorbers.
- The dimensions apply to type E82EVxxxKxB (with integrated EMC filter) and type E82EVxxxKxB200 (without EMC filter).



4.1.2 Mounting with fixing rails (standard)

8200 vector 0.25 ... 2.2 kW

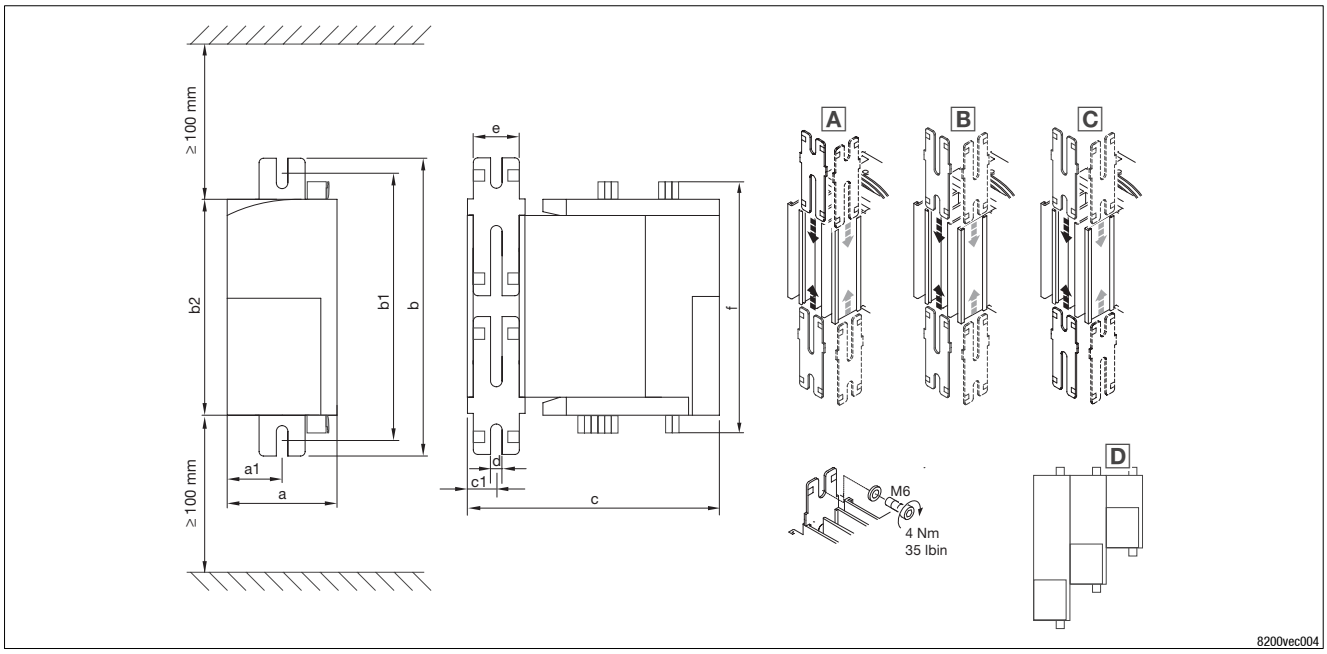


Fig. 4-1 Standard mounting with fixing rails 0.25 ... 2.2 kW

Dimensions in mm	a	a1	b			b1			b2	c	c1	d	e	f
			A	B	C	A	B	C						
E82EV251K2B E82EV371K2B	60	30	150	180	210	130...140	120...170	110...200	120	140	16	6.5	27.5	148
E82EV551KxB E82EV751KxB			210	240	270	190...200	180...230	170...260	180					208
E82EV152KxB[1)] E82EV222KxB [1)]			270 306 [2)]	300	-	250...260 280...295 [2)]	240...290	-	240	140 162 [2)]	16 39 [2)]	6.5	27.5	268

D Different sizes can only be mounted side-by-side when the smaller units are mounted to the right-hand-side of the bigger units!

1) Lateral mounting only possible with swivel mounting unit E82ZJ001 (accessories)

2) with E82ZJ001

8200 vector 3 ... 11 kW

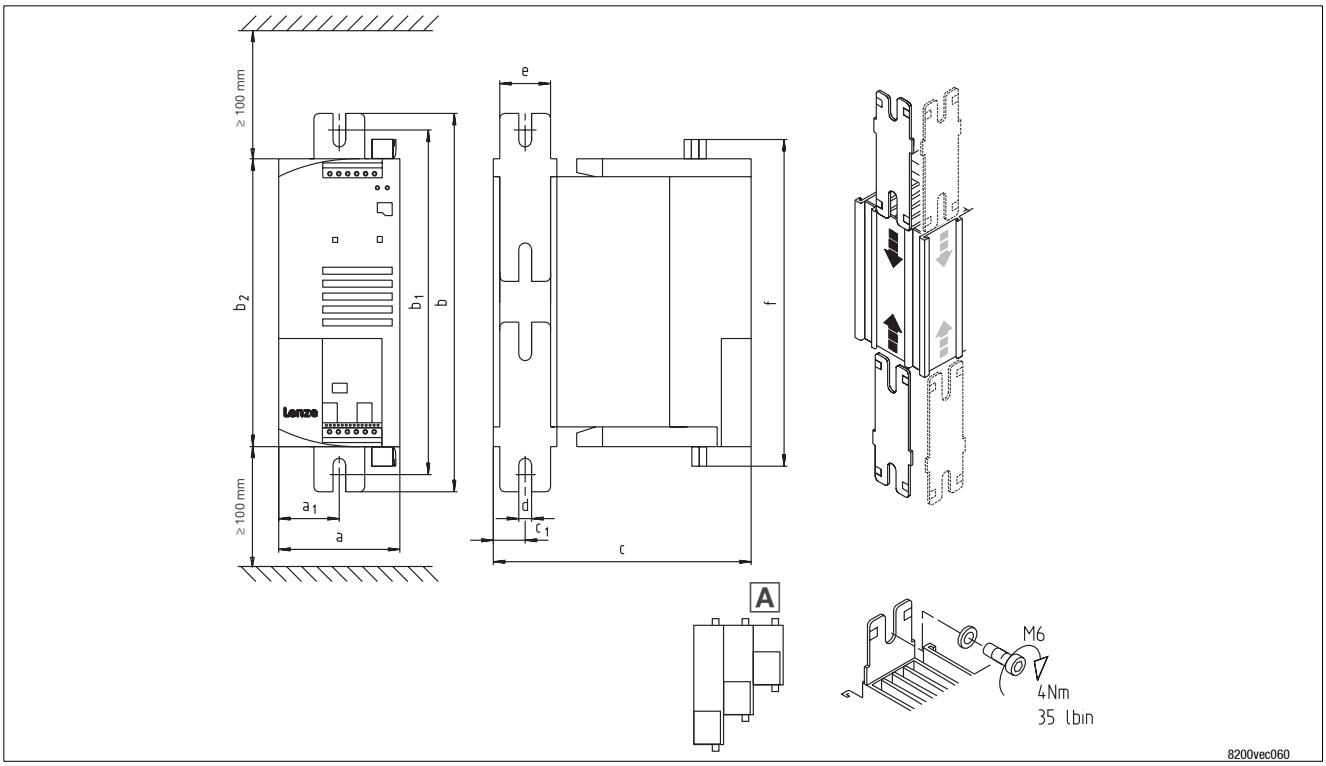


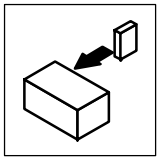
Fig. 4-3 Standard mounting with fixing rails 3 ... 11 kW

Dimensions in mm **8200 vector**	**a**	**a1**	**b**	**b1**	**b2**	**c**	**c1**	**d**	**e**	**f**
E82EV302K2B E82EV402K2B	100	50	270	255	240	140	16	6.5	27.5	268
E82EV552K2B 1) E82EV752K2B 1)	125	62.5	270 306 2)	255 280 ... 295 2)		140 162 2)	16 39 2)			
E82EV302K4B E82EV402K4B E82EV552K4B	100	50	270	255		140	16			
E82EV752K4B 1) E82EV113K4B 1)	125	62.5	270 306 2)	255 280 ... 295 2)		140 162 2)	16 39 2)			

A Different sizes can only be mounted side-by-side when the smaller units are mounted to the right-hand-side of the bigger units!

1) Side mounting only possible with swivel holding unit E82ZJ006 (accessories)

2) with E82ZJ006



4.1.3 DIN rail mounting

The accessories for DIN rail mounting are not included in the delivery package.

Order number: E82ZJ002 for 8200 vector 0.25 ... 2.2 kW

Order number: E82ZJ008 for 8200 vector 3 ... 11 kW in preparation

8200 vector 0.25 ... 2.2 kW

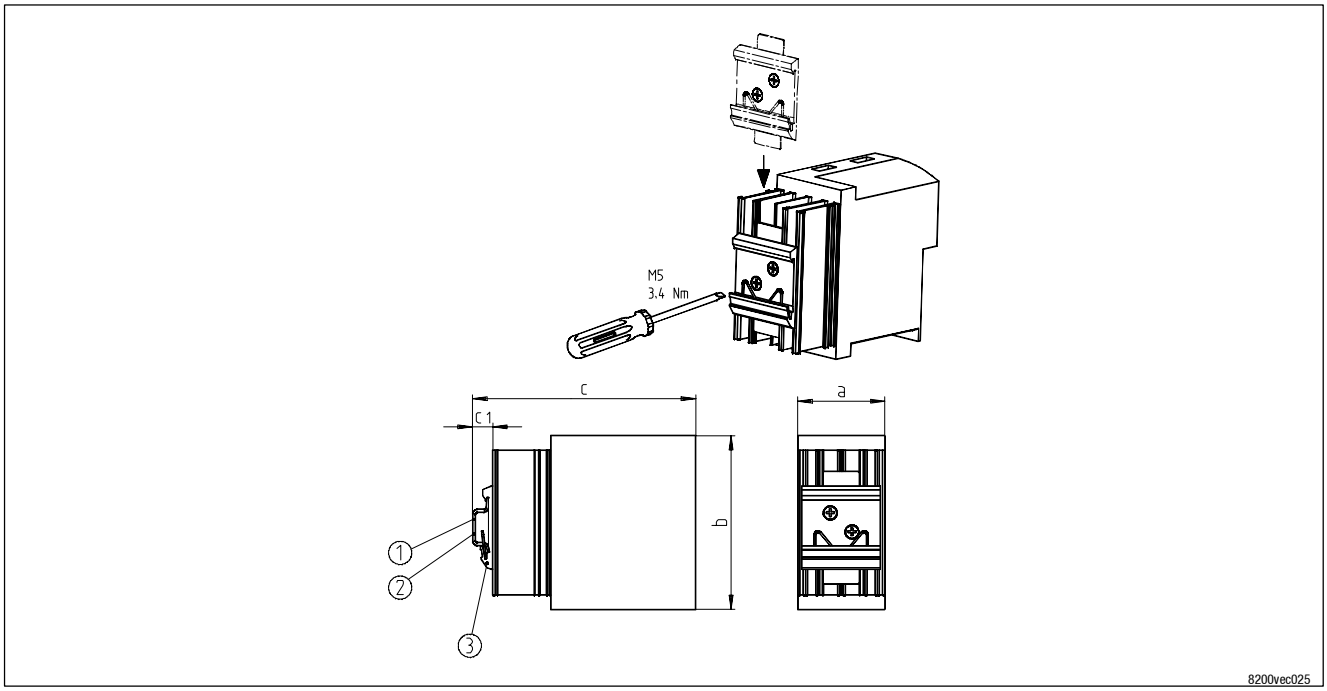


Fig. 4-4 DIN rail mounting 0.25 ... 2.2 kW

Dimensions in mm	a	b	c		c_1	
8200 vector			①	②	①	②
E82EV251K2B E82EV371K2B	60	120	158	151	18	11
E82EV551K2B E82EV751K2B		180				
E82EV152K2B E82EV222K2B		240				
E82EV551K4B E82EV751K4B		180				
E82EV152K4B E82EV222K4B		240				

① DIN rail 35 x 15 or ② DIN rail 35 x 7.5

③ DIN-rail assembly

4.1.4 Mounting with shield connection

4.1.4.1 Shield connection with clamps

The shield connection with clamps is not included in the delivery package.

Order number E82ZWES for 8200 vector 0.25 ... 2.2 kW

Order number E82ZWES001 for 8200 vector 3 ... 11 kW

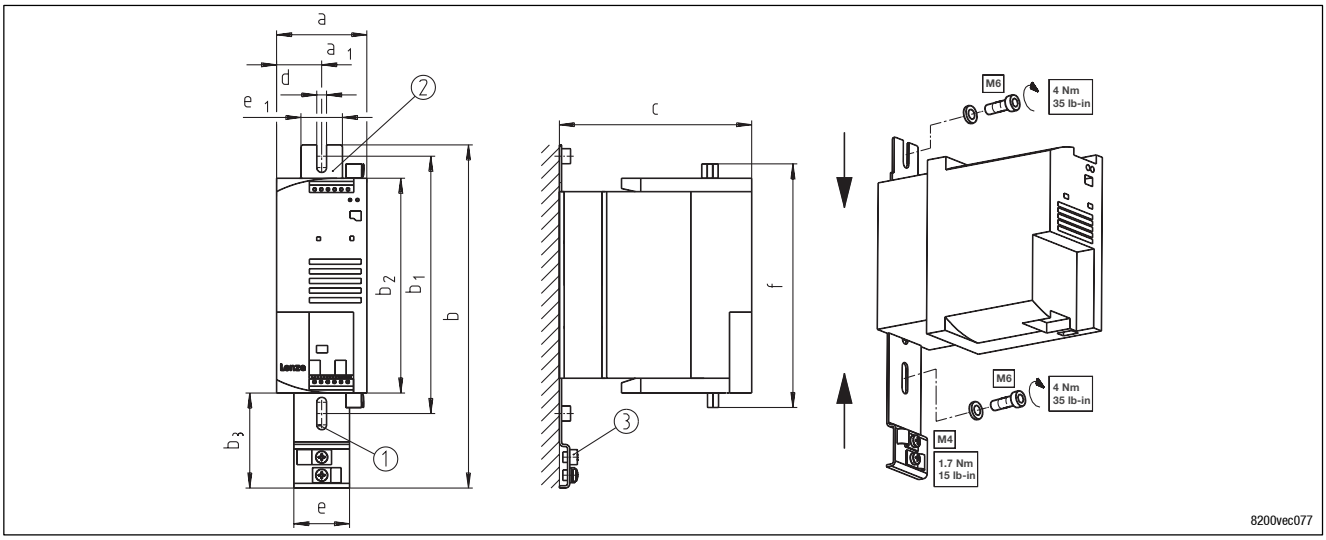
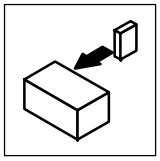


Fig. 4-5 Mounting with shield connections with clamps

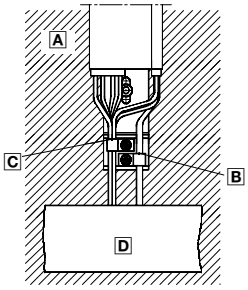
① Shield connection with clamps E82ZWES or E82ZWES001
② Mounting rail from standard delivery package
③ Shield clamps from standard delivery package

Dimensions in mm **8200 vector**	**a**	**a_1**	**b**	**b_1**	**b_2**	**b_3**	**c**	**d**	**e**	**e_1**	**f**
E82EV251K2B E82EV371K2B	60	30	218	130 ... 140	120	78	140	6.5	37	27.5	148
E82EV551KxB E82EV751KxB			278	190 ... 200	180						208
E82EV152KxB E82EV222KxB			338	250 ... 260	240						268
E82EV302K2B E82EV402K2B	100	50	338	255 ... 270	240	78	140	6.5	37	27.5	268
E82EV552K2B E82EV752K2B	125	62.5									
E82EV302K4B **E82EV402K4B** E82EV552k4B	**100**	**50**									
E82EV752K4B E82EV113K4B	125	62.5									



Installation

Mechanical installation - Mounting with shield connection

Mounting		
A	Mounting plate with electrically conductive surface	
B	Motor cable	
C	Control cable, cable for brake resistor, cable for thermal contact/PTC	
D	Cable duct	

4.1.4.2 Shield connection with clips

The shield connection with clips is not included in the delivery package.

Order number E82ZWEK for 8200 vector 0.25 ... 2.2 kW

Order number E82ZWEK001 for 8200 vector 3 ... 11 kW

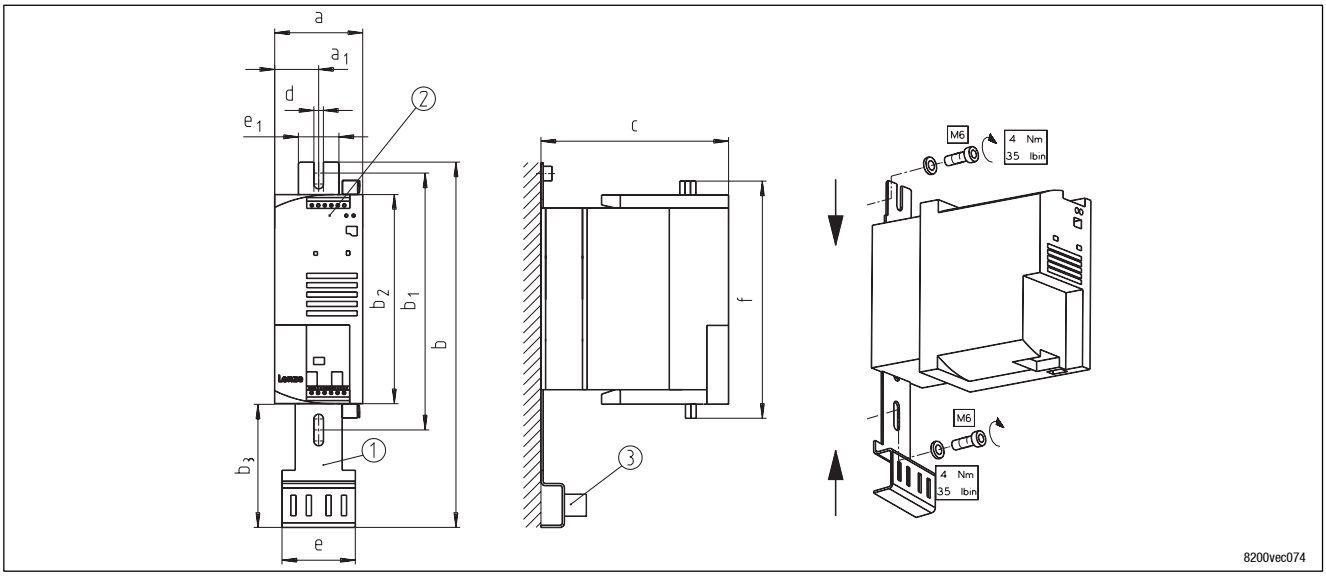
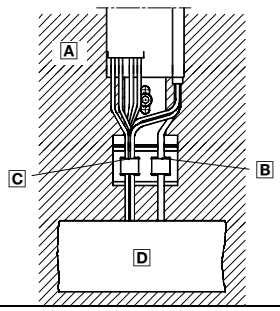


Fig. 4-6 Mounting with shield connections with clips

① Shield connection with clips E82ZWEK or E82ZWEK001
② Mounting rail from standard delivery package
③ Clips

Dimensions in mm **8200 vector**	**a**	**a_1**	**b**	**b_1**	**b_2**	**b_3**	**c**	**d**	**e**	**e_1**	**f**
E82EV251K2B E82EV371K2B	60	30	219	130 ... 140	120	79	140	6.5	50	27.5	148
E82EV551KxB E82EV751KxB			279	190 ... 200	180						208
E82EV152KxB E82EV222KxB			339	250 ... 260	240						268
E82EV302K2B E82EV402K2B	100	50	339	255 ... 270	240	79	140	6.5	50	27.5	268
E82EV552K2B E82EV752K2B	125	62.5									
E82EV302K2B **E82EV402K2B** E82EV552K4B	**100**	**50**									
E82EV752K4B E82EV113K4B	125	62.5									

Mounting	
A	Mounting plate with electrically conductive surface
B	Motor cable
C	Control cable, cable for brake resistor, cable for thermal contact/PTC
D	Cable duct



4.1.5 Lateral mounting

Lateral mounting of the controller is possible on both sides. The controller is either fixed or can be swivelled depending on the mounting point. Both mounting types use the same mounting kit.

4.1.5.1 Fixed lateral mounting

- The controllers 0.25 ... 0.75 kW can be mounted with the rails included in the delivery package.
- The controllers 1.5 ... 11 kW require a mounting kit.
  – Order number E82ZJ001 for 8200 vector 1.5 ... 2.2 kW
  – Order number E82ZJ005 for 8200 vector 3 ... 4 kW (230 V)
  – Order number E82ZJ006 for 8200 vector 5.5 ... 7.5 kW (230 V)
  – Order number E82ZJ005 for 8200 vector 3 ... 5.5 kW (400/500 V)
  – Order number E82ZJ006 for 8200 vector 7.5 ... 11 kW (400/500 V)

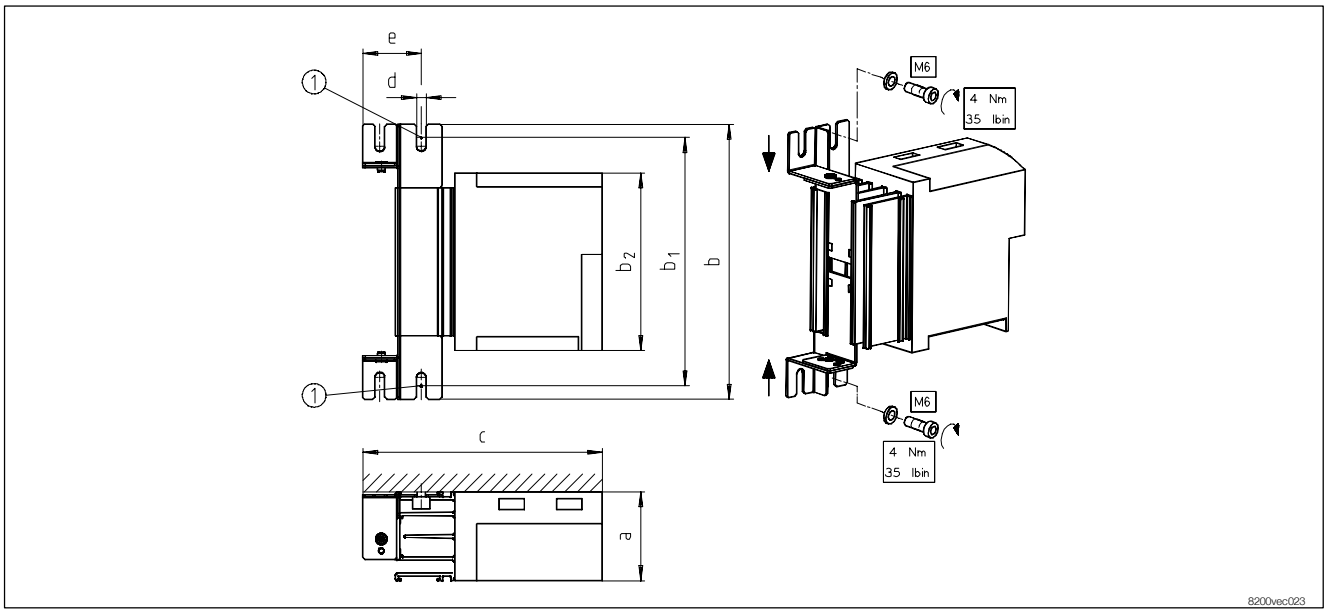


Fig. 4-7 Fixed lateral mounting

① bolt here

Dimensions in mm		a	b	b_1	b_2	c	d	e
8200 vector	Mounting kit							
E82EV251K2B E82EV371K2B E82EV551KxB E82EV751KxB	-	Use the rails included in the delivery package for fixed lateral mounting. Dimensions: 📖 4-2						
E82EV152KxB E82EV222KxB	E82ZJ001	60	306	280 ... 295	240	162	6.5	39
E82EV302K2B E82EV402K2B	E82ZJ005	100	306	280 ... 295	240	162	6.5	39
E82EV552K2B E82EV752K2B	E82ZJ006	125						
E82EV302K4B E82EV402K4B E82EV552K4B	E82ZJ005	100						
E82EV752K4B E82EV113K4B	E82ZJ006	125						

4.1.5.2 Swivelling lateral mounting

- All controllers require a mounting kit:
  – Order number E82ZJ001 for 8200 vector 0.25 ... 2.2 kW
  – Order number E82ZJ005 for 8200 vector 3 ... 4 kW (230 V)
  – Order number E82ZJ006 for 8200 vector 5.5 ... 7.5 kW (230 V)
  – Order number E82ZJ005 for 8200 vector 3 ... 5.5 kW (400/500 V)
  – Order number E82ZJ006 for 8200 vector 7.5 ... 11 kW (400/500 V)

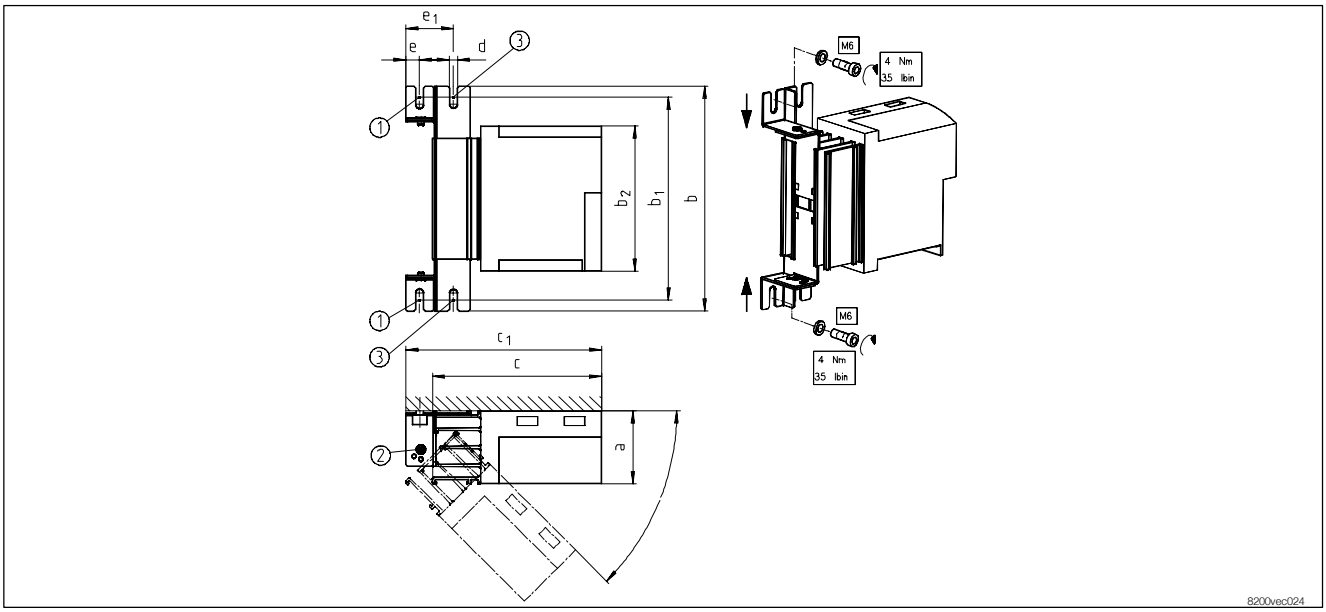
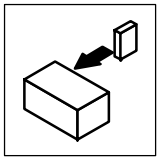


Fig. 4-8 Swivelling lateral mounting

① bolt here
② Rotating point, stops at 45°, 90°, 135°, 180°
③ bolt here to fasten the controller at 0° position.

Dimensions in mm		a	b	b_1	b_2	c	c_1	d	e	e_1
8200 vector	Mounting kit									
E82EV251K2B E82EV371K2B	E82ZJ001	60	186	160 ... 175	120	140	162	6.5	11.5	39
E82EV551KxB E82EV751KxB			246	220 ... 235	180					
E82EV152KxB E82EV222KxB			306	280 ... 295	240					
E82EV302K2B E82EV402K2B	E82ZJ005	100	306	280 ... 295	240	140	162	6.5	11.5	39
E82EV552K2B E82EV752K2B	E82ZJ006	125								
E82EV302K4B E82EV402K4B E82EV552K4B	E82ZJ005	100								
E82EV752K4B E82EV113K4B	E82ZJ006	125								



4.1.6 Thermally separated mounting (push-through technique)

Use the controller type E82DVxxxKxB for mounting using push-through technique.The delivery package includes all parts and components required for mounting.

8200 vector 0.25 ... 0.75 kW

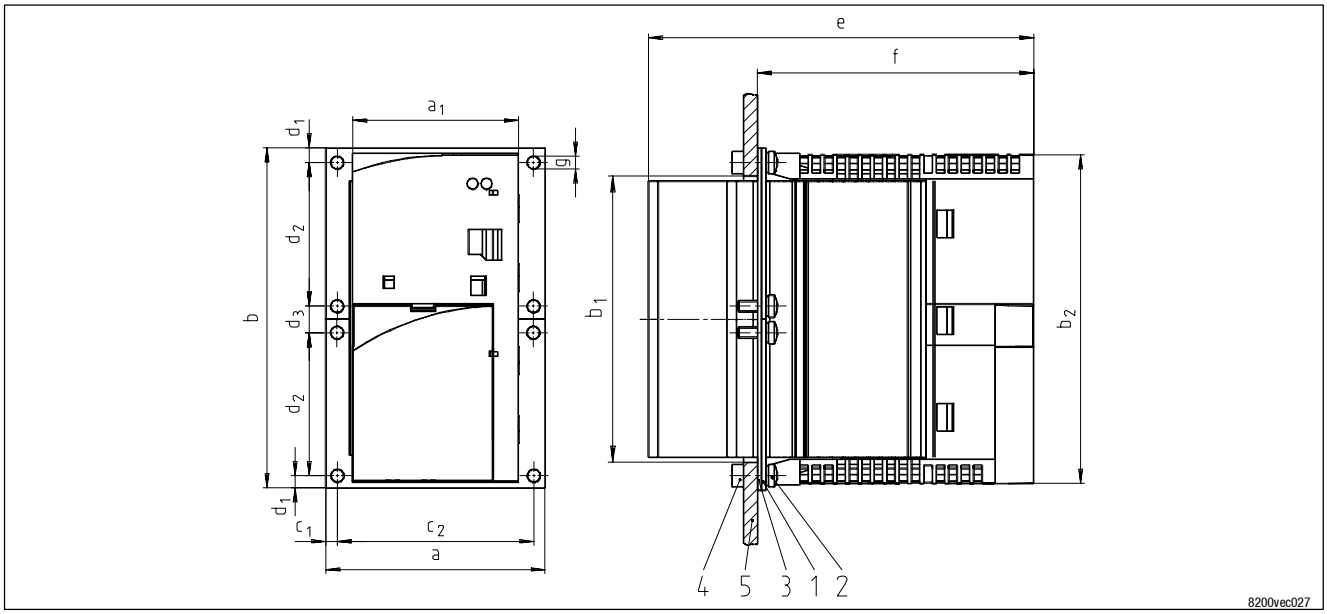


Fig. 4-9 Dimensions for thermally separted mounting 0.25 ... 0.75 kW

1 Fixing frames
2 Screw M4x10
3 Gasket
4 Hex nut M4
5 Control cabinet rear panel

Dimensions in mm **8200 vector**	**a**	**b**	**b_2**	**c_1**	**c_2**	**d_1**	**d_2**	**d_3**	**e**	**f**	**g**
E82DV251K2B	79.4	124	120	4.2	71	5	52	10	140	100	4.5
E82DV371K2B											
E82DV551KxB		184	180				82				
E82DV751KxB											

Cut-out in control cabinet

Dimensions in mm **8200 vector**	**a_1**	**b_1**
E82DV251K2B	61	101
E82DV371K2B		
E82DV551KxB		161
E82DV751KxB		

Mounting

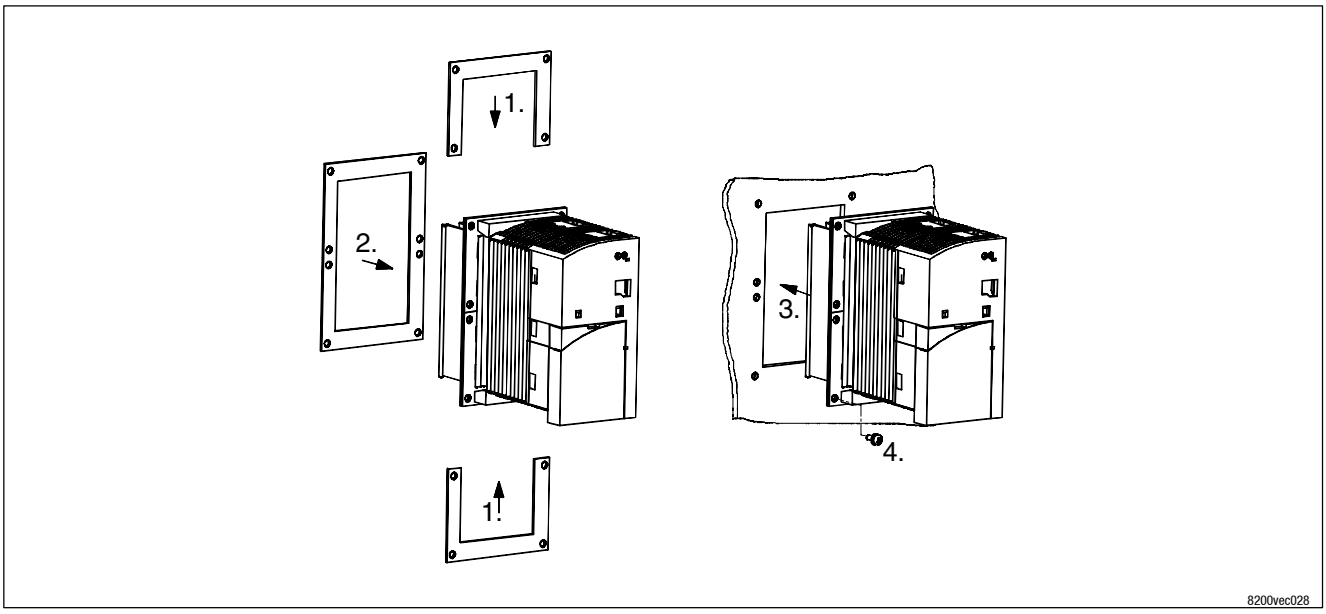
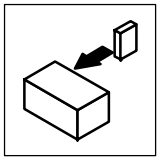


Fig. 4-10 Thermally separated mounting 0.25 ... 0.75 kW

1. Insert support
2. Insert seal
3. Insert the 8200 vector into the cut-out
4. Fasten it with M4x10 screws



Installation

Mechanical installation - Push-through technique

8200 vector 1.5 ... 2.2 kW

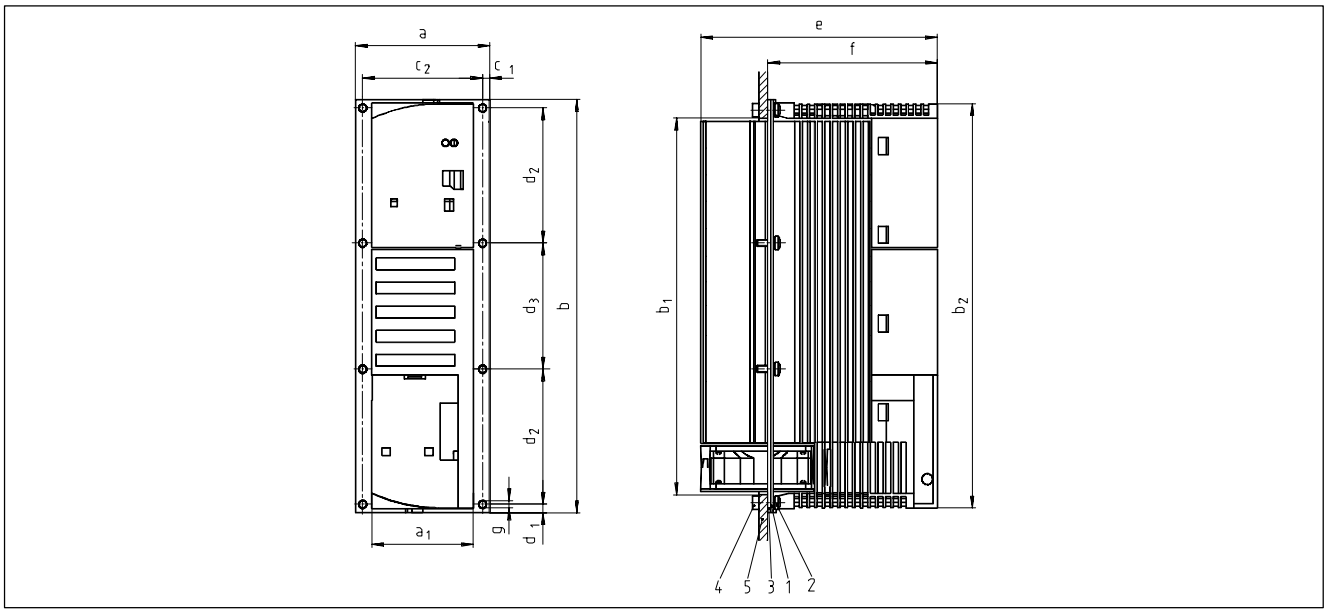


Fig. 4-11 Dimensions for thermally separted mounting 1.5 ... 2.2 kW

1 Support
2 Screw M4x10
3 Gasket
4 Hex nut M4
5 Control cabinet rear panel

Dimensions in mm **8200 vector**	**a**	**b**	**b_2**	**c_1**	**c_2**	**d_1**	**d_2**	**d_3**	**e**	**f**	**g**
E82DV152K2B	79.4	244.5	240	4.2	71	5	80	74.5	140	100	4.5
E82DV222K2B											
E82DV152K4B											
E82DV222k4B											

Cut-out in control cabinet

	a_1 [mm]	**b_1** [mm]
E82DV152K2B	61	221
E82DV222K2B		
E82DV152K4B		
E82DV222k4B		

Mounting

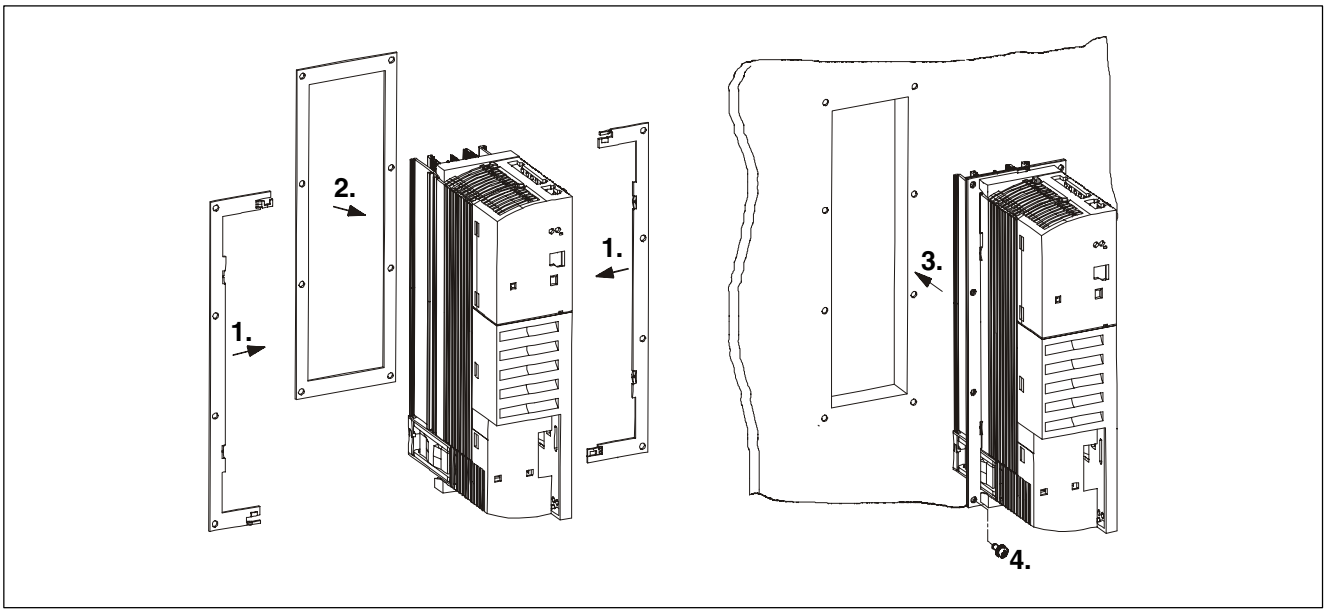
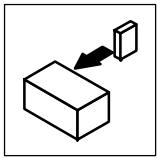


Fig. 4-12 Thermally separated mounting 1.5 ... 2.2 kW

1. Insert support
2. Insert seal
3. Insert the 8200 vector into the cut-out
4. Fasten it with M4x10 screws



4.1.7 Mounting in ”cold plate” technique

When using ”cold plate” technique the controllers can be mounted to sum coolers. Use controllers of type E82CVxxxKxB.

Cooler requirements

The following points are important to ensure safe operation of drive controllers:

- Good thermal contact with the cooler:
  – The contact area between the cooler and the drive controller must be at least as large as the cooling plate of the drive controller.
  – Plane contact area, deviation max. to 0.05 mm.
  – The cooler and heatsink must be attached using all the screwed joints that are specified.
- Thermal resistance R_{th} according to table. The values are valid for operation with the drive controllers under rated conditions.

8200 vector		Cooling path Heatsink - environment	Weight
Type	Power to be dissipated P_{loss} [W]	R_{th} [°C/W]	[kg]
E82CV251K2B	15	≤ 1.50	0.6
E82CV371K2B	20	≤ 1.50	0.6
E82CV551K2B	30	≤ 1.00	0.9
E82CV751K2B	40	≤ 1.00	0.9
E82CV152K2B	70	≤ 0.30	1.1
E82CV222K2B 1)	100	≤ 0.30	1.1
E82CV302K2B 2)	110	≤ 0.23	2.4
E82CV402K2B 2)	150	≤ 0.23	2.4
E82CV552K2B 2)	205	≤ 0.13	3
E82CV752K2B 2)	270	≤ 0.13	3
E82CV551K4B	30	≤ 1.00	0.9
E82CV751K4B	40	≤ 1.00	0.9
E82CV152K4B	65	≤ 0.30	1.1
E82CV222K4B	100	≤ 0.30	1.1
E82CV302K4B 2)	110	≤ 0.23	2.4
E82CV402K4B 2)	140	≤ 0.23	2.4
E82CV552K4B 2)	190	≤ 0.23	3
E82CV752K4B 2)	255	≤ 0.13	3
E82CV113K4B 2)	360	≤ 0.13	3

1) Max. output current at 8 kHz chopper frequency: 8.5 A!

2) in preparation

- Ambient temperature - controllers
  – The rated data and the derating for higher temperatures still apply for the ambient temperature of the drive controller.
- Heat distribution between common heatsinks/coolers within the control cabinet
  – If you assemble several components (controller, brake units, etc.) on a common cooler, then care must be taken that the temperature of the controller heatsinks does not exceed 75 °C.

8200 vector 0.25 ... 2.2 kW

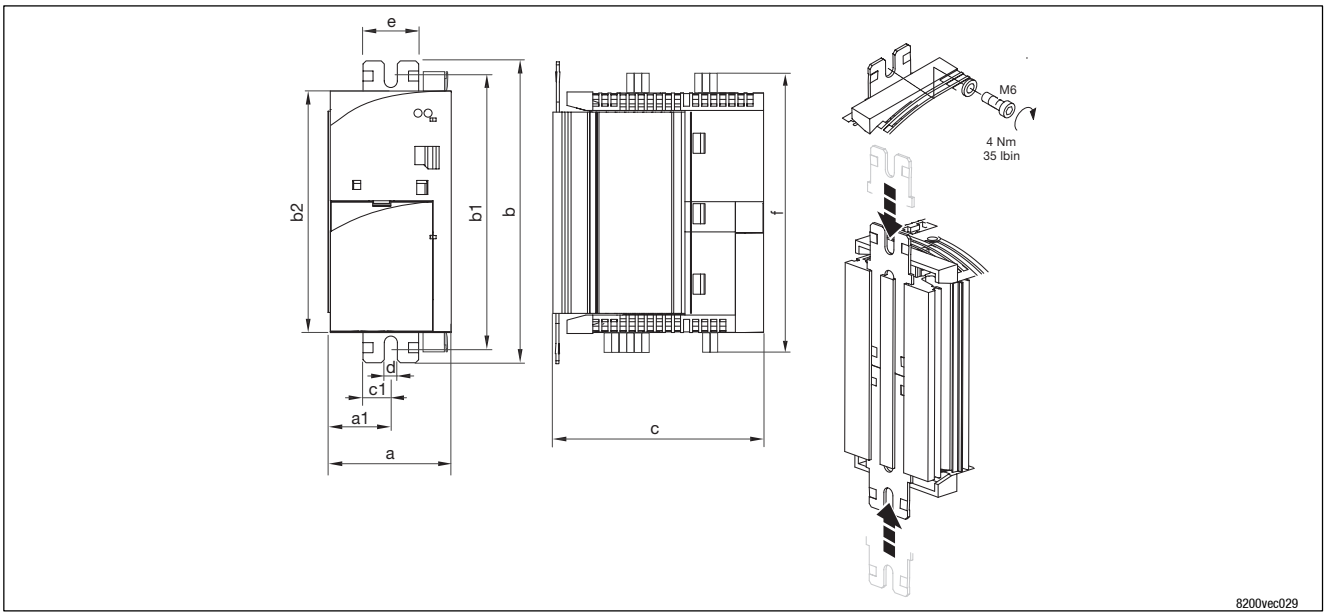


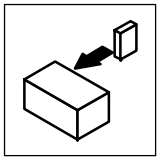
Fig. 4-13 Dimensions for mounting in ”Cold plate” technique 0.25 ... 2.2 kW

Dimensions in mm	a	a1	b	b1	b2	c	d	e	f
8200 vector									
E82CV251K2B E82CV371K2B	60	30	150	130 ... 140	120	106	6.5	27.5	148
E82CV551KxB E82CV751KxB			210	190 ... 200	180				208
E82CV152KxB E82CV222KxB			270	250 ... 260	240				268

Mounting

- Apply heat-conducting paste before you bolt together the cooler and the heatsink to keep the thermal resistance as low as possible.
- The quantity of heat-conducting paste supplied in the delivery package is sufficient for approx. 1000 cm^2.

1. Slide the mounting rails into the heatsink from the top and from the bottom
2. Clean the area of contact between the heatsink and the cooler with methylated spirits.
3. Apply a thin layer of heat-conducting paste.
4. Bolt the drive controller onto the cooler using two screws.



4.2 Electrical installation

4.2.1 Important notes

Stop!

The controller does not contain any electrostatically dangerous components!

Prior to assembly and service operations, the personnel must be free of electrostatic charge.

4.2.1.1 Protection of persons

Danger!

Before working on the controller check that no voltage is applied to the power terminals, the relay output and the pins of the FIF interface.

- Because the power terminals U, V, W, BR1, BR2 and the pins of the FIF interface remain live for at least 3 minutes after mains switch-off.
- Because the power terminals L1, L2, L3; U, V, W, +UG, -UG, BR1, BR2 and the pins of the FIF interface remain live when the motor is stopped.
- Because the relay outputs K11, K12, K14 can remain live when the controller is disconnected from the mains.

Use of e.l.c.bs (📖 4-18)

Pluggable terminal strips

All pluggable connection terminals must only be connected or disconnected when no voltage is applied!

Replace defective fuses

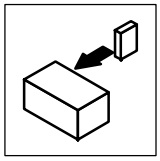
- Replace defective fuses with the prescribed type only when no voltage is applied.
- In DC-bus connection all controllers must be inhibited and disconnected from the mains.

Disconnect controller from the mains

Make a safety connection/disconnection between the controller and the mains only via a contactor on the input side.

4.2.1.2 Motor protection

- Almost entire protection against overload:
  – By overcurrent relays or temperature monitoring
  – We recommend PTC thermistors or thermal contacts to monitor the motor temperature. (Lenze three-phase AC motors are all equipped with thermal contacts (NC contacts)
  – PTCs or thermal contacts can be connected to the controller.
- Only use motors with an insulation suitable for inverter operation:
  – Insulation resistance: min. $\hat{u}$ = 1,5 kV, min. dv/dt = 5 kV/μs
  – Lenze-three-phase AC motors are designed for inverter operation.
  – If you want to use motors with an unknown insulation resistance, please contact your motor supplier.



4.2.1.3 Mains types/mains conditions

Please observe the restrictions of each mains type!

mains	Operation of the controllers	Notes
with earthed neutral (TT/TN mains)	No restrictions	Observe controller ratings
with insulated neutral (IT mains)	Possible, if the controller is protected in the event of an earth fault in the mains supply • by suitable equipment for detecting an earth fault and • the controller is disconnected directly from the mains	In the event of an earth fault at the inverter output, safe operation cannot be guaranteed.
DC supply via $+U_G/-U_G$	allowed if the DC voltage is symmetrical with PE	Controller will be destroyed if $+U_G$-conductor or $-U_G$-conductor are earthed.

4.2.1.4 Operation at a public mains (EN 61000-3-2)

The European Standard EN 61000-3-2 stipulates limit values for harmonic currents. Non-linear consumption (e.g. by frequency inverters) causes harmonic currents which 'interfere' the supplying mains. The standard helps to ensure the high quality of public mains systems and reduce mains load.

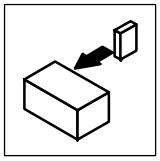
Tip!

The standard only applies to public mains systems. Mains systems which have their own transformer station as common in industry are not public. The standard does not apply to them.

If a machine or system consists of several components, the limit values apply to the entire machine or system.

If you observe all measures stated, the controllers do not exceed the limit values according to EN 61000-3-2. The machine/system manufacturer is responsible for the compliance with the regulations of the machine:

	Connection voltage	Power	Measure
8200 vector	**[V]**	**[kW]**	
E82EV251K2B	1/N/PE AC 230 V	0.25	Use assigned mains choke
E82EV371K2B		0.37	
E82EV551K2B		0.55	Use active filter (in preparation)
E82EV751K2B		0.75	
E82EV551K2B	3/PE AC 230 V	0.55	Use assigned mains choke
E82EV751K2B		0.75	
E82EV551K4B	3/PE AC 400 V	0.55	
E82EV751K4B		0.75	



4.2.1.5 Operation with e.l.c.bs (earth-leakage circuit breakers)

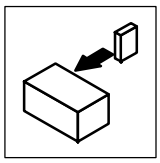
Danger!

The controllers are equipped with an internal mains rectifier. In the event of a short-circuit to frame, a DC fault current can prevent the activation of the AC-sensitive or pulse-current sensitive ELCB and thus block the protective function for all electrical equipment operated on this ELCB.

- We recommend the following to protect persons and animals (DIN VDE 0100):
  – Pulse-current sensitive e.l.c.bs in machines where controllers are connected to a single-phase mains (L1/N).
  – All-current sensitive e.l.c.bs in machines where controllers are connected to a three-phase mains (L1/L2/L3).
- E.l.c.bs must only be installed between mains supply and controller.
- E.l.c.bs can be activated although not wanted by
  – capacitive leakage currents of the cable shields during operation (especially with long, shielded motor cables),
  – simultaneous connection of several controllers to the mains supply,
  – use of additional RFI filters.
- The speciations for e.l.c.bs given in the chapter ”Technical data” apply to low-capacity and shielded motor cables (rough value):
  – E82EVxxxKxB without additional measures
  – E82EVxxxKxB200 with SD RFI filter

4.2.1.6 Interactions with compensation equipment

- Controllers only consume a very small fundamental reactive power from the AC mains. A compensation is therefore not necessary.
- If you operate the controllers at a mains with compensation equipment, the compensation equipment must be equipped with chokes.
  – Please consult the supplier of the compensation equipment.



4.2.1.7 Cable specifications

Power connections

- The cables used must comply with the approvals required for the application (e.g. UL).
- Use low-capacity motor cables. Capacitance per unit length:
  – Core/core ≤ 75 pF/m
  – Core/shield ≤ 150 pF/m
- Max. permissible motor cable length without additional measures (if you have to comply with EMC regulations, the permissible cable lengths can change).
  – Shielded: 50 m
  – Unshielded: 100 m

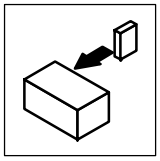
Control connection

- Control cables must always be shielded to avoid interference.

Shielded cables

The efficiency of shielded cables is determined by

- a good shield connection
  – a contact surface as large as possible
- a low resistance:
  – Only use screens with tin-plated or nickel-plated copper braids!
  – Shields of steel braid are not suitable.
- For the overlapping degree of the shield braid:
  – Min. 70 to 80 % with overlapping angle of 90°.



4.2.1.8 Wiring of terminal strips

The enclosed terminal strips are tested according to the specifications of the

- DIN VDE 0627:1986-06 (partially)
- DIN EN 60999:1994-04 (partially)

Checked and tested are, for instance, mechanical, electrical and thermal load, vibration, damage of conductors, loose conductors, corrosion, ageing.

Stop!

Proceed as follows to avoid damage of the contacts:

- Mount only when the controller is not connected to the mains.
- Wire the terminal strips before connecting them!
- Unused terminal strips must also be plugged in to protect the contacts.

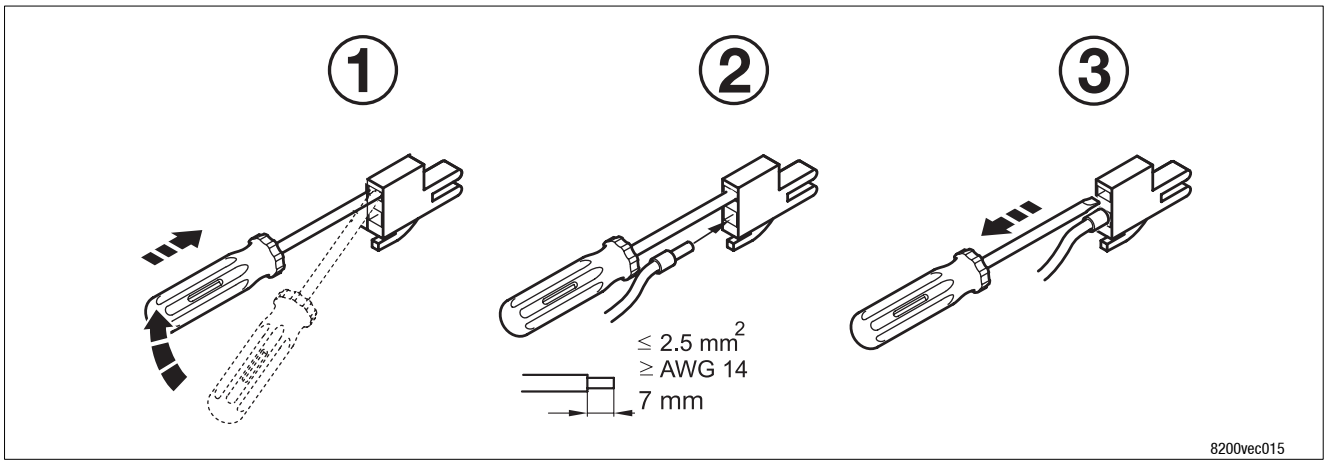
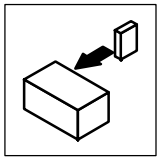


Fig. 4-14 Wiring of the terminals strips

Tip!

Wiring without wire end ferrules is always possible.



4.2.2 Installation according to EMC requirements

The electromagnetic compatibility (EMC) of a machine depends on the type of installation and care taken.

If you observe the following measures, you can assume that the machine will operate without any EMC problems caused by the drive system.

4.2.2.1 Assembly

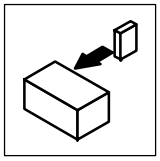
- Connect the frequency inverter and mains choke to the earthing mounting plate with a surface as large as possible:
  - Mounting plates with conductive surfaces (zinc-coated, cadmium-coated) ensure permanent contact.
  - If the mounting plate is painted, the paint must be removed.
  - Do not mount on DIN rails.
- If you use several mounting plates:
  - Connect as much surface as possible of the mounting plates (e.g. with copper bands).
- Ensure the separation of motor cable and signal or mains cable.
- Do not use the same terminal strip for mains input and motor output.
- Cable guides as close as possible to the reference potential. Unguided cables have the same effect as aerials.

4.2.2.2 Filters

- Only use RFI filters and main chokes assigned to the devices:
  - RFI filters reduce impermissible high-frequency interference to a permissible value.
  - Mains chokes reduce the r.m.s. current consumption of the inverter at the mains.

4.2.2.3 Shielding

- Use shielded, low-capacity motor cables. Capacitance per unit length:
  - Core/core ≤ 75 pF/m
  - Core/shield ≤ 150 pF/m
- Ensure a shield surface as large as possible with the mounting plate.
- If contactors, circuit breakers ore terminals are located in the motor cable:
  - Connect the shields of the connected cables also to the mounting plate, with a surface as large as possible.
- Connect the shield with PE in the motor terminal box:
  - Metal glands at the motor terminal box ensure a good connection of the shield and the motor housing.
- If the mains cable between RFI filter and frequency inverter is longer than 300 mm:
  - Shield mains cables.
  - Connect the shield of the mains cable to the mounting plate with a surface as large as possible.
- If you use a brake resistor:
  - Connect the shield of the brake resistor cable to the mounting plate with a surface as large as possible.
- If you use controllers in DC-bus operation:
  - Shield the cables between frequency inverter (+UG/-UG) and the neutral point of the DC bus.
  - Connect both shield ends to the mounting plate with a surface as large as possible.
- Shield the control cables:
  - Connect both shield ends of the control cables.



4.2.2.4 Earthing

- Earth all components (controller, RFI filter, motor filter, mains choke) using suitable cables connected to a central point (PE).
- Do not exceed the defined minimum cross-sections:
  – For EMC the cable surface and the contact are important, i.e. use large cross-sections (surfaces).

4.2.2.5 Radio interference suppression according to EN 55011

Internal switching processes in controllers cause interferences which can impair the functionality of other devices.

The EN 55011 stipulates limit values for interferences depending on the application site.

Limit value class A	The limit value class is often required for industrial mains systems which are separated from mains systems in residential areas.
Limit value class B (comprises limit value class A)	If frequency inverters are operated in residential areas, other devices can be interfered (e.g. radios, television sets). These applications often require limit value class B, EN 55011. The values are much lower than for limit value class A.

The 8200 vector frequency inverter has two different options for radio interference suppression:

8200 vector frequency inverter with integrated EMC filter (types E82EVxxxKxB)

- Compliance with limit value classes A and B to EN 55011 without additional measures (limit value class B type dependent over the power range 3 ... 11 kW).
- The maximum motor cable length depends on the limit value class, the 8200 vector type and the chopper frequency. For longer motor cable lengths (e. g. > 20 m with limit value class A) we recommend to use types E82EVxxxKxB200 in combination with a subassembly filter.

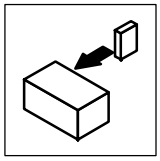
8200 vector frequency inverter without EMC filter (types E82EVxxxKxB200)

- Compliance with limit value classes A and B to EN 55011 with subassembly filters for long motor cables.
- You can choose from two different filter types:
  – SD RFI filters (short distance) for motor cable lengths up to 20 m. SD RFI filters are also suitable for operation at a 30 mA e.l.c.b. (📖 4-18)
  – LD RFI filters (long distance) for motor cables up to 50 m. If you want to use longer motor cables, the LD RFI filter can be combined with a motor filter.

			Maximum permissible motor cable length when using a subassembly RFI filter.					
			SD [1]		**LD**		**LD + motor filter [2]**	
		Limit value class	A	B	A	B	A	B
8200 vector	**Mains**	**Power**						
E82EVxxxKxB200	230 V 400 V	0.25 ... 11 kW	20 m	20 m	50 m	50 m	200 m	100 m

1) SD RFI filters are suitable for operation at a 30 mA e.l.c.b. (motor cable length approx. 10 m)

2) Operation is only permitted with a 8 kHz chopper frequency, V/f characteristic control, a maximum output frequency of 480 Hz. The motor cable does not have to be shielded.



4.2.2.6 Principle layout in the control cabinet

8200 vector 0.25 ... 2.2 kW

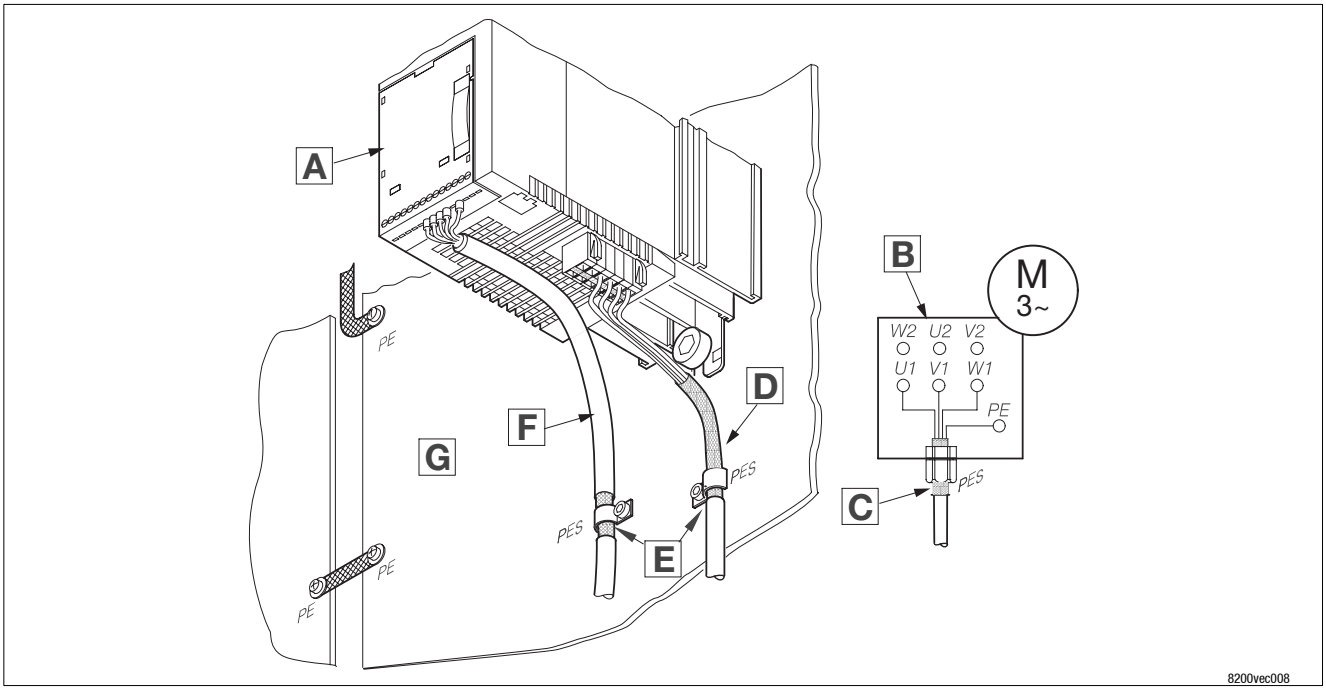
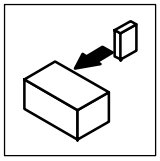


Fig. 4-15 Installation of 8200 vector 0.25 ... 2.2 kW according to EMC standards

Control cables and mains cables must be separated from the motor cable to avoid interferences.	
A	Function module (option)
B	Star or delta connection as indicated on the motor nameplate
C	EMC-cable connector (not included in the delivery package)
D	Shielded motor cable, low-capacity (core/core ≤ 75 pF/m; core/shield ≤ 150 pF/m)
E	Connect the cable shield to PE with a surface as large as possible (PES). Use enclosed clamps.
F	Control cable (optional) - always shield control cables
G	Mounting plate with electrically conductive surface



Installation

Electrical installation - Installation according to EMC requirements

8200 vector 3 ... 11 kW

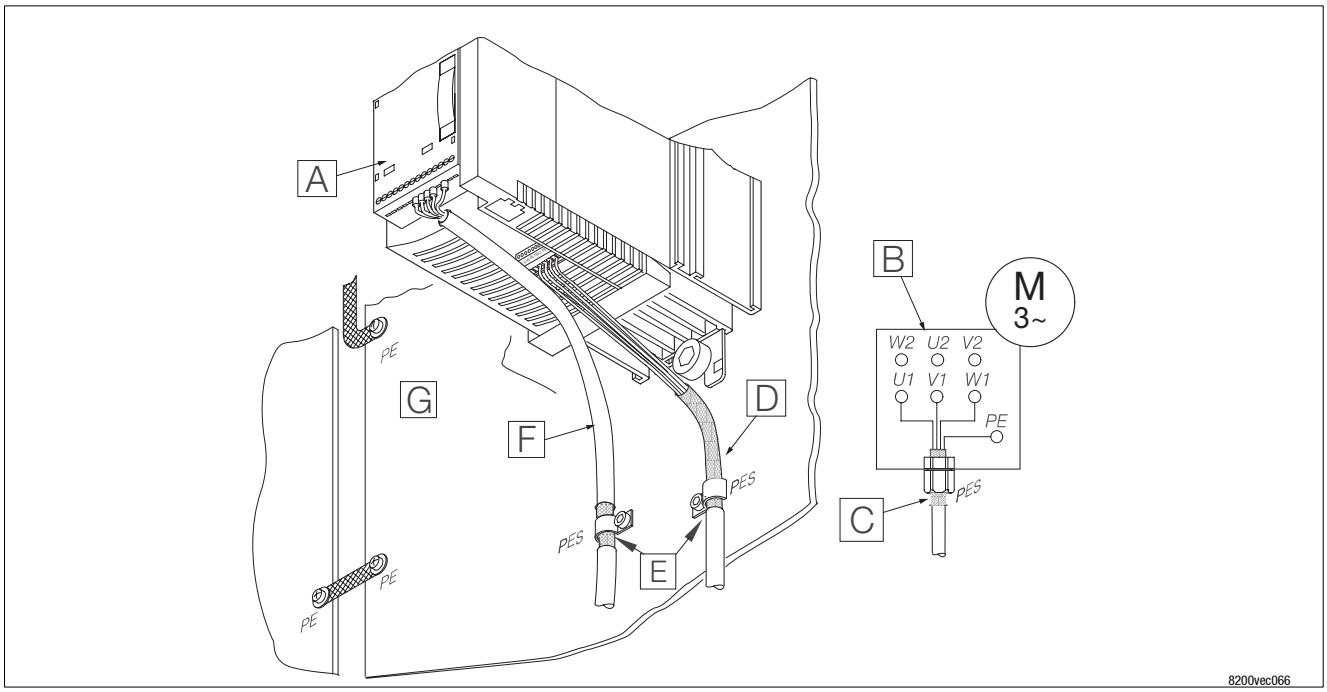


Fig. 4-16 Installation of 8200 vector 3 ... 11 kW according to EMC standards

Control cables and mains cables must be separated from the motor cable to avoid interferences.	
A	Function module (option)
B	Star or delta connection as indicated on the motor nameplate
C	EMC-cable connector (not included in the delivery package)
D	Shielded motor cable, low-capacity (core/core ≤ 75 pF/m; core/shield ≤ 150 pF/m)
E	Connect the cable shield to PE with a surface as large as possible (PES). Use enclosed clamps.
F	Control cable (optional) - always shield control cables
G	Mounting plate with electrically conductive surface

4.2.3 Power connections

4.2.3.1 Mains connection 230/240 V

Stop!

- Controller type E82EVxxxK **2B** must only be connected to a mains voltage of 1/N/PE AC 180 ... 264 V or 3/PE AC 100 ... 264 V. Higher mains voltages will destroy the controller!
- The discharge current to PE is > 3.5 mA. EN 50178 requires a fixed installation. Double PE connection required.

8200 vector 0.25 ... 2.2 kW

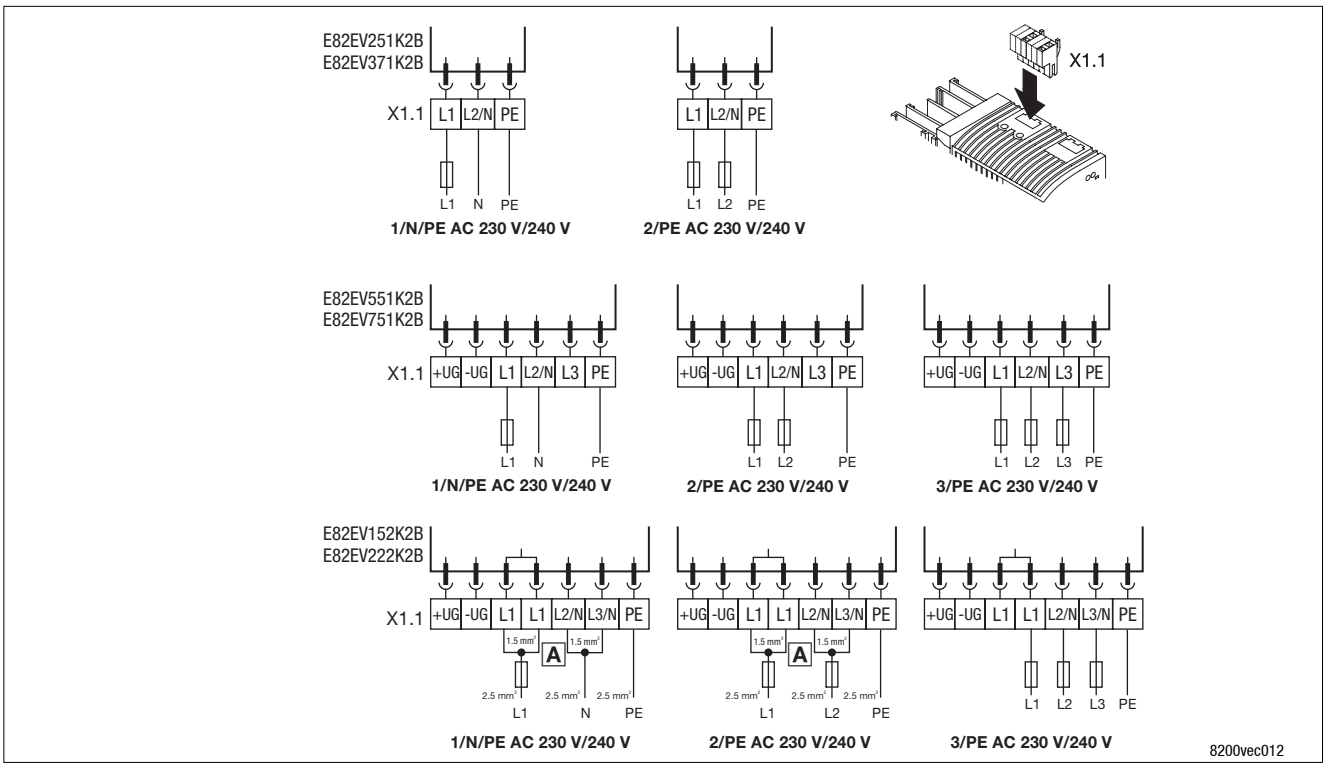
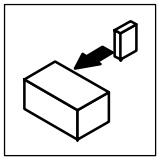


Fig. 4-17 Mains connection 230/240 V 0.25 ... 2.2 kW

E82EV222K2B	Operation only with mains choke
A	Use two separate cables 1.5 mm² to connect the terminals!
X1.1/+UG, X1.1/-UG	DC supply (DC-bus operation - see Operating Instructions)



Installation

Electrical installation - Power connections

8200 vector 3 ... 7.5 kW

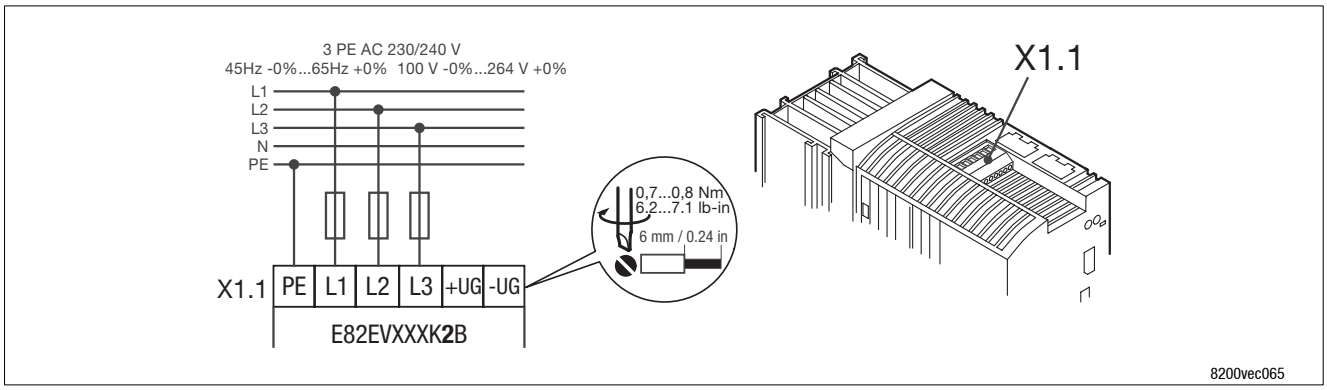


Fig. 4-18 Mains connection 230/240 V 3 ... 7.5 kW

E82EV752K2B	Operation only with mains choke
X1.1/+UG, X1.1/-UG	DC supply (DC-bus operation - see Operating Instructions)

4.2.3.2 Mains connection 400/500 V

8200 vector 0.55 ... 2.2 kW

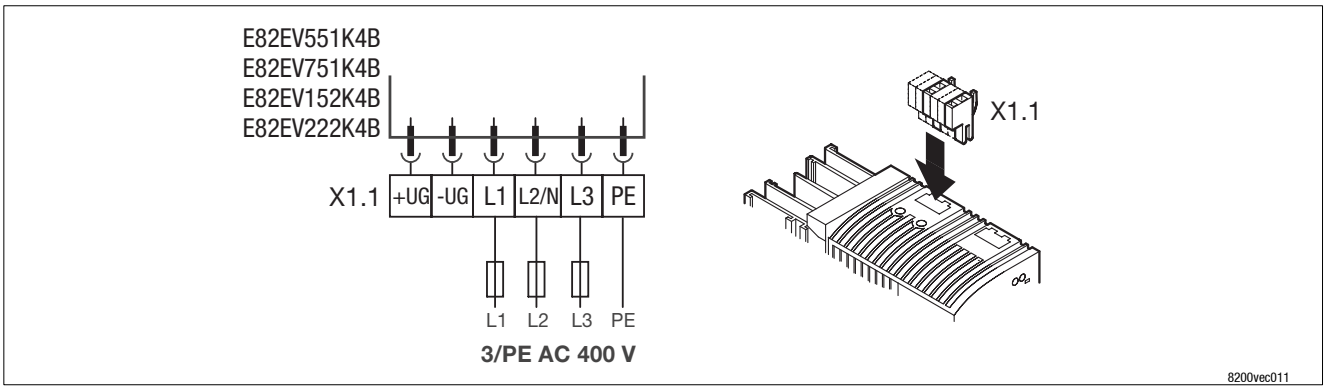


Fig. 4-19 Mains connection 400/500 V 0.55 ... 2.2 kW

X1.1/+UG, X1.1/-UG	DC supply (DC-bus operation - see Operating Instructions)

8200 vector 3 ... 11 kW

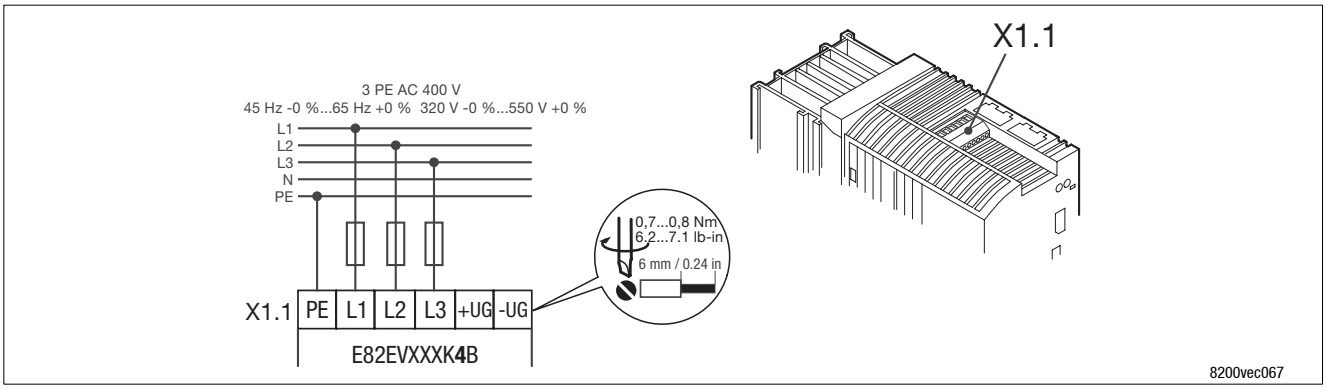
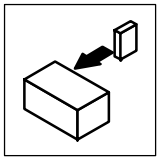


Fig. 4-20 Mains connection 400/500 V controller 3 ... 11 kW

X1.1/+UG, X1.1/-UG	DC supply (DC-bus operation - see Operating Instructions)



4.2.3.3 Motor connection/external brake resistor

Danger!

- After the connection of a PTC thermistor or thermal contact all control terminals only have a basic insulation (single isolating distance).
- Protection against contact in the event of a defective insulating distance can only be ensured by external measures (e.g. double insulation).

