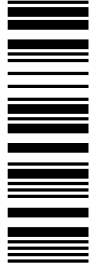
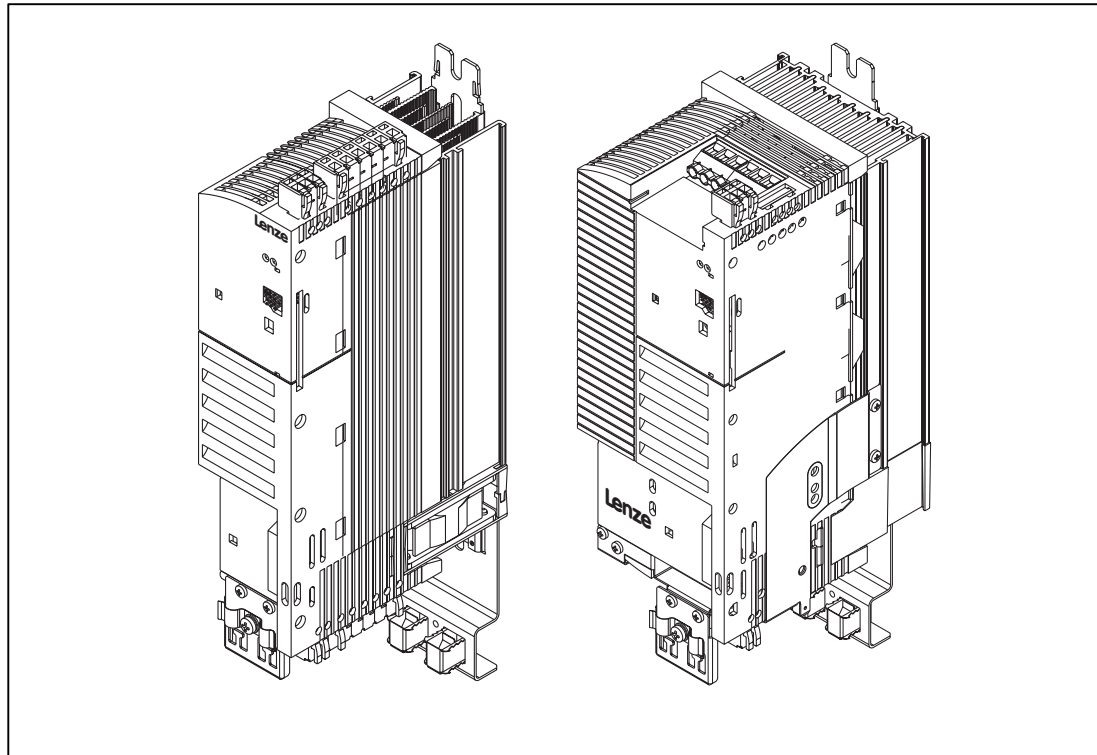


EDBEMVCAN  
00475778



# Lenze

## ***Wiring according to EMC with fieldbus function module "System bus (CAN)"***



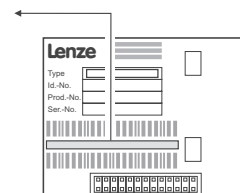
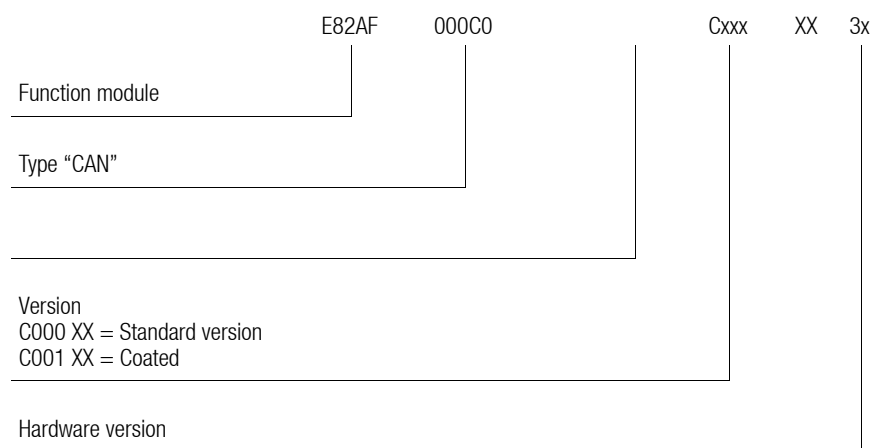
***Global Drive***

