L-force catalogue

Automation systems
Drive solutions

Controls
Inverter
Motors
Gearboxes
Engineering Tools

Inverter: Inverter Drives 8400 protec, Inverter Drives 8400 motec

Lenze

Contents of the L-force catalogue

Selected portfolio

Additional portfolio

Lenze makes many things easy for you.

With our motivated and committed approach, we work together with you to create the best possible solution and set your ideas in motion - whether you are looking to optimise an existing machine or develop a new one. We always strive to make things easy and seek perfection therein. This is anchored in our thinking, in our services and in every detail of our products.

1

Developing ideas

Are you looking to build the best machine possible and already have some initial ideas? Then get these down on paper together with us, starting with small innovative details and stretching all the way to completely new machines. Working together, we will develop an intelligent and sustainable concept that is perfectly aligned with your specific requirements.

2

Drafting concepts

We see welcome challenges in your machine tasks, supporting you with our comprehensive expertise and providing valuable impetus for your innovations. We take a holistic view of the individual motion and control functions here and draw up consistent, end-to-end drive and automation solutions for you - keeping everything as easy as possible and as extensive as necessary.

3

Implementing solutions

Our easy formula for satisfied customers is to establish an active partnership with fast decision making processes and an individually tailored offer. We have been using this principle to meet the ever more specialised customer requirements in the field of machine engineering for many years.

4

Manufacturing machines

Functional diversity in perfect harmony: as one of the few full-range providers in the market, we can provide you with precisely those products that you actually need for any machine task – no more and no less. Our L-force product portfolio, a consistent platform for implementing drive and automation tasks, is invaluable in this regard.

5

Ensuring productivity

Productivity, reliability and new performance peaks on a daily basis – these are our key success factors for your machine. After delivery, we offer you cleverly devised service concepts to ensure continued safe operation. The primary focus here is on technical support, based on the excellent application expertise of our highly-skilled and knowledgeable after-sales team.

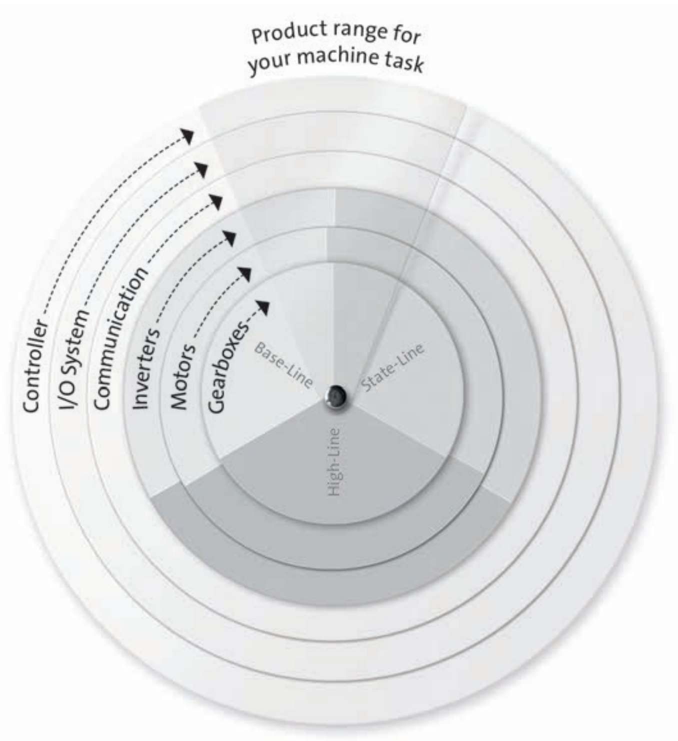
A matter of principle: the right products for every application.

Lenze's extensive L-force product portfolio follows a very simple principle. The functions of our finely scaled products are assigned to the three lines Base-Line, State-Line or High-Line.

But what does this mean for you? It allows you to quickly recognise which products represent the best solution for your own specific requirements.

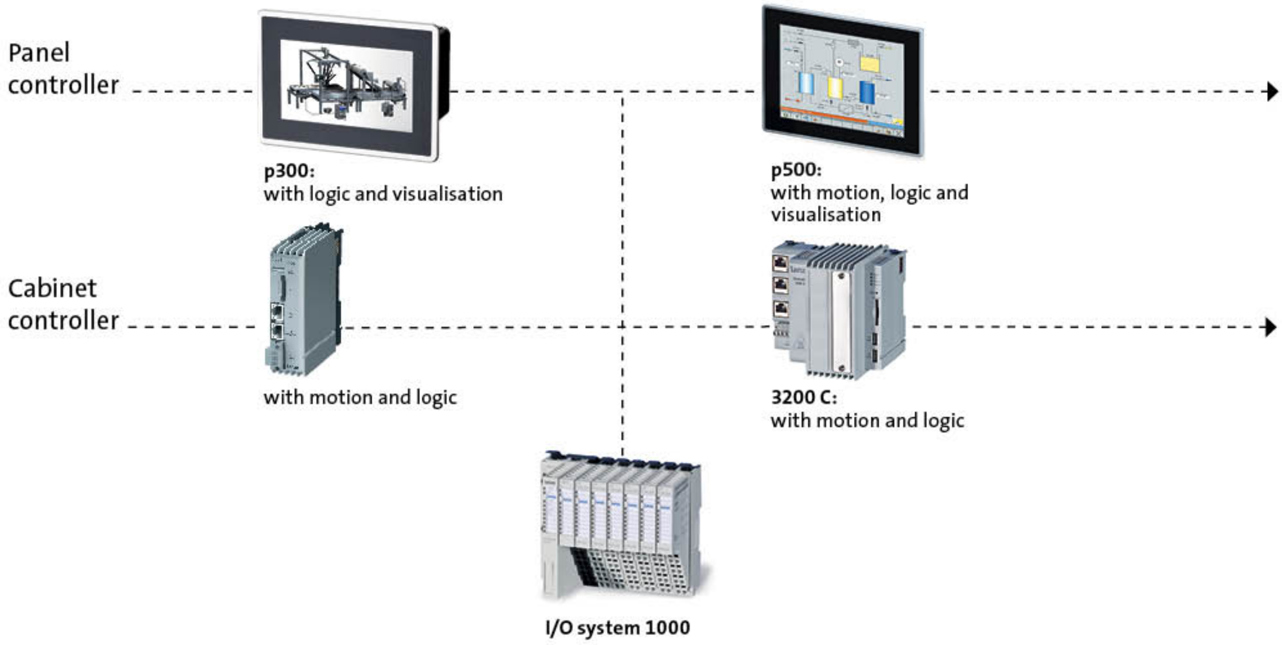
Powerful products with a major impact:
- Easy handling
- High quality and durability
- Reliable technologies in tune with the latest developments

Lenze products undergo the most stringent testing in our own laboratory. This allows us to ensure that you will receive consistently high quality and a long service life. In addition to this, five logistics centres ensure that the Lenze products you select are available for quick delivery anywhere across the globe.

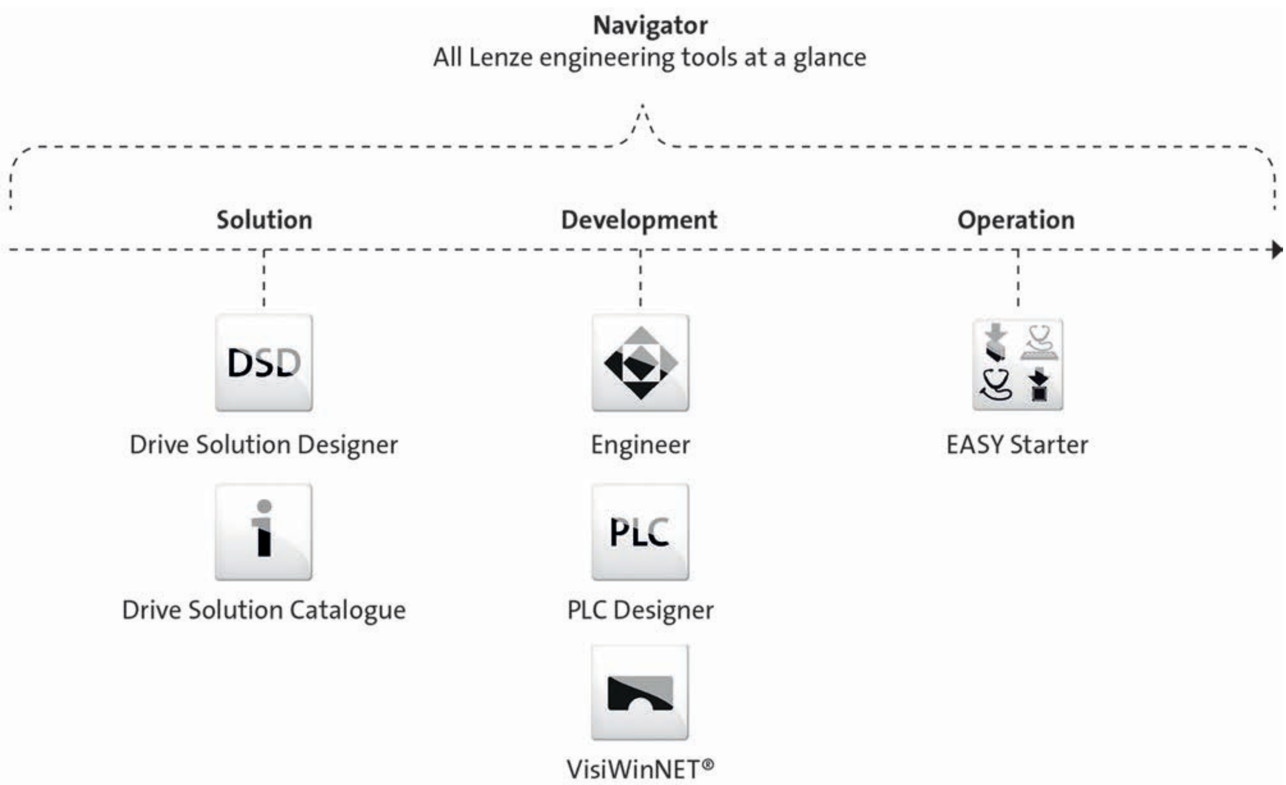


L-force product portfolio

Controls

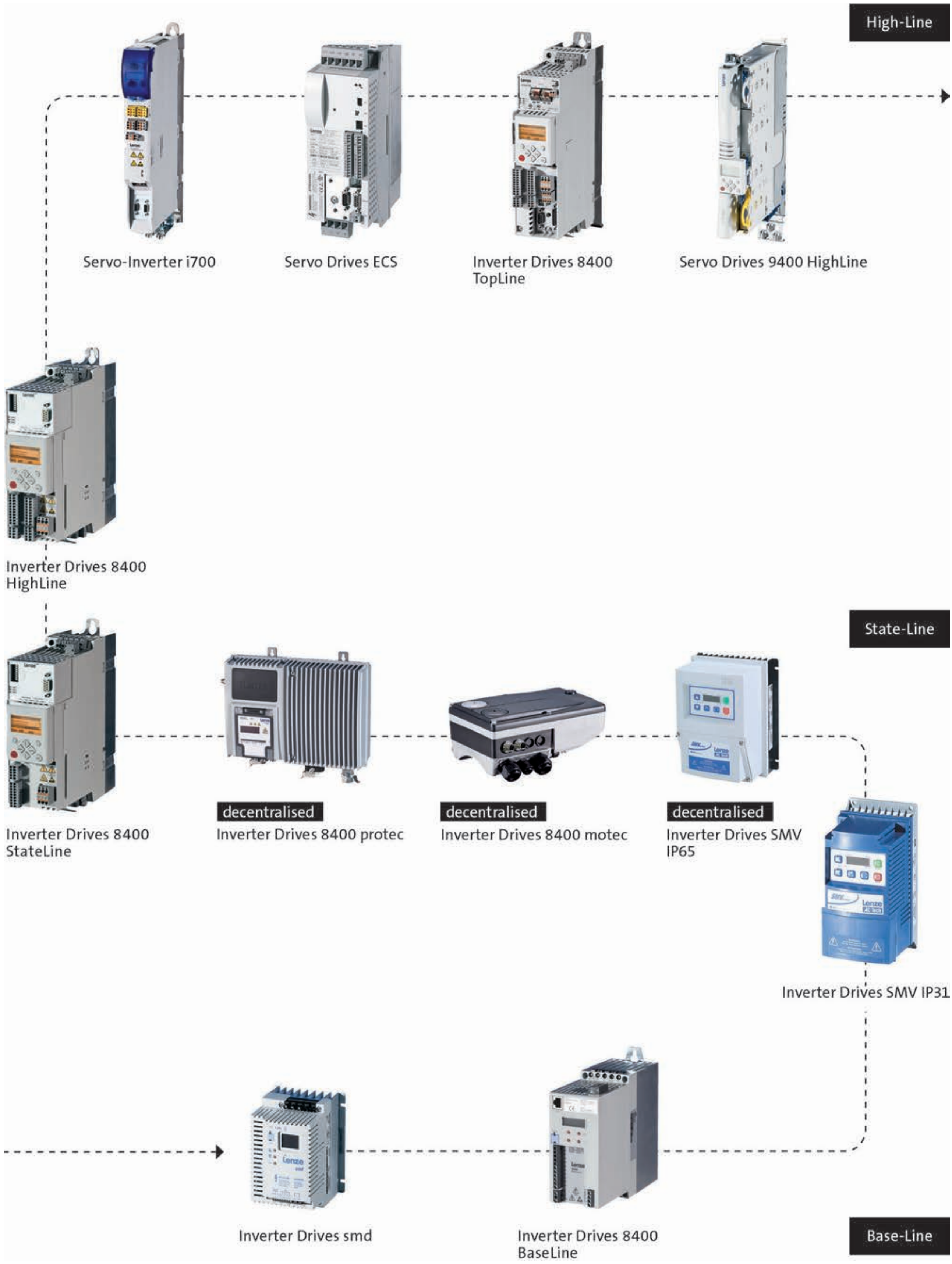


Engineering Tools



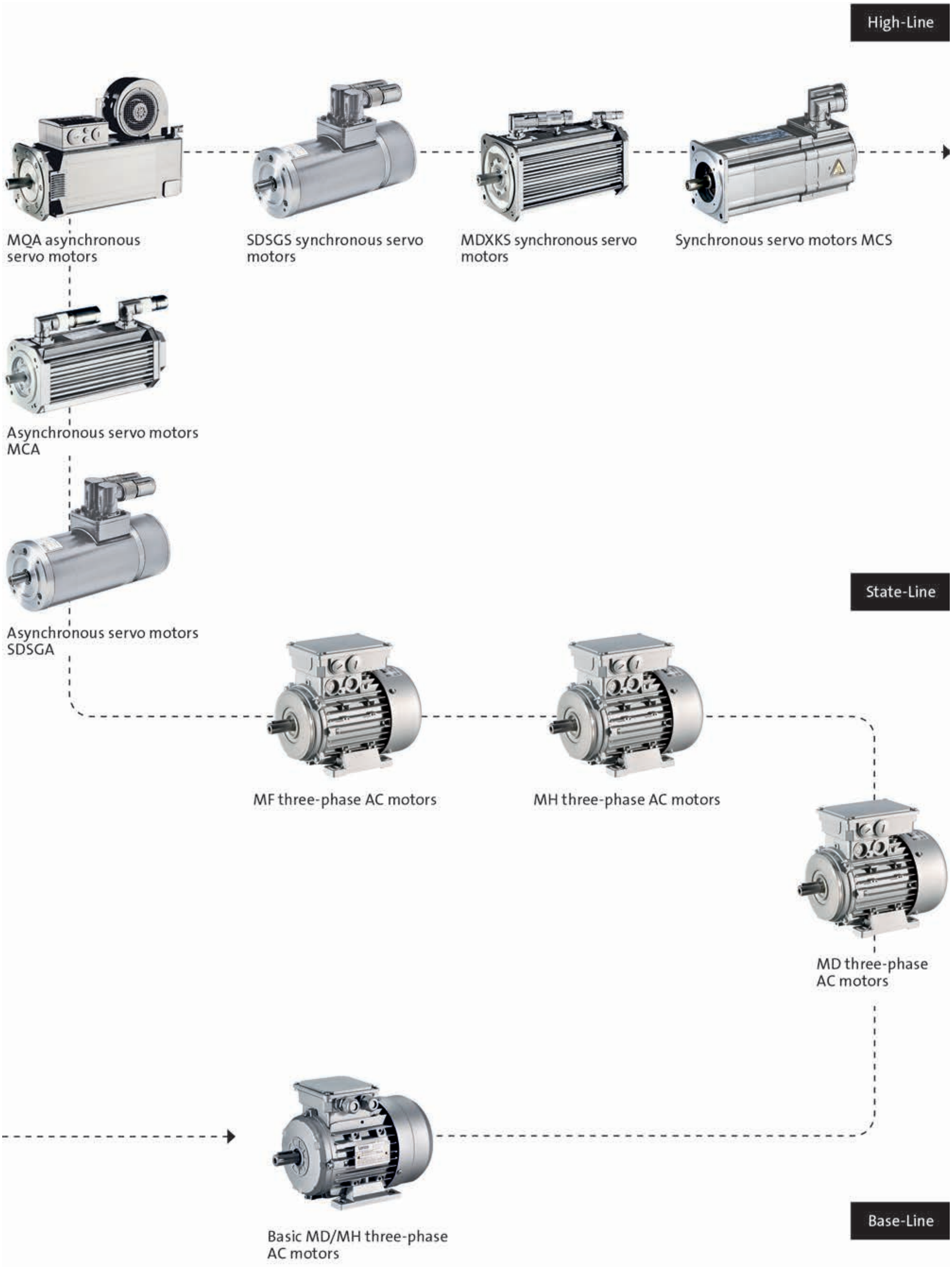
L-force product portfolio

Inverter



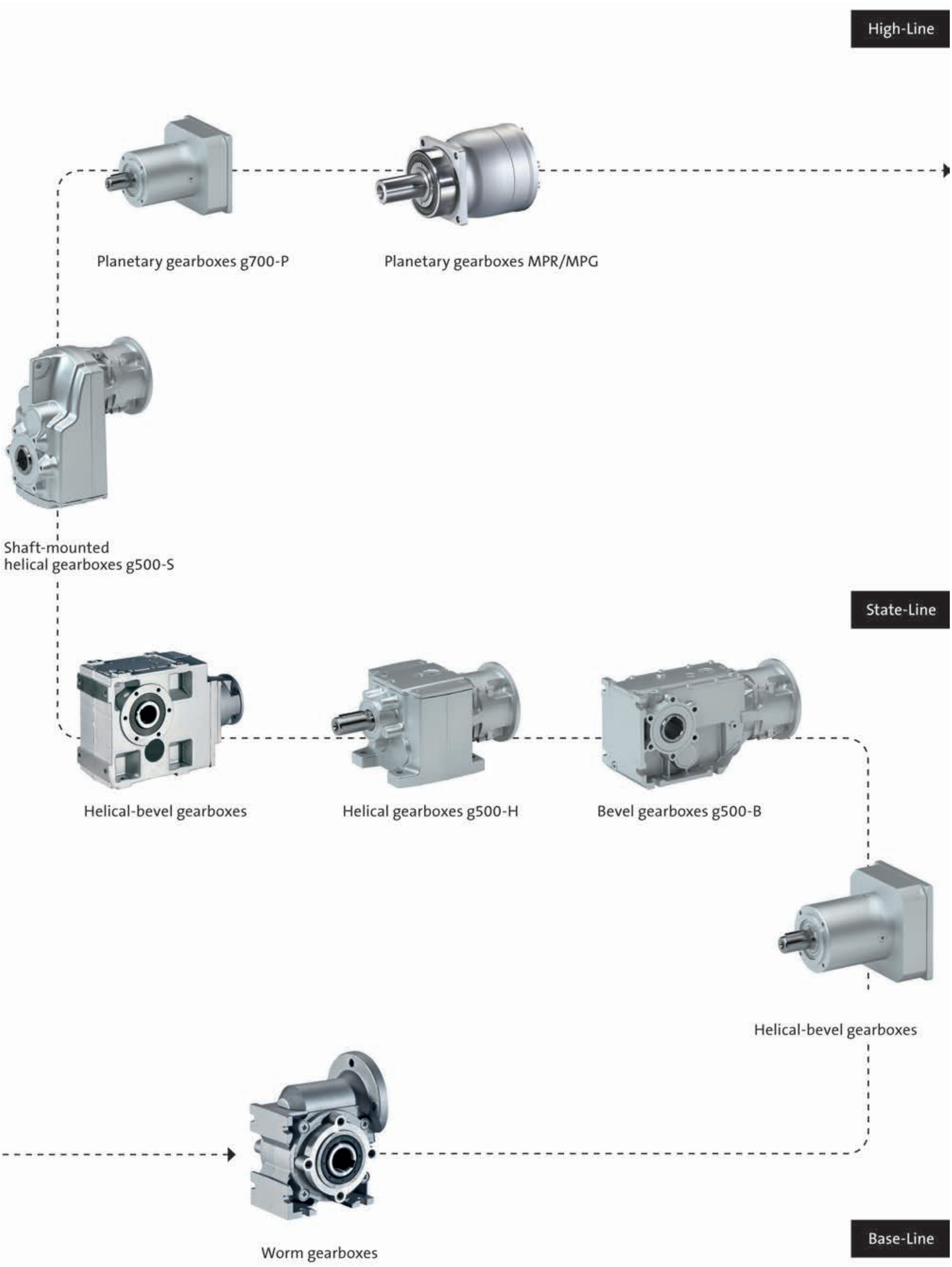
L-force product portfolio

Motors



L-force product portfolio

Gearboxes



Inverter Drives 8400 protec

0.75 to 7.5 kW

Inverter Drives 8400 protec

Contents

Product key

E84D H M B C 751 4 G 2 S N C E

Design
H – HighLine

Mains connection
M – Hybrid plug 2 x Q4/2
P – Hybrid plug 1 x Q4/2

Motor holding brake control
B – Fast switch modular plug
F – Integrated half-wave brake rectifier in Q8 plug

Series
C – 24 V internal, limited mains voltage and temperature range

Power
751 – 0.75 kW
152 – 1.5 kW
302 – 3.0 kW
402 – 4.0 kW
752 – 7.5 kW

Voltage class
4 – 400/500 V, 3/PE AC

Communication
G – EtherNet/IP C – CANopen
R – PROFINET
On request:
P – PROFIBUS

Communication connection system
2 – Push-pull
5 – M12 plug, separate M12 plug for SSI
6 – Push-pull, separate M12 plug for SSI
On request:
1 – M12
3 – M12 plug, separate M12 plug for CAN on board
4 – Push-pull, separate M12 plug for CAN on board
7 – M12 plug, separate M12 plugs for CAN on board and SSI
8 – Push-pull, separate M12 plugs for CAN on board and SSI

Extension module
S – No extension module

Drive - based safety
N – no Drive-based safety
J – Safety option 10
L – Safety option 30
On request:
K – Safety option 20

Control element
C – Service switch with protective function
On request:
N – No control element

Brake resistor
E – Connection for external brake resistor
On request:
N – No brake resistor

Equipment

Display and diagnostics

Status LEDs
L-force diagnostic interface

Safety system

optional

Brake resistor

Plug connection

Mains connection

Pluggable in loop-through technique

Motor connection

Connection via hybrid cable

Pluggable control connections

For commnication purposes and inputs/outputs

List of abbreviations

b	[mm]	Dimensions
C_{th}	[KWs]	Thermal capacity
f_{ch}	[kHz]	Switching frequency
h	[mm]	Dimensions
H_{max}	[m]	Site altitude
I_{max}	[A]	Max. DC-bus current
$I_{max, out}$	[A]	Max. output current
$I_{N, AC}$	[A]	Rated mains current
$I_{N, DC}$	[A]	Rated DC-bus current
$I_{N, out}$	[A]	Rated output current
l_{max}	[m]	Max. cable length
m	[kg]	Mass
P	[kW]	Typical motor power
$P_{max, 1}$	[kW]	Max. output power
P_V	[kW]	Power loss
P_N	[kW]	Rated power
R_{min}	[Ω]	Min. brake resistance
R_N	[Ω]	Rated resistance
t	[mm]	Dimensions
U_{AC}	[V]	Mains voltage
U_{DC}	[V]	DC supply
$U_{N, AC}$	[V]	Rated voltage
U_{out}	[V]	Max. output voltage

ASM	Asynchronous motor
DIAG	Slot for diagnostic adapter
DIN	Deutsches Institut für Normung e.V.
EN	European standard
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 60721-3	Classification of environmental conditions; Part 3: Classes of environmental parameters and their limit values
EN 61800-3	Electrical variable speed drives Part 3: EMC requirements including special test methods
IEC	International Electrotechnical Commission
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
IM	International Mounting Code
IP	International Protection Code
MCI	Slot for communication module (module communication interface)
NEMA	National Electrical Manufacturers Association
UL	Underwriters Laboratory Listed Product
UR	Underwriters Laboratory Recognized Product
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)

8400 protec

The wall-mounted device with a high degree of integration for complex decentralised systems. It excels through its robust design, high degree of operational reliability and fast installation.

This inverter with a high level of functionality facilitates both basic and servo-based applications. The Inverter Drives 8400 protec is supplied with all modules and interfaces ready to be connected.

On-site diagnostics
- A large display provide constant information on the operating status of the device.
- The clearly laid out LEDs provide additional diagnostics information. The fast diagnostics system thereby makes an effective contribution to increasing system availability.

Decentralised integrated positioning
- Implementing affordable and decentralised positioning applications with asynchronous motors. Whether switch-off, tabular or absolute positioning: the Inverter Drives 8400 protec offers integrated solutions for these applications. The ability to connect incremental and absolute value encoders rounds off this scope of functions.
- The parameters are set conveniently using the "L-force Engineer" here. The range also has a freely editable function block interconnection for integration of logic, arithmetic and mathematic program through graphic programming.

Safety engineering in line with EN ISO 13849-1
- The certified safety system enables not only the connection of local safety elements and safe communication via PROFIsafe, but also a series of safety functions.
- Safe torque off (STO)
- Safe stop 1 (SS1)
- Emergency stop (SSE)
- Safe operation mode selector (OMS)
- Safe enable switch (ES)

Further benefits
- 200% overload current (3s)
- V/f control with and without encoder
- Sensorless vector control
- Servo control
- Short-circuit and earth-fault protected
- DC-injection braking
- S-shaped ramp for smooth acceleration
- Max. output frequency 599 Hz
- 15 fixed frequencies
- Standardised connectors
- CAN, EtherNet/IP, PROFIBUS, PROFINET

Inverter Drives 8400 protec

Functions and features

Mode	
	8400 protec
Conrol types, motor control	
Sensorless vector control (SLVC)	For three-phase asynchronous motors
V/f control (VFCplus)	For three-phase AC motors and asynchronous servo motor (linear or square-law)
Basic functions	
	Freely assignable user menu Free function block interconnection with extensive function library Parameter change-over DC brake function Flying restart circuit S-shaped ramps for smooth acceleration PID controller 15 fixed frequencies Masking frequencies
Technology applications	
	Speed actuating drive Switch-off positioning without feedback Table positioning without feedback
Monitoring and protective measures	
	Short circuit Earth fault Overvoltage Motor phase failure Overcurrent I^2 x t-Motor monitoring Motor overtemperature Mains phase failure Protection against restart for cyclic mains switching Motor stalling
Diagnostics	
	Data logger, logbook, oscilloscope functions
Status display	18 LEDs
Diagnostic interface	Integrated For USB diagnostic adapter or keypad (diagnosis terminal)
Braking operation	
Brake chopper	Integrated
Brake resistor	External

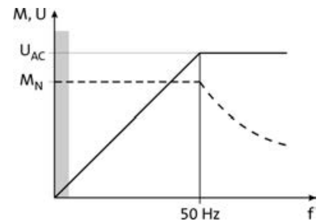
Operating modes

An inverter enables energy-efficient operation of a system in virtually all application cases. The various operating modes, which can be created by making just a few simple settings, facilitate this. The following characteristics and corresponding specifications listed on the following pages can be used to calculate the optimum operating mode during the project planning phase.

Standard setting

In its initial state when delivered, the inverter is set up for basic operation with a three-phase AC motor with V/f control. When operated in this mode, the rated torque of the motor is available in a setting range up to 50 Hz.

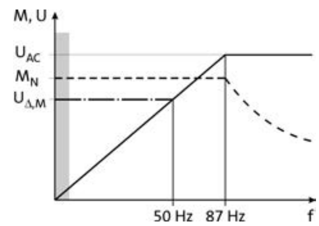
V/f at 50 Hz



Extended setting range up to 87 Hz

If the V/f reference point on the inverter is set to 87 Hz, the rated torque can be used across an extended setting range. Here, a 230/400V motor is for example used and operated in a delta layout with a 400V inverter. The setting range is then increased by 40 %. The inverter must be dimensioned for a rated motor current of 230 V.

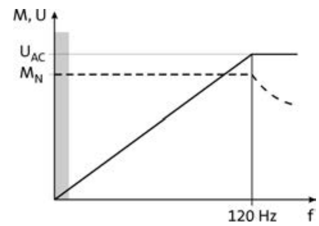
V/f at 87 Hz



Operation with inverter-optimised MF motors

Large setting ranges and optimum operation at the rated torque: these are the strengths of the MF motor when used in combination with an inverter. The motors are optimised for a setting range up to 120 Hz. Compared to conventional 50Hz operation, the setting range increases by 250 %. It is quite simply not possible for a drive to be operated any more efficiently in a machine.

V/f at 120 Hz



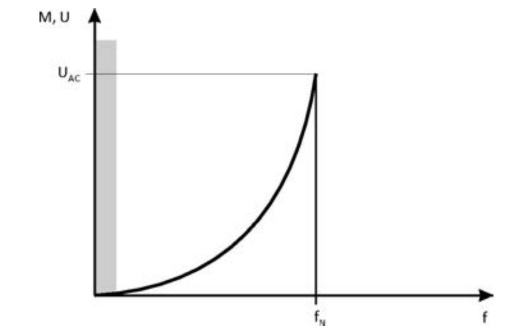
Operating modes

Square-law V/f characteristic control

The output voltage is increased quadratically to the output frequency. In case of low output frequencies, the motor voltage can be increased to ensure a minimum current for the breakaway torque. In the field weakening range, the output voltage of the inverter is constant (mains voltage) and the frequency can be further increased depending on the load. The maximum torque of the motor is reduced quadratically to the frequency increase, the maximum output power of the motor being constant.

Application areas are for instance:
- Pumps
- Blowers
- Fans

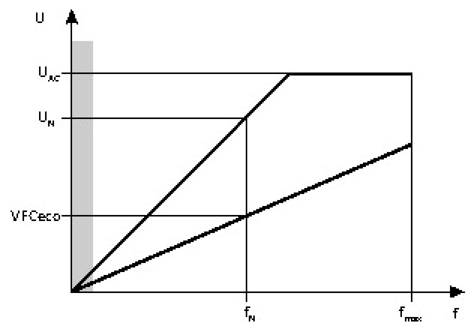
Square-law characteristic



VFCeco energy saving mode

The VFCeco mode has a special effect in the partial load operational range. Usually, three-phase AC motors are supplied there with a higher magnetising current than required by the operating conditions. The VFCeco mode reduces the losses in the partial load operational range so that savings up to 30 % are possible.

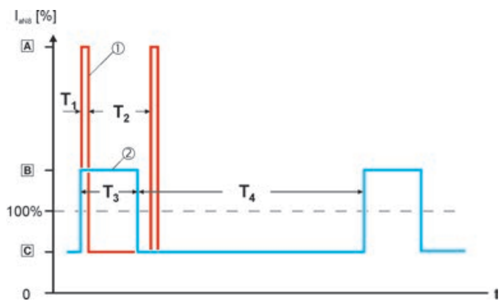
VFCeco energy saving mode



Overcurrent operation

The inverters can be driven at higher amperages beyond the rated current if the duration of this overcurrent operation is time limited. Two utilisation cycles with a duration of 15 s and 180 s are defined. Within these utilisation cycles, an overcurrent is possible for a certain time if afterwards an accordingly long recovery phase takes place. For both utilisation cycles, a moving average is determined separately. The adjacent diagram shows both cycles: 15 s in red and 180 s in blue. The overload times t_{ol} are 3 s (T_1) and 60 s (T_3) respectively, the corresponding recovery times t_{re} are 12 s (T_2) and 120 s (T_4) respectively. The following tables show the resulting maximum output currents. Monitoring of the device utilisation (I x t) activates the set error response (trip or warning if one of the two utilisation values exceeds the limit of 100 %.

Overcurrent operation



Standards and operating conditions

Mode			
Product			8400 protec
Conformity			
CE			Low-Voltage Directive
			2014/35/EU [UKCA: S.I. 2016/1101]
EAC			TP TC 004/2011 (TR CU 004/2011) TP TC 020/2011 (TR CU 020/2011)
Approval			
UL 508C			Power Conversion Equipment (file no. E132659)
CSA			CSA 22.2 No. 14
Degree of protection			
EN 60529			IP65 mit Bedienelement "C" IP64
NEMA 250			
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -25 °C ... +60 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -25 °C ... +75 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -25°C ... +55 °C)
Current derating at over 40°C			2.5 % / K
Site altitude			
Amsl	H_{max}	[m]	4000
Current derating at over 1000 m		[%/1000 m]	5
Vibration resistance			
Transport (EN 60721-3-2)			2M2
Operation (EN 60721-3-3)			3M4
Operation (Germanischer Lloyd)			General conditions: acceleration resistant up to 2 g

Mode	
Product	8400 protec
Supply form	
	Systems with earthed star point (TN and TT systems)
Noise emission	
EN 61800-3	Integrated RFI suppression: cable-guided, category C2 up to 20 m shielded motor cable
Insulation resistance	
EN 61800-5-1	≤ 2000 m amsl overvoltage category III > 2000 m amsl overvoltage category II
Degree of pollution	
EN 61800-5-1	2
Protective insulation of control circuits	
EN 61800-5-1	Safe mains isolation: double/reinforced insulation

Rated data 400 V

- The data is valid for operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.

Typical motor power				
4-pole asynchronous motor	P	[kW]	0.75	1.50
Product key				
Inverter			E84D□□□7514□□S□	E84D□□□1524□□S□
Mains voltage range				
	U_{AC}	[V]	3/PE AC 320 V-0% ... 440 V+0%, 45 Hz-0 % ... 65 Hz+0%	
Rated mains current				
	$I_{N, AC}$	[A]	4.1	5.5
Rated output current				
	$I_{N, out}$	[A]	2.4	3.9
Rated switching frequency				
	f_{ch}	[kHz]	8	
Output current				
2 kHz	I_{out}	[A]	2.4	3.9
4 kHz	I_{out}	[A]	2.4	3.9
8 kHz	I_{out}	[A]	2.4	3.9
16 kHz	I_{out}	[A]	1.6	2.3

Data for 60 s overload

Max. output current				
	$I_{max, out}$	[A]	3.6	5.9
Overload time				
	t_{ol}	[s]	60.0	
Recovery time				
	t_{re}	[s]	120.0	

Data for 3 s overload

Max. short-time output current				
	$I_{max, out}$	[A]	4.8	7.8
Overload time				
	t_{ol}	[s]	3.0	
Recovery time				
	t_{re}	[s]	75.0	

4.1

Rated data 400 V

- The data is valid for operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.

				
Typical motor power				
4-pole asynchronous motor	P	[kW]	0.75	1.50
Product key				
Inverter			E84D□□□7514□□S□	E84D□□□1524□□S□
Power loss				
	P_V	[kW]	0.066 [2]	0.084 [2]
Mass				
	m	[kg]	7.6	
Max. cable length				
Shielded motor cable	l_{max}	[m]	20	

Brake chopper rated data

Rated power, Brake chopper				
	P_N	[kW]	0.9	2.0
Max. output power, Brake chopper				
	$P_{max, 1}$	[kW]	3.5	
Min. brake resistance				
	R_{min}	[Ω]	150.0	

Dimensions

Dimensions			
Height	h	[mm]	260 [3]
Width	b	[mm]	353
Depth	t	[mm]	110

[1] Technically possible cable lengths, irrespective of EMC requirements
[2] Operation at rated output current $I_{N, out}$.
[3] + 30 mm with connector shell.

Rated data 400 V

- The data is valid for operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.

					
Typical motor power					
4-pole asynchronous motor	P	[kW]	3.00	4.00	7.50
Product key					
Inverter			E84D□□□3024□□S□	E84D□□□4024□□S□	E84D□□□7524□□S□
Mains voltage range					
	U_{AC}	[V]	3/PE AC 320 V-0% ... 440 V+0%, 45 Hz-0 % ... 65 Hz+0%		
Rated mains current					
	$I_{N, AC}$	[A]	9.7	12.9	20.8
Rated output current					
	$I_{N, out}$	[A]	7.3	9.5	16.0
Rated switching frequency					
	f_{ch}	[kHz]	8		
Output current					
2 kHz	I_{out}	[A]	7.3	9.5	16.0
4 kHz	I_{out}	[A]	7.3	9.5	16.0
8 kHz	I_{out}	[A]	7.3	9.5	16.0
16 kHz	I_{out}	[A]	4.9	6.3	10.7

Data for 60 s overload

Max. output current					
	$I_{max, out}$	[A]	11.0	14.3	19.0
Overload time					
	t_{ol}	[s]	60.0		
Recovery time					
	t_{re}	[s]	120.0		

Data for 3 s overload

Max. short-time output current					
	$I_{max, out}$	[A]	14.6	19.0	32.0
Overload time					
	t_{ol}	[s]	3.0		
Recovery time					
	t_{re}	[s]	75.0		

Rated data 400 V

- The data is valid for operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.

					
Typical motor power					
4-pole asynchronous motor	P	[kW]	3.00	4.00	7.50
Product key					
Inverter			E84D□□□3024□□S□	E84D□□□4024□□S□	E84D□□□7524□□S□
Power loss					
	P_V	[kW]	0.150 [2)]	0.155 [2)]	0.232
Mass					
	m	[kg]	11.3		
Max. cable length					
Shielded motor cable	l_{max}	[m]	50		

4.1

Brake chopper rated data

Rated power, Brake chopper				
	P_N	[kW]	3.9	5.2
Max. output power, Brake chopper				
	$P_{max, 1}$	[kW]	11.2	
Min. brake resistance				
	R_{min}	[Ω]	47.0	

Dimensions

Dimensions			
Height	h	[mm]	260 [3)]
Width	b	[mm]	434
Depth	t	[mm]	148

1) Technically possible cable lengths, irrespective of EMC requirements
2) Operation at rated output current $I_{N, out}$.
3) + 30 mm with connector shell.

Mains connection

- ► The mains fuse and cable cross-section specifications are for a mains connection of 3 x 400 V.
- ► Class gG/gl fuses or class gRL semiconductor fuses.
- ► The cable cross-sections apply to PVC-insulated copper cables.
- ► Use for installation with UL-approved cables, fuses and brackets.

Typical motor power	**Mains voltage**	**Product key**	**Circuit breaker**	**Fuse**		**Mains connection**
4-pole asynchronous motor		Inverter		EN 60204-1	UL	Cross-section (without mains choke)
P	U_{AC}		I	I	I	q
[kW]	[V]		[A]	[A]	[A]	[mm2]
0.75	3 AC 320 ... 440	E84D□□□7514□□S□	C16	16	15	2.5
1.50		E84D□□□1524□□S□				
3.00		E84D□□□3024□□S□				
4.00		E84D□□□4024□□S□	C20	20	20	4.0
7.50		E84D□□□7524□□S□				

4.1

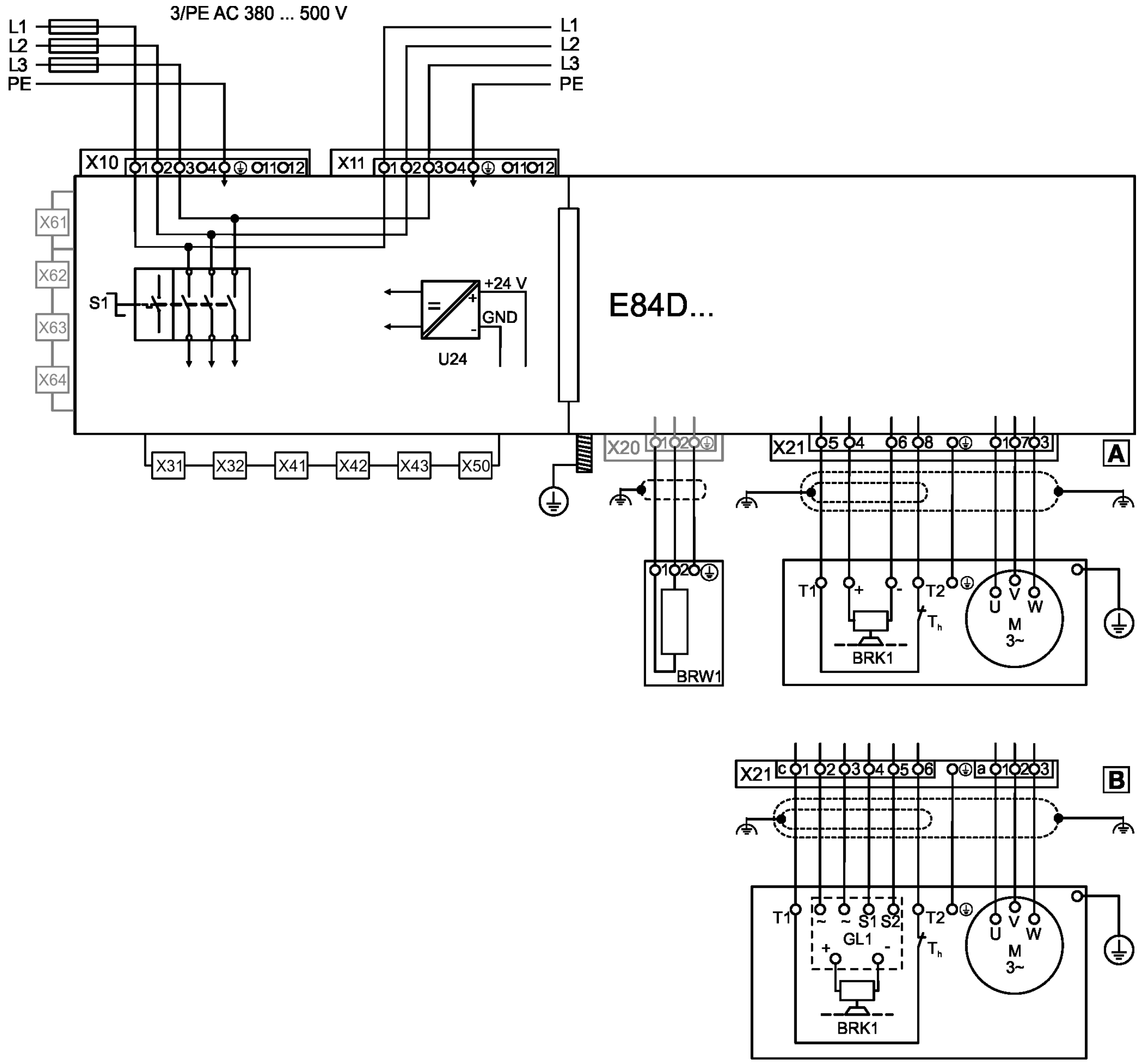
Motor connection

- ► Keep motor cables as short as possible, as this has a positive effect on the drive behaviour.
- ► With group drives (multiple motors on one inverter), the resulting cable length is the key factor. This can be calculated using the hardware manual.
- ► Electric strength of the motor cable: 1 kV as per VDE 250-1.

Typical motor power	**Mains voltage**	**Product key**	**Max. cable length**	
4-pole asynchronous motor		Inverter	shielded C2 without external measures	shielded C2 with external measures
P	U_{AC}		l_{max}	l_{max}
[kW]	[V]		[m]	[m]
0.75	3 AC 320 ... 440	E84D□□□7514□□S□	20	20
1.50		E84D□□□1524□□S□		
3.00		E84D□□□3024□□S□		
4.00		E84D□□□4024□□S□		
7.50		E84D□□□7524□□S□		

Connection diagrams

Wiring example for connecting Inverter Drives 8400 protec to 3 x 400V



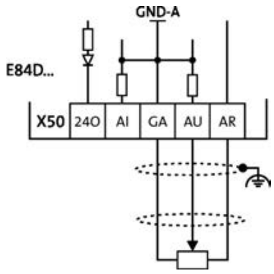
[A] Motor connection system: connector type Q8/0
[B] Motor connection system: modular connector type

Control connections

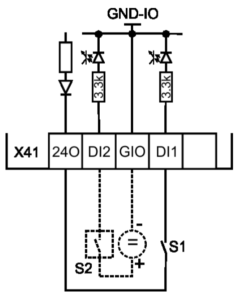
Mode	
Product	8400 protec
Analog inputs	
Number	1 Optional: voltage or current input
Resolution	10 bits
Value range	0 ... 10V, 0/4 ... 20mA
Digital inputs	
Number	6 or 4 (configurable)
Switching level	PLC (IEC 61131-2)
Max. input current	11mA
Function	
Digital outputs	
Number	0 or 2 (configurable)
Switching level	PLC (IEC 61131-2)
Max. output current	200mA per output
External 24 V DC supply	
	To support communication when the 400 V is switched off
Internal 24 V DC supply	
	Max. 1 A for inputs/outputs and sensor feeds
Interfaces	
CAN	On board
Extensions	Integrated fieldbus communication
Safety engineering	1-2 safe inputs for passive/active actuators/PROFIsafe/PROFIsafe, depending on the safety option selected
Drive interface	
Encoder input	Via 2 digital inputs, HTL, 2-track, 10 kHz 100 kHz, can also be used as a frequency input, SSI input (instead of analog input),

Control connections

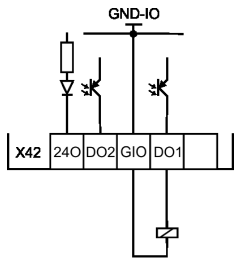
Connection of analog inputs and outputs



Connection of digital inputs and outputs



Connection of digital inputs and outputs



Memory module

All drive settings for the 8400 are stored on the memory module, which is a pluggable memory chip. The memory module ensures that drives can be replaced quickly and without errors being made.

Mode	Features	Product key
Memory module	• For 8400 StateLine, HighLine, Topline and protec • Packaging unit: 5 items	E84AYM10S/M

Safety engineering

The following safety functions are integrated into the communication modules depending on the device version:

Safety option 10
- Safe torque off (STO)

- The drive is safely disconnected when a request is sent via connected active or passive sensors

Safety option 20
- Safe torque off (STO)
- Safety stop 1 (SS1)
- Safe stop emergency (SSE)
- Safe operation mode selector (OMS)
- Safe enable switch (ES)

- The drive is safely disconnected by a higher-level safety PLC by means of PROFIsafe/PROFINET

Safety option 30
- Safe torque off (STO)
- Safe stop 1 (SS1)
- Safe stop emergency (SSE)
- Safe operation mode selector (OMS)
- Safe enable switch (ES)

- The drive is safely disconnected by a higher-level safety PLC by means of PROFIsafe/PROFINET and via connected active or passive sensors

Safety functions			
Basic error limit (at 25 °C)	10	20	30
Certification			
EN ISO 13849-1	Category 4 / PLe	Category 3 / PLe	
EN 61800-5-2	SIL 3		
EN 62061	SIL 3		
IEC 61508	SIL 3		
Fail-safe state			
	Safe torque off		

Communication modules

Inverter Drives 8400 protec are supplied with permanently installed communication modules. As well as containing the components for fieldbus communication, these modules also include the digital inputs and outputs. An analog input or a synchronous serial interface (SSI) can also be provided as an option.

Overview

	Digital inputs	Digital outputs	Analog inputs
Communication module	Number	Number	Number
EtherNet/IP	6 or 4 (configurable)	0 or 2 (configurable)	1 [1)]
PROFIBUS	6 or 4 (configurable)	0 or 2 (configurable)	1 [1)]
PROFINET	6 or 4 (configurable)	0 or 2 (configurable)	1 [1)]

[1)] Or as a synchronous serial interface (SSI).

EtherNet communication module

The EtherNet/IP communication module based on standard TCP and UDP enables the Inverter Dives 8400 motec to support a continuous communication from the field level right through to the controlling system. The product key E84D□□□□□□□□G indicates an inverter with an integrated communication module
The benefits of this system include:

- Currently widespread fieldbus based on real-time Ethernet
- Supports DHCP and BootP in allocating the IP address
- Devices linked via EtherNet/IP can be implemented seamlessly and with minimum configuration expense via mapping into the I/O tree of the RSLogix programming tool

Mode	Features
Communication module	
EtherNet/IP	• Supports multicast messages, UCMM, ACD, BOOTP/DHCP, VLAN-Tagging/DSCP

Technical data

Mode			
Communication module			EtherNet/IP
Communication			
Medium			CAT5e S/FTP according to ISO/ICE11801 / EN50173
Communication profile			EtherNET/IP, AC Drive
Baud rate			
	b	[MBit/s]	10/100 (full duplex/half duplex)
Node			
			Slave (Adapter)
Network topology			
			Tree, star and line
Process data words (PCD)			
16 Bit			1 ... 16
Number of bus nodes			
			max. 254 im Subnetz
Max. cable length			
between two nodes	l_{max}	[m]	100

PROFIBUS communication modules

With the PROFIBUS communication module, the 8400 protec supports the most widespread current fieldbus system. It is integrated in the inverter with the product key E84D□□□□□□□□P.

The benefits of this system include:
- Widespread and very powerful fieldbus system
- Integrated I/O node. Capable of communication and reading inputs even when the 400V supply is switched off.

Mode	Features
Communication module	
PROFIBUS	• DPVO: basic functionalities such as cyclical data exchange and diagnostics • DPV1: supports acyclical data exchange for parameter setting, operation and alarm handling

Technical data

Mode			
Communication module			PROFIBUS
Communication			
Medium			RS 485
Communication profile			PROFIBUS-DP-V1 PROFIBUS-DP-V0
Device profile			PROFIDrive, version 3
Baud rate			
	b	[kBit/s]	9.6 ... 12 000 (automatic detection)
Node			
			Slave
Network topology			
			with repeater: line or tree without repeater: line
Process data words (PCD)			
16 Bit			1 ... 16
DP user data length			
			Optional parameter channel (4 words) + process data words
Number of bus nodes			
			31 slaves + 1 master per bus segment With repeaters: 125
Max. cable length			
per bus segment	l_{max}	[m]	1200 (depending on the baud rate and the cable type used)

PROFINET communication modules

With the PROFINET communication module, the 8400 protec supports a fieldbus system for continuous communication from the field level right through to company management level. It is integrated in the inverter with the product key E84D□□□□□□□□R.

The benefits of this system include:
- Fieldbus system capable of handling large data volumes
- Use of IT standards
- Integrated switch allows direct looping of PROFINET via the inverters
- Integrated I/O node. Capable of communication and reading inputs even when the 400V supply is switched off.

Mode	Features
Communication module	
PROFINET	• Automatic detection of the 100 Mbps baud rate • Creation of a line topology through integrated 2-port switch • Support for I&M 0 to 4 functionality for identification of the standard device • Link / Activity

Technical data

Mode			
Communication module			PROFINET
Communication			
Medium			CAT5e S/FTP according to ISO/ICE11801 (2002)
Communication profile			PROFINET RT Conf. Class B
Baud rate			
	b	[MBit/s]	10/100
Node			
			Slave (Device)
Network topology			
			Tree, star and line
Number of logical process data channels			
			1 ring as client (media redundancy)
Process data words (PCD)			
16 Bit			1 ... 16
Max. cable length			
between two nodes	l_{max}	[m]	100

Brake resistors

An external brake resistor is required to brake high moments of inertia or in the event of prolonged operation in generator mode; this resistor converts braking energy into heat.

The brake resistors recommended in the table below have been dimensioned for approx. 1.5 times the regenerative power, with a cycle time of 15/135 s (brake/rest ratio). These brake resistors generally meet the usual requirements of standard applications.

The brake resistors are fitted with a thermostat (potential-free NC contact).

Brake resistor

Typical motor power	**Mains voltage**	**Product key**		**Rated resistance**	**Rated power**	**Thermal capacity**	**Dimensions**	**Mass**
4-pole asynchronous motor		Inverter	Brake resistor					
P	U_{AC}			R_N	P_N	C_{th}	h x b x t	m
[kW]	[V]			[Ω]	[kW]	[KWs]	[mm]	[kg]
0.75	3 AC 320 ... 440	E84D□□□7514□□S□	ERBS240R300W	240.0	0.30	45.0	382 x 124 x 122	2.0
1.50		E84D□□□1524□□S□	ERBS180R350W	180.0	0.35	53.0		
3.00		E84D□□□3024□□S□	ERBS047R400W	47.0	0.40	60.0	400 x 110 x 105	2.3
4.00		E84D□□□4024□□S□						
7.50		E84D□□□7524□□S□						

USB diagnostic adapter

The operation, parameter setting and diagnostics of the Inverter Drives 8400 and the Servo Drives 9400 via the L-force diagnostics is made with the keypad X400 or a PC. The connection of a PC can be made via a USB interface and the USB diagnostic adapter.

For connecting the USB diagnostic adapter with the L-force diagnostics interface (DIAG) tat the inverter, three different connecting cables are separately available in the lengths 2.5 m, 5 m and 10 m. The connection can be established during operation. The engineering tools EASY Starter or Engineer can be used to carry out the operation, parameter setting or diagnostics of the inverters. Both tools have simple intuitive surfaces. This enables a quick and easy commissioning.

Optionally to the USB diagnostic adapter, the PC system bus adapter can be used. For this purpose, a CANopen interface must be available at the inverter.

USB diagnostic adapter incl. connecting cable to the PC

► The engineering tools EASY Starter or Engineer are used for operation, parameter setting and diagnostics of the inverters.

Mode		Features	Product key
USB diagnostic adapter		• Input-side voltage supply via USB connection on PC • Output-side voltage supply via inverter's diagnostic interface • Diagnostic LEDs • Electrical isolation of PC and inverter • Hot-pluggable	E94AZCUS

Connecting cables for USB diagnostic adapter

Mode	Features	Product key
Connecting cable for USB diagnostic adapter	• Length: 2.5 m	EWL0070
	• Length: 5 m	EWL0071
	• Length: 10 m	EWL0072

Diagnosis terminal

The diagnosis terminal can be used as an alternative to a PC if you are looking for an easy way to operate the inverter, set parameters or carry out diagnostics locally. The structured menus and plain text display provide quick access to data.
The diagnosis terminal can be plugged into the inverter's L-force diagnostic interface (DIAG) from the outside.

Diagnosis terminal

Mode	Features	Slot	Product key
Diagnosis terminal	• Diagnosis terminal inside robust housing • incl. 2.5 m cable • Degree of protection IP20 • For 8400 motec and protec.	DIAG	EZAEBK2003

Switch/potentiometer unit

The switch / potentiometer unit is fitted directly to the 8400 motec or in a different position within the system. An analogue setpoint can be specified with the switch/potentiometer unit and the control connections integrated in the inverter by using the integrated potentiometer; the rotary switch can, for example, be used to start/stop the drive or change the direction of rotation.
The switch/potentiometer unit is supplied with a 2.5 m connection cable.

Switch/potentiometer unit

Mode	Product key
Switch/potentiometer unit (IP65)	E82ZBU

System cables

For connection of the motor, Lenze provides finished hybrid cables. They are optimally matched to the connection between the Drive Package components. Motor connection, blower connection, brake connection and temperature monitoring are integrated in the cables. Cables up to a length of 100 m can be selected in increments of 0.1 m.

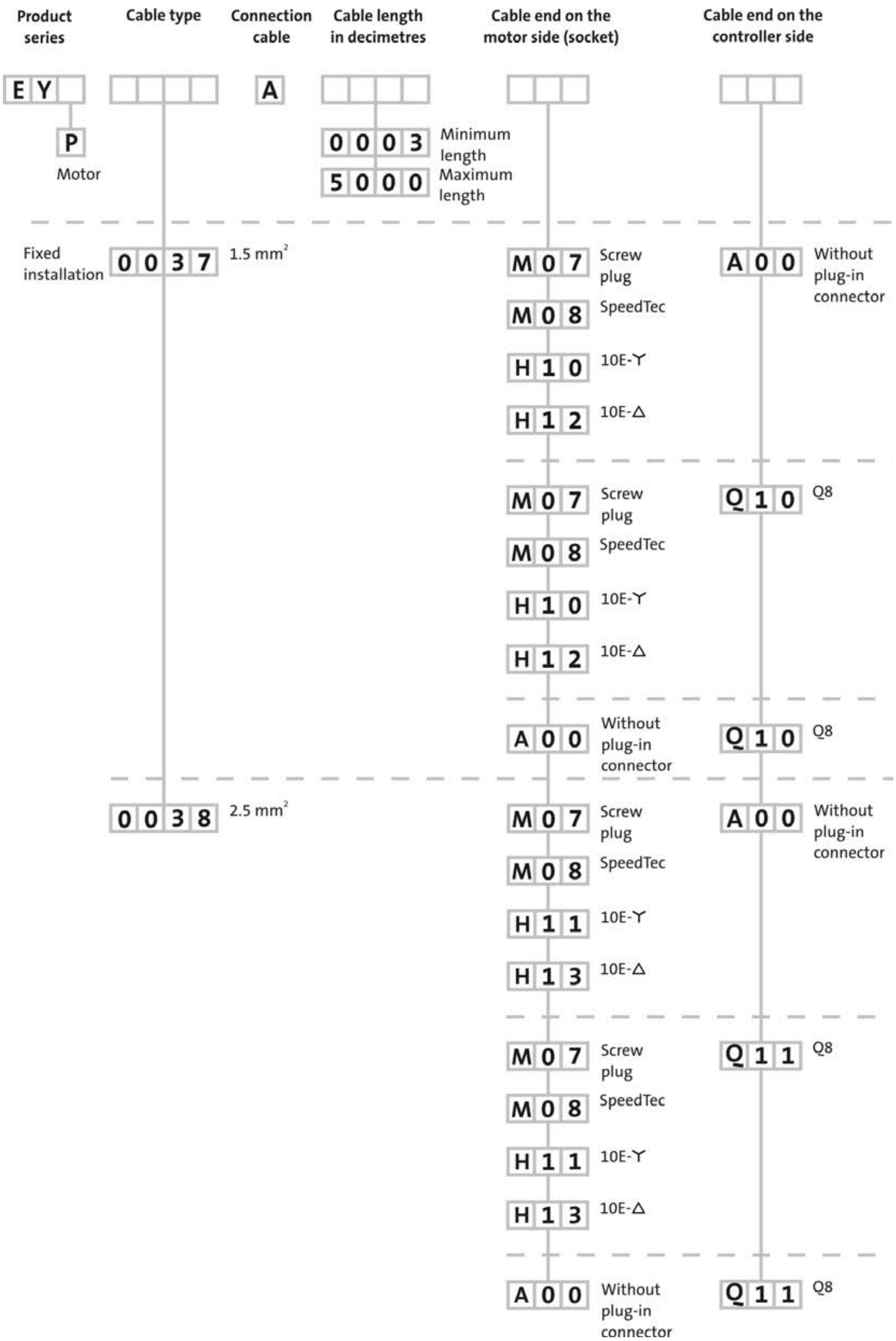
10-pole cables

Available with cross-sections 1.5^2 and 2.5^2 with connection for brake or thermal contact.

Product series	Cable type	Connection cable	Cable length in decimetres	Cable end on the motor side (socket)	Cable end on the controller side
E Y P (Motor)		A	0 0 0 3 Minimum length; 5 0 0 0 Maximum length		
	Fixed installation 0 0 3 9 $1.5\ mm^2$			H 0 7 Modular 16A	A 0 0 Without plug-in connector
					Q 0 8 Modular 40A
				A 0 0 Without plug-in connector	Q 0 8 Modular 40A
	0 0 4 0 $2.5\ mm^2$			H 0 8 Modular 16A	A 0 0 Without plug-in connector
					Q 0 9 Modular 40A
				H 0 9 Modular 40A	A 0 0 Without plug-in connector
					Q 0 9 Modular 40A
				A 0 0 Without plug-in connector	Q 0 9 Modular 40A
	0 0 4 6 $4.0\ mm^2$			H 1 4 Modular 40A	A 0 0 Without plug-in connector
	0 0 4 7 $10.0\ mm^2$			H 1 5 Modular 40A	A 0 0 Without plug-in connector

8-pole cables

Available with cross-sections 1.5² and 2.52 ² with connection for brake and thermal contact.



4.1

Inverter Drives 8400 motec

Decentralized frequency inverters for motor and wall mounting

0.37 ... 7.5 kW

Inverter Drives 8400 motec

Contents

List of abbreviations

W	[mm]	Width
C_{th}	[kWs]	Thermal capacity
f_{ch}	[kHz]	Rated switching frequency
H	[mm]	Height
$I_{N, out}$	[A]	Rated output current
$I_{N, AC}$	[A]	Rated mains current
m	[kg]	Mass
n_{max}	[rpm]	Max. speed
P	[kW]	Typical motor power
P_V	[kW]	Power loss
P_N	[kW]	Rated power
R_N	[Ω]	Rated resistance
D	[mm]	Depth
U_{AC}	[V]	Mains voltage
U_{DC}	[V]	DC supply
$U_{N, AC}$	[V]	Rated voltage
U_{out}	[V]	Max. output voltage

ASM	Asynchronous motor
DIAG	Slot for diagnostic adapter
DIN	Deutsches Institut für Normung (German Institute for Standardization)
EN	European standard
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 60721-3	Classification of environmental conditions; part 3: Classes of environmental parameters and their limiting values
EN 61800-3	Electrical variable speed drives Part 3: EMC requirements, including specific test procedures
IEC	International Electrotechnical Commission
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
IM	International Mounting Code
IP	International Protection Code
MCI	Plug-in station for the Communication Unit (communication interface module)
NEMA	National Electrical Manufacturers Association
UL	Underwriters Laboratory Listed Product
UR	Underwriters Laboratory Recognized Product
VDE	Verband deutscher Elektrotechniker (Association of German Electrical Engineers)

8400 motec

Maximized user-friendly operation and installation are characteristics of the 8400 motec.

Particularly when used for decentralized drive solutions, the 8400 motec shows excellent efficiency with regard to space, time and energy.

Space savings
- Integrated safety technology and fieldbus communication tailored to individual requirements
- The modular structure minimizes your spares inventory

Time benefit
- Pluggable connection system to reduce mounting and installation times: "Unpack, connect and you're done!"
- Easy replacement of the memory module facilitates standard set-up and increases availability

Energy efficienc
- “VFC eco” mode offers intelligent adaptation of the magnetizing current.
- Up to 30 % energy savings possible in partial load operations

Variety
- Use our »Product Finder« to filter products based on various criteria to locate precisely the item you need. You can also use the function to configure your products and obtain configurable CAD data.

Further benefit
- 200 % overload current (3 s)
- V/f control with and without encoder
- Sensorless vector control
- Sensorless control of synchronous motors
- Short circuit and earth fault proof
- DC-injection braking
- S-ramps for smooth acceleration
- Max. output frequency 300 Hz
- CANopen, PROFIBUS, PROFINET, EtherCAT®, EtherNet/IP, POWERLINK and AS-Interface
- Safety function STO

Wonderfully simple
- Large LED ensures that operating status is clearly visible from a distance; blinking informs users as to error causes.

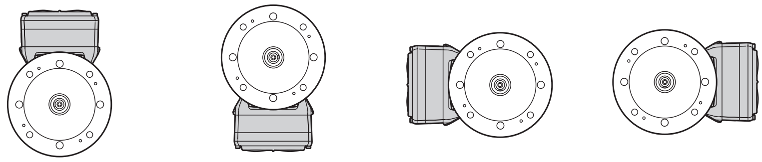
Mechanically and electrically robust
- Thanks to the high degree of protection (IP65), ideally suited for use in the harshest environments.

A real benefi in decentralized applications
- The 8400 motec meets all the requirements of a modern, universally deployable and cost-efficient motor inverter. This makes it ideally suited for decentralized tasks in the field of intralogistics, such as at airports or distribution centers.

Assembly options for motor mounting

In the case of motor mounting, the 8400 motec can be operated without derating regardless of the alignment.

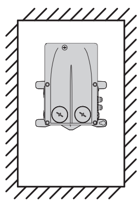
8400 motec for motor mounting



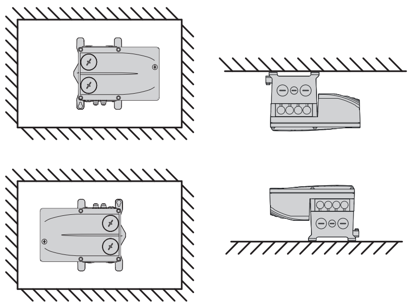
Assembly options for wall mounting

The 8400 motec can be mounted on the wall, or the chassis, in various directions. The technical data for the mounting arrangement must be observed when selecting the mounting direction.

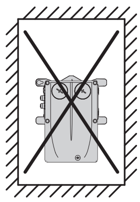
8400 motec for wall mounting



With rating data

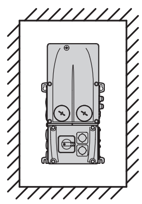


0.37 ... 3.0 kW: with derating
4.0 ... 7.5 kW: with rated data

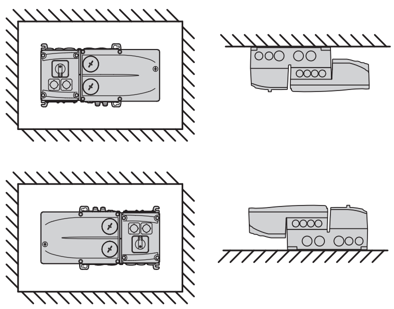


0.37 ... 3.0 kW: not permissible
4.0 ... 7.5 kW: with rated data

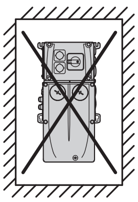
8400 motec for wall mounting with service switch



With rating data



0.37 ... 3.0 kW: with derating
4.0 ... 7.5 kW: with rated data



0.37 ... 3.0 kW: not permissible
4.0 ... 7.5 kW: with rated data

The combinable units

The modular, sophisticated design of the 8400 motec, which comprises the “Drive Units”, “Communication Unit” and “Wiring Unit”, shows how flexible this drive is.
After selecting which units you want, you can order three different versions of the 8400 motec:

- **Motor mounting for geared motors**
  The 8400 motec is delivered mounted on a Lenze geared motor/ three-phase AC motor with optional mounting parts following pretesting. In addition, the underlying, detailed motor parameters are preconfigured to facilitate commissioning.
- **Motor mounting set**
  The 8400 motec is delivered as a set of individual parts – with or without mounting parts – and then mounted on the motor on site.
- **Wall mounting**
  The 8400 motec for wall mounting is always completely assembled and delivered as a unit after testing. It is delivered as individual units if cable glands are selected as the connection system.

When the units are individually ordered, they are delivered in separate packages.

Drive Unit

- Inverter power section
- Easy commissioning via DIP switch, potentiometer or diagnosis terminal
- Easy to replace memory module
- A large LED display to show statuses

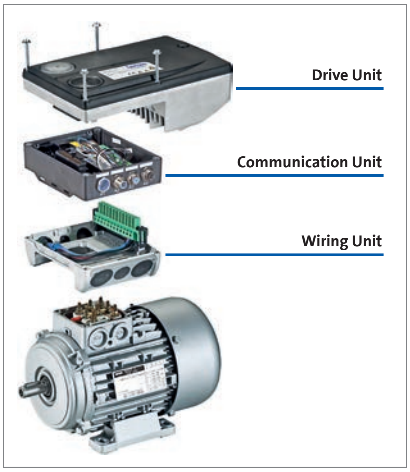
Communication Unit

- Interface for I/Os and fieldbus links
- AS-Interface, POWER, CANopen, EtherCAT®, EtherNet/IP, PROFIBUS or PROFINET
- I/Os and on-board safety technology
- Pluggable M12 connection system

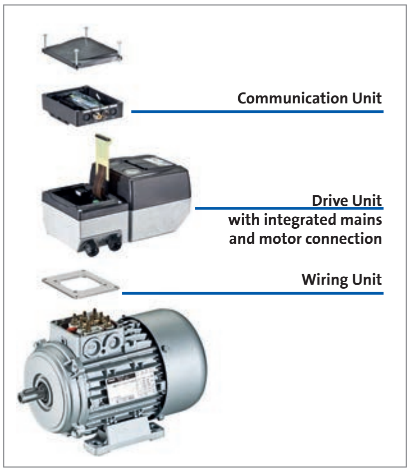
Wiring Unit and Frame Unit

- Connections to mains and drive
- Flexible connection options such as cable glands and diverse plug-in connectors
- Connection for brake resistor
- Connection for spring-applied brake

Motor mounting

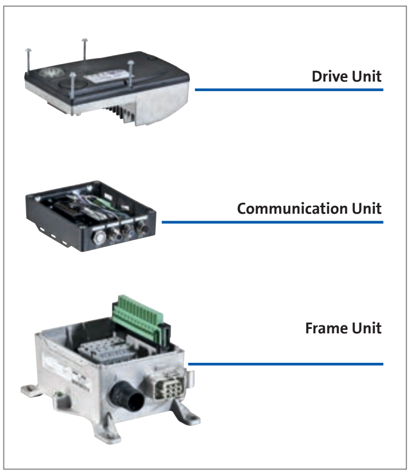


8400 motec 0.37 ... 3.0 kW

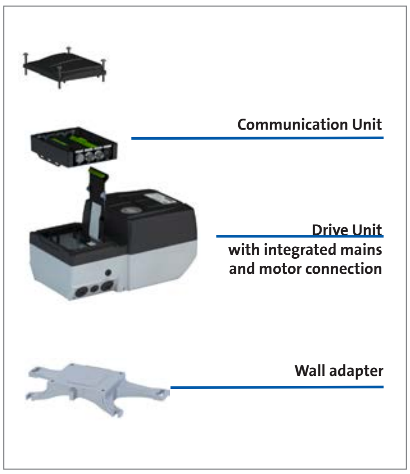


8400 motec 4.0 ... 7.5 kW

Wall mounting without switch

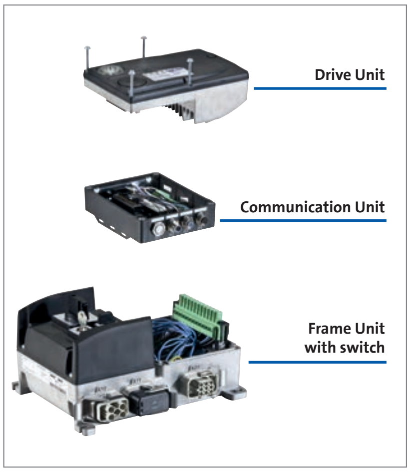


8400 motec for wall mounting
0.37 ... 3.0 kW



8400 motec for wall mounting
4.0 ... 7.5 kW

Wall mounting with switch

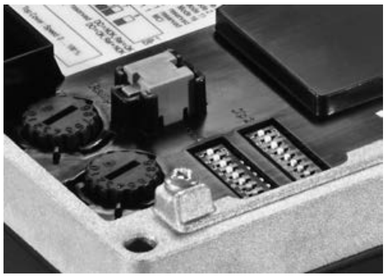


8400 motec with switch for wall mounting 0.37 ... 3.0 kW

8400 motec with switch for wall mounting 4.0 ... 7.5 kW

Drive Unit

The Drive Unit has DIP switches and potentiometers on its underside, adjacent to the power unit, with which the inverter can be put into operation very easily. They are used to adjust configuration, speed and ramp settings. In this way, the Drive Unit can be quickly and easily matched with the equipment.



DIP switches on Drive Unit

The diagnosis adapter can be connected next to the status display in order to perform diagnostics. This does not require dismantling of the drive. With the potentiometer that can be accessed from above, you can make speed settings while the motor is actually running.

Drive Unit diagnostic terminal

Drive Unit diagnostic terminal

Functions and features

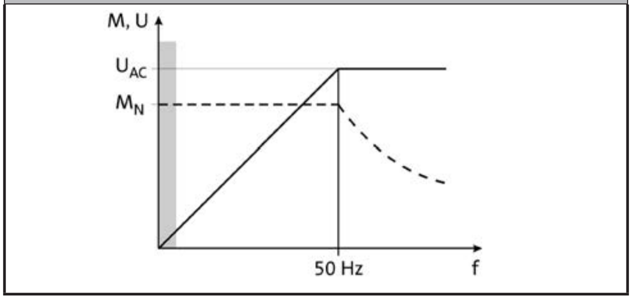
Version	
Product	8400 motec
Control mode, motor control	
Sensorless vector control (SLVC)	Speed control for three-phase asynchronous motors
Sensorless vector control (SLVC) with torque mode	Torque control for three-phase asynchronous motors
Sensorless control (SL PSM)	For synchronous motors
V/f characteristic control linear/square-law (VFCplus)	For three-phase AC motors and asynchronous servo motors
Energy-saving function (VFC eco)	For three-phase asynchronous motors
V/f characteristic control (VFC closed loop)	For asynchronous servo motors
Basic functions	
	Freely assignable user menu Parameter change-over DC brake function Flying restart circuit S-shaped ramps for smooth acceleration PID controller 3 fixed frequencies Masking frequencies
Technology applications	
	Speed actuating drive Switch-off positioning without feedback
Monitoring and protective measures	
	Short circuit Earth fault Overvoltage Motor phase failure Overcurrent I^2 x t-Motor monitoring Motor overtemperature Mains phase failure Protection in the event of cyclic mains switching Motor stalling
Diagnostics	
	Data logger, logbook
Status displays	1 LED
Diagnostic interface	Integrated For USB diagnostic adapter or keypad (diagnosis terminal)
Braking operation	
Brake chopper	Integrated
Brake resistor	Built-on module or external

Operating modes

An inverter ensures energy-efficient system operation in virtually every application case. The easily selectable operating modes are used for this purpose. The following characteristics and matching technical data listed on the following pages are used to determine the optimum operating mode during the project planning phase.