8200 vector 0.55 ... 2.2 kW

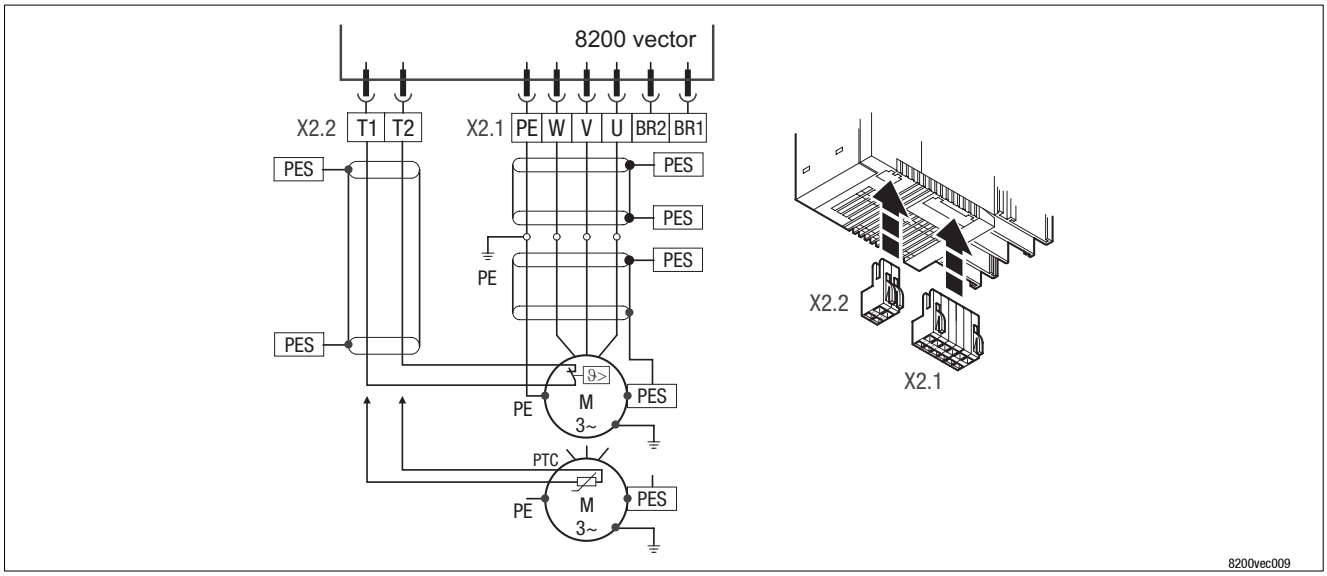


Fig. 4-21 Motor connection 0.25 ... 2.2 kW

	Use low-capacity motor cables! (Core/core ≤ 75 pF/m, core/shield ≤ 150 pF/m) The shorter the motor cables, the better the drive response!
PES	HF-screen end by PE connection through screen bracket. or EMC cable connection.
X2.1/PE	Earthing of the 8200 vector at the output side
X2.1/BR1, X2.1/BR2	Connection terminals for the brake resistor (For information about the operation with brake resistor see the Operating Instructions)
X2.2/T1, X2.2/T2	Connection terminals motor temperature monitoring through PTC thermistors or thermal contacts **Activate motor temperature monitoring under C0119 (e. g. C0119 = 1)!**

Cable cross-sections U, V, W, PE						
Type	mm^2	AWG		Type	mm^2	AWG
E82EV251K2B / E82EV371K2B	1	18				
E82EV551K2B / E82EV751K2B	1	18		E82EV551K4B / E82EV751K4B	1	18
E82EV152K2B / E82EV222K2B	1.5	16		E82EV152K4B / E82EV222K4B	1.5	16

8200 vector 3 ... 11 kW

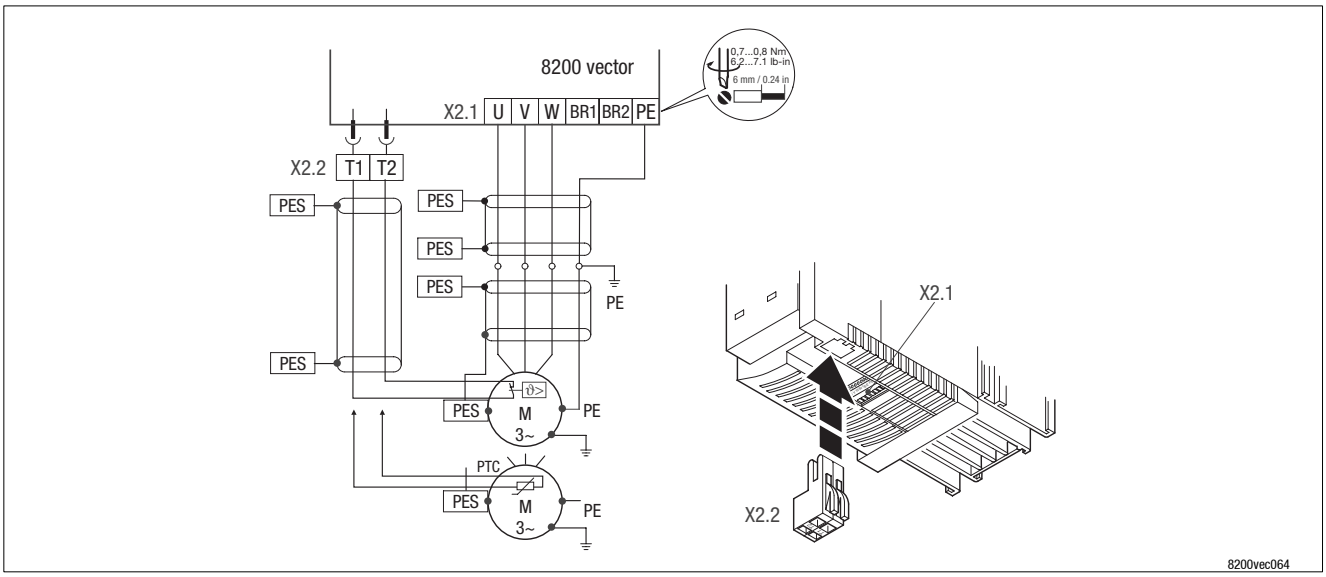
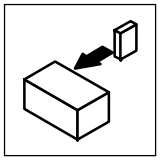


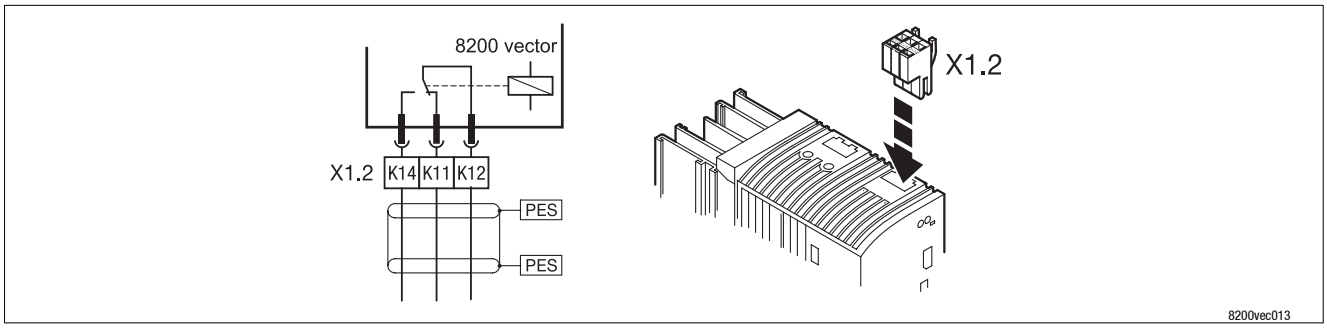
Fig. 4-22 Motor connection 3 ... 11 kW

	Use low-capacity motor cables! (Core/core ≤ 75 pF/m, core/shield ≤ 150 pF/m) The shorter the motor cables, the better the drive response!
PES	HF-screen end by PE connection through screen bracket. or EMC cable connection.
X2.1/PE	Earthing of the 8200 vector at the output side
X2.1/BR1, X2.1/BR2	Connection terminals for the brake resistor (For information about the operation with brake resistor see the Operating Instructions)
X2.2/T1, X2.2/T2	Connection terminals motor temperature monitoring through PTC thermistors or thermal contacts **Activate motor temperature monitoring under C0119 (e. g. C0119 = 1)!**

Cable cross-sections U, V, W, PE						
Type	mm^2	AWG		Type	mm^2	AWG
E82EV302K2B	2.5	12		E82EV302K4B	1	16
E82EV402K2B	4	10		E82EV402K4B	1.5	14
E82EV552K2B	6	10		E82EV552K4B	2.5	12
E82EV752K2B	6	10		E82EV752K4B	4	10
				E82EV113K4B	4	10



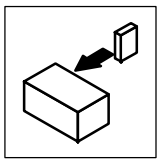
4.2.4 Relay output connection



	Function	Relay setting switched	Message (Lenze setting)	Technical data
X1.2/K11	Relay output normally-closed contact	opened	TRIP	AC 250 V/3 A DC 24 V/2 A ... DC 240 V/0.22 A
X1.2/K12	Mid position contact			
X1.2/K14	Relay output - normally-open contact	closed	TRIP	
PES	HF-screen end by PE connection through screen bracket.			

Tip!

- A connection of the relay output is not required for operation!
- The output message can be changed under C0008 or C0415/1.
- The relay output can also be used to control a holding brake at a motor.



4.2.5 Control connections

The basic controller version is not equipped with control terminals. The controllers can be equipped with control terminals by using different I/O function module for the FIF interface.

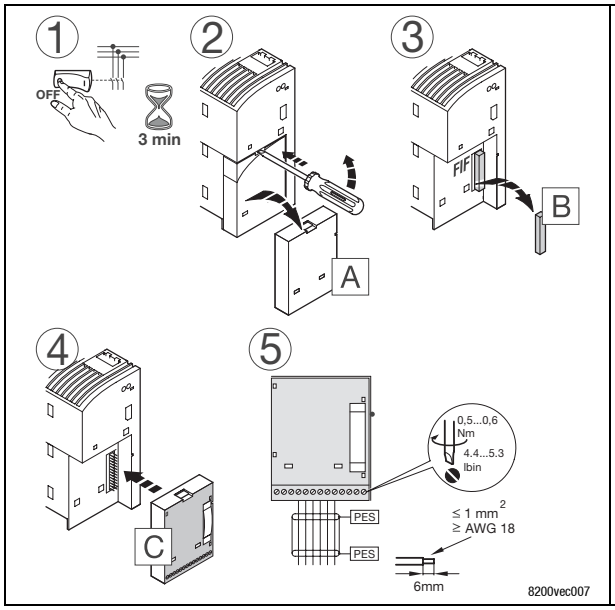
4.2.5.1 Mounting/dismounting of I/O function modules

Mounting

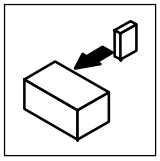
Danger!

The pins of the FIF interface carry dangerous voltage!

- Mount/dismount the function module only when the controller is disconnected from the mains.
- After disconnection from the mains wait for at least 3 minutes before you start working on the module.



1. **Disconnect the controller from the mains and wait for at least 3 minutes!**
2. Remove and store A dummy cap.
3. Remove and keep B FIF cover.
4. Plug the function module C onto the FIF interface.



Installation

Electrical installation - Control connections

Disassembly

Dismount the function module only if it is absolutely necessary (e.g. when the controller is replaced).

The pin strip which is used to connect the function module is part of the contact system of the controller. It has not been designed for repeated connection and disconnection of the function module.

Danger!

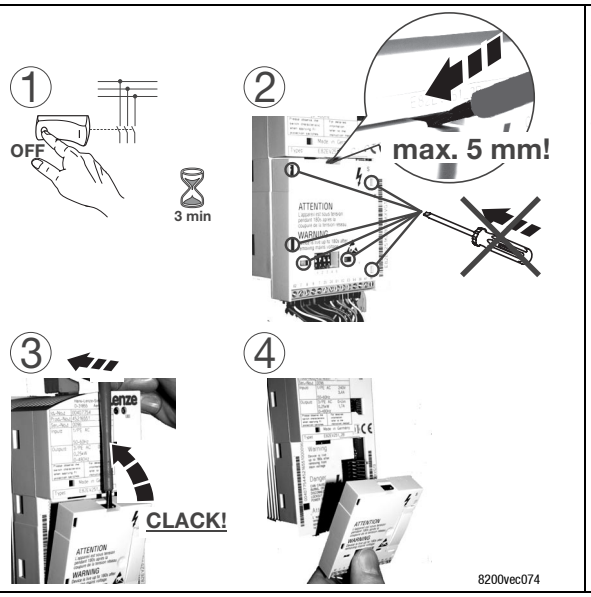
The pins of the FIF interface carry dangerous voltage!

- Dismount the function module only when the controller is disconnected from the mains.
- After disconnection from the mains wait for at least 3 minutes before you start working on the module.

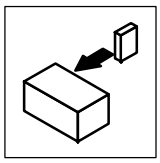
Stop!

The function module can be damaged when being dismounted. Therefore observe the following:

- The screw driver must only be inserted into the hole at the top of the function module (see figure, next page). The screw driver must not be inserted more than 5 mm.
- Never use the screw driver with any other holes of the function module!



1. **Disconnect the controller from the mains and wait for at least 3 minutes!**
2. Insert the screw driver max. 5 mm into the hole at the top of the function module.
3. Press the screw driver up to unlatch the function module. Press until you hear a snap noise.
4. Cautiously remove the function module from the controller using the screw driver.

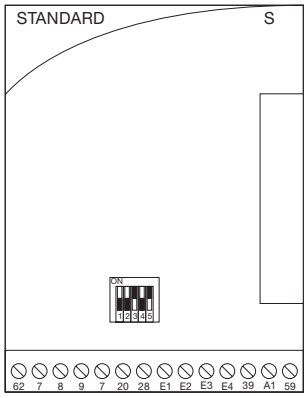
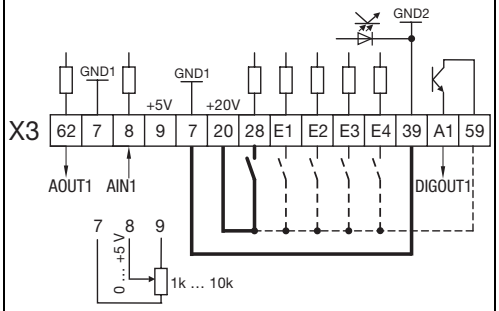
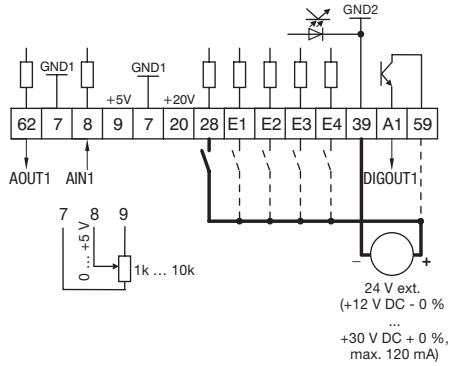


4.2.5.2 Terminal assignment - Standard I/O E82ZAFS

The device is wired using a terminal strip which is integrated into the module.

Stop!

Shield control cables to avoid interferences!

	Internal voltage supply X3/20 (+20 V DC, max. 40 mA)	External voltage supply + 24 V DC (+12 V DC - 0 % ... +30 V DC + 0 %, max. 120 mA)
		

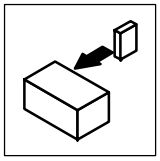
Min. wiring required for operation

Screw terminal data		
Max. cable cross-sections		Tightening torques
rigid	flexible	
1.5 mm² (AWG 16)	1.0 mm² (AWG 18) 0.5 mm² (AWG 20) 0.5 mm² (AWG 20)	0.5 ... 0.6 Nm (4.4 .. 5.3 lb-in)

Configuration of analog signals via DIP switch						
Signal to X3/8	Switch position					C0034
	1	2	3	4	5	
0 ... +5 V	OFF	OFF	ON	OFF	OFF	0
0 ... +10 V (Lenze setting)	**OFF**	**OFF**	**ON**	**OFF**	**ON**	**0**
0 ... 20 mA	OFF	OFF	ON	ON	OFF	0
4 ... 20 mA	OFF	OFF	ON	ON	OFF	1
4 ... 20 mA Open-circuit monitoring	OFF	OFF	ON	ON	OFF	3
-10 V ... +10 V	ON	ON	OFF	OFF	OFF	2

Tip!

- DIP switch and C0034 must be set for the same range, otherwise the controller cannot interprete the analog signal to X3/8 correctly.
- If a setpoint potentiometer is internally supplied through X3/9, the DIP switch must be set for a voltage range of 0 ... 5 V. Otherwise not the whole speed range can be provided.



Installation

Electrical installation - Control connections

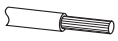
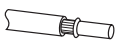
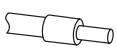
Terminal assignment						
X3	**Signal type**	**Function (bold = Lenze setting)**	**level**			**Technical data**
8	Analog input	Act. or setpoint input (Use DIP switch and C0034 to change the range!)	0 ... +5 V **0 ... +10 V** -10 V ... +10 V [1] 0 ... +20 mA +4 ... +20 mA +4 ... +20 mA (open-circuit monitored)			Resolution: 10 bit Linearity error: ±0.5 % Temperature error: 0.3 % (0 ... +60°C) Input resistance: • Voltage signal: > 50 kê • • Current signal: 250 ê •
62	Analog output	**Output frequency**	0 ... +10V			Resolution: 10 bit Linearity error: ±0.5 % Temperature error: 0.3 % (0 ... +60°C) Load capacity: max. 2 mA
28	Digital inputs	Controller inhibit (CINH)	1 = START			Input resistance: 3.3 kΩ 1 = HIGH (+12 ... +30 V) 0 = LOW (0 ... +3 V) (PLC level, HTL)
E1 [2]		**Activation of JOG values** **JOG1 = 20 Hz** **JOG2 = 30 Hz** **JOG3 = 40 Hz**		E1	E2	
			JOG1	1	0	
E2			JOG2	0	1	
			JOG3	1	1	
E3		**DC brake (DCB)**	1 = DCB active			
E4		**Change of direction of rotation** **CW/CCW rotation**		E4		
			CW	0		
			CCW	1		
A1	Digital output	**Ready for operation**	0/+20 V at DC internal 0/+24 V at DC external			Load capability: 10 mA 50 mA
9	-	Internal, stabilized DC voltage supply for setpoint potentiometer	+5.2 V (ref.: X3/7)			Load capacity: max. 10 mA
20	-	Internal DC voltage supply for control of digital inputs and output	+20 V (ref.: X3/7)			Load capacity: max. 70 mA (sum of all output currents)
59	-	DC supply for A1	+20 V (internal, bridge to X3/20)			
			+24 V (external)			
7	-	GND1, reference potential for analog signals	-			isolated to GND2
39	-	GND2, reference potential for digital signals	-			isolated to GND1

1) Offset (C0026) and gain (C0027) must be adjusted separately for every function module.
Repeat the adjustment if the function module has been exchanged or the default setting has been loaded

2) or frequency input 0 ... 10 kHz, configuration under C0425

4.2.5.3 Terminal assignment - standard I/O PT E82ZAFS100

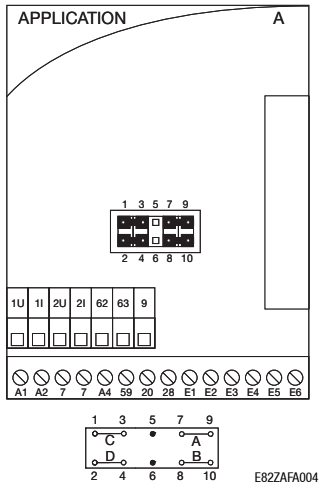
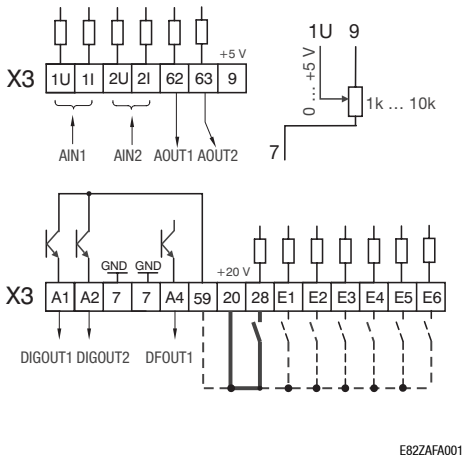
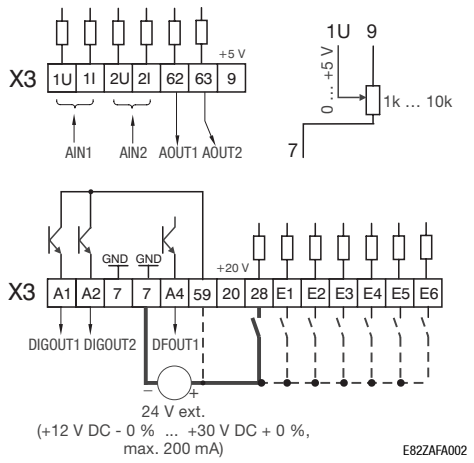
- The device is wired using an attachable terminal block for larger cable cross-sections. The function module stands out approx. 13 mm because of the attachable terminal block.
- The standard I/O PT is wired like the standard I/O.
- Please note: The standard I/O PT has got one terminal 7 (GND1) only.

Screw terminal data		
Max. cable cross-sections		**Tightening torques**
rigid	**flexible**	
 1.5 mm² (AWG 16)	 1.5 mm² (AWG 16)  1.5 mm² (AWG 16)  0.5 mm² (AWG 20)	0.5 ... 0.6 Nm (4.4 .. 5.3 lb-in)

4.2.5.4 Terminal assignment - Application I/O E82ZAFA

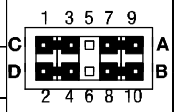
Stop!

Shield control cables to avoid interferences!

	Internal voltage supply X3/20 (+20 V DC, max. 70 mA)	Supply via external voltage source + 24 V DC (+12 V DC - 0 % ... +30 V DC + 0 %, max. 200 mA)
		
		Min. wiring required for operation

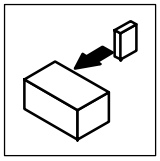
Screw terminal data		
Max. cable cross-sections		Tightening torques
rigid	flexible	
1.5 mm² (AWG 16)	1.0 mm² (AWG 18) 0.5 mm² (AWG 20) 0.5 mm² (AWG 20)	0.5 ... 0.6 Nm (4.4 .. 5.3 lb-in)

Configuration of analog signals via jumper



		Possible levels [1]		
Analog inputs		0 ... +5 V	**0 ... +10 V**	-10 V ... +10 V
X3/1U (Voltage input 1, AIN1)	Jumper A Code	7 - 9: free C0034/1 = 0	**7 - 9** **C0034/1 = 0**	7 - 9 C0034/1 = 1
X3/2U (Voltage input 2, AIN2)	Jumper B Code	8 - 10: free C0034/2 = 0	**8 - 10** **C0034/2 = 0**	8 - 10 C0034/2 = 1
		0 ... 20 mA	4 ... 20 mA	4 ... 20 mA (open-circuit monitored)
X3/1I (Current input 1, AIN1)	Jumper A, B Code	optional C0034/1 = 2	optional C0034/1 = 3	optional C0034/1 = 4
X3/2I (Current input 2, AIN2)	Jumper A, B Code	optional C0034/2 = 2	optional C0034/2 = 3	optional C0034/2 = 4
Analog outputs		**0 ... +10 V**	0 ... 20 mA	4 ... 20 mA
X3/62 (Analog output 1, AOUT1)	Jumper C Code	**1 - 3** **C0424/1 = 0**	3 - 5 C0424/1 = 0	3 - 5 C0424/1 = 1
X3/62 (Analog output 2, AOUT2)	Jumper D Code	**2 - 4** **C0424/2 = 0**	4 - 6 C0424/2 = 0	4 - 6 C0424/2 = 1

[1] Printed in bold: Status as delivered



Installation

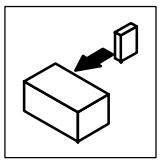
Electrical installation - Control connections

Tip!

- Jumper and C0034 must be set for the same range, otherwise the controller cannot interprete the analog signal to AIN1 and AIN2 correctly.
- If a setpoint potentiometer is internally supplied via X3/9, set the jumper for a voltage range between 0 and 5 V. Otherwise not the whole speed range can be provided.

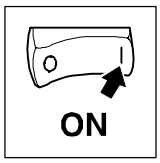
Terminal assignment						
X3/	**Signal type**	**Function (**bold = **Lenze setting)**	**level**			**Technical data**
1U/2U	Analog inputs	Actual or setpoint inputs (master voltage) User jumper and C0034 to change range	0 ... +5 V **0 ... +10 V** -10 V ... +10 V			Resolution: 10 bit Linearity fault: ± 0.5 % Temperature fault: 0.3 % (0 ... +60 °C) Input resistance • Voltage signal: > 50 k Ω • Current signal: 250 Ω
1I/2I		Actual or setpoint inputs (master current) User jumper and C0034 to change range	0 ... +20 mA +4 ... +20 mA +4 ... +20 mA (open-circuit monitored)			
62	Analog outputs	**Output frequency**	**0 ... +10 V** 0 ... +20 mA 4 ... +20 mA			Resolution: 10 bit Linearity error: ±0.5 % Temperature error: 0.3 % (0 ... +60 °C) Load capacity (0 ... +10 V): max. 2 mA R_L (0/4... 20 mA) ≤ 500 Ω
63		**Motor current**				
28	Digital inputs	Controller inhibit (CINH)	1 = START			Input resistance: 3 kΩ 1 = HIGH (+12 ... +30 V) 0 = LOW (0 ... +3 V) (PLC level, HTL)
E1[1)]		**Activation of JOG values** **JOG1 = 20 Hz** **JOG2 = 30 Hz** **JOG3 = 40 Hz**		E1	E2	
E2[1)]			JOG1	1	0	
			JOG2	0	1	
			JOG3	1	1	
E3		**DC-injection brake (DCB)**	1 = DCB			
E4		**Change of direction of rotation** **CW/CCW rotation**		E4		
			CW	0		
			CCW	1		
E5		**not prefabricated**	-			
E6		**not prefabricated**	-			
A1	Digital outputs	**Ready for operation**	0/+20 V at DC internal 0/+24 V at DC external			Load capability: 10 mA 50 mA
A2		**not prefabricated**				
A4	Frequency output	**DC bus voltage**	HIGH: +18 V ... +24 V (HTL) LOW: 0 V			50 Hz ...10 kHz Load capacity: max. 8 mA
9	-	Internal, stabilised DC voltage supply for setpoint potentiometer	+5.2 V			Load capacity: max. 10 mA
20	-	Internal DC voltage supply for control of digital inputs and output	+20 V			Load capacity: max. 70 mA
59	-	DC supply for X3/A1 and X3/A2	+20 V (internal, bridge to X3/20)			
			+24 V (external)			
7	-	GND, reference potential	-			

[1)] or frequency input 0 ... 100 kHz, single or two track, configuration via C0425



4.2.5.5 Wiring - Bus function module

- System bus (CAN): (📖 9-2)
- For all other bus function modules (e. g. PROFIBUS-DP, INTERBUS, ...) see the corresponding Mounting and Operating Instructions.



5 Commissioning

5.1 Before you start

Tip!

- The controller is default set to drive the following matching four-pole asynchronous standard motors:
  – 230/400 V, 50 Hz
  – 280/480 V, 60 Hz
  – 400 V, 50 Hz
- Keep to the switch-on sequence. (📖 5-7)
- In the event of faults or errors during commissiong, see chapter ”Troubleshooting and fault elimination”: (📖 8-1)

Check ...

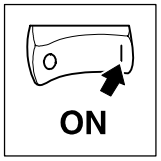
... before connecting the controller to the voltage supply

- Check the wiring for completeness, short circuit and earth fault
- If you do not use a function module (as delivered):
  – Is the FIF cover mounted?
- If you use the internal voltage source X3/20 of the standard I/O:
  – Are the terminals X3/7 and X3/39 bridged?

... the setting of the main drive parameters before enabling the controller

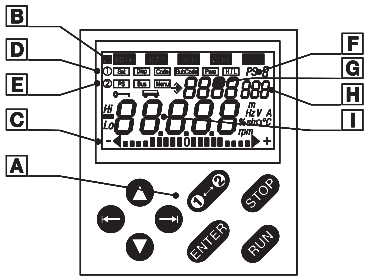
- Is the V/f rated frequency adapted to the motor connection? (📖 7-4)
- Is the configuration of the analog inputs and outputs adapted to the wiring? (📖 7-38)
- Is the configuration of the digital inputs and outputs adapted to the wiring? (📖 7-45)
- Are the drive parameters relevant for your application set correctly?

If necessary, use the keypad or PC to adapt them. (📖 6-1 ff)



5.2 Parameter setting using the keypad

The keypad is available as accessory. A full description can be obtained from the information included in the keypad delivery.

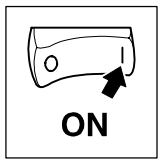


A	Function keys	
B	Status display	
C	Bargraph display	
D	Function bar 1	
E	Function bar 2	
F	Parameter set	Changes possible when lamp is blinking
G	Code number	
H	Subcode number	
I	Parameter value with unit	

5.2.1 Menu structure

All parameters for controller setting or monitoring are saved in codes under the menus USEr and ALL. The codes have numbers G and are abbreviated in the text with a "C" before the number. Some codes store the parameters in numerical "subcodes" H to ensure that parameter setting is clearly structured (example: C0517 menu USEr).

- The menu USEr
  - is active after every mains switching or keypad attachment during operation.
  - contains all codes for a standard application with linear V/f characteristic control (Lenze setting).
  - can be modified as required under C0517.
- The menu ALL
  - contains all codes.
  - shows a list of all codes in ascending order.
- The change between USEr and ALL and how to change parameters in the codes is described on the following pages.



5.2.2 The menu USEr - The 10 most important drive parameters

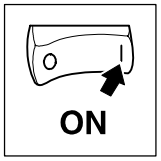
After mains switching or plugging in the keypad during operation, the 10 codes defined to be the most important in the user menu USEr (Code C0517) are available immediately.

In default setting the menu contains USEr all codes required for a standard application with linear V/f characteristic control.

Code	Name	Lenze setting				
C0050	Output frequency		Display: Output frequency without slip compensation			
C0034	Setpoint selection range	-0-	Standard I/O	X3/8: 0 ... 5 V / 0 ... 10 V / 0 ... 20 mA		
			Application I/O	X3/1U: 0 ... 5 V / 0 ... 10 V X3/2U: 0 ... 5 V / 0 ... 10 V		
C0007	Fixed configuration of digital inputs	-0-	E4	E3	E2	E1
			CW/CCW	DCB	JOG2/3	JOG1/3
			CW/CCW rotation	DC-injection brake	Selection of fixed setpoints	
C0010	Minimum output frequency	0.00 Hz				
C0011	Maximum output frequency	50.00 Hz				
C0012	Acceleration time main setpoint	5.00 sec				
C0013	Deceleration time main setpoint	5.00 sec				
C0015	V/f rated frequency	50.00 Hz				
C0016	U_{min} boost	depending on the inverter type				
C0002	Parameter set transfer/reset	see code table (📖 14-9)				

Tip!

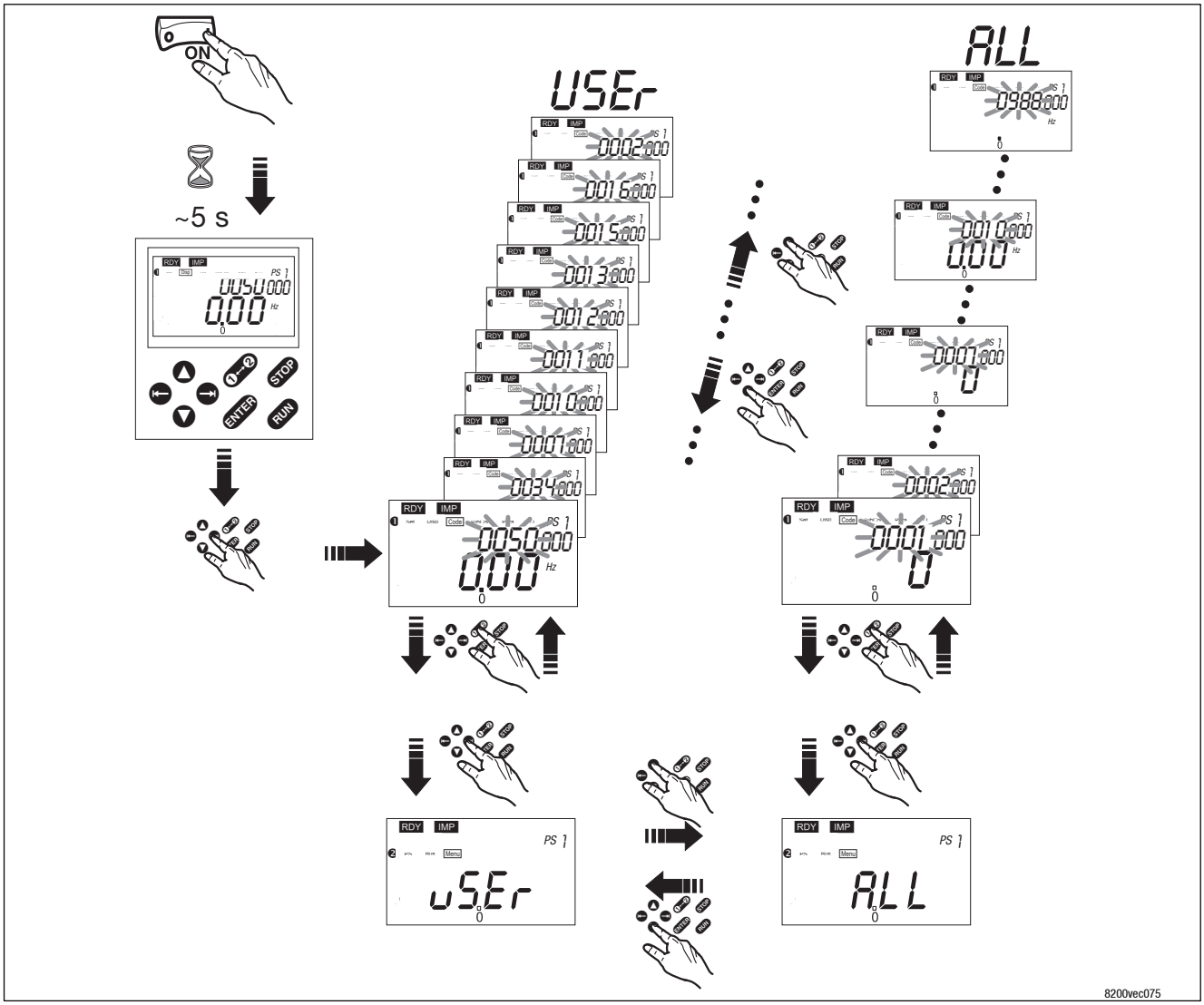
Use C0002 "Parameter set transfer" to easily transfer configurations from one controller to the other or to reset the controller to Lenze settings.



Commissioning

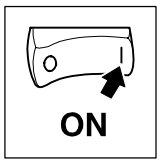
Parameter setting using the keypad

5.2.3 Change between the menus *USEr* and *ALL*



5.2.4 Parameter change in menus

Step		Keys	Display	Note	Example	
1.	Controller inhibit	STOP	RDY IMP	Only necessary if you want to change codes marked with "[ ]" in the code table, e. g. [C0002]. All other parameters can be changed during operation.		
2.	Set parameters	←→	Code			Reduce C0012 (acceleration time) from 5.00 s to 1.00 s
3.		▲	*XXXX*	Select code	*0012*	
4.		→	SubCode *001*	For codes without subcodes: Jump to Para (and then 6.)		
5.		▼▲	*XXX*	Select subcode		
6.		→	Para		*5.00* s	
7.		▼▲	*XXXXX*	Set parameters	*1.00* s	
8.		ENTER	*STOrE*	Acknowledge entry if → blinking		
		←		Acknowledge entry if → is not blinking; ENTER is not active		
9.				Restart the "loop" at 2. to set other parmeters.		



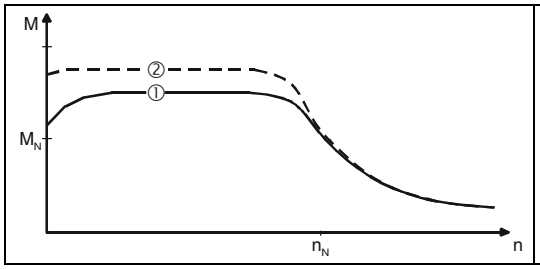
5.3 Selection of the correct control mode

The following table helps you to find the correct control mode for standard applications. You can choose between V/f characteristic control, vector control and sensor torque control:

V/f characteristic control is the classic control mode for standard applications.

The vector control provides better control features than the V/f characteristic control because of:

- a higher torque over the whole speed range
- higher speed accuracy and smooth running features
- higher efficiency

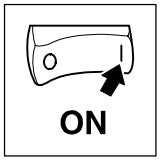


① V/f characteristic control
② Vector control

Tip!

The parameters for the corresponding control mode are to be set as follows:

- for linear V/f characteristic control in menu *USEr*
- for square-law V/f characteristic control, vector control or sensorless torque in menu *ALL*

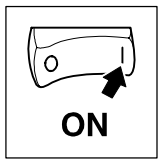


Commissioning

Selection of the correct control mode

Application	Operating mode	
	C0014	
Stand-alone drives	**recommended**	**alternatively**
with extremely alternating loads	-4-	-2-
with heavy start conditions	-4-	-2-
with speed control (speed feedback)	-2-	-4-
with high dynamic response (e. g. positioning and infeed drives)	-2-	-
with torque setpoint	-5-	-
with torque limitation (power control)	-2-	-4-
three-phase AC reluctance motors	-2-	-
three-phase sliding rotor motors	-2-	-
three-phase motors with fixed frequency-voltage characteristic	-2-	-
Pump and fan drives with square-law load characteristic	-3-	-2- / -4-
Group drives (several motors connected to controller)		
identical motors and identical loads	-2-	-
different motors and/or changing loads	-2-	-

C0014 = -2-: linear V/f characteristic control
C0014 = -3-: square-law V/f characteristic control
C0014 = -4-: vector control
C0014 = -5-: sensorless torque control



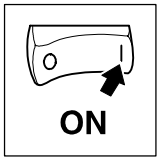
5.4 Commissioning - V/f characteristic control

5.4.1 Commissioning without function module

Stop!

- The controller can only be used when the FIF cover is mounted!
  - If the FIF cover is missing, the green LED will be blinking (keypad: RDY IMP). The controller is inhibited.
  - The FIF cover is mounted when the inverter is delivered. It is under the blind cover (see fold-out page).
- Since the controller does not provide any control terminals when the function module is not attached, starting and stopping during operation is possible by switching the mains.
  - Allow a break of three minutes between two switch-on procedures for cyclic mains switching!
- Function Set stores the setpoint at the time when operation is interrupted by switching the mains or mains failures. The drive restarts automatically as soon as the mains connection is built up again.
- If the drive does not start in step 7. (IMP is not off), press RUN to enable the controller

Switch-on sequence			Note
1.	Attach the keypad		
2.	Switch on the mains	 ON	
3.	The keypad is in “Disp” mode after approx. 2 s and indicates the output frequency (C0050)		The menu *USEr* is active
4.	Select the setpoint via the function Set		
A	Set activate	Disp ⇐ Set	
B	CW rotation	▲	IMP Off The drive is now running with Lenze settings. The display shows the output frequency.
C	CCW rotation	▼	
5.	If necessary, optimise the drive response 📖 7-1 ff.		

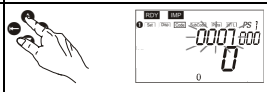
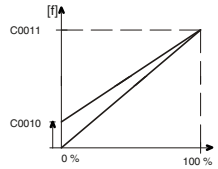
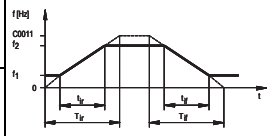
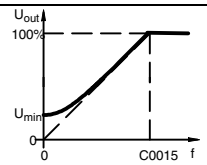


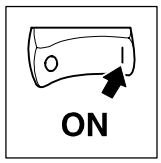
Commissioning

V/f characteristic control

5.4.2 Commissioning with standard I/O

The following instructions apply to controllers equipped with a Standard-I/O module and a three-phase AC motor which has been selected accordingly

Switch-on sequence			Note
1.	Attach the keypad		
2.	Ensure that controller inhibit is active after mains connection.		Terminal X3/28 = LOW
3.	Switch on the mains		
4.	The keypad is in “Disp” mode after approx. 2 s and indicates the output frequency (C0050)		The menu *USEr* is active
5.	Change to the Code mode to configure the basic settings for your drive		Blinking on the display: *0050*
6.	Adapt the voltage range/current range to the analog setpoint (C0034) Lenze setting: -0-, (0 ... 5 V/0 ... 10 V/0 ... 20 mA)		Set the DIP switch on the standard-I/O to the same range (see Mounting Instructions for the standard-I/O)
7.	Adapt the terminal configuration to the wiring (C0007) Lenze setting: -0-, i. e. E1: JOG1/3 JOG frequency selection E2: JOG2/3 E3: DCB DC brake E4: CW/CCW operation		
8.	Set the minimum output frequency (C0010) Lenze setting: 0.00 Hz		
9.	Set the maximum output frequency (C0011) Lenze setting: 50.00 Hz		
10.	Set the acceleration time T_{ir} (C0012) **Lenze setting: 5.00 s**		$T_{ir} = t_{ir} \cdot \frac{C0011}{f_2 - f_1}$ t_{ir} = acceleration time wanted
11.	Set the deceleration time T_{if} (C0013) **Lenze setting: 5.00 s**		$T_{if} = t_{if} \cdot \frac{C0011}{f_2 - f_1}$ t_{if} = deceleration time wanted
12.	Set the V/f-rated frequency (C0015) Lenze setting: 50.00 Hz		
13.	Set the V_{min} boost (C0016) Lenze settings: Depending on the controller type		The Lenze setting is suitable for all common applications
14.	If you want to change the settings, please go to the menu *RLL* . (📖 5-4)	E.g. JOG frequencies (C0037, C0038, C0039), deceleration time for quick stop (QSP) (C0105) or motor temperature monitoring (C0119)	The most important codes listed in the menu *RLL* are explained in the code table. (📖 14-9)
When you are ready with parameter setting:			
15.	Setpoint selection	E.g. via potentiometer at terminals 7, 8, 9	
16.	Enable the controller.		Terminal X3/28 = HIGH
17.	The drive should now be running at e.g. 30 Hz		If the drive does not start, press RUN in addition

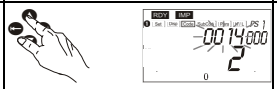


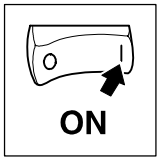
5.5 Commissioning - Vector control

5.5.1 Commissioning without function module

Stop!

- The controller can only be used when the FIF cover is mounted!
  - – If the FIF cover is missing, the green LED will be blinking (keypad: RDY IMP). The controller is inhibited.
  - – The FIF cover is mounted when the inverter is delivered. It is under the blind cover (see fold-out page).
- Since the controller does not provide any control terminals when the function module is not attached, starting and stopping during operation is possible by switching the mains.
  - – Allow a break of three minutes between two switch-on procedures for cyclic mains switching!
- Function Set stores the setpoint at the time when operation is interrupted by switching the mains or mains failures. The drive restarts automatically as soon as the mains connection is built up again.
- If the drive does not start in step 7 (IMP is not off), press RUN to enable the controller

Switch-on sequence			Note
1.	Attach the keypad		
2.	Switch on the mains		
3.	The keypad is in “Disp” mode after approx. 2 s and indicates the output frequency (C0050)		The menu *USEr* is active
4.	Change to the menu *ALL* (📖 5-4)		The most important codes listed in the menu *ALL* are explained in the code table. (📖 14-9)
5.	Change to the Code mode to configure the basic settings for your drive		Blinking on the display: *0001*
6.	Set the control mode ”Vector control” (C0014 = 4) Lenze setting: Linear V/f characteristic control (C0014 = 2)		
7.	Select the setpoint via the function Set		
D	Set activate	Disp ⊖ Set	
E	CW rotation	▲	IMP Off The drive is now running with Lenze settings. The display shows the output frequency.
F	CCW rotation	▼	
8.	If necessary, optimise the drive response 📖 7-1 ff.		

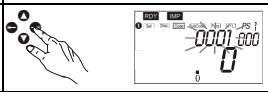
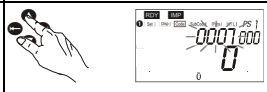
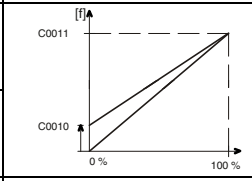
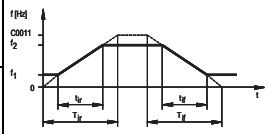
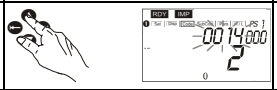
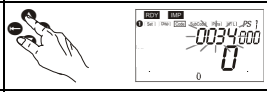
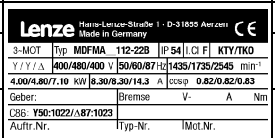


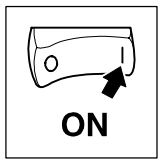
Commissioning

Vector control

5.5.2 Commissioning with standard I/O

The following Instructions apply to controllers equipped with a Standard-I/O function module and a three-phase AC motor which has been selected accordingly.

Switch-on sequence			Note
1.	Attach the keypad		
2.	Ensure that controller inhibit is active after mains connection.		Terminal X3/28 = LOW
3.	Switch on the mains		
4.	The keypad is in “Disp” mode after approx. 2 s and indicates the output frequency (C0050)		The menu *USEr* is active
5.	Change to the menu *ALL* (📖 5-4)		The most important codes listed in the menu *ALL* are explained in the code table. (📖 14-9)
6.	Change to the Code mode to configure the basic settings for your drive		Blinking on the display: *0001*
7.	Adapt the terminal configuration to the wiring (C0007) Lenze setting: -0-, i. e. E1: JOG1/3 JOG frequency selection E2: JOG2/3 E3: DCB DC brake E4: CW/CCW operation		
8.	Set the minimum output frequency (C0010) Lenze setting: 0.00 Hz		
9.	Set the maximum output frequency (C0011) Lenze setting: 50.00 Hz		
10.	Set the acceleration time T_{ir} (C0012) **Lenze setting: 5.00 s**		$T_{ir} = t_{ir} \cdot \frac{C0011}{f_2 - f_1}$ t_{ir} = acceleration time wanted
11.	Set the deceleration time T_{if} (C0013) **Lenze setting: 5.00 s**		$T_{if} = t_{if} \cdot \frac{C0011}{f_2 - f_1}$ t_{if} = deceleration time wanted
12.	Set the control mode ”Vector control” (C0014 = 4) Lenze setting: Linear V/f characteristic control (C0014 = 2)		
13.	Adapt the voltage/current range to the analog setpoint (C0034) Lenze setting: -0-, (0 ... 5 V/0 ... 10 V/0 ... 20 mA)		Set the DIP switch on the standard-I/O to the same range (see Mounting Instructions for the standard-I/O)
14.	Enter the motor data		See motor nameplate
A	Rated motor speed (C0087) Lenze setting: 1390 rpm		
B	Rated motor current (C0088) Lenze setting: Depending on the controller		Enter the value for the motor connection type (star/delta) selected!
C	Rated motor frequency (C0089) Lenze setting: 50 Hz		
D	Rated motor voltage (C0090) Lenze setting: Depending on the controller		Enter the value for the motor connection type (star/delta) selected!
E	Motor-cosφ (C0091) Lenze setting: Depending on the controller		

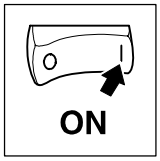


Switch-on sequence			Note
15.	Motor parameter identification (C0148)		
A	Ensure that the controller is inhibited (terminal X3/28 = LOW)		
B	Set C0148 = 1 ENTER in addition		
C	Enable the controller (terminal X3/28 = HIGH)	The motor makes a high-pitched tone. The motor does not rotate!	Identification starts, the segment IMP is off.
D	If the segment becomes active after approx. 30 s, IMP controller inhibit must be activated. (terminal X3/28 = LOW)	Calculated and stored: • V/f rated frequency (C0015) • Slip compensation (C0021) • Motor stator inductance (C0092) Measured and stored: • Motor stator resistance (C0084) = Total resistance of motor cable and motor	Identification is completed.
16.	If necessary, adjust more parameters	E. g. JOG frequencies (C0037, C0038, C0039), deceleration time for quick stop (QSP) (C0105) or motor temperature monitoring (C0119)	
After parameter setting:			
17.	Setpoint selection	E.g. via potentiometer at terminals 7, 8, 9	
18.	Enable the controller.		Terminal X3/28 = HIGH
19.	The drive should now be running at e.g. 30 Hz		If the drive does not start, press RUN in addition

5.5.3 Vector control optimisation

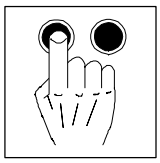
In general, the vector control is ready for operation after the motor parameters have been identified. Vector control must only be optimised for the following drive performance:

Drive performance	Remedy	Note
Rough motor run and motor current (C0054) > 60 % rated motor current in idle running (stationary operation)	1. Reduction of motor inductance (C0092) by 10 % 2. Check of motor current under C0054 3. If the motor current is (C0054) > approx. 50 % of the rated motor current, reduce C0092 until approx. 50 % rated motor current is reached.	Reduce C0092 by max. 20 %!
Torque too low for frequencies f < 5 Hz (starting torque)	Increase of motor resistance (C0084) or increase of motor inductance (C0092)	
Poor constant speed at high loads (setpoint and motor speed are not proportional).	Increase of slip compensation (C0021)	Overcompensation results in drive instability!
Error messages OC1, OC3, OC4 or OC5 for acceleration times (C0012) < 1 s (controller can no longer follow the dynamic processes)	Change readjustment time of the I_{max} controller (C0078): • Reduction of C0078 = I_{max} controller becomes quicker (more dynamic) • Increase of C0078 = I_{max} controller becomes slower (”smoother”)	



Commissioning

Vector control



6 Parameter setting

6.1 General information

- The controller can be adapted to your application by setting parameters. A detailed description of the function can be found in the function library. (📖 7-1 ff.)
- The function parameters are stored as numerical codes:
  – Codes are marked in the text with a ”C”.
  – The code table gives you a quick overview over all codes. The codes are sorted according to their numbers and can be used as reference. (📖 14-9)

The parameters are set using a keypad or PC or via the parameter channel of a bus system:

Parameter setting with keypad or PC

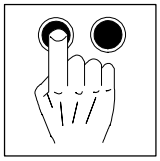
- For more detailed information about parameter setting with the keypad see (📖 6-2)
- For more detailed information about parameter setting with the PC see the Operating Instructions for the communication module LECOM-A/B (RS232/RS485) EMF2102IB-V001.
- Keypad and PC can also be used to
  – control your controller (e. g. inhibit and enable)
  – select setpoints
  – display operating data
  – transfer parameter sets to other controllers

Parameter setting with a bus system

- For more information about the function module “System bus (CAN)” see (📖 9-1)
- More detailed information about other bus modules can be found in the corresponding Operating Instructions.

Tip!

- The signal flow charts give an overview over all configurable signals. (📖 14-1)
- If you get confused while you set the parameters for your drive, reload the factory setting with C0002 and start again.



6.2 Parameter setting with the keypad

The parameters are set using the keypad.

If you do not use a hand terminal, the keypad can be directly attached to the AIF interface. The hand terminal can be connected with different cable lengths.

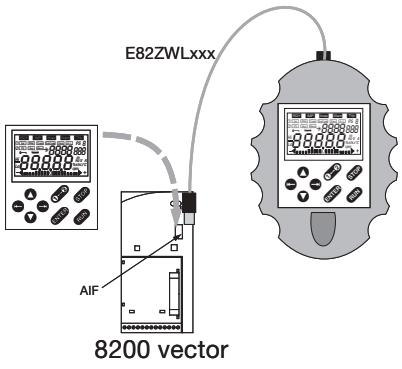
Tip!

The keypad can be attached or detached and parameters can be set during operation.

6.2.1 General data/application conditions

Insulation voltage to reference earth/PE	50 V AC
Type of protection	IP20 IP55 with hand terminal
Ambient temperature	during operation: -10 ... +60 °C during transport: -25 ... +70 °C during storage -25 ... +60 °C
Climatic conditions	Class 3K3 to EN 50178 (without condensation, average relative humidity 85 %)
Dimensions (L x W x H)	74 mm x 60 mm x 17 mm

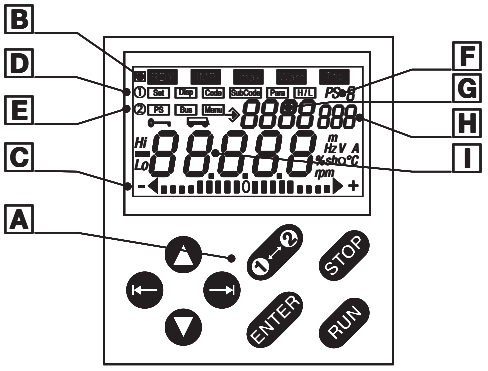
6.2.2 Installation/commissioning

With hand terminal	**Without hand terminal**	**Basic principle**
1. Insert the keypad into the hand terminal and fix the screws. 2. Connect the hand terminal to the AIF interface using a connection cable. – Please ensure that the plug is fixed tightly in the hand terminal! Otherwise the connection can be interrupted.	1. Attach the keypad to the AIF interface.	
The communication module is ready for operation as soon as the mains voltage is switched on. You can communicate with the drive.		

Tip!

- The keypad is mounted to the terminal with a screw (remove rubber sheath).
- The keypad can be mounted to a control cabinet door with the ”Mounting kit for control cabinets” E82ZBHT (board cut-out 45.3 x 45.3 mm).

6.2.3 Displays and functions



A	Function keys	
B	Status display	
C	Bar-graph display	
D	Function bar 1	
E	Function bar 2	
F	For changing active parameter sets	The value can be changed if it is blinking.
G	Code number	
H	Subcode number	
I	Parameter value with unit	

A Function keys

Press key	Function	Explanation
RUN	Enable controller	X3/28 must be at HIGH level.
STOP	Inhibit controller (CINH) or quick stop (QSP)	Configuration in C0469.
①⟷②	Change to function bar 1 ↔ Function bar 2	
⬅➡	To right/left in active function bar.	Current function will be framed.
▲▼	Increase/decrease value. Quick change: Keep key pressed.	Only blinking values can be changed.
ENTER	Parameters can be stored if ➔ is blinking. Acknowledgement by *STOrE* in the display	

B Status display

Description of error messages: (📖 8-1 ff)

Display	Meaning	Explanation
RDY	Ready for operation	
IMP	Pulse inhibit	Power outputs inhibited
Imax	Set current limit exceeded	C0022 (motor mode) or C0023 (generator mode)
Warn	Warning active	
Trip	Error active	

C Bar-graph display

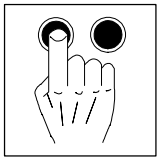
	Value set under C0004 in %. (Lenze setting: Controller load C0056).	Display range: - 180 % ... + 180 % (every bar = 20 %)

D Function bar 1

Function	Meaning	Explanation
Set	Setpoint selection via ▼▲	Not possible when password protection is active (display = *"LOC"*)
Disp	Display function: • User menu, memory location 1 (C0517/1), display • Display active parameter set	Active after every main connection
Code	Code selection	Display of active code in 4-digit display G
SubCode	Subcode selection	Display of active subcode number in 3-digit display H
Para	Change of parameter value of a (sub)code	Display of current value in 5-digit display I
H / L	Display of values longer than 5 digits	
	H: higher value locations	Display *"HI"*
	L: lowervalue locations	Display *"LO"*

E Function bar 2

Function	Meaning	Explanation
PS	Select parameter set 1 ... parameter set 4 for changing	• Display, e.g. PS *2* (F) • Parameter sets can only be activated with digital signals (configuarion under C0410).
Bus	Selection of system bus (CAN) devices	The selected device can be parameterised by the current drive. 🚗 = function active
Menu	Select menu **User menu is active after mains switching. If necessary *ALL* to address all codes.**	*uSEr* List of codes in the user menu (C0517) *ALL* List of all codes *FunCI* Only specific codes for bus function modules, e.g. INTERBUS, PROFIBUS-DP and LECOM-B



Parameter setting

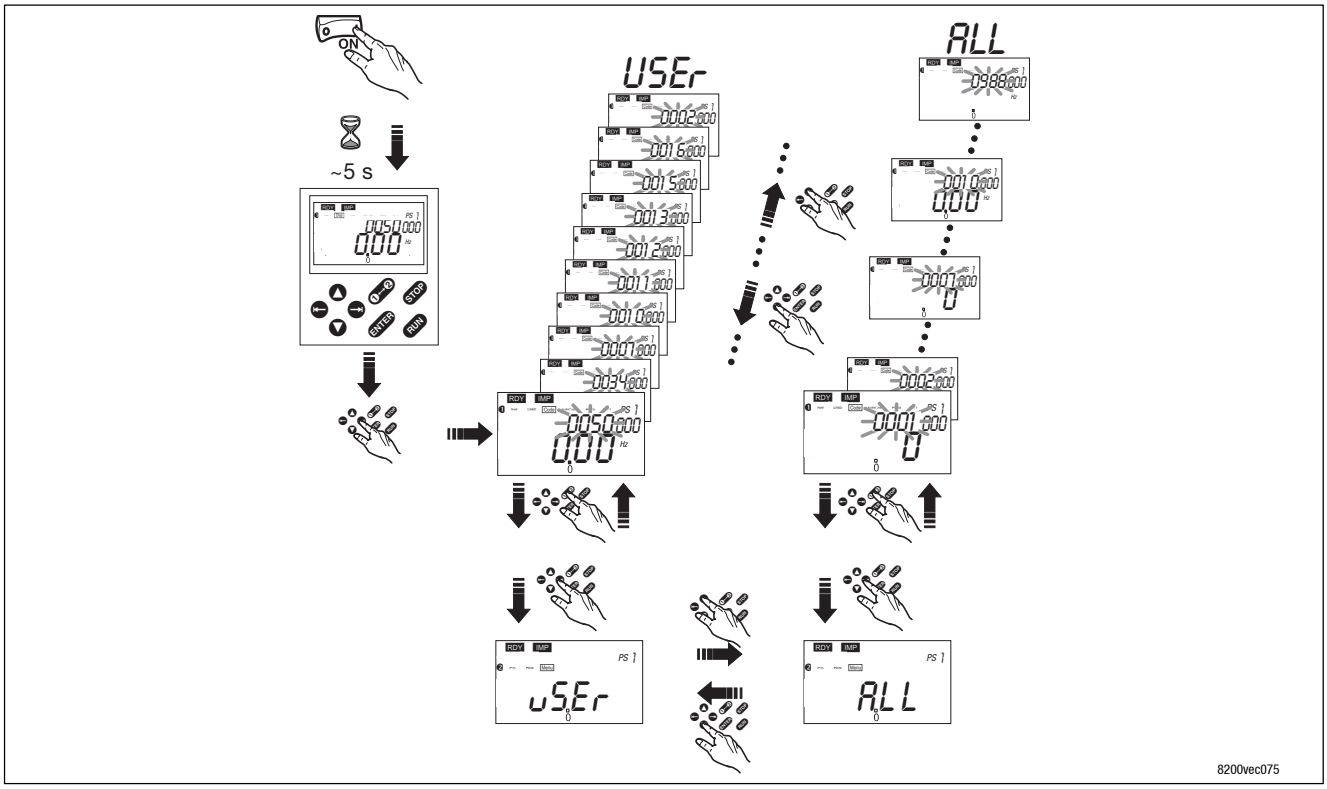
With keypad

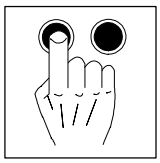
6.2.4 Menu structure

All parameters for controller setting or monitoring are saved in codes under the menus *USEr* and *ALL*. The codes have numbers G and are abbreviated in the text with a "C" before the number. Some codes store the parameters in numerical "subcodes" H to ensure that parameter setting is clearly structured (example: C0517 menu *USEr*).

- The menu *USEr*
  - is active after every mains switching or keypad attachment during operation.
  - contains all codes for a standard application with linear V/f characteristic control (Lenze setting).
  - can be modified as required under C0517.
- The menu *ALL*
  - contains all codes.
  - shows a list of all codes in ascending order.
- The change between *USEr* and *ALL* and how to change parameters in the codes is described on the following pages.

Change between the menus *USEr* and *ALL*





6.2.5 Changing and storing parameters with the keypad

Tip!

User menu is active after mains switching. Change to the menu *ALL* to address all codes.

Action		Keys	Result	Note	Example	
1.	Plug in the keypad		Disp *XX.XX* Hz	Function Disp is activated. The first code in the user menu will be displayed (C0517/1, Lenze setting: C0050 = output frequency).		
2.	If necessary change to the menu "ALL"	①→②	❷	Change to function bar 2		
3.		←→	Menu			
4.		▼▲	*ALL*	Select menu "ALL" (list of all codes)		
5.		①→②	❶	Confirm selection and change to function bar 1		
6.	Inhibit controller	STOP	RDY IMP	Only necessary if you want to change C0002, C0148, C0174 and/or C0469		
7.	Parameter setting	←→	Code			C0412, assign 3 to subcode 3.
8.		▼▲	*XXXX*	Select code	*0412*	
9.		→	SubCode *001*	For codes without subcodes: Jump automatically to Para		
10.		▼▲	*XXX*	Select subcode	*003*	
11.		→	Para			
12.		▼▲	*XXXXX*	Set parameters	*3*	
13.		ENTER	*STOrE*	Confirm entry if → blinking		
		←		Confirm entry if → is not blinking; ENTER is not active		
14.				Restart the "loop" at 7. to set other parmeters.		

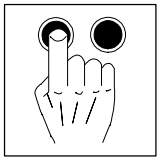
6.2.6 Change of parameter sets

Tip!

The keypad can only be used to go to parameter sets to be changed. You have to use digital signals to activate a parameter set for operation (configuration under C0410)!

The presently active parameter set can also be indicated by the function Disp .

Action		Keys	Result	Note	Example	
1.	Selection function	①→②	❷	Change to function bar 2		Select parameter set 2.
2.		←→	PS			
3.	Select parameter set	▼▲	*1 ... 4*	Select parameter set to be changed	*2*	
4.		①→②	❶	Confirm selection and change to function bar 1		
5.	Set parameters			As described in chapter 6.2.5		



Parameter setting

With keypad

6.2.7 Remote parameter setting of system bus devices

Tip!

Instead of using the function Bus the system bus device can also be selected under C0370.

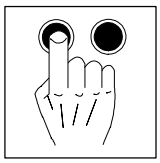
Action		Keys	Result	Note	Example	
1.	Selection function	①→②	❷	Change to function bar 2		Remote parameter setting of system bus device 32.
2.		←→	Bus			
3.	Select the device's address.	↓↑	1 ... 63	Select device's address.(📖 9-5 ff)	32	
4.		①→②	❶ 🚗	Confirm the address and change to function bar 1. The remote parameter setting of the device is not completed.		
5.	Set parameters			As described in chapter 6.2.5 All settings are diverted to the selected device.		

6.2.8 Change entries in the user menu

Tip!

For more detailed information about the user menu see (📖 7-58)

Action		Keys	Result	Note	Example	
1.	Change to the menu "ALL"	①→②	❷	Change to function bar 2		
2.		←→	Menu			
3.		↓↑	ALL	Select menu "ALL" (list of all codes)		
4.		①→②	❶	Confirm selection and change to function bar 1		
5.	Select user menu	→	Code			Enter C0014 (control mode) on location 2 in the user menu. The existing settings will be overwritten.
6.		↑	0517	Code for user menu	0517	
7.	Select memory location	←→	SubCode 001	The code stored under C0517/1 is displayed. (Lenze setting: Output frequency C0050)		
8.		↑	001 ... 010	Select subcode	002	
9.	Change entry	→	Para			
10.		↓↑	XXXXX	Enter code number It is not checked whether the code number exists. "0" to delecte entry.	14	
11.		ENTER	StOrE	Confirm entry		
12.				Restart the "loop" at 7. to change other memory locations.		



6.2.9 Activate password protection

(Available as of version E82 ... Vx11 together with the keypad, version E82B ... Vx10)

Tip!

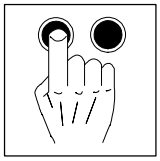
- If the password protection is activated (C0094 = 1 ... 9999) only the user menu can be freely accessed.
- All other functions require the correct password.
- Please observe that also the password protected parameters will be overwritten when parameter sets are transferred. The password will not be transferred.
- Do not forget your password! If you cannot remember the password, it can only be reset via PC or a bus system.

6.2.9.1 Activation of password protection

Action		Keys	Result	Note	Example	
1.	Change to the menu "ALL"	1→2	❷	Change to function bar 2		
2.		←→	Menu			
3.		▼▲	ALL	Select menu "ALL" (list of all codes)		
4.		1→2	❶	Confirm selection and change to function bar 1		
5.	Password entry	→	Code			Enter and activate password 123
6.		▲	0094	Password code	0094	
7.		→	Para			
8.		▲	XXXX	Password setting	123	
9.		ENTER	STOrE	Password confirmation		
10.	Activate password by changing to the user menu	1→2	❷	Change to function bar 2		
11.		←→	Menu			
12.		▼▲	uSEr	Select user menu		
13.		1→2	❶ 🔑	Confirm selection and change to function bar 1 The key symbol indicates that the password protection is active.		

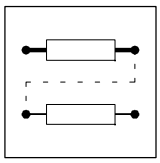
6.2.9.2 Calling up a password protected function

Action		Keys	Result	Note	Example	
1.	Calling up a password protected function	various	PASS 0 🔑	You tried to call up a password protected function. 0 blinking		Temporarily deactivate password 123
2.	Temporarily deactivate password protection	▲	PASS XXXX 🔑	Password setting	123	
3.		ENTER	STOrE	Password confirmation 🔑 Off		
4.	Free access to all functions	various		All functions can be freely accessed.		
5.	Reactivate password protection by changing to the user menu	1→2	❷	Change to function bar 2		
6.		←→	Menu			
7.		▼▲	uSEr	Select user menu		
8.		1→2	❶ 🔑	Confirm selection and change to function bar 1 The password protection is active again.		



6.2.9.3 Continuous deactivation of password protection

Action		Keys	Result	Note	Example	
1.	Change to the menu "ALL"	1→2	PASS 0 🔑	0 blinking		Continuous deactivation of password 123
2.		▲	PASS XXXX 🔑	Password setting	123	
3.		ENTER	StOrE	Password confirmation 🔑 Off		
4.		1→2	❷	Change to function bar 2		
5.		←→	Menu			
6.		▼▲	ALL	Select menu "ALL" (list of all codes)		
7.		1→2	❶	Confirm selection and change to function bar 1		
8.	Continuous deactivation of password protection	→	Code			
9.		▲	0094	Password code	0094	
10.		→	Para			
11.		▲	0	Delete password	0	
12.		ENTER	StOrE	Confirm entry You can freely access all functions.		



7 Function library

The function library gives all information needed to adapt your controller to your application. The chapter is subdivided into the following sections:

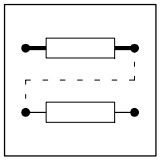
- Select control mode, optimise operating behaviour
- Limit value setting
- Acceleration, decleration, braking, stopping
- Configuration of analog and digital setpoints
- Motor data entry/automatic detection
- Process controller I_{max} controller
- Free connection of analog signals
- Free connection of digital signals, message output
- Thermal motor monitoring , error detection
- Display of operating data, diagnostics
- Parameter set management
- Individual grouping of drive parameters - The user menu

Tip!

- Signal flow charts show how codes are integrated into signal processing. (📖 14-1 ff.)
- The code table lists all codes in numerical order and explains them briefly. (📖 14-9 ff.)

For free signal configuration:

- Select the source from the targets point of view:
  – Ask yourself “Where does the signal come from?”
  – That makes it easy to find the correct entry for a code.
- A source can have several targets:
  – It is thus possible that double assignment occur when targets are assigned to sources.
  – For instance, the assignment of E1 remains the same even if the frequency input E1 is activated (Lenze setting: ”JOG1 activation!). The previous assignment must be deleted with C0410/1 = 255 to ensure trouble-free operation.
  – Ensure that only the targets wanted are assigned to a source.
- A target can have one source only.



7.1 Selection of control mode, optimisation of operating behaviour

7.1.1 Control mode

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0014↲	Control mode	-2-	-2-	V/f characteristic control V ~ f (Linear characteristic with constant V_{min} boost)	• Commissioning without motor parameter identification possible • Benefit of identification with C0148: – Improved smooth running at low speed – V/f rated frequency (C0015) and slip (C0021) are calculated and do not have to be entered	📖 7-2
			-3-	V/f characteristic control V ~ f^2 (Square-law characteristic with constant V_{min} boost)		
			-4-	Vector control	**Identify the motor parameters before commissioning with C0148! Otherwise commissioning is not possible!**	
			-5-	Sensorless torque control with speed limitation • Torque setpoint via C0412/6 • Speed limitation via setpoint 1 (NSET1-N1), if C0412/1 is assigned, if not via max. frequency (C0011)		

Function

Under C0014 you can set the control mode and the voltage characteristic. It is also possible to adapt your drive to different load characteristics:

- Linear characteristic for drives with a load torque squared in relation to the speed.
- Square-law characteristic for drives with a load torque squared in relation to the speed.
  – Square-law V/f characteristics are mainly used for centrifugal pump and fan drives. It is however necessary to check whether your individual pump or fan application can be driven with this control mode.
  – If your pump or fan drive is not suitable for operation with a square-law V/f characteristic, select control mode C0014 = -2- or -4-.

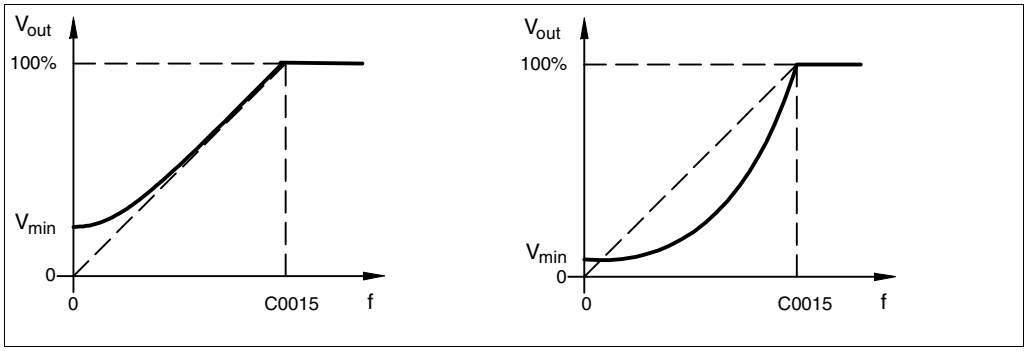
V/f characteristic control with V_{min}boost

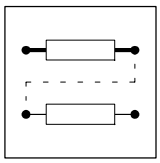
Select the classical V/f-control with constant V_{min}boost (C0016) for operation of the following drives:

- Multi-motor application (several motors are connected to a controller)
- Three-phase AC reluctance motors
- Three-phase sliding rotor motors
- Operation with special motors with assigned frequency-voltage characteristic
- Positioning and infeed drives with high dynamic response
- Hoists

C0014 = -2-
Linear characteristic

C0014 = -3-
Square-law (quadratic) characteristic (e.g. for pumps, blowers)





Vector control
Compared with the V/f characteristic control the vector control offers considerably higher torque and lower current consumption during idle running. The vector control is an improved motor current control following the Lenze FTC technology.
Select vector control for operation of the following drives:
- Single drives with extremely changing loads
- Single drives with heavy start conditions
- Multi-motor applications with the same motors and the same load distribution
- Sensorless speed control of three-phase standard motors together with slip compensation (C0021)

Sensorless torque control with speed limitation
The setpoint (C0412/6) is interpreted as torque setpoint. Actual values are not required.
Application with, for instance, winding drives.

Adjustment

V/f characteristic control (C0014 = -2- or C0014 = -3-):
1. Selection of V/f rated frequency C0015.
2. V_{min} boost (C0016) selection.

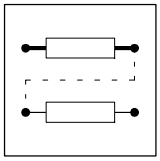
Vector control (C0014 = -4-):
- Parameters must be identified! (📖 7-31)
- The control mode C0014 = -4- should only be used with slip compensation (C0021). The ”sensorless speed control” is thus optimised for the process.
- The power code of the connected motor should not be more the two classes lower than the one of the motor assigned to the controller.

Important
- Only change from V/f characteristic control to vector control and vice versa when the controller is inhibited.
- Do not use the control mode ”Toque control” (C0014 = 5) for application with power control! 📖 13-15
- Optimum drive behaviour in process controller applications, e.g. with speed control or dancer position control C0014 = 2 or C0014 = 4.
  – If you need a high torque at low speed we recommend the control mode “Vector control” (C0014 = 4)

Special features

C0014 = -3-
- High inertias result in a reduced acceleration of the drive.
  – This response can be avoided by changing the parameter sets (e.g. acceleration with C0014 = -2-).

C0014 = -4-
- **Not** possible if
  – drives with different loads are connected to an inverter.
  – drives with different rated powers are connected to an inverter.



7.1.2 V/f characteristic

7.1.2.1 V/f rated frequency

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0015	V/f rated frequency	50.00	7.50	{0.02 Hz}	960.00	Setting applies to all mains voltages permitted	📖 7-4

Function at C0014 = -2-, -3-

The V/f rated frequency determines the slope of the V/f characteristic and has considerable influence on the current, torque and power performance of the motor.

Function at C0014 = -4-

The V/f rated frequency influences the internal parameters of a motor model when using the control mode "Vector control".

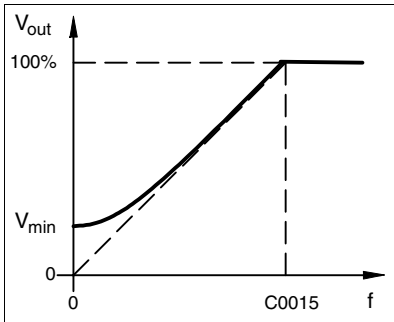
Adjustment

$$C0015\ [Hz] = \frac{V\ [V]}{V_M\ [V]} \cdot f_M\ [Hz]$$

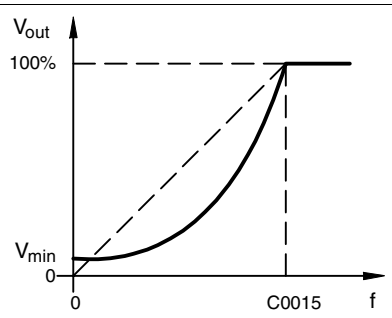
V = 400 V for types E82xVxxxK4B
V = 230 V for types E82xVxxxK2B
V_M Rated motor voltage depending on type of connection, see nameplate
f_M Rated motor frequency according to nameplate

Examples for 230 or 400 V mains voltage

C0014 = -2-
Linear characteristic



C0014 = -3-
Square-law (quadratic) characteristic (e.g. for pumps, fans)



Examples for 400 V controllers

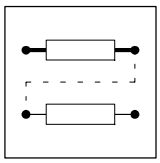
Motor			C0015 setting
Voltage	Frequency	Connection	
230/400 V	50 Hz	Y	50 Hz
220/380 V	50 Hz	Y	52.6 Hz
280/480 V	60 Hz	Y	50 Hz
400/690 V 400 V	50 Hz 50 Hz	Δ	50 Hz
230/400 V 280/480 V 400 V	50 Hz 60 Hz 87 Hz	Δ	87 Hz
220/380 V	50 Hz	Δ	90.9 Hz

Tip:

- 4-pole asynchronous motors which are designed for a rated frequency of 50 Hz in star connection, can be operated in delta connection if the constant excitement does not exceed 87 Hz.
  - The motor current and the motor power are then increased by the factor ✓3 = 1.73.
  - The field weakening range starts above 87 Hz.
- Advantages:
  - Higher speed-setting range
  - 73 % higher power efficiency with standard motors.
- In principle, this method can also be used with higher-pole motors (6,8,...).
  - Observe the mechanical limit speed when using 2-pole asynchronous motors.

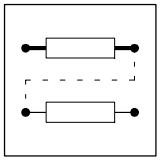
Examples for 230 V controllers

Motor			C0015 setting
Voltage	Frequency	Connection	
230/400 V	50 Hz	Δ	50 Hz
220/380 V	50 Hz	Δ	52.3 Hz



Important

- An internal mains compensation compensates fluctuations in the mains during operation. Therefore they do not have to be considered for the setting of C0015.
- The motor parameter identification automatically assigns C0015.
- Depending on the settings under C0015, it can be necessary to adapt the maximum output frequency under C0011 to ensure that the entire speed range will be used.



7.1.2.2 V_{min} boost

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0016	V_{min} boost	→	0.00	{0.2 %}	40.0	→ Depending on the controller Setting applies to all mains voltages permitted	📖 7-6

Function with V/f characteristic control
C0014 = -2-, -3-

Load independent motor voltage boost in the output frequency range below V/f rated frequency. You can thus optimise the torque performance of the inverter drive.

Adjustment

C0016 must always be adapted to the asynchronous motor used. Otherwise, the motor can be destroyed or damaged by overtemperature or the inverter can be supplied with overcurrent.

1. Operate the motor in idle running at approx. slip frequency (f ≈ 5 Hz).

Calculate the slip frequency

$$f_s = f_r \cdot \frac{n_{rsyn} - n_r}{n_{rsyn}}$$

$$n_{rsyn} = \frac{f_r \cdot 60}{p}$$

f_s	Slip frequency
f_r	Rated frequency to motor nameplate [Hz]
n_{rsyn}	Synchronous motor speed [min^{-1}]
n_r	Rated speed to motor nameplate [min^{-1}]
p	Number of pole pairs

2. Increase V_{min} , until the following motor current is reached:
   – Motor in short-term operation at 0 Hz ≤ f ≤ 25 Hz:
   Motor with integrated ventilation: $I_{motor} \leq I_{r\ motor}$
   Motor with forced ventilation: $I_{motor} \leq I_{r\ motor}$
   – Motor in continuous operation at 0 Hz ≤ f ≤ 25 Hz:
   Motor with integrated ventilation: $I_{motor} \leq 0.8 \cdot I_{r\ motor}$
   Motor with forced ventilation: $I_{Motor} \leq I_{r\ motor}$

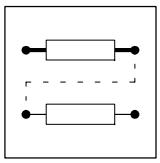
Important

Please observe the thermal behaviour of the connected asynchronous motor at low output frequencies when adjusting it:

- Experience shows that standard asynchronous motors of insulation class B can be operated for a short time at rated current over the speed range of 0 Hz ≤ f ≤ 25 Hz.
- Contact the motor manufacturer for exact setting values for the max. permissible motor current in the lower frequency range of internally ventilated motors.

Function with vector or torque control
C0014 = -4-, -5-

V_{min} is not effective.



7.1.3 Running optimisation

7.1.3.1 Slip compensation

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0021	Slip compensation	0.0	-50.0	{0.1 %}	50.0		📖 7-7

Function

Under load, the speed of an asynchronous machine is reduced. This load dependent speed drop is called slip. The slip can be partly compensated by setting C0021 accordingly. The slip compensation is effective for all control modes (C0014).

- Slip increase with C0021 < 0 (at C0014 = -2-, -3-)
  – "Smoother" drive behaviour at strong shocks or applications with several motors.
- In the frequency range of 5 Hz ... 50 Hz (87 Hz), the deviation from the rated speed is ≤ 0.5 % (guide value). The error becomes bigger in the field weakening range.

Adjustment

1. Rough setting by means of the motor data:

$$s = \frac{n_{Nsyn} - n_N}{n_{Nsyn}} \cdot 100\ \%$$

$$n_{Nsyn} = \frac{f_N \cdot 60}{p}$$

s	Slip constant (C0021) [%]
n_{Nsyn}	Synchronous motor speed [min^{-1}]
n_r	Rated speed to motor nameplate [min^{-1}]
f_r	Rated frequency to motor nameplate [Hz]
p	No. of pole pairs (1, 2, 3, ...)

2. Empirical precise setting of the slip compensation:
   – Correct C0021 until no load-dependent speed drop occurs in the required speed range between idle running of max. motor load.

Example with motor data: 4 kW / 1435 min^{-1} / 50 Hz

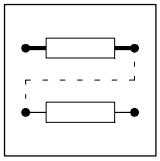
$$n_{Nsyn} = \frac{50Hz \cdot 60}{2} = 1500\,min^{-1}$$

$$s = \frac{1500\,min^{-1} - 1435\,min^{-1}}{1500\,min^{-1}} \cdot 100\ \% = 4.33\ \%$$

Preset C0021 = 4.3 %

Important

- If C0021 is set too high, overcompensation can occur and lead to an instability of the drive.
- Set C0021 = 0.0 for speed control with internal process controller.
- The motor parameter identification with C0148 automatically assigns C0021.



7.1.3.2 Chopper frequency

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0018	Chopper frequency	-2-	-0-	2 kHz		📖 7-8
			-1-	4 kHz		
			-2-	8 kHz		
			-3-	16 kHz		
C0144	Chopper frequency derating	-1-	-0-	No temperature-depending chopper frequency derating		📖 7-8
			-1-	Automatic chopper frequency derating at ϑ_{max} - 5 °C		

Function C0018

With this function you set the chopper frequency of the inverter. With Lenze setting, the chopper frequency is 8 kHz. Reasons for other parameter settings may be:

- 2 kHz, 4 kHz:
  – Improved running performance at low output frequencies
- 16 kHz:
  – Reduced noise emission in the connected motor
  – Good shine wave of the motor current for applications with outputs frequencies > 150 Hz, e. g. middle frequency drives.

Important

With chopper frequency 16 kHz, the device suffers power losses which must be compensated by derating the output current. (📖 3-4)

Function C0144

- C0144 = -0-
  – With chopper frequency 8 kHz or 16 kHz ánd if the max. permissible heatsink temperature is exceeded (ϑ_{max}) the inverter will be inhibited, TRIP will be indicated and the motor idles.
- C0144 = -1- (automatic chopper frequency derating):
  – With chopper frequency 8 kHz or 16 kHz and if the controller exceeds the permissible heatsink temperature of ϑ_{max} - 5 °C, the controller derates the chopper frequency automatically to 4 kHz and thus ensures operation.
  – After the heatsink has cooled down, the copper frequency is automatically increased again.

Important

- The current limitation under C0022/C0023 is not automatically influenced by the selected chopper frequency.
- The chopper frequency is automatically set to its optimum value depending on the apparent motor current and output frequency to ensure troublefree operation.
  – The noise emission changes.
  – The function cannot be modified by the user.

7.1.3.3 Oscillation damping

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0079	Oscillation damping	2	0	{1}	80	Depending on the controller	📖 7-8

Function

Suppression of idling oscillations when:

- a drive does not match, i.e. rated controller power - motor
  e.g. operation at high chopper frequency and the related power derating
- Operation of higher-pole motors
- Operation of special motors

Compensation of resonances in the drive

- Some asynchronous motors can show this behaviour when being operated with a chopper frequency of approx. 20 Hz ... 40 Hz. As a result, operation can be instable (current and speed fluctuations).

Adjustment

1. Approach with speed oscillations.
2. Reduce the oscillations by changing C0079 step-by-step.
   – Indicators for smooth running can be a uniform motor current or the reduction of mechanical vibrations in the bearing seat.

Important

Compensate resonances in speed-controlled operation by means of the speed controller parameters.

7.1.3.4 Skip frequencies

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0625*	Skip frequency 1	480.00	0.00	{0.02 Hz}	480.00		📖 7-9
C0626*	Skip frequency 2	480.00	0.00	{0.02 Hz}	480.00		
C0627*	Skip frequency 3	480.00	0.00	{0.02 Hz}	480.00		
C0628*	Bandwidth of skip frequencies	0.00	0.00	{0.01 %}	100.00	Applies to C0625, C0626, C0627	

Function

With certain output frequencies, mechanical resonances might occur in the drive (e.g. fan). The skip frequencies suppress these unwanted output frequencies. The bandwidth (△f) determines the skip frequency range.
With skip frequency = 480.00 Hz, the function is not active.
The function is in the block NSET1 before the ramp function generator.

Adjustment

- Set skip frequencies under C0625, C0626, C0627.
- C0628 defines the bandwidth for skip frequenies.
  – Calculation of bandwidth (△f) for skip frequencies:

$$\Delta f\,[Hz] = f_s\,[Hz] \cdot \frac{C0628\,[\%]}{100\,\%}$$

f_s Skip frequency

Important

- Skip frequencies only effect main setpoings.
- C0625, C0626, C0627, C0628 are the same for all parameter sets.