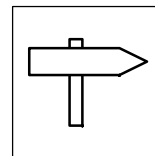
***Frequency inverter***

***8200 vector series***

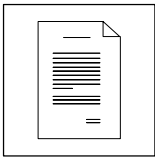
***0.25 kW ... 11 kW***

This documentation is valid for system bus function modules (CAN) as of version:





<b>1</b>	<b>Preface and general information</b> .....	<b>2</b>
1.1	About these Instructions .....	2
1.2	Terminology used .....	2
<b>2</b>	<b>Safety instructions</b> .....	<b>3</b>
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## ***Preface and general information***

# **1 Preface and general information**

## **1.1 About these Instructions**

- This EMC brochure is based on the Operating Instructions of the basic device and the different CAN modules.
- It is intended for all persons who design and install the "system bus (CAN)" fieldbus function module.
- It describes special measures to set up a CE-typical drive system with the "system bus (CAN)" fieldbus function module and the 8200 vector frequency inverter.
- If the measures described here are executed in a complete and correct way, the following can be assured:
  - The 8200 frequency inverter does not radiate any EMC interferences.
  - The operation of the bus system is not influenced by any EMC interferences.

## **1.2 Terminology used**

<b>Term</b>	<b>In the following text used for</b>
<b>Controller</b>	Any frequency inverter, servo inverter, or DC controller of Lenze
<b>vector</b>	8200 vector frequency inverter
<b>Drive</b>	Lenze controller in combination with a geared motor, three-phase AC motor, and other Lenze drive components
<b>AIF</b>	<b>Automation InterFace</b> : Interface for a communication module.
<b>FIF</b>	<b>Function InterFace</b> : Interface for a function module.
<b>Cxxxx/y</b>	Subcode y of code Cxxxx (e.g. C0410/3 = Subcode 3 of code C0410)
<b>Xk/y</b>	Terminal y on terminal strip Xk (e.g. X3/28 = Terminal 28 on terminal strip X3)
 xx-yyy	Cross reference to a page



## 2 Safety instructions

### General

Lenze controllers (frequency inverters, servo inverters, DC controllers) can include live and rotating parts - depending on their type of protection - during operation. Surfaces can be hot.

Non-authorized removal of the required cover, inappropriate use, incorrect installation or operation, creates the risk of severe injury to persons or damage to material assets.

For more detailed 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 or 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 installation, assembly, commissioning, and operation of the product and who have the qualifications necessary for their occupation.

### Application as directed

Drive controllers are components which are designed for installation in electrical systems or machinery. They are not to be used as household appliances. They are intended exclusively for professional and commercial purposes according to EN 61000-3-2. This documentation includes information in compliance with the EN 61000-3-2.

When installing the drive controllers in machines, commissioning (i.e. starting of operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 98/37/EC (Machinery Directive); EN 60204 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 of the series EN 50178/DIN VDE 0160 apply to the controllers.

The technical data and information on the connection conditions must be obtained from the nameplate and the documentation. They must be observed in any case.

**Warning:** The availability of controllers is restricted according to EN 61800-3. These products can cause radio interferences in residential areas. In this case, special measures are required.

### Transport, storage

Please observe the notes on transport, storage and appropriate handling.

Observe the climatic conditions according to EN 50178.

### Installation

The controllers must be installed and cooled according to the regulations given in the documentation.

Ensure proper handling and avoid mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.

Controllers contain electrostatically sensitive components which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!



## Safety information

### Lenze controllers

#### Electrical connection

When working on live drive controllers, the applicable national regulations for the prevention of accidents (e.g. VBG 4) must be observed.

The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the documentation.

The documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system or machine is responsible for the compliance with the required limit values demanded by the EMC legislation.