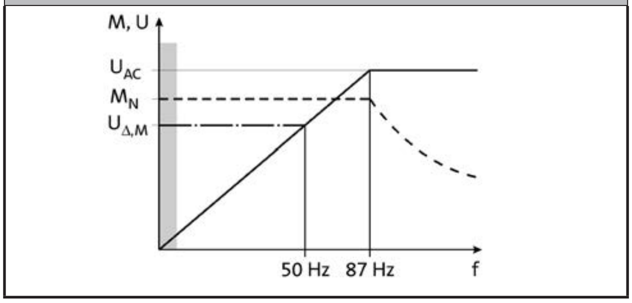
Standard setting
In the "as delivered" condition, the inverter is configured for single operation on a three-phase AC motor with V/f-closed loop control. When operated in this mode, the rated torque of the motor is available in a range adjustable up to 50 Hz.

V/f at 50 Hz



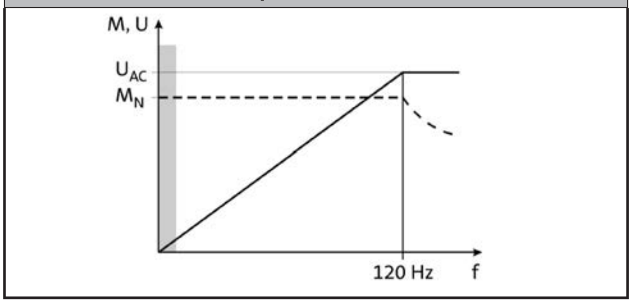
Extended setting range up to 87 Hz
If the V/f inflexion point is set to 87 Hz, the rated torque can also be taken into consideration in the extended setting range. In this case, for instance, a 230/400 V-motor is used and operated on a 400 V inverter in delta connection. The adjustment range is increased by 40%. The inverter must be dimensioned for a rated motor current of 230 V.

V/f at 87 Hz



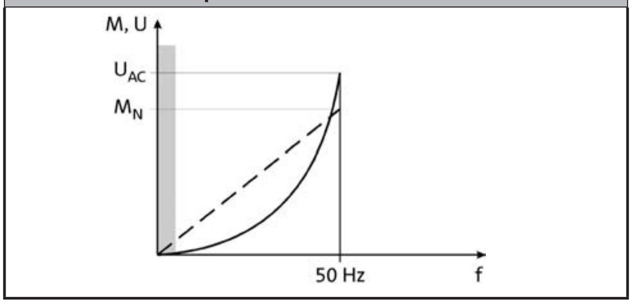
Operation with inverter-optimized MF motors
Large adjustment range and optimized operation with rated torque. These are the strengths of the MF motor when used in combination with an inverter. The motors are optimized for a setting range up to 120 Hz. Compared to conventional 50 Hz operation, the setting range increases by 250%. It is quite simply not possible for a drive to be operated any more efficiently in a machine.

V/f at 120 Hz



Operation with low loads
This operating mode can be used for various applications, e.g., for fans and pumps:
In fan or pump applications, the load response follows a square-law characteristic, depending on the speed. An overload capability of 1.2 x is often sufficient. This means the inverter can be operated at increased power, i.e., the inverter can be dimensioned one power size smaller. The square-law characteristic which corresponds to the load behavior can be set in the inverter.

Square-law characteristic



Operating modes

Energy saving mode VFC-eco
The inverters make energy efficiency particularly easy with the "VFC eco" function. This function significantly reduces energy demand, particularly in the partial load operational range. Combined with the new L-force MF three-phase AC motors, this drive solution impresses with the maximum energy efficiency of a Lenze BlueGreen solution.

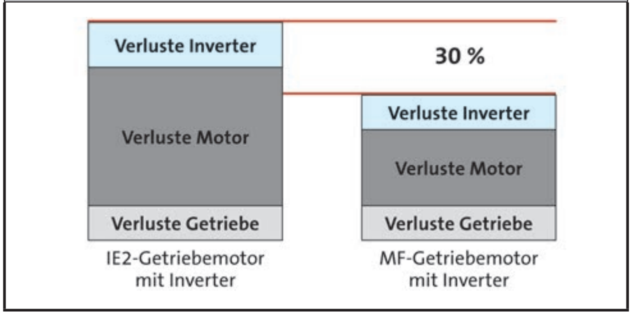
The "VFC eco" mode adapts the magnetizing current of a motor intelligently to meet actual needs. This is particularly useful in partial load operational range as it is precisely here that three-phase AC motors need to be supplied with a greater magnetizing current than the operating conditions actually require. In practice, the "VFC eco" mode reduces losses to such an extent that savings of up to 30% are within reach.

Energy efficiency can then be increased again with the MF three-phase AC motors. These motors have been specifically designed for operation with frequency inverters. They operate at 120 Hz instead of 50 Hz, as 4-pole three-phase AC motors are most efficient at this frequency.

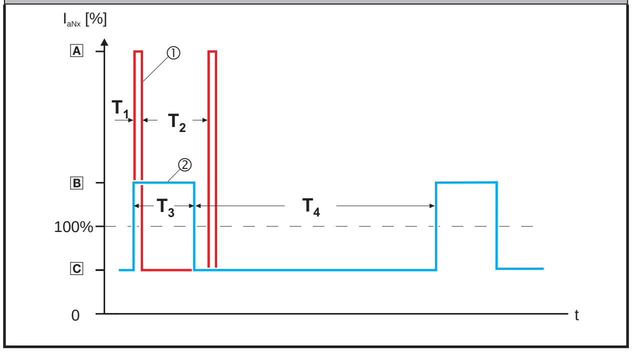
Overcurrent operation
The inverters can be operated at higher amperages beyond the rated current if the duration of this overcurrent operation is time limited. Two utilization cycles of 15 s and 180 s are defined. Within these utilization cycles, an overcurrent is possible for a certain time if afterwards an accordingly long recovery phase takes place. One moving average is determined separately for each utilization cycle. The adjacent diagram shows the two cycles: 15 s in red and 180 s in blue. The overload time is 3 s (T1) or 60 s (T3), so the recovery time is therefore 12 s (T2) or 120 s (T4). The following data tables show the possible maximum output currents.
The monitoring of the device utilization (Ixt) causes the set error response (trip or warning) if one of the two utilization values exceeds the threshold of 100 %.

Switching frequencies
For inverters, the term "switching frequency" means the frequency with which the output modules (inverters) are switched on and off. The switching frequency on the 8400 motec can be set to values between 4 and 16 kHz; the selection depends on the output.
The inverter can provide a higher output current at a switching frequency of 4 kHz to allow for the losses – i.e., heat – generated by module switching operations. Additionally, a distinction is made between operation at a permanently set switching frequency and a variably set switching frequency, whereby the switching frequency is automatically reduced based on the output current. The data for operation at increased output is permissible for operation at a switching frequency of 4 kHz and at an ambient temperature of max. 40 °C.

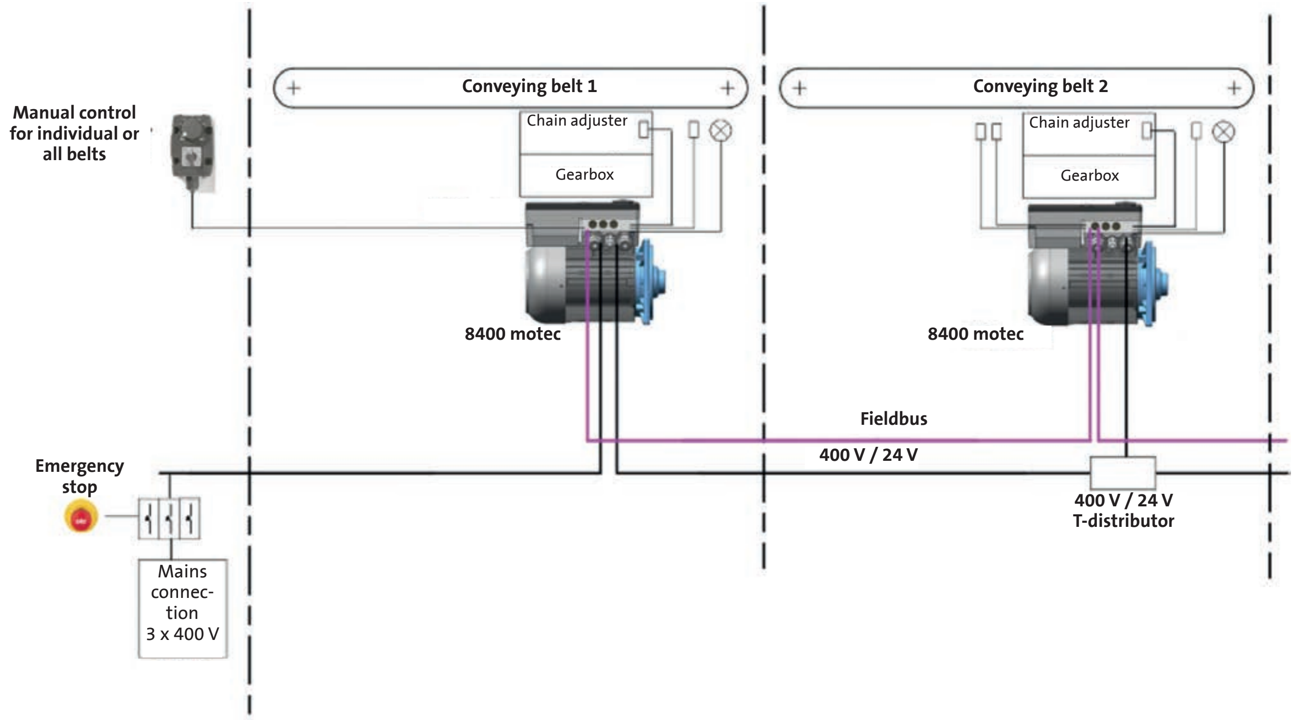
Energy saving mode VFC-eco



Overcurrent operation

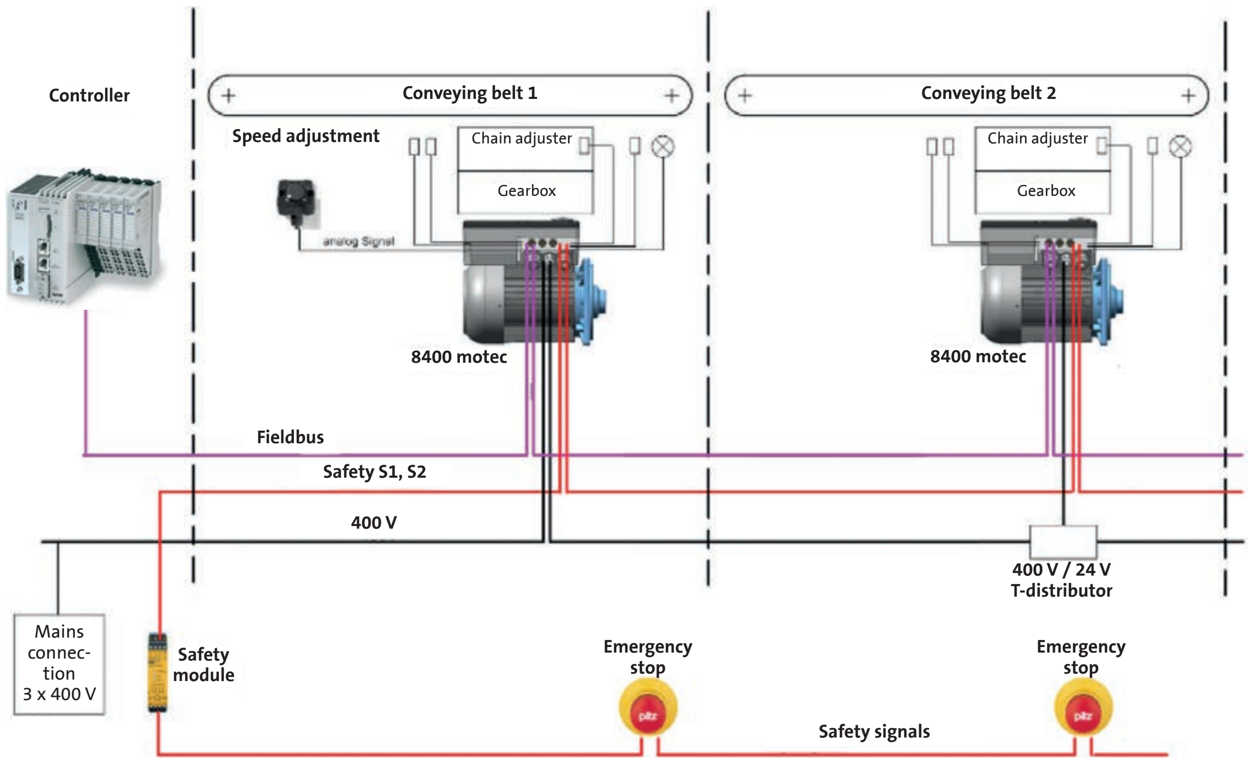


Topologies for decentralized drive technology



4.2

Extension of safety technology

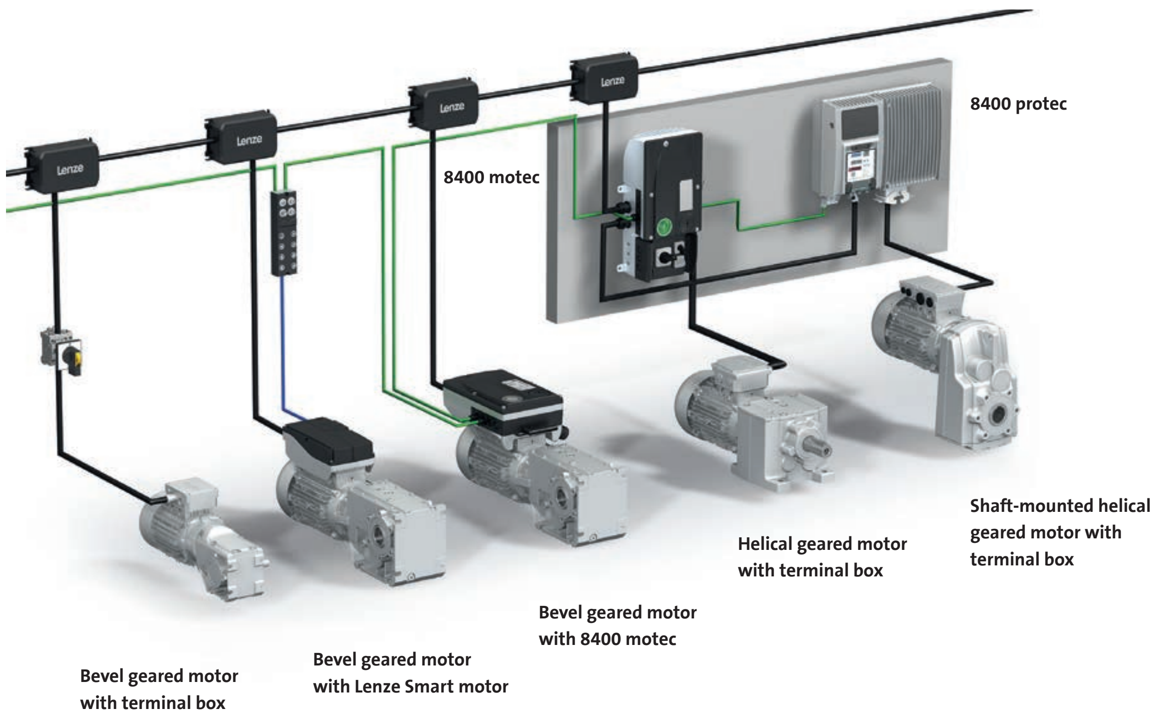


Application example of an overall interconnected system

Lenze components can be used to create an entire compact decentralized drive solution within the overall interconnected system.

Mains operation:
The IE1, IE2 and IE3 three-phase geared motors and the Lenze Smart Motor m300 in combination with the g500 gearboxes.

Inverter operation
The various three-phase geared motors in combination with the 8400 motec inverter for motor and wall mounting and the 8400 protec for wall mounting.
Easy and clear wiring via terminal boxes or plug-in connectors ensure safe operation and a high level of service safety.



Standards and operating conditions

Version			
Product			8400 motec
Conformity			
CE			2014/35/EU: Low-Voltage Directive [UKCA: S.I. 2016/1101] 2014/30/EU: EMC Directive [UKCA: S.I. 2016/1091]
EAC			TP TC 004/2011 (TR CU 004/2011) TP TC 020/2011 (TR CU 020/2011)
Approval			
UL 508C			Power Conversion Equipment (File-No. E132659/E170350)
CSA			CSA 22.2 No. 247-13
Protection class			
EN 60529			Standard: IP65 Frame Unit – service switch with protective function: IP64 Frame Unit – service switch: IP54 Frame Unit - service switch with control elements: IP54
NEMA 250			Interior: Type 4x Wall mounting 0.37 ... 3 kW: Type 12 Frame Unit – mains connection with M15: Type 1
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Operation (EN 60721-3-3) 3K3			3K3 (temperature: -30 °C ... +55 °C)
Current derating			2.5%/K Operation at 4 kHz above 45°C Operation at 8/16 kHz above 40°C
Site altitude			
above sea level	H_{max}	[m]	4,000
Current derating at over 1,000 m		[%/1,000 m]	5
Vibration resistance			
Transport (EN 60721-3-2)			2M2
Operation (EN 60721-3-3)			Motor mounting, 0.37 ... 7.5 kW: 3M6 Wall mounting, 0.37 ... 7.5 kW: 3M4
Operation (Germanischer Lloyd)			General conditions: Acceleration resistant up to 2 g

Version	
Product	8400 motec
Mainstype	
	Systems with earthed star point (TN and TT systems) Systems with high-resistance or isolated star point (IT systems)
Noise emission	
EN 61800-3	Interference suppression measures integrated: Conducted, category C1 1) For wall mounting: Category C2 with a shielded motor cable of up to 20 m when $F_{ch= 4\ kHz}$
Insulation resistance	
EN 61800-5-1	0 ... 2,000 m above sea level: overvoltage category III 2,000 ... 4,000 m above sea level: overvoltage category II
Degree of pollution	
EN 61800-5-1	2
Protective insulation of control circuits	
EN 61800-5-1	Safe mains isolation: double/reinforced insulation

Characteristics of the motor holding brake		
Designation	**Description**	**Rated value**
X1		
BD1 (+) BD2 (-)	Connection of a motor holding brake	400 V mains: DC 180 V
		480 V mains: DC 215 V
	Max. output current	0.3 A
	Max. output power	55 VA
	Output voltage at 0.37 ... 1.5 kW	The rated coil voltage is neither increased nor reduced.
	Output voltage at 2.2 ... 7.5 kW	To ensure a safe release of the brake, 130 % of the rated coil voltage is connected to the coil for 0.3 s. Then, this voltage is reduced to 65 % of the rated coil voltage.

1) Applies to 4 kHz, from 4 kW category C2 for 4 and 8 kHz.

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

						
Typical motor power						
4-pole asynchronous motor	P	[kW]	0.37	0.55 1)	0.55	0.75 1)
Product key						
Drive Unit			E84DGDVB37142PS		E84DGDVB55142PS	
Motor mounting			E84DVBM3714□□□2□□		E84DVBM5514□□□2□□	
Wall mounting			Z□5□□□□□□□□137□□□□		Z□5□□□□□□□□155□□□□	
Mains voltage range						
	U_{AC}	[V]	3/PE AC 320 V - 0 % ... 528 V + 0 %, 45 Hz - 0 % ... 65 Hz + 0 %			
Rated mains current						
	$I_{N, AC}$	[A]	1.3	1.6	1.8	2.2
Rated output current						
	$I_{N, out}$	[A]	1.3	1.6	1.8	2.2
Rated switching frequency						
	f_{ch}	[kHz]	8	4	8	4
output current						
4 kHz	$I_{, out}$	[A]	1.3	1.6	1.8	2.2
8 kHz	$I_{, out}$	[A]	1.3		1.8	
16 kHz	$I_{, out}$	[A]	0.9		1.2	

Data for 60 s overload

Max. output current				
	$I_{max, out}$	[A]	2.0	2.7
Overload time				
	t_{ol}	[s]	60.0	
Recovery time				
	t_{ret}	[s]	120.0	

Data for 3 s overload

Max. short-time output current				
	$I_{max, out}$	[A]	2.6	3.6
Overload time				
	t_{ol}	[s]	3.0	
Recovery time				
	t_{ret}	[s]	12.0	

1) Operating mode, increased rated power at 40 °C ambient temperature

4.2

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating data in the hardware manual must be observed.

						
Typical motor power						
4-pole asynchronous motor	P	[kW]	0.37	0.55 [1]	0.55	0.75 [1]
Product key						
Drive Unit			E84DGDVB37142PS		E84DGDVB55142PS	
Motor mounting			E84DVBM3714□□□2□□		E84DVBM5514□□□2□□	
Wall mounting			Z□5□□□□□□□□137□□□□		Z□5□□□□□□□□155□□□□	
Power loss						
	P_V	[kW]	0.026		0.033	
Mass						
	m	[kg]	2.6			
Max. cable length						
Shielded motor cable [3]	l_{max}	[m]	20			

Brake chopper rated data

Rated power, brake chopper						
	P_N	[kW]	0.4	0.5	0.6	0.7
Max. output power, brake chopper						
	$P_{Max, 1}$	[kW]	0.6		0.8	
Min. brake resistance						
	R_{min}	[Ω]	180			

Dimensions

Dimensions			
Height	H	[mm]	109
Width	W	[mm]	161
Depth	D	[mm]	241

1)Operating mode, increased rated power at 40 °C ambient temperature
3)Technically possible cable lengths, irrespective of EMC requirements

4.2

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

						
Typical motor power						
4-pole asynchronous motor	P	[kW]	0.75	1.1 [1]	1.1	1.5 [1]
Product key						
Drive Unit			E84DGDVB75142PS		E84DGDVB11242PS	
Motor mounting			E84DVBM7514□□□2□□		E84DVBM1124□□□2□□	
Wall mounting			Z□5□□□□□□□□□175□□□□		Z□5□□□□□□□□□211□□□□	
Mains voltage range						
	U_{AC}	[V]	3/PE AC 320 V - 0 % ... 528 V + 0 %, 45 Hz - 0 % ... 65 Hz + 0 %			
Rated mains current						
	$I_{N, AC}$	[A]	2.4	2.9	3.2	3.8
Rated output current						
	$I_{N, out}$	[A]	2.4	2.9	3.2	3.8
Rated switching frequency						
	f_{ch}	[kHz]	8	4	8	4
output current						
4 kHz	$I_{, out}$	[A]	2.4	2.9	3.2	3.8
8 kHz	$I_{, out}$	[A]	2.4		3.2	
16 kHz	$I_{, out}$	[A]	1.6		2.1	

Data for 60 s overload

Max. output current				
	$I_{max, out}$	[A]	3.6	4.8
Overload time				
	t_{ol}	[s]	60.0	
Recovery time				
	t_{ret}	[s]	120.0	

Data for 3 s overload

Max. short-time output current				
	$I_{max, out}$	[A]	4.8	6.4
Overload time				
	t_{ol}	[s]	3.0	
Recovery time				
	t_{ret}	[s]	12.0	

1) Operating mode, increased rated power at 40 °C ambient temperature

4.2

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables. For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

						
Typical motor power						
4-pole asynchronous motor	P	[kW]	0.75	1.1 [1)]	1.1	1.5 [1)]
Product key						
Drive Unit			E84DGDVB75142PS		E84DGDVB11242PS	
Motor mounting			E84DVBM7514□□□2□□		E84DVBM1124□□□2□□	
Wall mounting			Z□5□□□□□□□□175□□□□		Z□5□□□□□□□□211□□□□	
Power loss						
	P_V	[kW]	0.041		0.052	
Mass						
	m	[kg]	2.6			
Max. cable length						
Shielded motor cable [3)]	l_{max}	[m]	20			

Brake chopper rated data

Rated power, brake chopper						
	P_N	[kW]	0.8	0.9	1.1	1.3
Max. output power, brake chopper						
	$P_{Max, 1}$	[kW]	1.3		1.7	
Min. brake resistance						
	R_{min}	[Ω]	180			

Dimensions

Dimensions			
Height	H	[mm]	109
Width	W	[mm]	161
Depth	D	[mm]	241

1)Operating mode, increased rated power at 40 °C ambient temperature
3)Technically possible cable lengths, irrespective of EMC requirements

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

						
Typical motor power						
4-pole asynchronous motor	P	[kW]	1.5	2.2 1) 2)	2.2	3.0 1)
Product key						
Drive Unit			E84DGDVB15242PS		E84DGDVB22242PS	
Motor mounting			E84DVBM1524□□□2□□		E84DVBM2224S□□□2□□	
Wall mounting			Z□5□□□□□□□□□215□□□□		Z□5□□□□□□□□□222□□□□	
Mains voltage range						
	U_{AC}	[V]	3/PE AC 320 V - 0 % ... 528 V + 0 %, 45 Hz - 0 % ... 65 Hz + 0 %			
Rated mains current						
	$I_{N, AC}$	[A]	3.8	4.6	5.5	6.7
Rated output current						
	$I_{N, out}$	[A]	3.9	4.7	5.6	6.7
Rated switching frequency						
	f_{ch}	[kHz]	8	4	8	4
output current						
4 kHz	$I_{, out}$	[A]	3.9	4.7	5.6	6.7
8 kHz	$I_{, out}$	[A]	3.9		5.6	
16 kHz	$I_{, out}$	[A]	2.6		3.7	

Data for 60 s overload

Max. output current				
	$I_{max, out}$	[A]	5.9	8.4
Overload time				
	t_{ol}	[s]	60.0	
Recovery time				
	t_{ret}	[s]	120.0	

Data for 3 s overload

Max. short-time output current				
	$I_{max, out}$	[A]	7.8	11.2
Overload time				
	t_{ol}	[s]	3.0	
Recovery time				
	t_{ret}	[s]	12.0	

1)Operating mode, increased rated power at 40 °C ambient temperature
2)Only applies to motor mounting

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

						
Typical motor power						
4-pole asynchronous motor	P	[kW]	1.5	2.2 [1) 2)]	2.2	3.0 [1)]
Product key						
Drive Unit			E84DGDVB15242PS		E84DGDVB22242PS	
Motor mounting			E84DVBM1524□□□2□□		E84DVBM2224□□□2□□	
Wall mounting			Z□5□□□□□□□□215□□□□		Z□5□□□□□□□□222□□□□	
Power loss						
	P_V	[kW]	0.061		0.088	
Mass						
	m	[kg]	2.6		3.5	
Max. cable length						
Shielded motor cable [3)]	l_{max}	[m]	20			

Brake chopper rated data

Rated power, brake chopper						
	P_N	[kW]	1.5	1.8	2.2	2.6
Max. output power, brake chopper						
	$P_{Max,1}$	[kW]	2.3		3.3	
Min. brake resistance						
	R_{min}	[Ω]	180		100	

Dimensions

Dimensions				
Height	H	[mm]	109	135
Width	W	[mm]	161	176
Depth	D	[mm]	241	261

1)Operating mode, increased rated power at 40 °C ambient temperature
2)Only applies to motor mounting
3)Technically possible cable lengths, irrespective of EMC requirements

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

						
Typical motor power						
4-pole asynchronous motor	P	[kW]	3.0	4.0 [1) 2)]	4.0	5.5 [1)]
Product key						
Drive Unit			E84DGDVB30242PS		E84DGDVB40242PS	
Motor mounting			E84DVBM3024□□□2□□		E84DVBM40242□□□2□□	
Wall mounting			Z□5□□□□□□□□230□□□□		Z□5□□□□□□□□240□□□□	
Mains voltage range						
	U_{AC}	[V]	3/PE AC 320 V - 0 % ... 528 V + 0 %, 45 Hz - 0 % ... 65 Hz + 0 %			
Rated mains current						
	$I_{N, AC}$	[A]	7.2	8.6	9.3	11.3
Rated output current						
	$I_{N, out}$	[A]	7.3	8.8	9.5	11.4
Rated switching frequency						
	f_{ch}	[kHz]	8	4	8	4
output current						
4 kHz	$I_{, out}$	[A]	7.3	8.8	9.5	11.4
8 kHz	$I_{, out}$	[A]	7.3		9.5	
16 kHz	$I_{, out}$	[A]	4.9		6.3	

Data for 60 s overload

Max. output current				
	$I_{max, out}$	[A]	11.0	14.3
Overload time				
	t_{ol}	[s]	60.0	
Recovery time				
	t_{ret}	[s]	120.0	

Data for 3 s overload

Max. short-time output current				
	$I_{max, out}$	[A]	14.6	19.0
Overload time				
	t_{ol}	[s]	3.0	
Recovery time				
	t_{ret}	[s]	12.0	

1)Operating mode, increased rated power at 40 °C ambient temperature
2)Only applies to motor mounting

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

						
Typical motor power						
4-pole asynchronous motor	P	[kW]	3.0	4.0 1) 2)	4.0	5.5 1)
Product key						
Drive Unit			E84DGDVB30242PS		E84DGDVB40242PS	
Motor mounting			E84DVBM3024□□□2□□		E84DVBM40242□□□2□□	
Wall mounting			Z□5□□□□□□□□230□□□□		Z□5□□□□□□□□240□□□□	
Power loss						
	P_V	[kW]	0.11		0.14	
Mass						
	m	[kg]	3.5		5.3	
Max. cable length						
Shielded motor cable 3)	I_{max}	[m]	20			

Brake chopper rated data

Rated power, brake chopper				
	P_N	[kW]	3.0	4.0
Max. output power, brake chopper				
	$P_{Max, 1}$	[kW]	4.5	5.5
Min. brake resistance				
	R_{min}	[Ω]	100	47.0

Dimensions

Dimensions				
Height	H	[mm]	135	176
Width	W	[mm]	176	195
Depth	D	[mm]	261	325

1)Operating mode, increased rated power at 40 °C ambient temperature
2)Only applies to motor mounting
3)Technically possible cable lengths, irrespective of EMC requirements

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

Typical motor power						
4-pole asynchronous motor	P	[kW]	5.5	7.5 1)	7.5	9.2 1) 4)
Product key						
Drive Unit			E84DGDVB55242PS		E84DGDVB75242PS	
Motor mounting			E84DVBM5524□□□2□□		E84DVBM7524□□□2□□	
Wall mounting			Z□5□□□□□□□□□255□□□□		Z□5□□□□□□□□□275□□□□	
Mains voltage range						
	U_{AC}	[V]	3/PE AC 320 V - 0 % ... 528 V + 0 %, 45 Hz - 0 % ... 65 Hz + 0 %			
Rated mains current						
	$I_{N, AC}$	[A]	12.8	15.4	16.3	19.6
Rated output current						
	$I_{N, out}$	[A]	13.0	15.6	16.5	19.8
Rated switching frequency						
	f_{ch}	[kHz]	8	4	8	4
output current						
4 kHz	$I_{, out}$	[A]	13.0	15.6	16.5	19.8
8 kHz	$I_{, out}$	[A]	13.0		16.5	
16 kHz	$I_{, out}$	[A]	8.7		11.0	

Data for 60 s overload

Max. output current				
	$I_{max, out}$	[A]	19.5	24.8
Overload time				
	t_{ol}	[s]	60.0	
Recovery time				
	t_{ret}	[s]	120.0	

Data for 3 s overload

Max. short-time output current				
	$I_{max, out}$	[A]	26.0	33.0
Overload time				
	t_{ol}	[s]	3.0	
Recovery time				
	t_{ret}	[s]	12.0	

1)Operating mode, increased rated power at 40 °C ambient tempera-ture4)Operation at 9.2 kW is not permissible with the Q8/0 connector.

Rated data 400 V

- The data applies to operation at 400 V AC.
- Unless otherwise specified, the data refers to the default setting.
- The product key of the inverter for motor mounting is specified in the technical data tables.
- For wall mounting of devices up to 3 kW, the corresponding derating figures in the hardware manual must be observed.

Typical motor power						
4-pole asynchronous motor	P	[kW]	5.5	7.5 [1]	7.5	9.2 [1) 4)]
Product key						
Drive Unit			E84DGDVB55242PS		E84DGDVB75242PS	
Motor mounting			E84DVBM5524□□□2□□		E84DVBM7524□□□2□□	
Wall mounting			Z□5□□□□□□□□255□□□□		Z□5□□□□□□□□275□□□□	
Power loss						
	P_V	[kW]	0.19		0.23	
Mass						
	m	[kg]	5.3			
Max. cable length						
Shielded motor cable [3]	I_{max}	[m]	20			

Brake chopper rated data

Rated power, brake chopper						
	P_N	[kW]	5.5	6.6	7.5	9.2
Max. output power, brake chopper						
	$P_{Max, 1}$	[kW]	7.5		9.2	
Min. brake resistance						
	R_{min}	[s]	47.0			

Dimensions

Dimensions			
Height	H	[mm]	176
Width	W	[mm]	195
Depth	D	[mm]	325

1)Operating mode, increased rated power at 40 °C ambient temperature
3)Technically possible cable lengths, irrespective of EMC requirements
4)Operation at 9.2 kW is not permissible with the Q8/0 connector.

Mains connection

- The data given for mains fuses and cable cross-sections is intended for a mains connection of 3 x 400 V for individual connection.
- Class gG/gl fuses or class gRL semiconductor fuses.
- The cable cross-sections apply to PVC-insulated copper cables.
- Use for installation with UL-approved cables, fuses and brackets.

<table>
<tr><th>Typical motor power</th><th>Mains voltage</th><th>Automatic circuit breaker</th><th colspan="2">Fuse</th><th>Mains connection</th></tr>
<tr><td>4-pole asynchronous motor</td><td></td><td></td><td>EN 60204-1</td><td>UL</td><td>Cross-section (w/o power choke)</td></tr>
<tr><td>P</td><td>U_{AC}</td><td>I</td><td>I</td><td>I</td><td>q</td></tr>
<tr><td>[kW]</td><td>[V]</td><td>[A]</td><td>[A]</td><td>[A]</td><td>[mm2]</td></tr>
<tr><td>0.37</td><td rowspan="10">3 AC 320 ... 528</td><td rowspan="7">C16</td><td rowspan="7">16</td><td rowspan="7">15</td><td rowspan="7">2.5</td></tr>
<tr><td>0.55</td></tr>
<tr><td>0.75</td></tr>
<tr><td>1.1</td></tr>
<tr><td>1.5</td></tr>
<tr><td>2.2</td></tr>
<tr><td>3.0</td></tr>
<tr><td>4.0</td><td rowspan="3">C20</td><td rowspan="3">20</td><td rowspan="3">20</td><td rowspan="3">4.0</td></tr>
<tr><td>5.5</td></tr>
<tr><td>7.5</td></tr>
</table>

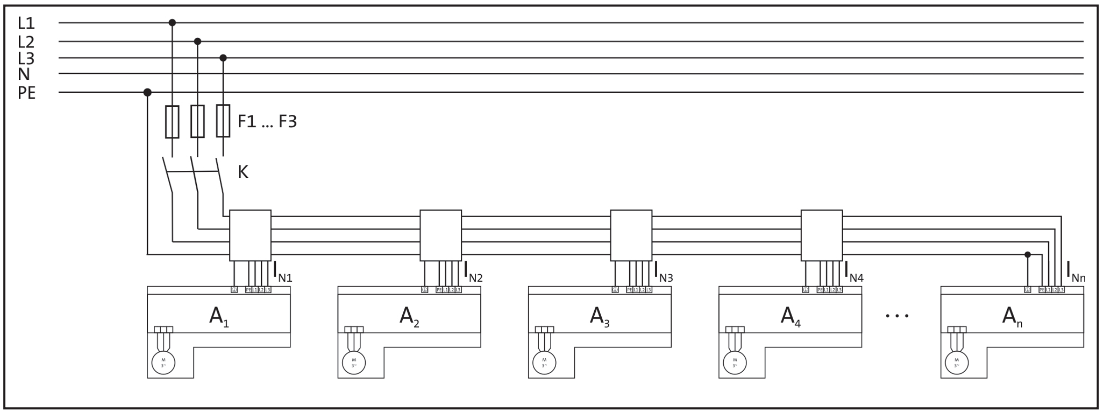
Motor connection

- Keep motor cables as short as possible, as this has a positive effect on the drive behavior.
- For group drives (several motors on one inverter), the resulting cable length is authoritative. For help with the calculation, see the hardware manual.
- Electric strength of the motor cable: 1 kV according to VDE 250-1.

<table>
<tr><th colspan="4">EMC</th></tr>
<tr><td colspan="4">Interference emission (in TN and TT systems)</td></tr>
<tr><td>Cable-guided</td><td rowspan="4">EN 61800–3</td><td colspan="2"></td></tr>
<tr><td rowspan="3">Motor mounting</td><td>0.37 ... 1.5 kW, $f_{ch \leq 8\ kHz}$</td><td>Category C1</td></tr>
<tr><td>2.2 ... 3.0 kW, $f_{ch \leq 4\ kHz}$</td><td>Category C1</td></tr>
<tr><td>4.0 ... 7.5 kW</td><td>Category C2</td></tr>
<tr><td>Wall mounting and Lenze system cable 20 m</td><td>EN 61800–3</td><td>0.37 ... 7.5 kW, $f_{ch \leq 4\ kHz}$</td><td>Category C2</td></tr>
<tr><td>Wall mounting and Lenze system cable 10 m</td><td>EN 61800–3</td><td>0.37 ... 7.5 kW, $f_{ch \leq 8\ kHz}$</td><td>Category C2</td></tr>
<tr><td rowspan="2">Radiation</td><td rowspan="2">EN 61800–3</td><td>0.37 ... 1.5 kW, $f_{ch \leq 8\ kHz}$</td><td>Category C1</td></tr>
<tr><td>2.2 ... 7.5 kW, $f_{ch \leq 8\ kHz}$</td><td>Category C2</td></tr>
</table>

Group installation

- Use of copper cables insulated with PVC
- Conductor temperature ≤ 70 °C, ambient temperature ≤ 40 °C
- No bundling of cables or wires, thee wires under load
- Typical utilization of the cable cross-section: 80 %
- Simultaneity factor: 100 %



4.2

Max. total rated mains currents at 40 °C				
Cable installation in accordance with		EN 60204-1		
Main line				
Laying system		B2		
Cable cross-section	mm2	1.5	2.5	4.0
Stub				
Laying system		C		
Cable cross-section	mm2	1.5	2.5	2.5
Max. cable current	A	13.1	17.4	21
Fuse				
Characteristic		gG/gL		
Max. rated current ($I_{max} \geq I_{N1} + I_{N2} + I_{N3} + I_{Nn}$)	A	10	16	20
Circuit breaker				
Characteristic		gRL		
Max. rated current ($I_{max} \geq I_{N1} + I_{N2} + I_{N3} + I_{Nn}$)	A	10	16	20
Example: Number of 8400 motec units, each with 0.75 kW		3	5	7

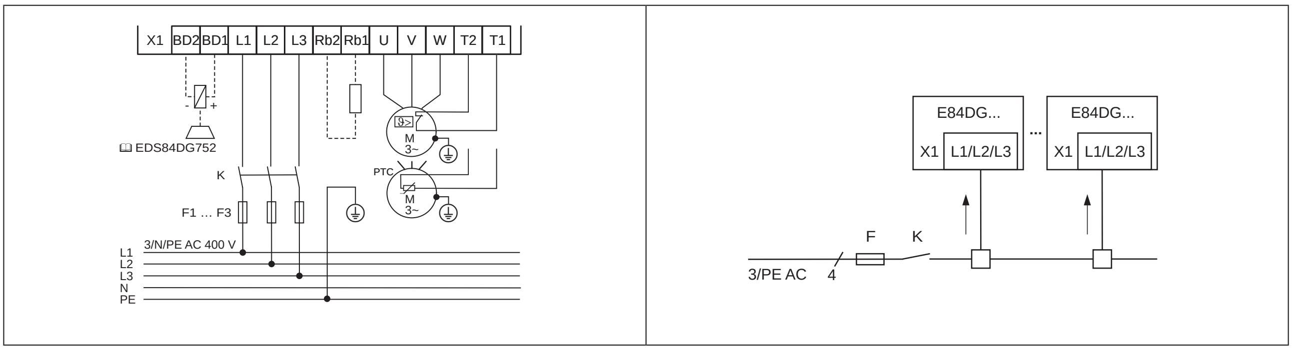
Max. total rated mains currents at 40 °C				
Cable installation in accordance with		NFPA 70, NFPA 79		
Main line				
Laying system		B2		
Cable cross-section	AWG	16	14	12
Stub				
Laying system				
Cable cross-section	AWG	16	14	14
Max. cable current	A	8.0	12.0	15
Fuse				
Characteristic				
Max. rated current ($I_{max} \geq I_{N1} + I_{N2} + I_{N3} + I_{Nn}$)	A	10	15	15
Circuit breaker				
Characteristic				
Max. rated current ($I_{max} \geq I_{N1} + I_{N2} + I_{N3} + I_{Nn}$)	A	10	15	15
Example: Number of 8400 motec units, each with 0.75 kW		3	5	7

Electrical installation

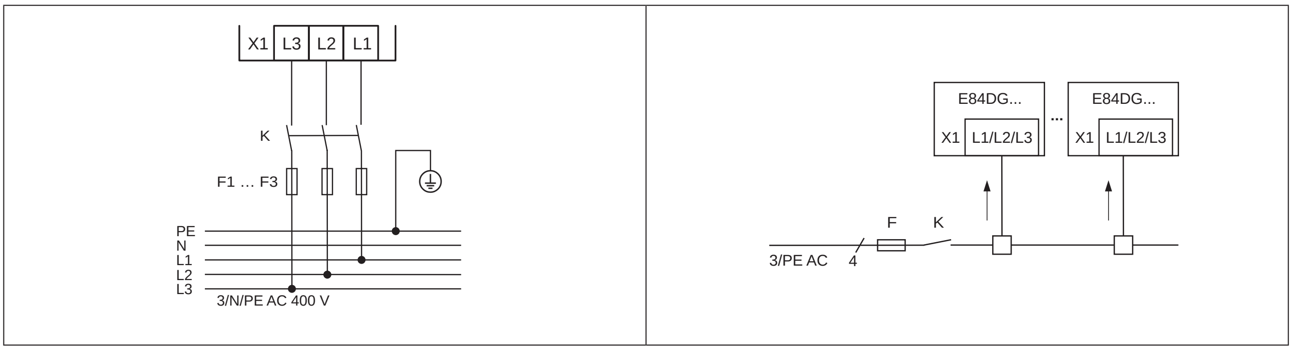
Power connections

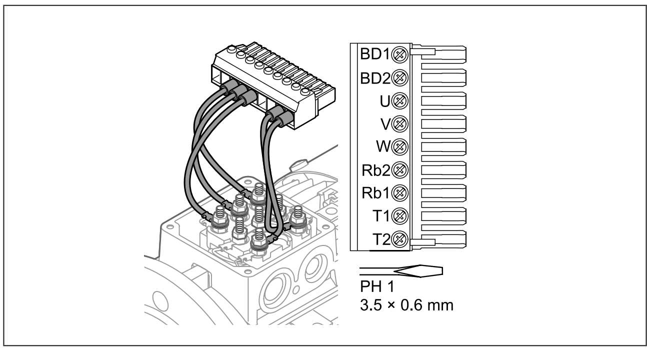
Basic circuit diagram

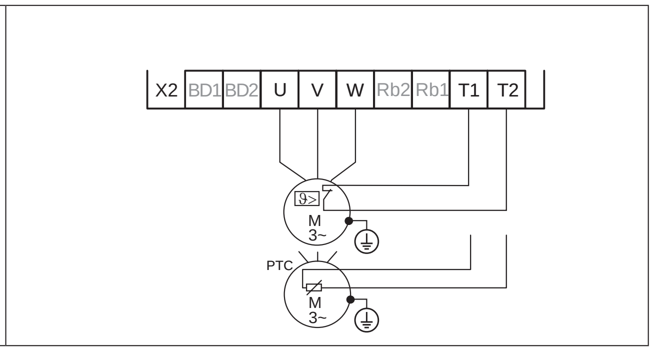
0.37 ... 3.0 kW



4.0 ... 7.5 kW







4.2

Communication Units

The Communication Units support the following functions:
- Control of inverters via digital and analogue signals
- Control of the inverter via the fieldbus systems
- Support for “safe torque off” functionality
- Connection options for sensors and actuators
- The sensors can be powered by the internal 24 V supply
- Connection options via cable glands and M12 connector. A total of up to 8 screwed connections / plugs can be used. Depending on their function, the individual Communication Units are equipped with the corresponding connections by default.

Communication Unit

	Controller enable	Digital inputs	Digital outputs	Relay outputs	Analog inputs	Safety STO 2 channels (SIA and SIB)	External 24 V supply
	Number	Number	Number	Number	Number	Number	Number
I/O modules							
Basic I/O	1	2	-	1	-	-	-
Standard I/O	1	5	1	1	1	-	-
Standard I/O + M12	1	5	1	1	1	-	-
Extended I/O	1	8	1	1	2	-	-
Fieldbus							
AS-Interface / standard I/O							
AS-Interface / enhanced I/O	1	5	1	-	-	-	via fieldbus
AS-Interface / enhanced 2 I/O							
CANopen / standard I/O	1	5	1	-	-	-	-
CANopen / enhanced I/O							
EtherCAT / standard I/O							
EtherCAT enhanced I/O							
EtherCAT / enhanced 2 I/O							
EtherNet/IP / standard I/O							
EtherNet/IP / enhanced I/O							
EtherNet/IP / enhanced 2 I/O							
POWERLINK / standard I/O							
POWERLINK / enhanced I/O	1	5	1	-	-	-	1
POWERLINK / enhanced 2 I/O							
PROFIBUS / standard I/O							
PROFIBUS / enhanced I/O							
PROFIBUS / enhanced 2 I/O							
PROFINET / standard I/O							
PROFINET / enhanced I/O							
PROFINET / enhanced 2 I/O							
Fieldbus with safety							
AS-Interface STO / standard I/O	1	5	1	1	1	1	via fieldbus
AS-Interface STO / enhanced I/O							
CANopen STO / standard I/O	1	5	1	1	1	1	-
CANopen STO / enhanced I/O							
EtherCAT STO / standard I/O							
EtherCAT STO / enhanced I/O							
EtherCAT STO / enhanced 2 I/O							
EtherNet/IP STO / standard I/O							
EtherNet/IP STO / enhanced I/O							
EtherNet/IP STO / enhanced 2 I/O							
POWERLINK STO / standard I/O							
POWERLINK STO / enhanced I/O	1	5	1	1	1	1	1
POWERLINK STO / enhanced 2 I/O							
PROFIBUS STO / standard I/O							
PROFIBUS STO / enhanced I/O							
PROFIBUS STO / enhanced 2 I/O							
PROFINET STO / standard I/O							
PROFINET STO / enhanced I/O							
PROFINET STO / enhanced 2 I/O							

General technical data

Version	
Product	8400 motec
Analog inputs	
	Switchable: Voltage or current input
Resolution	10 bits
Value range	0 ... 10 V, 0/4 ... 20 mA
Value range extended I/O	-10 ... +10 V
Digital inputs	
Switching level	PLC (IEC 61131-2)
Function	Parameterizable
Digital outputs	
Switching level	PLC (IEC 61131-2)
Max. output current	50 mA
Function	Parameterizable
Relay	
Contact	Normally-open contact (NO/COM)
Connection	AC 250 V, 3 A
Connection	DC 24 V, 2 A ... 240 V, 0.16 A
Function	Parameterizable
External 24 V supply	
	To support communication when the 400 V is switched off
Internal 24 V supply	
	Max. 100 mA for inputs/outputs and sensor feeds
Interfaces	
Extensions	Fieldbus via Communication Unit
Safety technology	Dual-channel STO input
Drive interface	
Encoder input	Via 2 digital inputs, HTL, 2-track, 7.5 kHz / 10 kHz

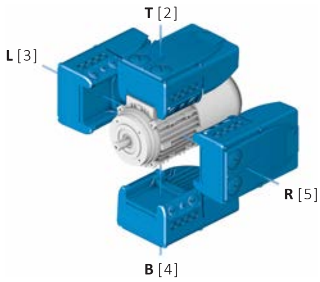
Safety engineering

The “safe torque off (STO)” safety function is integrated into certain versions of the Communication Unit with fieldbus.

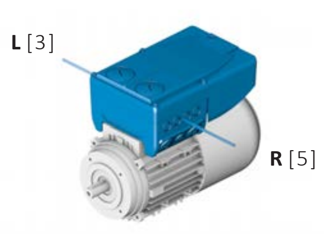
Communication Unit	AS-Interface STO	CANopen STO	EtherCAT STO	EtherNet/IP STO	POWERLINK STO	PROFIBUS STO	PROFINET STO
Certific tion							
EN ISO 13849-1	PLe category 4						
EN 61800-5-2	SIL 3						
EN 62061	SIL 3						
IEC 61508	SIL 3						
Fail-safe state							
	Safe torque off						

Mounting position designations

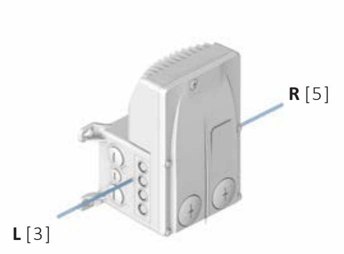
Terminal box position
T is the standard position.



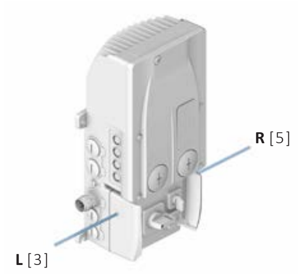
Position of the connections
The position of the connections must be taken into consideration when configuring or selecting product extensions.



Motor mounting / geared motor

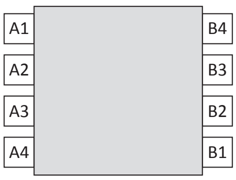


Wall mounting



with switch, wall mounting

Connection designation



The basic design of the Communication Units includes standard positions for the M12 connectors. These can be seen in the respective data tables on the following pages.
The connection position of the M12 connectors for the IOs and the network connection (fieldbus) can be selected in the Lenze »Product Finder« configuration tool.

Communication Unit Basic I/O

The Communication Unit Basic I/O provides the inverter with a minimum number of digital inputs and outputs for the simplest operations.

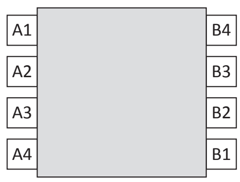
Communication Unit Basic I/O

Standards and operating conditions

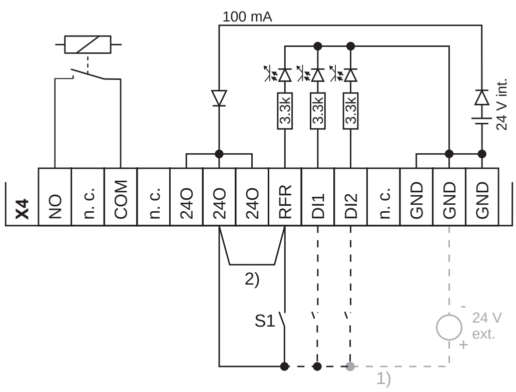
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

4.2

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
Basic I/O	Controller enable (RFR)	1			E84DGFCNNNP
	Digital inputs (DI)	2			
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	-			
	Relay (NO/COM)	1			
	LED network	-			
	Network	-			
	External 24 V supply	-			

Connection of Basic I/O inputs and outputs



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

Communication Unit Standard I/O

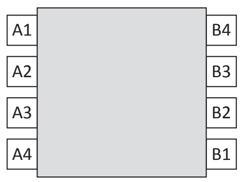
The Communication Unit Standard I/O provides the inverter with a number of digital inputs and outputs and is mainly intended for standard applications.

Communication Unit Standard I/O

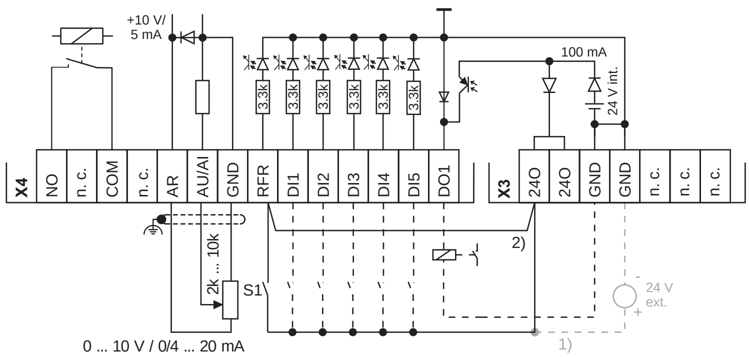
Standards and operating conditions

Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
Standard I/O	Controller enable (RFR)	1			E84DGFCSNNP
	Digital inputs (DI)	5			
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	LED network	-			
	Network	-			
	External 24 V supply	-			

Connection inputs and outputs Standard I/O



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

Communication Unit Standard I/O + M12

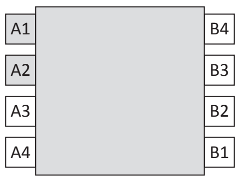
The Communication Unit Standard I/O provides the inverter with a number of digital inputs and outputs, and is mainly intended for standard applications.

Communication Unit Standard I/O + M12

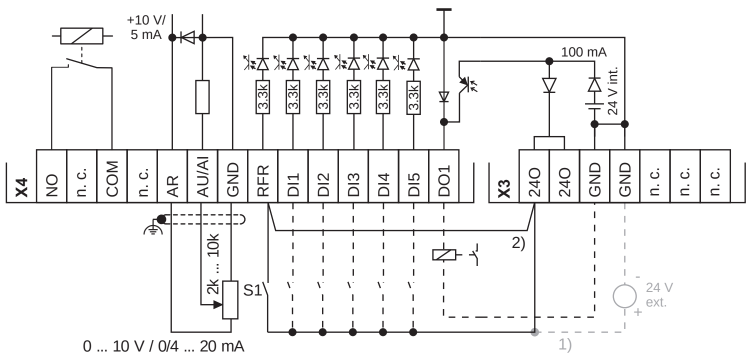
Standards and operating conditions

Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

Connections

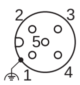
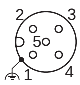
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
Standard I/O + M12	Controller enable (RFR)	1			**E84DGFCS1NP**
	Digital inputs (DI)	5	DI1/DI2 to A1 DI3 to A2		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to A2		
	Relay (NO/COM)	1			
	LED network	-			
	Network	-			
	External 24 V supply	-			

Connection inputs and outputs Standard I/O



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

E84DGFCS1NP	●			●			
			A1			**A2**	
	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	
		2	DI2		2	DI3	
		3	GND		3	GND	
		4	DI1		4	DO1	
		5	n. c.		5	n. c.	

Communication Unit Extended-I/O

In addition to the standard I/O, the Communication Unit Extended I/O provides the inverter with two additional digital inputs and one analog input and is intended for use with higher-order applications.

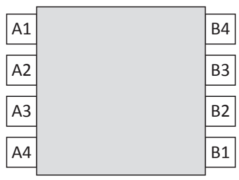
Communication Unit Extended-I/O

Standards and operating conditions

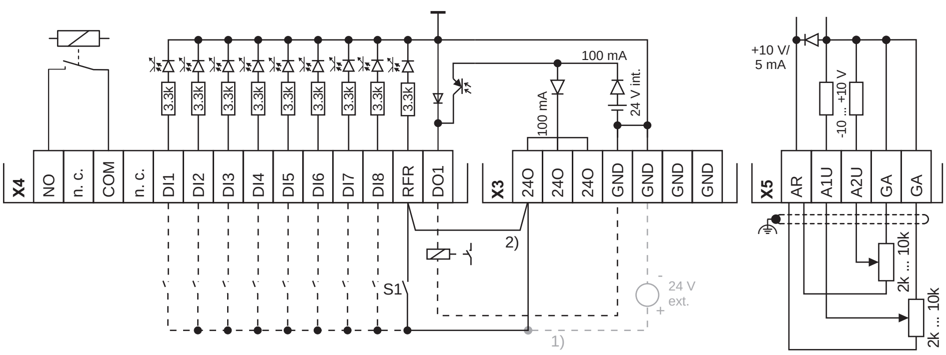
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

4.2

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
Extended I/O	Controller enable (RFR)	1		 A1 A2 A3 A4 B4 B3 B2 B1	**E84DGFCXNNP**
	Digital inputs (DI)	8			
	Analog inputs (AU/AI)	2			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	LED network	-			
	Network	-			
	External 24 V supply	-			

Connection inputs and outputs Extended I/O



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

Communication Unit AS-Interface (AS-i)

The Communication Unit AS-Interface allows control of the 8400 motec by sending digital control signals. The AS-i bus system has become the established solution for transferring digital signals on the lowest field level. It is designed for applications that do not require the use of powerful fieldbus systems. The advantages of this system are:

- Easy handling and commissioning
- Reduction of wiring complexity
- Easy integration into existing systems
- Cost reductions

Communication Unit AS-Interface

Standards and operating conditions

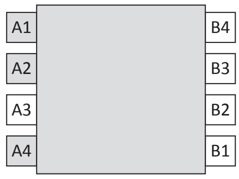
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

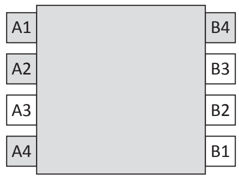
Technical data

Standard			
			EN 50295 / IEC 62026-2
Communication			
Communication profile			AS-Interface V3.0
Medium			2-wire cable for data and auxiliary power
Network topology			
			Free topology (line, ring, tree, star)
Bus nodes			
			Slave (single or dual) max. 31 standard slaves or safe slaves Max. 62 A/B slaves
Number of bus nodes			
			1 ... 31
Max. cable length			
WW	l_{max}	[m]	100 without repeaters / extenders 300 including 2 repeaters / extenders 500 only for star-shaped mains including repeaters / extenders
Transfer rate			
		[kbps]	167 (gross value) 53 (net at data transmission = 32%)
Rated voltage			
	$U_{N, DC}$	[V]	24.0

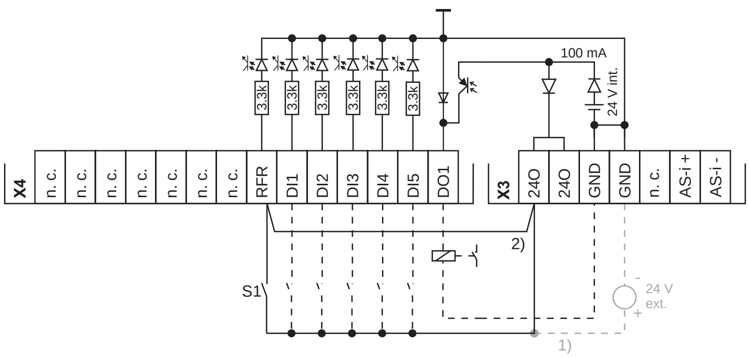
Communication Unit AS-Interface (AS-i)

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
AS-Interface / standard I/O	Controller enable (RFR)	1			**E84DGFCAFNP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1			
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	ASI+/ASI-	ASI+/ASI- to A2		
	External 24 V supply	via fieldbus			

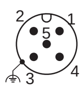
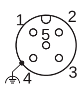
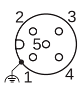
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
AS-Interface / enhanced I/O	Controller enable (RFR)	1			**E84DGFCAENP**
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	ASI+/ASI-	ASI+/ASI- to A2		
	External 24 V supply	via fieldbus			

Connection inputs and outputs AS-Interface



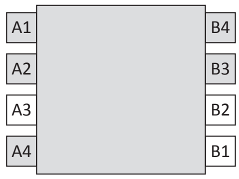
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

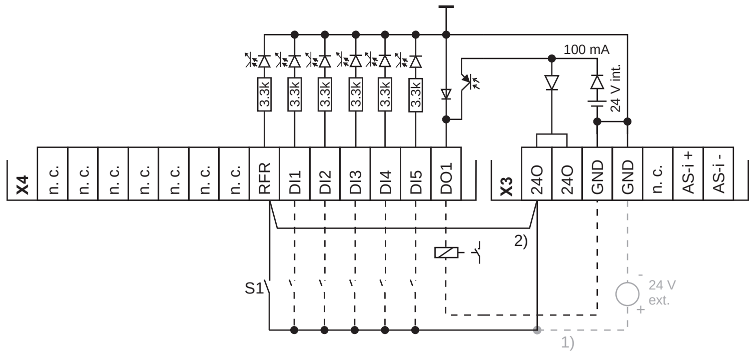
E84DGFCxFNx	●						
E84DGFCxENx	●			●			
			A2			**B4**	
	 M12 male socket A-Coding	1	AS-i+ (IN)	 M12 female socket A-Coding	1	24O	
		2	n. c.		2	DI3	
		3	AS-i- (OUT)		3	GND	
		4	n. c.		4	DO1	
		5	n. c.		5	n. c.	
			A4				
	 M12 female socket A-Coding	1	24O				
		2	DI2				
		3	GND				
		4	DI1				
		5	n. c.				

Communication Unit AS-Interface (AS-i)

Connections

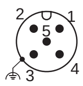
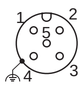
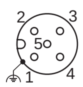
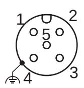
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
	Controller enable (RFR)	1			
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4 DI4/DI5 to B3		
	Analog inputs (AU/AI)	-			
AS-Interface / enhanced 2 I/O	Digital outputs (DO)	1	DO1 to B4		**E84DGFCAGNP**
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	ASI+/ASI-	ASI+/ASI- to A2		
	External 24 V supply	via fieldbus			

Connection inputs and outputs AS-Interface



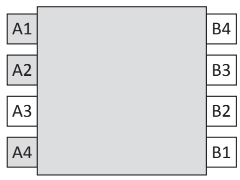
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

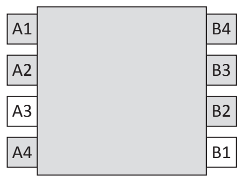
M12 connector pin assignment

E84DGFCxGNx	●			●			
			A2			**B3**	
	M12 male socket A-Coding	1	AS-i+ (IN)	M12 female socket A-Coding	1	24O	
		2	n. c.		2	DI5	
		3	AS-i- (OUT)		3	GND	
		4	n. c.		4	DI4	
		5	n. c.		5	n. c.	
			A4			**B4**	
	M12 female socket A-Coding	1	24O	M12 female socket A-Coding	1	24O	
		2	DI2		2	DI3	
		3	GND		3	GND	
		4	DI1		4	DO1	
		5	n. c.		5	n. c.	

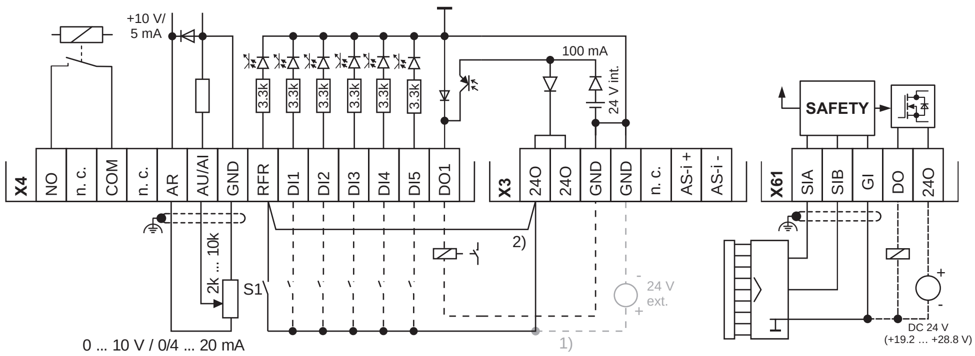
Communication Unit AS-Interface (AS-i) STO

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
AS-Interface STO / standard I/O	Controller enable (RFR)	1			E84DGFCAFJP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	ASI+/ASI-	ASI+/ASI- to A2		
	STO	SIA/SIB/GI/DO			
	External 24 V supply	via fieldbus			

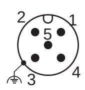
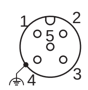
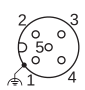
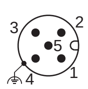
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
AS-Interface STO / enhanced I/O	Controller enable (RFR)	1			E84DGFCAEJP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1	AU/AI to B2		
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1	NO/COM to B3		
	LED network		LED to A1		
	Network	ASI+/ASI-	ASI+/ASI- to A2		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	via fieldbus			

Connection inputs and outputs AS-Interface STO



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

E84DGFCxFJx	●						
E84DGFCxEJx	●			●			
			A2			B2	B3
	 M12 male socket A-Coding	1	AS-i+ (IN)	 M12 female socket A-Coding	1	24O	24O
		2	n. c.		2	AU/AI	DO1
		3	AS-i- (OUT)		3	GND	GND
		4	n. c.		4	Controller	COM
		5	n. c.		5	n. c.	NO
			A4			B4	
	 M12 female socket A-Coding	1	24O	 M12 male socket A-Coding	1	SIA	
		2	DI2		2	SIB	
		3	GND		3	DO	
		4	DI1		4	24O	
		5	n. c.		5	GI	

Communication Unit CANopen

The Communication Unit CANopen allows control of the 8400 motec by sending digital control signals via the “CANopen” bus system. The advantages of this system are:
- Straightforward, yet extremely powerful, bus system
- Cost-effective
- Easy system integration, as there is a wide range of sensors and actuators available on the market.

Communication Unit CANopen

Standards and operating conditions

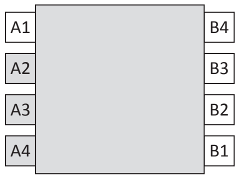
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

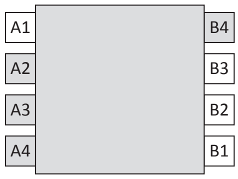
Technical data

Communication			
Medium			DIN ISO 11898
Communication profile			CANopen, DS301 V4.02 Lenze system bus
Baud rate			
	W	[kbps]	20 50 125 250 500 800 1,000
Bus nodes			
			Slave mini-master
Network topology			
			Line with terminating resistor of 120 Ω on both sides
Number of logical process data channels			
			2 transmit PDOs and 2 receive PDOs (each with 1 ... 8 bytes)
Number of logical parameter data channels			
			max. 2 server SDO channels (with 1 ... 8 bytes)
Number of bus nodes			
			63
Max. cable length			
	l_{max}	[m]	13 at 1,000 kbps 38 at 800 kbps 113 at 500 kbps 275 at 250 kbps 600 at 125 kbps 1,575 at 50 kbps 4,013 at 20 kbps
Rated voltage			
	$U_{N, DC}$	[V]	24.0

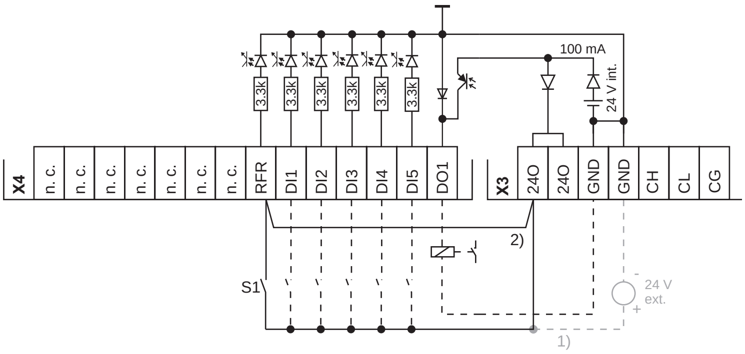
Communication Unit CANopen

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
CAN / tandard I/O	Controller enable (RFR)	1			E84DGFCCFNP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1			
	Relay (NO/COM)	-			
	Network	CAN input	CAN input to A2		
	Network	CAN output	CAN output to A3		
	External 24 V supply	-			

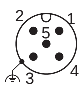
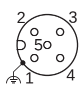
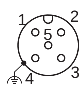
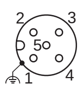
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
CAN / enhanced I/O	Controller enable (RFR)	1			E84DGFCCENP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	-			
	Network	CAN input	CAN input to A2		
	Network	CAN output	CAN output to A3		
	External 24 V supply	-			

Connection inputs and outputs CANopen



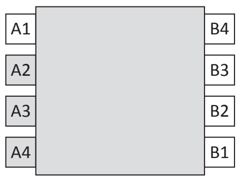
1)Alternative configuration.2)In case of external control, remove the controller enable jumper.

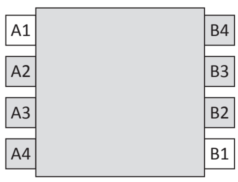
M12 connector pin assignment

E84DGFCxFNx	●			●					
E84DGFCxENx	●			●			●		
			A2			A4			B4
	 M12 male socket A-Coding	1	n. c.	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O
		2	n. c.		2	DI2		2	DI3
		3	CG		3	GND		3	GND
		4	CH		4	DI1		4	DO1
		5	CL		5	n. c.		5	n. c.
			A3						
	 M12 female socket A-Coding	1	n. c.						
		2	n. c.						
		3	CG						
		4	CH						
		5	CL						

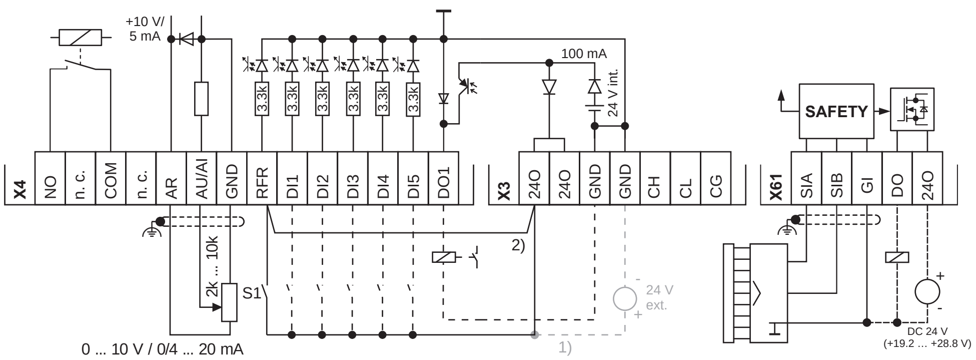
Communication Unit CANopen STO

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
CAN STO / standard I/O	Controller enable (RFR)	1			E84DGFCCFJP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	Network	CAN input	CAN input to A2		
	Network	CAN output	CAN output to A3		
	STO	SIA/SIB/GI/DO			
	External 24 V supply	-			

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
CAN STO / enhanced I/O	Controller enable (RFR)	1			E84DGFCCEJP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1	AU/AI to B2		
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1	NO/COM to B3		
	Network	CAN input	CAN input to A2		
	Network	CAN output	CAN output to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	-			

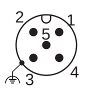
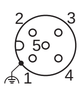
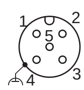
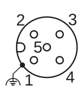
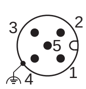
Connection inputs and outputs CANopen STO



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

E84DGFCxFJx	●	●	
E84DGFCxEJx	●	●	●

			A2			A4			B2	B3
	 M12 male socket A-Coding	1	n. c.	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	n. c.		2	DI2		2	AU/AI	DO1
		3	CG		3	GND		3	GND	GND
		4	CH		4	DI1		4	Controller	COM
		5	CL		5	n. c.		5	n. c.	NO
			A3						B4	
	 M12 female socket A-Coding	1	n. c.				 M12 male socket A-Coding	1	SIA	
		2	n. c.					2	SIB	
		3	CG					3	DO	
		4	CH					4	24O	
		5	CL					5	GI	

Communication Unit EtherCAT®

With the Communication Unit EtherCAT®, the motec 8400 supports consistent communication from the field level to the management level.
The advantages of this system are:
- Use of IT standards
- Integrated switch allows direct looping of EtherCAT® via the inverters
- Integrated I/O node. Capable of communication and reading inputs even when the 400 V supply is switched off.
- Option for connecting a 24 V supply

Communication Unit EtherCAT®

Standards and operating conditions

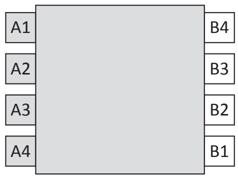
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

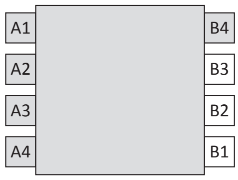
Technical data

Communication			
Medium			CAT5e S/FTP according to ISO/ICE11801 (2002)
Communication profile			CoE (CANopen over EtherCAT)
Baud rate			
	b	[kbps]	100
Bus nodes			
			Slave
Network topology			
			Line Switch
Number of logical process data channels			
			1
Process data words (PCD)			
to the master			1 ... 10 (max. 20 bytes, 16 bits / word)
from the master			1 ... 8 (max. 16 bytes, 16 bits / word)
Parameter data			
Max. mailbox size for CoE transfer		[Bytes]	128
Number of bus nodes			
			Max. 65,535
Max. cable length			
per bus segment	l_{max}	[m]	100 (typical)
Rated voltage			
	$U_{N, DC}$	[V]	24.0

Communication Unit EtherCAT®

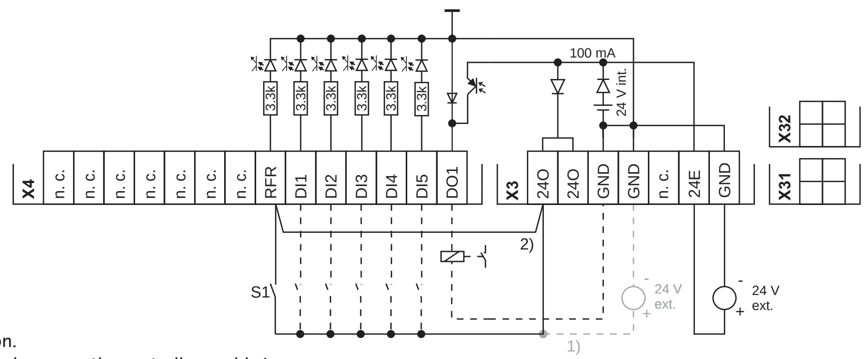
Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherCAT / standard I/O	Controller enable (RFR)	1			**E84DGFCTFNP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1			
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	EtherCAT In	EtherCAT In to A2		
	Network	EtherCAT Out	EtherCAT Out to A3		
	External 24 V supply	-			

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherCAT / enhanced I/O	Controller enable (RFR)	1			**E84DGFCTENP**
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	EtherCAT In	EtherCAT In to A2		
	Network	EtherCAT Out	EtherCAT Out to A3		
	External 24 V supply	-			

4.2

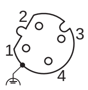
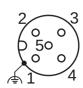
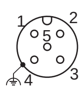
Connection inputs and outputs EtherCAT

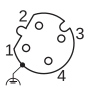


1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

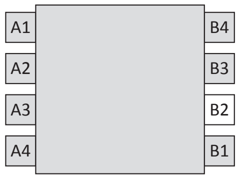
E84DGFCxFNx	●	●	
E84DGFCxENx	●	●	●

	Pin	A2		Pin	A4		Pin	B4
 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O
	2	RX+		2	DI2		2	DI3
	3	TX-		3	GND		3	GND
	4	RX-		4	DI1		4	DO1
				5	n. c.		5	n. c.