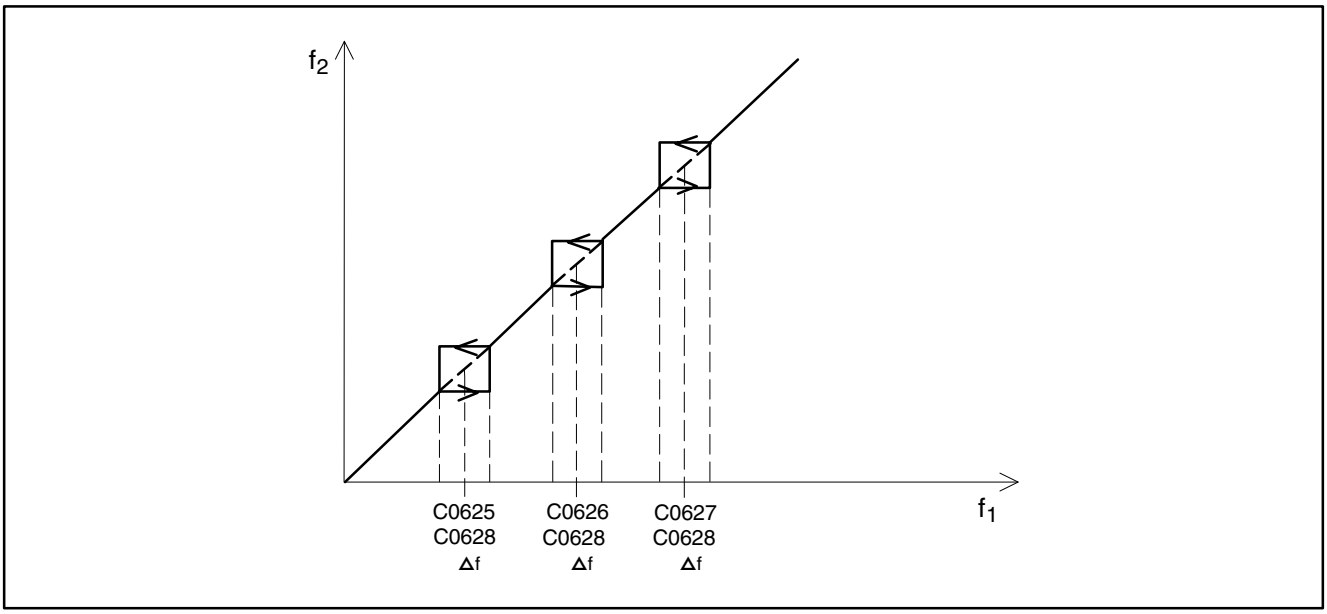
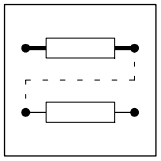


Fig. 7-1 Skip frequencies and their bandwidth (△f)



7.1.4 Behaviour in the event of mains switching, mains failure or controller inhibit

7.1.4.1 Start conditions/flying-restart circuit

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0142↲	Start condition	-1-	-0-	Automatic start inhibited Flying restart not active	Start after LOW-HIGH level change at X3/28	📖 7-10
			-1-	Automatic start, if X3/28 = HIGH Flying restart not active		
			-2-	Automatic start inhibited Flying-restart circuit active	Start after LOW-HIGH level change at X3/28	
			-3-	Automatic start, if X3/28 = HIGH Flying-restart circuit active		
C0143*↲	Selection of flying-restart	-0-	-0-	Max. output frequency (C0011) ... 0 Hz	Motor speed selected for the indicated range	
			-1-	Last output frequency ... 0 Hz		
			-2-	Frequency setpoint addition (NSET1-NOUT)	The corresponding value is input after controller enable.	
			-3-	Act. process controller value (C0412/5) addition (PCTRL1-ACT)		

Function

Determines the controller behaviour afer a restart after controller inhibit, mains switching or a mains failure. With activated flying-restart circuit, the controller automatically synchronises to a coasting motor or adds a setpoint signal after mains disconnection.

- C0143 = -0-, -1- (find motor speed)
  - The controller calculates the output frequency required for the current speed of the idling motor, is connected and accelerates the motor until it reaches its setpoint.
  - Advantage: Steady and smooth acceleration/deceleration
  - Disadvantage: "Real starting" not before the current motor speed has been found. Fast "real starting" is possible if you use the function "Controlled deceleration after mains failure/mains switch-off". (📖 7-11)
- C0143 = -2-, -3- (set signal)
  - The controller sets the output frequency required for the frequency setpoint or actual process controller value.

Drive performance

Start options with flying-restart circuit

- C0142 = -0-
  - The drive does not restart after a mains disconnection before a LOW/HIGH level change at the input CINH (X3/28).
- C0142 = -1-
  - The drive automatically decelerates after a mains disconnection if a HIGH level is applied to the input CINH (X3/28). The controller simultaneously sets all integrators to zero and enables them again.

Start options with flying-restart circuit

- C0142 = -2-
  - Restart with flying-restart circuit after a LOW/HIGH level change at the input CINH (X3/28).
- C0142 = -3-
  - Atuomatic restart with flying-restart circuit if a HIGH level is applied to the input CINH (X3/28).
- Determine under C0143 whether the motor speed is to be found or a signal set.

Important

C0143 = -0-, -1-

- The flying-restart circuit must not be used, if several motors with different inertias are connected to a controller.
- The flying-restart circuit does only search the selected direction of rotation for synchronisation.
- The flying restart works properly for drives with high moments of inertia.
- With machines with low moments of inertial and small friction, the motor can restart for a short time or reverse after controller enable.

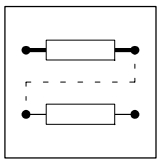
C0143 = --3-

- The actual process controller value must only be set if a speed-proportional signal is available in C0412/5!

Tip

If the flying-restart circuit **is not required** for every drive start, but only after mains reconnection:

- Bridge X3/28 with HIGH level and start the controller using the function "QSP" (C0142 = -3- and C0106 = 0 s).
- The flying-restart circuit is now only **activated** for the first mains connection.



7.1.4.2 Controlled deceleration after mains failure/mains switch-off

Stop!

- Function can only be used with 8200 vector up to 1.5 kW.
- The deceleration time until standstill cannot be defined. It depends on the machine/system components (moment of inertia, friction,...). .

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0988*	DC-bus voltage threshold for DC-bus voltage control	0	0	{1 %}	200	• C0988 = 0 % – Parameter set changeover via DC-bus voltage deactivated • Changeover always between PAR1 nd PAR2 • Parameter set changeover via terminal, bus or PC is not possible if C0988 > 0!	📖 7-11 📖 7-20

Function

- Controlled motor deceleration to standstill (f = 0) in the event of a mains disconnection or mains failure.
- If the motor is not standsting still when being reconnected to the mains, it is accelerated along the acceleration ramp (C0012) to the preselected setpoint. There is no delay time as it occurs with active flying-restart circuit.
  – Advantage: Immediate "real start", no delay as with active flying-restart circuit (📖 7-10)
  – Disadvantage: "Harder" transition at restart

The function can be used with or without external brake resistor:

Without external brake resistor

- Controlled motor deceleration to standstill (f = 0) when controller is active.
- The braking energy is generated through the system losses (controller and motor).

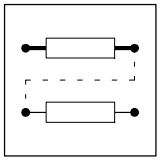
With external brake resistor

- Automatic, quick motor deceleration to standstill (f = 0).
- The deceleration time is shorter than without external brake resistor.

Functionality

1. Mains voltage is interrupted.
2. DC-bus voltage (V_{DC}) lower than value in C0988 ⇒ PAR1 is activated.
3. QSP in PAR1 starts operation in generator mode.
4. V_{DC} higher than value in C0988.
5. PAR2 is activated ⇒ The motor accelerates at Tir (C0012 in PAR2).
6. "Loop" restarts at 2.

The "loop" 2. to 6. is repeated until the motor speed is approx. 0, since the rotation energy in the motor keeps up V_{DC} .



Function library

Selection of control mode, optimisation of operating behaviour

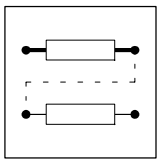
Adjustment	Code	PAR1 setting (active in the event of mains failure)	PAR2 setting (active in normal operation)	Note
Threshold	C0988	C0988 = 100 % exactly corresponds to the mains voltage AC 230V or 400 V. Adapt C0988 to the undervoltage from the mains side.		
		AC 230 V or AC 400 V 10 % undervoltage ⇨ C0988 = 75 % ... 85 %	AC 460 V 10 % undervoltage ⇨ C0988 = 75 % ... 98 %	Most uniform deceleration can be achieved by setting the upper limit of the bandwidth.
Terminal configuration	C0410	Assign a digital input (X3/E1 ... X3/E6) to C0410/4 (QSP).	Select terminal configuration for normal operation.	With Lenze setting, QSP is LOW active.
With QSP In normal operation		• Invert this input under C0411.	• Assign QSP (not inverted) to the digital input assigned with QSP in PAR.	
Without QSP In normal operation		• Do not use this input.	• Do not use the digital input assigned with QSP in PAR1.	
Quick stop in the event of mains failure without external brake resistor.	C0105	Ensure with the setting that the motor decelerates to standstill in a controlled way after mains disconnection: 1. Set the same value as in PAR2. 2. Switch off the mains voltage. – PAR1 will be activated. – Observe whether the controller indicates “Overvoltage OU” during controlled deceleration. 3. Reduce the value and swith the mains unit the controller indicates OU during deceleration. 4. Increase this value by approx. 20 % and use it as final setting.	Set the deceleration time for QSP required for the application.	
Quick stop in the event of mains failure with external brake resistor.	C0105	1. Set the same value as in PAR2. 2. Reduce the value until the required deceleration time after mains switch-off is available.	Set the deceleration time for QSP required for the application.	• Do not exceed the generative current limit during deceleration. • Select the external brake resistor large enough.

Important

- Parameter set changeover via terminal, bus or PC is not possible if C0988 > 0!
- C0988 is the same in all parameter sets.

Tip!

If the drive is stopped with emergeny off (controller is enabled by mains) controlled operation can be ensured by setting the function“Controlled deceleration in the event of a mains failure/mains disconnection”.



7.1.4.3 Controller inhibit

Caution!

Do not use controller inhibit (DCTRL1-CINH) as emergency off. Controller inhibit (CINH) only inhibits the power outputs and does **not** disconnect the controller from the mains.

Function

- Power output inhibit.
  - The drive idles to standstill without torque.
  - Keypad status display: IMP (Pulse inhibit)
  - The green LED of the controller is blinking.

Activation

- LOW level at X3/28 (cannot be inverted)
- C0410/10 ≠ 0: LOW level at signal source for CINH (level can be inverted under 0411)
- With C0469 = 1: STOP press
  - Restart with RUN

Important

- X3/28, C0410/10 and RUN have the same effect as an AND operation.
- A restart takes place at an output frequency of 0 Hz.
  - Rotating masses can cause overload, if the flying-restart circuit (C0142) is not active.

Tip!

It is also possible to inhibit and enable the controller under C0040 or read the status of controller inhibit.

If you set parameters via the parameter channel in bus operation, controller inhibit can also be set under C0040.

7.2 Limit value setting

7.2.1 Speed range

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0010	Minimum output frequency	0.00	0.00 → **14.5 Hz**	{0.02 Hz}	480.00	• C0010 is not effective with bipolar setpoint selection (-10 V ... + 10 V) • C0010 has no effect on AIN2 → **Speed setting range 1 : 6 for Lenze geared motors:** Setting absolutely required for operation with Lenze geared motors.	📖 7-14
C0011	Maximum output frequency	50.00	7.50 → **87 Hz**	{0.02 Hz}	480.00		
C0236 (A)	Acceleration time - minimum frequency limitation	0.00	0.00	{0.02 s}	1300.00	Ref. to C0011 Minimum frequency limitation = C0239	
C0239	Lowest frequency limit	-480.00	-480.00 = not active	{0.02 Hz}	480.00	• The value does not fall below limit independently of the setpoint. • If the minimum frequency limitation is active, the automatic DC-injection brake (auto DCB) must be deactivated (C0019 = 0 or C0106 = 0).	📖 7-14

Function

The speed setting range required for the application can be set via the selection of output frequencies:
- C0010 corresponds to the speed at 0 % speed setpoint selection.
- C0011 corresponds to the speed at 100 % speed setpoint selection.
- C0239 sets the speed. Independently of the setpoint, the value cannot fall below this speed (e.g. for fans, dancer position control or dry running protection for pumps).

Adjustment

Relation between output frequency and synchronous speed of the motor:

$$n_{Nsyn} = \frac{C0011 \cdot 60}{p}$$

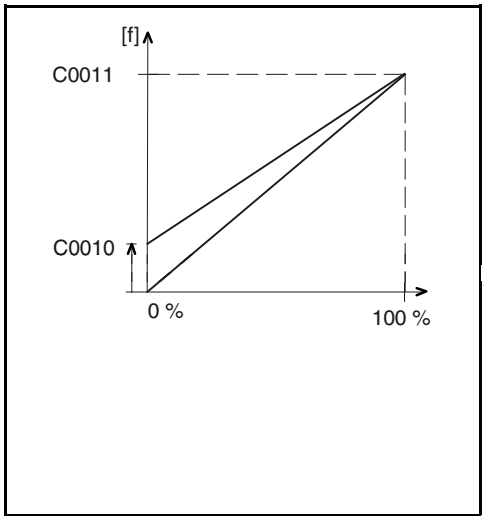
n_{Nsyn} Synchronous motor speed [min^{-1}]
C0011 Max. output frequency [Hz]
p No. of pole pairs (1, 2, 3, ...)

Example: 4 pole asynchronous motor:
p = 2, C0011 = 50 Hz

$$n_{Nsyn} = \frac{50 \cdot 60}{2} = 1500\,min^{-1}$$

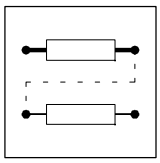
Important

- The setting C0010 > C0011 limits to C0011.
- C0011 has the same effect as a limitation when selecting setpoints via JOG values.
- C0011 is an internal normalisation variable.
  – Bigger changes should only be made when the controller is inhibited.
- C0010 has no effect
  – on AIN2 of the application I/O
  – when the setpoint is selected via frequency input
- Observe the maximum speed of the motor!



Special features

- With output frequencies > 300 Hz:
  – Avoid chopper frequencies < 8 kHz.
- The display values of C0010 and C0011 can be related to a process variable under C0500 and C0501.
- C0239 = 0.00 Hz only allows one direction of rotation.
- C0010 is approached via the acceleration ramp!
- When using standard I/O, C0239 is approached without acceleration ramp (jolt!). When using application I/O, C0236 can be used to set an acceleration time for C0239.



7.2.2 Current limit values (I_{max} limit values

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0022	I_{max} limit (motor mode)	150	30	{1 %}	150		🕮 7-15
C0023	I_{max}-limit in the generator mode	150	30	{1 %}	150	C0023 = 30 %: Function not active if C0014 = -2-, -3-:	

Function

The controllers are equipped with a current-limit control which determines the dynamic response under load. The measured load is compared with the limit values set under C0022 for motor load and C0023 for generator load. If the current limits are exceeded, the controller changes its dynamic behaviour.

- C0023 = 30 %
  - Current limit controller for generator mode not active (only for V/f characteristic control C0014 = -2-, -3-). (🕮 7-2).
  - Can be useful for applications with medium frequency asynchronous motors and fault detection of motor or generator mode.

Adjustment

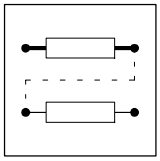
- Set the acceleration and deceleration times so that the drive can follow the speed profile without reaching I_{max} of the controller.
- Note the current derating at a chopper frequency of 16 kHz. (🕮 3-4)

Controller performance when a limit value is reached

- During acceleration:
  - Increase of the acceleration ramp
- During deceleration:
  - Increase of the deceleration ramp:
- With increasing load and constant speed:
  - When the current limit of the motor mode is reached: Output frequency derating to 0 Hz.
  - When the current limit in the generator mode is reached: Increase of output frequency to max. frequency (C0011).
  - Stopping of output frequency change if the load falls below the limit value.
  - If suddenly a load is applied to the motor shaft (e.g. drive is blocked), the overcurrent switch-off can be activated (error message OCX).
- With C0023 = 30 % and C0014 = -2-, -3-:
  - With motor and generator overload (C0054 > C0022): Output frequency derating to 0 Hz.
  - Stopping of output frequency change if the load falls below the limit value.

Important

- A correct current control in generator mode is only possible with a brake resistor.
- C0022 and C0023 refer to the rated output current at a chopper frequency of 8 kHz. (🕮 3-4)



7.3 Acceleration, deceleration, braking, stopping

7.3.1 Acceleration and deceleration times, S-ramps

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0012	Acceleration time main setpoint	5.00	0.00	{0.02 s}	1300.00	Reference: frequency change 0 Hz ... C0011 • Additional setpoint ⇨ C0220 • Acceleration times to be activated via digital signals ⇨ C0101	📖 7-16
C0013	Deceleration time main setpoint	5.00	0.00	{0.02 s}	1300.00	Reference: frequency change C0011 ... 0 Hz • Additional setpoint ⇨ C0221 • Deceleration times to be activated via digital signals ⇨ C0103	
C0101 (A)	Acceleration times main setpoint						📖 7-16
1	C0012	5.00	0.00	{0.02 s}	1300.00	Binary coding of the digital signal sources assigned under C0410/27 and C0410/28 determines active time pair C0410/27 C0410/28 active LOW LOW C0012; C0013 HIGH LOW T_{ir} 1; T_{if} 1 LOW HIGH T_{ir} 2; T_{if} 2 HIGH HIGH T_{ir} 3; T_{if} 3	
2	T_{ir} 1	2.50					
3	T_{ir} 2	0.50					
4	T_{ir} 3	10.00					
C0103 (A)	Deceleration times main setpoint						
1	C0013	5.00	0.00	{0.02 s}	1300.00		
2	T_{if} 1	2.50					
3	T_{if} 2	0.50					
4	T_{if} 3	10.00					
C0182*	Integration time S–ramps	0.00	0.00	{0.01 s}	50.00	• C0182 = 0.00: Linear ramp function generator operation • C0182 > 0.00: S-shaped ramp function generator (smooth)	📖 7-16
C0220*	Acceleration time - additional setpoint (PCTRL1-NADD)	5.00	0.00	{0.02 s}	1300.00	Main setpoint ⇨ C0012 C0220 individually adjustable in every parameter set when using application-I/O	📖 7-16
C0221*	Deceleration time - additional setpoint (PCTRL1-NADD)	5.00	0.00	{0.02 s}	1300.00	Main setpoint ⇨ C0013 C0221 individually adjustable in every parameter set when using application-I/O	

Function

The acceleration and deceleration times determine the controller response after a setpoint change.
An adjustable transmission element (PT1) is connected after the ramp function generator (NSET1-RFG1). It is thus possible to set a s-shaped reaction of the frequency setpoint. This function ensures absolutely smooth drive starts:

- C0182 = 0.00: Linear ramp function generator operation
- C0182 > 0.00: S-shaped ramp function generator operation (smooth)

Another 3 acceleration and deceleration times are available via terminals.

Adjustment

- The acceleration and deceleration times refer to an output frequency change from 0 Hz to the max. output frequency set under C0011.
- Calculate the times T_{ir} and T_{if} which must be set under C0012 and C0013.
  – t_{ir} and t_{if} are the times desired for the change between f_1 and f_2:

$$T_{ir} = t_{ir} \cdot \frac{C0011}{f_2 - f_1} \qquad T_{if} = t_{if} \cdot \frac{C0011}{f_2 - f_1}$$

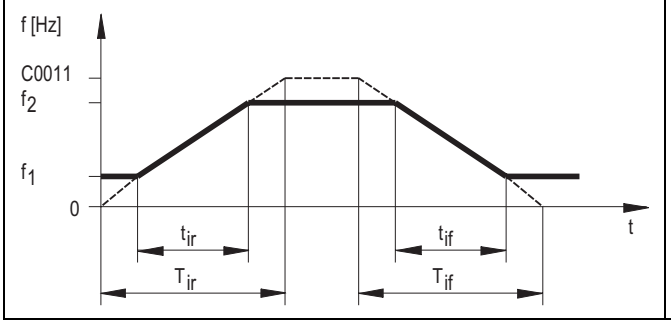
Important

- Under unfavourable operating conditions, too short acceleration and deceleration times can lead to the deactivation of the controller with the indication of TRIP OC5. In these cases, the acceleratin and deceleration times should be short enough that the drive can follow the speed profile without reaching I_{max} of the controller.
- C0182 is the same in all parameter sets.
- C0182 does not effect the additional setpoint (PCTRL1-NADD)
- Application example for S-ramps: 📖 13-14, setpoint summation (basic and additional load operation)

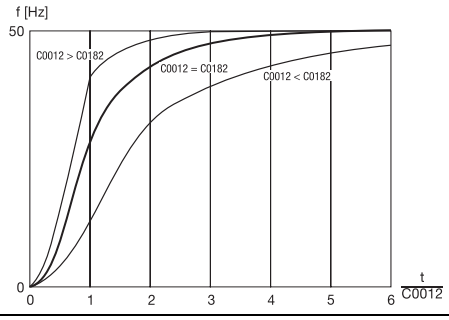
Special features

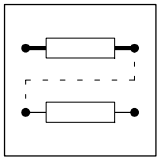
- The ramp function generator input of the main setpoint can be set to 0 under C0410/6. The main setpoint decelerates to 0 Hz along the deceleration ramp (C0013) as long as the function is active.
  – With setpoint summation or in controlled operation the drive can continue to run.
- The ramp function generator of the main setpoint can be stopped under C0410/5 (NSET1-RFG1-STOP). The value of the ramp function generator output remains the same as long as the function is active.

Linear ramp function generator



S-shaped ramp function generator





7.3.2 Quick stop (QSP)

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0105	Deceleration time quick stop (QSP)	5.00	0.00	{0.02 s}	1300.00	Quick stop decelerates the drive to standstill according to the deceleration time set under C0105. If the output frequency falls below the threshold C0019, the DC-injection brake (DCB) will be activated. **Exception:** Lower frequency limit C0239 > 0 Hz: Quick stop decelerates the drive to standstill according to the deceleration time set under C0105.	📖 7-18

Function

Quick stop decelerates the drive to standstill according to the deceleration time set under C0105.
If f falls below the threshold C0019, the DC-injection brake (DCB) will be activated. After the holding time (C0106) the controller sets pulse inhibit (display: IMP). (📖 7-19)

Activation

- C0410/4 ≠ 0:
  – LOW level at signal source for QSP (invert level under C0411)
- C0469 = -2-: STOP must be pressed.
  – Restart with RUN
- C0007 = -14- ... -22-, -34-, -47-:
  – LOW level at X3/E3 and X3/E4
  – HIGH level at X3/E3 and X3/E4 when switching the mains
- C0007 = -46-, -49-:
  – LOW level at X3/E2
- C0007 = -2-, -4-, -8-, -9-, -13-, -30-, -31-, -32-, -36-, -37-, -40-, -43-, -45-:
  – LOW level at X3/E3
- C0007 = -33-, -42-:
  – LOW level at X3/E4

Important

- Quick stop effects the mains setpoint and the additional setpoint.
- Quick stop does not effect the process controller.

7.3.3 Change of direction of rotation (CW/CCW)

Function

Change of direction of motor rotation via digital control signals. The time required depends on the ramp times set for the mains setpoint (deceleration time C0013, acceleration time C0012, and acceleration time S-ramps C0182).

Not failsafe change of the direction of rotation

Activation

- C0007 = -0- ... -13-, -23-, -43-, -45-: Change via X3/E4.
- C0410/3 ≠ 0: Change via freely configurable signal source.

If all connections are correct in phase and all inputs are HIGH active, the result will be a

- CW rotation field at LOW level and a CCW rotation field at HIGH level.

Important

- The drive can reverse the direction of rotation in the event of a control-voltage failure or an open circuit.
- Changes are only possible in the main setpoint.

Failsafe change of the direction of rotation

Activation

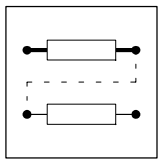
- C0007 = -14- ... -22-, -34-, -47-: Failsafe change of direction of rotation via X3/E3, X3/E4.
- C0410/22 ≠ 0 and C0410/23 ≠ 0: Failsafe change via freely configurable signal source.

If all connections are correct in phase and all inputs are HIGH active, the result will be a

Function	Signal source	
	Level for CW/QSP	Level for CCW/QSP
CCW rotation	LOW	HIGH
CW rotation	HIGH	LOW
Quick stop	LOW	LOW
unchanged	HIGH	HIGH

Important

- HIGH level at CW/QSP and CCW/QSP: The direction of rotation results from the signal active first.
- HIGH level when switching the mains on at CW/QSP and CCW/QSP: The controller activates quick stop (QSP).
- Changes are only possible in the main setpoint.



7.3.4 Braking without brake resistor

7.3.4.1 DC-injection brake (DCB)

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0035*↲	DC injection brake (DCB) control mode	-0-	-0-	Brake voltage selection under C0036		Holding time ⇨ C0107	🕮 7-19
			-1-	Brake current selection under C0036			
C0036	Voltage/current DCB	→	0	{0.02 %}	150 %	→ depending on the controller • Reference M_r, I_r • Setting applies to all mains voltages permitted	
C0107	Holding time DCB	999.00	1.00	{0.01 s}	999.00 = ∞	Holding time, if DCB is activated via an external terminal or control word.	🕮 7-19
C0196*↲	Activation of auto–DCB	-0-	-0-	Auto-DCB active, if PCTRL1-SET3 < C0019			🕮 7-19
			-1-	Auto-DCB active, if PCTRL1-SET3 < C0019 **and** NSET1-RFG1-IN < C0019			
C0019	Threshold for automatic DC-injection brake (Auto DCB)	0.10	0.00 = not active	{0.02 Hz}	480.00	Holding time ⇨ C0106 Deactivate the automatic DC injection brake when the minimum frequency limit C0239 is active!	🕮 7-19
C0106	Holding time auto DCB	0.50	0.00 = auto DCB not active	{0.01 s}	999.00 = ∞	Holding time, if DCB is activated because the value falls below the setting in C0019.	🕮 7-19

Function

The DC-injection brake enables quick deceleration of the drive to standstill without using an external brake resistor. The DC-injection brake can be activated via terminal or automatically.

- The brake torque is lower than for braking in generator mode with external brake resistors.
  – Possible brake torque: approx. 20 % ... 30 % of the rated motor torque.
- A brake voltage or a brake current can be selected.
- C0196 improves the motor starting behaviour when the automatic DC-injection brake is activated (e.g. for operation of hoists).

Adjustment

1. Select under C0035 whether you want to use a brake voltage or brake current.
2. Enter the brake voltage or brake current in per cent under C0036.
   – If C0035 = -0- the value indicated refers to the rated controller voltage.
   – If C0035 = -1- the value indicated refers to the rated controller current.
3. Select how to activate the DC-injection brake:
   – Via digital input signal (configuration with C0410/15)
   – Automatically when the value falls below the threshold set under C0019 (condition: C0106 > 0.00 s)

Activation via input signal

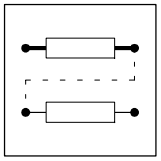
HIGH active inputs

Code		HIGH level at	Function
C0007	-17-	X3/E1	DCB is active until X3/E1 = LOW.
	-3-, -7-, -14-, 19	X3/E2	DCB is active until X3/E2 = LOW.
	8215 / 8216 / 8217 / 8218	X3/E3	DCB is active until X3/E3 = LOW.
	-31-, -36-, -51-	X3/E4	DCB is active until X3/E4 = LOW.
C0410/15	≠ 0	Signal source	DCB is active until signal source = LOW.

After the holding time (C0107) the controller sets pulse inhibit (display: IMP).

Automatic activation

1. Select the holding time >0.00 s under C0106:
   – Automatic DC-injection brake is active for the time set. Afterwards, the controller sets pulse inhibit (display: IMP).
2. Select the input condition for automatic DC-injection braking under C0196:
   – C0196 = -0-: DCB active if C0050 < C0019
   – C0196 = -1-: DCB active if C0050 < C0019 **and** setpoint < C0019
3. Set the threshold under C0019:
   – The threshold indicates when the DC-injection brake is activated.



Function library

Acceleration, deceleration, braking, stopping

Important

- C0035 = -1-
  – The DC brake current is directly set under C0036 (ref. to rated controller current).
- C0035 = -0-
  – The DC brake current is indirectly set under C0036 (ref. to rated voltage) eingestellt.
- In the event of excessively long operation at high DC brake current the connected can be overheated!

Special features

- Use C0019 to adjust the deadband in the setpoint. If you do not want the DC-injection to be activated for this, set C0106 = 0.00 s.
- C0019 can be related to a process variable (🕮 7-54).

7.3.4.2 AC-motor braking

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0988*	DC-bus voltage threshold for DC-bus voltage control	0	0 {1 %} 200		• C0988 = 0 % – Parameter set changeover via DC-bus voltage deactivated • Changeover always between PAR1 and PAR2 • Parameter set changeover via terminal, bus or PC is not possible if C0988 > 0!	🕮 7-11 🕮 7-20

Function

With the parameter set changeover in dependence of the DC-bus voltage, the AC motor braking can be used as alternative for DC braking.

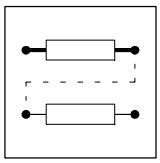
- The AC motor braking is a braking method without external brake resistor for the control mode “V/f-characteristic control with linear characteristic” (C0014 = -2-)”.
- With mains voltages up to approx. AC 400 V shorter braking times can be reached as with the DC-injection brake.
- The braking times for braking via external brake resistor are approx. 33% shorter than for AC motor braking.

Configuration of the parameter sets

Code	PAR1 setting (active in normal operation)	PAR2 setting (active in braking operation)	Note
C0013/ C0105	Braking time required for AC braking	Deceleration time of the drive with max. load without getting the message OU (overvoltage) during deleration.	• C0013 for braking along the main setpoint ramp • C0105 for braking along the QSP ramp
C0015	Value adapted to the drive, e.g. V/f vertex = 50 Hz	Depending on the drive power up to min. 25 % of the value under C015 in PAR1: • Rule of thumb: 2.2 kW ⇨ 50 % • Decrease for lower drive power, increase for higher drive power.	Thus the energy in the motor is decreased by overexcitation in PAR2.
C0016	Value adapted to the drive, e.g. V_{min} = 5 %	Depending on the drive power up to 500 % of the value under C0016 in PAR1: • Rule of thumb: 2.2 kW ⇨ factor 3 • For lower drive power increse the factor, for higher power decrease it.	Thus also in the lower speed range, the energy in the motor is decreased by overexcitation in PAR2.
C0988	Threshold Setting according to the mains voltage:		
	230 V, 400 V 440 V 460 V 480 V 500 V	⇨ 112 % ⇨ 123 % ⇨ 129 % ⇨ 134 % ⇨ 140 %	

Important

- AC motor braking can only be used together with the control mode “V/f-characteristic control with linear characteristic” (C0014 = -2-).
- Parameter set changeover is not possible via terminal, bus or PC if C988 > 0!
- The higher the mains voltage, the longer the deceleration time for AC braking must be set in PAR1, to fulfill the requirements stated above. It is therefore possible to achieve shorter deceleration times with the DCB if the mains voltage is high.
- C0988 is the same in all parameter sets.



7.4 Configuration of analog and digital setpoints and actual values

7.4.1 Setpoint source selection

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0001↵	Setpoint source selection (operating mode)	-0-	Setpoint source	• C0001 = 0 ... 3: The device can be controlled via terminals or PC/keypad • Check the assignment of setpoint source and analog signal under C0412 • AIF bus modules are, for instance, INTERBUS 2111, PROFIBUS-DP 2133, System bus (CAN) 2171, LECOM A/B/LI 2102 **C0001 = 3 must be set to select a setpoint via a process data channel of an AIF bus module! Otherwise the process data will not be evaluated!**	📖 7-21
		-0-	Other sources as parameter channel/process data channel of AIF		
		-1-	Parameter channel of an AIF bus module		
		-2-	Other sources as parameter channel/process data channel of AIF		
		-3-	Process data channel of an AIF bus module (AIF-IN.W1 or AIF-IN.W2)		

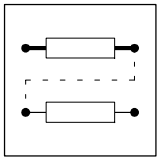
Function

Fixed setpoint source selection.

- C0001 = -0-, -2-: Setpoint source as described in the following. The setpoint source is assigned to the internal analog signal under C0412.
- C0001 = -1-: Setpoint source is parameter channel of AIF. The freely configurable signals are “switched off” (C0412/x = 0 or 255). The setpoint must be written to the codes which are assigned to the signals (see signal flow charts or description of C0412).
- C0001 = -3-: Setpoint source is parameter data channel of AIF. The setpoint is written to an AIF input word (AIF-IN.W1 or AIF-IN.W2) geschrieben. The AIF input word must be assigned to the internal analog signal under C0412.

Important

- With C0001 = -0-, -1- or -2- operation can start after the controller has been enabled.
- C0001 = 3 must be set to select a setpoint via a process data channel of an AIF bus module! Otherwise the process data will not be evaluated.
- With C0001 = -3- quick stop (QSP) is set after mains switch-o.!
  – PC: Deactivate QSP using the control word C0135, bit 3 = 0.
  – Keypad: Set C0469 = -2-. RUN must be pressed.



7.4.2 Analog setpoints via terminal

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0026*	Offset analog input 1 (AIN1–OFFSET)	0.0	-200.0	{0.1 %}	200.0	• Settings for X3/8 and X3/1U, X3/1I • The max. limit of the setpoint value range of C0034 equals 100 % • C0026 and C0413/1 are identical	📖 7-22
C0027*	Gain analog input 1 (AIN1-GAIN)	100.0	-1500.0	{0.1 %}	1500.0	• Settings for X3/8 and X3/1U, X3/1I • 100.0 % = Gain 1 • Inverse setpoint selection by negative gain and negative offset • C0027 and C0414/1 are identical	
C0034*↲	Setpoint selection range Standard–I/O (X3/8)					Observe the switch position of the function module!	📖 7-22
		-0-	-0-	0 ... 5 V / 0 ... 10 V / 0 ... 20 mA			
			-1-	4 ... 20 mA			
			-2-	-10 V ... +10 V		• Minimum output frequency (C0010) not effective • Individual adjustment of offset and gain	
			-3-	4 ... 20 mA Open-circuit monitoring		TRIP Sd5, if I < 4 mA	
C0034*↲ (A)	Setpoint selection range Application I/O					Observe the jumper setting of the function module!	📖 7-22
1	X3/1U, X3/1I	-0-	-0-	Voltage unipolar 0 ... 5 V / 0 ... 10 V			
2	X3/2U, X3/2I		-1-	Voltage bipolar -10 V ... +10 V		Minimum output frequency (C0010) not effective	
			-2-	Current 0 ... 20 mA			
			-3-	Current 4 ... 20 mA			
			-4-	Current 4 ... 20 mA open-circuit monitored		TRIP Sd5 if I < 4 mA	
C0413*	Offset analog inputs					The max. limit of the setpoint value range of C0034 equals 100 %	📖 7-22
1	AIN1-OFFSET	0.0	-200.0	{0.1 %}	200.0	Settings for X3/8 and X3/1U, X3/1I C0413/1 and C0026 are identical	
2	AIN2-OFFSET	0.0				Setting for X3/2U, X3/2I (application I/O only)	
C0414*	Gain analog inputs					• 100.0 % = Gain 1 • Inverse setpoint selection by negative gain and negative offset	
1	AIN1-GAIN	100.0	-1500.0	{0.1 %}	1500.0	Settings for X3/8 and X3/1U, X3/1I C0414/1 and C0027 are identical	
2	AIN2-GAIN	100.0				Setting for X3/2U, X3/2I (application I/O only)	

Function

Selection and adjustment of analog signals via terminal as setpoint or actual value.

Activation configured

Select a configuration suitable for the application under C0005.

Activation freely configured

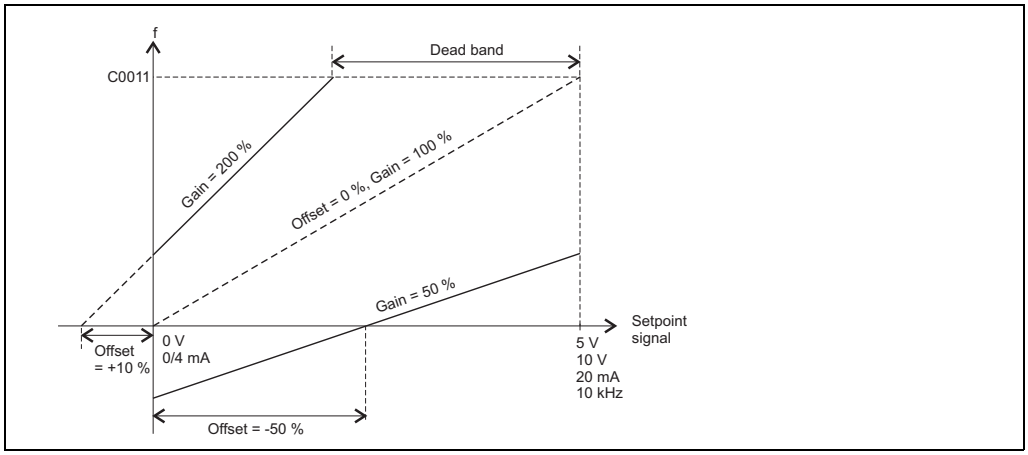
Assign an analog input terminal to the setpoint or actual value under C0412 (C0412/x = 1 or 4).

Adjustment

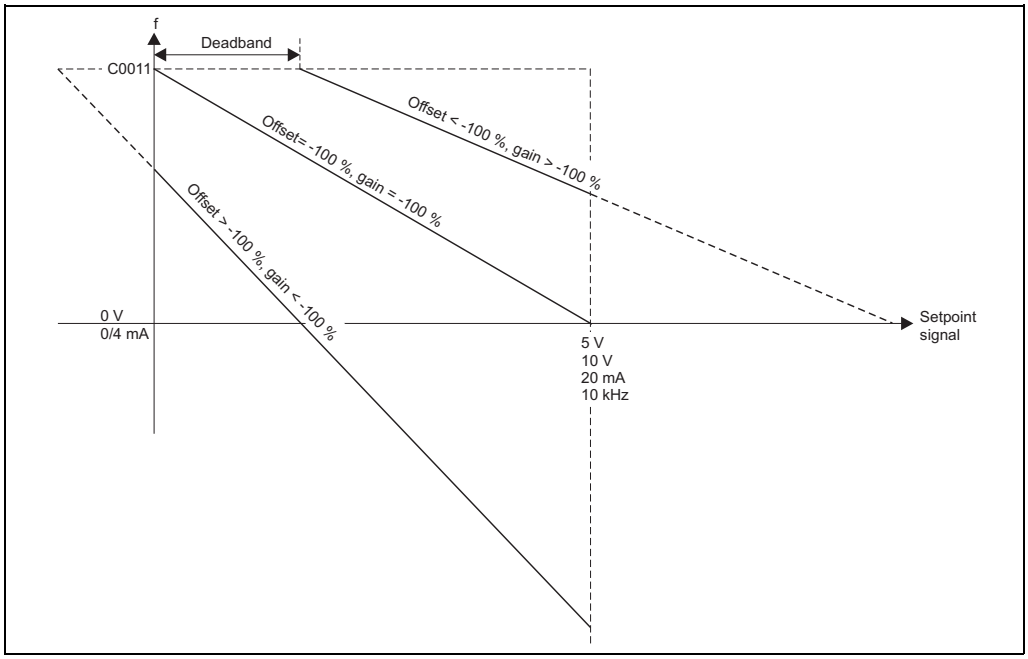
1. Selt the setpoint range under C0034.
2. Set the switch and jumper at the function module for the same range. Otherwise the setpoint signal cannot be interpreted correctly.
   – The setpoint signal is only evaluated in the setpoint range set (C0034), independently of the gain.
   – The minimum output frequency (C0010) corresponds to 0 % setpoint signal.
   – With offset ≠ 0 % and/or inverse setpoint selection the value can fall below the value set under C0010.
3. If necessary, adjust the gain (C0414)
   – The gain always effects setpoint signal and offset.
   – 100 % equals gain factor = 1.
4. If necessary, adjust the offset (C0413).
   – An offset shifts the characteristic (📖 7-23).
   – A deadband can be created using offset and C0239 (min. frequency limit).

Adjustment

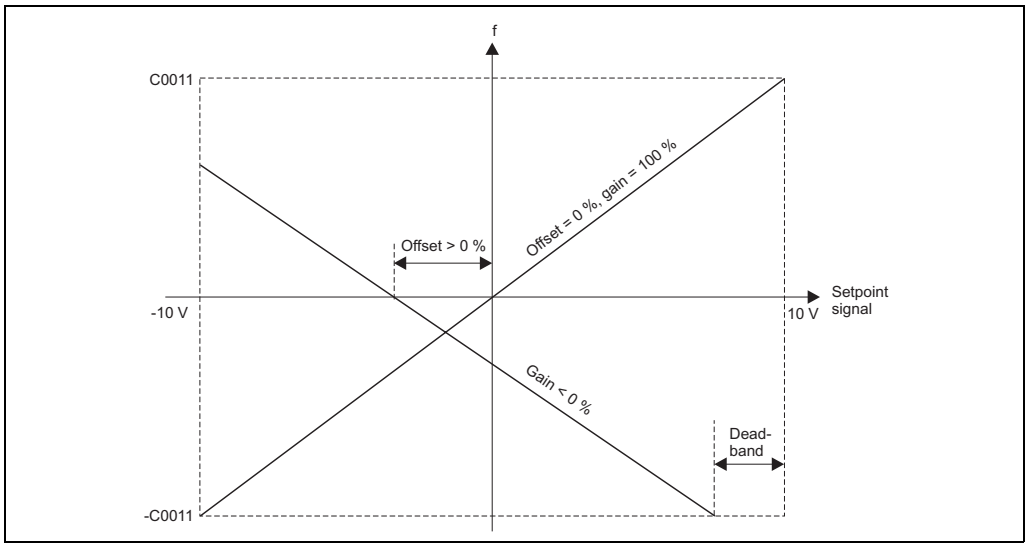
Unipolar setpoint selection

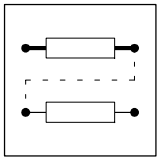


Inverse setpoint selection



Bipolar setpoint selection





Function library

Configuration of analog and digital setpoints and actual values

Example

A dead band of + 2 V (= 20 %) is to be set for an inverset setpoint selection (0 ... +10 V). The output frequency is to be inversed the higher the setpoint signal and is to reach - 30 % at setpoint +10 V.

Tip:

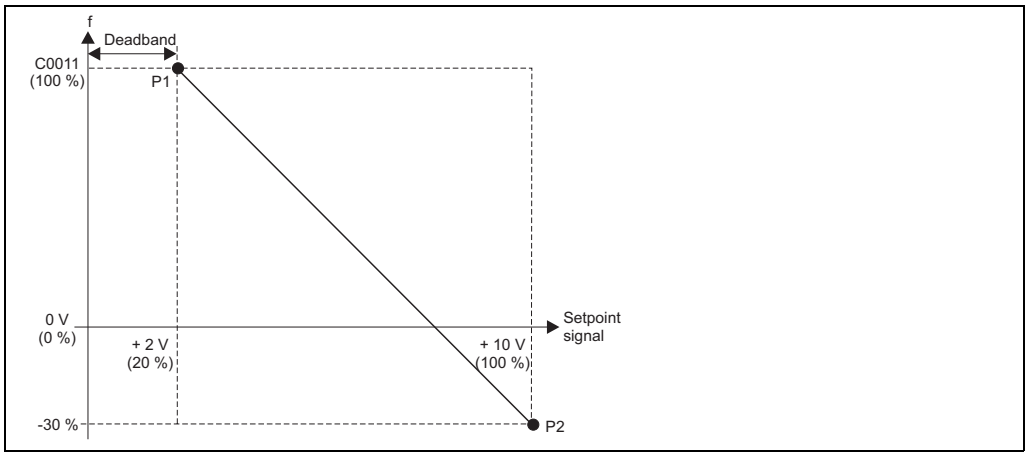
- P1 and P2 can be any point on a line.
- Please consider the signs in front of a value.

Gain calculation

$$\text{Gain [\%]} = \frac{f(P_2) - f(P_1)}{V(P_2) - V(P_1)} \cdot 100\,\% = \frac{-30\,\% - 100\,\%}{100\,\% - 20\,\%} \cdot 100\,\% = -162.5\,\%$$

Offset calculation

$$\text{Offset } (P_2)\text{ [\%]} = \frac{f(P_2)\text{ [\%]}}{\text{gain [\%]}} \cdot 100\,\% - V(P_2)\text{ [\%]} = \frac{-30\,\%}{-162.5\,\%} \cdot 100\,\% - 100\,\% = -81.5\,\%$$



Calibration when using a process controller

If, for instance, the control range of a pressure control is to be limited to a value lower than the rated sensor value Pr, the effective pressure setpoint can be proportionally reduced under C0027, C0414).

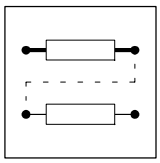
Example:

- Actual pressure value via pressure sensor (P_r = 0 - 200 mbar) at X3/2U (C0412/5 = 4).
- Analog pressure setpoint via X3/1U (C0412/4 = 1).
- The maximum pressure is to be limited to 120 mbar. Reduce the effective pressure setpoint via the gain of the analog input:

$$\text{C0414/1} = \frac{P_1}{P_r} \cdot 100\,\% = \frac{120\text{ mbar}}{200\text{ mbar}} \cdot 100\,\% = 60\,\%$$

Important

C0026, C0027, C0413 and C0414 are identical in all parameter sets.



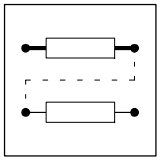
7.4.3 Digital setpoints via frequency input

Code		Possible settings						IMPORTANT	
No.	Name	Lenze	Selection						
C0425↵*	Configuration frequency input single track X3/E1 (DFIN1)	-2-		f_r	Δf_{min}	t	f_{max}	• f_r = Normalisation frequency – f_r corresponds to C0011 • Δf_{min} = Resolution • t = Scanning rate – The lower the scanning rate the higher the dynamical response. • f_{max} = Maximum frequency which can be processed independently of C0425 – Set C0425 that the frequency coming from the encoder is lower than f max at maximum motor speed • Activate frequency input with C0410/24 = 1 • Adjust frequency input under C0426 and C0427	📖 7-25
			-0-	100 Hz	1/200	1 s	300 Hz		
			-1-	1 kHz	1/200	100 msec	3 kHz		
			-2-	10 kHz	1/200	10 msec	10 kHz		
			-3-	10 kHz	1/1000	50 msec	10 kHz		
			-4-	10 kHz	1/10000	500 msec	10 kHz		
			-5- (A)	100 kHz	1/400	2 msec	100 kHz		
			-6- (A)	100 kHz	1/1000	5 msec	100 kHz		
			-7- (A)	100 kHz	1/2000	10 msec	100 kHz		
	Configuration frequency input two tracks X3/E1, X3/E2 (DFIN1)		-10- (A)	100 Hz	1/200	1 s	300 Hz		
			-11- (A)	1 kHz	1/200	100 msec	3 kHz		
			-12- (A)	10 kHz	1/200	10 msec	10 kHz		
			-13- (A)	10 kHz	1/1000	50 msec	10 kHz		
			-14- (A)	10 kHz	1/10000	500 msec	10 kHz		
			-15- (A)	100 kHz	1/400	2 msec	100 kHz		
			-16- (A)	100 kHz	1/1000	5 msec	100 kHz		
			-17- (A)	100 kHz	1/2000	10 msec	100 kHz		
C0426*	Gain frequency input X3/E1, X3/E2 (A) (DFIN1-GAIN)	100	-1500.0		{0.1 %}		1500.0	$C0426 = \frac{f_r\,(C0425)}{\frac{n_{max}}{60\ s} \cdot inc/rev} \cdot \frac{C0011 - f_s}{C0011} \cdot 100\ \%$ • n_{max} = Maximum process speed of motor in min^{-1} • f_s = Slip frequency in Hz	
C0427*	Offset frequency input X3/E1, X3/E2 (A) (DFIN1-OFFSET)	0.0	-100.0		{0.1 %}		100.0		
C0428* (A)	Gain frequency output (DFOUT1-OUT)	100	0.0		{0.1 %}		1500.0		
C0435*↵ (A)	Automatic adjustment frequency input	0	0 = not active		{1}		4096	• Only require for speed control with digital feedback via HTL encoder • Calculates the gain C0426, depending on C0425 and C0011 • C0426 will be recalculated after every change of C0011 or C0425. • **Always enter number of increments divided by number of pole pairs of the motor!** – Example: Encoder increments = 4096, motor 4 poles – C0435 = 2048	

Function

Selection and adjustment of a digital frequency as setpoint or actual value.

- 0 Hz ... 10 kHz at X3/E1 for operation with standard I/O
- 0 Hz ... 100 kHz at X3/E1 (single track) or at X3/E1 and X3/E2 (two tracks) for operation with application I/O



Function library

Configuration of analog and digital setpoints and actual values

Activation configured

1. C0007 = -28- ... -45-, -48-, -49-, -50-, -51- configures X3/E1 as frequency input.
2. Selection configuration which evaluates the frequency input under C0005 (C0005 = -2-, -3-, -5-, -6-, -7-).

Activation freely configured

1. Assign the signal source "frequency input" to the required setpoint or actual value under C0412 (C0412/x = 2).
2. Activate the frequency input under C0410/24 = 1.

Adjustment

1. Enter frequency, resolution, scanning time and type (single track, two tracks) of the setpoint signal (C0425).
2. Set the gain and ensure that the input frequency corresponds to the normalisation frequency at maximum process speed of the motor (C0426).
   – The gain always effects setpoint signal and offset.
   – 100 % equals gain factor = 1(📖 7-23).

Gain calculation

$$C0426 = \frac{f_r\,(C0425)}{\frac{n_{max}}{60\ s} \cdot inc/rev} \cdot \frac{C0011 - f_s}{C0011} \cdot 100\ \%$$

$f_{r\,(C0425)}$	Normalisation frequency from C0425
n_{max}	Maximum process speed of the motor in min^{-1}
f_s	Slip frequency in Hz
inc/rev	Pulses/revolution (encoder)

Calculate the slip frequency

$$f_s = f_r \cdot \frac{n_{rsyn} - n_r}{n_{rsyn}}$$

$$n_{rsyn} = \frac{f_r \cdot 60}{p}$$

f_r	Rated frequency according to motor nameplate [Hz]
n_{rsyn}	Synchronous motor speed [min^{-1}]
n_r	Rated speed to motor nameplate [min^{-1}]
p	Number of pole pairs

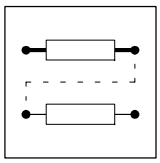
3. If necessary, adjust the offset (C0427).
   – An offset shifts the characteristic (📖 7-23).

Tip

- For higher accuracy requirements, select a higher resolution under C0425 taking into account the scanning time.
- The direction of rotation of the motor can be evaluated with a two track frequency signal.

Important

- If you use X3/E1 or X3/E1 and X3/E2 as frequency inputs, you must ensure that the inputs are not connected to other digial signals. These connections must be disconnected under C0410, otherwise the controller cannot interprete the setpoint signal correctly. (📖 14-1 ff)
- C0010 (minimum output frequency) is not effective.



7.4.4 Setpoints via function ”Motor potentiometer”

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0265*↲	Configuration motor potentiometer	-3-	-0- Start value = power off -1- Start value = C0010 -2- Start value = 0 -3- Start value = power off QSP, if UP/DOWN = LOW -4- Start value = C0010 QSP, if UP/DOWN = LOW -5- Start value = 0 QSP, if UP/DOWN = LOW	• Start value: output frequency which is approached with Tir (C0012) when the mains is switched on and the motor potentiometer is activated: – ”Power off” = act. value if mains is off – ”C0010”: min. output frequency from C0010 – ”0” = output frequency 0 Hz • C0265 = -3-, -4-, -5-: – QSP reduces the motor potentiometer along the QSP ramp (C0105)	📖 7-27

Function

Setpoint selection via two digital signals (UP/DOWN), which are controlled by means of,for instance, simple pushbuttons. The output frequency in changed via the acceleration and deceleration times set for the main setpoint (C0012/C0013) or for the additional setpoint (C0220/C0221).

Activation configured

C0007 = -10-, -11-, -12-, -13-, -21-, -23-, -24-, -25-, -26-, -27-, -44-

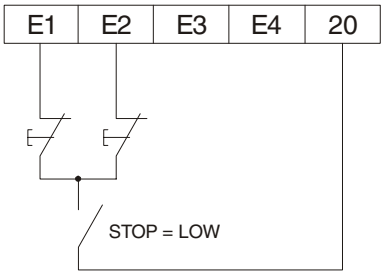
Activation freely configured

1. UP and DOWN linked with external signal sources: C0410/7 (UP) ≠ 0 and C0410/8 (DOWN) ≠ 0
2. Assign the signal source ”Motor potentiometer” to the required setpoint under C0412 (C0412/x = 3). (📖 7-38)

Function	UP	DOWN
Decelerate setpoint to 0 Hz along QSP ramp	LOW	LOW
Decelerate the setpoint along the main setpoint ramp (C0013) to minimum output frequency (C0010). (Setpoint must have been higher than value set under C0010)	LOW	HIGH
Accelerate the setpoint along the main setpoint acceleration ramp (C0012) to maximum output frquency (C0011)	HIGH	LOW
Setpoint remains constant	HIGH	HIGH

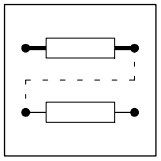
Examples

Activation of the function “Motor potentiometer”, e. g. via NC contacts
E1 = ”DOWN”: Configuration with C0410/8 = 1
E2 = ”UP”: Configuration with C0410/7 = 2



Important

- The function ”Motor potentiometer” usually requires an I/O module. It can however also be ussed with digital bus signals.
- Proceed as follows if the setpoint selection via motor potentiometer is used together with the function module standard I/O:
  – Link the output signal MPOT1-OUT only with the signals NSET1-N1, NSET1-N2 or PCTRL1-NADD under C0412.
  – Otherwise the setpoint will jump!
- JOG frequencies have priority over the function “Motor potentiometer”.
- The setpoint is saved
  – when switching the mains (see C0265),
  – when the controller is inhibited (CINH),
  – when error messages occur
- C0265 = -3-, -4-, -5-:
  – Activation of the QSP funcation at C0410/4 resets the motor potentiometer to 0 Hz along the QSP ramp (C0105).
- The additional setpoint is added when using the motor potentiometer function.



7.4.5 Setpoints via JOG frequencies

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0037	JOG1	20.00	-480.00	{0.02 Hz}	480.00	JOG = Setpoint Additional JOG frequencies ⇨ C0440	📖 7-28
C0038	JOG2	30.00	-480.00	{0.02 Hz}	480.00		
C0039	JOG3	40.00	-480.00	{0.02 Hz}	480.00		
C0440 (A)	Additional JOG values					JOG = Setpoint Activation via configuration under C0410	📖 7-28
1	JOG 1	20.00	-650.00	{0.02 Hz	650.00	C04401/1 and C0037 are the same	
2	JOG 2	30.00				C04401/2 and C0038 are the same	
3	JOG 3	40.00				C04401/3 and C0039 are the same	
4	JOG 4	15.00					
5	JOG 5	25.00					
6	JOG 6	35.00					
7	JOG 7	45.00					

Function

You can store up to three fixed setpoints per parameter set and retrieve them using digital input signals.
With the application I/O 7 fixed setpoints are available per parameter set.

Activation of 3 JOG values

- Fixed configuration, activation via digital inputs:
  – C0007 = -0- ... -6-, -9-, -14-, -15-, -16-, -20-, -22-, -28-, -29-, -30-, -35-, -37- ... -41-, -46-, -47-, -49-, -50-
- Free configuration, activation via digital input signals
  – C0410/1 ≠ 0 and/or C0410/2 ≠ 0

HIGH active inputs

Setpoint input via	Level at		
	NSET1-JOG1/3	NSET1-JOG2/3	
other setpoint source	LOW	LOW	
JOG 1	HIGH	LOW	
JOG 2	LOW	HIGH	
JOG 3	HIGH	HIGH	

Activation of 7 JOG values with application I/O

- Free configuration, activation via digital input signals
  – C0410/1 ≠ 0 and/or C0410/2 ≠ 0 and/or C0410/33 ≠ 0

HIGH active inputs

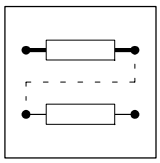
Setpoint input via	Level at		
	NSET1-JOG1/3/5/7	NSET1-JOG2/3/6/7	NSET1-JOG4/5/6/7
other setpoint source	LOW	LOW	LOW
JOG 1	HIGH	LOW	LOW
JOG 2	LOW	HIGH	LOW
JOG 3	HIGH	HIGH	LOW
JOG 4	LOW	LOW	HIGH
JOG 5	HIGH	LOW	HIGH
JOG 6	LOW	HIGH	HIGH
JOG 7	HIGH	HIGH	HIGH

Important

- The setting under C0011 also limits the output frequency for JOG values.
- The setting under C0010 is not effective if the setpoints are selected through JOG values.
- JOG values have priority over NSET1-N1 and NSET1-N2.

Special features

- You can relate the display value of the parameter to a process value. (📖 7-54)
- The additional setpoint is added to JOG frequencies.



7.4.6 Setpoints via keypad

Function

Setpoints can be selected using the keypad.

Adjustment

1. With ⬅ or ➡ jump to Set .
2. Set the setpoint using ▼ or ▲
   – If the controller is enabled, the changed setpoint has a direct effect on the drive.
   – The setpoint is saved when the controller is inhibited. After the controller has been enabled, the drive accelerates or decelerates to the setpoint set last.
   – The keypad setpoint can be read and selected under C0140.

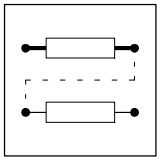
Important

- Setpoints selected by means of the keypad are stored when the controller is disconnected from the mains or operation is interrupted.
- The keypad setpoint is added to the main setpoint.
- Setpoint selection via Set also influences NSET1-N1 and NSET1-N2.
  – Setpoints can be individually set for NSET1-N1 and NSET-N2 under C0046 and C0044.
  Set C0412/1 = 0 and C0412/2 = 0.
- Set C0140 = 0 if the setpoint is not selected under Set .
- The drive can start again after controller enable!
- Observe the start conditions under C0142 (🕮 7-10).

7.4.7 Setpoints via a bus system

Function

Setpoints or actual values can be preselected for FIF by means of a bus function module or AIF by means of a bus module. Detailed descriptions can be found in the corresponding Instructions.



7.4.8 Setpoint changeover (manual/remote changeover)

Function

- Changeover between the setpoints NSET1-N1 and NSET1-N2 (signal flow charts: 📖 14-1 ff).
- With manual/remote changeover (H/Re) it is for instance possible to change from remote operation to manual operation in the event of setting or service at the drive.
  - The remote source does not have to be changed for manual operation.
  - In manual operation the setpoint is selected via potentiometer, motor potentiometer or keypad/PC.
- Examples for setpoint changeovers:
  - Bus operation ⇔ Keypad or PC
  - Bus operation ⇔ Analog setpoint via terminal
  - Keypad or PC ⇔ Analog setpoint via terminal
  - Function “Motor potentiometer” ⇔ Analog setpoint via terminal
  - Analog setpoint via terminal ⇔ Setpoint via frequency input
  - Analog input 1 ⇔ Analog input 2 (application I/O only)

Activation

- Setpoint assignment for remote operation C0412/1.
- Setpoint assignment for manual operation C0412/2.
- C0410/17 (H/Re) signal source assignment.
- HIGH active inputs
  - Manual operation active if signal source for H/Re = HIGH

Activation of ”bus operation ⇔ keypad or PC”

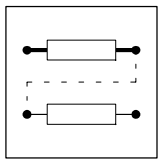
1. Internally invert a digital input (E5 or E6) not used with Lenze setting under C0411.
2. Assign this input C0410/17 (H/Re) to activate manual operation.
3. If the inversion of the digital input reset (C0411 = 0), remote operation will be active again.

Example:

- Invert X3/E6 with C0411 = -32-.
- Assign X3/E6 to the subcode C0410/17 with C0410/17 = 6.
- The setpoint can be selected under C0044 using the keypad or PC

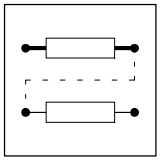
Important

- The safety functions controller inhibit (CINH) and quick stop (QSP) set in remote operation will be reset when manual operation is being activated. Check whether the master system reactivates these functions after a changeover.
- JOG frequency are not effected by a manual/remote changeover.
- Set Keypad changes effect NSET1-N1 **and** NSET-N2.
  - Use C0046 (NSET1-N1) and C0044 (NSET1-N2) for separated setpoint selection.
- The keypad key STOP is not active in manual operation!



7.5 Motor data entry/automatic detection

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0084	Motor stator resistance	0.000	0.000	{0.001 Ω}	64.000		📖 7-31
C0087	Rated motor speed	1390	300	{1 rpm}	16000		
C0088	Rated motor current	→	0.0	{0.1 A}	480.0	→ depending on the controller 0.0 ... 2.0 x rated output current of the controller	
C0089	Rated motor frequency	50	10	{1 Hz}	960		
C0090	Rated motor voltage	→	50	{1 V}	500	→ 230 V with 230 V controllers, 400 V with 400 V controllers	
C0091	Motor cos φ	→	0.40	{0.1}	1.0	→ depending on the controller	
C0092	Motor stator inductance	0.0	0.0	{0.1 mH}	2000.0		
[C0148]*	Motor parameter identification	-0-	-0-	Ready		**Only when the motor is cold!** 1. Inhibit controller, wait until drive is in standstill 2. Enter the correct motor data under C0087, C0088, C0089, C0090, C0091 (see motor nameplate). 3. C0148 = set 1 by ENTER 4. Enable controller The identification – starts, IMP Off – takes approx. 30 s – is completed when IMP is on again 5. Controller inhibit	📖 7-31
			-1-	Start identification • V/f rated frequency (C0015), slip compensation (C0021) and motor stator inductivity (C0092) are calculated and saved. • The motor stator resistance (C0084) = total resistance of motor cable and motor is measured and saved			



Function library

Motor data entry/automatic detection

Function

Entire detection of motor data and motor cable influences.
Must be done before the first commissioning of vector control (C0014 = -4-) or sensorless torque control (C0014 = -5-).
Otherwise commissioning is not possible.

Adjustment

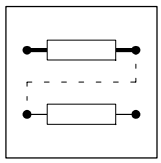
1. Inhibit the controller. And wait until the drive is in standstill.
2. Enter C0087, C0088, C0089, C0090 and C0091 of your motor (see nameplate):
   – It is absolutely necessary to enter correct data since important parameters such as slip compensation, idle running current and I^2t monitoring are based on these values.
   – Enter rated motor current (C0088) and rated motor voltage (C0090) according to the connection type (star or delta).
3. Select C0148 = -1- and confirm with ENTER.
4. Enable controller. Identification starts (green controller LED blinking quickly).
   – The motor stator resistance is measured and stored under C0084.
   – The motor stator inductance is calculated from the data entered and stored under C0092.
   – The V/f rated frequency is calculated and stored under C0015.
   – The slip is calculated and stored under C0021.
   – The identification takes approx. 30 s.
   – Identification is completed when the green controller LED comes on (keypad, GDC: IMP is active).
5. Inhibit the controller.

Important

- Ensure that the motor is cold when the identification is started!
  – During identification current flow via the controller outputs U, V.
  – The load machine can remain connected. Holding brakes can remain in their braking position.
  – With idling motors a small angle shift can occur at the motor shaft.
- The motor data are corrected automatically during operation (max. ±25 %) to compensate for temperature fluctuations.
  – The values under C0084 and C0092 calculated by C0148 become active after mains switching.
- The values under C0084 and C0092 can be manually entered or corrected.
- Only the parameter set activated via the digital input signals will be identified.
  – If you want to detect motor data for any other parameter set, this parameter set must be activated via digital input signals before it can be identified.

Tip

The motor parameter identification influences the smooth running behaviour. The smooth running behaviour at low speeds can be improved with the control mode V/f characteristic control with constant V min boost (C0014 = -2- or -3-).



7.6 Process controller, current limitation controller

7.6.1 PID controller as process controller

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0070	Process controller gain	1.00	0.00 = P component not active	{0.01} 300.00		📖 7-33
C0071	Process controller readjustment time	100	10	{1} 9999 = I component not active		
C0072	Differential component of process controller	0.0	0.0 = D component not active	{0.1} 5.0		
C0074	Process controller influence	0.0	0.0	{0.1 %} 100.0		
C0238↵	Frequency precontrol	-2-	-0-	No precontrol (only process controller)	Process controller has full influence	📖 7-33
			-1-	Precontrol (total setpoint + process controller)	Process controller has limited influence	📖 7-35
			-2-	No precontrol (only total setpoint)	Process controller has no influence (not active)	
					Total setpoint (PCTRL1-SET3) = Main setpoint + additional setpoint	

Function

Control of pressure, temperature, flow rate, humidity, level, dancer position, speed ...
The process controller requires a setpoint and an actual value (e.g. from a sensor). If setpoint and actual value are selected as analog values (potiometer, PLC), the controller must be equipped with an application I/O to build up a control circuit.

Adjustment

C0071	Resulting readjustment time T_r
10 ... 5000	10 ms ... 5000 ms
5000 ... 6000	5 s ... 10 s
6000 ... 7000	10 s ... 100 s
7000 ... 8000	100 s ... 1000 s
8000 ... 9998	1000 s ... 9998 s

The values in the following table are to be understood as guide values. Fine adjustment is always necessary.
Set C0070, C0071 and C0072 that the target value is

- reached quickly
- with minimum overshooting

when the setpoints and actual values are changed

Guide values for pressure control and flow rate

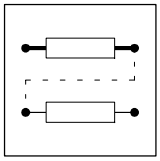
- The differential component K_D (C0072) is usually not required for pressure and flow rate control (C0072 = 0).
- Set the influence (C0074) to 100 %.
- Deactivate the frequency precontrol (C0238 = -0-)

Code	Gases	Liquids
C0070 (K_P)	0.1	0.02 ... 0.1
C0071 (T_r)	5000 (T_r = 5 s)	200 ... 1000 (T_r = 0.2 s ... 1 s)
C0072 (K_D)	0	0

Guide values for speed control

See the application example “Speed control” (📖 13-8).

Code		
C0070 (K_P)	5	
C0071 (T_r)	100 (T_r = 0.1 s)	
C0072 (K_D)	0	



Function library

Process controller, current limitation controller

PID controller influence (C0074)

When you use process control with frequency precontrol (C0238 = -1-), e. g. speed control, the control factor is important.

- The control factor is calculated from the difference of the values under C0050 (output frequency) and C0051 (actual process controller value).
- The control factor determines the influence (C0074) of the process controller
- The influence (C0074) refers to the maximum output frequency (C0011).
- C0074 influences the control circuit stability. C0074 should be set to a value as low as possible.

Calculate influence C0074 [%]:

$$\text{Influence [\%]} = \frac{\text{C0050} - \text{C0051}}{\text{C0011}} \cdot 100\ \%$$

Example:
The influence is to be calculated for the following values:
C0011 = 50 Hz, C0050 = 53 Hz, C0051 = 50 Hz

$$6\ \% = \frac{53\ \text{Hz} - 50\ \text{Hz}}{50\ \text{Hz}} \cdot 100\ \%$$

- Set the influence that the process controller output covers the calculated value in every operating point.
  - With this example (influence = 6 %) set C0074 = 10 %. This is a guide value including tolerances which must always be taken into consideration.
- If the influence (C0074) is too high, the control circuit can become unstable.

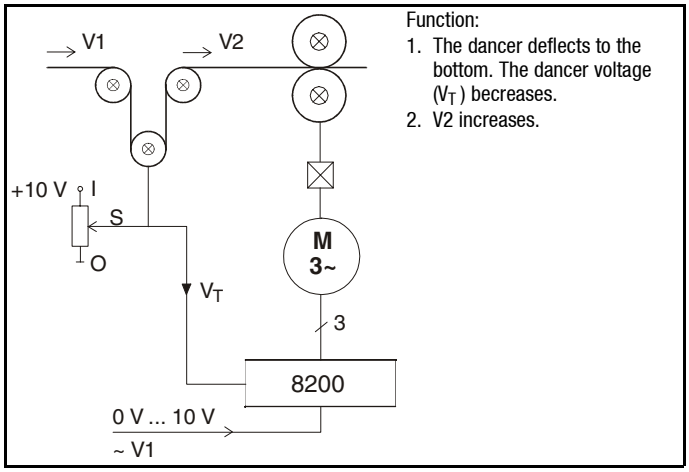
Additive influence of the process controller

Conditions:

- C0051 = Positive actual value
- C0181 = Select positive setpoint
- C0238 = -1- (with frequency precontrol)
- Potentiometer connections of the dancer
  - End (E) = +10 V
  - Beginning (A) = GND

The direction of control action of the process controller is added to the main setpoint.

Example: Dancer control with additive influence of the process controller



Function:
1. The dancer deflects to the bottom. The dancer voltage (V_T) becreases.
2. V2 increases.

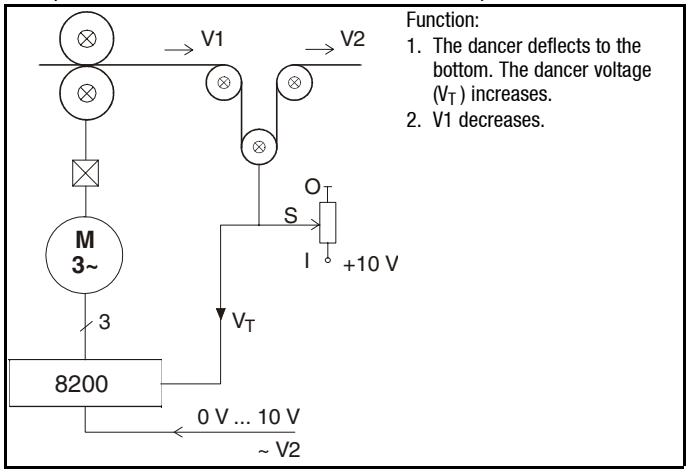
Subtractive influence of process controller

Conditions:

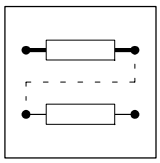
- C0051 = Positive actual value
- C0181 = Select positive setpoint
- C0238 = -1- (with frequency precontrol)
- Potentiometer connections of the dancer
  - End (E) = +10 V
  - Beginning (A) = GND

The direction of control action of the process controller output is subtracted from the main setpoint.

Example: Dancer control with substractive influence of the process controller



Function:
1. The dancer deflects to the bottom. The dancer voltage (V_T) increases.
2. V1 decreases.



7.6.1.1 Setpoint selection for the process controller

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0138*	Process controller setpoint 1 (PCTRL1-SET1)	0.00	-480.00	{0.02 Hz}	480.00	• Selection if C0412/4 = FIXED-FREE • Display if C0412/4 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	📖 7-35
C0181*	Process controller setpoint 2 (PCTRL1-SET2)	0.00	-480.00	{0.02 Hz}	480.00		📖 7-35
C0145*↲	Process controller setpoint source	-0-	-0-	Total setpoint (PCTRL1-SET3)		Main setpoint + additional setpoint	📖 7-35
			-1-	C0181 (PCTRL1-SET2)		• Setpoint selection not possible via – JOG values – Set function of the keypad – C0044, C0046 and C0049 – in connection with manual/remote changeover, skip frequencies, ramp function generator, additional setpoint • Activate the automatic DC-injection brake (auto DCB) with C0019 = 0 or C0106 = 0	
			-2-	C0412/4 (PCTRL1-SET1)			

Function

Selection of a frequency setpoint, e.g. for
- the dancer position for a dancer control in a line drive,
- the pressure setpoint in a pressure control.

Activation

C0145 = -0-
- 📖 7-21 ff., possible setpoint selections
  – Process controller setpoint = Precontrol value PCTRL1-SET3

C0145 = -1-
- Setpoint for process controller = Value under C0181.
  – Applications are e.g. dancer controls, pressure and flow rate controls

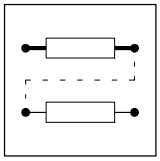
C0145 = -2-
- Setpoint for process controller = Freely configured signal via C0412/4.
  – The setpoint directly effects the process controller
  – Selection also possible under C0138 (like C0181)

Tip

Select C0145 = 0 if the setpoint is to be selected via:
- JOG values
- Set function of the keypad
- in connection with manual/remote changeover, skip frequencies, ramp function generator, additional setpoint
- C0044, C0046 and C0049.

Important

- Select C0145 = 0 if the setpoint is to be selected via:
  – JOG values
  – Set function of the keypad
  – C0044, C0046 and C0049.
  – in connection with manual/remote changeover, skip frequencies, ramp function generator, additional setpoint
- C0145 = -1- or -2-:
  – Activate the automatic DC-injection brake (auto DCB) with C0019 = 0 or C0106 = 0
- C0181 is the same in all parameter sets.



7.6.1.2 Actual value selection for the process controller

Function

The actual value is the process feedback signal (e. g. from a pressure or speed encoder).

Activation

C0412/5 ≠ 0 Freely configured signal = Act. process controller value	C0051 Actual process controller value display (PCTRL1-ACT)

7.6.1.3 Integral action component switch-off (PCTRL1-I-OFF)

Function

The process controller output sends the difference between setpoint and actual value, if necessary use gain V_P.

- Thus overcontrolled starting and stopping can be avoided. When the controller is operating normally, the integral action component K_I can be connected.
- Application: e.g. dancer position control

Activation via terminal

C0007 = -28- ... -34-, -48-, -50-, -51-: HIGH level at X3/E2	C0410/18 ≠ 0: HIGH level at C0410/18.
The signal level is indicated for not inverted input signals.	

Activation via frequency threshold

C0184 > 0.0 Hz

7.6.1.4 Process controller switch-off (PCTRL1-OFF)

Function

The process controller output does not send signals as long as this function is active.

Activation

C0007 = -48-, -49-, -50-: HIGH level at X3/E4	C0410/19 ≠ 0: HIGH level at C0410/19.
The signal level is indicated for not inverted input signals.	

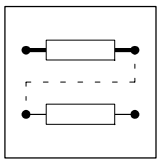
7.6.1.5 Process controller stop (PCTRL1-STOP)

Function

The process controller output value is frozen when the function is activated. The value remains unchanged as long as the function is not active.

Activation

C0410/21 ≠ 0:
HIGH level at C0410/21.
The signal level is indicated for not inverted input signals.



7.6.2 Current limitation controller (I_{max} controller)

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0077*	Gain I_{max} controller	0.25	0.00 = P component not active	{0.01}	16.00		📖 7-37
C0078*	Integral action time I_{max} controller	65	12	{1 ms}	9990 = I component not active		

Function

The I_{max} controller is adjustable for controlling high moments of inertia.

Adjustment

The Imax controller is factory set to stability.
Settings for controlling high moment of inertia:

- C0014 = -2- or C0014 = -3- (V/f characteristic control)
- V_P (C0077): ≈ 0.06
- T_i (C0078): ≈ 750 ms

Important

C0077 and C0078 are the same for all parameter sets.

7.7 Free connection of analog signals

7.7.1 Free configuration of analog input signals

Code		Possible settings			IMPORTANT		
No.	Name	Lenze	Selection				
C0412↵	Free configuration of analog input signals			Connection between external analog signal sources and internal analog signals Analog signal source	**A selection made under C0005, C0007 will be copied to the corresponding subcode of C0412. A change of C0412 sets C0005 = -255-, C0007 = -255-!**		📖 7-38
1	Setpoint 1 (NSET1–N1)	1	0 255	not assigned (FIXED-FREE) or selection via keypad or parameter channel of an AIF bus module	Either NSET1-N1 or NSET1-N2 active Changeover with C0410/17	Parameter channel: C0046	
2	Setpoint 2 (NSET1-N2)	1	1	X3/8 or X3/1U, X3/1I (AIN1-OUT)		Parameter channel: C0044	
3	Additional setpoint (PCTRL1-NADD)	255	2	Frequency input (DFIN1-OUT) (Observe C0410/24, C0425, C0426, C0427)	Is added to NSET1-N1, NSET1-N2, JOG values and the function Set of the keypad Parameter channel: C0049		
4	Process controller setpoint 1 (PCTRL1-SET1)	255	3 4	Motor potentiometer (MPOT1-OUT) X3/2U, X3/2I (AIN2-OUT, application I/O only)			
5	Act. process controller value (PCTRL1-ACT)	255	5 ... 9	Input signal = constantly 0 (FIXED0)	Parameter channel: C0051, if C0238 = 1, 2		
6	Torque setpoint or torque limit value (MCTRL1-MSET)	255	10 11	AIF input word 1 (AIF-IN.W1) AIF input word 2 (AIF-IN.W2) (Only evaluated if C0001 =3!)	Observe C0014! Actual torque values not required. 16384 ≡ 100 % torque setpoint Condition for selection via terminal (C0412/6 = 1, 2 oder 4): Analog input gain is set to C0414/x, C0426 = 32768/C0011 [%]	Parameter channel: C0047	
7	Reserved	255	20 ... 23	CAN-IN1.W1 ... W4/FIF-IN.W1 ... W4 Word 1 (20) ... word 4 (23)			
8	MCTRL1-VOLT-ADD	255	30 ... 33	CAN-IN2.W1 ... W4 Word 1 (24) ... word 4 (27)	Only for special applications. Modifications only when agreed on by Lenze!		
9	MCTRL1-PHI-ADD	255	200	Word-by-word assignment of signals from the function module INTERBUS or PROFIBUS to FIF (see C0005)			

Function

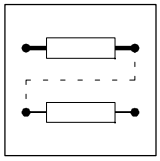
- Internal analog signals can be freely assigned to external analog signal sources:
  – Analog inputs (X3/8, X3/1U, X3/2U, X3/1I, X3/2I)
  – Frequency input
  – Function “Motor potentiometer”
  – Analog process data input words
- Examples:
  – C0412/1 = 2: Signal source for setpoint 1 (NSET1-N1) is the frequency input
  – C0412/5 = 23: Signal source for the actual process controller value (PCTRL1-ACT) is CAN-IN1/word 4
- A signal source can be assigned to several targets.

Important

- **The process data input words CAN-IN1.W1, CAN-IN1.W2, CAN-IN2.W1 and CAN-IN2.W2 can be defined as analog word or as digital word (16 bit). If you link them with internal analog signals (C0412/x = 20, 21 or 30, 31), they must be defined as analog input words. Otherwise the controller cannot interprete the signal correctly.**
- C0412 can be different for the parameter sets.

Special features

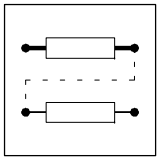
Use C0005 to configure some of the signal sources for analog inputs. The corresponding subcodes of C0412 will be adapted automatically.



7.7.2 Free configuration of analog output signals

7.7.2.1 Configuration of analog outputs

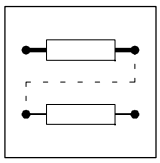
Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0419↲	Free configuration of analog outputs			Analog signal output to terminal Analog signal source	• **The selection made under C0111 is copied to C0419/1. A change of C0419/1 sets C0111 = 255!** • C0419/2, C0419/3 only active in operation with application–I/O • DFOUT1: 50 ... 10 kHz	📖 7-39
1	X3/62 (AOUT1-IN)	0	0	Output frequency (MCTRL1-NOUT+SLIP)	6 V/12 mA/5.85 kHz ≡ C0011	
2	X3/63 (AOUT2-IN)	2	1	Controller load (MCTRL1-MOUT)	3 V/6 mA/2.925 kHz ≡ Rated motor torque with vector control (C0014 = 4), otherwise rated active inverter current (active current/C0091)	
3	X3/A4 (DFOUT1-IN)	3	2	Apparent motor current (MCTRL1-IMOT)	3 V/6 mA/2.925 kHz ≡ Rated inverter current	
			3	DC-bus voltage (MCTRL1-DCVOLT)	6 V/12 mA/5.85 kHz ≡ DC 1000 V (400 V- mains 6 V/12 mA/5.85 kHz ≡ DC 380 V (230 V mains)	
			4	Motor power	3 V/6 mA/2.925 kHz ≡ Rated motor power	
			5	Motor voltage (MCTRL1-VOLT)	4.8 V/9.6 mA/4.68 kHz ≡ Rated motor voltage	
			6	1/output frequency (1/C0050) (MCTRL1-1/NOUT)	2 V/4 mA/1.95 kHz ≡ 0.5 × C0011	
			7	Output frequency with limits (NSET1-C0010...C0011)	0 V/0 mA/4 mA/0 kHz ≡ f = f_{min} (C0010) 6 V/12 mA/5.85 kHz ≡ f = f_{max} (C0011)	
			8	Operation with process controller (C0238 = 0, 1): Act. process controller value (PCTRL1-ACT) Operation without process controller (C0238 = 2): Output frequency without slip (MCTRL1-NOUT)	6 V/12 mA/5.85 kHz ≡ C0011	
			9	Ready for operation (DCTRL1-RDY)	Selection -9- ... -25- corresponds to the digital functions of the relay output K1 (C0008) or the digital output A1 (C0117): LOW = 0 V/0 mA/4 mA/ 0 kHz HIGH = 10 V/20 mA/10 kHz	
			10	TRIP fault message (DCTRL1-TRIP)		
			11	Motor is running (DCTRL1-RUN)		
			12	Motor is running / CW rotation (DCTRL1-RUN-CW)		
			13	Motor is running / CCW rotation (DCTRL1-RUN-CCW)		
			14	Output frequency = 0 (DCTRL1-NOUT=0)		
			15	Frequency setpoint reached (MCTRL1-RFG1=NOUT)		
			16	Q_{min} threshold reached (PCTRL1-QMIN)		
			17	I_{max} limit reached (MCTRL1-IMAX) C0014 = -5-: Torque setpoint reached		
			18	Overtemperature (ϑ_{max} - 5 °C) (DCTRL1-OH-WARN)		
			19	TRIP or Q_{min} or pulse inhibit (IMP) active (DCTRL1-TRIP-QMIN-IMP)		
			20	PTC warning (DCTRL1-PTC-WARN)		
			21	Apparent motor current < current threshold (DCTRL1-IMOT<ILIM)	Belt monitoring Apparent motor current = C0054 Current threshold = C0156	
			22	Apparent motor current < current threshold and Q_{min} threshold reached (DCTRL1-(IMOT<ILIM)-QMIN)		
			23	Apparent motor current < current threshold and RFG 1: Input = output (DCTRL1-(IMOT<ILIM)-RFG-I=0)		
			24	Warning motor phase failure (DCTRL1-LP1-WARN)		
			25	Minimum output frequency reached (PCTRL1-NMIN)		



Function library

Free connection of analog signals

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0419↵ (cont.)	Free configuration of analog outputs			Analog signal output to terminal Analog signal source		📖 7-39
			27	Output frequency without slip (MCTRL1-NOUT)	6 V/12 mA/5.85 kHz ≡ C0011	
			28	Act. process controller value (PCTRL1-ACT)		
			29	Process controller setpoint (PCTRL1-SET1)	6 V/12 mA/5.85 kHz ≡ C0011	
			30	Process controller output (PCTRL1-OUT)		
			31	Ramp function generator input (NSET1-RFG1-IN)		
			32	Ramp function generator output (NSET1-NOUT)		
			33 (A)	PID controller output (PCTRL1-PID-OUT)		
			34 (A)	Process controller output (PCTRL1-NOUT)		
			35	Input signal at X3/8 or X3/1U, X3/1I, evaluated with gain (C0414/1 or C0027) and offset (C0413/1 or C0026) (AIN1-OUT)	6 V/12 mA/5.85 kHz ≡ Maximum value analog input signal (5 V, 10 V, 20 mA, 10 kHz) Condition: Gain of analog input or frequency input set to: C0414/x, C0426 = 100 %	
			36	Input signal at frequency input X3/E1, evaluated with gain (C0426) and offset (C0427) (DFIN1-OUT)		
			37	Motor potentiometer output (MPOT1-OUT)		
			38	Input signal at X3/2U, X3/2I, evaluated with gain (C0414/2) and offset (C0413/2) (AIN2-OUT)		
			40 41	AIF input word 1 (AIF-IN.W1) AIF input word 2 (AIF-IN.W2)	Setpoint to drive from communication module to AIF 10 V/20 mA/10 kHz ≡ 1000	
			50 ... 53 60 ... 63	CAN-IN1.W1 ... 4 oder FIF-IN.W1 ... FIF-IN.W4 Word 1 (50) ... word 4 (53) CAN-IN2.W1 ... 4 Word 1 (60) ... word 4 (63)	Setpoints to drive from function module to FIF 10 V/20 mA/10 kHz ≡ 1000	
			255	Not assigned (FIXED-FREE)		
C0108*	Gain analog output X3/62 (AOUT1-GAIN)	128	0	{1} 255	Standard I/O: C0108 and C0420 are the same Application I/O: C0108 and C0420/1 are the same	📖 7-39
C0109*	Offset analog output X3/62 (AOUT1-OFFSET)	0.00	-10.00	{0.01 V} 10.00	Standard I/O: C0109 and C0422 are the same Application I/O: C0109 and C0422/1 are the same	
C0420*	Gain analog output X3/62 (AOUT1-GAIN) Standard I/O	128	0	{1} 255	128 ≡ Gain 1 C0420 and C0108 are the same	📖 7-39
C0420* (A)	Gain analog outputs Application I/O				128 ≡ Gain 1	
1	X3/62 (AOUT1-GAIN)	128	0	{1} 255	C0420/1 and C0108 are the same	
2	X3/63 (AOUT2-GAIN)					
C0422*	Offset analog output X3/62 (AOUT1-OFFSET) Standard I/O	0.00	-10.00	{0.01 V} 10.00	C0422 and C0109 are the same	📖 7-39
C0422* (A)	Offset analog outputs Application I/O					
1	X3/62 (AOUT1-OFFSET)	0.00	-10.00	{0.01 V} 10.00	C0422/1 and C0109 are the same	
2	X3/63 (AOUT2-OFFSET)					



Code		Possible settings		IMPORTANT
No.	Name	Lenze	Selection	
C0424*↲ (A)	Output signal range - analog outputs Application–I/O			Observe the jumper setting of the function module! (as of version application-I/O E82ZAFA ... Vx11)
1	X3/62 (AOUT1)	-0-	-0- 0 ... 10 V / 0 ... 20 mA	
2	X3/63 (AOUT2)	-0-	-1- 4 ... 20 mA	

Function

- Analog process or monitoring signals can be freely assigned to the analog outputs (X3/62, X3/63) and the frequency output (X3/A4).
- Currents can also be output when using the application I/O.
  – Range: 0 ... 20 mA, as of software version 1.1 also 4 ... 20 mA
  – Seting via jumper at module and C0424
- Examples:
  – C0419/1 = 51: Assigns X3/62 to the process data word CAN-IN2/word 2.
  – C0419/3 = 14: Assigns X3/A4 to the monitoring message “Output frequency = 0”.
- A signal source can be assigned to several targets.