#### Operation

Systems including controllers must be equipped with additional monitoring and protection devices according to the corresponding standards (e.g. technical equipment, regulations for the prevention of accidents, etc.). If necessary, adapt the controllers to your application. Please observe the corresponding information given in the Instructions.

After the controller has been disconnected from the supply voltage, live components and power connection must not be touched immediately since capacitors could be charged. Please observe the corresponding notes on the controller.

All covers and doors must be closed during operation.

**Note for UL-approved systems with integrated controllers:** UL warnings are notes which apply to UL systems. The documentation contains special information about UL.

#### Safe standstill

Variant V004 of the controller series 9300 and 9300 vector, variant x4x of the controller series 8200 vector and axis module ECSxAxxx support the function "Safe standstill", protection against unintentional restart, according to the requirements of Appendix I, No. 1.2.7 of the EC Directive "Machinery" 98/37/EC, DIN EN 954-1 category 3 and DIN EN 1037. It is absolutely necessary to observe the information about the function "Safe standstill" in the corresponding documentation and instructions.

#### Maintenance and servicing

The controllers do not require any maintenance, if the application conditions prescribed are observed.

In operating areas with polluted ambient air, the cooling surfaces of the controller can get dirty or the cooling openings can block. Under these conditions a regular cleaning of the cooling surfaces and cooling openings is essential. Do not use sharp or pointed objects for this purpose!

#### Disposal

Recycle metals and plastics. Dispose of printed circuit board assemblies according to the state of the art.

**The product-specific safety and application notes in these Instructions must also be observed!**

## Safety information

### Residual hazards, Layout of the safety instructions



## 2.1 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, +UG, -UG, BR1 and BR2 remain live for at least 3 minutes after mains switch-off.
  - because the power terminals L1, L2, L3; U, V, W, +UG, -UG, BR1 and BR2 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 non-fail safe function "Selection of direction of rotation" via the digital signal DCTRL1-CW/CCW (C0007 = 0 ... 13, C0410/3 ≠ 255):
  - In the event of an open circuit or failure of the control voltage, the drive can change its direction of rotation.
- If you use the function "Flying-restart circuit" (C0142 = 2, 3) with machines with a low moment of inertia and a minimum friction:
  - After controller enable in standstill, the motor can start for a short time or change its direction of rotation for a short time.
- The heatsink of the controller has an operating temperature of > 80°C:
  - Direct skin contact with the heatsink 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 supply voltage can overload and destroy the input current limitation of the controller:
  - In case of cyclic mains switching over a longer period of time three minutes have to pass between two starting operations!

### Motor protection

- 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.

### Controller/system protection

- 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.



## Safety information

### Residual hazards, Layout of the safety instructions

## 2.2 Layout of the safety instructions




All safety information given in these Instructions have got the same layout:



Pictograph (indicates the type of danger)

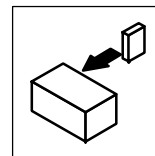
**Signal word!** (indicates the severity of danger)

Note (describes the danger and explains how to avoid it)

Pictograph	Signal word	Signal word Meaning	Possible consequences if the safety information is disregarded
		<b>Danger!</b>	
 Dangerous electrical voltage	<b>Warning!</b>	<b>Possible, very dangerous situation for persons</b>	Death or most severe injuries
	<b>Caution!</b>	<b>Possible, dangerous situation for persons</b>	Injuries
 General danger	<b>Stop!</b>	<b>Possible material damage</b>	Damage of the drive system or its surroundings
	<b>Note!</b>	<b>Useful note or tip</b> If you observe it, handling of the drive system will be easier.	

## Wiring according to EMC requirements

Always observe these basic rules



### 3 Wiring according to EMC requirements (structure of a CE-typical drive system)



#### Stop!

This chapter exclusively describes additional measures to be taken to set up a CE-typical drive system with the "system bus (CAN)" function module.

A trouble-free operation of the bus system can only be ensured when the 8200 vector frequency inverter and the bus system are installed and wired according to the directives of the CE-typical drive system!