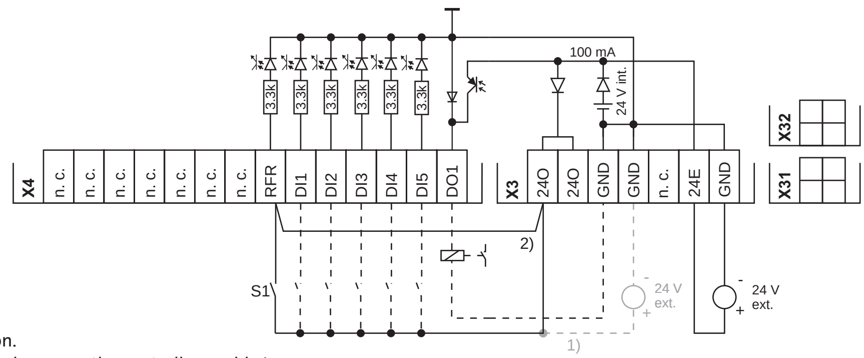
	Pin	A3
 M12 female socket D-Coding	1	TX+
	2	RX+
	3	TX-
	4	RX-

Communication Unit EtherCAT®

Connections

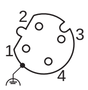
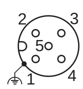
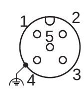
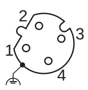
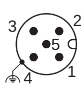
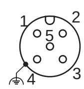
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherCAT / enhanced 2 I/O	Controller enable (RFR)	1			E84DGFCTGNP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4 DI4/DI5 to B3		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	EtherCAT In	EtherCAT In to A2		
	Network	EtherCAT Out	EtherCAT Out to A3		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs EtherCAT



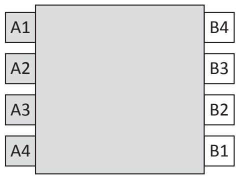
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

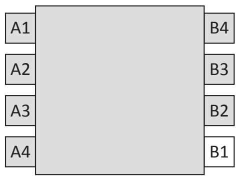
M12 connector pin assignment

E84DGFCxGNx	●			●			●		
			A2			**A4**			**B3**
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O
		2	RX+		2	DI2		2	DI5
		3	TX-		3	GND		3	GND
		4	RX-		4	DI1		4	DI4
					5	n. c.		5	n. c.
			A3			**B1**			**B4**
	 M12 female socket D-Coding	1	TX+	 M12 male socket A-Coding	1	24E	 M12 female socket A-Coding	1	24O
		2	RX+		2	n. c.		2	DI3
		3	TX-		3	GND		3	GND
		4	RX-		4	n. c.		4	DO1
					5	n. c.		5	n. c.

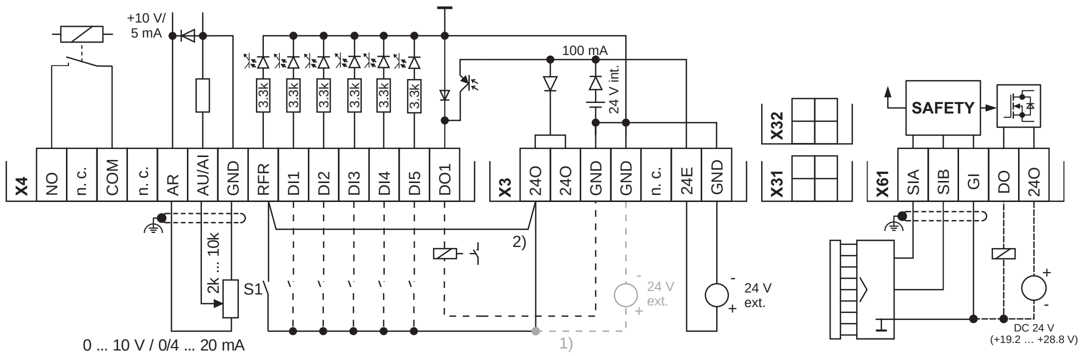
Communication Unit EtherCAT® STO

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherCAT STO / standard I/O	Controller enable (RFR)	1			E84DGFCTFJP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	EtherCAT In	EtherCAT In to A2		
	Network	EtherCAT Out	EtherCAT Out to A3		
	STO	SIA/SIB/GI/DO			
	External 24 V supply	-			

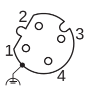
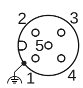
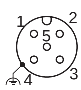
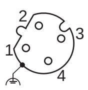
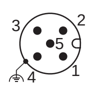
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherCAT STO / enhanced I/O	Controller enable (RFR)	1			E84DGFCTEJP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)		AU/AI to B2		
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)		NO/COM to B3		
	LED network		LED to A1		
	Network	EtherCAT In	EtherCAT In to A2		
	Network	EtherCAT Out	EtherCAT Out to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	-			

Connection inputs and outputs EtherCAT STO



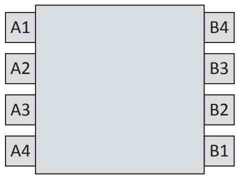
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

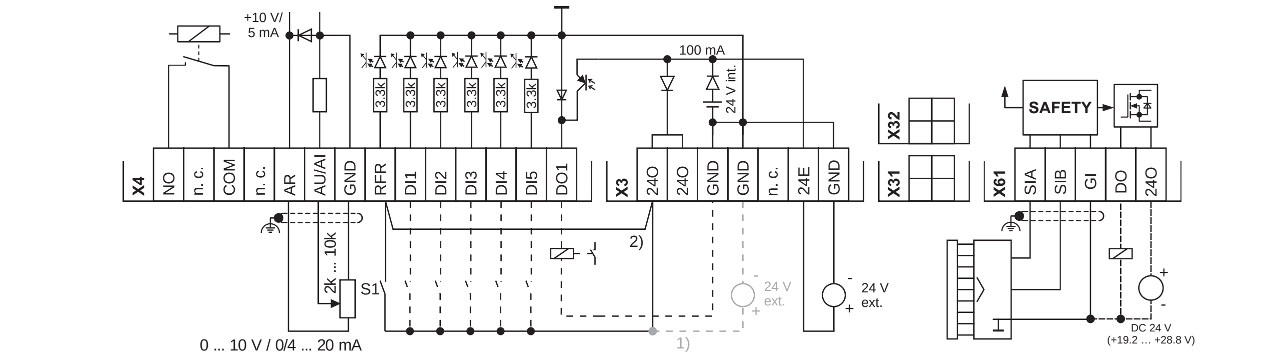
E84DGFCxFJx	●			●						
E84DGFCxEJx	●			●			●			
			A2			A4			B2	B3
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RX+		2	DI2		2	AU/AI	DO1
		3	TX-		3	GND		3	GND	GND
		4	RX-		4	DI1		4	Controller	COM
					5	n. c.		5	n. c.	NO
			A3						B4	
	 M12 female socket D-Coding	1	TX+				 M12 male socket A-Coding	1	SIA	
		2	RX+					2	SIB	
		3	TX-					3	DO	
		4	RX-					4	24O	
								5	GI	

Communication Unit EtherCAT® STO

Connections

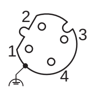
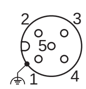
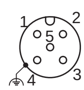
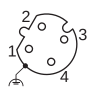
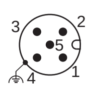
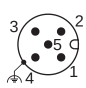
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherCAT STO / enhanced 2 I/O	Controller enable (RFR)	1			E84DGFCTGJP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4 DI4/DI5 to B2		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	EtherCAT In	EtherCAT In to A2		
	Network	EtherCAT Out	EtherCAT Out to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs EtherCAT STO



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

E84DGFCxGJx	●			●			●			
			A2			A4			B2	B3
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RX+		2	DI2		2	DI5	DI3
		3	TX-		3	GND		3	GND	GND
		4	RX-		4	DI1		4	DI4	DO1
					5	n. c.		5	n. c.	n. c.
			A3			B1			B4	
	 M12 female socket D-Coding	1	TX+	 M12 male socket A-Coding	1	24E	 M12 male socket A-Coding	1	SIA	
		2	RX+		2	n. c.		2	SIB	
		3	TX-		3	GND		3	DO	
		4	RX-		4	n. c.		4	24O	
					5	n. c.		5	GI	

Communication Unit EtherNet/IP

The Communication Unit EtherNet/IP, based on standard TCP and UDP, supports continuous communication with the 8400 motec from the field level to the controlling system.

- The advantages of this system are:
- Currently widespread fieldbus based on real time Ethernet
- Supports DHCP and BootP in allocating the IP address
- Devices linked via EtherNet/IP can be implemented seamlessly and with minimum configuration effort via mapping into the I/O tree of the RSLogix programming tool.
- Integrated I/O node. Capable of communication and reading inputs even when the 400 V supply is switched off.
- Option for connecting a 24 V supply

Communication Unit EtherNet/IP

Standards and operating conditions

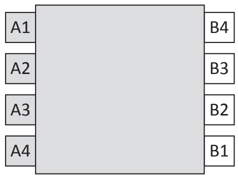
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

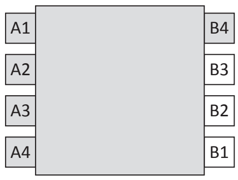
Technical data

Communication			
Medium			CAT5e S/FTP according to ISO/ICE11801 / EN50173
Communication profile			EtherNET/IP, AC Drive
Baud rate			
		[Mbps]	10/100 (full duplex/half duplex)
Bus nodes			
			Slave (adapter)
Network topology			
			Tree, star and line
Number of logical process data channels			
			1
Process data words (PCD)			
16 bits			1 ... 16
Number of bus nodes			
			Max. 254 in the subnetwork
Max. cable length			
per bus segment	l_{max}	[m]	100
Rated voltage			
	$U_{N, DC}$	[V]	24.0

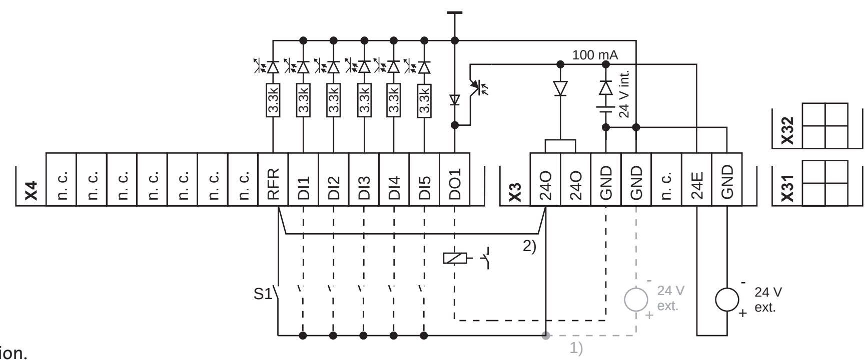
Communication Unit EtherNet/IP

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherNet/IP / standard I/O	Controller enable (RFR)	1			E84DGFCGFNP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1			
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	EtherNet/IP Port 1	EtherNet/IP Port 1 to A2		
	Network	EtherNet/IP Port 2	EtherNet/IP Port 1 to A3		
	External 24 V supply	-			

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherNet/IP / enhanced I/O	Controller enable (RFR)	1			E84DGFCGENP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	EtherNet/IP Port 1	EtherNet/IP Port 1 to A2		
	Network	EtherNet/IP Port 2	EtherNet/IP Port 1 to A3		
	External 24 V supply	-			

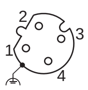
Connection inputs and outputs EtherNet/IP

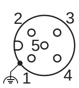


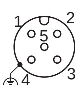
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

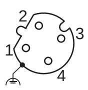
M12 connector pin assignment

E84DGFCxFNx	●	●	
E84DGFCxENx	●	●	●

Connector	Pin	A2
 M12 female socket D-Coding	1	TX+
	2	RX+
	3	TX-
	4	RX-

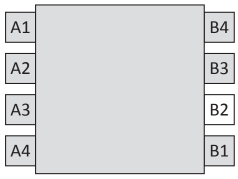
Connector	Pin	A4
 M12 female socket A-Coding	1	24O
	2	DI2
	3	GND
	4	DI1
	5	n. c.

Connector	Pin	B4
 M12 female socket A-Coding	1	24O
	2	DI3
	3	GND
	4	DO1
	5	n. c.

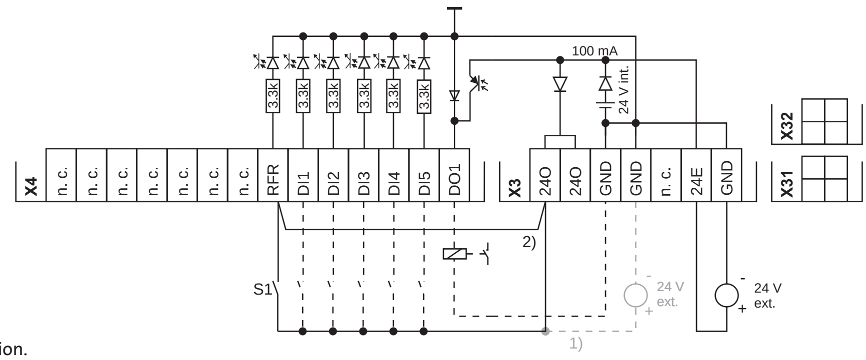
Connector	Pin	A3
 M12 female socket D-Coding	1	TX+
	2	RX+
	3	TX-
	4	RX-

Communication Unit EtherNet/IP

Connections

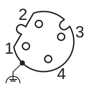
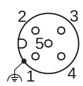
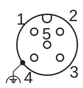
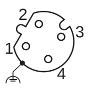
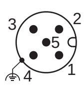
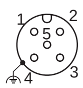
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherNet/IP / enhanced 2 I/O	Controller enable (RFR)	1			E84DGFCGGNP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4 DI4/DI5 to B3		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	EtherNet/IP Port 1	EtherNet/IP Port 1 to A2		
	Network	EtherNet/IP Port 2	EtherNet/IP Port 1 to A3		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs EtherNet/IP



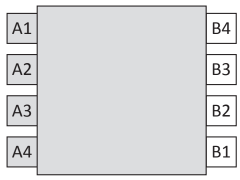
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

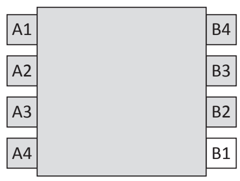
M12 connector pin assignment

E84DGFCxGNx	●			●			●		
			A2			**A4**			**B3**
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O
		2	RX+		2	DI2		2	DI5
		3	TX-		3	GND		3	GND
		4	RX-		4	DI1		4	DI4
					5	n. c.		5	n. c.
			A3			**B1**			**B4**
	 M12 female socket D-Coding	1	TX+	 M12 male socket A-Coding	1	24E	 M12 female socket A-Coding	1	24O
		2	RX+		2	n. c.		2	DI3
		3	TX-		3	GND		3	GND
		4	RX-		4	n. c.		4	DO1
					5	n. c.		5	n. c.

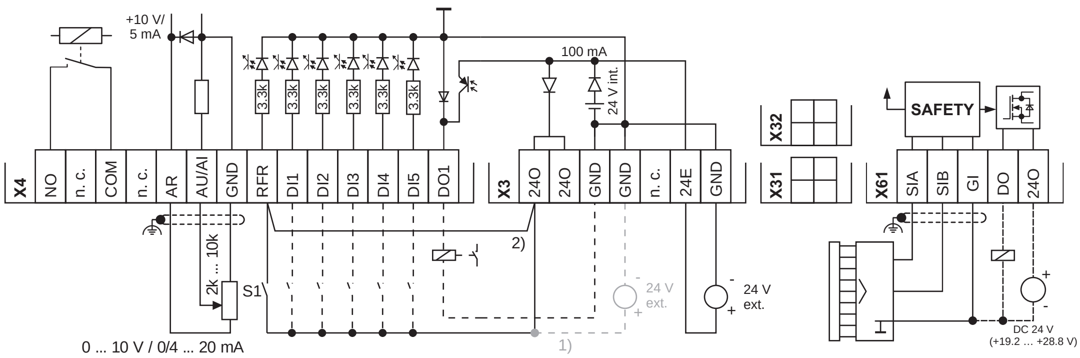
Communication Unit EtherNet/IP STO

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherNet/IP STO / standard I/O	Controller enable (RFR)	1			**E84DGFCGFJP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	EtherNet/IP Port 1	EtherNet/IP Port 1 to A2		
	Network	EtherNet/IP Port 2	EtherNet/IP Port 1 to A3		
	STO	SIA/SIB/GI/DO			
	External 24 V supply	-			

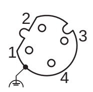
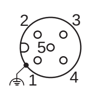
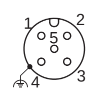
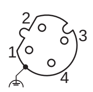
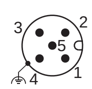
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherNet/IP STO / enhanced I/O	Controller enable (RFR)	1			**E84DGFCGEJP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1	AU/AI to B2		
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1	NO/COM to B3		
	LED network		LED to A1		
	Network	EtherNet/IP Port 1	EtherNet/IP Port 1 to A2		
	Network	EtherNet/IP Port 2	EtherNet/IP Port 1 to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	-			

Connection inputs and outputs EtherNet/IP STO



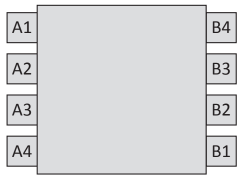
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

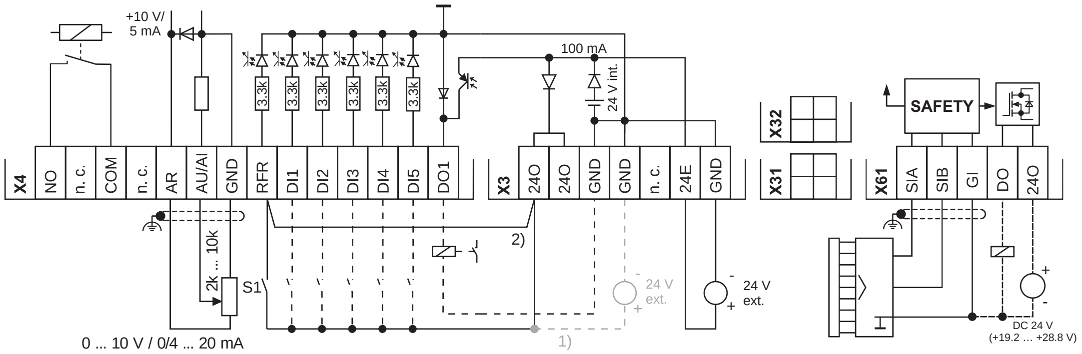
E84DGFCxFJx	●			●						
E84DGFCxEJx	●			●			●			
			A2			A4			B2	B3
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RX+		2	DI2		2	AU/AI	DO1
		3	TX-		3	GND		3	GND	GND
		4	RX-		4	DI1		4	Controller	COM
					5	n. c.		5	n. c.	NO
			A3						B4	
	 M12 female socket D-Coding	1	TX+				 M12 male socket A-Coding	1	SIA	
		2	RX+					2	SIB	
		3	TX-					3	DO	
		4	RX-					4	24O	
								5	GI	

Communication Unit EtherNet/IP STO

Connections

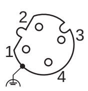
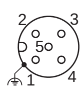
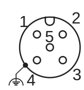
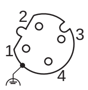
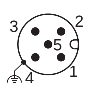
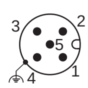
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
EtherNet/IP STO / enhanced 2 I/O	Controller enable (RFR)	1			E84DGFCGGJP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B3 DI4/DI5 to B2		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	EtherNet/IP Port 1	EtherNet/IP Port 1 to A2		
	Network	EtherNet/IP Port 2	EtherNet/IP Port 1 to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs EtherNet/IP STO



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

E84DGFCxGJx	●			●			●			
			A2			A4			B2	B3
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RX+		2	DI2		2	DI5	DI3
		3	TX-		3	GND		3	GND	GND
		4	RX-		4	DI1		4	DI4	DO1
					5	n. c.		5	n. c.	n. c.
			A3			B1			B4	
	 M12 female socket D-Coding	1	TX+	 M12 male socket A-Coding	1	24E	 M12 male socket A-Coding	1	SIA	
		2	RX+		2	n. c.		2	SIB	
		3	TX-		3	GND		3	DO	
		4	RX-		4	n. c.		4	24O	
					5	n. c.		5	GI	

Communication Unit POWERLINK

POWERLINK is a real-time capable fieldbus system based on Ethernet. POWERLINK specifies a communications protocol based on CANopen in order to exchange usage data.
The advantages of this system are:

- The integrated safety system can be used on machines for the protection of persons.
- Integrated I/O node. Capable of communication and reading inputs even when the 400 V supply is switched off.
- Option for connecting a 24 V supply

Communication Unit POWERLINK

Standards and operating conditions

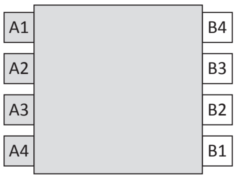
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

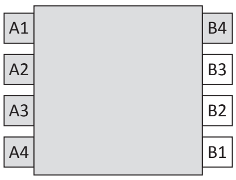
Technical data

Communication			
Medium			CAT5e S/FTP according to ISO/ICE11801 (2002)
Communication profile			Ethernet POWERLINK V2
Baud rate			
	b	[kbps]	100
Bus nodes			
			Controlled node
Network topology			
			Tree, star and line
Number of logical process data channels			
			1
Process data words (PCD)			
6 bits			1 ... 6
Parameter data			
Max. mailbox size for CoE transfer		[Bytes]	128
Number of bus nodes			
			Max. 239 in the subnetwork
Max. cable length			
per bus segment	l_{max}	[m]	100 (typical)
Rated voltage			
	$U_{N, DC}$	[V]	24.0

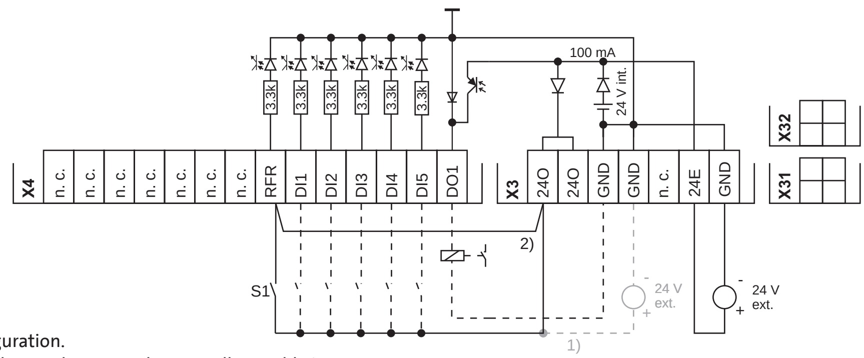
Communication Unit POWERLINK

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
POWERLINK / standard I/O	Controller enable (RFR)	1			**E84DGFCLFNP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1			
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	POWERLINK In	POWERLINK In to A2		
	Network	POWERLINK Out	POWERLINK Out to A3		
	External 24 V supply	-			

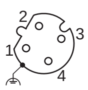
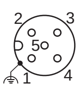
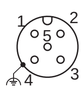
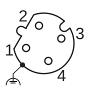
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
POWERLINK / enhanced I/O	Controller enable (RFR)	1			**E84DGFCLENP**
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	POWERLINK In	POWERLINK In to A2		
	Network	POWERLINK Out	POWERLINK Out to A3		
	External 24 V supply	-			

Connection inputs and outputs POWERLINK



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

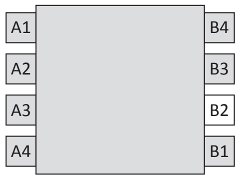
M12 connector pin assignment

E84DGFCxFNx	●			●							
E84DGFCxENx	●			●				●			
			A2			**A4**				**B4**	
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O		 M12 female socket A-Coding	1	24O	
		2	RX+		2	DI2			2	DI3	
		3	TX-		3	GND			3	GND	
		4	RX-		4	DI1			4	DO1	
					5	n. c.			5	n. c.	
			A3								
	 M12 female socket D-Coding	1	TX+								
		2	RX+								
		3	TX-								
		4	RX-								

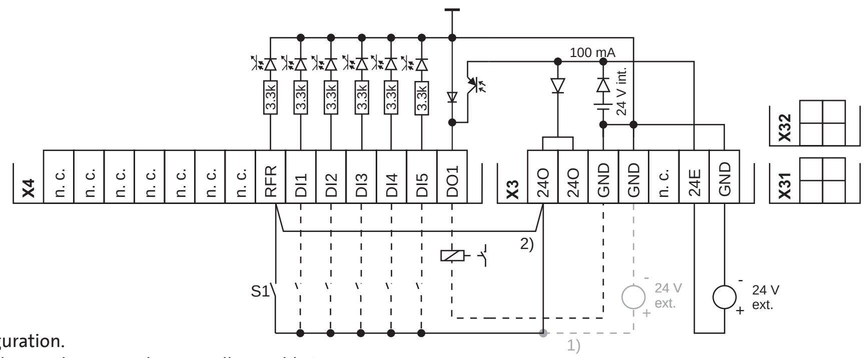
4.2

Communication Unit POWERLINK

Connections

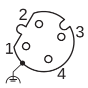
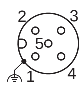
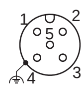
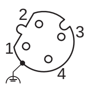
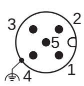
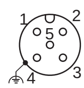
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
POWERLINK / enhanced 2 I/O	Controller enable (RFR)	1			**E84DGFCLGNP**
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4 DI4/DI5 to B3		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	POWERLINK In	POWERLINK In to A2		
	Network	POWERLINK Out	POWERLINK Out to A3		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs POWERLINK



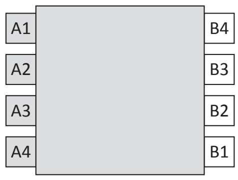
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

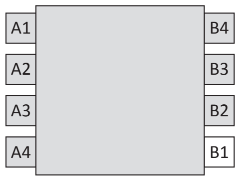
M12 connector pin assignment

E84DGFCxGNx	●			●			●		
			A2			**A4**			**B3**
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O
		2	RX+		2	DI2		2	DI5
		3	TX-		3	GND		3	GND
		4	RX-		4	DI1		4	DI4
					5	n. c.		5	n. c.
			A3			**B1**			**B4**
	 M12 female socket D-Coding	1	TX+	 M12 male socket A-Coding	1	24E	 M12 female socket A-Coding	1	24O
		2	RX+		2	n. c.		2	DI3
		3	TX-		3	GND		3	GND
		4	RX-		4	n. c.		4	DO1
					5	n. c.		5	n. c.

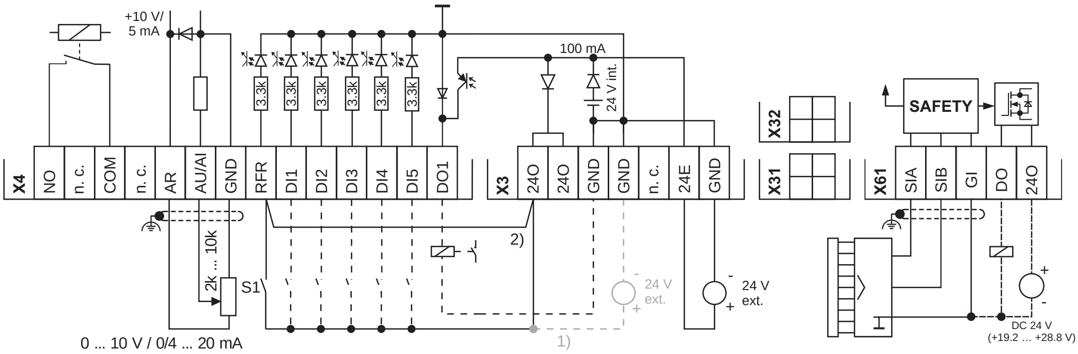
Communication Unit POWERLINK STO

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
POWERLINK STO / standard I/O	Controller enable (RFR)	1			**E84DGFCLFJP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	POWERLINK In	POWERLINK In to A2		
	Network	POWERLINK Out	POWERLINK Out to A3		
	STO	SIA/SIB/GI/DO			
	External 24 V supply	-			

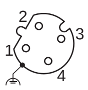
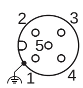
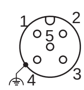
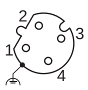
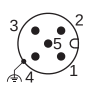
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
POWERLINK STO / enhanced I/O	Controller enable (RFR)	1			**E84DGFCLEJP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1	AU/AI to B2		
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1	NO/COM to B3		
	LED network		LED to A1		
	Network	POWERLINK In	POWERLINK In to A2		
	Network	POWERLINK Out	POWERLINK Out to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	-			

Connection of inputs and outputs POWERLINK STO



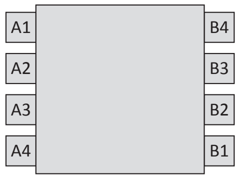
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

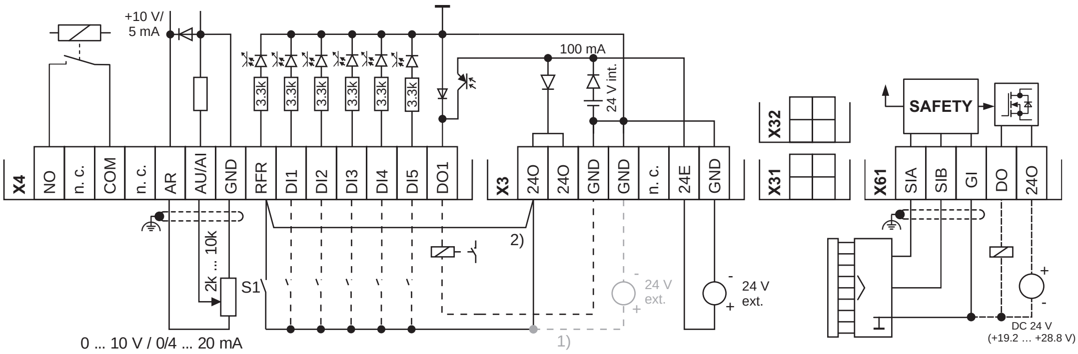
E84DGFCxFJx	●			●						
E84DGFCxEJx	●			●			●			
			A2			A4			B2	B3
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RX+		2	DI2		2	AU/AI	DO1
		3	TX-		3	GND		3	GND	GND
		4	RX-		4	DI1		4	Controller	COM
					5	n. c.		5	n. c.	NO
			A3						B4	
	 M12 female socket D-Coding	1	TX+				 M12 male socket A-Coding	1	SIA	
		2	RX+					2	SIB	
		3	TX-					3	DO	
		4	RX-					4	24O	
								5	GI	

Communication Unit POWERLINK STO

Connections

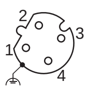
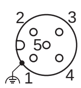
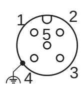
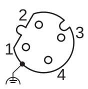
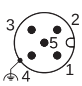
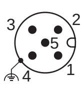
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
POWERLINK STO / enhanced 2 I/O	Controller enable (RFR)	1			**E84DGFCLGJP**
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B43 DI4/DI5 to B2		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	POWERLINK In	POWERLINK In to A2		
	Network	POWERLINK Out	POWERLINK Out to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	1	24E to B1		

Connection of inputs and outputs POWERLINK STO



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

E84DGFCxGJx	●			●			●			
			A2			**A4**			**B2**	**B3**
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RX+		2	DI2		2	DI5	DI3
		3	TX-		3	GND		3	GND	GND
		4	RX-		4	DI1		4	DI4	DO1
					5	n. c.		5	n. c.	n. c.
			A3			**B1**			**B4**	
	 M12 female socket D-Coding	1	TX+	 M12 male socket A-Coding	1	24E	 M12 male socket A-Coding	1	SIA	
		2	RX+		2	n. c.		2	SIB	
		3	TX-		3	GND		3	DO	
		4	RX-		4	n. c.		4	24O	
					5	n. c.		5	GI	

Communication Unit PROFIBUS

The 8400 motec uses the Communication Unit PROFIBUS to support the currently popular fieldbus system. The advantages of this system are:

- Widely used and extremely powerful fieldbus system
- Integrated I/O node. Capable of communication and reading inputs even when the 400 V supply is switched off.
- Option for connecting a 24 V supply

Communication Unit PROFIBUS

Standards and operating conditions

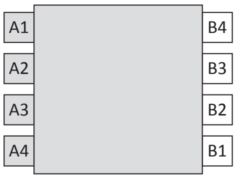
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

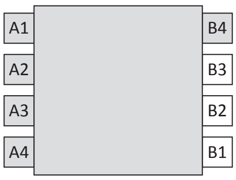
Technical data

Communication			
Medium			RS 485
Communication profile			PROFIBUS-DP-V0 (DRIVECOM) PROFIBUS-DP-V1 (PROFIdrive)
Baud rate			
	b	[kbps]	9.6 ... 12,000 (automatic detection)
Bus nodes			
			Slave
Network topology			
			with repeater: Line or tree without repeater: Line
Process data words (PCD)			
16 bits			1 ... 8
DP user data length			
			Optional parameter channel (4 words) + process data words Acyclic parameter data channel (DP-V1): max 240 bytes
Number of bus nodes			
			31 slaves + 1 master per bus segment With repeaters: 125
Max. cable length			
per bus segment	l_{max}	[m]	1,200 (depending on the baud rate and the cable type used)
Rated voltage			
	$U_{N, DC}$	[V]	24.0

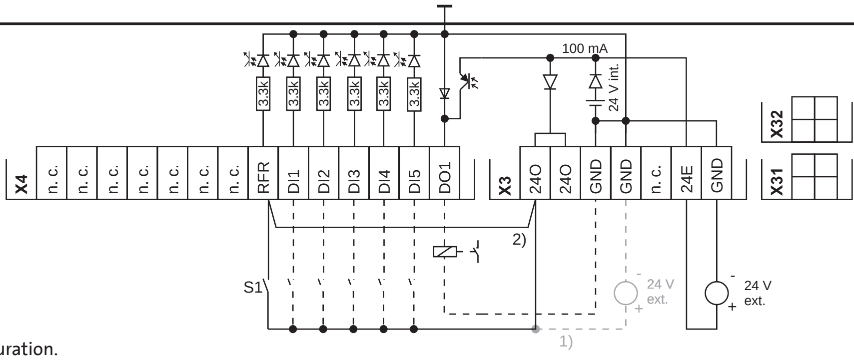
Communication Unit PROFIBUS

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFIBUS / standard I/O	Controller enable (RFR)	1			E84DGFCPFNP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1			
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	PROFIBUS input	PROFIBUS input to A2		
	Network	PROFIBUS output	PROFIBUS output to A3		
	External 24 V supply	-			

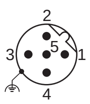
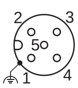
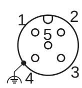
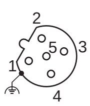
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFIBUS / enhanced I/O	Controller enable (RFR)	1			E84DGFCPENP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	PROFIBUS input	PROFIBUS input to A2		
	Network	PROFIBUS output	PROFIBUS output to A3		
	External 24 V supply	-			

Connection inputs and outputs PROFIBUS



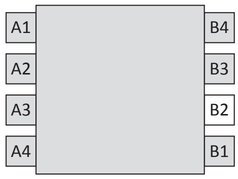
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

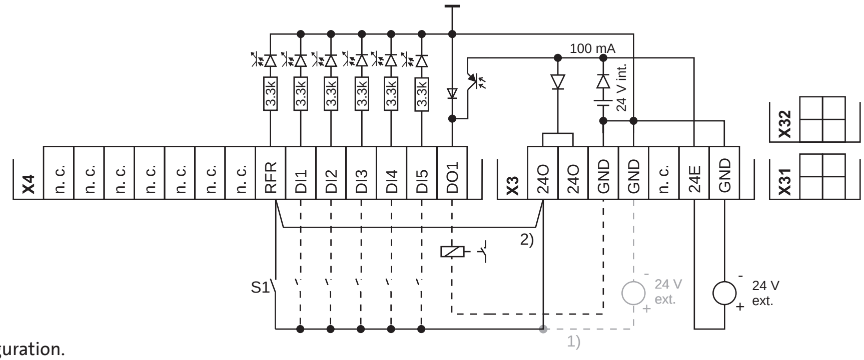
<table>
<tr><td>E84DGFCxFNx</td><td colspan="3">●</td><td colspan="3">●</td><td colspan="3"></td></tr>
<tr><td>E84DGFCxENx</td><td colspan="3">●</td><td colspan="3">●</td><td colspan="3">●</td></tr>
<tr><td rowspan="6"></td><td colspan="2"></td><td>A2</td><td colspan="2"></td><td>A4</td><td colspan="2"></td><td>B4</td></tr>
<tr><td rowspan="5">M12 male socket B-Coding</td><td>1</td><td>n. c.</td><td rowspan="5">M12 female socket A-Coding</td><td>1</td><td>24O</td><td rowspan="5">M12 female socket A-Coding</td><td>1</td><td>24O</td></tr>
<tr><td>2</td><td>RxD/TxD-N (A)</td><td>2</td><td>DI2</td><td>2</td><td>DI3</td></tr>
<tr><td>3</td><td>n. c.</td><td>3</td><td>GND</td><td>3</td><td>GND</td></tr>
<tr><td>4</td><td>RxD/TxD-P (B)</td><td>4</td><td>DI1</td><td>4</td><td>DO1</td></tr>
<tr><td>5</td><td>n. c.</td><td>5</td><td>n. c.</td><td>5</td><td>n. c.</td></tr>
<tr><td rowspan="6"></td><td colspan="2"></td><td>A3</td><td rowspan="6" colspan="3"></td><td rowspan="6" colspan="3"></td></tr>
<tr><td rowspan="5">M12 female socket B-Coding</td><td>1</td><td>P5V2</td></tr>
<tr><td>2</td><td>RxD/TxD-N (A)</td></tr>
<tr><td>3</td><td>M5V2</td></tr>
<tr><td>4</td><td>RxD/TxD-P (B)</td></tr>
<tr><td>5</td><td>n. c.</td></tr>
</table>

Communication Unit PROFIBUS

Connections

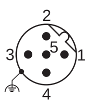
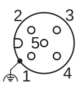
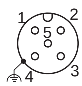
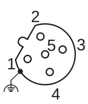
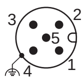
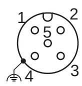
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFIBUS / enhanced 2 I/O	Controller enable (RFR)	1			**E84DGFCPGNP**
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4 DI4/DI5 to B3		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	PROFIBUS input	PROFIBUS input to A2		
	Network	PROFIBUS output	PROFIBUS output to A3		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs PROFIBUS



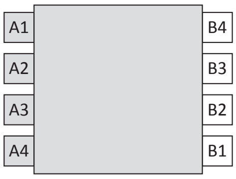
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

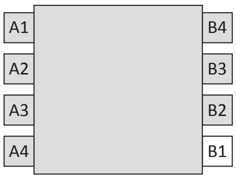
M12 connector pin assignment

E84DGFCxGNx	●			●			●		
			A2			**A4**			**B3**
		1	n. c.		1	24O		1	24O
		2	RxD/TxD-N (A)		2	DI2		2	DI5
		3	n. c.		3	GND		3	GND
	M12 male socket B-Coding	4	RxD/TxD-P (B)	M12 female socket A-Coding	4	DI1	M12 female socket A-Coding	4	DI4
		5	n. c.		5	n. c.		5	n. c.
			A3			**B1**			**B4**
		1	P5V2		1	24E		1	24O
		2	RxD/TxD-N (A)		2	n. c.		2	DI3
		3	M5V2		3	GND		3	GND
	M12 female socket B-Coding	4	RxD/TxD-P (B)	M12 male socket A-Coding	4	n. c.	M12 female socket A-Coding	4	DO1
		5	n. c.		5	n. c.		5	n. c.

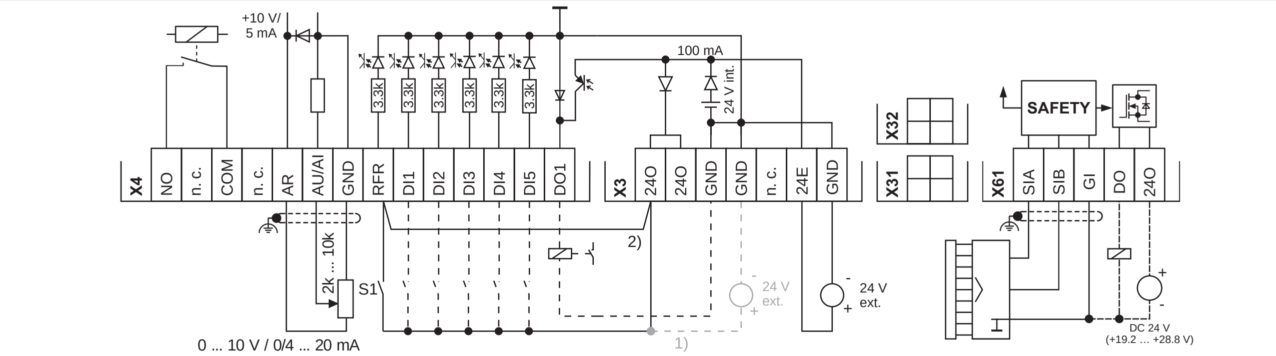
Communication Unit PROFIBUS STO

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFIBUS STO / standard I/O	Controller enable (RFR)	1			**E84DGFCPFJP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	PROFIBUS input	PROFIBUS input to A2		
	Network	PROFIBUS output	PROFIBUS output to A3		
	STO	SIA/SIB/GI/DO			
	External 24 V supply	-			

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFIBUS STO / enhanced I/O	Controller enable (RFR)	1			**E84DGFCPEJP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1	AU/AI to B2		
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1	NO/COM to B3		
	LED network		LED to A1		
	Network	PROFIBUS input	PROFIBUS input to A2		
	Network	PROFIBUS output	PROFIBUS output to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	-			

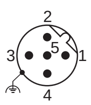
Connection inputs and outputs PROFIBUS

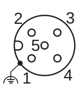


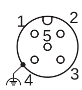
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

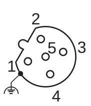
M12 connector pin assignment

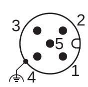
E84DGFCxFJx	●	●	
E84DGFCxEJx	●	●	●

		A2
 M12 male socket B-Coding	1	n. c.
	2	RxD/TxD-N (A)
	3	n. c.
	4	RxD/TxD-P (B)
	5	n. c.

		A4
 M12 female socket A-Coding	1	24O
	2	DI2
	3	GND
	4	DI1
	5	n. c.

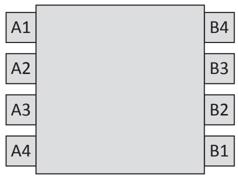
		B2	B3
 M12 female socket A-Coding	1	24O	24O
	2	AU/AI	DO1
	3	GND	GND
	4	Controller	COM
	5	n. c.	NO

		A3
 M12 female socket B-Coding	1	P5V2
	2	RxD/TxD-N (A)
	3	M5V2
	4	RxD/TxD-P (B)
	5	n. c.

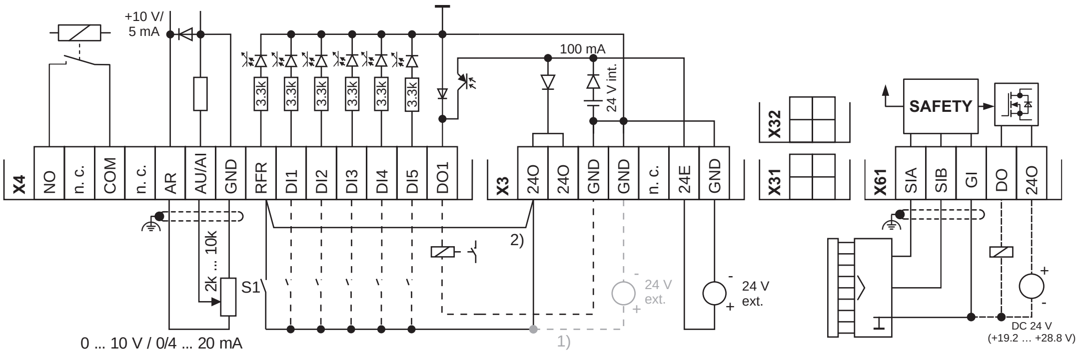
		B4
 M12 male socket A-Coding	1	SIA
	2	SIB
	3	DO
	4	24O
	5	GI

Communication Unit PROFIBUS STO

Connections

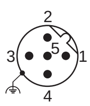
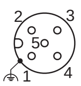
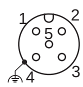
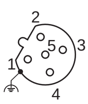
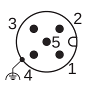
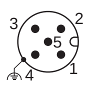
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFIBUS STO / enhanced 2 I/O	Controller enable (RFR)	1			**E84DGFCPGJP**
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B3 DI4/DI5 to B2		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	PROFIBUS input	PROFIBUS input to A2		
	Network	PROFIBUS output	PROFIBUS output to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs PROFIBUS



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

E84DGFCxGJx	●			●			●			
			A2			**A4**			**B2**	**B3**
	 M12 male socket B-Coding	1	n. c.	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RxD/TxD-N (A)		2	DI2		2	DI5	DI3
		3	n. c.		3	GND		3	GND	GND
		4	RxD/TxD-P (B)		4	DI1		4	DI4	DO1
		5	n. c.		5	n. c.		5	n. c.	n. c.
			A3			**B1**			**B4**	
	 M12 female socket B-Coding	1	P5V2	 M12 male socket A-Coding	1	24E	 M12 male socket A-Coding	1	SIA	
		2	RxD/TxD-N (A)		2	n. c.		2	SIB	
		3	M5V2		3	GND		3	DO	
		4	RxD/TxD-P (B)		4	n. c.		4	24O	
		5	n. c.		5	n. c.		5	GI	

Communication Unit PROFINET

With the Communication Unit PROFINET, the motec 8400 supports consistent communication from the field level to the management level.
The advantages of this system are:

- Use of IT standards
- Integrated switch allows direct looping of PROFINET via the inverters
- Integrated I/O node. Capable of communication and reading inputs even when the 400 V supply is switched off.
- Option for connecting a 24 V supply

Communication Unit PROFINET

Standards and operating conditions

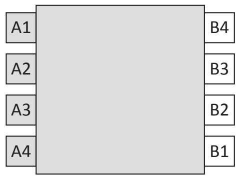
Protection class			
EN 60529			IP65
Climatic conditions			
Storage (EN 60721-3-1)			1K3 (temperature: -30 °C ... +60 °C)
Operation (EN 60721-3-3)			3K3 (temperature: -30 °C ... +55 °C)
Transport (EN 60721-3-2)			2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to reference earth/PE			
EN 61800-5-1	U_{AC}	[V]	50.0

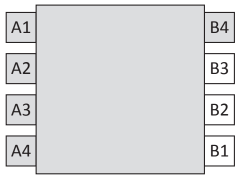
Technical data

Communication			
Medium			CAT5e S/FTP according to ISO/ICE11801 (2002)
Communication profile			PROFINET RT Conf. Class B
Baud rate			
	b	[Mbps]	100
Bus nodes			
			Slave (device)
Network topology			
			Tree, star and line
Number of logical process data channels			
			1
Process data words (PCD)			
			1 ... 10 words to control system (16 bits/word, max. 20 bytes) 1 ... 8 words from the control system (16 bits/word, max. 16 bytes)
Number of bus nodes			
			31 slaves + 1 master per bus segment With repeaters: 125
Max. cable length			
per bus segment	l_{max}	[m]	100
Rated voltage			
	$U_{N, DC}$	[V]	24.0

Communication Unit PROFINET

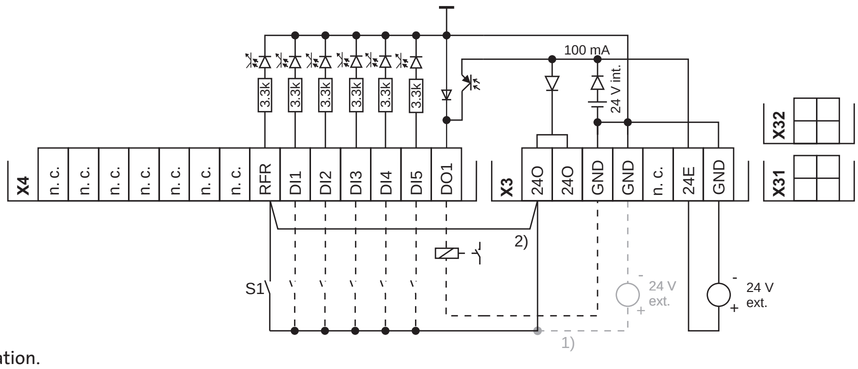
Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFINET / standard I/O	Controller enable (RFR)	1			**E84DGFCRFNP**
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1			
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	PROFINET Port 1	PROFINET Port 1 to A2		
	Network	PROFINET Port 2	PROFINET Port 2 to A3		
	External 24 V supply	-			

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFINET / enhanced I/O	Controller enable (RFR)	1			**E84DGFCRENP**
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4		
	Analog inputs (AU/AI)	-			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	-			
	LED network		LED to A1		
	Network	PROFINET Port 1	PROFINET Port 1 to A2		
	Network	PROFINET Port 2	PROFINET Port 2 to A3		
	External 24 V supply	-			

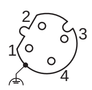
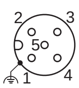
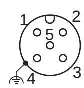
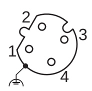
4.2

Connection inputs and outputs PROFINET



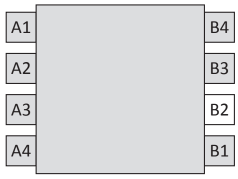
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

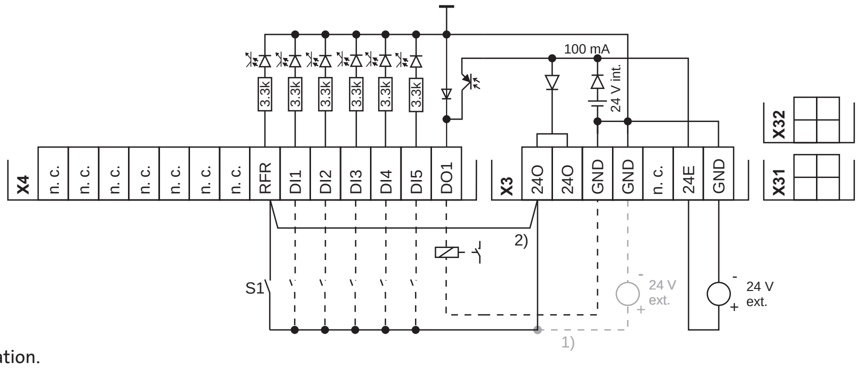
E84DGFCxFNx	●			●					
E84DGFCxENx	●			●			●		
			A2			A4			B4
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O
		2	RX+		2	DI2		2	DI3
		3	TX-		3	GND		3	GND
		4	RX-		4	DI1		4	DO1
					5	n. c.		5	n. c.
			A3						
	 M12 female socket D-Coding	1	TX+						
		2	RX+						
		3	TX-						
		4	RX-						

Communication Unit PROFINET

Connections

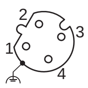
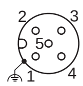
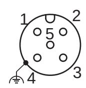
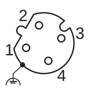
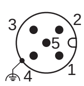
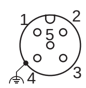
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFINET / enhanced 2 I/O	Controller enable (RFR)	1			E84DGFCRGNP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B4 DI4/DI5 to B3		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B4		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	PROFINET Port 1	PROFINET Port 1 to A2		
	Network	PROFINET Port 2	PROFINET Port 2 to A3		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs PROFINET



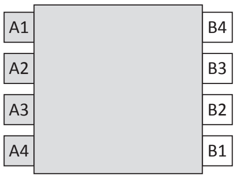
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

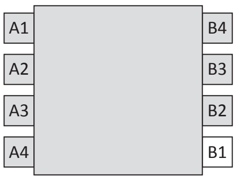
M12 connector pin assignment

E84DGFCxGNx	●			●			●		
			A2			A4			B3
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O
		2	RX+		2	DI2		2	DI5
		3	TX-		3	GND		3	GND
		4	RX-		4	DI1		4	DI4
					5	n. c.		5	n. c.
			A3			B1			B4
	 M12 female socket D-Coding	1	TX+	 M12 male socket A-Coding	1	24E	 M12 female socket A-Coding	1	24O
		2	RX+		2	n. c.		2	DI3
		3	TX-		3	GND		3	GND
		4	RX-		4	n. c.		4	DO1
					5	n. c.		5	n. c.

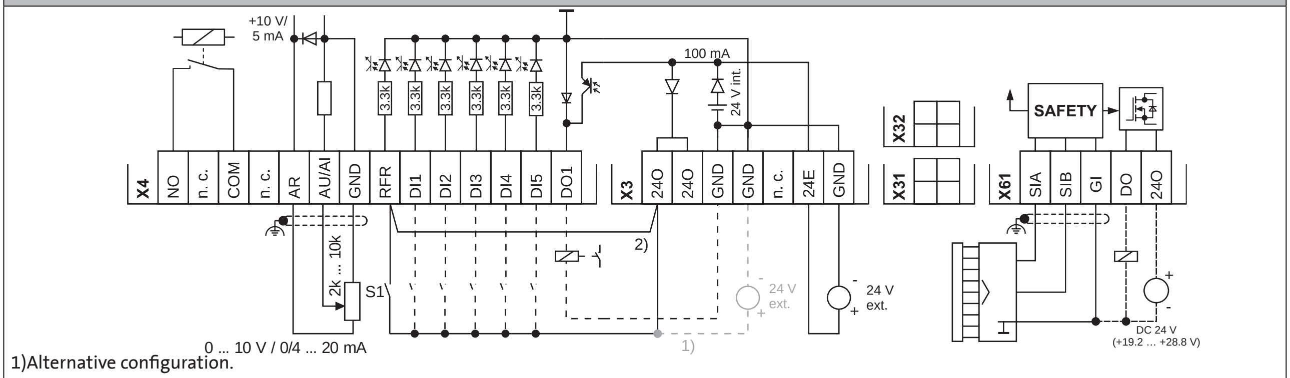
Communication Unit PROFINET STO

Connections

Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFINET STO / standard I/O	Controller enable (RFR)	1			E84DGFCRFJP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1			
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	PROFINET Port 1	PROFINET Port 1 to A2		
	Network	PROFINET Port 2	PROFINET Port 2 to A3		
	STO	SIA/SIB/GI/DO			
	External 24 V supply	-			

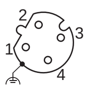
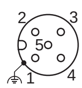
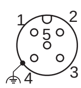
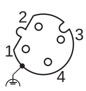
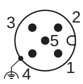
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFINET STO / enhanced I/O	Controller enable (RFR)	1			E84DGFCREJP
	Digital inputs (DI)	5	DI1/DI2 to A4		
	Analog inputs (AU/AI)	1	AU/AI to B2		
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1	NO/COM to B3		
	LED network		LED to A1		
	Network	PROFINET Port 1	PROFINET Port 1 to A2		
	Network	PROFINET Port 2	PROFINET Port 2 to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	-			

Connection inputs and outputs PROFINET STO



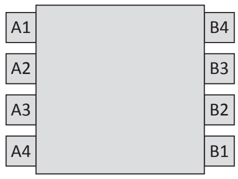
1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

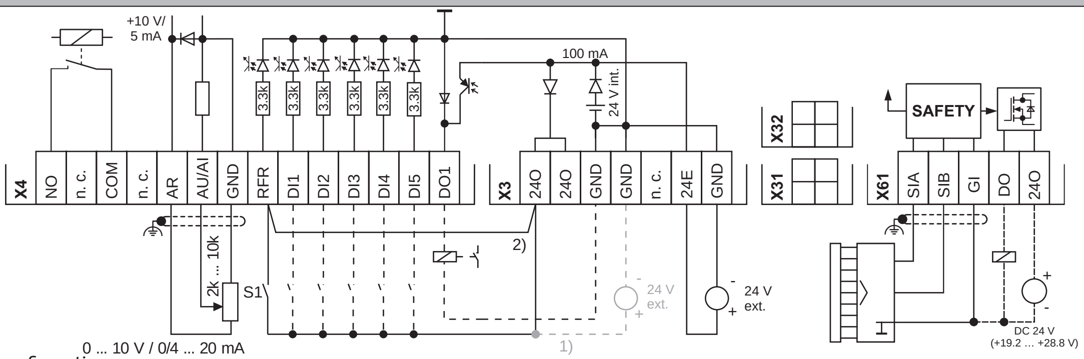
E84DGFCxFJx	●			●						
E84DGFCxEJx	●			●			●			
			A2			A4			B2	B3
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RX+		2	DI2		2	AU/AI	DO1
		3	TX-		3	GND		3	GND	GND
		4	RX-		4	DI1		4	Controller	COM
					5	n. c.		5	n. c.	NO
			A3						B4	
	 M12 female socket D-Coding	1	TX+				 M12 male socket A-Coding	1	SIA	
		2	RX+					2	SIB	
		3	TX-					3	DO	
		4	RX-					4	24O	
								5	GI	

Communication Unit PROFINET STO

Connections

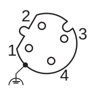
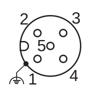
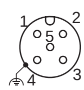
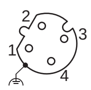
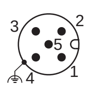
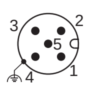
Version	Features	Connections	Pin assignment	Pin arrangement	Product key
PROFINET STO / enhanced 2 I/O	Controller enable (RFR)	1			E84DGFCRGJP
	Digital inputs (DI)	5	DI1/DI2 to A4 DI3 to B3 DI4/DI5 to B2		
	Analog inputs (AU/AI)	1			
	Digital outputs (DO)	1	DO1 to B3		
	Relay (NO/COM)	1			
	LED network		LED to A1		
	Network	PROFINET Port 1	PROFINET Port 1 to A2		
	Network	PROFINET Port 2	PROFINET Port 2 to A3		
	STO	SIA/SIB/GI/DO	SIA/SIB/GI/DO to B4		
	External 24 V supply	1	24E to B1		

Connection inputs and outputs PROFINET STO



1)Alternative configuration.
2)In case of external control, remove the controller enable jumper.

M12 connector pin assignment

E84DGFCxGJx	●			●			●			
			A2			A4			B2	B3
	 M12 female socket D-Coding	1	TX+	 M12 female socket A-Coding	1	24O	 M12 female socket A-Coding	1	24O	24O
		2	RX+		2	DI2		2	DI5	DI3
		3	TX-		3	GND		3	GND	GND
		4	RX-		4	DI1		4	DI4	DO1
					5	n. c.		5	n. c.	n. c.
			A3			B1			B4	
	 M12 female socket D-Coding	1	TX+	 M12 male socket A-Coding	1	24E	 M12 male socket A-Coding	1	SIA	
		2	RX+		2	n. c.		2	SIB	
		3	TX-		3	GND		3	DO	
		4	RX-		4	n. c.		4	24O	
					5	n. c.		5	GI	

Wiring Unit for motor mounting

The Wiring Unit is the interface between the various Lenze motors and the 8400 motec. Mounting additional modules to the Wiring Unit provides significant flexibility for the connection of the mains, motor, brake and brake resistor, such as:

- Q4/2 plug-in module as Q4/2 plug connection or loop-through connection
- QUICKON V2 and M15 connector for mains connection
- Attachable external brake resistor for braking operation via the integrated brake chopper

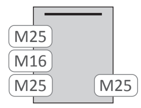
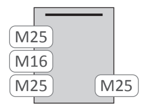
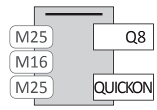
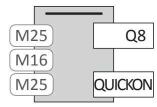
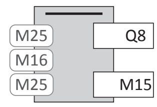
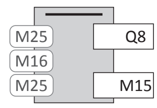
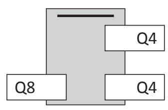
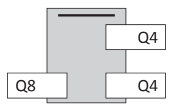
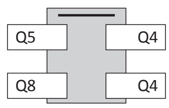
Product key	Version	Inverter	Motor frame sizes	
E84DGVN1E	Wiring Unit	E84DGDVB3714PS E84DGDVB5514PS E84DGDVB7514PS E84DGDVB1124PS	063 071	
E84DGVN2E		E84DGDVB5514PS E84DGDVB7514PS E84DGDVB1124PS E84DGDVB1524PS	080 090 100	
E84DGVN3E		E84DGDVB2224PS E84DGDVB3024PS	080 090 100 112	
E84DGVN4E		E84DGDVB4024PS E84DGDVB5524PS E84DGDVB7524PS	080 090 100 112	
E84DGVN5E		E84DGDVB5524PS E84DGDVB7524PS	132	

Frame Unit Wall mounting 0.37 to 3.0 kW

The 8400 motec is mounted on the wall using the Frame Unit. The Frame Unit without switch is available in the following combinations:

- In cable gland version
- In connector version, 2 x Q4/2 for mains loops and 1 x Q8/0 for motor connection
- In connector version, 1x QUICKON V2 or M15 for mains connection and 1 x Q8/0 for motor connection
- With integrated 90 Ω brake resistor (30 W, 0.6 kWs) or 1 x Q5/0 to connect an external brake resistor

Frame Unit

Product key	Connection system	Mains connection	Motor connection	Brake resistor	Position		Drive Unit type
					L [3]	R [5]	
E84DGS2EENNNP	Cable gland	-	-	Not integrated			E84DGDVB3714PS E84DGDVB5514PS E84DGDVB7514PS E84DGDVB1124PS E84DGDVB1524PS E84DGDVB2224PS E84DGDVB3024PS
E84DGS2EENKNP		-	-	Integrated			
E84DGS2SCNNNP	Pluggable	1x QUICKON V2	1x Q8/0	Not integrated			
E84DGS2SCNKNP		1x QUICKON V2	1x Q8/0	Integrated			
E84DGS2ICNNNP		1x M15	1x Q8/0	Not integrated			
E84DGS2ICNKNP		1x M15	1x Q8/0	Integrated			
E84DGS2KCNNNP		2x Q4/2	1x Q8/0	Not integrated			
E84DGS2KCNKNP		2x Q4/2	1x Q8/0	Integrated			
E84DGS2KCNMNP		2x Q4/2	1x Q8/0	Externally connectable using 1x Q5/0			

Wall adapter Wall mounting 4.0 to 7.5 kW

A wall adapter is used for wall mounting of 4.0 to 7.5 kW, which can be purchased either as a component or as part of a complete wall mounting set.
The Drive Unit of the 8400 motec can be mounted directly on the wall adapter and complies with protection class IP65.

Wall adapter

Product key	Version	Features	For
E84DZMAWE2	Wall adapter	• Degree of protection IP65 • Easy installation	E84DGDVB4024PS E84DGDVB5524PS E84DGDVB7524PS

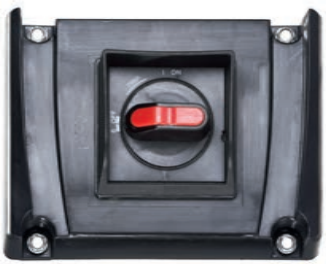
Frame Unit with switch Wall mounting 0.37 to 3.0 kW

The Frame Unit with switch is a wiring and switch box for wall mounting and performance class up to 3.0 kW. The protection classes of the switches are listed in the Technical Data. The Frame Unit with switch is available in the following combinations:

- In cable gland version
- In connector version, 2 x Q4/2 for mains loops and 1 x Q8/0 for motor connection
- In connector version, 1 x QUICKON V2 for mains connection and 1 x Q8/0 for motor connection
- In connector version, 1 x M15 for mains connection and 1 x Q8/0 for motor connection
- With service switch
- Service switch with control elements
- Service switch with protective function
- With integrated 220 Ω brake resistor (15 W, 0.6 kWs) or 1 x Q5/0 to connect an external brake resistor

Frame Unit with switch

Switch functions				Protection class
Service switch with protective function	Mains supply ON/OFF, rated current 25 A, short circuit protection			IP64
Service switch	Mains supply ON/OFF, rated current 20 A			IP54
Service switch with control elements	Left position	Center	Right position	
Service switch	Mains supply ON/OFF, rated current 20 A			IP54
Operational control 1 (key-operated switch)	Manual operation		Automatic	
Control element 2	Motor counter-clockwise rotation		Motor clockwise rotation	



Service switch with protective function

Service switch

Service switch with control elements

Product key	Switch type	Connection system	Mains connection	Motor connection	Brake resistor	Position		Drive Unit type
						L [3]	R [5]	
E84DGS3LEBNND	Service switch							
E84DGS3LEKNND	Service switch with protective function	Cable gland	-	-	Not integrated	M25 M25 M25 M20 M20		
E84DGS3LEENND	Service switch with control elements							
E84DGS3LEBCND	Service switch							
E84DGS3LEKCND	Service switch with protective function	Cable gland	-	-	Integrated	M25 M25 M25 M20 M20		
E84DGS3LEECND	Service switch with control elements							
E84DGS3KCBNND	Service switch							
E84DGS3KCKNND	Service switch with protective function	Pluggable	2x Q4/2	1x Q8/0	Not integrated		Q8 Q4 Q4	
E84DGS3KCENND	Service switch with control elements							
E84DGS3KCBCND	Service switch							
E84DGS3KCKCND	Service switch with protective function	Pluggable	2x Q4/2	1x Q8/0	Integrated		Q8 Q4 Q4	
E84DGS3KCECND	Service switch with control elements							
E84DGS3KCBLND	Service switch							
E84DGS3KCKLND	Service switch with protective function	Pluggable	2x Q4/2	1x Q8/0	Externally connect-able using 1x Q5/0		Q5 Q8 Q4 Q4	E84DGDVB3714PS E84DGDVB5514PS E84DGDVB7514PS E84DGDVB1124PS E84DGDVB1524PS E84DGDVB2224PS E84DGDVB3024PS
E84DGS3KCELND	Service switch with control elements							
E84DGS3SCBNND	Service switch							
E84DGS3SCKNND	Service switch with protective function	Pluggable	1x QUICKON V2	1x Q8/0	Not integrated	M25 M25 QUICKON M20 M20	Q8	
E84DGS3SCENND	Service switch with control elements							
E84DGS3SCBCND	Service switch							
E84DGS3SCKCND	Service switch with protective function	Pluggable	1x QUICKON V2	1x Q8/0	Integrated	M25 M25 QUICKON M20 M20	Q8	
E84DGS3SCECND	Service switch with control elements							
E84DGS3ICBNND	Service switch							
E84DGS3ICKNND	Service switch with protective function	Pluggable	1x M15	1x Q8/0	Not integrated	M25 M25 M15 M20 M20	Q8	
E84DGS3ICENND	Service switch with control elements							
E84DGS3ICBCND	Service switch							
E84DGS3ICKCND	Service switch with protective function	Pluggable	1x M15	1x Q8/0	Integrated	M25 M25 M15 M20 M20	Q8	
E84DGS3ICECND	Service switch with control elements							

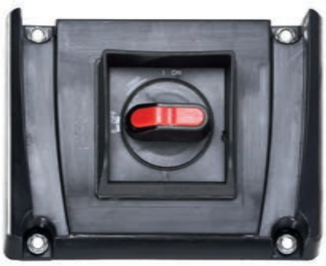
Frame Unit with switch Wall mounting 4.0 to 7.5 kW

The Frame Unit with switch is a wiring and switch box for wall mounting and power class 4.0 to 7.5 kW. The protection classes of the switches are listed in the Technical Data. The Frame Unit with switch is available in the following combinations:

- In connector version, 2 x Q4/2 for mains loops and 1 x Q8/0 for motor connection
- With service switch
- Service switch with control elements
- Service switch with protective function
- With 1 x Q5/0 to connect an external brake resistor

Frame Unit with switch

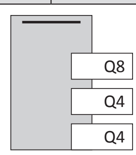
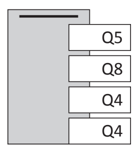
Switch functions				Protection class
Service switch with protective function	Mains supply ON/OFF, rated current 25 A, short circuit protection			IP64
Service switch	Mains supply ON/OFF, rated current 20 A			IP54
Service switch with control elements	Left position	Center	Right position	
Service switch	Mains supply ON/OFF, rated current 20 A			IP54
Operational control 1 (key-operated switch)	Manual operation		Automatic	
Control element 2	Motor counter-clockwise rotation		Motor clockwise rotation	



Service switch with protective function

Service switch

Service switch with control elements

Product key	Switch type	Connection system	Mains connection	Motor connection	Brake resistor	Position L [3]	Position R [5]	Drive Unit type
E84DGS3KCBNND	Service switch	Pluggable	2x Q4/2	1x Q8/0	Not integrated			E84DGDVB4024PS E84DGDVB5524PS E84DGDVB7524PS
E84DGS3KCKNND	Service switch with protective function							
E84DGS3KCENND	Service switch with control elements							
E84DGS3KCBLND	Service switch	Pluggable	2x Q4/2	1x Q8/0	Externally connect-able using 1x Q5/0			
E84DGS3KCKLND	Service switch with protective function							
E84DGS3KCELND	Service switch with control elements							

Possible components of the 8400 motec system

Drive Unit

USB diagnostic adapter - E94AZCUS

Diagnosis terminal - EZAEBK2001

Memory module - E84AYM205/M

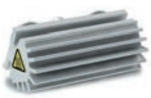
Communication Unit

M12 connector - EZAEVE013/M

Switch/potentiometer unit, connection via B-side - E82ZBU

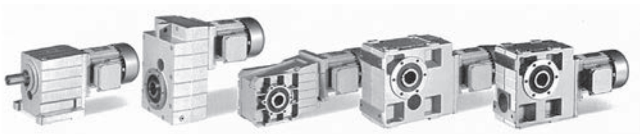
Wiring Unit

External brake resistor



External brake resistor, can be mounted on the Wiring Unit in position R [5] or L [3]

Plug-in connector, versions available for mounting in position R [5] or L [3]



Mounted on geared motor

Memory module

All device settings for the 8400 are stored on a plug-in memory chip, the memory module. The memory module ensures that drives can be replaced quickly and without errors.

Version	Features	Product key
Memory module	• For 8400 BaseLine, 8400 motec • Packaging unit: 12 pieces	E84AYM20S/M

M12 connector

The M12 plug-in connector can easily be added by breaking open the cutouts in the Communication Unit. The Communication Unit is wired by means of plug-in terminals. This means additional I/Os can also be plugged in.

Version	Features	Product key
M12 connector	• A coded, 5-pin, female • Packaging unit: 5 pieces	EZAEVE013/M

Connector modules

Screwed sockets are available by default in the 8400 motec for mains connection. Plug-in modules can also be used as an alternative. Because of the universal connection options offered by the modules, a supply bus can be set up using plugs and couplings without the need for any external accessories.

Features	Version	Product key for mounting in ...	
		Position L [3]	Position R [5]
Mains supply	1x Q4/2 • 4 power contacts and PE: 32 A / 400 V • 2 control contacts: 10 A / 24 V	E84DZEVBRPNP 	E84DZEVBLPNP 
Mains supply with daisy chain	2x Q4/2 • 4 power contacts and PE: 32 A / 400 V • 2 control contacts: 10 A / 24 V	E84DZEVBRPRP 	E84DZEVBLPRP 
Motor connection for wall mounting	1x Q8/0 • 8 power contacts and PE: 16 A / 400 V • Suitable for rated motor power ≤ 7.5 kW	E84DZEVBRCNP 	E84DZEVBLCNP 
Motor connection for wall mounting Connection for an external brake resistor	1x Q8/0 • 8 power contacts and PE: 16 A / 400 V • Suitable for rated motor power ≤ 7.5 kW 1x Q5/0	E84DZEVBRCFP 	-
Connection for an external brake resistor	1x Q5/0	E84DZEVBRNFP 	E84DZEVBLNFP 

Accessories for the QUICKON V2 power cabling

The following QUICKON variants can be mounted to match the power cabling.

Device connection	Illustrations	Features	Product key
QUICKON V2 connector (wall duct)		• Applications with single mains connection directly on the Wiring Unit, i.e., Frame Unit • Suitable for rated power up to ≤ 3 kW • For all sizes, 20 A / 690 V (UL: 15 A / 690 V)	EWS0102
5 x QUICKON V2 nut		Connection cycles: maximum of 10	
		Cable diameter 6 ... 10 mm	EWS0103/M
		Cable diameter 9 ... 14 mm	EWS0104/M
5 x QUICKON V2 connector with QUICKON V2 nut		Connection cycles: more than 50	
		Cable diameter 6 ... 10 mm	EWS0105/M
		Cable diameter 9 ... 14 mm	EWS0106/M

4.2

Connector for the M15 terminal

The following connectors can be fitted to the connecting cable for the M15 terminal.