Adjustment

C0108 or C0420:

- 128 equals an output signal of 6 V or 12 mA (Lenze setting) at X3/62 or X3/63.

Level with Lenze setting

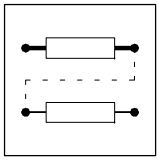
Selection	Signal	Level
0	Output frequency	6 V, if output frequency = C0011
1	Controller load	3 V, if C0056 = 100 %
2	Apparent motor current	3 V, if C0054 = rated controller current
3	DC-bus voltage	6 V at 1000 V DC (with 3 AC/400 V)
4	Motor power	3 V at rated power, P_r = C0052 * C0056
5	Motor voltage	4.8 V at C0052 = 400 V (with 3 AC/400 V)
6	1/output frequency	2.5 V, if C0011 = 50 Hz, C0050 = 20 Hz
7	C0010 ... C0011	Output voltage [V] = 6.00 V · $\frac{f - C0011}{C0011 - C0010}$
8	Actual process controller value	6 V, if C0051 = max. output frequency

Important

- **The process data input words CAN-IN1.W1/FIF-IN.W1, CAN-IN1.W2/FIF-IN.W2, CAN-IN2.W1 and CAN-IN2.W2 can be defined as analog word or digital word (16 bit). If you link them with analog outputs (C0419/x = 50, 51 or 60, 61), they must be defined as analog input words. Otherwise the output signal would be incorrect.**
- Selection 0 and 7: Output with slip compensation
- Selection 8:
  – Output frequency without slip compensation (C0412/5 = 0), e.g. with setpoint cascades
  – Actual process controller value (C0412/5 ≠ 0)
- C0419 can be different for the parameter sets.

Special features

- Use C0111 to assign monitoring messages to the analog output X3/62. C0419/1 is automatically adapted.
- Selection 9 ... 25 corresponds to the relay output functions of C0008:
  – LOW = 0 V or 0/4 mA
  – HIGH = 10 V or 20 mA



Function library

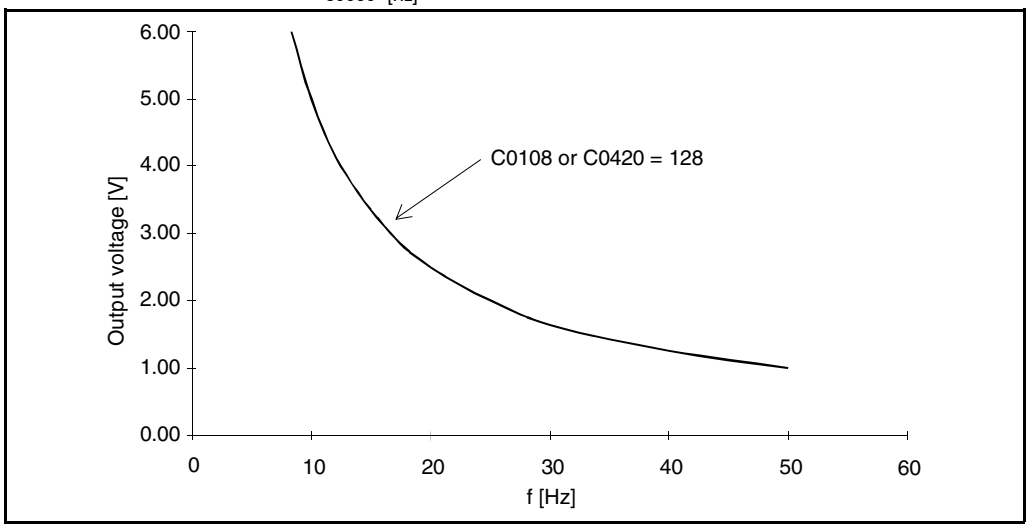
Free connection of analog signals

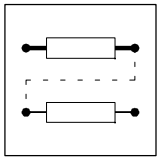
Tip for selection 6

The analog signal is reciprocal to the output frequency. This signal can be used for the time indication (e.g. machining time of a product).

Example: Output signal = 0 ... 10 V

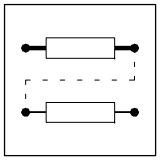
$$\text{Output voltage [V]} = 1.00\ \text{V} \cdot \frac{\text{C0011 [Hz]}}{\text{C0050 [Hz]}} \cdot \frac{\text{C0108}}{128}$$





7.7.2.2 Free configuration of analog process data output words

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0421↲	Free configuration analog process data output words			Output of analog signals on bus Analog signal source	• **With Lenze setting, CAN-OUT1.W1 and FIF-OUT.W1 are defined as digital outputs and the 16-bit controller status word 1 (C0417) is assigned to them.** • **If you want to output analog values (C0421/3 ≠ 255), the digital assignment must be deleted (C0417/x = 255)! Otherwise the output signal would be incorrect.**	📖 7-43
1	AIF-OUT.W1	8	0	Output frequency with slip (MCTRL1-NOUT+SLIP)	24000 ≡ 480 Hz	
2	AIF-OUT.W2	0	1	Controller load (MCTRL1-MOUT)	16383 ≡ Rated motor torque with vector control (C0014 = 4), otherwise rated active inverter current (active current/C0091)	
3	CAN-OUT1.W1 / FIF-OUT.W1	255	2	Apparent motor current (MCTRL1-IMOT)	16383 ≡ Rated inverter current	
4	CAN-OUT1.W2 / FIF-OUT.W2	255	3	DC-bus voltage (MCTRL1-DCVOLT)	16383 ≡ 1000 VDC at 400 V mains 16383 ≡ 380 VDC at 230 V mains	
5	CAN-OUT1.W3 / FIF-OUT.W3	255	4	Motor power	285 ≡ Rated motor power	
6	CAN-OUT1.W4 / FIF-OUT.W4	255	5	Motor voltage (MCTRL1-VOLT)	16383 ≡ Rated motor voltage	
7	CAN-OUT2.W1	255	6	1/output frequency (1/C0050) (MCTRL1-1/NOUT)	195 ≡ 0.5 × C0011	
8	CAN-OUT2.W2	255	7	Output frequency with limits (NSET1-C0010...C0011)	24000 ≡ 480 Hz $0 \equiv f < C0010$ $\frac{24000 \cdot (f - C0010)}{480\ Hz} \equiv f \geq C0010$	
9	CAN-OUT2.W3	255	8	Operation with process controller (C0238 = 0, 1): Act. process controller value (PCTRL1-ACT)	24000 ≡ 480 Hz	
10	CAN-OUT2.W4	255		Operation without process controller (C0238 = 2): Output frequency without slip (MCTRL1-NOUT)		
			9	Ready for operation (DCTRL1-RDY)	Selection -9- ... -25- corresponds to the digital functions of the relay output K1 (C0008) or the digital output A1 (C0117): LOW = 0 V/0 mA/4 mA HIGH = 10 V/20 mA	
			10	TRIP fault message (DCTRL1-TRIP)		
			11	Motor is running (DCTRL1-RUN)		
			12	Motor is running / CW rotation (DCTRL1-RUN-CW)		
			13	Motor is running / CCW rotation (DCTRL1-RUN-CCW)		
			14	Output frequency = 0 (DCTRL1-NOUT=0)		
			15	Frequency setpoint reached (MCTRL1-RFG1=NOUT)		
			16	Q_{min} threshold reached (PCTRL1-QMIN)		
			17	I_{max} limit reached (MCTRL1-IMAX) C0014 = -5-: Torque setpoint reached		
			18	Overtemperature (ϑ_{max} -5 °C) (DCTRL1-OH-WARN)		
			19	TRIP or Q_{min} or pulse inhibit (IMP) (DCTRL1-IMP)		
			20	PTC warning (DCTRL1-PTC-WARN)		
			21	Apparent motor current < current threshold (DCTRL1-IMOT<ILIM)	Belt monitoring Apparent motor current = C0054 Current threshold = C0156	
			22	Apparent motor current < current threshold and Q_{min} threshold reached (DCTRL1-(IMOT<ILIM)-QMIN)		
			23	Apparent motor current < current threshold and RFG 1: Input = output (DCTRL1-(IMOT<ILIM)-RFG-I=0)		
			24	Warning motor phase failure (DCTRL1-LP1-WARN)		



Function library

Free connection of analog signals

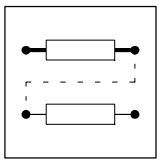
Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0421↲ (cont.)	Free configuration analog process data output words		Output of analog signals on bus Analog signal source		📖 7-43
		25	Minimum output frequency reached (PCTRL1-NMIN)		
		27	Output frequency without slip (MCTRL1-NOUT)	24000 ≡ 480 Hz	
		28	Act. process controller value (PCTRL1-ACT)		
		29	Process controller setpoint (PCTRL1-SET1)		
		30	Process controller output (PCTRL1-OUT)		
		31	Ramp function generator input (NSET1-RFG1-IN)		
		32	Ramp function generator output (NSET1-NOUT)		
		33 (A)	PID controller output (PCTRL1-PID-OUT)		
		34 (A)	Process controller output (PCTRL1-NOUT)		
		35	Input signal at X3/8 or X3/1U, X3/1I, evaluated with gain (C0414/1 or C0027) and offset (C0413/1 or C0026) (AIN1-OUT)	1000 ≡ Maximum value analog input signal (5 V, 10 V, 20 mA, 10 kHz) Condition: Gain of analog input or frequency input set to: C0414/x, C0426 = 20/C0011 [%]	
		36	Input signal at frequency input X3/E1, evaluated with gain (C0426) and offset (C0427) (DFIN1-OUT)		
		37	Motor potentiometer output (MPOT1-OUT)		
		38	Input signal at X3/2U, X3/2I, evaluated with gain (C0414/2) and offset (C0413/2) (AIN2-OUT)		
		40 41	AIF input word 1 (AIF-IN.W1) AIF input word 2 (AIF-IN.W2)	Setpoint to drive from communication module to AIF Normalisation via AIF	
		50 ... 53 60 ... 63	CAN-IN1.W1 ... 4 oder FIF-IN.W1 ... FIF-IN.W4 Word 1 (50) ... word 4 (53) CAN-IN2.W1 ... 4 Word 1 (60) ... word 4 (63)	Setpoints to controller from CAN or function module to FIF Normalisation via CAN or FIF	
		255	Not assigned (FIXED-FREE)		

Function

- Analog process or monitoring signals can be freely assigned to the analog output words.
- Examples:
  - C0421/3 = 5: Assigns CAN-OUT1/word1 to the monitoring signal “Motor voltage” zu.
  - C0421/8 = 61: Assigns CAN-OUT2/word 2 to the process data input word CAN-IN2/word 2.
- A signal source can be assigned to several targets.

Important

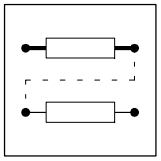
- **The process data output words CAN-OUT1.W1/FIF-OUT.W1, CAN-OUT2.W1 and FIF-OUT.W2 can also be assigned to C0417 and C0418 with 16-bit status information each:**
  - **If digitally configured under C0417 or C0418 not simultaneous analog assignment with C0421 (C0421/x = 255)!**
  - **With analog configuration under C0421 no simultaneous digital assignment with C0417 and C0418 (C0417/x = 255, C0418/x = 255)!**
  - **Otherwise the output signal would be incorrect.**
- **The process data input words CAN-IN1.W1/FIF-IN.W1, CAN-IN1.W2/FIF-IN.W2, CAN-IN2.W1 and CAN-IN2.W2 can be defined as analog word or digital word (16 bit). If you link them with analog process data output words (C0421/x = 50, 51 oder 60, 61), they must be defined as analog input words. Otherwise the output signal would be incorrect.**
- C0421 can be different for the parameter sets.



7.8 Free connection of digital signals, message output

7.8.1 Free configuration of digital input signals

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0410↲	Free configuration of digital input signals			Linkage of external signal sources to internal digital signals Digital signals source	• **A selection made under C0007 is copied to the corresponding subcode of C0410. A change of C0410 sets C0007 = -255-!**	🕮 7-45
1	NSET1-JOG1/3 NSET1-JOG1/3/5/7 (A)	1	0 255	Not assigned (FIXED-FREE)	Selection of fixed setpoints C0410/1 C0410/2 active C0410/33 C0046 LOW LOW LOW JOG1 HIGH LOW LOW JOG2 LOW HIGH LOW ... ... JOG7 HIGH HIGH HIGH	
2	NSET1-JOG2/3 NSET1-JOG2/3/6/7 (A)	2	1 ... 6	Digital inputs X3/E1 ... X3/E6 (DIGIN1 ... 6) X3/E1 (1) ... X3/E6 (6) E5, E6 only application I/O		
3	DCTRL1-CW/CCW	4	7	PTC input (X2.2/T1, X2.2/T2)	CW = CW rotation LOW CCW = CCW rotation HIGH	
4	DCTRL1-QSP	255	10 ... 25	AIF control word (AIF-CTRL) Bit 0 (10) ... bit 15 (25)	Quick stop (via terminal LOW active)	
5	NSET1-RFG1-STOP	255			Ramp function generator main setpoint stop	
6	NSET1-RFG1-0	255	30 ... 45	CAN-IN1.W1/FIF-IN.W1 Bit 0 (30) ... bit 15 (45)	Ramp function generator input must be set "0" for mains setpoint	
7	MPOT1-UP	255			Motor potentiometer functions	
8	MPOT1-DOWN	255	50 ... 65	CAN-IN1.W2/FIF-IN.W2 Bit 0 (50) ... bit 15 (65)		
9	Reserved	255				
10	DCTRL1-CINH	255			Controller inhibit (via terminal LOW active)	
11	DCTRL1-TRIP-SET	255	70 ... 85	CAN-IN2.W1 Bit 0 (70) ... bit 15 (85)	External error (via terminal LOW active)	
12	DCTRL1-TRIP-RESET	255			Error reset	
13	DCTRL1-PAR2/4	255	90 ... 105	CAN-IN2.W2 Bit 0 (90) ... bit 15 (105)	Parameter set changeover (if C0988 = 0) **if C0410/13 and C0410/14 use the same source in all parameter sets. Otherwise it is not possible to change between the parameter sets.**	
14	DCTRL1-PAR3/4	255			C0410/13 C0410/14 active LOW LOW PAR1 HIGH LOW PAR2 LOW HIGH PAR3 HIGH HIGH PAR4	
15	MCTRL1-DCB	3	200	Bit-by-bit assignment of the FIF control words (FIF-CTRL1, FIF-CTRL2) from the function module INTERBUS or PROFIBUS-DP (see C0005)	DC-injection brake	
16 (A)	PCTRL1-RFG2-LOADI	255			Actual process controller value (PCTRL1-ACT) must be connected to process controller ramp function generator (PCTRL1-RFG2)	
17	DCTRL1-H/Re	255			Manual/remote changeover	
18	PCTRL1-I-OFF	255			Switch off I-component of the process controller	
19	PCTRL1-OFF	255			Process controller switch off	
20	Reserved	255				
21	PCTRL1-STOP	255			Process controller stop (value "frozen")	
22	DCTRL1-CW/QSP	255			Failsafe change of the direction of rotation	
23	DCTRL1-CCW/QSP	255				
24	DFIN1-ON	255			0 = Frequency input not active 1 = Frequency input active Frequency input configuration under C0425 and C0426	



Function library

Free connection of digital signals, message output

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0410↲ (cont.)	Free configuration of digital input signals		Linkage of external signal sources to internal digital signals Digital signals source	• **A selection made under C0007 is copied to the corresponding subcode of C0410. A change of C0410 sets C0007 = -255-!**	
25 (A)	PCTRL1-FOLL1-0	255		Compensator at reset ramp C0193 to "0"	
26 (A)	Reserved	255			
27 (A)	NSET1-TI1/3	255		Activate acceleration times C0410/27 C0410/28 active LOW LOW C0012; C0013 HIGH LOW T_{ir} 1; T_{if} 1 LOW HIGH T_{ir} 2; T_{if} 2 HIGH HIGH T_{ir} 3; T_{if} 3	
28 (A)	NSET1-TI2/3	255			
29 (A)	PCTRL1-FADING	255		Process controller output on (LOW)/ off (HIGH)	
30 (A)	PCTRL1-INV-ON	255		Process controller output inversion	
31 (A)	PCTRL1-NADD-OFF	255		Switch off additional setpoint	
32 (A)	PCTRL1-RFG2-0	255		Decelerate process controller ramp function generator input to "0" along ramp C0226	
33 (A)	NSET1-JOG4/5/6/7	255			
C0411↲	Level inversion digital inputs E1 ... E6	-0-	E6 (2^5) E5 (2^4) E4 (2^3) E3 (2^2) E2 (2^1) E1 (2^0) -0- 0 0 0 0 0 0 -1- 0 0 0 0 0 1 -2- 0 0 0 0 1 0 -3- 0 0 0 0 1 1 ... ... -63- 1 1 1 1 1 1	• The binary value of the selected number determines the input levels: – 0: Ex is not inverted (HIGH active) – 1: Ex is inverted (LOW active) • C0114 and C0411 are identical • E5, E6 only application I/O **The function "Parameter set changeover" cannot be inverted!**	📖 7-45

Function

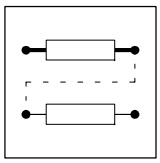
- Digital functions can be freely assigned to the digital inputs (X3/E1 ... X3/E6) and software inputs (process data input words). It is thus possible to achieve a freely configured controller control.
- Example:
  – C0410/10 = 2: Signal source for "CINH (controller inhibit)" is X3/E2.
  – C0410/15 = 32: Signal source for "DCB (DC-injection brake)" is CAN-IN1 word1, bit 3.
- A signal source can be assigned to several targets. Please ensure reasonable assignments. Otherwise it is possible to activate functions which cannot be operated together (e.g. QSP and DCB assigned to X3/E3 at the same time).

Important

- **The process data input words CAN-IN1.W1, CAN-IN1.W2, CAN-IN2.W1 and CAN-IN2.W2 can be defined as analog word or as digital word (16 bit).If you link internal digital signals (C0410/x = 30 ... 105), they must be defined as digital input words. Otherwise the controller would interprete the bit control information incorrectly.**
- Level:
  – Hardware inputs (X3/E1 ... X3/E6): HIGH = +12 V ... +30 V; LOW = 0 V ... +3 V
  – Software inputs (process data input words): HIGH = bit logic 1; LOW = bit logic 0
  – For level inversion see code table C0114/C0411.
- Response times: 1.5 ... 2.5 ms
- C0410 can be different for the parameter sets.

Special features

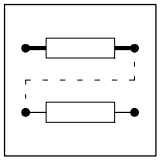
Use C0007 to configure terminals X3/E1 ... X3/E4 block-by-block. The corresponding subcodes of C0410 will be adapted automatically.



7.8.2 Free configuration of digital output signals

7.8.2.1 Configuration digital outputs

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0415↲	Free configuration of digital outputs		Output of digital signals to terminals	• **A selection under C0008 will be copied to C0415/1. A change of C0415/1 sets C0008 = -255-!** • **A selection under C0117 will be copied to C0415/2. A changef of C0415/2 sets C0117 = -255-!** • **C0415/3 only application–I/O**	📖 7-47
1	Relay output K1 (RELAY)	25	0 Not assigned (FIXED-FREE) 255		
			1 PAR-B0 active (DCTRL1-PAR-B0)		
			2 Pulse inhibit active (DCTRL1-IMP)		
2	Digital output X3/A1 (DIGOUT1)	16	3 I_{max} limit reached (MCTRL1-IMAX) (C0014 = -5-: Torque setpoint reached)		
			4 Frequency setpoint reached (MCTRL1-RFG1=NOUT)		
3	Digital output X3/A2 (DIGOUT2)	255	5 Ramp functin generator 1: Input = output (NSET1-RFG1-I=0)	RFG1 = Ramp function generator main setpoint	
			6 Q_{min} threshold higher (PCTRL1-QMIN)	active PAR-B1 PAR-B0 PAR1 LOW LOW PAR2 LOW HIGH PAR3 HIGH LOW PAR4 HIGH HIGH	
			7 Output frequency = 0 (DCTRL1-NOUT=0)		
			8 Controller inhibit active (DCTRL1-CINH)		
			9...12 Reserved		
			13 Overtemperature (ϑ_{max} -5 °C) (DCTRL1-OH-WARN)		
			14 DC-bus overvoltage (DCTRL1-OV)		
			15 CCW rotation (DCTRL1-CCW)		
			16 Ready for operation (DCTRL1-RDY)		
			17 PAR-B1 active (DCTRL1-PAR-B1)		
			18 TRIP or Q_{min} or pulse inhibit (IMP) active (DCTRL1-TRIP-QMIN-IMP)		
			19 PTC warning (DCTRL1-PTC-WARN)		
			20 Apparent motor current < current threshold (DCTRL1-IMOT<ILIM)	Belt monitoring Apparent motor current = C0054 Current threshold = C0156	
			21 Apparent motor current < current threshold and Q_{min} threshold reached (DCTRL1-(IMOT<ILIM)-QMIN		
			22 Apparent motor current < current threshold and RFG 1: Input = output (DCTRL1-(IMOT<ILIM)-RFG-I=0)		
			23 Warning motor phase failure (DCTRL1-LP1-WARN)		
			24 Minimum output frequency reached (PCTRL1-NMIN)		
			25 TRIP fault message (DCTRL1-TRIP)		
			26 Motor is running (DCTRL1-RUN)		
			27 Motor is running/CW rotation (DCTRL1-RUN-CW)		
			28 Motor is running/CCW rotation (DCTRL1-RUN-CCW)		
			29 Process controller input = process controller output (PCTRL1-SET=ACT)		
			30 Reserved		
			31 Apparent motor current > current threshold and ramp function generator 1: Input = output (DCTRL1-(IMOT>ILIM)-RFG-I=0)	Overload monitoring Apparent motor current = C0054 Current threshold = C0156	
			32 ... 37 X3/E1 (32) ... X3/E6 (37)	Digital input terminals	



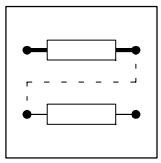
Function library

Free connection of digital signals, message output

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0415↵ (cont.)	Free configuration of digital outputs			Output of digital signals to terminals			📖 7-47
			40...55	AIF control word (AIF-CTRL) Bit 0 (40) ... bit 15 (55)		Bits of fieldbus input words Assigned bits of AIF-CTRL: Bit 3: QSP Bit 7: CINH Bit 10: TRIP-SET Bit 11: TRIP-RESET	
			60...75	CAN-IN1.W1 or FIF-IN.W1 Bit 0 (60) ... bit 15 (75)			
			80...95	CAN-IN1.W2 or FIF-IN.W2 Bit 0 (80) ... bit 15 (95)			
			100...115	CAN-IN2.W1, bit 0 (100) ... bit 15 (115)			
			120...135	CAN-IN2.W2, bit 0 (120) ... bit 15 (135)			
			140...172	Status application I/O		Only active when using application I/O	
				140	Torque threshold 1 reached (MSET1=MACT)		
				141	Torque threshold 2 reached (MSET2=MACT)		
				142	Process controller output limit reached (PCTRL1-LIM)		
				143 ... 172	Reserved		
C0416↵	Level inversion digital outputs	0		X3/A2	X3/A1	Relay K1	• 0: Output not inverted (HIGH-aktiv) • 1: Output inverted(LOW-aktiv) • X3/A2 only application I/O	📖 7-47
			-0-	0	0	0		
			-1-	0	0	1		
			-2-	0	1	0		
			-3-	0	1	1		
			-4-	1	0	0		
			-5-	1	0	1		
			-6-	1	1	0		
			-7-	1	1	1		
C0423* (A)	Delay digital outputs		0.000	{0.001 s}		65.000	"Debouncing" of digital outputs (as of version application-I/O E82ZAFA ... Vx11) • Switches the digital output if the linked signal is still active after the time set. • Digital output reset with delay	📖 7-47
1	Relay output K1 (RELAY)	0.000						
2	Digital output X3/A1 (DIGOUT1)	0.000						
3	Digital output X3/A2 (DIGOUT2)	0.000						

Function

- Digital signals can be freely assigned to the digital outputs (X3/A1, X3/A2, realy output K1).
- Examples:
  – C0415/2 = 15: The monitoring message “CCW rotation” is output to A1.
  – C0415/1 = 60: Bit 1 of the process data word CAN-IN1/Wort 1 is output to K1.
- A signal source can be assigned to several targets.



Switching conditions

Selection under C0415	Relays/digital output (not inverted)
1	Picks up/HIGH, if PAR2 or PAR4 active
2	Picks up/HIGH if STOP, controller inhibit (CINH), overvoltage, undervoltage
3	Picks up/HIGH if motor current = C0022 or C0023
4	Picks up/HIGH if output frequency = frequency setpoint
5	Picks up/HIGH if condition met
6	Picks up/HIGH if output frequency > C0017 (related to setpoint)
7	Picks up/HIGH, because • frequency setpoint = 0 Hz, t_{if} over • DCB aktiv • controller inhibited (CINH)
8	Picks up/HIGH, if controller is inhibited by • X3/28 = LOW • C0410/10 = active • STOP
13	Picks up/HIGH at a heatsink temperature of $\geq \vartheta_{max}$ -5 °C
14	Picks up/HIGH, when permissible voltage threshold is reached
15	Picks up/HIGH with CCW rotation
16	Picks up/HIGH, if controller is ready for operation Drops out/LOW if • TRIP fault message • undervoltage/overvoltage
17	Picks up/HIGH, if PAR3 or PAR4 active
18	Drops out/LOW, if at least one of the three conditions (selection 25 or 6 or 2) is met
19	Drops out/LOW, if motor overtemperature is indicated by thermostat or PTC
20, 21, 22, 23	Picks up/HIGH if condition met
24	Picks up/HIGH if output frequency > C0010
25	Picks up/HIGH with TRIP error message
26	Picks up/HIGH if output frequency ≠ 0 Hz
27	Picks up/HIGH if output frequency > 0 Hz
28	Picks up/HIGH if output frequency < 0 Hz
29	Picks up/HIGH, if condition met
30	Reserved
31	Picks up/HIGH, if condition met
32 ... 37	Picks up/HIGH, if HIGH level is applied to the corresponding digital input
40 ... 135	Picks up/HIGH, if HIGH level is applied to the corresponding bit
140 ... 142	Picks up/HIGH, if condition met

Important

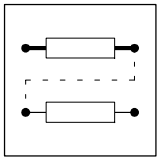
- **The process data input words CAN-IN1.W1/FIF-IN.W1, CAN-IN1.W2/FIF-IN.W2, CAN-IN2.W1 and CAN-IN2.W2 can be defined as analog word or digital word (16 bit). If you link digital outputs (C0415/x = 60 ... 135), they must be defined as digital input words. Otherwise the output signal would be incorrect.**
- C0415 can be different for the parameter sets.
- Use C0416 to invert digital outputs.
- Monitoring signals 20, 21, 22
  - The display value (C0054) is smoothened with a ring memory with 500 ms.
  - The value set under C0156 corresponds to a percentage of the rated controller current I_r.
  - If you use the control mode “Square characteristic” (C0014 = -3-), C0156 will be adapted internally via the output frequency:

$$C0156_{intern}\,[\%] = C0156\,[\%] \cdot \frac{f^2\,[Hz^2]}{C0011^2\,[Hz^2]}$$

  - This function monitors e.g. a belt.

Special features

- Use C0008 to assign monitoring messages to the relay output K1. C0415/1 is automatically adapted.
- Use C0117 to assign monitoring messages to the digital output X3/A1. C0415/2 is automatically adapted.



7.8.2.2 Free configuration of digital process data output words

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0417*↲	Free configuration of controller status messages (1)		Output of digital signals to bus	• The assignment is mapped to the – Controller status word 1 (C0150) – AIF status word (AIF-STAT) – FIF output word 1 (FIF-OUT.W1) – Output word 1 in the CAN object 1 (CAN-OUT1.W1) → **Fixed assignment to AIF in operation with communication modules: INTERBUS 2111, PROFIBUS-DP 2131 or LECOM-A/B/LI 2102. Modifications are not allowed!** If you use function modules system bus (CAN), INTERBUS, PROFIBUS-DP to FIF, all bits are freely configurable.	📖 7-50
1	Bit 0	1	Digital signal sources like C0415		
2	Bit 1	2 →			
3	Bit 2	3			
4	Bit 3	4			
5	Bit 4	5			
6	Bit 5	6			
7	Bit 6	7 →			
8	Bit 7	8 →			
9	Bit 8	9 →	11|10|9|8 controller status 0000 Controller initialization 0010 Switch-on inhibit 0011 Operation inhibited 0100 Flying-restart circuit active 0101 DC-injection brake active 0110 Operation enabled 0111 Message active 1000 Active fault		
10	Bit 9	10 →			
11	Bit 10	11 →			
12	Bit 11	12 →			
13	Bit 12	13 →			
14	Bit 13	14 →			
15	Bit 14	15			
16	Bit 15	16			
C0418*↲	Free configuration of controller status messages (2)		Output of digital signals to bus	• The assignment is mapped to the – Controller status word 2 (C0151) – FIF output word 2 (FIF-OUT.W2) – Output word 1 in the CAN object 2 (CAN-OUT2.W1) • All bits can be freely configured	📖 7-50
1	Bit 0	255	Digital signal sources like C0415		
...	...				
16	Bit 15	255			

Function

- Digital signals can be summarised as status information which will be automatically assigned to status word bits.
- Examples:
  – C0417/4 = 16: Assigns bit 3 to the monitoring function “Ready for operation”.
  – C0418/15 = 101: Assigns bit 14 to bit 2 of CAN-IN2.W1.
- A signal source can be assigned to several targets.

Important

- **The process data output words CAN-OUT1.W1/FIF-OUT.W1, CAN-OUT2.W1 and FIF-OUT.W2 can also be assigned as analog word under C0421:**
  – **If digitally configured under C0417 or C0418 not simultaneous analog assignment with C0421 (C0421/x = 255)!**
  – **With analog configuration under C0421 no simultaneous digital assignment with C0417 and C0418 (C0417/x = 255, C0418/x = 255)!**
  – **Otherwise the status information would be incorrect.**
- The configuration under C0417 is mapped to the AIF status word 1 (C0150), FIF output word 1 (FIF-OUT.W1) and output word 1 of the CAN object 1 (CAN-OUT1.W1).
- The configuration under C0418 is mapped to the AIF status word 2 (C0151), FIF output word 2 (FIF-OUT.W2) and output word 1 of the CAN object 2 (CAN-OUT2.W1).
- C0417 and C0418 can be different for the parameter sets.

7.9 Thermal motor monitoring, error detection

7.9.1 Thermal motor monitoring

7.9.1.1 $I^2 \times t$ monitoring

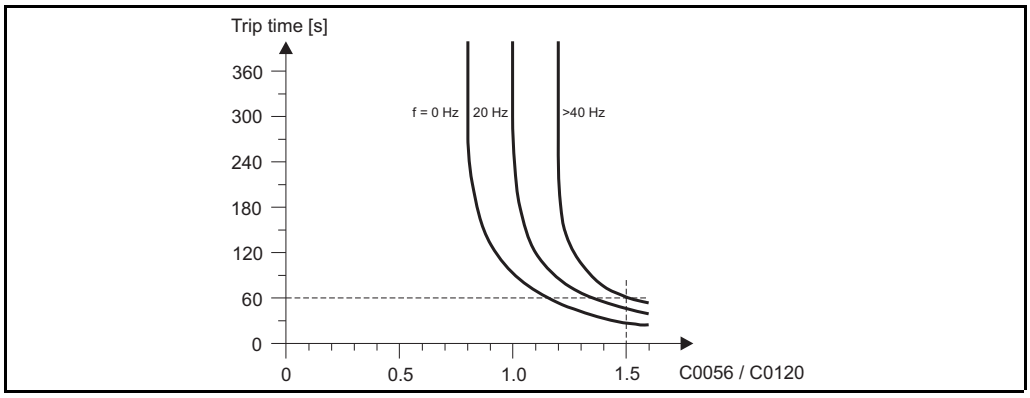
Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0120	I^2t switch-off	0	0 = not active	{1 %}	200	Reference: Apparent motor current (C0054)	📖 7-51

Function

With the $I^2 \times t$ monitoring, self-ventilated three-phase AC motors can be thermally monitored without using sensors.

Adjustment

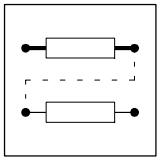
- Enter an individual load limit for the motor connected.
  – If this values is exceeded for a longer period of time, the controller will set the fault OC6 and switch-off (see chart).
- The current limits C0022 and C0023 only have indirect influence on the $I^2 \times t$ calculation:
  – The settings of C0022 and C0023 can make the operation with maximum controller load (C0056) impossible.
- When selecting a drive which does not match (output current much higher than rated motor current):
  – Reduce C0120 by the factor of the mismatch.



Example:
With C0120 = 100 % and a load of C0056 = 150 %, the devices switches off at f > 40 Hz after 60 s or sooner at f < 40 Hz.

Important

- The setting 0 % deactivates the function.
- This monitoring does not fully protect the motor since the calculated motor temperature is set to "0" after every mains connection or disconnection. The connected motor can be overheated if
  – it is already hot and is still overloaded.
  – the cooling-air stream is interrupted or the air is too hot.
- Full motor protection can be achieved using a PTC thermistor or thermostat in the motor.
- To prevent motors with forced ventilation from starting too early, this function can be deactivated.
- If you want to monitor power-adapted motors at < 100 % load, C0120 must also be reduced accordingly.
- If the controller operates at increased rated power, the $I^2 \cdot t$ switch-off can be activated if C0120 is set to ≤ 100 %.



7.9.1.2 PTC motor monitoring/earth fault detection

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0119↲	Configuration PTC input / earth fault detection	-0-	-0-	PTC input not active	Earth fault detection active	• Signal output configuration under C0415 • Deactivate the earth fault detection if it is activated unintentionally	📖 7-52
			-1-	PTC input active, TRIP set			
			-2-	PTC input active, Warning set			
			-3-	PTC input not active	Earth fault detection		
			-4-	PTC input active, TRIP set			
			-5-	PTC input active, Warning set			

Function

Input for the connection of PTC resistors to DIN44081 and DIN44082. The motor temperatur can be detected and integrated in the drive monitoring.
This input can also be used for the connection of a thermostat (normally-close)-
We recommend to always activate the PTC input for operation with motors equipped with PTC resistors or thermostats. By this you prevent the motor from overheating.

Activation

1. Connect the monitoring circuit of the motor to X2/T1 and X2/T2.
2. Parameter setting for the evaluation of the PTC signal:
   If the PTC evalution detects an overtemperature, it can be evaluated in three ways:
   – C0119 = -0-, -3-: PTC not active
   – C0119 = -1-, -4-: TRIP error message (display = OH3 Trip, LECOM error number = 53)
   – C0119 = -2-, -5-: Warning (display = OH51 Warn, LECOM error number = 203)

Important

- The controller can only evaluate a motor-PTC system.
  – It is not allowed to connect several motor PTC systems in parallel or in series.
- If you connect several motors to an inverter, use thermistors (normally close) to monitor the motor temperature.
  – Thermostats must be connected in series for evaluation.
- The error or warning message is indicated at approx. R ≤ 1.6 kΩ.
- If, for a functionality test, the PTC input is assigned to a variable resistor, the following occurs:
  – R > 2 kΩ no error or warning message.
  – R < 250 Ω no message.
- All Lenze three-phase AC motors are equipped with thermostats.

7.9.2 Error detection (DCTRL1-TRIP-SET/DCTRL1-TRIP-RESET)

Function

If the function DCTRL1-TRIP-SET is activated, external error can be detected and thus be integrated into the monitoring system. The controller indicates the fault EEr and sets controller inhibit.

Activation of fixed configurations

HIGH active inputs

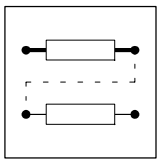
C0007	X3/E1	X3/E2	X3/E3	X3/E4
-7-, -8-, -18-, -19-	LOW			
-5-, -6-, -9-, -20-, -38- ... -43-		LOW		
10-, -27-			LOW	
-32-				LOW

Activation freely configured

- C0410/11 (DCTRL1-TRIP-SET) signal source assignment.
- HIGH active inputs
  – Signal source for DCTRL1-TRIP-SET = LOW activates the function.

Important

Error message reset: 📖 8-6.

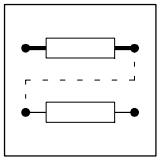


7.10 Display of operating data, diagnostics

7.10.1 Display of operating data

7.10.1.1 Display values

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0004*↲	Bar-graph display	56	All codes possible 56 = controller load (C0056)			• Bargraph display indicates the selected in % after power on • Range -180 % ... +180 %	
C0044*	Setpoint 2 (NSET1-N2)		-480.00	{0.02 Hz}	480.00	• Selection, if C0412/2 = FIXED-FREE • Display, if C0412/2 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	
C0046*	Setpoint 1 (NSET1-N1)		-480.00	{0.02 Hz}	480.00	• Selection, if C0412/1 = FIXED-FREE • Display, if C0412/1 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	
C0047*	Torque setpoint or torque limit value (MCTRL1-MSET)		0 Ref.: Rated motor torque detected by motor parameter identification	{1 %}	400	Control mode "Sensorless torque control" (C0014 = 5): • Torque setpoint selection, if C0412/6 = FIXED-FREE • Torque setpoint display, if C0412/6 ≠ FIXED-FREE Control mode "V/f characteristic control" or "Vector control" (C0014 = 2, 3, 4): • Torque limit value display, if C0412/6 ≠ FIXED-FREE • Function not active (C0047 = 400), if C0412/6 = FIXED-FREE **The value set will be lost when switching the mains!**	
C0049*	Additional setpoint (PCTRL1-NADD)		-480.00	{0.02 Hz}	480.00	• Selection, if C0412/3 = 0 • Display, if C0412/3 ≠ 0 **The value set will be lost when switching the mains!**	
C0050*	Output frequency (MCTRL1-NOUT)		-480.00	{0.02 Hz}	480.00	Only display: Output frequency without slip compensation	
C0051*	Output frequency with slip compensation (MCTRL1-NOUT +SLIP) or Act. process controller value (PCTRL1-ACT)		-480.00	{0.02 Hz}	480.00	Operation without process controller (C0238 = 2): • Display only: Output frequency with slip compensation (MCTRL1-NOUT+SLIP) Operation with process controller (C0238 = 0, 1): • Selection, if C0412/5 = FIXED-FREE • Display, if C0412/5 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	📖 7-36
C0052*	Motor voltage (MCTRL1-VOLT)		0	{1 V}	1000	Only display	
C0053*	DC-bus voltage (MCTRL1-DCVOLT)		0	{1 V}	1000	Only display	
C0054*	Apparent motor current (MCTRL1-IMOT)		0.00	{0.01 A}	400.00	Only display	
C0056*	Controller load (MCTRL1-MOUT)		-255	{1 %}	255	Only display	



Function library

Display of operating data, diagnostics

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0061*	Heat sink temperature		0	{1 °C}	255	Only display • If > +85 °C: – Controller sets warning *OH* – Chopper frequency reduced if C0144 = 1 • If > +90 °C: – Controller sets TRIP *OH*	
C0138*	Process controller setpoint 1 (PCTRL1-SET1)	0.00	-480.00	{0.02 Hz}	480.00	• Selection if C0412/4 = FIXED-FREE • Display if C0412/4 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	📖 7-35

Function Some parameters measured during operation can be displayed on the keypad or PC.

7.10.1.2 Display value calibration

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0500*	Calibration of numerator variable	2000	1	{1}	25000	• The codes C0010, C0011, C0017, C0019, C0037, C0038, C0039, C0044, C0046, C0049, C0050, C0051, C0138, C0139, C0140, C0181, C0239, C0625, C0626, C0627 can be calibrated in a way that the keypad indicates a process variable. • If C0500/C0501 remain unchanged, the unit "Hz" will no longer be displayed.	📖 7-54
C0501*	Calibration of denominator process variable	10	1	{1}	25000		
C0500* (A)	Calibration of numerator variable	2000	1	{1}	25000	• The codes C0037, C0038, C0039, C0044, C0046, C0049, C0051, C0138, C0139, C0140, C0181 can be calibrated in a way that the keypad indicates a process variable with the unit selected under C0502. • Frequency-related codes (C0010, C0011, C0017, C0019, C0050, C0239, C0625, C0626, C0627) are always indicated in "Hz".	
C0501* (A)	Calibration of denominator process variable	10	1	{1}	25000		
C0502* (A)	Process variable unit	0	0: — 1: ms 2: s 4: A 5: V	6: rpm 9: °C 10: Hz 11: kVA 12: Nm	13: % 14: kW 15: N 16: mV 17: mΩ	18: Ω 19: hex 34: m 35: h 42: mH	

Function Absolute or relative selection and display of process variables (e.g. pressure, temperature, flow rate, humidity, speed)

Calibration Calibrated values are calculated from:

$$C0xxx = \frac{C0011}{200} \cdot \frac{C0500}{C0501}$$

Example:
A pressure setpoint is to be selected as relative and absolute value.
Values: P_{set} = 5 bar at C0011 = 50 Hz

a) Relative calibration in %

$$100\ \% = \frac{50}{200} \cdot \frac{C0500}{C0501} = \frac{50}{200} \cdot \frac{4000}{10}$$

E.g. C0500 = 4000, C0501 = 10

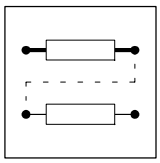
b) Absolute calibration in bar

$$5.00\ \text{bar} = \frac{50}{200} \cdot \frac{C0500}{C0501} = \frac{50}{200} \cdot \frac{200}{10}$$

E.g. C0500 = 200, C0501 = 10

Important
- The calibration always effects all selected codes.

Only for operation with standard I/O
- After the calibration, the output frequency [Hz] (C0050) can only be calculated via C0500 and C0501.



7.10.2 Diagnostics

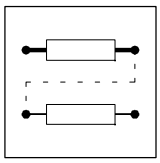
Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0093*	Controller type		xxxy	Only display • xxx = Power taken from nameplate (e. g. 551 = 550 W) • y = Voltage class (2 = 240 V, 4 = 400 V)	
C0099*	Software version		x.y	Only display x = Main version, y = Index	
C0161*	Actual fault			Display history buffer contents • Keypad: three-digit, alpha numerical fault detection • 9371BB keypad: LECOM fault number	📖 8-1 📖 8-3
C0162*	Last fault				
C0163*	Last but one fault				
C0164*	Last but two fault				
C0168*	Actual fault				
C0178*	Operating time		Total time CINH = HIGH {h}	Only display	
C0179*	Power-on time		Total time power-on {h}	Only display	
C0183*	Diagnostics		0 No fault 102 TRIP active 104 Message "Overvoltage (OU)" or "Undervoltage (LU)" active 142 Pulse inhibit 151 Quick stop active 161 DC-injection brake active 250 Warning active	Only display	
C0200*	Software ID number			Only PC display	
C0201*	Software generation date			Only PC display	
C0202*	Software ID number			Only keypad display	
1 ... 4				Output to keypad as string in 4 parts à 4 characters	
C0304 ... C0309	Service codes			**Modifications only by Lenze Service!**	
C0518	Service codes			**Modifications only by Lenze Service!**	
C0519					
C0520					
C01500*	Software number application I/O			Only PC display	
C1501*	Software creation date application I/O			Only PC display	
C1502 (A)	Software number application I/O			Output to keypad as string in 4 parts à 4 characters	
1	Part 1				
...	...				
4	Part 4				
C1504 ... C1507	Service codes application I/O			**Modifications only by Lenze Service!**	

Function Display codes for diagnostics

7.11 Parameter set management

7.11.1 Parameter set transfer

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
[C0002]*	Parameter set transfer	-0-	-0-	Function executed		📖 7-56
			Parameter sets of the controller			
			-1-	Lenze setting ⇨ PAR1	Overwrite the selected parameter set with the settings stored as default settings.	
			-2-	Lenze setting ⇨ PAR2		
			-3-	Lenze setting ⇨ PAR3		
			-4-	Lenze setting ⇨ PAR4		
			-10-	Keypad ⇨ PAR1 ... PAR4	Overwrite all parameter sets with the keypad data	
			-11-	Keypad ⇨ PAR1	Overwrite one parameter set with the keypad data	
			-12-	Keypad ⇨ PAR2		
			-13-	Keypad ⇨ PAR3		
			-14-	Keypad ⇨ PAR4		
			-20-	PAR1 ... PAR4 ⇨ Keypad	Copy all parameter sets to the keypad	
			Parameter sets of a function module to FIF		Not for standard I/O or system bus (CAN)	
			-31-	Lenze setting ⇨ FPAR1	Overwrite the selected parameter set of the function module with the settings stored as default setting.	
			-32-	Lenze setting ⇨ FPAR2		
			-33-	Lenze setting ⇨ FPAR3		
			-34-	Lenze setting ⇨ FPAR4		
			-40-	Keypad ⇨ FPAR1 ... FPAR4	Overwrite all parameter sets of the function module with the keypad data	
			-41-	Keypad ⇨ FPAR1	Overwrite one parameter set of the function module with the keypad data	
			-42-	Keypad ⇨ FPAR2		
			-43-	Keypad ⇨ FPAR3		
			-44-	Keypad ⇨ FPAR4		
			-50-	FPAR1 ... FPAR4 ⇨ Keypad	Copy all parameter sets of the function module to the keypad	
			Parameter sets of controller + function module to FIF		Not for standard I/O or system bus (CAN) **If you use an application I/O the parameter sets of controller and application I/O must always be transferred together!**	
			-61-	Lenze setting ⇨ PAR1 + FPAR1	Overwrite some parameter sets with the settings stored as default settings	
			-62-	Lenze setting ⇨ PAR2 + FPAR2		
			-63-	Lenze setting ⇨ PAR3 + FPAR3		
			-64-	Lenze setting ⇨ PAR4 + FPAR4		
			-70-	Keypad ⇨ PAR1 ... PAR4 + FPAR1 ... FPAR4	Overwrite all parameter sets with the keypad data	
			-71-	Keypad ⇨ PAR1 + FPAR1	Overwrite some parameter sets with the keypad data	
			-72-	Keypad ⇨ PAR2 + FPAR2		
			-73-	Keypad ⇨ PAR3 + FPAR3		
			-74-	Keypad ⇨ PAR4 + FPAR4		
			-80-	PAR1 ... PAR4 + FPAR1 ... FPAR4 ⇨ Keypad	Copy all parameter sets to the keypad	
C0003*↲	Non-volatile parameter saving	-1-	-0-	Do not save parameter in EEPROM	Data loss after mains disconnection	
			-1-	Always save parameter in EEPROM	• Active after every main connection • Cyclic parameter changes via bus module are not allowed.	



Function

Parameter set management with the keypad:
- The Lenze setting can be activated again.
- Transfer of parameter sets from the keypad to the controller or vice versa. The settings can thus be easily copied between controllers.

Loading of Lenze settings

1. Plug in the keypad
2. Inhibit the controller with STOP or terminal (X3/28 = LOW)
3. Select the selection number under C0002 and confirm with ENTER
   – E. g. C0002 = 1: Parameter set 1 of the controller is overwritten with the Lenze setting
4. If *StOrE* is off, the Lenze setting is loaded again

Parameter set transfer from the controller to the keypad

1. Plug in the keypad
2. Inhibit the controller with STOP or terminal (X3/28 = LOW)
3. Set C0002 = 20 or 50 or 80 and confirm with ENTER
4. If *SAvE* is off, all parameter sets have been transferred to the keypad

Transfer of parameter sets from the keypad to the controller

1. Plug in the keypad
2. Inhibit the controller with STOP or terminal (X3/28 = LOW)
3. Select the selection number under C0002 and confirm with ENTER
   – E. g. C0002 = 10: All parameter sets of the controller are overwritten with the keypad settings
   – E. g. C0002 = 11: Parameter set 1 of the controller is overwritten with the keypad settings
4. If *LOAd* is off, the parameter sets have been transferred to the controller

Important

- Do not disconnect the keypad as long as *StOrE*, *SAVE* or *LOAd* is indicated (= transfer)!
  – If you disconnect it during transfer, the error Fehler "Prx" or "PT5" will be set. (📖 8-3)
- The parameter set transfer also changes password-protected codes!

7.11.2 Parameter set changeover (PAR, PAR2/4, PAR3/4)

Function

- Switches between the four parameter sests of the controller during operation (ONLINE). Thus 9 additional JOG values or additional acceleration and deceleration times are available.
- The function PAR switches between parameter sets 1 and 2.
- The functions PAR-B0 and PAR-B1 enable the changeover between all 4 parameter sets of the controller.

PAR activation

HIGH active inputs

C0007	Active parameter set	X3/E2	X3/E3
-4-, -8-, -15-, -17, -18-, -35-, -36-, -37-, -44-, -45-	PAR1	LOW	
	PAR2	HIGH	
-1-, -3-, -6-, -7-, -12-, -24-, -33-, -38-, -46-, -51-	PAR1		LOW
	PAR2		HIGH

PAR-B0, PAR-B1 activation

Assign signal sources to C0410/13 (PAR-B0) and C0410/14 (PAR-B1).
HIGH active inputs

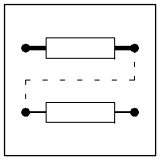
Signal source		Active parameter set
Level for PAR-B0	Level for PAR-B1	
LOW	LOW	PAR1
HIGH	LOW	PAR2
LOW	HIGH	PAR3
HIGH	HIGH	PAR4

Important

- **The parameter set changeover via terminal is not possible if the automatic changeover via DC-bus voltage is active (C0988 ≠ 0)!**
- With Lenze setting, the controller uses PAR1.
- If you switch between the parameter sets via terminals, PAR and PAR-B0 and PAR-B1 must be assigned to the same terminals of all parameter sets.
- The codes marked with * in the code table are the same for all parameter sets.
- The active parameter set is displayed in the keypad when using the function Disp (e. g. PS *2*).

Special features

If the control mode (C0014) is different for the parameter sets, you should only switch between the parameter sets when the controller is inhibited (CINH).



7.12 Individual grouping of drive parameters - The menu USEr

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0517*↲	User menu				• After mains switching or when using the function Disp the code from C0517/1 will be displayed. • In Lenze setting, the user menu contains the most important codes for setting up the control mode "V/f characteristic control with linear characteristic" • When the password protection is activated, only the codes entered under C0517 are freely accessible. • Enter the required code numbers in the subcodes.	📖 7-58
1	Memory 1	50	C0050	Output frequency (MCTRL1-NOUT)		
2	Memory 2	34	C0034	Analog setpoint selection range		
3	Memory 3	7	C0007	Fixed configuration - digital input signals		
4	Memory 4	10	C0010	Minimum output frequency		
5	Memory 5	11	C0011	Maximum output frequency		
6	Memory 6	12	C0012	Acceleration time main setpoint		
7	Memory 7	13	C0013	Deceleration time main setpoint		
8	Memory 8	15	C0015	V/f rated frequency		
9	Memory 9	16	C0016	V_{min} boost		
10	Memory 10	2	C0002	Parameter set transfer		

Function

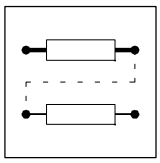
- Fast access to 10 codes
- Individual combination of 10 codes most important for your application.

Important

- The user menu is active after mains switching or keypad attachment.
- Adapt the user menu using the keypad: (📖 6-6)
- Setting-up a password protection: (📖 6-7)

Tip!

- Use the user menu to select "tailored" codes for your application to be used by your personnel if the password protection is activated additionally. Your personnel can only change codes listed in the user menu.
- Example: The personnel operating a transportation system shall be able to change the speed of the conveyor using the keypad (▼▲). The current speed is to be set and indicated in "rpm".
  - – Assign C0140 to memory 1 of the user menu (C0517/1 = 140)
  - – Delete all other entries from the user menu (C0517/2 ... C0517/10 = 0)
  - – Convert the value indicated under C0140 into "rpm" using C0500/C0501 (📖 7-54)
  - – Activate the password protection (C0094 > 0)
  - – The current conveyor speed will be indicated after the keypad has been attached or power on.
  - – Select ⏎ to activate the function Para and to change the speed during operation using the ▼▲ keys. The speed set last wirll be stored when the mains is switched off.



8 Troubleshooting and fault elimination

The controller LEDs and the status information at the keypad immidiately indicate errors or operation problems. (📖 8-1)

You can analyse an error using the history buffer. The list “Error messages” helps you to eliminate the error. (📖 8-3)

8.1 Troubleshooting

8.1.1 Operating status display

During operation, the operating status of the controller is indicated by means of two LEDs.

LED		Operating status
green	red	
on	off	Controller enabled
on	on	Mains switched on and automatic start inhibited
blinking	off	Controller inhibited
off	blinking every second	Fault active, check under C0161
off	blinking every 0.4 seconds	Undervoltage or overvoltage
fast blinking	off	Motor parameter identification

8.1.2 Error analysis with history buffer

The history buffer is used to trace errors. Error messages are stored in the history buffer in the order of their occurrence.

The memory locations can be retrieved via the codes.

Structure of the history buffer			
Code	Memory unit	Entry	Note
C0161	Memory unit 1	Active fault	If the fault is no longer active or has been acknowledged: • The contents of the memory locations 1-3 will be saved in a ”higher” location. • The contents of the memory location 4 will be eliminated from the history buffer and cannot be read any longer. • Memory location 1 will be deleted (= no active fault).
C0162	Memory unit 2	Last fault	
C0163	Memory unit 3	Last but one fault	
C0164	Memory unit 4	Last but two fault	

8.2 Maloperation of the drive

Fault	Cause	Remedy	
Motor does not rotate	DC-bus voltage too low (Red LED is blinking every 0.4 s; keypad display *LU*)	Check mains voltage	
	Controller inhibited (Green LED is blinking, keypad display: IMP)	Remove the controller inhibit, controller inhibit can be set through several sources	📖 7-13
	Automatic start inhibited (C0142 = 0 or 2)	LOW-HIGH signal at X3/28 If necessary, correct start condition (C0142)	
	DC injection brake active (DCB)	Deactivate DC-injection brake	📖 7-19
	Mechanical motor brake is not released	Manual or electrical release of mechanical motor brake	
	Quick stop (QSP) active (keypad display: IMP)	Remove quick stop	📖 7-18
	Setpoint = 0	Setpoint selection	📖 7-21 ff
	JOG setpoint activated and JOG frequency = 0	JOG setpoint selection (C0037 ... C0039)	📖 7-28
	Active fault	Eliminate fault	📖 8-3
	Wrong parameter set active	Change to correct parameter set via terminal	📖 7-19
	Control mode C0014 = -4-, -5-, but no motor parameter identification	Motor parameter identification (C0148)	📖 7-31 📖 7-2
	Under C0410 several functions, which exclude each other, are assigned to the same signal source.	Correct configuration in C0410	📖 7-45
	Use internal voltage source X3/20 for function modules Standard-I/O, INTERBUS, PROFIBUS-DP or LECOM-B (RS485): Bridge between X3/7 and X3/39 is missing	Bridge terminals	
Motor does not rotate smoothly	Defective motor cable	Check motor cable	
	Maximum current set too low (C0022, C0023)	Adaptation to the application	📖 7-15
	Motor underexcited or overexcited	Check parameter setting (C0015, C0016, C0014)	📖 7-2 ff
	C0084, C0087, C0088, C0089, C0090, C0091 and/or C0092 are not adapted to the motor data	Manual adaptation or identification of motor parameters (C0148)	📖 7-31
Current consumption of motor too high	Setting of C0016 too high	Correct setting	📖 7-6
	Setting of C0015 too low	Correct setting	📖 7-4
	C0084, C0087, C0088, C0089, C0090, C0091 and/or C0092 are not adapted to the motor data	Manual adaptation or identification of motor parameters (C0148)	📖 7-31
Motor rotates, setpoints are "0"	With the function Set of the keypad a setpoint has been selected.	Set the setpoint to "0" by C0140 = 0	📖 7-29
Motor parameter identification stops with error LP1	Motor phase failure detection active (C0597 = 1)	Deactivate with C0597 = 0 before identification; reactivate after identification (C0597 = 1)	
	Motor too small compared with rated power		
	DC injection brake is active (terminal assigned)		
Unacceptable drive response with vector control	various	Vector control optimisation	📖 5-11

8.3 Error messages at the keypad or in the parameter setting program Global Drive Control

LEDs at the controller (operating status display)

LED		Operating status
green	red	
on	off	Controller enabled
on	on	Mains switched on and automatic start inhibited
blinking	off	Controller inhibited
off	blinking every second	Fault active, check under C0161
off	blinking every 0.4 seconds	Undervoltage switch-off
fast blinking	off	Motor parameter identification

Fault messages at the keypad or in the parameter setting program Global Drive Control

Display		Fault	Cause	Remedy
Keypad	PC 1)			
nOEr	0	No fault	-	-
CCr Trip	71	System fault	Strong interferences on control cables	Shield control cables
			Ground or earth loops in the wiring	
CE0 Trip	61	Communication fault to AIF	Faulty transmission of control commands via AIF	Insert the communication module into the hand terminal
CE1 Trip	62	Communication fault to CAN-IN1 with Sync control	CAN-IN1 object receives faulty data or communication is interrupted	• Plug-in connection - bus module ⇔ Check FIF • Check transmitter • Increase monitoring time under C0357/1 if necessary
CE2 Trip	63	Communication error to CAN-IN2	CAN-IN2 object receives faulty data or communication is interrupted	• Plug-in connection - bus module ⇔ Check FIF • Check transmitter • Increase monitoring time under C0357/2 if necessary
CE3 Trip	64	Communication error to CAN-IN1 with event or time control	CAN-IN1 object receives faulty data or communication is interrupted	• Plug-in connection - bus module ⇔ Check FIF • Check transmitter • Increase monitoring time under C0357/3 if necessary
CE4 Trip	65	BUS-OFF (many communication faults occurred)	Controller has received too many incorrect telegrams via the system bus and has been disconnected	• Check whether bus terminator available • Check screen contact of the cables • Check PE connection • Check bus load, if necessary, reduce the baud rate
CE5 Trip	66	CAN Time-Out	For remote parameter setting via system bus (C0370): Slave does not answer. Communication monitoring time exceeded.	• Check system bus wiring • Check system bus configuration
			For operation with module in FIF: Internal fault	Contact Lenze
CE6 Trip	67	Function module system bus (CAN) on FIF has set "Warning" or "BUS-OFF" (only generated if C0128 = 1)	CAN controller sets "Warning" or "BUS OFF"	• Check whether bus terminator available • Check screen contact of the cables • Check PE connection • Check bus load, if necessary, reduce the baud rate
EEr Trip	91	External fault (TRIP-SET)	A digital input assigned to the TRIP-Set function has been activated.	Check external encoder
H05 Trip	105	Internal fault		Contact Lenze
Id1 Trip	140	Faulty parameter identification	Motor not connected	Connect motor
LP1 Trip	32	Fault in motor phase (only generated if C0597 = 1)	• Failure of one/several motor phase(s) • Motor current too low	• Check motor cables, • Check V_{min} boost • Connect motor to corresponding power or adapt the motor under C0599.
LP1	182	Fault in motor phase (only generated if C0597 = 2)		
LU IMP	1030	DC-bus undervoltage	Mains voltage too low	Check mains voltage
			DC-bus voltage too low	Check supply module
			400 V controller connected to 240 V mains	Connect controller to the appropriate mains voltage

Troubleshooting and fault elimination

Error messages

Display Keypad	PC 1)	Fault	Cause	Remedy
OC1 Trip	11	Short-circuit	Short-circuit	• Find reason for short-circuit; check motor cable • Check brake resistor
			Excessive capacitive charging current of the motor cable	Use shorter motor cables with lower charging current
OC2 Trip	12	Earth fault	Grounded motor phase	Check motor, check motor cable
			Excessive capacitive charging current of the motor cable	Use shorter motor cables with lower charging current
				For testing purposes the earth fault detection can be deactivated
OC3 Trip	13	Overload inverter during acceleration or short circuit	Acceleration time too short (C0012)	• Increase acceleration time • Check drive selection
			Defective motor cable	Check wiring
			Interturn fault in the motor	Check motor
OC4 Trip	14	Controller overload during deceleration	Deceleration time set too short (C0013)	• Increase deceleration time • Check rating of external brake resistor
OC5 Trip	15	Controller overload in stationary operation	Frequent and long overload	Check drive selection
OC6 Trip	16	Motor overload (I^2 x t overload)	Motor is thermally overloaded, for instance, because of • impermissible continuous current • frequent or too long acceleration processes	 • Check drive selection • Check setting of C0120
OH Trip	50	Heatsink temperature > +85 °C	Ambient temperature T_{amb} > +60 °C	• Allow controller to cool and ensure better ventilation • Check ambient temperature
OH Warn	-	Heatsink temperature > +80 °C	Heat sink very dirty	Clean heat sink
			Impermissibly high currents or too frequent and too long acceleration	• Check drive selection • Check load, if necessary, replace defective bearings
OH3 Trip	53	PTC monitoring (TRIP) (only generated if C0119 = 1 or 4)	Motor too hot because of excessive currents or frequent and too long accelerations	Check drive selection
			PTC not connected	Connect PTC or switch off monitoring
OH4 Trip	54	Controller overtemperature	Controller too hot inside	• Reduce controller load • Improve cooling • Check fan in the controller
OH51	203	PTC monitoring (only generated if C0119 = 2 or 5)	Motor too hot because of excessive currents or frequent and too long accelerations	Check drive selection
			PTC not connected	Connect PTC or switch off monitoring
OU IMP	1020	DC-bus overvoltage	Mains voltage too high	Check voltage supply
			Braking operation	• Prolong deceleration times. • Operation with external brake resistor: – Check dimensioning, connection and cable of the brake resistor. – Increase the deceleration times
			Earth leakage on the motor side	Check motor cable and motor for earth fault (disconnect motor from inverter)
Pr Trip	75	Faulty parameter transfer when using the keypad	All parameter sets are defective	It is absolutely necessary to repeat the data transfer or load the Lenze setting before enabling the controller.
Pr1 Trip	72	Wrong PAR1 transfer when using the keypad.	PAR1 is defective.	
Pr2 Trip	73	Wrong PAR2 transfer when using the keypad.	PAR2 is defective.	
Pr3 Trip	77	Wrong PAR3 transfer when using the keypad.	PAR3 is defective	
Pr4 Trip	78	Wrong PAR4 transfer when using the keypad.	PAR4 is defective	
Pr5 Trip	79	Internal fault		Contact Lenze

Troubleshooting and fault elimination

Error messages

Display Keypad	PC 1)	Fault	Cause	Remedy
PTS Trip	81	Time fault during parameter set transfer	Data flow from keypad or PC interrupted, e. g. keypad was disconnected during transfer	It is absolutely necessary to repeat the data transfer or load the Lenze setting before enabling the controller.
rST Trip	76	Faulty auto-TRIP reset	More than 8 fault messages in 10 minutes	Depends on the fault message
SdS Trip	85	Open circuit in analog input (setpoint range 4 ... 20 mA)	Current at analog input < 4 mA	Close circuit at analog input

1) LECOM fault number

8.4 Error message reset

TRIP

Pulse inhibit will only be reset after the error has been eliminated and the error message has been acknowledged.

Tip!

A TRIP can have several reasons. An error message can only be acknowledged after all TRIP reasons have been eliminated.

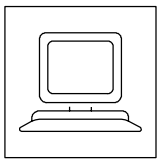
Code		Possible settings			IMPORTANT
No.	Name	Lenze	Selection		
C0043	TRIP reset		-0-	No current error	Reset active error with C0043 = 0
			-1-	Active error	
C0170↵	Configuration TRIP reset	-0-	-0-	TRIP reset by mains switching, STOP, LOW–signal at X3/28, via function module (exception: LECOM-B) or communication module	• TRIP reset via function module or communication module with C0043, C0410/12 or C0135 bit 11. • Auto TRIP reset automatically resets all errors after the time set under C0171.
			-1-	like -0- and additional auto TRIP reset	
			-2-	TRIP reset by mains switching, LOW–signal at X3/28 or via function module (except LECOM–B)	
			-3-	TRIP reset by mains switching	
C0171	Delay for auto-TRIP reset	0.00	0.00	{0.01 s} 60.00	

Function

You can select whether error are to be reset manually or automatically.

Important

- Every mains switching results in a TRIP reset.
- With more than 8 Auto-TRIP resets within 10 minutes, the controller sets TRIP and indicates rST.
- TRIP reset also resets the auto TRIP counter.



9 Automation

9.1 Function module system bus (CAN) E82ZAFC

9.1.1 Description

The function module system bus (CAN) is a component for the frequency inverters 8200 motec and 8200 vector, which connects the controllers to the serial communication system CAN (Controller Area Network).

The controllers can also be retrofitted.

The function module extends the controller functionality, e.g. by:

- Parameter preselection/remote parameter setting
- Data exchange between controllers
- Connection with
  – external control and master systems
  – Decentralised terminal extensions
  – Operating units

9.1.2 Technical data

9.1.2.1 General data and application conditions

Communication profile	based on CANopen				
Communication medium	DIN ISO 11898				
Network topology	Line (terminated at both ends with 120 Ω)				
System bus participants	Master or slave				
Max. number of participants	63				
Baud rate [kbit/s]	20	50	125	250	500
Max. bus length [m]	2500	980	480	230	80
Electrical connection	Screw terminals, isolated terminal for controller inhibit (CINH)				
DC voltage supply	internal (in the event of failure of the controller the bus system will continue operation)				
Insulation voltages for bus systems:					
• to PE	50 V AC		(mains isolation)		
• external supply (terminal 39/59)	-		(no mains isolation)		
• power stage of the 8200 vector	270 V AC		(double basic insulation)		
• to control terminals:					
– 8200 vector (internal supply)	-		(no mains isolation)		
– 8200 vector (external supply)	100 V AC		(basic insulation)		
• bus system - external	-		(no mains isolation)		
Ambient temperature	Operation:		-20 ... +60 °C		
	during transport:		-25 ... +70 °C		
	during storage		-25 ... +60 °C		
Climatic conditions	Class 3K3 to EN 50178 (without condensation, average relative humidity 85 %)				

9.1.2.2 Communication times

The system bus communciation times depend on

- Data priority
- Bus load
- Baud rate
- Processing time in the controller

Telegram run times						Processing times in the controller	
	Baud rate [kBits/s]					Parameter channel	Process data
	20	50	125	250	500		
Run time/processing time [ms]	6.5	2.6	1.04	0.52	0.26	< 20	1 ... 2

9.1.3 Installation

9.1.3.1 Mechanical installation

See Mounting Instructions

9.1.3.2 Electrical installation

Terminal assignment

Supply of terminal 28 (controller inhibit) via internal voltage source	Supply of terminal 28 (controller inhibit) via external voltage source

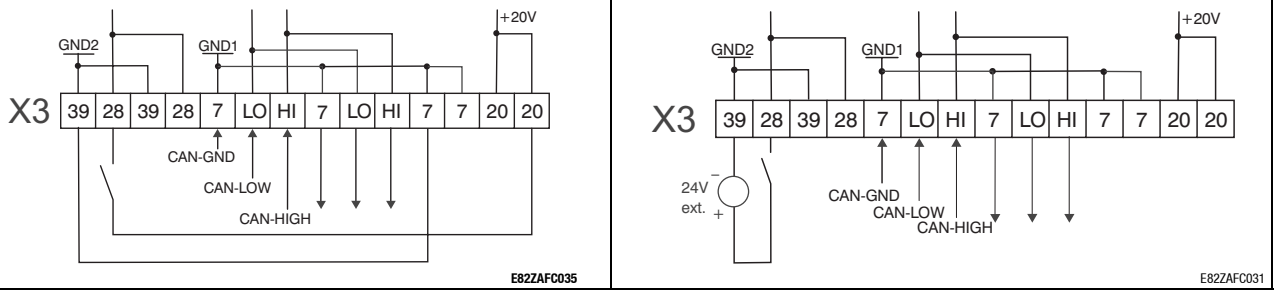


Fig. 9-1 Terminal assignment of the function module

Terminal	Explanation	
X3/39	GND2	Reference potential 2 (only for X3/28)
X3/28	CINH	Controller inhibit • Start = HIGH (+12 V ... +30 V) • Stop = LOW (0 V ... +3 V)
X3/7	GND1	Reference potential 1
X3/LO	CAN-LOW	System bus LOW (data cable)
X3/HI	CAN-HIGH	System bus HIGH (data cable)
X3/20		+ 20 V internal for CINH (reference: X3/7)

Screw terminal data		
Max. cable cross-sections		Tightening torques
rigid	flexible	
1.5 mm² (AWG 16)	1.0 mm² (AWG 18) 0.5 mm² (AWG 20) 0.5 mm² (AWG 20)	0.5 ... 0.6 Nm (4.4 .. 5.3 lb-in)

Wiring of the system bus network

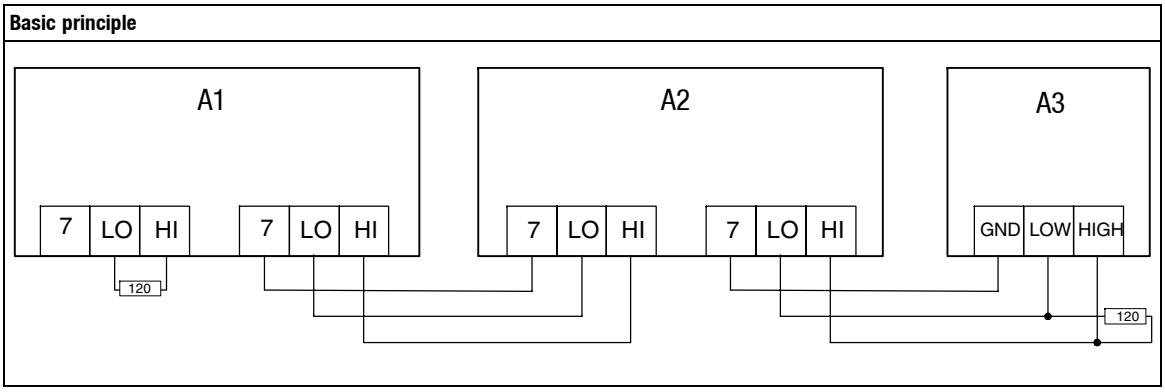


Fig. 9-2 Principle structure of a system bus network
A1 Controller 1
A2 Controller 2
A3 PLC/PC, system bus compatible

Specification for system bus cable		
Total length	ó **300 m**	ó **1000 m**
Cable type	LIYCY 2 x 2 x 0,5 mm^2 (twisted in pairs with shield)	CYPIMF 2 x 2 x 0.5 mm^2 (twisted in pairs with shield)
Cable resistance	≤ 40 è/km	≤ 40 è/km
Capacitance per unit length	≤ 130 nF/km	≤ 60 nF/km
Connection	Pair 1 (white/brown): CAN-LOW and CAN-HIGH Pair 2 (green/yellow): CAN-GND	

Tip!

A terminating resistance of 120 Ω must be connected between the terminals CAN-LOW and CAN-HIGH at the first and last device connected to the system bus.

9.1.4 Commissioning with function module system bus (CAN)

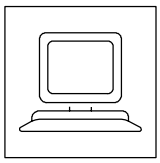
Stop!

Before switching on the mains voltage, check the wiring for completeness, earth fault and short circuit.

First switch-on of a system bus network with higher-level master (e.g. PLC)

1. Switch on the mains voltage. The green LED of the controller is blinking.
2. If necessary, adjust the baud rate (system bus baud rate) (C0351) using the keypad or PC.
   – Lenze setting: 500 kBaud
   – Changes will only be accepted when the command “Reset node” (C0358 = 1) has been set.
3. With several controllers in a network:
   – System bus controller address (C0350) must be set for every controller using the keypad or PC. Every address in the network can be used only once.
   – Lenze setting: 1
   – Changes will only be accepted when the command “Reset node” (C0358 = 1) has been set.
4. Communication with the drive is now possible, i.e. all codes can be read and changeable codes and be overwritten.
   – If necessary, adapt the codes to your application.
5. Configure the setpoint source:
   – C0412/1 = 20 ... 23: Setpoint source is a word of the sync controlled process data channel 1 (CAN1)
   – E.g. C0412/1 = 21: Setpoint source is CAN-IN1.W2.
6. Master sets system bus (CAN) to ”OPERATIONAL”.
7. Setpoint selection:
   – Send setpoint via CAN word selected (e.g. CAN-IN1.W2).
8. Send sync telegram.
   – Sync telegrams can only be received if C0360 = 1 (sync control) is set.
9. Enable the controller via terminal (HIGH signal at X3/28).

The drive should be running now.



9.1.5 Parameter setting

If the controller parameters are set via the function module system bus (CAN), use a PC, PLC or other operating and input devices. More information can be found in the corresponding software documentation.

9.1.5.1 Parameter channels

Parameters are values stored as codes in Lenze controllers. Parameters are changed for e.g. individual settings or when the material being processed by a machine is changed.

The 2 parameter channels (SDO = Service Data Object) in the function bus module system bus (CAN) enable the connection of 2 different parameter setting devices, e.g., PC and other operating unit connected at the same time.

Parameters are transferred at low priority.

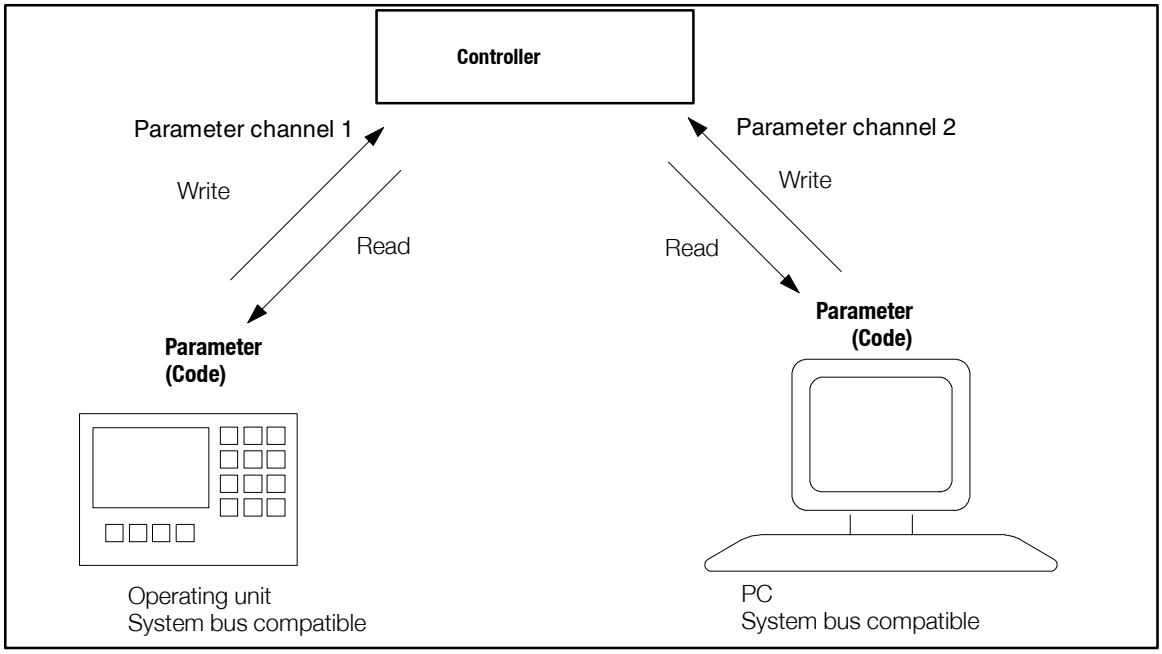


Fig. 9-3 Connection of parameter setting devices via two parameter channels

9.1.5.2 Process data channels

Process data (e.g. setpoints and actual values) are transferred and processed at higher priority and high speed. The function module system bus (CAN) provides the following:

A cyclic, synchronised process data channel (CAN1) for communication with a host (process data objects CAN-IN1 and CAN-OUT1)

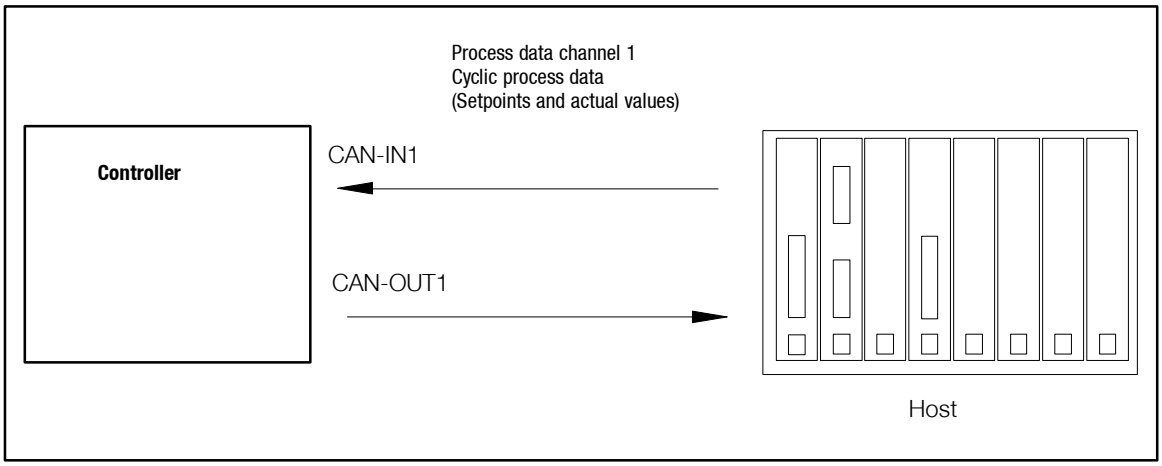


Fig. 9-4 Process data objects CAN-IN1 and CAN-OUT1 for communication with higher-level master systems

Event-controlled process data channel (CAN2) for controller communication (process data objects CAN-IN2 and CAN-OUT2)

Decentralised input and output terminals and higher-level master systems can use CAN2, too.

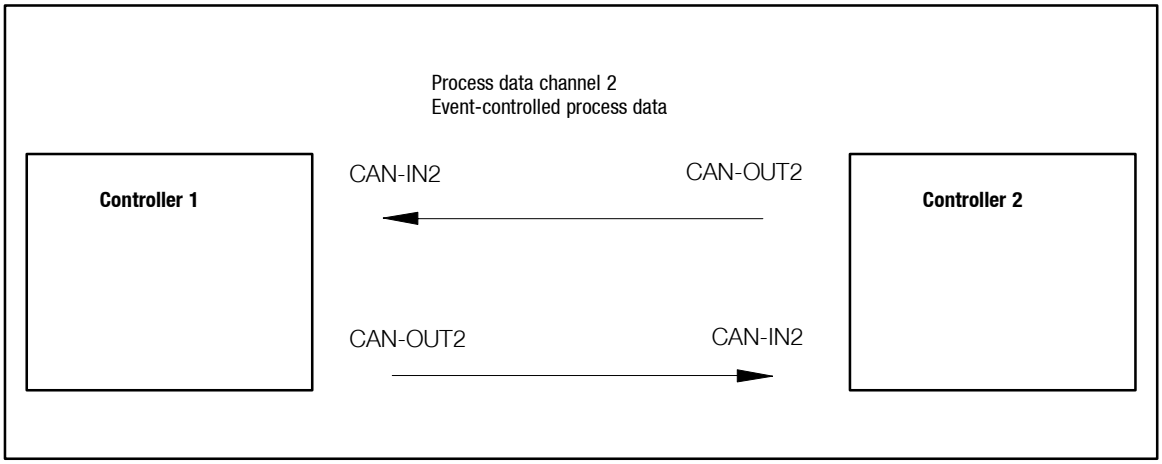


Fig. 9-5 Event-controlled process data channel for controller communication

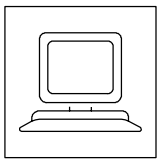
Tip!