#### Specification for system bus cable

Total length	≤ 300 m	≤ 1000 m
Cable type	LIYCY 2 x 2 x 0.5 mm <sup>2</sup> (twisted in pairs with shield)	CYPIMF 2 x 2 x 0.5 mm <sup>2</sup> (twisted in pairs with shield)
Cable resistance	≤ 40 Ω/km	≤ 40 Ω/km
Capacitance per unit length	≤ 130 nF/km	≤ 60 nF/km
Connection	Pair 1 (white/brown): LOW and HIGH Paar 2 (green/yellow): GND	



#### Stop!

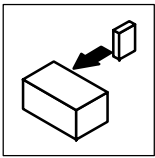
- Only use cables with an extra core pair for CAN-GND.
- Only if CAN-GND is connected correctly, a trouble-free bus operation is ensured.

#### Connect the bus terminating resistors

One terminating resistor each must be connected to the first and last bus station with a terminating resistance of 120 Ω.

#### The bus cable must be shielded correctly

- Connect the shield of the bus cable to both sides.
- Extensively strip the insulation from the bus cable.
- Connect the shield with the shield sheet by means of shield clamps.



## Wiring according to EMC requirements

Always observe these basic rules

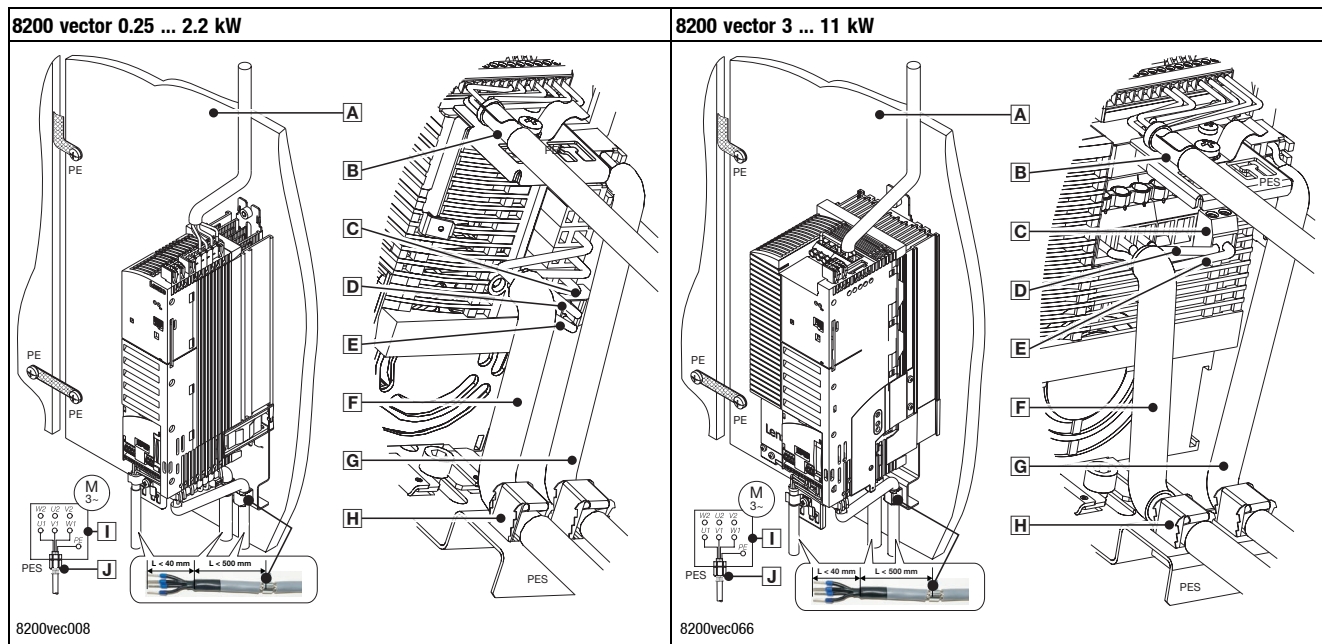
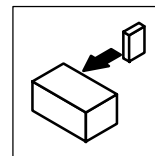