Version	Illustrations	Features	Product key
M15 connector (wall duct)		• Applications with single mains connection directly on the Wiring Unit, i.e., Frame Unit • 4 power contacts and PE: 16 A / 600 V • 2 control contacts: 10 A / 24 V • Suitable for rated power up to ≤ 3 kW • Not UL-approved	EWS0107
5 x M15 connector		• Connection cross-section 6 x 2.5 mm² • Crimp sockets • Plastic w/o shielding • Not UL-approved	EWS0109/M

System cables

Predefined cables with connectors facilitate the connection between the inverter and motor or brake resistor. Other configurations are possible on request.

Version		Illustrations	Features	Product key
On the motor side	On the device side			
Connection: Motor, motor holding brake, and temperature monitoring			8-pole cable, for fixed installation, 2.5 mm^2	
8-pin ICN connector with screw plug	Q8/0 connector		Cable length: 2.5 m	EYP0038A0025M07Q11
			Cable length: 5 m	EYP0038A0050M07Q11
Connection: Motor, motor holding brake, and temperature monitoring			8-pole cable, for fixed installation, 2.5 mm^2	
Open cable	Q8/0 connector		Cable length: 2.5 m	EYP0038A0025A00Q11
			Cable length: 5 m	EYP0038A0050A00Q11
Connection: Motor operating at 50/60 Hz, motor holding brake, and temperature monitoring			8-pole cable, for fixed installation, 2.5 mm^2	
HAN 10E-Y connector, star connection	Q8/0 connector		Cable length: 2.5 m	EYP0038A0025H11Q11
			Cable length: 5 m	EYP0038A0050H11Q11
Connection: Motor operating at 87/120 Hz, motor holding brake, and temperature monitoring			8-pole cable, for fixed installation, 2.5 mm^2	
HAN 10E-Δ connector, delta connection	Q8/0 connector		Cable length: 2.5 m	EYP0038A0025H13Q11
			Cable length: 5 m	EYP0038A0050H13Q11
At the brake resistor end	On the device side			
Connection: Brake resistor			3-pole cable, for fixed installation, 2.5 mm^2	
Open cable	Q5/0 connector		Cable length: 1.5 m	EYR0052A0015H18A03
			Cable length: 2.5 m	EYR0052A0025H18A03
			Cable length: 5 m	EYR0052A0050H18A03

Brake resistors

To decelerate greater moments of inertia or with a longer operation in generator mode an external brake resistor is required. It converts braking energy into heat. Besides the optionally integrated 220/90 Ω (15/30 W) brake resistors for wall mounting, the following brake resistors are also available.

External brake resistor

External brake resistor on the Wiring Unit

An external brake resistor can be mounted on the side of the 8400 motec Wiring Unit or Drive Unit instead of the plug-in modules or cable gland.

<table>
<tr><th>Typical motor power</th><th>Mains voltage</th><th>Brake resistor</th><th>Rated resistance</th><th>Rated power</th><th>Thermal capacity</th></tr>
<tr><td>4-pole asynchronous motor</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>P</td><td>U_{AC}</td><td></td><td>R_N</td><td>P_N</td><td>C_{th}</td></tr>
<tr><td>[kW]</td><td>[V]</td><td></td><td>[Ω]</td><td>[W]</td><td>[kWs]</td></tr>
<tr><td>0.37</td><td rowspan="10">3 AC
320 ... 528</td><td rowspan="5">E84DZEW220R001</td><td rowspan="5">220.0</td><td rowspan="10">40.0</td><td rowspan="10">0.6</td></tr>
<tr><td>0.55</td></tr>
<tr><td>0.75</td></tr>
<tr><td>1.1</td></tr>
<tr><td>1.5</td></tr>
<tr><td>2.2</td><td rowspan="2">E84DZEW100R001</td><td rowspan="2">100.0</td></tr>
<tr><td>3.0</td></tr>
<tr><td>4.0</td><td rowspan="3">E84DZEW47R0001</td><td rowspan="3">47.0</td></tr>
<tr><td>5.5</td></tr>
<tr><td>7.5</td></tr>
</table>

External brake resistor

The brake resistors recommended in the table below have been set or approx. 1.5 times the regenerative power cycle time of 15/135 s (brake/rest ratio). These brake resistors generally meet the usual requirements of standard applications.
The brake resistors are fitted with a thermostat (potential-free NC contact). The resistors meet IP65 or type 4 (NEMA 250) specifications.

Brake resistor

Typical motor power	Mains voltage	Brake resistor	Rated resistance	Rated power	Thermal capacity	Dimensions	Mass
4-pole asynchronous motor							
P	U_{AC}		R_N	P_N	C_{th}	H x W x D	m
[kW]	[V]		[Ω]	[W]	[kWs]	[mm]	[kg]
0.37	3 AC 320 ... 528	ERBS180R350W	180.0	350.0	53.0	382 x 124 x 122	2.0
0.55							
0.75							
1.1							
1.5							
2.2		ERBS180R350W	100.0	625.0	94.0	566 x 124 x 122	3.0
3.0							
4.0		ERBR047R400W	47.0	400.0	60.0	400 x 110 x 105	2.3
5.5							
7.5		ERBR047R400W	47.0	800.0	120.0	710 x 110 x 105	3.9

4.2

USB diagnostic adapter

The operation, parameterization and diagnostics of the 8400 motec via the L-force diagnostic interface takes place using the diagnosis terminal or a PC. A PC can be connected via the USB interface and the USB diagnostic adapter.

For connecting the USB diagnostic adapter to the L-force diagnostics interface (DIAG) on the inverter, three different cable lengths of 2.5 m, 5 m and 10 m are available separately. The connection can be made during operation. The engineering tools EASY Starter or Engineer are used for operation, parameter setting and diagnostics of the inverters. Both tools have simple, intuitive interfaces. Commissioning can therefore be carried out quickly and easily.

Instead of the USB diagnostic adapter, the PC system bus adapter can be used. This necessitates a CANopen interface on the inverter.

- The 'EASY Starter' or 'Engineer' engineering tools are used to operate, parameterize and diagnose the inverters.

USB diagnostic adapter incl. connecting cable to PC

Version		Features	Product key
USB diagnostic adapter		• Input side voltage supply via USB connection from PC • Output-side voltage supply via inverter’s diagnostic interface • Diagnostic LEDs • Electrical isolation of PC and inverters • Supports hot plugging	E94AZCUS

Connecting cables for USB diagnostic adapter

Version	Features	Product key
Connecting cable for USB diagnostic adapter	• Length: 2.5 m	EWL0070
	• Length: 5 m	EWL0071
	• Length: 10 m	EWL0072

Diagnosis terminal

The diagnosis terminal can be used for local operation, parameterization or diagnostics as a simple alternative to a PC. The structured menus and plain text display provide quick access to data.
The diagnosis terminal can be plugged into the inverter's L-force diagnostic interface from the outside.

Diagnosis terminal

Version	Features	Slot	Product key
Diagnosis terminal	• Diagnosis terminal in a robust housing • Incl. 2.5m cable • Degree of protection IP20 • For 8400 motec and 8400 protec	Diagnostic interface	EZAEBK2001

Switch/potentiometer unit

The switch/potentiometer unit is mounted at one point in the system. An analog setpoint can be specified with the switch/potentiometer unit and the control connections integrated in the inverter by using the integrated potentiometer; the rotary switch can, for example, be used to start/stop the drive or change the direction of rotation.
The switch/potentiometer unit is supplied with a 2.5 m connection cable.

Switch/potentiometer unit

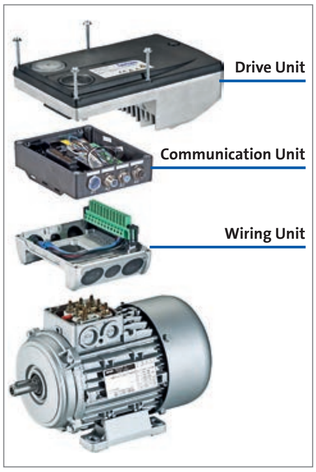
Version	Product key
Switch/potentiometer unit (IP65)	E82ZBU

8400 motec motor mounting

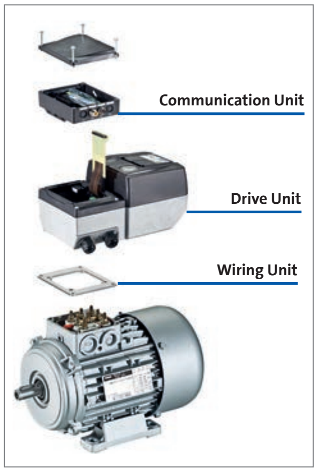
The 8400 motec can be delivered mounted on a motor or geared motor, or as a set of individual pieces. A set comprises:

- Drive Unit
- Communication Unit
- Wiring Unit
- Configured attachments

The Wiring Units are modified by default for Lenze motor types 063 to 132, with 0.37 to 7.5 kW. We recommend using our configuration tool »Product Finder« for the detailed configuration. Special accessories can be selected to adapt the system to the circumstances of use on site.

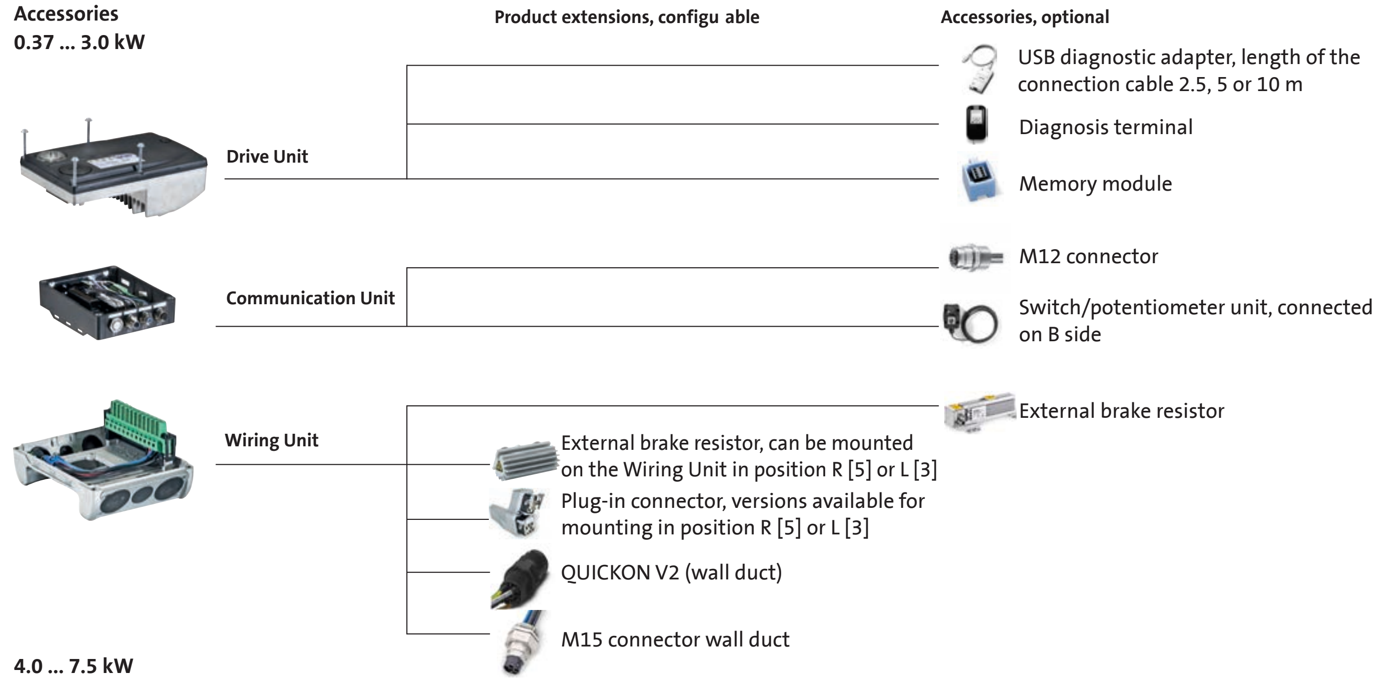


8400 motec 0.37 ... 3.0 kW

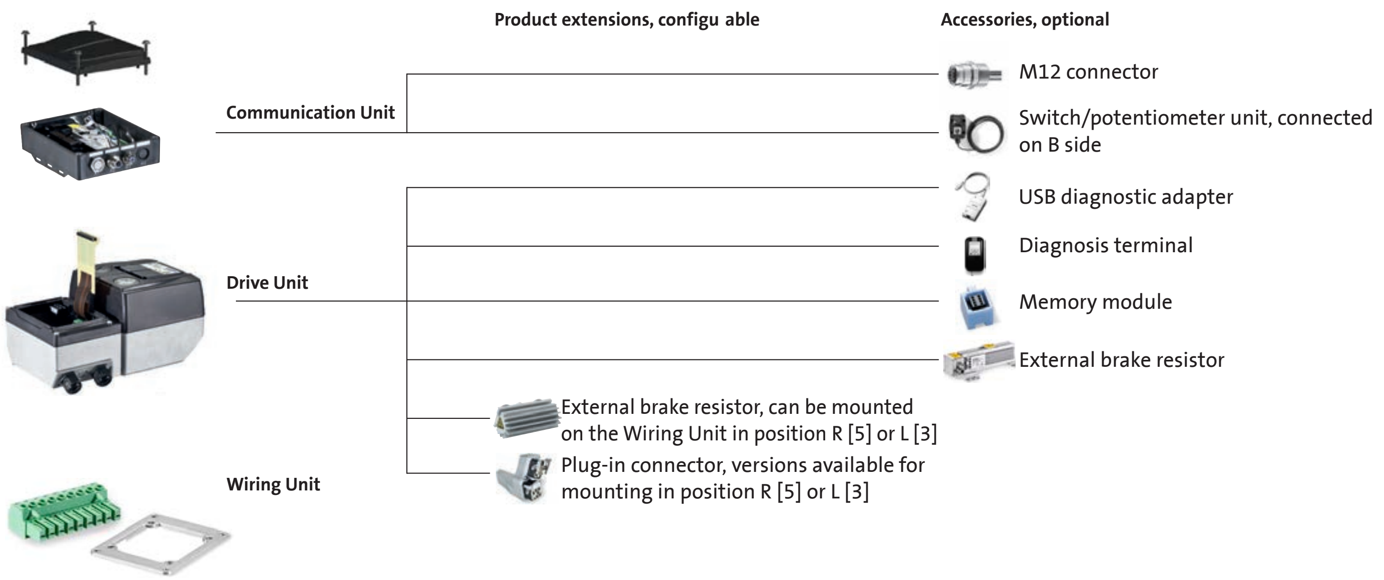


8400 motec 4.0 ... 7.5 kW

Accessories
0.37 ... 3.0 kW



4.0 ... 7.5 kW



Product key

Motor mounting	E	8	4	D	F	B	M				4	S				2	P	
Set comprising: Drive Unit, Communication Unit and Wiring Unit																		
Power																		
0.37 kW								3	7	1								
0.55 kW								5	5	1								
0.75 kW								7	5	1								
1.1 kW								1	1	2								
1.5 kW								1	5	2								
2.2 kW								2	2	2								
3.0 kW								3	0	2								
4.0 kW								4	0	2								
5.5 kW								5	5	2								
7.5 kW								7	5	2								
I/O modules																		
Basic I/O													N	N	N			
Standard I/O													S	N	N			
Standard I/O + M12													S	1	N			
Extended I/O													X	N	N			
Communication Unit with fieldbu																		
CAN / standard I/O													C	F	N			
CAN / enhanced I/O													C	E	N			
CAN STO / standard I/O													C	F	J			
CAN STO / enhanced I/O													C	E	J			
AS-Interface / standard I/O													A	F	N			
AS-Interface / enhanced I/O													A	E	N			
AS-Interface / enhanced 2 I/O													A	G	N			
AS-Interface STO / standard I/O													A	F	J			
AS-Interface STO / enhanced I/O													A	E	J			
PROFIBUS / standard I/O													P	F	N			
PROFIBUS / enhanced I/O													P	E	N			
PROFIBUS / enhanced 2 I/O													P	G	N			
PROFIBUS STO / standard I/O													P	F	J			
PROFIBUS STO / enhanced I/O													P	E	J			
PROFIBUS STO / enhanced 2 I/O													P	G	J			
PROFINET / standard I/O													R	F	N			
PROFINET / enhanced I/O													R	E	N			
PROFINET / enhanced 2 I/O													R	G	N			
PROFINET STO / standard I/O													R	F	J			
PROFINET STO / enhanced I/O													R	E	J			
PROFINET STO / enhanced 2 I/O													R	G	J			
EtherCAT / standard I/O													T	F	N			
EtherCAT enhanced I/O													T	E	N			
EtherCAT / enhanced 2 I/O													T	G	N			
EtherCAT STO / standard I/O													T	F	J			
EtherCAT STO / enhanced I/O													T	E	J			
EtherCAT STO / enhanced 2 I/O													T	G	J			
EtherNet/IP / standard I/O													G	F	N			
EtherNet/IP / enhanced I/O													G	E	N			
EtherNet/IP / enhanced 2 I/O													G	G	N			
EtherNet/IP STO / standard I/O													G	F	J			
EtherNet/IP STO / enhanced I/O													G	E	J			
EtherNet/IP STO / enhanced 2 I/O													G	G	J			
POWERLINK / standard I/O													L	F	N			
POWERLINK / enhanced I/O													L	E	N			
POWERLINK / enhanced 2 I/O													L	G	N			
POWERLINK STO / standard I/O													L	F	J			
POWERLINK STO / enhanced I/O													L	E	J			
POWERLINK STO / enhanced 2 I/O													L	G	J			
Wiring Unit for motor frame size																		
(063/071) for 0.37 ... 1.1 kW																		1
(080/090/100) for 0.55 ... 1.5 kW																		2
(080/090/100/112) for 2.2 ... 3.0 kW																		3
(080/090/100/112) for 4.0 ... 7.5 kW																		4
(132) for 5.5 ... 7.5 kW																		5

The optional plug connections that can be selected for the mains or brake resistor connection are not shown in this product key.

8400 motec wall mounting

The assembly for wall mounting consists of:
- Drive Unit
- Communication Unit
- Frame Unit (0.37 - 3.0 kW), wall adapter (4.0 - 7.5 kW)

The cable gland version is delivered as a set of individual parts. The version with plug-in connector is delivered as a fully mounted unit.

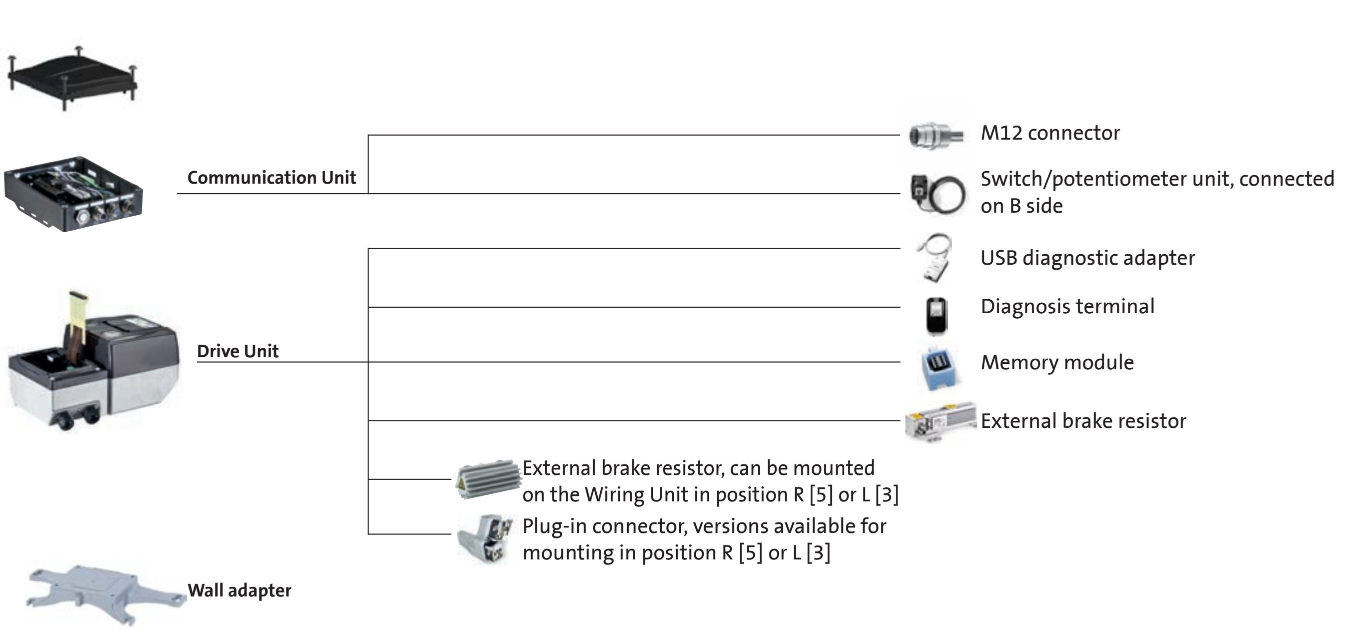
For wall mounting 0.37 3.0 kW, an internal brake resistor can also be ordered. For wall mounting 4.0 ... 7.5 kW, a mounted brake resistor can also be ordered. We recommend using our configuration tool »Product Finder« for the detailed configuration.
Special accessories can be selected to adapt the system to the circumstances of use on site.

0.37 ... 3.0 kW

4.0 ... 7.5 kW

Accessories
0.37 ... 3.0 kW

4.0 ... 7.5 kW



4.2

Product key

Wall mounting	**Z**	**2**	**5**			**0**									**F**	**0**	**0**	
Mains connection 1 x QUICKON V2, motor connection 1 x Q8/0				C	0													S
Mains connection, motor connection cable gland				A	0													k
Mains connection 2x Q4/2, motor connection 1 x Q8/0				B	B													
Mains connection M15, motor connection 1 x Q8/0				E	D													
Brake resistor																		
None							0											
Integrated 90 Ω (30 W) up to rated power 3 kW							B											
Mounted on the Drive Unit 47 Ω (40 W) with a rated power of 4 kW or more							C											
Connection for external brake resistor 1 x Q5/0							E											
I/O modules																		
Basic I/O								0	A	0	A							
Standard I/O								0	B	0	A							
Standard I/O + M12								0	B	0	B							
Extended I/O								0	D	0	A							
Communication Unit with fieldbu																		
CAN / standard I/O								C	C	0	E							
CAN / enhanced I/O								C	C	0	J							
CAN STO / standard I/O								C	B	A	E							
CAN STO / enhanced I/O								C	B	A	F							
AS-Interface / standard I/O								A	C	0	C							
AS-Interface / enhanced I/O								A	C	0	I							
AS-Interface / enhanced 2 I/O								A	C	0	L							
AS-Interface STO / standard I/O								A	B	A	C							
AS-Interface STO / enhanced I/O								A	B	A	D							
PROFIBUS / standard I/O								P	C	0	G							
PROFIBUS / enhanced I/O								P	C	0	k							
PROFIBUS / enhanced 2 I/O								P	C	0	L							
PROFIBUS STO / standard I/O								P	B	A	G							
PROFIBUS STO / enhanced I/O								P	B	A	H							
PROFIBUS STO / enhanced 2 I/O								P	B	A	P							
PROFINET / standard I/O								R	C	0	G							
PROFINET / enhanced I/O								R	C	0	k							
PROFINET / enhanced 2 I/O								R	C	0	L							
PROFINET STO / standard I/O								R	B	A	G							
PROFINET STO / enhanced I/O								R	B	A	H							
PROFINET STO / enhanced 2 I/O								R	B	A	P							
EtherCAT / standard I/O								T	C	0	G							
EtherCAT enhanced I/O								T	C	0	k							
EtherCAT / enhanced 2 I/O								T	C	0	L							
EtherCAT STO / standard I/O								T	B	A	G							
EtherCAT STO / enhanced I/O								T	B	A	H							
EtherCAT STO / enhanced 2 I/O								T	B	A	P							
EtherNet/IP / standard I/O								G	C	0	G							
EtherNet/IP / enhanced I/O								G	C	0	k							
EtherNet/IP / enhanced 2 I/O								G	C	0	L							
EtherNet/IP STO / standard I/O								G	B	A	G							
EtherNet/IP STO / enhanced I/O								G	B	A	H							
EtherNet/IP STO / enhanced 2 I/O								G	B	A	P							
POWERLINK / standard I/O								L	C	0	G							
POWERLINK / enhanced I/O								L	C	0	k							
POWERLINK / enhanced 2 I/O								L	C	0	L							
POWERLINK STO / standard I/O								L	B	A	G							
POWERLINK STO / enhanced I/O								L	B	A	H							
POWERLINK STO / enhanced 2 I/O								L	B	A	P							
Power																		
0.37 kW												1	3	7				
0.55 kW												1	5	5				
0.75 kW												1	7	5				
1.1 kW												2	1	1				
1.5 kW												2	1	5				
2.2 kW												2	2	2				
3.0 kW												2	3	0				
4.0 kW												2	4	0				
5.5 kW												2	5	5				
7.5 kW												2	7	5				

8400 motec with switch, wall mounting

The modules for wall mounting consist of:
- Drive Unit
- Communication Unit
- Frame Unit with switch

The cable gland version is delivered as a set of individual parts. The version with plug-in connector is delivered as a fully mounted unit. Various switch types with different protection classes can be selected:
- Service switch, IP54
- Service switch with control elements, IP54
- Service switch with protective function, IP64

We recommend using our configuration tool »Product Finder« for the detailed configuration. Special accessories can be selected to adapt the system to the circumstances of use on site.

0.37 ... 3.0 kW

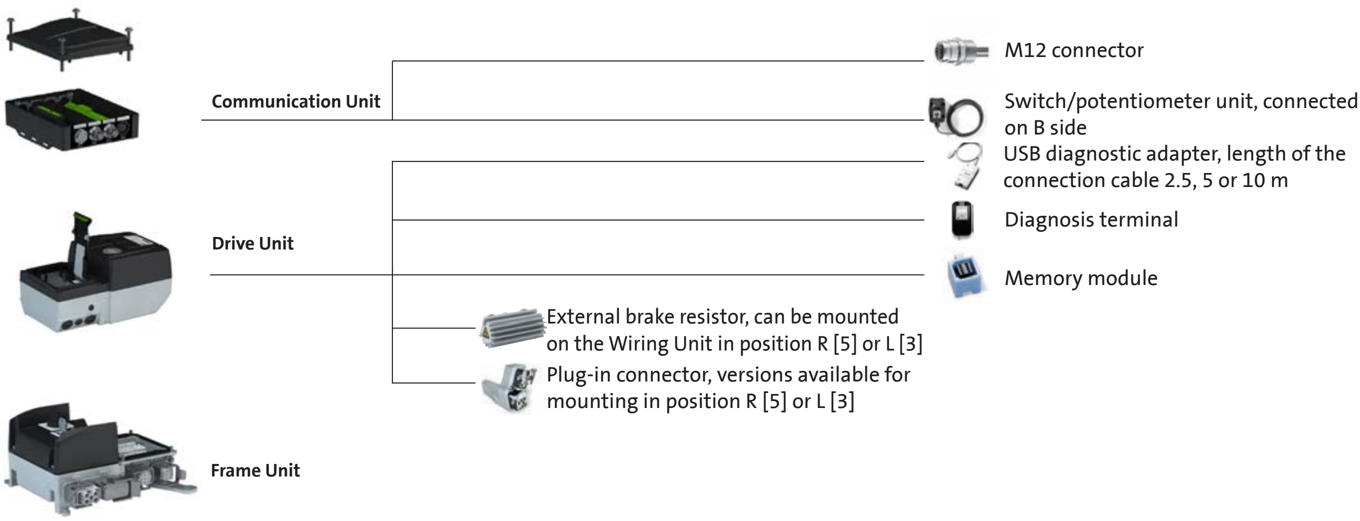
4.0 ... 7.5 kW

Accessories
0.37 ... 3.0 kW

Product extensions, configu able | **Accessories, optional**

Accessories
4.0 ... 7.5 kW

Product extensions, configu able | **Accessories, optional**



Product key

Wall mounting with switch	**Z**	**3**	**5**												**F**	**0**	**0**	
Mains connection 2x Q4/2, motor connection 1 x Q8/0, supplied as 1 unit				B	B													S
Mains connection, motor connection cable gland supplied as a set				A	0													k
Mains connection 1 x QUICKON V2, motor connection 1 x Q8/0				C	0													S
Mains connection M15, motor connection 1 x Q8/0				E	D													S
Service switch																		
Service switch						A												
Service switch with protective function						B												
Service switch with control elements						C												
Brake resistor																		
None							0											
Integrated 220 Ω resistor (15 W)							A											
Connection for external brake resistor 1 x Q5/0							E											
I/O modules																		
Basic I/O								0	A	0	A							
Standard I/O								0	B	0	A							
Standard I/O + M12								0	B	0	B							
Extended I/O								0	D	0	A							
Communication Unit with fieldbu																		
CAN / standard I/O								C	C	0	E							
CAN / enhanced I/O								C	C	0	J							
CAN STO / standard I/O								C	B	A	E							
CAN STO / enhanced I/O								C	B	A	F							
AS-Interface / standard I/O								A	C	0	C							
AS-Interface / enhanced I/O								A	C	0	I							
AS-Interface / enhanced 2 I/O								A	C	0	L							
AS-Interface STO / standard I/O								A	B	A	C							
AS-Interface STO / enhanced I/O								A	B	A	D							
PROFIBUS / standard I/O								P	C	0	G							
PROFIBUS / enhanced I/O								P	C	0	k							
PROFIBUS / enhanced 2 I/O								P	C	0	L							
PROFIBUS STO / standard I/O								P	B	A	G							
PROFIBUS STO / enhanced I/O								P	B	A	H							
PROFIBUS STO / enhanced 2 I/O								P	B	A	P							
PROFINET / standard I/O								R	C	0	G							
PROFINET / enhanced I/O								R	C	0	k							
PROFINET / enhanced 2 I/O								R	C	0	L							
PROFINET STO / standard I/O								R	B	A	G							
PROFINET STO / enhanced I/O								R	B	A	H							
PROFINET STO / enhanced 2 I/O								R	B	A	P							
EtherCAT / standard I/O								T	C	0	G							
EtherCAT enhanced I/O								T	C	0	k							
EtherCAT / enhanced 2 I/O								T	C	0	L							
EtherCAT STO / standard I/O								T	B	A	G							
EtherCAT STO / enhanced I/O								T	B	A	H							
EtherCAT STO / enhanced 2 I/O								T	B	A	P							
EtherNet/IP / standard I/O								G	C	0	G							
EtherNet/IP / enhanced I/O								G	C	0	k							
EtherNet/IP / enhanced 2 I/O								G	C	0	L							
EtherNet/IP STO / standard I/O								G	B	A	G							
EtherNet/IP STO / enhanced I/O								G	B	A	H							
EtherNet/IP STO / enhanced 2 I/O								G	B	A	P							
POWERLINK / standard I/O								L	C	0	G							
POWERLINK / enhanced I/O								L	C	0	k							
POWERLINK / enhanced 2 I/O								L	C	0	L							
POWERLINK STO / standard I/O								L	B	A	G							
POWERLINK STO / enhanced I/O								L	B	A	H							
POWERLINK STO / enhanced 2 I/O								L	B	A	P							
Power																		
0.37 kW												1	3	7				
0.55 kW												1	5	5				
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2.2 kW												2	2	2				
3.0 kW												2	3	0				
4.0 kW												2	4	0				
5.5 kW												2	5	5				
7.5 kW												2	7	5				

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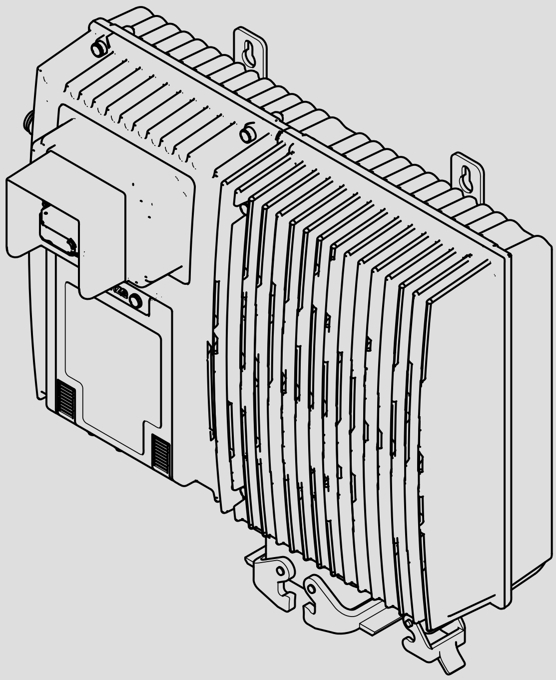
EDS84DPS424
13553590

L-force *Drives*

Translation **Hardware Manual**

8400 protec *0.75 ... 7.5 kW*



E84Dxxxxxxx HighLine/StateLine/EMS

Decentralised frequency inverter

1 About this documentation

Contents

The hardware manual contains the complete information on the intended use of the 8400 protec controllers in the StateLine and HighLine versions.

Validity

These instructions apply to decentralised 8400 protec frequency inverters with the following type designation:

Type designation	From HW	From SW
E84D**S**xxx... (StateLine)	VA	01.01
E84D**H**xxx... (HighLine)	VA	02.02
E84D**D**xxx... (EMS)	VA	01.00
E84D**E**xxx... (EMS)	VA	01.00
E84D**F**xxx... (EMS)	VA	01.00
E84D**L**xxx... (EMS)	VA	01.00
E84D**P**xxx... (EMS)	VA	01.00

Further information on the type code can be obtained from the ”Product description” chapter.

Target group

This hardware manual is intended for all persons who design, install, commission, and set 8400 protec controllers.

Tip!

Information and auxiliary devices related to the Lenze products can be found in the download area at

http://www.Lenze.com

1.1 Document history

Material number	Version			Description
13553590	6.2	09/2022	TD00	Complemented: Conformity UKCA, update
13553590	6.1	08/2019	TD15	Error corrections
13553590	6.0	05/2018	TD23	Update, error corrections
13446170	5.0	10/2013	TD15	Supplements by UL
13424171	4.1	04/2013	TD15	Extended up to 7.5 kW and corrections
13398961	3.0	05/2012	TD15	Additions and corrections
13382536	2.0	06/2011	TD15	Extended by EMS version
13368849	1.1	04/2011	TD15	General revision
13334905	1.0	04/2010	TD15	First edition

1.2 Conventions used

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

Spelling of numbers		
Decimal separator	Point	In general, the decimal point is used. For instance: 1234.56
Warnings		
UL warnings	Ⓤ	Given in English and French
UR warnings	Ⓡ	Given in English and French
Text		
Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
Icons		
Page reference	🕮	Reference to another page with additional information For instance: 🕮 16 = see page 16
Documentation reference	ⓘ	Reference to another documentation with additional information For example: ⓘ EDKxxx = see documentation EDKxxx

1.3 Terms and abbreviations used

Axis, drive	Lenze controller combined with a motor or geared motor and other Lenze drive components
Basic insulation	Insulation providing basic protection against hazardous shock currents
Controller	Any frequency inverter, servo inverter, or DC speed controller
Device size	Used as generic term for a group of devices which have the same dimensions (depth, height and width) but different power ratings.
Double insulation	Basic insulation and additional insulation
Functional insulation	Insulation ensuring perfect operation
Holding brake	See motor holding brake
Motor holding brake	The motor holding brake serves to statically hold e.g. a position during the downtimes of a robot, travelling, synchronous, or hoist drive.
Reinforced insulation	Uniform insulation system, same protection as double insulation
Spring-applied brake	Design type of a (motor) holding brake (electromechanically released, spring-applied operation)
Standard device	Used as generic term when actions and features are described which are very similar or the same for different versions or device sizes, e.g. ● mechanical installation or ● power terminals
EMS	**E**lectrified **M**onorail **S**ystem, e.g. monorail overhead conveyors, automated guided vehicle systems
Half wave (coded)	Process for transmitting control signals via contact conductor Control bar and message bar, also with coding
Power wave	Process for transmitting control signals with mains voltage
DECA BUS	Process for transmitting control signals via rail bus
PLC	Programmable logic controller, compatible with IEC 61131
IrRC	Infrared remote control
IrDA	Infrared data interface
Cxxxxx/y	Subcode y of code Cxxxx (e.g. C0410/3 = subcode 3 of code C0410)
Xk/y	Terminal y on terminal strip Xk (e.g. X3/28 = terminal 28 on terminal strip X3)

AC	AC current or AC voltage
DC	DC current or DC voltage
V_{LR} [V]	Rated mains voltage
U_{DC} [V]	DC voltage
U_{M} [V]	Output voltage / voltage at the motor terminals
I_{LR} [A]	Rated mains current
I_{aR} [A]	Rated output current
I_{aM} [A]	Maximum output current
I_{PE} [mA]	Discharge current
P_{R} [kW]	Rated motor power
P_{V} [W]	Inverter power loss
P_{DC} [kW]	Power at the DC voltage end
S_{R} [kVA]	Apparent output power of the controller
M_{R} [Nm]	Rated torque
f_{max} [Hz]	Maximum frequency
L [mH]	Inductance
R [Ω]	Resistor
DIN	Deutsches Institut für Normung
EMC	Electromagnetic compatibility
EN	European standard
IEC	International Electrotechnical Commission
IP	International Protection Code
NEMA	National Electrical Manufacturers Association
VDE	Verband deutscher Elektrotechniker
CE	Communauté Européene
UL	Underwriters Laboratories

Terms and abbreviations of the safety system

Abbreviation	Meaning
24O	24 V voltage supply for non-safe monitoring
Cat.	Category according to EN 954-1 (valid until 30 November 2009)
DO	Non-safe feedback output
F-PLC	Safety PLC
GSDML	File containing device-specific data to establish PROFINET communication
GSE	File containing device-specific data to establish PROFIBUS communication
OFF state	Signal status of the safety sensors when they are activated or respond
ON state	Signal status of the safety sensors during normal operation
Opto supply	Optocoupler supply for controlling the drivers
OSSD	Output Signal Switching Device, tested signal output
PELV	Protective Extra Low Voltage
PL	Performance Level according to EN ISO 13849-1
PM	P/N switching signal paths
PP	P/P switching signal paths
PS	PROFIsafe
PWM	Pulse Width Modulation
S-Bus	Safety bus
SD-In	Safe input (Safe Digital Input)
SD-Out	Safe output (Safe Digital Output)
SELV	Safety Extra Low Voltage
SIA, SIB	Safe Input, channel A or B, respectively
SIL	Safety Integrity Level according to IEC 61508
SO	Integrated safety option

Abbreviation	Safety function
AIE	Error acknowledgement (Acknowledge In Error)
AIS	Restart acknowledgement (Acknowledge In Stop)
ES	Safe enable switch
OMS	Operation Mode Selector
SS1	Safe Stop 1
SSE	Safe Stop Emergency
STO	Safe Torque Off Formerly: Safe standstill

1.4 Notes used

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

Safety instructions

Structure of safety instructions:

Danger!

(characterises the type and severity of danger)

Note

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

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
STOP Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
Note!	Important note to ensure troublefree operation
Tip!	Useful tip for simple handling
	Reference to another documentation

Special safety instructions and application notes

Pictograph and signal word	Meaning
Warnings!	**Safety note or application note for the operation according to UL or CSA requirements.** The measures are required to meet the requirements according to UL or CSA.
Warnings!	

2 Safety instructions

2.1 General safety and application notes for Lenze controllers

For your personal safety

Disregarding the following basic safety measures may lead to severe personal injury and damage to material assets:

- ► Use the product as intended.
- ► Never operate the product if damages are visible.
- ► Never operate the product unless fully assembled.
- ► Do not make any technical changes to the product.
- ► Only use the accessories approved for the product.
- ► Only use original spare parts of the manufacturer.
- ► Observe all regulations for the prevention of accidents, directives and laws applicable on site.
- ► Transport, installation, commissioning and maintenance work must only be carried out by qualified personnel.
  - – Observe IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and all national regulations for the prevention of accidents.
  - – According to the basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- ► Observe all specifications in this documentation.
  - – This is the condition for safe and troublefree operation and the achievement of the specified product features.
  - – The procedural notes and circuit details described in this documentation are only proposals. It is up to the user to check whether they can be transferred to the particular applications. Lenze SE does not accept any liability for the suitability of the procedures and circuit proposals described.
- ► Lenze inverters (frequency inverters, servo inverters, DC speed controllers) and the accessory components can include live and moving parts (depending ontheir type of protection) during operation. Surfaces can be hot.
  - – Nonauthorized removal of the required cover, inappropriate use, incorrect installation or operation create the risk of severe injury to persons or damage to material assets.
  - – For more information, please see the documentation.
- ► High amounts of energy are produced in the drive. Therefore it is required to wear personal protective equipment (body protection, headgear, eye and ear protection, hand guard).

Application as directed

Inverters are components which are designed for installation in electrical systems or machines. They are not to be used as domestic appliances, but only for industrial purposes according to EN 6100032.

When inverters are installed into machines, commissioning (i.e. starting of the operation as directed) is prohibited until it is proven that the machine complies with the regulations of 2006/42/EC: Machinery Directive [UKCA: S.I. 2008/1597 - The Supply of Machinery (Safety) Regulations 2008]; EN 60204 must be observed.

Commissioning (i.e. starting of the operation as directed) is only allowed when there is compliance with 2014/30/EU: EMC Directive [UKCA: S.I. 2016/1091 - The Electromagnetic Compatibility Regulations 2016].

The inverters meet the requirements of 2014/35/EU: Low-Voltage Directive [UKCA: S.I. 2016/1101 - The Electrical Equipment (Safety) Regulations 2016]. The harmonised standard EN 61800-5-1 applies to the inverters.

The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.

Warning: Inverters are products which can be installed in drive systems of category C2 according to EN 61800-3. These products can cause radio interferences in residential areas. In this case, special measures can be necessary.

Transport, storage

Observe the notes on transport, storage, and appropriate handling.

Observe the climatic conditions according to the technical data.

Installation

The inverters must be installed and cooled according to the instructions given in the corresponding documentation.

The ambient air must not exceed degree of pollution 2 according to EN 61800-5-1.

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

Inverters contain electrostatic sensitive devices which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since thismight endanger your health!

Electrical connection

When working on live inverters, observe the applicable national regulations for the prevention of accidents.

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

This documentation contains information on installation in compliance with EMC (shielding, earthing, filter, and cables). These notes must also be observed for CE-markedinverters. The manufacturer of the system is responsible for compliance with the limit values demanded by EMC legislation.

Lenze inverters may cause a DC current in the PE conductor. If a residual current device (RCD) is used for protection against direct or indirect contact for an inverter withthree-phase supply, only a residual current device (RCD) of type B is permissible on the supply side of the inverter. If the inverter has a single-phase supply, a residual current device (RCD) of type A is also permissible. Apart from using a residual current device (RCD), other protective measures can be taken as well, e.g. electrical isolation by double or reinforced insulation or isolation from the supply system by means of a transformer.

Operation

If necessary, systems including inverters must be equipped with additional monitoring and protection devices according to the valid safety regulations (e.g. law on technical equipment, regulations for the prevention of accidents). The inverters can be adapted to your application. Please observe the corresponding information given in the documentation.

After the inverter has been disconnected from the supply voltage, all live components and power terminals must not be touched immediately because capacitors can still be charged. Please observe the corresponding stickers on the inverter.

All protection covers and doors must be shut during operation.

Note for UL-approved systems with installed inverters: UL warnings are notes that only apply to UL systems. The documentation contains special UL notes.

Safety functions

Certain inverter versions support safety functions (e.g. ”Safe torque off”, formerly ”Safe standstill”) according to the requirements of 2006/42/EC: Machinery Directive [UKCA: S.I. 2008/1597 - The Supply of Machinery (Safety) Regulations 2008]. The notes on the integrated safety system provided in this documentation must be observed.

Maintenance and servicing

The inverters do not require any maintenance if the prescribed operating conditions are observed.

Disposal

Recycle metal and plastic materials. Ensure professional disposal of assembled PCBs.

The product-specific safety and application notes given in these instructions must be observed!

2.2 General safety and application notes for Lenze motors

General

Low-voltage machines have dangerous, live and rotating parts as well as possibly hot surfaces.

Synchronous machines induce voltages at open terminals during operation.

All operations serving transport, connection, commissioning and maintenance are to be carried out by skilled, responsible technical personnel (observe EN 50110-1 (VDE 0105-1) and IEC 60364). Improper handling can cause severe injuries or damages.

Lowvoltage machines may only be operated under the conditions that are indicated in the section ”Application as directed”.

The conditions at the place of installation must comply with the data given on the nameplate and in the documentation.

Application as directed

Lowvoltage machines are intended for commercial installations. They comply with the harmonised standards of the series IEC/EN 60034 (VDE 0530). Their use in potentially explosive atmospheres is prohibited unless they are expressly intended for such use (follow additional instructions).

Lowvoltage machines are components for installation into machines as defined in 2006/42/EC: Machinery Directive [UKCA: S.I. 2008/1597 - The Supply of Machinery (Safety) Regulations 2008]. Commissioning is prohibited until the conformity of the end product with this directive has been established (follow i. a. EN 60204-1).

Lowvoltage machines with IP23 protection or less are only intended for outdoor use when applying special protective features.

The integrated brakes must not be used as safety brakes. It cannot be ruled out that factors which cannot be influenced, such as oil ingress due to a defective Aside shaft seal, cause a brake torque reduction.

Transport, storage

Damages must be reported immediately upon receipt to the forwarder; if required, commissioning must be excluded. Tighten screwedin ring bolts before transport. They are designed for the weight of the lowvoltage machines, do not apply extra loads. If necessary, use suitable and adequately dimensioned means of transport (e. g. rope guides).

Remove transport locking devices before commissioning. Reuse them for further transport. When storing low-voltage machines, ensure a dry, dustfree and low-vibration ($v_{eff} \leq 0.2$ mm/s) environment (bearing damage while being stored).

Installation

Ensure an even surface, solid foot/flange mounting and exact alignment if a direct clutch is connected. Avoid resonances with the rotational frequency and double mains frequency which may be caused by the assembly. Turn rotor by hand, listen for unusual slipping noises. Check the direction of rotation when the clutch is not active (observe section ”Electrical connection”).

Use appropriate means to mount or remove belt pulleys and clutches (heating) and cover them with a touch guard. Avoid impermissible belt tensions.

The machines are halfkey balanced. The clutch must be halfkey balanced, too. The visible jutting out part of the key must be removed.

If required, provide pipe connections. Designs with shaft end at bottom must be protected with a cover which prevents the ingress of foreign particles into the fan. Free circulation of the cooling air must be ensured. The exhaust air also the exhaust air of other machines next to the drive system must not be taken in immediately.

Electrical connection

All operations must only be carried out by qualified and skilled personnel on the lowvoltage machine at standstill and deenergised and provided with a safe guard to prevent an unintentional restart.This also applies to auxiliary circuits (e. g. brake, encoder, blower).

Check safe isolation from supply!

If the tolerances specified in EN 600341; IEC 34 (VDE 05301) voltage ±5 %, frequency ±2 %, waveform, symmetry are exceeded, more heat will be generated and the electromagnetic compatibility will be affected.

Observe the data on the nameplate, operating notes, and the connection diagram in the terminal box.

The connection must ensure a continuous and safe electrical supply (no loose wire ends); use appropriate cable terminals. The connection to the PE conductor must be safe. The plug-in connectors must be bolt tightly (tostop).

The clearances between blank, live parts and to earth must not fall below 8 mm at $V_{rated} \leq 550$ V, 10 mm at $V_{rated} \leq 725$ V, 14 mm at $V_{rated} \leq 1000$ V.

The terminal box must be free of foreign particles, dirt and moisture. All unused cable entries and the box itself must be sealed against dust and water.

Commissioning and operation

Before commissioning after longer storage periods, measure insulation resistance. In case of values ≤ 1 kΩ per volt of rated voltage, dry winding.

For trial run without output elements, lock the featherkey. Do not deactivate the protective devices, not even in a trial run.

Check the correct operation of the brake before commissioning lowvoltage machines with brakes.

Integrated thermal detectors do not provide full protection for the machine. If necessary, limit the maximum current. Parameterise the controller so that the motor will be switched off with $I > I_{rated}$ after a few seconds of operation, especially at the risk of blocking.

Vibrational severities $v_{eff} \leq 3.5$ mm/s ($P_{rated} \leq 15$ kW) or 4.5 mm/s ($P_{rated} > 15$ kW) are acceptable if the clutch is activated.

If deviations from normal operation occur, e.g. increased temperatures, noises, vibrations, find the cause and, if required, contact the manufacturer. In case of doubt, switch off the lowvoltage machine.

If the machine is exposed to dirt, clean the air paths regularly.

Shaft sealing rings and roller bearings have a limited service life.

Regrease bearings with relubricating devices while the lowvoltage machine is running. Only use the grease recommended by the manufacturer. If the grease drain holes are sealed with a plug, (IP54 drive end; IP23 drive and nondrive end), remove plug before commissioning. Seal bore holes with grease. Replace prelubricated bearings (2Z bearing) after approx. 10,000 h 20,000 h, at the latest however after 3 4 years.

The product-specific safety and application notes given in these instructions must be observed!!

2.3 Residual hazards

Protection of persons

- Before working on the controller, check if no voltage is applied to the power terminals.
- The operating temperature of the heatsink at the controller is very high. Skin contact with the heatsink causes burns. If required, provide for protective covers.
- Before working on the controller, check if no voltage is applied to the power terminals because
  - depending on the device - the power terminals U, V, W, Rb1, and Rb2 remain live for at least 3 ... 20 minutes after disconnecting the mains.
  - the power terminals L1, L2, L3; U, V, W, Rb1, and Rb2 remain live when the motor is stopped.

Device protection

- Frequent switching on of the mains voltage (e.g. inching mode via mains contactor) may overload or destroy the controller.

Motor protection

- Frequent switching on may overheat the connected motor.
- Use PTC thermistors or thermostats with PTC characteristics to monitor the motor.
- Depending on the controller settings, the connected motor can be overheated by:
  - For instance, longer DC-braking operations.
  - Longer operation of self-ventilated motors at low speed.

Protection of the machine/system

- Drives can reach dangerous overspeeds (e.g. setting of high output frequencies in connection with motors and machines unsuitable for such conditions):
  - The controllers do not offer any protection against such operating conditions. Use additional components for this purpose.
- Switch **contactors in the motor cable** only if the controller is inhibited.

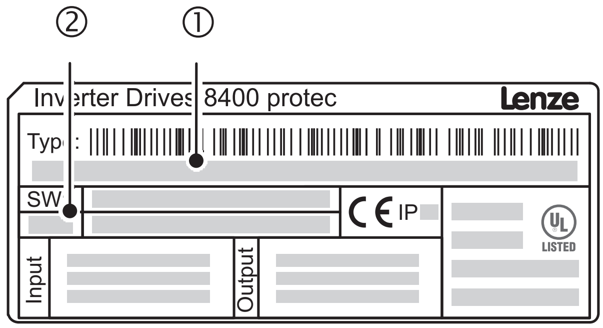
  When switching contactors in the motor cable while the controller is enabled, you can activate monitoring functions of the controller. If no monitoring function is activated, switching is permissible.
- All unused connectors must be closed with protection covers or blanking plugs.

3 Product description

3.1 Device features

Decentralised 8400 protec frequency inverter	Version		
Features	**HighLine**	**StateLine**	**EMS**
Power range	0.75 ... 7.5 kW	0.75 ... 4 kW	0.75 ... 7.5 kW
Mounting type	Wall-mounted device		
Brake management	Control of a mechanical motor holding brake		
24 V supply			
Internal (depending on mains voltage)	✓	✓	✓
24 V buffer voltage possible (for maintaining the control functionality in the case of mains failure)	✓	✓	-
Interfaces			
Digital inputs,	6	6	14
can be configured as outputs	2	2	2 or 4
Analog inputs	1	1	1
or optionally synchronous serial interface (SSI)		-	
Optional: RS485 or/and RS422	-	-	2 x RS485 2 x RS422 1 x RS485 / RS422 each
Remote control, infrared (IrRC)	✓ (from SW V12)	-	✓
Data interface, infrared (IrDA)	-	-	✓
Optional:			
Drive-based safety	Safety option (SO) 10, 20 or 30		-
Operation in generator mode	Internal or external brake resistor		
Control element	Various service switches		
			Rocker switch
Operation			
200 % overload current for 3 s	✓	✓	✓
S ramps for jerk-free acceleration and deceleration	✓	✓	✓
Protection against restart for cyclic mains switching	✓	✓	✓
Technology applications			
Speed actuating drive	✓	✓	✓
Switch-off positioning	✓	✓	✓
Absolute positioning	✓	-	✓
Table positioning	✓	-	✓
EMS-specific communication			
Half wave	-	-	✓
Half wave coded	-	-	✓
Power wave	-	-	✓
DECA BUS	-	-	✓
Inductive energy transmission	-	-	✓
PLC functionality	-	-	✓

3.2 Identification



E84DWAK001

① Type designation (📖 23)
② Version

Note

The type designation serves to identify detailed device properties with the following type code. The listing of the type code, features, and device properties does not consider any limitations of possible combinations.

In the HighLine and StateLine versions, certain combinations are not possible:

Possible ...			
either			or
Safety option 30	<	>	CAN on board
Analog input	<	>	SSI

Impossible ...			
			with/in
PROFIBUS	<	>	Push-pull
CANopen	<	>	Push-pull
SSI	<	>	StateLine
EtherNet/IP	<	>	Safety option 20 or 30

3.3 Type code

StateLine, HighLine

	E84D	x	x	x	x	xxx	x	x	x	x	x	x	x

Product series
Inverter Drives 8400 protec

Version

H = HighLine

S = Stateline (on request)

Mains connection and 24 V supply

D = Circular connector Molex, 1x mains and 1x 24 V (on request)

H = 1 circular connector Molex (Brad Mini-Change) (on request)

M = 2 hybrid plugs, type Q4/2

P = 1 hybrid plug, type Q4/2

Motor holding brake control
(with connection system for motor)

B = Fast switch, plug type Modular

C = Integrated half-wave brake rectifier, cold brake, plug type Q8/0 (on request)

F = Integrated half-wave brake rectifier, fast switch, plug type Q8/0

Series

C = 24 V internal

Power, e.g.

152 = 15×10^2 W = 1.5 kW

Voltage class

4 = 400/500 V, 3/PE AC

Communication (fieldbus)

C = CANopen (on request)

G = EtherNet/IP™

P = PROFIBUS® (on request)

R = PROFINET®

Communication connection system

see ”Possible combinations” table (🕮 29)

Extension module

S = None

Drive-based safety

N = None

J = Safety option 10

K = Safety option 20 (on request)

L = Safety option 30

Control element

N = None

C = Service switch with protective function

	E84D	x	x	x	x	xxx	x	x	x	x	x	x	x

Brake resistor

N =	None (on request)
E =	external, plug type Q5/0
F =	external, circular connector Molex (on request)
R =	Internal (on request)

EMS version

	E84D	x	x	x	x	xxx	x	x	x	x	x	x	x

Product series
Inverter Drives 8400 protec EMS

Special communication version for monorail overhead conveyor applications

D = DECA bus
E = Half wave
F = Inductive system
L = Half wave coded
P = Power wave

Connection system for mains and 24-V supply of the brake control in case of inductive systems

M = 2 hybrid plugs, type Q4/2
P = 1 hybrid plug, type Q4/2

Motor holding brake control
(with connection system for motor)

B = Fast switch (Plug type Modular)
H = Integrated half-wave brake rectifier (Plug type Han 10E)
K = Integrated half-wave brake rectifier (Plug type Q8/0)
V = 24 V DC (only inductive system) Plug type Q8/0

Series

Only for inductive system version:
C = 24 V DC internal
Only for half wave version:
D = Half wave 400 V AC / reference phase L1 // 24 V DC internal
E = Half wave 400 V AC / reference phase L3 // 24 V DC internal
Only for coded half wave version:
F = Half wave 230 V AC / reference phase L1 // 24V DC internal
G = Half wave 230 V AC / reference phase L3 // 24V DC internal
Only for power wave version or DECA bus:
E = Half wave 400 V AC / reference phase L3 // 24 V DC internal

Power, e.g.
152 = 15 x 10^2 W = 1.5 kW

Voltage class
4 = 400/500 V, 3/PE AC

Communication (fieldbus)
C = CANopen

Configuration of input and output range
1 = CANopen and analog input via M12 plug
5 = CANopen and SSI via M12 plug

Extension module
B = Digital I/O, CAN, 2 x RS485
C = Digital I/O, CAN, RS485, RS422
D = Digital I/O, CAN, 2 x RS422

	E84D	x	x	x	x	xxx	x	x	x	x	x	x	x

Drive-based safety

N = None

Control element

N = None

C = Service switch with protective function

R = Rocker switch for EMS (without mains disconnection)

Brake resistor

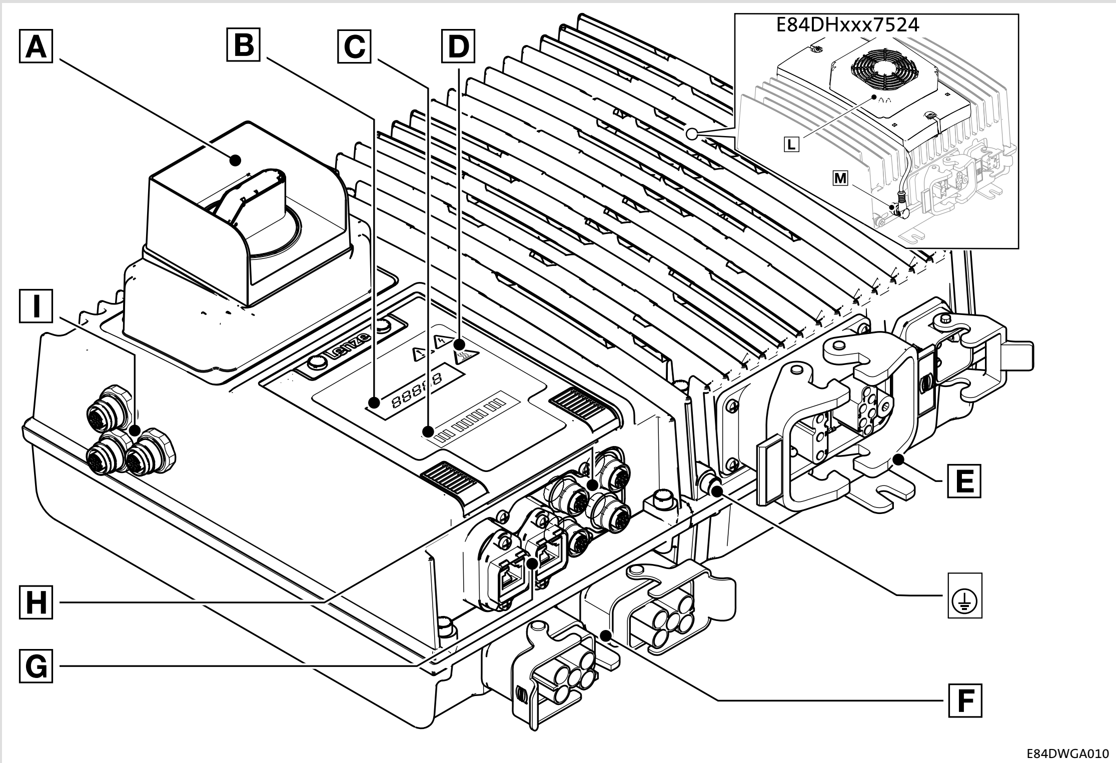
N = None

E = External

R = Internal

3.4 Overview of standard devices

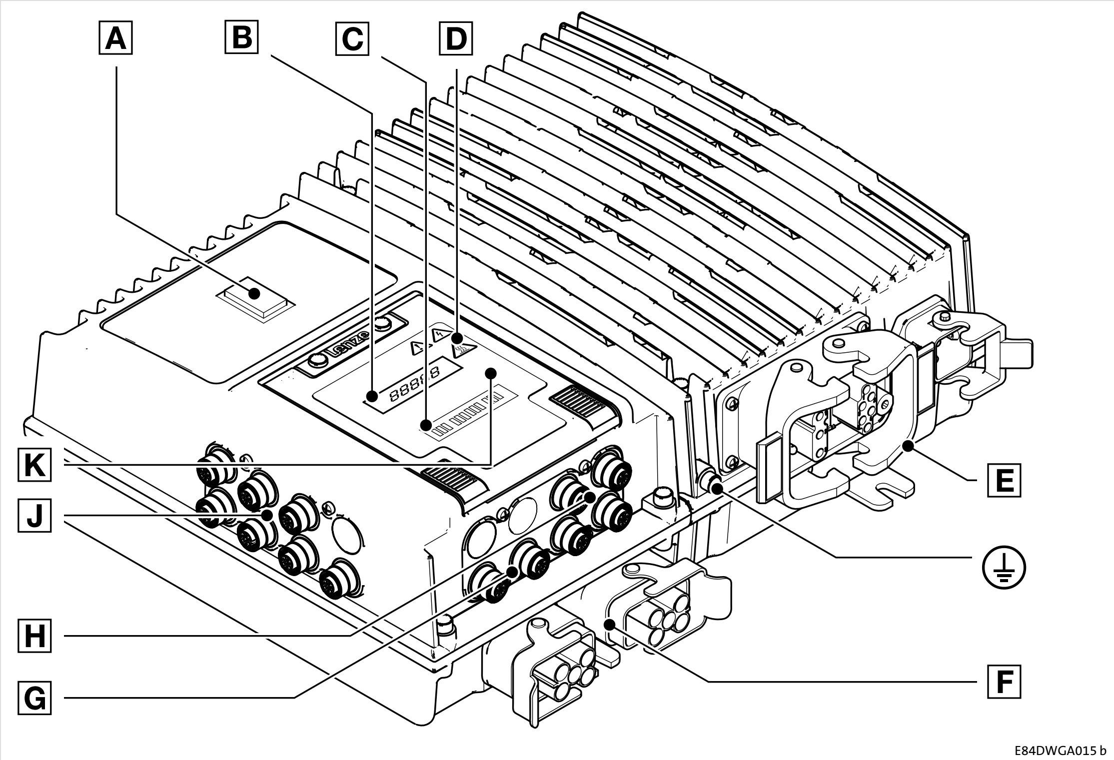
StateLine, HighLine



Control elements and overview of connections		
Pos.	**Description/function**	**Page(s)**
A	Control element, various versions, optional	23
B	Display for values and messages, 5 characters	167
C	LED status display	161
D	Warning symbols	See below
E	Motor and brake resistor connections	From 87
F	Connections for mains and 24 V supply voltage	
G	Fieldbus connections	From 64
H	Input and output connections	
I	Connections for safety system and/or CAN on board	
⏚	PE connections, M6 thread	-
L	only E84DHxxx7524: External fan	
M	Operating voltage for the external fan	-

Pos.	Icon	Description
D		**Long discharge time**: All power terminals remain live for up to 3 minutes after mains disconnection!
		High discharge current: Carry out fixed installation and PE connection according to EN 61800-5-1!
		Electrostatic sensitive devices: Before working on the device, the personnel must be free of electrostatic charge!
		Hot surface: Risk of burns! Hot surfaces should not be touched without wearing protective gloves.

EMS version



Control elements and connection overview of the EMS version		
Pos.	**Description/function**	**Page(s)**
A	Control element, various versions, optional	25
B	Display for values and messages, 5 characters	167
C	LED status display	161
D	Warning symbols	See below
E	Motor and brake resistor connections	From 87
F	Mains connections and EMS-specific communication	
G	Fieldbus connections	From 64
H	Input and output connections	
J	EMS extension connection	23
K	Infrared receiver/transmitter	167
⏚	PE connections, M6 thread	-

Pos.	Icon	Description
D		**Long discharge time**: All power terminals remain live for up to 3 minutes after mains disconnection!
		High discharge current: Carry out fixed installation and PE connection according to EN 61800-5-1!
		Electrostatic sensitive devices: Before working on the device, the personnel must be free of electrostatic charge!
		Hot surface: Risk of burns! Hot surfaces should not be touched without wearing protective gloves.

3.5 Communication

The available combinations of communication and connection system can be seen from the table.

Type code characteristics		Connection system version				
Communication (fieldbus)	Input / output area configuration	Fieldbus		SSI 3)	Analog input	CAN on board
		Push-pull	M12	M12	M12	M12
CANopen 1) 4)						
C	1 4)	-	☑	-	☑	-
	5 4)	-	☑	☑	-	-
PROFIBUS 4)						
P	1 4)	-	☑	-	☑	-
	3 4)	-	☑	-	☑	☑ 2)
	5 4)	-	☑	☑	-	-
	7 4)	-	☑	☑	-	☑ 2)
PROFINET / EtherNet/IP 1)						
R / G	1 4)	-	☑	-	☑	-
	2	☑	-	-	☑	-
	3 4)	-	☑	-	☑	☑ 2)
	4 4)	☑	-	-	☑	☑ 2)
	5	-	☑	☑	-	-
	6	☑	-	☑	-	-
	7 4)	-	☑	☑	-	☑ 2)
	8 4)	☑	-	☑	-	☑ 2)

☑ designed
1) cannot be combined with safety options 20 and 30
2) cannot be combined with safety option 30
3) not in StateLine version
4) on request
- impossible

3.5.1 CAN port

Detailed information on CAN can be found in the software manual.

CAN on board

"CAN on board" is only suited for short point-to-point connections between two controllers, e.g. for synchronisation. Pay attention to notes on EMC-compliant wiring and short cable lengths as there is no isolation towards the control electronics of the controller.

Node address and baud rate must be parameterised using the »Engineer«.

CANopen

CANopen is executed as isolated fieldbus and suited for multiple-node networks.

In case of fieldbuses, node address and baud rate can be set using the DIP switch under the service hatch or parameterised using the »Engineer«.

3.5.2 Infrared remote control receiver

For remote control, the devices are equipped with an infrared receiver (IrRC) (supported from SW version 12 onwards).

The actions enabled by the infrared remote control (LDEZIRRC) are freely programmable. For more information see the software manual and the online help for the LS_IRInterface system block.

Note!

A trouble-free operation of the optical interface requires:

- ► Clear line of sight between transmitter and receiver
  - – Maximum distance IrRC: ~ 5 m
  - – Maximum distance IrDA: ~ 1 m
  - – Angle of incidence: ~ 30 °
  - – Avoid direct solar radiation
  - – Environment without interfering transmitter (e.g. from adjacent stations)
- ► Clean and scratch-free service hatch

3.5.3 Extensions in EMS version

For EMS device versions, additional interfaces are implemented for control :

- ► Additional digital inputs and outputs
- ► Infrared data interface (IrDA)
- ► RS485 and/or RS422 serial interface

The type designation indicates which extensions are implemented in a device (🕮 25).

Overview of EMS extensions

Indicator in the type code	Connection			
	Digital I/O X45, X46, X47, X48 M12, 5-pole, A-coded	RS485 X81, X82 M12, 8-pole, A-coded	RS422	CANopen master PLC X34 M12, 5-pole, A-coded
B	6 x DI 2 x DI/O (X46 configurable)	2 x	-	☑
C		1 x	1 x	☑
D		-	2 x	☑

☑ designed
\- impossible

3.5.4 Infrared interface

The EMS versions come with an implemented infrared interface for data transfer (IrDA).

The actions enabled via the interface or the reading of parameter data (codes) are freely programmable in the PLC program.

Note!

A trouble-free operation of the optical interface requires:

- ► Clear line of sight between transmitter and receiver
  - – Maximum distance IrRC: ~ 5 m
  - – Maximum distance IrDA: ~ 1 m
  - – Angle of incidence: ~ 30 °
  - – Avoid direct solar radiation
  - – Environment without interfering transmitter (e.g. from adjacent stations)
- ► Clean and scratch-free service hatch

3.6 Concepts for the mains connection

8400 protec controllers support the implementation of various concepts for the mains connection. Here, a distinction is drawn between wiring using a:

- Standard cable - commercially available cable
- Hybrid cable - special cable for mains voltage and buffer/control voltage, including shielding if required

The following must be observed when selecting the wiring:

- Permissible back-up fuse: max. 32 A
- Permissible current for plug contacts 24 V supply: max. 10 A
- Select the cable cross-sections in compliance with applicable standards and directives.
  – Mains/PE: max. 6 mm^2
  – 24 V supply: max. 2.5 mm^2

3.6.1 Concepts for the connection of individual axes

The following versions are possible according to device version (see type code for mains connection system):

Standard cable ①

The mains voltage is connected to the controller by means of a standard cable (plug X10).

The 24 V supply of the controller is generated inside the device (mains-operated supply). After the mains voltage has been switched off, all device functions including the control electronics are deactivated. The switch function of Ethernet fieldbuses is also inactive.

Hybrid cable with external 24 V buffer voltage ②

The mains voltage and an external 24 V buffer voltage are fed using a hybrid cable (plug X10). Depending on the state of the external 24 V supply, it is possible for the control electronics to remain active even if the mains is switched off.

Standard cable with external 24 V buffer voltage ③

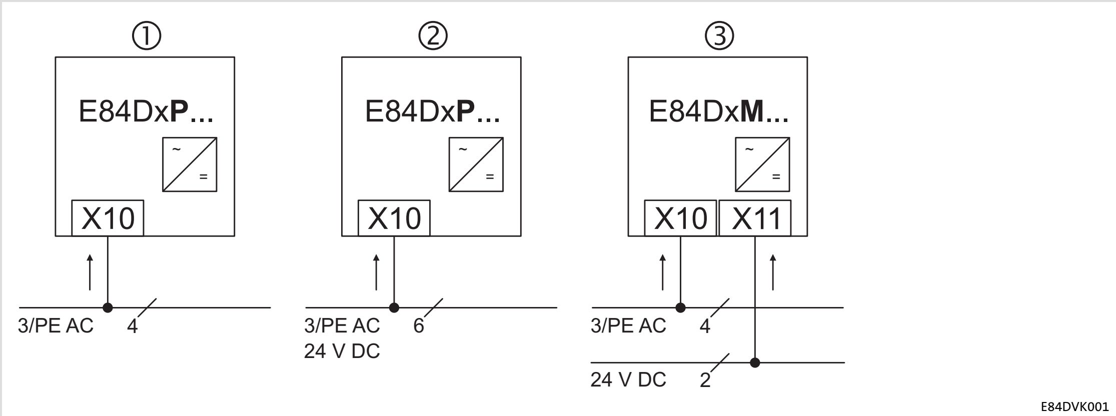
Since the connector housings only allow for one cable access per Q4/2 connector, the E84Dx**M**... device version (loop-through technique) can be used to implement this concept for connection.

Here, the mains voltage is connected to the controller by means of a standard cable (plug X10). The external 24 V buffer voltage is connected by means of a standard cable (plug X11). Depending on the state of the external 24 V supply, it is possible for the control electronics to remain active even if the mains is switched off.

Note!

This concept for connection implies that the mains voltage at plug X10 is also applied at plug X11 at the same time.

Wiring principle



①	8400 protec in version E84Dx**P**...
X10	Mains connection 3/PE AC with standard cable
②	8400 protec in version E84Dx**P**...
X10	Mains connection 3/PE AC with 24 V DC buffer voltage and hybrid cable
③	8400 protec in version E84Dx**M**...
X10	Mains connection 3/PE AC with standard cable
X11	24 V DC buffer voltage with standard cable

3.6.2 Concepts for the connection of the power bus

Spacious plants are often organised in lines. A clearly structured cable routing leads to a typical line topology. Two connection types are used:

- Loop-through technique from device to device
  - Here, the mains voltage and the 24 V buffer voltage are applied at X10 and X11 at the same time.
- Branch of power distributors

Depending on the type of cables and the 24 V supply, the following implementations are possible.

Possible loop-through arrangements:

Standard cable ①

The mains voltage is distributed among the devices by means of a standard cable (plugs X10 and X11). The 24 V supply of the controller is generated inside the device (mains-operated supply). After the mains voltage has been switched off, all device functions including the control electronics are deactivated. The switch function of Ethernet fieldbuses is also inactive.

Hybrid cable with external 24 V buffer voltage ②

The mains voltage and an external 24 V buffer voltage (self-contained) are distributed among the devices using a cable (plugs X10 and X11). Depending on the state of the external 24 V supply, it is possible for the control electronics to remain active even if the mains is switched off.

Arrangements including power distributors:

Standard cable including power distributors③

The mains voltage is carried in a cable and distributed to the device by power distributors (plug X10). The 24 V supply of the controller is generated inside the device (mains-operated supply). After the mains voltage has been switched off, all device functions including the control electronics are deactivated. The switch function of Ethernet fieldbuses is also inactive.

