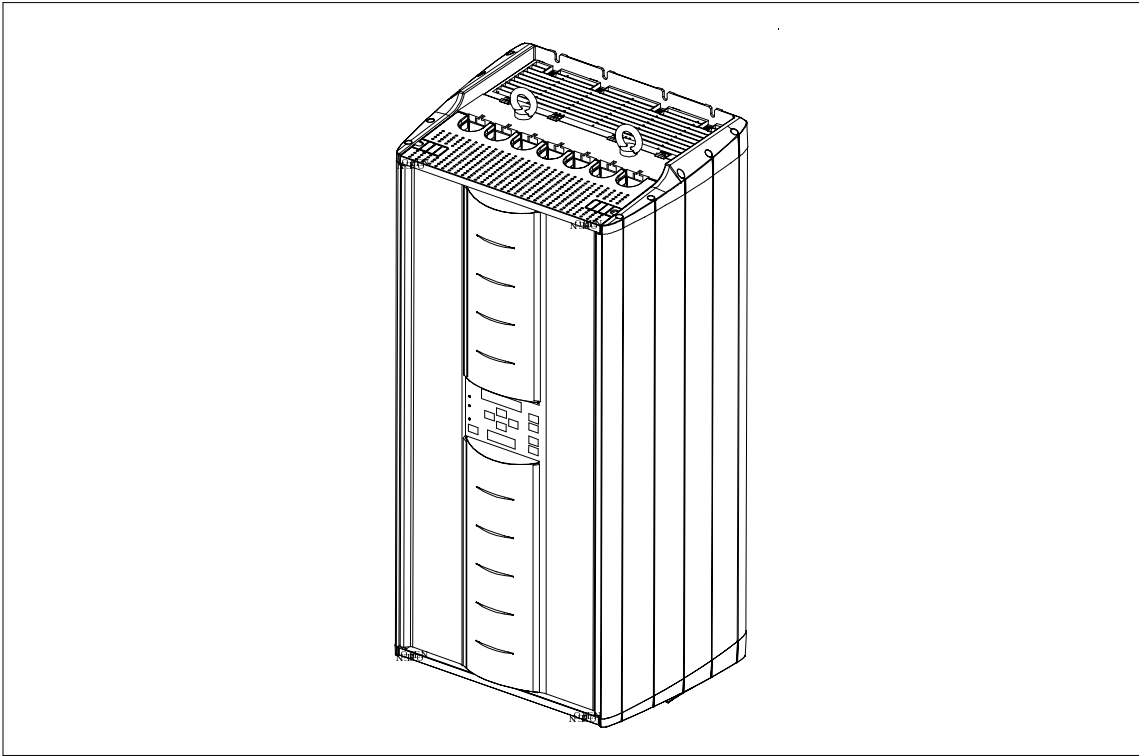


EDB9300UES
00402016

Lenze

Operating Instructions



Global Drive
Frequency inverters
8230 series

Power range 110 ... 250 kW



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Comments

Expressions used

Note:

A note shows important or additional information separately from the text.

Important!

Important means that the instructions given must be followed precisely in order to prevent any loss of data or damage.

Warning!

Warning means that the operator may be injured if the relevant instructions are not followed.

Limitation of liability

Unless agreed elsewhere the latest issue of the “General Supply Conditions for Products and Services of the Electrical Industry” applies accordingly.

We are not obliged to make software updates or upgrades available to users.

Modifications to improve handling and updates for new types of equipment can only be offered to registered users at preferential prices.

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1 Brief description

1.1 General

8230 frequency inverter are processor-controlled pulse inverters with a field-orientated control concept for continuous low-loss speed adjustment of AC motors.

The power stack consists of a diode rectifier in a 3-phase bridge circuit on the mains side and an IGBT inverter on the motor side.

The basic inverter models are designed for standard applications. Through suitable options (eg. bus couplers, encoder interface) the units can be integrated into automation systems and can also fulfil highly dynamic requirements.

Operation of all units is identical throughout the entire type range. Easy familiarisation and operation as well as maximum flexibility were the prime objectives during development.

The inverters are operated and parameters adjusted by means of a control unit (BDE).

Connection to automation systems is possible through conventional bus systems (see field bus coupler options).

With a mains voltage range from 380 to 480 V build-in units cover the power range from 144 kVA to 330 kVA.

In conjunction with standard asynchronous motors the drive capacities provided are therefore as follows:

- At unit rated current
110 kW to 200 kW, 400 V
- At unit 1.5 x rated current
132 kW to 250 kW, 400 V

Note:

This operating manual applies to the following units:

8230 frequency inverter

Software version:

V2.0

Important!

8230 frequency inverter are designed as standard for operating on earthed networks.

1.2 Basic operation

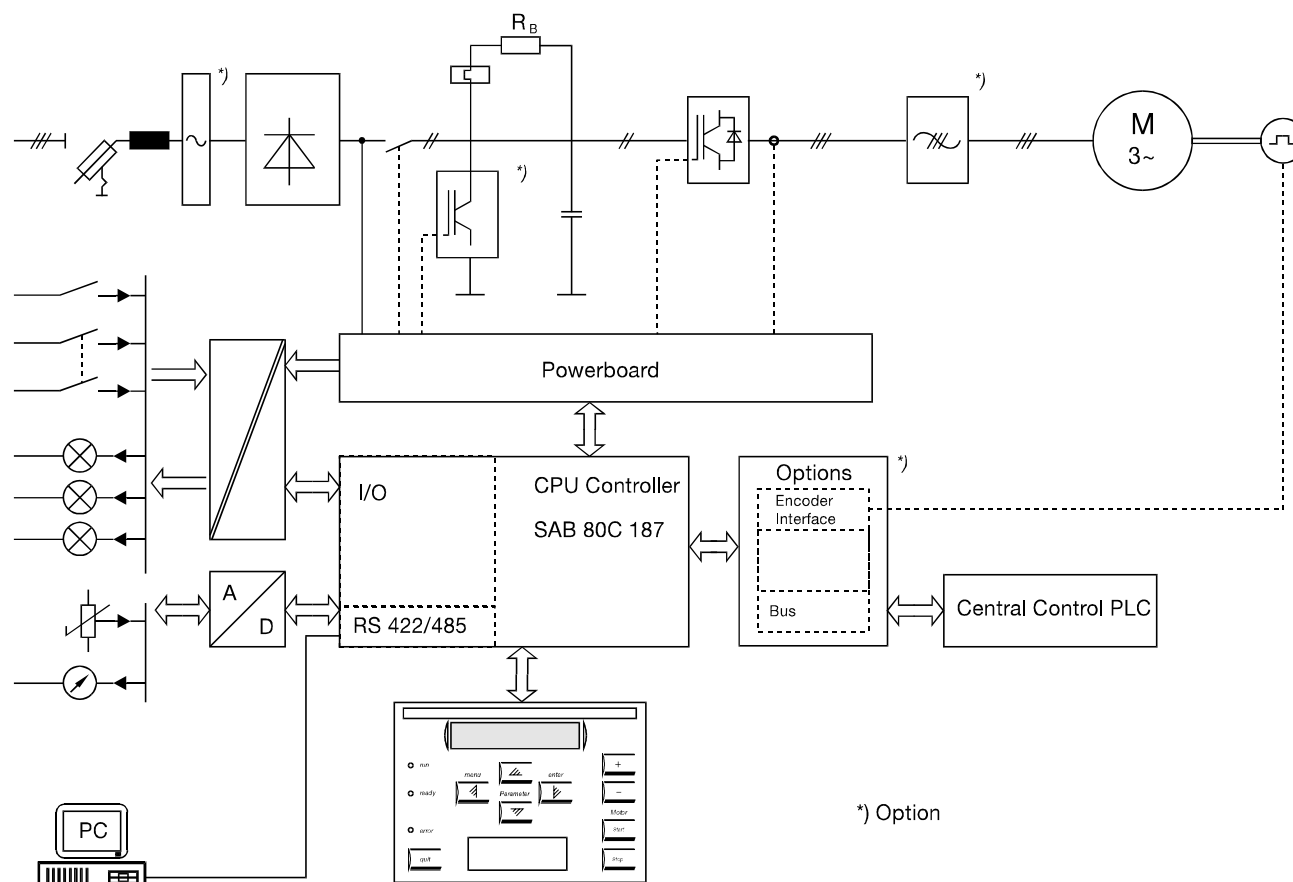
The link voltage is generated from the mains supply through the mains rectifier. A 3-phase choke connected to the mains supply reduces harmonic currents and serves to decouple the unit from other converters (consumers) on the same supply network. 8230 frequency inverter are connected as standard to an earthed network. The link voltage is smoothed by high quality electrolytic capacitors. With the motor converter these provide the magnetising reactive power required by the motor and decouple the converter on the mains side from the inverter on the motor side.

Through optimised pulse width modulation the motor converter generates from the link voltage a sinusoidal 3-phase system with variable frequency and voltage.

A power dump (option) in conjunction with a braking resistor allows braking energy to be used in regenerative operation.

Control and regulation of the 8230 frequency inverter are fully digital. Different control structures such as, frequency control, speed control with or without encoder and torque control with or without encoder can be selected, depending on the application requirements. The field-orientated control concept provides control dynamics directly comparable to those of a DC drive.

In addition, various inputs and outputs can be connected individually according to the task involved. Thus the drive system can very easily be customised for the requirements of the specific application.



*) Option

Fig. 1: Summary circuit diagram, basic layout, operation

1.3 Main features

- Consistent range of Types for drives from 110 kW to 250 kW with IGBT inverters
- Supply voltage ranges:
 - 3AC 380 V ... 460 V +10 %/ -15 % ... 480 V +6 %/ -15 %
- Standard design for connection to earthed networks
- Output frequency range: 0 ... 300 Hz
- 120% overload capacity for 60 s related to 1.2 rated controller current (Applications with medium overload)
- 150% overload capacity for 60 s related to 1.5 rated controller current (Applications with high overload)
- Standard asynchronous motors can be used without power reduction
- High dynamics: Torque rise time: $t_{an} = 2$ to 8 ms
- 8230 frequency inverter units are resistant to idling, short circuit and earth fault
- DC system bus supply for several 8230 frequency inverter through DC link connection (option)
- 4Q operation (option) through power dump with braking resistor
- Mains supply power connections at top and motor connections at foot
- Motor temperature monitoring by thermistor processing electronics (PTC)
- Easy, user-friendly system structure
- Consistent and easily learned operation via control unit (option) with plain text display (various languages available)
- Extensive additional operating facilities via PC, for example menu control, user-controlled commissioning, oscilloscope function
- Control structures available:
 - Frequency control
 - Speed control with or without incremental rotation encoder
 - Torque control with or without incremental rotation encoder

- Kinetic back-up on mains failure
Back-up operation of the control electronics using the kinetic energy in the drive systems at speeds close to zero, also suitable for flow machines
- Capture without torque surge
(the inverter is applied to the de-excited motor while the motor is running)
- Automatic restart facility after mains failure
(Parameter-adjustable up to 15 s as standard)
- Conventional drive through standard terminal strip
 - 12 digital potential-separated inputs for control signals (eg. Start, Stop etc.), of which 3 inputs are parameter-adjustable through selection list
 - 4 digital potential-free outputs for messages (On, Ready, Error, free output parameter-adjustable through selection list, 1 output "Ready" can be re-assigned via technology)
 - 2 free adjustable and scaleable analog outputs
 - 2 scaleable analog demand inputs
 - 2 parameter sets switchable via control unit or terminal strip
- Expansion of standard terminal strip (I/O interface option)
 - 20 configurable digital inputs with separate potential
 - 8 configurable digital outputs with separate potential
 - 2 configurable analog demand inputs
 - 2 configurable analog outputs
- Comprehensive testing and diagnostics facilities:
 - Self-test on control electronics and hardware
 - Event memory with timings of all binary events with first value error message and documentation
 - Error log with timing details
 - Protocol log for documenting all parameter changes
- Comprehensive protection and monitoring facilities.

2 Technical Data

2.1 Key to types, rating plate

The type data includes the following information. An example:

Lenze		Hans-Lenze-Strasse 1 D-31855 Aerzen		
		Made in Germany		
Global Drive 8230				
				
Type	EVF8234BE			
Id.-No.	00395613			
Input	3/PEAC 400/460V 360/430A 50/60Hz			
Output	3/PEAC 0-460V 400/483A 200/250kW 0-300Hz			
Overload	600A / 60s (400V) 520A / 60s (460V)			
		Sach.-No.	029. 206879	
		Ser.-No.	00001	

Fig. 2: 8230 frequency inverter rating plate

The following details are required for identifying the unit:

- Type No :
- Serial No :

2.2 Series of types

8230 frequency inverter for 3-phase AC connection

8230 frequency inverter 150 ... 275 kVA, 3AC 380 ... 480 V
Processor-controlled pulse inverter with field-orientated control concept for continuous low-loss speed adjustment of standard AC motors.

8230 frequency inverter	Frame size	Unit input current,	Unit output current			Supply voltage
		mains current ⁵⁾ eff [A]	1.2 x rated current ¹⁾ [A]	1.5 x rated current ²⁾ [A]	Max. current 60 s ³⁾ [A]	
8231	8	195 (230)	257	216	324	3 AC 50/60Hz
8232	8A	230 (270)	304	257	365	380 ... 460 V
8233	9	290 (360)	396	325	488	+10/-15 %
8234	9A	360 (430)	483	400	600	...480 V +6/-15 %

Table 1: 8230 frequency inverter series

- ¹⁾ Rated current with overload capacity 1.2 x rated current
- ²⁾ Rated current with overload capacity 1.5 x rated current
- ³⁾ Max. current for max. 60 s overload, cycle time 600 s
- ⁴⁾ Mains commutation choke not included in scope of supply.
- ⁵⁾ The details for the mains current with the standard mains choke are based on a mains short circuit capacity in relation to the inverter power of 100 : 1 at unit output current = rated current. Values in brackets are valid for 1.2 rated current.

Frame size	Dimensions H x W x D [mm]	Weight ca. [kg]
8	1049 x 495 x 419	90
8A	1224 x 495 x 419	90
9	1499 x 495 x 419	140
9A	1674 x 495 x 419	140

Table 2: 8230 frequency inverter frame sizes

Scope of supply: Build-in unit, IP20

2.2.1 Technical data at rated current

Overload capacity 1.2 x rated current

The technical data shown in Table 3 applies at a pulse frequency of $f_p = 3 \text{ kHz}$, as supplied ex works, and a maximum air supply temperature up to $40 \text{ }^\circ\text{C}$.

8230 frequency inverter	Rated current [A]	Max. current ¹⁾ for max. 60 s [A]	Unit rated current [kVA] at rated current				motor rating ²⁾ [kW]	
			400 V	415 V	460 V	480 V	400 ... 415 V	460 ... 480 V
8231	257	324	178	185	205	214	132	151
8231	304	365	211	218	241	252	160	172
8231	396	488	275	285	316	330	200	230
8231	483	600	335	347	385	400	250	285

Table 3: Technical data at rated current with overload capacity 1.2 x rated current

- ¹⁾ 120 % overload for total max. 60 s on a load cycle of 1 : 10 / cycle time 600 s
- ²⁾ motor rating based on standard 2, 4 and 6 pole motors at 400 ... 415 V or 460 ... 480 V rated voltage.

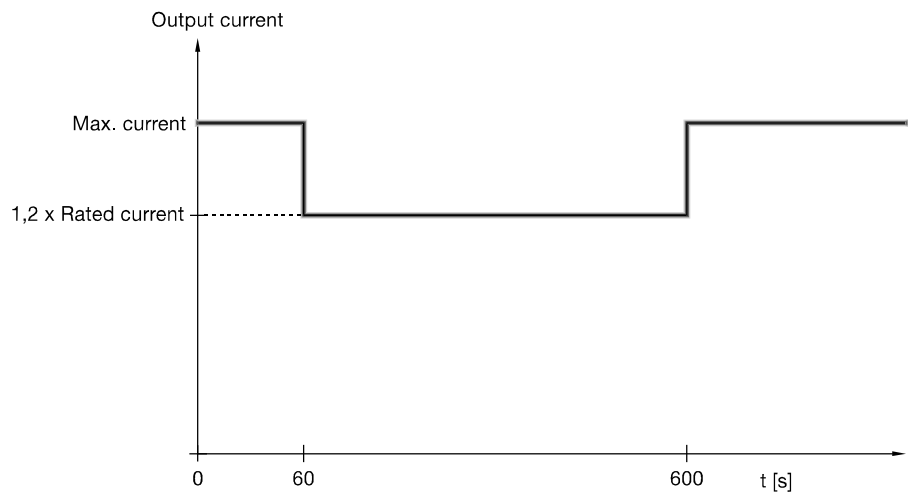


Fig. 3: 8230 frequency inverter Overload capacity 1.2 x rated current

2.2.2 Technical data
at rated current 1.5

Overload capacity 1.5 x rated current

The technical data shown in Table 4 applies at a pulse frequency of $f_p = 3 \text{ kHz}$ as set ex works, and a maximum air supply temperature up to $50 \text{ }^\circ\text{C}$.

8230 frequency inverter	Rated current [A]	Max. current ¹⁾ for max. 60 s [A]	Unit rated current [kVA] at rated current				motor rating ²⁾ [kW]	
			400 V	415 V	460 V	480 V	400 ... 415 V	460 ... 480 V
8231	216	324	150	155	172	180	110	126
8231	325	365	178	185	205	214	132	151
8231	396	488	225	234	259	270	160	184
8231	400	600	275	287	318	333	200	230

Table 4: Technical data at rated current with overload capacity 1.5 x rated current

- ¹⁾ 150 % overload for total max. 60 s on a load cycle of 1 : 10 / cycle time 600 s
- ²⁾ motor rating based on standard 2, 4 and 6 pole motors at 400 ... 415 V or 460 ... 480 V rated voltage.

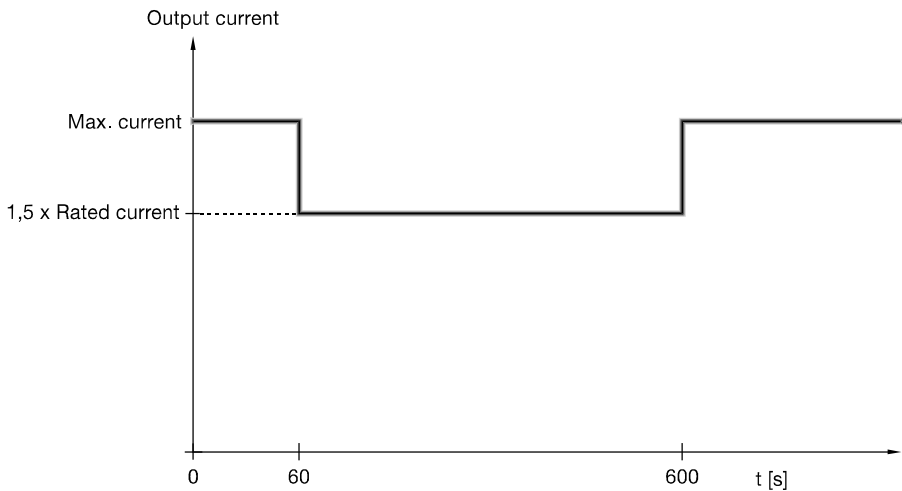


Fig. 4: 8230 frequency inverter Overload capacity 1.5 x rated current

2.2.3 Power loss and cooling air volume

The rise in temperature of the cooling air at rated current is $\Delta\vartheta \leq 16\text{ }^{\circ}\text{C}$ for the cooling air volume stated and when the installation clearances are maintained.

8230 frequency inverter	Frame size	Cooling air volume ²⁾ [m³/h]	Rated current [A]	Power loss ¹⁾ [kW] at rated current and 3AC supply voltage		
				400 V	460 V	480 V
8331	8	580	257	3,73	3,84	3,88
8232	8A	730	304	4,45	4,63	4,70
8233	9	950	396	5,55	5,80	5,88
8234	9A	1100	483	6,50	6,80	6,88

Table 5: Power loss and cooling air volume at rated current

¹⁾ The values stated apply to a pulse frequency of $f_p = 3\text{ kHz}$
²⁾ The values apply to a static pressure increase of $\Delta p \approx 32\text{ Pa}$ between cooling air inlet and outlet.

8230 frequency inverter	Frame size	Cooling air volume ²⁾ [m³/h]	Rated current [A]	Power loss ¹⁾ [kW] at rated current and 3AC supply voltage		
				400 V	460 V	480 V
8331	8	580	216	3,14	3,22	3,24
8232	8A	730	257	3,78	3,94	4,00
8233	9	950	325	4,54	4,74	4,83
8234	9A	1100	400	5,60	5,85	5,96

Table 6: Power loss and cooling air volume at 1.5 x rated current

¹⁾ The values stated apply to a pulse frequency of $f_p = 3\text{ kHz}$
²⁾ The values apply to a static pressure increase of $\Delta p \approx 32\text{ Pa}$ between cooling air inlet and outlet.

2.3 System data

• Mains supply voltage	3AC 400 ... 460 V; +10/-15 % ... 480 V; +6/-15 %
• Mains frequency	50 ... 60 Hz ±5 %
• Power factor	
- Mains base frequency	$\cos \varphi_1 > 0.97$
- Total at rated current depending on mains impedance	$\lambda_N \gg 0.88 \text{ ind} - 0.93 \text{ ind}$
• Output voltage	3AC 0 ... U_{mains}
• Approvals	prEN50178:1994/VDE0160 CE mark according to low voltage directive
• Efficiency at rated power	≥ 0.97
• Overload factor	1.2 for max. 60 s at rated current 1.2 1.5 for max. 60 s at rated current 1.5 cycle time $\geq 10 \text{ min}$
• Min. operating frequency	
With encoder	0 Hz
Without encoder	motor: 1 Hz regenerative: 2.5 Hz
• Max. operating frequency	300 Hz
• Speed adjustment range	for speed control without encoder 1:50 ¹⁾ with encoder >1:1000 ¹⁾ The adjustment range is 1:20 in regenerative operation using the control structure "Speed control without encoder"
• Speed accuracy	for speed control without encoder 0.5 % with encoder with digital demand preset 0.05 %
• Torque rise times	For speed control with or without encoder 2 ... 8 ms
• Frequency resolution	10 mHz standard adjustable with parameter f_{100}
• Frequency stability for frequency control	<0.01 % standard <0.001 % option, on application

• Frequency accuracy for frequency control	<0.01 %
• Temperature response of analog demand	<0.01 %/°C
• Speed encoder	incremental encoder see encoder interface option
• Noise	A-weighted sound pressure level frame size 8 <70 dB(A) frame size 8A <73 dB(A) frame size 9 <72 dB(A) frame size 9A <74 dB(A)
• Overtemperature shutdown	frame size 8 at >95 °C frame size 8A at >105 °C frame size 9 at >105 °C frame size 9A at >105 °C
• Ambient temperature Operation Storage	0 ... +55 °C ¹⁾ -25 °C ... +65 °C
• Cooling	corced air cooling see section 2.2.3 for cooling air volumes
• Coolant temperature	0 ... 40 °C at rated current, overload factor 1.2 for 60 s every 10 minutes up to max. 55 °C with power reduction 2 % per 1 °K 0 ... 50 °C at rated current, overload factor 1.5 for 60 s every 10 minutes up to max. 55 °C with power reduction 2 % per 1 °K
• Installation altitude	≤1000 m above MSL, up to max. 2200 m with power reduction 1.2 % per 100 m
• Storage time	Without reforming the capacitors: 2 years, 5 months of which at temperatures over 40°C
• Protection classes Build-in units Cubicle-mounted units	IP20 IP21 Standard IP31, IP43, IP54 Option
• Environment class	DIN EN 60721 Part 3-3 3K3 / 3M2 / 3C2 ²⁾ / 2K2
- Max. relative humidity	85 % at 28 °C, condensation not permitted
- Insulation	Contamination Class II to DIN VDE 0110
• Permitted switching frequency	Precharging circuit duty cycle = 2 %/180 s, max. 20 per hour
• Power loss of control electronics	ca. 130 W with control board, no additional options

- Mechanical use (Vibration) prEN50178:1994/IPA90 DIN IEC86
T.2-6 10 ... 150 Hz
- Electromagnetic compatibility³⁾ :
 - Interference resistance To IEC1800-3 (IEC22G/21/CDV), EN50082-2, suitable for use in an industrial environment
 - Radiated interference To IEC1800-3 (IEC22G/21/CDV)
 - industrial mains supply AC mains choke⁴⁾
 - public supply network Additional RFI filter⁴⁾

EN50081-2, limit to EN55011 Group 1 Class A:
Mains choke and RFI filter⁴⁾
EN50081-1, limit to EN55011 Group 1 Class B:
Mains choke, RFI filter and Motor filter⁴⁾

¹⁾ Adequate convection cooling must be provided for the 8230 frequency inverter control electronics. No heat build up inside the 8230 frequency inverter.
²⁾ No salt spray mist.
³⁾ Connection to earthed network
⁴⁾ see section 3.7 for optional measures

- Pulse frequency adjustable
 - Standard 3 kHz
 - Maximum Up to 6 kHz

For a chopping frequency of $f_p=6$ kHz, a power reduction to 1.5 rated current is required.
- Servicing Data memory battery replacement required, see section 7.1
Fan replacement recommended, see section 7.2
Check power connection screws, see section 7.3

Power reduction curves

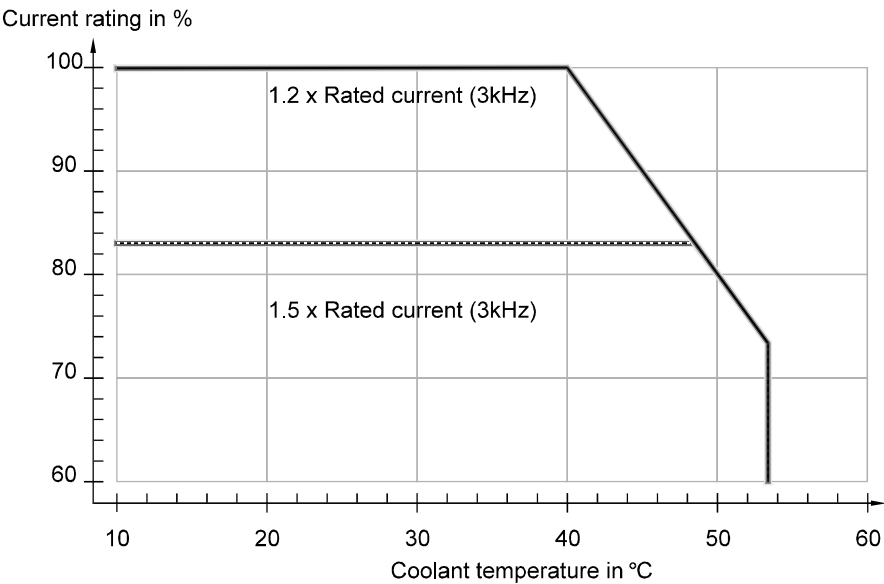
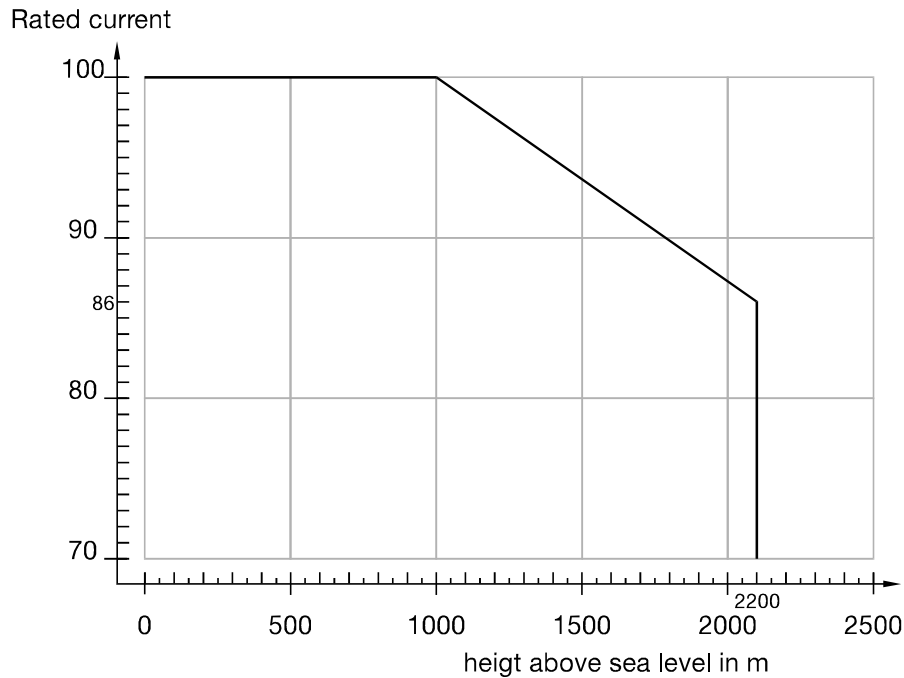


Fig. 5: Power reduction curves (Derating) 8230 frequency inverter

Efficiency curves

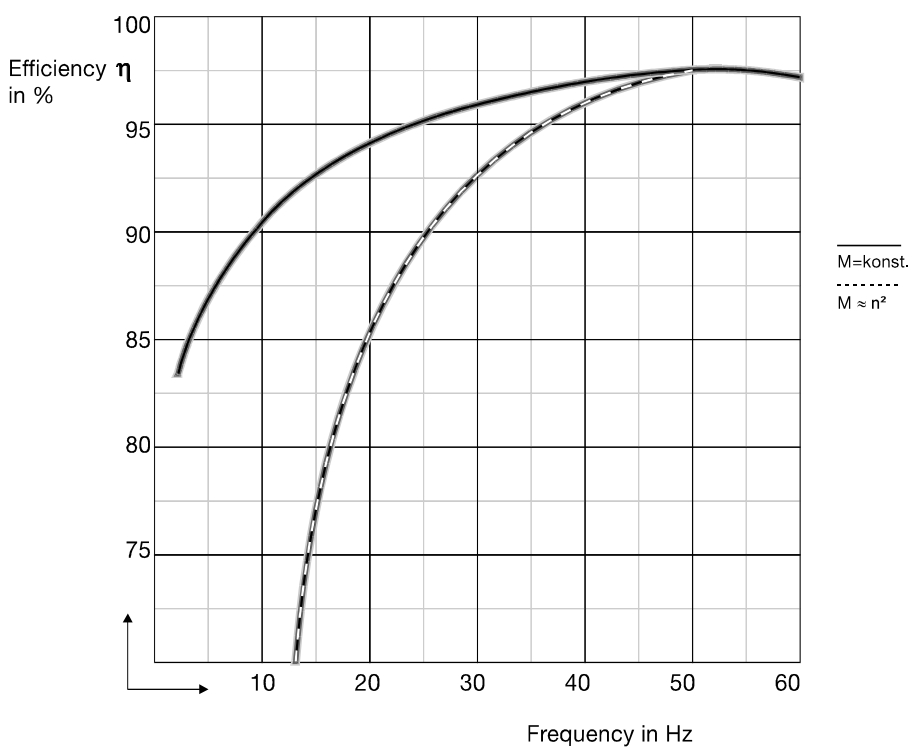


Fig. 6: 8230 frequency inverter Efficiency curves

The curves in Fig. 6 apply to pulse frequency 3 at a 400 ... 460 V supply voltage.

2.3.1 Standards, operating conditions and certificates

2.3.1.1 Standards applicable	As per 06.1996
VDE 0100-540	Installation of heavy current systems with rated voltages up to 1000 V; selection and installation in electrical equipment, earthing, protective conductor, potential compensation conductor
VDE 0106-100	Protection against electric shock; configuration of actuator components close to parts which are dangerous to touch
VDE 0110	Insulation coordination for electrical equipment in low voltage systems. Rating of air gaps and creepage distances
VDE 0160/pr EN50178	Installing electronic equipment on heavy current systems
DIN EN 60146-1-1 (IEC 146-1-1)	Semiconductor converters; general requirements and mains-fed converters; basic requirements (DIN VDE 0558 Part 11: 1994-03)
DIN EN 60146-1-3 (IEC 146-1-3)	General requirements and mains-fed converters, transformers and choke coils (DIN VDE 0558 Part 8: 1994-03)
IEC 1000-4-2	Resistance to electrostatic discharge, requirements and test methods (conversion IEC 801-2)
IEC 1000-4-3	Resistance to electromagnetic HF fields, requirements and test methods
IEC 1000-4-4	Resistance to fast electrical transients and bursts (conversion IEC 801-4)
IEC 801-5	Resistance to surge voltages on mains supply cables (surge pulses)
IEC 1000-4-5	Resistance to voltage peaks
DIN EN 55011	Radio interference suppression of electrical plant and equipment; (VDE 0875 Part 11), limits and test methods for radio interference suppression of industrial, scientific and medical high frequency equipment
DIN EN 55022	Electromagnetic compatibility of equipment in information processing and telecommunications technology (VDE 0878 Part 3), limits and test methods for radio interference suppression on technical information equipment
IEC1800-3/prEN61800-3:1995 (IEC22G/21/CDV)	EMC product standard for variable speed drives EMC interference resistance and radiated interference Anforderungen und Meßverfahren
DIN EN 50081-1	Electromagnetic compatibility (EMC); specialist basic standard for radiated interference; Part 1: Residential, business and light industry
DIN EN 50081-2	Electromagnetic compatibility (EMC); specialist basic standard, radiated interference; Part 2: Industrial
DIN EN 50082-1	Electromagnetic compatibility (EMC); specialist basic standard, interference resistance; Part 1: Residential, business and light industry
DIN EN 50082-2	Electromagnetic compatibility (EMC); specialist basic standard, interference resistance, Part 2: Industrial (VDE 0839 Part 82-2)

DIN EN 60204-1 (IEC 204-1)	Machine safety; electrical equipment on machines; Part 1: General requirements (VDE0113 Part 1: 1993-06)
DIN EN 60249-2	Basic materials for printed circuits; Part 2: Individual conditions
DIN EN 60529	Protection classes by enclosure (IP Code)
DIN EN 60721-3	Classification of environmental conditions - Classes of environmental influences and limits
IEC 68-2	Electrical technology; basic environmental test methods; tests
IEC 364-5-54	DIN VDE 0110 TS10: 1995-12
DIN EN 60439-1:1994	Low voltage switchgear combinations VDE 0660 Part 500 1994-04

2.3.1.2 Certificate

DIN EN ISO 9001	Model for quality assurance in development, design, production, assembly, testing, sales and maintenance.
UL/CSA	Certification in preparation

2.3.1.3 CE Certificate

CE mark	CE mark to low voltage directive 73/23 EC 1995 See appendix for EC Certificate of Conformity.
VDE0160/prEN50178	Fitting heavy current systems with electronic equipment

2.3.2 CE mark

The 8230 frequency inverter frequency inverter carries the CE mark. This confirms for monitoring authorities responsible in the European Union (EU) that the unit complies with the low voltage guideline 73/23 EC and the CE mark guideline 93/68/EC. The certificate of conformity with the low voltage guideline is available on request.

The 8230 frequency inverter frequency inverter is completed into a drive system by the connection of an AC motor and electrical components, safety equipment and external radio interference suppression components. Installation must be carried out by experienced personnel in compliance with the relevant rules and regulations.

No certificate of conformity is required for the 8230 frequency inverter as an "independently operated unit" in the sense of EMC Directive 89/336/EC. The 8230 frequency inverter is classified according to CEMEP2 for use and supply through the industry, trade and other users experienced in the field of electromagnetic compatibility (EMC).

Type tests on electromagnetic compatibility (EMC) were carried out to demonstrate compliance with the documented EMC-relevant IEC standards, DIN EN standards, EMC installation guidelines and specified combinations with optional radio interference suppression components in this operating manual when connected to an earthed mains supply. Compliance with the EMC installation instructions in section 3.6 is essential.

Section 3.7 provides optional measures for guaranteeing EMC.

IEC 22G/21/CDV

EMC product standard including specific test methods for power drive systems;

EMC product standard for drive converters;

EMC radiated interference and interference resistance.

DIN EN 50082¹⁾

Electromagnetic compatibility (EMC)

Specialist basic standard, interference resistance

Part 1: Residential, business and light industry connected to the public electricity supply network

(VDE 0839 Part 82-1)

Part 2: Industrial¹⁾ (VDE 0839 Part 82-2).

DIN EN 50081

Electromagnetic compatibility (EMC)

Specialist basic standard, radiated interference

Part 1: Residential, business and industrial connected to the public electricity supply network

(VDE 0839 Part 81-1). Limit to EN 55011 Group 1 Class B

Part 2: Industrial¹⁾ (VDE 0839 Part 81-2). Limit to EN 55011 Group 1 Class A

¹⁾ Compare ESD, burst and surge limits on the following page

EMC interference resistance IEC1800-3/prEN61800-3 (IEC224/21CDV); EN50082-2

The following limits for interference resistance are fulfilled when a mains choke and screened control cables are used.

Requirement	Standard	Severity level
ESD (Static discharge)	IEC1000-4-2 (IEC 801-2)	Air discharge (AD) ± 8 kV Contact discharge (CD) ± 6 kV
Burst (Transients)	IEC1000-4-4 (IEC 801-4)	Mains connection 2 kV, 5 kHz _{kap} Load connection 2 kV, 5 kHz _{kap} Demand 2 kV, 5 kHz _{kap} General interfaces 2 kV, 5 kHz _{kap}
Surge (Surge voltages)	IEC 801-5	Mains/load connection 1,2 / 50 μ s phase - PE 2 kV 1,2 / 50 μ s phase - phase 2 kV

Limit curves, radio interference voltage

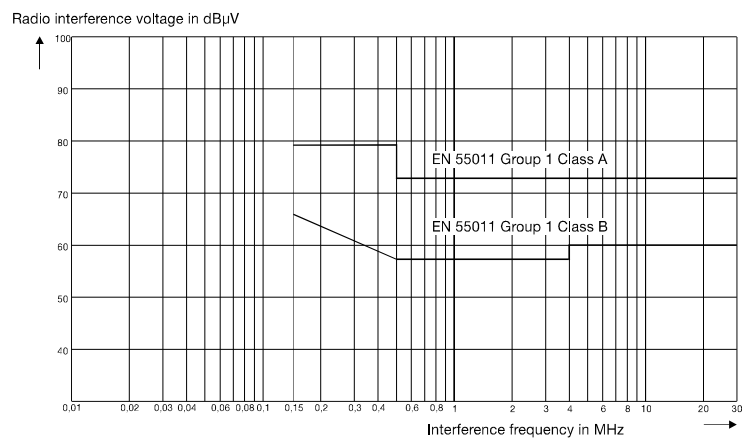


Fig. 7: Limit curves (QPK-Quasi Peak) radio interference voltage

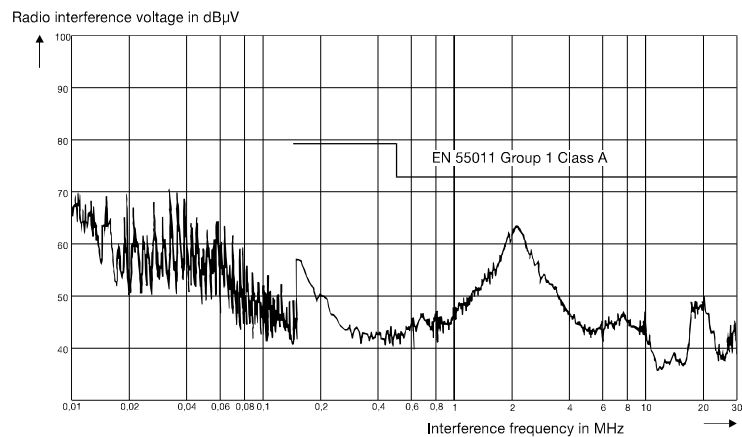


Fig. 8: Typical interference voltage characteristic at mains input

Fig. 8 shows the typical interference voltage characteristic at the mains input in the example of the 8230 frequency inverter. Differences are possible according to the connection configuration and unit involved.

2.4 Supply components

The 8230 frequency inverter can be supplied with power through connection of the units to a 3-phase supply.

2.4.1 Components for 3AC supply

The components for connecting the 8230 frequency inverter to an AC network are determined according to the 8230 frequency inverter type rating.
The basic components

- Semiconductor fuse recommended for brake chopper
- mains choke (2.4.1.2)
- mains fuse (2.4.1.3) with gL characteristic

are required to VDE and are shown in the tables below.

Minimum cross-sections for mains supply cables with PVC insulation to EN 60204-1:1992 are given at an ambient temperature of $\vartheta = 40\text{ }^{\circ}\text{C}$ and laying method E.

In the event that the supply includes separation points, the additional components

- fuse isolator, 3-pole
- fuse circuit breaker (2.4.1.4)
- mains contactor / main contactor (2.4.1.3)

are to be used.

2.4.1.1 Fuses for 3AC mains connection

Mains fuses with aR characteristic (semiconductor protection)

frequency inverter type	fuse type	fuse current rate (A)
8231	EFSFF3750AXP	375
8232	EFSFF4500AXP	450
8233	EFSFF5500AXP	550
8234	EFSFF7000AXP	700

Table 7: Semiconductor fuses

- Design to DIN 43 653
- Screw straps with 110 mm length
 - Fuse indicator

These parts are mounted on the fuse base SI DIN 110630 or are installed in conjunction with the fuse circuit breaker.
See section 2.4.1.4 for fuse circuit breakers.
Fuses can also be equipped with microswitches for fuse monitoring.

Accessories: Semiconductor fuse 110 mm DIN 43653

designation	holder type
Single pole fuse base Length 110 mm with	EFH10003
Microswitch + Indicator	EFZ0007
Adapter	EFZ0005

Table 8: Semiconductor fuses accessories

2.4.1.2 Mains chokes (3-phase chokes)

Mains choke is required in the supply cable to reduce the harmonics and limit commutation failures. The mains chokes for the relevant 8230 frequency inverter types are listed in the table below.

Mains chokes are not included in the 8230 frequency inverter.