Fig. 1 Installation principle according to EMC requirements

- A** Mounting plate with electrically conductive surface
- B** Control cable to function module, connect the shielding to the EMC shield sheet (PES) with a surface as large as possible
- C** 2-pole terminal for motor PE and motor shield
- D** PE of the motor cable
- E** Shield of the motor cable
- F** Shielded motor cable, low-capacitance  
(Core/core  $1.5 \text{ mm}^2 \leq 75 \text{ pF/m}$ ; from  $2.5 \text{ mm}^2 \leq 100 \text{ pF/m}$ ; core/shield  $\leq 150 \text{ pF/m}$ )
- G** Shielded PTC cable or thermal contact cable
- H** Provide a large-surface connection of the cable shields with the EMC shield sheet (PES). Use the enclosed shield clamps.
- I** Star or delta connection as indicated on the motor nameplate
- J** EMC cable gland (not included in the scope of supply)

## Wiring according to EMC requirements

Always observe these basic rules



**Do not use cable lengths other than indicated.**

1. Please check the compliance with the total cable length in Tab. 3-1.

The total cable length is specified by the baud rate.

<b>Baud rate</b> [kBit/s]	20	50	125	250	500
<b>Total cable length</b> [m]	3910	1510	590	250	80

Tab. 3-1

Total cable length

2. Please check the compliance with the segment cable length in Tab. 3-2.

The segment cable length is specified by the cable cross-section used and the number of stations. Without a repeater the segment cable length corresponds to the total cable length.

Station	Cable cross-section			
	0.25 mm <sup>2</sup>	0.5 mm <sup>2</sup>	0.75 mm <sup>2</sup>	1.0 mm <sup>2</sup>
2	240 m	430 m	650 m	940 m
5	230 m	420 m	640 m	920 m
10	230 m	410 m	620 m	900 m
20	210 m	390 m	580 m	850 m
32	200 m	360 m	550 m	800 m
63	170 m	310 m	470 m	690 m

Tab. 3-2


Segment cable length

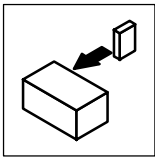
3. Please compare both values.

If the value given in Tab. 3-2 is smaller than the total cable length given in Tab. 3-1, repeaters must be used. Repeaters divide the total cable length into segments.



### Note!

- Please note the reduction of the total cable length due to the signal delay of the repeater (see example  10).
- Mixed operation
  - There is a mixed operation, if different devices are connected to the same mains.
  - If the total cable lengths of the stations are different but having the same baud rate, the smaller value must be used in order to determine the max. cable length.




## Wiring according to EMC requirements

**Always observe these basic rules**

### Example: Selection help

Given:

- Cable cross-section: 0.5 mm<sup>2</sup> (acc. to cable specification  7 )
- Number of stations: 63
- Repeater: Lenze repeater, type 2176 (cable reduction: 30 m)

At maximum number of stations (63) the following cable lengths / number of repeaters must be complied with:

Baud rate [kbit/s]	20	50	125	250	500
Max. cable length [m]	3550	1390	560	250	80
Segment cable length [m]	310	310	310	250	80
Number of repeaters	12	4	1	-	-

### Example: Check repeater application

Given:

- Baud rate: 125 kBit/s
- Cable cross-section: 0.5 mm<sup>2</sup>
- Number of stations: 28
- Cable length: 450 m

1. Total cable length at 125 kbits/s

590 m from Tab. 3-1

2. Segment cable length for 28 stations and a cable cross-section of 0.5mm<sup>2</sup> .

360 m from Tab. 3-2

3. Comparison

The value in point 2. is smaller than the cable length of 450 m.

4. Conclusion

- It is not possible to use a cable length of 450 m without applying a repeater.
- After 360 m (point 2.) a repeater must be applied.

5. Max. cable length with repeater application

- The Lenze repeater is used, type 2176 (cable reduction: 30 m)

• Calculation of the max. cable length:  
590 m (according to Tab. 3-1) minus 30 m (cable reduction)

→ Max. possible cable length with repeater: 560 m.

→ The cable length wanted is now possible.



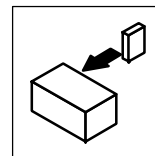
### Note!