Hybrid cable with power distributors and external 24 V buffer voltage ④

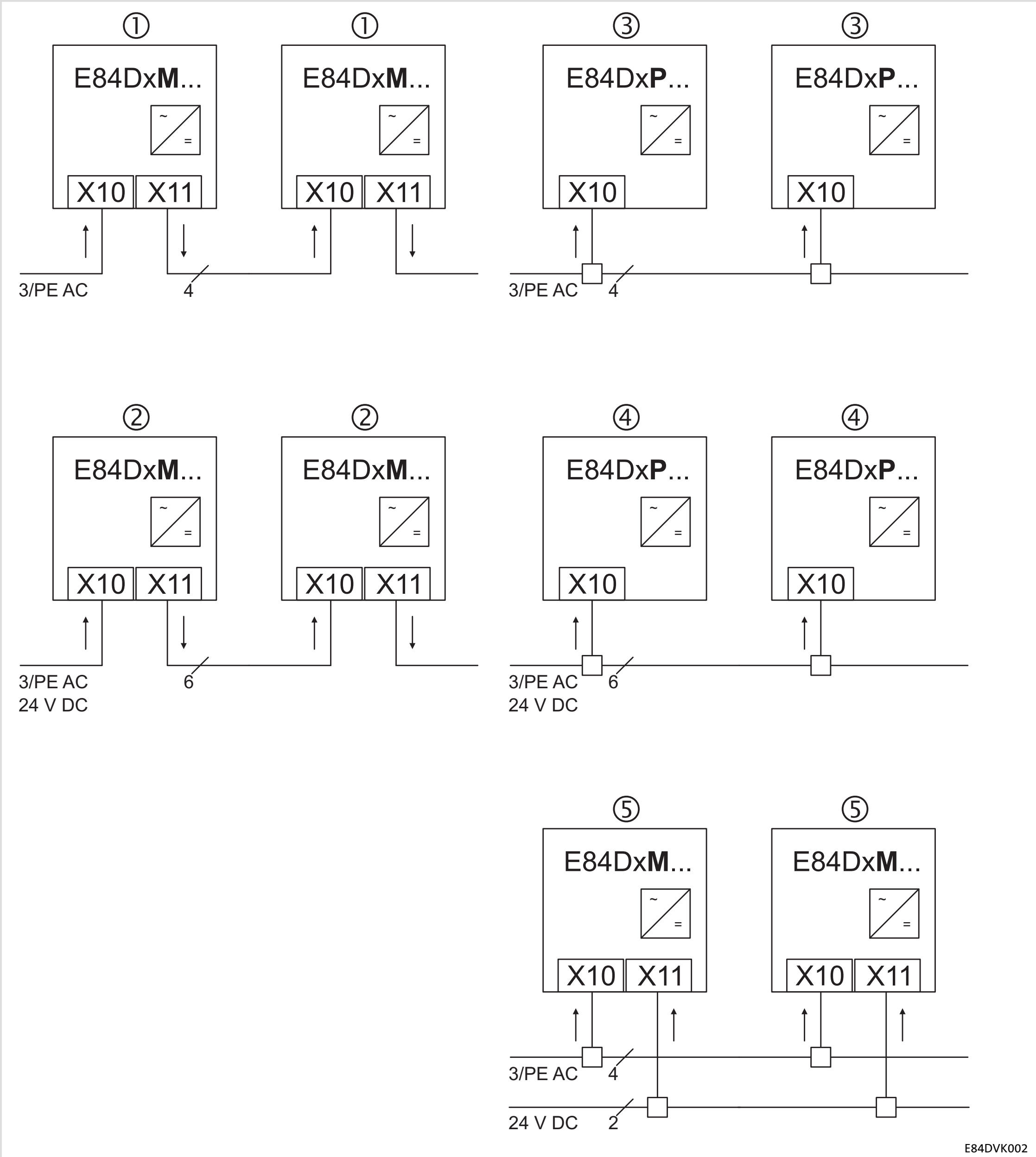
The mains voltage and the 24 V buffer voltage are carried in a cable and distributed to the device by power distributors (plug X10). Depending on the state of the external 24 V supply, it is possible for the control electronics to remain active even if the mains is switched off.

Standard cable with power distributors and external 24 V buffer voltage ⑤

Isolated cable routing for mains voltage and 24 V buffer voltage.

Here, the mains voltage is connected to the controller by means of a standard cable (plug X10). The external 24 V buffer voltage (self-contained) is connected by means of a standard cable (plug X11). Depending on the state of the external 24 V supply, it is possible for the control electronics to remain active even if the mains is switched off.

Wiring principle



①	Loop-through technique with 8400 protec in version E84Dx**M**...
X10, X11	Mains connection 3/PE AC with standard cable
②	Loop-through technique with 8400 protec in version E84Dx**M**...
X10, X11	Mains connection 3/PE AC with 24 V DC supply voltage and hybrid cable
③	Power distributor with 8400 protec in version E84Dx**P**...
X10	Mains connection 3/PE AC with standard cable
④	Power distributor with 8400 protec in version E84Dx**P**...
X10	Mains connection 3/PE AC with 24 V DC supply voltage and hybrid cable
⑤	Power distributor with 8400 protec in version E84Dx**M**...
X10	Mains connection 3/PE AC with standard cable
X11	24 V DC buffer voltage with standard cable

3.7 EMS mains connection concepts

The mains connection concepts can also be realised with 8400 protec EMS, e.g.

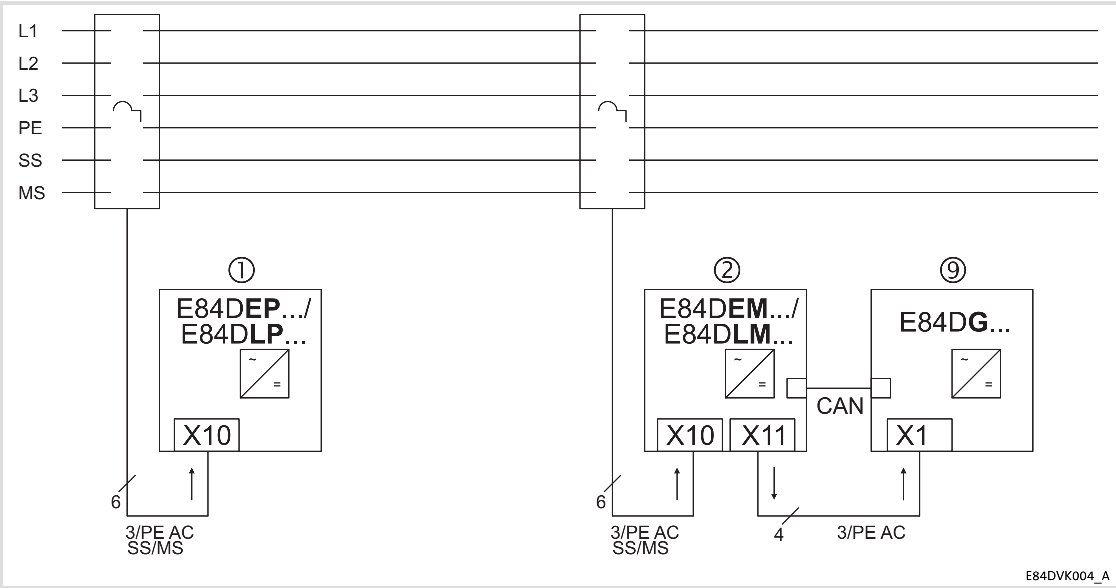
- ► Loop-through technique from device to device for multi-axis applications

Moreover, 8400 protec EMS controllers support the following (depending on the device version):

- ► Contact conductor connection for mains, control bar and message bar (half wave and coded half wave)
- ► Control signals via mains voltage (power wave)
- ► Control signals via rail bus
- ► Inductive transmission of energy and signals

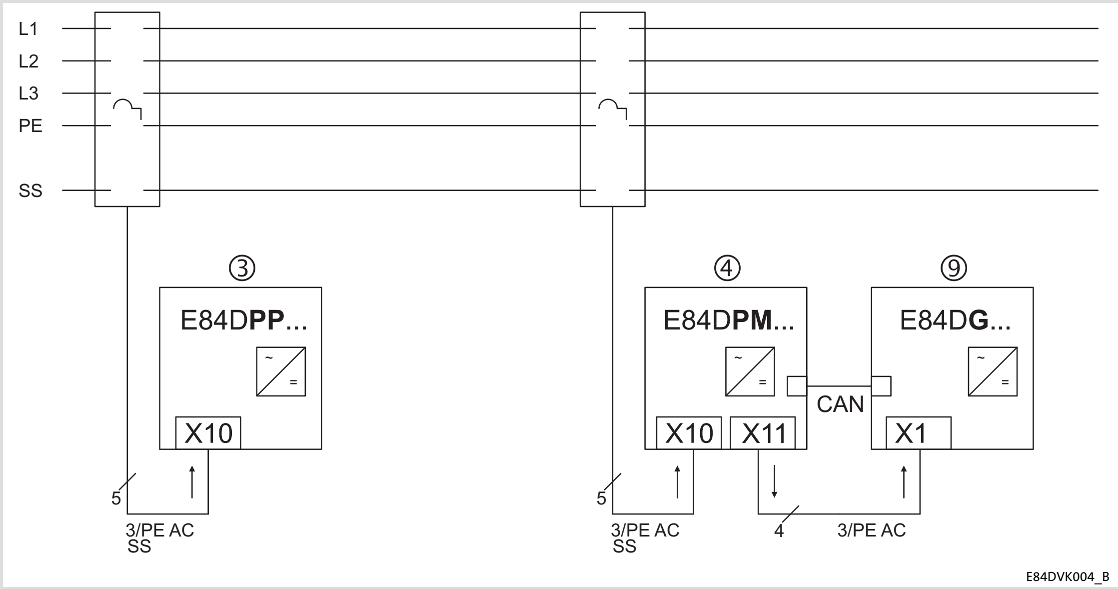
For establishing a drive system, more adjusted components are required.

3.7.1 Half wave (coded)



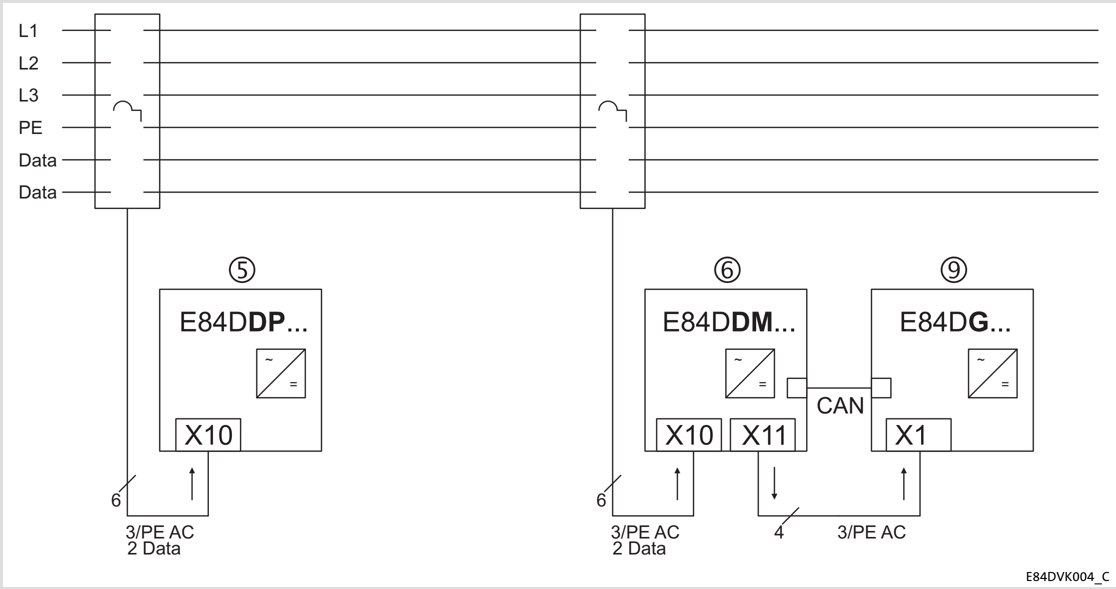
L1 ... L3, PE	Sliding bar conductors for mains and PE conductor
SS	Control bar SS1, SS2
ms	Message bar MS1
①	8400 protec EMS controller for single-axis drive
②	8400 protec EMS controller for multi-axis drive
X10	Mains
X11	Mains loop-through technique
CAN	CANopen communication
⑨	Controller, e.g. 8400 motec, as auxiliary drive
X1	Mains (with accessory plug-in module E84DZEVB...: X10)

3.7.2 Power wave



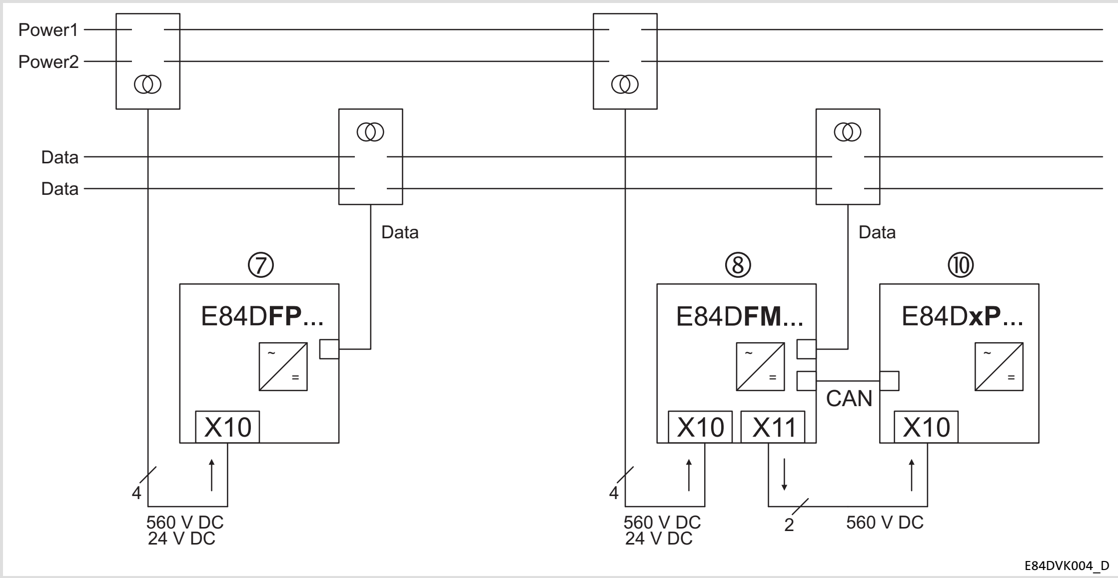
L1 ... L3, PE	Sliding bar conductors for mains and PE conductor
SS	Control bar Data±, SS1
③	8400 protec EMS controller for single-axis drive
④	8400 protec EMS controller for multi-axis drive
X10	Mains
X11	Mains loop-through technique
CAN	Communication of CANopen master PLC
⑨	Controller, e.g. 8400 motec, as auxiliary drive
X1	Mains (with accessory plug-in module E84DZEVB...: X10)

3.7.3 DECA bus



L1 ... L3, PE	Sliding bar conductors for mains and PE conductor
Data	Signal rails Data±, SS1
⑤	8400 protec EMS controller for single-axis drive
⑥	8400 protec EMS controller for multi-axis drive
X10	Mains
X11	Mains loop-through technique
CAN	Communication of CANopen master PLC
⑨	Controller, e.g. 8400 motec, as auxiliary drive
X1	Mains (with accessory plug-in module E84DZEVB...: X10)

3.7.4 Inductive



Power1/2	Inductive energy transmission (24 V DC for controlling a motor holding brake)
Data	Inductive data transfer
⑦	8400 protec EMS controller for single-axis drive
⑧	8400 protec EMS controller for multi-axis drive
X10	Mains
X11	Mains loop-through technique
CAN	Communication of CANopen master PLC
⑩	Controller, e.g. 8400 protec, as auxiliary drive
X10	DC mains voltage

4 Technical data

4.1 General data and operating conditions

General data

Conformity and approval			
Conformity			
CE	2006/42/EC	Machinery Directive (only relevant for safety components)	
	2014/35/EU	Low-Voltage Directive	
	2014/30/EU	EMC Directive	
	2011/65/EU	RoHS Directive	
	2009/125/EC	Ecodesign Directive	
UKCA	S.I. 2008/1597	The Supply of Machinery (Safety) Regulations 2008 (only relevant for safety components)	
	S.I. 2016/1101	The Electrical Equipment (Safety) Regulations 2016	
	S.I. 2016/1091	The Electromagnetic Compatibility Regulations 2016	
	S.I. 2012/3032	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012	
	S.I. 2021/745	The Ecodesign for Energy-Related Products and Energy Information Regulations 2021	
EAC	TP TC 004/2011 (TR CU 004/2011)	On safety of low voltage equipment	Eurasian Conformity TR CU: Technical Regulation of Customs Union
	TP TC 020/2011 (TR CU 020/2011)	Electromagnetic compatibility of technical means	Eurasian Conformity TR CU: Technical Regulation of Customs Union
China RoHS	SJ/T 11364-2014	Marking for the restriction of the use of hazardous substances in electrical and electronic product	
Approval			
$_{C}UL_{US}$	UL 508C CSA 22.2 No. 274-13	Power Conversion Equipment, File No. 132659	
	-	No UL approval for control element W	

Protection of persons and equipment			
Enclosure	EN 60529	IP65	All unused connectors must be closed with protection covers or blanking plugs.
		Deviating enclosure by options:	
		IP64 with control element C	
		IP54 with control element W	
		IP55 with external fan for 7.5 kW devices	
	NEMA	Type 4X, indoor only	
(Earth) leakage current	EN 61800-5-1	> 3.5 mA AC, > 10 mA DC	Observe the regulations and safety instructions!
Total fault current		< 100 mA Earth-leakage circuit breakers of type B can be used.	
additional equipotential bonding		M6 thread outside at the housing for connecting a 16mm^2 PE cable	
Protective insulation of control circuits	EN 61800-5-1	Safe isolation from mains by double (reinforced) insulation	
Insulation resistance	EN 61800-5-1	< 2000 m site altitude: Overvoltage category III	
		> 2000 m site altitude: Overvoltage category II	
Short-circuit strength	EN 61800-5-1	Motor connection: Limited, controller is inhibited, error acknowledgement required	
		Phase/phase not earth-fault-proof	Max. short-circuit current to be expected: 10 kA
		Motor holding brake connection: no	
		Brake resistor connection: no	
		PTC connection: not earth-fault-proof	
		Control terminals: full	
SCCR		CE: 5 kA	
Protective measures for		● Short circuit on the motor side at switchon and during operation ● Earth fault at switchon ● Motor stalling ● Motor overtemperature – Input for PTC or thermal contact – I^2t monitoring	
Cyclic mains switching		● 3 switching/minute ● maximally 20 switching/hour A circuit that can be reset automatically protects the device against destruction.	
Installation	EN 60204-1	Cable protection on the supply side is max. 32 A with ● cable cross-section (L1, L2, L3): 6 mm^2 ● laying system B2 max. short-circuit current: < 10 kA	

Operating conditions

Ambient conditions		
Climatic		
Storage	EN 60721-3-1	1K3 (-25 ... +60 °C)
Transport	EN 60721-3-2	2K3 (-25 ... +75 °C)
Operation	EN 60721-3-3	3K3 (-25 ... +55 °C) "K" or "L" safety system included: -25 ... +45 °C
		Operation at 2/4 kHz: > +45 °C: Reduce the rated output current by 2.5 %/°C. Operation at 8/16 kHz: > +40 °C: Reduce the rated output current by 2.5 %/°C.
Site altitude		0 ... 4000 m amsl Above 1000 ... 4000 m amsl: Reduce the rated output current by 5 %/ 1000 m.
Pollution	EN 61800-5-1	Degree of pollution 2
Mechanical		
Vibration resistance (9.81 m/s² = 1 g)		
Transport	EN 60721-3-2	2M2
	EN 61800-2	2 ... 9 Hz: Amplitude 3.5 mm
		10 ... 200 Hz: Acceleration resistant up to 10 m/s²
		200 ... 500 Hz: Acceleration resistant up to 15 m/s²
Operation	Germanischer Lloyd	General conditions: Acceleration resistant up to 2 g
	EN 60721-3-3	3M4
	EN 61800-5-1	10 ... 57 Hz: Amplitude 0.075 mm
		57 ... 150 Hz: Acceleration resistant up to 1 g

Supply conditions		
Mains connection		
Power system		
TT, TN (with earthed neutral)		Operation is permitted without any restrictions.
IT		Only permitted with devices of voltage class "E" (see type code).
Motor connection		
Motors	EN 60034	Only use motors suitable for inverter operation. Insulation resistance: min. û ≥1.5 kV, min. du/dt ≥5 kV/µs
Length of the motor cable		< 20 m (Lenze system cable, shielded)

Mounting conditions		
Mounting place		Wall Ensure convection cooling in the niches.)
Mounting position		
Standard mounting		Display to the front Vertically suspended, -30 ... +30 °
		In case of greater angles of tilt: Operation at 2/4 kHz: > +40 °C: Reduce the rated output current by 2.5 %/°C. Operation at 8/16 kHz: > +35 °C: Reduce the rated output current by 2.5 %/°C.
Free space		📖 72

Requirements on the motor cable			
Capacitance per unit length			
≤ 1.5 mm^2/AWG 16		$C_{Core/core}/C_{Core/shield} \leq 75/150$ pF/m	
≥ 2.5 mm^2/AWG 12		$C_{core/core}/C_{Core/shield} \leq 100/\leq 150$ pF/m	
Electric strength			
	VDE 0250-1	$U_0/U = 0.6/1.0$ kV	(U_0 = r.m.s. value external - conductor/PE, U = r.m.s. value - external conductor/external conductor)
	UL	U ≥ 600 V	(U = r.m.s. value external conductor/external conductor)

EMC		
Noise emission		
Cable-guided	EN 61800-3	Up to 20 m shielded motor cable (Lenze system cable): category C2
Radiation		Category C2
Noise immunity (according to requirements of EN 61800-3)		
Electrostatic discharge (ESD)	EN 61000-4-2	8 kV with air discharge, 4 kV with contact discharge against housing
Radio frequency		
Cable-guided	EN 61000-4-6	150 kHz ... 80 MHz, 10 V/m 80 % AM (1kHz)
Interference (housing)	EN 61000-4-3	80 MHz ... 1000 MHz, 10 V/m 80 % AM (1kHz)
Burst		
Power terminals and interfaces	EN 61000-4-4	2 kV/5 kHz
Signal interfaces	EN 61000-4-4	1 kV/5 kHz
Control terminals	EN 61000-4-4	2 kV/5 kHz
Surge		
Power terminals	EN 61000-4-5	1.2/50 µs, 1 kV phase/phase, 2 kV phase/PE
Control terminals	EN 61000-4-5	1.2/50 µs, 1 kV
Operation on public supply systems	EN 61000-3-2 EN 61000-3-12	The devices are intended for use in an industrial environment. When being used on public network, additional measures must be taken to limit the expected radio interference. The compliance with the requirements for the machine/plant is the responsibility of the manufacturer of the machine or system!
	EN 61000-3-2	< 0.5 kW: with mains choke
		0.5 ... 1 kW: with active filter
		> 1 kW at mains current ≤ 16 A: No limit values for harmonic currents
	EN 61000-3-12	Mains current > 16 A: further measures are required for compliance with the standard

Open and closed loop control			
Open and closed loop control processes			
		VFCplus: ● V loop (linear or square-law) ● V/f closed loop SLVC: ● Sensorless vector control (torque/speed)	
	Only for HighLine device version	SC: ● Servo control (torque/speed)	
	from SW version 12	VFCplus eco: ● Energy-efficient V/f characteristic SL PSM: ● Sensorless synchronous control (torque/speed)	
Switching frequency			
		2 kHz, 4 kHz, 8 kHz, 16 kHz, Optionally noise optimised or power-loss optimised	
Torque behaviour			
	Setting range	1 : 10	In a setting range of 3 ... 50 Hz
Sensorless vector control (speed)			
	Minimum output frequency	0.5 Hz (0 ... M_{rated})	
	Setting range	1 : 10	Based on 50 Hz and M_{rated}
	Accuracy	±0.5 %	In a setting range of 3 ... 50 Hz
	Smooth running	±0.1 Hz	
Output frequency			
	Range	-599 Hz ... +599 Hz	
	Absolute resolution	0.2 Hz	
	Standardised resolution	Parameter data: 0.01 %, process data: 0.006 % (= 2^{14})	
Digital setpoint selection			
	Accuracy	±0.01 %	
Analog setpoint selection			
	Accuracy	±1 %	Based on the final value

EMS version

Half-wave system			
E84DE..., E84DL...			
Control bar			
Z system		No	
Number		2	
Signal level		Full wave	
		Positive half wave	
		Negative half wave	
		Coded half wave	
Reference voltage or switched voltage		L3 L1 possible with different hardware configuration	
Rated voltage		400-480 V AC, 50-60 Hz	
		Coded half wave: 230 V AC, 50-60 Hz	
Switching threshold		50 Hz: 270 V AC (243 ... 297 V AC) 60 Hz: 330 V AC (297 ... 363 V AC)	
Power input		1.5 W (400 V AC)	for 1 x half wave
Signalling bar			
Number		1	
Signal level		Full wave	
		Positive half wave	
		Negative half wave	
Reference voltage or switched voltage		L3 L1 possible with different hardware configuration	
Short circuit protection		PTC protection (500 Ω connected in series)	
Reference voltage		400 ... 480 V	
Switching current		max. 28 mA AC	

4.2 Rated data

4.2.1 Overview

Basis of the data			
Mains	Voltage U_{Lrated} [V]	Voltage range U_{Lrated} [V]	Frequency range f [Hz]
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 - 0 % ... 65 + 0 %
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 - 0 % ... 65 + 0 %

Output switching frequency f = 4 kHz

Input data

	Voltage [V]	Frequency [Hz]	Rated current [A] up to +45 °C ①	Rated current [A] up to +55 °C ①	Number of phases
E84Dxxxx7514	400/500	50/60	4.1/3.2	3.0/2.4	3
E84Dxxxx1524	400/500	50/60	5.5/4.4	3.5/3.1	3
E84Dxxxx3024	400/500	50/60	9.7/7.9	7.3/6.0	3
E84Dxxxx4024	400/500	50/60	12.9/11.0	9.5/8.1	3
E84DHxxx7524	400/500	50/60	20.8/16.6	15.6/12.5	3

① Ambient temperature during operation

Rated data of the 24-V buffer voltage (preserves the control functionality in the event of a mains failure):

Typ	Supply voltage for control electronics of the controller (safely separated power supply unit SELV/PELV) Voltage range U_{DC} [V DC]	Current consumption at + 24 V DC [A] Min. 1)	Current consumption at + 24 V DC [A] Max. 2)
E84Dxxxx7514	+ 24 (+19.2 - 0 % ... +28.8 + 0 %)	0.2 ... 0.6	2
E84Dxxxx1524			
E84Dxxxx3024			
E84Dxxxx4024			
E84DHxxx7524			

1) according to optional equipment, digital inputs and outputs are not wired
2) digital inputs and outputs are completely wired

Note!

The maximum total current of the 24 V voltage supply for external actuators and encoders is 1 A, e.g. ports

- Digital inputs/outputs at X4x,
- Analog input at X50 or SSI at X80, and
- Serial interfaces RS485/RS422 at X81/X82.

Output data

	Voltage [V]	Frequency [Hz]	Rated current [A]		Number of phases
			up to +45 °C ①	up to +55 °C ①	
E84Dxxxx7514	0 ... 400/500	0 ... 1000	2.4/1.9	1.8/1.4	3
E84Dxxxx1524	0 ... 400/500	0 ... 1000	3.9/3.1	2.9/2.3	3
E84Dxxxx3024	0 ... 400/500	0 ... 1000	7.3/5.8	5.5/4.4	3
E84Dxxxx4024	0 ... 400/500	0 ... 1000	9.5/7.6	7.1/5.7	3
E84DHxxx7524	0 ... 400/500	0 ... 1000	16.0/12.8	12.0/9.6	3

① Ambient temperature during operation

Power losses

	Power loss P_V [W]	
Type	when operating with rated output current I_{arated}	when controller is inhibited
E84Dxxxx7514	66	27
E84Dxxxx1524	84	
E84Dxxxx3024	127	
E84Dxxxx4024	155	
E84DHxxx7524	232	

4.2.2 Operation at rated mains voltage 400 V

Basis of the data			
Mains	**Voltage**	**Voltage range**	**Frequency range**
	U_{Lrated} [V]	U_{Lrated} [V]	f [Hz]
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 - 0 % ... 65 + 0 %

Type	**Mains current** at I_{arated} I_{Lrated} [A]	**Output power** U, V, W S_{arated} [kVA]	**Motor power** 4 pol. ASM P_{arated} [kW]
E84Dxxxx7514	4.1	1.5	0.75
E84Dxxxx1524	5.5	2.4	1.5
E84Dxxxx3024	9.7	4.6	3.0
E84Dxxxx4024	12.9	5.9	4.0
E84DHxxx7524	20.8	10.0	7.5

	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
Type	$I_{arated2}$	I_{aM2}	$I_{arated4}$	I_{aM4}	$I_{arated8}$	I_{aM8}	$I_{arated16}$	I_{aM16}
E84Dxxxx7514	2.4	4.8	2.4	4.8	2.4	4.8	1.6	3.2
E84Dxxxx1524	3.9	7.8	3.9	7.8	3.9	7.8	2.3	5.2
E84Dxxxx3024	7.3	14.6	7.3	14.6	7.3	14.6	4.9	9.7
E84Dxxxx4024	9.5	19.0	9.5	19.0	9.5	19.0	6.3	12.7
E84DHxxx7524	16.0	32.0	16.0	32.0	16.0	30.0	10.7	21.3

I_{aNx} Rated value of continuous output current

I_{aMx} Maximum output current (overload current)
- Periodic load change of 3 s with I_{aMx} and recovery time of 12 s according to the tables under chapter 4.4
- Can be obtained in the setting ”x kHz fixed/...” in C00018

Switching frequency: If the maximum heatsink temperature is reached, the switching frequency is reduced to 4 kHz.

In the setting ”x kHz var./...” in C00018 the switching frequency is reduced depending on the output current.

Depending on the switching frequency and e.g. the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).

Rated data for internal brake chopper

Switching threshold V_{BRmax}: 725 V, adjustable

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
Internal brake resistor								
E84Dxxx7514 E84Dxxx1524	220	3.3	2.4	0.5	0.05 1)	-	-	-
E84Dxxx3024 E84Dxxx4024 E84Dxxx7524	-	-	-	-	-	-	-	-
External brake resistor								
E84Dxxx7514	150	4.8	3.5	1.4	0.9	300	60	-
E84Dxxx1524	150	4.8	3.5	2.9	2.0	300	60	-
E84Dxxx3024	47	15.4	11.2	5.7	3.9	300	60	-
E84Dxxx4024	47	15.4	11.2	7.5	5.2	300	60	-
E84Dxxx7524	47	15.4	11.2	14.1	9.8	300	60	-

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time
1)	**Max. heat Q_B: 3 kWs** Max. power loss in the internal brake resistor P_{Bdav}: see table

	f_{ch} [kHz]	I_a [A]	P_{Bdav} [W] T_{amb} 20 °C	30 °C	40 °C	45 °C
E84Dxxx7514	4	2.4	50	47	-	27
		1.4	50	50	-	37
	8	2.4	48	34	21	-
		1.4	50	49	35	-
E84Dxxx1524	4	3.9	42	28	-	8
		2.34	50	47	-	27
	8	3.9	22	9	0	-
		2.34	48	34	21	-

f_{ch}	Output switching frequency
I_a	Motor current
P_{Bdav}	Permissible power loss in the **internal** brake resistor, averaged over 60 s and dependent on T_{amb} (Linear interpolation/extrapolation via T_{amb} is permissible. Here, the application must limit the power loss in the brake resistor to $P_{Bdav} \leq P_{Bd}$.)
T_{amb}	Ambient temperature

Fuses and cable cross-sections

Operation without external mains choke/mains filter								
Type	Installation according to EN 60204-1 1)					Installation according to UL 2)		FI 3)
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
			B2	C	F			
	[A]	[A]	[mm²]	[mm²]	[mm²]	[A]	[AWG]	[mA]
E84Dxxxx7514	32	32	6	-	-	30	8	≥ 300
E84Dxxxx1524	32	32	6	-	-	30	8	≥ 300
E84Dxxxx3024	32	32	6	-	-	30	8	≥ 300
E84Dxxxx4024	32	32	6	-	-	30	8	≥ 300
E84DHxxx7524	32	32	6	-	-	30	8	≥ 300

1) These values are recommendations only. Other dimensioning values/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.
2) Use UL-approved cables, fuses and fuse holders only.
UL fuse: voltage ≥ 500 V, tripping characteristic for example ”H”, ”K5” or ”CC”. The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45°C.
3) Universal-current sensitive earth-leakage circuit breaker, short-time delay
If cables are longer than 50 m, the protective circuit-breaker may respond, depending on the cable type and switching frequency.
① Circuit breaker
② Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category
③ Fuse
Observe national and regional regulations

4.2.3 Operation at a rated mains voltage of 500 V

Basis of the data			
Mains	**Voltage** U_{Lrated} [V]	**Voltage range** U_{Lrated} [V]	**Frequency range** f [Hz]
3/PE AC	500	400 - 0 % ... 550 + 0 %	45 - 0 % ... 65 + 0 %

Type	**Mains current at I_{arated}** I_{Lrated} [A]	**Output power** U, V, W S_{arated} [kVA]	**Motor power** 4 pol. ASM P_{arated} [kW]
E84Dxxxx7514	3.2	1.5	0.75
E84Dxxxx1524	4.4	2.4	1.5
E84Dxxxx3024	7.9	4.6	3.0
E84Dxxxx4024	11.0	5.9	4.0
E84DHxxx7524	16.6	10.0	7.5

	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
Type	$I_{arated2}$	I_{aM2}	$I_{arated4}$	I_{aM4}	$I_{arated8}$	I_{aM8}	$I_{arated16}$	I_{aM16}
E84Dxxx7514	1.9	3.8	1.9	3.8	1.9	3.8	1.3	2.6
E84Dxxx1524	3.1	6.2	3.1	6.2	3.1	6.2	2.1	4.2
E84Dxxx3024	5.8	11.6	5.8	11.6	5.8	11.6	3.9	7.8
E84Dxxx4024	7.6	15.2	7.6	15.2	7.6	15.2	5.1	10.1
E84DHxx7524	12.8	25.6	12.8	25.6	12.8	24.0	8.5	17.1

I_{aNx} Rated value of continuous output current

I_{aMx} Maximum output current (overload current)
- Periodic load change of 3 s with I_{aMx} and recovery time of 12 s according to the tables under chapter 4.4
- Can be obtained in the setting ”x kHz fixed/...” in C00018

Switching frequency: If the maximum heatsink temperature is reached, the switching frequency is reduced to 4 kHz.

In the setting ”x kHz var./...” in C00018 the switching frequency is reduced depending on the output current.

Depending on the switching frequency and e.g. the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).

Rated data for internal brake chopper

Switching threshold V_{BRmax}: 790 V, adjustable

Type	R_{Bmin} [Ω]	I_{BRmax} [A]	P_{BRmax} [kW]	I_{BRd} [A]	P_{Bd} [kW]	t_Z [s]	t_{on} [s]	t_{fp} [s]
Internal brake resistor								
E84Dxxx7514 E84Dxxx1524	220	3.6	2.8	0.5	0.05 1)	-	-	-
E84Dxxx3024 E84Dxxx4024 E84Dxxx7524	-	-	-	-	-	-	-	-
External brake resistor								
E84Dxxx7514	150	5.3	4.2	1.4	1.2	300	60	-
E84Dxxx1524	150	5.3	4.2	2.9	2.5	300	60	-
E84Dxxx3024	47	16.8	13.3	5.7	4.9	300	60	-
E84Dxxx4024	47	16.8	13.3	14.1	12.2	300	60	-

R_{Bmin}	Minimum brake resistance, nominal value ±10 %
I_{BRmax}	Peak current
P_{BRmax}	Peak braking power
I_{BRd}	Continuous current RMS - important for the dimensioning of the cables
P_{Bd}	Continuous braking power
t_Z	Cycle time, periodic load change with running time and recovery time
t_{on}	Running time
$t_Z - t_{on}$	Recovery time
t_{fp}	Maximum running time without initial load and compliance with the recovery time
1)	**Max. heat Q_B: 3 kWs** Max. power loss in the internal brake resistor P_{Bdav}: see table

	f_{ch} [kHz]	I_a [A]	P_{Bdav} [W] T_{amb} 20 °C	30 °C	40 °C	45 °C
E84Dxxx7514	4	1.9	50	47	-	27
		1.14	50	41	-	21
	8	1.9	48	34	21	-
		1.14	36	23	10	-
E84Dxxx1524	4	3.1	42	28	-	8
		1.86	50	47	-	27
	8	3.1	22	9	0	-
		1.86	48	34	21	-

f_{ch}	Output switching frequency
I_a	Motor current
P_{Bdav}	Permissible power loss in the **internal** brake resistor, averaged over 60 s and dependent on T_{amb} (Linear interpolation/extrapolation via T_{amb} is permissible. Here, the application must limit the power loss in the brake resistor to $P_{Bdav} \leq P_{Bd}$.)
T_{amb}	Ambient temperature

Fuses and cable cross-sections

Operation without external mains choke/mains filter								
Type	Installation according to EN 60204-1 1)					Installation according to UL 2)		FI 3)
	①	②	L1, L2, L3 - Laying system			③	L1, L2, L3	
			B2	C	F			
	[A]	[A]	[mm²]	[mm²]	[mm²]	[A]	[AWG]	[mA]
E84Dxxxx7514	32	32	6	-	-	30	8	≥ 300
E84Dxxxx1524	32	32	6	-	-	30	8	≥ 300
E84Dxxxx3024	32	32	6	-	-	30	8	≥ 300
E84Dxxxx4024	32	32	6	-	-	30	8	≥ 300
E84DHxxx7524	32	32	6	-	-	30	8	≥ 300

1) These values are recommendations only. Other dimensioning values/laying systems are possible (e.g. according to VDE 0298-4). The cable cross-sections apply under the following conditions: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.

2) Use UL-approved cables, fuses and fuse holders only.
UL fuse: voltage ≥ 500 V, tripping characteristic for example ”H”, ”K5” or ”CC”. The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45°C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delay
If cables are longer than 50 m, the protective circuit-breaker may respond, depending on the cable type and switching frequency.

① Circuit breaker
② Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category
③ Fuse

Observe national and regional regulations

4.3 Current characteristics

The controller limits its maximally possible motor current under the following operating conditions (”current derating”):

- If the maximum heatsink temperature is exceeded
  - In this case, the controller switches independently from switching frequency mode of 16 kHz to 8 kHz and from 8 kHz to 4 kHz (but not from 4 kHz to 2 kHz). This function can be deactivated via C00144.
    When the heatsink temperature continues to rise, the inverter output will be inhibited and the error message ”Trip” occurs. This also occurs when the switching frequency reduction is deactivated.
- In case of output frequencies f_{out} < |5 Hz|
- As a function of the switching frequency modes ”fixed” or ”variable”

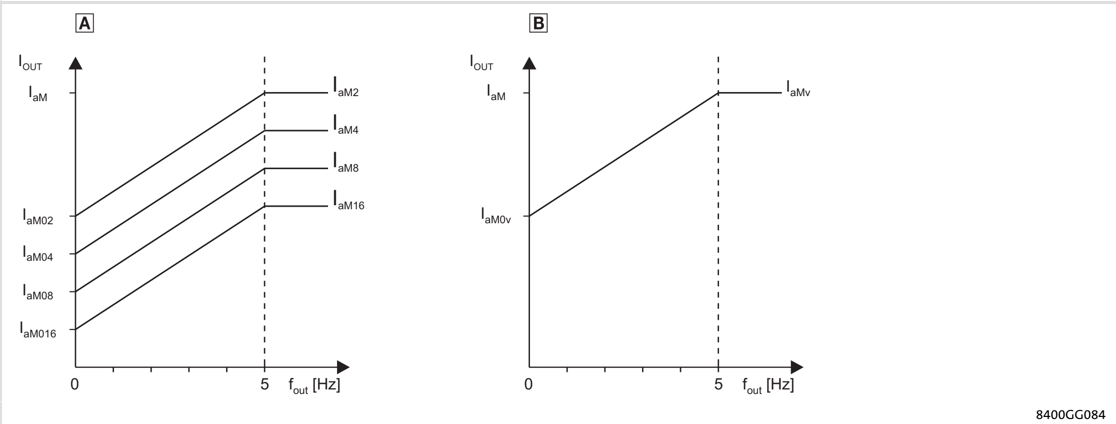


Fig. 4-1 Current derating characteristics

A	Derating curve depending on the fixed switching frequency
B	Derating curve depending on the variable switching frequency

I_{out}	Output current
I_{aM}	Maximum output current (overload current)
I_{aMx}	Maximum output current (overload current) at different switching frequencies: 2kHz, 4kHz, 8kHz and 16kHz
I_{aM0x}	Maximum output current (overload current) at f_{out} = 0Hz and different switching frequencies: 2kHz, 4kHz, 8kHz, 16kHz
I_{aMv}	Maximum output current (overload current) at a variable switching frequency
I_{aM0v}	Maximum output current (overload current) at f_{out} = 0Hz and a variable switching frequency
f_{out}	Field frequency at the output U, V, W

Type	Maximum output currents [A][1)] at a fixed switching frequency and U_{LN} = 400V							
	2 kHz		4 kHz		8 kHz		16 kHz	
	I_{aM02}	I_{aM2}	I_{aM04}	I_{aM4}	I_{aM08}	I_{aM8}	I_{aM016}	I_{aM16}
E84Dxxxx7514	4.8	4.8	4.8	4.8	2.8	4.8	1.8	4.0
E84Dxxxx1524	5.9	7.8	5.9	7.8	4.1	7.8	2.5	6.4
E84Dxxxx3024	11.0	14.6	11.0	14.6	9.5	14.6	5.5	9.5
E84Dxxxx4024	14.3	19.0	13.8	19.0	9.5	17.1	5.7	9.5
E84DHxxx7524	16.0	32.0	16.0	32.0	17.0	30.0	10.7	21.3

Type	Maximum output currents [A][1)] at a fixed switching frequency and U_{LN} = 500V							
	2 kHz		4 kHz		8 kHz		16 kHz	
	I_{aM02}	I_{aM2}	I_{aM04}	I_{aM4}	I_{aM08}	I_{aM8}	I_{aM016}	I_{aM16}
E84Dxxxx7514	4.8	4.8	4.4	4.4	2.1	4.4	1.4	3.1
E84Dxxxx1524	5.9	7.8	5.9	7.2	3.2	7.2	1.9	3.4
E84Dxxxx3024	11.0	14.6	10.6	13.5	7.4	13.5	4.2	7.4
E84Dxxxx4024	14.3	19.0	10.7	17.6	7.3	13.4	4.3	7.3
E84DHxxx7524	16.0	25.6	12.8	25.6	13.6	24.0	8.5	17.1

1) The shown values apply to the operation with ambient temperatures of up to +45°C for 2/4kHz and up to +40°C for 8/16kHz. For ambient temperatures between +40/45°C and +55°C, a derating from 2.5 %/K to the given values must be observed.

4.4 Overcurrent operation

The controllers are designed for an overcurrent limited in time. The load due to defined, cyclic operation is determined by the "Ixt" monitoring function. The "Ixt" function comprises two moving averaging procedures which are checked in parallel:

- temporary moving averaging of the apparent motor current for pulse loads
- continuous moving averaging of the apparent motor current for permanent loads

Type of utilisation	Utilisation cycle	Monitoring function	
		Condition	**Code**
Pulse utilisation	15 s	I_{aNx} > 160 %	• Display in C00064/2 • Display of the maximum value in C00064/1
Permanent utilisation	180 s	The monitoring function is permanently active.	• Display in C00064/3 • Display of the maximum value in C00064/1

If the maximum value in code C00064/1 exceeds 100%, a "warning" will be generated or a "trip" will be triggered (according to setting).

The curves of typical load functions and the simulation of the "Ixt" function are shown in the following illustration:

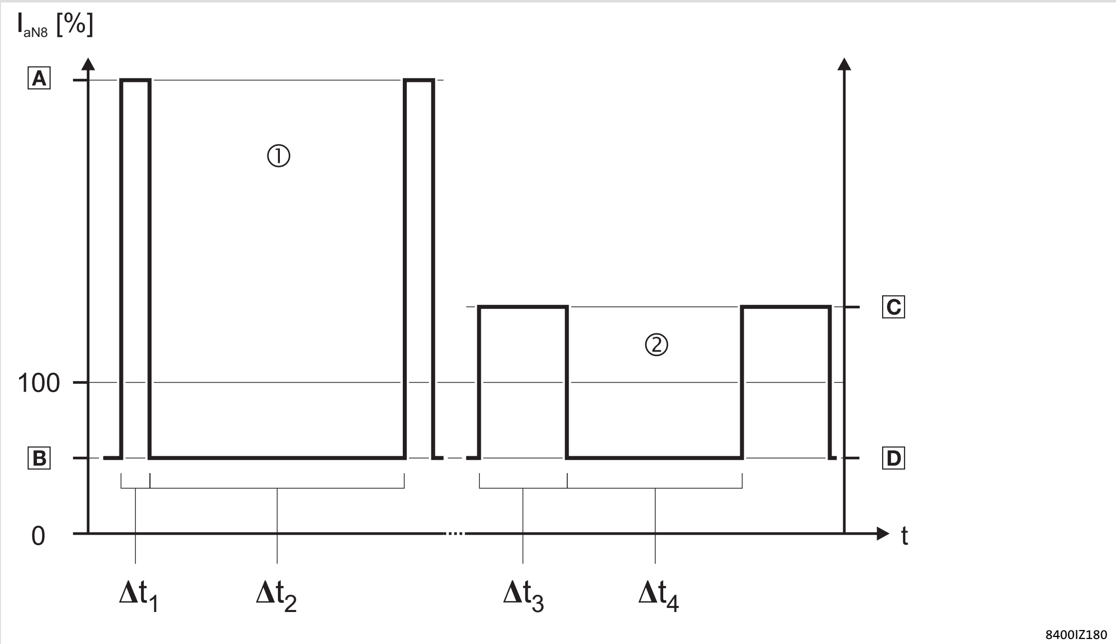


Fig. 4-2 Overcurrent capacity at 45° C

①	Pulse load (15 s cycle)	Calculation equation:
A	Peak current	$$\frac{A \cdot \Delta t_1 + B \cdot \Delta t_2}{\Delta t_1 + \Delta t_2} \le 100\%$$
B	Unloading current	
Δt_1	Peak current period	
Δt_2	Unloading current period	
②	Permanent load (180 s cycle)	Calculation equation:
C	Peak current	$$\frac{C \cdot \Delta t_3 + D \cdot \Delta t_4}{\Delta t_3 + \Delta t_4} \le 100\%$$
D	Unloading current	
Δt_3	Peak current period	
Δt_4	Unloading current period	
I_{arx}	Rated value of continuous output current	

Type	I_{amax}/I_{aR8} [%] in 15-s cycle ①							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	A	B	A	B	A	B	A	B
E84Dxxx7514	200	75	200	75	200	75	133	50
E84Dxxx1524							120	45
E84Dxxx3024							133	50
E84Dxxx4024								
E84Dxxx7524								

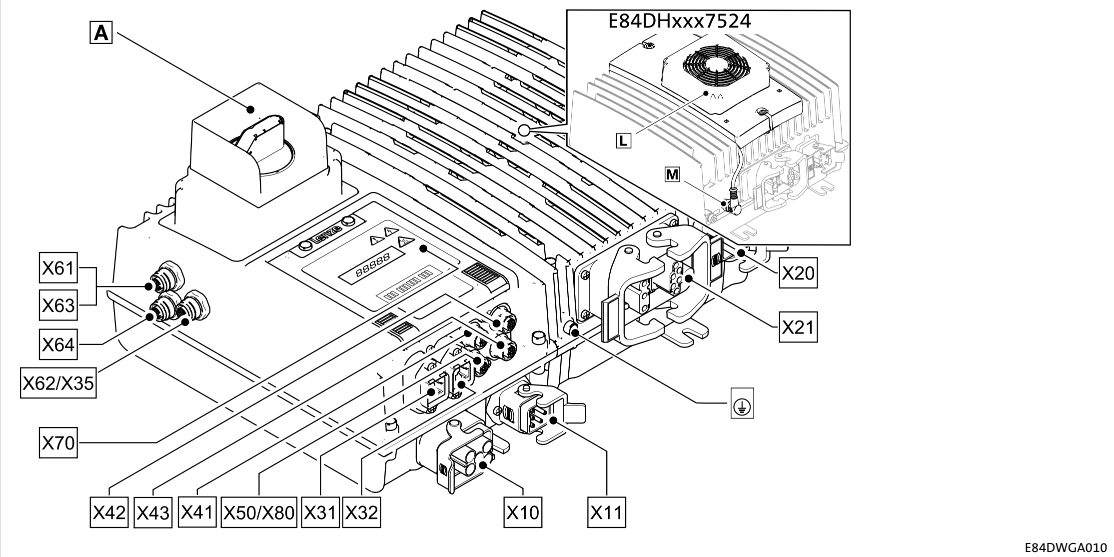
Type	I_{amax}/I_{aR8} [%] in 180-s cycle ②							
	f = 2 kHz		f = 4 kHz		f = 8 kHz		f = 16 kHz	
	C	D	C	D	C	D	C	D
E84Dxxx7514	150	75	150	75	150	75	100	50
E84Dxxx1524							90	45
E84Dxxx3024							100	50
E84Dxxx4024								
E84Dxxx7524								

Tip!
For calculations of application-specific cycles please contact your Lenze contact person.

4.5 Terminal description

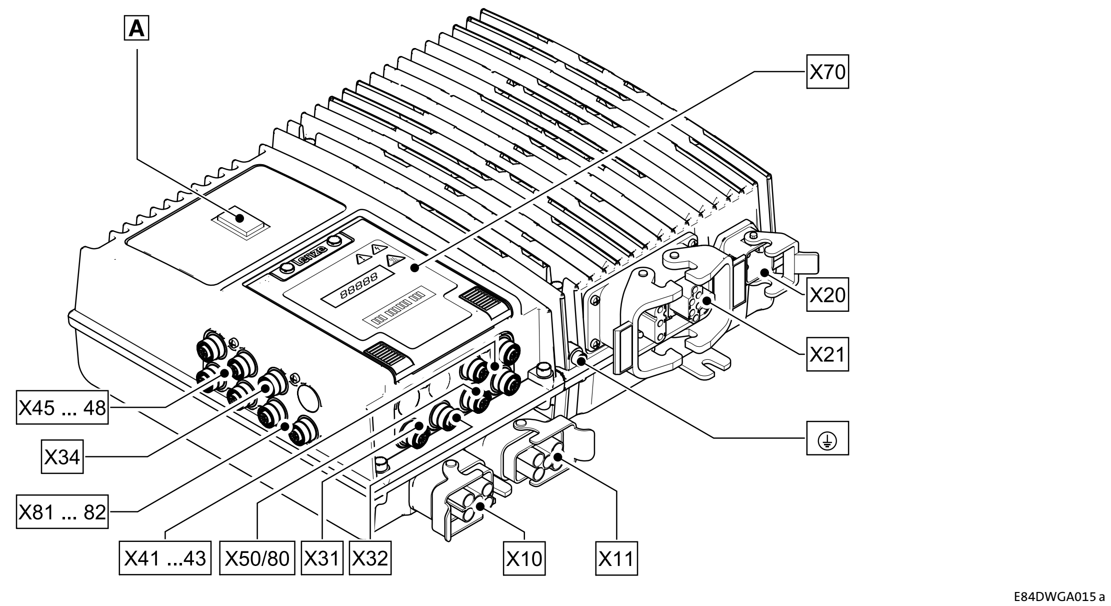
Overview

StateLine, HighLine



Operational controls and connections		
Pos.	**Function**	**Description**
A	Control element	Optional
⏚	PE connection	for M6 ring cable lug
X10	Mains and 24-V buffer voltage	DESINA Q4/2, pins Optional: Molex (📖 87)
X11	Optional: Loop-through technique - mains and 24-V buffer voltage	DESINA Q4/2, sockets (optional) Optional: Molex
X20	Optional: For external brake resistor	Q5/0, sockets (optional) Optional: Molex
X21	Motor, temperature monitoring and motor holding brake	Q8/0, Modular or 10E, sockets
X31	Fieldbus input	Socket RJ45 or M12, A-coded, male
X32	Fieldbus output	Socket RJ45 or M12, A-coded, female
X35	CAN on board	M12, 5-pole sockets, A-coded
X41	Digital inputs DI1 and DI2	M12, 5-pole sockets, A-coded
X42	Digital inputs DI3 and DI4, also configurable as digital outputs DO1 and DO2	
X43	Digital inputs DI5 and DI6	
X50	Analog input AI, AU	M12, 5-pole sockets, A-coded
X61	Safety system, option 10	M12, 5-pole pins, A-coded
X62	Safety system, option 30	M12, 5-pole sockets, A-coded
X63		M12, 8-pole sockets, A-coded
X64		
X70	Diagnostics	Socket RJ69
X80	Synchronous serial interface (SSI)	M12, 8-pole sockets, A-coded
L	only E84DHxxx7524: External fan	
M	Operating voltage for the external fan	-

EMS version



Operational controls and connections		
Pos.	**Function**	**Description**
A	Control element	Optional
⏚	PE connection	for M6 ring cable lug
X10	Mains and 24-V buffer voltage	DESINA Q4/2, pins
X11	Optional: Loop-through technique - mains and 24-V buffer voltage	DESINA Q4/2, sockets (optional) Optional: Molex
X20	Optional: For external brake resistor	Q5/0, sockets (optional) Optional: Molex
X21	Motor, temperature monitoring and motor holding brake	Q8/0, Modular or 10E, sockets
X31	Fieldbus input	M12, A-coded, pins
X32	Fieldbus output	M12, A-coded, sockets
X34	CANopen master PLC	M12, 5-pole, A-coded, sockets
X41	Digital inputs DI1 and DI2	M12, 5-pole sockets, A-coded
X42	Digital inputs DI3 and DI4, also configurable as digital outputs DO1 and DO2	
X43	Digital inputs DI5 and DI6	
X45	Digital inputs DI7 and DI8	M12, 5-pole, A-coded, sockets
X46	Digital inputs DI9 and DI10, also configurable as digital outputs DO3 and DO4	
X47	Digital inputs DI11 and DI12	
X48	Digital inputs DI13 and DI14	
X50	Analog input AI, AU	M12, 5-pole sockets, A-coded
X70	Diagnostics	Socket RJ69
X80	Synchronous serial interface (SSI)	M12, 8-pole sockets, A-coded
X81 **X82**	RS485/RS422	M12, 8-pole, A-coded, sockets

4.6 Supply concept of control voltage

8400 protec controllers generate the 24 V supply voltage of the control electronics from the mains voltage by means of an integrated power supply unit (mains-operated supply).

An external 24 V buffer voltage from a safely separated power supply unit (SELV/PELV) must be connected in order to implement a self-contained supply of the control electronics.

The 24 V supply voltage is required for the control electronics and other components such as fieldbus communication and/or drive-based safety.
In addition, the supply voltage is available at the terminals, irrespective of the fact whether it is fed internally or externally. Information on the supply voltage at the digital and analog terminals is provided under:

- Digital inputs(📖 64)
- Digital outputs(📖 65)
- Analog inputs(📖 66)
- Synchronous serial interface (SSI) (📖 66)

The supply voltage is preferentially used for:

- Connecting potential-free contacts to digital inputs
- Supplying external sensors

At an external 24 V supply voltage, the rated values may deviate according to the voltage source.

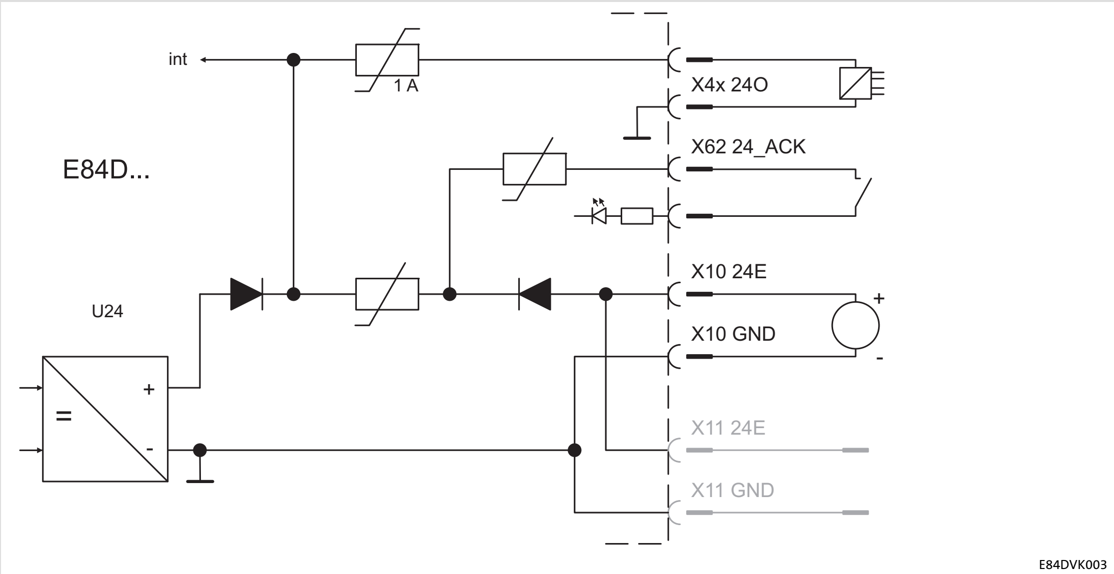
4.6.1 Internal 24 V supply voltage

At an internal 24 V supply voltage, the maximally permissible total current of terminals X4x, X50/X8x is 1 A.

4.6.2 External supply voltage 24 V

Detailed information on the X10 and X11 pin assignment with the external 24 V supply is provided on page 87.

Example circuit



X10 ...	External 24 V buffer voltage at the mains connection
X11 ...	External 24 V supply at the mains connection in loop-through technique (for devices of the E84DxM... version)
X4x ...	24 V supply of the digital sensors
X62 ...	24 V supply of the safety system
U24	Internal 24 V supply
int	Voltage supply of the control electronics

An external 24 V supply voltage must comply with the following rated values to ensure trouble-free operation of the controller.

X10		
Pin / Name	**Feature**	**Rated value**
11 / 24E 12 / GND	Connection for external 24 V supply voltage by a safely separated power supply unit (required for feeding the control electronics and the communication module independent of the mains supply)	24 V in accordance with IEC 61131-2 19.2 ... 28.8 V Max. residual ripple ± 5 % SELV/PELV
	Suppression of voltage pulses	Suppressor diode 36 V, bidirectional
	Electric strength of external voltage	+30 V
	Excess current release	Automatically resettable
	Polarity reversal protection	When polarity is reversed: No function and no destruction
	Current consumption	Approx. 0.6 A during operation if inputs/outputs are not configured Max. 2.0 A during operation with typical input/output configuration
		Max. 1.5 A starting current for 100 ms
	Capacity to be charged	2000 µF
	Max. load for plug contacts	10 A

X11		
Pin / Name	**Feature**	**Rated value**
11 / 24E 12 / GND	Connection for an external 24 V supply voltage (loop-through arrangement)	24 V according to IEC 61131-2 (cp. X10)
	Number of devices included in the loop-through arrangement	is limited by the voltage drop due to max. current= 10 A and max. cable cross-section = 2.5 mm^2
	Max. load for plug contacts	10 A

X4x, X50/X8x		
Pin / Name	**Feature**	**Rated value**
1 / 24O 3 / GIO	24 V supply of the external sensors or potential-free contacts	External supply at 24E: voltage drop < 2.5 V Internal supply: DC 18 ... 28 V
	Max. output current	200 mA per output
	Total current for X4x, X50/X8x	1 A
	Electric strength of external voltage	+30 V
	Excess current release	Automatically resettable

4.7 Control terminals

4.7.1 Digital inputs

X41 ... X43		
Pin / Name	**Features**	**Rated value**
4 / DI1 2 / DI2	Digital input 1/2 at X41	In accordance with IEC 61131-2, type 1 or Two-track frequency input, for HTL encoders 0 ... 100 kHz
4 / DI3 2 / DI4	Digital input 3/4 at X42	In accordance with IEC 61131-2, type 1 DI4 - typical delay time: ● 5 μs at rising edge ● 25 μs at falling edge
4 / DI5 2 / DI6	Digital input 5/6 at X43	In accordance with IEC 61131-2, type 1 or Single-track frequency input, 0 ... 7.5 kHz DI5/DI6 - typical delay time: ● 5 μs at rising edge ● 25 μs at falling edge
1 / 24O 3 / GIO	24 V supply of the external sensors or potential-free contacts	External supply at 24E: Voltage drop < 2.5 V
	Total current for X4x, X50/X8x	1 A

Extensions in the EMS version

X45 ... X48		
Pin / Name	**Features**	**Rated value**
4 / DI7 2 / DI8	Digital input 7/8 at X45	according to IEC 61131-2, type 1
4 / DI9 2 / DI10	Digital input 9/10 at X46 (configurable with DO3/DO4)	
4 / DI11 2 / DI12	Digital input 11/12 at X47	
4 / DI13 2 / DI14	Digital input 13/14 at X48	
5 / n. c.	not assigned	-
1 / 24O 3 / GIO	24 V supply of the external sensors or potential-free contacts	External supply at 24E: Voltage drop < 2.5 V
	Total current for X41 ... X48	1 A

4.7.2 Digital outputs

X42 - configured		
Labelling	**Features**	**Rated value**
4 / DO1 2 / DO2 3 / GIO	Digital output	According to IEC61131-2, type 1
	External-voltage protected	up to +30 V Integrated polarity reversal protection diode for switching inductive loads
	Isolation	🕮 76
	Level	LOW < +5 V High > +15 V
	Time-dependent behaviour	LOW - HIGH / HIGH - LOW max. 250 µs
	Behaviour during overload	Reduced voltage or periodic switch-off/on
	Behaviour in case of reset and during switch-on	Outputs are switched-off (LOW)
	Cycle time	1 ms
	Max. output current	200 mA per output
1 / 24O 3 / GIO	24 V supply of the external sensors or potential-free contacts	External supply at 24E: Voltage drop < 2.5 V
	Total current for X4x, X50/X8x	1 A

Extensions in the EMS version

X46 - configured		
Labelling	**Features**	**Rated value**
4 / DO3 2 / DO4 3 / GIO	Digital output	According to IEC61131-2, type 1
	External-voltage protected	up to +30 V Integrated polarity reversal protection diode for switching inductive loads
	Isolation	🕮 76
	Level	LOW < +5 V High > +15 V
	Time-dependent behaviour	LOW - HIGH / HIGH - LOW max. 250 µs
	Behaviour during overload	Reduced voltage or periodic switch-off/on
	Behaviour in case of reset and during switch-on	Outputs are switched-off (LOW)
	Cycle time	1 ms
	Max. output current	200 mA per output
1 / 24O 3 / GIO	24 V supply of the external sensors or potential-free contacts	External supply at 24E: Voltage drop < 2.5 V
	Total current for X4x, X50/X8x	1 A

4.7.3 Analog inputs

X50		
Pin / Name	**Feature**	**Rated value**
4 / AU 3 / GA	Voltage input	0.3 ... 10 V (V < 0.3 V □ ”0”)
	Input resistance	> 80 kΩ
	Sampling frequency	1 kHz (1 ms)
	Accuracy	± 0.1 V
	Electric strength of external voltage	± 15 V
	A/D converter	Resolution 10 bits + sign Error: 1 digit ≡ 0.1 %, based on the final value
2 / AI 3 / GA	Current input, parameterisable	0.6 ... +20 mA (I < 0.6mA □ ”0”)
		4 ... +20 mA, fail-safe
	Input resistance	220 Ω
	Input current in case of open circuit	Display ”0” (I < 0.6 mA)
	Sampling frequency	1 kHz (1 ms)
	Accuracy	± 0.2 mA
	Electric strength of external voltage	± 15 V
	A/D converter	10 bit resolution Error: 1 digit ≡ 0.1 %, based on the final value
1 / 24O 3 / GIO	24 V supply of the external sensors or potential-free contacts	External supply at 24E: Voltage drop < 2.5 V
	Total current for X4x, X50/X8x	1 A

4.7.4 Synchronous serial interface (SSI)

X80		
Pin / Name	**Feature**	**Rated value**
1 / CLK+	Pos. clock signal	Bit rate: 100 .... 1000 kbits Data word width: 1 ... 32 bits (effective) Code: Gray an binary
2 / CLK-	Neg. clock signal	
3 / Data+	Pos. data line	
4 / Data-	Neg. data line	
5 / n. c.	Not assigned	
6 / n. c.	Not assigned	
8 / 24O 7 / GIO	24 V supply of the external SSI encoders	External supply at 24E: Voltage drop < 2.5 V
	Total current for X4x, X50/X8x	1 A

4.7.5 Remote control (IrRC)

IrRC (Infrared Remote Control)		
Pin / Name	Features	Rated value
-	Reach	~5 m
	Angle of incidence	~30 °

4.7.6 Interfaces of the EMS version

CANopen Master PLC

X34		
Pin / Name	**Features**	**Rated value**
1 / ⏚	Shielding (functional earth)	-
2 / n. c.	not assigned	-
3 / CAN_GND	CAN GND	Bit rate: adjustable up to 1 Mbit Isolation: Function separation
4 / CANH	CAN HIGH	
5 / CANL	CAN LOW	

RS485/422 PLC

X81/X82			
Pin / Name	Features		Rated value
	RS485	RS422	
The assignment depends on the device version (📖 135).	24 V supply		according to IEC 61131-2, type 1
	RS485A’	Reception + (Data+)	• according to: – ANSI/TIA/EIA-485-A-98 – ANSI/TIA/EIA-422 • Bit rate: Adjustable up to 115.2 kbit • Isolation: Function separation • At RS422, PLC supports evaluation of SSI encoders (max. 150 kHz).
	RS485B’	Reception (Data-)	
	RS485A	Transmission+ (CLK+)	
	RS485B	Transmission- (CLK-)	

Infrared interface (IrDA)

IrDA (Infrared Data Association)		
Pin / Name	Features	Rated value
-	Reach	~1 m
	Angle of incidence	~30 °

4.7.7 Motor holding brake connection

Version according to type code: B (AC voltage: fast switch)

X21		
Pin / Name	**Feature**	**Rated value**
	Connection of a motor holding brake to the external brake rectifier in the motor terminal box	
	Max. switching capacity	55 W
	Internal switching time	< 10 ms
	Isolation	Basic insulation (📖 76)
	Time-dependent behaviour	See software manual, chapter holding brake control / parameterisation
	Behaviour in case of reset and during switch-on	Outputs are switched-off / open
	Operating frequency	Max. 60/min
	Short-circuit strength	no
c2 / ~ c3 / ~	Switched mains voltage (L1/L2) for a brake rectifier	
	Switching voltage	AC 400/480 V according to IEC 61131-2
c4 / S1 c5 / S2	Potential-free contact for switching the external brake rectifier on the DC side. For this purpose, the brake rectifier must be equipped with a spark suppressor.	
	Switching voltage	DC 250 V

Version according to type code: F (DC voltage: integrated brake rectifier)

X21			
Pin / Name	**Feature**		**Rated value**
6 / BD1 4 / BD2	Connection of a motor holding brake		
	Integrated brake rectifier		Half-wave rectification with increased ripple
	Output voltage (dependent on mains voltage)	AC 400 V	DC 180 V
		AC 500 V	DC 225 V
	Max. output power		55 W
	Internal switching time		< 1 ms
	Time-dependent behaviour		See software manual, chapter holding brake control / parameterisation
	Short-circuit strength		no
	Behaviour in case of reset and during switch-on		Outputs are switched off
	Operating frequency		Max. 60/min

Version according to type code: V (24 V DC voltage)

(only EMS version)

X21		
Pin / Name	**Feature**	**Rated value**
6 / BD1 4 / BD2	Connection of a motor holding brake	
	Output voltage (dependent on the supply voltage)	DC 24 V
	Max. output power	48 W
	Internal switching time	< 1 ms
	Time-dependent behaviour	See software manual, chapter holding brake control / parameterisation
	Short-circuit strength	Yes
	Behaviour in case of reset and during switch-on	Outputs are switched off
	Operating frequency	Max. 60/min

Version according to type code: C (DC voltage: cold brake)

X21			
Pin / Name	**Feature**		**Rated value**
6 / BD1 4 / BD2	Connection of a motor holding brake		
	Voltage boost for 0.3 s		130 %
	Voltage reduction (cold brake) after 0.3 s		65 % Half-wave rectification with increased ripple
	Output voltage (dependent on mains voltage)	AC 400 V	DC 180 V
		AC 500 V	DC 225 V
	Max. output power		55 W
	Internal switching time		< 1 ms
	Time-dependent behaviour		See software manual, chapter holding brake control / parameterisation
	Short-circuit strength		no
	Behaviour in case of reset and during switch-on		Outputs are switched off
	Operating frequency		Max. 60/min

STOP

Stop!

Damage of the devices

A defective motor holding brake or a short circuit on the X21 connection (motor and built-on accessories) causes internal damage to the device.

Possible consequences:

- ► If a defective motor holding brake is connected, the replacement device is also damaged immediately.

Protective measures:

- ► When devices are replaced due to malfunction of the brake control, ensure that defect-free motor holding brakes are connected.
- ► Check whether the motor holding brake and the connecting cable are free from defects.
- ► Replace or repair defective components.

5 Mechanical installation

5.1 Important notes

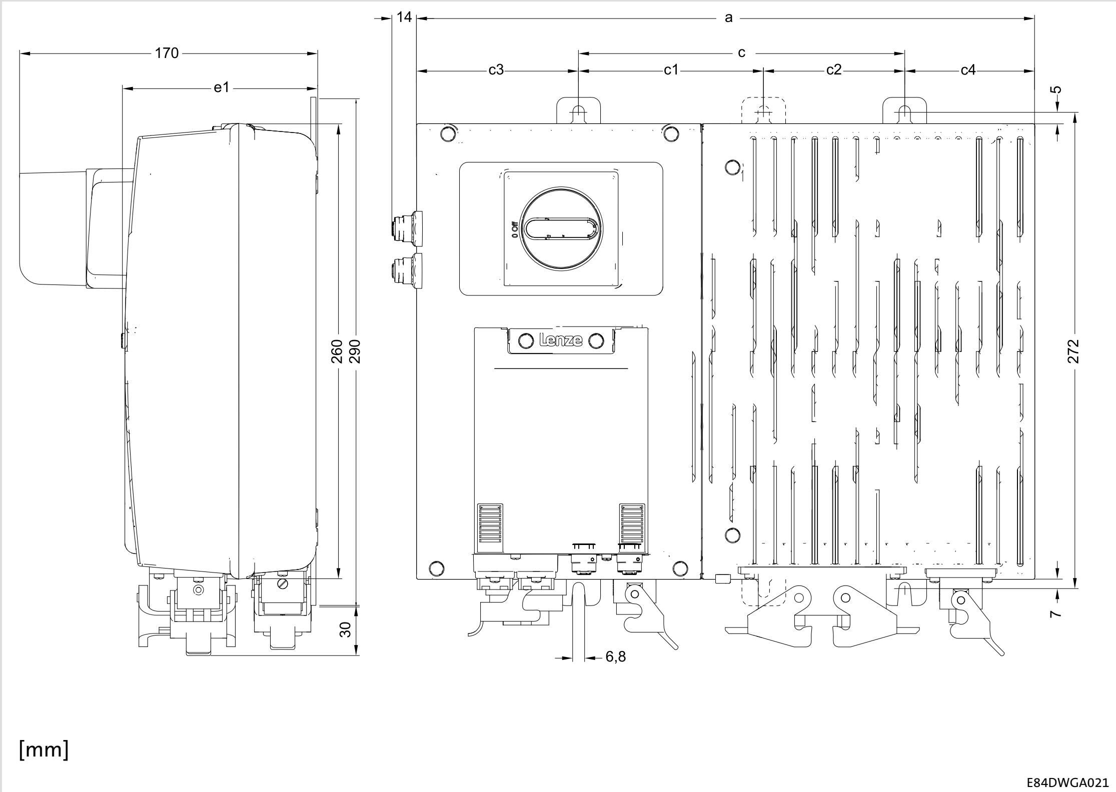
- If the cooling air is polluted (fluff, (conductive) dust, soot, aggressive gases), take adequate countermeasures, as e.g.:
  – Cleaning of the cooling ribs on the controller in regular intervals
  – Separate air guide
- Possible mounting position:
  – Vertically suspended
- Maintain the specified free spaces above and below the controller to other installations!
- Ensure untroubled cooling and exhaust air flow.
- In case of continuous vibrations or shocks use vibration dampers.

Depending on the size, four or six screws M6 x >10 mm are required for the mounting. The mounting location and material must ensure a durable mechanical connection.