The mains choke must be allocated individually to each 8230 frequency inverter to guarantee decoupling when several units are operated at the same mains supply point. A mains choke of high rating is not suitable for several low power 8230 frequency inverter units.

Mains chokes improve the overvoltage protection. The impedance of the choke forms a voltage divider with the impedance on the mains side. When the choke is not saturated magnetically it limits the current rise when the voltage rises. This prevents excessive overvoltages at the 8230 frequency inverter mains input.

frequency inverter type	Mains choke with medium overload	Mains choke with high overload
8231	ELN3-0011H270	ELN3-0014H200
8232	ELN3-0011H270	ELN3-0011H270
8233	ELN3-0009H370	ELN3-0009H300
8234	ELN3-0006H450	ELN3-0009H370

Table 9: Mains chokes

Characteristics

Relative short circuit voltage	$u_K = 3.8 \%$ (400 V supply voltage, rated output current)
Operating voltage	380 V ... 460 V +10/-15 %, 50/60 Hz $\pm 5 \%$
Protection class	IP 00
Mode	DB
Environment class	DIN EN 60721 Part 3-3 3K3 / 3M2 / 3C2 / 2K2

See section 2.8.2 for dimensions, weights and installation instructions

Harmonics

The mains converter consists of an uncontrolled 6-pulse bridge circuit (B6) with diodes. Capacitors which decouple the mains converter from the motor converter are fitted on the link and maintain the continuous flow of current to the motor converter. A varying amount of energy is taken from the link capacitor depending on the load on the motor, whereby the mains converter compensates for the reduction in charging according to the mains voltage characteristic, i.e. the phase position of the current, in contrast to the thyristor mains converter, remains almost constant and is not dependent on the momentary value.

The effective mains impedance and the load conditions affect the shape of the mains current curve and therefore the harmonic content, whereby the mains choke and the ratio between the mains short-circuit voltage and the inverter apparent power are decisive for the harmonic content.

Commutation notches

If the ratio between the mains short-circuit power to the complete rated controller power is less than 30 : 1 with a standard mains choke, special mains chokes to limit commutation notches in the mains voltage at public mains according to prEN50178/VDE0160:1991 are to be used.

If the feedback is evaluated on the basis of VDEW¹⁾ recommendations, the ratio must not be smaller than approx. 100 : 1 with mains chokes.

¹⁾ VDEW = Association of German Electricity Supply Companies.

In large industrial plant it is possible to reduce the dominant 5th harmonic in 6-pulse mains converters by connecting some of the converter load through transformers with a phase shift of 30° electrical in relation to the other transformers. Another transformer circuit in switching group Yy0 with a compensation winding could be implemented instead of the Dy5 circuit often used. In this configuration, for example, the 5th harmonic can be reduced by more than 50 % provided that both converters have the same overlap angle.

2.4.1.3 Line fuses for operation class gL and cable cross-sections

Installation instructions for a 3AC 8230 frequency inverter connection in the customer's low voltage distribution system:
The NH fuses recommended for operation class gL and the cable cross-sections to be used for 8230 frequency inverter 3AC mains connections are shown in the following table. Minimum cross-sections for mains supplies cables with PVC insulation according to EN 60204-1:1992 are given for an ambient temperature of $\vartheta = 40\text{ °C}$ and laying method E.

8230 frequency inverter type	Unit output current			Recommended fuse gL characteristics	Recommended cable cross-sections for PVC insulated copper cable 3-phase cables NYY/ NYM
	1.2 x Rated current	1.5 x Rated current	Max. current for 60 s	Type	
	[A]	[A]	[A]		
8231	257	216	324	315 A Gr.2	2x3x95 mm ²
8232	304	257	365	355 A Gr.2	2x3x120 mm ²
8233	396	325	488	400 A Gr.2	2x3x150 mm ²
8234	483	400	600	500 A Gr.3	2x3x185 mm ²

Table 10: 8230 frequency inverter AC line fuses

2.4.1.4 Fuse circuit breakers

The above semiconductor fuses (aR-Characteristics) with 100 mm length to DIN 43 653 can be installed as an alternative to fuse bases in conjunction with the hand-operated fuse circuit breaker.
This creates a separation point in the 3AC mains supply and all poles of the semiconductor fuses can be switched.

2.4.1.5 Mains contactor

Contactors 3 AC 400 V, 50/60 Hz
On 3AC mains supplies which include (automatic) on/off switching of the mains voltage at the 8230 frequency inverter input (eg. 8230 frequency inverter units with optional brake chopper and braking resistor), 3-phase contactors according to the following tables are used.

Important! Note the mains contactor control voltage!

8230 frequency inverter type	Unit output current			Contactors 3 AC
	1.2 x Rated current	1.5 x Rated current	Max. current for 60 s	Type
	[A]	[A]	[A]	
8231	257	216	324	LS247.22
8232	304	257	365	LS247.22
8233	396	325	488	CA-5-550A
8234	483	400	600	CA-5-550A

Table 11: Mains contactors

Mains contactors and accessories are stated for 400 V, 50/60 Hz mains voltage.

2.5 Options

The user can install optional assemblies and function modules to adapt the 8230 frequency inverter to many different applications.

2.5.1 Control unit (BDE)

The control unit for the 8230 frequency inverter allows you to operate, control and monitor the unit. Values are displayed with the physical units of measurement used. The BDE has a 2-line, 20-character LCD display, 3 LEDs and 9 keys (5 keys for controlling the machine and 4 keys for parameter adjustment). Display contrast can be adjusted using a potentiometer on the rear (the PCB side). The BDE can be used regardless of the 8230 frequency inverter type rating and software version. It can be installed in the front door of the unit or located up to 2 m away, in the door of a another cubicle for example. If the BDE is installed in the door of a cubicle, a protection class up to IP54 is possible when the contact surface between the BDE and the door is sealed.

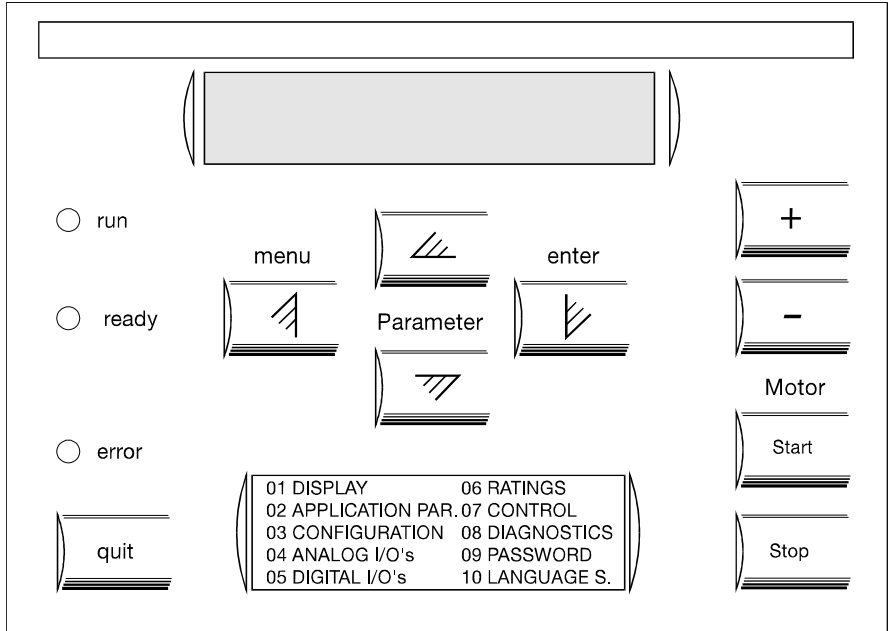


Fig. 9: 8230 frequency inverter BDE control unit

Note:
The menu label is removable.

If after delivery of the 8230 frequency inverter the control unit is removed and installed separately, for example in a cubicle door, the installation opening in the 8230 frequency inverter must be sealed with a blank panel.

The menu label can be replaced very easily and is available in all languages used for the menu.

Designation	
menu label	German
menu label	English
menu label	French

2.5.2 Brake chopper
and braking resistors

The 8230 frequency inverter can additionally be equipped with a brake chopper for applications involving regenerative operation, for example braking processes. Regenerative operation of the drive occurs if negative load torque or negative acceleration torque (braking torque) occurs in the speed range. In the majority of all applications braking processes are the cause of regenerative drive operation. The 8230 frequency inverter can be equipped with a power dump for this application. Braking energy is then converted by the power dump into heat in an external resistor.

In this case the 8230 frequency inverter link voltage is limited to a fixed value, the link current is reversed and is taken off through the power dump and the external braking resistor.

You can estimate whether a 8230 frequency inverter with a power dump for braking is required if you have the following drive parameters available:

- P_{nom} Motor rating [kW]
- n_{nom} Rated motor speed [rpm]
- n_1 Motor speed before braking [rpm]
- n_2 Motor speed after braking [rpm]
- t_B Braking time required [s]
- t_c Load cycle repeat time [s]
- M_L Load torque on the motor shaft [Nm]
- J Total inertia applied to the motor shaft [kgm²]

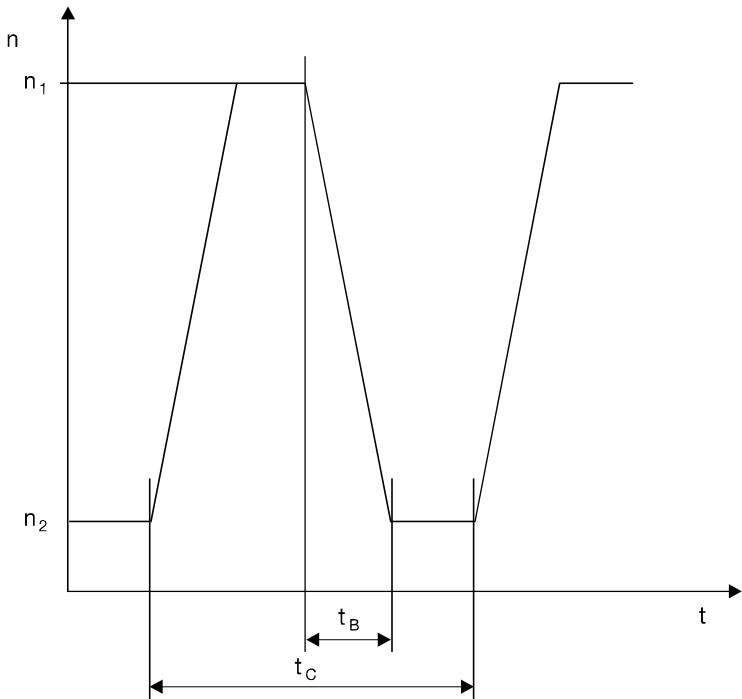


Fig. 10: Load cycle diagram

With this information you can calculate the rated motor torque M_N and the braking torque:

Motor rated torque
$$M_{nom} = \frac{P_{nom} \cdot 9550}{n_{nom}}$$

Braking torque
$$M_B = \frac{J(n_1 - n_2)}{9,55 \cdot t_B} M_L$$

The ratio between braking torque and rated motor torque determines whether a power dump is required.

At low braking torque ($0.1 \dots 0.2 \times M_{rated}$) the drive system is braked by its own losses.

- 1. $M_B/M_{nom} \leq 0,1 \dots 0,2$ No power dump required
- 2. $M_B/M_{nom} > 0,1 \dots 0,2$ Power dump required

2.5.2.1 Brake chopper

The brake chopper is built in the 8230 frequency inverter, if version BE was ordered. The table below shows the brake chopper with the relevant technical data for the 8230 frequency inverter types.

8230 frequency inverter type	Brake chopper			
	$I_{Br\ max}^{2)}$ [A]	U_D [V]	$R_{min}^{1)}$ [Ω]	$P_{Br\ max}$ [kW]
8231	300	750	2.5	225
8232	300	750	2.5	225
8233	600	750	1.25	450
8234	600	750	1.25	450

¹⁾ R_{min} for 750V U_D
²⁾ Duty cycle = 100 %

Table 12: Brake chopper

Important!

In drive applications with a brake chopper the temperatures of the braking resistors used must be monitored! If the monitor responds, the mains voltage at the power input to the 8230 frequency inverter must be switched off, i.e. the monitor must trigger a mains contactor on the 3AC supply to the 8230 frequency inverter.

2.5.2.2 Braking resistors

The mean braking capacity and the duty cycle are determined for selecting the braking resistor (assuming braking is required). In addition, the minimum braking resistor or the maximum braking power of each 8230 frequency inverter with a power dump must be observed.

Determining the mean braking capacity:

Power: Energy content of one braking process:

$$W_B = 0,0055 \text{ J} \times (n_1^2 - n_2^2) \quad \begin{array}{ll} [W_B] & = \text{Ws} \\ [J] & = \text{kgm}^2 \\ [n_1, n_2] & = \text{min}^{-1} \end{array}$$

Mean braking power for the complete braking process:

$$P_{BV} = W_B / t_B \quad \begin{array}{ll} [P_{BV}] & = \text{W} \\ [t_B] & = \text{s} \end{array}$$

The braking resistor is rated for the mean braking power and the duty cycle permitted according to the resistor.

If several braking processes occur during a load cycle, the individual mean braking powers P_{BV1} , P_{BV2} P_{BVn} must be calculated and related to the cycle time t_c . The resultant effective mean braking power $P_{BVe\text{ff}}$ must match the continuous capacity of the braking resistor:

$$P_{BVe\text{ff}} = \sqrt{\frac{P_{BV1}^2 \cdot t_{b1} + P_{BV2}^2 \cdot t_{b2} + \dots + P_{BVn}^2 \cdot t_{bn}}{t_c}}$$

The continuous capacity of the braking resistor must at least match the mean braking capacity P_{BV} or $P_{BVe\text{ff}}$ respectively as shown above.

Important!

The brake resistors used must be monitored thermally by an overload protection. The brake resistors offered by Lenze have an integrated temperature monitoring. When using several resistors in parallel, the individual monitoring contacts must be connected in series (normally-closed contacts).

Note:

When determining the rating of a braking resistor the type of load involved is an important criterion.

The size of the braking resistor for a sudden load is determined only by the weight of the active material and for the theoretical continuous power only by the radiating surface of the resistor material.

In discontinuous operation the rating is determined by the power permitted and the duty cycle. The values shown in Table 13 for the duty cycle are preferred and, unless stated otherwise, refer to a maximum duty cycle of 15 s.

Example:

With a 10 % duty cycle the resistor may be switched on continuously for a maximum of 15 seconds. Also permissible, for example, would be 5 seconds on and 45 seconds off. A load cycle with 20 seconds on and then 180 seconds off would not be permissible.

Technical data of braking resistors:

Type ERBD015R04K0	0.4 kW / 15 Ω
Resistance	15 Ω
Peak load	40 kW
Duty cycle % / 150 s	10 %
Max. rating	600 kW
Continuous capacity $\vartheta = 45\text{ °C}$	4 kW
Continuous current at DC 750 V	16 A
Peak current at DC 750 V	50 A
Permitted ambient temperature	-25 ... +45 °C
	max. 55 °C: Power reduction of 1 % / 1 °C
Protection class	IP 20

Table 13: Technical data of braking resistors

8230 frequency inverter	Assignment of braking resistors					
	Number of parallel resistors	Total resistance	Total continuous power	Total continuous current	Total peak power	Total peak current
		[Ohm]	[kW]	[A]	[kW]	[A]
8231	4	3.7	16	64	150	200
8232	5	3.0	20	80	187	250
8233	6	2.5	24	96	225	300
8234	8	1.9	32	128	300	400

Table 14: Assignment of braking resistors

Observe the installation notes in section 3.
Dimensions and installation drawings: See section 2.8.7.

Important!

The brake resistors used must be monitored thermally by an overload protection. The alarm contact(s) are to be integrated into the control of the drive (plant) such that the mains voltage is switched off at the power input of the 8230 frequency inverter, if the contact responds. This means that the main contactor or power switch in the 3AC supply is opened.

2.5.3 RFI filters

frequency inverter type	RFI filters with medium overload	RFI filters with high overload
8231	EZF3-250A001	EZF3-250A001
8232	ELN3-320A001	EZF3-250A001
8233	ELN3-600A001	EZF3-320A001
8234	ELN3-600A001	EZF3-600A001

Table 15: RFI filters

See section 2.8.10 for dimensions and weights.

Important!

RFI filters are only used on earthed networks.

2.5.4 Motor filters and output chokes

2.5.4.1 Motor filters

The use of the latest semiconductor technology allows extremely short times for switching the circuit breakers in frequency inverters on or off. 8230 frequency inverter are IGBT pulse inverters whose output voltage has rising or falling flanks of approx. 2 ... 3 kV/ μ s. Output filters for 8230 frequency inverter units are available for unlimited use with the benefits of IGBT technology when using a wide range of asynchronous 3-phase motors with different winding insulation voltages. These filters reduce the voltage rate of rise. An excessive voltage rise at the motor terminal box is determined by the cable length and the windings on the 3-phase motor used, through capacitive coupling. 8230 frequency inverter motor filters reduce this excessive rise in voltage through their built-in attenuation circuit. The 8230 frequency inverter motor filter prevents premature ageing of the insulation and therefore early failure if insulation limits are exceeded.

In general:

- du/dt → The shorter the motor cable length, the more critical the rate of rise
- Excessive voltage rise → When longer motor cables are used the amplitude of the voltage rise and fall at the motor terminal box can increase beyond the critical value for the mains supply voltage.

Higher cable inductance and capacitance on longer motor cables, however, reduces the du/dt value. The maximum voltage amplitude is therefore also reduced, so that the voltage rate of rise is reduced when an inductance due to longer cables applies.

The motor du/dt filters developed for 8230 frequency inverter units reduce the output voltage rise and fall times to below 500 V/ μ s (VDE 0503T1 Sheet 2). At the same time the filter design limits the rise time and the amplitude of the voltages and currents occurring in comparison to earth potential.

When using screened motor cable a du/dt filter also attenuates the amplitude and rate of rise of the screen current. This significantly reduces the effects of adjacent unscreened cables.

The limit for transient overvoltages is maintained when the cable lengths specified for the filter are observed.

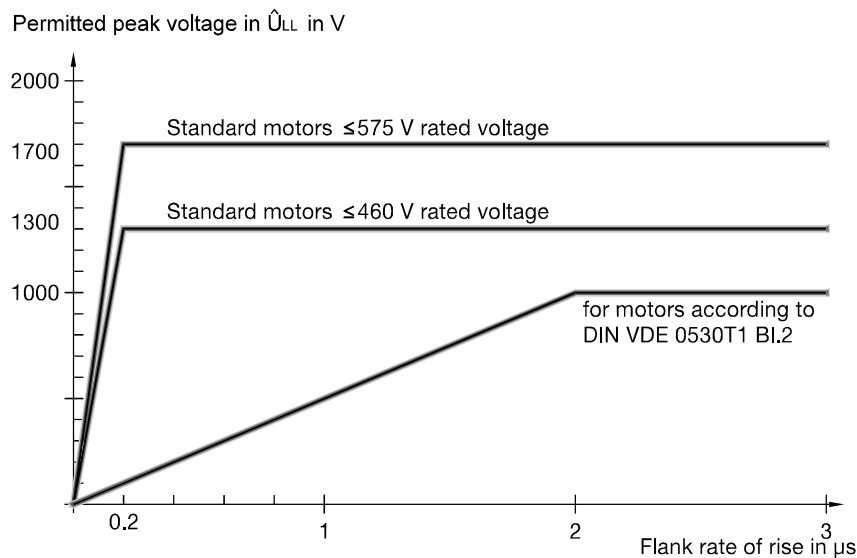


Fig. 11: Permitted limits for motor insulation

Application range of motor filters:

- With mains supply voltages $U_N \leq 460\text{ V}$ standard motors or motors with equivalent insulation characteristics can be used on 8230 frequency inverter. Standard motors of 400 V ... 460 V are designed for the voltage rates of rise and fall and voltage peaks of up to 1300 V which occur during inverter operation. If other makes of motors are used, please contact the motor supplier concerning suitability for inverter operation. 8230 frequency inverter motor filters are to be used if the insulation resistance of the motors and the maximum permitted voltage in the motor terminal box does not match the required value of 1300 V and the permitted voltage rate of rise in the winding insulation is $<3\text{ kV}/\mu\text{s}$. If the motors do not satisfy these requirements, 8230 frequency inverter motor filters or application-dependent output chokes are to be used.
- With long parallel runs of unscreened motor cables in industrial applications a motor filter is recommended to reduce the effect of adjacent cable runs caused by direct magnetic coupling.
- Radiated interference, particularly for high frequency components in the motor current, is reduced by limiting the voltage rate of rise when using motor cables which are not screened.

frequency inverter type	Motor filters with medium overload	Motor filters with high overload
8231	ELM3-0040H260	ELM3-0050H220
8232	ELM3-0030H330	ELM3-0040H260
8233	ELM3-0025H400	ELM3-0030H330
8234	ELM3-0020H500	ELM3-0025H400

Table 16: motor filters

See section 2.8.8 and 2.8.9 for dimensions, weights and power losses.

Note:

See section 3.5 “Mains and motor connection” for further information and the maximum permitted motor cable length when using filters.

Motor filters are ready to connect components which contain:

- 3-phase iron core choke
- Push-pull choke
- Pulse capacitors
- Attenuation resistors

Protection class:	IP 00
Mode of operation:	DB
Operating frequency:	max. 150 Hz
	Motor filters for higher frequencies available on application

Important!

8230 frequency inverter motor du/dt filters are designed for a maximum pulse frequency of 3 kHz.

Fig. 12 shows the basic configuration and connection of motor filters with 8230 frequency inverter.

See section 3.5 "Mains and motor connection" for further information. See sections 2.8.8 and 2.8.9 for dimensions and weights.

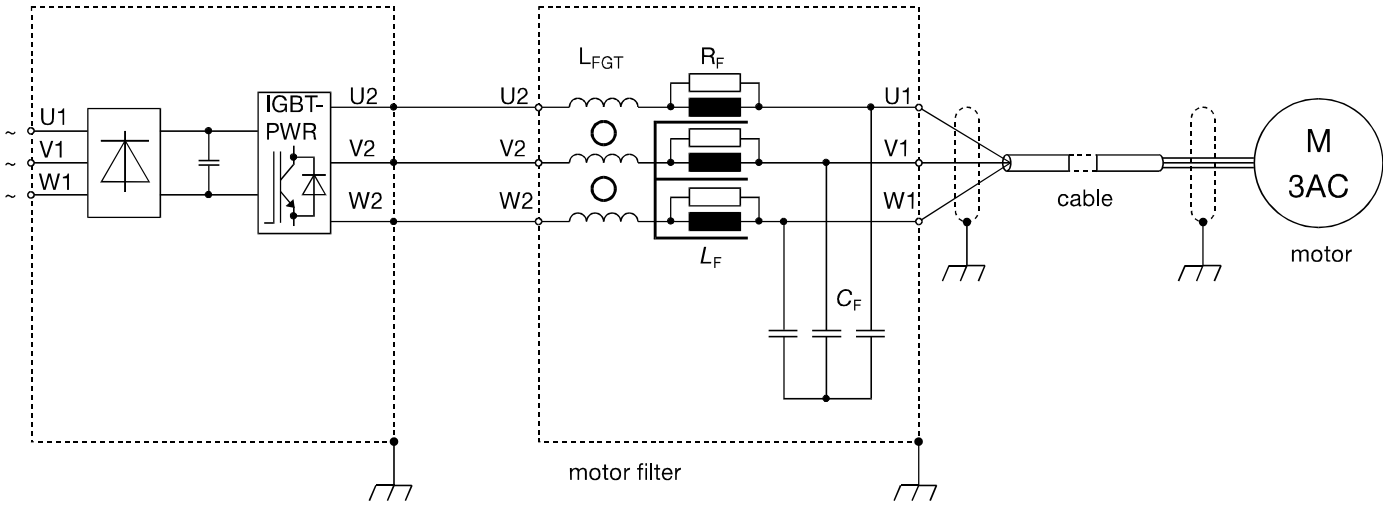


Fig. 12: Circuit diagram of motor filter for limiting the output voltage rate of rise

2.5.4.2 Motor choke

The motor choke makes it possible to use longer cable lengths between the 8230 frequency inverter and the motor. Motor chokes reduce the output voltage rates of rise and fall and attenuate the high frequency recharging currents caused by cable capacitance. The motor choke is also to be installed in multiple motor applications. The recharging current amplitudes are higher, the higher are the pulse frequency/voltage rate of rise and the effective capacitance through the motor cables. This means on average also higher currents can be found. As fault currents occurring on the motor current circuit are also detected by earth current detection, pulses may be disabled and fault shutdowns may occur when long motor cables are used and the earth fault threshold is set too low. The motor choke reduces these fault currents and is to be used if cable length is excessive and the 8230 frequency inverter is operated “*without an output circuit*”, see also Table 24.

Alternatively a 8230 frequency inverter motor filter is to be used if required for insulation protection.

If an output choke is fitted, the motors used must be designed for the maximum voltage ratings since a reduction in the maximum voltage amplitude can only be expected when longer cables (approx. 150 m) are used.

A common output choke at the inverter output is generally to be provided in multiple motor applications.

frequency inverter type	Motor choke with medium overload	Motor choke with high overload
8231	ELD3-0040H260	ELD3-0050H220
8232	ELD3-0030H330	ELD3-0040H260
8233	ELD3-0025H400	ELD3-0030H330
8234	ELD3-0020H500	ELD3-0025H400

Table 17: Output chokes for 8230 frequency inverter

Characteristics

Iron core choke	3-leg configuration optimised for inverter operation
Operating voltage	400 V ... 460 V
Operating frequency	max. 150 Hz Ferrite core output chokes for higher frequencies by request
Protection class	IP 00
Mode of operation	DB
Environment class	DIN EN 60721 Part 3-3 3K3 / 3M2 / 3C2 / 2K2

Important!

8230 frequency inverter motor filters are designed for a maximum pulse frequency of 3 kHz.

See section 3.5 for further information.

See section 2.8.10 for dimensions, weights and losses.

2.5.6 Option boards

The options encoder interface is an option board which is installed on the rack of the information electronics.

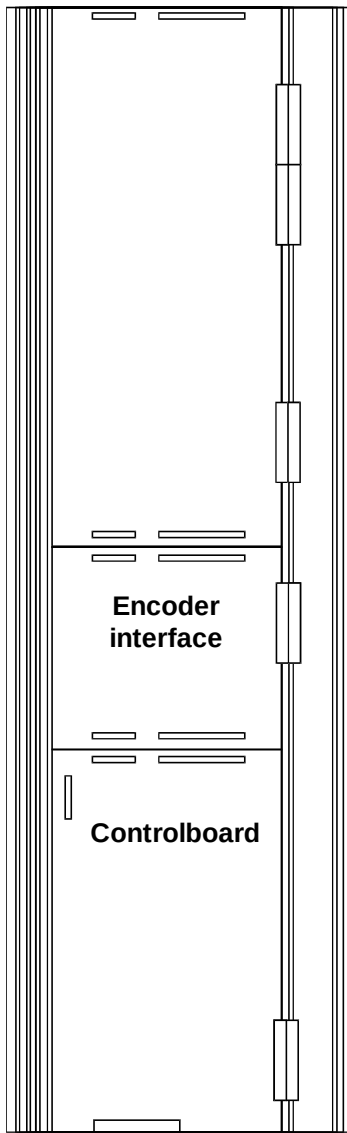


Fig. 13: Configurations, frame size 8 and 9

Note:

The bus terminator (included in the connection kit) must always be fitted when options are installed (64 pol.).

2.5.6.1 Encoder interface EMZ8235IB

The encoder interface is an assembly for detecting the speed when using an incremental encoder. It is required for 8230 frequency inverter drive controls with a speed actual value encoder to achieve higher control quality and an extension of the speed adjustment range to values above 1:1000.

The assembly consists of:

- Encoder interface
- Bus adapter cable 40 mm
- Supply adapter cable 40 mm
- Mechanical fixings
- Bus terminator

Fig. 14 shows the basic configuration of the encoder interface assembly.

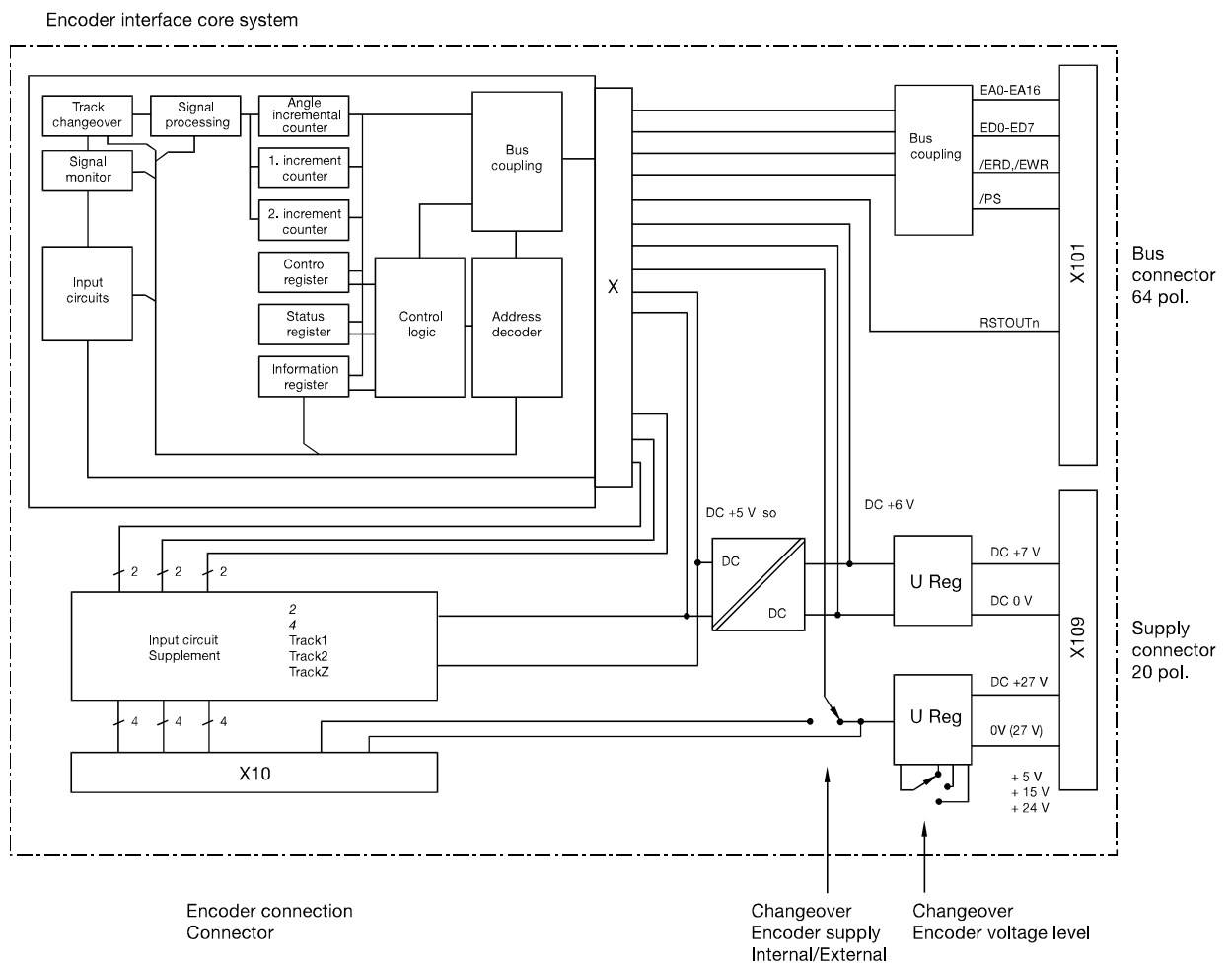


Fig. 14: Structure diagram of encoder interface

The encoder interface is connected to the I/O bus through bus connector X101. The supply to the assembly is through connector X109 from the +7 V and +24 V supply voltages in the 8230 frequency inverter. The voltage controllers for the encoder interface generate the supply voltage for the core system (the logic modules) and the supply voltages for the encoder. The incremental encoder is connected through terminal strip X10. The terminal wiring for the X10 encoder connection terminal strip on the encoder interface is shown in Fig. 15.

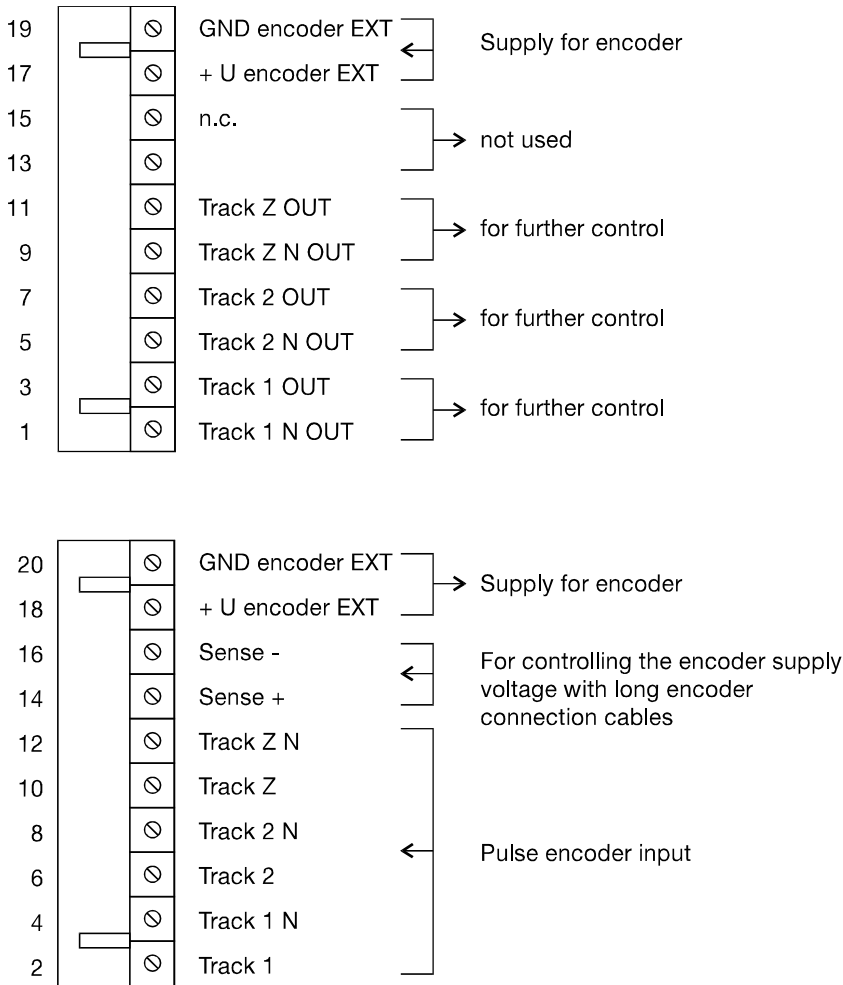


Fig. 15: Encoder interface terminal wiring

The supply voltage for the incremental encoder can be taken either internally from the encoder interface or from an external voltage source. The external voltage source is then connected according to Fig. 15 to terminals X10:17 and X10:19.

If the incremental encoder is supplied internally through the encoder interface the supply voltage can be switched to either DC +5 V, DC +15 V or DC +24 V. Switching is achieved by moving jumper X11 to the appropriate position.

The symmetrical encoder signals (differential track signals) for Track 1, Track 1N, Track 2, Track 2N, Track Z, Track ZN are detected and processed through differential input stages in a voltage range from approx. 3 V ... 24 V and are output to the terminals according to Fig. 15 as the signals TRACK1OUT, TRACK1NOUT, TRACK2OUT, TRACK2NOUT, TRACKZOUT, TRACKZNOUT for further use at a voltage level of

DC +5 V. Output at the 15 V or 24 V voltage level is in preparation. The encoder track signals are monitored for wire break. The LEDs ARDY (Track 1 / Track 1N), BRDY (Track 2 / Track 2N), ORDY (Track Z / Track ZN) ... indicate that the track signals are intact, see Fig. 16.

If symmetrical encoder signals are connected, the two hook switches S20a and S20B are in position 1. Asymmetrical encoder signals cannot be processed directly.

The zero pulses (Track Z / Track ZN) of the incremental encoder are not processed at the present time and need not be connected.

When a 5 V encoder supply voltage is used, connection of a sense signal at E83 :X10 terminal :12/:14 allows compensation for voltage drops. Through internal calibration the voltage actual value is processed and the voltage drop is controlled within the adjustment range (TTL level).

The maximum cable length for connecting an incremental encoder however is also limited by the maximum frequency which can be transmitted. The notes on connection must be observed.

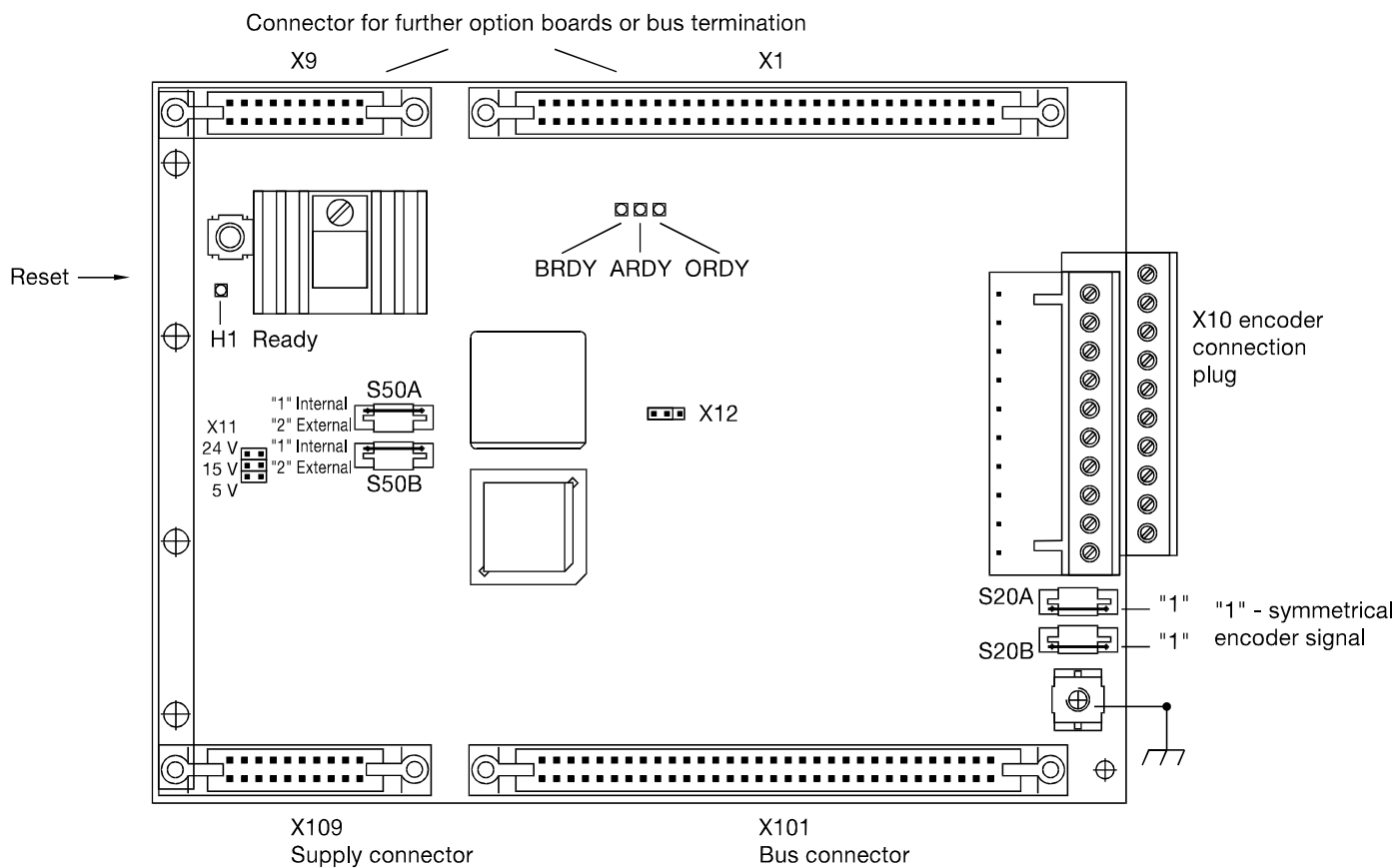


Fig. 16: Encoder interface - indicators, selector switches, connectors

The input and output signals for the encoder interface are connected through the plug-in terminal strip X10. Connection to the A10 control board is by means of ribbon cables.

Technical data of inputs and outputs

Inputs (incremental encoder)	1 encoder input
Configuration:	2 differential inputs, separate potential, for 2 incremental encoder tracks offset through 90° 1 differential input, separate potential, for the zero pulse track (not essential)
Input voltage level:	+5 V/+15 V/+24 V adjustable
Input frequency of track signals:	Max. 1 MHz
Loading per Differential input	≤35 mA
Dimensions (width x heigth):	168 mm x 120 mm
Weight:	ca. 0.35 kg

Outputs (encoder interface)

1 output for encoder track signals for further processing

Configuration:	2 differential outputs, separate potential (+5 V isolated) for 2 incremental encoders tracks offset through 90° 1 differential output, separate potential (+5 V isolated) for the zero pulse track
Voltage level:	DC +5 V (15 V and 24 V in preparation)
Load rating per track:	20 mA

Incremental encoder supply

Configuration:	Switch controller output / internal
Voltage level:	5 V / 15 V / 24 V adjustable
Rating:	350 mA

The supply for the incremental encoder can be switched to “external” using hook switches S50A and S50B. The incremental encoder is then fed from an external voltage source through the “External voltage source” input. Switch position 1 = “internal”, 2 = “external”. The “external voltage source” may be max. DC +24 V.

Unit software required

From 8230 frequency inverter Unit software SW V2.0

Note:

The procedure for connecting option boards through adapter cables must be followed accurately. If several option boards are used, the following procedures must be observed:

- The encoder interface must always be connected directly at the control board, using the shortest possible cable.