Repeaters are recommended as

- Service interface  
Advantage: Trouble-free connection during bus operation is possible.
- Calibration interface  
Advantage: Calibration/programming unit remains electrically isolated.

## Wiring according to EMC requirements

Always observe these basic rules



### Avoid potential differences between the nodes of the CAN network

Potential differences (reference to PE) between the nodes of the CAN network can cause communication interferences and / or destroy the modules.

Avoid potential differences by

- connecting every CAN station with the same earth reference potential (PE) of the machine / system with a low-resistance distance as short as possible.
- using an equipotential bonding between the stations.
- providing a low-resistance earth reference of the machine / system to total earth.

### Use of AIF and FIF communication modules

The RS 232 / 485 interface and the external 24 V DC voltage supply of the Lecom parameter setting module A/B EMF 2102 IBC are galvanically decoupled. That is why no compensating currents develop even in case of potential differences.

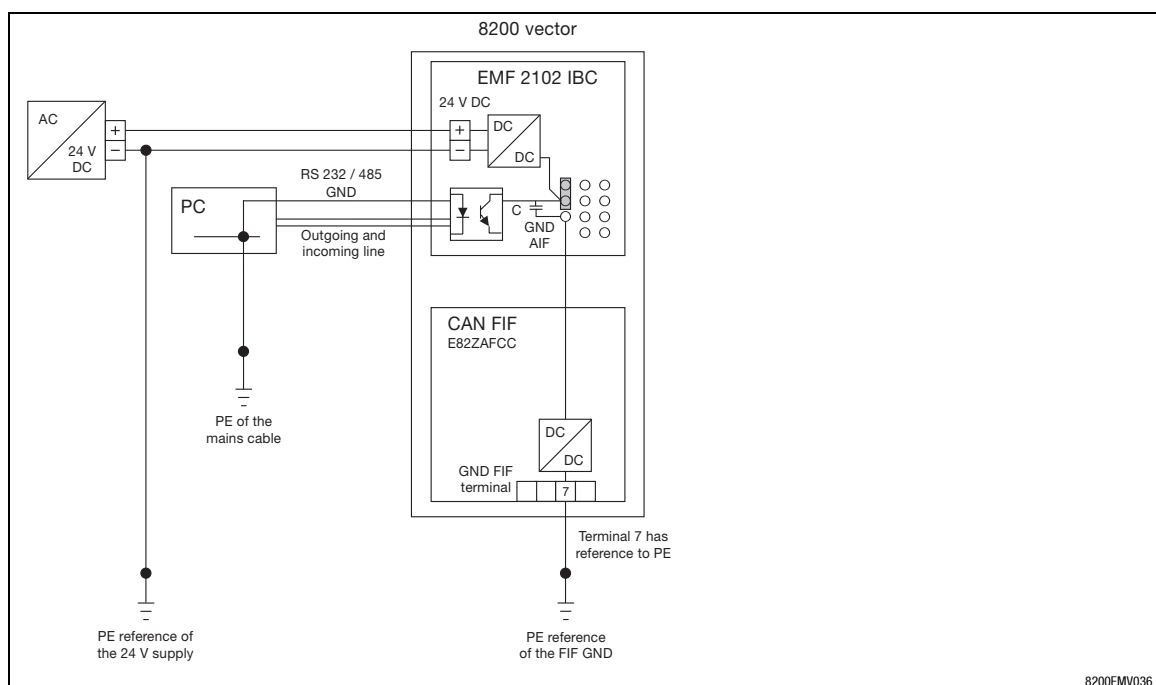
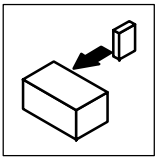


Fig. 2

Use of AIF and FIF communication modules

Possible combinations of the fieldbus function module E82ZAFCC are given in the table of the same name (see below).