- CAN1 can be used for event control or time control like CAN2 (selection under C0360).
- Output data of event-controlled process data channels can be cyclically transferred and the times can be adjusted (setting under C0356)

9.1.5.3 Parameter addressing (code/index)

Controller parameters are addressed via an index. The index for Lenze codes ranges between 16567 ($40C0_{hex}$) and 24575 ($5FFF_{hex}$)

Conversion formula: Index = 24575 - Lenze code



9.1.5.4 Configuration of the system bus network

Selection of a master for the network C0352

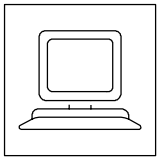
C0352	Value	Note
0	Slave (Lenze setting)	• One controller must be selected as master if you want to transfer data between controllers connected to the system bus network without having a higher-level host. • The master functionality is only required for the initialisation phase of the drive system. • The master changes its status from pre-operational to operational. • Data can only be exchanged via process data objects when the status operational is set. • It is possible to set a boot-up time for the master for the initialisation phase (📖 9-8).
1	Master	

General addressing C0350

C0350	Value	Note
	1 (Lenze setting) ... 63	• C0350 enables addressing of all data objects (parameter and process data channels). • Communication between the system bus participants via event-controlled process data channel: – If all controllers have addresses in rising order and no one is missing, the switching of event-controlled data objects allows communication between the controllers. Example: – Controller 1: C0350 = 1 Controller 2: C0350 = 2 Controller 3: C0350 = 3 – Assign the data objects as follows: CAN-OUT2 controller 1 → CAN-IN2 controller 2 CAN-OUT2 controller 2 → CAN-IN2 controller 3 • Communication between system bus devices via cyclic, synchronised process data channel: – Sychronised process data CAN-IN1 and CAN-OUT1 (C0360 = 1) can be exchanged between controller if a system bus device can send the sync telegram (e.g. Lenze 9300 servo inverter). • Changes will only be accepted after one of the following actions: – Mains switching – Command "Reset node" via the bus system – Reset node via C0358

Selective addressing of individual process data objects C0353

C0353	Value		Note
C0353/1 (Address selection CAN1 with sync control)	0	Addresses from C0350 (Lenze setting)	If data cannot be distributed as wanted with code C0350, ever process data object can have its own address from C0354. The data input objects to be addressed must be identical with the identifiers of the data output object. The identifier is a CAN-specific assignment aspect for a message. If you use devices such as decentralised digital inputs and outputs, observe the resulting identifiers. • Changes will only be accepted after one of the following actions: – Mains switching – Command "Reset node" via the bus system – Reset node via C0358 • The resulting identifiers can be retrieved under C0355.
	1	Address for CAN-IN1 from C0354/1 Address for CAN-OUT1 from C0354/2	
C0353/2 (Address selection CAN2)	0	Addresses from C0350 (Lenze setting)	
	1	Address for CAN-IN2 from C0354/3 Address for CAN-OUT2 from C0354/4	
C0353/1 (Address selection CAN1 for event or time control)	0	Addresses from C0350 (Lenze setting)	
	1	Address for CAN-IN1 from C0354/5 Address for CAN-OUT1 from C0354/6	



Time settings for the system bus C0356

C0356	Value		Note
C0356/1 (Boot-up)	3000 ms (Lenze setting)		Time setting for the boot-up of the master (only valid if C0352 = 1) Usually the Lenze setting is enough. If the network comprises several controllers without having a higher-level host which control the initialisation of the CAN network, one of the controllers must be selected as master and carry out the initialisation. For this the master activates the entire CAN network and starts process data transfer. (Status change from preoperation to operation). In C0356 it is determined when the CAN network is initialised after power-on.
C0356/2 (Cycle time CAN-OUT2)	0	Event-controlled	• Event-controlled process data transfer – The process data output object will only be sent if a value of the output object changes. • Cyclic process data transfer – The process data output object is sent according to the cycle time set here. • C0356/3 is only active if C0360 = 0
	> 0	Cyclic	
C0356/3 (Cycle time CAN-OUT1)	0	Event-controlled	
	> 0	Cyclic	
C0356/4 (CAN delay)		Delay time	Cyclic sending starts after the boot-up and delay time.

Monitoring times C0357

C0357	Display	Note
C0357/1 C0357/3	Monitoring time CAN-IN1	Monitors the process data input objects for telegrams received within the time defined here: • If a telegram is received within the time set, the corresponding monitoring time will be reset and started again. • If no telegram is received within the time set, the controller sets trip CE1/CE3 (CAN-IN1) or CE2 (CAN-IN2). • If the controller receives too many faulty telegrams it disconnects itself from the bus and sets trip CE4 (bus off).
C0357/2	Monitoring time CAN-IN2	

Reset node C358

C0358	Value	Note
0	Not active/reset node carried out	• Changes of baud rate, addresses of process data objects or controller addresses will only become effective after a reset node. • A reset node can also be set by – repeated mains switching – Reset node via the bus system
1	Start reset node	

9.1.6 Communication profile of the system bus

9.1.6.1 Data description

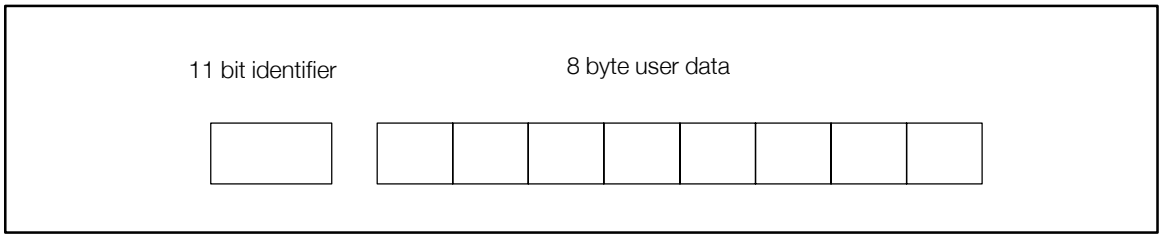


Fig. 9-6 Principle structure of a CAN telegram

Identifier	The identifier determines the priority of a message. CANopen also codes: • Controller address • The user data object to be transferred.
User data	User data can be used for: • Initialisation (communication via system bus) • Parameter setting of controllers (with Lenze controllers: reading and writing of codes) • Process data (for fast, often cyclical processes such as setpoint/act. value transfer)

9.1.6.2 Controller addressing

The CAN bus system is message and device oriented. Every message has its unambiguous identifier. CANopen ensures device orientation by having just one sender per message. The identifiers are automatically calculated from the addresses entered in the controller. Exception: Network management identifiers

Message		**Identifier for C0353/x = 0** (System bus address source is C0350)	**Identifier for C0353/x = 1** (System bus address source is C0354/x)
Network management		0	
Sync telegram		128	
Parameter channel 1 to drive		1536 + address in C0350	
Parameter channel 2 to drive		1600 + address in C0350	
Parameter channel 1 from drive		1408 + address in C0350	
Parameter channel 2 from drive		1472 + address in C0350	
Process data channel to drive (CAN-IN1)	Sync-controlled (C0360 = 1)	512 + address in C0350	384 + address in C0354/1
	Time-controlled (C0360 = 0)	768 + address in C0350	384 + address in C0354/5
Process-data channel from drive (CAN-OUT1)	Sync-controlled (C0360 = 1)	384 + address in C0350	384 + address in C0354/2
	Time-controlled (C0360 = 0)	769 + address in C0350	384 + address in C0354/6
Process data channel from drive (CAN-IN2)		640 + address in C0350	384 + address in C0354/3
Process data channel from drive (CAN-OUT2)		641 + address in C0350	384 + address in C0354/4

Tip!

The identifiers can be retrieved under C0355.

9.1.6.3 The three communication phases of a CAN network

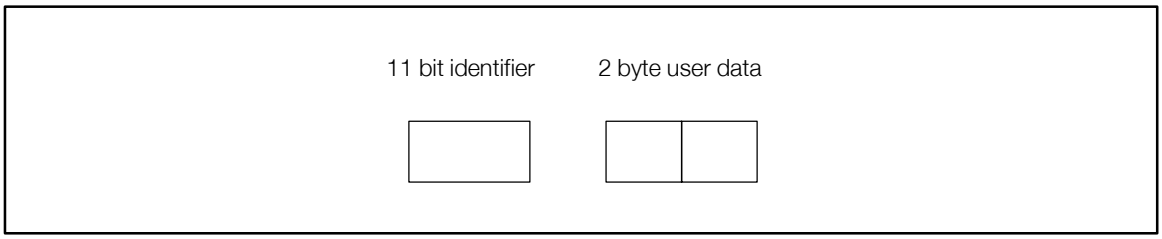


Fig. 9-7 Telegram to change between communication phases

Telegrams with the identifier 0 and 2 byte user data enable a change between the communication phases.

Status	Explanation
a	**"Initialisation"** The drive does not take part in data transfer on the bus. This status is reached after the controller has been switched on. It is also possible to repeat parts of the initialisation or the complete initialisation by sending different telegrams. All parameters already set will be overwritten with its standard values. After initialisation has been completed, the drive automatically sets the status "preoperational".
b	**"Preoperational"** The drive can receive parameter setting data. Process data are ignored.
c	**"Operational"** The drive can receive parameter setting and process data.

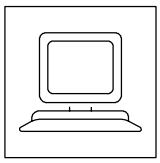
The change between communication phases is controlled by the network master and applies to the entire network. A normal device can be defined as master under C0352.

The master sends a telegram with a delay after power on (time adjustable under C0356/1) which sets the entire network into the operational status.

Telegrams to change between communication phases				
from	**to**	**Data (hex)**	**Note**	
Pre-operational	Operational	01xx	Process and parameter setting data active	• xx = 00_{hex}: – The telegram addresses all bus devices. – The status of all bus participants is changed at the same time. • xx = Controller address: – Only the status of the selected device will be changed.
Operational	Pre-operational	80xx	Only parameter setting data active	
Operational	Initialisation	81xx	Resets the drive; all parameters are overwritten with standard values	
Pre-operational	Initialisation	81xx		
Operational	Initialisation	82xx	Resets the drive; only communication-relevant parameters will be reset	
Pre-operational	Initialisation	82xx		

Tip!

Communication via process data is only possible when the status "Operational" is active.



9.1.6.4 Parameter data structure

Parameters can be set via two software channels. They are preselected by the controller address.

The telegram for parameter setting is structured as follows:

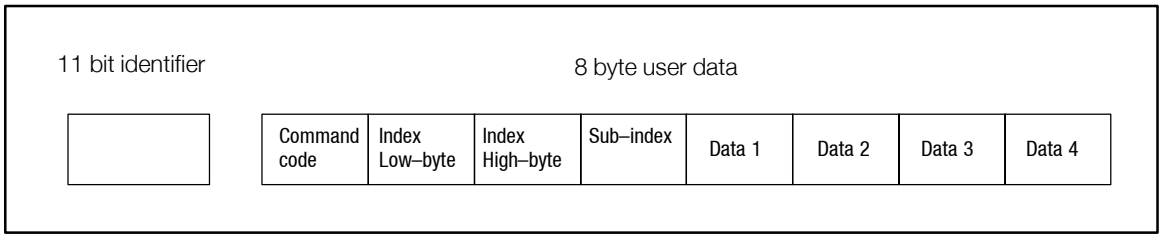


Fig. 9-8 Telegram structure parameter setting

Command code

The command code contains services for reading and writing parameters and information about the user data length:

Command code structure:

	Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)	Note
Service	Command Specifier (cs)			0	Length		e	s	Coding of user data length in bit 2 and bit 3: • 00 = 4 byte • 01 = 3 byte • 10 = 2 byte • 11 = 1 byte
Write request	0	0	1	0	x	x	1	1	
Write response	0	1	1	0	x	x	0	0	
Read request	0	1	0	0	x	x	0	0	
Read response	0	1	0	0	x	x	1	1	
Error response	1	0	0	0	0	0	0	0	

Example:

The most common parameters are data with 4 byte (32 bit) and 2 byte (16 bit) data length:

Services	4 byte (32 bit) data		2 byte (16 bit) data		Meaning
	hex	dec	hex	dec	
Write request	23_{hex}	35	$2B_{hex}$	43	Send parameters to drive
Write response	60_{hex}	96	60_{hex}	64	Controller response to write request (acknowledgement)
Read request	40_{hex}	64	40_{hex}	64	Request to read a controller parameter
Read response	43_{hex}	67	$4B_{hex}$	75	Response to read request with current value
Error response	80_{hex}	128	80_{hex}	128	The controller indicates a communication error

Index LOW byte, index HIGH byte

Lenze codes are selected with these two bytes according to the formula:

Index = 24575 - Lenze code - 2000 × (parameter set - 1)

Example:

Index of C0012 (acceleration time) in parameter set 1 = 24575 - 12 - 0 = 24563 = $5FF3_{hex}$

The entries following the left-justified Intel data format look as described in the following:
Index LOW byte = $F3_{hex}$
Index HIGH byte = $5F_{hex}$

Subindex

A subcode is addressed via the subindex. For codes without subcodes the subindex must always be 0.

Example:

Subindex of C0417/4 = 4_{hex}

Data 1 to data 4

Value to be transferred with up to 4 byte length.

Controller parameters are stored in all different formats. The most common format is Fixed-32. This is a format with 4 decimal codes. The parameters must be multiplied by 10.000.

Error message (Command code = 128 = 80_{hex})

In the event of an error the drive generates an error response. A 6 is transferred in the user data section in data 4 and an error code in data 3.

Possible error codes:

Command code	Data 3	Data 4	Meaning
80_{hex}	6	6	Index wrong
80_{hex}	5	6	Subindex wrong
80_{hex}	3	6	Access denied

Example: Write parameter

The acceleration time C0012 of the controller with address 1 is to be changed from 1 to 20 s via the parameter channel.

- Identifier calculation:
  – Identifier parameter channel 1 to controller = 1536 + controller address = 1536 + 1 = 1537
- Command code = Write request (send parameter to drive) = 23_{hex}
- Index calculation:
  – Index = 24575 - code number = 24575 - 12 = 24563 = $5FF3_{hex}$
  Subindex for C0012 = 0
- Calculation of acceleration time value:
  – 20 s * 10.000 = 200.000 = $00030D40_{hex}$
- Telegram to drive:

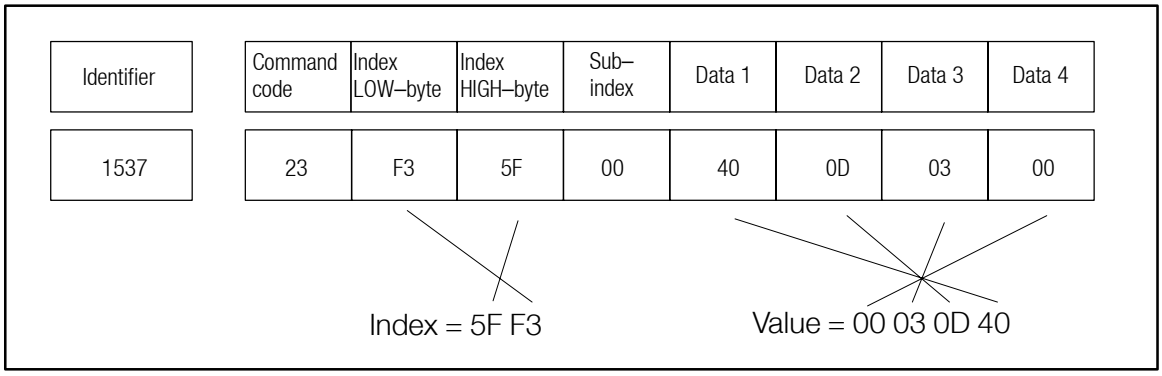


Fig. 9-9 Telegram to drive (write parameter)

- Telegram from drive when execution incorrect:

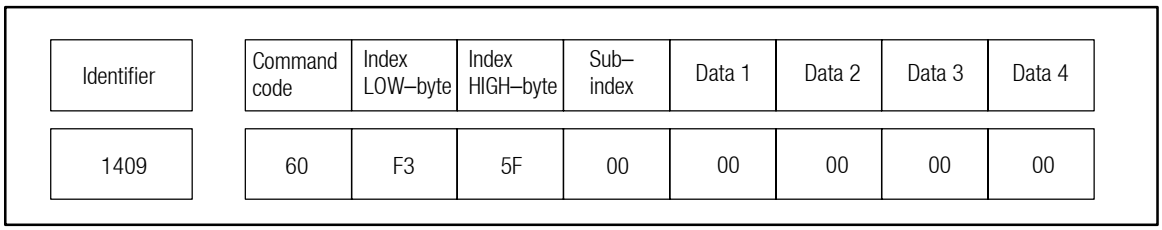


Fig. 9-10 Controller response when execution incorrect

Identifier parameter channel 1 from controller: 1408 + controller address = 1409
Command code = Write response (controller response (acknowledgement)) = 60_{hex}

Example: Read parameter

The heatsink temperature C0061 (43 °C) of the controller with address 5 is to be read via parameter channel 1.

- Identifier calculation:
  – Identifier of parameter channel 1 to controller = 1536 + controller address = 1536 + 5 = 1541
- Command code = Read request (read controller parameter) = 40_{hex}
- Index calculation:
  – Index = 24575 - code number = 24575 - 61 = 24514 = $5FC2_{hex}$
- Telegram to drive:

Identifier	Command code	Index LOW–byte	Index HIGH–byte	Sub–index	Data 1	Data 2	Data 3	Data 4
1541	40	C2	5F	00	00	00	00	00

Fig. 9-11 Telegram to drive (read parameter)

- Telegram from drive:

Identifier	Command code	Index LOW–byte	Index HIGH–byte	Sub–index	Data 1	Data 2	Data 3	Data 4
1413	43	C2	5F	00	B0	8F	06	00

Fig. 9-12 Telegram from drive

Identifier parameter channel 1 from controller = 1408 + controller address = 1413

Command code = Read response (response to read request with current value) = 43_{hex}

Index of read response = $5FC2_{hex}$
Subindex = 0 (no subindex for C0061)

Data 1 to data 4 = 43 °C * 10.000 = 430.000 = $00068FB0_{hex}$

9.1.6.5 Process data structure

For fast data exchange between the controllers or between controller and host the system provides two process data objects for input information (CAN-IN1, CAN-IN2) and two process data objects for output information (CAN-OUT1, CAN-OUT2).

It is thus also possible to transfer binary signals such as input terminal status or data in format 16 bit such as analog signals.

- Cyclic, synchronised process data (process data channel CAN1)
  - For fast cyclic data exchange the system provides a process data object for input signals (CAN-IN1) and a process data object for output signals (CAN-OUT1) with 8 byte user data each.
  - These data are for communication with the higher-level host (e.g. PLC).
  - CAN1 can also be used with event control (setting under C0360).
- Event-controlled process data (process data channel CAN2)
  - For event-controlled data exchange the system provides a process data object for input signals (CAN-IN2) and a process data object for output signals (CAN-OUT2) with 8 byte user data each.
  - Output data are transferred whenever a value is changed in the user data.
  - This process data channel is especially suitable for data exchange between controllers and decentralised terminal extension. It can also be used by a host.

Cyclic process data

Reading and accepting of cyclic process data by the controller requires a sync telegram.

The sync telegram is the trigger point for data acceptance and activates the sending process. For cyclic process data processing the sync telegram must be generated accordingly by the host.

Synchronisation of cyclic process data

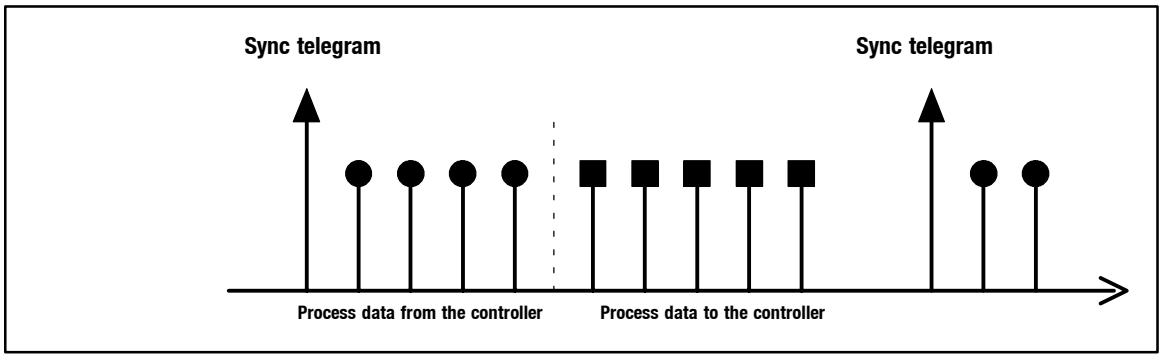
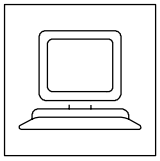


Fig. 9-13 Sync telegram (asynchronous data not considered)

Cyclic process data will be sent from the controller after a sync telegram. Afterwards the data will be transferred to the controllers. The sync telegrams ensure data acceptance.

All other telegrams, such asparameters or event-controlled process data, are accepted asynchronously after they have been transferred.



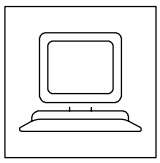
Automation

System bus (CAN)

Structure of process data telegrams in cyclic process data channels (C0360 = 1)

Identifier	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

	User data assignment			
	Byte	**Word assignment (16 bit)**	**Bit assignment**	**Internal signal assignment via**
Cyclic process data telegram to drive CAN-IN1	1	CAN-IN1.W1 (LOW byte)	CAN-IN1.B0 … CAN-IN1.B15	C0410 (digital) C0412 (analog)
	2	CAN-IN1.W1 (HIGH byte)		
	3	CAN-IN1.W2 (LOW byte)	CAN-IN1.B16 … CAN-IN1.B31	C0410 (digital) C0412 (analog)
	4	CAN-IN1.W2 (HIGH byte)		
	5	CAN-IN1.W3 (LOW byte)		C0412
	6	CAN-IN1.W3 (HIGH byte)		
	7	CAN-IN1.W4 (LOW byte)		C0412
	8	CAN-IN1.W4 (HIGH byte)		
				Configuration via
Cyclic process data telegram from drive CAN–OUT1	1	CAN-OUT1.W1 (LOW byte)	CAN-OUT1.B0 … CAN-OUT1.B15	C0417 (digital) C0421/3 (analog)
	2	CAN-OUT1.W1 (HIGH byte)		
	3	CAN-OUT1.W2 (LOW byte)		C0421/4
	4	CAN-OUT1.W2 (HIGH byte)		
	5	CAN-OUT1.W3 (LOW byte)		C0421/5
	6	CAN-OUT1.W3 (HIGH byte)		
	7	CAN-OUT1.W4 (LOW byte)		C0421/6
	8	CAN-OUT1.W4 (HIGH byte)		



Event-controlled process data optionally with adjustable cycle time

8 bytes are available per data object.

Output data are transferred when a value of these 8 bytes changes or according to the cycle time set under C0356/2 for CAN-OUT2 or C0356/3 for CAN-OUT1.

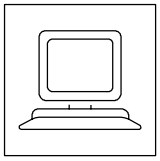
Structure of process data telegrams in event-controlled process data channels

Identifier	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8

	User data assignment			
	Byte	**Word assignment (16 bit)**	**Bit assignment**	**Internal signal assignment via**
Process data telegram to drive CAN-IN2 (accepts system bus device immediately)	1	CAN-IN2.W1 (LOW byte)	CAN-IN2.B0 … CAN-IN2.B15	C0410 (digital) C0412 (analog)
	2	CAN-IN2.W1 (HIGH byte)		
	3	CAN-IN2.W2 (LOW byte)	CAN-IN2.B16 … CAN-IN2.B31	C0410 (digital) C0412 (analog)
	4	CAN-IN2.W2 (HIGH byte)		
	5	CAN-IN2.W3 (LOW byte)		C0412
	6	CAN-IN2.W3 (HIGH byte)		
	7	CAN-IN2.W4 (LOW byte)		C0412
	8	CAN-IN2.W4 (HIGH byte)		
				Configuration via
Event-controlled process data telegram from drive CAN-OUT2	1	CAN-OUT2.W1 (LOW byte)	CAN-OUT2.B0 … CAN-OUT2.B15	C0418 (digital) C0421/7 (analog)
	2	CAN-OUT2.W1 (HIGH byte)		
	3	CAN-OUT2.W2 (LOW byte)		C0421/8
	4	CAN-OUT2.W2 (HIGH byte)		
	5	CAN-OUT2.W3 (LOW byte)		C0421/9
	6	CAN-OUT2.W3 (HIGH byte)		
	7	CAN-OUT2.W4 (LOW byte)		C0421/10
	8	CAN-OUT2.W4 (HIGH byte)		

Tip!

The structure of process data telegrams is similar for process data channel CAN1, if this channel is used with event control (C0360 = 0).



9.2 Automation with the function modules INTERBUS, PROFIBUS-DP, LECOM-B (RS485)

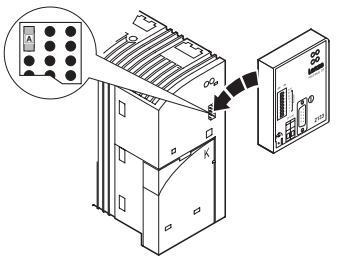
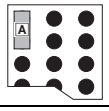
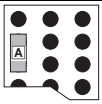
Automation with the function modules INTERBUS, PROFIBUS-DP, LECOM-B (RS485) is described in the Operating Instructions “Fieldbus function modules for 8200 motec /8200 vector frequency inverters”.

9.3 Parallel operation of AIF and FIF interfaces

9.3.1 Possible combinations

Both controller interfaces - Automation Interface (AIF) and Functions Interface (FIF) - can be used in parallel and with different modules. It is for instance possible to set the parameters for system bus devices via keypad or PC.

Communication module mounting

<table>
<tr><td colspan="2"> 
</td><td>Attach/detach the communication module to/from the AIF interface.
This is also possible during operation.</td></tr>
<tr><td>External voltage supply
(Lenze setting)</td><td>Internal voltage supply</td><td rowspan="2">As of version E82EVxxxKxBxxXX 1F 14 the communication modules can also be supplied externally.
For internal voltage supply the A must be connected to the position indicated.</td></tr>
<tr><td>  </td><td>  </td></tr>
</table>

Possible combinations		Communication module in AIF				
Function module in FIF		Keypad E82ZBC [1]	LECOM-A/B (RS232/RS485) 2102.V001 LECOM-B (RS485) 2102.V002 LECOM-LI (LWL) 2102.V003	INTERBUS 2111	PROFIBUS-DP 2131	System bus (CAN) 2171/2172
Standard I/O	**E82ZAFS**	✓✓	✓✓	✓✓	✓✓	✓✓
Standard I/O PT	**E82ZAFS100**	✓✓	✓✓	✓✓	✓✓	✓✓
Application I/O	**E82ZAFA**	✓✓	✓	✓	✓	✓
INTERBUS	**E82ZAFI**	✓✓	(✓)	☒	☒	(✓)
PROFIBUS-DP	**E82ZAFP**	✓✓	(✓)	☒	☒	(✓)
LECOM-B (RS485)	**E82ZAFL**	✓✓	(✓)	☒	☒	(✓)
System bus (CAN)	**E82ZAFC**	✓✓	✓✓	✓✓	✓✓	✓✓

[1] Independently of the jumper position always supplied internally.

✓✓ Combination possible, communication module can be supplied internally or externally.

✓ Combination possible, communication module must be supplied externally!

(✓) Combination possible, communication module can only be used for parameter setting (external supply).

☒ Combination not possible

Tip!

The Operating Instructions for field modules inform in detail about the commissioning and parameter setting. (📖 12-10)

9.3.1.1 Example ”Setpoint summation in a conveyor system”

A conveyor system is controlled via the fieldbus INTERBUS. The setpoint can be manually corrected when additional load are applied to some components of the sytem.

- Accessories required for the controller
  – Function module INTERBUS
  – Keypad

Task

- Main setpoint selection for basic load via fieldbus function module ”INTERBUS”.
- Additional setpoint selection for additional load at site via communication module ”keypad”, e.g. via function Set. (📖 7-29)

Configuration

Configuration	Code	Setting	Note
Basic controller configuration			Drive behaviour, acceleration and deceleration times, etc. must be set for every controller (📖 5-2 ff)
Main setpoint source configuration (NSET1-N1)	C0412/1	200	Setpoint source is function module INTERBUS
	C1511/2	3	Process data output word 2 of the master (PAW2) must be assigned to the signal NSET1-N1. (Lenze setting) Observe the master normalisation.

9.3.1.2 Example ”Processing of external signals via fieldbus”

A 8200 vector controls a pump in a pump chamber. Select the setpoint via INTERBUS. Analog and ditial signals at the controller terminals are transferred to INTERBUS.

- Accessories required for the controller
  – Communication module INTERBUS 2111
  – Function module standard I/O

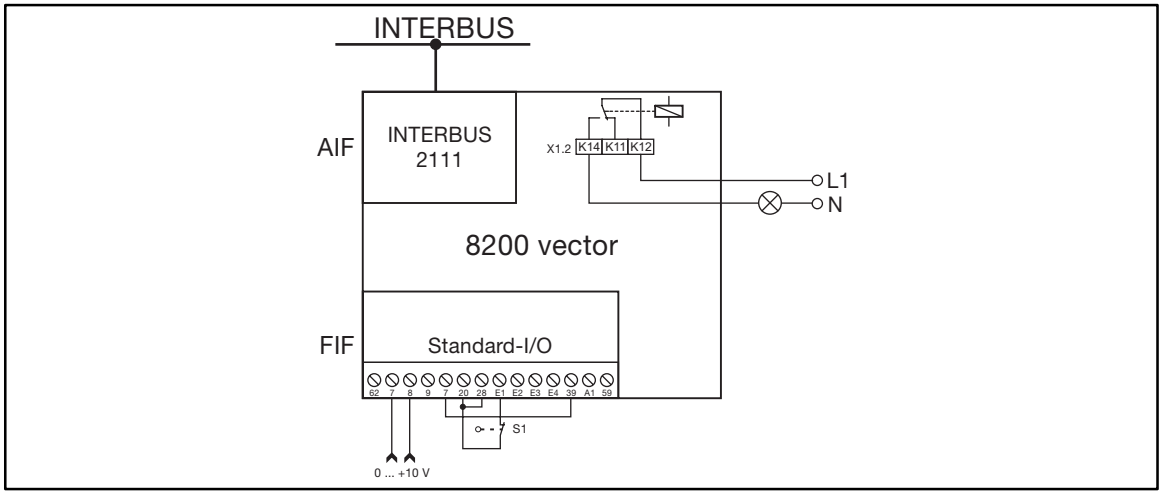


Fig. 9-14 Schematic diagram for the example “Processing of external signals via INTERBUS”

Task

- The water level of the water tank (encoder signal 0 ... 10 V) is sent from the controller to the INTERBUS. When ”level 90 %” is reached, the host activates the relay K1 of the controller to switch on a warning lamp in the pump chamber.
- The digital signal of a float (S1, “Tank overflow”) is also sent from the controller to the INTERBUS. The host can activate all switch-off mechanisms.

Configuration

Configuration	Code	Setting	Note
Basic controller configuration			Drive behaviour, acceleration and deceleration times, etc. must be set for every controller (📖 5-2 ff)
Controller configuration for process data communication via AIF	C0001	3	Settings required to evaluate process data via AIF
Main setpoint source configuration (NSET1-N1)	C0412/1	11	Setpoint source is the process data input word AIF-IN.W2. The master must be configured in a way that a process data ouput word (POW) of the master overwrites AIF-IN.W2 of the controller with the setpoint. Observe the master normalisation.
Water level signal to INTERBUS via communication module	C0421/1	35	Signal source for the process data output word AIF-OUT.W1 is the evaluated signal at the analog input X3/8 (0 ... 10 V). Observe the signal normalisation.
Overflow message to INTERBUS via communication module	C0417/1	32	Signal source for the first bit of the AIF status word is the digital signal “Overflow” at digital input X3/E1.
Configuratin of warning signal for relay output K1	C0415/1	40	The master must be configured in a way that a process data output word (POW) of the master sets bit 0 of the AIF control word (AIF-CTRL) and thus activates relay K1.

9.3.2 Diversion of process data or parameter data to system bus (CAN)

If you use the function module ”Systembus (CAN)”, process data and parameter data can be exchanged using a fieldbus module.

- Process data
  – With two analog input words (AIF-IN.W1, AIF-IN.W2) and two output words (AIF-OUT.W1, AIF-OUT.W2) max. two analog signals (e.g. setpoints) can be diverted to the system bus network and sent back. The data are configured with C0421.
  – Use the digital input word (AIF-CTRL) to divert control information to the system bus network. Status information are retrieved with the digital output word (AIF-STAT).
- Parameter data
  – C0370 determines the address of the system bus device to which the parameter are diverted.

9.3.2.1 Example ”Process data exchange between PROFIBUS-DP and system bus (CAN)”

Two controllers are networked via a system bus (CAN). They communicate with the host via the fieldbus PROFIBUS-DP. The PROFIBUS master controls the two controllers independently of each other. Controller 1 connects the system bus to the PROFIBUS:

- Accessories required for the controllers
  – Communication module PROFIBUS-DP 2131 for controller 1
  – A system bus (CAN) function module for every controller

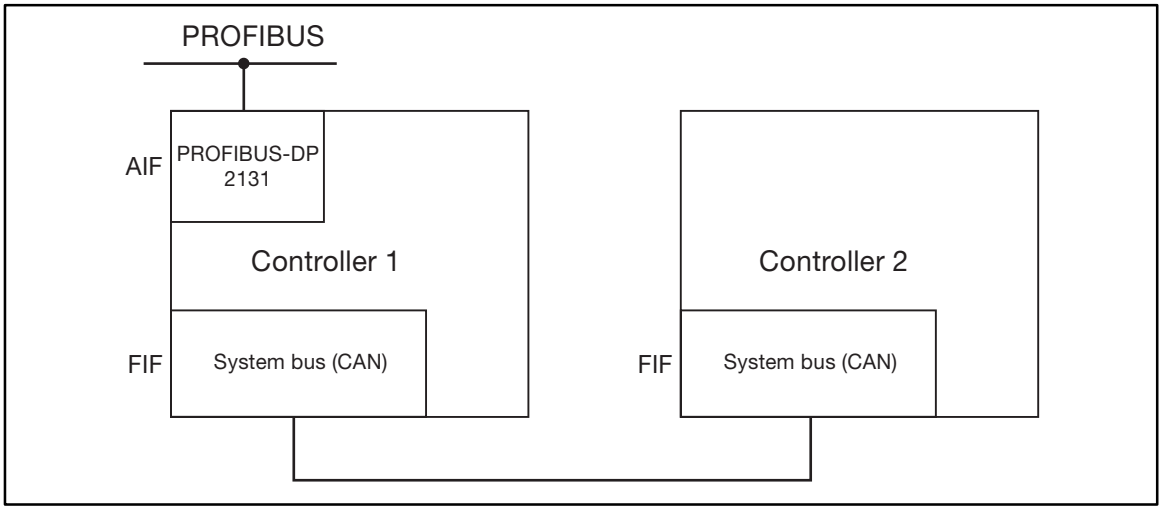
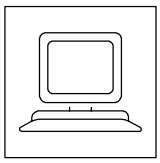


Fig. 9-15 Example for parallel operation of communication module PROFIBUS-DP and function module system bus (CAN)

Tip!

Controller 2 can be a 9300 or 8200 motec.

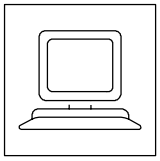


Task

- Setpoints and control commands from the PROFIBUS master:
  - – Setpoint for controller 1 via AIF input word 1 (AIF-IN.W1)
  - – Setpoint for controller 2 via AIF input word 2 (AIF-IN.W2)
  - – Control commands CINH, TRIP-RESET and QSP for controller 1 and controller 2 via AIF control word (AIF-CTRL). Controller 2 is to be controlled independently of controller 1.
- Actual values and status information to the PROFIBUS master:
  - – Actual value of controller 1 via AIF output word 1 (AIF-OUT.W1)
  - – Actual value of controller 2 via AIF output word 2 (AIF-OUT.W2)
  - – Controller status ”CINH” and ”controller status” of controller 1 and 2 via AIF status word (AIF-STAT)

Configuration

Configuration		Code	Setting		Note
			A1	A2	
Basic configuration of controllers A1 and A2					Drive behaviour, acceleration and deceleration times, etc. must be set for every controller (📖 5-2 ff)
A1 configuration for process data communication via AIF		C0001	3	-	Settings required to evaluate process data via AIF
System configuration					
	System bus address	C0350	1	2	Different addresses for unambiguous controller addressing
	System bus address source	C0353/1	0		Source for address of the CAN1 object of A1 is C0350
				1	Source for address of the CAN1 object of A2 is C0354
	Address CAN object 1 of A1		-	-	Determined by source C0350: Address CAN-OUT1 = 386 Address CAN-IN1 = 385
	Address CAN object 1 of A2	C0354/5	-	386	Address CAN-IN1 (links CAN-IN1 and CAN-OUT1 of A1)
		C0354/6	-	385	Address CAN-OUT1 (links CAN-OUT1 and CAN-IN1 of A1)
	Master selection	C0352	1	-	Controller 1 is system bus master
	Control selection	C0360	0	0	Time control
	Cycle time for time control	C0356/2	10	10	Every controller send object CAN-OUT1 every 10 ms
Configuration of data flow for A1					
Setpoint	NSET1-N1 source assignment	C0412/1	10	-	Setpoint source for A1 is AIF-IN.W1
Actual value	Actual value assignment to output word AIF-OUT.W1	C0421/1	0	-	AIF-OUT.W1 ⇦ MCTRL1-NOUT+SLIP (output frequency)
Control commands	QSP, CINH and TRIP-RESET		-	-	Master sends control commands for A1 via assigned bits of the AIF control word (AIF-CTRL): B3 = QSP, B9 = CINH, B11 = TRIP-RESET
Status information	”Controller status” and CINH		-	-	Master reads the assigned bits of status word 1 (AIF-STAT) of A1: B8 ... B11 = controller status, B7 = CINH



Automation

Parallel operation of AIF and FIF interfaces

Configuration		Code	Setting		Note
			A1	A2	
Configuration of data flow for A2					
Setpoint	A1 transfers the setpoint for A2 to the system bus	C0421/5	41	-	A2 setpoint assignment to word 3 in A1 CAN object 1 CAN-OUT1.W3 ⇦ AIF-IN.W2
	NSET1-N1 source assignment	C0412/1	-	22	Setpoint source for A2 is CAN-IN1.W3 NSET1-N1 ⇦ CAN-IN1.W3
Actual value	Actual value assignment to output word CAN-OUT1.W3	C0421/5	-	0	CAN-OUT1.W3 ⇦ MCTRL1-NOUT+SLIP (output frequency)
	A1 transfers actual value of A2 to PROFIBUS master	C0421/2	52	-	AIF-OUT.W2 ⇦ CAN-IN1.W3
Control commands	QSP, CINH and TRIP-RESET				Master sends control commands for A2 via freely connectable bits of the AIF control word (AIF-CTRL) of A1, e. g.: B4 = QSP, B5 = CINH, B6 = TRIP-RESET
	A1 transfers the control commands for A2 to the system bus	C0418/1	44	-	QSP: CAN-OUT2.W1, bit 0 ⇦ AIF-CTRL, bit 4
		C0418/2	45	-	CINH: CAN-OUT2.W1, bit 1 ⇦ AIF-CTRL, Bit 5
		C0418/3	46	-	TRIP-RESET: CAN-OUT2.W1, bit 2 ⇦ AIF-CTRL, bit 6
	Source assignment QSP, CINH snd TRIP-RESET	C0410/4	-	70	NSET1-QSP: ⇦ CAN-IN2.W1, bit 0
		C0410/10	-	71	DCTRL1-CINH: ⇦ CAN-IN2.W1, bit 1
		C0410/12	-	72	DCTRL1-TRIP-RESET: ⇦ CAN-IN2.W1, bit 2
Status information	”Controller status” and CINH				Map the assigned bits of controller status word 1 of A2 to the output word CAN-OUT1.W1: B8 ... B11 = controller status, B7 = CINH
	Status information assignment output word CAN-OUT1.W1	C0417/8	-	8	CAN-OUT1.W1, bit 7 ⇦ CINH
		C0417/9 ... C0417/12	-	9 ... 12	CAN-OUT1.W1, bit 8 ... 11 ⇦ Controller status
	A1 provides status information of A2 for the master				Mapp status information of A2 to freely assignable bits of AIF status word (AIF-STAT) of A1
		C0417/15	74	-	AIF-STAT, bit 14: ⇦ CAN-IN1.W1, bit 7 (CINH)
		C0417/3 ... C0417/6	62 ... 65	-	AIF-STAT, bit 2: ⇦ CAN-IN1.W1, bit 8 ... AIF-STAT, bit 5: ⇦ CAN-IN1.W1, bit 11

9.3.2.2 Example ”Parameter data diversion from LECOM-B (RS485) to system bus (CAN) (remote parameter setting)”

10 controllers are networked via the system bus (CAN). They communicate with the host via the Lenze fieldbus LECOM-B (RS485).

- Accessories required for the controller
  – Communication module LECOM-B 2102IB.V002 for controller 1
  – A function module system bus (CAN) for every controller

Tip!

- The processing time for parameter orders in the controller is typically < 40 ms when the interfaces operate in parallel. Therefore the example given here should only be used for applications which are not time-critical.
- System bus devices can also be 9300 Lenze controllers or 8200 motec controllers.
- Controller 1 must be a 8200 vector.

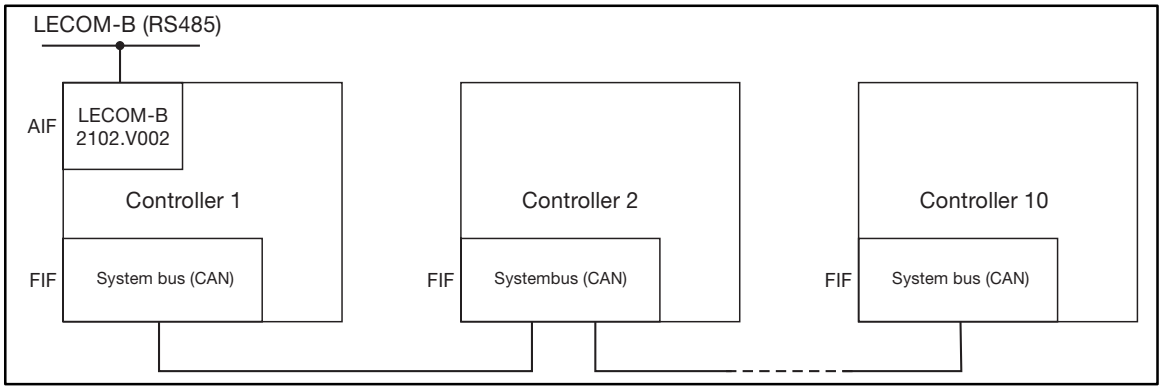


Fig. 9-16 Principle structure required to divert parameter data from Lenze fieldbus LECOM-B to a system bus network

Task

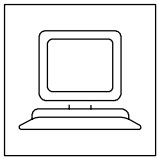
- LECOM-B preselects the setpoints for the controllers under C0046.
  – For remote parameter setting the address must be transferred before the setpoint by LECOM-B (C0370). C0370 determines the address of the system bus device to which controller 1 transfers the setpoint.

Configuration

Configuration	Code	Setting	Note
Basic controller configuration			Drive behaviour, acceleration and deceleration times, etc. must be set for every controller (📖 5-2 ff)
System bus addresses must be set for every controller	C0350	1 (A1) ... 10 (A10)	Every system bus device must have an unambiguous address
Setpoint source configuration for every controller	C0412/1	0	Setpoint source is C0046 for every controller.

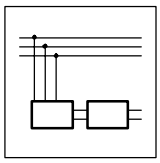
Stop!

With cyclic writing of parameter data C0003 must be set to 3 (data not stored in EEPROM). Otherwise the EEPROM can be damaged.



Automation

Parallel operation of AIF and FIF interfaces

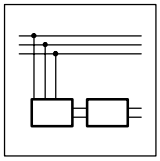


10 DC-bus connection

This chapter describes DC-bus connections of frequency inverters of the series 8200 vector and 8220 and servo inverters of the series 9300 (including all technology variants: “Positioning controller”, “Register controller”, “Cam profiler”, “vector”).

10.1 Function

- DC-bus connections of drive systems enable the exchange of energy between connected controllers.
- If one or more controllers operate in generator mode (braking), the energy will be fed into the shared DC-voltage bus or the DC source. The energy will then be available to the controllers which operate in motor mode.
- The energy from the three-phase AC mains can be supplied as follows:
  – 934x regenerative power supply module in DC-bus connection
  – 936X feedback module in DC-bus connection
  – One or several controllers in DC-bus connection
  – Combination of regenerative power supply modules and controllers
- The use of brake units, supply units and the energy consumption from the three-phase AC mains can be reduced.
- The number of mains supplies and the related expenses (e.g. wiring) can be perfectly adapted to your application.



Network of several drives

Important notes

10.2 Conditions for trouble-free network operation

Stop!

- Only network controllers with the same DC-bus/mains voltage range (see table below).
- Adapt the thresholds for brake units and brake transistors.
- All supplies should only be operated with the prescribed mains chokes/mains filters! (📖 10-9)

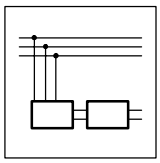
10.2.1 Possible combinations of Lenze controllers connected in a network

Type	Data	E82EVXXXK2B	E82EVXXXK4B	822X	93XX
E82EVXXXK2B	①	1 / N / PE / AC / 180 V - 0 % ... 264 V + 0% 45 Hz - 0 % ... 65 Hz + 0 %			
	②	DC 140 V ... 370 V			
	③	DC 380 V			
E82EVXXXK4B	①		3 / PE / AC / 320 V - 0 % ... 550 V + 0 % 45 Hz - 0 % ... 65 Hz + 0 %		
	②		DC 450 V ... 775 V		
	③		DC 725 V/765 V		
822X **824X**	①		3 / PE / AC / 320 V - 0 % ... 528 V + 0 % 48 Hz - 0 % ... 62 Hz + 0 %		
	②		DC 460 V ... 740 V		
	③		DC 725 V/765 V		
821X	①		3 / PE / AC / 320 V - 0 % ... 510 V + 0 % 45 Hz - 0 % ... 65 Hz + 0 %		
	②		DC 450 V ... 715 V		
	③		DC 725 V/765 V		
93XX	①		3 / PE / AC / 320 V - 0 % ... 528 V + 0 % 48 Hz - 0 % ... 62 Hz + 0 %		
	②		DC 460 V ... 740 V		
	③		DC 725 V/765 V		

① Max. permissible mains-voltage range
② Permissible DC-bus voltage range
③ Threshold of external brake unit (option)

Tip!

If all conditions stated above are met, the Lenze controllers type 821X and 824X can also be connected in a network.



10.2.2 Network connection

10.2.2.1 Cable protection/cable cross-section

- Mains fuses and cable cross-sections of the mains cables must be selected according to the mains currents resulting from the supply power $P_{DC100\%}$. Observe national standards, temperatures and other conditions. (📖 10-6)
- Asymmetries in the network can cause a values higher by a factor between 1.35 and 1.5.
- Formula for the mains current in networks:

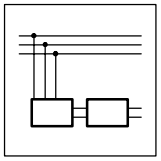
$$I_{mains}\,[A] \approx \frac{P_{DC100\%}\,[W]}{1.6 \cdot V_{mains}\,[V]}$$

10.2.2.2 Mains choke/mains filter/EMC

- Always use mains chokes/mains filters for networks. (📖 10-9)
- Function:
  - Mains-current limitation
  - Current/power symmetry of the mains input circuits of the controllers in decentral network operation.
- Select mains chokes/mains filters for rated current.

Tip!

- Please observe that networks require different mains chokes/mains filters than stand-alone operations.
- Compliance with the EMC regulations must be checked. Also check the use of a central interference suppressor in the AC supply.



10.2.2.3 Controller protection

Switch-on conditions

- **Ensure simultaneous mains connection of all controller connected to the network.**
  - Use of a central mains contactor (📖 10-20)
  - Decentral switching of the mains supply is possible if the switching of all individual contactors is monitored (feedback to PLC and the switching follows the same cycle.

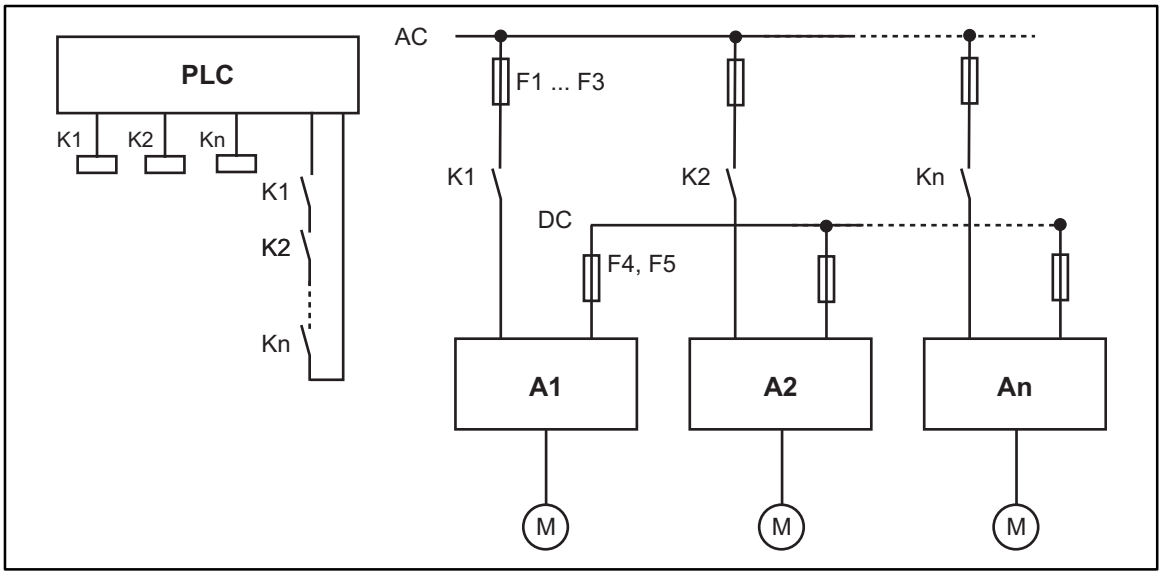


Fig. 10-1 Decentral switching of the mains supply in networks
A1 ... An Controller 1 ... controller n
F1 ... F3 Mains fuses
F4 ... F5 DC fuses
K1 ... Kn Mains contactors

Adaptation to mains voltage

- C0173 must be set to the same value for all 93XX controllers connected in the network.

Mains failure detection with decentral supply

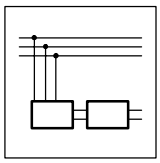
The mains supply of every controller must be monitored because it is possible that the supplies remaining active in the network after a supply failed become overloaded. Therefore:

- Switch off the entire network if a mains failure occurs. (📖 10-20)
- Use switching elements for mains failure detection and a warning system:
  - Thermal overcurrent release (bimetal relay) connected after the mains fuses
  - Cable protection by means of power switch with thermal and magnetic releases and integrated alarm contact

Additional capacities in the DC-bus

If additional capacities are connected to the DC-bus, the input rectifier or the regenerative power supply unit can be overloaded.

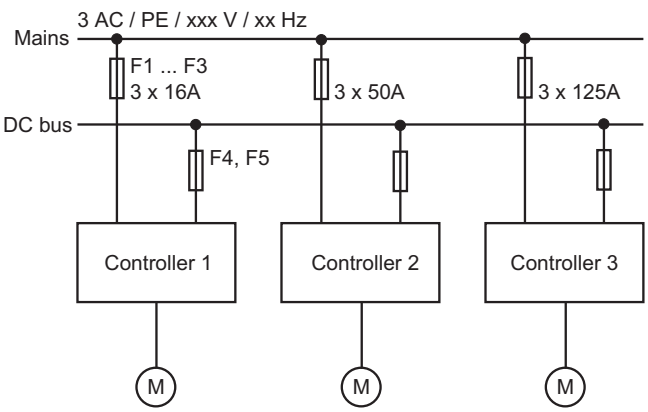
Ensure appropriate resistors.



10.2.3 DC-bus connection

- Ensure short cables to the common DC-bus star point.
- Select the cable cross-section for the DC-bus according to the sum of mains supplies.jLeitungsquerschnitt der DC-Schiene nach der Summe der Netzeinspeisungen auslegen.

Example

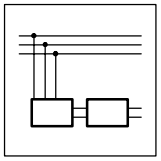


- Sum of the possible permanent r.m.s. currents of the parallel mains supplies: 16A + 50A + 125A = 191A
- The cable cross-section is selected according to the resulting current of 191A and the local conditions, as for instance, ambient temperature, conductor material, conductor type, type of laying, expansion, standards and regulations.

- Ensure low cable inductivity:
  - DC-bus star point in control cabinet above parallel busbar.
  - Cables between controller ($+U_G$, $-U_G$) and DC-bus star point must be routed in parallel or twisted.
- Use screened cables.
- Controllers must be protected by additional DC-bus fuses F4, F5. The fuses protect the controller from the following:
  - Internal short-circuit
  - Internal earth fault
  - Short-circuit in the DC-bus $+U_G$ → $-U_G$,
  - Earth fault in the DC-bus $+U_G$ → PE or $-U_G$ → PE.

Tip!

- With only two controllers connected to the network, one fuse pair F4/F5 is sufficient.
  - The rating must be made taking into account the weakest controller.
- Connect an additional fuse pair F4/F5 before each controller if you use more than two controllers in a network.
- More information about fuses: (📖 10-7)



Network of several drives

Important notes

10.2.4 Fuses and cable cross-sections for a network of several drives

The values in the table apply to operation of controllers connected to the DC-bus network with P_{DC} = 100%, i.e. max. rated controller power on the DC-bus level. (📖 10-10)

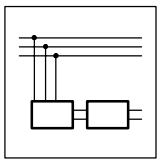
For operation with reduced power it is possible to select smaller fuses and cable cross-sections.

Type	Mains input L1, L2, L3, PE Operation with mains filter/mains choke					DC input +UG, -UG		
	Fuse F1, F2, F3		E.l.c.b.	Cable cross-section [1]		Fuses F4, F5	Cable cross-section [1]	
	VDE	UL	VDE	mm²	AWG		mm²	AWG
E82EV551K2B	M 6A	5A	B 6A	1	18	CC6A	1	18
E82EV751K2B	M 6A	5A	B 6A	1.5	16	CC8A	1	18
E82EV152K2B	M 10A	10A	B 10A	1.5	16	CC12A	1.5	16
E82EV222K2B	M 16A	15A	B 16A	2.5	14	CC16A	2.5	14
E82EV551K4B	M 6A	5A	B 6A	1	18	CC6A	1	18
E82EV751K4B	M 6A	5A	B 6A	1	18	CC6A	1	18
E82EV152K4B	M 10A	10A	B 10A	1.5	16	CC8A	1	18
E82EV222K4B	M 10A	10A	B 10A	1.5	16	CC10A	1	18
9341	M 16A	15A		2.5	14	20A	4	12
9342	M 32A	30A		6	10	40A	10	8
9343	M 63A	60A		25	4	80A	25	3
9364	M 100A	100A		50	1			
9365	M 200A	200A		95	3 / 0			
9321, 8241	M 6A	5A	C 6A	1	18	6A	1	18
E82EV551K4B, E82EV751K4B	M 6A	5A	B 6A	1	18	6A	1	18
9322, 8242, 8211	M 6A	5A	C 6A	1	18	6A	1	18
8212	M 6A	5A	B 6A	1	18	6A	1	18
9323, 8243	M 10A	10A	B 10A	1.5	16	12A	1.5	14
E82EV152K4B, E82EV222K4B	M 10A	10A	B 10A	1.5	16	10A	1.5	16
8213, 8214	M 10A	10A	B 10A	1.5	16	10A	1.5	16
9324, 8244	M 10A	10A	B 10A	1.5	16	12A	1.5	14
E82EV302K4B	M 16A	15A	B 16 A	2.5	14	16A	2.5	12
8215, E82EV402K4B	M 16A	15A	B 16 A	2.5	14	16A	2.5	12
9325, 8245, 8216	M 20A	20A	B 20A	4	12	20A	4	12
E82EV552K4B	M 20A	20A	B 20A	4	12	25A	4	10
E82EV752K4B	M 25A	25A	B 25A	4	10	40A	10	8
9326, 8246, 8217, 8218, E82EV113K4B	M 32A	30A	B 32A	6	10	40A	10	8
9327, 8221, E82EV153K4B	M 63A	60A		25	4	80A	25	3
9328, 8222, E82EV223K4B	M 80A	70A		25	4	80A	25	3
9329, 8223, E82EV303K4B	M 80A	80A		25	3	100A	50	1
9330, 8224, E82EV453K4B	M 125A	125A		50	0	2*80A	2*25	2*3
9331, 8225, E82EV553K4B	M 160A	150A		70	0	2*100A	2*50	2*1
9332, 9333, 8226, 8227, E82EV753K4B, E82EV903K4B	M 200A	200A		95	3 / 0	3*80A	3*25	3*3

[1] Observe national and regional regulations (e.g. VDE0113, EN 60204)!

Tip!

We recommend to use fuse holders with alarm contact when the network is supplied decentrally. If a fulse fails it is thus possible to switch off the entire drive network.



10.2.5 Protection in networks

You have the possibility of selecting a graded protection concept for network operation. The damage risks depends on the type of protection. The following table helps to analyze the risk.

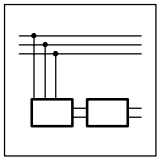
Please note:

On the motor side, the cable protection is supported by the current limitation of the controller. Prerequisite:

- The current limit set for the controller corresponds to the rated current of the connected motor.
- For group drives we recommend additional individual protection.

Definition: ”Internal error”

- Controllers:
  – The error is located between the connection at the DC bus and in the controller before the terminals U, V, W.
- Supply modules:
  – The fault is located between the mains input (terminals L1, L2, L3) and the farthest point of the DC-bus.



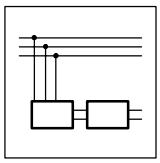
Network of several drives

Important notes

	Protection by mains fuses without monitoring function (F1 ... F3)	
Protection of	**Cable protection** • on the mains side • on the DC-bus • on the motor side	**No unit protection**
Possible faults	One/several controllers with • internal short ciruit ($+U_G \rightarrow -U_G$) • internal earth fault ($+U_G \rightarrow$ PE/$-U_G \rightarrow$ PE) • motor-side earth fault on phase W	Mains failure of a controller with decentral supply.
Risk	Several parallel controllers supply the fault location(s) via the DC-bus. This may lead to overload of the intact controller, as the faulty controller is not selectively activated on the DC-bus. Possible damage with central and decentral supply • Destruction of the controller concerned • Destruction of the controllers still intact • Destruction of the supply unit	If a mains-side supply/input fails because F1...F3 blows, the controllers still active in the network can be overloaded.
Note	The extent of destruction depends on the ratio "DC-bus power of the whole system / rated power of the controller concerned".	

	Protection by mains fuses with monitoring function (F1 ... F3)		
Protection of	**Cable protection** • on the mains side • on the DC-bus • on the motor side	**Unit protection in the event of overload** If a supply/input fails because F1...F3 blows, the remaining controllers which are connected will not be overloaded as the alarm contact switches off the mains and thus the whole network.	**No unit protection in the event of short circuit**
Possible faults	One/several controllers with • internal short ciruit ($+U_G \rightarrow -U_G$) • internal earth fault ($+U_G \rightarrow$ PE/$-U_G \rightarrow$ PE) • motor-side earth fault on phase W		
Risk	Several parallel controllers supply the fault location(s) via the DC-bus. This may lead to overload of the intact controller, as the faulty controller is not selectively activated on the DC-bus. Possible damage with central and decentral supply • Destruction of the controller concerned • Destruction of the controllers still intact • Destruction of the supply unit		
Note	The extent of destruction depends on the ratio "DC-bus power of the whole system / rated power of the controller concerned".		

	Protection by mains fuses with monitoring function (F1 ... F3) and DC fuses F4 ... F5		
Protection of	**Cable protection** • on the mains side • on the DC-bus • on the motor side	**Unit protection in the event of overload** If a supply/input fails because F1...F3 blows, the remaining controllers which are connected will not be overloaded as the alarm contact switches off the mains and thus the whole network.	**Unit protection in the event of short circuit**
Possible faults	One or more controllers with – internal short ciruit ($+U_G \rightarrow -U_G$) – internal earth fault ($+U_G \rightarrow$ PE/$-U_G \rightarrow$ PE) – motor-side earth fault on phase W		
Risk	Possible damage with central and decentral supply • Destruction of the controller concerned		
Note	The selective activation on the mains and DC side reduces the extent of destruction.		



10.3 Selection

In the following table you will find some basic data to select a drive network. Two examples explain the use of the tables.

10.3.1 Conditions

The powers indicated in table Tab. 10-2 can only be applied if the following conditions are met by the DC-bus connection:

	Condition
All supply units	Connection of the three-phase AC mains only with prescribed mains filters/mains chokes Tab. 10-1
Mains voltage	V_{mains} = 400 V / 50 Hz (Tab. 10-2)
Chopper frequencies	93XX 8 kHz
	8200 vector 822X 824X 821X 4 kHz or 8 kHz.
Ambient temperature	max. +40 °C
Motors (three-phase AC asynchronous motors, asynchronous servo motors, synchronous servo motors)	Simultaneity factor F_g = 1 (All motors operate simultaneously with 100 % motor load)

10.3.2 Required mains filters or mains chokes

Controller/supply unit/feedback unit		**Mains choke**		
Type	**Rated mains current [A]**	**Rated current [A]**	**Inductivity [mH]**	**Order no.**
9341	12.0	12.0	1,20	EZN3A0120H012
9342	24.0	24.0	0.88	EZN3A0088H024
9343	45.0	45.0	0.55	EZN3A0055H045
9364	74.0	85.0	0.38	ELN3-0038H085
9365	148.0	170.0	0.17	ELN3-0017H170
9321, 8241	4.2	4.5	9.00	EZN3A0900H004
E82EV551K4B, E82EV751K4B	2.3	3.0	15.00	EZN3A1500H003
9322, 8242, 8211	3.3	4.5	9.00	EZN3A0900H004
8212	3.5	4.5	9.00	EZN3A0900H004
9323, 8243	7.0	7.0	5.00	EZN3A0500H007
E82EV152K4B, E82EV222K4B	5.8	6.1	6.80	E82ZL22234B
8213, 8214	6.5	7.0	5.00	EZN3A0500H007
9324, 8244	7.6	9.0	4.00	EZN3A0400H009
E82EVK302K4B	9.2	13.0	3.00	EZN3A0300H013
8215, E82EV402K4B	10.0	13.0	3.00	EZN3A0300H013
9325, 8245, 8216	12.0	13.0	3.00	EZN3A0300H013
E82EV552K4B	13.6	13.0	3.00	EZN3A0300H013
E82EV752K4B	17.6	24.0	1.50	ELN3-0150H024
9326, 8246, 8217, 8218, E82EV113K4B	21.8	24.0	1.50	EZN3A0150H024
9327, 8221, E82EV153K4B	45.0	45.0	0.75	ELN3-0075H045
9328, 8222, E82EV223K4B	50.0	55.0	0.88	ELN3-0088H055
9329, 8223, E82EV303K4B	55.2	60.0	0.55	EZN3A0055H060
9330, 8224, E82EV453K4B	91.7	105.0	0,27	ELN3-0027H105
9331, 8225, E82EV553K4B	103.8	105.0	0.27	ELN3-0027H105
9332, 9333, 8226, 8227, E82EV753K4B, E82EV903K4B	161.7	170.0	0.17	ELN3-0017H170

Tab. 10-1 Prescribed mains chokes for supply inits in the network.

10.3.3 Supplies - 400 V controllers

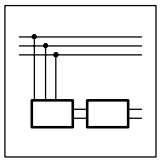
Supplies in DC-bus connection - 400 V controllers																									
1. supply	9341	9342	9365	9343	9330, 8224, 453K4B	752K4B	9332, 9333, 8226, 8227, 753K4B, 903K4B	302K4B	9331, 8225, 553K4B	9364	9322, 8242, 8211	8215, 402K4B	9329, 8223, 303K4B	9324, 8244	8212	8213, 8214	9326, 8246, 8217, 8218, 113K4B	9327, 8221, 153K4B	551K4B, 751K4B	9323, 8243	9325, 8245, 8216	9321, 8241	152K4B, 222K4B	552K4B	9328, 8222, 223K4B
PDC	**7.2**	**14.4**	**100**	**27.0**	**60.5**	**11.6**	**106.7**	**6.1**	**68.5**	**50.0**	**2.2**	**6.6**	**36.4**	**5.0**	**2.3**	**4.3**	**14.4**	**29.7**	**1.5**	**4.6**	**7.9**	**2.8**	**3.8**	**9.0**	**33.0**
Ploss	0.2	0.2	0.4	0.4	1.1	0.3	2.4	0.1	1.5	0.2	0.1	0.2	0.8	0.2	0.1	0.1	0.4	0.4	0.1	0.1	0.3	0.1	0.1	0.2	0.6
Supply 2...n																									
9341																									
9342																									
9365	48.2	70.8	81.8																						
9343			21.8																						
9330, 8224, 453K4B	28.8	42.2	48.8	49.5	49.5																				
752K4B	5.2	7.6	8.8	8.9	8.9	9.5																			
9332, 9333, 8226, 8227, 753K4B, 903K4B	47.1	69.1	79.9	81.0	81.0	86.4	87.3																		
302K4B	2.6	3.8	4.4	4.5	4.5	4.8	4.8	5.0																	
9331, 8225, 553K4B	28.8	42.2	48.8	49.5	49.5	52.8	53.4	55.2	56.0																
9364	20.9	30.7	35.5	36.0	36.0	38.4	38.8	40.2	40.8	40.9															
9322, 8242, 8211	0.9	1.3	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8														
8215, 402K4B	2.6	3.8	4.4	4.5	4.5	4.8	4.8	5.0	5.0	5.1	5.3	5.4													
9329, 8223, 303K4B	14.1	20.7	24.0	24.3	24.3	25.9	26.2	27.1	27.5	27.6	29.1	29.4	29.8												
9324, 8244	1.9	2.8	3.3	3.3	3.3	3.6	3.6	3.7	3.8	3.8	4.0	4.0	4.1	4.1											
8212	0.9	1.3	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.8	1.8	1.8	1.8	1.9										
8213, 8214	1.6	2.3	2.6	2.7	2.7	2.9	2.9	3.0	3.0	3.0	3.2	3.2	3.3	3.3	3.4	3.5									
9326, 8246, 8217, 8218, 113K4B	5.2	7.6	8.8	8.9	8.9	9.5	9.6	9.9	10.1	10.1	10.7	10.8	10.9	11.0	11.3	11.7	11.8								
9327, 8221, 153K4B	10.4	15.2	17.6	17.8	17.8	19.0	19.2	19.9	20.2	20.2	21.4	21.6	21.9	21.9	22.7	23.4	23.5	24.3							
551K4B, 751K4B	0.5	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2						
9323, 8243	1.5	2.3	2.6	2.7	2.7	2.8	2.9	3.0	3.0	3.0	3.2	3.2	3.3	3.3	3.4	3.5	3.5	3.6	3.7	3.8					
9325, 8245, 8216	2.6	3.8	4.4	4.4	4.4	4.7	4.8	5.0	5.0	5.0	5.3	5.4	5.5	5.5	5.7	5.8	5.9	6.1	6.2	6.3	6.5				
9321, 8241	0.9	1.3	1.5	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.9	2.0	2.0	2.0	2.1	2.1	2.2	2.3			
152K4B, 222K4B	1.1	1.7	1.9	2.0	2.0	2.1	2.1	2.2	2.2	2.2	2.3	2.4	2.4	2.4	2.5	2.6	2.6	2.7	2.7	2.8	2.8	3.0	3.1		
552K4B	2.6	3.8	4.4	4.5	4.5	4.8	4.8	5.0	5.1	5.1	5.4	5.4	5.5	5.5	5.7	5.9	5.9	6.1	6.2	6.3	6.5	6.8	7.1	7.4	
9328, 8222, 223K4B	8.8	13.0	15.0	15.2	15.2	16.2	16.4	16.9	17.2	17.3	18.2	18.4	18.6	18.7	19.3	19.9	20.1	20.7	21.2	21.5	22.1	23.2	24.2	25.0	27.0

Tab. 10-2 Supplies in DC-bus connection (400 V devices)

How to use the table:
1. Look under "1. supply" from left to right until you find a controller connected to the network
2. Look for more devices in the same column and add the powers until the required sum power is reached. Ever added devices must be supplied.

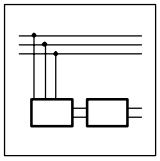
Empty fields
Supply combinations not possible

Parallel connection of regenerative power supply units not possible



10.3.4 Supplies - 240 V controllers

in preparation



10.3.5 Selection examples

10.3.5.1 4 drives just supplied via controllers (static power)

Drive data			
Controller		Motor	
Drive	Type	Power	Efficiency η
Drive 1	9330	22 kW	0.91
Drive 2	9325	5.5 kW	0.83
Drive 3	E82EV302K4B	3.0 kW	0.81
Drive 4	E82EV152K4B	1.5 kW	0.78

1. Determine DC-power requirements:
   – Power loss P_{loss} of Tab. 10-2.

$$P_{DC} = \sum_{i=1}^{4}\left(\frac{P_{M_i}}{\eta} + P_{V_i}\right)$$

$$P_{DC} = \frac{45\ kW}{0.9} + 1.1\ kW + \frac{5.5\ kW}{0.83} + 0.261\ kW + \frac{3.0\ kW}{0.81} + 0.15\ kW + \frac{1.5\ kW}{0.78} + 0.1\ kW = 63.3\ kW$$

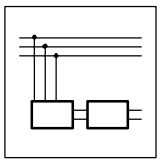
2. Determine first input:
   – $P_{DC100\%}$ of Tab. 10-2.

	9330	E82EV302K4B	9325	E82EV152K4B
$P_{DC100\%}$	60.5 kW	6.1 kW	7.9 kW	3.5 kW

   – First supply unit is 9330 (1st unit in line 1).
   – I.e. required additional supply power: 63.3 kW - 60.5 kW = 2.8 kW
3. Determine the second input:
   – Find supply power for 9325, E82EV302K4B, E82EV152K4B in column ”9330” in Tab. 10-2.

	E82EV302K4B	9325	E82EV152K4B
P_{DC2}	4.5 kW	4.4 kW	2.0 kW

   – The power of 9325 is high enough.
4. Result:
   – This network must be connected to the three-phase AC mains using 9330 and 9325 controllers.



10.3.5.2 4 drives supplied via 934X regenerative power supply module (static power)

The example uses 934X:

Drive data			
Controller		**Motor**	
Drive	**Type**	**Power**	**Efficiency η**
Drive 1	9330	22 kW	0.91
Drive 2	9325	5.5 kW	0.83
Drive 3	E82EV302K4B	3.0 kW	0.81
Drive 4	E82EV152K4B	1.5 kW	0.78

1. Determine DC-power requirements:
   – Power loss P_V of Tab. 10-2.

$$P_{DC} = \sum_{i=1}^{4}\left(\frac{P_{M_i}}{\eta} + P_{V_i}\right)$$

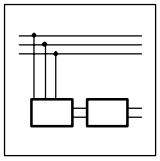
$$P_{DC} = \frac{45\ kW}{0.9} + 1.1\ kW + \frac{5.5\ kW}{0.83} + 0.261\ kW + \frac{3.0\ kW}{0.81} + 0.15\ kW + \frac{1.5\ kW}{0.78} + 0.1\ kW = 63.3\ kW$$

2. Determine required supply module:

	Powers	**9341**	**9342**	**9343**
	P_{DC}	63.3 kW	63.3 kW	63.3 kW
	P_{V934X}	0.1 kW	0.2 kW	0.4 kW
	$P_{DCtotal}$	63.4 kW	63.5 kW	63.7 kW
1. supply	P_{DC934X}	7.2 kW	14.4 kW	27.0 kW
2. supply	P_{DC9330}	28.8 kW	42.2 kW	49.5 kW
	$P_{DC302K4B}$	2.6 kW	3.8 kW	4.5 kW
	P_{DC9325}	2.6 kW	3.8 kW	4.4 kW
	$P_{DC152K4B}$	1.1 kW	1.7 kW	2.0 kW
	Max. possible input power	42.3 kW	65.9 kW	87.4 kW

   – Network operation is possible with 9342 or 9343. Since $P_{DCtotal}$ is higher than P_{DC934X}, the network requires a second supply. The selection of a regnerative power supply module depends on the required feedback power.

3. Determine the second input:
   – Network with 9342: Second supply at 9330, third at E82EV302K4B, fourth at 9325
   – Network with 9343: Second supply at 9330 (better, only 2 supplies)



Network of several drives

Selection

Tip!

the supply via regenerative power supply modules has advantages compared to the supply via controllers if

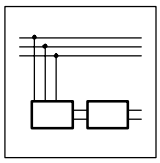
- additional brake power is required
- brake power must be dissipated without heat generation
- the number of mains supplies and thus wiring can be reduced.

The best ”mixture” between central and decentral supply depends on the application.

Example: With low brake power and high drive power the regenerative supply module can only be used with brake power. The missing drive power is decentrally supplied via controllers in the network.

Stop!

Do not connect regenerative power supply modules in parallel, they will be destroyed.



10.3.5.3 Dynamic processes

Stop!

- The data given in this chapter only apply to coordinated and rigid movements! In some cases, the network must be selected for static power. (📖 10-12, 10-13)
- If the controllers are not selected according to their application, they can be damaged during operation.

If you consider dynamic processes in the network (motors work with changing power), the number of supply units can be reduced.

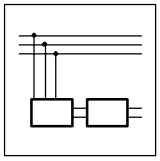
Important for the selection of supply units is the continuous power P_{DC} and the peak power P_{max} of the network.

1. Continuous power regquired:
   – Graphical determination. This methods is usually reliable. (📖 10-16)
   – Approximate calculation

$$P_{DC} \approx \frac{\sum_{i=1}^{n}(P_i \cdot t_i)}{T}$$

Important
The approximate calculation cannot be used with network with changing loads or drives that go into rest
T [s]: Cycle time
P_i [W]: Motor power during a cycle
t_i [s]: Time of P_i during a cycle

2. Graphical determination of peak power (📖 10-16)
3. Consideration of power losses
   – Consider the losses of all controllers connected in the network when you determine the continuous power and the peak power. (📖 10-10)
4. Selection of supply terminals
   – Select a controller or/and regenerative power supply unit (📖 10-12, 10-13)
   – In general the maximum overload (max. 60 s) of the supply terminals must be higher than the peak drive power of the network.



Network of several drives

Selection

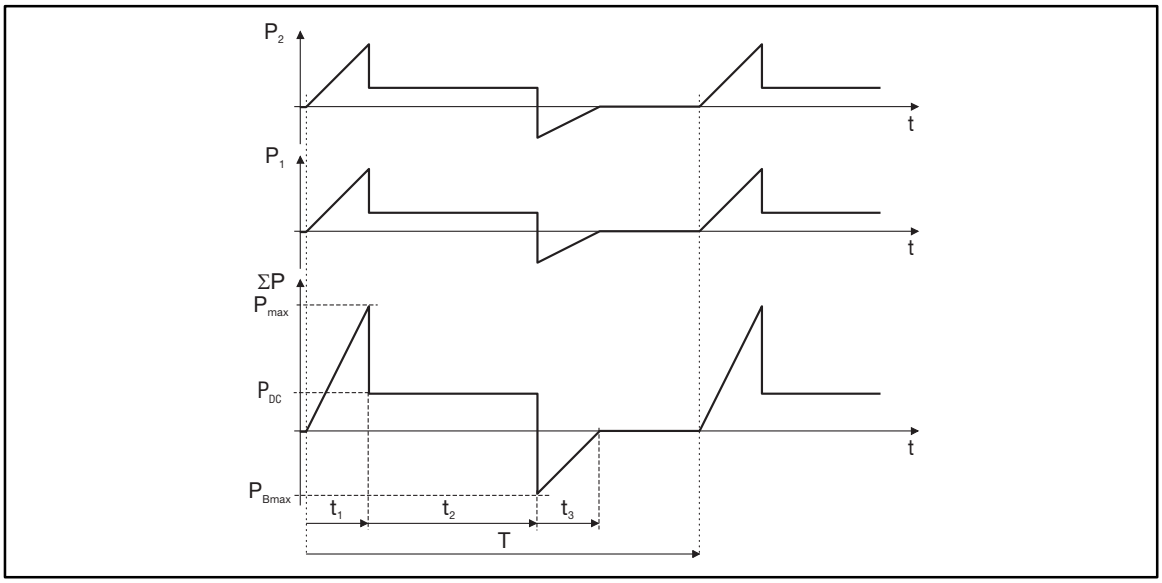


Fig. 10-2 Example with 2 **simultaneously** accelerated or decelerated drives

P1:	Power characteristic for the 1st drive
P2:	Power characteristic for the 2nd drive
∑P:	Addition of power characteristics
P_{Bmax}:	Peak brake power in the network
P_{max}:	Peak drive power in the network
P_{DC}	Continuous power

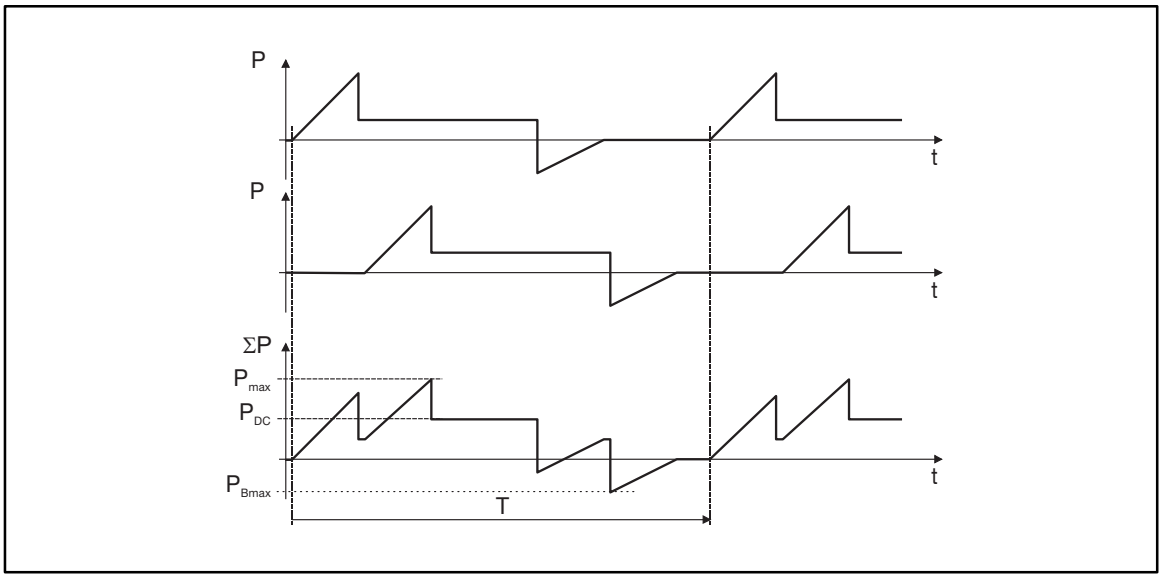


Fig. 10-3 Example with 2 **not simulatenously** accelerated or decelerated drives

P1:	Power characteristic for the 1st drive
P2:	Power characteristic for the 2nd drive
∑P:	Sum power of the network.
P_{Bmax}:	Peak brake power in the network
Pmax:	Peak drive power in the network
P_{DC}	Continuous power

With example Fig. 10-3, the peak brake power required is (P_{max} and P_{Bmax}) higher than in example Fig. 10-2.

10.4 Central supply (see supply terminal)

The controller DC bus is supplied via **a** central supply terminal Supply sources are:

- Netowrk of 230 V controllers
  – DC source
- Network of 400 V controllers
  – DC source
  – Regenerative power supply unit
  – Controller with reserve power

10.4.1 Central supply via external DC source

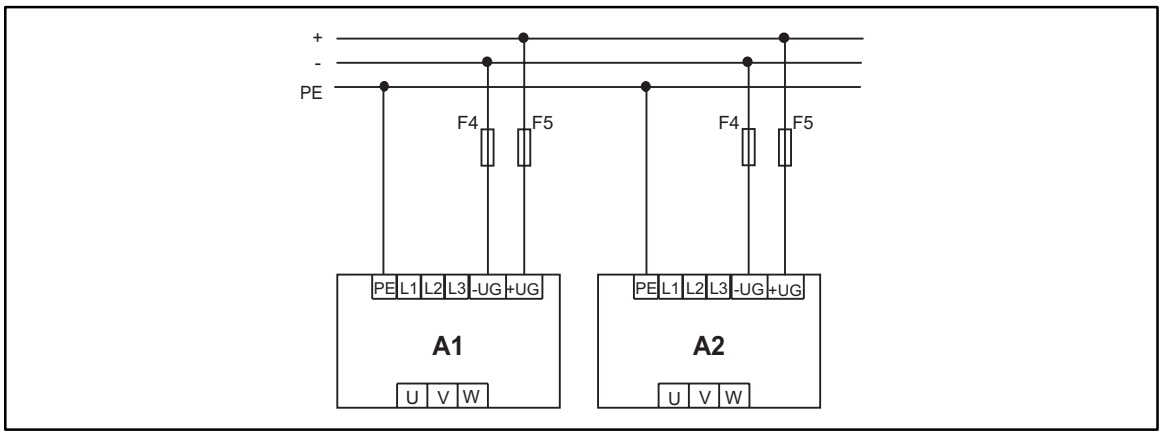


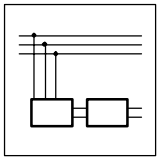
Fig. 10-4 Schematic diagram: Network of 230 V controllers with central supply from external DC source
A1, A2 230 V controller of 8200 vector series
F4, F5 DC fuses(📖 10-6)

STOP

Stop!