Ratings and connection

To compensate for interference (push-pull interference) on cables, encoders with two pulse tracks offset through 90° electrical and with complimentary outputs are used. To guarantee high resistance to interference it is recommended that encoders with a 24 V operating voltage are used.

The quality of the encoder cable is critical for the maximum encoder frequency which can be transmitted. Screened cables with conductors twisted in pairs are to be used. The screen is connected at both ends.

In the system, encoder cables must be laid separately from power cables (spacing ≥ 0.3 m for up to 200 m cable length). It is recommended that the encoder cable be connected directly to the encoder interface, without any separation points. The screen is to be fully surrounded by clamps and connected to the control electronics cassette. See section 3.6 for supplementary notes on connection.

Recommended encoder cable: LIYCY 3 x 2 x 0,75 mm² (twisted in pairs)
Guideline values for possible cable lengths for incremental encoder cable

Max. encoder cable length: l [m]	Max. encoder frequency: f _G [kHz]	$f_G = \frac{Z \cdot n [\text{Imp} \cdot \text{min}^{-1}]}{60 \cdot 10^3} [\text{kHz}]$
30	300	
00	160	
200	100	
300	50	

For more stringent requirements the details given by the manufacturer of incremental encoder systems for higher transmission frequencies should also be observed and matched sets of special cables should also be used.

Maximum speed of the drive:

$$n_{\max} = 60 \cdot 10^3 \cdot \frac{f_{G\max}}{Z}$$

Z	Encoder pulses per revolution	[p/rev]
n _{max}	Max. motor speed	[rpm]
f _{Gmax}	Max. encoder frequency	[kHz]

Minimum speed of the drive:

$$n_{\min} = \frac{60 \cdot 10^3}{T_{\max} \cdot Z \cdot 2}$$

T _{max}	Max. time between 2 pulse [ms]
with T _{max} = 25 ms	

For technical reasons lower values for n_{min} are interpreted as motor standstill.

To achieve high resolution for speed measurement the encoder should have a high number of pulses per revolution. At high motor speeds this is counteracted by the limit on transmission frequency resulting from long encoder cables and the technical data of incremental encoders.

Encoders of 1000 pulses per revolution and above are recommended. Depending on the manufacturer, incremental encoders using a 24 V supply voltage operate up to a maximum sensing frequency of approx. 160 kHz.

Example configurations Cable length = 100 m, frequency limit = 100 kHz.

$n_{\max}$ [rpm]	6000	4000	3000	2400	1670
$n_{\min}$ [rpm]	1.2	0.8	0.6	0.5	0.4
Line markings [p/rev]	1000	1500	2000	2500	3600

2.5.6.2 Operation on a mains supply with no earth

Important!

The limits for radio interference suppression as stated in this operating manual apply only to earthed networks. If other equipment is operated at the same mains supply point, the EMC interference resistance of the equipment used is to be checked with the mains supply operator and matched to the 8230 frequency inverter.

2.6 Summary circuit diagrams

2.6.1 Summary circuit diagram, 8230 frequency inverter

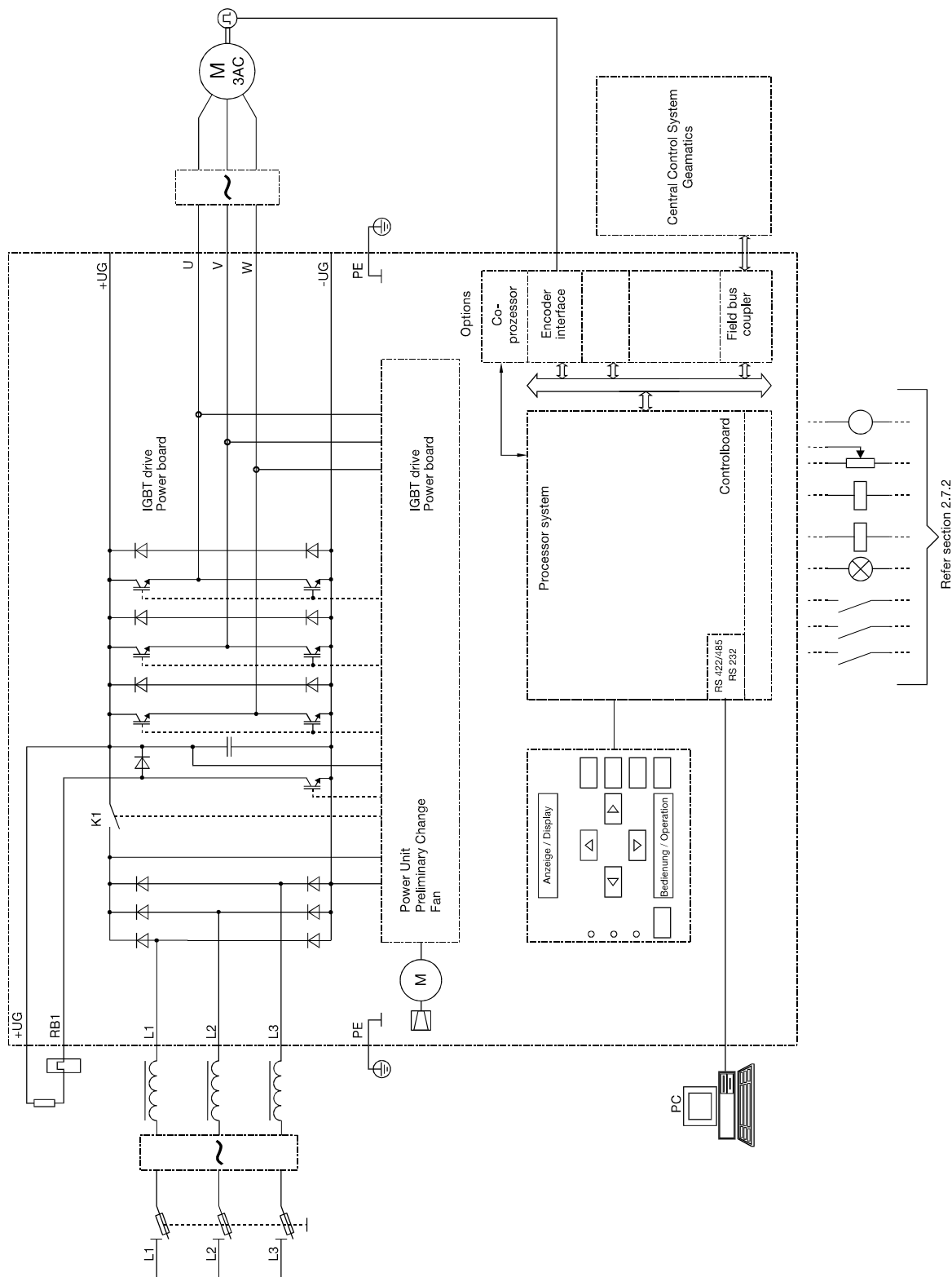


Fig. 17: 8230 frequency inverter with 3AC supply

2.7 Connection, terminal wiring

2.7.1 Power stack

The power stack consists of a B6 diode input bridge, charging circuit, link and inverter.

The AC bridge connections U1, V1, W1 are connected to the 3-phase AC supply network L1, L2, and L3.

2.7.1.1 3AC supply

Connections at top	Function
PE	Earth terminal
L1	} Mains supply 3AC 400 ... 460 V
L2	
L3	
-	Not used
RB1	} Braking resistor
+UG	
	(+UG = link plus)
Connections at foot	Function
PE	Earth terminal
U1	} Motor connection
V1	
W1	
+UG	Link plus
-UG	Link minus
PE	Earth terminal

Fig. 18 shows the 8230 frequency inverter power connections for a 3AC supply. The 8230 frequency inverter supply components marked * are not essential.

Note:

In exceptional cases it can be necessary to reverse the order of components 1), see Fig. 18. This is the case, for example, if additional auxiliary supplies such as external motor fans are to be operated at the feed point or function earthing is not consistent.

Customer low voltage distribution

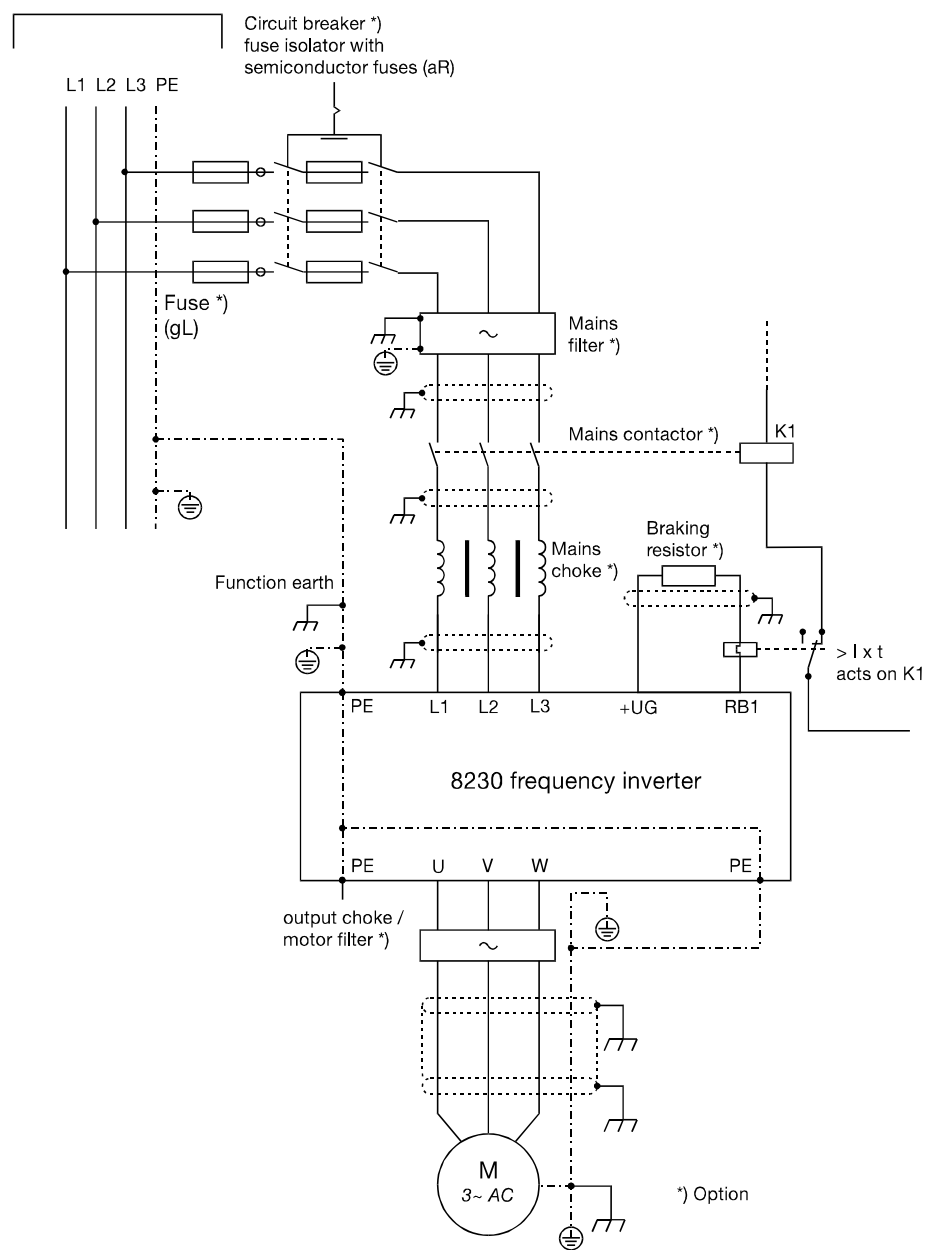


Fig. 18: 8230 frequency inverter power connection

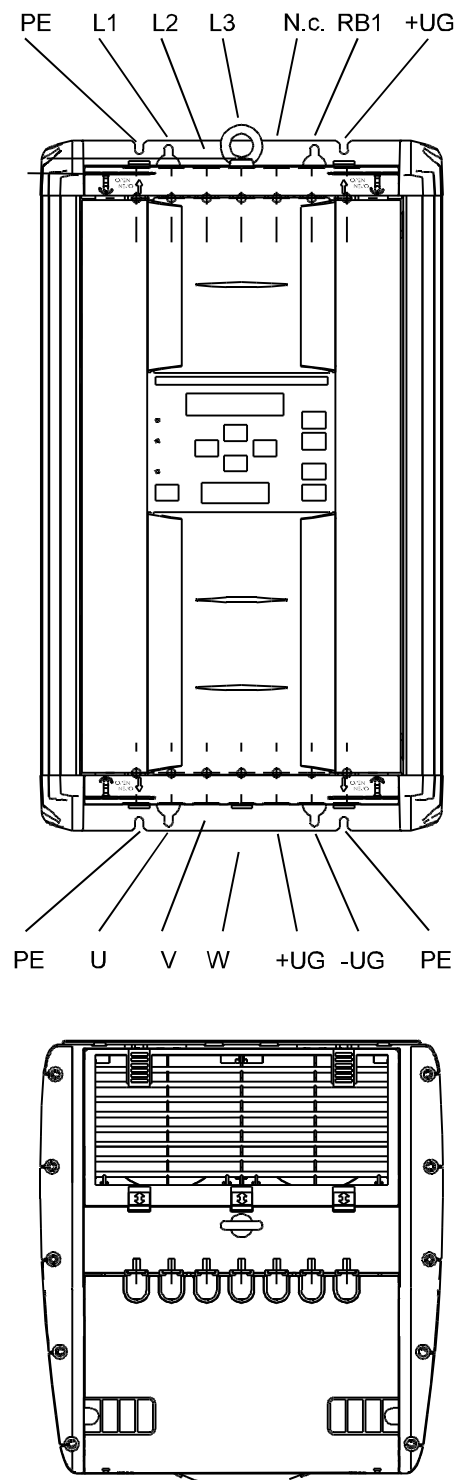


Fig. 19: 8230 frequency inverter power stack terminal wiring

2.7.2 Electronics section,
A10 control board

The 8230 frequency inverter is controlled via the terminal strip :X15 on A10 control board.
Fig. 20 shows the A10 control board with the clip-on terminal strip :X15 and the various plug connections.

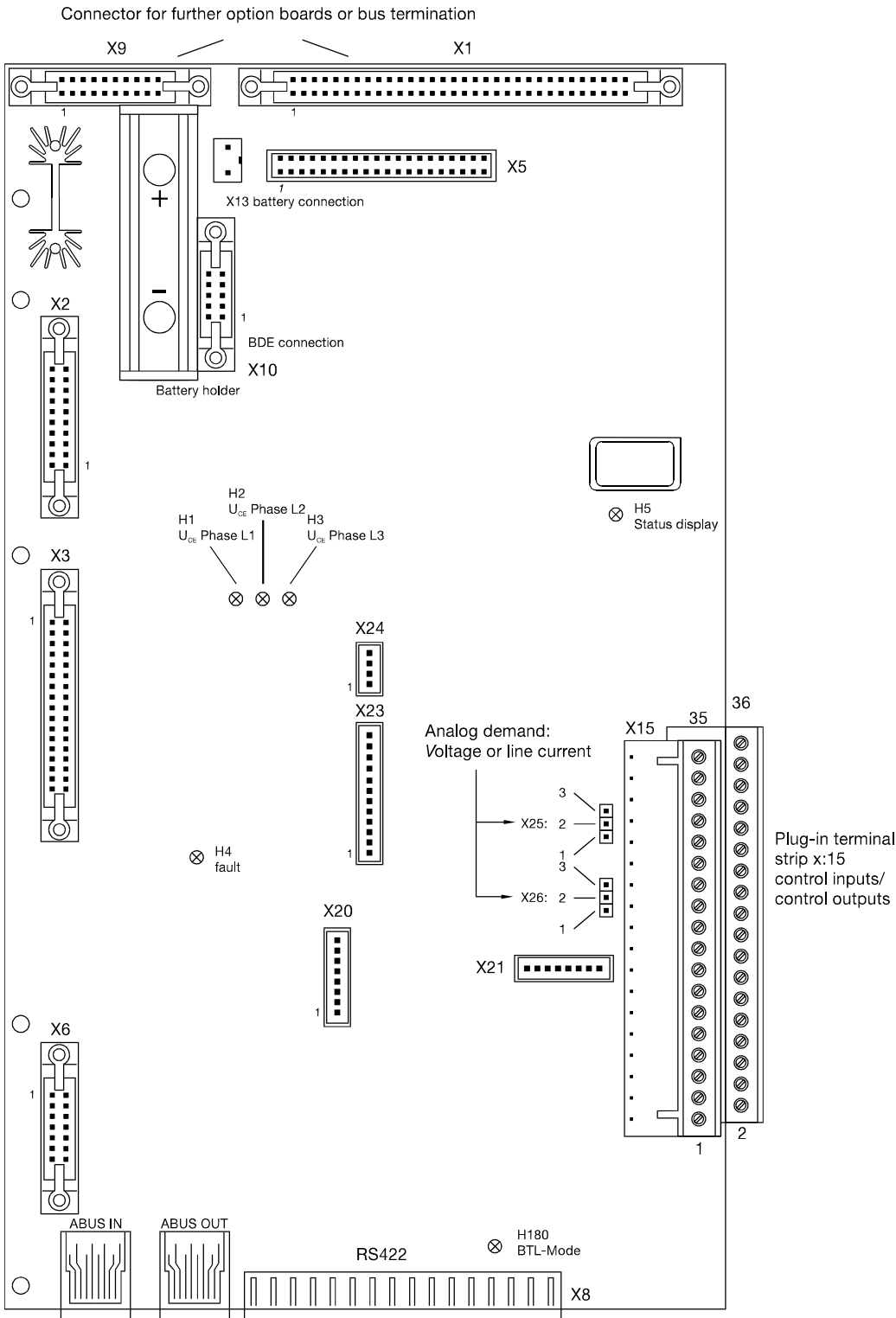


Fig. 20: A10 Control board, control and signal connections

2.7.2.1 Terminal strip wiring :X15 and signal functions

Terminal :X15	Function		Comments	
1)		:1	DC +24 V	Max. load: 800 mA
		:2	DC 0 V	Reference potential for DC +24 V
		:3	PTC-	Motor thermistor connection
		:4	Motor temperature	Motor thermistor connection
Binary inputs				
	:5	ON / STOP	Flank LOW • HIGH = ON	
	:6	MANUAL/AUTOMATIC	+24 V = Automatic; Open = Manual	
	:7	STOP	Flank HIGH • LOW = STOP	
	:8	FAST STOP	Open = Fast Stop	
	:9	LEFT	+24 V = Left	
	:10	INHIBIT	Open = Inhibit, drive idles down	
	:11	RIGHT	+24 V = Right	
	:12	EXTERNAL ERROR	Open = Inverter disabled	
	:13	QUIT	Flank LOW ® HIGH = acknowledge	
:14	DIGITAL INPUT 1	Function available		
:15	DIGITAL INPUT 2	Function available		
:16	DIGITAL INPUT 3	Function available		
Binary outputs				
	:17	Relay contact	READY	DC 30 V; 0,5 A max. closed on "READY" 2)
	:18	Relay contact	ON	DC 30 V; 0,5 A max. closed on "ON"
	:19	Relay contact	ERROR	DC 30 V; 0,5 A max. closed on "ERROR" 3)
	:20	Relay contact 2)	SPEED	DC 30 V; 0,5 A max.
	:21	Relay contact 2)	REACHED	Function available
	:22	Relay contact 2)		Standard: "SPEED REACHED" 3),4)
	:23	Relay contact 2)		parallel to terminal 1
	:24	Relay contact 2)		parallel to terminal 2
:25	DC +24 V			
:26	DC 0 V			
Demand inputs			Analog outputs	
:27	MAIN DEMAND (-)	Differential input		
:28	MAIN DEMAND (+)	Differential input		
:29	ADDIT. DEMAND (-)	Differential input		
:30	ADDIT. DEMAND (+)	Differential input		
:31	DC +10 V	Rating: 20 mA resistant to short circuit		
:32	DC -10 V	Rating: 20 mA resistant to short circuit		
:33	A-OUTPUT 1	Rating: 3 mA		
:34	DC 0 V	Reference potential 0 V for DC ± 10 V		
:35	A-OUTPUT 2	Rating: 3 mA		
:36	DC 0 V A-OUTPUT	Reference potential 0 V Analog outp. A-OUTPUT 1, A-OUTPUT 2		

1) As supplied: Terminals :7, :8, :10, :11, :12 are connected to +24 V (terminal :1). Terminals :3 and :4 are bridged. The 8230 frequency inverter can therefore be controlled directly via the control unit.

2) The function can be re-directed with the PC handling software if required

3) The function can be inverted if required

4) The output can be adjusted.

Motor thermistor connection PTC-MOTOR-TEMP

A PTC resistor according to DIN 44081 is used for monitoring the motor temperature.

PTC cold	$R_{PTC} < 2 \text{ k}\Omega$
PTC hot	$R_{PTC} > 2.4 \text{ k}\Omega$

The comparator in the 8230 frequency inverter switches at a resistance value of $2.1 \text{ k}\Omega$ to $2.3 \text{ k}\Omega$ and has $0.1 \text{ k}\Omega$ hysteresis. The temperature trigger curve is very steep in this range. If a switch contact is connected here (TMA), the low contact current of 2 mA should be noted. Suitable switching contacts must be used.

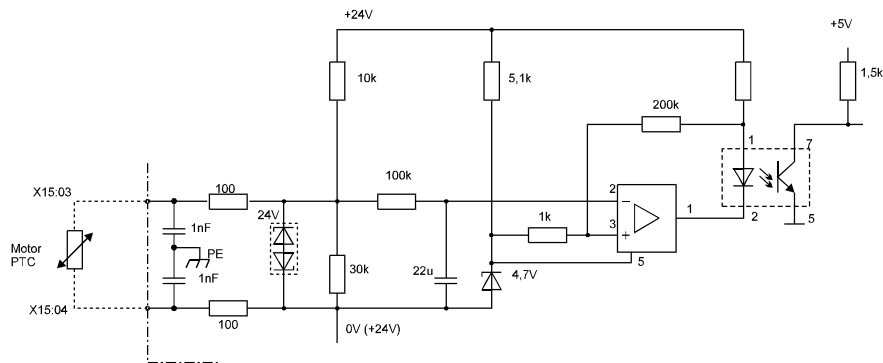


Fig. 21: Motor thermistor connection

Binary inputs

Design:	Optocoupler
Number:	12
Input level:	24 V / 14 mA

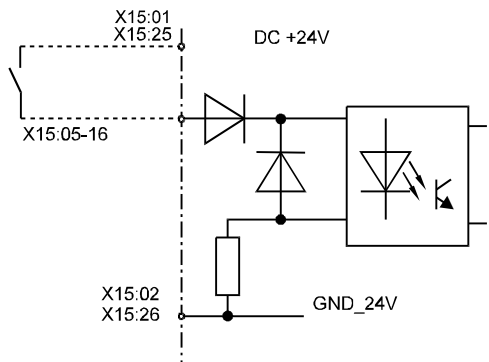


Fig. 22: Binary signal input

The inputs can be switched with a signal level of DC +12 V ... +30 V (positive logic). The internal DC +24 V supply voltage should be used wherever possible. The input current is 14 mA per input. The standard terminal wiring is stated in section 2.7.2.1. The binary input signals have a common reference potential at X15 :02 and X15 :26.

Binary outputs

Number: 4
Design: Relay, potential-free
Rating: DC 30 V; 0,5 A

See section 2.7.2.1 for the standard terminal wiring.

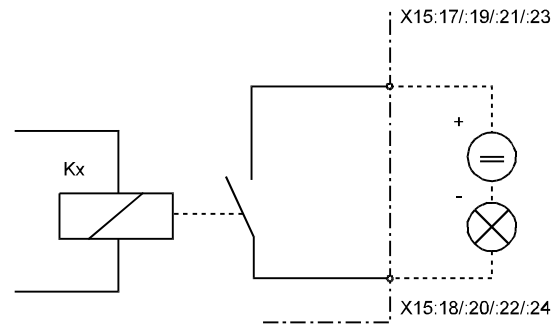


Fig. 23: Binary signal output

Demand inputs

Number: 2
Design: Differential input
Signal level: 0 ... ±10 V switchable
0 (4) ... ±20 mA
A/D resolution: 10 bit

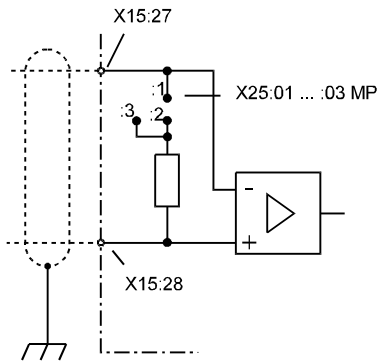


Fig. 24: Main demand input

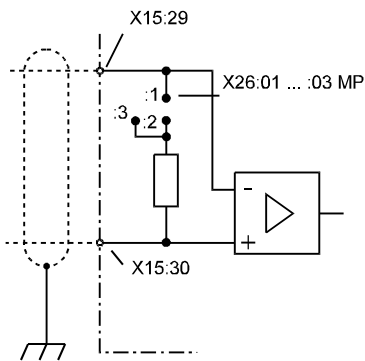


Fig. 25: Additional demand input

The input signal level is selected by plugging the jumpers on pins X25 or X26 (see Fig. 20).

Jumper setting:		Input signal level:
X25:2 - X25:3 and X26:2 - X26:3 (Parked position)	}	DC -10 V ... +10 V or DC 0 V ... +10 V
X25:1 - X25:2 X26:1 - X26:2 (Bridged)	}	DC 0 mA ... 20 mA or DC 4 mA ... 20 mA

Analog outputs

Number:	2
Design:	Operational amplifier
Signal level:	0 ... ±10 V / 3 mA max.
D/A resolution:	11 bit + polarity
Standard setting:	Output 1 = Output frequency Output 2 = Motor current
See section 4.4.4	

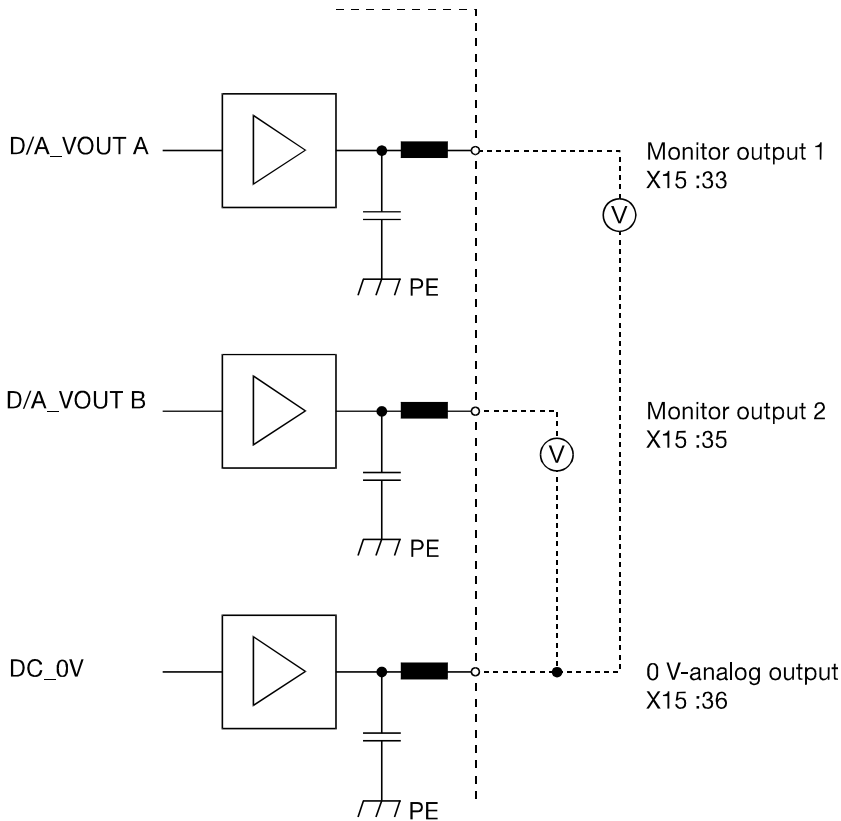


Fig. 26: Analog signal outputs

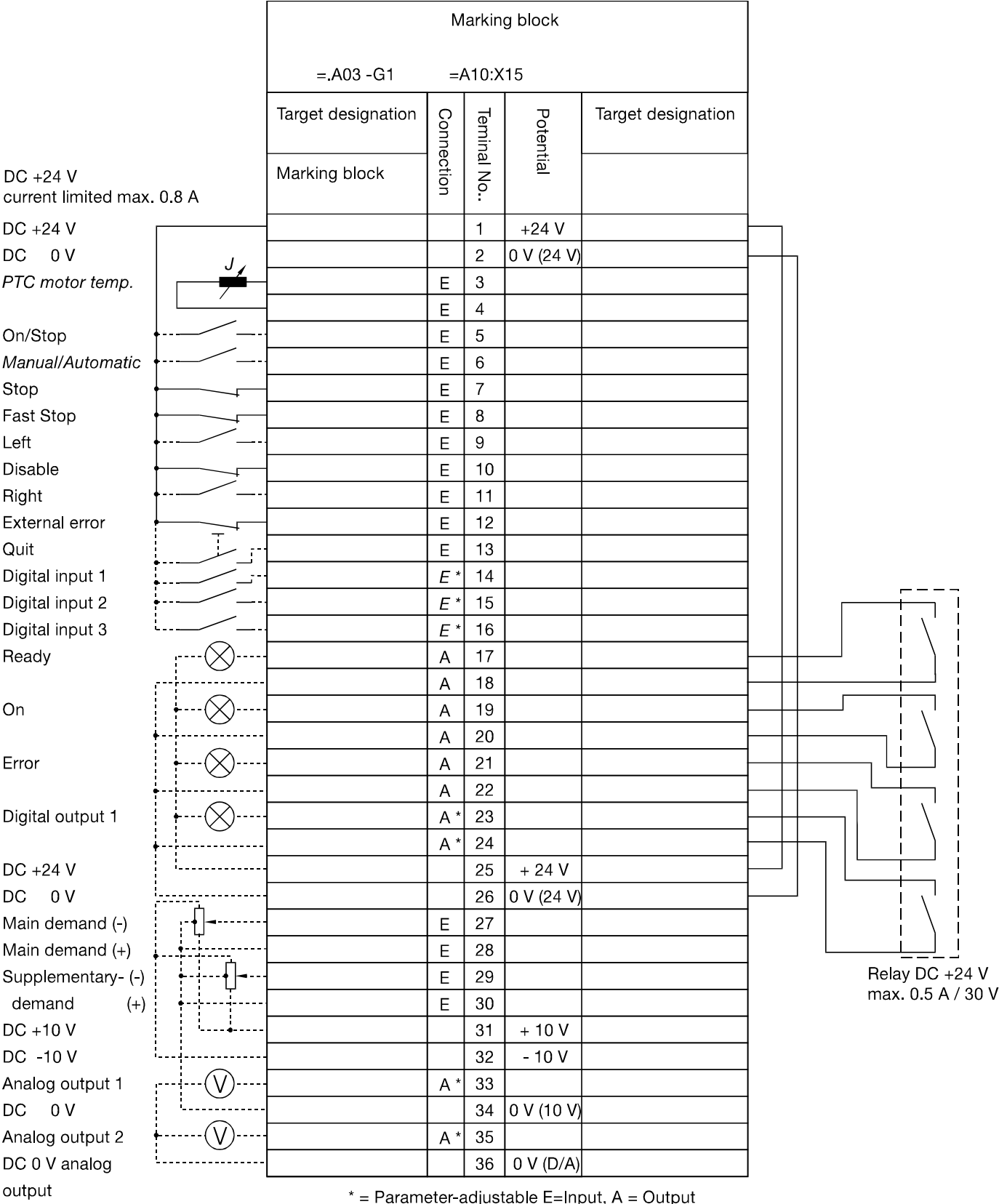


Fig. 27: A10 Control board X15 terminal strip wiring

Terminal :8	FAST STOP Fast Stop function by a flank from HIGH to LOW. The drive runs to zero at the parameter-adjustable "ramp fast stop". The pulses are then disabled and the internal DC main contactor is de-energised. If the optional brake chopper with braking resistor is connected, the link is force-discharged after approx. 30 s.
Terminal :9	LEFT Left, demand enable on HIGH If "demand preset 0 ... +10 V" or "line current" is preset, operation in the left direction is enabled with a HIGH signal at terminal :9. Negative values at the demand input produce a demand of zero. If neither LEFT nor RIGHT is HIGH, no direction is enabled. If both LEFT and RIGHT are HIGH, the signal set first takes priority.
Terminal :10	DISABLE Inverter disable This disables the pulses on LOW and de-energises the internal DC main contactor. If the optional brake chopper with braking resistor is connected, the link is force-discharged after approx. 30 s.
Terminal :11	RIGHT Right, demand enable on HIGH If "demand preset 0 ... +10 V" or "line current" is preset, the right direction is enabled on a HIGH signal at terminal :11. Negative values at the demand input result in a demand of zero. If neither LEFT nor RIGHT is HIGH, no direction is enabled. If both LEFT and RIGHT are HIGH, the signal set first takes priority.
Terminal :12	EXTERNAL ERROR Opening the external error contact causes the inverter to be disabled and de-energises the DC contactor. The motor idles down. Restarting is only possible after an acknowledgement.
Terminal :13	ERROR RESET Acknowledgement of an error A change in level from LOW to HIGH is an acknowledgement.
Terminal :14	D-INPUT 1 Digital input 1 Function parameter-adjustable (05 Digital I/O →Terminal :14) Standard setting: - Motor potentiometer higher Alternatively: - Select fixed speed.1 Input resistance: 4.8 kΩ

Terminal :15	D-INPUT 2 Digital input 2 Function parameter-adjustable (05 Digital I/O → Terminal :15) Standard setting: - Motor potentiometer higher Alternatively: - Select fixed speed.2 Input resistance: 4.8 kΩ
Terminal :16	D-INPUT 3 Digital input 3 Function parameter-adjustable (05 Digital I/O → Terminal :16) Standard setting: - Jogging Alternatively: - Change parameter set - Select ramp 2 - Select fixed speed 3 - Input resistance: 4.8 kΩ
Terminal :17/:18	READY Relay “ready” The contact closes when a voltage is applied, no errors are present and no mains supply phase failure has occurred. This function can be altered using the PC handling software (See standard technology configuration). Contact rating - as standard: 30 V, 500 mA to $\cos \varphi \geq 0.9$; Apply load to relay coils
Terminal :19/:20	ON Relay “on” This contact closes when the drive is “ready” and the inverter is pulsing. Contact rating as terminal :17/:18
Terminal :21/:22	ERROR Relay “Error” This contact closes after an error shutdown. Operation is only possible after an acknowledgement. Contact rating as terminal :17/:18 The function can be inverted by parameter adjustment.
Terminal :23/:24	D-OUTPUT 1 Digital output Parameter-adjustable (05 Digital I/O → Terminal :23/:24) (Standard setting: “Speed reached” - see section 4.4.5) Contact rating as terminal:17/:18 This function can be inverted by parameter adjustment.
Terminal :27/:28	MAIN DEMAND Differential input for MAIN DEMAND Burden 500 Ω with a line current demand Input parameter-adjustable as speed or torque input (07 Regulation → control structure: As supplied: Speed demand) The input is designed as a differential amplifier input. Input resistance: 40 kΩ Resolution: 10 bit + polarity

Terminal :29/:30	ADDITIONAL DEMAND Differential input, additional demand As terminal :27/:28 Terminal :31 + 10 V/ 20 mA } Supply voltage for Terminal :32 - 10 V / 20 mA } Demand channels (short-circuit resistant)
Terminal :31	DC +10 V 20 mA voltage supply for demand channels
Terminal :32	DC -10 V 20 mA voltage supply for demand channels
Terminal :33	A-OUTPUT 1 Analog output for an analog value 0 ... ±10 V Function adjustable (04 Analog I/O → Terminal :33) (Standard setting: Output frequency - see section 4.4.4) Scaling adjustable through 04 Analog I/O - Scale analog output Rating: 3 mA; load ≥ 3.3 kΩ D/A transformer: 12 bit accuracy, 0.3 % resolution
Terminal :34	0 V Reference potential for DC ±10 V
Terminal :35	A-OUTPUT 2 Analog output for an analog value 0 ... ±10 V As analog output 1 (Standard setting: Motor current - see section 4.4.4)
Terminal :36	DC 0V A-OUTPUT 0 V for analog outputs A-OUTPUT 1 and A-OUTPUT 2

2.8 Dimensions,
Installation drawing, weights

2.8.1 8230 frequency inverter build-in units

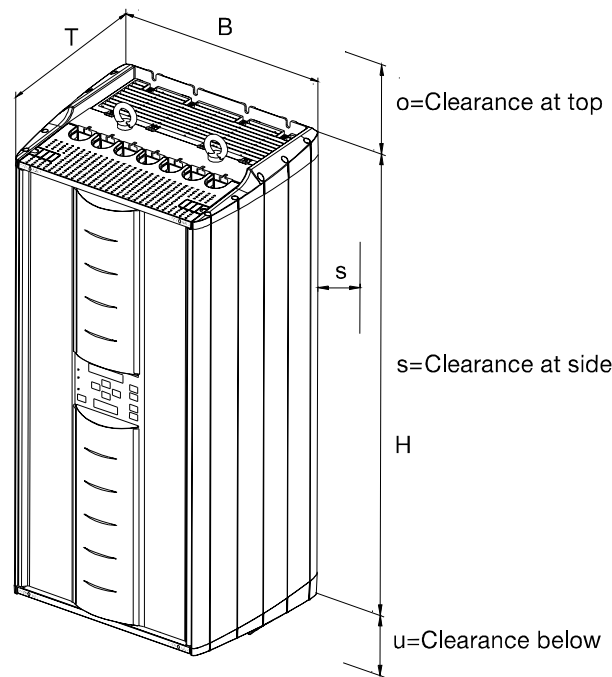


Fig. 28: Dimensions, 8230 frequency inverter build-in units

The clearances above, below and to the side must be provided. The mains choke may not be installed directly under the unit.

8230 frequency inverter type	Frame size	Enclosure dimensions			Weight [kg]	Installation clearances (Clearance for cooling air inlets)		
		Width B [mm]	Depth T ¹⁾ [mm]	Height H [mm]		top o [mm]	bottom u [mm]	at side s [mm]
8231	8	495	419	1049	90	300	200	0
8232	8A	495	419	1225	90	300	200	0
8233	9	495	419	1499	140	300	200	0
8234	9A	495	419	1675	140	300	200	0

¹⁾ The unit depth can be reduced by 19 mm by removing the decorative facia on the door.