For fastening the devices, we recommend:

- M6 cheese head screw, hexagon socket, according to DIN 912/ISO 4762
- M6 cheese head screw, torx, according to ISO 14579

5.2 Dimensions

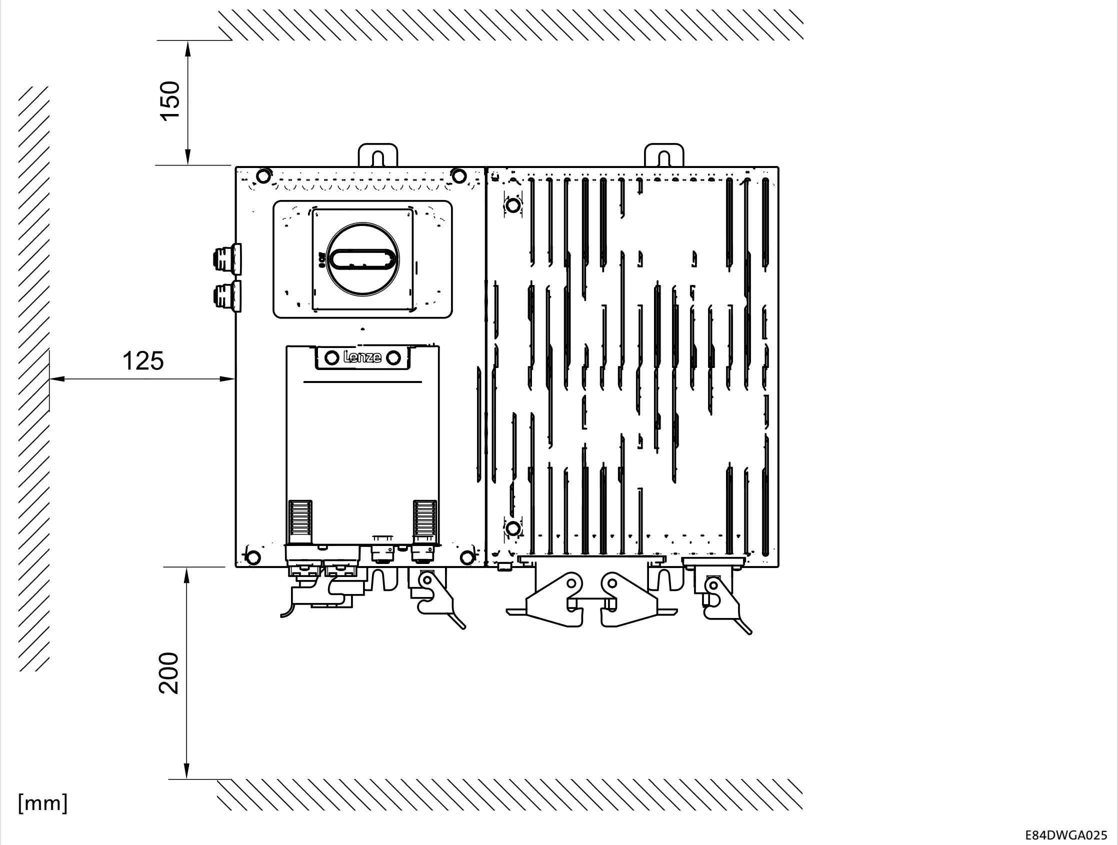


	[mm]						
	a	c	c1 = c2	c3	c4	e1	[kg]
E84Dxxxx7514 E84Dxxxx1524	353	186	-	92	75	110	7.0 ... 7.5
E84Dxxxx3024 E84Dxxxx4024	434	290	145	92	52	148	8.9 ... 9.4
E84DHxxx7524	434	290	145	92	52	195	9.1 ... 9.6

5.3 Mounting clearance

Note!

The actual free space is determined by the connectors used and the cable bending radii.



6 Electrical installation - HighLine/StateLine version

6.1 Important notes

Danger!

Dangerous electrical voltage

All power terminals remain live for up to three minutes after mains disconnection.

Possible consequences:

► Death or severe injuries when touching the power terminals.

Protective measures:

► Switch off the power supply and wait for at least three minutes before working on the power terminals.

► Make sure that all power terminals are deenergised.

Danger!

► The contacts of the power connectors **X10, X11, X20 and X21** may carry dangerous voltage if the frequency inverter is connected to the mains. Thus, deenergise the frequency inverter before working on it.

► Earth the device by means of X10 and by connecting it to functional earth (earthing bolt) in order to prevent injury to persons and malfunctioning.

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

► Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

► Implement the actions required in the EN 61800-5-1. Especially:
  – Fixed installation
  – PE connection must conform to standards (PE conductor diameter ≥ 10 mm² or PE conductor must be connected twice)

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

- ► Destruction of the device if the mains voltage is too high.

Protective measures:

- ► Observe the maximally permissible mains voltage.
- ► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Stop!

Pluggable terminal strips or plug connections

Plugging or removing the terminal strips or plug connections during operation may cause high voltages and arcing.

Possible consequences:

- ► Damage of the devices

Protective measures:

- ► Switch off device.
- ► Only plug or remove the terminal strips or plug connections in deenergised status.

Note!

Switching on the controller motor side is permissible for safety shutdown (emergency stop) and for operation of several motors on the controller in V/f operating mode.

Please observe the following:

- ► When switching with the controller is enabled, you can activate monitoring functions of the controller. If no monitoring function is activated, switching is permissible.
- ► The switching elements at the motor end must be rated for DC voltages V_{DCmax} = 800 V.

Note!

Only with the **control element**

► **C** = service switch with protective function

the device can be disconnected from the mains voltage.

Note!

The counter plugs of the power terminals must be equipped with connector housings with a vertical outgoing cable.

Note!

- ► **It is absolutely necessary to keep the plastic caps on the connectors for the control terminals and interfaces!**
- ► During transport, storage, and operation, ports not used must be sealed using the plastic caps, in order to maintain the product features in accordance with the technical data.
- ► Only if this note is observed, the product features certified are ensured for devices with a safety system.

EMC-compliant wiring

Note!

- ► Establish a good conductive connection to protective earth by means of a copper-braid cable (e.g. mounting surface, machine earth or building earth).
- ► Lay control cables and data lines separately from the motor cables.
- ► Connect the shields of the control cables and data lines **at both ends**.

6.1.1 Electrical isolation

The protective insulation of the "8400 Inverter Drives" controllers is implemented according to EN 61800-5-1. The following illustration shows the insulation concept.

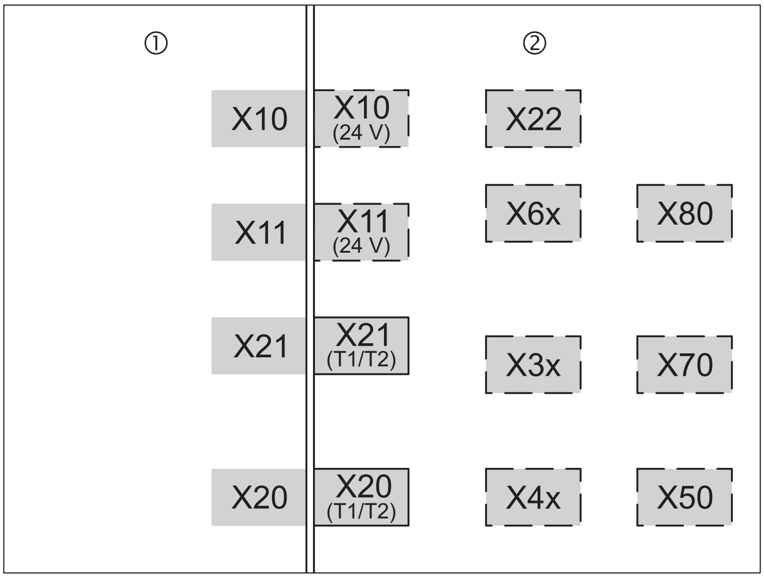


Fig. 6-1 Electrical isolation between power terminals, control terminals and housing

⋮	Isolation by functional insulation
I	Isolation by basic insulation
II	Safe isolation by double or reinforced insulation Protection against accidental contact is guaranteed without any further measures.
①	Power connections
X10, X11	Mains
X21	Motor
X20	Brake resistor
②	Control terminals
X10 (24 V) X11 (24 V)	24 V supply voltage
X20 (T1/T2)	brake resistor temperature monitoring
X21 (T1/T2)	Motor temperature monitoring
X22	Voltage supply of external fan - only for 7.5 kW devices
X3x	Fieldbus communication
X4x	Digital inputs/outputs
X50	Analog input
X6x	Safety system
X70	Diagnostics
X80	SSI

6.1.2 Device protection

- ► In case of condensation, do not connect the controller to the mains voltage before the moisture has evaporated completely.
- ► The controller must be protected by external fuses.
- ► Unused control inputs and outputs must be closed according to the intended type of protection.

6.1.3 Maximum motor cable length

- Keep the motor cable as short as possible since this has a positive effect on the drive behaviour.
- The maximally permissible motor cable length is: 20 m, shielded
  - at rated mains voltage
  - at a switching frequency of 8 kHz

Note!

If the conditions for electromagnetic compatibility must be observed, the permissible cable lengths may vary.

6.1.4 Motor protection

- Extensive protection against overload:
  - By overcurrent relays or temperature monitoring.
  - We recommend the use of PTC thermistors or thermostats to monitor the motor temperature.
  - PTC thermistors or thermostats can be connected to the controller.
  - For monitoring the motor, we recommend the use of the I^2xt monitoring.
- Only use motors with an insulation suitable for the inverter operation:
  - Insulation resistance: min. û = 1.5 kV, min. du/dt = 5 kV/µs
  - When using motors with an unknown insulation resistance, please contact your motor supplier.

6.2 Safety instructions for the installation according to U_L or U_R

Original - English

Warnings!

- Branch circuit protection:
  Suitable for use on a circuit capable of delivering not more than 200 000 rms symmetrical amperes, 500 V maximum.
  – When Protected by CC, T, or J Class Fuses.
- Integral solid state protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
- Overload Protection = 125 % of rated FLA.
- Use 75 °C copper wire only, except for control circuits.
- Use Class 1 wire only.
- Enclosed Device, suitable for use in a UL Type 4X (Indoor) Environment.
- Suitable for use in a surrounding air temperature of 45 °C, and
  – additionally 55 °C when de-rating rules are followed.
- Suitable for use in a compartment handling conditioned air.
- The device is provided with internal overload protection. For information on the protection level of the internal overload protection for a motor load, see the corresponding Software Manual or Online Help under the topic ”Motor load monitoring (I^2xt)”. This function has to be activated; i. e. the reaction must be changed from ”Warning” (factory setting) to ”Fault”.
- For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Manual or Online Help.

Warnings!

The opening of branch-circuit protective device may be an indication that a fault has been interrupted.

To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined and replaced if damaged or equivalent.

6.3 Safety instructions for the installation according to U_L or U_R

Original - French

Warnings!

- Branch circuit protection:
  Suitable for use on a circuit capable of delivering not more than 200 000 rms symmetrical amperes, 500 V maximum.
  – When Protected by CC, T, or J Class Fuses.
- Integral solid state protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
- Overload Protection = 125 % of rated FLA.
- Use 75 °C copper wire only, except for control circuits.
- Use Class 1 wire only.
- Enclosed Device, suitable for use in a UL Type 4X (Indoor) Environment.
- Suitable for use in a surrounding air temperature of 45 °C, and
  – additionally 55 °C when de-rating rules are followed.
- Suitable for use in a compartment handling conditioned air.
- The device is provided with internal overload protection. For information on the protection level of the internal overload protection for a motor load, see the corresponding Software Manual or Online Help under the topic ”Motor load monitoring (I^2xt)”. This function has to be activated; i. e. the reaction must be changed from ”Warning” (factory setting) to ”Fault”.
- For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Manual or Online Help.

Warnings!

The opening of branch-circuit protective device may be an indication that a fault has been interrupted.

To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined and replaced if damaged or equivalent.

6.4 Installation according to EMC (installation of a CE-typical drive system)

Design of the cables

- ► It is imperative to comply with the regulations concerning minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- ► The cables used must comply with the approvals required for the location (e.g. UL).

6.4.1 Shielding

Requirements

- ► The effectiveness of a shielded cable is reached by:
  - – Providing a good shield connection through large-surface shield contact.
  - – Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - – Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - – Keeping unshielded cable ends as short as possible.

Use system cables or shielded cables for these connections:

- ► Motor
- ► External brake resistor (☞ Mounting Instructions of the brake resistor)
- ► Motor holding brake (shielding is required when being integrated into the motor cable; connection to optional motor brake control)
- ► Motor temperature monitoring
- ► Analog signals (inputs and outputs; single-sided shield connection to the controller)
- ► Fieldbus communication (e.g. CANopen ,PROFIBUS, PROFINET, ...)
- ► Safety system
- ► CAN on board

The following connections need not be shielded:

- ► Mains
- ► 24-V supply
- ► Digital signals (inputs and outputs).
  - – We recommend to use shielded cables for a cable length from approximately 5 m on or in environments with strong interferences.

Connection system

- ► Directly apply the shielding in the plug.
  - – Extensively apply the shielding and ensure electrical conductivity.
  - – If required, additionally connect the shield to the cable clamp rail.

6.4.2 Motor cable

- Only use shielded motor cables with braids made of tinned or nickel-plated copper. Shields made of steel braids are not suitable.
  – The overlap rate of the braid must be at least 70 % with an overlap angle of 90 °.
- The cables used must correspond to the requirements at the location (e.g. EN 60204-1).
- Use Lenze system cables.
- Extensively apply the shielding in the plug and attach it in a way which ensures electrical conductivity.
- The motor cable is optimally installed if
  – it is separated from mains cables and control cables,
  – it only crosses mains cables and control cables at right angles,
  – it is not interrupted.
- If the motor cable must be opened all the same (e.g. due to chokes, contactors, or terminals):
  – The unshielded cable ends may not be longer than 100 mm (depending on the cable cross-section).
  – Install chokes, contactors, terminals etc. spatially separated from other components (with a min. distance of 100 mm).
  – Install the shield of the motor cable directly before and behind the point of separation to the mounting plate with a large surface.
- Connect the shield with a large surface to PE in the terminal box of the motor at the motor housing.
  – Metal EMC cable glands at the motor terminal box ensure a large surface connection of the shield with the motor housing.

6.4.3 Control cables

- Control cables must be shielded to minimise interference injections.
- For lengths of 200 mm and more, use only shielded cables for analog and digital inputs and outputs. Under 200 mm, unshielded but twisted cables may be used.
- Connect the shield correctly:
  – The shield connections of the control cables must be at a distance of at least 50 mm from the shield connections of the motor cables and DC cables.
  – Connect the shield of digital input and output cables at both ends.
  – Connect the shield of analog input and output cables at one end (at the drive controller).
- To achieve an optimum shielding effect (in case of very long cables, with high interference) one shield end of analog input and output cables can be connected to PE potential via a capacitor (e.g. 10 nF/250 V) (see sketch).

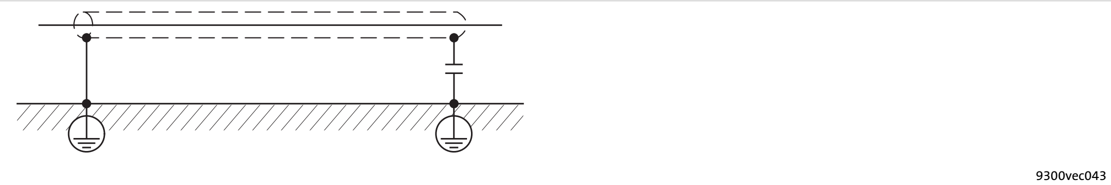


Fig. 6-2 Shielding of long, analog control cables

6.4.4 Wiring

Notes on the laying of cables:

- In the case of greater cable lengths, a greater cable distance between the cables is required.
- In the case of parallel routing (cable trays) of cables with different types of signals, the degree of interference can be minimised by using a metallic cable separator or isolated cable ducts.

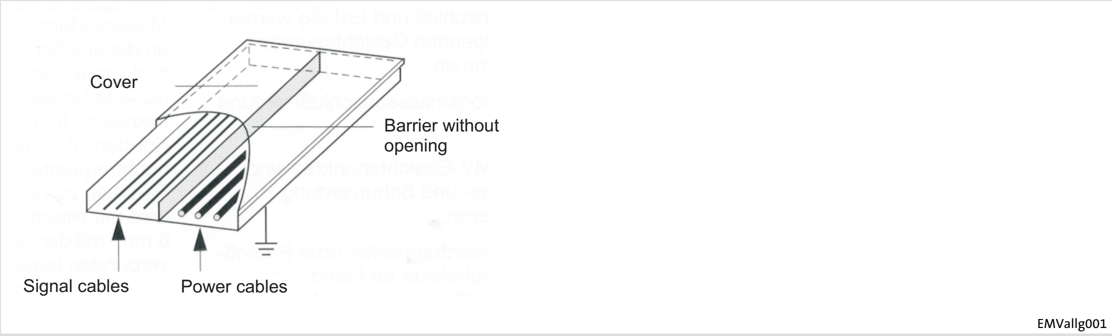


Fig. 6-3 Cable routing in the cable duct with barrier

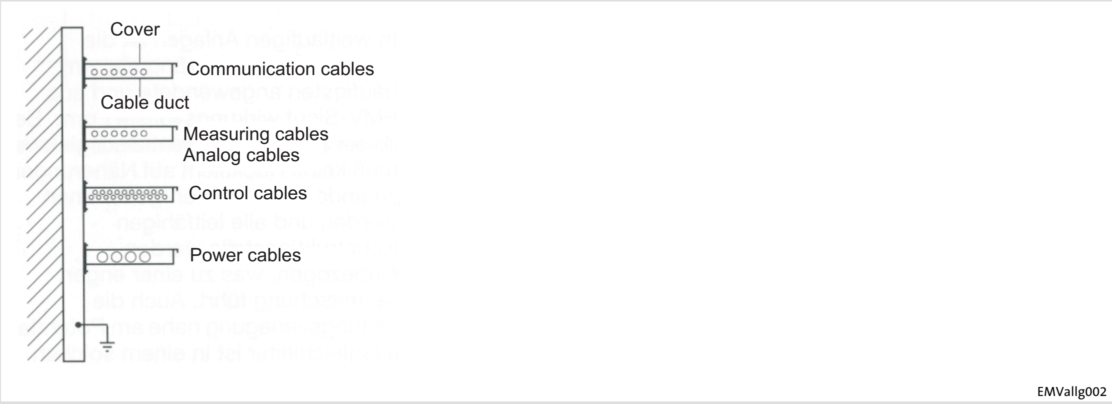


Fig. 6-4 Cable routing in separated cable ducts

Wiring on the mains side

- It is possible to connect the controller, mains choke or RFI filter to the mains via single cores or unshielded cables.
- The cable cross-section must be rated for the assigned fuse protection (VDE 0160).

Wiring on the motor side

Stop!

The motor cable is highly susceptible to interference. Therefore you will achieve an optimum wiring on the motor side if you

- exclusively use shielded and low-capacitance motor cables.
- do **not** integrate any further cable into the motor cable (e.g. for blowers etc.).
- shield the supply cable for temperature monitoring of the motor (PTC or thermostat) and install it separately from the motor cable.

Special conditions allow you to integrate the supply cable for temperature monitoring of the motor into the motor cable: (🕮 81)

Danger!

Uncontrolled motor movements can occur

If the motor cable is damaged, a short circuit between the brake control cables and the motor cables can cause motor movements with low torque.

Possible consequences:

- Personnel in the vicinity of the motor can be injured.

Protective measures:

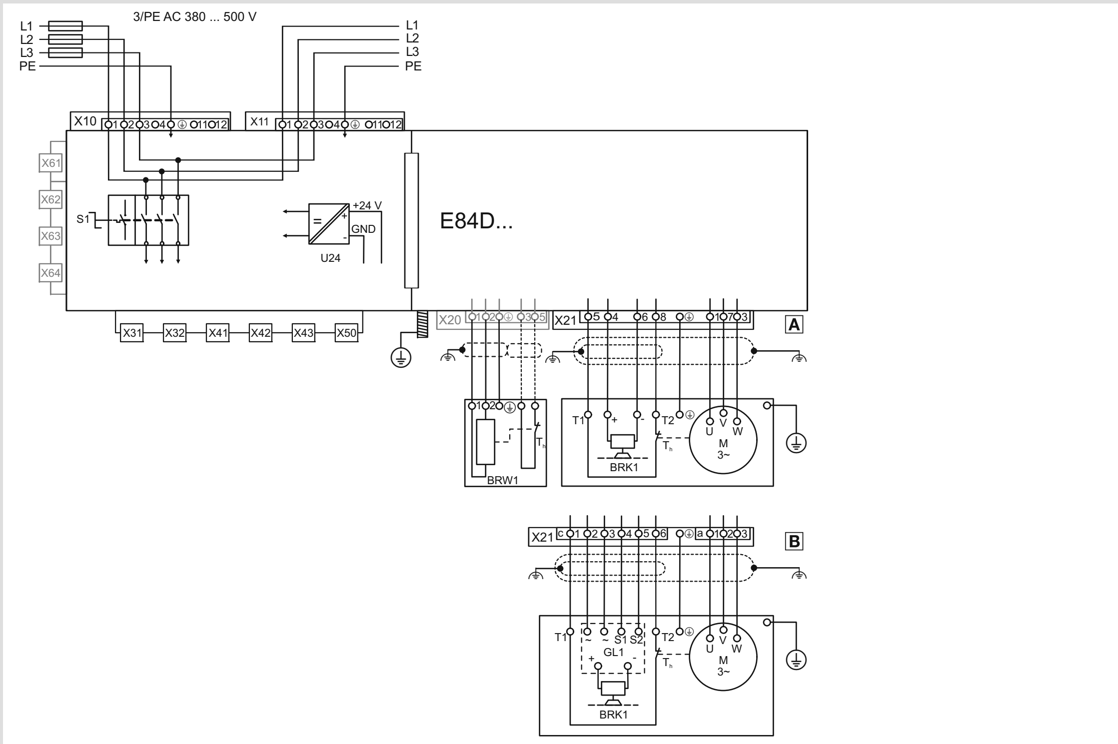
- Install motor cable in a protected way (e.g. in a cable duct).

6.4.5 Detecting and eliminating EMC interferences

Fault	Cause	Remedy
Interferences of analog setpoints of your own or other devices and measuring systems	Unshielded motor cable	Use shielded motor cable
	Shield contact is not extensive enough	Carry out optimal shielding as specified
	Shield of the motor cable is interrupted by terminal strips, switched, etc.	• Separate components from other component part with a minimum distance of 100 mm • Use motor choke/motor filter
	Install additional unshielded cables inside the motor cable (e.g. for motor temperature monitoring)	Install and shield additional cables separately
	Too long and unshielded cable ends of the motor cable	Shorten unshielded cable ends to maximally 40 mm

6.5 Devices in a power range of 0.75 ... 7.5 kW (3/PE AC 400 V)

6.5.1 Example circuits

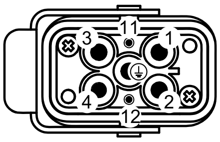


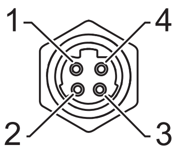
E84DWSP055

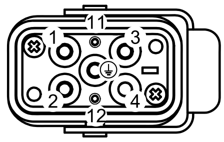
E84D...	8400 protec controller
S1	Service switch control element (optional)
U24	Supply voltage 24 V internal
BRK1	Spring-applied brake
GL1	Spring-applied brake control
BRW1	External brake resistor at optional terminal X20 - for E84DHxxx7524: Direct connection of the thermal contact
T_h	PTC thermistor (PTC) or thermal contact (NC contact)
M	Motor
A	Motor connection system: Plug type Q8/0
B	Motor connection system: Plug type Modular
X31 ... X50	Communication, inputs and outputs
X61 ... X64	Optional: Drive-based safety

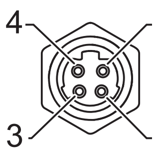
6.5.2 Terminal assignment of the power connections

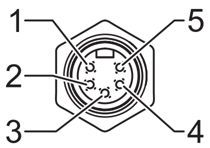
Mains connection

X10 - port for mains			
Pin	**Connection**	**Description**	**Data**
 84DWTX0100		DESINA type Q4/2, pins	
1	L1	Mains phase L1	Max. 6 mm^2
2	L2	Mains phase L2	
3	L3	Mains phase L3	
⏚	PE	PE conductor	
11	24E	External 24-V power supply	Max. 2.5 mm^2
12	GND	External reference potential	

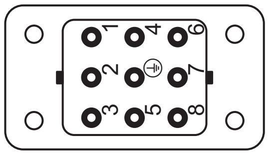
X10 - mains connection - device version E84Dx**D**... and E84Dx**H**...			
Pin	**Connection**	**Description**	**Data**
 E84DWTXXMO 1		Type Molex, Brad Mini-Change, pins	
1	L1	Mains phase L1	max. 14 AWG
2	L2	Mains phase L2	
3	L3	Mains phase L3	
4	PE ⏚	PE conductor	

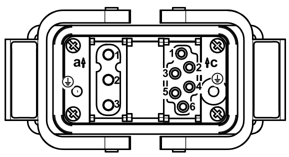
X11 - mains loop-through technique (optional)			
Pin	**Connection**	**Description**	**Data**
 84DWTX0110		DESINA type Q4/2, sockets	
1	L1	Phase L1	Max. 6 mm^2
2	L2	Phase L2	
3	L3	Phase L3	
⏚	PE	PE conductor	
11	24E	External 24-V power supply	Max. 2.5 mm^2
12	GND	External reference potential	

X11 - mains connection - device version E84Dx**D**...			
Pin	**Connection**	**Description**	**Data**
 E84DWTXXMO 4		Type Molex, Brad Mini-Change, pins	
1	n. c.	not assigned	max. 16 AWG
2	24E	External 24 V voltage supply	
3	GND	External reference potential 24 V	
4	n. c.	not assigned	

X11 - mains connection - device version E84Dx**H**...			
Pin	**Connection**	**Description**	**Data**
 E84DWTXXMO 2		Type Molex, Brad Mini-Change, pins	
4	24E	External 24 V voltage supply	max. 16 AWG
2	GND	External reference potential 24 V	
3	PE ⏚	PE conductor	
1, 5	n. c.	not assigned	

Motor connection

X21 - motor connection - device version E84Dxx**C**...			
Pin	**Connection**	**Description**	**Data**
 84DWTX0210		Type Q8/0, sockets Use Lenze system cable: EYP0037xxxxxxxxQ10, 8-core, 1.5 mm^2 EYP0038xxxxxxxxQ11, 8 core, 2.5 mm^2	
2	n. c.	Grooved pin as a protection against mix-up with power bus	
1	U	Motor phase U	Max. 4 mm^2 Max. output voltage: mains voltage Max. permanent output current: type-dependent
3	W	Motor phase W	
7	V	Motor phase V	
4	BD2	Motor holding brake (reference conductor)	Max. 4 mm^2
6	BD1	Motor holding brake	
5	+PTC	Motor temperature monitoring	Max. 4 mm^2 PTC thermistor (PTC) or thermal contact (NC contact)
8	-PTC		
⏚	PE	PE conductor	Max. 4 mm^2

X21 - motor connection - device version E84Dxx**B**...			
Pin	**Connection**	**Description**	**Data**
 84DWTX0211		Type Modular, sockets Use Lenze system cable: EYP0039xxxxxxxxQ08, 10-core, 1.5 mm^2 EYP0040xxxxxxxxQ09, 10-core, 2.5 mm^2	
a1	U	Motor phase U	Max. 6 mm^2 Max. output voltage: mains voltage Max. permanent output current: type-dependent
a2	V	Motor phase V	
a3	W	Motor phase W	
c1	+PTC	Motor temperature monitoring	Max. 4 mm^2 PTC thermistor (PTC) or thermal contact (NC contact)
c6	-PTC		
c2	~	Supply voltage of brake rectifier	Max. 4 mm^2 V_{rated} = mains voltage-dependent The brake rectifier is mounted in the terminal box of the motor.
c3	~		
c4	S1	Switch for separation on the DC side	
c5	S2		
⏚	PE	PE conductor	Max. 6 mm^2

Stop!

Damage of the devices

A defective motor holding brake or a short circuit on the X21 connection (motor and built-on accessories) causes internal damage to the device.

Possible consequences:

► If a defective motor holding brake is connected, the replacement device is also damaged immediately.

Protective measures:

► When devices are replaced due to malfunction of the brake control, ensure that defect-free motor holding brakes are connected.

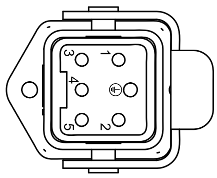
► Check whether the motor holding brake and the connecting cable are free from defects.

► Replace or repair defective components.

Note!

In the Lenze setting, the temperature monitoring of the motor is activated! To start motors without thermal detectors, the response of the motor temperature monitoring must be deactivated (C00585). Alternatively, a wire jumper between +PTC and -PTC can be used to simulate a normal temperature.

Connection of external brake resistor

X20 - connection of external brake resistor (optional)			
Pin	**Connection**	**Description**	**Data**
 E84DWX0202		Type Q5, sockets	
1	RB2	Brake resistor	max. 2.5 mm^2
2	RB1		
3	T1	only E84DHxxx7524: brake resistor temperature monitoring	
5	T2		
4	n. c.	not assigned	
⏚	PE	PE conductor	

X20 - connection of external brake resistor (optional, - device version E84DxxxxxxxxxxxxF**)**			
Pin	**Connection**	**Description**	**Data**
 E84DWTXXMO 3		Type Molex, Brad Mini-Change, sockets	
1	RB1	Brake resistor	max. 16 AWG
5	RB2		
3	PE ⏚	PE conductor	
2, 4, 6	n. c.	not assigned	

6.6 Control terminals

6.6.1 Diagnostics

The following can be optionally connected to the X70 diagnostic interface:

► USB diagnostic adapter E94AZCUS

In combination with the Lenze PC software »Engineer«, the diagnostic adapter serves to make comprehensive settings via dialogs, e.g. for initial commissioning.

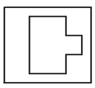
► EZAEBK2001diagnosis terminal

The diagnosis terminal comprises the keypad including housing and a connecting cable.

The diagnosis terminal can be used to control or change individual settings. In a quick commissioning menu, the basic settings of the controller can be parameterised using the diagnosis terminal.

The X70 plug is located behind the service hatch. Apply a little pressure to open the service hatch and push the two plastic bars down. Tools are not required.

After using the diagnostic interface, remove the connecting cable at X70 and completely close the service hatch.

X70 - diagnostic interface			
Pin	**Signal**	**Description**	**Data**
 8400HLC009		Type RJ69, 10-pole, socket	
1 ... 10	internal	Terminal for diagnosis terminal or diagnostic adapter	

6.6.2 Analog input

The analog input can be used either as voltage input or as current input.

X50- analog inputs AI, AU			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	AI	Current input	0 ... +20 mA 4 ... +20 mA
3	GA	Reference potential	
4	AU	Voltage input	0 ... 10 V
5	Controller	10 V reference voltage (output)	+ 10 V, max. 10 mA

Example circuit

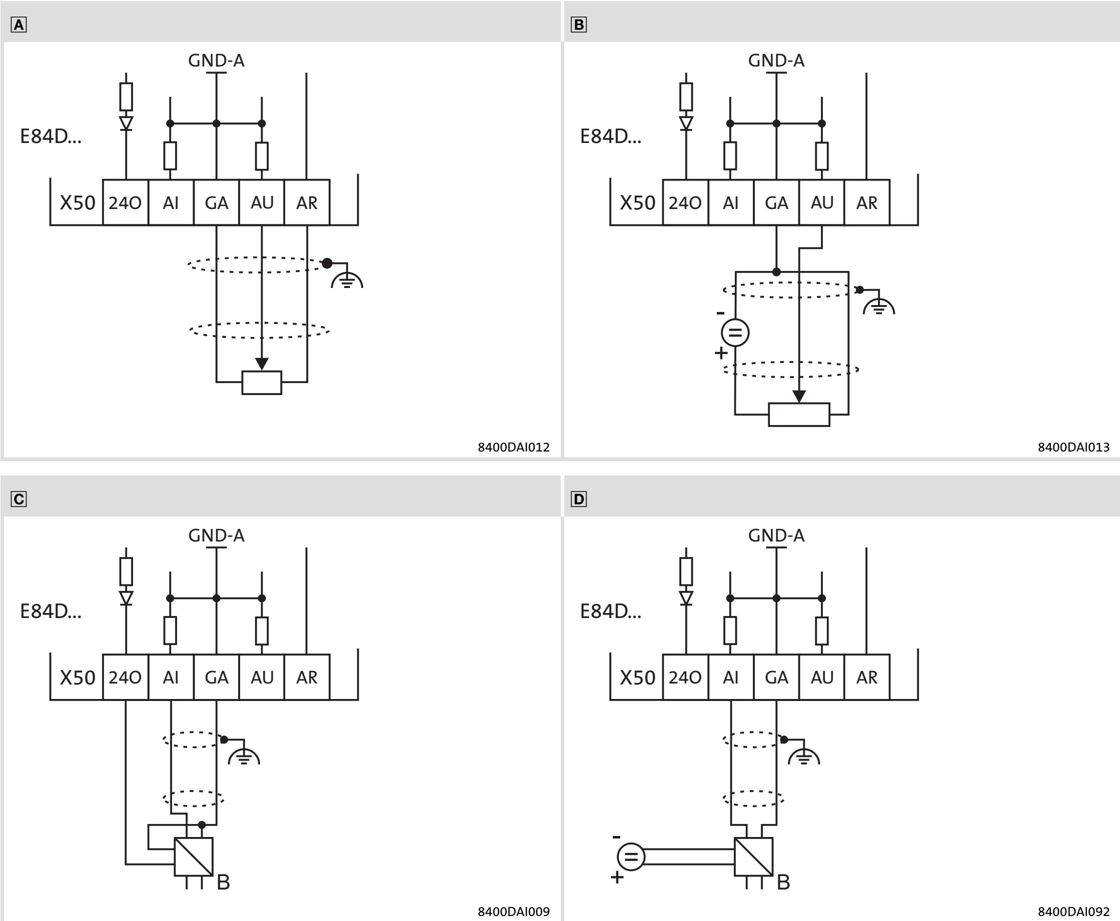


Fig. 6-5 Wiring examples of the analog input

A	Potentiometer with internal reference voltage AR	
B	Potentiometer with external reference voltage	
C	External master current selection based on a sensor signal 0 - 20 mA.	
D	External master current selection based on a sensor signal 0 - 20 mA. External sensor supply.	
X50	Connection for analog input	
GA	GND-A	Ground reference potential for the analog inputs and outputs
⏚	EMC shield connection	
U	Measuring device	
B	Measuring transducer	

6.6.3 Digital inputs and outputs

Note!

The maximum total current of the 24 V voltage supply for external actuators and encoders is 1 A, e.g. ports

- ► Digital inputs/outputs at X4x,
- ► Analog input at X50 or SSI at X80, and
- ► Serial interfaces RS485/RS422 at X81/X82.

Digital inputs

X41 - digital inputs DI1, DI2			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI2	Digital input 2	According to IEC61131-2, type 1 or Two-track frequency input for HTL encoder 0 ... 100 kHz
3	GIO	Reference potential	HIGH +15 .... +30 V DC LOW 0 ... +5 V
4	DI1	Digital input 1	8 mA at 24 V DC
5	n. c.	Not assigned	

X42 - digital inputs DI3, DI4			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI4 (DO2)	Digital input 4 (also available as digital output)	HIGH +15 .... +30 V DC
3	GIO	Reference potential	LOW 0 ... +5 V
4	DI3 (DO1)	Digital input 3 (also available as digital output)	8 mA at 24 V DC
5	n. c.	Not assigned	

X43 - digital inputs DI5, DI6			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI6	digital input 6	according to IEC61131-2, type 1 or Single-track frequency input, 0 ... 7.5 kHz
3	GIO	Reference potential	HIGH +15 .... +30 V DC LOW 0 ... +5 V
4	DI5	digital input 5	8 mA at 24 V DC
5	n. c.	not assigned	

Example circuit

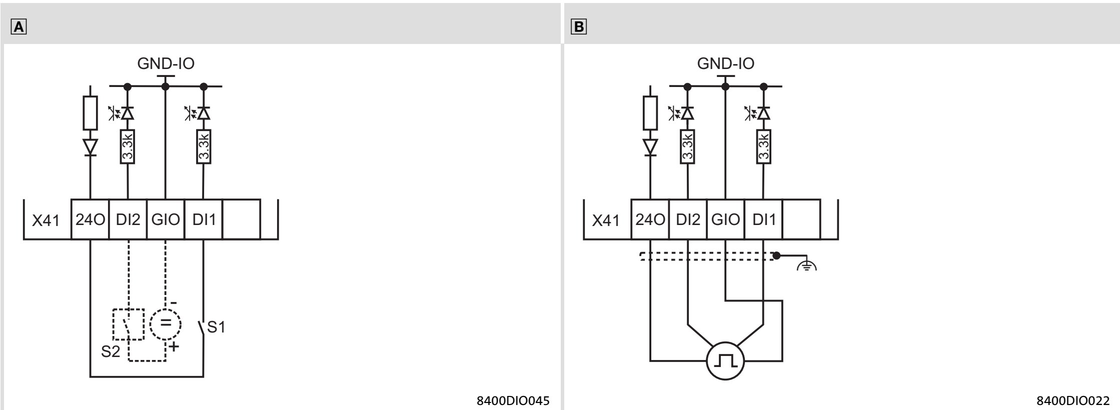


Fig. 6-6 Wiring examples of the digital inputs

A	Wiring of digital inputs, examples:
S1	Potential-free contact, at internal 24 V supply
S2	Signal source, e.g. PLC or with external 24 V supply
B	Connection of an HTL incremental encoder with a maximum input frequency of 100 kHz DI1 track A DI2 track B
X41	Plugs for digital inputs X41 ... X43
GIO	Ground reference potential for the digital inputs and outputs (GND-IO)

Digital outputs

Note!

If inductive loads are being connected, it is essential to use a spark suppressor at the digital output.

X42 - digital outputs DO1, DO2 (configured digital input!)

Pin	Signal	Description	Data	
	84DPSO05_5	Type M12, 5-pole sockets		
1	24O	24 V supply of the external sensors		
2	DO2	digital output 2 (configured)	HIGH	+24 V or V_{DC} at X10
3	GIO	Reference potential	LOW	0 ... +5 V
4	DO1	digital output 1 (configured)	max. 200 mA per output	
5	n. c.	Not assigned		

Example circuit

A | B

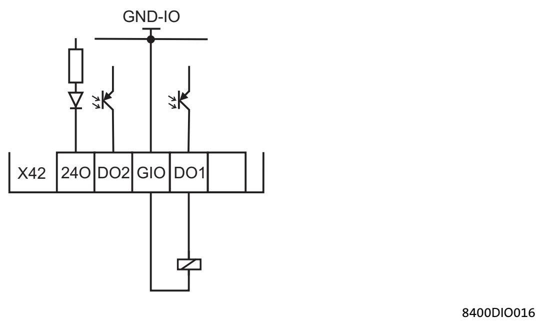


Fig. 6-7 Wiring examples of the digital inputs and outputs

A	Digital control (relay, valve, ...) with internal 24 V supply
B	-
X42	Plug for the digital outputs (configured)
GIO	Ground reference potential for the digital inputs and outputs (GND-IO)

6.6.4 Synchronous serial interface (SSI)

X80 - SSI			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_8	M12 type, 8-pole sockets	
1	CLK+	Pos. clock signal	
2	CLK-	Neg. clock signal	
3	Data+	Pos. data line	
4	Data-	Neg. data line	
5	n. c.	Not assigned	-
6	n. c.	Not assigned	-
7	GIO	Reference potential	External supply at 24E: Voltage drop < 2.5 V Total current for X4x, X50/X8x: 1 A
8	24O	24 V supply of the external SSI encoders	

6.7 Communication

Carry out the installation in accordance with the mounting directives of the fieldbus systems in order to prevent a faulty communication. Please observe the notes on the additional equipotential bonding.

Stop!

High compensation currents

High compensation currents can flow via the shield of the fieldbus cable.

Possible consequences:

Damage to material assets or failures

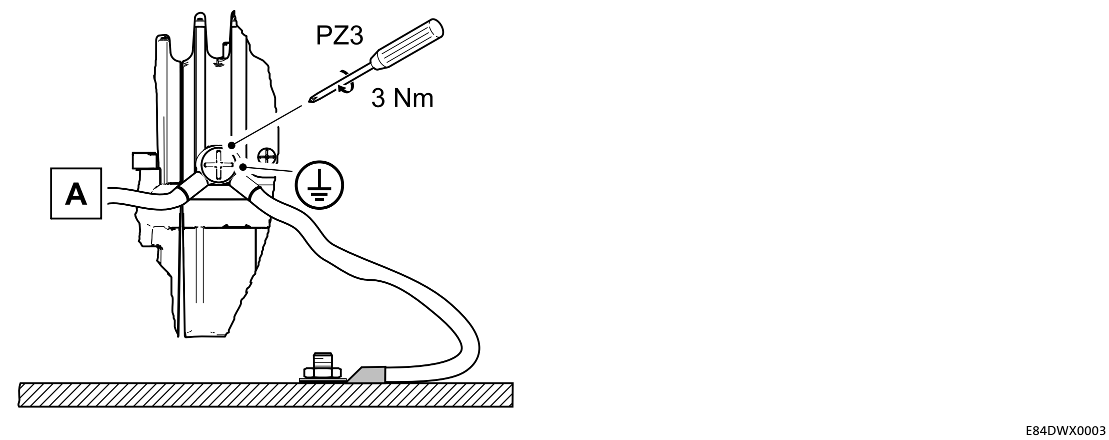
Protective measures:

Prevent compensation currents via the shield of the fieldbus cable as follows:

► Connect all fieldbus nodes with a 16 mm^2 cable via the earthing studs.

► Lay this cable in parallel to the bus cable.

► Ensure a highly conductive connection of all earthing studs with a copper braid cable to the mounting surface.

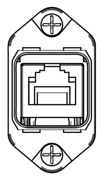


⏚	Earthing for compliance with EMC conditions, prevents compensation currents via the shield of the fieldbus cable
A	16 mm^2 equalizing conductor with ring cable lug M6

The communication cables of the available fieldbus systems can be installed using different plug versions. The type code provides information on the design of one device.

6.7.1 PROFINET® / EtherNet/IP™

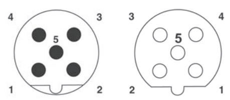
Push-pull plug

X31 - fieldbus input, X32 fieldbus output			
Pin	**Signal**	**Description**	**Data**
	84DWTX0311	AIDA standard, type RJ45, socket, 8-pole	
1	Tx+	Transmit path + (transmit)	
2	Tx-	Transmit path - (transmit)	
3	Rx+	Receive path + (receive)	
4	res.	-	
5	res.		
6	Rx-	Receive path - (receive)	
7	res.	-	
8	res.		

M12 plug, 4-pole

X3x - communication			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type M12, 4-pole, D-coded X31 -> sockets X32 -> sockets	
1	Tx+	Transmit path +	
2	Rx+	Receive path +	
3	Tx-	Transmit path -	
4	Rx-	Receive path -	

6.7.2 PROFIBUS®

X3x - communication			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type M12, 5-pole, B-coded X31 -> input -> pins X32 -> output -> sockets	
1	P5V2	• Only assigned at the output	5 V DC / 30 mA (bus termination)
2	RxD/TxD-N	Data line A (received/transmitted data, minus)	
3	M5V2	Data ground (ground to 5 V)	
4	RxD/TxD-P	Data line B (received/transmitted data, plus)	
5	n. c.	- (shield connection above the housing)	

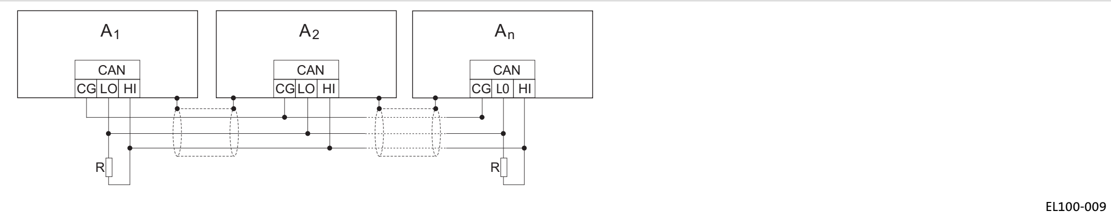
The station address can be set via DIP switches 1 ... 64 behind the service hatch.

6.7.3 CANopen®

X3x - communication			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type: M12, 5-pole, A-coded X31 -> pins X32 -> sockets	
1	n. c.	Not assigned	CAN specification
2	n. c.	Not assigned	
3	CG	CAN-Ground	
4	CH	CAN-HIGH	
5	CL	CAN-LOW	

Example circuit

Wiring example



Terminating resistors of 120 Ω are not integrated and must be wired externally.

6.7.4 CAN on board

X35 - communication			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type: M12, 5-pole, A-coded, sockets	
1	n. c.	Not assigned	CAN specification From HW version VD onwards, the 120 Ω terminating resistor is integrated. HW version: see C00210/10
2	n. c.	Not assigned	
3	CG	CAN-Ground	
4	CH	CAN-HIGH	
5	CL	CAN-LOW	

Software manual for the standard device / »Engineer« online help

Here, detailed information is provided about ...

► CAN communication;
► Parameter setting and configuration;
► System bus (CAN) diagnostics.

6.8 Safety engineering

Please observe the following safety instructions and application notes to preserve the certified safety engineering features and to ensure trouble-free and safe operation.

Danger!

Danger to life through improper installation

Improper installation of safety engineering systems can cause an uncontrolled starting action of the drives.

Possible consequences:

► Death or severe injuries

Protective measures:

► Safety engineering systems may only be installed and commissioned by qualified and skilled personnel.

► All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of ISO 138491 and ISO 13849-2. This includes i.a.:
– Switches, relays with at least IP54 enclosure.
– Control cabinet with at least IP54 enclosure.
– Please refer to ISO 138491 and ISO 13849-2 for all further requirements.

► Wiring must be shielded.

► All safety relevant cables outside the control cabinet must be protected, e.g. by means of a cable duct:
– Ensure that no short circuits can occur.
– For further measures see EN ISO 13849-2.

► If an external force acts upon the drive axes, additional brakes are required. Please observe that hanging loads are subject to the force of gravity!

Danger!

Danger to life by improper installation

Improper installation of the safety equipment may cause an uncontrolled start of the drives.

Possible consequences:

► Death or severe injury

Protective measures:

Shield the cables between the plugs for the safety equipment and the connected components (e.g. sensors, devices, ...).

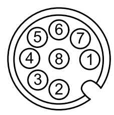
Note!

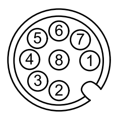
Please observe during transport, storage and operation:

► Cover unused connectors for control connections and interfaces with the plastic covers provided to preserve the certified safety technology features.

X61 - connection of safety system ”Safety Option 10”			
Pin	**Connection**	**Description**	**Data**
	84DPSO05_5	M12, 5-pole pins, A-coded	
1	SIA	Safe input, channel A	I_{typ} = 45 mA LOW: -3 ... 5 V HIGH: 18 ... 30 V Supply through safely separated power supply unit (SELV/PELV).
2	SIB	Safe input, channel, B	
5	GI	1. GND potential for SIA/SIB 2. GND potential for the non-safe signalling output	
4	24O	24-V voltage supply for the non-safe signalling output	24 V, max. 0.2 A short-circuit-proof Supply through safely separated power supply unit (SELV/PELV). High active
3	DO1	Non-safe signalling output: ”SafeTorqueOff” with 2-channel request by SIA **and** SIB	

X62 - connection of safety engineering system ”Safety Option 30”			
Pin	**Connection**	**Description**	**Data**
	84DPSO05_5	M12, 5-pole sockets, A-coded	
1	AIE	Error acknowledgement	
2	24_ACK	24-V supply voltage for reset button	max. 300 mA
3	AIS	Restart acknowledgement	
4	GND_SM	GND potential	
5	GND_SM		

X63 - connection of the ”Safety Option 30” safety engineering system			
Pin	**Connection**	**Description**	**Data**
	84DSO05_8	M12, sockets 8-pole, A-coded	
1	CLA	Clock output, channel A	
2	CLB	Clock output, channel B	
3	GND_CLK	GND potential - clock output, channel A	
4	I1A	Safe input 1, channel A	
5	GND_I1	GND potential - input 1, channel A	
6	I1B	Safe input 1, channel B	
7	GND_CLK	GND potential - clock output, channel B	
8	GND_I1	GND potential - input 1, channel B	

X64 - connection of the ”Safety Option 30” safety engineering system			
Pin	**Connection**	**Description**	**Data**
	84DSO05_8	M12, sockets 8-pole, A-coded	
1	CLA	Clock output, channel A	
2	CLB	Clock output, channel B	
3	GND_CLK	GND potential - clock output, channel A	
4	I2A	Safe input 2, channel A	
5	GND_I2	GND potential - input 2, channel A	
6	I2B	Safe input 2, channel B	
7	GND_CLK	GND potential - clock output, channel B	
8	GND_I2	GND potential - input 2, channel B	

7 Electrical installation - EMS version

7.1 Important notes

Danger!

Dangerous electrical voltage

All power terminals remain live for up to three minutes after mains disconnection.

Possible consequences:

- Death or severe injuries when touching the power terminals.

Protective measures:

- Switch off the power supply and wait for at least three minutes before working on the power terminals.
- Make sure that all power terminals are deenergised.

Danger!

- The contacts of the power connectors **X10, X11, X20 and X21** may carry dangerous voltage if the frequency inverter is connected to the mains. Thus, deenergise the frequency inverter before working on it.
- Earth the device by means of X10 and by connecting it to functional earth (earthing bolt) in order to prevent injury to persons and malfunctioning.

Danger!

Dangerous voltage

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

Possible consequences:

- Death or severe injuries when the device is touched in the event of a fault.

Protective measures:

- Implement the actions required in the EN 61800-5-1. Especially:
  - Fixed installation
  - PE connection must conform to standards (PE conductor diameter $\geq$ 10 mm^2 or PE conductor must be connected twice)

Stop!

No device protection if the mains voltage is too high

The mains input is not internally fused.

Possible consequences:

- ► Destruction of the device if the mains voltage is too high.

Protective measures:

- ► Observe the maximally permissible mains voltage.
- ► Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

Stop!

Pluggable terminal strips or plug connections

Plugging or removing the terminal strips or plug connections during operation may cause high voltages and arcing.

Possible consequences:

- ► Damage of the devices

Protective measures:

- ► Switch off device.
- ► Only plug or remove the terminal strips or plug connections in deenergised status.

Note!

Switching on the controller motor side is permissible for safety shutdown (emergency stop) and for operation of several motors on the controller in V/f operating mode.

Please observe the following:

- ► When switching with the controller is enabled, you can activate monitoring functions of the controller. If no monitoring function is activated, switching is permissible.
- ► The switching elements at the motor end must be rated for DC voltages V_{DCmax} = 800 V.

Note!

Only with the **control element**

► **C** = service switch with protective function

the device can be disconnected from the mains voltage.

Note!

The counter plugs of the power terminals must be equipped with connector housings with a vertical outgoing cable.

Note!

- **It is absolutely necessary to keep the plastic caps on the connectors for the control terminals and interfaces!**
- During transport, storage, and operation, ports not used must be sealed using the plastic caps, in order to maintain the product features in accordance with the technical data.
- Only if this note is observed, the product features certified are ensured for devices with a safety system.

EMC-compliant wiring

Note!

- Establish a good conductive connection to protective earth by means of a copper-braid cable (e.g. mounting surface, machine earth or building earth).
- Lay control cables and data lines separately from the motor cables.
- Connect the shields of the control cables and data lines **at both ends**.

7.1.1 Electrical isolation

The protective insulation of the "8400 Inverter Drives" controllers is implemented according to EN 61800-5-1. The following illustration shows the insulation concept.

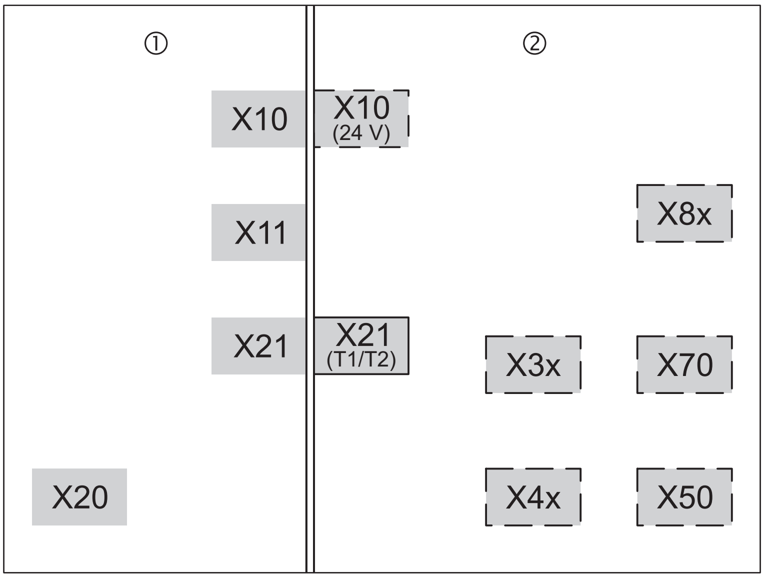


Fig. 7-1 Electrical isolation between power terminals, control terminals and housing

⁞	Isolation by functional insulation
I	Isolation by basic insulation
II	Safe isolation by double or reinforced insulation Protection against accidental contact is guaranteed without any further measures.
①	Power terminals
X10, X11	Mains
X21	Motor
X20	Brake resistor
②	Control terminals
X10 (24 V)	24 V supply voltage for the motor holding brake
X21 (T1/T2)	Motor temperature monitoring
X3x	Fieldbus communication, CAnopen Master PLC
X4x	Digital inputs/outputs
X50	Analog input
X70	Diagnostics
X8x	SSI, RS485/422

7.1.2 Device protection

- ► In case of condensation, do not connect the controller to the mains voltage before the moisture has evaporated completely.
- ► The controller must be protected by external fuses.
- ► Unused control inputs and outputs must be closed according to the intended type of protection.

7.1.3 Maximum motor cable length

- Keep the motor cable as short as possible since this has a positive effect on the drive behaviour.
- The maximally permissible motor cable length is: 20 m, shielded
  - at rated mains voltage
  - at a switching frequency of 8 kHz

Note!

If the conditions for electromagnetic compatibility must be observed, the permissible cable lengths may vary.

7.1.4 Motor protection

- Extensive protection against overload:
  - By overcurrent relays or temperature monitoring.
  - We recommend the use of PTC thermistors or thermostats to monitor the motor temperature.
  - PTC thermistors or thermostats can be connected to the controller.
  - For monitoring the motor, we recommend the use of the I^2xt monitoring.
- Only use motors with an insulation suitable for the inverter operation:
  - Insulation resistance: min. û = 1.5 kV, min. du/dt = 5 kV/µs
  - When using motors with an unknown insulation resistance, please contact your motor supplier.

7.2 Safety instructions for the installation according to U_L or U_R

Original - English

Warnings!

- Branch circuit protection:
  Suitable for use on a circuit capable of delivering not more than 200 000 rms symmetrical amperes, 500 V maximum.
  – When Protected by CC, T, or J Class Fuses.
- Integral solid state protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
- Overload Protection = 125 % of rated FLA.
- Use 75 °C copper wire only, except for control circuits.
- Use Class 1 wire only.
- Enclosed Device, suitable for use in a UL Type 4X (Indoor) Environment.
- Suitable for use in a surrounding air temperature of 45 °C, and
  – additionally 55 °C when de-rating rules are followed.
- Suitable for use in a compartment handling conditioned air.
- The device is provided with internal overload protection. For information on the protection level of the internal overload protection for a motor load, see the corresponding Software Manual or Online Help under the topic ”Motor load monitoring (I^2xt)”. This function has to be activated; i. e. the reaction must be changed from ”Warning” (factory setting) to ”Fault”.
- For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Manual or Online Help.

Warnings!

The opening of branch-circuit protective device may be an indication that a fault has been interrupted.

To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined and replaced if damaged or equivalent.

7.3 Safety instructions for the installation according to U_L or U_R

Original - French

Warnings!

- Branch circuit protection:
  Suitable for use on a circuit capable of delivering not more than 200 000 rms symmetrical amperes, 500 V maximum.
  – When Protected by CC, T, or J Class Fuses.
- Integral solid state protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
- Overload Protection = 125 % of rated FLA.
- Use 75 °C copper wire only, except for control circuits.
- Use Class 1 wire only.
- Enclosed Device, suitable for use in a UL Type 4X (Indoor) Environment.
- Suitable for use in a surrounding air temperature of 45 °C, and
  – additionally 55 °C when de-rating rules are followed.
- Suitable for use in a compartment handling conditioned air.
- The device is provided with internal overload protection. For information on the protection level of the internal overload protection for a motor load, see the corresponding Software Manual or Online Help under the topic ”Motor load monitoring (I^2xt)”. This function has to be activated; i. e. the reaction must be changed from ”Warning” (factory setting) to ”Fault”.
- For information on rating and proper connection of the thermal protector (only for connection to motors having integral thermal protection), see the corresponding Manual or Online Help.

Warnings!

The opening of branch-circuit protective device may be an indication that a fault has been interrupted.

To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined and replaced if damaged or equivalent.

7.4 Installation according to EMC (installation of a CE-typical drive system)

Design of the cables

- It is imperative to comply with the regulations concerning minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- The cables used must comply with the approvals required for the location (e.g. UL).

7.4.1 Shielding

Requirements

- The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90 °.
  - Keeping unshielded cable ends as short as possible.

Use system cables or shielded cables for these connections:

- Motor
- External brake resistor (Mounting Instructions of the brake resistor)
- Motor holding brake (shielding is required when being integrated into the motor cable; connection to optional motor brake control)
- Motor temperature monitoring
- Fieldbus communication (e.g. CANopen)
- Serial interfaces (e.g. SSI, RS485/422)

The following connections need not be shielded:

- Mains
- 24 V supply for motor holding brakes
- Digital signals (inputs and outputs). From a cable length of approx. 5 m onwards, we recommend to use shielded cables.

Connection system

- Directly apply the shielding in the plug.
  - Extensively apply the shielding and ensure electrical conductivity.
  - If required, additionally connect the shield to the cable clamp rail.

7.4.2 Motor cable

- Only use shielded motor cables with braids made of tinned or nickel-plated copper. Shields made of steel braids are not suitable.
  – The overlap rate of the braid must be at least 70 % with an overlap angle of 90 °.
- The cables used must correspond to the requirements at the location (e.g. EN 60204-1).
- Use Lenze system cables.
- Extensively apply the shielding in the plug and attach it in a way which ensures electrical conductivity.
- The motor cable is optimally installed if
  – it is separated from mains cables and control cables,
  – it only crosses mains cables and control cables at right angles,
  – it is not interrupted.
- If the motor cable must be opened all the same (e.g. due to chokes, contactors, or terminals):
  – The unshielded cable ends may not be longer than 100 mm (depending on the cable cross-section).
  – Install chokes, contactors, terminals etc. spatially separated from other components (with a min. distance of 100 mm).
  – Install the shield of the motor cable directly before and behind the point of separation to the mounting plate with a large surface.
- Connect the shield with a large surface to PE in the terminal box of the motor at the motor housing.
  – Metal EMC cable glands at the motor terminal box ensure a large surface connection of the shield with the motor housing.

7.4.3 Control cables

- Control cables must be shielded to minimise interference injections.
- For lengths of 200 mm and more, use only shielded cables for analog and digital inputs and outputs. Under 200 mm, unshielded but twisted cables may be used.
- Connect the shield correctly:
  – The shield connections of the control cables must be at a distance of at least 50 mm from the shield connections of the motor cables and DC cables.
  – Connect the shield of digital input and output cables at both ends.
  – Connect the shield of analog input and output cables at one end (at the drive controller).
- To achieve an optimum shielding effect (in case of very long cables, with high interference) one shield end of analog input and output cables can be connected to PE potential via a capacitor (e.g. 10 nF/250 V) (see sketch).

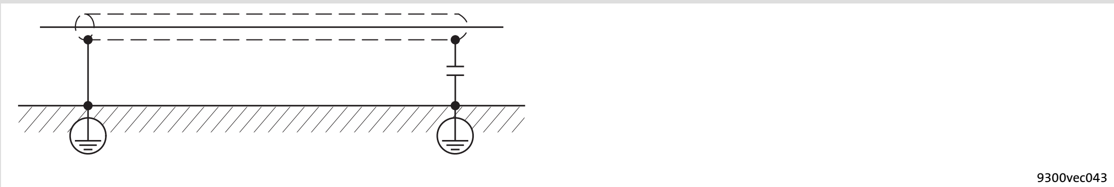


Fig. 7-2 Shielding of long, analog control cables

7.4.4 Wiring

Notes on the laying of cables:

- In the case of greater cable lengths, a greater cable distance between the cables is required.
- In the case of parallel routing (cable trays) of cables with different types of signals, the degree of interference can be minimised by using a metallic cable separator or isolated cable ducts.

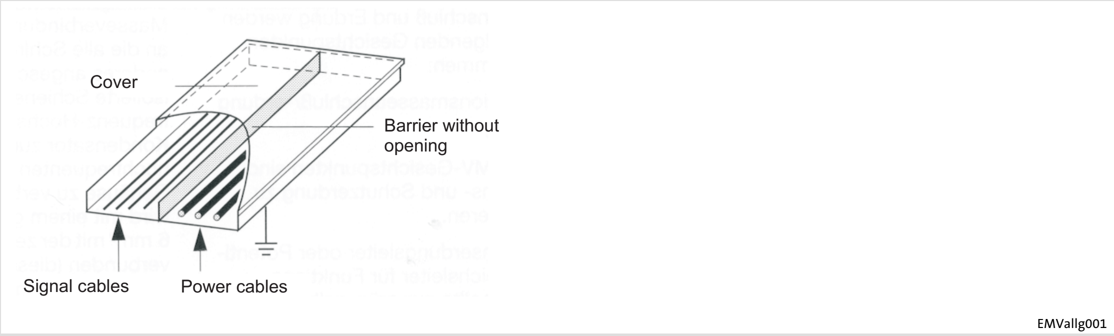


Fig. 7-3 Cable routing in the cable duct with barrier

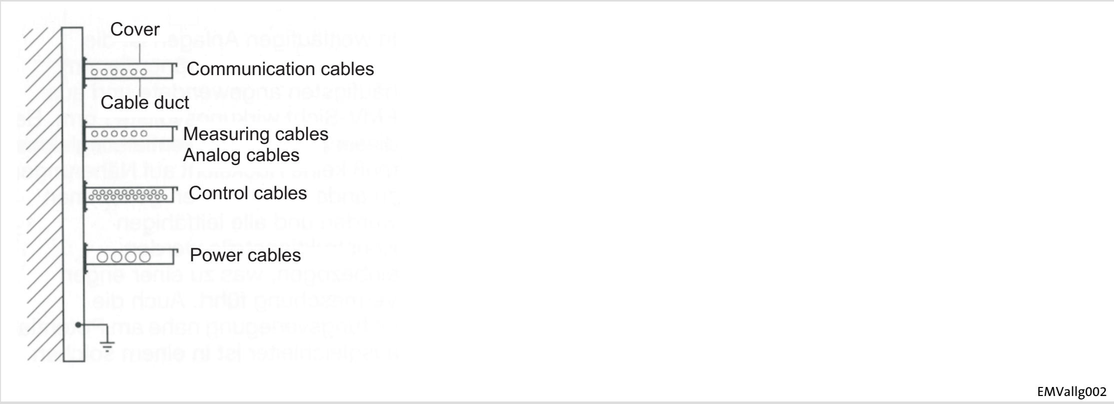


Fig. 7-4 Cable routing in separated cable ducts

Wiring on the mains side

- It is possible to connect the controller, mains choke or RFI filter to the mains via single cores or unshielded cables.
- The cable cross-section must be rated for the assigned fuse protection (VDE 0160).

Wiring on the motor side

STOP

Stop!

The motor cable is highly susceptible to interference. Therefore you will achieve an optimum wiring on the motor side if you

- exclusively use shielded and low-capacitance motor cables.
- do **not** integrate any further cable into the motor cable (e.g. for blowers etc.).
- shield the supply cable for temperature monitoring of the motor (PTC or thermostat) and install it separately from the motor cable.

Special conditions allow you to integrate the supply cable for temperature monitoring of the motor into the motor cable: (📖 114)

Danger!

Uncontrolled motor movements can occur

If the motor cable is damaged, a short circuit between the brake control cables and the motor cables can cause motor movements with low torque.

Possible consequences:

- Personnel in the vicinity of the motor can be injured.

Protective measures:

- Install motor cable in a protected way (e.g. in a cable duct).

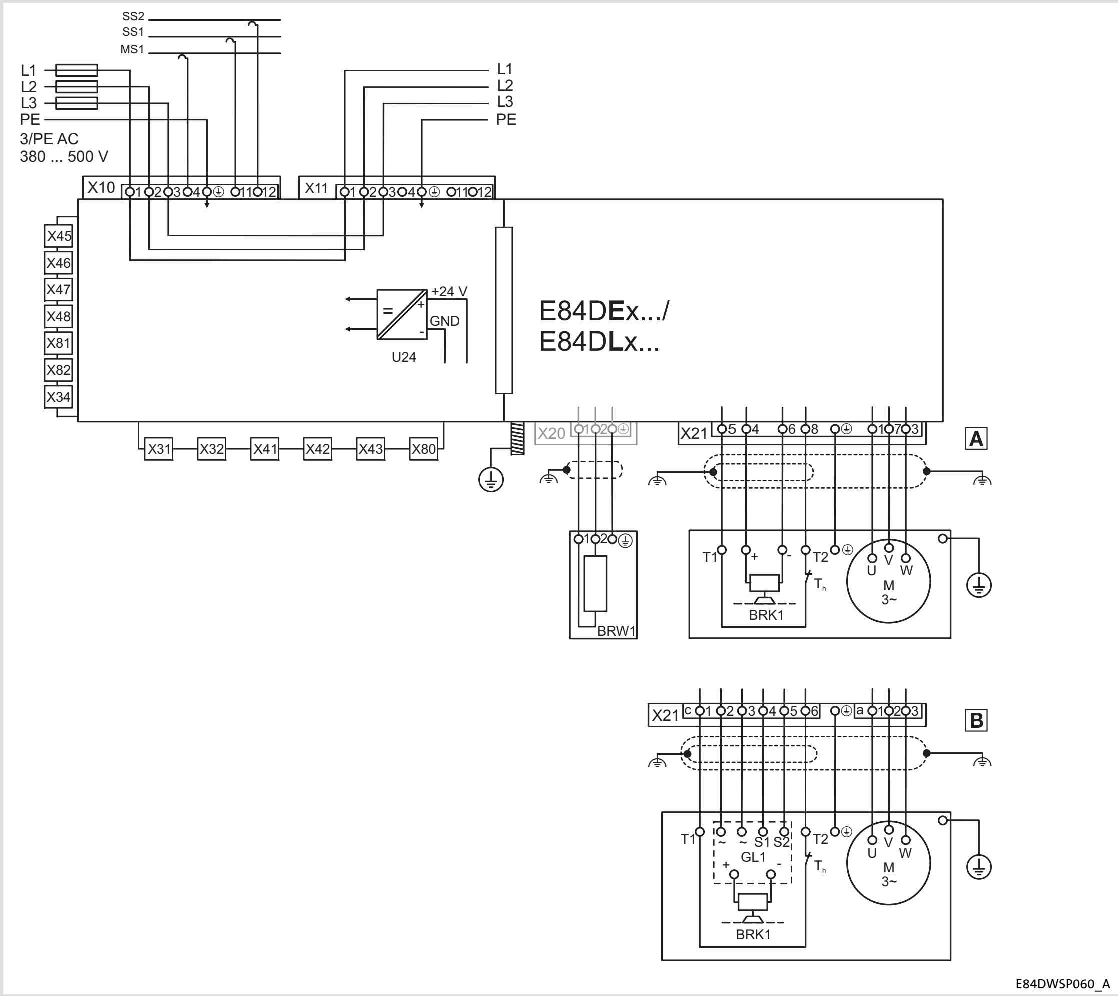
7.4.5 Detecting and eliminating EMC interferences

Fault	Cause	Remedy
Interferences of analog setpoints of your own or other devices and measuring systems	Unshielded motor cable	Use shielded motor cable
	Shield contact is not extensive enough	Carry out optimal shielding as specified
	Shield of the motor cable is interrupted by terminal strips, switched, etc.	● Separate components from other component part with a minimum distance of 100 mm ● Use motor choke/motor filter
	Install additional unshielded cables inside the motor cable (e.g. for motor temperature monitoring)	Install and shield additional cables separately
	Too long and unshielded cable ends of the motor cable	Shorten unshielded cable ends to maximally 40 mm

7.5 Devices in a power range of 0.75 ... 4 kW (3/PE AC 400 V)

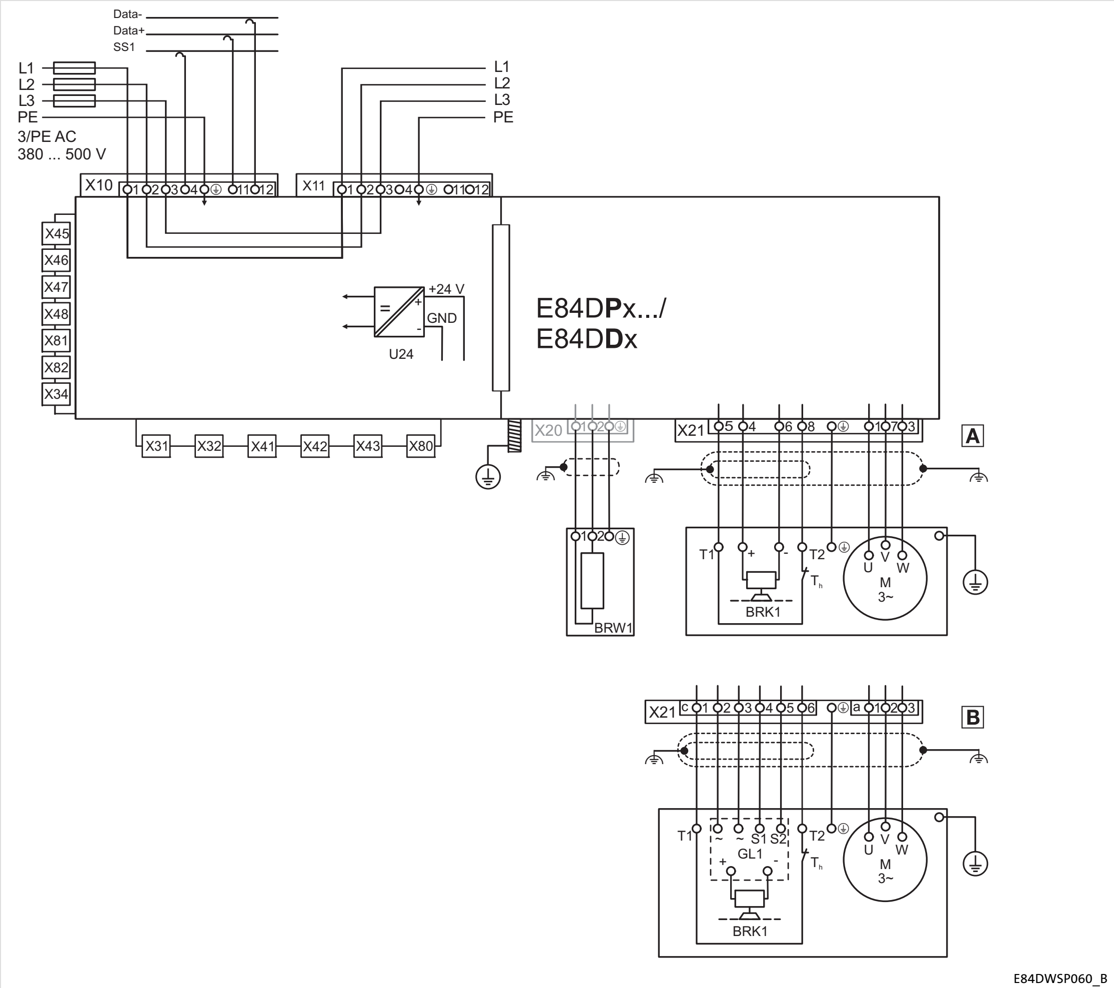
7.5.1 Example circuits

Half wave / half wave coded



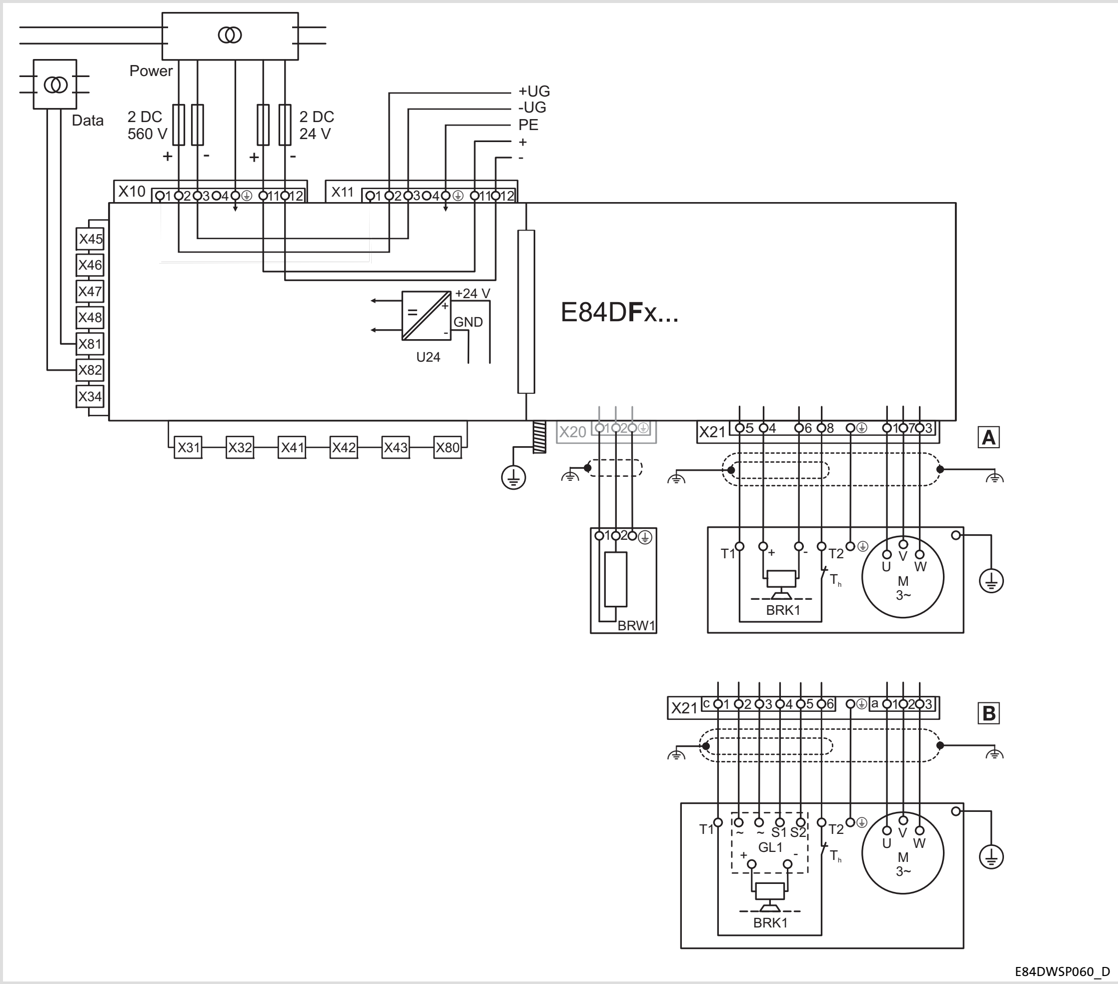
E84D**E**x... / E84D**L**x...	8400 protec EMS controller, half wave / half wave coded
X10: L1, L2, L3, PE	Mains voltage
X10: SS1, SS2, MS1	EMS: control bars, signalling bars
X11	Mains voltage loop-through technique (optional)
X31 ... X32	Fieldbus communication
X34	CANopen master PLC
X41 ... X43	DIO
X45 ... X48	EMS: Further DIO
X80	SSI
X81/X82	EMS: RS485/422
M	Motor
A	Motor connection system: Plug type Q8/0
B	Motor connection system: Plug type Modular
T_h	PTC thermistor (PTC) or thermal contact (NC contact)
BRK1	Spring-applied brake
GL1	Spring-applied brake control
BRW1	External brake resistor at the optional terminal X20
U24	Supply voltage 24 V internal

Power wave / DECA bus



E84D**P**x... / E84D**D**x...	8400 protec EMS controller, power wave / DECA bus
X10: L1, L2, L3, PE	Mains voltage
X10: data±, SS1	EMS: Signalling bars, control bars
X11	Mains voltage loop-through technique (optional)
X31 ... X32	Fieldbus communication
X34	CANopen master PLC
X41 ... X43	DIO
X45 ... X48	EMS: Further DIO
X80	SSI
X81/X82	EMS: RS485/422
M	Motor
A	Motor connection system: Plug type Q8/0
B	Motor connection system: Plug type Modular
T_h	PTC thermistor (PTC) or thermal contact (NC contact)
BRK1	Spring-applied brake
GL1	Spring-applied brake control
BRW1	External brake resistor at the optional terminal X20
U24	Supply voltage 24 V internal

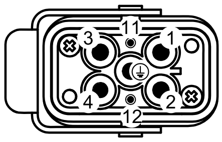
Inductive

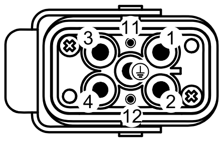


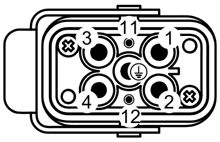
E84D**F**x...	8400 protec EMS controller, inductive system
X10: +UG, -UG, PE	560 V DC (mains voltage)
X10: +, -	24 V DC (motor holding brake)
X11	Mains voltage loop-through technique (optional)
X31 ... X32	Fieldbus communication
X34	CANopen master PLC
X41 ... X43	DIO
X45 ... X48	EMS: Further DIO
X80	SSI
X81/X82	EMS: RS485/422
M	Motor
A	Motor connection system: Plug type Q8/0
B	Motor connection system: Plug type Modular
T_h	PTC thermistor (PTC) or thermal contact (NC contact)
BRK1	Spring-applied brake
GL1	Spring-applied brake control
BRW1	External brake resistor at the optional terminal X20
U24	Supply voltage 24 V internal

7.5.2 Terminal assignment of the power connections

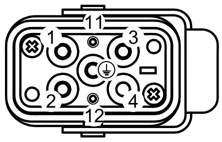
Mains connection

X10 - port for mains, signalling bar, and control bar			
Pin	**Connection**	**Description**	**Data**
 84DWTX0100		DESINA type Q4/2, pins	Version: 8400 protec EMS Type designation: ● E84D**Ex**... (half wave) ● E84D**Lx**... (half wave coded)
1	L1	Mains phase L1	Max. 6 mm^2
2	L2	Mains phase L2	
3	L3	Mains phase L3	
4	MS1	Signalling bar 1	
⏚	PE	PE conductor	
11	SS1	Control bar 1 (Half wave/half wave coded)	Max. 2.5 mm^2
12	SS2	Control bar 2 (half wave optional)	

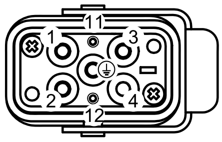
X10 - port for mains, power wave / DECA and control bar			
Pin	**Connection**	**Description**	**Data**
 84DWTX0100		DESINA type Q4/2, pins	Version: 8400 protec EMS Type designation: ● E84D**Px**... (power wave) ● E84D**Dx**... (DECA bus)
1	L1	Mains phase L1	Max. 6 mm^2
2	L2	Mains phase L2	
3	L3	Mains phase L3	
4	SS1	Control bar 1	
⏚	PE	PE conductor	
11	Data+	PW+ / DECA+	Max. 2.5 mm^2
12	Data-	/ DECA-	

X10 - port for DC supply			
Pin	**Connection**	**Description**	**Data**
 84DWTX0100		DESINA type Q4/2, pins	Version: 8400 protec EMS Type designation: ● E84D**Fx**... (inductive)
1	n. c.	Not assigned	Max. 6 mm^2
2	+UG	DC-bus voltage +	
3	-UG	DC-bus voltage -	
4	n. c.	Not assigned	
⏚	PE	PE conductor	
11	+	External supply voltage for motor holding brake 24 V DC	Max. 2.5 mm^2
12	-	External reference potential 24 V DC	

X11 - port for mains loop-through technique (optional)

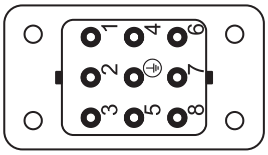
Pin	Connection	Description	Data
 84DWTX0110		DESINA type Q4/2, sockets	Version: 8400 protec EMS Type designation: ● E84D**EM**... (half wave) ● E84D**LM**... (half wave coded) ● E84D**PM**... (power wave) ● E84D**DM**... (DECA bus)
1	L1	Mains phase L1	Max. 6 mm²
2	L2	Mains phase L2	
3	L3	Mains phase L3	
4	n. c.	Not assigned	
⏚	PE	PE conductor	
11	n. c.	Not assigned	Max. 2.5 mm²
12	n. c.	Not assigned	

X11 - port for loop-through technique DC supply (optional)

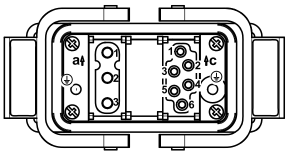
Pin	Connection	Description	Data
 84DWTX0110		DESINA type Q4/2, sockets	Version: 8400 protec EMS Type designation: ● E84D**FM**... (inductive)
1	n. c.	Not assigned	Max. 6 mm²
2	+UG	DC-bus voltage +	
3	-UG	DC-bus voltage -	
4	n. c.	Not assigned	
⏚	PE	PE conductor	
11	+	External supply voltage for motor holding brake 24 V DC	Max. 2.5 mm²
12	-	External reference potential 24 V DC	

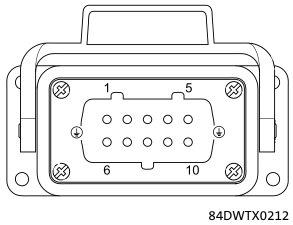
Motor connection

X21 - motor connection - device version E84Dxx**C**...