The following conditions must be met to ensure troublefree operation:

- General measures (📖 10-2)
- The voltage flow $+U_G \rightarrow PE$ / $-U_G \rightarrow PE$ must be symmetrical!
  – The controller will be destroyed, if $+U_G$ or $-U_G$ are earthed.



10.4.2 Central supply via 934X regenerative power supply unit of 400 V controllers

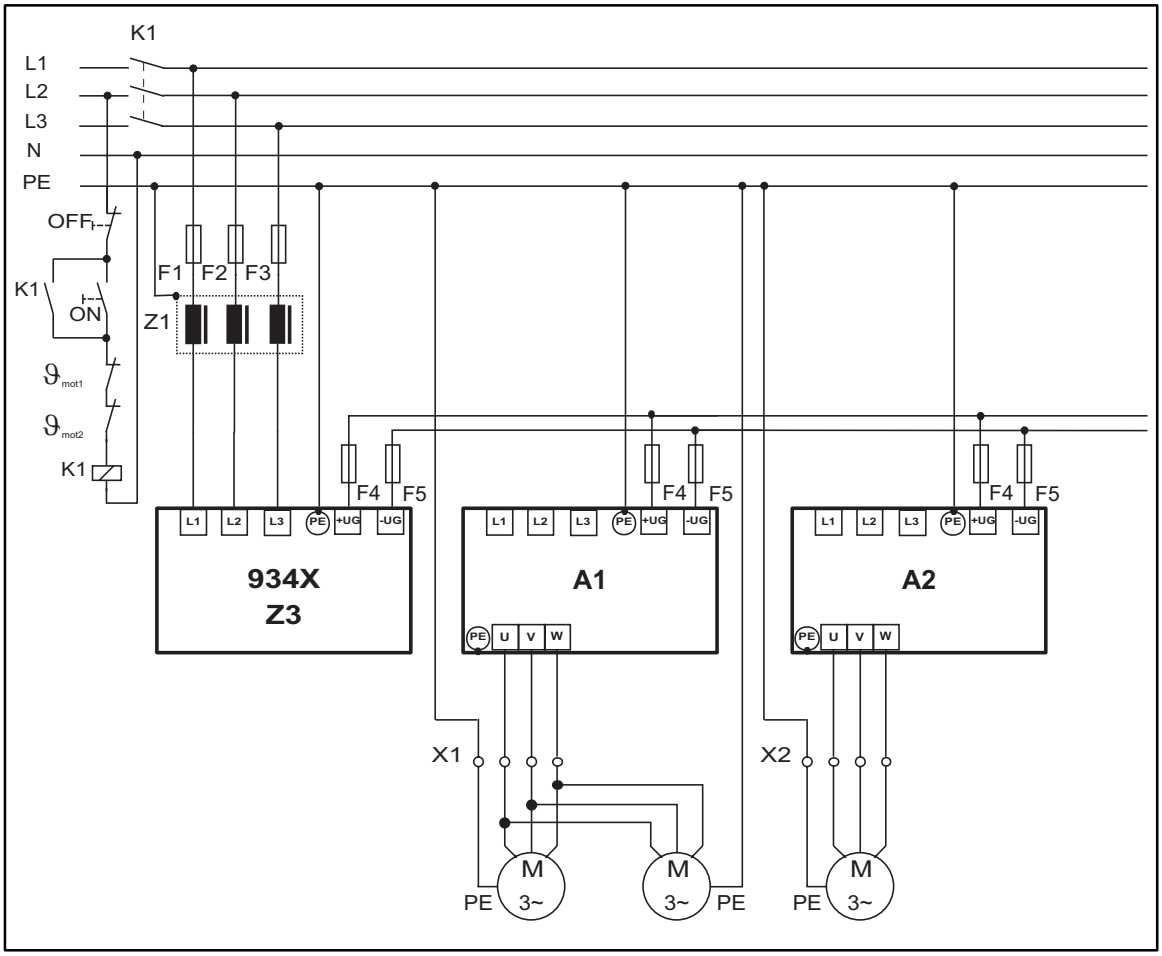


Fig. 10-5 Schematic drawing: Network of 400 V controllers with centrial supply from 934X regenerative power supply module

A1, A2	400 V controller of the 8200 vector, 8220 or 9300 series
Z1	Mains filters/mains chokes (📖 10-9)
Z3	934X regenerative power supply unit
F1 ... F3	Mains fuses (📖 10-6)
F4 ... F5	DC fuses (📖 10-6)
K1	Main contactor

10.5 Decentral supply (several supply terminals)

The controller DC bus is supplied via **several** controllers connected to the mains in parallel. A 400 V mains can use **one** additional regenerative power supply unit.

10.5.1 Decentral supply with single or two-phase mains connection

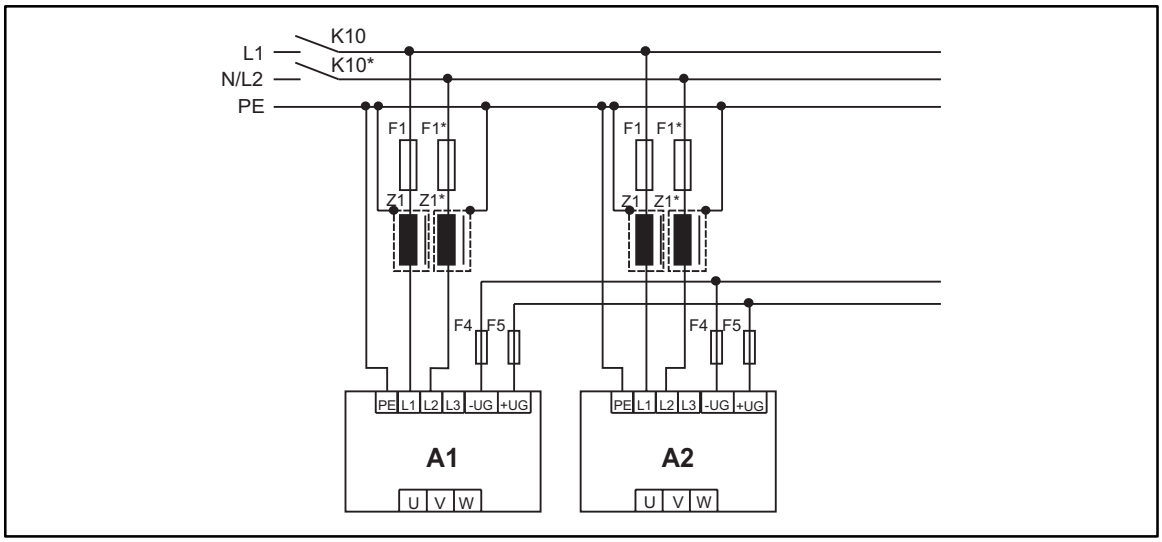


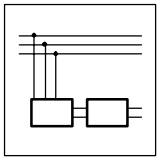
Fig. 10-6 Schematic diagram: Network of 230 V controller with decentral supply with single or two-phase mains connection

A1, A2	230 V controller of 8200 vector series
Z1, Z1*	Mains choke/mains filter (📖 10-9)
F1, F1*	Mains fuses (📖 10-6)
F4, F5	DC fuses (📖 10-6)
K10, K10*	Mains contactor
F1*, K10*, Z1*	Only when connected to 2AC PE 180 V - 0 % ... 264 V +0 %, 48 Hz -0 %... 62 Hz +0 %

Stop!

The following conditions must be met to ensure troublefree operation:

- General measures (📖 10-2)
- In-phase connection on the mains side!
- With two-phase supply
  – Cable and overload protection via second assigned mains fuse F1*.
  – Ensure current and power symmetry by the second mains choke/mains filter.



10.5.2 Decentral supply with three-phase mains connection

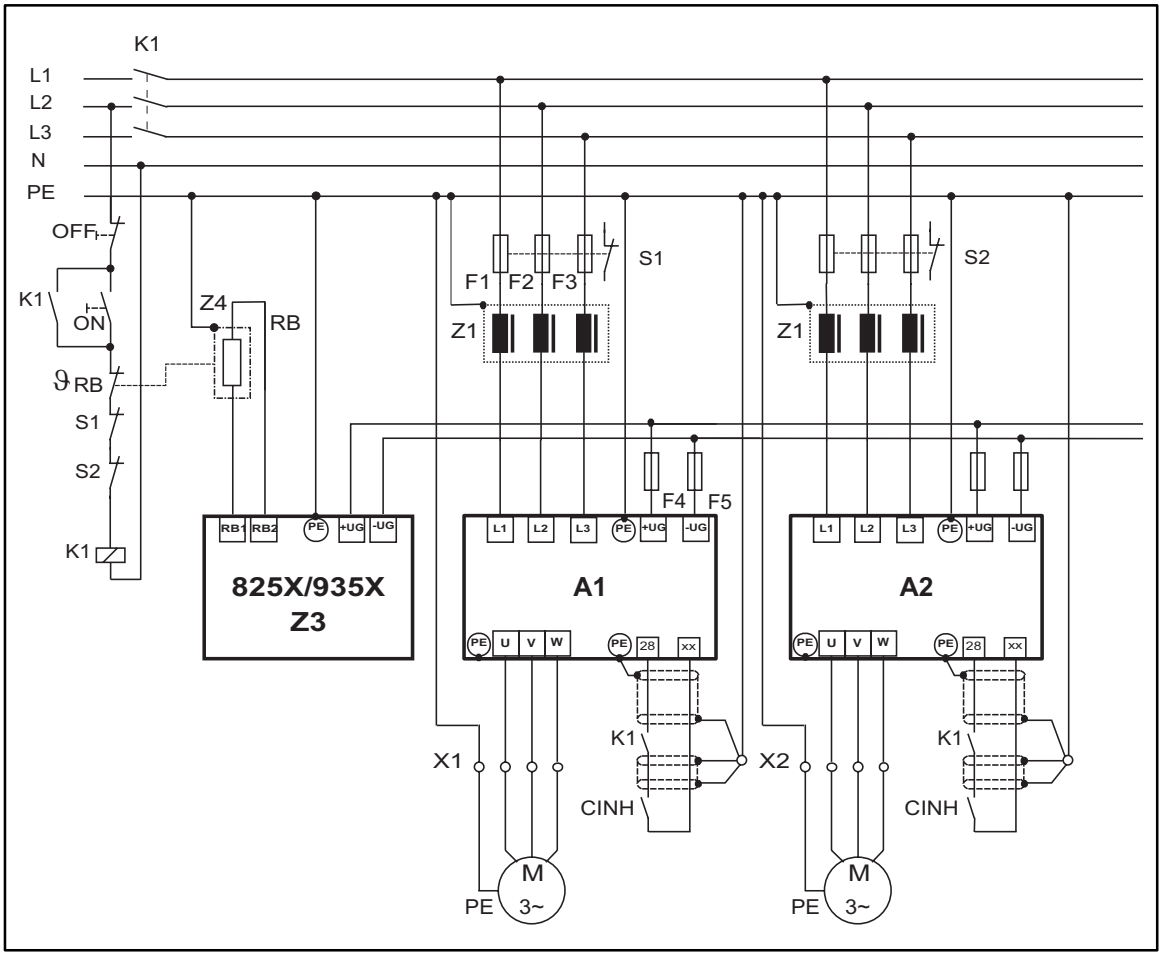


Fig. 10-7 Schematic drawing: Network of three-phase connected controllers with decentral supply and additional brake unit

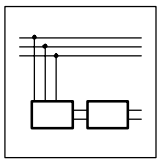
A1, A2	230 V controller 8200 vector or 400 V controller 8200 vector, 8220 oder 9300
Z1	Mains choke/mains filter (📖 10-9)
Z3	Brake unit (📖 12-9)
Z4	Brake resistor (📖 12-9)
F1, F2, F3	Netzsicherungen (📖 10-6)
F4, F5	DC fuses (📖 10-6)
K10	Mains contactor

Stop!

825X and 935X brake units must only be operated together with Lenze brake resistors! Otherwise the brake units can be damaged!

Tip!

With 400 V mains systems it is also possible to use a regenerative power supply unit instead of a brake unit. Advantage: No heat generation in generator mode.



10.6 Braking operation in the network

10.6.1 Possibilities

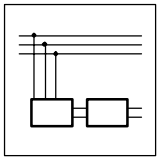
If the braking energy created in generator operation by the drive network, the voltage will be increased in the entire DC-bus. If the maximum DC-bus voltage is exceeded, the controllers set pulse inhibit (message "overvoltage") and the drives idle to standstill. There are different possibilities to use the generated braking energy:

	Application with	Special features
934X regenerative power supply unit	Long braking processes	• Braking energy is fed back into supplying mains • No heat generation
Brake module 8251, 8252 or 9351	Regular braking at low power Rare braking at medium power	• Brake resistor integrated • No additional switching measures required • Example: (📖 10-20)
Brake chopper 8253 or 9352	Regular braking at high power Long braking processes at high power	• External brake resistor required • Brake resistors can become very hot, if necessary, take prevention measures • Example: (📖 10-20)
Brake resistor at controller	Regular braking at low power Rare braking at medium power	• Only with 8200 vector, since the brake transistor is integrated • See also: (📖 11-4)

Stop!

- Possibilities for braking energy dissipation in the network
  – must not be combined.
  – must only be used once (e.g. it is not possible to use two brake modules in parallel)
- Mains voltage at 93XX controllers and 935X brake units must be set in the same way:
  – For 93XX via C0173
  – For 935X via S1 and S2

Otherwise network components can be destroyed.



Network of several drives

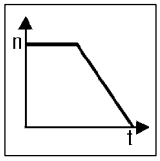
Braking operation in the network

10.6.2 Selection

- The selection of components for braking operation depends on the continuous braking power, peak braking power and the application.
- Continuous braking power and peak braking power can be found out by using graphs:
  – Example: (📖 10-16)
  – Observe all available emergency off measures
- Provide a safety switch-off in the event of overheating if you use a brake resistor or brake module. Use the thermostat of the brake resistor/brake module to
  – disconnect all controllers from the mains.
  – set controller inhibit in all controllers (terminal 28 = LOW)
  – Example: (📖 10-20)

Tip!

- If the controllers are not braked at the same time, the continuous and peak brake power can be reduced.
- Observe the maximum overload capacity of the regenerative power supply unit and the switch-on cycle of the brake resistor.



11 Braking operation

11.1 Braking operation without additional measures

For smaller loads the functions ”DC-injection brake DCB” or ”AC-motor braking” can be set.

- DC-injection brake: (📖 7-19)
- AC-motor braking: (📖 7-20)

11.2 Braking operation iwth three-phase AC brake motors

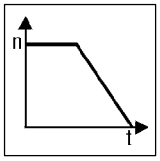
Lenze three-phase AC motors and G-motion geared motors can be equipped with spring-operated brakes. Brake rectifiers are required to supply spring-operated brakes (180 VDC, 205 VDC).

The selection of brake rectifiers depends on the input voltage $_{AC}$ and the rated voltage of the brake coil (V_{coil}):

Brake rectifier selection					
	Type/Order No.	**Max. input voltage V_{AC}**	**Output voltage V_{DC}**	**Max. output current**	**Example**
Bridge rectifier 6-pole	E82ZWBR1	270 V + 0 %	$V_{DC} = 0.9 \times V_{AC}$	0.75 A	$V_{coil} = 205\ V_{DC} \equiv$ V_{DC} at $V_{AC} = 230$ V
Half-wave recitifier 6-pole	E82ZWBR3	460 V + 0 %	$V_{DC} = 0.45 \times V_{AC}$	0.75 A	$V_{coil} = 180\ V_{DC} \equiv$ V_{DC} at $V_{AC} = 400$ V

Tip!

Lenze geared motors with brake motor and Lenze three-phase AC brake motors are delivered as standard with 4-pole brake rectifiers. These brake rectifiers are for AC switching of the brake.



Braking operation

Brake control

The brake can be switched on the DC and the AC side. With DC switching the delay times are considerably shorter. It is thus possible to build up a switch-off positioning system with reproduceable braking path. DC switching requires a spark suppressor to protect the contract and the coil. The spark suppressor is integrated in 6 pole brake rectifiers.

The relay output of the controller can be used for brake switching. Alternatively, the brake can be switched via an external control contact (e.g. PLC).

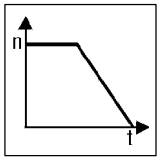
The following table shows the control possibilities for Lenze spring-operated brakes. The indications made refer to a rated mains voltage of 230 V ±10 % or 400 V ±10 %:

			Brake motor						
			Brake size	06	08	10	12	14	16	18
			Brake torque	4 Nm	8 Nm	16 Nm	32 Nm	60 Nm	80 Nm	150 Nm
			Motor frame size	063/071	080/090	090/100	100	112/132	132/160	160
V_{coil}	**Rectifier**	**Switching via controller relay output**							
180 V	Half wave	DC switching		☒				☒	
		DC switching or direct DC switching		✓				(✓)	
205 V	Bridge	AC switching		✓				✓	
		DC switching or direct DC switching		✓				(✓)	
24 V	Not necessary	Direct DC switching		✓				(✓)	

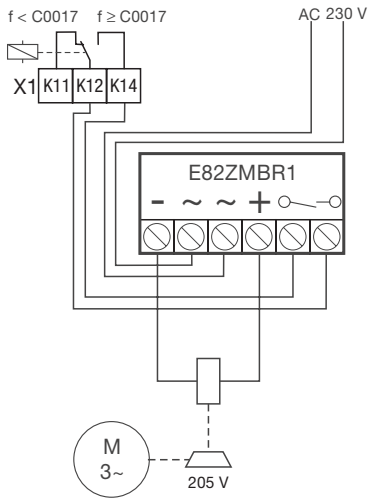
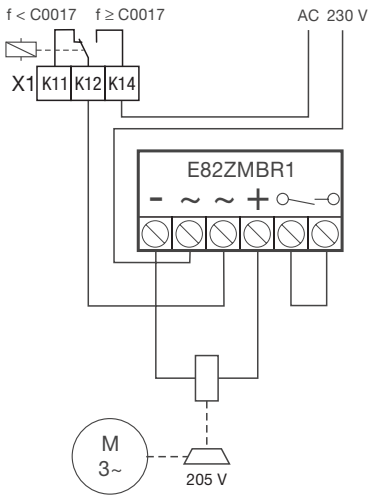
✓ Permissible

(✓) Only permissible with additional relay

☒ Not admissible



Wiring

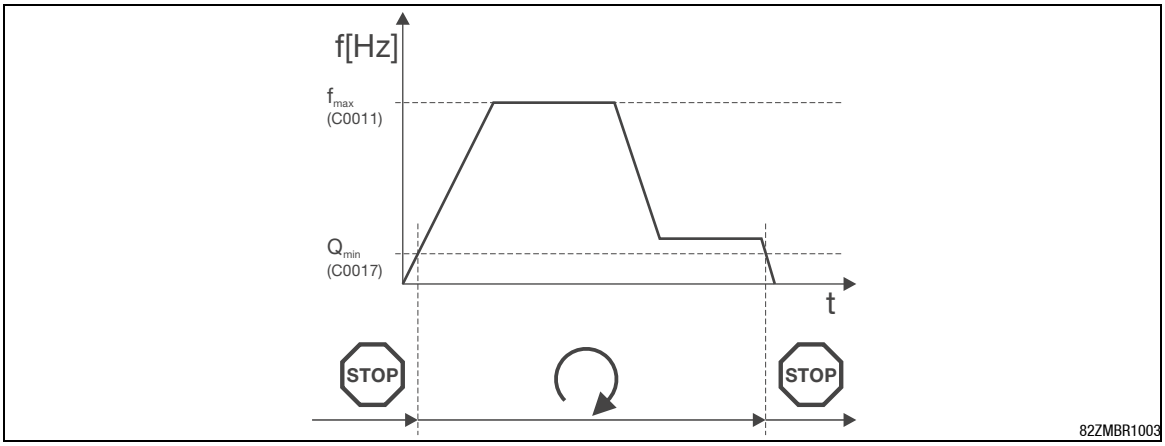
DC switching (quick brake reaction)	AC switching (delayed brake reaction)
	

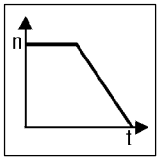
Parameter setting

If you want to control the electro-mechanical motor brake via the controller relay output, the relay must be programmed.

Example: Activation/deactivation of the brake (205 V) when a certain threshold is exceeded. The braking process can be activated by a digital signal which decelerates to quick stop:

- Configure the relay output for brake control
  – Signal “Value below Q_{min} threshold ” must be assigned to the relay output by setting C0008 = 7
- Set the frequency threshold Q_{min} under C0017
  – The brake is activated when the setpoint falls below Q_{min}
  – The brake is released when the setpoint exceeds Q_{min}





Braking operation

11.3 Braking operation with external brake resistor

Larger moments of inertia or longer generator-mode operation require an external brake resistor. It converts mechanical energy into heat.

The brake transistor integrated in the controller switches the external brake resistor in addition when the DC-voltage exceeds a threshold. It can thus be avoided that the controller sets "overvoltage" and pulse inhibit and forces the drive to coast to standstill. Extneral brake resistors ensure braking operation at any time.

The threshold can be adapted to the mains voltage if you are using 400 V controllers (8200 vector).

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
[C0174]*	Brake transistor threshold	100	78 {1 %} 110 Recommended setting V_{mains} [3/PE AC xxx V] / C0174 [%] / V_{DC} [V DC]: 380 / 78 / 618 400 / 81 / 642 415 / 84 / 665 440 / 89 / 704 460 / 93 / 735 480 / 97 / 767 500 / 100 / 790		**Not active with 8200 motec and 240 V controller 8200 vector (fixed threshold 380 V)** • 100 % = Threshold DC 790 V • 110 % = Brake transistor switched off • U_{DC} = Threshold in V DC • The recommended setting allows max. 10 % mains overvoltage	11-4

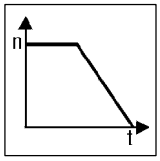
11.3.1 Number of brake resistors

The Lenze brake resistors recommended in the tables are selected for the corresponding controllers (ref. to 150 % power in generator mode). They are suitable for most applications.

For special applications such as centrifuges, hoists, etc., the brake resistor must meet the following conditions:

Brake resistor	Application	
Criteria	with active load	with passive load
Peak brake power [W]	$\geq P_{max} \cdot \eta_e \cdot \eta_m \cdot \frac{t_1}{t_{cycl}}$	$\geq \frac{P_{max} \cdot \eta_e \cdot \eta_m}{2} \cdot \frac{t_1}{t_{cycl}}$
Thermal capacity [Ws]	$\geq P_{max} \cdot \eta_e \cdot \eta_m \cdot t_1$	$\geq \frac{P_{max} \cdot \eta_e \cdot \eta_m}{2} \cdot t_1$
Resistance [Ω]	$R_{min} \leq R \leq \frac{U_{DC}^2}{P_{max} \cdot \eta_e \cdot \eta_m}$	

Active load	Can move without being influenced by the controller (e.g. hoists, unwinders)
Passive load	Decelerates to standstill without influence of the controller (e.g. horizontal traversing drives, centrifuges, fans)
V_{DC} [V]	Brake transistor threshold from C0174
P_{max} [W]	Max. brake power determined by the application
η_e	Electrical efficiency (controller + motor) Guide values: 0.54 (0.25 kW) ... 0.85 (11 kW)
η_m	Mechanical efficiency (gearbox, machine)
t_1 [s]	Braking time
t_{cycl} [s]	Cycle time = Time between two braking processes (= t1 + break)
R_{min} [Ω]	Smallest permissible brake resistor (see rated data for the integrated brake transistor)

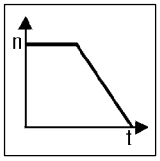


11.3.2 Rated data for the integrated brake transistor

8200 vector, 230 V

Brake transistor		8200 vector, 230 V					
		E82EV251K2B	E82EV371K2B	E82EV551K2B	E82EV751K2B	E82EV152K2B	E82EV222K2B
Threshold V_{DC}	[V DC]	380 (fixed					
Peak brake current Î	[A DC]	0.85		4.0		8.6	
Max. continuous current	[A DC]	0.85		2.0		5.8	
Smallest permissible brake resistor R_{min}	[Ω]	470		90		47	
Current reduction		2.5 %/°C derating above 40 °C peak brake current 5 %/1000 m derating above 1000 m a.m.s.l.					
Switch-on cycle		Max. 60 s at peak brake current, then at least 60 s break					
Recommended Lenze brake resistor	Order no.	ERBM470R020W		ERBM200R100W		ERBM082R150W	ERBM052R200W

Brake transistor		8200 vector, 230 V			
		E82EV302K2B	E82EV402K2B	E82EV552K2B	E82EV752K2B
Threshold V_{DC}	[V DC]	380 (fixed			
Peak brake current Î	[A DC]	13.0	13.0	20.0	20.0
Max. continuous current	[A DC]	8.0	10.7	14.7	20.0
Smallest permissible brake resistor R_{min}	[Ω]	29		19	
Current reduction		2.5 %/°C derating above 40 °C peak brake current 5 %/1000 m derating above 1000 m a.m.s.l.			
Switch-on cycle		Max. 60 s at peak brake current, then at least 60 s break			
Recommended Lenze brake resistor	Order no.	ERBD047R01K2	ERBD047R01K2	ERBD047R01K2	ERBD047R01K2

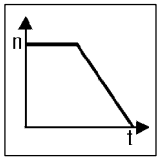


Braking operation

8200 vector, 400 V

Brake transistor		8200 vector, 400 V			
		E82EV551K4B	E82EV751K4B	E82EV152K4B	E82EV222K4B
Threshold V_{DC}	[V DC]	790 (adjustable)			
Peak brake current Î	[A DC]	1.9		3.8	5.6
Max. continuous current	[A DC]	0.96		1.92	2.8
Smallest permissible brake resistor (V_{DC} =790 V)	[Ω]	455		230	155
Current reduction		2.5 %/°C derating above 40 °C peak brake current 5 %/1000 m derating above 1000 m a.m.s.l.			
Switch-on cycle		Max. 60 s at peak brake current, then at least 60 s break			
Recommended Lenze brake resistor	Order no.	ERBM470R100W		ERBM370R150W	ERBM240R200W

Brake transistor		8200 vector, 400 V				8200 vector, 400 V
		E82EV302K4B	E82EV402K4B	E82EV552K4B	E82EV752K4B	E82EV113K4B
Threshold V_{DC}	[V DC]	790 (adjustable)				
Peak brake current Î	[A DC]	7.8	7.8	11.4	16.5	23.5
Max. continuous current	[A DC]	3.9	5.1	7.0	9.6	14.1
Smallest permissible brake resistor (V_{DC} =790 V)	[Ω]	100	100	68	47	33
Current reduction		2.5 %/°C derating above 40 °C peak brake current 5 %/1000 m derating above 1000 m a.m.s.l.				
Switch-on cycle		Max. 60 s at peak brake current, then at least 60 s break				
Recommended Lenze brake resistor	Order no.	ERBD180R300W	ERBD100R600W	ERBD092R600W	ERBD068R800W	ERBD047R01K2



11.3.3 Rated data for Lenze brake resistors

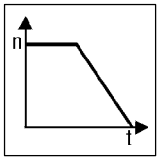
Lenze brake resistors (IP20)							
	R	Continuous power**	Thermal capacity	Switch-on cycle	Cable cross-section		Weight
Order number	[Ω]	[kW]	[kWs]		[mm²]	AWG	[kg]
ERBM470R020W*	470	0.02	3.0	1:10 Braking for max. 15 s, then at least 150 s break	1	18	0.22
ERBM470R050W*	470	0.05	7.5		1	18	0.56
ERBM470R100W	470	0.1	15		1	18	0.76
ERBM200R100W*	200	0.1	15		1	18	0.6
ERBM370R150W	370	0.15	22.5		1	18	0.93
ERBM100R150W*	100	0.15	22.5		1	18	0.93
ERBM082R150W*	82	0.15	22.5		1	18	0.93
ERBM240R200W	240	0.2	30		1	18	1.25
ERBM082R200W*	82	0.2	30		1	18	1.25
ERBM052R200W*	52	0.2	30		1	18	1.25
ERBD180R300W	180	0.3	45		1	18	2.0
ERBD100R600W	100	0.6	90		1	18	3.1
ERBD082R600W	82	0.6	90		1.5	16	3.1
ERBD068R800W	68	0.8	120		1.5	16	4.3
ERBD047R01K2	47	1.2	180		2.5	14	4.9

* only for inverters with 230 V rated mains voltage

** The continuous power is a value important for the selection of brake resistors. Braking at peak brake power (V^2_{DC}/R)
Observe national and regional regulations (e. g. VDE 0113, EN 60204)

Tip!

- All brake resistors are equipped with a thermostat (isolated NC contact) (not ERBM470R020W)
- If necessary, several brake resistors can be connected in series or in parallel. (Caution: Do not have values below the lowest permissible value!)



Braking operation

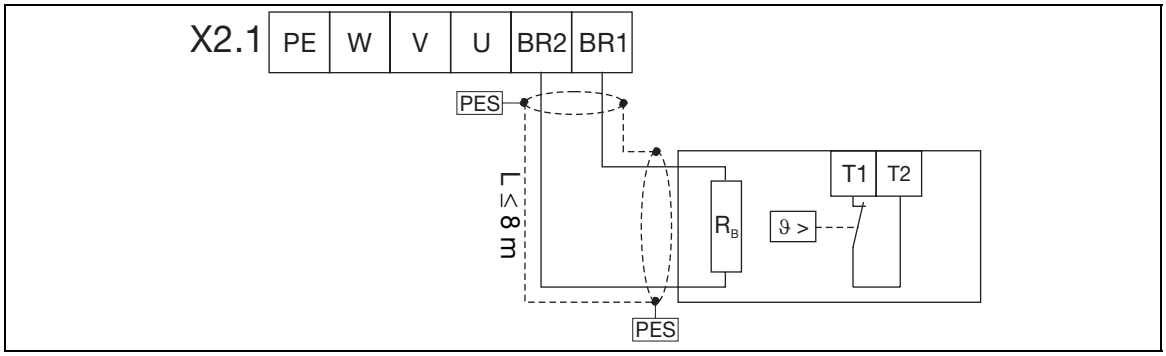
Installation

- Brake resistors can become very hot, they can even burn. Therefore brake resistors must be mounted in a way that the high temperatures can not damage anything.
- Provide a safety switch-off in the event the brake resistor overheats.
- Use temperature contacts of the brake resistor (e. g. T1 / T2) as control contacts to disconnect the controller from the mains.

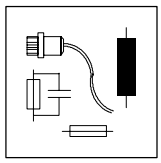
Tip!

Shielding of cables is only required to comply with existing regulations (e. g. VDE 0160, EN 50178).

Connection diagram



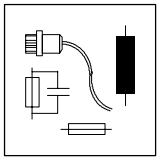
PES HF-shield end by PE connection through shield bracket.



12 Accessories

12.1 Accessories

Accessories	Name		Order number
Function modules [1]	Standard I/O		E82ZAFS
	Standard I/O PT		E82ZAFS100
	Application I/O		E82ZAFA
	System bus (CAN)		E82ZAFC
	LECOM-B (RS485)		E82ZAFL
	INTERBUS		E82ZAFI
	PROFIBUS-DP		E82ZAFP
	DeviceNet/CANopen		E82ZAFD
	AS interface (in preparation)		E82ZAFF
Communication modules	LECOM-LI (optical fibre)		EMF2102IB-V003
	LECOM-B (RS485)		EMF2102IB-V002
	LECOM-A/B (RS232/485)		EMF2102IB-V001
	LON (in preparation)		EMF2141IB
	System bus (CAN)		EMF2171IB
	System bus (CAN) (with addressing)		EMF2172IB
	INTERBUS		EMF2111IB
	INTERBUS loop		EMF2112IB
	PROFIBUS-DP		EMF2133IB
	DeviceNet/CANopen		EMF2175IB
	Keypad		E82ZBC
Others	Hand terminal = Keypad with handheld (additional connection cable required)		E82ZBB
	Mounting kit for control cabinet [2] (additional connection cable required)		E82ZBHT
	Connection cable	2.5 m	E82ZWL025
		5 m	E82ZWL050
		10 m	E82ZWL100
	Parameter setting software “Global Drive Control (GDC)”		ESP-GDC2
	Parameter setting software “Global Drive Control (GDCeasy)”		ESP-GDC2-E
	PC system cable RS232	0.5 m	EWL0048
		5 m	EWL0020
		10 m	EWL0021
	Optical fibre adapter for normal sending		EMF2125IB
	Optical fibre adapter for increased sending rates		EMF2126IB
	Power supply for optical fibre adapter		EJ0013
	Optical fibre, 1-core, black PE sheath (simple protection), per meter		EWZ0007
	Optical fibre, I-core, red PUR sheath (reinforced), per meter		EWZ0006
	Setpoint potentiometer		ERPD0001k0001W
	Knob for setpoint potentiometer		ERZ0001
	Scale for setpoint potentiometer		ERZ0002
	Digital display		EPD203
Braking operation	Half-wave rectifier (14.630.33.016)		E82ZWBR3
	Bridge rectifier (14.630.32.016)		E82ZWBR1



Accessories

Accessories/documentation

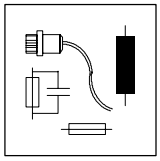
Accessories	Name		Order number
Automation	Drive PLC		EPL-10200
	Extension board 1		EPZ-10201
	Extension board 2		EPZ-10202
	Extension board 3		EPZ-10203
	Drive PLC Developer Studio BASIC		ESP-DDS1-B
	Drive PLC Developer Studio PROFESSIONAL		ESP-DDS1-P
	PC system bus converter (voltage supply via keypad with DIN connection)		EMF2173IB
	PC system bus converter (voltage supply via keypad with PS2 connection)		EMF2173IB-V002
	Terminal extension for system bus (CAN)		EMZ9374IB

1) Lacquered version (not standard I/O PT): Add “001” to your order number, e. g. E82ZAFS001 for “standard I/O lacquered”.

2) Required if the keypad is to be mounted into a control cabinet

12.2 Documentation

Documentation		Order number		
		German	English	French
Operating Instructions	Global Drive frequency inverters 8200 vector 0.25 ... 11 kW	EDB82EVD	EDB82EVU	EDB82EVF
	Fieldbus function modules PROFIBUS-DP, INTERBUS, LECOM-B (RS485)	E82ZAD	E82ZAU	E82ZAF
	Communication module LECOM-A/B (RS232/RS485), LECOM-B (RS485), LECOM-LI (LWL)	EDB2102DB	EDB2102UB	EDB2102FB
	Communication module INTERBUS 2111	EDB2111DB	EDB2111UB	EDB2111FB
	Communication module PROFIBUS-DP 2131	EDB2131DB	EDB2131UB	EDB2131FB
	Communication module PROFIBUS-DP 2133	EDB2133DB	EDB2133UB	EDB2133FB
	Communication module system bus (CAN) 2171/2172	EDB2172DB	EDB2172UB	EDB2172FB
	Communication module DeviceNet/CANopen 2175	EDB2175DB	EDB2175UB	EDB2175FB
Catalogs	Catalog ”8200 vector frequency inverter”	Please contact your Lenze representative		
	Catalogs with all corresponding motors, geared motors and electromechanical brakes			



12.3 Type-specific accessories - 230 V mains voltage

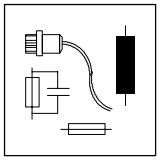
12.3.1 Operation at rated power (normal operation)

Mains connection, single-phase/PE AC 230 V - operation at rated power (normal operation)						
	8200 vector type					
	E82EV251K2B	E82EV371K2B	E82EV551K2B	E82EV751K2B	E82EV152K2B	E82EV222K2B
Accessories	Order number					
E.I.c.b.	EFA1C10A	EFA1C10A	EFA1B10A	EFA1B16A EFA1B10A [2)]	EFA1B20A EFA1B16A[2)]	EFA1B20A
Fuse	EFSM-0100AWE	EFSM-0100AWE	EFSM-0100AWE	EFSM-0160AWE EFSM-0100AWE [2)]	EFSM-0200AWE EFSM-0160AWE [2)]	EFSM-0200AWE
Fuse holder	EFH10001					
Mains choke	ELN1-0900H005		ELN1-0500H009		E82ZL22212B	E82ZL22212B [3)]
RFI filter SD [1)]	E82ZZ37112B200		E82ZZ75112B200		E82ZZ22212B200	
RFI filter LD [1)]	E82ZZ37112B210		E82ZZ75112B210		E82ZZ22212B210	
Motor filter	E82ZM22232B					
Brake resistor	ERBM470R020W		ERBM200R100W		ERBM082R150W	ERBM052R200W
DIN-rail assembly	E82ZJ002					
EMV support with clamp	E82ZWES					
EMV support with clip	E82ZWEK					
Swivel support	E82ZJ001					

1) only n combination with 8200 vector, types E82EVxxxKxB200 (without EMC filter)

2) for operation with mains choke

3) always use a mains choke



Accessories

Type-specific accessories - 230 V mains voltage

Mains connection, three-phase 3/PE AC 230 V - operation at rated power (normal operation)				
	8200 vector type			
	E82EV551K2B	**E82EV751K2B**	**E82EV152K2B**	**E82EV222K2B**
Accessories	**Order number**			
E.l.c.b.	EFA3B06A	EFA3B10A EFA3B06A [2)]	EFA3B16A EFA3B10A [2)]	EFA3B16A EFA3B10A [2)]
Fuse	EFSM-0060AWE	EFSM-0100AWE EFSM-0060AWE [2)]	EFSM-0160AWE EFSM-0100AWE [2)]	EFSM-0160AWE EFSM-0100AWE [2)]
Fuse holder	EFH10001			
Mains choke	E82ZL75132B		E82ZL22232B	
RFI filter SD [1)]	E82ZZ75132B200		E82ZZ22232B200	
RFI filter LD [1)]	E82ZZ75132B210		E82ZZ22232B210	
Motor filter	E82ZM22232B			
Brake resistor	ERBM200R100W		ERBM082R150W	ERBM052R200W
DIN-rail assembly	E82ZJ002			
EMV support with clamp	E82ZWES			
EMV support with clip	E82ZWEK			
Swivel support	E82ZJ001			

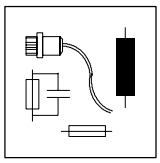
Mains connection, three-phase 3/PE AC 230 V - operation at rated power (normal operation)				
	8200 vector type			
	E82EV302K2B	**E82EV402K2B**	**E82EV552K2B**	**E82EV752K2B**
Accessories	**Order number**			
E.l.c.b.	EFA3B20A EFA3B16A[2)]	EFA3B25A EFA3B20A [2)]	- EFA3B25A [2)]	-
Fuse	EFSM-0200AWE EFSM-0160AWE [2)]	EFSM-0250AXH EFSM-0200AWE [2)]	EFSM-320AWH EFSM-250AXH [2)]	EFSM-0320AWH
Fuse holder	EFH10001	EFH10002 EFH10001 [2)]	EFH10002	
Mains choke	ELN3-0120H017		ELN3-0120H025	ELN3-0088H035 [3)]
RFI filter SD [1)]	E82ZZ40232B200*		E82ZZ75232B200*	
RFI filter LD [1)]	E82ZZ40232B210*		E82ZZ75232B210*	
Motor filter	in preparation			
Brake resistor	ERBD047R01K2			
DIN-rail assembly	E82ZJ008			
EMV support with clamp	E82ZWES001			
EMV support with clip	E82ZWEK001			
Swivel support	E82ZJ005		E82ZJ006	

* in preparation

1) only in combination with 8200 vector, types E82EVxxxKxB200 (without EMC filter)

2) for operation with mains choke

3) always use a mains choke



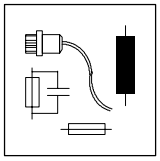
12.3.2 Operation at increased rated power

Mains connection, single-phase 1/N/PE AC 230 V - operation at rated power (normal operation)				
	8200 vector type			
	E82EV251K2B	**E82EV551K2B**	**E82EV751K2B**	**E82EV152K2B**
Accessories	**Order number**			
E.l.c.b.	EFA1C10A	EFA1B10A	EFA1B16A	EFA1B20A
Fuse	EFSM-0100AWE	EFSM-0100AWE	EFSM-0160AWE	EFSM-0200AWE
Fuse holder	EFH10001			
Mains choke	ELN1-0900H005	ELN1-0500H009	ELN1-0500H009 [3]	E82ZL22212B
RFI filter SD [1]	E82ZZ37112B200	E82ZZ75112B200		E82ZZ22212B200
RFI filter LD [1]	E82ZZ37112B210	E82ZZ75112B210		E82ZZ22212B210
Motor filter	E82ZM22232B			
Brake resistor	ERBM470R020W	ERBM200R100W		ERBM082R150W
DIN-rail assembly	E82ZJ002			
EMV support with clamp	E82ZWES			
EMV support with clip	E82ZWEK			
Swivel support	E82ZJ001			

1) only in combination with 8200 vector, types E82EVxxxKxB200 (without EMC filter)

2) for operation with mains choke

3) always use a mains choke



Accessories

Type-specific accessories - 230 V mains voltage

Mains connection, three-phase 3/PE AC 230 V - operation at increased rated power			
	8200 vector type		
	E82EV551K2B	E82EV751K2B	E82EV152K2B
Accessories	Order number		
E.l.c.b.	EFA3B06A	EFA3B10A	EFA3B16A EFA3B10A [2]
Fuse	EFSM-0060AWE	EFSM-0100AWE	EFSM-0160AWE EFSM-0100AWE [2]
Fuse holder	EFH10001		
Mains choke	E82ZL75132B	E82ZL75132B [3]	E82ZL22232B
RFI filter SD [1]	E82ZZ75132B200		E82ZZ22232B200
RFI filter LD [1]	E82ZZ75132B210		E82ZZ22232B210
Motor filter	E82ZM22232B		
Brake resistor	ERBM200R100W		ERBM082R150W
DIN-rail assembly	E82ZJ002		
EMV support with clamp	E82ZWES		
EMV support with clip	E82ZWEK		
Swivel support	E82ZJ001		

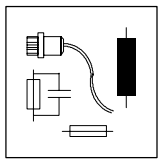
Mains connection, three-phase 3/PE AC 230 V - operation at increased rated power		
	8200 vector type	
	E82EV302K2B	E82EV52K2B
Accessories	Order number	
E.l.c.b.	EFA3B25A EFA3B20A [2]	EFA3B32A
Fuse	EFSM-0250AXH EFSM-0200AWE [2]	EFSM-0320AWH
Fuse holder	EFH10002 EFH10001 [2]	EFH10002
Mains choke	ELN3-0120H017	ELN3-0088H035 [3]
RFI filter SD [1]	E82ZZ40232B200*	E82ZZ75232B200*
RFI filter LD [1]	E82ZZ40232B210*	E82ZZ75232B210*
Motor filter	in preparation	
Brake resistor	ERBD047R01K2	
DIN-rail assembly	E82ZJ008	
EMV support with clamp	E82ZWES001	
EMV support with clip	E82ZWEK001	
Swivel support	E82ZJ005	E82ZJ006

* in preparation

[1] only in combination with 8200 vector, types E82EVxxxKxB200 (without EMC filter)

[2] for operation with mains choke

[3] always use a mains choke



12.4 Type-specific accessories - 400 V mains voltage

12.4.1 Operation at rated power (normal operation)

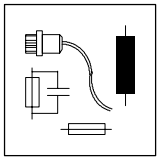
Mains connection 3/PE AC 400 V - operation at rated power (normal operation)				
	8200 vector type			
	E82EV551K4B	E82EV751K4B	E82EV152K4B	E82EV222K4B
Accessories	Order number			
E.l.c.b.	EFA3B06A	EFA3B06A	EFA3B10A	EFA3B10A
Fuse	EFSM-0060AWE	EFSM-0060AWE	EFSM-0100AWE	EFSM-0100AWE
Fuse holder	EFH10001			
Mains choke	EZN3A1500H003		E82ZL22234B	
RFI filter SD [1]	E82ZZ75134B200		E82ZZ22234B200	
RFI filter LD [1]	E82ZZ75134B210		E82ZZ22234B210	
Motor filter	E82ZM75134B		E82ZM22234B020	
Brake resistor	ERBM470R100W		ERBM370R150W	ERBM240R200W
DIN-rail assembly	E82ZJ002			
EMV support with clamp	E82ZWES			
EMV support with clip	E82ZWEK			
Swivel support	E82ZJ001			

Mains connection 3/PE AC 400 V - operation at rated power (normal operation)					
	8200 vector type				
	E82EV302K4B	E82EV402K4B	E82EV552K4B	E82EV752K4B	E82EV113K4B
Accessories	Order number				
E.l.c.b.	EFA3B16A EFA3B10A[2]	EFA3B16A	EFA3B25A EFA3B20A[2]	EFA3B32A EFA3B20A[2]	EFA3B32A
Fuse	EFSM-0160AWE EFSM-0100AWE [2]	EFSM-0160AWE	EFSM-0250AXH EFSM-0200AWE [2]	EFSM-0320AWH EFSM-0200AWE [2]	EFSM-0320AWH
Fuse holder	EFH10001		EFH10002 EFH10001 [2]	EFH10002 EFH10001 [2]	EFH10002
Mains choke	EZN3A0500H007	EZN3A0300H013		ELN3-0120H017	ELN3-0150H024 [3]
RFI filter SD [1]	E82ZZ55234B200			E82ZZ11334B200	
RFI filter LD [1]	E82ZZ55234B210			E82ZZ11334B210	
Motor filter	E82ZM40234B		E82ZM75234B		E82ZM11334B
Brake resistor	ERBD180R300W	ERBD100R600W	ERBD082R600W	ERBD068R800W	ERBD047R01K2
DIN-rail assembly	E82ZJ008				
EMV support with clamp	E82ZWES001				
EMV support with clip	E82ZWEK001				
Swivel support	E82ZJ005			E82ZJ006	

[1] only in combination with 8200 vector, types E82EVxxxKxB200 (without EMC filter)

[2] for operation with mains choke

[3] always use a mains choke



Accessories

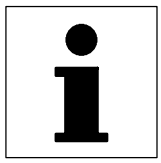
Type-specific accessories - 400 V mains voltage

12.4.2 Operation at increased rated power

Mains connection 3/PE AC 400 V - operation at increased rated power			
	8200 vector type		
	E82EV551K4B	**E82EV751K4B**	**E82EV222K4B**
Accessories	**Order number**		
E.l.c.b.	EFA3B06A	EFA3B06A	EFA3B10A
Fuse	EFSM-0060AWE	EFSM-0060AWE	EFSM-0100AWE
Fuse holder	EFH10001		
Mains choke	EZN3A1500H003	EZN3A1500H003 3)	EZ82ZL22234B 3)
RFI filter SD 1)	E82ZZ75134B200		E82ZZ22234B200
RFI filter LD 1)	E82ZZ75134B210		E82ZZ22234B210
Motor filter	E82ZM75134B		E82ZM22234B020
Brake resistor	ERBM470R100W		ERBM240R200W
DIN-rail assembly	E82ZJ002		
EMV support with clamp	E82ZWES		
EMV support with clip	E82ZWEK		
Swivel support	E82ZJ001		

Mains connection 3/PE AC 400 V - operation at increased rated power			
	8200 vector type		
	E82EV302K4B	**E82EV402K4B**	**E82EV752K4B**
Accessories	**Order number**		
E.l.c.b.	EFA3B16A EFA3B10A 2)	EFA3B16A	EFA3B25A
Fuse	EFSM-0160AWE EFSM-0100AWE 2)	EFSM-0160AWE	EFSM-0250AXH
Fuse holder	EFH10001		EFH10002
Mains choke	EZN3A0300H013	EZN3A0300H013 3)	ELN3-0150H024 3)
RFI filter SD 1)	E82ZZ55234B200		E82ZZ11334B200
RFI filter LD 1)	E82ZZ55234B210		E82ZZ11334B210
Motor filter	E82ZM40234B		E82ZM75234B
Brake resistor	ERBD180R300W	ERBD100R600W	ERBD068R800W
DIN-rail assembly	E82ZJ008		
EMV support with clamp	E82ZWES001		
EMV support with clip	E82ZWEK001		
Swivel support	E82ZJ005		E82ZJ006

1) only in combination with 8200 vector, types E82EVxxxKxB200 (without EMC filter)
2) for operation with mains choke
3) always use a mains choke



13 Application examples

13.1 Pressure regulation

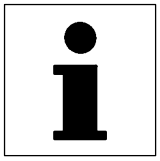
A centrifugal pump (square load characteristic) hold the pressure in a pipe system at a constant level (e.g. water supply of households or industrial premises).

Conditions

- Operation with a PLC (pressure setpoint selection, night reduction).
- Setting up operation at site possible.
- The pressure is lowered during the night. The pump works in an uncontrolled mode at low and constant speed.
- The output frequency must never fall below 10 kHz (dry running).
- Avoid pressure peaks in the system.
- Avoid mechanical resonances at approx. 30 Hz output frequency.
- Overheat motor protection.
- Error message to PLC.
- At site display of operating status and actual pressure value.
- At site pump stop.

Functions used

- Internal process controller for pressure control
  – Pressure setpoint from PLC (4 ... 20 mA)
  – Actual pressure value from sensor (0 ... 10 V)
- Manual/remote changeover for setting-up operation at site
  – Manual: Pressure setpoint via pushbutton with motor potentiometer function (UP/DOWN)
  – Remote: Pressure setpoint from PLC
- JOG speed for night reduction (activated via PLC).
- Dry-running protection (setpoint-independent min. speed).
- Smooth start along S ramp.
- Suppression of mechanical resonance with a skip frequency.
- PTC motor monitoring.
- Trip error message via digital output.
- Ready for operation via relay output.
- Configurable analog output for actual pressure value.
- Electrical controller inhibit (CINH).



Application examples

Application-specific configuration

- Motor parameter identification. (📖 7-31)

Code		Settings					IMPORTANT
No.	Name	Value	Meaning				
C0014↲	Control mode	3		V/f characteristic control V ~ f			Square-law characteristic with constant V_{min} boost
C0410			Digital signal source				
8	DOWN	1	E1	Inputs of pushbuttons “UP” and “DOWN”			
7	UP	2	E2				
1	JOG1/3	3	E3	JOG speed for night reduction			Activation of the JOG speed deactivates the process controller.
19	PCTRL1-OFF	3	E3	Process controller deactivation			
17	H/Re	4	E4	Changeover PLC/setting up operation at site			
C0412			Analog signal source				
1	Setpoint 1 (NSET1-N1)	1	X3/2I				Pressure setpoint (manual)
2	Setpoint 2 (NSET1-N2)	3	MPOT1-OUT	Motor potentiometer function			Pressure setpoint (remote)
5	Act. process controller value (PCTRL1-ACT)	4	X3/1U				Actual pressure value
C0145	Process controller setpoint source	0		Total setpoint (PCTRL1-SET3)			Main setpoint + additional setpoint
C0070	Process controller gain	→					If necessary, adapt to process → More information: 📖 7-33 ff.
C0071	Process controller readjustment time	→					
C0072	Differential component of process controller	→					
C0074	Process controller influence	100.0	0.0	{0.1 %}	100.0		
C0238↲	Frequency precontrol	-0-	-0-	No precontrol (only process controller)			Process controller has full influence
C0419	Free configuration of analog outputs		Analog signal source				
1	X3/62 (AOUT1-IN)	8		Actual process controller value			
C0037	JOG1	17					Derating to approx. 1/3 of rated motor speed
C0239↲	Minimum frequency limitation	10.00					Setpoint-independent minimum speed
C0182*	Integration time S-ramps	0.50 s		Smooth start			
C0625*	Skip frequency 1	30.00 Hz					
C0628*	Bandwidth of skip frequencies	10.00 %					ref. to C0625
C0119↲	Configuration PTC input/earth fault detection	4		PTC input active, TRIP set			
C0415	Free configuration of digital outputs						
1	Relay output K1	16		Ready for operation			
2	Digital output X3/A1	25		Trip error message			

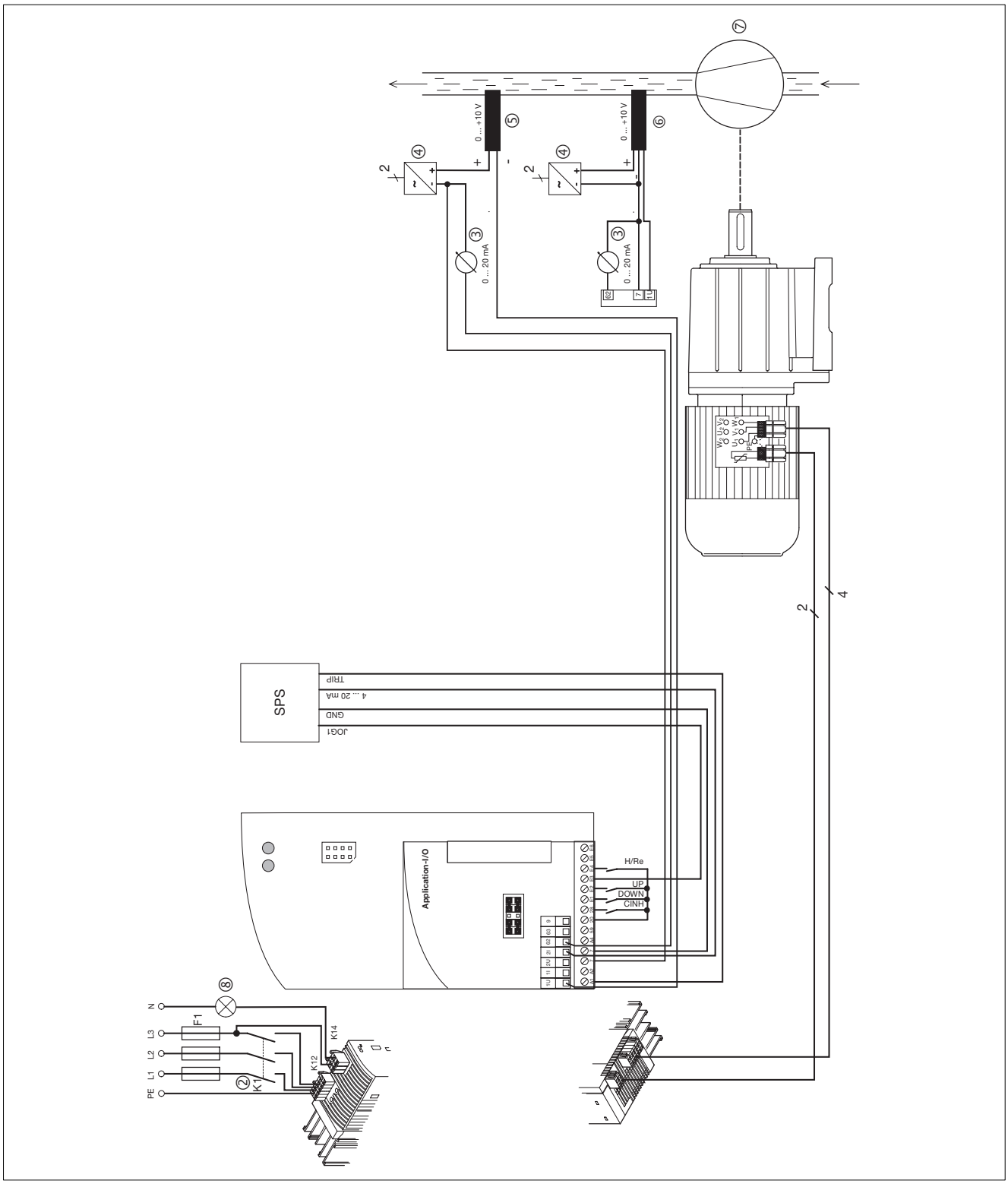
Jumper positions at application I/O

- Jumper A in position 7-9 (actual pressure value 0 ... 10 V at X3/1U)
- Remove jumper B (setpoint selection via master current at X3/2I), (see C0034)
- Jumper C in position 3-5 (actual pressure value output as current signal at X3/62)
- Jumper D in position 2-4 or 4-6, since X3/63 is not assigned.

Tip!

- With this example, the controller must be equipped with an application-I/O , because it required two analog inputs.
- If the pressure setpoint is selected via PC, keypad or JOG value instead of PLC, a standard I/O will be enough.

Application examples



② Mains contactor
③ Analog display for actual pressure value
④ External power supply
⑤ 2 conductor pressure sensor
⑥ 3 conductor pressure sensor
⑦ Pump
⑧ Light on = ready for operation

⑤, ⑥: use one pressure sensor only

Fig. 13-1 Principle wiring of a pressure regulation

13.2 Operation with medium-frequency motors

Medium-frequency asynchronous motors are used for high and controllable speeds. Possible applications are hobbing mills for wood machining, fans, vacuum pumps, concrete machinery, polishing drives.

Selection

- If the motor is to be braked quickly an external brake resistor is required to brake high moments of inertia. (📖 11-4)
- Set the speed setting range in a way that motors with self ventilation will always be sufficiently cooled (setting range as load function).

Application-specific configuration

Code	Name	Setting	Note
C0011	Max. output frequency		Set to the value indicated on the motor nameplate, but not higher than 400 Hz.
C0012	Acceleration time main setpoint		Setting must ensure acceleration below the current limit.
C0013	Deceleration time main setpoint		Setting must ensure that braking is still possible with or without an external brake resistor without getting the error message “Overvoltage (OU)”.
C0014	Operating mode	-2-	Linear characteristic (best operating behaviour for medium-frequency motors)
C0015	V/f rated frequency		📖 7-4
C0016	V_{min} boost		Setting depends on load at low frequencies. Recommendation: 0 %
C0018	Chopper frequency	-3-	16 kHz (smooth running only at 16 kHz) Observe power derating 📖 3-4
C0021	Slip compensation	0 %	Usually not required.
C0022	I_{max} limit (motor mode)		Set to rated motor current. 150 % with short acceleratin times and high moments of inertia.
C0023	I_{max}-limit in the generator mode	150 %	Lenze setting
C0106	Holding time for DCB	0 s	DC-injection brake must be off!
C0144	Chopper-frequency derating	-0-	No derating

13.3 Dancer position control (line drive)

The dancer position controls the material tension while the machine is running. The example describes the synchronisation of material web speed v_2 to line speed v_1 . This application requires an application-I/O.

Functions used

- Internal process controller as position controller.
- Selection of the line speed v_1 via X3/1U.
- Actual dancer position value of dancer potentiometer via X3/2U.
- Setting-up speed via X3/E3 as JOG value.
- Dancer position controller switch off via X3/E4 (external) or internally via Q_{min} (C0017) and C0415/1 = 6.

Application examples

Application-specific configuration

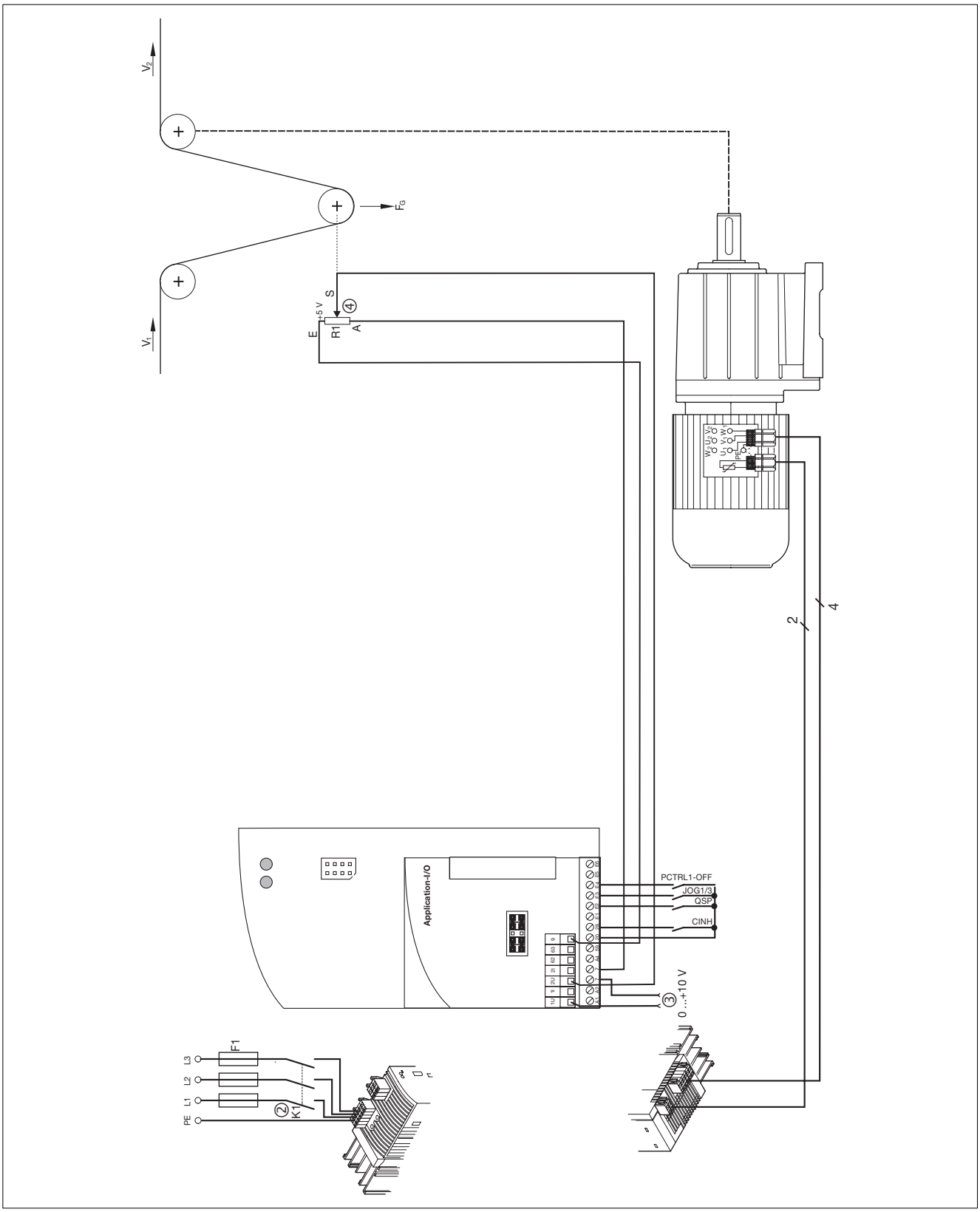
- Basic settings. (📖 5-2)
- Motor parameter identification. (📖 7-31)
- If necessary, calibration of setpoints and actual values to process variables. (📖 7-54)

Code		Settings		IMPORTANT
No.	Name	Value	Meaning	
C0410			Digital signal source	
1	JOG1/3	3	X3/E3 Setpoint setting	
4	QSP	2	X3/E2 Quick stop activation	
19	PCTRL1-OFF	4	X3/E4 Dancer position controller switch off	
C0412			Analog signal source	
1	Setpoint 1 (NSET1-N1)	1	X3/1U	Line speed v_1
5	Act. process controller value (PCTRL1-ACT)	4	X3/2U	Actual dancer position value
C0037	JOG1	20.00		Fixed set-up speed v_1 for material guidance, individually adjustable.
C0070	Process controller gain	1.00		Adaptation to process More information: 📖 7-33
C0071	Process controller readjustment time	100		
C0072	Differential component of process controller	0.0		
C0074	Process controller influence	10.0 %		
C0105	Deceleration time QSP	approx. 1 s		E.g. as emergency stop function. The settings must ensure braking of the controller to standstill within a very short time. Check whether the application needs an external brake resistor.
C0145	Process controller setpoint source	-1-	C0181 (PCTRL1-SET2)	
C0181*	Process controller setpoint 2 (PCTRL1-SET2)	Value of C0051	Position the dancer as required, C0051 = read actual dancer position value.	C0181 should not be set to “0”, because the position setpoint would be generated from the mains setpoint.
C0239↲	Lowest frequency limit	0.00 Hz		Direction of rotation cannot be changed via the process controller.
C0238↲	Frequency precontrol	-1-	Precontrol (total setpoint + process controller) Total setpoint (PCTRL1-SET3) = Main setpoint + additional setpoint	Process controller has limited influence.

Adjustment

Set C0070, C0071, C0072 in a way that if the dancer changes its actual position, its original position can be reached quickly and without excessive overshooting.

1. X3/E4 = HIGH (process controller stop), C0072 = 0 (no influence).
2. Set C0070.
3. X3/E4 = LOW, C0072 = 0 (no influence).
4. Set C0071.
5. Set C0072.



② Mains contactor
③ Main setpoint ~V_1
④ Dancer potentiometer

Fig. 13-2 Principle wiring of a dancer position control

13.4 Speed control

Tip!

Lenze three-phase AC motors and Lenze geared motors are available with Lenze pulse encoder ITD21 (512/2048 increments, HTL output signals). Thus a two-track speed feedback (tracks A and B) can be used with the application I/O function module.

Example

Speed control with inductive, single track 3-conductor sensor

The speed control is to compensate the difference between actual speed and speed setpoint caused by load (motor and generator mode).

The motor speed is detected by an inductive sensor (e.g. gear, metalic fan wheel, cam). The sensor can detect the speed either directly at the motor or in the machine.

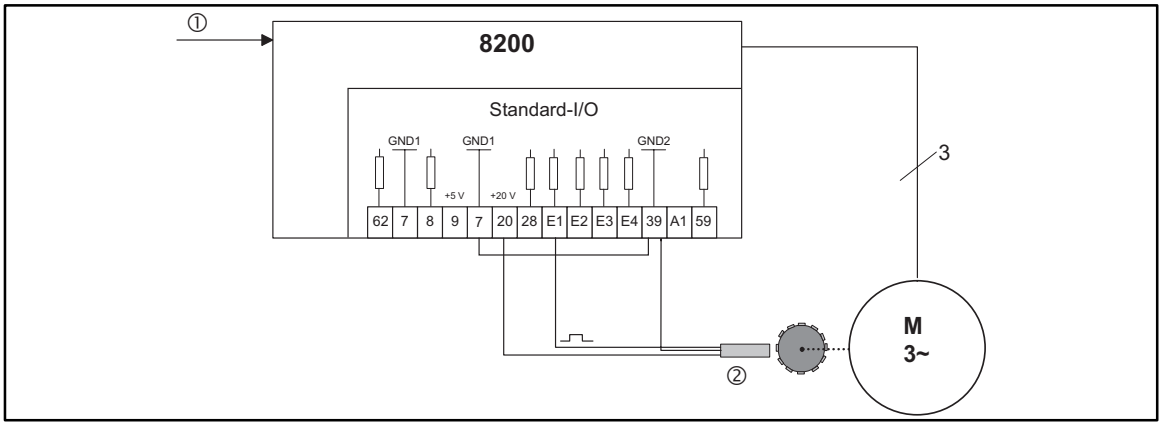


Fig. 13-3 Speed control with 3-conductor sensor

① Setpoint
② 3-conductor sensor

8200: 8200 motec or 8200 vector

Speed sensor requirements

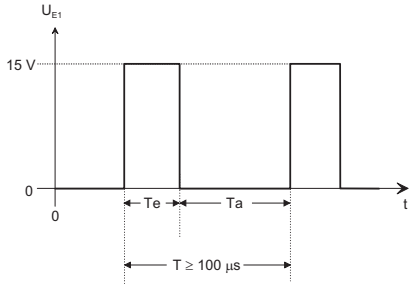
- The maximum frequency of inductive sensors is usually between 1 and 6 kHz, depending on its design.
- At the detection point, the number of attenuation cams per revolution must ensure an output frequency of the sensor as high as possible.
- The control dynamics will be sufficient if the output frequency ($f_{act.}$) is > 0.5 kHz at rated speed.
- If the current consumption of the sensor is not higher than the value permitted at X3/20, a 3-conductor sensor can be directly connected to the controller.

Output frequency calculation

$$f_{ist} = \frac{z \cdot n}{60}$$

z = Number of cams per revolution
n = Speed at detection point in [min^{-1}]
$f_{act.}$ = Output frequency of the sensor in [Hz]

Permissible pulse shapes at X3/E1

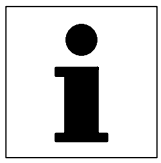


- Te = on (HIGH)
- Ta = off (LOW)

Permissible level range:
- LOW: 0 ... +3 V
- HIGH: +12 ... +30 V

Permissible range of the scanning ratio:
- Te : Ta = 1 : 1 to Te : Ta = 1 : 5

Tip!
Every digital speed sensor which meets the requirements can be used.



Application-specific configuration

- Basic settings (📖 5-2)

Code		Settings		IMPORTANT
		Value	Meaning	
C0410	Free configuration of digital input signals			Configuration frequency input X3/E1
24	DFIN1-ON	-1-		
C0412	Free configuration of analog input signals		Analog signal source	
5	Actual process controller value (PCTRL1-ACT)	-2-		
C0011	Maximum output frequency		$(1 + \frac{\text{C0074 [\%]}}{100}) \cdot \frac{p}{60} \cdot n_{max}$	p = No. of pole pairs n_{max} = Max. speed [min^{-1}]
C0014↲	Control mode	-2	V/f-characteristic control	Dynamics in control mode “vector control” to low
C0019	Operating threshold of auto DCB	approx. 0.5 Hz		Adaptation to the application
C0021	Slip compensation	0 %		No slip compensation with controlled compensation
C0035*↲	Selection DCB	-1-	Brake current selection under C0036	
C0036	Voltage/current DCB	50 ... 100 %		Adaptation to the application
C0070	Process controller gain	1 ... 15		5 = typical
C0071	Process controller readjustment time	50 ... 500 ms		100 ms = typical
C0072	Differential component of process controller	0		not active
C0074	Process controller influence	2 ... 10 %	$S_N = \frac{n_0 - n_N}{n_0}$ Example $S_N = \frac{1500 - 1400}{1500} = 6.67\ \%$	• Adaptation to the application • 200% rated motor slip (2 * S_r) adjustment
C0106	Holding time auto DCB	1 s		• Guide value • Afterwards the controller sets controller inhibit
C0181*	Process controller setpoint 2 (PCTRL1-SET2)			• Adaptation to the application • Selection with keypad or PC • 📖 7-35 : More possibilities for setting the setpoint
C0196*↲	Activation of auto–DCB	-1-	DCB active at C0050 < C0019 and setpoint < C0019	
C0238↲	Frequency precontrol	-1-		With frequency precontrol
C0239↲	Lowest frequency limit	0 Hz		Unipolar, no change of direction of rotation
C0425↲*	Configuration frequency input X3/E1 (DFIN1)			Set C0425 that the frequency coming from the encoder is lower than f_{max}
C0426*	Gain frequency input X3/E1, X3/E2 (A) (DFIN1-GAIN)	100	-1500.0 {0.1 %} 1500.0	$C0426 = \frac{f_r(C0425)}{\frac{n_{max}}{60\ s} \cdot inc/rev} \cdot \frac{C0011 - f_s}{C0011} \cdot 100\ \%$ • n_{max} = Maximum process speed of motor in min^{-1} • f_s = Slip frequency in Hz

Application examples

Adjustment (see example in Fig. 13-3)

Conditions

- A 4-pole motor is to be operated up to n_{max} = 1500 min^{-1} . The motor has the following data:
  – Rated speed n_r = 1390 min^{-1}
  – Rated frequency f_r = 50 Hz
  – Slip s_r = 7.3 %
  – Slip frequency f_s = 3.7 Hz
- The pulse encoder delivers 6 increments/revolution (inc/rev).
  – The maximum frequency at X3/E1 at maximum speed is:

$$\frac{1500}{60\ s} \cdot 6 = 150\ Hz$$

- Process controller influence (C0074) setting to 200 % rated slip:
  – C0074 = 14.6 %
- Calculation of maximum output frequency (C0011):

$$\left(1 + \frac{C0074\ [\%]}{100}\right) \cdot \frac{p}{60} \cdot n_{max}\ [min^{-1}] = 1.15 \cdot \frac{2 \cdot 1500}{60} = 57.5\ Hz$$

Adjustment of frequency input X3/E1

- C0425 = -0-
  – Normalisation frequency =100 Hz
  – Maximum frequency = 300 Hz
- Activation of frequency input with C0410/24 = 1.
  – Ensure that no other digital signal is assigned to E1 (no double assignment)!
- Assign the actual process controller value to the frequency input under C0412 (C0412/5 = 2)
- Gain C0426
  – The input frequency at X3/E1 is normalised to the value of the preselected frequency (100 Hz), i.e. internally 100 Hz correspond to the output frequency set under C0011.
  – C0426 must be recalculated after every change of C0011.

$$C0426 = \frac{f_N\ (C0425)}{\frac{n_{max}}{60\ s} \cdot inc/rev} \cdot \frac{C0011 - f_s}{C0011} \cdot 100\ \% = \frac{100}{150} \cdot \frac{57.5 - 3.7}{57.5} \cdot 100\ \% = 62.4\ \%$$

Tip!

If the number of increments per revolution is not known, you have to find out the gain to be set by experiment:

1. Set C0238 = 0 or 1.
2. Set the drive to the maximum required output frequency. The output frequency is now determined by the frequency precontrol.
3. Use C0426 to set the gain in a way that the actual value (C0051) equals the setpoint (C0050).

13.5 Group drive (operation with several motors)

Several motors can be connected to the controller in parallel. The sum of the individual motor currents must not exceed the rated controller current.

Installation

- The motor cable is wired in e.g. a terminal box.
- Every motor must be equipped with a thermostat (NC contact). The series connection must be connected to X2/T1 and X2/T2 using a separate cable.
- Only use shielded cables. (📖 4-19) . Connect the shield with PE with a surface as large as possible. (📖 4-23) .
- Resulting cable lengths:

$$I_{res} = \text{Sum of all motor cable lengths} \times \sqrt{\text{No. of motor cables}}$$

Application-specific configuration

- Basic settings. (📖 5-2)
- Control mode C0014 = -2- evtl. -4-. (📖 7-2)
- PTC input C0119 = -1-. (📖 7-52)

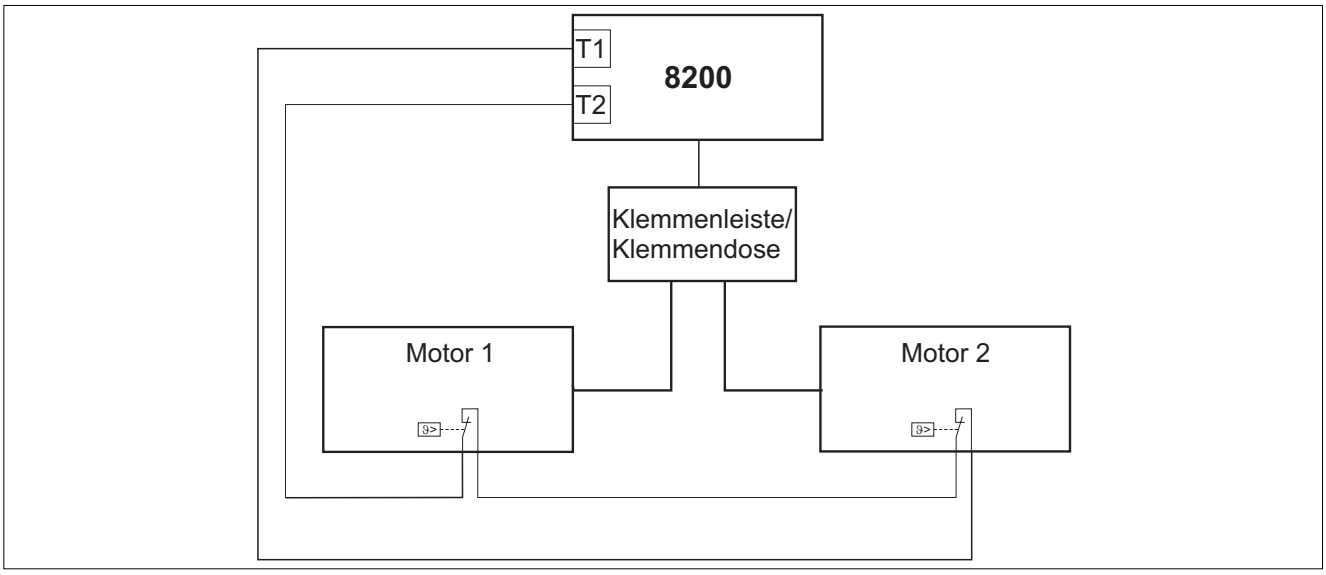
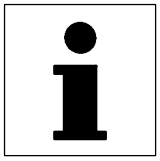


Fig. 13-4 Basic structure of a group drive

Tip!

You can monitor motor cables and operating elements using the motor phase failure detection. (📖 14-40, C0597)



13.6 Sequential circuit

Two refrigeration compressors supply several refrigeration devices which are switched on and off in irregular intervals.

Tip!

With the function module application I/O it is not necessary to use the external time delay element of Fig. 13-5. The time delay for the relay output K1 is set under C0423/1. The time delay avoids that compressor 2 is switched on when the actual value fluctuates just a little bit.

Conditions

- Compressor 1 is controlled by means of a 8200 motec or 8200 vector.
- Compressor 2 is connected to the mains and is switched on and off depending on the consumption.
- The pressure setpoint of the process is selected as fixed value.

Functions used

- Controller enable/inhibit to start and stop
- Process controller
- Fixed frequency
- Programmable relay output
- Adjustable thresholds
- Parameter set changeover

Application-specific configuration

- Basic settings. (📖 5-2)
- Process controller configuration:
  – Process controller optimisation (📖 7-33)
  – Process controller has full influence: C0238 = -0-, C0074 = 100 %
  – Process controller setpoint source = Total setpoint: C0145 = -0-
  – Process setpoint = JOG frequency JOG1 (in PAR1 and PAR2 continuously active via X3/E1): C0037 = 50 Hz
- Adaption of parameter set 1 (PAR1) to application:
  – Continuous activation of X3/E1 (LOW active): C0411 = -1-
  – Threshold for compressor 2: C0017 = 45 Hz.
  – Connection of compressor 2 via relay: C0415/1 = 6.
- Adaptation of parameter set 2 (PAR2) to application:
  – Continuous activation of X3/E1 (LOW active): C0411 = -1-
  – Threshold for disconnection of compressor 2: C0010 = 15 Hz (minimum frequency).
  – Disconnection of compressor 2 via relay: C0415/1 = 24.
  – Relay output inversion: C0416 = -1-.
- PAR changeover (PAR1 ⇔ PAR2) via X3/E2: C0410/13 = 2.

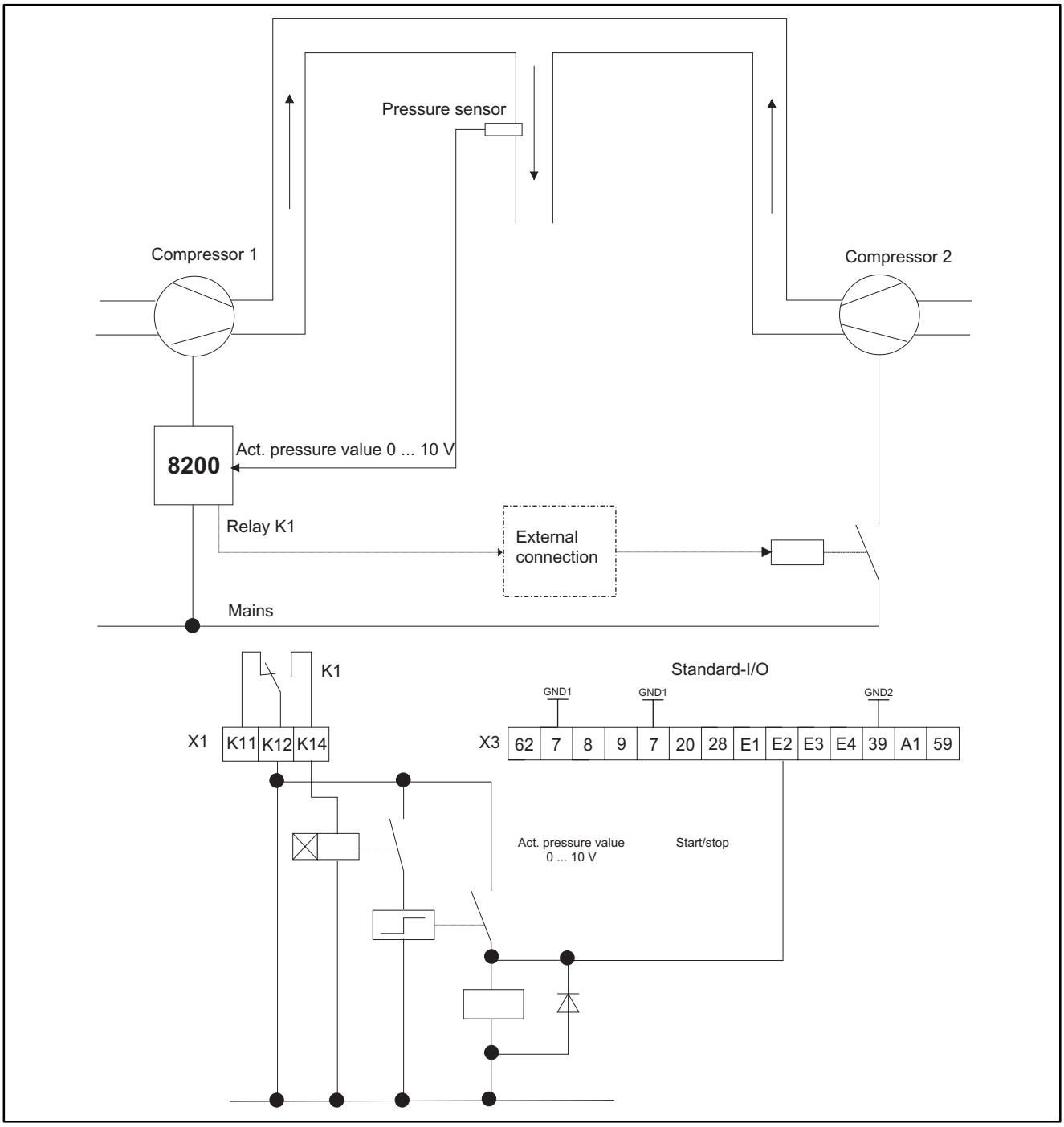


Fig. 13-5 Principle of sequential circuits

8200: 8200 motec oder 8200 vector

Function: Fig. 13-5
1. Activate the threshold 45 Hz K1 in PAR1.
2. If K1 remains picked up, K2 is connected.
3. Compressor 2 is connected via K3. At the same time the parameter set is changed via X3/E2 (process controller is not affected)-
4. K1 picks up when the minimum frequency is reached (depending on load). After time K1T is over, K2 picks up again.
5. Compressor 2 is switched off. The parameter set is changed backed to PAR1.
• K1T debounces the switching point of compressor 2 (adapt dely time to process).