Table 18: Dimensions, weights, installation clearances

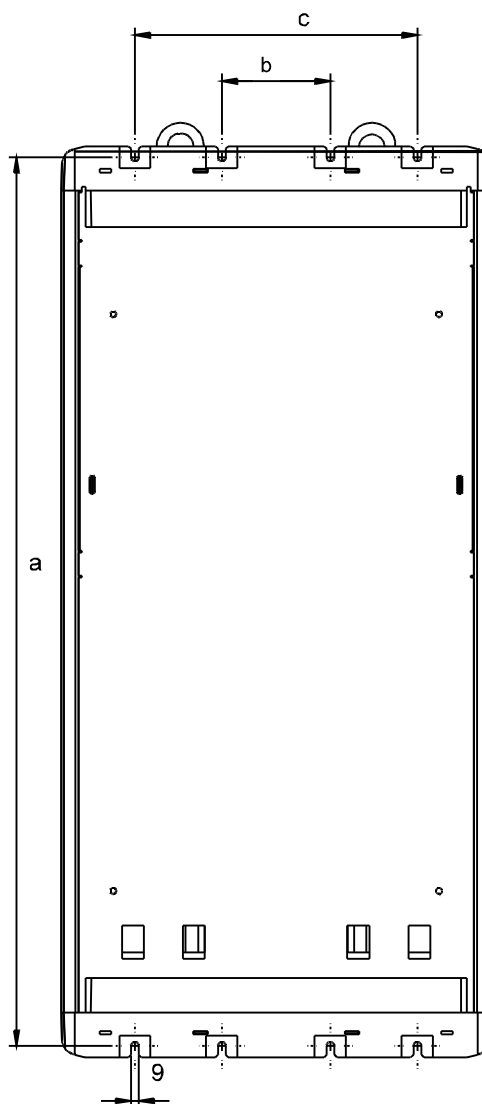
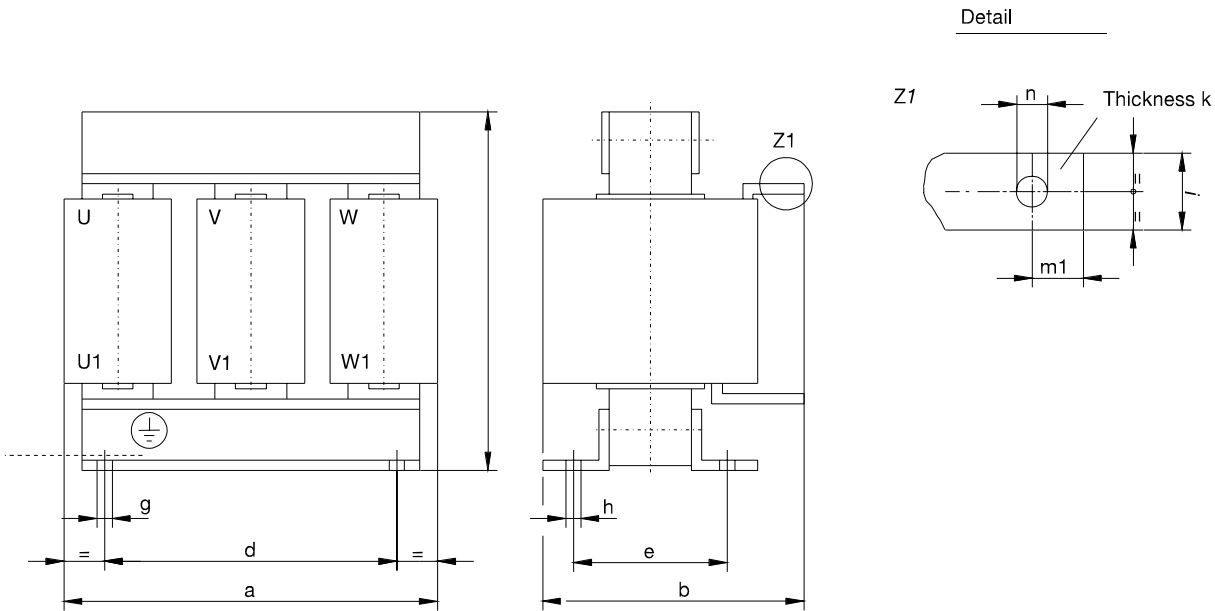


Fig. 29: Installation dimensions

8230 frequency inverter type	Frame size	Installation dimens.			Bolt connections, wall-mounting				
		a [mm]	b [mm]	c [mm]	Slot Ø [mm]	Number above below		Steel bolt 8.8	Tightening torque [Nm]
8231	8	1021	125	325	9	4	4	M8	12
8232	8A	1021	125	325	9	4	4	M8	12
8233	9	1471	125	325	9	4	4	M8	12
8234	9A	1471	125	325	9	4	4	M8	12

Table 19: Installation dimensions and bolt connections

2.8.2 Mains chokes for 8230 frequency inverter

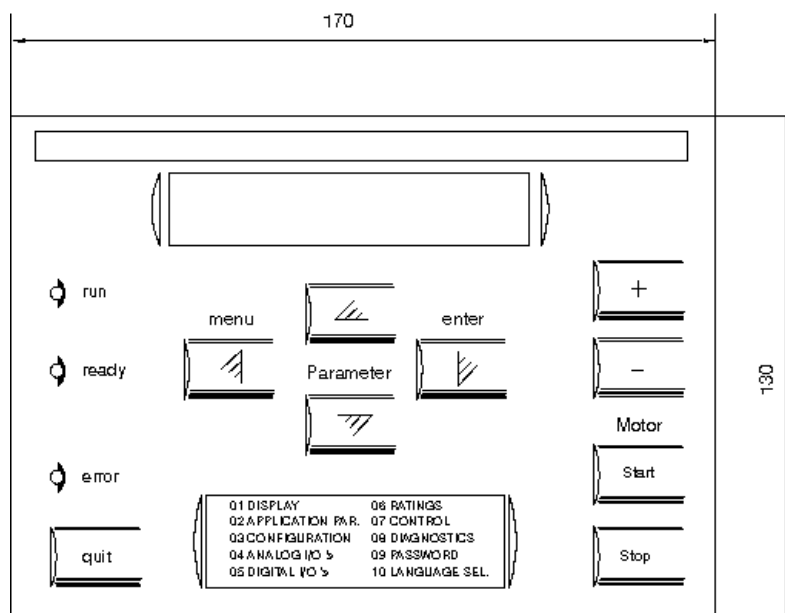


Mains choke/type	Mains choke / AC choke					Installation dimensions				Weight	Losses P _V ca. [W]
	Dimensions					g	h	ixk	n		
	a	b	c	d	e						
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]	
ELN3-0014H200	300	170	290	274	88	8.3	16	30 x 3	10.5	32	220
ELN3-0011H270	300	190	290	274	114	8.3	16	35 x 4	12.5	40	280
ELN3-0009H300	300	200	290	274	114	10.5	18	35 x 4	12.5	44	290
ELN3-0009H370	360	210	343	330	107	10.5	18	50 x 5	12.5	58	380
ELN3-0006H450	360	210	343	330	107	10.5	18	50 x 5	12.5	58	460

2.8.3 Installation drawing for control unit

The control unit BDE can also be installed in the door of the cubicle door if required.

Fig. 31 shows the cut-out for installation in the cubicle door.



Cut-out for installation of 8230 frequency inverter control unit front view:

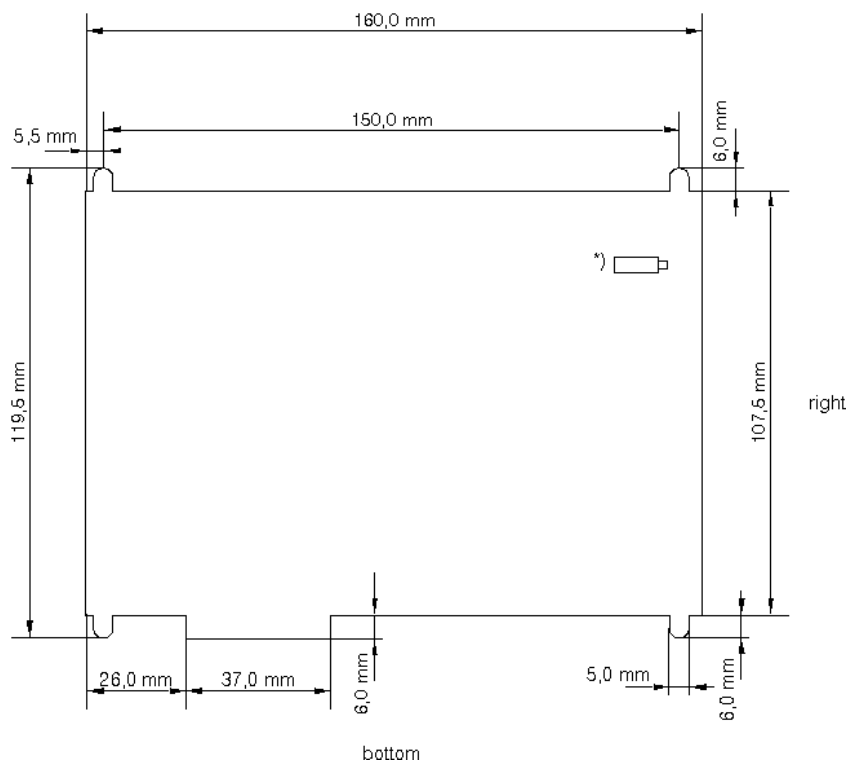


Fig. 31: Control unit BDE - door cut-out

Door panel max. 2.0 mm thick

*) Potentiometer for display contrast adjustment

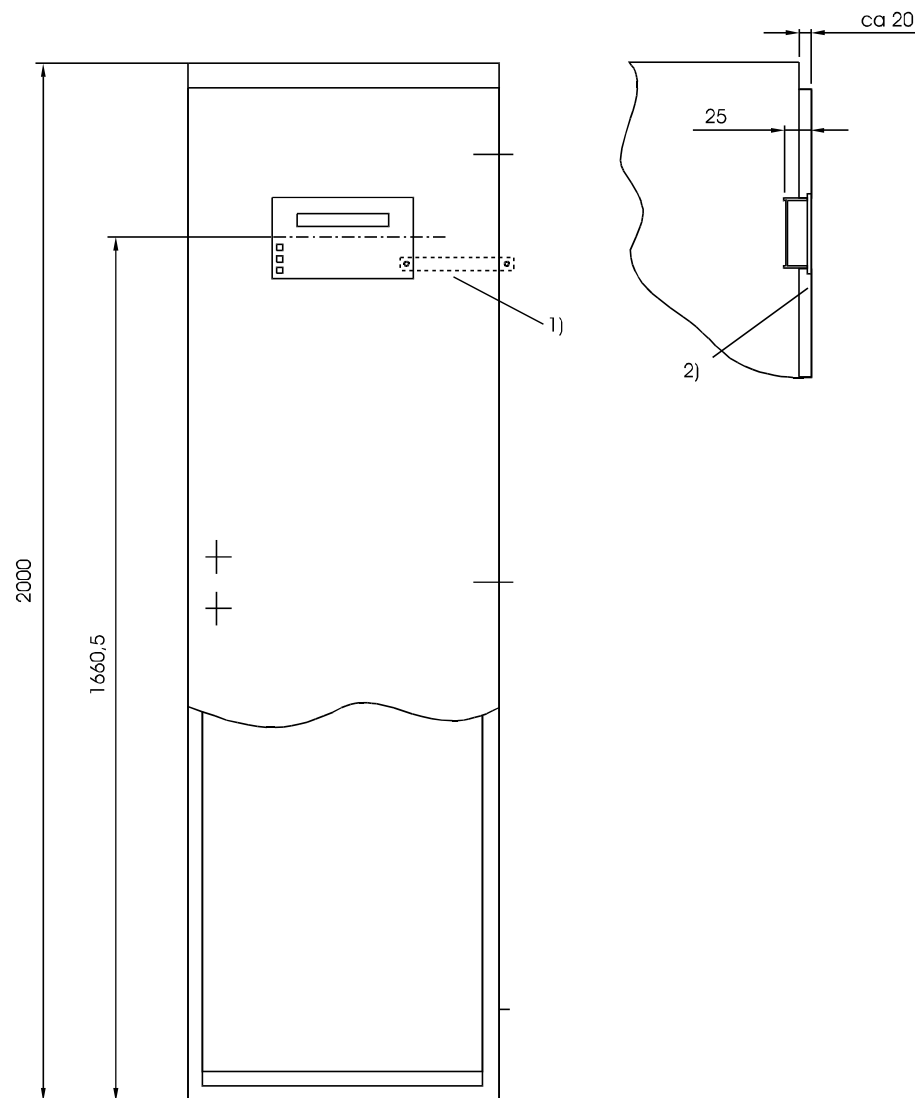


Fig. 32: Layout of BDE in the door (Cubicle earthed against HF)

Note:

When the control unit is installed in the cubicle door it is essential that the door hinges are bridged with straps to conduct HF.

Any paint on the contact points between the support frame and the door panel must be removed. We recommend the control unit should also be earthed to the frame using an earth strap¹⁾, e.g. copper plate 20 x 0.15 mm.

In protection classes $\geq$ IPx3 the contact surface²⁾ of the BDE is to be sealed with 1K sealant.

2.8.4 Dimensions and installation dimensions
Base for semiconductor fuses
of operating class gR with 110 mm length

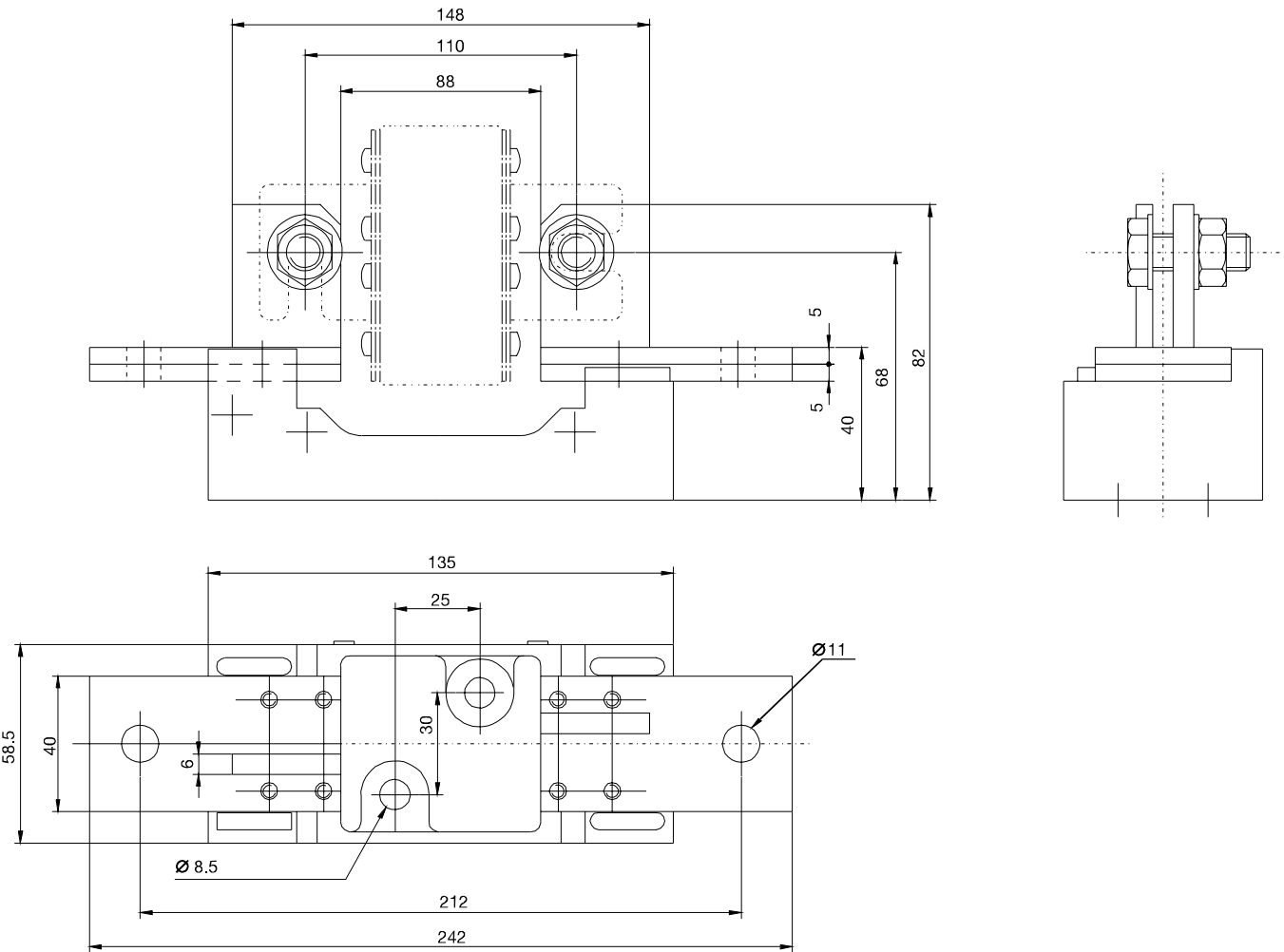


Fig. 33: Fuse base SI DIN 110 630

When protecting the 8230 frequency inverter using semiconductor fuses to DIN 43653 (screw strap with 110 mm length) 3 fuse bases SI DIN 110 630 (Fig. 33) must be installed in a row.

2.8.7 Dimensions and installation dimensions
Braking resistor

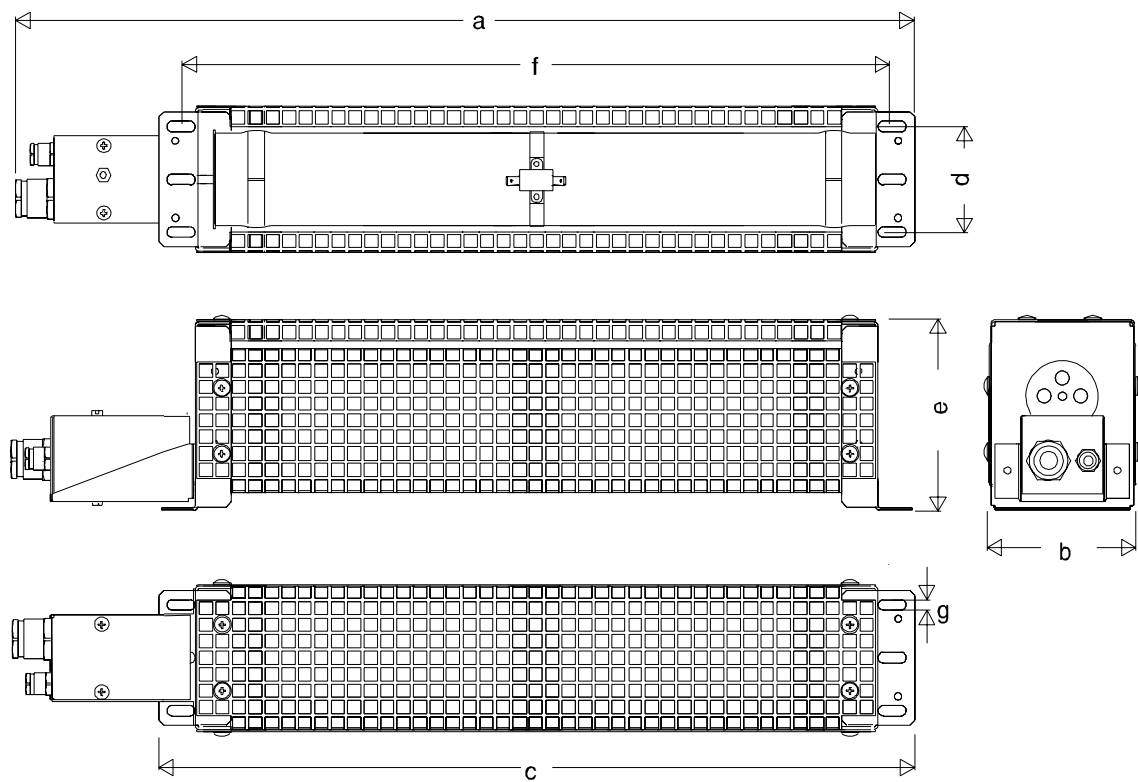


Fig. 34: Braking resistors

Braking resistor Type	Braking resistor Dimensions						
	a	b	c	d	e	f	g
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
ERBD015R04K0	640	265	554	240	229	526	9

See installation note in section 3

2.8.8 Dimensions and weights motor filters

Motor filter type	8230 frequency inverter motor filter				Installation dimensions		Losses ¹⁾ [W]
	Weight [kg]	Width [mm]	Depth [mm]	Height [mm]	Width [mm]	Height [mm]	
ELM3-0050H220	60	425	422	410	390	380	460
ELM3-0040H260	72	500	422	410	390	380	510
ELM3-0030H330	84	500	422	410	390	380	630
ELM3-0025H400	108	500	422	410	390	380	690
ELM3-0020H500	115	500	422	410	390	380	760

Table 20: Dimensions and weights, motor filters

¹⁾ The losses stated are approximate only and refer to the rated data of the relevant unit at 400 V rated voltage and 3 kHz pulse frequency. This is based on a motor cable length of approx. 100 m NYCWY which is rated according to the connection instructions given in this operating manual.

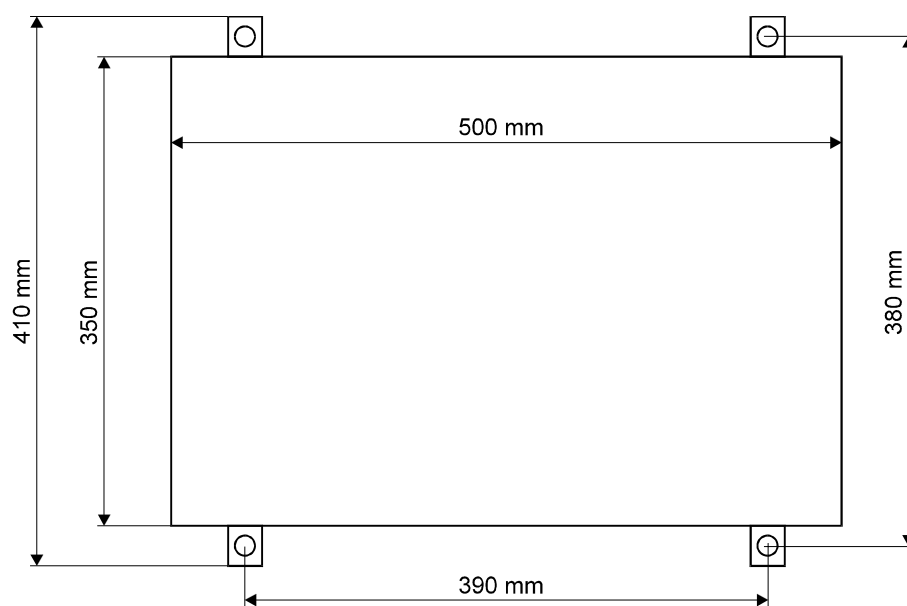


Fig. 35: Dimensions motor filters

2.8.9 Motor choke

Motor choke Type	Weight	Dimensions								Losses ¹⁾ P _V ca. [W]
		a	b	c	d	e	n	g	h	
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
ELD3-0050H220	34.0	300	177	270	240	120	10.5	11	15	~160
ELD3-0040H260	40.0	300	190	270	240	133	14	11	15	~190
ELD3-0030H330	45.0	300	210	270	240	145	14	11	15	~240
ELD3-0025H400	62.0	300	236	270	240	171	14	11	15	~300
ELD3-0020H500	64.0	300	236	270	240	171	17.5	11	15	~370

Table 34: Dimensions and weights, motor choke

¹⁾ The losses stated are approximate only and refer to the rated data of the relevant unit at 400 V rated voltage and 3 kHz pulse frequency. This is based on a motor cable length of approx. 100 m NYCWY which is rated according to the connection instructions given in this operating manual.

Detail

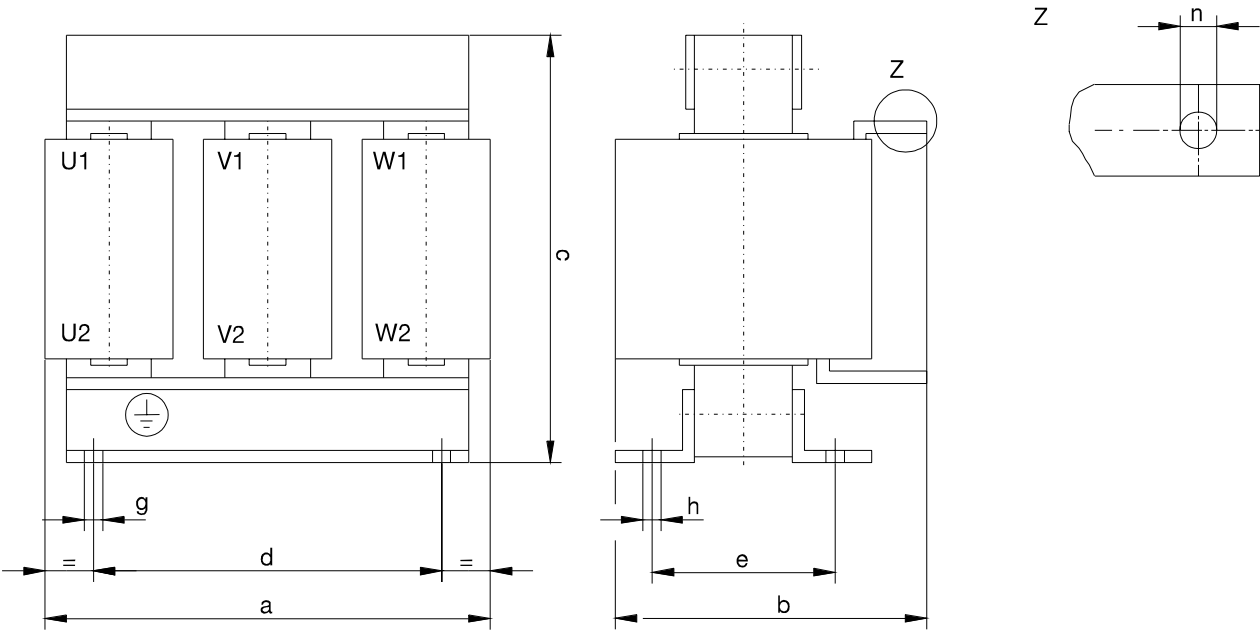


Fig. 36: Dimensions motor choke

2.8.10 Dimensions and weights

RFI filters

RFI filter	Width [mm]	Depth [mm]	Height [mm]	Weight [kg]
EZF3-250A001	190	115	390	15,0
EZF3-320A001	260	115	390	21,0
EZF3-600A001	260	115	440	22,0

Table 21: Dimensions and weights, RFI filter

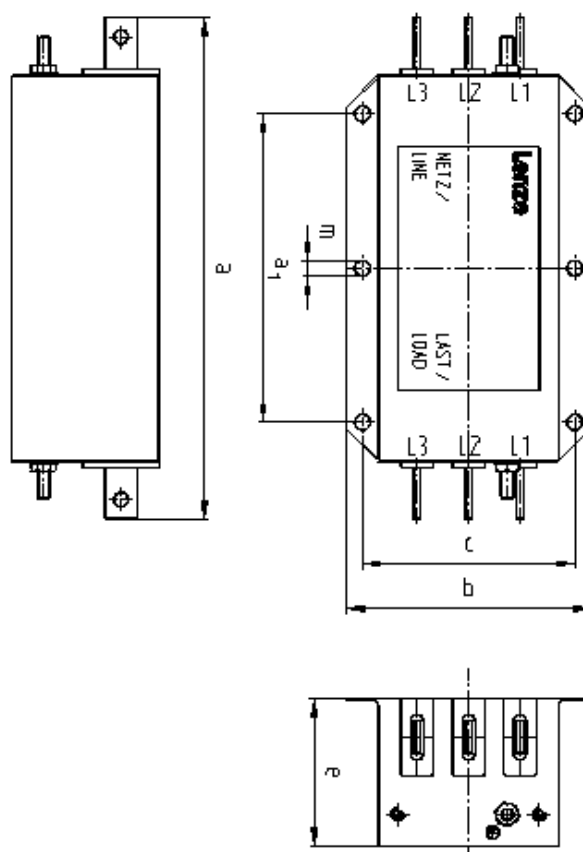


Fig. 37: Dimension drawing, RFI filter

RFI filter Type	RFI filter Dimensions					
	a	a1	b	c	e	m
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
EZF3-250A001	380	240	190	165	115	12
EZF3-320A001	380	240	260	235	115	12
EZF3-600A001	430	290	260	235	115	12

3 Transport, Installation and Connection

3.1 Safety instructions



During transport and on installation of each unit it is important to remember that the centre of gravity is not located at the centre of the unit itself. The asymmetrical loads resulting during transit and installation must therefore be taken into account accordingly.

Heavy units must always be lifted using suitable equipment and trained personnel. Units may only be transported in the correct position using the eyebolts provided. They may not be placed on their side for transportation purposes. A pallet must be used for transport with a forklift truck.

Uniform distribution of the load is essential when lifting. The force applied to all eyebolts must be equal.

The support cables may not vary more than 30 degrees from the vertical.

Heavy vibration and severe shock must be avoided during transport and when lifting and lowering.

After installation the eyebolts should be removed and stored safely in case they are needed in the future.

Incorrect lifting and transportation of the units can cause severe or even fatal physical injury and extensive material damage.

Build-in units are designed for wall-mounting. The securing bolts to be used must always be of the correct size (see section 3.4).

Please note the following when connecting inverters:

- All work on the unit and its installation must be executed in accordance with the national and local electrical regulations and conditions. This means that the inverter must be earthed correctly at the protective earth connections to ensure that no easily accessible part of the unit is at mains potential or carries any other dangerous voltage.

Attention!

If inverters are not earthed it is possible for the casing to carry dangerous voltages which can cause fatal or severe physical injury or extensive material damage.

- Check that the load connected, i.e. the cables and motors, are not earthed.
- Check the rated supply voltage and current as well as the motor data according to the 8230 frequency inverter rating plate.
- Build-in units must be installed in panelled cubicles or rooms which are only accessible to trained personnel.
- The user is responsible for ensuring that inverters and other equipment are installed and connected in accordance with the accepted rules of technology and the local regulations in the country concerned. This must take into account the cable dimensions, fusing, earthing, isolation, separation, insulation monitoring and overcurrent protection in particular.

The safety instructions given inside the cover and in section 5.1 must be observed.

3.2 Storage

8230 frequency inverter are packed according to the climatic and other conditions expected in transit and in the country for which they are intended. All notes on the packaging concerning transport, storage and correct handling must be observed. The consignment may not be stored outdoors. Stacking is prohibited! Storage rooms must be dry and well ventilated.

Permitted storage temperature -25 ... +65 °C

8230 frequency inverter units contain high quality aluminium electrolytic capacitors. Their reliability may be affected if they are stored in the uncharged condition for longer periods, particularly at high temperatures.

8230 frequency inverter can be stored without charge for at least 2 years, of which max. 5 months may be at storage temperatures of over 40 °C. The 8230 frequency inverter should be checked after this storage period has elapsed. The aluminium electrolytic capacitors should be reformed by suitably trained personnel before charging at the rated voltage. Please refer to section 7.4 for instructions on forming.

3.3 Transport

The units may only be transported with forklift trucks when standing vertically on a pallet and in their cardboard packaging. When unpacked, transport is also possible using the eyebolts provided on the inverter. Uniform distribution of the load is essential. When lifting using the eyebolts the force on all bolts must be equal and vertical.

Heavy vibration and severe shocks are to be avoided, for example when lowering. Always check the unit for completeness and any evidence of damage when unpacking.

If damage in transit is discovered, it must be recorded and reported immediately to the carriers.

3.4 Installation

According to their protection class IP 20 all 8230 frequency inverter units are to be installed in clean dry rooms ventilated with sufficient clean cooling air according to the power losses involved. The rated 8230 frequency inverter data may vary in other protection classes. The volume of cooling air required for the power losses is to be provided, i.e. adequate ventilation must be ensured. The coolant temperature may not fall below 0 °C. If the coolant temperature is above 40 °C or 50 °C respectively at constant load torque and 150 % overload, the current must be reduced by 2 % per Kelvin up to max. 55 °C and if the unit is installed above 1000 m to max. 2200 m above mean sea level an additional current reduction of 1.2 % per 100 m must be taken into account accordingly.

8230 frequency inverter are designed for vertical wall mounting in switchgear cubicles, booths and boxes.

The following bolt connections (bolt sizes) are to be used for securing build-in units to the wall:

8230 frequency inverter	Top:	Bottom:	Tightening torque
	4 x M8	4 x M8	12 Nm

Table 22: Bolt sizes and tightening torque for securing 8230 frequency inverter units

Cooling is fan-assisted. An adequate clearance above the unit (see section 2.8) is to be provided to prevent heat build-up. Cooling air is fed in from below, where adequate clearances are also to be provided (see section 2.8). Internal air circulation must generally be prevented. Unsatisfactory ducting and air flow will result in overheating in the switchgear cubicle.

3.5 Connection and wiring

We recommend that 3-phase cables with the cross-sections stated in Table 23 below should be used for the power connections (the motor and mains supply). For reasons of electromagnetic compatibility the motor connection cable used should be a 3-phase cable with a concentric protective conductor. This protective conductor (screen sleeve) in the motor cable is to be earthed at both ends. A connection bracket (option) is available for connecting several cables to a power connection strap.

The screw connections are to be secured to prevent loosening through vibration and temperature fluctuation, using a suitable spring component. The bolt sizes and tightening torque levels are given in Table 23. Power cables must be secured to suitable cable brackets for strain relief purposes. The PE connection on the unit must be connected to a good earth. Mains supply cables and motor cables are to be laid separately according to the EMC connection instructions.

When connecting the motor to the 8230 frequency inverter it is important to ensure that no other power circuit (e.g. reactive power compensation) is connected to the motor connection. This is particularly important when upgrading an existing system. The motor star point may not be earthed.

Control and signal cables for the control electronics are to be laid and connected in accordance with the EMC connection instructions.

Connecting signal leads

Electronic control circuits are considered low power circuits (< 2 A) according to DIN EN 60204 Part 1 (VDE 0113 Part 1, 6). In approximation to this standard we recommend the following cross-sections for terminal strip wiring on fixed indoor systems for reasons of the mechanical strength and interference resistance:

- Single core, multi-wire (stranded) cables at least 1 mm²,
in switchgear cubicles at least 0.5 mm²
- Multi-wire screened cable at least 0.75 mm²
in switchgear cubicles at least 0.5 mm²

Note:

The cable cross-sections stated in Table 23 can only be considered general guidelines. The cable dimensions must satisfy the regulations and any works standards applicable at the installation.

8230 frequency inverter Type	Mains connection		Motor connection		Screw connection Motor + Mains connection	
	Recommended copper cable cross-sections	Applicable overload protection NH fuse	Recommended copper cable cross-sections	Steel screw Strength class 8.8, not greased	Tightening torque	Max. direct single connection cross-section at the unit
	[mm²]		[mm²]		[Nm]	[mm²]
8231	2 x 3 x 95	315 A	2 x 3 x 95	M12	92	200
8232	2 x 3 x 120	355 A	2 x 3 x 120	M12	92	200
8233	2 x 3 x 150	400 A	2 x 3 x 150	M12	92	200
8234	2 x 3 x 185	500 A	2 x 3 x 185	M12	92	200

Table 23: Cable connections

Note concerning motor connection

The following main factors must be taken into consideration for connecting motors to the 8230 frequency inverter:

- 8230 frequency inverter unit type: As standard the response threshold for earth fault detection on the motor side is 10 % I_N.
- 8230 frequency inverter pulse frequency
- Motor insulation system: Details from the motor manufacturer concerning the max. motor voltage/current in the motor terminal box, suitability for inverter operation
- Cable type: Screened, with armouring or without screen
- Effective cable length: Parallel cables, group supply
- Cable cross-section: Voltage drop ≤ 1.75 % or ≤ 3 %

Cross-section [mm²]	Suitable screened heavy current cable 0.6/1 kV	
	Type	Manufacturer
to 25	Ölfex-Servo - 730 CY	Lappkabel
10 ... 120	Protoflex-EMV-CY 2YSLCY-J	Siemens
10 ... 185	NYCWY 3x XX/Y (für Y jeweils größter Wert)	Normkabel



The recommended guidelines for copper cable cross-sections guarantee a voltage drop of <3 % up to conductor temperatures of 50 °C. The values stated apply to a 400 V supply at rated current for frame size 1 up to approx. 80 m and for frame sizes 2, 3 and 4 up to approx. 160 m.

The maximum permitted cable lengths for connecting 3-phase asynchronous motors to the 8230 frequency inverter are stated in Table 24.

Max. permissible motor cable lengths of the 8230 frequency inverter

8230 frequency inverter Type	Max. suitable motor cable lengths, 8230 frequency inverter							
	Unscreened cable NYY/NYM ¹⁾				Screened cable NYCWY ¹⁾			
	no circuit ²⁾	with motor choke ^{2) 4)}	with motor filter ³⁾ U _N =400 V f _p =3 kHz	with motor filter ³⁾ U _N =460 V f _p =3 kHz	No circuit ²⁾	with motor choke ²⁾	with motor filter ³⁾ U _N =400 V f _p =3 kHz	with motor filter ³⁾ U _N =460 V f _p =3 kHz
	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
	8231	300	400	400 150 ⁵⁾	300 120 ⁵⁾	250	350	300 200 ⁵⁾
8232	300	450	450 150 ⁵⁾	350 120 ⁵⁾	250	350	350 200 ⁵⁾	250 150 ⁵⁾
8233	300	450	450 150 ⁵⁾	350 120 ⁵⁾	250	350	350 200 ⁵⁾	250 150 ⁵⁾
8234	300	450	450 150 ⁵⁾	350 120 ⁵⁾	250	350	350 200 ⁵⁾	250 150 ⁵⁾

Table 24: Max. permitted motor cable lengths

Notes:

- 1) PVC insulated 3-phase cable 0.6/1 kV to DIN/VDE 0271.
Cables with a braided screen providing a high degree of cover (comparable to control cables) are not required for supplying frequency inverters with regard to the EMC characteristics. These cables increase the capacitive load on the inverter so that it becomes necessary to reduce the cable lengths stated for NYCWY by approx. 40 %. Repeated parallel connection of these types of cables to increase the cross-section, if not stated expressly in Table 23, is only permitted with a proportional reduction in the lengths stated.
- 2) At an inverter pulse frequency of 6 kHz the resulting permitted cable length is reduced by 30 %.
- 3) If very high control dynamics are required, e.g. an enclosed control surface of ≤ 0.25 %/sec at a ± 50 % change in load at rated speed (VDI/VDE 2185), a direct connection between the 8230 frequency inverter and the motor must be taken into consideration during the design stage. The maximum voltage drop over the motor cable may not exceed 1.75 %. This value also applies to lifting equipment. A 5 % reserve in the mains voltage is to be taken into account with regard to the given dynamic control characteristics over 95 % of the motor type point. In addition, if necessary, the drive characteristics in the event of mains undervoltage are to be taken into account (IEC 34.1: Requirements concerning electronic equipment).
- 4) The output choke is used with the cable lengths stated in order to reduce the capacitive load caused by the motor cable and also reduces the voltage rate of rise. With cable lengths < 150 m the motors used must be designed for the maximum voltage loads stated in this section under "Notes: Winding insulation".
- 5) Compliance with the motor insulation limits according to DIN VDE 0530 Part 1, Supplement 2: 1991
Typically $U_{max} = 1000$ V; $du/dt = 500$ V/ μ s. Modern asynchronous motors for frequency inverter supply possess very high reserves in the insulation system by comparison to this limit.

The overall length is decisive in group drives or multiple motor supplies. The voltage drop across motor cables should not exceed 1.75 %.

With lower dynamic drive requirements the guideline value for the voltage drop over the motor cable is ≤ 3.0 % (DIN 18015).
The cable lengths stated are maximum values. No increase in the cross-section to reduce the voltage drop over long motor cables has been taken into account and should be determined if necessary, taking the motor power factor into consideration.

Voltage drop e [%]:

$$e = \frac{\sqrt{3} * I * l}{10 * U} (R * \cos\varphi + X * \sin\varphi)$$

U	Linked voltage [V]
I	Current load [A]
l	Supply length [m]
R	Resistance [Ω /km]
X	Inductive resistance [Ω /km] ¹⁾

1) The inductive voltage drop should be taken into consideration particularly with cable cross-sections $A \geq 50$ mm².

Cross-section [mm²]	Resistance R ₅₀ [Ω/km]	Inductive reactive resistance [Ω/km]
95	0.216	0.0754
120	0.171	0.0733
150	0.139	0.0733
185	0.110	0.0725

Table 25: Operating values for PVC insulated cable at 50 °C cable temperature.

To compensate for internal voltage drops 8230 frequency inverter units can simulate the output voltage in an over-modular manner. The voltage drop across the motor cable however cannot be compensated without direct measurement at the motor connection. However the motor current consumed increases almost proportionally through a reduced motor voltage at the same torque and increases the motor losses for a squared reduction in motor trip torque and a reduction in motor flux.

If the values for the voltage drop are exceeded, 3-phase asynchronous motors with $U_{\text{Motor}} < U_{\text{Mains}}$ are to be used. If standard 3-phase motors are used, a reduction in the type point can be made to determine the revised rating point.

Example: 50 Hz / 400 V changed to 47.5 Hz / 380 V

The level of interference on the mains side which is associated with the power is increased through longer motor cables. A mains filter is recommended if sensitive consumers are operated on the same mains supply and motor cable lengths exceed 50 m.

Notes on motor winding insulation

With mains supply voltages U_N of up to 460 V it is possible to use standard motors or motors with equivalent insulation characteristics with the 8230 frequency inverter. The 400 ... 460 V standard motors are designed for the voltage rates of rise and voltage peaks of up to 1300 V which occur during inverter operation. When using motors from other manufacturers it may be necessary to contact the supplier concerning the suitability of motors for inverter operation. 8230 frequency inverter motor filters are to be used if the insulation resistance of the motors and the max. permitted voltage in the motor terminal box do not match the 1300 V required and the permitted voltage rate of rise for the winding insulation is $< 3 \text{ kV}/\mu\text{s}$. If the motors do not meet these requirements, 8230 frequency inverter motor filters or motor chokes are to be provided.

Installation notes, braking resistors

All braking resistors are to be connected via short cables. Cable bundles are to be laid separately from other cables. For EMC reasons we recommend using only screened cables. The screen must be earthed at both ends and connected to the casing. The cable cross-sections must be rated at least according to the overcurrent protection device.

Braking resistors carry dangerous voltages to earth and must be protected so that they cannot be touched.

Braking resistors are to be installed externally so that the cooling air and the ambient temperature for 8230 frequency inverter units are not affected by the heat generated by the braking resistors.

An unrestricted flow of cooling air is essential for the braking resistors. The waste heat is emitted upwards. A minimum clearance of 200 mm is to be provided from adjacent components, walls, roofs or similar.

As electrical energy is converted in braking resistors the air and certain parts of the casing will inevitably become hot. The temperature may rise to 150 °K above the ambient temperature.

Notes on encoder connection

In the modes of operation “Speed control with encoder” and “Torque control with encoder” highly accurate speed actual value detection is necessary and incremental encoders must be used.

To compensate for the effects of interference (inphase interference) on the cables the encoders to be used have two pulse tracks offset through 90° electrical and complimentary outputs. To guarantee adequate interference resistance we recommend encoders with a 24 V operating voltage.

The quality and length of the encoder cable are criteria for the maximum encoder transmission frequency. Screened cables with the conductors twisted in pairs are to be used. The screen is to be connected at both ends.

These cables must be laid in the system so that they are separate from power cables. We recommend the encoder cable should run directly to the encoder interface, i.e. with no interruptions. The screen is to be surrounded fully using the screen clamps supplied, to ensure a firm connection at the control electronics cassette.

Recommended encoder cable:	LIYCY (TP) 3 x 2 x 0.75 mm ² (Data cable with copper braid, twisted in pairs)
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Example configurations, cable length = 100 m

n _{max} [rpm]	6000	4000	3000	2400	1670
n _{min} [rpm]	1.2	0.8	0.6	0.5	0.4
No. of markings [pulses per revolution]	1000	1500	2000	2500	3600

When using an incremental encoder with 1000 pulses per revolution the example for digital demand preset therefore results in a speed control accuracy of 0.05 % at n_{max}. The accuracy of the encoder and an undisrupted transmission capability particularly for 5 V encoders due to their low interference resistance play a major part in determining the accuracy of speed detection.

See section 2.5.6.1, Encoder interface, for using encoders and the technical data of the encoder input.