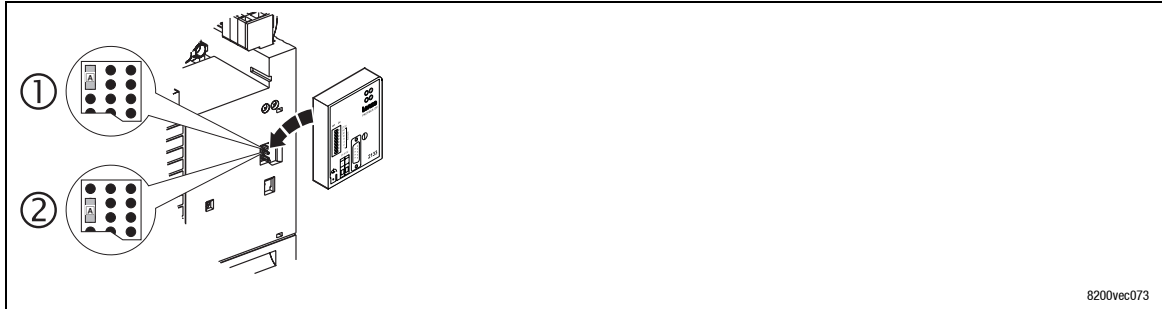
## Wiring according to EMC requirements

Always observe these basic rules



### Note!

For information on wiring and using bus communication modules please see the corresponding Mounting Instructions and Manuals.



8200vec073

Fig. 3

Mounting and selection of voltage supply for communication modules

- ⌘ Jumper for selecting the voltage supply
- ① External voltage supply (as-delivered condition)
- ② Voltage supply via internal voltage source

Plug the communication module onto the AIF interface or remove it. This is also possible during operation.

Possible combinations	Function module to FIF (Design: standard or PT)	Communication module to AIF							
		Keypad E82ZBC 1) Keypad XT EM29371BC 1)	LECOM -A/B 2102.V001 -LI 2102.V003 -A 2102.V004 1)	LECOM-B (RS485) 2102.V002	INTERBUS 2111/2113 INTERBUS- Loop 2112	PROFIBUS-DP 2131/2133	System bus (CAN) 2171/2172	CANopen / DeviceNet 2175	LON 2141
Standard I/O	E82ZAFSC	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Application I/O	E82ZAFAC	✓✓	✓	✓	✓	✓	✓	✓	✓
INTERBUS	E82ZAFIC	✓✓	(✓)	☒	☒	☒	☒	☒	☒
PROFIBUS-DP	E82ZAFPC	✓✓	(✓)	☒	☒	☒	☒	☒	☒
LECOM-B (RS485)	E82ZAFLC	✓✓	(✓)	☒	☒	☒	☒	☒	☒
System bus (CAN)	E82ZAFCC	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
System bus I/O-RS	E82ZAFCC100								
System bus I/O	E82ZAFCC200								
CANopen / DeviceNet 2)	E82ZAFD	✓✓	✓✓	☒	☒	☒	☒	☒	☒
AS-I	E82ZAFFC	✓✓	✓✓	☒	☒	☒	☒	☒	☒

- 1) Is always supplied independently of the jumper position via the internal voltage source.
- 2) In preparation
- ✓✓ Combination possible, communication module is supplied internally or externally
- ✓ Combination possible, communication module must be supplied externally!
- (✓) Combination possible, communication module can only be used for parameter setting (supplied internally or externally)
- ☒ No combination possible

## Recognising and eliminating EMC interferences



### 4 Recognising and eliminating EMC interferences



#### Note!

- "System bus" status information are given in code C0359.  
(0 = Operational, 1 = Pre-Operational, 2 = Warning, 3 = Bus-Off)
- Use the CAN analyser for any analysis.