13.7 Setpoint summation (basic and additional load operation)

Conveyors, pumps, etc. are often operated at a speed which is increased if necessary.

The speed is set by selection of a main and additional setpoint. The setpoints can have different sources (e.g. PLC or setpoint potentiometer). The controller adds both analog setpoints and increases the motor speed accordingly.

For smooth acceleration, acceleration and deceleration ramps of both setpoints can be adjusted. The main setpoint ramps can have a S-shape.

Application-specific configuration

- Basic settings. (📖 5-2)
- Setpoint summation configuration: Assign the setpoints to be added to C0412/1 and C0412/3. (📖 7-38)
- If necessary, adjust the main setpoint ramps under C0182. (📖 7-16)

Tip!

- Possible ways to select a setpoint: (📖 7-21 ff)
- The additional setpoint can be displayed under C0049 (alternatively: C0412/3 = 0).
- With controllers with standard I/O, the main setpoint must be selected via PC, keypad, JOG frequency or the function ”Motor potentiometer” because there is only one analog input available.
- If you use an application I/O, the additional setpoint can be switched on and off during operation ((C0410/31 ≠ 0)

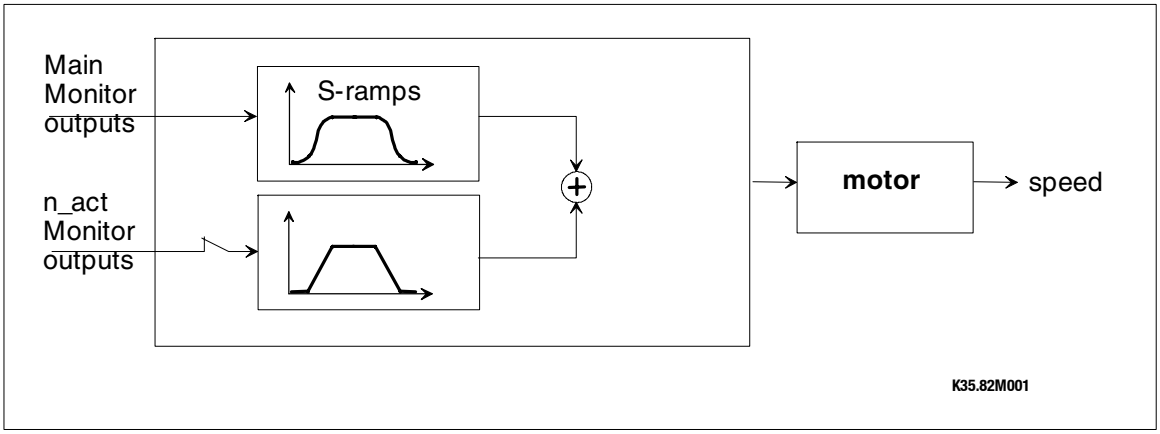


Fig. 13-6 Principle of setpoint summation

13.8 Power control (torque limitation)

The power control (torque limitation) generates a constant mass flow when moving masses which change their specific weight, usually air exposed to different temperatures.

Torque limit and speed setpoint are selected for the controller. The torque limit will not be exceeded because the speed is automatically adapted if the specific weight changes. The speed setpoint must be set in a way that it does not limit the speed adaption.

Control mode "Sensorless torque control" (C0014 = 5):
With sensorless torque contro, a constant torque is preselected. A defined speed limit must not be exceeded (speed limitation).

Application-specific configuration

- Basic settings. (📖 5-2)
- Control mode selection: C0014 ≠ 5! (📖 7-2)
- Torque limit value configuration: Assign C0412/6.
- Speed setpoint configuration: Assign C0412/1.

Tip!

- Set the max. output frequency C0011 for the max. permissible speed. Thus the speed does not have a limiting effect, the drive is constantly running at the set torque limit.
- The torque limit can be indicated under C0047.
- Possibilities to select speed and torque limits: (📖 7-21 ff)
- With standard I/O, the speed setpoint must be selected via PC, keypad, JOG frequency or the function "Motor potentiometer" because there is only one analog input available.
- Acceleration time and moment of inertia require a torque reserve.
- Power control should not be used with group drives.

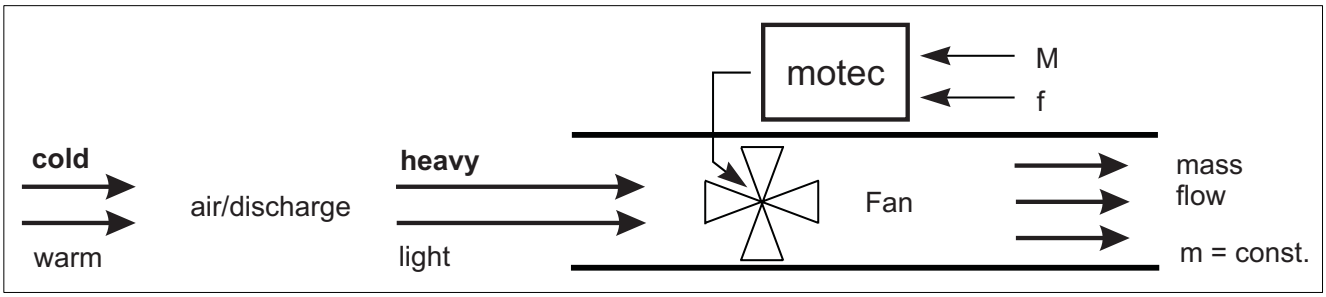
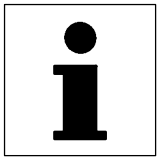


Fig. 13-7 Power control principle example: Fan

8200: 8200 motec or 8200 vector



Application examples

14 Appendix

14.1 Signal flow charts

How to read signal flow charts

Symbol	Meaning
	Signal connection in Lenze setting
	Fixed signal connection
	Analog input can be freely connected with an analog output which has the same labelling.
	
	Analog output
	
	Analog input to be used to connect the motor potentiometer output
	Motor potentiometer output
	Digital input can be freely connected with a digital output which has the same labelling.
	
	Digital output
	

14.1.1 Controller with standard I/O

14.1.1.1 Overview over signal processing

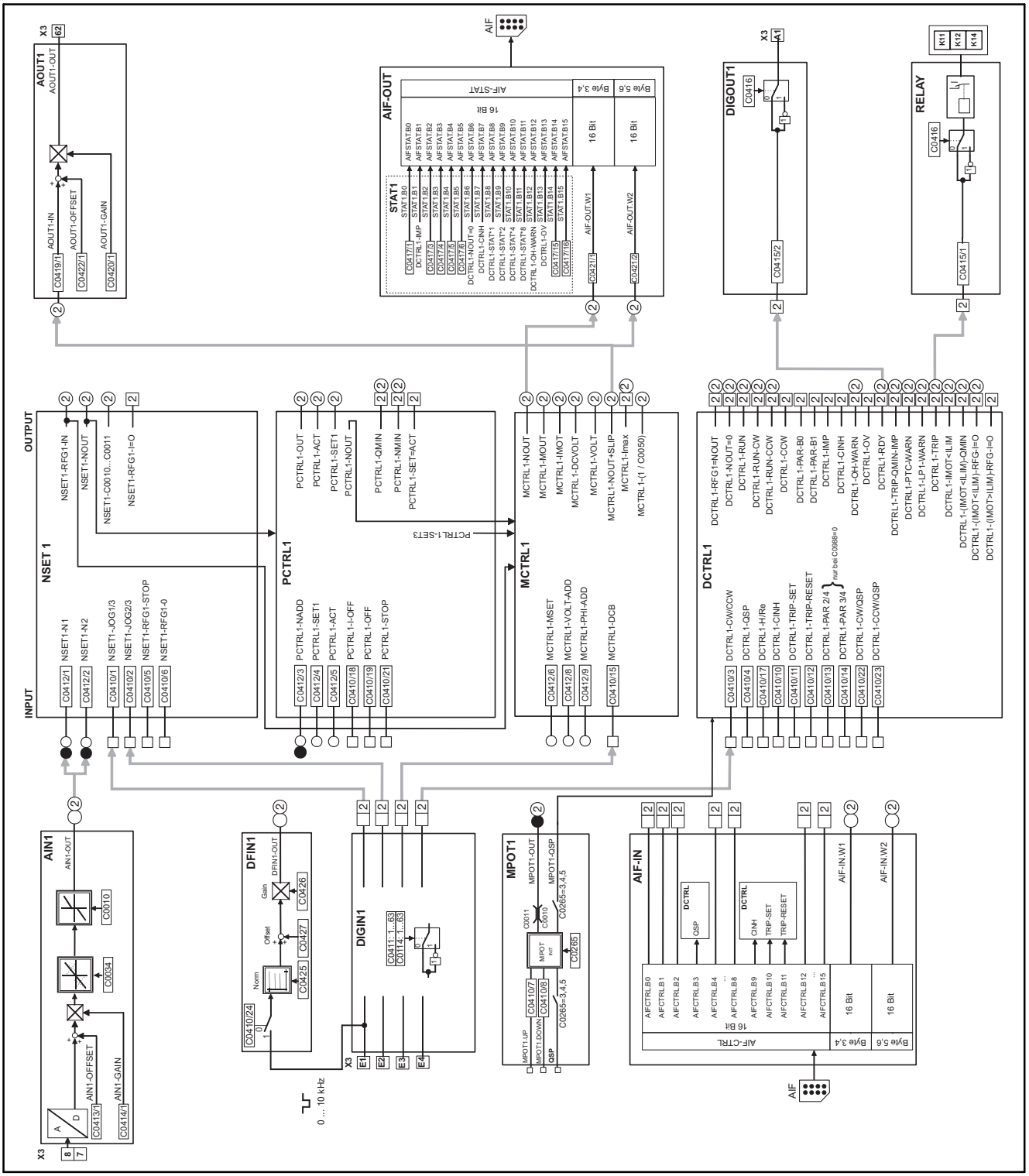


Fig. 14-1 Overview over signal processing with standard-I/O

14.1.1.2 Process controller and setpoint processing

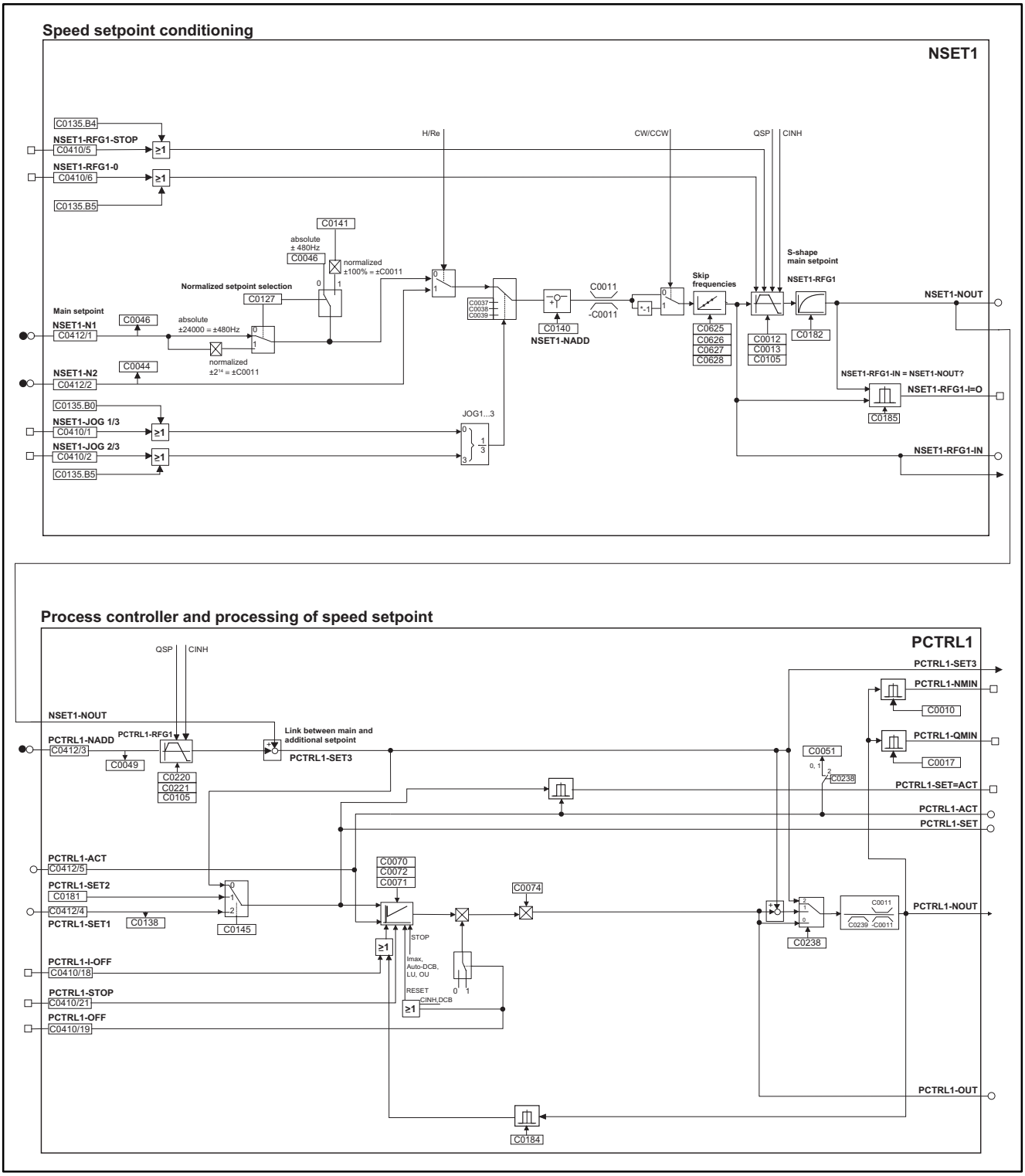


Fig. 14-2 Process controller and setpoint processing with standard I/O

14.1.1.3 Motor control

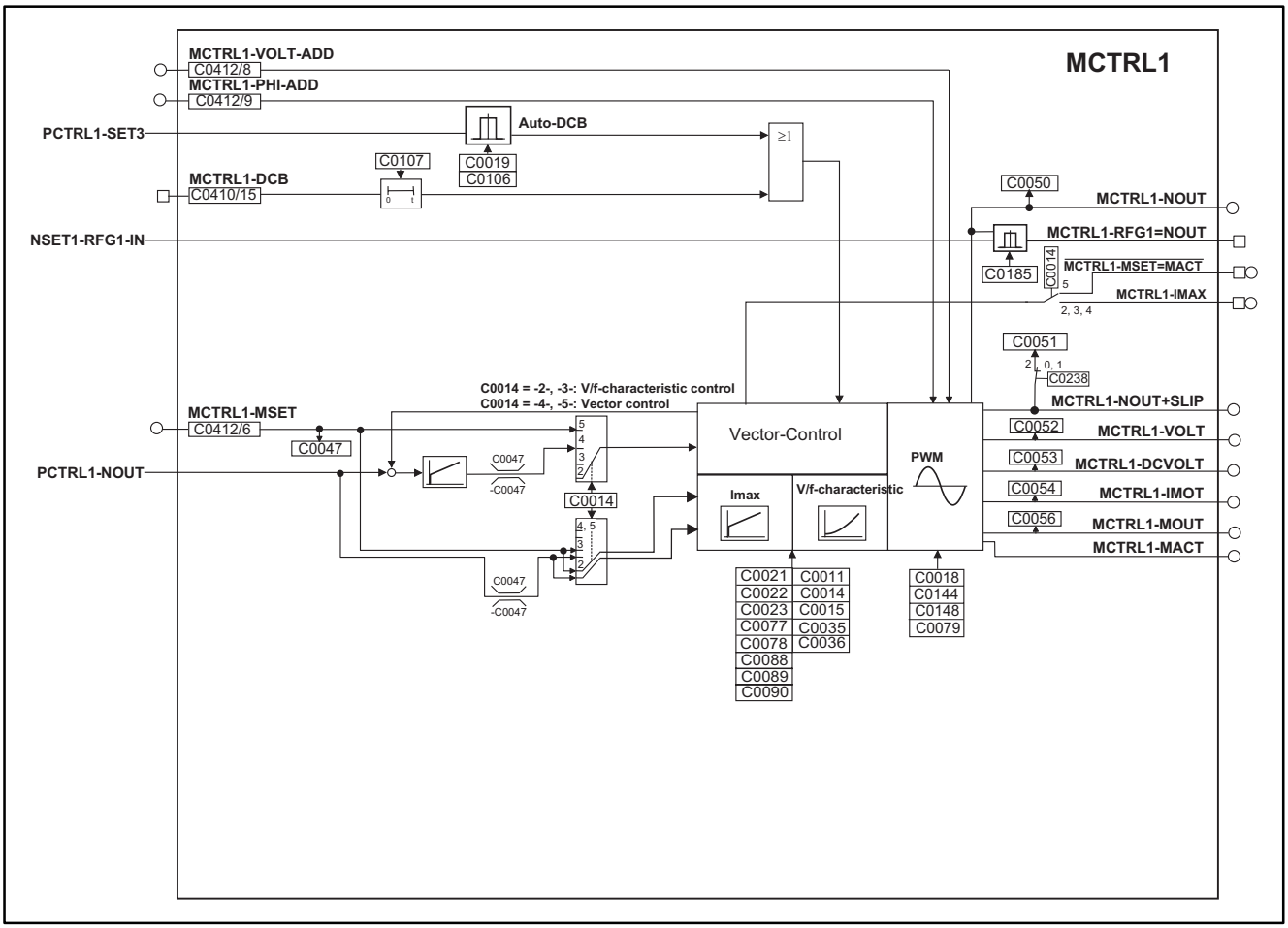


Fig. 14-3 Motor control with standard I/O

14.1.2 Controller with application I/O

14.1.2.1 Overview over signal processing

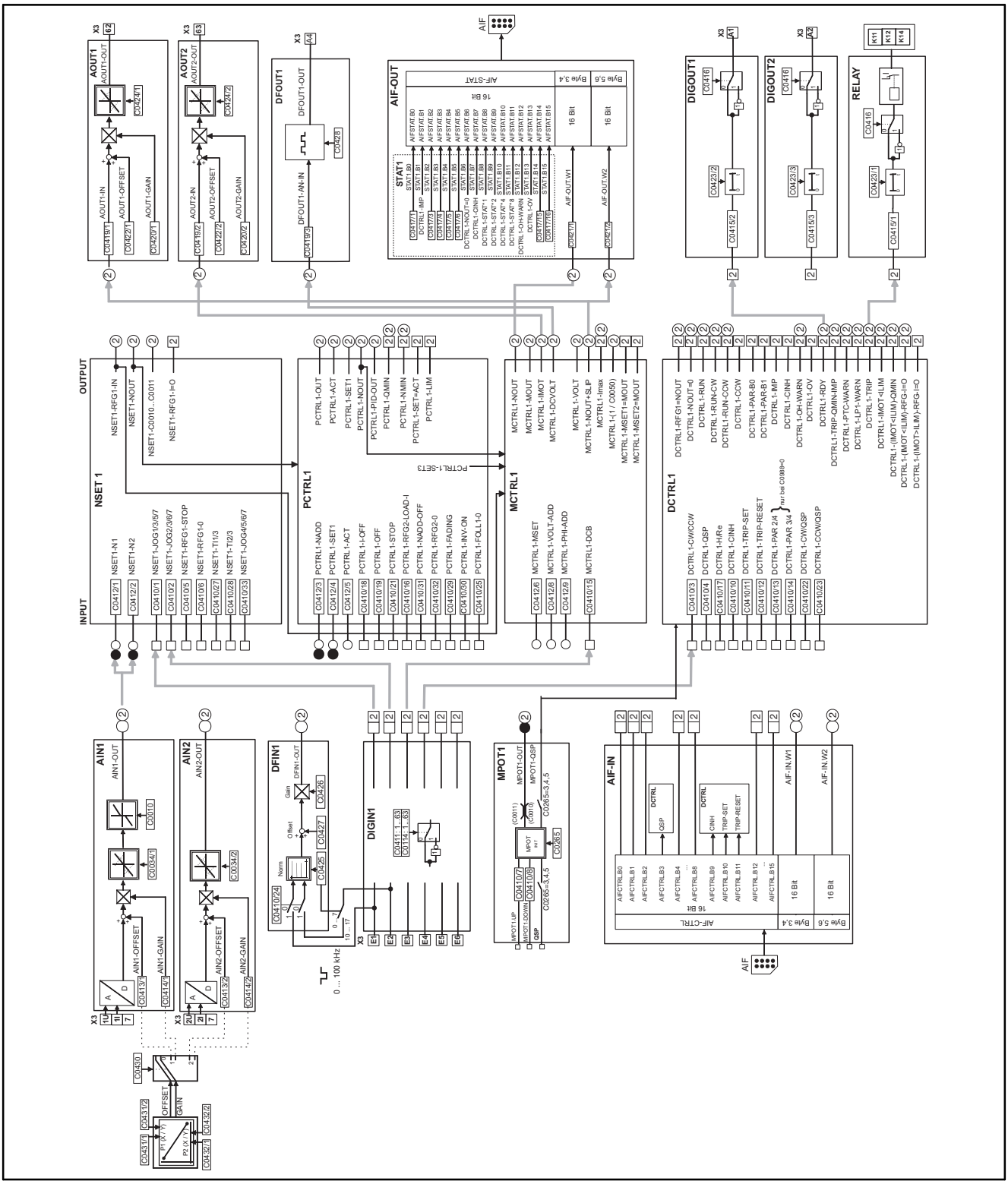


Fig. 14-4 Overview over signal processing with application I/O

14.1.2.2 Process controller and setpoint processing

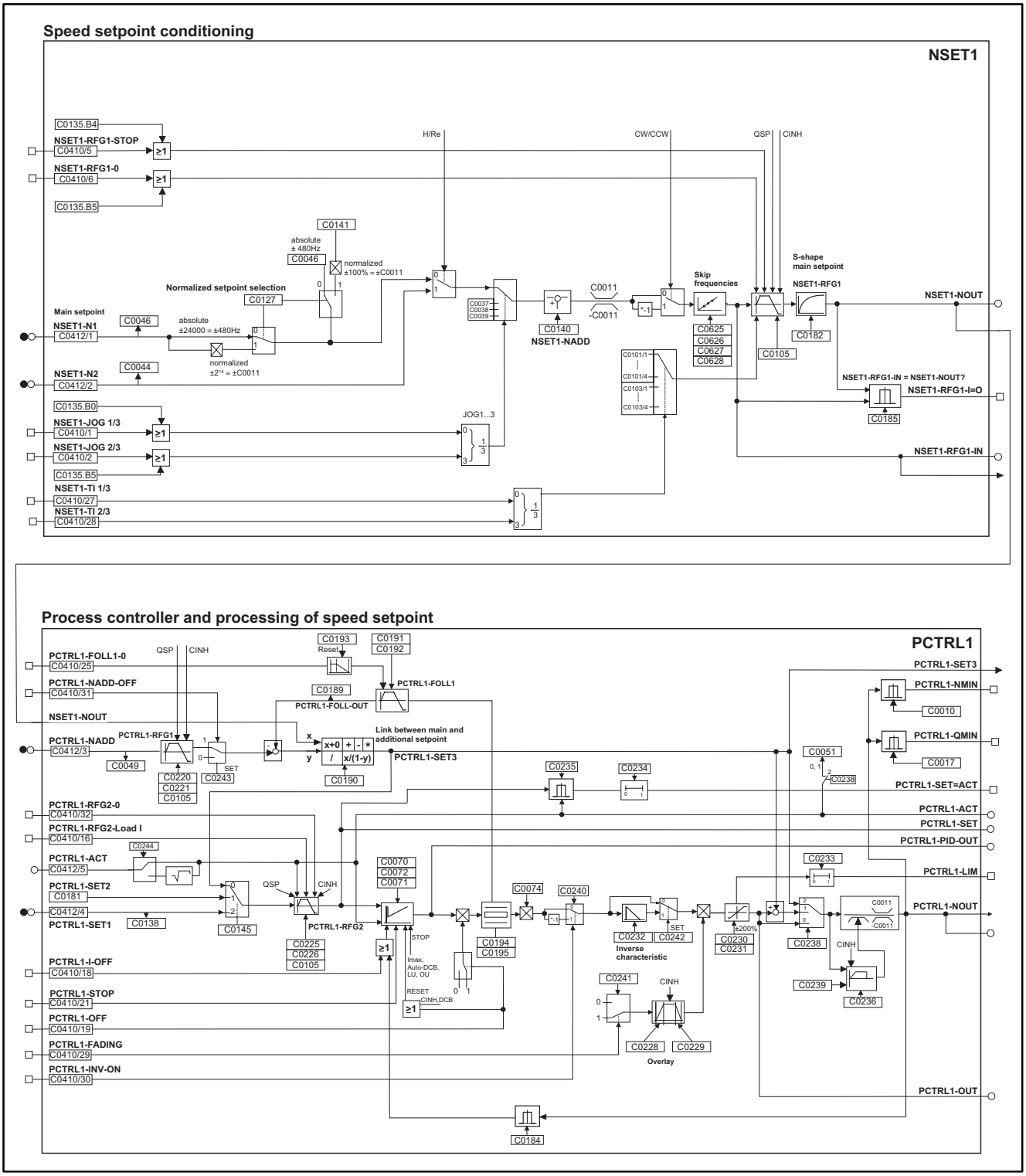


Fig. 14-5 Process controller and setpoing processing with application I/O

14.1.2.3 Motor control

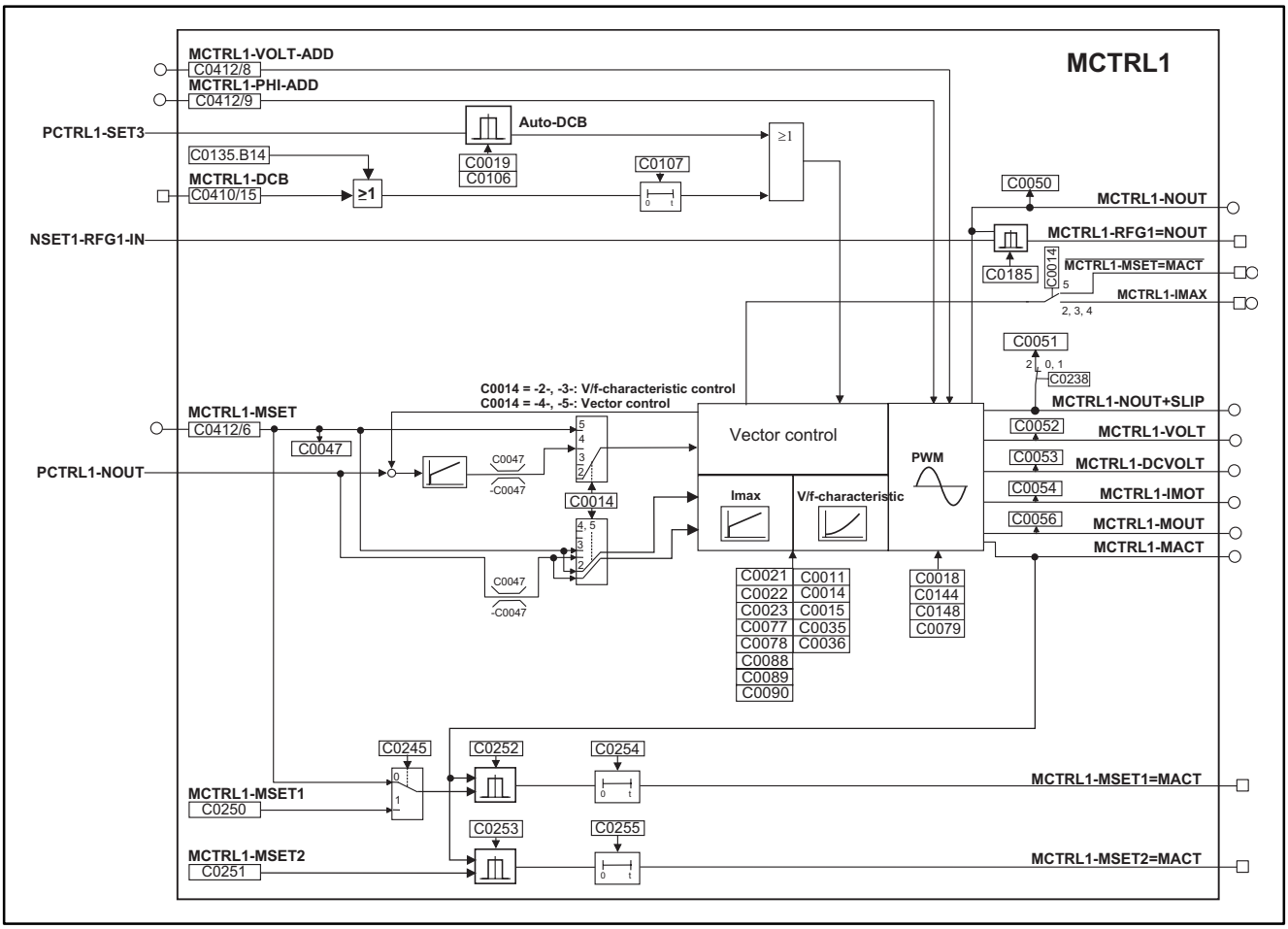
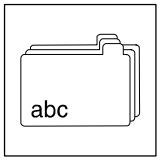
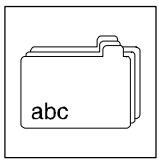


Fig. 14-6 Motor control with application I/O



Appendix

Signal flow charts - Application I/O



14.2 Code table

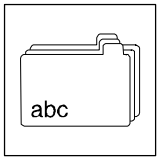
Tip!

This code table also applies to the 8200 motec as of version E82MV ... Vx1x!

- The codes are sorted according to their numbers and can be used as reference.
- Some functions are freely configurable. We recommend the ”free configuration” since this options guarantuees optimum flexibility in parameterisation.
- The cross references under “IMPORTANT” indicate where to find detailed code descriptions.
- How to read the code table:

Column	Abbreviation	Meaning	
Code	Cxxxx	Code Cxxxx	• The parameter value of a code can be different in every parameter set. • Parameter value accepsted immediately (ONLINE)
	Cxxxx 1	Subcode 1 of Cxxxx	
	Cxxxx 2	Subcode 2 of Cxxxx	
	Cxxxx*	The parameter value of a code is the same in all parameter sets	
	Cxxxx↵	Changed parameters will be accepted after pressing ENTER	
	[Cxxxx]	Changed parameters will be accepted after pressing ENTER if the controller is inhibited	
	(A)	Code, subcode or selection are only available when using an application-I/O	
Name		Code name	
Lenze		Lenze setting (value set at delivery or after overwriting of C0002 with Lenze setting)	
	→	Further information can be obtained from ”IMPORTANT”	
Selection	1 {1 %} 99	Min. value {Steps/unit} Max. value	
IMPORTANT	- 📖 Page x	Brief, important explanations Indicates where to find more detailed information	

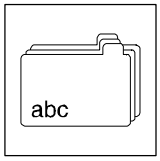
Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0001↵	Setpoint source selection (operating mode)	-0-	Setpoint source	• C0001 = 0 ... 3: The device can be controlled via terminals or PC/keypad • Check the assignment of setpoint source and analog signal under C0412 • AIF bus modules are, for instance, INTERBUS 2111, PROFIBUS-DP 2133, System bus (CAN) 2171, LECOM A/B/LI 2102 **C0001 = 3 must be set to select a setpoint via a process data channel of an AIF bus module! Otherwise the process data will not be evaluated!**	📖 7-21
		-0-	Other sources as parameter channel/process data channel of AIF		
		-1-	Parameter channel of an AIF bus module		
		-2-	Other sources as parameter channel/process data channel of AIF		
		-3-	Process data channel of an AIF bus module (AIF-IN.W1 or AIF-IN.W2)		



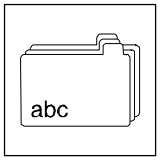
Appendix

Code table

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
[C0002]*	Parameter set transfer	-0-	-0-	Function executed		📖 7-56
			Parameter sets of the controller			
			-1-	Lenze setting ⇨ PAR1	Overwrite the selected parameter set with the settings stored as default settings.	
			-2-	Lenze setting ⇨ PAR2		
			-3-	Lenze setting ⇨ PAR3		
			-4-	Lenze setting ⇨ PAR4		
			-10-	Keypad ⇨ PAR1 ... PAR4	Overwrite all parameter sets with the keypad data	
			-11-	Keypad ⇨ PAR1	Overwrite one parameter set with the keypad data	
			-12-	Keypad ⇨ PAR2		
			-13-	Keypad ⇨ PAR3		
			-14-	Keypad ⇨ PAR4		
			-20-	PAR1 ... PAR4 ⇨ Keypad	Copy all parameter sets to the keypad	
			Parameter sets of a function module to FIF		Not for standard I/O or system bus (CAN)	
			-31-	Lenze setting ⇨ FPAR1	Overwrite the selected parameter set of the function module with the settings stored as default setting.	
			-32-	Lenze setting ⇨ FPAR2		
			-33-	Lenze setting ⇨ FPAR3		
			-34-	Lenze setting ⇨ FPAR4		
			-40-	Keypad ⇨ FPAR1 ... FPAR4	Overwrite all parameter sets of the function module with the keypad data	
			-41-	Keypad ⇨ FPAR1	Overwrite one parameter set of the function module with the keypad data	
			-42-	Keypad ⇨ FPAR2		
			-43-	Keypad ⇨ FPAR3		
			-44-	Keypad ⇨ FPAR4		
			-50-	FPAR1 ... FPAR4 ⇨ Keypad	Copy all parameter sets of the function module to the keypad	
			Parameter sets of controller + function module to FIF		Not for standard I/O or system bus (CAN) **If you use an application I/O the parameter sets of controller and application I/O must always be transferred together!**	
			-61-	Lenze setting ⇨ PAR1 + FPAR1	Overwrite some parameter sets with the settings stored as default settings	
			-62-	Lenze setting ⇨ PAR2 + FPAR2		
			-63-	Lenze setting ⇨ PAR3 + FPAR3		
			-64-	Lenze setting ⇨ PAR4 + FPAR4		
			-70-	Keypad ⇨ PAR1 ... PAR4 + FPAR1 ... FPAR4	Overwrite all parameter sets with the keypad data	
			-71-	Keypad ⇨ PAR1 + FPAR1	Overwrite some parameter sets with the keypad data	
			-72-	Keypad ⇨ PAR2 + FPAR2		
			-73-	Keypad ⇨ PAR3 + FPAR3		
			-74-	Keypad ⇨ PAR4 + FPAR4		
			-80-	PAR1 ... PAR4 + FPAR1 ... FPAR4 ⇨ Keypad	Copy all parameter sets to the keypad	
C0003*↲	Non-volatile parameter saving	-1-	-0-	Do not save parameter in EEPROM	Data loss after mains disconnection	
			-1-	Always save parameter in EEPROM	• Active after every main connection • Cyclic parameter changes via bus module are not allowed.	
C0004*↲	Bar-graph display	56		All codes possible 56 = controller load (C0056)	• Bargraph display indicates the selected in % after power on • Range -180 % ... +180 %	



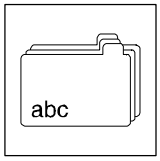
Code		Possible settings						IMPORTANT	
No.	Name	Lenze	Selection						
C0005↲	Fixed configuration analog input signals	-0-						• **Change under C0005 will be copied to the corresponding subcode of C0412. Free configuration under C0412 sets C0005 = 255!** • Configurations with X3/E1: – Additionally activate the frequency with C0410/24 = 1. – Otherwise the frequency input will not be evaluated!	🕮 7-38
			-0-	Setpoint for speed control via X3/8 or X3/1U, X3/1I					
			-1-	Setpoint for speed control via X3/8 with setpoint summation via frequency input X3/E1					
			-2-	Setpoint for speed control via frequency input X3/E1 with setpoint summation via X3/8					
			-3-	Setpoint for speed control via frequency input X3/E1, torque limitation via X3/8 (power control)					
			-4-	Setpoint for sensorless torque control via X3/8, speed limitation via C0011				Only active if C0014 = -5- (torque selection)	
			-5-	Setpoint for sensorless torque control via X3/8, speed limitation via frequency input X3/E1					
			-6-	Controlled operation; setpoint via X3/8 with digital feedback via X3/E1					
			-7-	Controlled operation; setpoint via frequency input X3/E1 with analog feedback via X3/8					
			-200-	All digital and analog input signals come are sent via the bus function module to FIF (e.g. INTERBUS, PROFIBUS-DP)				Sets C0410/x = 200 and C0412/x = 200	
			-255-	Free configuration under C0412				Display only Do not change C0005 since settings under C0412 can be lost	
C0007↲	Fixed configuration of digital inputs	-0-		E4	E3	E2	E1		🕮 7-45
			-0-	CW/CCW	DCB	JOG2/3	JOG1/3	• **Change under C0007 will be copied to the corresponding subcode of C0410. Free configuration under C0410 sets C0007 = -255-!** • CW = CW rotation • CCW = CCW rotation • DCB = DC-injection brake • PAR = Changeover (PAR1 ⇔ PAR2) PAR1 = LOW; PAR2 = HIGH – The corresponding terminal must be assigned to the function "PAR" in PAR1 and PAR2. – Configurations with "PAR" are only allowed if C0988 = -0- • JOG1/3, JOG2/3 = Selection of fixed setpoints JOG1: JOG1/3 = HIGH, JOG2/3 = LOW JOG2: JOG1/3 = LOW, JOG2/3 = HIGH JOG3: JOG1/3 = HIGH, JOG2/3 = HIGH • QSP = Quick stop • TRIP set = external fault • UP/DOWN = Motor potentiometer functions • H/Re = Hand/remote changeover • PCTRL1-I-OFF = Switch-off process controller I component • DFIN1-ON = Digital frequency input 0 ... 10 kHz • PCTRL1-OFF = Switch off process controller	
			-1-	CW/CCW	PAR	JOG2/3	JOG1/3		
			-2-	CW/CCW	QSP	JOG2/3	JOG1/3		
			-3-	CW/CCW	PAR	DCB	JOG1/3		
			-4-	CW/CCW	QSP	PAR	JOG1/3		
			-5-	CW/CCW	DCB	TRIP set	JOG1/3		
			-6-	CW/CCW	PAR	TRIP set	JOG1/3		
			-7-	CW/CCW	PAR	DCB	TRIP set		
			-8-	CW/CCW	QSP	PAR	TRIP set		
			-9-	CW/CCW	QSP	TRIP Set	JOG1/3		
			-10-	CW/CCW	TRIP Set	UP	DOWN		
			-11-	CW/CCW	DCB	UP	DOWN		
			-12-	CW/CCW	PAR	UP	DOWN		
			-13-	CW/CCW	QSP	UP	DOWN		
			-14-	CCW/QSP	CW/QSP	DCB	JOG1/3		
			-15-	CCW/QSP	CW/QSP	PAR	JOG1/3		
			-16-	CCW/QSP	CW/QSP	JOG2/3	JOG1/3		
			-17-	CCW/QSP	CW/QSP	PAR	DCB		
			-18-	CCW/QSP	CW/QSP	PAR	TRIP set		
			-19-	CCW/QSP	CW/QSP	DCB	TRIP set		
			-20-	CCW/QSP	CW/QSP	TRIP set	JOG1/3		
			-21-	CCW/QSP	CW/QSP	UP	DOWN		
			-22-	CCW/QSP	CW/QSP	UP	JOG1/3		
			-23-	H/Re	CW/CCW	UP	DOWN		



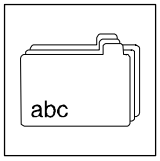
Appendix

Code table

Code		Possible settings						IMPORTANT
No.	Name	Lenze	Selection					
C0007↵ (cont.)	Fixed configuration of digital inputs	-0-	-24-	H/Re	PAR	UP	DOWN	• **Change under C0007 will be copied to the corresponding subcode of C0410. Free configuration under C0410 sets C0007 = -255-!** • CW = CW rotation • CCW = CCW rotation • DCB = DC-injection brake • PAR = Changeover (PAR1 ⇔ PAR2) PAR1 = LOW; PAR2 = HIGH – The corresponding terminal must be assigned to the function "PAR" in PAR1 and PAR2. – Configurations with "PAR" are only allowed if C0988 = -0- • JOG1/3, JOG2/3 = Selection of fixed setpoints JOG1: JOG1/3 = HIGH, JOG2/3 = LOW JOG2: JOG1/3 = LOW, JOG2/3 = HIGH JOG3: JOG1/3 = HIGH, JOG2/3 = HIGH • QSP = Quick stop • TRIP set = external fault • UP/DOWN = Motor potentiometer functions • H/Re = Hand/remote changeover • PCTRL1-I-OFF = Switch-off process controller I component • DFIN1-ON = Digital frequency input 0 ... 10 kHz • PCTRL1-OFF = Switch off process controller
			-25-	H/Re	DCB	UP	DOWN	
			-26-	H/Re	JOG1/3	UP	DOWN	
			-27-	H/Re	TRIP set	UP	DOWN	
			-28-	JOG2/3	JOG1/3	PCTRL1-I-OFF	DFIN1-ON	
			-29-	JOG2/3	DCB	PCTRL1-I-OFF	DFIN1-ON	
			-30-	JOG2/3	QSP	PCTRL1-I-OFF	DFIN1-ON	
			-31-	DCB	QSP	PCTRL1-I-OFF	DFIN1-ON	
			-32-	TRIP set	QSP	PCTRL1-I-OFF	DFIN1-ON	
			-33-	QSP	PAR	PCTRL1-I-OFF	DFIN1-ON	
			-34-	CW/QSP	CCW/QSP	PCTRL1-I-OFF	DFIN1-ON	
			-35-	JOG2/3	JOG1/3	PAR	DFIN1-ON	
			-36-	DCB	QSP	PAR	DFIN1-ON	
			-37-	JOG1/3	QSP	PAR	DFIN1-ON	
			-38-	JOG1/3	PAR	TRIP set	DFIN1-ON	
			-39-	JOG2/3	JOG1/3	TRIP set	DFIN1-ON	
			-40-	JOG1/3	QSP	TRIP set	DFIN1-ON	
			-41-	JOG1/3	DCB	TRIP set	DFIN1-ON	
			-42-	QSP	DCB	TRIP set	DFIN1-ON	
			-43-	CW/CCW	QSP	TRIP set	DFIN1-ON	
			-44-	UP	DOWN	PAR	DFIN1-ON	
			-45-	CW/CCW	QSP	PAR	DFIN1-ON	
			-46-	H/Re	PAR	QSP	JOG1/3	
			-47-	CW/QSP	CCW/QSP	H/Re	JOG1/3	
			-48-	PCTRL1- OFF	DCB	PCTRL1-I-OFF	DFIN1-ON	
			-49-	PCTRL1- OFF	JOG1/3	QSP	DFIN1-ON	
			-50-	PCTRL1- OFF	JOG1/3	PCTRL1-I-OFF	DFIN1-ON	
			-51-	DCB	PAR	PCTRL1-I-OFF	DFIN1-ON	
			-255-	Free configuration under C0410				Display only Do not change C0007 since settings under C0410 can be lost



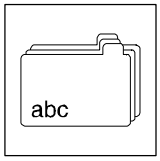
Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0008↲	Fixed configuration of relay output K1 (relay)	-1-				**Change under C0008 will be copied to C0415/1. Free configuration under C0415/1 sets C0008 = -255-!**	📖 7-47
			-0-	Ready for operation (DCTRL1-RDY)			
			-1-	TRIP fault message (DCTRL1-TRIP)			
			-2-	Motor is running (DCTRL1-RUN)			
			-3-	Motor is running / CW rotation (DCTRL1-RUN-CW)			
			-4-	Motor is running / CCW rotation (DCTRL1-RUN-CCW)			
			-5-	Output frequency = 0 (DCTRL1-NOUT=0)			
			-6-	Frequency setpoint reached (MCTRL-RFG1=NOUT)			
			-7-	Q_{min} threshold higher (PCTRL1-QMIN)			
			-8-	I_{max} limit reached (MCTRL1-IMAX) C0014 = -5-: Torque setpoint reached			
			-9-	Overtemperature (ϑ_{max} -5 °C) (DCTRL1-OH-WARN)			
			-10-	TRIP or Q_{min} or pulse inhibit (IMP) (DCTRL1-IMP)			
			-11-	PTC warning (DCTRL1-PTC-WARN)			
			-12-	Apparent motor current < current threshold (DCTRL1-IMOT<ILIM)		Belt monitoring Apparent motor current = C0054 Current threshold = C0156	
			-13-	Apparent motor current < current threshold and Q_{min} threshold reached (DCTRL1-(IMOT<ILIM)-QMIN)			
			-14-	Apparent motor current < current threshold and RFG 1: Input = output (DCTRL1-(IMOT<ILIM)-RFG1=0)			
			-15-	Warning motor phase failure (DCTRL1-LP1-WARN)			
			-16-	Minimum output frequency reached (PCTRL1-NMIN)			
			-255-	Free configuration under C0415/1		Display only Do not change C0008 since settings under C0415/1 can be lost	
C0009*↲	Controller address	1	1	{1}	99	For communcation module to AIF only: LECOM-A (RS232), LECOM-A/B/LI 2102, PROFIBUS-DP 2131, System bus (CAN) 2171/2172	
C0010	Minimum output frequency	0.00	0.00 → **14.5 Hz**	{0.02 Hz}	480.00	• C0010 is not effective with bipolar setpoint selection (-10 V ... + 10 V) • C0010 has no effect on AIN2 → **Speed setting range 1 : 6 for Lenze geared motors:** Setting absolutely required for operation with Lenze geared motors.	📖 7-14
C0011	Maximum output frequency	50.00	7.50 → **87 Hz**	{0.02 Hz}	480.00		
C0012	Acceleration time main setpoint	5.00	0.00	{0.02 s}	1300.00	Reference: frequency change 0 Hz ... C0011 • Additional setpoint ⇨ C0220 • Acceleration times to be activated via digital signals ⇨ C0101	📖 7-16
C0013	Deceleration time main setpoint	5.00	0.00	{0.02 s}	1300.00	Reference: frequency change C0011 ... 0 Hz • Additional setpoint ⇨ C0221 • Deceleration times to be activated via digital signals ⇨ C0103	



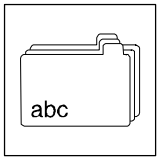
Appendix

Code table

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0014↲	Control mode	-2-	-2-	V/f characteristic control V ~ f (Linear characteristic with constant V_{min} boost)		• Commissioning without motor parameter identification possible • Benefit of identification with C0148: – Improved smooth running at low speed – V/f rated frequency (C0015) and slip (C0021) are calculated and do not have to be entered	🕮 7-2
			-3-	V/f-characteristic control V ~ f^2 (Square-law characteristic with constant V_{min} boost)			
			-4-	Vector control		**Identify the motor parameters before commissioning with C0148! Otherwise commissioning is not possible!**	
			-5-	Sensorless torque control with speed limitation • Torque setpoint via C0412/6 • Speed limitation via setpoint 1 (NSET1-N1), if C0412/1 is assigned, if not via max. frequency (C0011)			
C0015	V/f rated frequency	50.00	7.50	{0.02 Hz}	960.00	Setting applies to all mains voltages permitted	🕮 7-4
C0016	U_{min} boost	→	0.00	{0.2 %}	40.0	→ depending on the controller Setting applies to all mains voltages permitted	🕮 7-6
C0017	Frequency threshold Q_{min}	0.00	0.00	{0.02 Hz}	480.00	Programmable frequency threshold • Reference: Setpoint • Signal output configuration under C0415	
C0018↲	Chopper frequency	-2-	-0-	2 kHz			🕮 7-8
			-1-	4 kHz			
			-2-	8 kHz			
			-3-	16 kHz			
C0019	Threshold for automatic DC-injection brake (Auto DCB)	0.10	0.00 = not active	{0.02 Hz}	480.00	Holding time ⇨ C0106 Deactivate the automatic DC injection brake when the minimum frequency limit C0239 is active	🕮 7-19
C0021	Slip compensation	0.0	-50.0	{0.1 %}	50.0		🕮 7-7
C0022	I_{max} limit (motor mode)	150	30	{1 %}	150		🕮 7-15
C0023	I_{max}-limit in the generator mode	150	30	{1 %}	150	C0023 = 30 %: Function not active if C0014 = -2-, -3-:	
C0026*	Offset analog input 1 (AIN1–OFFSET)	0.0	-200.0	{0.1 %}	200.0	• Settings for X3/8 and X3/1U, X3/1I • The max. limit of the setpoint value range of C0034 equals 100 % • C0026 and C0413/1 are identical	🕮 7-22
C0027*	Gain analog input 1 (AIN1-GAIN)	100.0	-1500.0	{0.1 %}	1500.0	• Settings for X3/8 and X3/1U, X3/1I • 100.0 % = Gain 1 • Inverse setpoint selection by negative gain and negative offset • C0027 and C0414/1 are identical	
C0034*↲	Setpoint selection range Standard–I/O (X3/8)					Observe the switch position of the function module!	🕮 7-22
		-0-	-0-	0 ... 5 V / 0 ... 10 V / 0 ... 20 mA			
			-1-	4 ... 20 mA			
			-2-	-10 V ... +10 V		• Minimum output frequency (C0010) not effective • Individual adjustment of offset and gain	
			-3-	4 ... 20 mA Open-circuit monitoring		TRIP Sd5, if I < 4 mA	



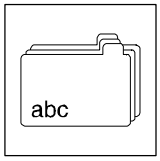
Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0034*↲ (A)	Setpoint selection range Application I/O					Observe the jumper setting of the function module!	📖 7-22
1	X3/1U, X3/1I	-0-	-0-	Voltage unipolar 0 ... 5 V / 0 ... 10 V			
2	X3/2U, X3/2I		-1-	Voltage bipolar -10 V ... +10 V		Minimum output frequency (C0010) not effective	
			-2-	Current 0 ... 20 mA			
			-3-	Current 4 ... 20 mA			
			-4-	Current 4 ... 20 mA open-circuit monitored		TRIP Sd5 if I < 4 mA	
C0035*↲	DC injection brake (DCB) control mode	-0-	-0-	Brake voltage selection under C0036		Holding time ⇨ C0107	📖 7-19
			-1-	Brake current selection under C0036			
C0036	Voltage/current DCB	→	0	{0.02 %}	150 %	→ Depending on the controller • Reference M_r, I_r • Setting applies to all mains voltages permitted	
C0037	JOG1	20.00	-480.00	{0.02 Hz}	480.00	JOG = Setpoint Additional JOG values ⇨ C0440	📖 7-28
C0038	JOG2	30.00	-480.00	{0.02 Hz}	480.00		
C0039	JOG3	40.00	-480.00	{0.02 Hz}	480.00		
C0040*↲	Controller inhibit		-0-	Controller inhibited (CINH)		Controller can only be enabled if X3/28 = HIGH	
			-1-	Controller enabled ($\overline{\text{CINH}}$)			
C0043*↲	TRIP reset		-0-	No current error		Reset active error with C0043 = 0	
			-1-	Active error			
C0044*	Setpoint 2 (NSET1-N2)		-480.00	{0.02 Hz}	480.00	• Selection, if C0412/2 = FIXED-FREE • Display, if C0412/2 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	
C0046*	Setpoint 1 (NSET1-N1)		-480.00	{0.02 Hz}	480.00	• Selection, if C0412/1 = FIXED-FREE • Display, if C0412/1 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	
C0047*	Torque setpoint or torque limit value (MCTRL1-MSET)		0	{1 %}	400	Control mode "Sensorless torque control" (C0014 = 5): • Torque setpoint selection, if C0412/6 = FIXED-FREE • Torque setpoint display, if C0412/6 ≠ FIXED-FREE Control mode "V/f characteristic control" or "Vector control" (C0014 = 2, 3, 4): • Torque limit value display, if C0412/6 ≠ FIXED-FREE • Function not active (C0047 = 400), if C0412/6 = FIXED-FREE **The value set will be lost when switching the mains!**	
			Ref.: Rated motor torque detected by motor parameter identification				
C0049*	Additional setpoint (PCTRL1-NADD)		-480.00	{0.02 Hz}	480.00	• Selection, if C0412/3 = 0 • Display, if C0412/3 ≠ 0 **The value set will be lost when switching the mains!**	
C0050*	Output frequency (MCTRL1-NOUT)		-480.00	{0.02 Hz}	480.00	Only display: Output frequency without slip compensation	
C0051*	Output frequency with slip compensation (MCTRL1-NOUT +SLIP) or actual process controller value (PCTRL1-ACT)		-480.00	{0.02 Hz}	480.00	Operation without process controller (C0238 = 2): • Display only: Output frequency with slip compensation (MCTRL1-NOUT+SLIP) Operation with process controller (C0238 = 0, 1): • Selection, if C0412/5 = FIXED-FREE • Display, if C0412/5 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	📖 7-36



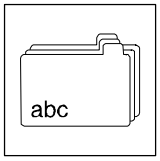
Appendix

Code table

Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0052*	Motor voltage (MCTRL1-VOLT)		0 {1 V}	1000	Only display	
C0053*	DC-bus voltage (MCTRL1-DCVOLT)		0 {1 V}	1000	Only display	
C0054*	Apparent motor current (MCTRL1-IMOT)		0.00 {0.01 A}	400.00	Display only	
C0056*	Controller load (MCTRL1-MOUT)		-255 {1 %}	255	Only display	
C0061*	Heat sink temperature		0 {1 °C}	255	Only display • If > +85 °C: – Controller sets warning *OH* – Chopper frequency reduced if C0144 = 1 • If > +90 °C: – Controller sets TRIP *OH*	
C0070	Process controller gain	1.00	0.00 = P component not active {0.01}	300.00		📖 7-33
C0071	Process controller readjustment time	100	10 {1}	9999 = I component not active		
C0072	Differential component of process controller	0.0	0.0 = D component not active {0.1}	5.0		
C0074	Process controller influence	0.0	0.0 {0.1 %}	100.0		
C0077*	Gain I_{max}controller	0.25	0.00 = P component not active {0.01}	16.00		📖 7-37
C0078*	Integral action time I_{max}controller	65	12 {1 ms}	9990 = I component not active		
C0079	Oscillation damping	2	0 {1}	80	depending on the controller	📖 7-8
C0084	Motor stator resistance	0.000	0.000 {0.001 Ω}	64.000		📖 7-31
C0087	Rated motor speed	1390	300 {1 rpm}	16000		
C0088	Rated motor current	→	0.0 {0.1 A}	480.0	→ depending on the controller 0.0 ... 2.0 x rated output current of the controller	
C0089	Rated motor frequency	50	10 {1 Hz}	960		
C0090	Rated motor voltage	→	50 {1 V}	500	→ 230 V with 230 V controllers, 400 V with 400 V controllers	
C0091	Motor cos φ	→	0.40 {0.1}	1.0	→ Depending on the controller	
C0092	Motor stator inductance	0.0	0.0 {0.1 mH}	2000.0		
C0093*	Controller type		xxxy		Display only • xxx = Power taken from nameplate (e. g. 551 = 550 W) • y = Voltage class (2 = 240 V, 4 = 400 V)	
C0094*	User password		0 {1}	9999	0 = No password protection 1 ... 9999 = Free access to user menu only	📖 6-7
C0099*	Software version		x.y		Only display x = Main version, y = Index	



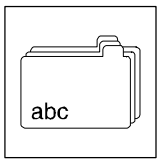
Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0101 (A)	Acceleration times main setpoint						📖 7-16
1	C0012	5.00	0.00	{0.02 s}	1300.00	Binary coding of the digital signal sources assigned under C0410/27 and C0410/28 determines active time pair C0410/27 C0410/28 active LOW LOW C0012; C0013 HIGH LOW T_{ir} 1; T_{if} 1 LOW HIGH T_{ir} 2; T_{if} 2 HIGH HIGH T_{ir} 3; T_{if} 3	
2	T_{ir} 1	2.50					
3	T_{ir} 2	0.50					
4	T_{ir} 3	10.00					
C0103 (A)	Deceleration times main setpoint						
1	C0013	5.00	0.00	{0.02 s}	1300.00		
2	T_{if} 1	2.50					
3	T_{if} 2	0.50					
4	T_{if} 3	10.00					
C0105	Deceleration time quick stop (QSP)	5.00	0.00	{0.02 s}	1300.00	Quick stop decelerates the drive to standstill according to the deceleration time set under C0105. If the output frequency falls below the threshold C0019, the DC-injection brake (DCB) will be activated. **Exception:** Lower frequency limit C0239 > 0 Hz: Quick stop decelerates the drive to standstill according to the deceleration time set under C0105.	📖 7-18
C0106	Holding time auto DCB	0.50	0.00 = auto DCB not active	{0.01 s}	999.00 = ∞	Holding time, if DCB is activated because the value falls below the setting in C0019.	📖 7-19
C0107	Holding time DCB	999.00	1.00	{0.01 s}	999.00 = ∞	Holding time, if DCB is activated via an external terminal or control word.	📖 7-19
C0108*	Gain analog output X3/62 (AOUT1-GAIN)	128	0	{1}	255	Standard I/O: C0108 and C0420 are the same Application I/O: C0108 and C0420/1 are the same	📖 7-39
C0109*	Offset analog output X3/62 (AOUT1-OFFSET)	0.00	-10.00	{0.01 V}	10.00	Standard I/O: C0109 and C0422 are the same Application I/O: C0109 and C0422/1 are the same	



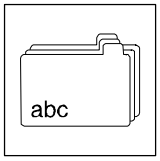
Appendix

Code table

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0111↲	Configuration analog output X3/62 (AOUT1-IN)		Analog signal output to terminal	**Change of C0111 is copied to C0419/1. Free configuration in C0419/1 sets C0111 = -255-!**	📖 7-39
		-0-	-0- Output frequency with slip (MCTRL1-NOUT+SLIP)	6 V/12 mA ≡ C0011	
			-1- Controller load (MCTRL1-MOUT)	3 V/6 mA ≡ Rated motor torque with vector control (C0014 = 4), otherwise rated active inverter current (active current/C0091)	
			-2- Apparent motor current (MCTRL1-IMOT)	3 V/6 mA ≡ Rated inverter current	
			-3- DC-bus voltage (MCTRL1-DCVOLT)	6 V/12 mA ≡ DC 1000 V (400 V mains) 6 V/12 mA ≡ DC 380 V (240 V mains)	
			-4- Motor power	3 V/6 mA ≡ Rated motor power	
			-5- Motor voltage (MCTRL1-VOLT)	4.8 V/9.6 mA ≡ Rated motor voltage	
			-6- 1/output frequency (1/C0050) (MCTRL1-1/NOUT)	2 V/4 mA ≡ 0.5 × C0011	
			-7- Output frequency with limits (NSET1-C0010...C0011)	0 V/0 mA/4 mA ≡ f = f_{min} (C0010) 6 V/12 mA ≡ f = f_{max} (C0011)	
			-8- Operation with process controller (C0238 = 0, 1): Act. process controller value (PCTRL1-ACT) Operation without process controller (C0238 = 2): Output frequency without slip (MCTRL1-NOUT)	6 V/12 mA ≡ C0011	
			-9- Ready for operation (DCTRL1-RDY)	Selection -9- ... -25- corresponds to the digital functions of the relay output K1 (C0008) or the digital output A1 (C0117): LOW = 0 V/0 mA/4 mA HIGH = 10 V/20 mA	
			-10- TRIP fault message (DCTRL1-TRIP)		
			-11- Motor is running (DCTRL1-RUN)		
			-12- Motor is running / CW rotation (DCTRL1-RUN-CW)		
			-13- Motor is running / CCW rotation (DCTRL1-RUN-CCW)		
			-14- Output frequency = 0 (DCTRL1-NOUT=0)		
			-15- Frequency setpoint reached (MCTRL1-RFG1=NOUT)		
			-16- Q_{min} threshold reached (PCTRL1-QMIN)		
			-17- I_{max} limit reached (MCTRL1-IMAX) C0014 = -5-: Torque setpoint reached		
			-18- Overtemperature (ϑ_{max} - 5 °C) (DCTRL1-OH-WARN)		
			-19- TRIP or Q_{min} or pulse inhibit (IMP) active (DCTRL1-TRIP-QMIN-IMP)		
			-20- PTC warning (DCTRL1-PTC-WARN)		
			-21- Apparent motor current < current threshold (DCTRL1-IMOT<ILIM)	Belt monitoring Apparent motor current = C0054 Current threshold = C0156	
			-22- Apparent motor current < current threshold and Q_{min} threshold reached (DCTRL1-(IMOT<ILIM)-QMIN)		
			-23- Apparent motor current < current threshold and RFG 1: Input = output (DCTRL1-(IMOT<ILIM)-RFG-I=0)		
			-24- Warning motor phase failure (DCTRL1-LP1-WARN)		
			-25- Minimum output frequency reached (PCTRL1-NMIN)		
			-255- Freely configured under C0419/1	Only display Do not change C0111 since settings under C0419/1 can be lost	



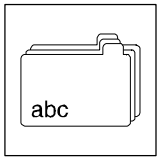
Code		Possible settings								IMPORTANT	
No.	Name	Lenze	Selection								
C0114↲	Level inversion digital inputs E1 ... E6	-0-		E6 2^5	E5 2^4	E4 2^3	E3 2^2	E2 2^1	E1 2^0	• The binary value of the selected number determines the input levels: – 0: Ex is not inverted (HIGH active) – 1: Ex is inverted (LOW active) • C0114 and C0411 are identical • E5, E6 only application I/O **The function "Parameter set changeover" cannot be inverted!**	
			-0-	0	0	0	0	0	0		
			-1-	0	0	0	0	0	1		
			-2-	0	0	0	0	1	0		
			-3-	0	0	0	0	1	1		
			...				...				
			-63-	1	1	1	1	1	1		
C0117↲	Fixed configuration of digital output A1 (DIGOUT1)	-0-								**Changes of C0117 will be copied to C0415/2. Free configuration under C0415/2 sets C0117 = -255-!**	📖 7-47
			-0- ... -16-	see C0008							
			-255-	Free configuration under C0415/2						Only display Do not change C0117 since settings under C0415/2 can be lost	
C0119↲	Configuration PTC input / earth fault detection	-0-	-0-	PTC input not active			Earth fault detection active			• Signal output configuration under C0415 • Deactivate the earth fault detection if it is activated unintentionally	📖 7-52
			-1-	PTC input active, TRIP set							
			-2-	PTC input active, Warning set							
			-3-	PTC input not active			Earth fault detection				
			-4-	PTC input active, TRIP set							
			-5-	PTC input active, Warning set							
C0120	I^2t switch-off	0	0 = not active	{1 %}					200	Reference: Apparent motor current (C0054)	📖 7-51
C0125*↲	LECOM baud rate	-0-	-0-	9600 baud						Only for LECOM-A (RS232)	
			-1-	4800 baud							
			-2-	2400 baud							
			-3-	1200 baud							
			-4-	19200 baud							
C0126*↲	Response in the event of communication errors	-2-	-0-	No TRIP when stopping the communication in the process data channel AIF No TRIP when stopping the communication between controller and function module on FIF						Monitors the process data channel of the AIF interface and communication via the FIF interface	
			-1-	TRIP (CE0) when stopping the communication in the process data channel AIF No TRIP when stopping the communication between controller and function module on FIF							
			-2-	No TRIP when stopping the communication in the process data channel AIF TRIP (CE5) when stopping the communication between controller and function module on FIF							
			-3-	TRIP (CE0) when stopping the communication in the process data channel AIF TRIP (CE5) when stopping the communication between controller and function module on FIF							
C0127↲	Setpoint selection	-0-	-0-	Absolute setpoint selection in Hz via C0046 or process data channel							
			-1-	Setpoint selection normalised via C0141 (0... 100 %) or process channel (±16384 = C0011)							
C0128*↲	Monitoring CAN communication on FIF	-0-	-0-	not active						Does not monitor the AIF interface	
			-1-	TRIP (CE6), if CAN controller sends "Warning" or "BUS-OFF"							



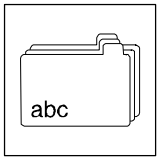
Appendix

Code table

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0135*	Controller control word (parameter channel)		Bit Assignment	• Control via parameter channel. The most important control commans are grouped as bit commands. • C0135 cannot be changed using the keypad	
			1|0 JOG1, JOG2, JOG3 or C0046 (NSET1-JOG1/3, NSET1-JOG2/3) 00 C0046 active 01 JOG1 (C0037) active 10 JOG2 (C0038) active 11 JOG3 (C0039) active		
			2 Current direction of rotation (DCTRL1-CW/CCW) 0 not inverted 1 inverted		
			3 Quick stop (DCTRL1-QSP) 0 not active 1 active		
			4 Stop ramp function generator (NSET1-RFG1-STOP) 0 not active 1 active		
			5 Ramp function generator input = 0 (NSET1-RFG1-0) 0 not active 1 active (deceleration to C0013)	RFG1 = Ramp function generator main setpoint	
			6 UP function motor potentiometer (MPOT1-UP) 0 not active 1 active		
			7 DOWN function motor potentiometer (MPOT1-DOWN) 0 not active 1 active		
			8 Reserved		
			9 Controller inhibit (DCTRL1-CINH) 0 Controller enabled 1 Controller inhibited		
			10 TRIP set (DCTRL1-TRIP-SET)	Sets "external error" (*EEr* , LECOM No. 91) (📖 8-3)	
			11 TRIP reset (DCTRL1-TRIP-RESET) 0 ⇒ 1 Edge causes TRIP reset		
			13|12 Parameter set changeover (DCTRL1-PAR2/4, DCTRL1-PAR3/4) 00 PAR1 01 PAR2 10 PAR3 11 PAR4		
			14 DC injection brake (MTCRL1-DCB) 0 not active 1 active		
			15 Reserved		
C0138*	Process controller setpoint 1 (PCTRL1-SET1)	0.00	-480.00 {0.02 Hz} 480.00	• Selection if C0412/4 = FIXED-FREE • Display if C0412/4 ≠ FIXED-FREE **The value set will be lost when switching the mains!**	📖 7-35
C0140*	Additive frequency setpoint (NSET1-NADD)	0.00	-480.00 {0.02 Hz} 480.00	• Selection via function Set of the keypad or the parameter channel • Is added to main setpoint • Value is stored when switching the mains or removing the keypad	



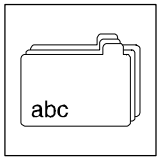
Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0141*	Setpoint normalisation	0.00	-100.00	{0.01 %}	100.00	• Only effective if C0127 = 1 • Reference: C0011 **The value set will be lost when switching the mains!**	
C0142↲	Start condition	-1-	-0-	Automatic start inhibited Flying restart not active		Start after LOW-HIGH level change at X3/28	🕮 7-10
			-1-	Automatic start, if X3/28 = HIGH Flying restart not active			
			-2-	Automatic start inhibited Flying-restart circuit active		Start after LOW-HIGH level change at X3/28	
			-3-	Automatic start, if X3/28 = HIGH Flying-restart circuit active			
C0143*↲	Selection of flying-restart	-0-	-0-	Max. output frequency (C0011) ... 0 Hz		Motor speed selected for the indicated range	
			-1-	Last output frequency ... 0 Hz			
			-2-	Frequency setpoint addition (NSET1-NOUT)		The corresponding value is input after controller enable.	
			-3-	Act. process controller value (C0412/5) addition (PCTRL1-ACT)			
C0144↲	Chopper frequency derating	-1-	-0-	No temperature depending chopper frequency derating			🕮 7-8
			-1-	Automatic chopper frequency derating at ϑ_{max} - 5 °C			
C0145*↲	Process controller setpoint source	-0-	-0-	Total setpoint (PCTRL1-SET3)		Main setpoint + additional setpoint	🕮 7-35
			-1-	C0181 (PCTRL1-SET2)		• Setpoint selection not possible via – JOG values – Set function of the keypad – C0044, C0046 and C0049 – in connection with manual/remote changeover, skip frequencies, ramp function generator, additional setpoint • Activate the automatic DC-injection brake (auto DCB) with C0019 = 0 or C0106 = 0	
			-2-	C0412/4 (PCTRL1-SET1)			
[C0148]*	Motor parameter identification	-0-	-0-	Ready		**Only when the motor is cold!** 1. Inhibit controller, wait until drive is in standstill 2. Enter the correct motor data under C0087, C0088, C0089, C0090, C0091 (see motor nameplate). 3. C0148 = set 1 by ENTER 4. Enable controller The identification – starts, IMP Off – takes approx. 30 s – is completed when IMP is on again 5. Controller inhibit	🕮 7-31
			-1-	Start identification • V/f-rated frequency (C0015), slip compensation (C0021) and motor stator inductivity (C0092) are calculated and saved. • The motor stator resistance (C0084) = total resistance of motor cable and motor is measured and saved			



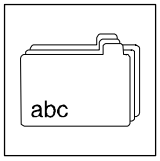
Appendix

Code table

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0150*	Controller status word 1 (parameter channel)		Bit Assignment 0 Mapping of C0417/1 1 Pulse inhibit (DCTRL1-IMP) 0 Power outputs enabled 1 Power outputs inhibited 2 Mapping of C0417/3 3 Mapping of C0417/4 4 Mapping of C0417/5 5 Mapping of C0417/6 6 Output frequency = 0 (DCTRL1-NOUT=0) 0 false 1 true 7 Controller inhibit (DCTRL1-CINH) 0 Controller enabled 1 Controller inhibited 11|10|9|8 controller status 0000 Controller initialization 0010 Switch-on inhibit 0011 Operation inhibited 0100 Flying-restart circuit active 0101 DC-injection brake active 0110 Operation enabled 0111 Message active 1000 Active fault 12 Overheat warning (DCTRL1-OH-WARN) 0 No warning 1 ϑ_{max} - 5 °C reached 13 DC-bus overvoltage (DCTRL1-OV) 0 No overvoltage 1 Overvoltage 14 Mapping of C0417/15 15 Mapping of C0417/16	• Scan of the controller status via parameter channel. The most important status information are grouped as bit pattern. • Some bits can be freely assigned to internal digital signals • Configuration in C0417	
C0151*	Controller status word 2 (parameter channel)		Bit Assignment 0 ... 15 Mapping of C0418/1 ... C0418/16	• The bits can be freely assigned to internal digital signals • Configuration in C0418	
C0156*	Current threshold	0	0 {1 %} 150	Programmable current threshold Signal output configuration under C0008 or C0415	
C0161*	Actual fault			Display history buffer contents • Keypad: three-digit, alpha numerical fault detection • 9371BB keypad: LECOM fault number	📖 8-1 📖 8-3
C0162*	Last fault				
C0163*	Last but one fault				
C0164*	Last but two fault				
C0168*	Actual fault				
C0170↵	Configuration TRIP reset	-0-	-0- TRIP reset by mains switching, STOP, LOW–signal at X3/28, via function module or communication module -1- like -0- and additional auto TRIP reset -2- TRIP reset through mains switching, via function module or communication module -3- TRIP reset by mains switching	• TRIP reset via function module or communication module with C0043, C0410/12 or C0135 bit 11. • Auto TRIP reset after the time set under C0171.	📖 8-6
C0171	Delay for auto-TRIP reset	0.00	0.00 {0.01 s} 60.00		



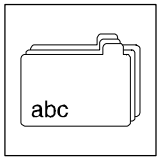
Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
[C0174]*	Brake transistor threshold	100	78 {1 %} 110 Recommended setting V_{mains} [3/PE AC xxx V] / C0174 [%] / V_{DC} [V DC]: 380 / 78 / 618 400 / 81 / 642 415 / 84 / 665 440 / 89 / 704 460 / 93 / 735 480 / 97 / 767 500 / 100 / 790	**Not active with 8200 motec and 240 V controller 8200 vector (fixed threshold 380 V)** • 100 % = Threshold DC 790 V • 110 % = Brake transistor switched off • V_{DC} = Threshold in V DC • The recommended setting allows max. 10 % mains overvoltage	11-4
C0178*	Operating time		Total time CINH = HIGH {h}	Only display	
C0179*	Power-on time		Total time power-on {h}	Only display	
C0181*	Process controller setpoint 2 (PCTRL1-SET2)	0.00	-480.00 {0.02 Hz} 480.00		7-35
C0182*	Integration time S–ramps	0.00	0.00 {0.01 s} 50.00	• C0182 = 0.00: Linear ramp function generator operation • C0182 > 0.00: S-shaped ramp function generator (smooth)	7-16
C0183*	Diagnostics		0 No fault 102 TRIP active 104 Message "Overvoltage (OU)" or "Undervoltage (LU)" active 142 Pulse inhibit 151 Quick stop active 161 DC-injection brake active 250 Warning active	Only display	
C0184*	Frequency threshold PCTRL1-I-OFF	0.0	0.0 {0.1 Hz} 25.0	• If the output frequency i < C0184, the I component of the process controller will be switched off • 0.0 Hz = Function not active	7-35
C0185*	Switching window for "Frequency setpoint reached (C0415/x = 4)" and "NSET1-RFG1-I=0 (C0415/x = 5)"	0	0 {1 %} 80	• C0415/x = 4 and C0415/x = 5 are active within a window around NSET1-RFG1-IN • Window in C0185 = 0%: ± 0,5 % ref. to C0011 • Window in C0185 > 0%: ± C0185 ref. to NSET1-RFG1-IN	
C0189* (A)	Output signal compensator (PCTRL1-FOLL 1-OUT)		-480.00 {0.02 Hz} 480.00	Only display Compensator = PCTRL1-FOLL1	
C0190*↲ (A)	Main and additional setpoint (PCTRL1-ARITH1)	-1-	-0- X + 0 -1- X + Y -2- X - Y -3- $\frac{X \cdot Y}{C0011}$ -4- $\frac{X}{Y} \cdot \frac{C0011}{100}$ -5- $\frac{X \cdot C0011}{C0011 - Y}$	Mathematical addition of mains setpoint (NSET1-NOUT) and additional setpoint (PCTRL1-NADD) The result is in Hz X = NSET1-NOUT Y = PCTRL1-NADD	
C0191 (A)	Compensator acceleration time	5.00	0.00 {0.02 s} 1300.00	Ref. to change 0 Hz ... C0011	
C0192 (A)	Compensator deceleration time	5.00	0.00 {0.02 s} 1300.00	Ref. to change C0011 ... 0 Hz	
C0193 (A)	Compensator reset	5.00	0.00 {0.02 s} 1300.00	Ref. to change C0011 ... 0 Hz Decelerate compensator to "0"	



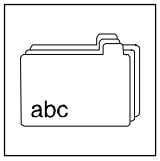
Appendix

Code table

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0194 (A)	Min. compensator activation threshold	-200.00	-200.00	{0.01 %}	200.00	Ref. to C0011 If the value falls below C0194: Compensator "runs" at C0191 or C0192 direction -C0011	
C0195 (A)	Max. compensator activation threshold	200.00	-200.00	{0.01 %}	200.00	Ref. to C0011 If C0195 is exceeded: Compensator "runs" at C0191 or C0192 direction +C0011	
C0196*↲	Activation of auto–DCB	-0-	-0-	Auto-DCB active, if PCTRL1-SET3 < C0019			📖 7-19
			-1-	Auto-DCB active, if PCTRL1-SET3 < C0019 **and** NSET1-RFG1-IN < C0019			
C0200*	Software ID number					Only PC display	
C0201*	Software generation date					Only PC display	
C0202*	Software ID number					Only keypad display	
1 ... 4						Output to keypad as string in 4 parts à 4 characters	
C0220*	Acceleration time - additional setpoint (PCTRL1-NADD)	5.00	0.00	{0.02 s}	1300.00	Main setpoint ⇨ C0012 C0220 individually adjustable in every parameter set when using application-I/O	📖 7-16
C0221*	Deceleration time - additional setpoint (PCTRL1-NADD)	5.00	0.00	{0.02 s}	1300.00	Main setpoint ⇨ C0013 C0221 individually adjustable in every parameter set when using application-I/O	
C0225 (A)	Acceleration time process controller setpoint (PCTRL1-SET1)	0.00	0.00	{0.02 s}	1300.00	Acceleration encoder for process controller setpoint = PCTRL1-RFG2	
C0226 (A)	Deceleration time process controller setpoint (PCTRL1-SET1)	0.00	0.00	{0.02 s}	1300.00		
C0228 (A)	Unhide time process controller	0.000	0.000	{0.001 s}	32.000	0.000 = Process controller output is transferred without unhiding	
C0229 (A)	Hide time process controller	0.000	0.000	{0.001 s}	32.000	0.000 = "Fading-off" switched off (C0241)	
C0230 (A)	Min. limit process controller output	-100.00	-200.00	{0.01 %}	200.00	Asymmetric limit of process controller output ref. to C0011 • If value falls below C0230 or exceeds C0231: – Output signal PCTRL1-LIM = HIGH after time set under C0233 • Set C0231 > C0230	
C0231 (A)	Max. limit process controller output	100.00	-200.00	{0.01 %}	200.00		
C0232 (A)	Offset inverse characteristic process controller	0.00	-200.0	{0.1 %}	200.0	Ref. to C0011	
C0233* (A)	Delay PCTRL1-LIM=HIGH	0.000	0.000	{0.001 s}	65.000	"Debouncing" of digital output signal PCTRL1-LIM (limit for process controller output exceeded) • Sets PCTRL1-LIM = HIGH if the following still applies after time set: – Value below C0230 or higher than C0231 • Transition HIGH ⇨ LOW without delay	



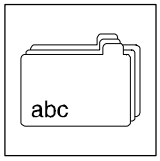
Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0234* (A)	Delay PCTRL1-SET=ACT	0.000	0.000	{0.001 s}	65.000	"Debouncing" of digital output signal PCTRL1-SET=ACT (process controller setpoint = process controller actual value) • Sets PCTRL1-SET=ACT = HIGH if the following still applies after time set: – Difference between PCTRL1-SET and PCTRL1-ACT is below threshold under C0235 • Transition HIGH ⇨ LOW without delay	
C0235* (A)	Difference threshold PCTRL1-SET=ACT	0.00	0.00	{0.01 Hz}	480.00	Threshold for the digital output signal PCTRL1-SET=ACT (process controller setpoint = process controller actual value) • Difference between PCTRL1-SET and PCTRL1-ACT is within limits under C0235: – PCTRL1-SET=ACT = HIGH after time set under C0234	
C0236 (A)	Acceleration time - minimum frequency limitation	0.00	0.00	{0.02 s}	1300.00	Ref. to C0011 Minimum frequency limitation = C0239	📖 7-14
C0238↲	Frequency precontrol	-2-	-0-	No precontrol (only process controller)		Process controller has full influence	📖 7-33 📖 7-35
			-1-	Precontrol (total setpoint + process controller)		Process controller has limited influence	
			-2-	No precontrol (only total setpoint)		Process controller has no influence (not active)	
						Total setpoint (PCTRL1-SET3) = Main setpoint + additional setpoint	
C0239	Lowest frequency limit	-480.00	-480.00 = not active	{0.02 Hz}	480.00	• The value does not fall below limit independently of the setpoint. • If the minimum frequency limitation is active, the automatic DC-injection brake (auto DCB) must be deactivated (C0019 = 0 or C0106 = 0).	📖 7-14
C0240↲ (A)	Process controller output inversion (PCTRL1-INV-ON) (parameter channel)	-0-	-0-	Not inverted		Set digital signal PCTRL1-INV-ON (process controller output inversion) via keypad/PC or parameter channel	
			-1-	Inverted			
C0241↲ (A)	Process controller unhiding/hiding (PCTRL1-FADING) (parameter channel)	-0-	-0-	Process controller unhiding		Set digital signal PCTRL1-FADING (process controller hiding/unhiding) via keypad/PC or parameter channel	
			-1-	Process controller hiding			
C0242↲ (A)	Activation of process controller inverse control	-0-	-0-	Normal control		Act. value increases ⇨ Output frequency increases	
			-1-	Inverse control		Act. value increases ⇨ Output frequency decreases	
C0243↲ (A)	Deactivation of additional setpoint (PCTRL 1-NADD-OFF) (parameter channel)	-0-	-0-	PCTRL1-NADD active		Set digital signal PCTRL1-NADD-OFF (deactivation of additional setpoint) via keypad/PC or parameter channel	
			-1-	PCTRL1-NADD not active			
C0244↲ (A)	Root function actual process controller value	-0-	-0-	not active			
			-1-	$\pm \sqrt{\lvert \text{PCTRL1-ACT} \rvert}$		Internal calculation 1. Storing sign of PCTRL1-ACT 2. Extraction of the root of the absolute value 3. Mulitply the result with the sign	