3.5.1 Potential separation

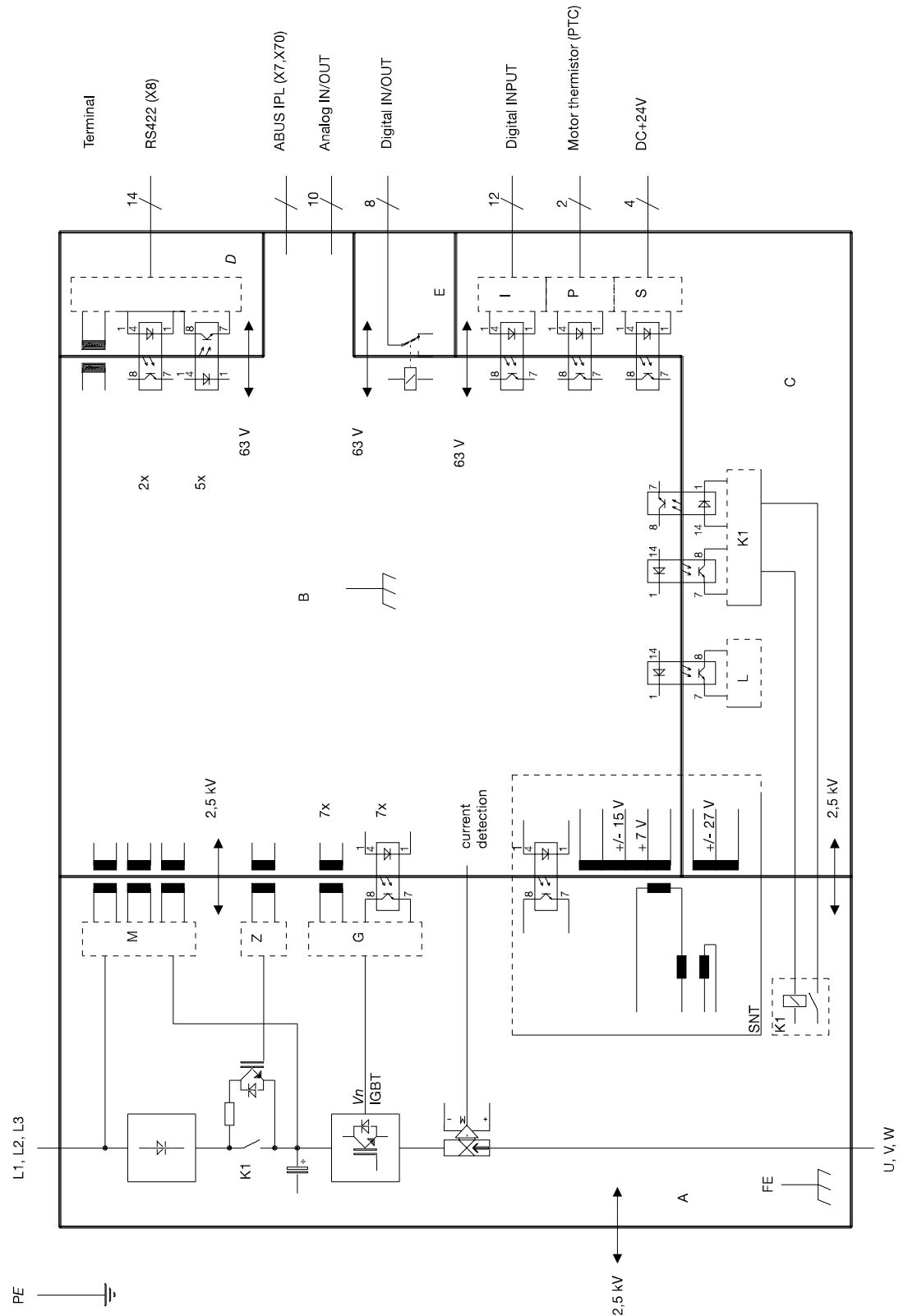


Fig. 38: 8230 frequency inverter potential separation concept

Potential

A	Power potential	
B	Electronics potential, earthed	DC ± 15 V, +7 V, +5 V
C	Auxiliary potential	DC ± 27 V, +24 V
D	Potential island for RS422 serial interface	DC + 5 V
E	External potential / customer potential	

Legend

M	Mains voltage detection Link voltage detection
Z	Link charging
G	IGBT control
SNT	Switch mode power supply
K1	Link contactor
L	Fan and fan control
I	Digital inputs
P	Motor thermistor (PTC) connection
S	DC +24 V and short circuit monitor

3.6 Installation and connection instructions for EMC

Fig.39 shows an example of an ideal layout for a 8230 frequency inverter with EMC components.

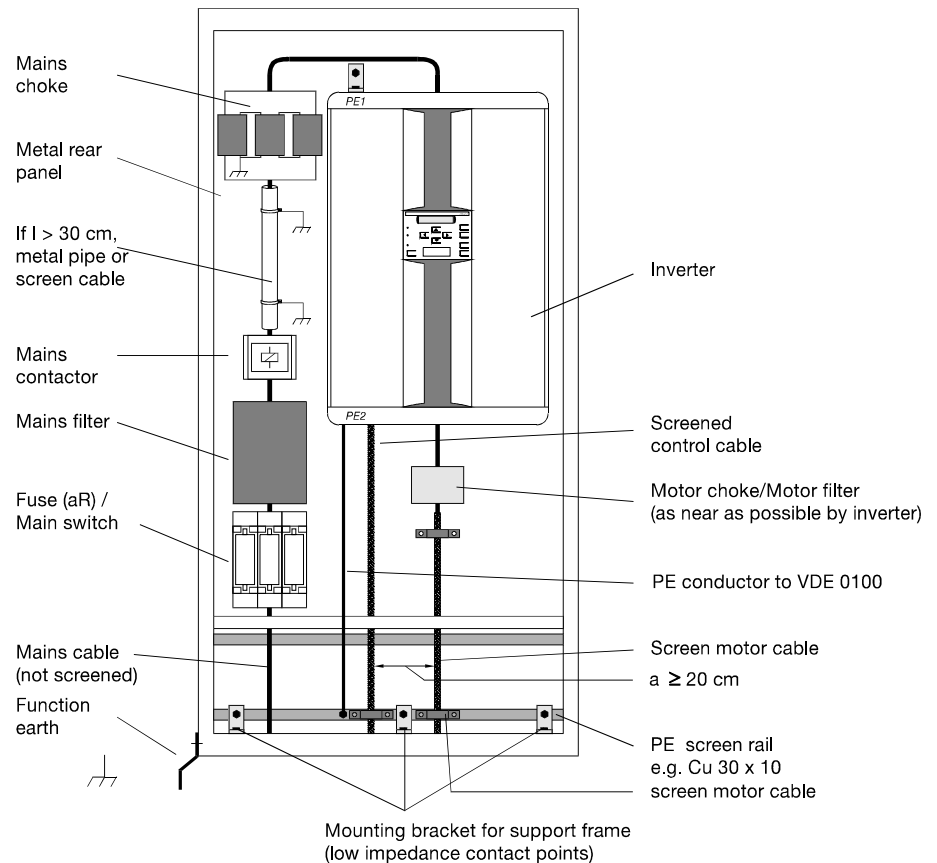


Fig.39: Example of cubicle layout, 8230 frequency inverter

Note:

The overview in Fig.39 illustrates the ideal position of components relevant to EMC.

In order to achieve good EMC in the drive system the following basic rules are recommended for cubicle construction, installation and layout.

These measures are to be considered part of industrial EMC installation practice and are summarised here.

- **Function earth**

All inactive metal parts are to be well connected. Inactive metal parts are all conducting parts which are electrically separated from active parts by at least basic insulation and can only carry a voltage if a fault occurs.

The function earth for the 8230 frequency inverter cubicle is most effectively provided by low-impedance connection (bare metal, low HF resistance, generous connections) of cubicle parts with the frames and inactive parts of the building (armouring and steel supports) which are to be included in potential compensation of the entire system. In addition to the screw connections for parts, broad flat bands with a large surface area are suitable as low-impedance connections. As far as possible parts made of aluminium should be used only to a limited extent and fitted using contact protection grease.

- A central connection is to be made between ground and the operating earth / protective conductor system to IEC 364-5.
DIN VDE 0100 also applies.
- Uniform reference potential should preferably be provided and all electrical equipment is to be earthed. It must be ensured that no external equipment can be damaged by the earthing of the control electronics in the 8230 frequency inverter.
- Parts of the system and cubicles containing other 8230 frequency inverter units, control cubicles, construction and machine parts etc. are always to be connected in a star configuration to the earth/protective conductor system to prevent loops.
If the system mainly involves drive cubicles, a method of earthing which is more efficient as far as EMC is concerned should be used on installation, i.e. earthing via a grid system.
- Induced interference is to be dispersed over large metal surfaces. All equipment such as RFI filters (including standard profile parts as well as PE and screen rails) are to be fixed to metal component parts to ensure low impedance. The PE / screen rail is the central earthing point in the 8230 frequency inverter cubicle and in cubicles of 600 mm width and above is to be secured to the cubicle frame or the mounting plate through at least three electrical contact points. A metal rear panel onto which all units are mounted is particularly recommended in a switchgear cubicle.
If mounting plates are used whose surfaces are not good conductors, for example painted, anodised or yellow chromated, the surface coating must be removed at equipment contact points.
Galvanised component parts for the cubicle and metal parts at contact points are ideal from the viewpoint of EMC. To achieve good EMC these components must be screened together directly to provide good contact.
Cubicles in which the complete edge of side and rear panels is in contact with the cubicle frame are recommended. The door is to be included using a connection method which is effective at HF.
- Screw connections on metal parts which are painted and anodised are to be fitted with special contact washers or the insulating coatings are to be removed. Low impedance contact surfaces must be cleaned thoroughly to remove paint before assembly. Protect all connection points against corrosion, using contact protection grease for example.
- According to the concept of EMC protection zones all signal leads are to be fed into the cubicle at just one level, if possible, not at several different levels.
- All switchgear cubicles involved in linked drives are to be connected with a potential compensation cable of at least 25 mm² if they do not include a screen rail or this rail is not continuous.
- No unswitched contactors, relays, solenoid valves, electromechanical meters, counters etc. may be used in a switchgear cubicle with the 8230 frequency inverter. All inductances installed on the same current circuit are to be connected with surge suppressors. DC-activated coils are to be connected with a diode or Z diode and AC-operated coils are damped using a varistor or an RC component. If contactors without surge suppressors are used in an adjacent cubicle, the cubicles are to be separated by a metal partition.
- Cables to the 8230 frequency inverter control electronics must be screened.

- Ideally the wiring should be divided into groups:
Power cables, power supply cables, analog signal leads, digital signal leads and the bus or data leads.
Power cables and the signal and data leads should be placed in separate ducts or bundles. Signal and data leads should preferably run close to grounded surfaces, e.g. support beams, metal rails, mounting plates or cubicle panelling. These measures are intended to suppress any “crosstalk” between parallel cables. Cables which hang unsupported may act as passive or active antennas and can cause interference.
Motor cables, mains supply cables and signal leads for the control electronics are to be spaced at least 0.2 m apart inside the switchgear cubicle. This spacing can be reduced where cables cross. Outside the switchgear cubicle the motor cables should be laid in separate bundles spaced at a distance of at least 0.3 m - and more when using longer parallel runs involving unscreened motor cables. No other current circuits may be fed through or on the motor cable.
The following guidelines can be given as the minimum spacing (a) between parallel screened signal leads and motor cables:

Up to 200 m	$a \geq 0.3 \text{ m}$
Up to 300 m	$a \geq 0.5 \text{ m}$
Up to 500 m	$a \geq 1.2 \text{ m}$

It is always better to use a separate metal cable track for laying control cables.

- Signal leads for the control electronics and control cables outside the switchgear cubicle are best laid on separate cable tracks to provide sufficient spacing to avoid interference. If no separate cable track can be provided, signal leads are to be partitioned off from power cables using chambers in the cable tracks and the chamber are to be fitted with covers. Cables for processing the motor temperature using thermistors are to be laid separately and never together with motor power circuits.
- Mains and motor cables are to be PVC insulated 3-phase cables according to DIN VDE 0271 1986-06. If single conductors are used they should preferably be twisted at 1 turn per 5 m and bundled in groups of three. If this is not the case, current distribution may be disrupted and in extreme cases, in addition to cable overloading, the drive system may malfunction.
- Practical experience with EMC has shown that motor connection cables with copper armouring or concentric corrugated protective conductors, for example NYCWY (3-core) should be used. If the screen is connected in a low-impedance configuration at both ends the screen sleeve / protective conductor guarantees good attenuation to reduce the HF interference radiated from the motor cable through high frequency recharging currents. The ground wiring should always have the maximum possible cross-section. Steel armoured motor cables are unsuitable for reasons of EMC.
- To ensure a good EMC connection the motor cable at the frequency inverter side is to be connected using pipe clamps, terminal clamps or screw connections which surround the cable fully at the contact point to provide a good connection to the screen bus or mounting plate.

- If contactors, motor protection switches or terminals are located on the screened motor cable, the screens of the cables connected at that point are to be continuous and of low impedance. In the motor terminal box the screen is to be connected with the PE / PA. Metal cable screw connections (nickel plated brass) at the metal connection box (do not use a plastic connection box) provides a very good connection between the screen and the motor casing. On the inverter side the screen is to be connected to the central screen rail and not directly to the unit.
- For reasons of EMC the motor cable should be as short as possible. The frequency inverter should preferably be located close to the motor. Additional radio interference suppression measures may be necessary in systems which are physically very large, depending on the situation. In particular improvements in potential compensation may be necessary. The motor cable lengths stated in this section were calculated on the basis of trials and are the maximum guideline values with regard to the inphase current occurring. The inphase current limits the dynamics and causes additional losses in the inverter. With dynamic direction changes at the zero crossover point it may be necessary to adjust some control parameters when commissioning drives without speed actual value detection, due to longer cables.
- Analog and digital control leads for the 8230 frequency inverter control electronics and data leads are to be laid using screened cable. The screen is to be connected firmly at both ends for good potential compensation. Good potential compensation will be achieved if a star or grid type earth system is used consistently. Applying the screen twice on short spacing distances in the cubicle increases the interference resistance. When transferring analog signals of low amplitudes in the mV range a single-sided application of the screen in the switchgear cubicle may only be necessary close to strong radiation fields, due to a low frequency "50 Hz hum". Generally cable screens are always connected at both ends. This is the only way to ensure good interference resistance at high frequencies throughout the entire range of interference frequencies. Without potential compensation the screen on control cables should only be connected at one end, however, but this is always a compromise. The cable screens are to be applied directly after they enter the cubicle, as this is where the highest interference amplitudes occur. Apply the screen generously to the screen / protective conductor rail and secure the screen with cable clamps, screen connection terminals or hose clamps, depending on the system involved. Continue the screen up to the terminal strip or, if necessary, up to the assembly at the 8230 frequency inverter or external modules, without any interruptions. The internal screen contacting facilities on the aluminium slide-in rack for the control electronics, which use round clamps, are always to be used for making contact with the screen. So-called "pigtailes" or similar must never be used for control leads. Such a path would be low impedance and the flow of the screen current close to signal conductors would allow the screen current to act as an interference current. The cable screen must always be connected directly at the end.
The cables at the 8230 frequency inverter terminal block are to be divided into analog input and output cables and digital input and output cables and these groups are to be laid separately using screened cables with both ends of the screen connected. Alternatively a double screen control / data cable is possible. In this case the outer screen is earthed to the side of the unit and the inner screen is earthed at the other end. As these cables generally have screens made of foil, mechanical damage can occur easily, even with just slight bending and pressure. An additional compensation cable is always particularly recommended if the potential difference between the relevant earthing points is $> 5 \text{ V}$. $25 \text{ mm}^2 \text{ Cu}$ is sufficient as an equalizer up to a cable of 200 m. For longer cables, at least $35 \text{ mm}^2 \text{ Cu}$ are recommended.

Above that length two separate compensator cables of 16 mm² copper should be used for reasons of EMC. The potential compensation cable should be laid so that the surface area enclosed between the signal cable and the compensation cable is as small as possible.

In difficult cases where additional radio interference suppression measures are needed, twisting with the cable affected by interference is a very efficient method for effectively suppressing malfunctions.

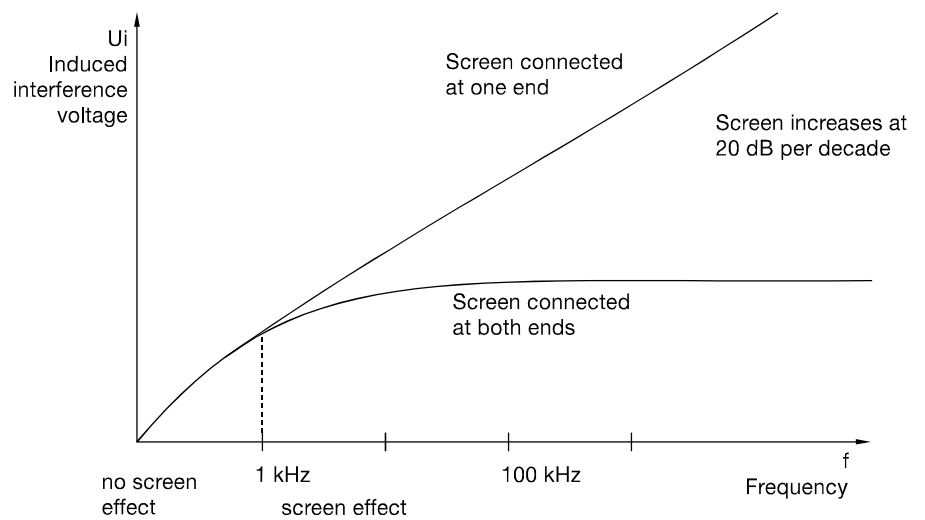


Fig. 40: Efficiency of screen contact for induced effects

- When the 8230 frequency inverter is supplied by an external 24 V auxiliary voltage this voltage may not supply several consumers in different cubicles. Ideally each 8230 frequency inverter should have power supplies of separate potential.
- The quality of the signal cable to the encoder is a critical factor for the maximum possible encoder frequency. Screened encoder cables with the conductors twisted in pairs, for example LIYCY 3 x 2 x 0.75 mm² at least, should always be used. The screen is to be connected well at both ends. Signal cables should preferably always be connected directly at the encoder interface, with no further terminals or separation points. Unused signal conductors are to be grounded.
- Only signal cables with a tinned copper screen braid should be used. The braid should provide at least 85 % cover. Cables with a foil screen are less suitable as they are easily damaged by bending and pressure.
- The screen is to be continuous to peripheral equipment such as demand potentiometers etc. Only one additional interruption point is permitted. This is to be such that less than 2 cm of the cable remain unscreened. The screens at both ends of the cable are to be connected through the screen rail (see Fig. 43). Various different round cable clamps are supplied with the unit for securing cable screens to the aluminium slide-in rack in the 8230 frequency inverter. It is to be secured using a M4 screw (see Fig. 44).

- If a RFI filter is used it should be installed as close as physically possible to the cubicle feed point, taking the cooling air requirements into account. With this installation the inverter cubicle may not contain any other unfiltered current circuits to the motor, e.g. cables for external fans, as otherwise the inverter radio interference suppression will be limited.

The filtered sections of the cable between the RFI filter and the commutation choke / supply terminals in the cubicle are to be screened or laid in armoured steel pipes or metal ducts (see Fig. 39) to avoid extraneous interference, for example through the motor cable if closely spaced and ≥ 30 cm in length. Under no circumstances may the RFI filter supply and return leads be placed in the same cable duct. RFI filters generate currents. According to prEN50178/VDE0160 a PE connection of at least 10 mm² is required. If other unswitched auxiliary power circuits are included, separate filtering is to be provided (Example: Uninterruptable auxiliary voltage, auxiliary supply).

- To prevent bridging of the RFI filter in the HF range the protective conductor may not be laid past the RFI filter to PE1 on the 8230 frequency inverter mains connection. The protective conductor is then connected to the lower terminal PE2 (see Fig. 39).
- If a mains contactor is fitted, the contactor control cables must be laid separately from other control cables in the cubicle.
- The 8230 frequency inverter has a built-in mains rectifier. After a short circuit a DC fault current can prevent the ELCB-protection switch from being triggered. Additional measures such as zeroing are therefore necessary or ELCB-protection switches which are sensitive to all currents can be used (VDE 0160 5.88). When rating the release current it is important to note that capacitive compensation currents occurring during operation can cause the interference suppression filters and cable screens to produce triggers in error. Depending on the filters involved, currents of up to approx. 300 mA can occur.

Important!

Operation of radio transmitters and radio telephones with a transmitter output capacity of >2 W is not permitted in the direct proximity of 8230 frequency inverter.

With lower power radio communication equipment and radio telephones operation is permitted when the 8230 frequency inverter is not open.

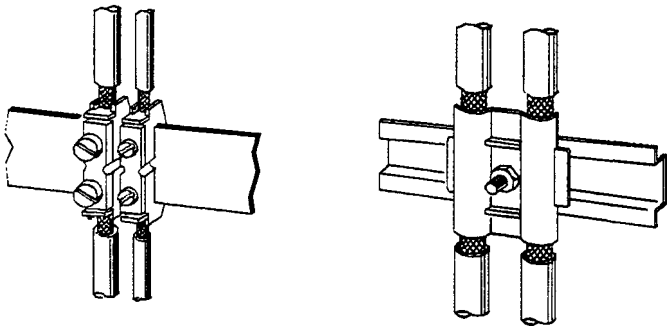


Fig. 41: Cable clamps used for earthing a continuous screen or at the screen end

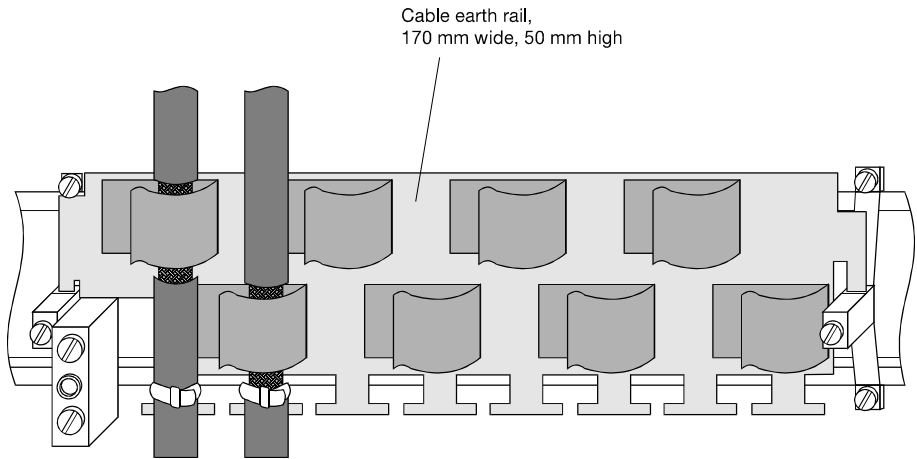


Fig. 42: Recommended cable earthing rail, 8230 frequency inverter cubicle

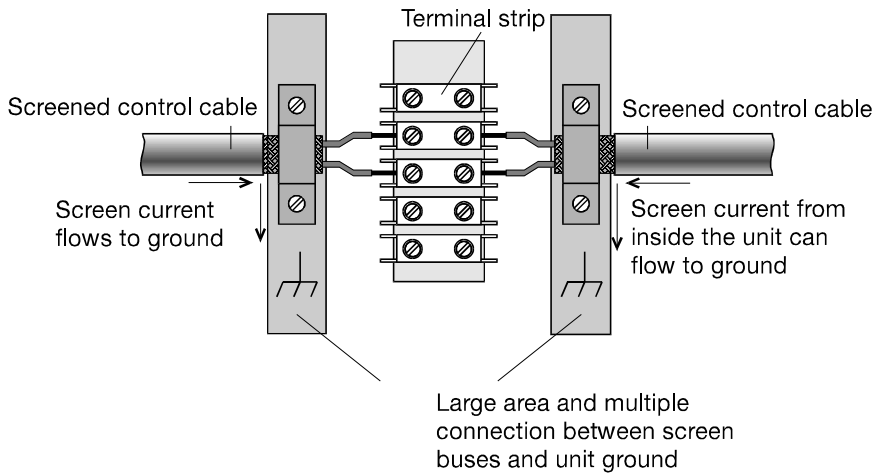
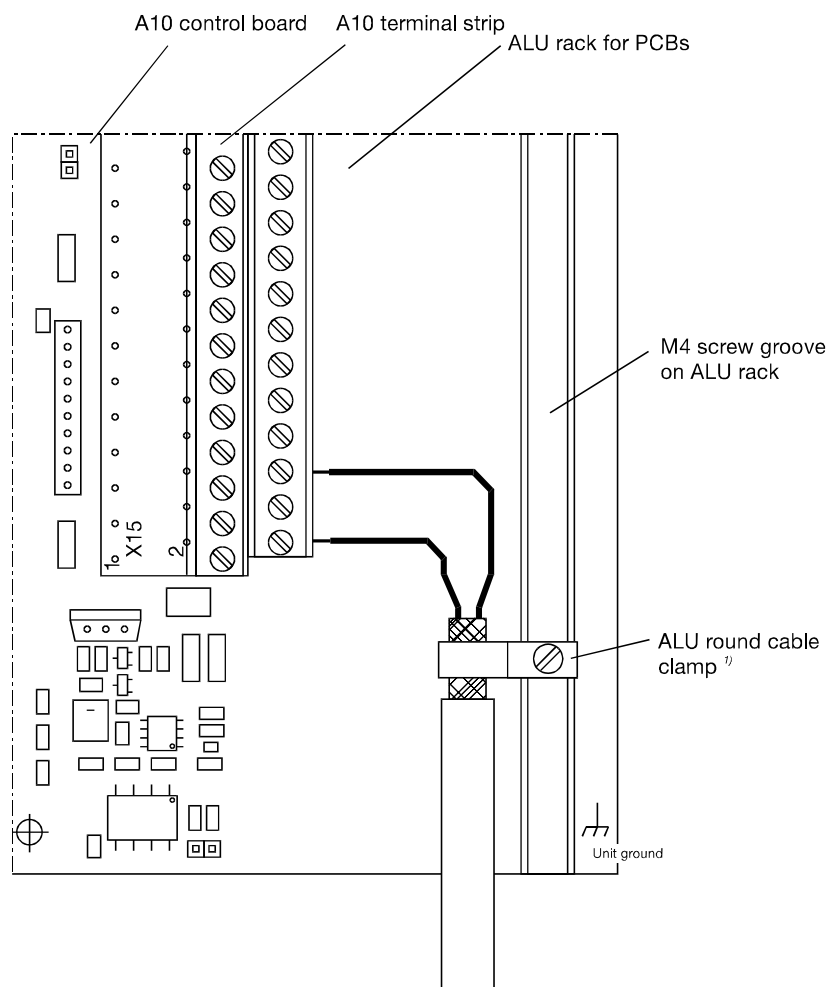


Fig. 43: Layout of a separation point in a screen cable, e.g. transfer terminal strip in cubicle



¹⁾ Two clamps each of 3 mm, 4 mm and 5 mm are included in the scope of supply. They can be ordered under Ref. No. 029.145 173.

Fig. 44: Handling cable screens at terminal block

Connection instructions, control cables

The correct EMC connection of control cables to the 8230 frequency inverter control board is to be made as shown in Fig. 45.

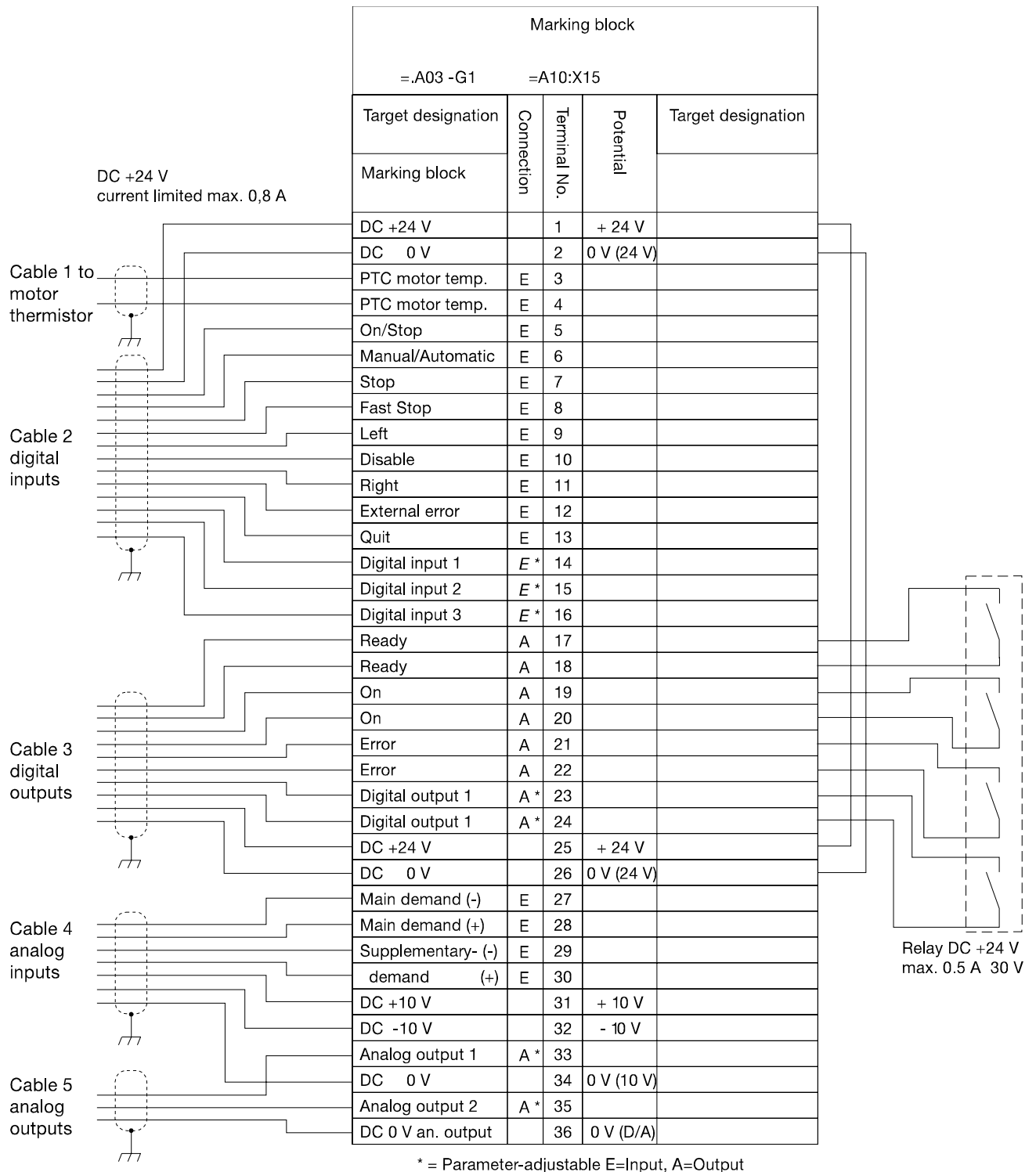


Fig. 45: Control connection, terminal strip A10 : X15 (Control board)

3.7 Specific measures for ensuring electromagnetic compatibility (EMC)

Depending on the environment, optional measures are necessary to comply with the EMC radiated interference conditions for drive converters.

IEC1800-3/prEN61800-3 (IEC 22G/21/CDV); Industrial:

To comply with the EMC requirements, no further options are required for radio interference suppression in addition to special consideration of the installation regulations and the instructions given in this documentation together with installation of mains chokes (3-phase chokes) and the use of screened control cables.

A RFI filter is recommended when using screened motor cables of above 50 m in length.

If other equipment which does not meet the interference resistance requirements of this product standard or the values according to EN50082-2 is installed on the same mains supply, radio interference measures are to be co-ordinated with the mains operator (IEC1800-3 / prEN61800-3 / IEC 22G/21/CDV).

Increasing the interference resistance of low power equipment is often far less complex or expensive. In industry it is therefore more economical to increase interference resistance than to reduce the radiated interference. In industry the EMC of the units should be based on a balanced mix of radiated interference and interference resistance.

IEC1800-3/prEN61800-3 (IEC 22G/21/CDV)

Residential, business and trade facilities as well as small businesses on the public electricity supply network.

A RFI filter is required in addition to the measures described for industry. Only the RFI filters stated in this operating manual guarantee compliance with the radio interference voltage according to limit EN55011 Class A (CISPR11 Class A). To meet these limits for radiated interference it is assumed that the cubicles used for the 8230 frequency inverter provide direct contact with the cubicle frame over the entire circumference of the side and rear panels. High coupling attenuation resistance is achieved by the cubicle function earth. In general no HF seals are required in cubicle doors for standard applications since the wavelength of the relevant radiated interference to be screened is approx. 0.5 ... 10 m. Screened copper-armoured motor cables of type NYCWY or -730CY with a good, low-impedance earth at both ends are to be used. The length of this motor connection cable may not exceed 150 m without taking into account further ancillary factors such as earth fault conditions and the system configuration. The cables to the braking resistor are to be screened.

EMC radiated interference to DIN EN 50081 Part 2: Limit EN55011 Group 1, Class A (CISPR11 Class A)

The measures stated in the last section to meet the limits for the public electricity supply network are required for compliance with this basic EMC standard.

EMC radiated interference to DIN EN50081 Part 1: Limit EN55011 Group 1 Class B (CISPR11 Class B)

Compliance with the measures stated for CISPR11 Class A is assumed. In addition an inphase choke is to be used at the inverter output.

Compliance with the interference voltage limit to EN55011 Class B (CISPR11 Class B) is achieved with these measures.

The length of the motor cables is limited to max. 60 m.

In comparison to CISPR11 Class A, further measures relating to the design and layout of the switchgear cubicle are necessary for compliance with the interference limit CISPR11 Class B for radiated interference (30 MHz - 1000 MHz).

In particular the switchgear cubicle must be fully sealed.

Cubicles are to be designed to guarantee good HF protection, if necessary using adapter kits after consultation with the manufacturer.

High EMC efficiency of the design in this frequency range is generally only possible by means of earthing. All measures for function earthing must be executed with great care. Metal PG screw connections (nickel plated brass) are to be used for the screen contacts when feeding the screened control and power cables into the cubicle and the motor terminal box.

Installation close to sensitive measurement and detection systems

A motor du/dt filter, if not already used for motor insulation protection, can be installed to further reduce any interference radiated by the motor cable, in addition to the measures stated for public electricity supply networks or the residential sector.

A du/dt filter is particularly recommended near sensitive measurement or detection equipment, sensors or comparable sensitive control units. This also applies particularly if radio signals in the long and medium wave band are used during operation for controlling the plant, e.g. transponder signals.

Important!

The classification of the measures stated here applies only to connection to an earthed network.

4 Operation and Software

4.1 Unit operation

The 8230 frequency inverter is normally operated through the BDE control unit. The following section describes operation using the control unit.

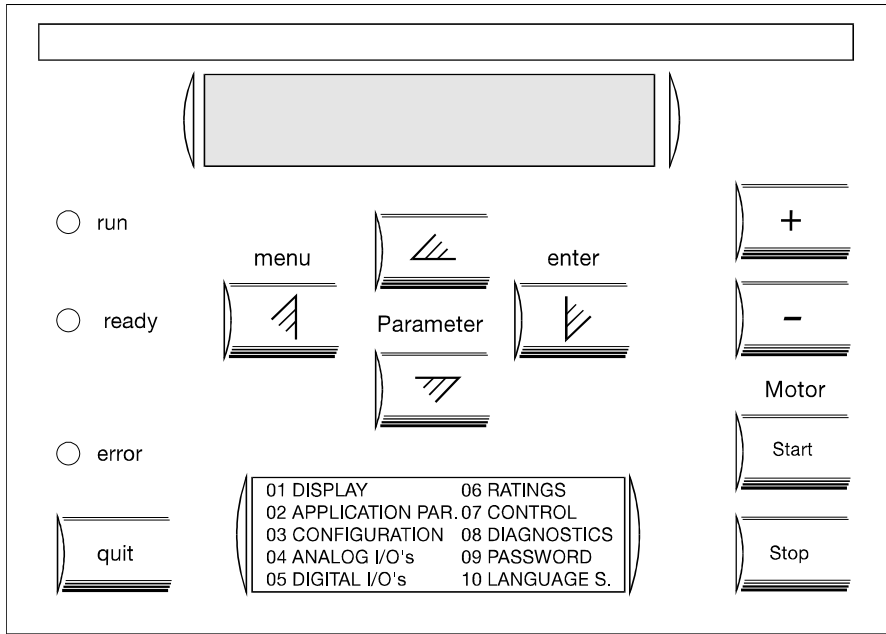


Fig. 46: 8230 frequencyinverter control unit BDE

4.1.1 Software structure

For operation with the control unit the user interface is divided into 2 levels.

Level 1 contains the main menu.
Level 2 is used to select the parameters required.

Mainmenu	Parameter
01 DIPSPY	Output frequency Speed Motor current
02 APPLICATION PAR.	Speed limit Ref.overspeed Ramp up
03 CONFIGURATION	Reaktion OFF Auto Testart Time RS422: Baudrate
04 ANALOG I/O's	Main demand 27/28 Add. demand 29/30 A-output 1:33 A-output 2:35
05 DIGITAL I/O's	D-Input 1:14 D-Input 2:15 D-Input 3:16 D-Output 1:23/24
06 RATINGS	Motor-type Nom. motor power Nom. motor voltage
07 CONTROL	Control structure Speed cntrl. Kp
08 DIAGNOSTICS	First Fault Event Nr.
09 PASSWORD	Protection Level Password Level 1 Password Level 2
10 LANGUAGE SEL.	Language

All options on the main menu are listed with the relevant codes on a label on the back of the control unit.

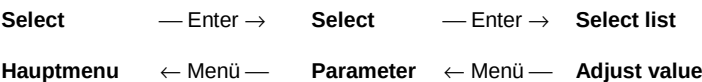
See section 4.3 for the full menu.

4.1.2 Control philosophy

Operation of the unit with the 8230 frequency inverter control unit is divided into 3 control levels:

- 1) "Select main menu"
- 2) "Select Parameter"
- 3) "Select from list" or "Adjust a parameter value"

You move to the next lower control level using the "Enter" (↵) key. You move back to the next higher level with the "Menu" key (⏮).



- In the "Select main menu" or "Select parameter" mode you can select a main menu option for the parameter using the "Up" (▲) and "Down" (▼) keys.
- In the "Select list / Adjust value" mode you can either select from a list (Example: Language: German / English / French) or adjust parameter values (eg. maximum speed: 1270 rpm → 1480 rpm).
- Parameters from the Select list are selected using the "Up" (▲) and "Down" (▼) keys.
If you select "Adjust a parameter value" using "Enter" (↵), the number before the decimal point is selected first. This can then be adjusted with the Up(▲) or Down (▼) keys. When you have selected the right-hand number you can save your entry by pressing the "Enter" (↵) key.
- If you made an adjustment in the "Select list/Adjust value" mode and saved it, this is indicated by the message "Info: Parameter adjusted" (the word "Info" will flash). This message will disappear after 2 seconds. It tells the operator that a change was made on this level.

4.2 Parameter adjustment

Key control

Selection in the relevant control level is with the “Up”(▲) and “Down”(▼) keys. You move one level lower or save or confirm a value by pressing “Enter”(↵). You move back up one level using the “Menu” key (◀).

Display control

The flashing cursor indicates your present level and the item you can select using the “Up”(▲) and “Down”(▼) keys.

- The code and the relevant menu option appears on the first line in the “**main menu**” level.

The second line is blank.

02 = APPLIKATION PAR.

A cursor flashes to the left next to the code. This indicates that you can change the code (= Menu block) using the “Up”(▲) and “Down”(▼) keys.

- After selecting the menu block required (in this case 02 Application parameter) using the “Up”(▲) / “Down”(▼) keys you can return to the “Select parameter” level using “Enter”(↵).

The display then appears as follows:

02 Speed limit
5 1/min

1. line: The “02” indicates the code for the menu block (in this case the application parameter). It no longer flashes as the menu block is already selected.

The first parameter of the relevant menu block (in this case “Speed limit”) appears to the right next to the code. The flashing cursor is positioned on the first letter of the parameter. It indicates that you are now on the “Select parameter” level. The parameter for the menu block already selected can now be selected with the “Up”(▲) and “Down”(▼) keys.

2. line: The value of the relevant parameter is displayed here. It has not yet been selected.

When you have selected the parameter required using the “Up”(▲) / “Down”(▼) keys, you can move to the “Adjust value” level by pressing the “Enter”(↵) key.

The display then appears as follows:



The first line shows the menu block you are in (in this case 02 = Speed limit) and the parameter you selected (in this case, maximum speed).

The flashing cursor on the second line is now located on the “1” as the highest value digit. The cursor indicates that this value can be adjusted using the “Up” (▲) / “Down” (▼) keys. The digits are selected with the “Enter” (↵) key and are adjusted with the keys “Up” (▲) / “Down” (▼). When you have selected or adjusted the lowest value digit the value is saved when you press the “Enter” (↵) key. This is confirmed by the display “Info: Parameter adjusted”. This message disappears automatically after 2 seconds.

If the control level “Change select list” does not contain a value as described above but a select list instead (eg. German, English, French under the “Language” parameter) you can select a parameter by pressing the “Up” (▲) / “Down” (▼) keys and save it using “Enter” (↵). This is also followed by the message “Info: “Parameter adjusted”) for approx. 2 seconds.