Pin	Connection	Description	Data
 84DWTX0210		Type Q8/0, sockets Use Lenze system cable: EYP0037xxxxxxxxQ10, 8-core, 1.5 mm² EYP0038xxxxxxxxQ11, 8 core, 2.5 mm²	
2	n. c.	Grooved pin as a protection against mix-up with power bus	
1	U	Motor phase U	Max. 4 mm² Max. output voltage: mains voltage Max. permanent output current: type-dependent
3	W	Motor phase W	
7	V	Motor phase V	
4	BD2	Motor holding brake (reference conductor)	Max. 4 mm²
6	BD1	Motor holding brake	
5	+PTC	Motor temperature monitoring	Max. 4 mm² PTC thermistor (PTC) or thermal contact (NC contact)
8	-PTC		
⏚	PE	PE conductor	Max. 4 mm²

X21 - motor connection - device version E84Dxx**B**...

Pin	Connection	Description	Data
 84DWTX0211		Type Modular, sockets Use Lenze system cable: EYP0039xxxxxxxxQ08, 10-core, 1.5 mm² EYP0040xxxxxxxxQ09, 10-core, 2.5 mm²	
a1	U	Motor phase U	Max. 6 mm² Max. output voltage: mains voltage Max. permanent output current: type-dependent
a2	V	Motor phase V	
a3	W	Motor phase W	
c1	+PTC	Motor temperature monitoring	Max. 4 mm² PTC thermistor (PTC) or thermal contact (NC contact)
c6	-PTC		
c2	~	Supply voltage of brake rectifier	Max. 4 mm² V_{rated} = mains voltage-dependent The brake rectifier is mounted in the terminal box of the motor.
c3	~		
c4	S1	Switch for separation on the DC side	
c5	S2		
⏚	PE	PE conductor	Max. 6 mm²

X21 - motor connection - device version E84Dx**H**...			
Pin	**Connection**	**Description**	**Data**
		Type Han 10E, sockets	
1	U	Motor phase U	Max. 4 mm^2 Max. output voltage: mains voltage Max. permanent output current: type-dependent
2	V	Motor phase W	
3	W	Motor phase V	
4	BD1	Motor holding brake	Max. 4 mm^2
9	BD2	Motor holding brake (reference conductor)	
5	+PTC	Motor temperature monitoring	Max. 4 mm^2 PTC thermistor (PTC) or thermal contact (NC contact)
10	-PTC		
6, 7, 8	n. c.	-	-
⏚	PE	PE conductor	Max. 4 mm^2, above housing

STOP

Stop!

Damage of the devices

A defective motor holding brake or a short circuit on the X21 connection (motor and built-on accessories) causes internal damage to the device.

Possible consequences:

- ► If a defective motor holding brake is connected, the replacement device is also damaged immediately.

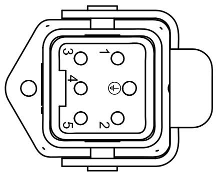
Protective measures:

- ► When devices are replaced due to malfunction of the brake control, ensure that defect-free motor holding brakes are connected.
- ► Check whether the motor holding brake and the connecting cable are free from defects.
- ► Replace or repair defective components.

Note!

In the Lenze setting, the temperature monitoring of the motor is activated! To start motors without thermal detectors, the response of the motor temperature monitoring must be deactivated (C00585). Alternatively, a wire jumper between +PTC and -PTC can be used to simulate a normal temperature.

Connection of external brake resistor

X20 - connection of external brake resistor (optional)			
Pin	**Connection**	**Description**	**Data**
 E84DWX0202		Type Q5, sockets	
1	RB2	Brake resistor	max. 2.5 mm^2
2	RB1		
3	T1	In preparation Brake resistor temperature monitoring	
5	T2		
4	n. c.	Not assigned	
⏚	PE	PE conductor	

7.6 Control terminals

7.6.1 Diagnostics

The following can be optionally connected to the X70 diagnostic interface:

- USB diagnostic adapter E94AZCUS

  In combination with the Lenze PC software »Engineer«, the diagnostic adapter serves to make comprehensive settings via dialogs, e.g. for initial commissioning.

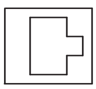
- EZAEBK2001diagnosis terminal

  The diagnosis terminal comprises the keypad including housing and a connecting cable.

  The diagnosis terminal can be used to control or change individual settings. In a quick commissioning menu, the basic settings of the controller can be parameterised using the diagnosis terminal.

The X70 plug is located behind the service hatch. Apply a little pressure to open the service hatch and push the two plastic bars down. Tools are not required.

After using the diagnostic interface, remove the connecting cable at X70 and completely close the service hatch.

X70 - diagnostic interface			
Pin	**Signal**	**Description**	**Data**
 8400HLC009		Type RJ69, 10-pole, socket	
1 ... 10	internal	Terminal for diagnosis terminal or diagnostic adapter	

7.6.2 Digital inputs and outputs

Note!

The maximum total current of the 24 V voltage supply for external actuators and encoders is 1 A, e.g. ports

- ► Digital inputs/outputs at X4x,
- ► Analog input at X50 or SSI at X80, and
- ► Serial interfaces RS485/RS422 at X81/X82.

Digital inputs

X41 - digital inputs DI1, DI2			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI2	Digital input 2	According to IEC61131-2, type 1 or Two-track frequency input for HTL encoder 0 ... 100 kHz
3	GIO	Reference potential	HIGH +15 .... +30 V DC LOW 0 ... +5 V
4	DI1	Digital input 1	8 mA at 24 V DC
5	n. c.	Not assigned	

X42 - digital inputs DI3, DI4			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI4 (DO2)	Digital input 4 (also available as digital output)	HIGH +15 .... +30 V DC
3	GIO	Reference potential	LOW 0 ... +5 V
4	DI3 (DO1)	Digital input 3 (also available as digital output)	8 mA at 24 V DC
5	n. c.	Not assigned	

X43 - digital inputs DI5, DI6

Pin	Signal	Description	Data
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI6	digital input 6	according to IEC61131-2, type 1 or Single-track frequency input, 0 ... 7.5 kHz
3	GIO	Reference potential	HIGH +15 .... +30 V DC LOW 0 ... +5 V
4	DI5	digital input 5	8 mA at 24 V DC
5	n. c.	not assigned	

X45 - digital inputs DI7, DI8

Pin	Signal	Description	Data
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI8	Digital input 8	HIGH +15 .... +30 V DC
3	GIO	Reference potential	LOW 0 ... +5 V
4	DI7	Digital input 7	8 mA at 24 V DC
5	n. c.	Not assigned	

X46 - digital inputs DI9, DI10

Pin	Signal	Description	Data
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI10 (DO4)	Digital input 10 (also available as digital output)	HIGH +15 .... +30 V DC
3	GIO	Reference potential	LOW 0 ... +5 V
4	DI9 (DO3)	Digital input 9 (also available as digital output)	8 mA at 24 V DC
5	n. c.	Not assigned	

X47 - digital inputs DI11, DI12

Pin	Signal	Description	Data
	84DPSO05_5	Type M12, 5-pole sockets	
1	24O	24 V supply of the external sensors	
2	DI12	Digital input 12	HIGH +15 .... +30 V DC
3	GIO	Reference potential	LOW 0 ... +5 V
4	DI11	Digital input 11	8 mA at 24 V DC
5	n. c.	Not assigned	

X48 - digital inputs DI13, DI14				
Pin	Signal	Description	Data	
	84DPSO05_5	Type M12, 5-pole sockets		
1	24O	24 V supply of the external sensors		
2	DI14	Digital input 14	HIGH	+15 .... +30 V DC
3	GIO	Reference potential	LOW	0 ... +5 V
4	DI13	Digital input 13	8 mA at 24 V DC	
5	n. c.	Not assigned		

Example circuit

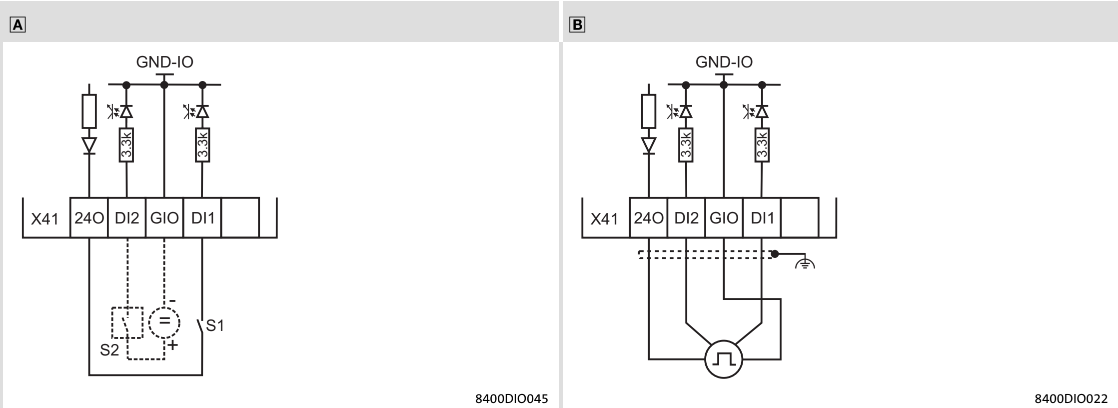


Fig. 7-5 Wiring examples of the digital inputs

A	Wiring of digital inputs, examples:	
S1	Potential-free contact, at internal 24 V supply	
S2	Signal source, e.g. PLC or with external 24 V supply	
B	Connection of an HTL incremental encoder with a maximum input frequency of 100 kHz	
	DI1	track A
	DI2	track B
X41	Plugs for digital inputs X41 ... X43	
GIO	Ground reference potential for the digital inputs and outputs (GND-IO)	

Digital outputs

> **Note!**
> If inductive loads are being connected, it is essential to use a spark suppressor at the digital output.

X42 - digital outputs DO1, DO2 (configured digital input!)				
Pin	**Signal**	**Description**	**Data**	
	84DPSO05_5	Type M12, 5-pole sockets		
1	24O	24 V supply of the external sensors		
2	DO2	digital output 2 (configured)	HIGH	+24 V or V_{DC} at X10
3	GIO	Reference potential	LOW	0 ... +5 V
4	DO1	digital output 1 (configured)	max. 200 mA per output	
5	n. c.	Not assigned		

X46 - digital outputs DO3, DO4 (configured digital inputs)				
Pin	Signal	Description	Data	
	84DPSO05_5	M12 type, 5-pole sockets, A-coded		
1	24O	24 V supply of the external sensors		
2	DO4	Digital output 4	HIGH	+24 V or V_{DC} at X10
3	GIO	Reference potential	LOW	0 ... +5 V
4	DO3	Digital output 3	Max. 200 mA per output	
5	n. c.	Not assigned		

Example circuit

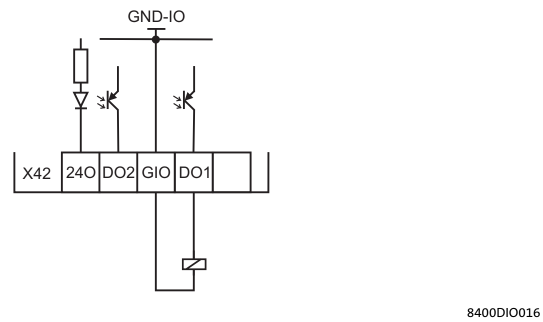
A	B
	

Fig. 7-6 Wiring examples of the digital inputs and outputs

A	Digital control (relay, valve, ...) with internal 24 V supply
B	-
X42	Plug for the digital outputs (configured)
GIO	Ground reference potential for the digital inputs and outputs (GND-IO)

7.6.3 Synchronous serial interface (SSI)

X80 - SSI			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_8	M12 type, 8-pole sockets	
1	CLK+	Pos. clock signal	
2	CLK-	Neg. clock signal	
3	Data+	Pos. data line	
4	Data-	Neg. data line	
5	n. c.	Not assigned	-
6	n. c.	Not assigned	-
7	GIO	Reference potential	External supply at 24E: Voltage drop < 2.5 V Total current for X4x, X50/X8x: 1 A
8	24O	24 V supply of the external SSI encoders	

7.6.4 Interfaces RS485/422 PLC

These connections are available with device versions:

- E84D**D**xxxxxxx**C1C**xxx
- E84D**E**xxxxxxx**C1C**xxx
- E84D**F**xxxxxxx**C1C**xxx
- E84D**L**xxxxxxx**C1C**xxx
- E84D**P**xxxxxxx**C1C**xxx

X81 - RS485 PLC			
Pin	Signal	Description	Data
	84DPSO05_8	M12 type, 8-pole sockets, A-coded	
1	+24V	24 V supply	In accordance with IEC 61131-2, type 1
2	RxD+	RS485A’	In accordance with ANSI/TIA/EIA-485-A-98
3	GND-EXT	Reference potential	24 V supply
4	RxD-	RS485B’	In accordance with ANSI/TIA/EIA-485-A-98
5	TxD+	RS485A	
6	TxD-	RS485B	
7	n. c.	not assigned	-
8	n. c.		

X82 - RS422 PLC			
Pin	Signal	Description	Data
	84DPSO05_8	M12 type, 8-pole sockets, A-coded	
1	+24V	24 V supply	In accordance with IEC 61131-2, type 1
2	RxD+	Reception+	In accordance with ANSI/TIA/EIA-422
3	GND-EXT	Reference potential	24 V supply
4	RxD-	Reception-	In accordance with ANSI/TIA/EIA-422
5	TxD+	Transmission+	
6	TxD-	Transmission-	
7	n. c.	not assigned	-
8	n. c.		

Please observe that the direct coupling of two 8400 protec EMS devices require an external connection with terminating resistors.

7.6.5 Interfaces RS485 PLC

These connections are available with device versions:

- ► E84D**D**xxxxxxx**C**x**B**xxx
- ► E84D**E**xxxxxxx**C**x**B**xxx
- ► E84D**F**xxxxxxx**C**x**B**xxx
- ► E84D**L**xxxxxxx**C**x**B**xxx
- ► E84D**P**xxxxxxx**C**x**B**xxx

X81/X82 - RS485 PLC			
Pin	Signal	Description	Data
	84DPSO05_8	M12 type, 8-pole sockets, A-coded	
1	TxD+	RS485A	In accordance with ANSI/TIA/EIA-485-A-98
2	TxD-	RS485B	
3	RxD+	RS485A’	
4	RxD-	RS485B’	
5	n. c.	Not assigned	-
6	n. c.		
7	GND-EXT	Reference potential	In accordance with IEC 61131-2, type 1
8	+24V	24 V supply	

7.6.6 Interfaces RS422 PLC

These connections are available with device versions:

- ► E84D**D**xxxxxxx**C**x**D**xxx
- ► E84D**E**xxxxxxx**C**x**D**xxx
- ► E84D**F**xxxxxxx**C**x**D**xxx
- ► E84D**L**xxxxxxx**C**x**D**xxx
- ► E84D**P**xxxxxxx**C**x**D**xxx

Because of the integrated PLC also SSI encoders can be evaluated at RS422 interfaces (max. 150 kHz).

X81/X82 - RS422 PLC			
Pin	Signal	Description	Data
	84DPSO05_8	M12 type, 8-pole sockets, A-coded	
1	TxD+ (CLK+)	Transmission+	• In accordance with ANSI/TIA/EIA-422 • At RS422, PLC supports evaluation of SSI encoders (max. 150 kHz).
2	TxD- (CLK-)	Transmission-	
3	RxD+ (Data+)	Reception+	
4	RxD- (Data-)	Reception-	
5	n. c.	Not assigned	-
6	n. c.		
7	GND-EXT	Reference potential	In accordance with IEC 61131-2, type 1
8	+24V	24 V supply	

Please observe that the direct coupling of two 8400 protec EMS devices require an external connection with terminating resistors.

7.7 Communication

Carry out the installation in accordance with the mounting directives of the fieldbus systems in order to prevent a faulty communication. Please observe the notes on the additional equipotential bonding.

Stop!

High compensation currents

High compensation currents can flow via the shield of the fieldbus cable.

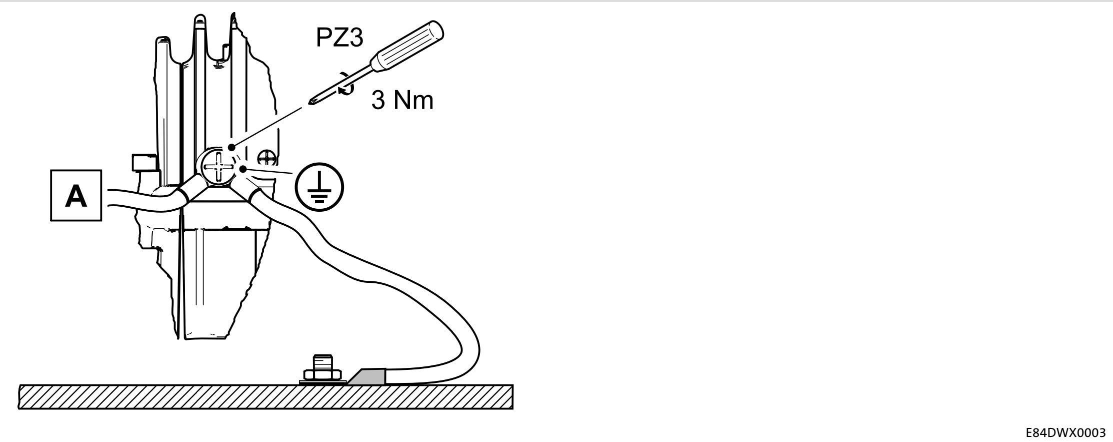
Possible consequences:

Damage to material assets or failures

Protective measures:

Prevent compensation currents via the shield of the fieldbus cable as follows:

- ► Connect all fieldbus nodes with a 16 mm^2 cable via the earthing studs.
- ► Lay this cable in parallel to the bus cable.
- ► Ensure a highly conductive connection of all earthing studs with a copper braid cable to the mounting surface.



⏚	Earthing for compliance with EMC conditions, prevents compensation currents via the shield of the fieldbus cable
A	16 mm^2 equalizing conductor with ring cable lug M6

The communication cables of the available fieldbus systems can be installed using different plug versions. The type code provides information on the design of one device.

7.7.1 CANopen

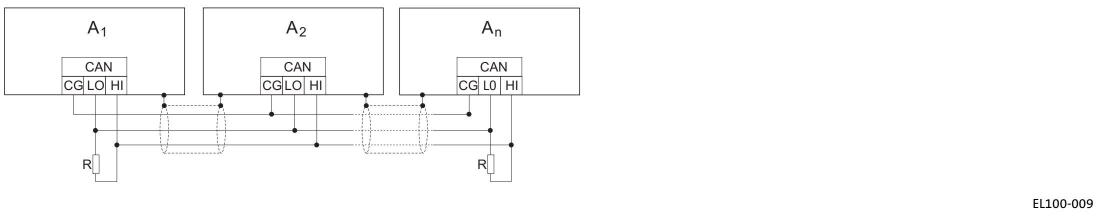
X3x - communication			
Pin	**Signal**	**Description**	**Data**
	84DPSO05_5	Type: M12, 5-pole, A-coded X31 -> pins X32 -> sockets	
1	n. c.	Not assigned	CAN specification
2	n. c.	Not assigned	
3	CG	CAN-Ground	
4	CH	CAN-HIGH	
5	CL	CAN-LOW	

7.7.2 CANopen master PLC

X34 - CANopen master PLC			
Pin	Signal	Description	Data
	84DPSO05_5	M12 type, 5-pole sockets, A-coded	
1	⏚	Shielding (functional earth)	-
2	n. c.	Not assigned	-
3	CAN_GND	CAN GND	
4	CANH	CAN HIGH	In accordance with CAN specification
5	CANL	CAN LOW	

Example circuit

Wiring example



Terminating resistors of 120 Ω are not integrated and must be wired externally.

Software manual for the standard device / »Engineer« online help

Here, detailed information is provided about ...

► CAN communication;

► Parameter setting and configuration;

► System bus (CAN) diagnostics.

8 Commissioning

Note!

- Please observe the general safety instructions (📖 14).
- Please observe the notes regarding residual hazards (📖 20).

Danger!

Uncontrolled motor movements may occur

Under certain conditions, the motor may rotate after mains connection.

Possible consequences:

- Near the machine or plant, situations may arise that are hazardous to persons.
- The machine or plant may be damaged by an unexpected start.

Protective measures:

- Commissioning with external 24 V supply and without mains voltage
- Remove motor connector X21. An active motor temperature monitoring prevents a motor voltage from being output. If the monitoring is deactivated, a voltage may be applied at the plug.
- Ensure that no setpoint is applied.

8.1 Before switching on

Note!

Please observe during transport, storage and operation:

- Cover unused connectors for control connections and interfaces with the plastic covers provided to preserve the certified safety technology features.

Check that all connectors are properly locked in order to ensure trouble-free operation.

Note!

- Comply with the respective switch-on sequence.
- In case of trouble during commissioning, the following supports you:
  - The ”Diagnostics” chapter
  - The online help in the »Engineer«
  - The software manual of the prevailing device version

In order to avoid injury to persons or damage to material assets, check ...

... before switching on the mains voltage:

- Check the wiring for completeness, short-circuit and earth fault
- The ”emergency switching off” function of the entire plant
- The motor circuit configuration (star/delta) must be adapted to the output voltage of the controller
- The in-phase connection of the motor
- The direction of rotation of the incremental encoder (if available)

...the setting of the most important drive parameters before controller enable to ensure the following:

- The V/f rated frequency is adapted to the motor circuit configuration!
- The drive parameters relevant for your application are set correctly!
- The configuration of the analog and digital inputs and outputs are adapted to the wiring!

Tip!

Use the L-force ”Engineer” to carry out extensive parameter setting and configuration. The L-force keypad can be used for quick commissioning and checking individual parameters. If you want to use the L-force ”Engineer”, the online help and the software documentation for the controller assist you.

8.2 Preparing the commissioning procedure

You need the following for commissioning:

- ► Computer with a Windows® operating system (XP, 7 or 2000)
- ► Lenze »Engineer« PC software
- ► Connection to the controller via an interface, e.g.
  – diagnostic interface X70 with diagnostic USB adapter
  – Fieldbus
- ► Software manual for the technology application used
- ► Hardware manual (GHB)
- ► Manual for the drive-based safety
- ► Communication manual for the network of the automation platform
- ► 24 V voltage supply for the control electronics of the controller
  – by switching on the mains voltage
  – alternatively by a 24-V buffer voltage

Follow the instructions of the software and/or read the documentation.

Selection of the appropriate commissioning tool

There are two ways to commission the 8400 frequency inverter:

- ► Commissioning using the keypad (or diagnosis terminal)
  – For simple drive tasks such as quick commissioning of the 'Speed closed-loop control' standard application
- ► Commissioning using the »Engineer«
  – For rather demanding drive tasks such as 'Table positioning' of the HighLine version
  – Supported by online help and accompanying software documentation (software manual)

Note!

The following can be used at the diagnostic interface X70:

- ► Diagnosis terminal X401 (EZAEBK2003)
  – The described settings with the keypad X401 can also be carried out with the diagnosis terminal X401.
- ► USB diagnostic adapter (E94AZCUS)

Notes on commissioning in the case of an external 24 V supply

The following sequence must be observed when commissioning devices with an external 24 V supply:

- Switch-on
  - Connection of the external 24 V supply
    The control electronics and fieldbus communication are started and the display shows the ”LU” message (undervoltage in the DC bus)
  - Connection of the 400 V mains voltage
    The message in the display goes off / changes over to .
- Switch-off
  - Switch-off of the 400 V mains voltage
  - Switch-off of the 24 V supply

Note!

The functions of the control electronics become inactive when the 24 V supply is switched off. The switch function of Ethernet-based fieldbuses is also inactive.

Switching the 24 V supply when the mains voltage is applied may lead to an error status in higher-level controls.

Notes for the commissioning of EMS versions

For EMS version devices, in addition the following has to be observed:

- Devices with a rocker switch control element
  - To enable the controller, the rocker switch has to be operated.
  - Operating the rocker switch again inhibits the controller.
- Device without a rocker switch control element
  The controller has to be enabled using the available communication options.

Notes for motor operation

Danger!

- For thermal reasons, continuous operation of self-ventilated motors at low field frequency and rated motor current is not permissible. If required, activate a motor temperature monitoring with C00585
  – motor temperature monitoring with I^2xt (see software manual)
  – motor temperature monitoring with motor PTC (see software manual).
- Select 87-Hz operation under code C00015 if an asynchronous motor in delta connection (nameplate data: 400 V⋎/230 V△) is to be operated on a frequency inverter for a supply voltage of 400 V.

Tip!

In the Lenze setting, the ”linear V/f characteristic” operating mode is set as motor control. The parameter settings are preset so that if the frequency inverter and the 50 Hz asynchronous machine match in terms of power, the controller is ready for operation without any further need for parameterisation and the motor operates satisfactorily.

Recommendations for the following application cases

- If the frequency inverter and the motor differ strongly in terms of power
  – Set code C00022 (I_{max} limit in motor mode) to 2.0 $I_{N(motor)}$.
- If a high starting torque is required
  – When the motor is idling, set the code C00016 (V_{min} boost) so that a rated motor current flows with a field frequency f = 3 Hz (C00058).
- For noise reduction
  – Set code C00018 to the value ”3” (switching frequency 16 $kHz_{sin\ var}$).
- If a high torque without feedback is to be available at low speeds, we recommend the ”vector control” mode.

8.3 Quick commissioning

Target

For test and demonstration purposes, the load-free motor shall be rotated in best time with an amount of wiring as little as possible and few settings.

Keypad or setpoint potentiometer

For this simple application, you can choose between two drive control options:

- Keypad control (📖 146), i.e. the X400 keypad is used as setpoint source
- Terminal control (📖 148), i.e. a setpoint potentiometer connected to the controller terminals is used as setpoint source

Diagnostics

In addition to the keypad, also use the LEDs on the front of the controller for drive diagnostics:

- Two LEDs indicate the device status (DRIVE READY and DRIVE ERROR)
- Two LEDs indicate the bus status (CAN-RUN and CAN-ERROR)

The LEDs for the bus status are less important during quick commissioning.

Tip!

The handling of the keypad X401 or the diagnosis terminal X401 is described in the operating instructions. The instructions are supplied with the keypad and are also included in electronic form on the product CD "L-force Inverter Drives 8400".

8.3.1 Keypad control

Commissioning steps

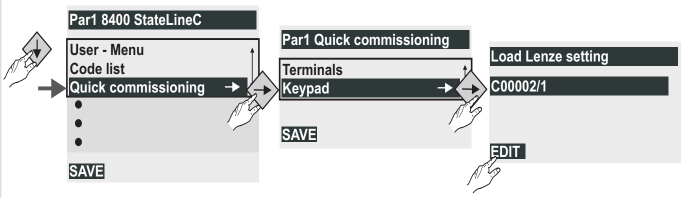
1. Wiring of power terminals

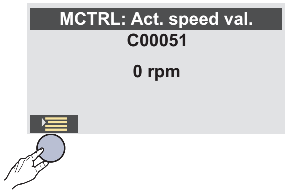
The "Electrical installation" chapter and the mounting instructions provide information on the correct wiring of the power terminals according to the requirements of your device.

2. Wiring of control terminals.
3. Load Lenze setting to controller

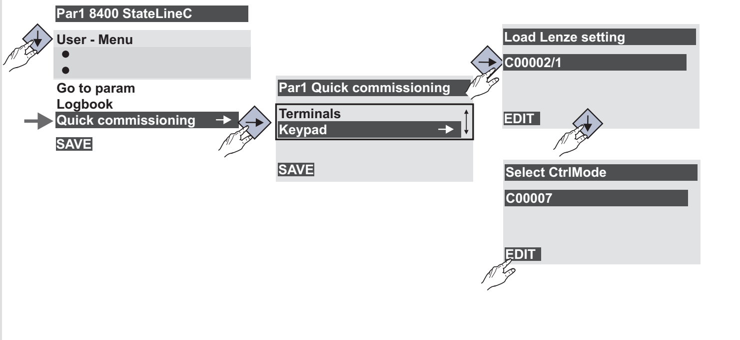
> **Note!**
> The application "actuating drive speed" is implemented with the Lenze setting.

	After attaching the keypad or switching on the controller with keypad attached, the connection between keypad and controller is established. The connection has been established when the code C00051 appears in the display. ● Then press the left function key.

	● Starting from "User menu" scroll down with button to "Quick commissioning" menu ● Click right button. ● Select "Keypad" menu. ● Click right button. ● Code 00002/1: – Parameterise with left "Edit" function key – Select value "1"- -> On/Start and confirm with right "OK" function key.

	● When the Lenze setting is loaded, the display goes off for a short time. ● When the display goes on again, the main menu appears. – The main menu settings can be defined by the user using codes C00465 ... C00469. ● Press the left function key to go to the user menu.

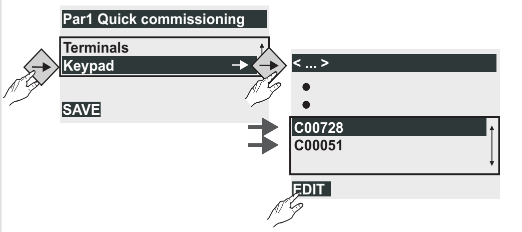
4. Set keypad control



Continue as in commissioning step ▶ 3. Load Lenze setting to controller:
- – ”Quick commissioning” menu
- – Keypad
- – Load Lenze setting

Use the ”down” navigation key to go to code C00007 for selecting the control mode:
- Select parameter code 00007 and parameterise with ”Edit”
- Select value ”20”- -> keypad and confirm with ”OK”.

5. Enable controller:
   – 8400 protec controllers are automatically enabled after mains connection. They can also be enabled or inhibited via code C00002/16.
6. Vary the motor speed using the keypad or by defining different fixed setpoints:



Keypad	Code	Subcode	Motor speed
	C00728	3	CCW rotation: -199.99 % .... 0 (of C00011) CW rotation: 0 .... +199.99 % (of C00011)
	C00051	-	Display of actual speed value

▶ Please observe:
   – The actual speed value: C00051

7. Save the settings with SAVE in the keypad.

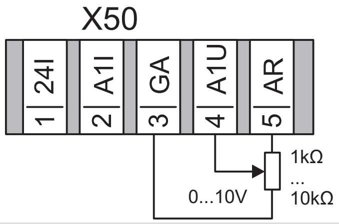
8.3.2 Terminal control

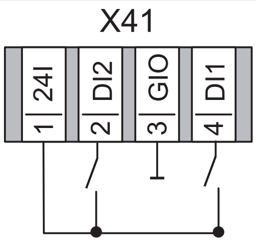
Commissioning steps

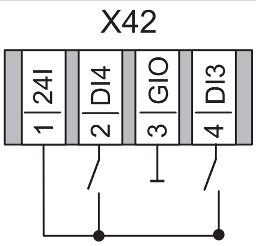
1. Wiring of power terminals

Make use of the Mounting Instructions supplied with the frequency inverter to wire the power terminals according to the requirements of your device.

2. Wiring of control terminals.

Analog inputs at X50	Assignment	Terminal control
	A1U	Setpoint selection 10 V (=100 %): 1500 min^{-1} (with 4-pole motor)

Wiring of the digital outputs at X41	Assignment	Terminal control
	DI1	Fixed frequency 1 ... fixed frequency 3, see table below
DI1 ... DI2: active = HIGH	DI2	

Wiring of the digital outputs at X42	Assignment	Terminal control
	DI3	DCB
DI3 ... DI4: active = HIGH	DI4	Direction of rotation left/right (CCW/CW)

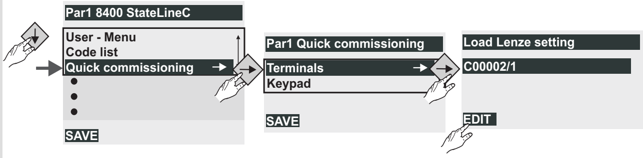
3. If you can be sure that the frequency inverter is in the default state (Lenze setting), you can skip the following step. If not, establish the Lenze setting of the frequency inverter. We recommend to use the keypad for this.

Note!

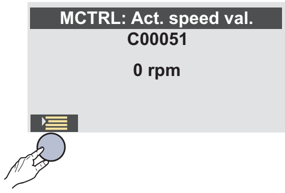
The application ”actuating drive speed” is implemented with the Lenze setting.

After attaching the keypad or switching on the controller with keypad attached, the connection between keypad and controller is established.
The connection has been established when the code C00051 appears in the display.

- Then press the left function key.



- Starting from ”User menu” scroll down with button to ”Quick commissioning” menu
- Click right button.
- Select ”Keypad” menu.
- Click right button.
- Code 00002/1:
  – Parameterise with left ”Edit” function key



- When the Lenze setting is loaded, the display goes off for a short time.
- When the display goes on again, the main menu appears.
  – The main menu settings can be defined by the user using codes C00465 ... C00469.
- Press the left function key to go to the user menu.

4. Enable controller:
   – 8400 protec controllers are automatically enabled after mains connection. The motor rotates according to the default value at the analog input or the defined fixed setpoints.
5. Vary the motor speed with the potentiometer or by defining different fixed setpoints:

DI2	DI1	Motor speed
0	0	Setpoint by potentiometer
0	1	40 % of C00011 (reference speed)
1	0	60 % of C00011 (reference speed)
1	1	80 % of C00011 (reference speed)

► Please observe
– the actual speed value: C00051
– the front LEDs (161)

6. Save the settings with SAVE in the keypad.

9 Braking operation

When electric motors are braked, the kinetic energy of the drive train is fed back into the DC circuit regeneratively. This energy leads to an increase in the DC bus voltage. In order to avoid overvoltage in the DC bus, several different strategies can be used:

- Braking operation without brake resistor

  For braking operation without brake resistor, integrated functions are used in the inverter which can be parameterised with the »Engineer«:

  – DC-injection brake DCB

  – Stop of the ramp function generator

  – Inverter motor brake (from software version 01.01)

  The functions are suitable for simple applications which do not require an exact compliance with the deceleration ramp. The functions can be combined, e. g. for an emergency braking in case the brake resistor fails.
- Braking operation with internal brake resistor
- Braking operation with external brake resistor
- Braking operation with spring-applied brake

Stop!

- The two braking procedures ”Stopping of the ramp function generator” and ”Inverter motor brake” are only active in speed-controlled applications if the position controller does not interfere!
- Do not additionally adapt the motor load (I2xt) if the inverter motor brake is used!
  In this case, the motor may thermally overload or the motor overload monitoring (I2xt) may be working incorrectly!

9.1 Braking operation without brake resistor

DC injection brake DCB

To decelerate small masses, the ”DC injection brake DCB” function can be parameterised. DC-injection braking enables a quick deceleration of the drive to standstill without the need for an external brake resistor.

- Code C00036 can be used to select the braking current.
- The maximum braking torque to be realised by the DC braking current amounts to approx. 20 ... 30 % of the rated motor torque. It is lower compared to braking action in generator mode with external brake resistor.
- Automatic DC-injection braking (Auto-DCB) improves the starting performance of the motor when the operation mode without speed feedback is used.

Further information on the relevant parameters can be obtained from the software manual.

Stopping of the ramp function generator

The "Stopping of the ramp function generator" response is set in C00175. If the brake chopper threshold in the DC-bus connection which results from C00173 and C00174 is exceeded, the ramp function generator is stopped.

This function is suitable for braking operations with reduced dynamics and torque oscillations.

Inverter motor brake

During this alternative braking procedure which can be selected in C00175, the energy conversion of the regenerative energy of the motor is achieved by dynamic acceleration/deceleration while the ramp function generator is ramped down.

The ramp function generator is stopped during acceleration. Using a hysteresis controller, the speed set in C00987 is added to the speed setpoint. The sign of the current actual speed is considered in the process. The ramp function generator is also stopped if an overvoltage occurs.

If the DC-bus voltage falls below a defined DC-bus voltage potential of the hysteresis controller, the connected additive speed is removed and the ramp function generator is enabled again.

The energy which results from the alternating acceleration and braking procedure due to this switching operation is converted into heat in the motor.

In general, the following applies to the "Inverter motor brake" function:

- ► The regenerative energy converted in the motor can be increased and the braking procedure can be accelerated if the additive speed setpoint is decelerated and the corresponding filter time constant is reduced.
- ► There may be procedure-related torque oscillations. Mechanical vibrations can be reduced by reducing the additive speed setpoint (C00987) or by increasing the filter time constant.

The illustration below provides a schematic overview of the function modes of the various braking procedures:

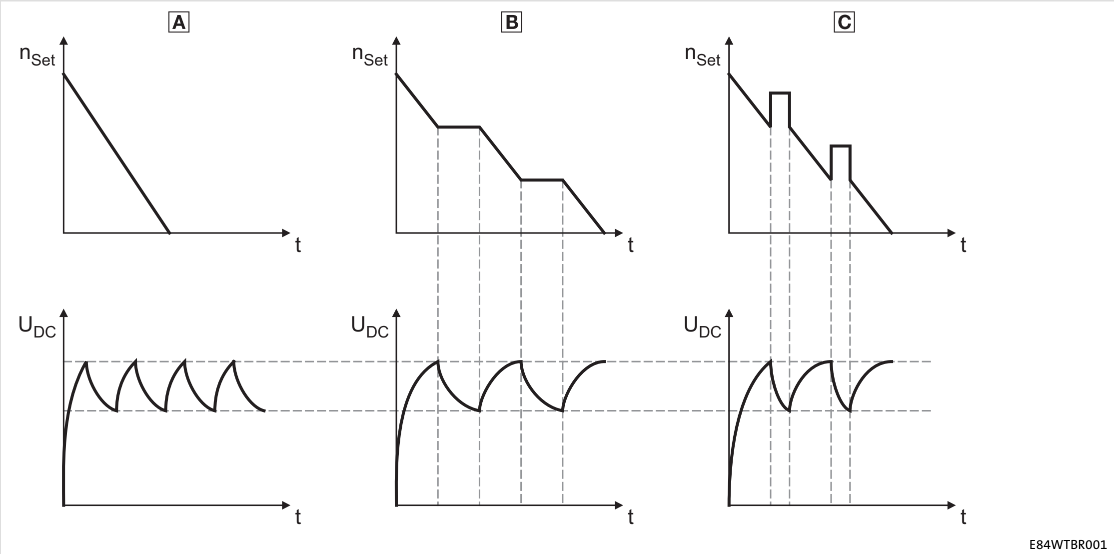


Fig. 9-1 Behaviour of the effective speed setpoint and the DC-bus voltage during the braking process

Further information on the parameterisation of all mentioned braking procedures for the respective device version is provided in the chapter "Motor control (MCTR)".

9.2 Braking operation with internal brake resistor

Inverters for motor powers of 0.75 kW and 1.5 kW are available with an internal brake resistor. For these inverters, the codes C00129, C00130 and C00131 cannot be parameterised. They are automatically set to the standard values of the internal brake resistor.

9.3 Braking operation with external brake resistor

To decelerate greater moments of inertia or with a longer operation in generator mode an external brake resistor is required. It converts braking energy into heat.

The brake resistor is connected if the DC-bus voltage exceeds the switching threshold. This prevents the controller from setting pulse inhibit through the ”Overvoltage” fault and the drive from coasting. The external brake resistor serves to control the braking process at any time.

The brake chopper integrated in the controller connects the external brake resistor.

- ► Adapt the switching threshold to the mains voltage (C00173/C00714, see software manual).

The rated data for the brake chopper are provided in the chapters 4.2.2 and 4.2.3.

9.3.1 Selection of the brake resistors

To decelerate greater moments of inertia or with a longer operation in generator mode an external brake resistor is required. It converts braking energy into heat.

The brake resistors recommended in the accessories chapter are designed to tolerate a regenerative power of approx. 1.5 times the normal value. The cycle time of the brake resistors is 150 s and includes a braking time of max. 15 s and a recovery time (pause) of min. 135 s.

- ► The brake resistors are equipped with a thermostat each (potential-free NC contact, switching capacity: AC 250V, 0.5A).
- ► To increase the power, brake resistors can be connected in parallel or in series.
  - – The resistance for the controller must not fall below the lowest permissible value.
  - – The thermostat of several brake resistors at a controller must always be connected in series.

Note!

The 8400 protec devices do not allow for the thermostats of brake resistors to be monitored via a specific terminal.

Exception: E84DHxxx7524

For special applications, e.g. centrifuges, the suitable brake resistor must meet the following criteria:

Brake resistor	Application	
Criterion	**with active load**	**with passive load**
Continuous braking power [W]	$\geq P_{max} \cdot \eta_e \cdot \eta_m \cdot \frac{t_1}{t_{zykl}}$	$\geq \frac{P_{max} \cdot \eta_e \cdot \eta_m}{2} \cdot \frac{t_1}{t_{zykl}}$
Heat quantity [Ws]	$\geq P_{max} \cdot \eta_e \cdot \eta_m \cdot t_1$	$\geq \frac{P_{max} \cdot \eta_e \cdot \eta_m}{2} \cdot t_1$
Resistance [Ω]	$R_{min} \leq R \leq \frac{U_{DC}^2}{P_{max} \cdot \eta_e \cdot \eta_m}$	

Active load	Can start to move independently of the drive (e.g. unwinder)
Passive load	Can stop independently of the drive (e.g. horizontal travelling drives, centrifuges, fans)
V_{DC} [V]	Brake chopper switching threshold from C0174
P_{max} [W]	Maximum occurring braking power determined by the application
η_e	Electrical efficiency (inverter + motor) Guide values: 0.54 (0.25 kW) ... 0.85 (11 kW)
η_m	Mechanical efficiency (gearbox, machine)
t_1 [s]	Braking time
t_{cycl} [s]	Cycle time = time between two successive braking processes (= t_1 + dead time)
R_{min} [Ω]	Minimum permissible brake resistance (see rated data of the integrated brake chopper)

9.3.2 Wiring of brake resistor

Danger!

Hazardous electrical voltage

During operation of the standard device and **up to 3 minutes after power-off** hazardous electrical voltages may occur at the terminals of the brake resistor.

Possible consequences:

- ► Death or severe injuries when touching the terminals.

Protective measures:

- ► Disconnect the standard device from the mains before working on the brake resistor.
- ► Check all power terminals for isolation from supply.
- ► Select the mounting location so that the operating conditions mentioned in the mounting instructions for the brake resistor are permanently guaranteed.

Danger!

Hot surface

The brake resistor may get very hot. (For temperatures see the mounting instructions for the brake resistor.)

Possible consequences:

- ► Severe burns when touching the brake resistor.
- ► Fire or smouldering fire if flammable material is placed near the brake resistor or may get to it.

Protective measures:

- ► Before working on the brake resistor, check its surface temperature.
- ► Select the mounting location so that the operating conditions mentioned in the mounting instructions for the brake resistor are permanently guaranteed.
- ► Protect the mounting location through fire prevention.

Protect the brake resistor and controller against destruction caused by overload:

- ► Establish an external safety shutdown using the thermostat of the brake resistor to disconnect the controller from the mains.
- ► Exception for devices with special connection for the thermostat of the brake resistor: Use the device-internal safety shutdown.

Connecting cable version

- ► up to 0.5 m: twisted and unshielded
- ► from 0.5 to 5 m: shielded
  – Use shielded cables to meet the EMC requirements.

Wiring principle

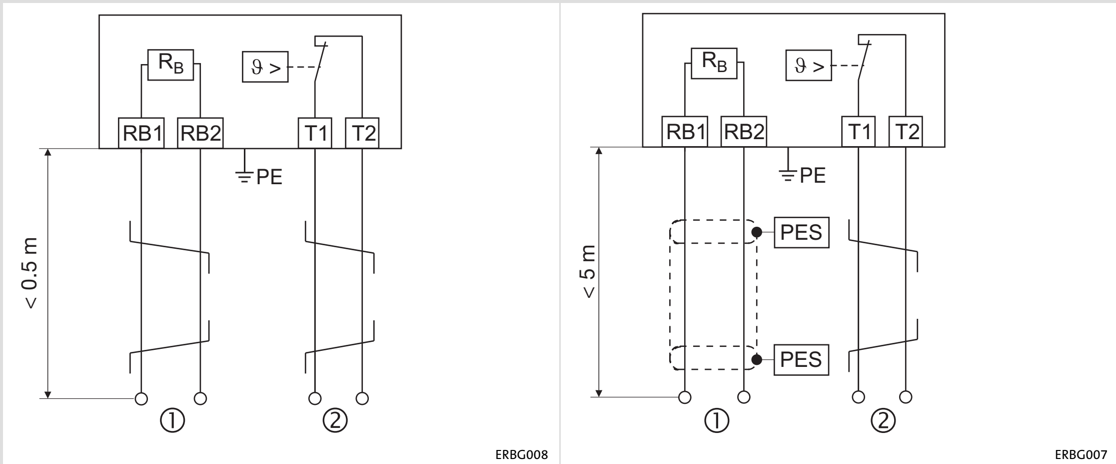


Fig. 9-2 Wiring of a brake resistor to the controller

PES	HF-shield termination by PE connection via shield clamp
Rb1, Rb2	Terminals of the brake resistor
①	Supply cable to the controller
T1, T2	Terminals temperature monitoring of the brake resistor (thermal contact/NC contact)
②	Supply cable for evaluation of temperature monitoring (to be integrated e.g. into the latch circuit of the mains contactor of the supply)

The brake resistor is thermally stressed due to converted braking power and may be thermally destroyed as a consequence of excessive braking power.

To avoid thermal overload of the brake resistor:

► set additional parameters in the »Engineer«

or

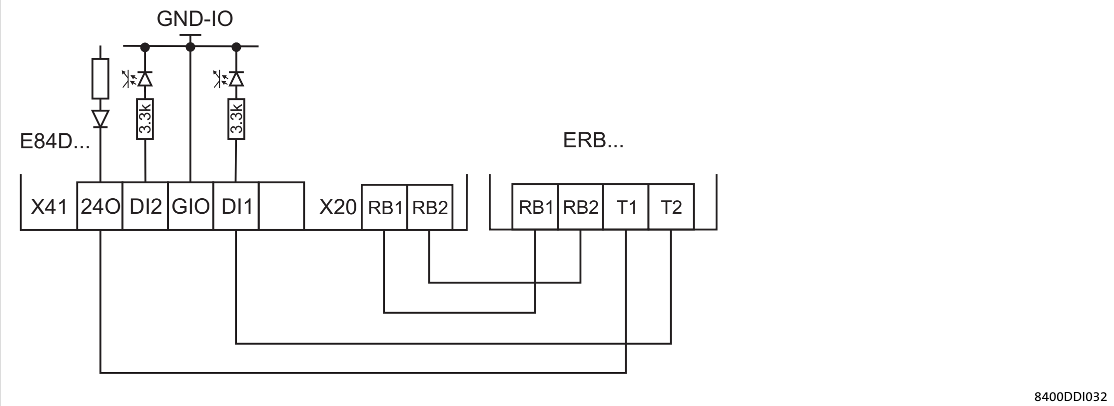
► implement external wiring using a temperature contact on the brake resistor (e.g. interrupted supply and activation of the mechanical brakes).

To protect the brake resistor:

► use the monitoring of the I^2xt utilisation of the controller which is proportional to the converted braking power.

Evaluation of the thermal contact via digital input

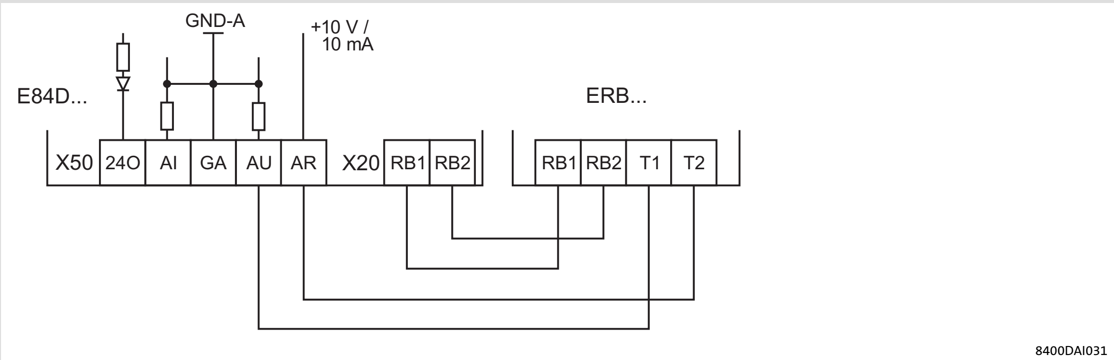
As an alternative to the integration of the thermal contact via a mains contactor, the brake resistor can also be monitored via a digital input. Please use a Lenze system cable. The response to the input signal must be parameterised in the FB Editor using the »Engineer«.



E84D...	8400 protec
X41	Digital input
X20	Brake resistor connection
ERB...	Brake resistor

Evaluation of the thermal contact via analog input

As an alternative to the integration of the thermal contact via a mains contactor, the brake resistor can also be monitored via an analog input. Please use a Lenze system cable. The response to the input signal must be parameterised in the FB Editor using the »Engineer«.



E84D...	8400 protec
X50	Analog input
X20	Brake resistor connection
ERB...	Brake resistor

Further information on brake resistor monitoring is provided in:

- ► the 8400 protec software manual, chapter "Motor control" ➔ "Monitorings"

9.4 Operation with spring-applied brake

9.4.1 Introduction

Stop!

The integrated brake control includes an electronic switch which can control a motor holding brake.

Only motor holding brakes which comply with the permissible data mentioned in the Technical Data may be connected to the integrated brake control. (If necessary, the holding brake must be controlled without a brake control via a digital output and a coupling relay.)

If the permissible values mentioned in the Technical Data are not observed:

- ► the brake control may be destroyed.
- ► a safe operation of the motor holding brake is not ensured.

Lenze three-phase AC motors and G-motion geared motors can be equipped with spring-applied brakes (motor holding brakes). 8400 protec controllers have an integrated motor brake control.

Switching the brake

- Fast switch design

  An external motor brake control module is required for the switching operations and the DC supply of the spring-applied brake. The suitable motor brake control module must be selected according to the rated data of the spring-applied brake.

  The fast switch option also offers the possibility of a quick switch-off. Here, a relay contact is controlled in the supply circuit of the coil via the inverter. In order to prevent sparking, the motor brake control module must be equipped with a spark suppressor.

  Wiring: See motor connection for type Modular

- ”Integrated brake rectifier” version

  The voltage required for controlling the motor brake is generated in the controller, dependent on the mains voltage value. The following motor brakes can be connected:

  – to the 400-V mains: coil voltage 180 V DC, max. 50 W

  – to the 500-V mains: coil voltage 225 V DC, max. 50 W

  The rated coil voltage is neither increased nor reduced.

  Wiring: See motor connection for type Q8/0

- ”24 V DC” version (only for EMS version)

  The voltage required for controlling the motor brake is fed into the inverter by an external voltage source. The following motor brakes can be connected:

  – Coil voltage 24 V DC

  Wiring: See motor connection for type Q8/0

- Cold brake design

  The voltage required for controlling the motor brake is generated in the controller proportionately to the mains voltage. The following motor brakes can be connected:

  – to the 400 V mains: coil voltage 180 V DC

  – to the 500 V mains: coil voltage 225 V DC

  To ensure a safe release of the brake, 130 % of the rated coil voltage is connected to the coil for 0.3 s. Then, this voltage is reduced to 65 % of the rated coil voltage.

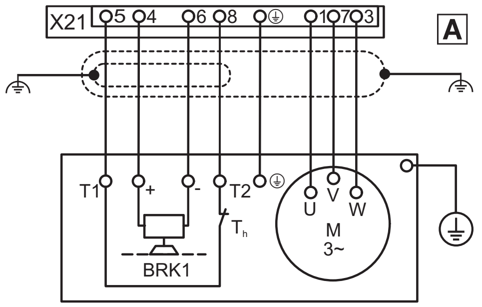
  Wiring: See motor connection for type Q8/0

Options for switching the brake:

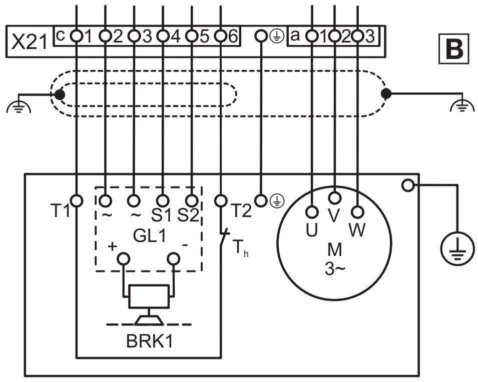
- Control via an external control contact (e. g. PLC)
- Control via a brake switch which is connected to a digital output of the controller. The digital output is parameterised accordingly.

The software manual provides further information on the parameterisation and integrated brake management.

9.4.2 Wiring



E84DWSP055_A



E84DWSP055_B

A	”Cold brake” or ”Integrated brake rectifier” wiring ”24 V DC” Connection system of plug type Q8/0
B	”Fast switch” wiring, connection system plug type Modular
X21	Motor connection
BRK1	Spring-applied brake
GL1	Spring-applied brake control
T_h	PTC thermistor (PTC) or thermal contact (NC contact)
M	Motor
⏚	HF-shield termination by large surface connection to PE.
⏚	Earthing

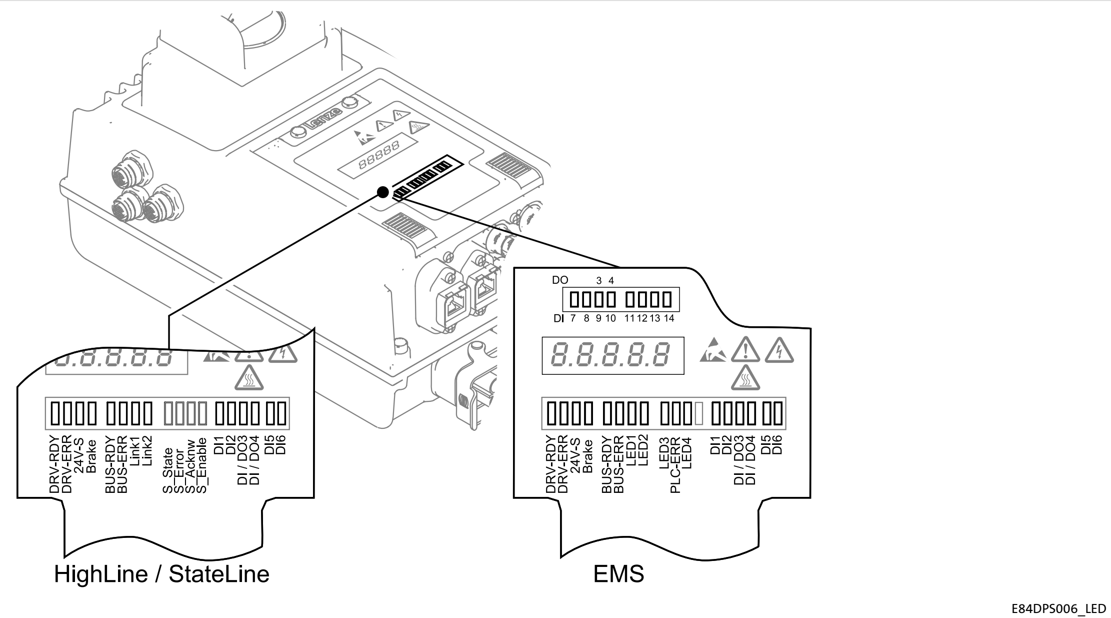
10 Diagnostics

10.1 Display of operating data, diagnostics

- ► LEDs on the controller provide information on the operating status.
- ► Basic diagnostics is performed directly on the controller.
- ► Use the keypad to perform easy and quick diagnostics.
  – The keypad can only be used in the diagnosis terminal version (= keypad including holder and connecting cable) for 8400 protec controllers. Please always substitute the term 'keypad' for 'diagnosis terminal' in the following.
- ► Perform comprehensive diagnostics and settings via your PC using the »Engineer« software.

10.1.1 Status display via controller LEDs

Depending on the version, during operation the operating status of the controller is displayed with LEDs. They are located on the front of the device.



E84DPS006_LED

Status display: device

Pos.	Colour	State	Description
DRV-RDY	green	on	Controller is ready
		blinking	Controller is enabled
ERR	red	on	System error
		blinking	Fault is active
		off	No fault
24V-S	green	on	24 V voltage is ready
		off	24-V voltage is not ready
Brake	yellow	on	Motor holding brake is controlled (released)
		off	Motor holding brake is not controlled (applied)

Status display: fieldbus interface

Pos.	Colour	State	Description
BUS-RDY	green	blinking	Communication has been established
		on	Communication has been stopped
		off	Communication has not been initialised
BUS-ERR	red	fast blinking	Communication error for PROFINET: Node not recognised
		blinking	for PROFINET: Node recognition
		on	Communication error
Link-1	yellow	fast blinking	only for PROFINET: Communication is active, telegrams are transmitted
		blinking	Initialisation
Link-2		off	Communication is not active

Status display: Digital signals

Pos.	Colour	State	Description
DI1	yellow	on	DI1 = HIGH
		off	DI1 = LOW
DI2	yellow	on	DI2 = HIGH
		off	DI2 = LOW
DI3/DO1	yellow	on	DI3/DO1 = HIGH
		off	DI3/DO1 = LOW
DI4/DO2	yellow	on	DI4/DO2 = HIGH
		off	DI4/DO2 = LOW
DI5	yellow	on	DI5 = HIGH
		off	DI5 = LOW
DI6	yellow	on	DI6 = HIGH
		off	DI6 = LOW

10.1.2 Extensions in EMS version

Pos.	Colour	Status	Description		
BUS-RDY	green	blinking	Communication has been established		
		on	Communication has been stopped		
		off	Communication is not initialised		
BUS-ERR	red	blinking fast	Communication error For PROFINET: Node not recognised		
		blinking	For PROFINET: Node recognition		
		on	Communication error		
LED1	yellow	-	Signalling controlled by the PLC program with adjustable blinking speed		
LED2					
LED3 (PLC-RDY)	green	flashes	PLC program is not available		
		blinking fast	PLC program is loaded/saved or parameters are saved		
		blinking	PLC program is started		
		on	PLC program is stopped		
		off	PLC status is undefined / device is switched off		
PLC-ERR	red	flashes 3x	Internal system error		
		flashes 2x	Parameter version or checksum invalid		
		flashes	Retain memory error		
		blinking fast	PLC program is stopped by watchdog monitoring		
		blinking	Error		
		off	No error / device switched off		
LED4 (PLC-Com)			Half wave	Half wave coded	DECA
	yellow	flashes 3x	Control bar: full wave	-	-
		flashes 2x	Control bar: negative half wave	-	Pre operational
		flashes	Control bar: positive half wave	-	Silent mode
		blinking fast	-	Command received	Operational
		blinking	Error	Error	Error
		on	-	-	Warning
		off	Control bar: no half wave		Not activated

Pos.	Colour	State	Description
DI7	yellow	on	DI7 = HIGH
		off	DI7 = LOW
DI8	yellow	on	DI8 = HIGH
		off	DI8 = LOW
DI9/DO3	yellow	on	DI9/DO3 = HIGH
		off	DI9/DO3 = LOW
DI10/DO4	yellow	on	DI10/DO4 = HIGH
		off	DI10/DO4 = LOW
DI11	yellow	on	DI11 = HIGH
		off	DI11 = LOW
DI12	yellow	on	DI12 = HIGH
		off	DI12 = LOW
DI13	yellow	on	DI13 = HIGH
		off	DI13 = LOW
DI14	yellow	on	DI14 = HIGH
		off	DI14 = LOW

10.1.3 Status display of the safety system via LEDs at the controller

Status display: drive-based safety

Pos.	Colour	State	Description
S-State	green	on	Communication between standard device and safety system is running
		blinking	Drive-based safety is in service status
		off	Communication between standard device and safety system is not possible
S-Error	red	on	Fault, trouble or warning
		blinking	Drive-based safety is not accepted by the standard device
		off	Error-free operation
S-Acknw	yellow	on	A parameter set acceptance must be acknowledged
S-Enable	yellow	on	Controller is enabled
		blinking	Safety function is active (non-safe display)

The status of safety option 10 is solely shown via the ”S-Enable” display. All other displays have no function.

Danger!

Danger to life due to wrong interpretation of the status display

A wrong interpretation of the status display of the drive-based safety may result in dangerous operating statuses.

Possible consequences:

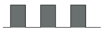
► Death or severe injuries

Protective measures:

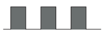
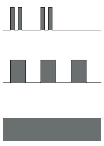
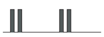
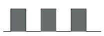
► The status display of the drive-based safety must not be used for safety-related purposes. The displays shown are unsafe.

Legend

The symbols used for indicating the LED states have the following meaning:

	LED flashes once approx. every 3 seconds (slow flash)
	LED flashes once approx. every 1.25 seconds (flash)
	LED flashes twice approx. every 1.25 seconds (double flash)
	LED blinks every second
	LED is permanently on

The LEDs ”DRIVE READY” and ”DRIVE ERROR” can blink in different ways depending on the device states which are explained in the following. This permits an easy device diagnostics without additional tools.

DRIVE READY (green)	DRIVE ERROR (red)	Status	Description
OFF	OFF	→ ”Init” state	**Initialisation is active**
	OFF	→ ”MotorIdent” state	**Motor data identification** – The ”MotorIdent” device state can only be reached by the ”SwitchON” device state and jumps back to that state after the action is completed.
	OFF	→ ”SafeTorqueOff” state	**This state is only possible in relation with a connected safety module and an existing power section supply!**
	OFF	→ ”ReadyToSwitchOn” state	**Device is ready to start** – This is the controller’s state directly after the initialisation has been completed.
	OFF	→ ”SwitchedOn” state	**Device is switched on** – This is the controller’s device state if the DC bus voltage is applied and the controller is still inhibited by the user (controller inhibit).
	OFF	→ ”OperationEnabled” state	**Operation** – In this device state, the motor follows the setpoint defined in the application.
		→ ”Warning” status display	**Operation/warning is active** – This display may occur in all device states if a monitoring mode responds the error response ”Warning” or ”Warning locked” has been parameterised for.
		→ ”TroubleQSP” state	**TroubleQSP is active** – This device state will be active as soon as a monitoring mode responds, the error response ”TroubleQSP” has been parameterised for.
OFF		→ ”Trouble” state	**Message is active** – This device state will be active as soon as a monitoring mode responds, the error response ”Message” has been parameterised for.
OFF		→ ”Fault” state	**Fault is active** – This device state will be active as soon as a monitoring mode responds, the error response ”Fault” has been parameterised for.
OFF		→ ”SystemFail” state	**System fault is active** – This device state will be active if a system fault occurs.

10.1.4 Drive diagnostics via the integrated display

The controller comes with an integrated 7-segment display which can show 4 or 5 characters depending on the device version.

The display has three different modes:

- Automatic display - when the controller is switched on, the parameter saved under the status value 1 is displayed.
- Manual operation display - when controlling the controller in manual operation.
- Message display - in case of errors or warnings. This display has the highest priority and overcontrols the other two modes.

The display is operated by the buttons T1 and T2.

- T1 - operator button for status display of subordinated devices (in preparation).
- T2 - operator button for browsing if several status messages or error messages have occurred at the same time.

Moreover, both buttons must be operated if the device is replaced for importing the safe parameters from the memory module into the safety module. More information on this can be found in the corresponding documentation.

Automatic display

In this mode, five preset parameters can be displayed subsequently. The selection button T2 serves to browse the parameters in ascending order:

- Status value 1: motor output frequency in [Hz]

  The output frequency is displayed as a function of the direction of rotation,i. e. a counter-clockwise rotation is displayed with a minus sign. The display area is between - 999 und 999 Hz with a resolution of 1 Hz.
- Status value 2: actual current value in [A], resolution 0.1 A
- Status value 3: device utilisation in [%]
- Status value 4: motor voltage in [V]
- Status value 5: DC-bus voltage in [V]

Manual operation display (in preparation)

- When the controller is changed over to the manual operation mode with the operator button, ”rc” is displayed.
- If an error is present in manual operation, the display changes between ”rc” and the error code every 0.5 s. If several errors are present, they are displayed alternately.
- When changing between CCW and CW rotation with the operator button, the motor output frequency is displayed without a sign in CW rotation and with a minus sign in CCW rotation.

Message display

If warnings or errors are present, these are shown in blinking mode.

Overview of the error messages of the operating system

The table below lists all error messages of the controller operating system in alphabetically ascending order of the abbreviated designation with the preset error response as well as the parameter for setting the error response, if available.