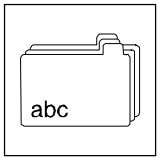
Appendix

Code table

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0245*↲ (A)	Comparison value for MSET1=MACT	-0-	-0-	MCTRL1-MSET (C0412/6 or C0047)		Selection of a comparison value for setting the digital output signal MSET1=MACT (torque threshold 1 = actual torque value) • If the difference between MCTRL1-MSET1 and MCTRL1-MACT or C0250 is within C0252: – MSET1=MACT = HIGH after time set under C0254	
			-1-	Value under C0250			
C0250* (A)	Torque threshold 1 (MCTRL1-MSET1)	0.0	-200.0	{0.1 %}	200.0	Related to rated motor torque	
C0251* (A)	Torque threshold 2 (MCTRL1-MSET2)	0.0	-200.0	{0.1 %}	200.0	Related to rated motor torque Comparison value for setting the digital output signal MSET2=MACT (torque threshold 2 = actual torque value) • If the difference between MCTRL1-MSET2 and MCTRL1-MACT is within C0253: – MSET2=MACT = HIGH after time set under C0255	
C0252* (A)	Difference threshold for MSET1=MACT	0.0	0.0	{0.1 %}	100.0		
C0253* (A)	Difference threshold for MSET2=MACT	0.0	0.0	{0.1 %}	100.0		
C0254* (A)	Delay MSET1=MACT	0.000	0.000	{0.001 s}	65.000	"Debouncing" of digital output signals MSET1=MACT • Sets MSET1=MACT = HIGH if the following still applies after time set: – Difference between MCTRL1-MSET1 and MCTRL1-MACT or C0250 is within the threshold under C0252 • Transition HIGH ⇨ LOW without delay	
C0255* (A)	Delay MSET2=MACT	0.000	0.000	{0.001 s}	65.000	"Debouncing" of digital output signals MSET2=MACT • Sets MSET2=MACT = HIGH if the following still applies after time set: – Difference between MCTRL1-MSET2 and MCTRL1-MACT is within values set under C0253 • Transition HIGH ⇨ LOW without delay	
C0265*↲	Configuration motor potentiometer	-3-	-0-	Start value = power off		• Start value: output frequency which is approached with Tir (C0012) when the **mains is switched on and the motor** potentiometer is activated: – "Power off" = act. value if mains is off – "C0010": min. output frequency from C0010 – "0" = output frequency 0 Hz • C0265 = -3-, -4-, -5-: – QSP reduces the motor potentiometer along the QSP ramp (C0105)	🕮 7-27
			-1-	Start value = C0010			
			-2-	Start value = 0			
			-3-	Start value = power off QSP, if UP/DOWN = LOW			
			-4-	Start value = C0010 QSP, if UP/DOWN = LOW			
			-5-	Start value = 0 QSP, if UP/DOWN = LOW			
C0304 ... C0309	Service codes					**Modifications only by Lenze Service!**	



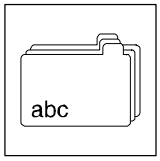
Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0350*↲	System bus node address	1	1 {1} 63	Changes will become effective after the command "reset node"	📖 9-7
C0351*↲	System bus baud rate	-0-	-0- 500 kbit/s	Changes will become effective after the command "reset node"	
			-1- 250 kbit/s		
			-2- 125 kbit/s		
			-3- 50 kbit/s		
			-4- 1000 kbit/s (presently not supported)		
			-5- 20 kbit/s		
C0352*↲	Configuration of system bus devices	-0-	-0- Slave	Changes will become effective after the command "reset node"	📖 9-7
			-1- Master		
C0353*↲	System bus address source			Address source for system bus process data channels	📖 9-7
1	CAN1 (sync)	-0-	-0- C0350 is source	Effective with sync control (C0360 = 1)	
2	CAN2	-0-	-1- C0354 is the source		
3	CAN1 (time)	-0-		Effective with event and time control (C0360 = 0)	
C0354*↲	Selective system bus address		0 {1} 513	Individual addressing of system bus process data objects	📖 9-9
1	CAN-IN1 (sync)	129		Effective with sync control (C0360 = 1)	
2	CAN-OUT1 (sync)	1			
3	CAN-IN2	257			
4	CAN-OUT2	258			
5	CAN-IN1 (time)	385		Effective with event and time control (C0360 = 0)	
6	CAN-OUT1 (time)	386			
C0355*↲	System bus identifier		0 {1} 2047	Only display	
1	CAN-IN1			Identifier of CAN1 with sync control (C0360 = 1)	
2	CAN-OUT1				
3	CAN-IN2				
4	CAN-OUT2				
5	CAN-IN1			Identifier of CAN1 with event or time control (C0360 = 0)	
6	CAN-OUT1				
C0356*↲	System bus time settings				📖 9-8
1	Boot up	3000	0 {1 ms} 65000	Required for CAN network without master	
2	Cycle time CAN-OUT2	0		0 = event-controlled process data transfer > 0 = cyclic process data transfer	
3	Cycle time CAN-OUT1	0		0 and C0360 = 0: event-controlled process data transfer > 0 and C0360 = 1: cyclic process data transfer	
4	CAN delay	20		Waiting time until cyclic sending after boot-up	
C0357*↲	System bus monitoring times				📖 9-8
1	CAN-IN1 (sync)	0	0 {1 ms} 65000	valid with C0360 = 1	
2	CAN-IN2	0	= monitoring not active		
3	CAN-IN1 (time)	0		valid with C0360 = 0	
C0358*↲	Reset node	-0-	-0- Without function	System bus reset node set-up	📖 9-8
			-1- System bus reset		
C0359*↲	System bus status		-0- Operational	Only display	
			-1- Pre-operational		
			-2- Warning		
			-3- Bus off		
C0360*↲	Control of process data channel CAN1	-1-	-0- Event or time control		
			-1- Sync control		



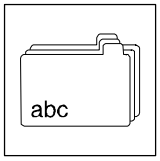
Appendix

Code table

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0370*↲	Activation of remote parameter setting		-0- Deactivated	Can only be read when using bus function modules on FIF	
			-1-...-63- Activates corresponding CAN address	-1- = CAN address 1 -63- = CAN address 63	
			-255- No system bus (CAN)	Only display	
C0372*	Function module identification		-0- No function module	Only display	
			-1- Standard I/O or AS-i		
			-2- System bus (CAN)		
			-6- Other function module on FIF	e.g. application I/O, INTERBUS, ...	
			-10- No valid recognition		
C0395*↲	LONGWORD process input data		Bit 0..15 Controller word (mapping to C0135)	For bus operation only Sending of control word and main setpoint in a telegram to controller	
			Bit 16...31 Setpoint 1 (NSET1-N1) (mapping to C0046)		
C0396*↲	LONGWORD process output data		Bit 0...15 Controller status word 1 (mapping of C0150)	For bus operation only Reading of status word and output frequency in a telegram from controller	
			Bit 16...31 Output frequency (MCTRL1-NOUT) (mapping of C0050)		



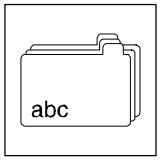
Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0410↲	Free configuration of digital input signals		Linkage of external signal sources to internal digital signals Digital signal source	• **A selection made under C0007 is copied to the corresponding subcode of C0410. A change of C0410 sets C0007 = -255-!**	🕮 7-45
1	NSET1-JOG1/3 NSET1-JOG1/3/5/7 (A)	1	0 255	Not assigned (FIXED-FREE) Selection of fixed setpoints C0410/1 C0410/2C active 0410/33 C0046 LOW LOW LOW JOG1 HIGH LOW LOW JOG2 LOW HIGH LOW ... ... JOG7 HIGH HIGH HIGH	
2	NSET1-JOG2/3 NSET1-JOG2/3/6/7 (A)	2	1 ... 6	Digital inputs X3/E1 ... X3/E6 (DIGIN1 ... 6) X3/E1 (1) ... X3/E6 (6) E5, E6 only application I/O	
3	DCTRL1-CW/CCW	4	7	PTC input (X2.2/T1, X2.2/T2)	CW = CW rotation LOW CCW = CCW rotation HIGH
4	DCTRL1-QSP	255	10 ... 25	AIF control word (AIF-CTRL) Bit 0 (10) ... bit 15 (25)	Quick stop (via terminal LOW active)
5	NSET1-RFG1-STOP	255			Ramp function generator main setpoint stop
6	NSET1-RFG1-0	255	30 ... 45	CAN-IN1.W1/FIF-IN.W1 Bit 0 (30) ... bit 15 (45)	Ramp function generator input must be set ”0” for mains setpoint
7	MPOT1-UP	255			Motor potentiometer functions
8	MPOT1-DOWN	255	50 ... 65	CAN-IN1.W2/FIF-IN.W2 Bit 0 (50) ... bit 15 (65)	
9	Reserved	255			
10	DCTRL1-CINH	255			Controller inhibit (via terminal LOW active)
11	DCTRL1-TRIP-SET	255	70 ... 85	CAN-IN2.W1 Bit 0 (70) ... bit 15 (85)	External error (via terminal LOW active)
12	DCTRL1-TRIP-RESET	255			Error reset
13	DCTRL1-PAR2/4	255	90 ... 105	CAN-IN2.W2 Bit 0 (90) ... bit 15 (105)	Parameter set changeover (if C0988 = 0) **if C0410/13 and C0410/14 use the same source in all parameter sets. Otherwise it is not possible to change between the parameter sets.**
14	DCTRL1-PAR3/4	255			C0410/13 C0410/14 active LOW LOW PAR1 HIGH LOW PAR2 LOW HIGH PAR3 HIGH HIGH PAR4
15	MCTRL1-DCB	3	200	Bit-by-bit assignment of the FIF control words (FIF-CTRL1, FIF-CTRL2) from the function module INTERBUS or PROFIBUS-DP (see C0005)	DC-injection brake
16 (A)	PCTRL1-RFG2-LOADI	255			Actual process controller value (PCTRL1-ACT) must be connected to process controller ramp function generator (PCTRL1-RFG2)
17	DCTRL1-H/Re	255			Manual/remote changeover
18	PCTRL1-I-OFF	255			Switch off I-component of the process controller
19	PCTRL1-OFF	255			Process controller switch off
20	Reserved	255			
21	PCTRL1-STOP	255			Process controller stop (value ”frozen”)
22	DCTRL1-CW/QSP	255			Failsafe change of the direction of rotation
23	DCTRL1-CCW/QSP	255			
24	DFIN1-ON	255			0 = Frequency input not active 1 = Frequency input active Frequency input configuration under C0425 and C0426



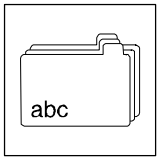
Appendix

Code table

Code		Possible settings								IMPORTANT	
No.	Name	Lenze	Selection								
C0410↲ (cont.)	Free configuration of digital input signals		Linkage of external signal sources to internal digital signals Digital signal source							• **A selection made under C0007 is copied to the corresponding subcode of C0410. A change of C0410 sets C0007 = -255-!**	
25 (A)	PCTRL1-FOLL1-0	255								Compensator at reset ramp C0193 to "0"	
26 (A)	Reserved	255									
27 (A)	NSET1-TI1/3	255								Activate acceleration times	
28 (A)	NSET1-TI2/3	255								C0410/27 C0410/28 active LOW LOW C0012; C0013 HIGH LOW T_{ir} 1; T_{if} 1 LOW HIGH T_{ir} 2; T_{if} 2 HIGH HIGH T_{ir} 3; T_{if} 3	
29 (A)	PCTRL1-FADING	255								Process controller output on (LOW)/ off (HIGH)	
30 (A)	PCTRL1-INV-ON	255								Process controller output inversion	
31 (A)	PCTRL1-NADD-OFF	255								Switch off additional setpoint	
32 (A)	PCTRL1-RFG2-0	255								Decelerate process controller ramp function generator input to "0" along ramp C0226	
33 (A)	NSET1-JOG4/5/6/7	255									
C0411↲	Level inversion digital inputs E1 ... E6	-0-		E6 2^5	E5 2^4	E4 2^3	E3 2^2	E2 2^1	E1 2^0	• The binary value of the selected number determines the input levels: – 0: Ex is not inverted (HIGH active) – 1: Ex is inverted (LOW active) • C0114 and C0411 are identical • E5, E6 only application I/O **The function "Parameter set changeover" cannot be inverted!**	📖 7-45
			-0-	0	0	0	0	0	0		
			-1-	0	0	0	0	0	1		
			-2-	0	0	0	0	1	0		
			-3-	0	0	0	0	1	1		
			...				...				
			-63-	1	1	1	1	1	1		



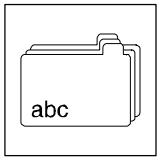
Code		Possible settings				IMPORTANT		
No.	Name	Lenze	Selection					
C0412↵	Free configuration of analog input signals				Connection between external analog signal sources and internal analog signals Analog signal source	**A selection made under C0005, C0007 will be copied to the corresponding subcode of C0412. A change of C0412 sets C0005 = -255-, C0007 = -255-!**		📖 7-38
1	Setpoint 1 (NSET1–N1)	1	0 255		not assigned (FIXED-FREE) or selection via keypad or parameter channel of an AIF bus module	Either NSET1-N1 or NSET1-N2 active Changeover with C0410/17	Parameter channel: C0046	
2	Setpoint 2 (NSET1-N2)	1	1		X3/8 or X3/1U, X3/1I (AIN1-OUT)		Parameter channel: C0044	
3	Additional setpoint (PCTRL1-NADD)	255	2		Frequency input (DFIN1-OUT) (Observe C0410/24, C0425, C0426, C0427)	Is added to NSET1-N1, NSET1-N2, JOG values and the function Set of the keypad Parameter channel: C0049		
4	Process controller setpoint 1 (PCTRL1-SET1)	255	3 4		Motor potentiometer (MPOT1-OUT) X3/2U, X3/2I (AIN2-OUT, application I/O only)			
5	Act. process controller value (PCTRL1-ACT)	255	5 ... 9		Input signal = constantly 0 (FIXED0)	Parameter channel: C0051, if C0238 = 1, 2		
6	Torque setpoint or torque limit value (MCTRL1-MSET)	255	10 11		AIF input word 1 (AIF-IN.W1) AIF input word 2 (AIF-IN.W2) (Only evaluated if C0001 =3!)	Observe C0014! Actual torque values not required. 16384 ≡ 100 % torque setpoint Condition for selection via terminal (C0412/6 = 1, 2 oder 4): Analog input gain is set to C0414/x, C0426 = 32768/C0011 [%]	Parameter channel: C0047	
7	Reserved	255	20 ... 23		CAN-IN1.W1 ... W4/FIF-IN.W1 ... W4 Word 1 (20) ... word 4 (23)			
8	MCTRL1-VOLT-ADD	255	30 ... 33		CAN-IN2.W1 ... W4 Word 1 (24) ... word 4 (27)	Only for special applications. Modifications only when agreed on by Lenze!		
9	MCTRL1-PHI-ADD	255	200		Word-by-word assignment of signals from the function module INTERBUS or PROFIBUS to FIF (see C0005)			
C0413*	Offset analog inputs					The max. limit of the setpoint value range of C0034 equals 100 %		📖 7-22
1	AIN1-OFFSET	0.0	-200.0	{0.1 %}	200.0	Settings for X3/8 and X3/1U, X3/1I C0413/1 and C0026 are identical		
2	AIN2-OFFSET	0.0				Setting for X3/2U, X3/2I (application I/O only)		
C0414*	Analog input gain					• 100.0 % = Gain 1 • Inverse setpoint selection by negative gain and negative offset		
1	AIN1-GAIN	100.0	-1500.0	{0.1 %}	1500.0	Settings for X3/8 and X3/1U, X3/1I C0414/1 and C0027 are identical		
2	AIN2-GAIN	100.0				Setting for X3/2U, X3/2I (application I/O only)		



Appendix

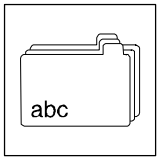
Code table

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0415↵	Free configuration of digital outputs		Output of digital signals to terminals	• **A selection under C0008 will be copied to C0415/1. A change of C0415/1 sets C0008 = -255-!** • **A selection under C0117 will be copied to C0415/2. A changef of C0415/2 sets C0117 = -255-!** • **C0415/3 only application–I/O**	📖 7-47
1	Relay output K1 (RELAY)	25	0 255 Not assigned (FIXED-FREE)		
			1 PAR-B0 active (DCTRL1-PAR-B0)		
			2 Pulse inhibit active (DCTRL1-IMP)		
2	Digital output X3/A1 (DIGOUT1)	16	3 I_{max} limit reached (MCTRL1-IMAX) (C0014 = -5-: Torque setpoint reached)		
			4 Frequency setpoint reached (MCTRL1-RFG1=NOUT)		
3	Digital output X3/A2 (DIGOUT2)	255	5 Ramp functin generator 1: Input = output (NSET1-RFG1-I=O)	RFG1 = Ramp function generator main setpoint	
			6 Q_{min} threshold higher (PCTRL1-QMIN)	active PAR-B1 PAR-B0 PAR1 LOW LOW PAR2 LOW HIGH PAR3 HIGH LOW PAR4 HIGH HIGH	
			7 Output frequency = 0 (DCTRL1-NOUT=0)		
			8 Controller inhibit active (DCTRL1-CINH)		
			9...12 Reserved		
			13 Overtemperature (ϑ_{max} -5 °C) (DCTRL1-OH-WARN)		
			14 DC-bus overvoltage (DCTRL1-OV)		
			15 CCW rotation (DCTRL1-CCW)		
			16 Ready for operation (DCTRL1-RDY)		
			17 PAR-B1 active (DCTRL1-PAR-B1)		
			18 TRIP or Q_{min} or pulse inhibit (IMP) active (DCTRL1-TRIP-QMIN-IMP)		
			19 PTC warning (DCTRL1-PTC-WARN)		
			20 Apparent motor current < current threshold (DCTRL1-IMOT<ILIM)	Belt monitoring Apparent motor current = C0054 Current threshold = C0156	
			21 Apparent motor current < current threshold and Q_{min} threshold reached (DCTRL1-(IMOT<ILIM)-QMIN		
			22 Apparent motor current < current threshold and RFG 1: Input = output (DCTRL1-(IMOT<ILIM)-RFG-I=0)		
			23 Warning motor phase failure (DCTRL1-LP1-WARN)		
			24 Minimum output frequency reached (PCTRL1-NMIN)		
			25 TRIP fault message (DCTRL1-TRIP)		
			26 Motor is running (DCTRL1-RUN)		
			27 Motor is running/CW rotation (DCTRL1-RUN-CW)		
			28 Motor is running/CCW rotation (DCTRL1-RUN-CCW)		
			29 Process controller input = process controller output (PCTRL1-SET=ACT)		
			30 Reserved		
			31 Apparent motor current > current threshold and ramp function generator 1: Input = output (DCTRL1-(IMOT>ILIM)-RFG-I=0)	Overload monitoring Apparent motor current = C0054 Current threshold = C0156	
			32 ... 37 X3/E1 (32) ... X3/E6 (37)	Digital input terminals	



Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0415↵ (cont.)	Free configuration of digital outputs		Output of digital signals to terminals		📖 7-47
			40...55 AIF control word (AIF-CTRL) Bit 0 (40) ... bit 15 (55) 60...75 CAN-IN1.W1 or FIF-IN.W1 Bit 0 (60) ... bit 15 (75) 80...95 CAN-IN1.W2 or FIF-IN.W2 Bit 0 (80) ... bit 15 (95) 100...115 CAN-IN2.W1, bit 0 (100) ... bit 15 (115) 120...135 CAN-IN2.W2, bit 0 (120) ... bit 15 (135)	Bits of fieldbus input words Assigned bits of AIF-CTRL: Bit 3: QSP Bit 7: CINH Bit 10: TRIP-SET Bit 11: TRIP-RESET	
			140...172 Status application I/O 140 Torque threshold 1 reached (MSET1=MACT) 141 Torque threshold 2 reached (MSET2=MACT) 142 Process controller output limit reached (PCTRL1-LIM) 143 ... 172 Reserved	Only active when using application I/O	
C0416↵	Level inversion digital outputs	0		• 0: Output not inverted (HIGH-aktiv) • 1: Output inverted(LOW-aktiv) • X3/A2 only application I/O	📖 7-47

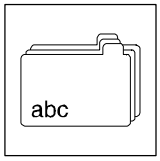
	X3/A2	X3/A1	Relay K1
-0-	0	0	0
-1-	0	0	1
-2-	0	1	0
-3-	0	1	1
-4-	1	0	0
-5-	1	0	1
-6-	1	1	0
-7-	1	1	1



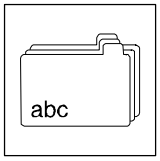
Appendix

Code table

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0417*↲	Free configuration of controller status messages (1)		Output of digital signals to bus	• The assignment is mapped to the – Controller status word 1 (C0150) – AIF status word (AIF-STAT) – FIF output word 1 (FIF-OUT.W1) – Output word 1 in the CAN object 1 (CAN-OUT1.W1) → **Fixed assignment to AIF in operation with communication modules: INTERBUS 2111, PROFIBUS-DP 2131 or LECOM-A/B/LI 2102. Modifications are not allowed!** If you use function modules system bus (CAN), INTERBUS, PROFIBUS-DP to FIF, all bits are freely configurable.	🕮 7-50
1	Bit 0	1	Digital signal sources like C0415		
2	Bit 1	2 →			
3	Bit 2	3			
4	Bit 3	4			
5	Bit 4	5			
6	Bit 5	6			
7	Bit 6	7 →			
8	Bit 7	8 →			
9	Bit 8	9 →	11|10|9|8 controller status 0000 Controller initialization 0010 Switch-on inhibit 0011 Operation inhibited **0100 Flying-restart circuit active** 0101 DC-injection brake active **0110 Operation enabled** 0111 Message active 1000 Active fault		
10	Bit 9	10 →			
11	Bit 10	11 →			
12	Bit 11	12 →			
13	Bit 12	13 →			
14	Bit 13	14 →			
15	Bit 14	15			
16	Bit 15	16			
C0418*↲	Free configuration of controller status messages (2)		Output of digital signals to bus	• The assignment is mapped to the – Controller status word 2 (C0151) – FIF output word 2 (FIF-OUT.W2) – Output word 1 in the CAN object 2 (CAN-OUT2.W1) • All bits can be freely configured	🕮 7-50
1	Bit 0	255	Digital signal sources like C0415		
...	...				
16	Bit 15	255			



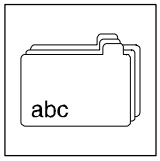
Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0419↲	Free configuration of analog outputs			Analog signal output to terminal Analog signal source	• **The selection made under C0111 is copied to C0419/1. A change of C0419/1 sets C0111 = 255!** • C0419/2, C0419/3 only active in operation with application–I/O • DFOUT1: 50 ... 10 kHz	📖 7-39
1	X3/62 (AOUT1-IN)	0	0	Output frequency (MCTRL1-NOUT+SLIP)	6 V/12 mA/5.85 kHz ≡ C0011	
2	X3/63 (AOUT2-IN)	2	1	Controller load (MCTRL1-MOUT)	3 V/6 mA/2.925 kHz ≡ Rated motor torque with vector control (C0014 = 4), otherwise rated active inverter current (active current/C0091)	
3	X3/A4 (DFOUT1-IN)	3	2	Apparent motor current (MCTRL1-IMOT)	3 V/6 mA/2.925 kHz ≡ Rated inverter current	
			3	DC-bus voltage (MCTRL1-DCVOLT)	6 V/12 mA/5.85 kHz ≡ DC 1000 V (400 V- mains 6 V/12 mA/5.85 kHz ≡ DC 380 V (230 V mains)	
			4	Motor power	3 V/6 mA/2.925 kHz ≡ Rated motor power	
			5	Motor voltage (MCTRL1-VOLT)	4.8 V/9.6 mA/4.68 kHz ≡ Rated motor voltage	
			6	1/output frequency (1/C0050) (MCTRL1-1/NOUT)	2 V/4 mA/1.95 kHz ≡ 0.5 × C0011	
			7	Output frequency with limits (NSET1-C0010...C0011)	0 V/0 mA/4 mA/0 kHz ≡ f = f_{min} (C0010) 6 V/12 mA/5.85 kHz ≡ f = f_{max} (C0011)	
			8	Operation with process controller (C0238 = 0, 1): Act. process controller value (PCTRL1-ACT) Operation without process controller (C0238 = 2): Output frequency without slip (MCTRL1-NOUT)	6 V/12 mA/5.85 kHz ≡ C0011	
			9	Ready for operation (DCTRL1-RDY)	Selection -9- ... -25- corresponds to the digital functions of the relay output K1 (C0008) or the digital output A1 (C0117): LOW = 0 V/0 mA/4 mA/ 0 kHz HIGH = 10 V/20 mA/10 kHz	
			10	TRIP fault message (DCTRL1-TRIP)		
			11	Motor is running (DCTRL1-RUN)		
			12	Motor is running / CW rotation (DCTRL1-RUN-CW)		
			13	Motor is running / CCW rotation (DCTRL1-RUN-CCW)		
			14	Output frequency = 0 (DCTRL1-NOUT=0)		
			15	Frequency setpoint reached (MCTRL1-RFG1=NOUT)		
			16	Q_{min} threshold reached (PCTRL1-QMIN)		
			17	I_{max} limit reached (MCTRL1-IMAX) C0014 = -5-: Torque setpoint reached		
			18	Overtemperature (ϑ_{max} - 5 °C) (DCTRL1-OH-WARN)		
			19	TRIP or Q_{min} or pulse inhibit (IMP) active (DCTRL1-TRIP-QMIN-IMP)		
			20	PTC warning (DCTRL1-PTC-WARN)		
			21	Apparent motor current < current threshold (DCTRL1-IMOT<ILIM)	Belt monitoring Apparent motor current = C0054 Current threshold = C0156	
			22	Apparent motor current < current threshold and Q_{min} threshold reached (DCTRL1-(IMOT<ILIM)-QMIN)		
			23	Apparent motor current < current threshold and RFG 1: Input = output (DCTRL1-(IMOT<ILIM)-RFG-I=0)		
			24	Warning motor phase failure (DCTRL1-LP1-WARN)		
			25	Minimum output frequency reached (PCTRL1-NMIN)		



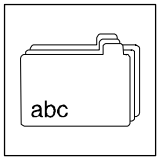
Appendix

Code table

Code		Possible settings		IMPORTANT	
No.	Name	Lenze	Selection		
C0419↵ (cont.)	Free configuration of analog outputs		Analog signal output to terminal Analog signal source		📖 7-39
			27 Output frequency without slip (MCTRL1-NOUT)	6 V/12 mA/5.85 kHz ≡ C0011	
			28 Act. process controller value (PCTRL1-ACT)		
			29 Process controller setpoint (PCTRL1-SET1)	6 V/12 mA/5.85 kHz ≡ C0011	
			30 Process controller output (PCTRL1-OUT)		
			31 Ramp function generator input (NSET1-RFG1-IN)		
			32 Ramp function generator output (NSET1-NOUT)		
			33 (A) PID controller output (PCTRL1-PID-OUT)		
			34 (A) Process controller output (PCTRL1-NOUT)		
			35 Input signal at X3/8 or X3/1U, X3/1I, evaluated with gain (C0414/1 or C0027) and offset (C0413/1 or C0026) (AIN1-OUT)	6 V/12 mA/5.85 kHz ≡ Maximum value analog input signal (5 V, 10 V, 20 mA, 10 kHz) Condition: Gain of analog input or frequency input set to: C0414/x, C0426 = 100 %	
			36 Input signal at frequency input X3/E1, evaluated with gain (C0426) and offset (C0427) (DFIN1-OUT)		
			37 Motor potentiometer output (MPOT1-OUT)		
			38 Input signal at X3/2U, X3/2I, evaluated with gain (C0414/2) and offset (C0413/2) (AIN2-OUT)		
			40 AIF input word 1 (AIF-IN.W1) 41 AIF input word 2 (AIF-IN.W2)	Setpoint to drive from communication module to AIF 10 V/20 mA/10 kHz ≡ 1000	
			50 ... 53 CAN-IN1.W1 ... 4 oder FIF-IN.W1 ... FIF-IN.W4 Word 1 (50) ... word 4 (53) 60 ... 63 CAN-IN2.W1 ... 4 Word 1 (60) ... word 4 (63)	Setpoints to drive from function module to FIF 10 V/20 mA/10 kHz ≡ 1000	
			255 Not assigned (FIXED-FREE)		
C0420*	Gain analog output X3/62 (AOUT1-GAIN) Standard I/O	128	0 {1} 255	128 ≡ Gain 1 C0420 and C0108 are the same	
C0420* (A)	Gain analog outputs Application I/O			128 ≡ Gain 1	
1	X3/62 (AOUT1-GAIN)	128	0 {1} 255	C0420/1 and C0108 are the same	
2	X3/63 (AOUT2-GAIN)				



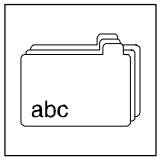
Code		Possible settings			IMPORTANT	
No.	Name	Lenze	Selection			
C0421↲	Free configuration analog process data output words			Output of analog signals on bus Analog signal source	• **With Lenze setting, CAN-OUT1.W1 and FIF-OUT.W1 are defined as digital outputs and the 16-bit controller status word 1 (C0417) is assigned to them.** • **If you want to output analog values (C0421/3 ≠ 255), the digital assignment must be deleted (C0417/x = 255)! Otherwise the output signal would be incorrect.**	📖 7-43
1	AIF-OUT.W1	8	0	Output frequency with slip (MCTRL1-NOUT+SLIP)	24000 ≡ 480 Hz	
2	AIF-OUT.W2	0	1	Controller load (MCTRL1-MOUT)	16383 ≡ Rated motor torque with vector control (C0014 = 4), otherwise rated active inverter current (active current/C0091)	
3	CAN-OUT1.W1 / FIF-OUT.W1	255	2	Apparent motor current (MCTRL1-IMOT)	16383 ≡ Rated inverter current	
4	CAN-OUT1.W2 / FIF-OUT.W2	255	3	DC-bus voltage (MCTRL1-DCVOLT)	16383 ≡ 1000 VDC at 400 V mains 16383 ≡ 380 VDC at 230 V mains	
5	CAN-OUT1.W3 / FIF-OUT.W3	255	4	Motor power	285 ≡ Rated motor power	
6	CAN-OUT1.W4 / FIF-OUT.W4	255	5	Motor voltage (MCTRL1-VOLT)	16383 ≡ Rated motor voltage	
7	CAN-OUT2.W1	255	6	1/output frequency (1/C0050) (MCTRL1-1/NOUT)	195 ≡ 0.5 × C0011	
8	CAN-OUT2.W2	255	7	Output frequency with limits (NSET1-C0010...C0011)	24000 ≡ 480 Hz $0 \equiv f < C0010$ $\frac{24000 \cdot (f - C0010)}{480\ Hz} \equiv f \geq C0010$	
9	CAN-OUT2.W3	255	8	Operation with process controller (C0238 = 0, 1): Act. process controller value (PCTRL1-ACT)	24000 ≡ 480 Hz	
10	CAN-OUT2.W4	255		Operation without process controller (C0238 = 2): Output frequency without slip (MCTRL1-NOUT)		
			9	Ready for operation (DCTRL1-RDY)	Selection -9- ... -25- corresponds to the digital functions of the relay output K1 (C0008) or the digital output A1 (C0117): LOW = 0 V/0 mA/4 mA HIGH = 10 V/20 mA	
			10	TRIP fault message (DCTRL1-TRIP)		
			11	Motor is running (DCTRL1-RUN)		
			12	Motor is running / CW rotation (DCTRL1-RUN-CW)		
			13	Motor is running / CCW rotation (DCTRL1-RUN-CCW)		
			14	Output frequency = 0 (DCTRL1-NOUT=0)		
			15	Frequency setpoint reached (MCTRL1-RFG1=NOUT)		
			16	Q_{min} threshold reached (PCTRL1-QMIN)		
			17	I_{max} limit reached (MCTRL1-IMAX) C0014 = -5-: Torque setpoint reached		
			18	Overtemperature (ϑ_{max} -5 °C) (DCTRL1-OH-WARN)		
			19	TRIP or Q_{min} or pulse inhibit (IMP) (DCTRL1-IMP)		
			20	PTC warning (DCTRL1-PTC-WARN)		
			21	Apparent motor current < current threshold (DCTRL1-IMOT<ILIM)	Belt monitoring Apparent motor current = C0054 Current threshold = C0156	
			22	Apparent motor current < current threshold and Q_{min} threshold reached (DCTRL1-(IMOT<ILIM)-QMIN)		
			23	Apparent motor current < current threshold and RFG 1: Input = output (DCTRL1-(IMOT<ILIM)-RFG-I=0)		
			24	Warning motor phase failure (DCTRL1-LP1-WARN)		
			25	Minimum output frequency reached (PCTRL1-NMIN)		



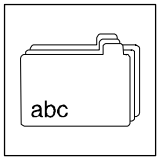
Appendix

Code table

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0421↲ (cont.)	Free configuration analog process data output words			Output of analog signals on bus Analog signal source			📖 7-43
			27	Output frequency without slip (MCTRL1-NOUT)		24000 ≡ 480 Hz	
			28	Act. process controller value (PCTRL1-ACT)			
			29	Process controller setpoint (PCTRL1-SET1)			
			30	Process controller output (PCTRL1-OUT)			
			31	Ramp function generator input (NSET1-RFG1-IN)			
			32	Ramp function generator output (NSET1-NOUT)			
			33 (A)	PID controller output (PCTRL1-PID-OUT)			
			34 (A)	Process controller output (PCTRL1-NOUT)			
			35	Input signal at X3/8 or X3/1U, X3/1I, evaluated with gain (C0414/1 or C0027) and offset (C0413/1 or C0026) (AIN1-OUT)		1000 ≡ Maximum value analog input signal (5 V, 10 V, 20 mA, 10 kHz) Condition: Gain of analog input or frequency input set to: C0414/x, C0426 = 20/C0011 [%]	
			36	Input signal at frequency input X3/E1, evaluated with gain (C0426) and offset (C0427) (DFIN1-OUT)			
			37	Motor potentiometer output (MPOT1-OUT)			
			38	Input signal at X3/2U, X3/2I, evaluated with gain (C0414/2) and offset (C0413/2) (AIN2-OUT)			
			40 41	AIF input word 1 (AIF-IN.W1) AIF input word 2 (AIF-IN.W2)		Setpoint to drive from communication module to AIF Normalisation via AIF	
			50 ... 53 60 ... 63	CAN-IN1.W1 ... 4 oder FIF-IN.W1 ... FIF-IN.W4 Word 1 (50) ... word 4 (53) CAN-IN2.W1 ... 4 Word 1 (60) ... word 4 (63)		Setpoints to controller from CAN or function module to FIF Normalisation via CAN or FIF	
			255	Not assigned (FIXED-FREE)			
C0422*	Offset analog output X3/62 (AOUT1-OFFSET) Standard I/O	0.00	-10.00	{0.01 V}	10.00	C0422 and C0109 are the same	📖 7-39
C0422* (A)	Offset analog outputs Application I/O						
1	X3/62 (AOUT1-OFFSET)	0.00	-10.00	{0.01 V}	10.00	C0422/1 and C0109 are the same	
2	X3/63 (AOUT2-OFFSET)						
C0423* (A)	Digital output delay		0.000	{0.001 s}	65.000	"Debouncing" of digital outputs (as of version application-I/O E82ZAFA ... Vx11) • Switches the digital output if the linked signal is still active after the time set. • Digital output reset with delay	📖 7-47
1	Relay output K1 (RELAY)	0.000					
2	Digital output X3/A1 (DIGOUT1)	0.000					
3	Digital output X3/A2 (DIGOUT2)	0.000					
C0424*↲ (A)	Output signal range - analog outputs Application–I/O					Observe the jumper setting of the function module! (as of version application-I/O E82ZAFA ... Vx11)	📖 7-39
1	X3/62 (AOUT1)	-0-	-0-	0 ... 10 V / 0 ... 20 mA			
2	X3/63 (AOUT2)	-0-	-1-	4 ... 20 mA			



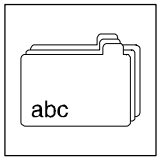
Code		Possible settings						IMPORTANT	
No.	Name	Lenze	Selection						
C0425↲*	Configuration frequency input single track X3/E1 (DFIN1)	-2-		f_r	Δf_{min}	t	f_{max}	• f_r = Normalisation frequency – f_r corresponds to C0011 • Δf_{min} = Resolution • t = Scanning rate – The lower the scanning rate the higher the dynamical response. • f_{max} = Maximum frequency which can be processed independently of C0425 – Set C0425 that the frequency coming from the encoder is lower than f_{max} • Activate frequency input with C0410/24 = 1 • Adjust frequency input under C0426 and C0427	📖 7-25
			-0-	100 Hz	1/200	1 s	300 Hz		
			-1-	1 kHz	1/200	100 msec	3 kHz		
			-2-	10 kHz	1/200	10 msec	10 kHz		
			-3-	10 kHz	1/1000	50 msec	10 kHz		
			-4-	10 kHz	1/10000	500 msec	10 kHz		
			-5- (A)	100 kHz	1/400	2 msec	100 kHz		
			-6- (A)	100 kHz	1/1000	5 msec	100 kHz		
			-7- (A)	100 kHz	1/2000	10 msec	100 kHz		
	Configuration frequency input two tracks X3/E1, X3/E2 (DFIN1)		-10- (A)	100 Hz	1/200	1 s	300 Hz		
			-11- (A)	1 kHz	1/200	100 msec	3 kHz		
			-12- (A)	10 kHz	1/200	10 msec	10 kHz		
			-13- (A)	10 kHz	1/1000	50 msec	10 kHz		
			-14- (A)	10 kHz	1/10000	500 msec	10 kHz		
			-15- (A)	100 kHz	1/400	2 msec	100 kHz		
			-16- (A)	100 kHz	1/1000	5 msec	100 kHz		
			-17- (A)	100 kHz	1/2000	10 msec	100 kHz		
C0426*	Gain frequency input X3/E1, X3/E2 (A) (DFIN1-GAIN)	100	-1500.0		{0.1 %}		1500.0	$C0426 = \frac{f_N(C0425)}{\frac{n_{max}}{60\,s} \cdot inc/rev} \cdot \frac{C0011 - f_s}{C0011} \cdot 100\,\%$ • n_{max} = Maximum process speed of motor in min^{-1} • f_s = Slip frequency in Hz	
C0427*	Offset frequency input X3/E1, X3/E2 (A) (DFIN1-OFFSET)	0.0	-100.0		{0.1 %}		100.0		
C0428* (A)	Gain frequency output (DFOUT1-OUT)	100	0.0		{0.1 %}		1500.0		
C0430*↲ (A)	Automatic analog input adjustsment	-0-	-0-	not active				Gain and offset are calculated by two points from the setpoint characteristic. Choose two points distant from each other to increase the calculation accuracy. 1. Select and input under C0430 which you want to calculate gain and offset for 2. Enter point 1 under C0431 X value (setpoint) and Y value (output frequency) 3. Enter point 2 under C0432 X value (setpoint) and Y value (output frequency) 4. Calculated values are automatically entered under C0413 (offset) and C0414 (gain)	📖 7-24
			-1-	Input point for X3/1U, X3/1I					
			-2-	Input points for X3/2U, X3/2I					
C0431*↲ (A)	Coordinates point 1		-100.0		{0.1 %}		100.0		
1	X (P1)	-100.0	Analog setpoint of P1 100 % = max. input value (5 V, 10 V or 20 mA)						
2	Y (P1)	-100.0	Output frequency of P1 100 % = C0011						
C0432*↲ (A)	Coordinates point 2		-100.0		{0.1 %}		100.0		
1	X (P2)	100.0	Analog setpoint of P1 100 % = max. input value (5 V, 10 V or 20 mA)						
2	Y (P2)	100.0	Output frequency of P1 100 % = C0011						
C0435*↲ (A)	Automatic frequency input adjustment	0	0 = not active		{1}		4096	• Only require for speed control with digital feedback via HTL encoder • Calculates the gain C0426, depending on C0425 and C0011 • C0426 will be recalculated after every change of C0011 or C0425. • **Always enter number of increments divided by number of pole pairs of the motor!** – Example: Encoder increments = 4096, motor 4 poles – C0435 = 2048	



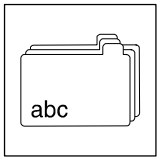
Appendix

Code table

Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0440 (A)	Additional JOG values					JOG = Setpoint Activation via configuration under C0410	📖 7-28
1	JOG 1	20.00	-650.00	{0.02 Hz	650.00	C04401/1 and C0037 are the same	
2	JOG 2	30.00				C04401/2 and C0038 are the same	
3	JOG 3	40.00				C04401/3 and C0039 are the same	
4	JOG 4	15.00					
5	JOG 5	25.00					
6	JOG 6	35.00					
7	JOG 7	45.00					
[C0469]*	Function of key STOP of the keypad	-1-	-0-	not active		Determines the function which is activated when pressing STOP. **Changes will only be active after mains switching!**	
			-1-	CINH (controller inhibit)			
			-2-	QSP (quick stop)			
C0500*	Calibration of numerator variable	2000	1	{1}	25000	• The codes C0010, C0011, C0017, C0019, C0037, C0038, C0039, C0044, C0046, C0049, C0050, C0051, C0138, C0139, **C0140**, **C0181**, **C0239**, **C0625**, **C0626**, C0627 can be calibrated in a way that the keypad indicates a process variable. • If C0500/C0501 remain unchanged, the unit "Hz" will no longer be displayed.	📖 7-54
C0501*	Calibration of denominator process variable	10	1	{1}	25000		
C0500* (A)	Calibration of numerator variable	2000	1	{1}	25000	• The codes C0037, C0038, C0039, C0044, C0046, C0049, C0051, C0138, C0139, C0140, C0181 can be calibrated in a way that the keypad indicates a process variable with the unit selected under **C0502**. • Frequency-related codes (C0010, C0011, C0017, C0019, C0050, C0239, C0625, C0626, C0627) are always indicated in "Hz".	
C0501* (A)	Calibration of denominator process variable	10	1	{1}	25000		
C0502* (A)	Process variable unit	0	0: — 1: ms 2: s 4: A 5: V	6: rpm 9: °C 10: Hz 11: kVA 12: Nm	13: % 14: kW 15: N 16: mV 17: mΩ	18: Ω 19: hex 34: m 35: h 42: mH	
C0517*↲	User menu					• After mains switching or when using the function Disp the code from C0517/1 will be displayed. • In Lenze setting, the user menu contains the most important codes for setting up the control mode "V/f characteristic control with linear characteristic" • When the password protection is activated, only the codes entered under C0517 are freely accessible. • Enter the required code numbers in the subcodes.	📖 7-58
1	Memory 1	50	C0050	Output frequency (MCTRL1-NOUT)			
2	Memory 2	34	C0034	Analog setpoint selection range			
3	Memory 3	7	C0007	Fixed configuration - digital input signals			
4	Memory 4	10	C0010	Minimum output frequency			
5	Memory 5	11	C0011	Maximum output frequency			
6	Memory 6	12	C0012	Acceleration time main setpoint			
7	Memory 7	13	C0013	Deceleration time main setpoint			
8	Memory 8	15	C0015	V/f rated frequency			
9	Memory 9	16	C0016	U_{min} boost			
10	Memory 10	2	C0002	Parameter set transfer			
C0518	Service codes					**Modifications only by Lenze Service!**	
C0519							
C0520							
C0597*↲	Configuration of motor phase failure detection **Configuration of** motor phase failure **detection** Configuration of motor phase failure detection	-0-				Deactivate it before motor parameter identification. Otherwise the identification will be stopped with the error message *LP1*	
			-0-	not active		Error messages:	
			-1-	TRIP is indicated		Keypad: *LP1*, bus: 32	
			-2-	Warning		Keypad: *LP1*, bus: 182	
C0599*↲	Current limit value for motor phase failure detection	5	1	{1 %}	50	• Threshold for C0597 • Reference: Rated controller current	



Code		Possible settings				IMPORTANT	
No.	Name	Lenze	Selection				
C0625*	Skip frequency 1	480.00	0.00	{0.02 Hz}	480.00		📖 7-9
C0626*	Skip frequency 2	480.00	0.00	{0.02 Hz}	480.00		
C0627*	Skip frequency 3	480.00	0.00	{0.02 Hz}	480.00		
C0628*	Bandwidth of skip frequencies	0.00	0.00	{0.01 %}	100.00	Applies to C0625, C0626, C0627	
C0988*	DC-bus voltage threshold for DC-bus voltage control	0	0	{1 %}	200	• C0988 = 0 % – Parameter set changeover via DC-bus voltage deactivated • Changeover always between PAR1 nd PAR2 • Parameter set changeover via terminal, bus or PC is not possible if C0988 > 0!	📖 7-11 📖 7-20
C01500*	Software number application I/O					Only PC display	
C1501*	Software creation date application I/O					Only PC display	
C1502 (A)	Software number application I/O					Output to keypad as string in 4 parts à 4 characters	
1	Part 1						
...	...						
4	Part 4						
C1504 ... C1507	Service codes application I/O					**Modifications only by Lenze Service!**	

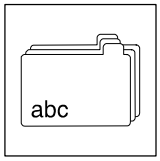


14.3 Attribute table

For writing programs it is necessary to have the data given in the attribute table. The table contains all information required for the parameter communication with the controller.

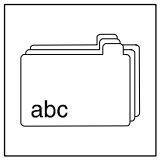
How to read the attribute table:

Column		**Meaning**	**Entry**	
Code		Name of the Lenze code	Cxxxx	
Index	dec	Index for parameter addressing. The subindex for array variables corresponds to the Lenze subcode number		Anly required for control via INTERBUS, PRAFIBUS-DP or system bus (CAN).
	hex			
Data	DS	Data structure	I	Single variable (one parameter element only)
			A	Array variable (several parameter elements)
	DA	No. of array elements (subcodes)	xx	
	DT	Data type	B8	1 byte bit coded
			B16	2 byte bit coded
			B32	4 byte bit coded
			FIX32	32 bit value with sign; decimal with 4 decimal codes
			I32	4 byte with sign
			U32	4 byte without sign
			VS	ASCII string
	DL	Data length in byte		
	Format	LECAM format	VD	ASCII decimal format
			VH	ASCII hexadecimal format
			VS	String format
			VA	Actett string format for data blocks
Access	LCM-R/W	Access permission for LECAM	Ra	Reading always allowed
			Wa	Writing always allowed
			W	Writing only under condition
	Condition	Condition for writing	CINH	Writing only allowed when the controller is inhibited



14.3.1 Attribute table for controllers with standard I/A

Code	Index		Data					Access	
	dec	hex	DS	DA	DL	DT	Format	LCM-R/W	Condition
C0001	24574dec	5FFEhex	I	1	4	FIX32	VD	Ra/Wa	
C0002	24573dec	5FFDhex	E	1	4	FIX32	VD	Ra/W	CINH
C0003	24572dec	5FFChex	E	1	4	FIX32	VD	Ra/Wa	
C0004	24571dec	5FFBhex	E	1	4	FIX32	VD	Ra/Wa	
C0005	24570dec	5FFAhex	E	1	4	FIX32	VD	Ra/Wa	
C0007	24568dec	5FF8hex	E	1	4	FIX32	VD	Ra/Wa	
C0008	24567dec	5FF7hex	E	1	4	FIX32	VD	Ra/Wa	
C0009	24566dec	5FF6hex	E	1	4	FIX32	VD	Ra/Wa	
C0010	24565dec	5FF5hex	E	1	4	FIX32	VD	Ra/Wa	
C0011	24564dec	5FF4hex	E	1	4	FIX32	VD	Ra/Wa	
C0012	24563dec	5FF3hex	E	1	4	FIX32	VD	Ra/Wa	
C0013	24562dec	5FF2hex	E	1	4	FIX32	VD	Ra/Wa	
C0014	24561dec	5FF1hex	E	1	4	FIX32	VD	Ra/Wa	
C0015	24560dec	5FF0hex	E	1	4	FIX32	VD	Ra/Wa	
C0016	24559dec	5FEFhex	E	1	4	FIX32	VD	Ra/Wa	
C0017	24558dec	5FEEhex	E	1	4	FIX32	VD	Ra/Wa	
C0018	24557dec	5FEDhex	E	1	4	FIX32	VD	Ra/Wa	
C0019	24556dec	5FEChex	E	1	4	FIX32	VD	Ra/Wa	
C0021	24554dec	5FEAhex	E	1	4	FIX32	VD	Ra/Wa	
C0022	24553dec	5FE9hex	E	1	4	FIX32	VD	Ra/Wa	
C0023	24552dec	5FE8hex	E	1	4	FIX32	VD	Ra/Wa	
C0026	24549dec	5FE5hex	E	1	4	FIX32	VD	Ra/Wa	
C0027	24548dec	5FE4hex	E	1	4	FIX32	VD	Ra/Wa	
C0034	24541dec	5FDDhex	E	1	4	FIX32	VD	Ra/Wa	
C0035	24540dec	5FDChex	E	1	4	FIX32	VD	Ra/Wa	
C0036	24539dec	5FDBhex	E	1	4	FIX32	VD	Ra/Wa	
C0037	24538dec	5FDAhex	E	1	4	FIX32	VD	Ra/Wa	
C0038	24537dec	5FD9hex	E	1	4	FIX32	VD	Ra/Wa	
C0039	24536dec	5FD8hex	E	1	4	FIX32	VD	Ra/Wa	
C0040	24535dec	5FD7hex	E	1	4	FIX32	VD	Ra/Wa	
C0043	24532dec	5FD4hex	E	1	4	FIX32	VD	Ra/Wa	
C0044	24531dec	5FD3hex	E	1	4	FIX32	VD	Ra	
C0046	24529dec	5FD1hex	E	1	4	FIX32	VD	Ra	
C0047	24528dec	5FD0hex	E	1	4	FIX32	VD	Ra	
C0049	24526dec	5FCEhex	E	1	4	FIX32	VD	Ra	
C0050	24525dec	5FCDhex	E	1	4	FIX32	VD	Ra	
C0051	24524dec	5FCChex	E	1	4	FIX32	VD	Ra	
C0052	24523dec	5FCBhex	E	1	4	FIX32	VD	Ra	
C0053	24522dec	5FCAhex	E	1	4	FIX32	VD	Ra	
C0054	24521dec	5FC9hex	E	1	4	FIX32	VD	Ra	
C0056	24519dec	5FC7hex	E	1	4	FIX32	VD	Ra	
C0061	24514dec	5FC2hex	E	1	4	FIX32	VD	Ra	
C0070	24505dec	5FB9hex	E	1	4	FIX32	VD	Ra/Wa	
C0071	24504dec	5FB8hex	E	1	4	FIX32	VD	Ra/Wa	
C0072	24503dec	5FB7hex	E	1	4	FIX32	VD	Ra/Wa	
C0074	24501dec	5FB5hex	E	1	4	FIX32	VD	Ra/Wa	
C0077	24498dec	5FB2hex	E	1	4	FIX32	VD	Ra/Wa	
C0078	24497dec	5FB1hex	E	1	4	FIX32	VD	Ra/Wa	
C0079	24496dec	5FB0hex	E	1	4	FIX32	VD	Ra/Wa	
C0084	24491dec	5FABhex	E	1	4	FIX32	VD	Ra/Wa	
C0087	24488dec	5FA8hex	E	1	4	FIX32	VD	Ra/Wa	
C0088	24487dec	5FA7hex	E	1	4	FIX32	VD	Ra/Wa	
C0089	24486dec	5FA6hex	E	1	4	FIX32	VD	Ra/Wa	
C0090	24485dec	5FA5hex	E	1	4	FIX32	VD	Ra/Wa	
C0091	24484dec	5FA4hex	E	1	4	FIX32	VD	Ra/Wa	
C0092	24483dec	5FA3hex	E	1	4	FIX32	VD	Ra/Wa	
C0093	24482dec	5FA2hex	E	1	4	FIX32	VD	Ra	
C0094	24481dec	5FA1hex	E	1	4	FIX32	VD	Ra	
C0099	24476dec	5F9Chex	E	1	4	FIX32	VD	Ra	
C0105	24470dec	5F96hex	E	1	4	FIX32	VD	Ra/Wa	



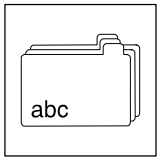
Appendix

Attribute table

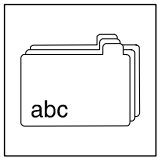
Code	Index		Data					Access	
	dec	hex	DS	DA	DL	DT	Format	LCM-R/W	Condition
C0106	24469dec	5F95hex	E	1	4	FIX32	VD	Ra/Wa	
C0107	24468dec	5F94hex	E	1	4	FIX32	VD	Ra/Wa	
C0108	24467dec	5F93hex	E	1	4	FIX32	VD	Ra/Wa	
C0109	24466dec	5F92hex	E	1	4	FIX32	VD	Ra/Wa	
C0111	24464dec	5F90hex	E	1	4	FIX32	VD	Ra/Wa	
C0114	24461dec	5F8Dhex	E	1	4	FIX32	VD	Ra/Wa	
C0117	24458dec	5F8Ahex	E	1	4	FIX32	VD	Ra/Wa	
C0119	24456dec	5F88hex	E	1	4	FIX32	VD	Ra/Wa	
C0120	24455dec	5F87hex	E	1	4	FIX32	VD	Ra/Wa	
C0125	24450dec	5F82hex	E	1	4	FIX32	VD	Ra/Wa	
C0126	24449dec	5F81hex	E	1	4	FIX32	VD	Ra/Wa	
C0127	24448dec	5F80hex	E	1	4	FIX32	VD	Ra/Wa	
C0135	24440dec	5F78hex	E	1	2	B16	VH	Ra	
C0138	24437dec	5F75hex	I	1	4	FEX32	VD	Ra	
C0139	24436dec	5F74hex	I	1	4	FEX32	VD	Ra	
C0140	24435dec	5F73hex	I	1	4	FEX32	VD	Ra/Wa	
C0141	24434dec	5F72hex	I	1	4	FEX32	VD	Ra/Wa	
C0142	24433dec	5F71hex	I	1	4	FEX32	VD	Ra/Wa	
C0143	24432dec	5F70hex	E	1	4	FIX32	VD	Ra/Wa	
C0144	24431dec	5F6Fhex	E	1	4	FIX32	VD	Ra/Wa	
C0145	24430dec	5F6Ehex	E	1	4	FIX32	VD	Ra/Wa	
C0148	24427dec	5F6Bhex	E	1	4	FIX32	VD	Ra/W	CINH
C0150	24425dec	5F69hex	E	1	2	B16	VH	Ra	
C0151	24424dec	5F68hex	E	1	2	B16	VH	Ra	
C0155	24420dec	5F64hex	E	1	2	B16	VH	Ra	
C0156	24419dec	5F63hex	E	1	4	FIX32	VD	Ra/Wa	
C0161	24414dec	5F5Ehex	E	1	4	FIX32	VD	Ra	
C0162	24413dec	5F5Dhex	E	1	4	FIX32	VD	Ra	
C0163	24412dec	5F5Chex	E	1	4	FIX32	VD	Ra	
C0164	24411dec	5F5Bhex	E	1	4	FIX32	VD	Ra	
C0165	24410dec	5F5Ahex	E	1	4	FIX32	VD	Ra/Wa	
C0168	24407dec	5F57hex	E	1	4	FIX32	VD	Ra	
C0170	24405dec	5F55hex	E	1	4	FIX32	VD	Ra/Wa	
C0171	24404dec	5F54hex	E	1	4	FIX32	VD	Ra/Wa	
C0174	24401dec	5F51hex	E	1	4	FIX32	VD	Ra/W	CINH
C0178	24397dec	5F4Dhex	E	1	4	FIX32	VD	Ra	
C0179	24396dec	5F4Chex	E	1	4	FIX32	VD	Ra	
C0181	24394dec	5F4Ahex	E	1	4	FIX32	VD	Ra/Wa	
C0182	24393dec	5F49hex	E	1	4	FIX32	VD	Ra/Wa	
C0183	24392dec	5F48hex	E	1	4	FIX32	VD	Ra	
C0184	24391dec	5F47hex	E	1	4	FIX32	VD	Ra/Wa	
C0185	24390dec	5F46hex	E	1	4	FIX32	VD	Ra/Wa	
C0196	24379dec	5F3Bhex	E	1	4	FIX32	VD	Ra/Wa	
C0200	24375dec	5F37hex	E	1	14	VS	VS	Ra	
C0201	24374dec	5F36hex	I	1	17	VS	VS	Ra	
C0202	24373dec	5F35hex	E	1	4	FIX32	VD	Ra	
C0220	24355dec	5F23hex	E	1	4	FIX32	VD	Ra/Wa	
C0221	24354dec	5F22hex	E	1	4	FIX32	VD	Ra/Wa	
C0238	24337dec	5F11hex	E	1	4	FIX32	VD	Ra/Wa	
C0239	24336dec	5F10hex	E	1	4	FIX32	VD	Ra/Wa	
C0265	24310dec	5EF6hex	E	1	4	FIX32	VD	Ra/Wa	
C0304	24271dec	5ECFhex	E	1	4	FIX32	VD	Ra/Wa	
C0305	24270dec	5ECEhex	E	1	4	FIX32	VD	Ra/Wa	
C0306	24269dec	5ECDhex	E	1	2	U16	VH	Ra/Wa	
C0307	24268dec	5ECChex	I	1	2	U16	VH	Ra/Wa	
C0308	24267dec	5ECBhex	E	1	4	FIX32	VD	Ra/Wa	
C0309	24266dec	5ECAhex	E	1	4	FIX32	VD	Ra/Wa	
C0350	24225dec	5EA1hex	E	1	4	FIX32	VD	Ra/Wa	
C0351	24224dec	5EA0hex	E	1	4	FIX32	VD	Ra/Wa	
C0352	24223dec	5E9Fhex	E	1	4	FIX32	VD	Ra/Wa	
C0353	24222dec	5E9Ehex	A	3	4	FEX32	VD	Ra/Wa	
C0354	24221dec	5E9Dhex	A	6	4	FIX32	VD	Ra/Wa	

Appendix

Attribute table



Code	Index		Data					Access	
	dec	hex	DS	DA	DL	DT	Format	LCM-R/W	Condition
C0355	24220dec	5E9Chex	A	6	4	FEX32	VD	Ra	
C0356	24219dec	5E9Bhex	A	4	4	FIX32	VD	Ra/Wa	
C0357	24218dec	5E9Ahex	A	3	4	FIX32	VD	Ra/Wa	
C0358	24217dec	5E99hex	E	1	4	FIX32	VD	Ra/Wa	
C0359	24216dec	5E98hex	E	1	4	FIX32	VD	Ra	
C0360	24215dec	5E97hex	E	1	4	FIX32	VD	Ra/Wa	
C0370	24205dec	5E8Dhex	E	1	4	FIX32	VD	Ra/Wa	
C0372	24203dec	5E8Bhex	E	1	4	FIX32	VD	Ra	
C0395	24180dec	5E74hex	E	1	4	B32	VH	Ra	
C0396	24179dec	5E73hex	E	1	4	B32	VH	Ra	
C0410	24165dec	5E65hex	A	25	4	FIX32	VD	Ra/Wa	
C0411	24164dec	5E64hex	E	1	4	FIX32	VD	Ra/Wa	
C0412	24163dec	5E63hex	A	9	4	FIX32	VD	Ra/Wa	
C0413	24162dec	5E62hex	A	2	4	FIX32	VD	Ra/Wa	
C0414	24161dec	5E61hex	A	2	4	FIX32	VD	Ra/Wa	
C0415	24160dec	5E60hex	A	3	4	FIX32	VD	Ra/Wa	
C0416	24159dec	5E5Fhex	E	1	4	FIX32	VD	Ra/Wa	
C0417	24158dec	5E5Ehex	A	16	4	FIX32	VD	Ra/Wa	
C0418	24157dec	5E5Dhex	A	16	4	FIX32	VD	Ra/Wa	
C0419	24156dec	5E5Chex	A	3	4	FIX32	VD	Ra/Wa	
C0420	24155dec	5E5Bhex	E	1	4	FIX32	VD	Ra/Wa	
C0421	24154dec	5E5Ahex	A	10	4	FIX32	VD	Ra/Wa	
C0422	24153dec	5E59hex	E	1	4	FIX32	VD	Ra/Wa	
C0425	24150dec	5E56hex	E	1	4	FIX32	VD	Ra/Wa	
C0426	24149dec	5E55hex	E	1	4	FIX32	VD	Ra/Wa	
C0427	24148dec	5E54hex	E	1	4	FIX32	VD	Ra/Wa	
C0469	24106dec	5E2Ahex	E	1	4	FIX32	VD	Ra/W	CINH
C0500	24075dec	5E0Bhex	E	1	4	FIX32	VD	Ra/Wa	
C0501	24074dec	5E0Ahex	E	1	4	FIX32	VD	Ra/Wa	
C0517	24058dec	5DFAhex	A	10	4	FIX32	VD	Ra/Wa	
C0518	24057dec	5DF9hex	A	250	4	FIX32	VD	Ra/Wa	
C0519	24056dec	5DF8hex	A	250	4	FIX32	VD	Ra	
C0597	23978dec	5DAAhex	E	1	4	FIX32	VD	Ra/Wa	
C0599	23976dec	5DA8hex	E	1	4	FIX32	VD	Ra/Wa	
C0625	23950dec	5D8Ehex	E	1	4	FIX32	VD	Ra/Wa	
C0626	23949dec	5D8Dhex	E	1	4	FIX32	VD	Ra/Wa	
C0627	23948dec	5D8Chex	E	1	4	FIX32	VD	Ra/Wa	
C0628	23947dec	5D8Bhex	E	1	4	FIX32	VD	Ra/Wa	
C0988	23587dec	5C23hex	E	1	4	FIX32	VD	Ra/Wa	



Appendix

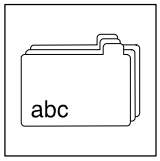
Attribute table

14.3.2 Attribute table for controllers with application I/A

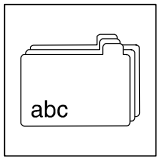
Code	Index		Data					Access	
	dec	hex	DS	DA	DL	DT	Format	LCM-R/W	Condition
C0001	24574dec	5FFEhex	E	1	FIX32	4	VD	Ra/Wa	
C0002	24573dec	5FFDhex	E	1	FIX32	4	VD	Ra/W	CINH
C0003	24572dec	5FFChex	E	1	FIX32	4	VD	Ra/Wa	
C0004	24571dec	5FFBhex	E	1	FIX32	4	VD	Ra/Wa	
C0005	24570dec	5FFAhex	E	1	FIX32	4	VD	Ra/Wa	
C0007	24568dec	5FF8hex	E	1	FIX32	4	VD	Ra/Wa	
C0008	24567dec	5FF7hex	E	1	FIX32	4	VD	Ra/Wa	
C0009	24566dec	5FF6hex	E	1	FIX32	4	VD	Ra/Wa	
C0010	24565dec	5FF5hex	E	1	FIX32	4	VD	Ra/Wa	
C0011	24564dec	5FF4hex	E	1	FIX32	4	VD	Ra/Wa	
C0012	24563dec	5FF3hex	E	1	FIX32	4	VD	Ra/Wa	
C0013	24562dec	5FF2hex	E	1	FIX32	4	VD	Ra/Wa	
C0014	24561dec	5FF1hex	E	1	FEX32	4	VD	Ra/Wa	
C0015	24560dec	5FF0hex	I	1	FIX32	4	VD	Ra/Wa	
C0016	24559dec	5FEFhex	E	1	FIX32	4	VD	Ra/Wa	
C0017	24558dec	5FEEhex	E	1	FIX32	4	VD	Ra/Wa	
C0018	24557dec	5FEDhex	E	1	FIX32	4	VD	Ra/Wa	
C0019	24556dec	5FEChex	E	1	FIX32	4	VD	Ra/Wa	
C0021	24554dec	5FEAhex	E	1	FIX32	4	VD	Ra/Wa	
C0022	24553dec	5FE9hex	E	1	FIX32	4	VD	Ra/Wa	
C0023	24552dec	5FE8hex	E	1	FIX32	4	VD	Ra/Wa	
C0026	24549dec	5FE5hex	E	1	FIX32	4	VD	Ra/Wa	
C0027	24548dec	5FE4hex	E	1	FIX32	4	VD	Ra/Wa	
C0034	24541dec	5FDDhex	A	2	FIX32	4	VD	Ra/Wa	
C0035	24540dec	5FDChex	E	1	FIX32	4	VD	Ra/Wa	
C0036	24539dec	5FDBhex	E	1	FIX32	4	VD	Ra/Wa	
C0037	24538dec	5FDAhex	E	1	FIX32	4	VD	Ra/Wa	
C0038	24537dec	5FD9hex	E	1	FIX32	4	VD	Ra/Wa	
C0039	24536dec	5FD8hex	E	1	FIX32	4	VD	Ra/Wa	
C0040	24535dec	5FD7hex	E	1	FIX32	4	VD	Ra/Wa	
C0043	24532dec	5FD4hex	E	1	FIX32	4	VD	Ra/Wa	
C0044	24531dec	5FD3hex	E	1	FIX32	4	VD	Ra	
C0046	24529dec	5FD1hex	E	1	FIX32	4	VD	Ra	
C0047	24528dec	5FD0hex	E	1	FIX32	4	VD	Ra	
C0049	24526dec	5FCEhex	E	1	FIX32	4	VD	Ra	
C0050	24525dec	5FCDhex	E	1	FIX32	4	VD	Ra	
C0051	24524dec	5FCChex	E	1	FIX32	4	VD	Ra	
C0052	24523dec	5FCBhex	E	1	FIX32	4	VD	Ra	
C0053	24522dec	5FCAhex	E	1	FIX32	4	VD	Ra	
C0054	24521dec	5FC9hex	E	1	FIX32	4	VD	Ra	
C0056	24519dec	5FC7hex	E	1	FIX32	4	VD	Ra	
C0061	24514dec	5FC2hex	E	1	FIX32	4	VD	Ra	
C0070	24505dec	5FB9hex	E	1	FIX32	4	VD	Ra/Wa	
C0071	24504dec	5FB8hex	E	1	FIX32	4	VD	Ra/Wa	
C0072	24503dec	5FB7hex	E	1	FIX32	4	VD	Ra/Wa	
C0074	24501dec	5FB5hex	E	1	FIX32	4	VD	Ra/Wa	
C0077	24498dec	5FB2hex	E	1	FIX32	4	VD	Ra/Wa	
C0078	24497dec	5FB1hex	E	1	FIX32	4	VD	Ra/Wa	
C0079	24496dec	5FB0hex	E	1	FIX32	4	VD	Ra/Wa	
C0084	24491dec	5FABhex	E	1	FIX32	4	VD	Ra/Wa	
C0087	24488dec	5FA8hex	E	1	FIX32	4	VD	Ra/Wa	
C0088	24487dec	5FA7hex	E	1	FIX32	4	VD	Ra/Wa	
C0089	24486dec	5FA6hex	E	1	FIX32	4	VD	Ra/Wa	
C0090	24485dec	5FA5hex	E	1	FIX32	4	VD	Ra/Wa	
C0091	24484dec	5FA4hex	E	1	FIX32	4	VD	Ra/Wa	
C0092	24483dec	5FA3hex	E	1	FIX32	4	VD	Ra/Wa	
C0093	24482dec	5FA2hex	E	1	FIX32	4	VD	Ra	
C0094	24481dec	5FA1hex	E	1	FIX32	4	VD	Ra	
C0099	24476dec	5F9Chex	E	1	FIX32	4	VD	Ra	
C0101	24474dec	5F9Ahex	E	1	FIX32	4	VD	Ra/Wa	

Appendix

Attribute table



Code	Index		Data					Access	
	dec	hex	DS	DA	DL	DT	Format	LCM-R/W	Condition
C0103	24472dec	5F98hex	E	1	FIX32	4	VD	Ra/Wa	
C0105	24470dec	5F96hex	E	1	FIX32	4	VD	Ra/Wa	
C0106	24469dec	5F95hex	E	1	FIX32	4	VD	Ra/Wa	
C0107	24468dec	5F94hex	E	1	FIX32	4	VD	Ra/Wa	
C0108	24467dec	5F93hex	E	1	FIX32	4	VD	Ra/Wa	
C0109	24466dec	5F92hex	E	1	FIX32	4	VD	Ra/Wa	
C0111	24464dec	5F90hex	E	1	FIX32	4	VD	Ra/Wa	
C0114	24461dec	5F8Dhex	E	1	FIX32	4	VD	Ra/Wa	
C0117	24458dec	5F8Ahex	E	1	FIX32	4	VD	Ra/Wa	
C0119	24456dec	5F88hex	E	1	FIX32	4	VD	Ra/Wa	
C0120	24455dec	5F87hex	E	1	FIX32	4	VD	Ra/Wa	
C0125	24450dec	5F82hex	E	1	FIX32	4	VD	Ra/Wa	
C0126	24449dec	5F81hex	E	1	FIX32	4	VD	Ra/Wa	
C0127	24448dec	5F80hex	E	1	FIX32	4	VD	Ra/Wa	
C0135	24440dec	5F78hex	E	1	B16	2	VH	Ra	
C0138	24437dec	5F75hex	E	1	FIX32	4	VD	Ra	
C0139	24436dec	5F74hex	E	1	FIX32	4	VD	Ra	
C0140	24435dec	5F73hex	E	1	FIX32	4	VD	Ra/Wa	
C0141	24434dec	5F72hex	E	1	FIX32	4	VD	Ra/Wa	
C0142	24433dec	5F71hex	E	1	FIX32	4	VD	Ra/Wa	
C0143	24432dec	5F70hex	E	1	FIX32	4	VD	Ra/Wa	
C0144	24431dec	5F6Fhex	E	1	FIX32	4	VD	Ra/Wa	
C0145	24430dec	5F6Ehex	E	1	FIX32	4	VD	Ra/Wa	
C0148	24427dec	5F6Bhex	E	1	FIX32	4	VD	Ra/W	CINH
C0150	24425dec	5F69hex	E	1	B16	2	VH	Ra	
C0151	24424dec	5F68hex	E	1	B16	2	VH	Ra	
C0152	24423dec	5F67hex	E	1	B16	2	VH	Ra	
C0155	24420dec	5F64hex	E	1	B16	2	VH	Ra	
C0156	24419dec	5F63hex	E	1	FIX32	4	VD	Ra/Wa	
C0161	24414dec	5F5Ehex	E	1	FIX32	4	VD	Ra	
C0162	24413dec	5F5Dhex	E	1	FIX32	4	VD	Ra	
C0163	24412dec	5F5Chex	E	1	FIX32	4	VD	Ra	
C0164	24411dec	5F5Bhex	E	1	FIX32	4	VD	Ra	
C0165	24410dec	5F5Ahex	E	1	FIX32	4	VD	Ra/Wa	
C0168	24407dec	5F57hex	E	1	FIX32	4	VD	Ra	
C0170	24405dec	5F55hex	E	1	FIX32	4	VD	Ra/Wa	
C0171	24404dec	5F54hex	E	1	FIX32	4	VD	Ra/Wa	
C0174	24401dec	5F51hex	E	1	FIX32	4	VD	Ra/W	CINH
C0178	24397dec	5F4Dhex	E	1	FIX32	4	VD	Ra	
C0179	24396dec	5F4Chex	E	1	FIX32	4	VD	Ra	
C0181	24394dec	5F4Ahex	E	1	FIX32	4	VD	Ra/Wa	
C0182	24393dec	5F49hex	E	1	FIX32	4	VD	Ra/Wa	
C0183	24392dec	5F48hex	E	1	FIX32	4	VD	Ra	
C0184	24391dec	5F47hex	E	1	FIX32	4	VD	Ra/Wa	
C0185	24390dec	5F46hex	E	1	FIX32	4	VD	Ra/Wa	
C0189	24386dec	5F42hex	E	1	FIX32	4	VD	Ra	
C0190	24385dec	5F41hex	E	1	FIX32	4	VD	Ra/Wa	
C0191	24384dec	5F40hex	E	1	FIX32	4	VD	Ra/Wa	
C0192	24383dec	5F3Fhex	E	1	FIX32	4	VD	Ra/Wa	
C0193	24382dec	5F3Ehex	E	1	FIX32	4	VD	Ra/Wa	
C0194	24381dec	5F3Dhex	E	1	FIX32	4	VD	Ra/Wa	
C0195	24380dec	5F3Chex	E	1	FIX32	4	VD	Ra/Wa	
C0196	24379dec	5F3Bhex	E	1	FIX32	4	VD	Ra/Wa	
C0200	24375dec	5F37hex	E	1	VS	14	VS	Ra	
C0201	24374dec	5F36hex	E	1	VS	17	VS	Ra	
C0202	24373dec	5F35hex	E	1	FIX32	4	VD	Ra	
C0220	24355dec	5F23hex	E	1	FIX32	4	VD	Ra/Wa	
C0221	24354dec	5F22hex	E	1	FIX32	4	VD	Ra/Wa	
C0225	24350dec	5F1Ehex	E	1	FIX32	4	VD	Ra/Wa	
C0226	24349dec	5F1Dhex	E	1	FIX32	4	VD	Ra/Wa	
C0228	24347dec	5F1Bhex	E	1	FIX32	4	VD	Ra/Wa	
C0229	24346dec	5F1Ahex	E	1	FIX32	4	VD	Ra/Wa	



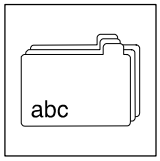
Appendix

Attribute table

Code	Index		Data					Access	
	dec	hex	DS	DA	DL	DT	Format	LCM-R/W	Condition
C0230	24345dec	5F19hex	E	1	FIX32	4	VD	Ra/Wa	
C0231	24344dec	5F18hex	E	1	FIX32	4	VD	Ra/Wa	
C0232	24343dec	5F17hex	E	1	FIX32	4	VD	Ra/Wa	
C0233	24342dec	5F16hex	E	1	FIX32	4	VD	Ra/Wa	
C0234	24341dec	5F15hex	E	1	FIX32	4	VD	Ra/Wa	
C0235	24340dec	5F14hex	E	1	FIX32	4	VD	Ra/Wa	
C0236	24339dec	5F13hex	E	1	FIX32	4	VD	Ra/Wa	
C0238	24337dec	5F11hex	E	1	FIX32	4	VD	Ra/Wa	
C0239	24336dec	5F10hex	E	1	FIX32	4	VD	Ra/Wa	
C0240	24335dec	5F0Fhex	E	1	FIX32	4	VD	Ra/Wa	
C0241	24334dec	5F0Ehex	E	1	FIX32	4	VD	Ra/Wa	
C0242	24333dec	5F0Dhex	E	1	FIX32	4	VD	Ra/Wa	
C0243	24332dec	5F0Chex	E	1	FIX32	4	VD	Ra/Wa	
C0244	24331dec	5F0Bhex	E	1	FIX32	4	VD	Ra/Wa	
C0245	24330dec	5F0Ahex	E	1	FIX32	4	VD	Ra/Wa	
C0250	24325dec	5F05hex	E	1	FIX32	4	VD	Ra/Wa	
C0251	24324dec	5F04hex	E	1	FIX32	4	VD	Ra/Wa	
C0252	24323dec	5F03hex	E	1	FIX32	4	VD	Ra/Wa	
C0253	24322dec	5F02hex	E	1	FIX32	4	VD	Ra/Wa	
C0254	24321dec	5F01hex	E	1	FIX32	4	VD	Ra/Wa	
C0255	24320dec	5F00hex	E	1	FIX32	4	VD	Ra/Wa	
C0265	24310dec	5EF6hex	E	1	FIX32	4	VD	Ra/Wa	
C0304	24271dec	5ECFhex	E	1	FIX32	4	VD	Ra/Wa	
C0305	24270dec	5ECEhex	E	1	FIX32	4	VD	Ra/Wa	
C0306	24269dec	5ECDhex	E	1	U16	2	VH	Ra/Wa	
C0307	24268dec	5ECChex	E	1	U16	2	VH	Ra/Wa	
C0308	24267dec	5ECBhex	E	1	FIX32	4	VD	Ra/Wa	
C0309	24266dec	5ECAhex	E	1	FIX32	4	VD	Ra/Wa	
C0350	24225dec	5EA1hex	E	1	FIX32	4	VD	Ra/Wa	
C0351	24224dec	5EA0hex	E	1	FIX32	4	VD	Ra/Wa	
C0352	24223dec	5E9Fhex	E	1	FIX32	4	VD	Ra/Wa	
C0353	24222dec	5E9Ehex	A	3	FIX32	4	VD	Ra/Wa	
C0354	24221dec	5E9Dhex	A	6	FIX32	4	VD	Ra/Wa	
C0355	24220dec	5E9Chex	A	6	FIX32	4	VD	Ra	
C0356	24219dec	5E9Bhex	A	4	FIX32	4	VD	Ra/Wa	
C0357	24218dec	5E9Ahex	A	3	FIX32	4	VD	Ra/Wa	
C0358	24217dec	5E99hex	E	1	FIX32	4	VD	Ra/Wa	
C0359	24216dec	5E98hex	E	1	FIX32	4	VD	Ra	
C0360	24215dec	5E97hex	E	1	FIX32	4	VD	Ra/Wa	
C0370	24205dec	5E8Dhex	E	1	FIX32	4	VD	Ra/Wa	
C0372	24203dec	5E8Bhex	E	1	FIX32	4	VD	Ra	
C0395	24180dec	5E74hex	E	1	B32	4	VH	Ra	
C0396	24179dec	5E73hex	E	1	B32	4	VH	Ra	
C0410	24165dec	5E65hex	A	32	FIX32	4	VD	Ra/Wa	
C0411	24164dec	5E64hex	E	1	FIX32	4	VD	Ra/Wa	
C0412	24163dec	5E63hex	A	9	FIX32	4	VD	Ra/Wa	
C0413	24162dec	5E62hex	A	2	FIX32	4	VD	Ra/Wa	
C0414	24161dec	5E61hex	A	2	FIX32	4	VD	Ra/Wa	
C0415	24160dec	5E60hex	A	3	FIX32	4	VD	Ra/Wa	
C0416	24159dec	5E5Fhex	E	1	FIX32	4	VD	Ra/Wa	
C0417	24158dec	5E5Ehex	A	16	FIX32	4	VD	Ra/Wa	
C0418	24157dec	5E5Dhex	A	16	FIX32	4	VD	Ra/Wa	
C0419	24156dec	5E5Chex	A	3	FIX32	4	VD	Ra/Wa	
C0420	24155dec	5E5Bhex	E	1	FIX32	4	VD	Ra/Wa	
C0421	24154dec	5E5Ahex	A	10	FIX32	4	VD	Ra/Wa	
C0422	24153dec	5E59hex	E	1	FIX32	4	VD	Ra/Wa	
C0423	24152dec	5E58hex	A	3	FIX32	4	VD	Ra/Wa	
C0424	24151dec	5E57hex	A	2	FIX32	4	VD	Ra/Wa	
C0425	24150dec	5E56hex	E	1	FIX32	4	VD	Ra/Wa	
C0426	24149dec	5E55hex	E	1	FIX32	4	VD	Ra/Wa	
C0427	24148dec	5E54hex	E	1	FIX32	4	VD	Ra/Wa	
C0428	24147dec	5E53hex	E	1	FIX32	4	VD	Ra/Wa	

Appendix

Attribute table



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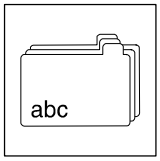
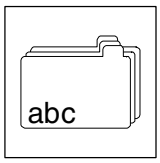
	dec	hex	DS	DA	DL	DT	Format	LCM-R/W	Condition
C0430	24145dec	5E51hex	E	1	FIX32	4	VD	Ra/Wa	
C0431	24144dec	5E50hex	E	1	FIX32	4	VD	Ra/Wa	
C0432	24143dec	5E4Fhex	E	1	FIX32	4	VD	Ra/Wa	
C0435	24140dec	5E4Chex	E	1	FIX32	4	VD	Ra/Wa	
C0469	24106dec	5E2Ahex	E	1	FIX32	4	VD	Ra/W	CINH
C0500	24075dec	5E0Bhex	E	1	FIX32	4	VD	Ra/Wa	
C0501	24074dec	5E0Ahex	E	1	FIX32	4	VD	Ra/Wa	
C0502	24073dec	5E09hex	E	1	FIX32	4	VD	Ra/Wa	
C0517	24058dec	5DFAhex	A	10	FIX32	4	VD	Ra/Wa	
C0518	24057dec	5DF9hex	A	250	FIX32	4	VD	Ra/Wa	
C0519	24056dec	5DF8hex	A	250	FIX32	4	VD	Ra	
C0597	23978dec	5DAAhex	E	1	FIX32	4	VD	Ra/Wa	
C0599	23976dec	5DA8hex	E	1	FIX32	4	VD	Ra/Wa	
C0625	23950dec	5D8Ehex	E	1	FIX32	4	VD	Ra/Wa	
C0626	23949dec	5D8Dhex	E	1	FIX32	4	VD	Ra/Wa	
C0627	23948dec	5D8Chex	E	1	FIX32	4	VD	Ra/Wa	
C0628	23947dec	5D8Bhex	E	1	FIX32	4	VD	Ra/Wa	
C0988	23587dec	5C23hex	E	1	FIX32	4	VD	Ra/Wa	
C1500	23075dec	5A23hex	E	1	VS	14	VS	Ra	
C1501	23074dec	5A22hex	E	1	VS	17	VS	Ra	
C1504	23071dec	5A1Fhex	E	1	FIX32	4	VD	Ra/Wa	
C1505	23070dec	5A1Ehex	E	1	FIX32	4	VD	Ra/Wa	
C1506	23069dec	5A1Dhex	E	1	U16	2	VH	Ra/Wa	
C1507	23068dec	5A1Chex	E	1	U16	2	VH	Ra/Wa	
C1550	23025dec	59F1hex	E	1	FIX32	4	VD	Ra/W	CINH



Appendix

Attribute table



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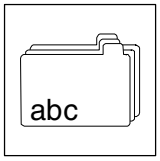

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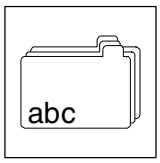

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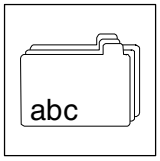

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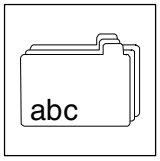

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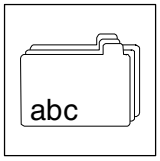

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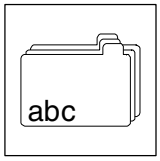

U

V

W