4.3 Menu

01 DISPLAY

		Output frequency	50.0 Hz
		Speed	1460.0 1/min ¹⁾
		Motor current	34.5 A
		Motor voltage	400.0 V
		Torque	120.0 Nm ¹⁾
		Motor power	18.5 kW ¹⁾
		DC link voltage	530.0 V
		Temp. heatsink.	25 °C
		Working time	49.50 h
		Date, Time	01.06.95 10:30:10
		Software ID	29152712
		Software Version	Lenze 8230 V2.0
		Drive Name	

02 APPLICATION PAR.

		Speed limit	1500 1/min
Protection Level 1		Ref. overspeed	1800 1/min
		Crnt.lmt.max.mot..	150 %
		Crnt.lmt.max.gen..	100 %
Protection Level 2		Crnt.lmt.nom.mot.	100 %
		Crnt.lmt.nom.gen.	100 %
		Ramp up	2.000 s
		Rampe down	5.000 s
		Ramp fast stop	0.200 s
		Motpot ramp up	10.000 s
		Motpot ramp down	10.000 s
		Motpot n-max	3000 1/min
		Motpot n-min	0.01 1/min
		Jogging speed	30.00 1/min
		Fixed speed 1	150.00 1/min
		Fixed speed 2	300.00 1/min
		Fixed speed 3	450.00 1/min
		Fixed speed 4	600.00 1/min
		Skip speed 1	750.0 1/min
		Skip band 1	0.0 1/min
		Skip speed 2	1500.0 1/min
		Bandbreite 2	0.0 1/min
		Skip speed 3	2250.0 1/min
		Skip band 3	0.0 1/min

¹⁾ No display at control structure = f-control

03 CONFIGURATION

		Reaction OFF		Discharge dc link No discharge
		Motpot reset		Reset at OFF No Reset
		Lock monitor.		Yes No
		Auto Restart Time		0 s
		MANUAL control		Terminal Control panel Fieldbus 1 Fieldbus 2 RS422
		MANUAL demand		Motpot Demand :27/:28 Demand :29/:30 Fieldbus 1 Fieldbus 2 RS422 Fixed speed Technology
		AUTO control		Terminal Control panel Fieldbus 1 Fieldbus 2 RS422
		AUTO demand		Motpot Demand :27/:28 Demand :29/:30 Fieldbus 1 Fieldbus 2 RS422 Fixed speed Technology
		MAN/AUTO c/cover.		At standstill During operation
		Invert: 21/22		No Yes
		Capture mode		No Yes
		Direction		One Two
		Kinetic back-up		Yes No
		RS422: Address		0
		RS422: Baudrate		19200 Baud
		Parameterset No.		1 2
Protection level 2	{	Copy Target: Set No.		1 2
		Copy Parameter Set Execute		Execute func.: Yes Execute func.: No
		Term. ParSet chan. .		Disable Enable
Protection level 2	{	Puls frequency		3 kHz / 6 kHz
Protection level 2	{	Transact. Release		XXXX
		Load Defaults		Execute func.: Yes Execute func.: No

04 ANALOG I/O's

		Main demand:27/:28		0 ... +10 V / 0 ... 20 mA -10 V ... +10 V 4 mA ... 20 mA 20 mA ... 4 mA
		Max. Main demand.		100.0 %
		Min. Main demand.		0.0 %
Protection level 1	[	Zero range main		0.5 %
		Add. demand 29/30		0 ... +10 V / 0 ... 20 mA -10 V ... +10 V 4 mA ... 20 mA 20 mA ... 4 mA
		Max. add. demand		100.0 %
		Min. add. demand		0.0 %
Protection level 1	[	Zero range add.d.		0.5 %
		Main + add.demand		No :27/:28 + :29/:30
		4-20 mA monitor		Warning Trip
		A-output 1:33		Output frequency ²⁾ Speed Motor current Motor voltage Torque Motor power DC link voltage Variable 1 (Xil armature current)
		Scaling A-output1		100.0 %
		A-output 2:35		Motor current ²⁾ Output frequency Speed Motor voltage Torque Motor power DC link voltage Variable 2 (Xil armature current)
		Scaling A-output2		100.0 %

²⁾ Standard setting

05 DIGITALE E/A's

D-input 1:14	☐	Motpot up Select fixed speed 1
D-input 2:15	☐	Motpot down Select fixed speed 2 Ext. Ramp choice
D-input 3:16	☐	Jogging Parametersatzumschaltung Select ramp 2 Select fixed speed 3
D-output 1:23/24	☐	Speed = ref. Speed = Zero Speed > N-ref Laststrom > IL-ref Warning Var. for:23/24
Invert. :23/24	☐	No Yes
Band speed = ref.	☐	30.00
Band speed = zero	☐	3.00
Reference speed	☐	750.00
Ref. load current	☐	100.00

06 RATINGS

Only display

Nom. inverter voltage	☐	400 V 460 V
Inverter kVA	☐	178...335 kVA
Mains voltage	☐	380 ...480 V
Brake type	☐	AC: without AC: with DC: with/ without
Nom.motor power	☐	110 kW
Nom.motor voltage	☐	380 V
Nom.motor speed	☐	1460 1/min
Nom.motor frequ.	☐	50 Hz
Switching mode	☐	Delta Star
Nom.motor curr.	☐	250 A
cos phi	☐	0.85
Stall torque/Rated torque	☐	3.0
M _{rated} /M _{stall}	☐	50 %
Number of strokes	☐	1000
Adjust mode	☐	No Yes
Adjust to 0	☐	0.00
R-stator + R-cable.	☐	0.5773
Fan trigger	☐	0 ... 65 °C

07 CONTROL

	Control structure		N-control without encoder F-control M-control without encoder N-control with encoder M-control with encoder
	Speed cntrl. Kp		10.000
	Speed cntrl. Tn		80.0 ms
Protection level 1	Or-controller Kp		0.144
	Or-controller Tn		2.0 ms
	Flux controller Kp		4.000
	Flux controller Tn		296.9 ms
Protection level 2	T controller Kp		10.000
	T controller Tn		500.0 ms

08 DIAGNOSTICS

First fault	
Fault Nr:	1
Event Nr:	1

09 PASSWORD

	Protection level	1
Protection level 1	Password Level 1	
	New Password 1	
	Changes	generally enabled generally disabled
	MMI: Changes	enabled disabled
Protection level 2	Password Level 2	
	New Password 2	
	Password Level 3	

10 LANGUAGE SELECT

Language	Deutsch English Francaise
----------	--

4.4 Description of parameters and displays

The following section describes the parameters and displays available through the 8230 frequency inverter BDE control unit. The parameters referring to the speed or frequency of the drive are linked to the reference values "standard frequency" and "number of pairs of poles".

Standard frequency

The "standard frequency" parameter contains the reference variable for displaying motor frequencies within the control. It affects amongst other things the frequency resolution and the maximum operating frequency as well as the frequency and speed limits set.

Frequency resolution = "Standard frequency"/16383
Max. operating frequency= 2 • "Standard frequency"
Standard setting: 100 Hz

Number of pairs of poles

The unit calculates the number of pairs of poles from the "motor rated frequency" and "motor rated speed" type data input.

4.4.1 Display

The following unit actual values are displayed in physical units in the DISPLAY menu block:

- Output frequency [Hz]
- Speed [rpm]
- Motor current [A]
- Motor voltage [V]
- Torque [Nm]
- Motor power [kW]
- Link voltage [V]
- Heatsink temperature [°C]
- Operating hours [h]
- Date, time [DD-MM-YY hh:mm:ss]

"Date, time" is used for the display and for setting the internal clock.

Also displayed is the software identification:

- Software ID = 29xxxxxx
- Software version = Lenze 8230 frequency inverter Vx.xx

The user can designate the drive with the parameter

- "Drive name". This can consist of 20 alphabetical characters.
Example: "Print roller 03".

4.4.2 Application parameter

Speed limit

This is a higher level demand limit which takes effect after demand selection and before the ramp. It serves to protect against excessive speed and is initialised at rated synchronous speed by the type data module.
The parameter setting is adjusted in proportion if the ratio between "standard frequency" and "no. of pairs of poles" is altered.
The speed limit corresponds to the "frequency limit" parameter.

Adjustment range: 0 ... $2 * \text{"standard frequency"} * 60/\text{no. of pairs of poles}$
As supplied: 1500 min⁻¹

Ref. overspeed

This parameter can be used to preset a speed comparison value which, if exceeded, causes the 8230 frequency inverter to shut down and enters a corresponding message in the error log.
This error must be acknowledged before the drive can be restarted.
The parameter setting is affected proportionally if the ratio between "standard frequency" and "no. of pairs of poles" is adjusted.

Adjustment range: 0 ... $2 * \text{"standard frequency"} * 60/\text{no. of pairs of poles}$
As supplied: 1800 min⁻¹

Max. motor current limit

This parameter determines the motor overload current which can be sustained for max. 60 s on a 10 % duty cycle. After the monitored overload duration the system switches back to the "rated motor current limit".
The value displayed is based on the load components in the motor rated current and in the constant flux range therefore corresponds to the torque.
If a parameter should change, the type data module initialises the limit to 150 % if permitted for the inverter maximum current.
If a value below the "rated motor current limit" is set as the overload limit, this is limited to the value of "max. motor current limit".
In the "frequency control" structure the inverter is shut down when the permitted overload duration is reached.

Adjustment range: 0 ... value which provides the maximum inverter current
As supplied: ca. 135 %

Max. regenerative current limit

This parameter determines the regenerative overload current which can be sustained for max. 60 s on a 10 % duty cycle. After the monitored overload duration the system switches back to the “rated regenerative current limit”.
The value displayed refers to the load components in the motor rated current and in the constant flux range therefore corresponds to the torque.
If a parameter should change, the type data module initialises the limit to 150 % if permitted for the maximum current of the inverter.
If a value below the “rated regenerative current limit” is set for the overload limit, this is limited to the value of “max. regenerative current limit”.

In the “frequency control” structure the inverter is shut down when the permitted overload duration is reached.

Adjustment range: 0 ... value which provides the maximum inverter current
As supplied: ca. 100 %

Rated motor current limit

This parameter determines the rated motor load current to which the system returns after an overload. The value displayed refers to the load components in the motor rated current and therefore corresponds to the torque in the constant flux range.
If a parameter should change, the type data module initialises the limit to 100 % provided that this does not exceed the inverter rated current.

Adjustment range: 0 ... value limited by the inverter rated current and “max. motor current limit”.
As supplied: 100 % (motor rated current)

Rated regenerative current limit

This parameter determines the regenerative rated load current to which the system returns after an overload. The value displayed refers to the load component in the motor rated current and so corresponds to the torque in the constant flux range.
If a parameter should change, the type data module initialises the limit to 100 % provided that the inverter rated current is not exceeded.

Adjustment range: 0 ... value limited by the inverter rated current and “max. regenerative current limit”.
As supplied: 100 % of motor rated current

Acceleration ramp

This parameter determines the acceleration time of the drive.
This time applies for travelling through a frequency range corresponding to half the value of the parameter “standard frequency”. With the standard parameter settings this means a frequency range of 50 Hz.
The value applies in both directions.

Adjustment range: 0.01 ... 600 s
As supplied: 2 s

Braking ramp

This parameter determines the braking time for the drive.
This time applies for travelling through a frequency range corresponding to half the value of the parameter "standard frequency". With the standard parameter settings this means a frequency range of 50 Hz. The value applies in both directions.

Adjustment range: 0.01 ... 600 s
As supplied: 5 s

Ramp, Fast Stop

This parameter determines the drive braking time for the FAST STOP function. This time applies for travelling through a frequency range corresponding to half the value of the parameter "standard frequency". With the standard parameter settings this means a frequency range of 50 Hz.
The value applies in both directions.
A FAST STOP is triggered by opening terminal 8.

Adjustment range: 0.01 ... 600 s
As supplied: 500 ms

Motor potentiometer ramp up

This parameter determines the integration time for the motor potentiometer in the UP direction.
This time applies for travelling through a frequency range corresponding to half the value of the parameter "standard frequency". With the standard parameter settings this means a frequency range of 50 Hz.
The value applies in both directions.

Adjustment range: 0.1 ... 1000 s
As supplied: 10 s

Motor potentiometer ramp down

This parameter determines the integration time for the motor potentiometer in the DOWN direction.
This time applies for travelling through a frequency range corresponding to half the value of the parameter "standard frequency". With the standard parameter settings this means a frequency range of 50 Hz.
The value applies in both directions.

Adjustment range: 0.1 ... 1000 s
As supplied: 10 s

Motor potentiometer n-max

This parameter determines the maximum speed for the motor potentiometer function. The type data module initialises the parameter at rated synchronous speed.
The parameter setting is adjusted proportionally if the ratio between "standard frequency" and "no. of pairs of poles" is altered.

Adjustment range: "Mot. pot. n-min"...2 * "Standard frequency" * 60/no. of pairs of poles
As supplied: 1500 min⁻¹

Motor potentiometer n-min

This parameter determines the minimum speed of the 8230 frequency inverter when controlled through the motor potentiometer function. If there should be a change in the ratio between "standard frequency" and "no. of pairs of poles", the parameter setting is affected proportionally. If a value greater than the "motor potentiometer n-max" is set, this is reset to the value of "motor potentiometer n-min".

Adjustment range: $0 \dots 2 * \text{"standard frequency"} * 60 / \text{no. of pairs of poles}$
As supplied: 0 min^{-1}

Jogging demand

This parameter determines the jogging speed. It is preset by driving terminal 16 (digital input 3 if the parameters are set accordingly). The type data module initialises this at $0.01 * \text{"standard frequency"} * 60 / \text{no. of pairs of poles}$. If the ratio between "standard frequency" and "no. of pairs of poles" should change, the parameter setting is adjusted proportionally.

Adjustment range: $0 \dots 0.1 * \text{"standard frequency"} * 60 / \text{no. of pairs of poles}$
As supplied: 30 min^{-1}

Fixed speed 1...4

Up to 4 fixed demands can be stored in the 8230 frequency inverter with these parameters and selected through digital inputs 1 and 2 (digital input 1 terminal :15). For this, the signal source selected through terminal 6 ("AUTO demand" or "MANUAL demand") must be set to "Fixed speed" and the appropriate function assigned to terminals :15 and :16 (see digital input 1 terminal :14, digital input 2 terminal :15). If the ratio between "standard frequency" and "no. of pairs of poles" should change, the parameter setting is adjusted in proportion.

Adjustment range: $0 \dots 2 * \text{"standard frequency"} * 60 / \text{no. of pairs of poles}$
As supplied: 150, 300, 450, 600 min^{-1}

Skip speed 1...3 Bandwidth 1...3

In the event of mechanical resonance in the machine it can be beneficial to skip certain speed ranges when stationary.

These speeds are avoided using parameter-adjustable skip speeds. Three skip speed parameters are available. The relevant bandwidth determines the skip range around the actual skip speeds.

If the bandwidth is to zero, no speeds are skipped.

If the ratio between "standard frequency" and "no. of pairs of poles" should change, the parameter settings are adjusted proportionally.

Skip speeds:
Adjustment range: $0 \dots 2 * \text{"standard frequency"} * 60 / \text{no. of pairs of poles}$
As supplied: 750, 1500, 3000 min^{-1}

Bandwidths:
Adjustment range: $0 \dots 0.1 * \text{"motor rated frequency"} * 60 / \text{no. of pairs of poles}$
As supplied: 0.0 min^{-1}

4.4.3 Configuration parameters

Reaction on Stop

This parameter determines the drive response to a shut-down through the control command ON / STOP (STOP = Low level).

- Select list: - No discharge
 - Discharge the link
As supplied: Discharge the link

Select "Discharge the link":
When a shut-down command is given the drive is brought to a controlled standstill. On standstill, the pulse inverter is disabled, the main contactor is de-energised and after 30 s the link is discharged. The link is only discharged if a power dump is installed and a braking resistor is connected.

Select "No discharge":
After the shut-down command the drive is brought to a controlled standstill. On standstill, the pulse inverter is disabled. The main contactor remains energised and the link remains charged.

Motor potentiometer RESET

This parameter determines whether the existing motor potentiometer demand should be saved or reset when the 8230 frequency inverter is switched off.

- Select list: - No reset
 - Reset on STOP
As supplied: Reset on STOP

Reset on STOP: The motor potentiometer is reset when the pulses are disabled.
No reset: When the pulses are disabled the existing motor potentiometer demand is saved and re-applied on restarting. The value is also saved during mains failure.

Blocking monitor

This parameter activates the "Drive blocked" monitor function.
If the blocking monitor is set to "Yes", the error signal "Drive blocked" is generated if the speed controller is at its limit for 2 seconds and the speed is zero during that period.

- Select list: - Yes
 - No
As supplied: Yes

AWE time

This parameter is used to set the maximum interrupt time caused by mains failure after which the automatic restart facility (AWE) can switch the drive on again. If the mains supply returns during the AWE time setting, a short automatic self-test lasting approx. 0.5 s is executed before an automatic restart if the On/Stop signal is still present.

If the mains supply only returns after the AWE restart time has elapsed, the 8230 frequency inverter must be switched on again. A high/low flank for the ON signal is then required to start the drive. The signal ON status is only checked once the self-test is complete. It is only then possible to generate an ON flank.

If "Kinetic back-up" is active, the pulses are not disabled directly on mains failure, as kinetic energy to support operation of the control electronics and for controlling the drive is taken from the drive until it is close to a standstill.

If "Capture" is active, after restarting drives without an incremental encoder a search is first executed and, when the motor synchronous frequency is detected, magnetisation is applied accordingly and the system is regulated to the actual speed demand.

If the 8230 frequency inverter control unit was selected as the control source for the On/Stop signal on mains supply failure or return, no automatic restart will take place.

Adjustment range: 0 ... 15 s
As supplied: 0 s

Note:

The controller is not reconnected automatically, if the operating unit of the 8230 frequency inverter was activated as the signal source for the ON/STOP signal during mains failure or mains recovery.

MANUAL control

This parameter selects the source of the control signals for "MANUAL" operation.

Select list: - Terminal strip
- Control unit
- Field bus 1
- Field bus 2
- RS422

As supplied: Control unit

Select control unit:

The control unit signals START, STOP, + (HIGHER), - (LOWER) and ACKNOWLEDGE are effective. All other control signals continue to take effect through the terminal strip. In particular this means: If the drive is to be controlled in the "MANUAL" mode via the control unit, the following terminals on the terminal strip are to be connected to +24 V (terminal :1 or terminal :25):

Terminal :7	(STOP)
Terminal :8	(Fast STOP)
Terminal :10	(Inverter disable)
Terminal :12	(External error)
Terminal :9 or :11	(Direction)

Select terminal strip:

The 8230 frequency inverter is controlled exclusively through the terminal strip. (The STOP signal is also effective through the control unit).

MANUAL demand

This parameter determines the source of the demand preset in the "MANUAL" mode.

- Select list:
- Motor potentiometer
 - Analog terminal 27/28
 - Analog terminal 29/30
 - Field bus 1
 - Field bus 2
 - RS422
 - Fixed speed
 - Technology
- As supplied:
- Motor potentiometer

AUTO control

This parameter selects the source for control signals for "AUTO" operation.

- Select list:
- Terminal strip
 - Control unit
 - Field bus 1
 - Field bus 2
 - RS422
- As supplied:
- Terminal strip

Select control unit:

The control unit signals START, STOP, + (HIGHER), - (LOWER) and ACKNOWLEDGE are effective. All other control signals continue to operate through the terminal strip. In particular this means: If the drive is to be operated in the "AUTO" mode through the control unit, the following terminals on the terminal strip are to be connected to +24 V (terminal :1 or terminal :25):

- Terminal :7

Terminal :8

Terminal :10

Terminal :12

Terminal :9 or :11
- (STOP)

(Fast STOP)

(Inverter disable)

(External error)

(Direction)

Select terminal strip:

The 8230 frequency inverter is controlled exclusively through the terminal strip. (The STOP signal is also active through the control unit).

AUTO demand

This parameter determines the source of the demand preset in the "AUTO" mode.

- | | |
|--------------|---|
| Select list: | <ul style="list-style-type: none">- Motor potentiometer- Analog terminal :27/:28- Analog terminal :29/:30- Field bus 1- Field bus 2- RS 422- Fixed speed- Technology |
| As supplied: | Motor potentiometer |

MANUAL / AUTO changeover

This parameter determines whether the changeover between manual and automatic operation is effective during operation or only when at a standstill.

- | | |
|-------------------------|--|
| Select list: | <ul style="list-style-type: none">- When at a standstill- When in operation |
| As supplied: | When at a standstill |
| Select "At standstill": | Changeover only possible at a standstill (pulses disabled). |
| Select "In operation": | Changeover also possible when motor is running. |

Note:

If the motor potentiometer is selected as the demand source, for example in the MANUAL mode, the motor potentiometer demand is controlled to the speed actual value on switching between AUTO/MANUAL. In general this control always applies regardless of the manual or remote mode if the motor potentiometer is selected as the demand source in the target operating mode. The motor potentiometer demand is unipolar. Negative demands are initialised at the positive value. In order to avoid unwanted reversing the changeover may only be made with unipolar demands.

Invert terminal 21/22

This parameter allows inversion of the signal output at terminal X15:21/:22 (error). This parameter is accessible from protection level 1.

- Selection list: - Yes
 - No
As supplied: No

Capture mode

In speed controlled operation and with frequency control the Capture facility allows the 8230 frequency inverter to be switched to a de-excited drive while the drive is running.
This parameter is accessible on level 2.
After a brief pause to ensure the motor is de-excited the search process begins at the capture start frequency - adjustable with the Capture Start Frequency parameter. The motor is magnetised to a flux demand of 20 % - variable with the parameter Capture Im-red (100 % = rated flux). During the search the output frequency is reduced to 0 Hz. If the search is not successful it is repeated in the opposite direction.
When the synchronous frequency is detected the motor is magnetised to rated flux and the controllers are enabled. The drive is controlled at the currently active speed demand.
In drives with an encoder the capture process is executed without searching for the actual speed, since the speed and direction are already known.
Conditions for almost totally smooth switching to a drive while running:
- Single drive
- Motor not excited
- No additional torque demands active during capture

The capture mode parameter must be set to YES to activate the mode.

- Selection list: - Yes
 - No
As supplied: No

Drive dirctions

Using this parameter you can select whether the controller is to search in one or two drive directions during the flying restart mode.
Selection list: - One
 - Two
As supplied: One

Kinetic back-up

This parameter activates kinetic back-up. In the event of brief mains failure this function provides a bridge using kinetic energy, i.e. the rotating mass in the drive system. The output frequency is regulated so that system losses are covered by over-synchronous operation of the motor. The link voltage get back-up. The drive speed drops during back-up. If the mains supply returns during the support period, the 8230 frequency inverter runs the drive to the preset speed demand using the ramp time set. The demand for the magnetising current controller is reduced as standard to 85 % of the value while back-up is active. This further lengthens the support time through power conservation.

Operation of the control electronics is supported by the energy drawn from the drive during its controlled run-down.
The back-up signal is generated internally by monitoring the link voltage.

- | | |
|--------------|-------|
| Select list: | - Yes |
| | - No |
| As supplied: | No |

RS422: Address

This parameter determines the unit address for the 8230 frequency inverter for communication through the RS422 serial interface (with the PC).

Adjustment range: 0 ... 15
As supplied: 0

RS422: Baud rate

This parameter determines the transfer speed for serial communication through the RS422 interface (PC).

Adjustment range: 2400 ... 19200 Baud
As supplied: 19200 Baud

Parameter set no.

This parameter indicates the currently active parameter set and allows switching to a second parameter set through entry of a different numerical value. For this, **Terminal: Parameter Set Changeover** must be disabled.
Two parameter sets can be selected.

Range: 1, 2
As supplied: 1

Copy target: Set accessible on level 2

Function for copying all settings used in the currently active parameter set to another parameter set selected with its parameter no. or by a terminal signal (D-Input 3 terminal :16).
This parameter set is accessible on level 2.
To copy a parameter set the parameter **copy target** is to be set to 2 and then the function: **Copy: Parameter** is executed. The value of the **copy target** parameter is to be set to match the target parameter set number and is automatically reset to zero after copying.

Terminal: Parameter set changeover

This parameter allows the digital control input D-input 3 terminal :16 to be enabled for switching parameter sets via the terminal strip. It is necessary for the parameter set changeover function to be configured accordingly for this control input (see section 4.4.5).

Selection list: - Disabled
 - Enabled
 As supplied: Disabled

Pulse frequency

This parameter determines the inverter pulse frequency. The output voltage vector is updated at the 1.5 kHz switching frequency and is output repeatedly at the pulse frequency.

Pulse frequencies above 3 kHz reduce the power of the inverter. Adjustment is only possible when the pulses are disabled.

Select list: - 3 kHz
 - 6 kHz
 As supplied: 3 kHz

Transaction enable

Any adjustment of certain specifically protected parameters must first be enabled. Adjustment can be enabled by entering the object number of the parameter requiring adjustment, in decimal form, as the transaction enable. The enable remains valid for approx. 1 minute. Transaction enable is automatically reset to zero after this time has elapsed or after an adjustment is made.

Example: One specifically protected parameter is the inverter type. It is only necessary to set the inverter type after the 8230 frequency inverter control board is replaced or the unit software is reprogrammed.

Load default values

With this parameter the 8230 frequency inverter can be reset to its default condition, i.e. all parameters are reset to their default values. This therefore cancels all parameter changes.

Select list: - Execute function: YES
 - Execute function: NO
 As supplied. Execute function: NO

The "Load default values" function is activated by "Execute function: YES".

Important!

All parameter settings are overwritten with the default values when the "Load default values" command is executed. Parameter set 1 is selected.

It is essential that the wiring and drive configuration match the settings in the parameter set.

4.4.4 Parameters for analog I/O

Main demand 27/28

The type and characteristics of the controlling analog demand source connected as the main demand to terminals :27/:28 are set with this parameter.

Select list:	- 0 ... +10 V / 0 ... 20 mA
	- -10 V ... +10 V
	- 4 mA ... 20 mA
	- 20 mA ... 4 mA
As supplied:	0 ...+10 V / 0 ... 20 mA

If this demand source is to take effect as a speed control variable, the signal source selected through terminal :6 ("AUTO demand" or "MANUAL demand") must be set to "Analog terminal :27/:28".

The drive direction is determined and enabled by the demand presets "LEFT (...)" and "RIGHT (...)". These must therefore be configured accordingly (see "AUTO control" or "MANUAL control").

If the bipolar demand source (-10 V ... +10 V) is selected, a positive demand in conjunction with the direction enable "RIGHT" results in a clockwise rotation field and a negative demand produces an anti-clockwise rotation field. The "LEFT" direction enable inverts the assignment described.

When using current demands the burden resistor is to be connected on printed circuit board A10 through a jumper X25, see section 2.7.2.1.

If 4 mA ... 20 mA or 20 mA ... 4 mA is selected, the wire break monitor (line current) is active (see parameter "4-20 mA monitor").

Max. main demand

This parameter belongs to a characteristic formation device on the main demand channel. It represents the upper limit of the range to which the analog demand read in from terminal :27/:28 is standardised and limited.

Adjustment range:	"Min. main demand" ... 400 %
As supplied:	100 %

Min. main demand

This parameter forms part of a characteristics formation device on the main demand channel. It represents the lower limit of the range to which the analog demand read in from terminal :27/:28 is standardised and limited.

With bipolar demands (-10 V ... +10 V) the parameter set has no effect (minimum = 0, see also parameter "Zero zone main demand").

If a value greater than "Max. main demand" is set, it is limited to the value of "Min. main demand".

Adjustment range:	0 % ... 400 %
As supplied:	0 %

Zero zone main demand

This parameter forms part of a characteristics formation device on the main demand channel.

With unipolar demands it determines the range in which the analog demand read in from terminal :27/:28 is limited to "Min. main demand".

With bipolar demands (-10 V ... +10 V) it defines the zero zone.

Adjustment range:	0 % ... 20 %
As supplied:	0,5 %

The effect of the characteristic generator is shown in Fig. 47 and Fig. 48.
Adjustment range: 0 % ... 20 %
As supplied: 0.5 %

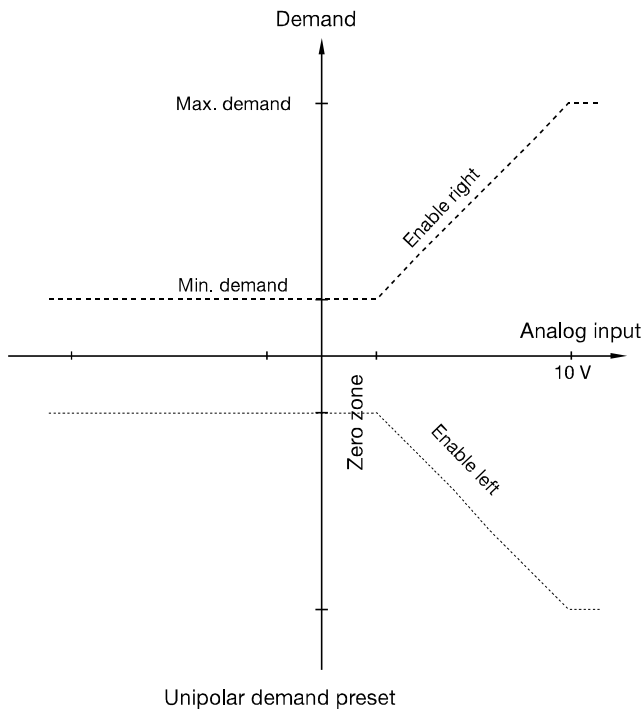


Fig. 47: Characteristic curve main demand an additional demand (unipolar demand)

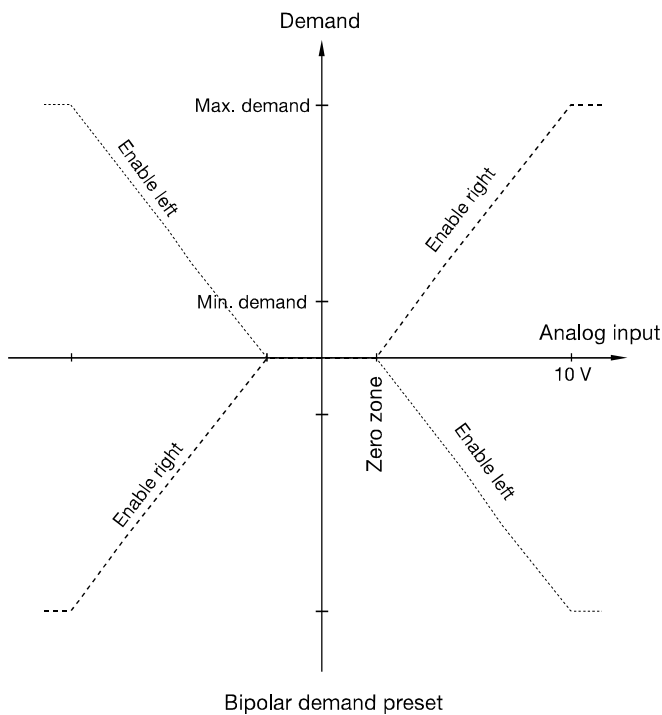


Fig. 48: Characteristic curve main demand an additional demand (bipolar demand)

Additional demand 29/30

This parameter sets the type and characteristic of the analog demand source to be controlled which is connected as an additional demand to terminals :29/:30.

- Select list:
- 0 ... +10 V / 0 ... 20 mA

- -10 V ... +10 V

- 4 mA ... 20 mA

- 20 mA ... 4 mA
- As supplied:
- 0 ... +10 V / 0 ... 20 mA

If this demand source is to act as speed control value, the signal source selected through terminal 6 ("AUTO demand" or "MANUAL demand") is to be set to "Analog terminal :29/:30".

It is also possible to define the demand from terminal 29/30 as an additional (speed) demand which is added to the selected main demand. For this, the parameter "Main + additional demand" is to be set to ":27/:28 + :29/:30".

The drive direction is determined or enabled by the enable signals "LEFT (...)", "RIGHT (...)". These must therefore be configured accordingly (see "AUTO control" or "MANUAL control").

If the bipolar demand source (-10 V ... +10 V) is selected, a positive demand in conjunction with the direction enable "RIGHT" results in a clockwise rotation field and a negative demand produces a counterclockwise field. The direction enable "LEFT" inverts the assignment described.

When using current demands the burden resistor is to be connected on printed circuit board A10 through jumper X26, see section 2.7.2.1.

When 4 mA ... 20 mA or 20 mA ... 4 mA is selected, the speed monitor (line current) is active (see parameter "4-20 mA monitor").

Max. additional demand

This parameter forms part of a characteristics formation device on the additional demand channel. It represents the upper limit of the range to which the analog demand read in from terminal :29/:30 is standardised and limited.

Adjustment range: "Min. additional demand" ... 400 %

As supplied: 100 %

Min. additional demand

This parameter forms part of a characteristics formation device on the additional demand channel. It represents the lower limit of the range to which the analog demand read in from terminal :29/:30 is standardised and limited.

With bipolar demands (-10 V ... +10 V) the parameter set is not effective (minimum = 0, see also parameter "Zero zone additional demand").

If a value greater than that of "Max. additional demand" is set, this is reset to the value of "Min. additional demand".

Adjustment range: 0 % ... 400 %

As supplied: 0 %

Zero zone additional demand

This demand forms part of a characteristics formation device on the additional demand channel.
With unipolar demands it determines the range in which the analog demand read in from terminal :29/:30 is limited to "Min. additional demand".
With bipolar demands (-10 V ... +10 V) it defines the zero zone.

Adjustment range: 0 % ... 20 %
As supplied: 0.5 %

Main + additional demand

This parameter allows you to add an additional demand to the main (speed) demand. As standard, the additional demand is the analog demand from terminal :29/:30.

Select list: - No
 - :27/:28 + :29/:30
As supplied: No

4-20mA monitor

This parameter determines the response on detection of a wire break. The monitors for the analog demands at terminals :27/:28 and :29/:30 are active if they were selected as 4-20mA (line current) demand sources.

Select list: - Warning
 - Shut down
As supplied: Shut down

Response:

- Warning:

Wire break detection generates a warning message in the event log. A signal can be output to terminals :23/:24 through the selector switch "D-Output 1 :23/:24".

- Shut down:

If this is selected, a wire break causes the 8230 frequency inverter to be shut down and creates a corresponding entry in the error log. The 8230 frequency inverter can only be switched on again when the error is acknowledged.

A-Output 1 terminal 33

This parameter determines which control variable is to be output as an analog signal at the monitor output (D/A output) terminal :33 (AA1). Digital resolution is 12 bit, the range of values at the analog output is -10 V ... +10 V.

Provided that Scal. A-Output 1 = 100 % the following apply according to the selection list:

- | | |
|--------------------|---|
| - Output frequency | $f = \text{standard frequency}$
(The standard frequency as supplied is 100 Hz.
At an output frequency of 50 Hz the voltage output is 5 V. In the negative direction also the output voltage is negative). |
| - Speed | $\text{Output: } 10V \times \frac{\text{Speed}}{\text{Speed on rated frequency}}$ eg. 5 V: Synchronous speed at 50 Hz.
In the negative direction also the output voltage is negative. |
| - Motor current | Output 10 V, if the r.m.s. value of the fundamental wave of the motor current is equal to the maximum maximum controller current. |
| - Motor voltage | Output 10 V, if the r.m.s. value of the fundamental wave of the motor voltage is equal to the rated mains voltage. |
| - Torque | 10 V with rated torque of the parameterized motor. |
| - Motor power | 10 V with rated power of the parameterized motor. |
| - Link voltage | Output 10 V, if the link voltage is equal to the rectification value of the rated mains voltage. |
| - Variable 1 = XIL | 100 % torque-forming component of motor current based on unit rated current. |
| As supplied: | Output frequency |

Scaling, A-Output 1

This parameter serves to scale the D/A output at terminal :33. It represents the reference value which produces a 10 V output.

Adjustment range: 0 ... 200 %
As supplied: 100 %

A-Output 2 terminal 35

This parameter determines which control variable is to be output as an analog value at the monitor output (D/A output) terminal :35 (AA1). Digital resolution is 12 bit, the range of values at the analog output is -10 V ... +10 V.
Provided that Scal. A-Output 2 = 100 % the following apply according to the selection list:

- Output frequency f = rated frequency
 (The rated frequency as supplied is 100 Hz.
 At an output frequency of 50 Hz the output voltage is 5 V. In the negative direction also the output voltage becomes negative).
 - Speed Output: $10V \cdot \frac{\text{Speed}}{\text{Speed on rated frequency}}$
 eg. 5 V: Synchronous speed at 50 Hz.
 In the negative direction also the output voltage is negative.
 - Motor current Output 10 V, if the r.m.s. value of the fundamental wave of the motor current is equal to the maximum maximum controller current.
 - Motor voltage Output 10 V, if the r.m.s. value of the fundamental wave of the motor voltage is equal to the rated mains voltage.
 - Torque 10 V with rated torque of the parameterized motor.
 - Motor power 10 V with rated power of the parameterized motor.
 - Link voltage Output 10 V, if the link voltage is equal to the rectification value of the rated mains voltage.
 - Variable 2 = XIM 100 % magnetising current based on the rated current of the unit.
- As supplied: Motor current

Scaling A-Output 2

This parameter is used for scaling the D/A output at terminal :35. It represents the reference value which produces a 10 V output.

- Adjustment range: 0 ... 200 %
As supplied. 100 %

4.4.5 Parameters for digital I/O's

D-Input 1 terminal 14

This parameter determines the function of the digital control input at terminal 14. The function is active at logic "High".

- Select list:
- Motor potentiometer higher
- Select fixed speed1
- As supplied:
- Motor potentiometer higher

If the parameter is set to "Select fixed speed 1", one of the fixed speeds stated in 02 Application parameters according to the following table is activated in conjunction with the function "Select fixed speed 2":

Select fixed speed 1	Select fixed speed 2	Activated fixed speed
0	0	"Fixed speed 1"
1	0	"Fixed speed 2"
0	1	"Fixed speed 3"
1	1	"Fixed speed 4"

"Fixed speed 1" to "Fixed speed 4" are specified in 02 = APPLICATION PARAMETERS.

IMPORTANT!

If the function of D-Input terminal :14 is not set to "Select fixed speed 1", the selection matrix for Select fixed speed 1 is 0.

The activated fixed speeds are only effective if the parameter for the MANUAL demand or AUTO demand in Menu 03 Configuration is set to fixed speed.

D-Input 2 terminal 15

This parameter determines the function of the digital control input at terminal :15. The function is active at logic "High".

- Select list:
- Motor potentiometer lower
- Select fixed speed 2
- As supplied:
- Motor potentiometer lower

If the parameter is set to "Select fixed speed 2", one of the fixed speeds given in 02 Application parameters according to the following table is activated in conjunction with the function "Select fixed speed 1":

Select fixed speed 1	Select fixed speed 2	Activated fixed speed
0	0	"Fixed speed 1"
1	0	"Fixed speed 2"
0	1	"Fixed speed 3"
1	1	"Fixed speed 4"

"Fixed speed 1" to "Fixed speed 4" are specified in 02 = APPLICATION PARAMETERS.

IMPORTANT!

If the function of the D-Input terminal :15 is not set to "Select fixed speed 2", the selection matrix for Select fixed speed 2 is 0.

The active fixed speeds are only effective if the parameter for MANUAL demand or AUTO demand in Menu 03 Configuration is set to fixed speed.

D-Input 3 terminal 16

This parameter determines the function of the digital control input at terminal :16. The function is active at logic "High".

- Select list:
- Jogging

- Parameter set changeover
- As supplied:
- Jogging

The "Jogging" function switches the system to the "Jogging demand" on the demand channel (see Application parameters).

D-Output1 23/24

This parameter determines which digital monitoring signal is output at terminals :23/:24. The signal has a decay delay of 200 ms. The signal to be output can be inverted through the parameter "Invert D-Output 1".

- Select list:
- Speed reached
 - Speed = zero
 - Speed > Ref. speed
 - Load current > I_{L-Ref}
 - Warning
- As supplied:
- Speed reached.

If "Warning" is selected, the temperature warning is output as well as the wire break monitor for the 4-20 mA demand sources if selected.
See "Window speed reached", "Window speed = 0", "Reference speed" and "Reference load current" for setting the comparison values and tolerances for the above monitors.

Invert:23/24

This parameter allows you invert the signal output at terminal :23/:24.

- Select list:
- Yes
 - No
- As supplied:
- No

Window speed reached

This parameter determines the band of tolerances within which the system detects that the drive is running at the specified speed.
The signal can be output through the field bus and, if configured accordingly, through :23/:24 (see parameter "D-Output 1 23/24").
If there is a change in the ratio between "Standard frequency" and "No. of pairs of poles", the parameter setting is affected in proportion.

- Adjustment range:
- $(0.001 \dots 0.1) \cdot \text{"Standard frequency"} \cdot 60 / \text{No. of pairs of poles}$
- As supplied:
- 25 min^{-1}

Window speed = 0

This parameter determines the band of tolerances within which drive standstill is detected.

Speed zero detection controls the STOP function in the start-up interlock. In addition, the monitor signal can be output through the field bus and, if configured accordingly, through terminal :23/:24 (see parameter "D-Output 1 :23/:24").

If there is a change in the ratio between "Standard frequency" and "No. of pairs of poles" the parameter setting is affected in proportion.

Adjustment range: (0,001...0,1) * "Standard frequency" * 60/No. of pairs of poles
As supplied: 3 min⁻¹

Reference speed

With this parameter you can preset a speed comparison value at which, if exceeded, the 8230 frequency inverter generates a signal.

The signal can be output through the field bus and, if configured accordingly, through terminal :23/:24 (see parameter "D-Output 1 :23/:24").

If there is a change in the ratio between "Standard frequency" and "No. of pairs of poles" the parameter setting is affected in proportion.

Adjustment range: 0 ... 2 * "Standard frequency" * 60/No. of pairs of poles
As supplied: 750 min⁻¹

Reference load current

With this parameter you can preset a comparison value for the load current (rotor current XIL) at which, if exceeded, the 8230 frequency inverter generates a signal. This signal can be output through the field bus and, if configured accordingly, through :23/:24 (see parameter "D-Output 1 :23/:24").

The reference value refers to the rated rotor current calculated from the motor type data.

Adjustment range: 0 ... value corresponding to max. inverter current .
As supplied: 100 %

4.4.6 Ratings

Inverter-nominal voltage

This parameter determines the value of the corresponding rated mains voltage of the inverter.

As supplied: Unit-based

Inverter kVA

This parameter specifies controller-specific references for the controller power.
This parameter can only be changed or entered again if the control board is replaced or the software is updated.

As supplied: Unit-based

Mains voltage

This parameter tells the control the rated mains supply voltage. The value entered is used to determine the operating range, monitoring of link charging and the starting voltage for special facilities such as "Support".