Disturbance	Cause	Remedy
<ul style="list-style-type: none"> <li>• Fieldbus communication interfered after controller has been enabled.</li> <li>• Communication interfered at low frequencies.</li> <li>• Yellow LED at the communication module is blinking irregularly</li> <li>• Green LED at the communication module is blinking sporadically</li> <li>• Drive stops without being able to derive the reason from C0135 (main control word), C0046 (setpoint) or C150 (status word)</li> <li>• Drive sets error EER, although not configured in C410/11 (FIXED FREE)</li> <li>• Drive sets error CCR</li> </ul>	Bus cable is shielded insufficiently	Optimise shielding of the bus cable: <ul style="list-style-type: none"> <li>• Provide a large-surface contact of the bus cable shield to the EMC shield sheet with shield clamps for each station.</li> </ul>
	Interference injection via motor cable	Optimise shielding of the motor cable: <ul style="list-style-type: none"> <li>• Provide a large-surface contact of the motor cable shield with the EMC shield sheet using shield clamps.</li> <li>• Provide a large-surface contact of the motor cable shield with the motor; Use EMC cable glands.</li> <li>• Avoid interruption of the motor cable due to terminals or contactors; Connect the shield to each clamping point.</li> </ul>
	Interference injection via PTC connection	Optimise PTC connection (terminals T1, T2): <ul style="list-style-type: none"> <li>• Separate and shield PTC cable.</li> <li>• Use EMC kit when PTC cable and motor cable are guided in one shield.</li> <li>• Remove PTC connection.</li> </ul>
	Insufficient earthing, insufficient equipotential bonding of the whole system	Optimise earthing and equipotential bonding of the whole system <ul style="list-style-type: none"> <li>• Connect all system components electrically with PE.</li> <li>• Install electrical isolation in the fieldbus (EMF2176).</li> </ul>
	Max. length of the bus cable is exceeded	Observe the maximum bus cable length: <ul style="list-style-type: none"> <li>• The maximum length depends on the baud rate (see the corresponding Instructions).</li> <li>• Observe the exact specification of the bus cable (see the corresponding Instructions).</li> </ul>
	Specification of the control cables has not been observed	Use the appropriate cable: <ul style="list-style-type: none"> <li>• Observe the exact specification (see the corresponding Instructions).</li> </ul>



## Recognising and eliminating EMC interferences

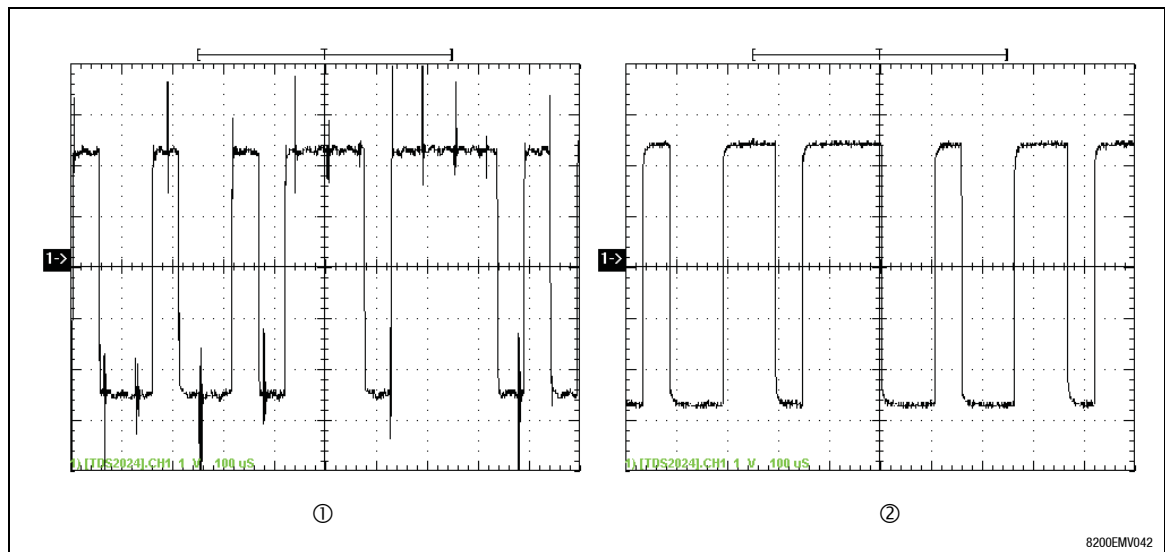
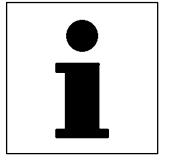
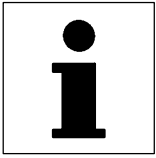


Fig. 4

Oscillograms of the system bus signals

- ① System bus signal with interference voltage
  - ② System bus signal without interference voltage
- Measuring points: CAN-HIGH - CAN-LOW





***Notes***