Adjustment range: 380 V ... 480 V
As supplied: 400 V

Braking device

This parameter specifies the control according to the device for the absorption of recovered energy. If there is no such device the DC bus voltage is limited by the control of the brake torque for „N control“ or „M control“. DC with/without is to be selected if a DC bus connection with several inverters (energy exchange), or an external brake chopper is used.

Select list:	- AC without - AC with - DC with/without		
As supplied:	Unit-based:	- without	In 8230 frequency
inverter			without braking chopper
		- with	In 8230 frequency
inverter			with braking chopper

Motor rated power

This parameter is used to set the rated power of the motor used. The value to be input is to be taken from the motor rating plate.

Adjustment range:	4 kW ... 250 kW
As supplied:	Select according to the inverter type.

Motor rated voltage

This parameter is used to set the motor rated supply voltage. The value corresponding to the selected circuit (star or delta) is to be taken from the motor rating plate.

Adjustment range:	220 V ... 690 V
As supplied:	380 V

Motor rated speed

This parameter is used to set the rated speed of the motor. The value is to be taken from the motor rating plate.

Adjustment range:	700 min ⁻¹ ... 24000 min ⁻¹
As supplied:	Value from the parameter set for the 4-pole standard asynchronous motor suitable for the type of inverter.

Important!

If synchronous speed of the motor is input as the rated speed, the motor will not start despite 1.5 x rated current and can be destroyed by overrating.

Motor rated frequency

Parameter for setting the motor rated frequency. Take the value from the motor rating plate.

Adjustment range: 50 Hz ... 300 Hz
As supplied: 50 Hz

Circuit type

Parameter for setting the circuit used on the motor winding.

Select list: - Star
 - Delta
As supplied: Star

Motor rated current

Parameter for setting the motor rated current.
The value corresponding to the circuit used (star or delta) is to be taken from the motor rating plate.

Adjustment range: 1 ... 1000 A
As supplied: Rated current of the largest standard asynchronous motor suitable for the inverter type.

cos Phi

Parameter for setting the rated cos-phi of the motor used, taken from the motor rating plate.

Adjustment range: 0.4 ... 0.99
As supplied: Value from the parameter set of the standard asynchronous motor suitable for the inverter type.

Trip torque / rated torque

Parameter for setting the ratio between M_k / M_N (trip torque / rated torque) for the motor used. If the exact value is not known (see motor list), the value suggested by the inverter is to be used.

Adjustment range: 1.8 ... 8
As supplied: Value from the parameter set of the standard asynchronous motor suitable for the inverter type.

M_{rated}/M_{stall}

Parameter to set the ratio between rated torque and stall torque. Since both values are different in their relationship to the field frequency, always set a higher value than the calculated value from the above parameter.

Adjustment range: 10 % ... 100 %
As supplied: 50 %

Number of lines

This parameter is used to set the number of lines (teeth) for the encoder used. It is only effective in the control structures "Speed control with encoder" and "Torque control with encoder". See also encoder interface in section 2.5.6.1 and notes on encoder connection in section 3.5.

Adjustment range: 0 ... 10000
As supplied 1000

Calibration mode

With this parameter (protection level 2) you can change from one structure to another to simplify calibration of the motor stator resistance "R-stator + R-cable". This calibration is not required for drives with low dynamic requirements.

Select list: - Yes
 - No
As supplied: No

Calibration:

If Calibration mode = Yes, the ramp speed controller and the II controller are disabled. The adjustment value of the Im control which serves as a criterion for calibration is output in the parameter "Calibrate to zero" (measurement point, zero calibration). The parameter "R-stator + R-cable" is adjusted analog to the output variable of the Im control until the adjustment value displayed is approx 0 (positive adjustment value → increase, or negative adjustment value → reduction in "R-stator + R-cable". If there should be problems on starting with the setting found in this way, the resistance is to be reduced by approx. 20 %. A more accurate but more time-consuming method of calibration is to determine the inverter voltage and the inverter current (according to the software display) by taking two measurements, whereby both pairs of values should differ by approx. 30 % due to the change in "R-stator + R-cable". The resistance according to Ohm's law is calculated from the differential voltage and the difference in the currents measured:

$$\text{"R-stator + R-cable"} = 0.5774 * (U1-U2) / (I1-I2)$$

Calibrate to 0

This parameter shows the value of the I_M controller adjustment value and serves for calibrating R-stator + R-cable of the motor used (see also the parameter "Calibration mode").

R-stator + R-cable

This parameter represents the line value of stator resistance for the asynchronous motor connected plus the resistance of the supply cables. It serves as a model for the replacement circuit diagram for preliminary control of the motor voltage and for adapting the controller parameters.
The value is calculated from the motor type data entered and can be optimised if required (see parameter "Calibration mode").

Adjustment range:	0 Ohm ... 100 Ohm
As supplied:	Value from the parameter set for the standard asynchronous motor suitable for the inverter type.

Fan Trigger

This parameter specifies the temperature threshold at which the fan(s) change(s) from the low to high speed.

Adjustment range:	0 ... 65 °C
As supplied:	55 °C

The parameter can only be changed in protection level 2.

4.4.7 Control parameters

Control structure

Parameter for setting the control structure.

The control structure can only be changed when the drive is at a standstill (pulses disabled).

Select list:	- Speed control without encoder - Speed control with encoder - Frequency control - Torque control without encoder - Torque control with encoder
As supplied:	Speed control without encoder

Speed control without encoder:

Speed control without an encoder is provided in this control structure. A pseudo speed actual value is used. Load-dependent frequency following occurs through a rotor model which calculates the slip frequency. Furthermore, load-dependent voltage following which is supported by the rotor and magnetising current controllers is also provided by preliminary control through a voltage model.

Speed control with encoder:

This control structure provides speed control with speed feedback. It uses a speed actual value which is detected by pulse encoders and the optional rotation encoder interface.

Load-dependent frequency following is produced by a rotor model which calculates the slip frequency. Furthermore, load-dependent voltage following supported by the rotor and magnetising current controllers is also provided by preliminary control through a voltage model.

The current limiter is activated when the current critical value monitor responds. An excessively steep acceleration ramp is extended by pauses in acceleration.

Frequency control:

In the frequency control structure the drive is controlled at its U/f characteristic.

Drive acceleration and braking are according to the ramp settings.

The pulses are disabled if the current critical value limiter responds when an acceleration ramp is set too steeply.

No load-dependent frequency and voltage following take place.

Suitable for operating:

- Low power asynchronous AC motors
- Multiple motor drives
- AC reluctance motors
- AC asynchronous motors
- All applications with a fixed frequency and voltage setting.

Torque control without encoder:

This control structure corresponds to that of speed control without encoder, whereby the speed controller is overdriven by the main demand preset. The additional demand controls the limits of the speed controller and therefore the load current demand (the rotor current control value) which in the constant flux range is proportional to torque. The parameters of the current limiter function determine the load current adjustment range.

Torque control with encoder:

This control structure corresponds to that of speed control with encoder, whereby the speed controller is overdriven by the main demand preset. The additional demand controls the limits of the speed controller and therefore the load current demand (the rotor current control value) which in the constant flux range is proportional to torque. The parameters of the current limiting function determine the load current adjustment range.

Speed control Kp

Parameter for adjusting the P gain of the speed controller.

Range: 0 ... 100 000
As supplied: 10

Speed Controller Tn

Parameter for adjusting the speed controller recovery time.

Range: 0 ... 10 000 s
As supplied: 80 ms

Or controller Kp ¹⁾

Parameter for setting the P gain of the flux orientation control. This parameter is set automatically according to the motor data entered but can be overwritten if required. A change on the "Type data" menu will initialise the parameter, i.e. the values entered are replaced.

Range: 0 ... 100 000
As supplied: (Calculated according to the type data)

¹⁾ Only accessible on protection level 1 and above.

Or control Tn ¹⁾

Parameter for adjusting the recovery time of the flux orientation control. This parameter is set automatically according to the motor data entered but can be overwritten if required.

A change on the "Type data" menu will initialise the parameter, i.e. the values input are replaced.

Range: 0 ... 10 000 s
As supplied: (Calculated according to the type data)

¹⁾ Only accessible on protection level 1 and above.

Flux control Kp ¹⁾

Parameter for setting the P gain of the flux control. This parameter is set automatically according to the motor data entered but can be overwritten if required.

A change on the "Type data" menu will initialise the parameter, i.e. the values entered are replaced.

Range: 0 ... 100 000
As supplied: 4

¹⁾ Only accessible on protection level 1 and above.

Flux control Tn ¹⁾

Parameter for setting the flux control recovery time. This parameter is set automatically according to the motor data entered but can be overwritten if required.

A change on the "Type data" menu will initialise the parameter, i.e. values entered are replaced.

Range: 0 ... 10 000 s
As supplied: (Calculated according to the type data)

¹⁾ Only accessible on protection level 1 and above.

4.4.8 Diagnosis

Error: First value

This parameter outputs the actual error which resulted in a 8230 frequency inverter error shut-down (the first error). This error is also written into the error log with the time details. The entry in the parameter "Error: First value" is deleted by the control command "Acknowledge".

Output event no.:

This parameter outputs the contents of one of the 32 items in the event log as a message. It is therefore possible to read out the logged events through the control unit.
The number entered (1 ... 32) corresponds to the relevant position in the event log whereby event no. 32 is the oldest entry and no. 1 is the most recent.
When the number is input, the corresponding event is transferred from the event log to the 8230 frequency inverter BDE control unit display with the timing details.

Output error no.:

This parameter outputs the contents of one of the 32 positions in the error log as a message. It is therefore possible to read out logged messages via the control unit.
The number entered (1 ... 32) corresponds to the relevant position in the error log, whereby error no. 32 is the oldest entry and no. 1 is the most recent.
When the number is input, the appropriate error is transferred from the error log to the 8230 frequency inverter BDE control unit display with the timing details.

4.4.9 Password

The "Access" menu controls authority to access the user interface. Three levels of protection are available to the operator:

- Level 0 - Always visible
- Level 1 - Protected
- Level 2 - Hidden

Level 0 is active as standard.

Levels 1 and 2 are accessed by entering the appropriate password (the password for level 1 or the password for level 2). The active level determines the range of parameters displayed and accessible. You can switch back to level "0" by entering "0" for the parameter "Protection level".

Protection level

Parameters for displaying and switching the active protection level.

Level 0
Level 0 is active without a password.

Additional parameters: - Standard parameters.

Level 1

Level 1 is activated by entering the correct password for level 1.

Accessible parameters: - Standard parameters
 - Protected parameters.

Level 2

Level 2 is activated by entering the correct password for level 2.

Accessible parameters: - Standard parameters
 - Protected parameters
 - Hidden parameters.

Password, Level 1

Parameter for entering the password for level 1.
When the password for level 1 specified under “New Password 1” is entered, the parameters of level 1 are displayed:

- Standard parameters
- Protected parameters.

New Password 1

This parameter is used for a new password for accessing level 1.

In the default setting, no password is specified.
Enable: Press ENTER twice

Changes

It is possible to inhibit all parameter changes (except for passwords) for all operator channels. This selection parameter is available as from protection level 1.

Select list: - Generally accessible
 - Generally not accessible
As supplied: Generally accessible.

Parameters can only be adjusted in the setting “Changes = Generally accessible”.
All parameter settings are frozen when this parameter is set to “Changes = Generally not accessible” and cannot be changed.

BDE: Changes

It is possible to inhibit all parameter changes (except for passwords) deliberately via the operating module. This selection parameter is available as from protection level 1.

Select list: - Enabled
 - Disabled
 As supplied: Enabled.

Parameters can only be adjusted through the control unit when this parameter is set to "BDE: Changes = Enabled". No parameters can be adjusted when this is set to "BDE: Changes = Disabled".

Password Level 2

Parameter for entering the password for level 2.
 When the correct password for level 2 is entered, the parameters of level 2 are displayed:

- Standard parameters
- Protected parameters
- Hidden parameters.

In the default setting, no password is specified.
 Enable: Press ENTER twice

New Password 2

This parameter specifies a new password for accessing level 2.

4.4.10 Language

In menu "10 = LANGUAGE SELECTION", the selection parameter „Language“ specifies the language of the language modules stored in the 8230 frequency inverter. All parameter and variable names and the texts in the event and fault memory are changed. Special national unit of variables such as temperature, are not changed.

Select list: - GERMAN
 - ENGLISH
 - FRENCH
 As supplied: GERMAN

All unit parameters and messages are displayed in English if "Language = ENGLISH".

5 Commissioning

5.1 Safety instructions for commissioning



The user must be familiar with handling the software (section 4) before commissioning the unit.

Electrical equipment represents a source of risk. The units described here carry dangerous voltages and control rotating mechanical parts. Death, severe physical injury and extensive material damage may result if these instructions are not followed.

Dangerous voltages of over 1000 V which can cause death or severe physical injury can occur during operation of these units. Extreme caution is essential when working on the unit. Please therefore note the following warnings.

Covers must remain installed during normal operation.

The conditions of VBG4 paragraph 2(2) must be observed for adjustment work during operation with the unit open.

Stand on an insulated mat (compliant with EGB) and ensure it is not earthed if you are carrying out commissioning work when the unit is switched on.

Do not use any technical equipment unless you are certain it is in perfect condition and undamaged. If an oscilloscope is used, it must be powered through an isolating transformer to prevent earth loops. The oscilloscope casing must be connected directly to the 8230 frequency inverter reference potential.

Test equipment such as oscilloscope probes, terminals etc. may only be fitted in the de-energised condition and taking potential compensation of electronics modules into consideration.

Correct implementation of the commissioning instructions on a step-by-step basis as stated in this manual will help prevent damage. Contact our Service Department if you require any further information.

Incorrect parameter adjustments and type data can damage the equipment and the complete drive. Set all parameters with extreme care and also note section 4.

Printed circuit boards and all plug connections may only be inserted or removed in the de-energised condition. This is the only way to avoid destruction of entire assemblies and risk to personnel.

Avoid touching any electronic modules. If this is not possible, discharge any static electricity immediately beforehand.

Static can be discharged by touching a conducting, earthed surface on the unit (eg. the zero bus or the ground point marked).

When working on the unit and motors it must be noted that motor cables may carry a voltage even if the pulses are disabled. 8230 frequency inverter must be disconnected from the mains supply for all work on motor cables and voltage levels must be checked first.

After isolating the 8230 frequency inverter from the mains supply it is important to note that the discharge time of the link capacitors can exceed one minute. Check the voltage before starting work..

If you are working on the machine or the motor feed cables, the main switch on the unit or the circuit breaker on the plant must be secured to prevent anyone from switching on again.

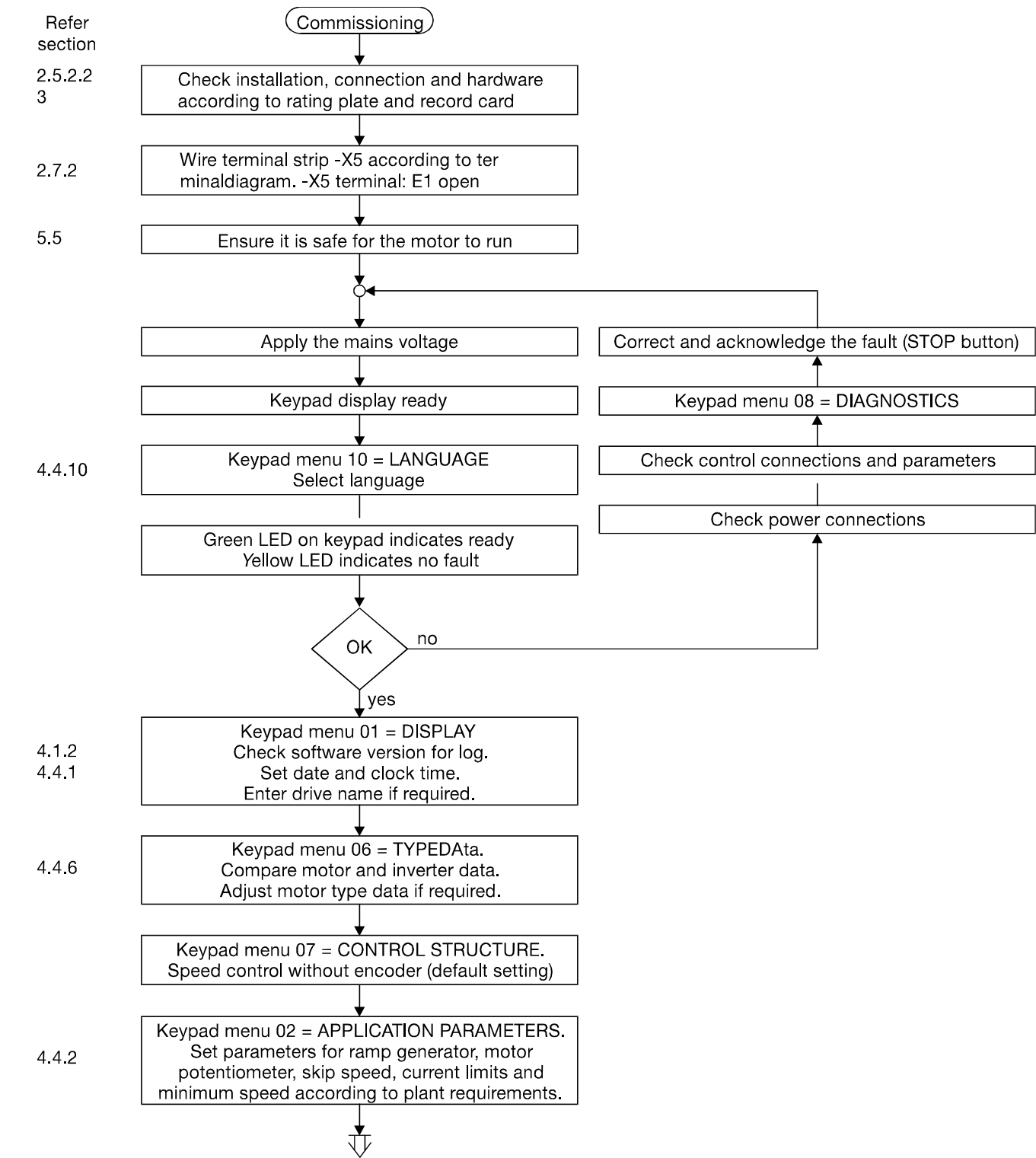
An mat compliant with EGB* must be used. This mat may not be earthed if commissioning work is being carried out with the unit switched on.

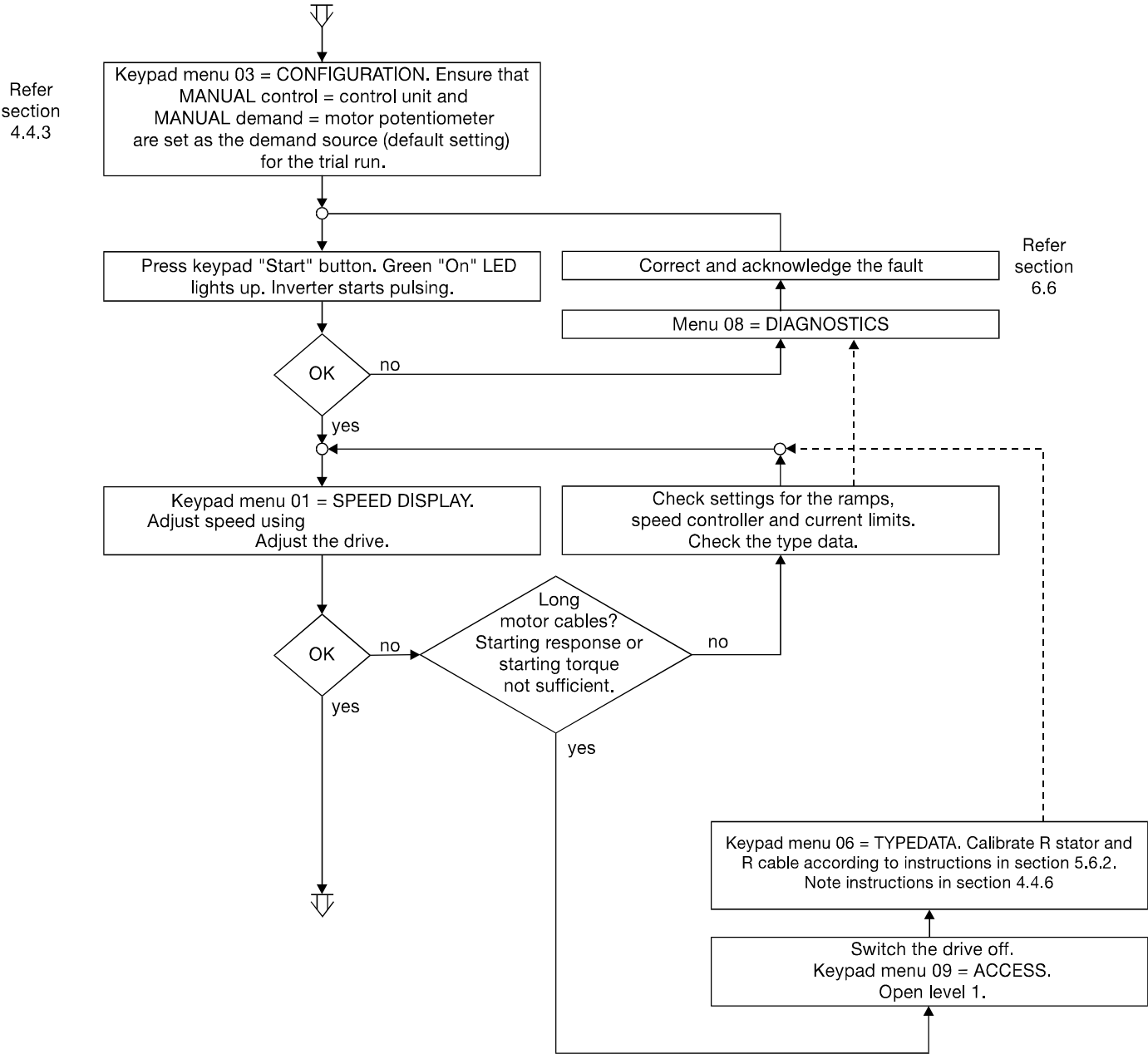
The general safety instructions on the second cover page and in section 3.1 must be observed.

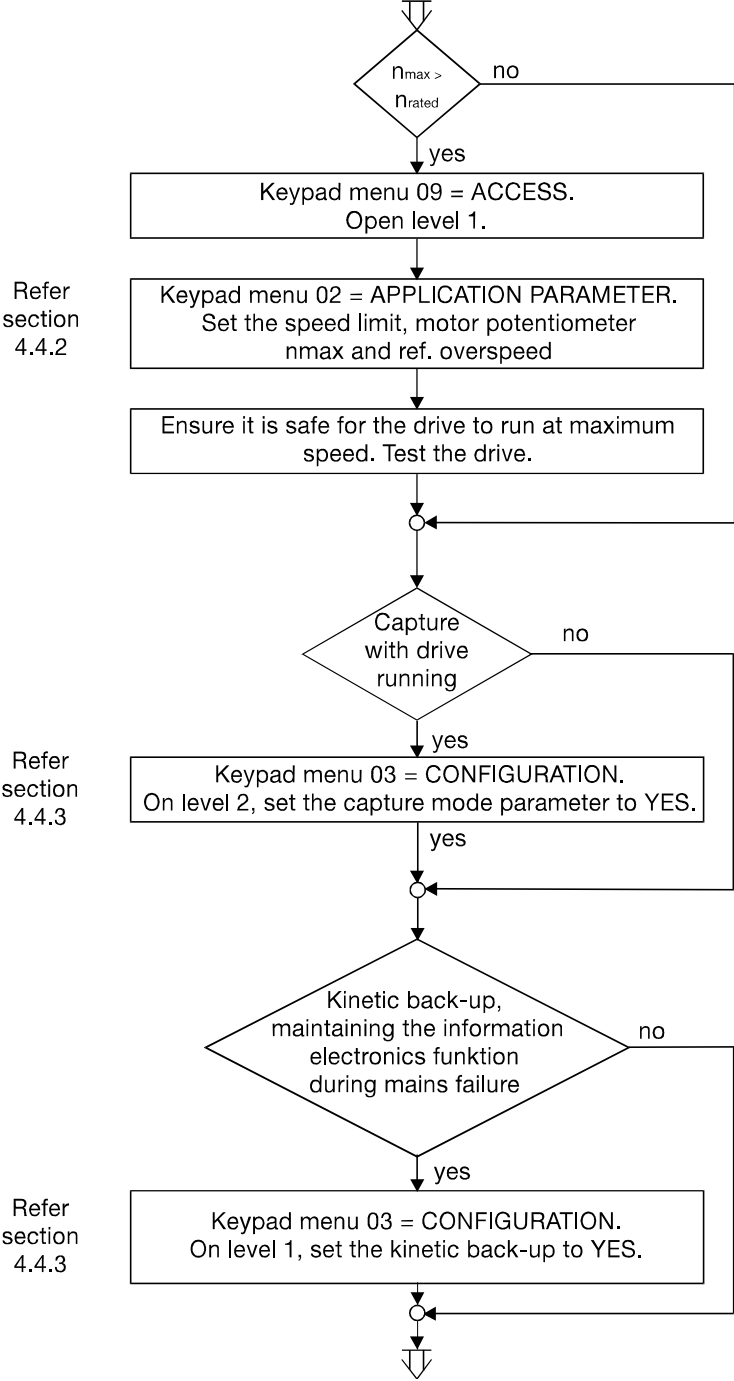
Check that the drive may run without endangering personnel and materials before switching on the mains supply. This must be ensured for the complete commissioning procedure.

* EGB: Components at risk through static electricity

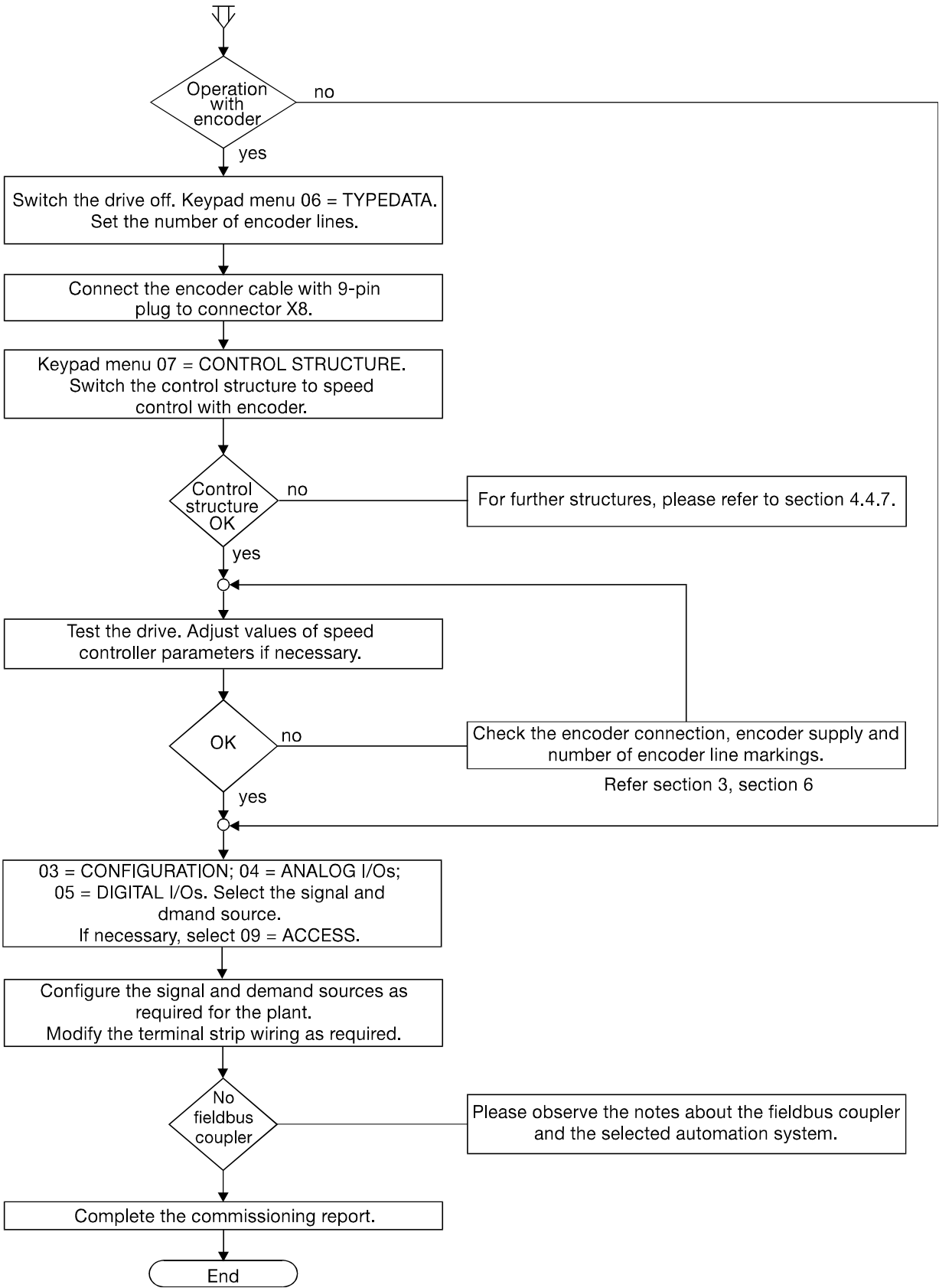
5.2 Commissioning sequence diagram, 8230 frequency inverter build-in unit







Refer
section
2.5.4.1



5.3 General

With the basic 8230 frequency inverter settings made in the factory the drive is ready for operation when the mains supply and the motor are connected and the 8230 frequency inverter can be operated using the BDE control unit. The terminal strip is wired for this method of control, see also section 2.7.2 Terminal wiring - Comments.

The operator must set the basic 8230 frequency inverter parameters for the actual data required according to section 5.6.2 onwards to match the 8230 frequency inverter to the mains supply, the motor and the plant.

Commissioning should therefore be effected in 3 stages:

1. Connecting the mains and motor

2. First commissioning using the BDE control unit

The existing mains data, motor data and type of load (squared or constant) are entered on the menu "06 Type data". Then the main user parameters such as minimum and maximum speed, acceleration and braking ramps are to be set. After checking or adjusting the motor potentiometer parameters the drive is then commissioned using the control unit.

3. Wiring the terminal strip

When the drive has run and the main drive data is set under section 2, the terminal strip is wired according to the requirements and the higher level control used.

This concludes basic commissioning.

5.4 Mains and motor connection

Connect the unit to the mains and motor according to section 2.7.1. First check whether the mains voltage lies within the 8230 frequency inverter rated voltage tolerances (380 V AC - 480 V AC).

Power and electronics cables must always be laid separately. The installation and connection instructions in section 3 must be observed. The connection cables must have the cross-sections stated in section 2. Fuses of class gL recommended in section 2 must be used to protect the power cables against overload. The semiconductor fuses and mains chokes to be used are listed in section 2. The mains chokes are included in the 8230 frequency inverter scope of supply and are supplied loose. The mains contactor, RFI filter, power dump and motor filters are options and are only required if necessary for the connection.

Standard motors or motors with equivalent insulation features can be connected to 8230 frequency inverters, if mains connecting voltage is $U_N \leq 460$ V. The standard motors 400 V ... 460 V are rated for rates of voltage rises and voltage peaks up to 1300 V. For other types, it may be necessary to ask the motor supplier whether the motors are suitable for inverter operation. Motor filters have to be used if the insulation strength of the motors and the maximum permissible voltage in the motor terminal box does not reach the required value of 1300 V and the permissible rate of voltage rise and winding insulation is < 3 kV/ μ s.

5.5 Commissioning Report

Drive:

Drive designation:

Type of drive:

Single motor driveMultiple motor drive

Speed adjustment range

ReversingField weakening
from Hz
from min⁻¹

Torque charakteristic:

M = const. M ~ n M ~ n²

M = f(n) as per enclosed charakteristicM and J based on motor shaft

M = f(t) as per load cycle diagram

Inertia moment:

J = kgm² Gear / ratio i =

Special operating conditions:

}

Mains supply:

TN Protection measures:

TT

IT

.....

RFI filter

Motor choke

Motor filter

Mains choke

Mains supply:

Direct, short circuit rating..... MVA

Rated voltage: 3AC V

50 Hz 60 Hz

Transformer, rating kVA
for mains voltage matching
Short circuit voltage. %

Motor connection:Cable length approx. m, Cabel type:

Code:		Lenze	Date	
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Motor:

Motor designation:

Suitability of the motor for inverter operation must be ensured by the purchaser.

Typ: Manufacturer: Motor-No.:

Mains operation: Rating = kW
 Rated voltage = V
 Rated current = A
 Trip torque/rated torque =
 Starting/rated current =
 cos • =
 Rated frequency = Hz
 Rated speed = min-1
 No. of pole pairs =
 c-/b-circuit a b a c
 Efficiency = %
 Insulation class

Inverter operation: Rating = kW
 Max. voltage = V
 Rated current = A
 Max. current = A
 Min. speed = min⁻¹
 Max. speed = min⁻¹
 Min. frequency = Hz
 Max. frequency = Hz
 field weakening from Hz

The motor data is required for 8230 frequency inverter adjustment.

Speed encoder:

Encoder designation: Number of strokes: Pulses per revolution

Type: Opti Fa. Esters Notes:
 POG9 D..... Fa. Hübner
 ROD..... Fa. Heidenhain

Supply voltage: DC 5 V DC 10 V DC 15 V DC 24 V
 mA mA mA mA

Incremental output signals: Spur 1 Spur 2 Spur Z
 Spur 1 Spur 2 Spur Z

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Inverter:

Inverter designation:

8230 frequency inverter Type: /

Rating: /

Rated current: A

Rated voltage:

Type of load: squared torque

current limit:

constant torque

Software version: V

Unit address: / /

Rating plate:

Lenze		Hans-Lenze-Strasse 1 D-31855 Aerzen Made in Germany	
Global Drive 8230			
Type			
Id.-No.			
Input			
Output			
Overload			
		Sach.-No.	
		Ser.-No.	

Dokuments: Product parts list:

Circuit diagram: 3

Data backup on Diskette:

Label:

Parameter set:par

Text file:txt

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Software:

Standard

.....

Standard setup:

Definition control structure:

Speed control with encoder

Speed control without encoder

Torque control with encoder

Torque control control without encoder

Frequency control

Functions:

AWE sec

kinetic back-up

capture mode

Display operating:

german

english

.....

Definition manual/automatic mode:

Manual /automatic control:

Control unit MBE

Terminal

Manual /automatic demands:

Motorpoti

Terminal :27/:28

Terminal :29/:30

Fixed demands

0...+10 V

0...+10 V

Fixed speed 1

-10 V...+10 V

-10 V...+10 V

Fixed speed 2a

4...20 mA

4...20 mA

Fixed speed 3

20...4 mA

20...4 mA

Fixed speed 4

.....

.....

.....

.....

Project design beyond standard scope:

no

yes:

Project description:

.....

.....

.....

.....

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Parameter setting

Object-Nr.	Parameter	Default setting	Unit	Value
01=DISPLAY				
2009	Drive Name			
206A	Date/Time			
02=Application Par.				
3225	Speed limit	1499.91	1/min	
3220	Ref. overspeed ¹⁾	1800	1/min	
4282	Crnt.lmt.max.mot.	144.4	%	
4283	Crnt.lmt.max.gen.	100.0	%	
4281	Crnt.lmt.nom.gen. ¹⁾	100.0	%	
4280	Crnt.lmt.nom.mot. ¹⁾	100.0	%	
3810	Ramp up	2000.0	ms	
3812	Ramp down	5000.0	ms	
3814	Ramp fast stop	500.0	ms	
3710	Motpot ramp up	10.000	s	
3711	Motpot ramp down	10.000	s	
3712	Motpot n-max	1499.9	1/min	
3713	Motpot n-min	0.0	1/min	
3204	Jogging speed	29.85	1/min	
3200	Fixed speed 1	149.97	1/min	
3201	Fixed speed 2	299.95	1/min	
3202	Fixed speed 3	449.92	1/min	
3203	Fixed speed 4	599.89	1/min	
3830	Skip speed 1	750.0	1/min	
3831	Skip band 1	0.0	1/min	
3832	Skip speed 2	1500.1	1/min	
3833	Skip band 2	0.0	1/min	
3834	Skip speed 3	2250.1	1/min	
3835	Skip band 3	0.0	1/min	
03=CONFIGURATION				
3103	Reaction OFF	Discharge dc link		
3107	Motpot reset	Reset at OFF		
3108	Lock monitor	Yes		
2069	Auto Restart Time	0.000 s		
3260	Manual - control	Control or Terminal		
3A80	Manual - demand	Motpot		
3261	AUTO - control	Terminal		
3A82	AUTO - demand	Motpot		
3105	MAN/AUTO c/over	At standstill		
3109	Invert:21/22	No		
4012	capture mode ²⁾	No		
	Direction drive	1		
3120	Kinetik support ¹⁾	No		
205D	Parameter Set Nr.	1		
205F	Copy Target: Set Nr. ²⁾	0		
3121	Term.ParSet chan.	Disabled		
439A	Puls frequency ²⁾	3	kHz	

¹⁾ Protection Level 1 ²⁾ Protection Level 2

Code:		Lenze	Date	
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Parameter setting

Object-Nr.	Parameter	Default setting	Unit	Value
04=ANALOG I/O's				
3240	Main demand. 27/28	0...10V/0...20mA		
3210	Max. main demand	100.00	%	
3211	Min. main demand	0.00	%	
3216	Zero range main ¹⁾	0.5	%	
3241	Add.demand 29/30	0...10V/0...20mA		
3218	Max. add demand	100.00	%	
3219	Min. add demand	0.00	%	
321A	Zero range add. d. ¹⁾	0.5	%	
310E	Main + add demand	No		
310A	4-20mA monitor	Trip		
3F00	A-output 1:33	Output frequency		
3F01	A-output 2:35	Motor current		
3F30	Skaling A-output 1	100.00	%	
3F31	Skaling A-output 2	100.00	%	
05=DIGITAL I/O's				
3250	D-input 1:14	Motpot up		
3251	D-input 2:15	Motpot down		
3252	D-input 3:16	Jogging		
3F05	D-Ausgang1 23/24	Speed = ref		
310D	Invert:23/24	No		
3223	Band speed = ref.	24.90	1/min	
3222	Band speed = zero	2.93	1/min	
3221	Reference speed	750.05	1/min	
3224	Ref. Load current	100.00	%	
06=RATINGS				
2211	Inverter-Type			
2222	Inverter currents ³⁾	Unit type dependent, not adjustable		
2212	Mains voltage	400	V	
2214	Type of load	squared torque		
2215	Break type	- ³⁾		
2281	Nom.motor power	- ⁴⁾	kW	
2284	Nom.motor voltage	380 ⁴⁾	V	
2288	Nom.motor speed	1460 ⁴⁾	1/min	
2287	Nom.motor frequ.	50 ⁴⁾	Hz	
2289	Star Delta	Stern ⁴⁾		
2283	Nom.motor current	- ⁴⁾	A	
2285	cos phi	0.85 ⁴⁾		
22C7	Motortype ³⁾	- ³⁾		
2286	Stall/Nom. torque	3.0 ⁴⁾		
2294	R-stator + R-cable ¹⁾	0.1924 ⁴⁾	Ohm	

¹⁾ Protection Level 1 ³⁾ Unit type dependent ⁴⁾ Motor type dependent

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Parameter settings

Object-Nr.	Parameter	Default setting	Unit	Value
07=CONTROL				
4010	Control structure	Speed ctr w. enc.		
4231	Speed contrl. Kp	10.000		
4233	Speed contrl. Tn	80.0	ms	
4221	Or-controller Kp ¹⁾	0.015		
4222	Or-controller Tn ¹⁾	12	ms	
4251	Flux controller Kp	4.000		
4252	Flux controller Tn	296.9	ms	
5130	t controller Kp	10.000		
5131	t controller Tn	500	ms	
08=DIAGNOSTICS				
210C	First Fault			
2111	Fault Nr.	No. No. No. No.		
2109	Event Nr.	No. No. No. No.		
09=PASSWORD				
2061	Protection Level	0		
2954	Changes ¹⁾	generelly enabled		
2058	MMI: Changes ¹⁾	enabled		
10=LANGUAGE SELECT				
2067	Language	ENGLISH		

¹⁾ Protection Lcecl 1

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5.6 First commissioning with the 8230 frequency inverter BDE control unit

Important!

As supplied, terminals :3 and :4 are bridged and terminals :5, :7, :8, :10, :11 and :12 are connected to +24 V (terminal 1). Thus the drive can be operated directly via the BDE control unit.

When the mains supply is switched on, the display on the control unit briefly shows the following information:

Lenze 8230
V 2.00

The green "Ready" LED on the control unit lights up to indicate the 8230 frequency inverter is ready. The display shows:

01 Output frequency
0.00 Hz

The language "GERMAN" as set in the factory is displayed.

It is not important if all 3 LEDs or just the yellow "Error" LED lights up briefly at this time. If the yellow "Error" LED remains on, the 8230 frequency inverter has detected an error. If the green "Ready" LED is not on, the unit is not ready for operation.

In this case the operator can use the keys on the main menu

08=DIAGNOSTICS

to obtain information about the drive status (first value, error, event).

5.6.1 Language Select

Communication with the 8230 frequency inverter through the control unit is possible in several languages. To set the language you require, switch the mains voltage on, press the menu (▲) key on the control unit once and use the key (▼) to select the main menu option "10=LANGUAGE SELECT".

10=LANGUAGE SELECT

Select the language required according to section 4.2.

10 Language
ENGLISH

5.6.2 Ratings

We will now enter the type data. This includes the mains voltage, the motor data and the load mode.

Select the main menu option 06 = RATINGS on the control unit.

06=RATINGS

The type data includes the following parameters:

- Rated inverter voltage ^{*)}
- Inverter kVA ^{*)}
- Mains voltage
- Break type
- Nom.Motor power
- Nom.Motor voltage
- Nom.Motor speed
- Nom.Motor frequency
- Type of circuit (Star/Delta)
- Nom.Motor current
- Cos Phi
- Motor type ^{*)}
- Stall torque/Rated torque
- Graduated number
- Adjust mode
- Adjust to 0
- R-stator + R-cable
- Fan Trigger

^{*)} Display only

The following parameters are to be set if they do not match the factory settings:

- **Mains voltage** with which the 8230 frequency inverter is to be operated.
- **Break type** The braking device permits electrical braking and prevents an excessive rise in the link voltage. The braking device takes effect at $U_D > 750\text{ V}$.

Setting - "Without":

This standard setting is used if no optional power dump (chopper) with a braking resistor is connected. In the speed control structure an excessive rise in the link voltage is prevented by the effect of the regenerative current limit.

In the U/f control structure the excessive rise in the link voltage must be prevented by suitable parameter settings for the braking ramps (braking ramp, ramp, fast stop, motor potentiometer ramp down).

Setting - "With":

This setting is used if the power dump (chopper) and a braking resistor are installed. This switches the optional braking resistor to the link circuit when a certain link voltage is reached. The overvoltage on the link determines the effect of the braking resistor.

Setting "DC with/without"

This setting is selected if a DC bus connection with several inverters (energy exchange) or an external brake chopper is used.

Rated motor data

The next parameters to be set are the rated motor data according to the motor rating plate. These include: Motor rated power, rated voltage, rated speed, rated frequency, circuit (star/delta), rated current, $\cos \phi$.

As the values for all standard motors are stored in software, the values for rated current, $\cos \phi$ and the ratio between trip torque and rated torque are inserted automatically. The values for a standard motor suitable for the inverter type used are selected. If no standard motor is used, the following parameters must be set by hand:

- Motor rated current, according to the circuit type (star or delta)
- $\cos \phi$
- Trip torque / rated torque. If M_k/M_N are not known, the default value, 3, is to be retained.

The motor is now ready for operation with these settings. It can be operated within the range of rated data using the control unit.

Adjust mode

The 8230 frequency inverter output voltage is preset in the calibration mode so that the magnetising current calculated from the type data flows even when the motor is at a standstill. This is achieved by matching the parameter R-stator + R-cable to the actual values of stator and cable resistance for the motor connected. The parameter R-stator + R-cable (object 2294) is calculated and entered automatically after the motor type data is input. The starting and operating characteristics of the asynchronous motor suitable for the inverter type are adequate in most cases with these settings. If the motor current is very much lower than the inverter rated current, the calculated value must be reduced (approximately according to the ratio between motor rated current and inverter rated current).

Calibration of R-stator + R-cable is then necessary if the starting characteristics are unsatisfactory and/or the motor cables used exceed 50 m in length. For long, screened motor cables > 200 m it may be favourable to select a lower than the corrected value because of the effective cable capacitance.

Calibration is activated under 06 = RATINGS by selecting the parameter:

06 Adjust mode
Yes

Press the **Enter** key (**↵**) and the **Up** key (**▲**) to set the parameter to Yes and confirm by pressing **Enter**(**↵**). When the unit responds, press the **Down** (**▼**) key to show the following display:

06 Adjust to 0
0.10 %

The display shows the adjustment value for the magnetising current control as a percentage. Switch the 8230 frequency inverter on using the **Start** key on the control unit. The **Run** LED is on, the display shows **positive values above 0.00 %**. Record the average value. Press the **Down** (**▼**) key to select parameter R-stator + R-cable. The display shows the stator resistance calculated with the type data, for example:

06 R-stator + R-cable
0.1484 Ω

Now increase the calculated resistance by approx. 25 %, confirm by pressing **Enter** (**↵**) and then check the adjustment value for the magnetising current control (06 = Adjust to 0). Increase the resistance in steps until the magnetising current adjustment value reaches a minimum which does not produce negative values. However, as only one parameter can be displayed at any one time, you must alternately select the parameters **“Calibrate to 0”** and **“R-stator + R-cable”**.

The following applies:

Measurement or adjustment value > 0	--->	Increase R-stator + R-cable
Measurement or adjustment value < 0	--->	Reduce R-stator + R-cable
Measurement or adjustment value ca. 0	--->	End calibration

After calibration, stop the drive by pressing **Stop** on the control unit and reset the **calibration mode parameter to No**. Otherwise the demand will remain disabled and the drive cannot run.

This completes the basic 8230 frequency inverter parameter adjustment. Other important parameter settings are described below.

5.6.3 Control structure

The next step is to select the "Control structure" parameter. This is located on the main menu under:



Possible settings for the control structure are as follows:

- Frequency control
- Speed control without encoder
- Speed control with (incremental) encoder
- Torque control without encoder (with higher level speed control)
- Torque control with (incremental) encoder and higher level speed control

5.6.4 Speed adjustment/ speed limit

The following parameters are determined as speed details regardless of the control structure selected. They are also to be adjusted, even for frequency control in rpm, and also apply to the torque control structure.

The speed limit (in rpm) indicates the maximum speed of the drive taking all additional demands into account. The corresponding maximum inverter output frequency is displayed automatically. This parameter is adjusted on the main menu under "02 = Application parameter".

The max. and min. speeds are also determined by the motor potentiometer parameter settings.

5.6.5 Field weakening

The following parameters under "02 = Application parameter" must be set for operation with field weakening:

- Increase the speed limit
- Increase the max. speed motor potentiometer
- Increase ref. overspeed

Protection level 1 must be selected for increasing the ref. overspeed parameter. This is possible on the main menu under "09 = Password".

5.6.6 Multiple motor operation
/Group supply

If two or more motors are always to be operated together on the 8230 frequency inverter with speed control, this group can be considered as a large motor with the correct type data settings (the total for all the motors connected) for rated current, rated voltage, rated speed and the power factor of the resultant machine in the structure speed regulation without encoder. In our experience the power factor should not be set to that of a comparably large motor. The trip torque/rated torque factor should be reduced.

In speed control without encoder the inverter output frequency is regulated according to the load and can assume values in excess of the type point frequency. If the power of the motors differs significantly or when a large number of small motors are used, the parameters can also be set for the frequency control structure as a pure characteristic control, neglecting the speed and current control characteristics. Speed instability may occur in this mode, especially with larger motors.

If motors of different power levels are connected and the parameters are set for the resulting total, small motors will inevitably be underexcited because they receive a smaller proportion of the compensation voltage due to the higher internal voltage drop.

If several asynchronous motors of the same rating are connected in a mechanically rigid coupling, speed regulation with encoder can be implemented, taking into account the possible slip difference in asynchronous motors. Depending on the mode of operation, the speed of the motors used and the load cycle a limit on the effect of the magnetising controller can positively affect the current control characteristics when operating at less than full load.

If the coupling is not rigid enough it is possible for the load to be distributed incorrectly. This can only be corrected by a better coupling or a load compensation control. At least one common output choke is to be used on group supplies. Motor cables must be limited in length so that the sum of the individual lengths lies within the maximum motor cable length stated for the 8230 frequency inverter. The connection instructions in section 3.5 apply accordingly.

The output choke is to be used on group supplies.

Suitable overcurrent protection facilities for pulse-shaped voltages are to be provided for the individual motors on group drives. A higher adjustment current must be taken into consideration for thermal overload protection with magnetic release. Overload protection facilities with an indirect release via a auxiliary contact are recommended.

The current limit set with the parameters is decisive for an overload in controlled operation, while the maximum permitted unit current can occur during frequency characteristic control.

Switching the motors in the speed control structure is possible if it is guaranteed that not more than 30 % of the motors used are switched off.

If the cable lengths stated are exceeded in large multiple motor systems one should first check whether motor connection cables can be grouped for most of their length and only branched off near the motors. As a second option the installation of output chokes with higher inductance should be examined.

5.6.7 Motor potentiometer function

As the drive is to be operated for basic commissioning using the motor potentiometer on the control unit, the speed or frequency limits (motor potentiometer n-max, motor potentiometer n-min), the acceleration time (motor potentiometer ramp up) and the braking time (motor potentiometer ramp down) are to be adjusted for the motor potentiometer function.

Switch the 8230 frequency inverter on by pressing the "Start" key on the control unit and run to maximum speed with the motor potentiometer (+ or - keys respectively) and then return to 0.

If overvoltage shut-downs should occur, eg. message "Overvoltage, link", extend the braking ramp for the motor potentiometer function and, if necessary, reduce the regenerative current limit.

The parameters required are located under "02 = Application parameters".

5.7 Terminal strip wiring

Operation of the 8230 frequency inverter and demand preset through the terminal strip is activated by switching from manual to automatic operation. For this, with the 8230 frequency inverter switched off, bridge terminals :6 and :1 (+24 V).

Wire the terminal strip according to the requirements involved in the plant. See also section 2.7.2.

Switch the 8230 frequency inverter on by applying the ON signal (terminal :5). Run the drive to maximum speed by increasing the demand signal. Check the braking ramps by suitable presets (Stop, Fast Stop) from medium speed and then from maximum speed. If necessary, extend the ramps (under "02 = Application parameters").

The following applies when using the main demand (terminal :27/:28):

$$10 \text{ V} = \text{max. speed} = \text{max. main demand (\%)} * \text{rated speed}$$

When operating with field weakening the parameter for maximum main demand must be increased to values above 100 %. This parameter is available on the main menu under "04 = Analog I/Os".

The speed limit and reference overspeed parameters must also be adjusted as required.

Switch the drive off by cancelling the ON signal.

The terminal strip for controlling the 8230 frequency inverter is located on the control board (-A10:X15). The terminal wiring is shown in Fig. 49.

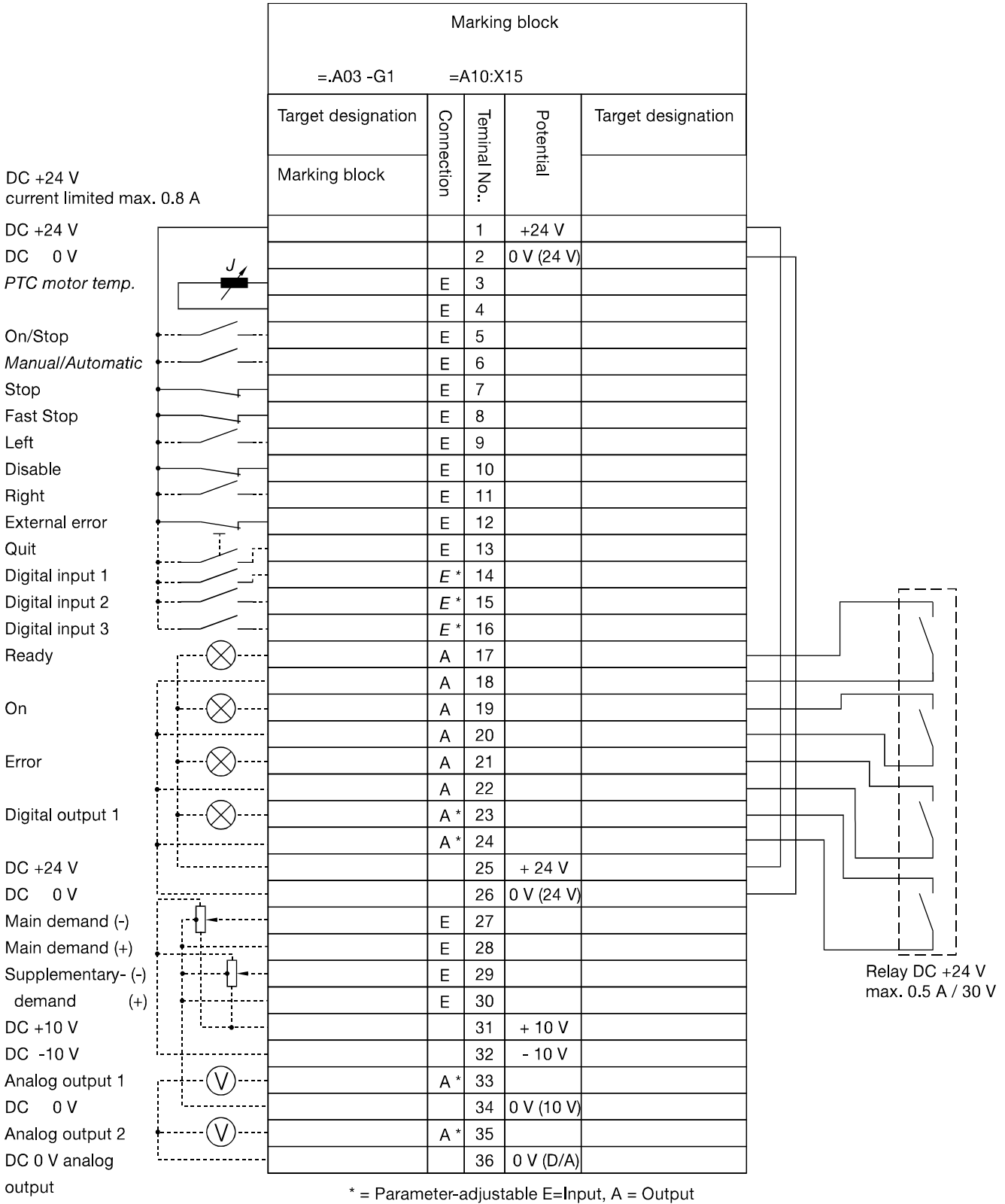


Fig. 49: Terminal strip wiring

5.8 Configuring the drive

See section 4.3

Select the menu "02 = Application parameters" and adjust the parameter required. When using fixed demands the digital inputs (terminals :14 and :15) are to be adjusted accordingly.

- Select the following main menu options consecutively:

03=CONFIGURATION
04=ANALOG I/O
05=DIGITAL I/O

and adjust accordingly.

Section 4.4 describes the meaning of these parameters.

5.9 Demand selection

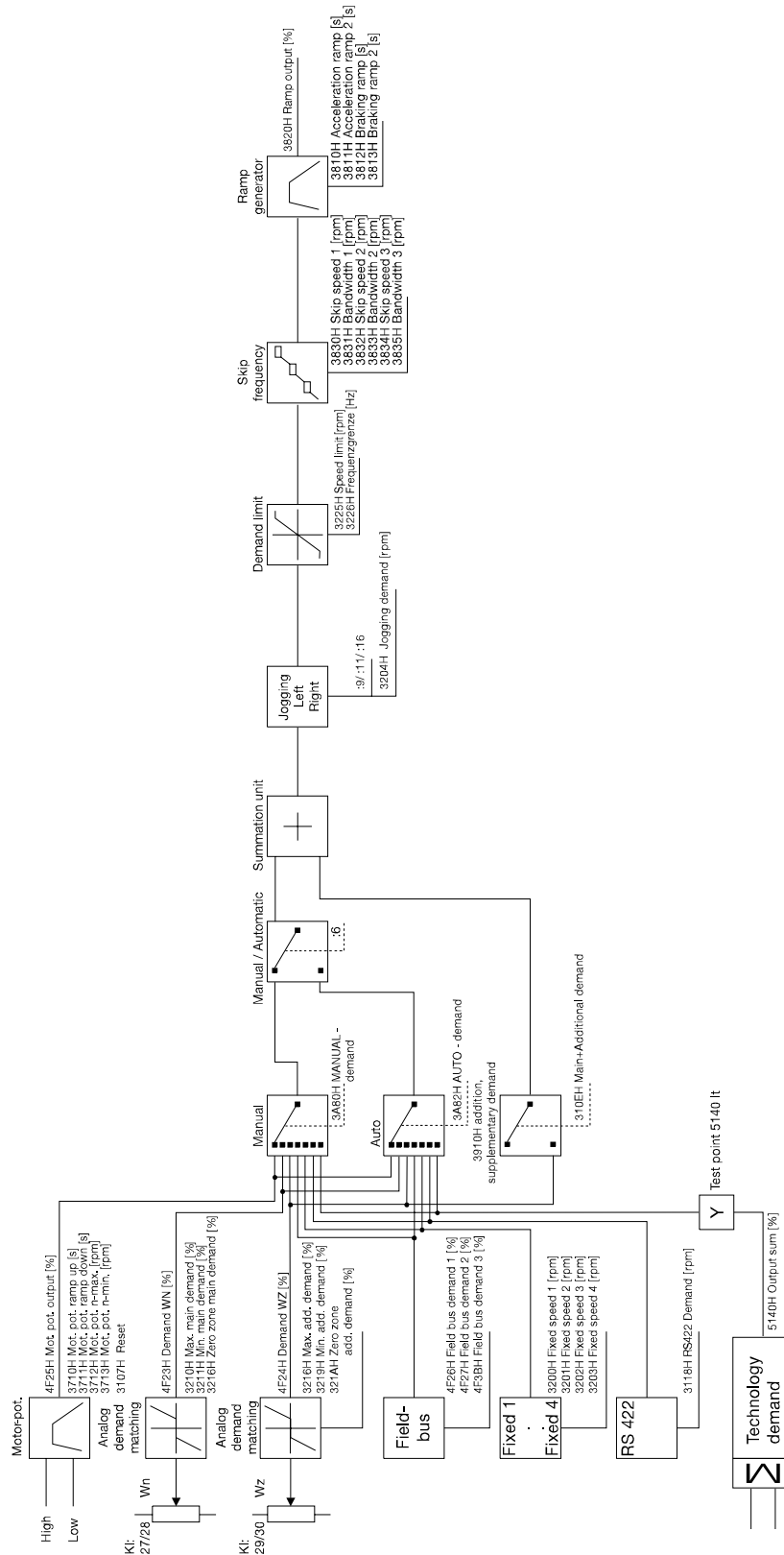


Fig. 50: Demand selection

5.10 Control structure

5.10.1 Frequency control

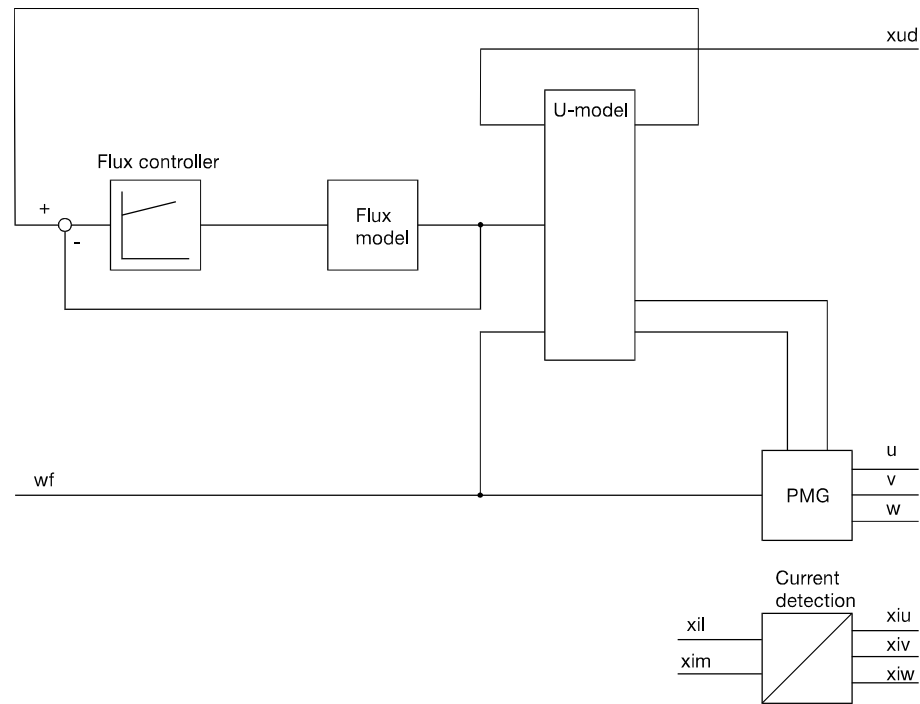


Fig. 51: Frequency control

5.10.2 Control without encoder

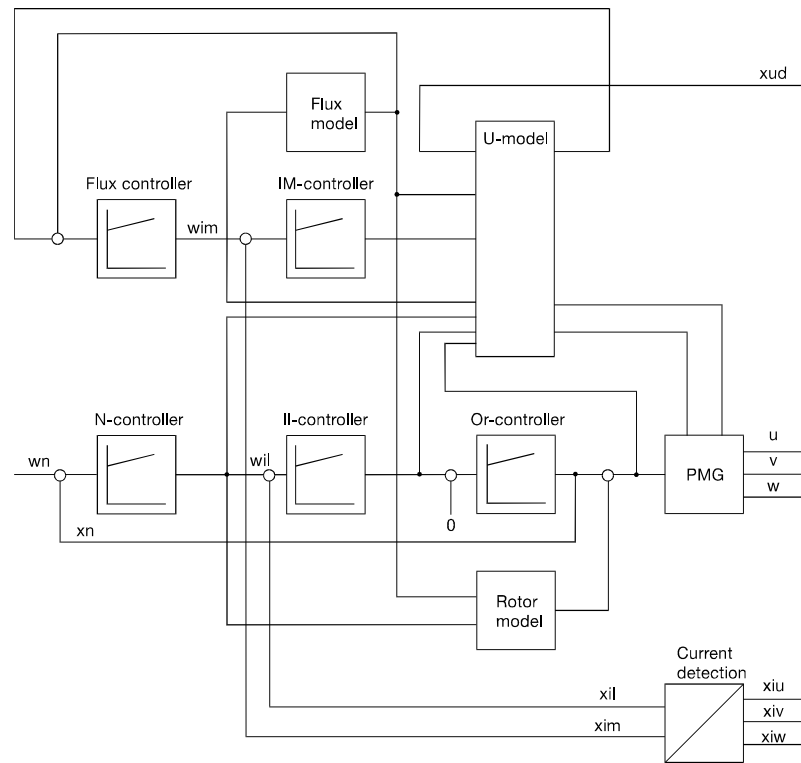


Fig. 52: Control without encoder

5.10.3 Control with encoder

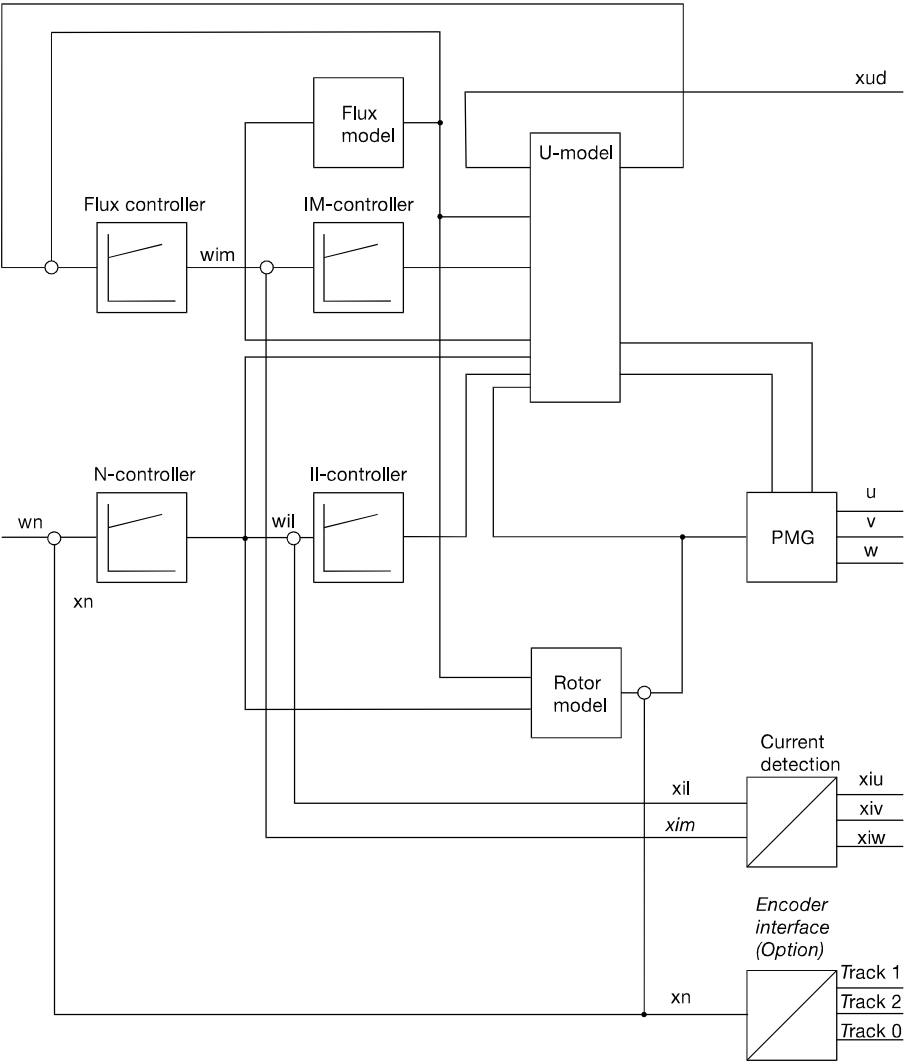


Fig. 53: Control with encoder

6 Help in the event of errors

6.1 First value log for error messages

The 8230 frequency inverter is protected by monitors. Events which do not put the unit directly at risk are recorded in an event log accessible on the extended menu. The extended menu is only accessible after entering the password. Errors which put the unit at risk are displayed on the basic menu under DIAGNOSIS → ERROR: _FIRSTVALUE.

6.2 Switching sequence on errors

As soon as an error occurs, the 8230 frequency inverter switches off the output current and de-energises the internal DC contactor. The “Error” LED and the output terminal :21/:22 “Error” are switched on, the “On” LED and the output terminal :19/:20 “On” are switched off.

The error message cannot be acknowledged as long as the cause of the error persists. If the cause is no longer evident or present, the LEDs and the output at terminal :17/:18 “Ready” are switched on. The error message can be acknowledged at the input terminal :19 with “Acknowledge”. The first value log is then erased and the LEDs and the output terminal :21/:22 “Error” are switched off.

6.3 Event log

The event log records each change in the status of the control (errors, events, inputs) with the time (hours, minutes, seconds, milliseconds). Events are recorded in the event log until the first value reaches memory location 15. Thus, in addition to the event which triggered the occurrence also the prior history and possible subsequent errors are recorded in the log. The event log has 32 memory locations where the last 32 events are stored. When more events occur, the oldest event is erased from the log.

The contents of the event log can be examined by entering the event number on the menu
08 DIAGNOSIS → OUTPUT EVENT NO:

Memory locations in the event log are counted through from 1 to 32. Location 32 contains the most recent event and location 1 contains the oldest.

6.4 Events

Events do not necessarily cause the inverter to be shut down but are recorded in the event log to provide information about the history of the error. The log shows whether an event is active [+] or inactive [-].

Event summary:

ON	STOP
LEFT	RIGHT
ACKNOWLEDGE	D_INPUT 1
D_INPUT 2	D_INPUT 3
AUTOMATIC	FAST-STOP
DISABLE	EXTERNAL ERROR
Phase failure	Mains failure
Heatsink overtemperature	Wire break 4-20 mA
AUTO RESTART AWE	DC link undervoltage
Failure, Track A	Failure, Track B

ON

The ON signal from the source selected by a manual/automatic changeover has changed. See terminal :5 for the ON signal function.

STOP

The STOP signal from the source selected by a manual/automatic changeover has changed. See terminal :7 for the STOP signal function.

LEFT

The LEFT signal from the source selected by a manual/automatic changeover has changed. See terminal :9 for the LEFT signal function.

RIGHT

The RIGHT signal from the source selected by a manual/automatic changeover has changed. See terminal :11 for the RIGHT signal function.

ACKNOWLEDGE

The ACKNOWLEDGE signal from the source selected by a manual/automatic changeover has changed. See terminal :13 for the acknowledge signal function.

D-INPUT 1

The level at D-Input 1 terminal :14 has changed. See function description.

D-INPUT 2

The level at D-Input 2 terminal :15 has changed. See function description.

D-INPUT 3

The level at D-Input 3 terminal :16 has changed. See function description.

AUTOMATIC

Manual/automatic changeover at terminal :6 was activated.

FAST-STOP

The level at terminal :6 has changed. See function description.

DISABLE

The level at terminal :10 has changed. See function description.

External error

Cause: The level at terminal :12 became LOW.
Remedy: If you have created an external fault chain at this terminal, check the releases involved. Check the terminal strip wiring.

Phase failure

The rectified mains voltage fell below 70 %. A phase failure during operation will not cause the inverter to shut down. If the link voltage is reduced by the load on the drive, a shut-down can occur due to "DC link undervoltage".
If the inverter is not in operation, it cannot be switched on if a phase has failed.

Mains failure

The rectified mains voltage fell below 70 % for more than 50 s. This event is recorded in the event log but does not have any other effect on operation of the inverter.

Heatsink overtemperature

Cause: The NTC for monitoring heatsink temperature registered that the temperature was too high. A warning is generated 5 °C before the error is triggered and this is also entered in the event log.

Remedy:
Check operation of the fan. Check the wiring of the fan and the NTC.

Wire break 4-20mA

Cause: One of the analog demand inputs, main demand :27/:28 or additional demand :29/:30, is set as the line current interface 4...20 mA and a current of less than 2 mA is flowing.

Remedy:
Check the wiring. The monitor can be disabled with the parameter "4-20mA monitor". Then the event is only recorded in the event log.

AUTO RESTART (AWE)

When the mains supply returns, the AWE auto restart facility becomes active. The inverter can also be switched on automatically by the auto restart facility without a change in the level of the ON signal. The function is activated with the AWE time parameter.

DC link undervoltage

The voltage on the link fell below a minimum value so that operation was no longer possible. Shut-down without an error trigger occurred, i.e. no entry in the error log and no need for acknowledgement.

Failure, Track A

Track A on the incremental encoder failed. A warning was generated. An error shut-down only occurs when both tracks fail, as the encoder interface is able to compensate for failure of one track as long as the direction does not change.

Failure, Track B

Track B on the incremental encoder failed. A warning was generated. An error shut-down only occurs when both tracks fail since the encoder interface is able to compensate for failure of one track as long as the direction does not change.

6.5 Error log

Errors basically cause the unit to shut down. Pulses are disabled immediately and the main contactor (DC) is de-energised. When the error is corrected, the unit can only be restarted after an acknowledgement is given. For this, if the AWE auto restart facility is not switched on, a positive flank is required at terminal :5 "ON", i.e. by pressing the ON switch.

Each error is recorded in the error log with the time (hours, minutes, seconds, milliseconds). Max. 32 errors are recorded in the log. If further errors occur, the oldest error in each case is erased.

The contents of the error log can be examined by entering the error number on the menu

08 DIAGNOSTICS • OUTPUT ERROR NO:

The memory locations in the error log are counted through from 1 to 32. Location 32 contains the most recent error and location 1 contains the oldest.

6.6 Errors

Errors cause the inverter to shut down and must be acknowledged.

Summary of errors:

Drive blocked	Charging not successful
Field bus failure	Encoder failure
Wire break 4-20mA	Earth fault
External error	DC contactor energised
Short circuit	Short circuit 24V
Short circuit UCE	Plug fault
Overload >60 s	Overspeed
DC link overvoltage	Link overvoltage
Overcurrent	Heatsink overtemperature
Motor overtemperature	UCE power dump

Drive blocked

Cause: If the speed control is at its limit for 2 s and the speed actual value is zero, this error is triggered.

Remedy: Check whether the drive is blocked or is heavy to start. Check the current limit settings responsible for limiting the speed control.

Note:

The monitor can be disabled with the parameter "Blocking monitor". This can be necessary if you want to apply torque at a standstill in the torque control structure.

Charging not successful

Cause: Link charging was interrupted because the voltage required on the link was not reached within the specified time. Monitoring is in two stages: 40 V must be exceeded 100 ms after starting charging and 470 V must be reached 3 s after starting charging.

Remedy:

Check the mains fuses and phase voltages. A phase could have failed. Perhaps the inverter was stored for too long and the link capacitors require re-forming.

Encoder failure

Cause: The encoder interface detected failure of both track signals for the incremental encoder.

Remedy: Check the encoder interface wiring

Note:

The message "Encoder failure" also appears after changing the control structure to "Operation with encoder". To correct this error, switch the supply voltage off and on again.

Wire break 4-20mA

Cause: One of the analog demand inputs, main demand :27/:28 or additional demand :29/:30, is set as the line current interface 4..20 mA and a current of less than 2 mA is flowing.

Remedy:

Check the wiring. The monitor can be disabled with the parameter "4-20 mA monitor". The event is then only recorded in the event log.

Earth fault

Cause: The sum of the momentary values of the three output currents is not zero.

Remedy:

Check the supply cables and the motor itself for an earth fault. In multiple motor drives with long parallel cables the trigger may respond.

External error

Cause: The level at terminal :12 became LOW.

Remedy:

If you have created an external fault chain at this terminal, check the relevant releases. Check the terminal strip wiring.

Short circuit

Cause: The momentary value of a phase current reached more than 3.1 times the effective inverter rated current. A hardware trigger reported this.

Remedy:

Check the wiring of the inverter and the motor. Check the inverter and motor data were entered correctly.

Short circuit 24V

Cause: The power supply for external wiring at the terminal strip is overloaded or short-circuited.

Remedy:

Check the wiring at the terminal strip.

Short circuit UCE

Cause: The monitor on one of the pulse amplifiers in the inverter detected that the collector/emitter voltage of the relevant IGBT became excessively high while conducting. This indicates a short circuit in the power stack or a defective pulse amplifier.
Remedy: Contact the Service Department.

Plug fault

Cause: The signal chain through all plugs on the printed circuit boards is interrupted.
Remedy:
Check the printed circuit board wiring.

Overload > 60s

Cause: The inverter current in the "frequency control" structure exceeded the rated current of the inverter for 60 s. As the current limiter is not effective in the frequency control structure, a shut-down was required.
Remedy:
Check the inverter and motor data settings. Check the continuous load and the load cycle for the drive.

Overspeed

Cause: The actual speed value is greater than the maximum value setting.
Remedy:
The maximum value is set with the parameter "Ref. overspeed". Increase this value.

Note:

Speed controller overshooting can trigger this error. Allow an adequate margin from the required maximum speed.

DC link overvoltage

Cause: The link voltage became excessively high. A hardware trigger stage detected this.
Remedy:
If no braking device (chopper) is fitted:
a) Check the "mains voltage" parameter
b) Was the rated motor data input correctly and was calibration completed?
c) Increase the time of the "braking ramp".

If a braking device is fitted:

Check whether the braking resistor is of the correct rating and is connected correctly.

Link overvoltage

Cause: The link voltage became too high. A software trigger stage detected this.

Remedy:

If no braking device (chopper) is fitted:

- a) Check the "mains voltage" parameter
- b) Was the rated motor data entered correctly and was calibration completed?
- c) Increase the time of the "braking ramp".

If a braking device is fitted:

Check whether the braking resistor is of the correct rating and is connected correctly.

Overcurrent

Cause: The momentary value of a phase current reached more than 2.7 times the effective inverter rated current several times consecutively. A hardware trigger detected this.

Remedy:

Check the wiring of the inverter and the motor. Check the inverter and motor data were entered correctly.

Heatsink overtemperature

Cause: The NTC for monitoring the heatsink temperature reported an excessive temperature. A warning is generated at 5 °C before the trigger point and is also entered in the event log.

Remedy: Check operation of the fan. Check the wiring of the fan and the NTC.

Motor overtemperature

Cause: The PTC for monitoring the motor temperature at terminal :3 / :4 became high impedance (> 2.4 kΩ).

Remedy:

Check the inverter and motor data as entered. Check the load cycle of your drive. Check the wiring and the connection for the motor thermistor.

UCE power dump

Cause: The monitor on the chopper pulse amplifier detected that the collector emitter voltage of the relevant IGBT became too high while conducting. This indicates a short circuit or a defective pulse amplifier.

Remedy:

Check the resistor wiring and value.

7 Maintenance

7.1 Battery for RAM and clock

The lithium battery G4 mounted on control board A10 in the 8230 frequency inverter is provided to operate the clock and the RAM when the supply voltage is off. If the operating voltage or the supply to the electronics is off for a long period, the battery will become exhausted.
With longer interruptions, of more than 5 months with the supply voltage or the supply to the control electronics switched off, the battery must be replaced every 18 months. With a duty cycle of >60 % and a continuous supply to the control electronics the battery is to be replaced every 4 years.

7.1.1 Battery change

Switch off the supply voltage or the supply to the control electronics before changing the battery and remove the battery plug X13. Do not switch the control electronics on yet. Remove the battery from its holder and fit the new battery. While the battery is being replaced the information is retained in a buffer powered by contactors. This buffer period must be less than 60 minutes. Record the replacement date on the new battery and below the unit rating plate.

7.1.2 Technical data of battery

Ref. No.:	029.131 768
Type:	Lithium primary cell, Mignon casing
Rated voltage:	3.5 V
Capacity:	1800 mAh
Dimensions:	Ø 14,7 x 52 mm
Disposal:	As special waste material or return to manufacturer
Storage capacity:	Typically 10 years
Storage and operating temperature:	- 55 °C to + 70 °C

7.2 Fans

To maintain 8230 frequency inverter availability the fans should be replaced at the latest after 40,000 hours operation. Contact Lenze for new fans.

The ventilation slots on the 8230 frequency inverter may become blocked if the cooling air is dirty. They are to be checked at regular intervals, particularly when through-mounting is used, and must be cleaned if necessary.

7.3 Power connections

The screw connections for the mains and motor power cables should be tightened at the specified torque levels at regular intervals, max. after 40,000 operating hours. Terminal and plug connections inside the unit are also to be inspected at the above intervals. The connections are to be secured if they are not seated correctly.

7.4 Reforming the link capacitors

The high quality aluminium electrolytic capacitors installed in the 8230 frequency inverter must be reformed before the 8230 frequency inverter is switched on after a longer period of storage with the power disconnected. Reforming is required for reconstructing the insulating layers. The storage temperature is very important for determining when reforming is necessary. If the storage temperature is exceeded during storage with the power disconnected, reforming with a limited current must be carried out before rated voltage is applied to the inverter, as otherwise the capacitors may be damaged and availability of the unit will be limited.

Storage time without reforming: 2 years
Of that, max. 5 months at a storage temperature of $\vartheta > 40\text{ °C}$ up to max. 65 °C

Important !

Reforming is required after 9 months when storing at temperatures over 55 °C up to max. 65 °C with the power disconnected.

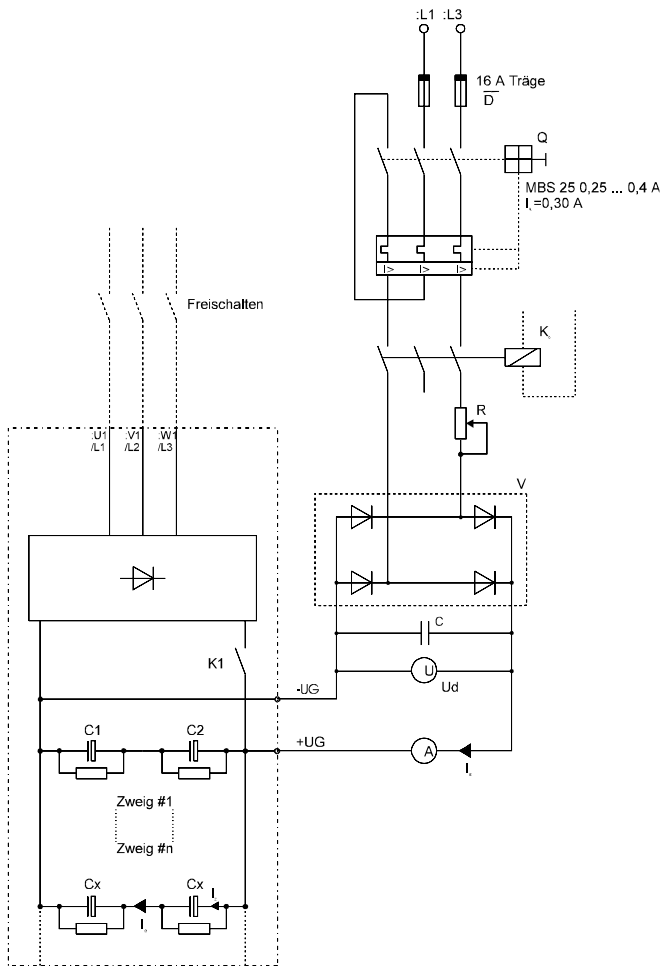


Fig. 54: Circuit for reforming link capacitors

Proposed dimensions for 380 ... 480 V:

C	R	V	Q
1µF/1600 V	1000 Ω/600 W	Isopack DDB2U15N 1600 V/12 A	MBS 25 0.25 ... 0.40 A

Reforming

- 1. Protect the supply and any auxiliary supply so that it cannot be switched on.
- 2. Construct the circuit according to Fig. 54 and set R to maximum resistance. Switch on Q and operate K₀
- 3. Measure the current I_E
- 4. If I_E < 3 * I₀ from Table 26, R is to be reduced until I_E > 3 * I₀
- 5. Wait until I_E < I₀
- 6. Set I_E > 3 * I₀ and return to section 5
- 7. End the reforming process.

Note:

Depending on the condition of the capacitors reforming may take several minutes and should be carried out while carefully observing the input current I_E.

8230 frequency inverter Type	No. of legs	n * I _Z [mA]	I ₀ [mA]	3 * I ₀ [mA]
8231	5	75	95	285
8232	6	90	110	330
8233	7	105	130	390
8234	8	120	150	450

Table 26: Guideline values for currents with a reformed link

Declaration of Conformity AAS-KE 001/9.95

Product description: This declaration of conformity relates to pulse-controlled inverters of the type serie

8230 frequency inverter

The above-described product is in conformity with the requirements laid down in the following European guidelines:

Number: 73 / 23 / EWG (EEC)

Text: Directive of the Council for the harmonization of legal provisions of the member states
concerning electrical equipment for use within defined voltage limits
- Low Voltage Directive -

The appendix contains further information concerning the compliance with this directive.

CE marking in: 1995

Issued by: AAS/E41 Mr. Beinhold
AAS/Q Mr. Bach