Error						
Group						
ID	Number	Abbr.	Text	Reaction	CAN code	Setting
106						
1	0x0601	PL01	PLC internal	No reaction	-	C00596/1
2	0x0602	PL02	PLC watchdog	No reaction	-	C00596/2
3	0x0603	PL03	PLC parameter error	No Reaction	-	C00596/3
4	0x0604	PL04	PLC retain data error	No reaction	-	C00596/4
21	0x0615	PL21	PLC program generic error 1	No reaction	-	C00596/9
22	0x0616	PL22	PLC program generic error 2	No reaction	-	C00596/10
23	0x0617	PL23	PLC program generic error 3	No reaction	-	C00596/11
24	0x0618	PL24	PLC program generic error 4	No reaction	-	C00596/12
25	0x0619	PL25	PLC program generic error 5	No reaction	-	C00596/13
26	0x061a	PL26	PLC program generic error 6	No reaction	-	C00596/14
27	0x061b	PL27	PLC program generic error 7	No reaction	-	C00596/15
28	0x061c	PL28	PLC program generic error 8	No reaction	-	C00596/16
111						
2	0x0b02	Su02	One mains phase is missing	Warning	0x3000	C00565
3	0x0b03	Su03	Too frequent mains switching	Fault	0x3000	-
4	0x0b04	Su04	CU supplied insufficiently	Fault	0x3000	-
5	0x0b05	Su05	IO supply overload	Warning	0x3000	C00598/4
119						
50	0x1332	OC5	Ixt overload	Fault	0x2000	-
1	0x1301	OH1	Heatsink overtemperature	Fault	0x4000	-
15	0x130f	OH3	Motor temperature (X21) triggered	Fault	0x4000	C00585
0	0x1300	OH4	Heatsink temp. > shutdown temp. -5°C	No reaction	0x4000	C00582

Error						
Group						
ID	Number	Abbr.	Text	Reaction	CAN code	Setting
123						
99	0x1763	FC1	Limitation of field controller	No reaction	0xF000	C00570/4
94	0x175e	FCH1	Switching frequency reduction	No reaction	0x2000	C00590
95	0x175f	FCH2	Maximum speed for Fchop	No reaction	0xF000	C00588
57	0x1739	ID1	Error: Motor data identification	WarningLocked	0xF000	-
58	0x173a	ID3	CINH motor data identification	WarningLocked	0xF000	-
59	0x173b	ID4	Error in resistor identification	Warning	0xF000	-
145	0x1791	LP1	Motor phase failure	No reaction	0x3000	C00597
15	0x170f	LU	DC bus undervoltage	Trouble	0x3100	C00600/1
16	0x1710	OC1	Power section short circuit	Fault	0x2000	-
17	0x1711	OC2	Power section earth fault	Fault	0x2000	-
105	0x1769	OC6	I^2xt overload - motor	Warning	0x2000	C00606
7	0x1707	OC7	Motor overcurrent	Fault	0x2000	-
30	0x171e	OC10	Maximum current reached	Fault	0x2000	-
71	0x1747	OC11	Clamp operation active	Warning	0xF000	-
65	0x1741	OC12	I^2xt overload - brake resistor	Fault	0xF000	-
90	0x175a	OC13	Exceedance of maximum current for Fch	Fault	0xF000	-
96	0x1760	OC14	Limitation of direct-axis current controller	No reaction	0xF000	C00570/1
97	0x1761	OC15	Limitation of cross current controller	No reaction	0xF000	C00570/2
98	0x1762	OC16	Limitation of torque controller	No reaction	0xF000	C00570/3
31	0x171f	OC17	Clamp sets pulse inhibit	No reaction	0xF000	C00569/1
32	0x1720	OS1	Maximum speed limit reached	No reaction	0x8400	C00579
1	0x1701	OT1	Maximum torque reached	No reaction	0x8300	C00608
93	0x175d	OT2	Speed controller output limited	No reaction	0xF000	C00567
14	0x170e	OU	DC bus overvoltage	Trouble	0x3100	-
205	0x17cd	SD3	Open circuit - feedback system	Fault	0x7300	C00586
200	0x17c8	SD10	Speed limit - feedback system 12	Fault	0x7300	C00607
201	0x17c9	SD11	Speed limit - feedback system 67	Fault	0x7300	C00607
125						
1	0x1901	An01	AIN1_I < 4 mA	TroubleQuickStop	0xF000	C00598/1
11	0x190b	Io11	DigOut level	Warning	0xF000	C00598/3
127						
2	0x1b02	CE04	MCI communication error	No reaction	0x7000	C01501/1
15	0x1b0f	CE0F	MCI control word	Fault	0xF000	C00594/2
128						
5	0x1c05	EDB1	EMS half wave error	No reaction	-	C00596/5
6	0x1c06	EHV1	EMS PowerwaveFail	No reaction	-	C00596/6
7	0x1907	EPV2	EMS DeCaBus error	No reaction	-	C00596/7

Error						
Group						
ID	Number	Abbr.	Text	Reaction	CAN code	Setting
131						
6	0x1f06	CA06	CAN CRC error	No reaction	0x8000	C00592/1
7	0x1f07	CA07	CAN bus warn	No reaction	0x8000	C00592/3
8	0x1f08	CA08	CAN bus stopped	No reaction	0x8000	C00592/4
11	0x1f0b	CA0b	CAN HeartBeatEvent	No reaction	0x8130	C00592/5
15	0x1f0f	CA0F	CAN control word	Fault	0xF000	C00594/2
0	0x1f00	CE4	CAN bus off	No reaction	0x8000	C00592/2
135						
1	0x2301	CE1	CAN RPDO1	No reaction	0x8100	C00593/1
2	0x2302	CE2	CAN RPDO2	No reaction	0x8100	C00593/2
3	0x2303	CE3	CAN RPDO3	No reaction	0x8100	C00593/3
4	0x2304	CP04	CAN RPDO4	No reaction	0x8100	C00593/4
140						
13	0x280d	MCI1	Module missing / incompatible	No reaction	0x7000	C01501/2
144						
1	0x2c01	PS01	No memory module	Warning	0x6300	-
2	0x2c02	PS02	Par.set invalid	Fault	0x6300	-
3	0x2c03	PS03	Device par.set invalid	Fault	0x6300	-
4	0x2c04	PS04	MCI par.set invalid	Fault	0x6300	-
7	0x2c07	PS07	Memory module par. invalid	Fault	0x6300	-
8	0x2c08	PS08	Device par. invalid	Fault	0x6300	-
9	0x2c09	PS09	Par. format invalid	Fault	0x6300	-
10	0x2c0a	PS10	Memory module binding invalid	Fault	-	-
145						
35	0x2d23	dF10	AutoTrip reset	Fault	0xF000	C00189/0
14	0x2d0e	dF14	SW-HW invalid	Fault	0x6100	-
24	0x2d18	dF18	BU RCOM error	Fault	0x6100	-
33	0x2d21	dF21	BU watchdog	Fault	0x6100	-
34	0x2d22	dF22	CU watchdog	Fault	0x6100	-
25	0x2d19	dF25	CU RCOM error	Fault	-	-
50	0x2d32	dF50	Retain error	Fault	0x6100	-
51	0x2d33	dF51	CuCcr error	Fault	0x6100	-
52	0x2d34	dF52	BuCcr error	Fault	0x6100	-

Group	ID	Number	Abbr.	Text	Reaction	CAN code	Setting
				Error			
184							
	1	0x5401	Ck01	Pos. HW limit switch	TroubleQuickStop	0x8600	C00595/1
	2	0x5402	Ck02	Neg. HW limit switch	TroubleQuickStop	0x8600	C00595/2
	7	0x5407	Ck03	Pos. SW limit position	TroubleQuickStop	0x8600	C00595/3
	8	0x5408	Ck04	Neg. SW limit position	TroubleQuickStop	0x8600	C00595/4
	153	0x5499	Ck05	Following error 1	Warning	0x8611	C00595/5
	154	0x549a	Ck06	Following error 2	Warning	0x8611	C00595/6
	155	0x549b	Ck07	Travel range limit exceeded	TroubleQuickStop	0x8612	C00595/7
	156	0x549c	Ck08	Home position unknown	WarningLocked	0x8612	C00595/8
	8005	0x54cd	Ck09	Positioning mode invalid	WarningLocked	0x8600	C00595/9
	8007	0x54cf	Ck10	Profile data implausible	WarningLocked	0x8600	C00595/10
	8009	0x54d1	Ck11	Operating mode invalid	Warning	0x8600	C00595/11
	8014	0x54d6	Ck12	Profile number invalid	WarningLocked	0x8600	C00595/12
	8015	0x54d7	Ck13	Error FB MCKCtrlInterface	Warning	0x8600	C00595/13
	15	0x540f	Ck14	Target position beyond SW limit position	WarningLocked	0x8600	C00595/14
	5	0x5405	Ck15	Error - brake message signal	Fault	0x8600	-
	64	0x5440	Ck16	Time overflow - manual operation	Fault	-	-
400							
	9	0x1a09	dH09	EEPROM power section	Fault	0x5530	-
	16	0x1a10	dH10	Fan failure	Warning	0x5000	C00566/0
	104	0x1a68	dH68	Adjustment data error CU	Fault	0x5530	-
	105	0x1a69	dH69	Adjustment data error BU	Fault	0x5530	-
98x							
0	1	-	US01	User error 1	No reaction	0x6200	C00581/1
1	2	-	US02	User error 2	No reaction	0x6200	C00581/2
2	3	-	US03	User error 3	No reaction	0x6200	C00581/3
3	4	-	US04	User error 4	No reaction	0x6200	C00581/4
4	1	-	US05	User error 5	No reaction	0x6200	C00581/5
5	2	-	US06	User error 6	No reaction	0x6200	C00581/6
6	3	-	US07	User error 7	No reaction	0x6200	C00581/7
7	4	-	US08	User error 8	No reaction	0x6200	C00581/8

Group ID	32 bit error number
Number	16 bit hex error number
Abbr.	first part of error message - is also indicated in the device display
Text	Full text - visible in the keypad or Engineer
Reaction	Lenze setting of the response to the error / event
CAN code	CAN emergency error code
Setting	Code for setting the response
SO	Group error - safety option
CI	Group error - fieldbus communication

10.1.5 Drive diagnostics

The controller measures relevant operating parameters which can be displayed using the diagnosis terminal or the PC.

Display of the controller status on the keypad

– If the keypad at the front of the controller is connected to the diagnostic interface X6, the area ① of the LCD displays the controller status via different symbols.

Icon	Meaning	Note
RDY	Controller is switched on.	→ "SwitchedON" state
RUN	Controller is enabled.	
STP	Application in the controller is stopped.	
QSP	Quick stop is active.	
CINH	Controller is inhibited.	The power outputs are inhibited.
OFF	Controller is ready to start	→ "ReadyToSwitchOn" state
Mmax	Speed controller 1 in the limitation	The drive is torque-controlled.
Imax	The set current limit is exceeded in motor or generator mode	
IMP	Pulse inhibit is active	The power outputs are inhibited.
!SFLT	System fault is active	
!FLT	Fault	→ "Fault" state
!TRB	Trouble	→ "Trouble" state
!TQSP	TroubleQSP	→ "TroubleQSP" state
WRN	Warning is active	→ "Warning" status display

Display parameters

The parameters listed in the following table serve to get information on current statuses and actual values of the controller for diagnostic purposes, e.g. with the keypad, via a bus system or using the »Engineer« (when an online connection has been established to the controller)

– In the »Engineer« parameter list and in the keypad, these parameters are classified in the **Diagnostics** category.

– A detailed description of these parameters can be found in the software manual of the prevailing device version.

Parameter	Display
C00183	Device state
C00168	Error number
C00051	Actual speed value
C00052	Motor voltage
C00054	Motor current
C00057/1	Maximum torque
C00057/2	Torque at maximum current
C00059	Motor - number of pole pairs
C00061	Heatsink temperature
C00062	Temp. inside the controller
C00063	Motor temperature
C00064	Device utilisation (I x t) over the last 180 seconds
C00065	Ext. 24-V voltage
C00066	Thermal motor load (I^2xt)
C00178	Time the controller was enabled (elapsed-time meter)
C00179	Time the mains was switched on (power-on time meter)

Identification data

The parameters listed in the following table which are classified in the »Engineer« parameter list and the keypad in the category **Identification → Controller** serve to display the identification data of the controller.

Parameter	Display
C00099	Firmware version
C00200	Firmware product type
C00201	Firmware compilation date
C00203/1 ... 9	HW product types
C00204/1 ... 9	HW serial numbers
C00205/1 ... 6	HW descriptions
C00206/1 ... 6	HW manufacturing data
C00210/1 ... 6	HW version

11 Safety engineering

11.1 Introduction

With increasing automation, protection of persons against hazardous movements is becoming more important. Functional safety describes the measures needed by means of electrical or electronic equipment to reduce or remove danger caused by failures.

During normal operation, safety equipment prevents people accessing hazardous areas. In certain operating modes, e.g. set-up mode, work needs to be carried out in hazardous areas. In these situations the machine operator must be protected by integrated drive and control measures.

Drive-based safety provides the conditions in the controls and drives to optimise the safety functions. Planning and installation expenditure is reduced. In comparison to the use of standard safety engineering, drive-based safety increases machine functionality and availability.

Drive-based safety with L-force | 8400 protec

Unlike control cabinet devices, decentralised drives are frequency inverters which are not locally mounted but directly attached to the application on site. Due to this product-specific property, they must meet demanding requirements for robustness and class of protection.

8400 protec controllers are optionally available with drive-based safety.

”Drive-based safety” stands for applied safety functions, which can be used for the protection of persons working on machines.

The motion functions are continued to be executed by the controller. The drive-based safety monitors the safe compliance with the limit values and provides the safe inputs and outputs. When the limit values are exceeded, the drive-based safety starts the control functions according to EN 60204-1 directly in the controller.

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 3 or 4 depending on the safety option according to EN ISO 13849-1.

11.2 Important notes

Application as directed

The controllers of the 8400 protec series that are equipped with drive-based safety must not be modified by the user. This concerns the unauthorised exchange or removal of the drive-based safety.

Danger!

Danger to life through improper installation

Improper installation of safety engineering systems can cause an uncontrolled starting action of the drives.

Possible consequences:

- Death or severe injuries

Protective measures:

- Safety engineering systems may only be installed and commissioned by qualified and skilled personnel.
- All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of ISO 138491 and ISO 13849-2. This includes i.a.:
  – Switches, relays with at least IP54 enclosure.
  – Control cabinet with at least IP54 enclosure.
  – Please refer to ISO 138491 and ISO 13849-2 for all further requirements.
- Wiring must be shielded.
- All safety relevant cables outside the control cabinet must be protected, e.g. by means of a cable duct:
  – Ensure that no short circuits can occur.
  – For further measures see EN ISO 13849-2.
- If an external force acts upon the drive axes, additional brakes are required. Please observe that hanging loads are subject to the force of gravity!

Danger!

When the ”safe torque off” (STO) function is used, an ”emergency switching-off” according to EN 60204 is not possible without additional measures. There is no electrical isolation, no service switch or repair switch between motor and controller!

“Emergency switching-off” requires an electrical isolation, e.g. by a central mains contactor!

11.3 Overview of safety options

Depending on the device version, the following safety functions are available:

Safety option 10

Due to safety option 10, the following safety functions can be used:

- Safe torque off (STO),
  formerly: safe standstill

If requested, the safe disconnection of the drive is achieved through:

- Directly connected active sensors
- Passive sensors connected to a safety switching device

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 4 according to EN ISO 13849-1.

Safety option 20

Due to safety option 20, the following safety functions can be used:

- Safe torque off (STO),
  formerly: safe standstill
- Safe stop 1 (SS1)
- Safe stop emergency (SSE)
- Safe operation mode selector (OMS)
- Safe enable switch (ES)

The safe disconnection of the drive is achieved through:

- a higher-level safety PLC via PROFIsafe/PROFINET
- a higher-level safety PLC via PROFIsafe/PROFIBUS

The functions of the safety option must be parameterised via the »Engineer«.

The motion functions are continued to be executed by the controller. The drive-based safety monitors the safe compliance with the limit values. When the limit values are exceeded, the drive-based safety starts the control functions according to EN 60204-1 directly in the controller.

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 3 according to EN ISO 13849-1.

Safety option 30

Due to safety option 30, the following safety functions can be used:

- Safe torque off (STO),
  formerly: safe standstill
- Safe stop 1 (SS1)
- Safe stop emergency (SSE)
- Safe operation mode selector (OMS)
- Safe enable switch (ES)

The safe disconnection of the drive is achieved through:

- a higher-level safety PLC via PROFIsafe/PROFINET
- connected active or passive sensors

The functions of the safety option must be parameterised via the »Engineer«.

The motion functions are continued to be executed by the controller. The drive-based safety monitors the safe compliance with the limit values. When the limit values are exceeded, the drive-based safety starts the control functions according to EN 60204-1 directly in the controller.

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 3 according to EN ISO 13849-1.

Further information on functional safety is provided in:
- the 8400 protec manual on drive-based safety
- the 8400 protec software manual on drive-based safety: Parameter setting & configuration

12 Accessories (overview)

Note!
You can find additional information on the accessories in the catalogue to this product series.

12.1 Overview

Coordinated accessories for L-force Inverter Drives 8400 protec:

- Lenze system cables
  - Motor connection
  - Brake resistor connection
  - Incremental HTL encoder
- Memory module
- USB-diagnostic adapter E94AZCUS
  - Connecting cables EWL007x
- PC system bus adapter EMF2173IBxxx/EMF2177IB
- Diagnosis terminal EZAEBK2001
- Brake resistors ERBSxxxRxxxW
- 24-V power supply units EZVxx00-00x
- EMS accessories

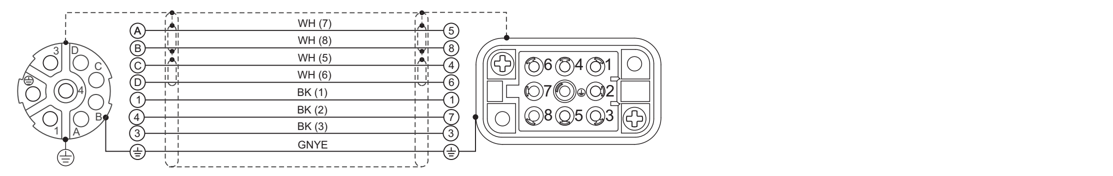
12.2 System cables

A wide variety of system cables is available for Lenze motors and controllers. Detailed information is provided in the ”System cables and system connectors” manual.

The available system cables for 8400 protec controllers are listed below.

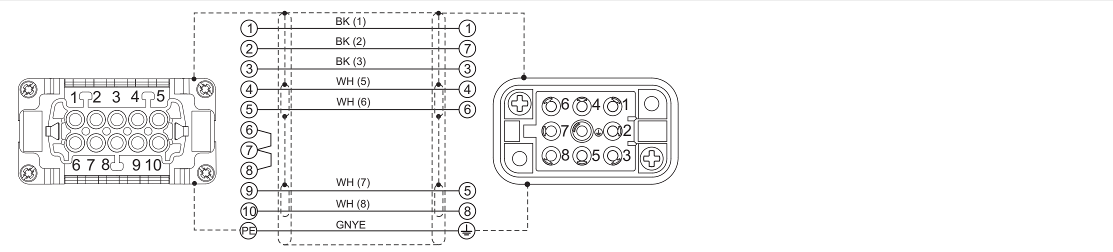
12.2.1 Motor cable

EYPxxxxAxxxxM07Q10, EYPxxxxAxxxxM07Q11, EYPxxxxAxxxxM08Q10, EYPxxxxAxxxxM08Q11



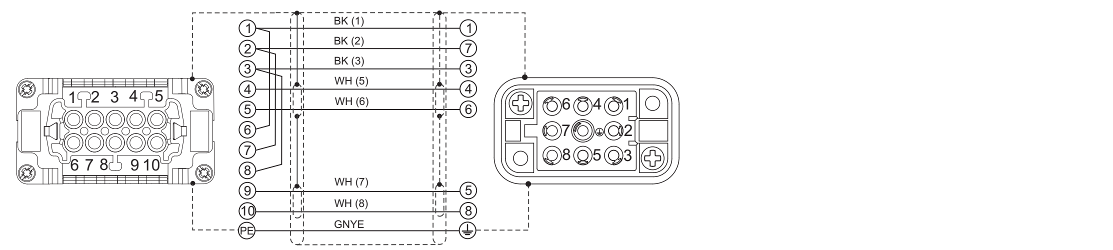
hb_mpamq_1

EYPxxxxAxxxxH10Q10, EYPxxxxAxxxxH11Q11



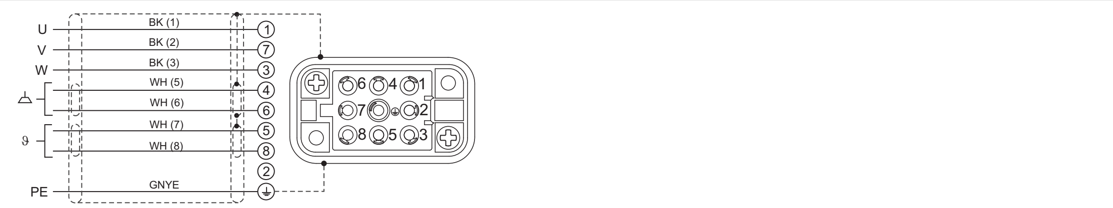
hb_mpahq_1

EYPxxxxAxxxxH12Q10, EYPxxxxAxxxxH13Q11



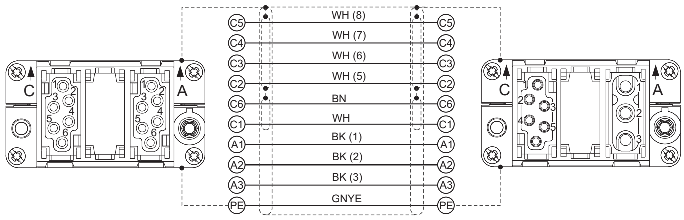
hb_mpahq_2

EYPxxxxAxxxxA00Q10, EYPxxxxAxxxxA00Q11



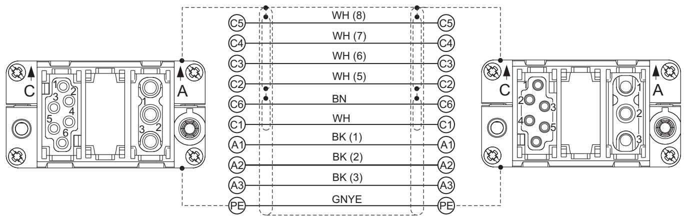
hb_mpaaq_1

EYPxxxxAxxxxH07Q08, EYPxxxxAxxxxH08Q09



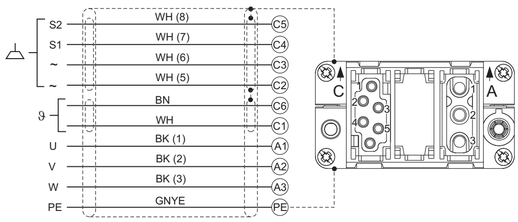
hb_mpahq_3

EYPxxxxAxxxxH09Q09



hb_mpahq_4

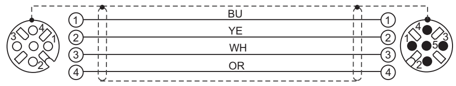
EYPxxxxAxxxxA00Q08, EYPxxxxAxxxxA00Q09



hb_mpaaq_2

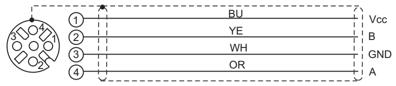
12.2.2 Incremental HTL encoder

EYF0048AxxxxD01B02



hb_efadb_1

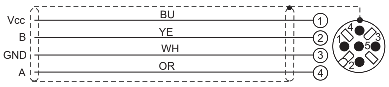
EYF0048AxxxxD01A00



hb_efada_1

EYF0048AxxxxA00B02

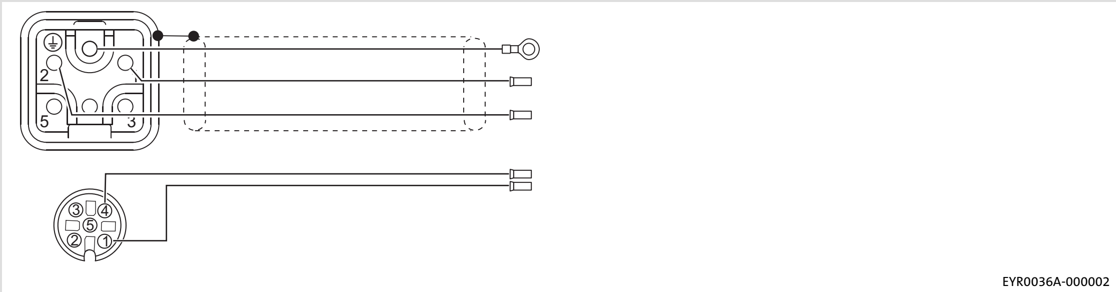
EYF0048AxxxxD01A00, EYF0048AxxxxA00B02, EYF0048AxxxxD01B02



hb_efaab_1

12.2.3 Connection of external brake resistor

EYR0036AxxxxB01A03



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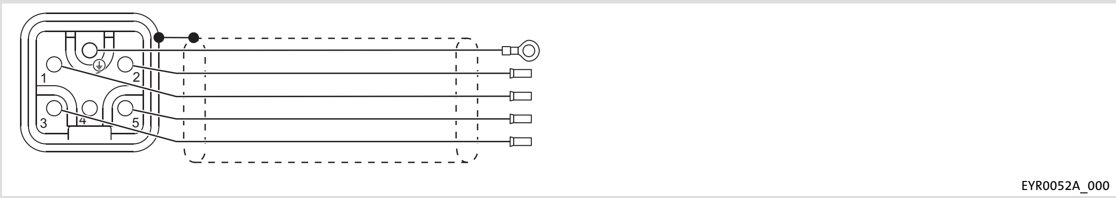
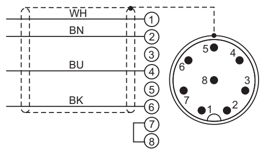


12.2.4 Connection of safety sensors and actuators

EYF0041Axxxxxxxxxx



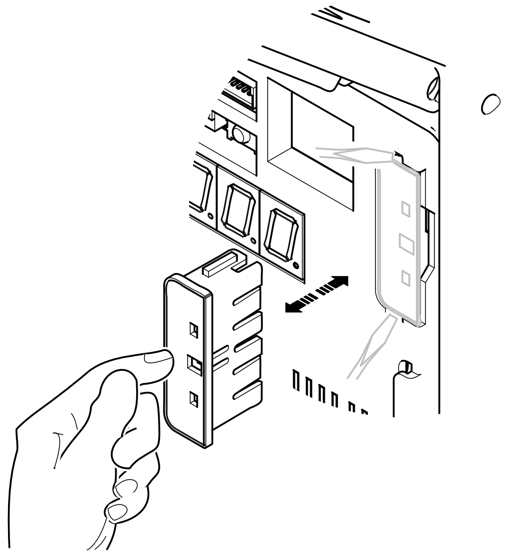
sfax1_2

12.3 Memory module

Stop!

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.



8400DMM1

12.3.1 E84AYM10S

Name: Memory module (for StateLine/HighLine version)

Type designation: E84AYM10S (/M = 5 pcs/VPE)

Slot: MMI

The parameters of the controller are stored in the memory module.

The pluggable memory module enables a quick parameter set transfer to an identical controller. Possible reasons for a parameter set transfer are:

- Duplication of similar applications in a series of identical drives.
- Restorage of an application after device replacement.

The required steps for a parameter set transfer are described in the software manual.

In order to remove the memory module, use a suitable screwdriver to lever the module out at the upper and lower groove. In order to plug in the module, insert it into the slot and push it with light pressure until end position is reached.

12.3.2 E84AYM30S

Name: Memory module (for EMS version)

Type designation: E84AYM30S (/M = 5 pcs/VPE)

Slot: MMI

The parameters o the controller are stored in the memory module. Moreover, this module has further memory capacity for PLC programs and retain variables.

The pluggable memory module enables a quick parameter set transfer to an identical controller. Possible reasons for a parameter set transfer are:

- ► Duplication of similar applications in a series of identical drives.
- ► Restorage of an application after device replacement.

The required steps for a parameter set transfer are described in the software manual.

In order to remove the memory module, use a suitable screwdriver to lever the module out at the upper and lower groove. In order to plug in the module, insert it into the slot and push it with light pressure until end position is reached.

12.4 Diagnosis terminal

The X400 diagnosis terminal is a simple means for parameter setting and diagnostics on site. Clearly structured menus and a plain text menu grant quick data access. The diagnosis terminal is connected to the X70 diagnostic interface (behind the service hatch). The diagnosis terminal is based on the X400 keypad, extended by a holder and a connecting cable.

Name: Diagnosis terminal X400

Type designation: EZAEBK200x

Slot: X70

Features

- In a robust housing
- Suitable for installation into the control cabinet door
- 2.5 m connecting cable, exchangeable
- Enclosure IP65 is possible for installation into the control cabinet
- Menu-driven diagnostics and parameter setting
- Backlighted graphic display for representing information
- 4 navigation keys, 2 context-sensitive keys
- Adjustable RUN/STOP function
- Hot-plug capable
- Enclosure IP20

12.5 Infrared remote control (IrRC)

The infrared remote control LDEZIRRC serves to execute up to 18 functions. The system-specific functions (key assignment) are described in the documentation of the system.

Change-over from automatic operation to manual infrared operation

- Press [ON] key
  – Display: c---
- enter the desired vehicle number (e.g. 020) within 8 s, using the number keys [0 ... 9]
  – Display: c020

Note!

If no vehicle number is entered, the control remains in automatic operation and continues to travel, if required!

The vehicle number ensures that the remote control only addresses the control of the desired vehicle.

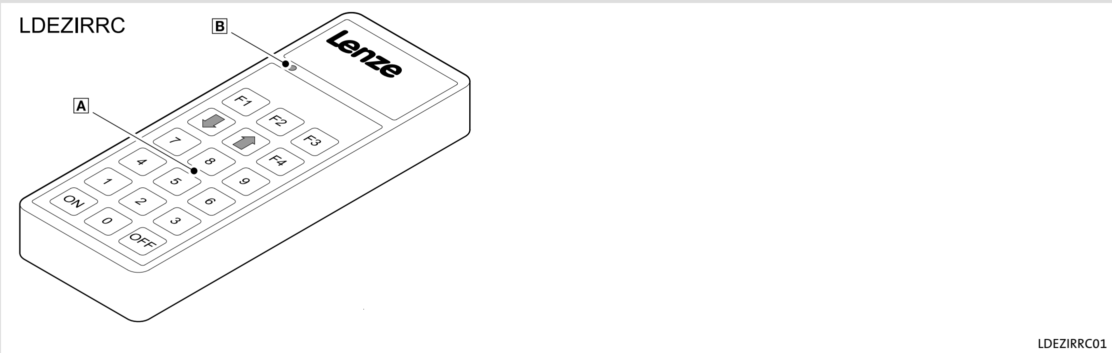
In manual infrared operation, the automatic distance control is switched off. Moreover, control is even possible with active error (except for internal errors).

Change-over from manual infrared operation to automatic operation

Press [OFF] key

Note!

The manual infrared operation is not reset by switching the mains.



A Key field
B Control LED "Transmit"

12.6 External brake resistors

Assignment of controller - brake resistor

Controller	External brake resistor	
	400 V	500 V
E84Dxxxx7514	ERBS180R350WNQN000	ERBS180R350WNQN000
E84Dxxxx1524		
E84Dxxxx3024	ERBS047R400W ERBS047R800W	ERBS047R400W ERBS047R800W
E84Dxxxx4024		
E84DHxxx7524		

12.7 Power supply units

External power supply units are available for supplying the control electronic with an external 24-V supply, if required.

Advantages of an external supply: Parameter setting and diagnostics of the controller with a deenergised mains input.

	Mains		Secondary	
Type	V_{LN} [V]	I_{LN} [A]	V_{DC} [V]	I_{DC} [A]
EZV1200-000	230 (1/N/PE AC)	0.8	24 (22.5 ... 28.5)	5
EZV2400-000		1.2		10
EZV4800-000		2.3		20
EZV1200-001	400 (3/PE AC)	0.3		5
EZV2400-001		0.6		10
EZV4800-001		1.0		20

12.8 EMS accessories

- LDEZHMTX - half wave transmission module

  Interface module for the half-wave command selection (transmission module) via a control bar between the mobile control at the vehicle and the stationary system. The connection of up to 8 channels is possible.

- LDEZHMRX - half wave reception module

  Interface module for the half-wave feedback (reception module) via a signalling bar between the mobile control at the vehicle and the stationary system. The connection of up to 8 channels is possible.

- LDEZPW10238Kxx - Power wave

  Communication module with up to 1023 commands for data exchange between the stationary system centre and the mobile control at the vehicle. For communicating with the central PLC, PROFIBUS-DP, DeviceNet or INTERBUS CU are available.

- LDEZLDC1Kxx - rail bus local data concentrator

  Communication module (master) for data exchange between the system PLC and the bus transfer unit on the rail bus or inductive data transfer. Depending on the communication medium, an LDEZLMDC (contact conductor rail bus) or an LDEZLMIDAT (inductive data transfer) interface can be connected.

- LDEZLMDC - rail bus CAN bus driver module

  Interface module - CAN bus driver for the rail bus, (implementation TTL -> 50 V DC) for plugging onto the data concentrator (master - bus transfer unit) LDEZLDC1KPB, LDC1KDN, for bidirectional data exchange with mobile control.

- LDEZIRDS - infrared station with fieldbus link

  The infrared station is used for bidirectional data exchange between the stationary system PLC and the mobile control at the vehicle.

  Vehicle-specific process data and maintenance data can be transmitted. Communication is possible with central PLC via PROFINET I/O, (PROFIBUS DP, EtherNet /IP and DeviceNet on request).

- LDEZEXIRD - external infrared module (remote control receiver with LED display)

  The external infrared module serves to be connected to a Lenze control system CCU/ICU series with LDEZDrive PLCC and is an external display as well as an infrared remote control receiver. The connection to the LDEZDPLCC is made via the system bus (CAN) which provides the option to mount it to any position of the vehicle.

13 Appendix

13.1 Declarations of conformity

Lenze

2233986.09

EU-Konformitätserklärung	EU Declaration of Conformity
LENZE SE, Hans-Lenze-Strasse 1, 31855 Aerzen GERMANY	
erklärt in alleiniger Verantwortung die Übereinstimmung der Produkte	declares under sole responsibility compliance of the products
Antriebsregler der Baureihen:	Controllers of the series:

E84Duvwx7514xxyxxz
E84Duvwx1524xxyxxz
E84Duvwx3024xxyxxz
E84Duvwx4024xxyxxz
E84Duvwx7524xxyxxz

u = D, E, F, H, L, P, S
v = B, D, H, M, P
w = B, C, F, G, H, J, K, V
x = 0...9, A...Z
y = B, C, D, S
z = E, N, R

mit der	with the
Niederspannungsrichtlinie 2014/35/EU	**Low Voltage Directive** 2014/35/EU
Angewandte harmonisierte Normen:	**Applied harmonized standards:**

EN 61800-5-1:2007 + A1:2017

EMV- Richtlinie 2014/30/EU	**EMC Directive** 2014/30/EU
Angewandte harmonisierte Normen:	**Applied harmonized standards:**

EN 61800-3:2004 + A1:2012
EN IEC 61800-3:2018

Ökodesignrichtlinie	**Verordnung**	**ErP Directive**	**Commission Regulation**
2009/125/EG	2019/1781 [≥01.07.2021]	2014/34/EU	2019/1781 [≥01.07.2021]
Angewandte Normen:		**Applied standards:**	

EN 61800-9-2:2017

RoHS Richtline	**Verordnung**	**RoHS Directive**	**Commission Regulation**
2011/65/EU	2015/863 + 2017/2102	2011/65/EU	2015/863 + 2017/2103
Angewandte harmonisierte Normen:		**Applied harmonized standards:**	

EN IEC 63000:2018

Die Sicherheitshinweise der Betriebanleitung sind zu beachten.

Die aufgeführten Produkte sind im Sinne der EMV- Richtlinie keine eigenständig betreibbare Produkte. Die Einhaltung der Richtlinie setzt den korrekten Einbau der Produkte, die Beachtung der spezifischen Installationshinweise und der Produktdokumentation voraus. Dies wurde an bestimmten Anlagenkonfigurationen nachgewiesen.

Die Produkte sind bestimmt zum Einbau in Maschinen. Die Inbetriebnahme ist solange untersagt bis festgestellt wurde, dass die Maschine, in welche diese Produkte eingebaut werden sollen, den Bestimmungen der o.g. EU-Richtlinie entsprechen.

The safety instructions of the manual are to be considered.

According to the EMC directive, the listed devices are not independently operable products. Compliance of the directive requires the correct installation of the product, the observance of specific installation notes and product documentation. This was tested on specific system configurations.

These products are intended for installation in machines. Operation is prohibited until it has been determined that the machines in which these products are to be installed, conforms to the above mentioned EU Directive.

Ort / Datum Place / date	**Vorstand** Chief Technology Officer	**Dokumentationsverantwortlicher** Responsible for documentation
Aerzen 12.05.2021	*Dipl.-Ing. Frank Maier*	i.V. T. Pieper *i.V. Torsten Pieper*

2251689.07

EU-Konformitätserklärung | EU Declaration of Conformity

LENZE SE, Hans-Lenze-Strasse 1, 31855 Aerzen GERMANY

erklärt in alleiniger Verantwortung die Übereinstimmung der Produkte | declares under sole responsibility compliance of the products

8400 protec
E84DxxxxxxxxxxxJxx (SO10)

mit der | with the

Maschinenrichtlinie
2006/42/EG Anhang VIII und IX

Machinery Directive
2006/42/EC Annex VIII and IX

Angewandte harmonisierte Normen: | **Applied harmonized standards:**

Sicherer Halt	Stopp Kategorie 0	EN 60204-1	:2018	Stop category 0	Safe torque off
	Kategorie 4 Performance Level (PL): PL e	EN ISO 13849-1	:2015	Category 4 Performance Level (PL): PL e	
Sicherheitsfunktionen siehe Betriebsanleitung.	SIL 3	EN 61508 1-7 EN 62061 +AC +A1 +A2 EN 61800-5-2	:2010 :2005 :2010 :2013 :2015 :2017	SIL 3	For safety functions see manual.
		EN 61800-5-1 +A1	:2007 :2017		

Konformitätsbewertung | **Conformity assessment**

CE 0035

Benannte Stelle	**notified body**	TÜV Rheinland Industrie Service GmbH Am Grauen Stein 51105 Köln / Germany
Zertifikate	Certificates	01/205/5146.02/21
Gültigkeit	Date of expiry	2026-09

EMV- Richtlinie
2014/30/EU

EMC Directive
2014/30/EU

Angewandte harmonisierte Normen: | **Applied harmonized standards:**

EN 61800-3:2004 + A1:2012
EN 61800-3:2018

RoHS- Richtline
2011/65/EU

RoHS Directive
2011/65/EU

Angewandte harmonisierte Normen: | **Applied harmonized standards:**

EN IEC 63000:2018

Die Sicherheitshinweise der Betriebanleitung sind zu beachten.

The safety instructions of the manual are to be considered.

Die Produkte sind bestimmt zum Einbau in Maschinen. Die Inbetriebnahme ist solange untersagt bis festgestellt wurde, dass die Maschine, in welche diese Produkte eingebaut werden sollen, den Bestimmungen der o.g. EU-Richtlinie entsprechen.

These products are intended for installation in machines. Operation is prohibited until it has been determined that the machines in which these products are to be installed, conforms to the above mentioned EU Directive.

Ort / Datum Place / date	**Geschäftsführer** Managing Director	**Dokumentationsverantwortlicher** Responsible for documentation
Aerzen 21.09.2021	*Dipl.-Ing. Frank Maier*	i.V. T. Wedemeyer *i.V. T. Wedemeyer*

2251690.06

EU-Konformitätserklärung | EU Declaration of Conformity

LENZE SE, Hans-Lenze-Strasse 1, 31855 Aerzen GERMANY

erklärt in alleiniger Verantwortung die Übereinstimmung der Produkte | declares under sole responsibility compliance of the products

8400 protec - E84DxxxxxxxxxxxKxx (SO20)
8400 protec - E84DxxxxxxxxxxxLxx (SO30)

mit der | with the

Maschinenrichtlinie 2006/42/EG Anhang VIII und IX | **Machinery Directive** 2006/42/EC Annex VIII and IX

Angewandte harmonisierte Normen: | **Applied harmonized standards:**

		EN 60204-1	:2018		
	Kategorie 3 Performance Level (PL): PL e	EN ISO 13849-1	:2015	Category 3 Performance Level (PL): PL e	
Sicherheitsfunktionen siehe Betriebsanleitung.	SIL 3	EN 61508 1-7	:2010	SIL 3	For safety functions see manual.
		EN 62061 +AC +A1 +A2	:2005 :2010 :2013 :2015		
		EN 61800-5-2	:2017		
		EN 61800-5-1 +A1	:2007 :2017		

Konformitätsbewertung | **Conformity assessment**

CE 0035

Benannte Stelle	**notified body**	TÜV Rheinland Industrie Service GmbH Am Grauen Stein 51105 Köln / Germany
Zertifikate	Certificates	01/205/5146.02/21
Gültigkeit	Date of expiry	2026-09

EMV- Richtlinie 2014/30/EU | **EMC Directive** 2014/30/EU

Angewandte harmonisierte Normen: | **Applied harmonized standards:**

EN 61800-3:2004 + A1:2012
EN 61800-3:2018

RoHS- Richtline 2011/65/EU | **RoHS Directive** 2011/65/EU

Angewandte harmonisierte Normen: | **Applied harmonized standards:**

EN IEC 63000:2018

Die Sicherheitshinweise der Betriebanleitung sind zu beachten.

The safety instructions of the manual are to be considered.

Die Produkte sind bestimmt zum Einbau in Maschinen. Die Inbetriebnahme ist solange untersagt bis festgestellt wurde, dass die Maschine, in welche diese Produkte eingebaut werden sollen, den Bestimmungen der o.g. EU-Richtlinie entsprechen.

These products are intended for installation in machines. Operation is prohibited until it has been determined that the machines in which these products are to be installed, conforms to the above mentioned EU Directive.

Ort / Datum
Place / date

Aerzen 21.09.2021

Geschäftsführer
Managing Director

Dipl.-Ing. Frank Maier

Dokumentationsverantwortlicher
Responsible for documentation

i.V. T. Wedemeyer

i.V. T. Wedemeyer

2460406.00

UK Declaration of Conformity

Manufacturer

LENZE SE, Hans-Lenze-Strasse 1, 31855 Aerzen GERMANY

Authorised representative

LENZE Ltd., 6, Abbey Court Fraser Road Priory, Business Park, MK44 3WH Bedford

declares under sole responsibility compliance of the products

8400 protec
E84DxxxxxxxxxxxJxx (SO10)

with the

The Supply of Machinery (Safety) Regulations 2008 — S.I. 2008 No. 1597

Applied designated standards:

Safe torque off	EN 60204-1	:2018	
	EN ISO 13849-1	:2015	Category 4 Performance Level: PL e
For safety functions see manual.	EN 61508 1-7	:2010	SIL 3
	EN 62061 +AC +A1 +A2	:2005 :2010 :2013 :2015	
	EN 61800-5-2	:2007 + 2017	
	EN 61800-5-1 + A1	:2007 :2017	

Conformity assessment

UK CA

Approved Body	TUV Rheinland UK Ltd 1011 Stratford Road Solihull, B90 4BN Approved Body No. 2571
Certificates	01/205U/5146.00/22
Date of expiry	2026-09

The Electromagnetic Compatibility Regulations 2016 — S.I. 2016 No. 1091

Applied designated standards:

EN 61800-3:2004 + A1:2012
EN IEC 61800-3:2018

The Ecodesign for Energy-Related Products and Energy Information Regulations 2021

Applied designated standards:

EN 61800-9-2:2017

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 — S.I. 2012 No. 3032

Applied designated standards:

EN IEC 63000:2018

The safety instructions of the manual are to be considered.

These products are intended for installation in machines. Operation is prohibited until it has been determined that the machines in which these products are to be installed, conforms to the above mentioned Regulations.

Place / date	Chief Technology Officer	Responsible for documentation
Aerzen 09.05.2022	*Dipl.-Ing. Frank Maier*	i.V. *i.V. Torsten Wedemeyer*

2460409.00

UK Declaration of Conformity

Manufacturer

LENZE SE, Hans-Lenze-Strasse 1, 31855 Aerzen GERMANY

Authorised representative

LENZE Ltd., 6, Abbey Court Fraser Road Priory, Business Park, MK44 3WH Bedford

declares under sole responsibility compliance of the products

8400 protec - E84DxxxxxxxxxxxKxx (SO20)
8400 protec - E84DxxxxxxxxxxxLxx (SO30)

with the

The Supply of Machinery (Safety) Regulations 2008 — S.I. 2008 No. 1597

Applied designated standards:

Safe torque off	EN 60204-1	:2018		
	EN ISO 13849-1	:2015	Category 3 Performance Level: PL e	
For safety functions see manual.	EN 61508 1-7	:2010		SIL 3
	EN 62061 +AC +A1 +A2	:2005 :2010 :2013 :2015		
	EN 61800-5-2	:2007 + 2017		
	EN 61800-5-1 + A1	:2007 :2017		

Conformity assessment

UK CA

Approved Body	TUV Rheinland UK Ltd 1011 Stratford Road Solihull, B90 4BN Approved Body No. 2571
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Date of expiry	2026-09

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Applied designated standards:

EN 61800-3:2004 + A1:2012
EN IEC 61800-3:2018

The Ecodesign for Energy-Related Products and Energy Information Regulations 2021

Applied designated standards:

EN 61800-9-2:2017

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 — S.I. 2012 No. 3032

Applied designated standards:

EN IEC 63000:2018

The safety instructions of the manual are to be considered.

These products are intended for installation in machines. Operation is prohibited until it has been determined that the machines in which these products are to be installed, conforms to the above mentioned Regulations.

Place / date		Chief Technology Officer	Responsible for documentation
Aerzen	09.05.2022	*Dipl.-Ing. Frank Maier*	i.V. T. Wedemeyer *i.V. Torsten Wedemeyer*

13.2 Ecodesign Directive

REGULATION (EU) 2019/1781

8400 protec frequency inverter

Product information acc. to REGULATION (EU) 2019/1781 (ANNEX I, Section 4)

Power losses							
0; 25	f; I	%	3.6	1.8	1.5	1.4	0.7
0; 50	f; I	%	3.8	2.0	1.6	1.5	0.9
0; 100	f; I	%	4.2	2.3	2.0	1.9	1.2
50; 25	f; I	%	3.7	1.8	1.5	1.4	0.8
50; 50	f; I	%	3.8	2.0	1.7	1.6	0.9
50; 100	f; I	%	4.2	2.4	2.1	2.0	1.4
90; 50	f; I	%	3.9	2.1	1.7	1.6	1.0
90; 100	f; I	%	4.3	2.5	2.2	2.1	1.5
Standby losses		%	1.6	0.8	0.5	0.4	0.2
Efficiency level			IE2	IE2	IE2	IE2	IE2
Manufacturer			Lenze SE · Hans-Lenze-Str. 1 · 31855 Aerzen · GERMANY				
Commercial registration number			Hannover HRB 204803				
Product's model identifier			E84D□□□□7514	E84D□□□□1524	E84D□□□□3024	E84D□□□□4024	E84D□□□□7524
Apparent output power		kVA	1.5	2.4	4.6	5.9	10
Indicative motor rated power output		kW	0.75	1.5	3	4	7.5
Rated output current		A	2.4	3.9	7.3	9.5	16
Maximum operating temperature		°C	45				
Rated supply frequency		Hz	50				
Rated supply voltage		V	400				
Switching frequency		kHz	4				
Rated apparent output power		kVA	1.71	3.3	5.85	7.38	14.4

□	Placeholder for product variants
Operating point (f; I)	f = relative motor stator frequency; I = relative torque-producing current
Power losses	Power losses at operating points (f; I) and in standby mode relate to the rated apparent output power. For power losses for options (e.g. for diagnostics) and for accessories (e.g. mains chokes) please refer to further product documentation on the product web page.

13.3 Index

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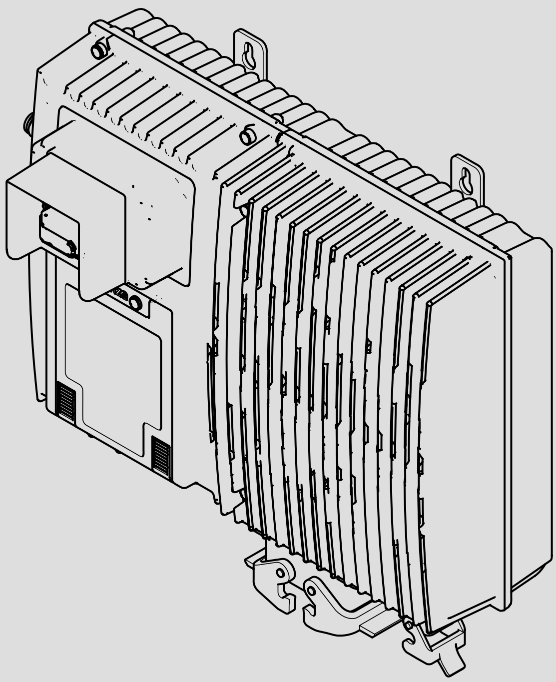
EDS84DPS424 ▪ 13553590 ▪ EN ▪ 6.2 ▪ TD00
10 9 8 7 6 5 4 3 2 1

EDS84DPSO01
13368902

L-force *Drives*

Translation **Manual**

8400 protec



SO10 / SO20 / SO30

Drive-based safety

Lenze

Please read these instructions and the documentation of the standard device before you start working!
Observe the safety instructions given therein!

1 About this documentation

Contents

The manual provides full information on the application as directed of the 8400 protec controllers in the StateLine or HighLine versions including drive-based safety.

Validity

Type	Type designation	from hardware version	from software version
8400 protec StateLine mit SO10	E84DSxxxxxxxxxxJxx	PB	-
8400 protec StateLine mit SO20	E84DSxxxxxxxxxxKxx	PB	-
8400 protec StateLine mit SO30	E84DSxxxxxxxxxxLxx	PB	-
8400 protec HighLine mit SO10	E84DHxxxxxxxxxxJxx	PB	-
8400 protec HighLine mit SO20	E84DHxxxxxxxxxxKxx	PB	-
8400 protec HighLine mit SO30	E84DHxxxxxxxxxxLxx	PB	-

Target group

This manual is intended for all persons who design, install, commission, and adjust controllers of the 8400 protec series with drive-based safety.

Tip!

Information and auxiliary devices around the Lenze products can be found in the download area at

http://www.Lenze.com

1.1 Document history

Material number	Version			Description
13290952	1.0	03/2009	TD03	First edition
13295461	1.1	05/2009	TD03	Minor corrections to the "Certification" chapter
13297773	2.0	06/2009	TD15	Corrected and amended by further safety options
13368902	2.1	04/2011	TD15	General revision

1.2 Conventions used

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

Type of information	Identification	Examples/notes
Spelling of numbers		
Decimal separator	Point	In general, the decimal point is used. For instance: 1234.56
Warnings		
UL warnings	Ⓤ	Are only given in English.
UR warnings	ᴿᵁ	
Text		
Program name	» «	PC software For example: »Engineer«, »Global Drive Control« (GDC)
Icons		
Page reference	🕮	Reference to another page with additional information For instance: 🕮 16 = see page 16

1.3 Terms and abbreviations used

Abbreviation	Meaning
24O	24 V voltage supply for non-safe monitoring
Cat.	Category according to EN 954-1 (valid until 30 November 2009)
DO	Non-safe feedback output
F-PLC	Safety PLC
GSDML	File containing device-specific data to establish PROFINET communication
GSE	File containing device-specific data to establish PROFIBUS communication
OFF state	Signal status of the safety sensors when they are activated or respond
ON state	Signal status of the safety sensors during normal operation
Opto supply	Optocoupler supply for controlling the drivers
OSSD	Output Signal Switching Device, tested signal output
PELV	Protective Extra Low Voltage
PL	Performance Level according to EN ISO 13849-1
PM	P/N switching signal paths
PP	P/P switching signal paths
PS	PROFIsafe
PWM	Pulse Width Modulation
S-Bus	Safety bus
SD-In	Safe input (Safe Digital Input)
SD-Out	Safe output (Safe Digital Output)
SELV	Safety Extra Low Voltage
SIA, SIB	Safe Input, channel A or B, respectively
SIL	Safety Integrity Level according to IEC 61508
SO	Integrated safety option

Abbreviation	Safety function
AIE	Error acknowledgement (Acknowledge In Error)
AIS	Restart acknowledgement (Acknowledge In Stop)
ES	Safe enable switch
OMS	Operation Mode Selector
SS1	Safe Stop 1
SSE	Safe Stop Emergency
STO	Safe Torque Off Formerly: Safe standstill

1.4 Notes used

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

Safety instructions

Structure of safety instructions:

Danger!
(characterises the type and severity of danger)
Note
(describes the danger and gives information about how to prevent dangerous situations)

Pictograph and signal word	Meaning
Danger!	**Danger of personal injury through dangerous electrical voltage.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
Danger!	**Danger of personal injury through a general source of danger.** Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
STOP Stop!	**Danger of property damage.** Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph and signal word	Meaning
Note!	Important note to ensure troublefree operation
Tip!	Useful tip for simple handling
	Reference to another documentation

Special safety instructions and application notes for UL and UR

Pictograph and signal word	Meaning
Warnings!	**Safety or application note for the operation of a UL-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.
Warnings!	**Safety or application note for the operation of a UR-approved device in UL-approved systems.** Possibly the drive system is not operated in compliance with UL if the corresponding measures are not taken.

2 Safety engineering

2.1 Introduction

With increasing automation, protection of persons against hazardous movements is becoming more important. Functional safety describes the measures needed by means of electrical or electronic equipment to reduce or remove danger caused by failures.

During normal operation, safety equipment prevents people accessing hazardous areas. In certain operating modes, e.g. set-up mode, work needs to be carried out in hazardous areas. In these situations the machine operator must be protected by integrated drive and control measures.

Drive-based safety provides the conditions in the controls and drives to optimise the safety functions. Planning and installation expenditure is reduced. In comparison to the use of standard safety engineering, drive-based safety increases machine functionality and availability.

Drive-based safety with L-force | 8400 protec

Unlike control cabinet devices, decentralised drives are frequency inverters which are not locally mounted but directly attached to the application on site. Due to this product-specific property, they must meet demanding requirements for robustness and class of protection.

8400 protec controllers are optionally available with drive-based safety.

"Drive-based safety" stands for applied safety functions, which can be used for the protection of persons working on machines.

The motion functions are continued to be executed by the controller. The drive-based safety monitors the safe compliance with the limit values and provides the safe inputs and outputs. When the limit values are exceeded, the drive-based safety starts the control functions according to EN 60204-1 directly in the controller.

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 3 or 4 depending on the safety option according to EN ISO 13849-1.

2.2 Important notes

Application as directed

The controllers that are equipped with safety engineering must not be modified by the user. This concerns the unauthorised exchange or removal of the safety engineering.

Danger!

Danger to life through improper installation

Improper installation of safety engineering systems can cause an uncontrolled starting action of the drives.

Possible consequences:

- ► Death or severe injuries

Protective measures:

- ► Safety engineering systems may only be installed and commissioned by qualified and skilled personnel.
- ► All control components (switches, relays, PLC, ...) and the control cabinet must comply with the requirements of ISO 138491 and ISO 13849-2. This includes i.a.:
  - – Switches, relays with at least IP54 enclosure.
  - – Control cabinet with at least IP54 enclosure.
  - – Please refer to ISO 138491 and ISO 13849-2 for all further requirements.
- ► Wiring must be shielded.
- ► All safety relevant cables outside the control cabinet must be protected, e.g. by means of a cable duct:
  - – Ensure that no short circuits can occur.
  - – For further measures see EN ISO 13849-2.
- ► If an external force acts upon the drive axes, additional brakes are required. Please observe that hanging loads are subject to the force of gravity!

Danger!

When the ”safe torque off” (STO) function is used, an ”emergency switching-off” according to EN 60204 is not possible without additional measures. There is no electrical isolation, no service switch or repair switch between motor and controller!

“Emergency switching-off” requires an electrical isolation, e.g. by a central mains contactor!

During operation

After the installation is completed, the operator must check the wiring of the safety function.

The functional test must be repeated at regular intervals. The time intervals to be selected depend on the application, the entire system and the corresponding risk analysis. The inspection interval should not exceed one year.

Residual hazards

In case of a short-circuit of two power transistors a residual movement of the motor of up to 180 °/number of pole pairs may occur! (Example: 4-pole motor ⇒ residual movement max. 180 °/2 = 90 °)

This residual movement must be considered in the risk analysis, e.g. safe torque off for main spindle drives.

2.2.1 Hazard and risk analysis

This documentation can only accentuate the need for hazard analysis. The user of the integrated safety system must read up on standards and the legal situation:

Before the launch of a machine, the manufacturer of the machine must conduct a hazard analysis according to Machinery Directive 2006/42/EC to determine the hazards associated with the application of the machine. The Machinery Directive refers to three basic principles for the highest possible level of safety:

- Hazard elimination / minimisation by the construction itself.
- Required protective measures must be taken against hazards which cannot be eliminated.
- Existing residual hazards must be documented and the user must be informed of them.

Detailed information on the hazard analysis procedure is provided in the EN 1050, risk assessment principles. The results of the hazard analysis determine the category for safety-related control systems according to EN ISO 13849-1. Safety-oriented parts of the machine control must be compliant.

2.2.2 Standards

Safety regulations are confirmed by laws and other governmental guidelines and measures and the prevailing opinion among experts, e.g. by technical regulations.

The regulations and rules to be applied must be observed in accordance with the application.

2.3 Acceptance

2.3.1 Description

The machine manufacturer must check and prove the operability of the safety functions used.

Inspector

The machine manufacturer must authorise a person with expertise and knowledge of the safety functions to carry out the test.

Test report

The test result of every safety function must be documented and signed by the inspector.

> **Note!**
> If parameters of the safety functions are changed, the inspector must repeat the test and record the results in the test report.

Scope of test

A complete test comprises the following:

- Documenting the plant including the safety functions:
  – Creating an overview screen of the plant
  – Describing the plant
  – Describing the safety equipment
  – Documenting the safety functions used
- Checking the function of the safety functions used:
  – "Safe torque off" function, STO
  – "Safe stop 1" function, SS1
  – "Safe emergency stop" function, SSE
- Preparing the test report:
  – Documenting the functional test
  – Checking the parameters
  – Signing the test report
- Preparing the appendix with test records:
  – Protocols from the plant
  – External recording

2.3.2 Periodic inspections

The correct sequence of the safety-oriented functions must be checked in periodic inspections. The risk analysis or applicable regulations determine the time distances between the tests. The inspection interval should not exceed one year.

2.4 Basics for safety sensors

Passive sensors

Passive sensors are two-channel switching elements with contacts. The connecting cables and the sensor function must be monitored.

The contacts must switch simultaneously (equivalently). Nevertheless, safety functions will be activated as soon as at least one channel is switched.

The switches must be wired according to the closed-circuit principle.

Examples of passive sensors:

- Door contact switch
- Emergency-off control units

Active sensors

Active sensors are units with 2-channel semiconductor outputs (OSSD outputs). With the integrated safety system of this device series, test pulses < 1 ms for monitoring the outputs and cables are permissible. The maximally permissible connection capacity of the outputs is to be observed.

P/M-switching sensors switch the positive and negative cable or the signal and ground wire of a sensor signal.

The outputs have to switch simultaneously. Nevertheless, safety functions are triggered as soon as at least one channel is switched.

Examples of active sensors:

- Lightgrid
- Laser scanner
- Control systems

Use of the safety option 30 (SO30):

Sensor inputs

For unused sensor inputs, ”Input deactivated” must be parameterised.

Connected deactivated sensors can create the false impression of safety technology being provided. For this reason, a deactivation of sensors by parameter setting only is not permissible and not possible. It is monitored that no sensor signal is pending.

3 Safety option 10

3.1 Operating mode

3.1.1 Introduction

Due to safety option 10, the following safety functions can be used:

- Safe torque off (STO),
  formerly: safe standstill

If requested, the safe disconnection of the drive is achieved through:

- Directly connected active sensors
- Passive sensors connected to a safety switching device

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 4 according to EN ISO 13849-1.

Danger!

If the request for the safety function is cancelled, the drive will restart automatically.

You must provide external measures which ensure that the drive only restarts after a confirmation (EN 60204).

3.1.2 Disconnecting paths

The transmission of the pulse width modulation is safely switched (off) by the safety unit. After this, the power drivers do not generate a rotating field. The motor is safely switched to torqueless operation (STO).

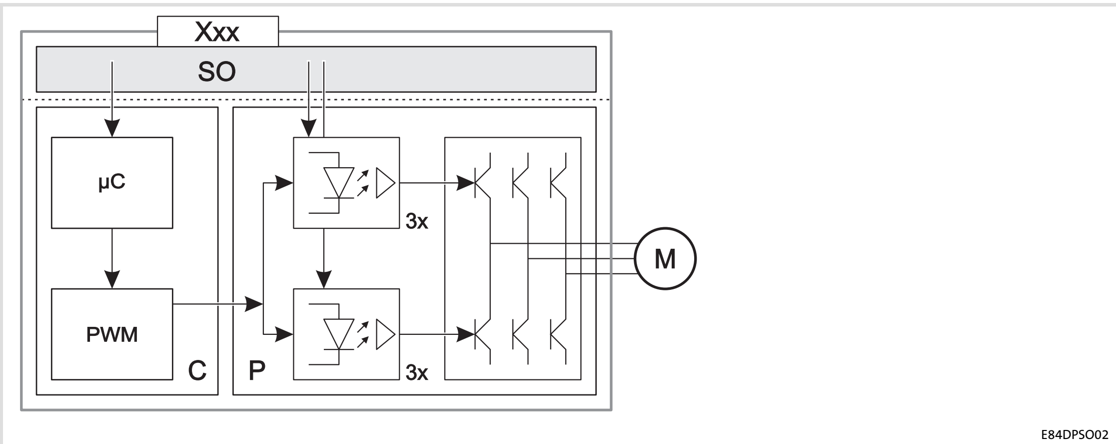


Fig. 3-1 Operating principle of safety unit

SO	Safety option 10, 20, or 30
xxx	Control terminals used in safety engineering systems or safety bus
C	Control section
µC	Microcontroller
PWM	Pulse width modulation
P	Power section
M	Motor

3.1.3 Safety status

When the controller is disconnected from the safety unit, the ”Safe torque off” (STO) status is set (C00155 bit 10 = 1).

3.1.4 Fail-safe status

When internal errors of the safety unit are detected, the motor is safely switched to torqueless operation (fail-safe status).

3.2 Status display

The operating status of the ”STO” safety function is displayed using an LED on the front of the controller.

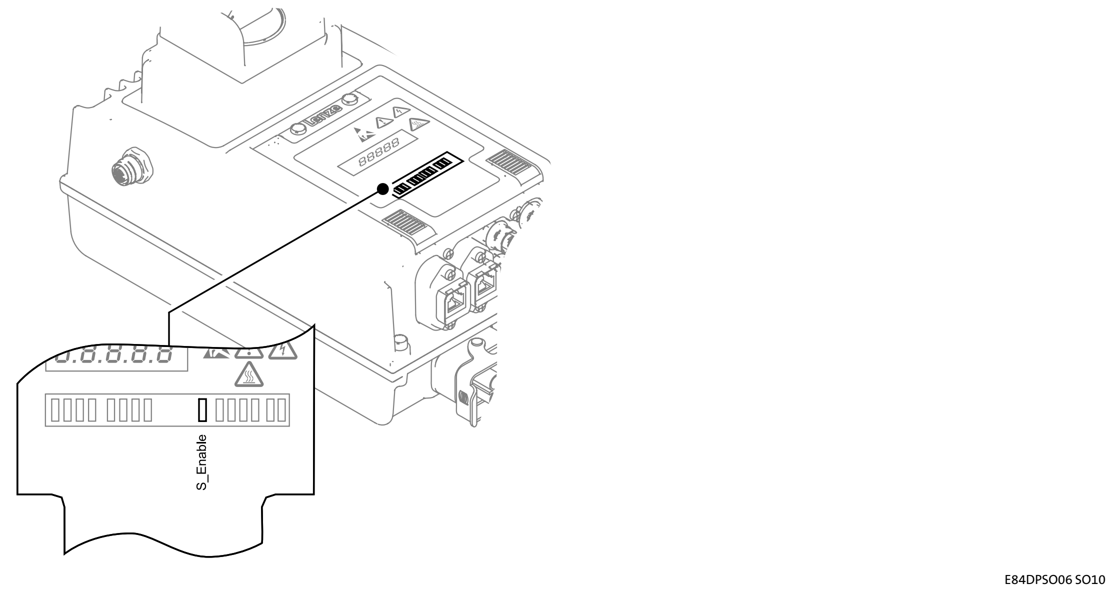


Fig. 3-2 Position of the LED for the drive-based safety on the device

Pos.	Colour	State	Description
S-Enable	yellow	on	Controller is enabled
		blinking	Safety function is active (non-safe display)

The status of safety option 10 is solely shown via the ”S-Enable” display. All other displays have no function.

3.3 Technical data

Supply

The safe input and the output are isolated and designed for a low-voltage supply through a safely separated power supply unit (SELV/PELV) of 24 V DC. P/N switching input signals and test pulses ≤ 1 ms are permissible.

Active sensors are directly connected to the X61 circular connector.

Passive sensors are connected to the X61 circular connector via a switching device. The switching device must comply with the required performance level of the application.

There is no monitoring for short circuits.

Detailed features of the inputs and outputs of the safety unit

Terminal	Specification	[Unit]	min.	typ.	max.
SIA, SIB	Low signal	V	-3	0	5
	High signal	V	18	24	30
	Input capacitance at switch-off	nF		3	
	Input delay (tolerated test pulse)	ms			1
	Switch-off time (depending on the controller)	ms	2.5	4	
	Running time	ms		3	
	Input current	mA		45	50
	Input capacitance at switch-on, reduced	μF		22	
GI	GND potential for SIA / SIB and for the non-safe signalling output				
24O	Supply voltage through safely separated power supply unit (SELV/PELV)	V	18	24	30
DO	Low signal	V		0	0.8
	High signal	V	18	24	30
24O, DO	Output current	A			0.2

Truth table

Safe input / channel		Signalling output	Controller	
SIA	SIB	DO1/DO	Description of device status	Enable
0	0	1	”Safe torque off” activated	0
0	1	0		0
1	0	0		0
1	1	0	Drive active	1

Note!

Safe inputs have two channels (...A/...B). The channels must be triggered separately and simultaneously (equivalent).

Active triggering of only one channel indicates faulty sensors or impermissible wiring.

Despite this, the integrated safety system is activated as soon as at least one channel has been triggered.

3.4 Electrical installation

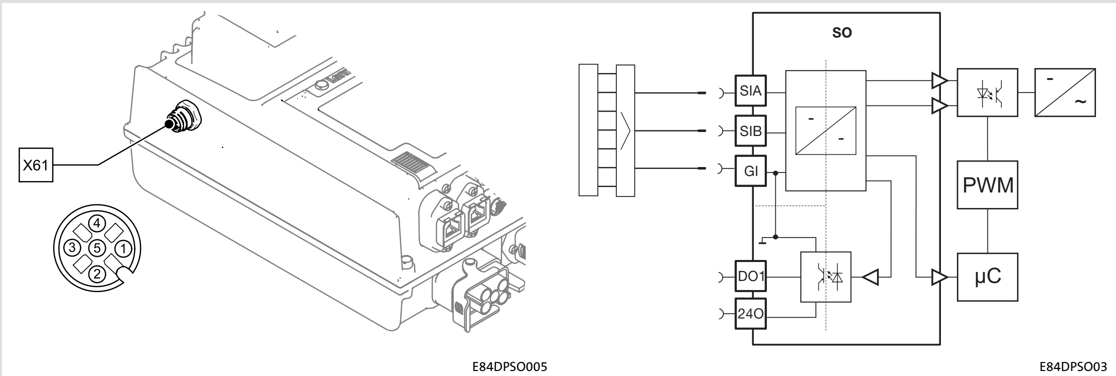


Fig. 3-3 Block diagram - safe torque off (STO)

SO	Safety option 10
X61	M12 circular connector for safety engineering systems
SIA, SIB, GI	Connections for shutdown paths
24O, DO1	Feedback connections
µC	Microcontroller
PWM	Pulse width modulation

X61 - connection of safety system "Safety Option 10"

Pin	Connection	Description	Data
	84DPSO05_5	M12, 5-pole pins, A-coded	
1	SIA	Safe input, channel A	I_{typ} = 45 mA LOW: -3 ... 5 V HIGH: 18 ... 30 V Supply through safely separated power supply unit (SELV/PELV).
2	SIB	Safe input, channel, B	
5	GI	1. GND potential for SIA/SIB 2. GND potential for the non-safe signalling output	
4	24O	24-V voltage supply for the non-safe signalling output	24 V, max. 0.2 A short-circuit-proof Supply through safely separated power supply unit (SELV/PELV). High active
3	DO1	Non-safe signalling output: "SafeTorqueOff" with 2-channel request by SIA **and** SIB	

3.5 Certification

Tip!

The ”TÜV Rheinland Group” certificate is available on the Internet under:
http://www. Lenze.com

4 Safety option 20

4.1 Operating mode

4.1.1 Introduction

Due to safety option 20, the following safety functions can be used:

- Safe torque off (STO),
  formerly: safe standstill
- Safe stop 1 (SS1)
- Safe stop emergency (SSE)
- Safe operation mode selector (OMS)
- Safe enable switch (ES)

The safe disconnection of the drive is achieved through:

- a higher-level safety PLC via PROFIsafe/PROFINET
- a higher-level safety PLC via PROFIsafe/PROFIBUS

The functions of the safety option must be parameterised via the »Engineer«.

The motion functions are continued to be executed by the controller. The drive-based safety monitors the safe compliance with the limit values. When the limit values are exceeded, the drive-based safety starts the control functions according to EN 60204-1 directly in the controller.

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 3 according to EN ISO 13849-1.

4.1.2 Disconnecting paths

The transmission of the pulse width modulation is safely switched (off) by the safety unit. After this, the power drivers do not generate a rotating field. The motor is safely switched to torqueless operation (STO).

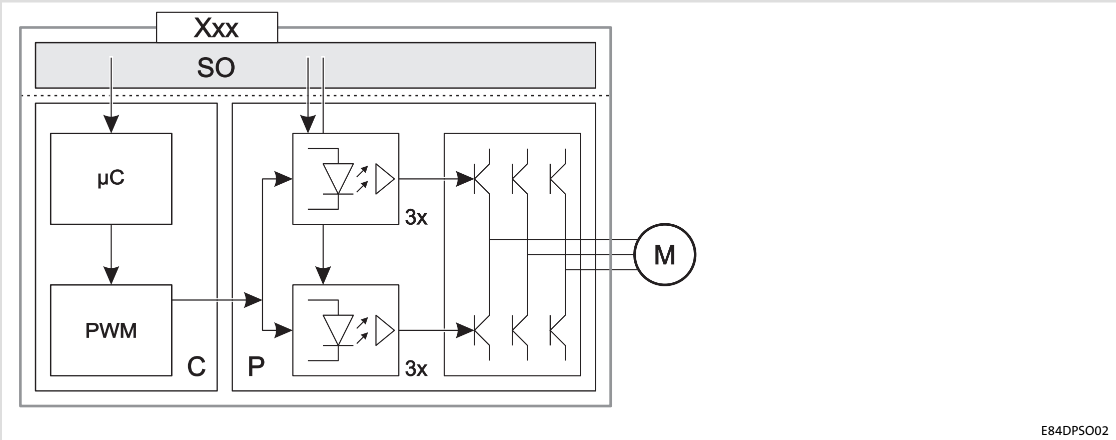


Fig. 4-1 Operating principle of safety unit

SO	Safety option 10, 20, or 30
xxx	Control terminals used in safety engineering systems or safety bus
C	Control section
µC	Microcontroller
PWM	Pulse width modulation
P	Power section
M	Motor

4.1.3 Safety status

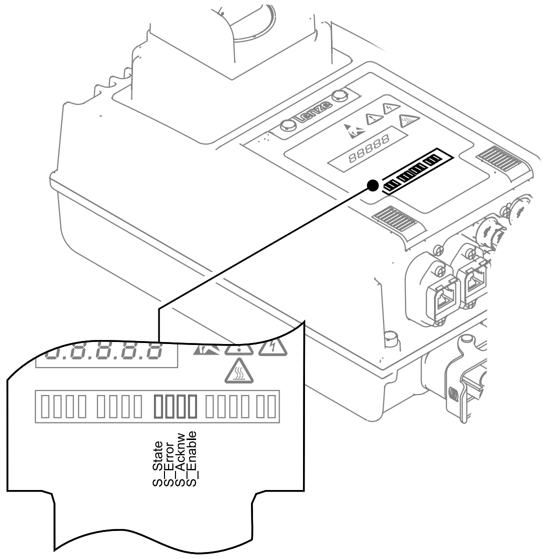
When the controller is disconnected from the safety unit, the "Safe torque off" (STO) status is set (C00155 bit 10 = 1).

4.1.4 Fail-safe status

When internal errors of the safety unit are detected, the motor is safely switched to torqueless operation (fail-safe status).

4.2 Status display

Light-emitting diodes (LED) on the front of the controller display the operating status of the safety engineering system.



E84DPSO06 SO20

Pos.	Colour	State	Description
S-State	green	on	Communication between standard device and safety system is running
		blinking	Drive-based safety is in service status
		off	Communication between standard device and safety system is not possible
S-Error	red	on	Fault, trouble or warning
		blinking	Drive-based safety is not accepted by the standard device
		off	Error-free operation
S-Acknw	yellow	on	A parameter set acceptance must be acknowledged
S-Enable	yellow	on	Controller is enabled
		blinking	Safety function is active (non-safe display)

4.3 Technical data

Safety option 20 is exclusively controlled via the safety bus. Supply voltages, signal levels etc. of the used safety bus system are relevant.

Since there are no inputs or outputs at the application end, connection data need not be specified.

4.4 Electrical installation

Safety option 20 does not require external wiring because the safety functions are exclusively controlled via the used safety bus.

4.5 Certification

Tip!

The ”TÜV Rheinland Group” certificate is available on the Internet under:
http://www. Lenze.com

4.6 Safety functions

The available safety functions comply with the safety functions of safety option 30 (🕮 45). However, the safety engineering system is exclusively controlled via the safety bus. Therefore, the controller with safety option 20 is not provided with connections for safety sensors.

4.7 Safe parameter setting

Note!

Safety-relevant parameters can exclusively be transmitted to the drive-based safety by safe parameter setting using the »Engineer«.

The parameter set is saved to the memory module and the drive-based safety with a definite module ID which must comply with the effective safety address in the drive-based safety.

The following is required for the parameterisation and configuration of the safety option:

- A computer with a Windows® operating system (XP or 2000)
- The Lenze »Engineer« PC software
- Connection with the controller via an interface.
  – diagnostic interface X70 with diagnostic USB adapter
  – PROFINET
  – Ethernet

Further information and help can be found in:

- the online help of the controller with safety option
- the 8400 protec software manual, integrated safety system ..., order designation: EDS84DWTSO

4.7.1 Parameter setting

Safety-relevant parameters can exclusively be transmitted to the drive-based safety by safe parameter setting. The parameter set is saved to the memory module and the drive-based safety with a definite module ID which must comply with the effective safety address in the drive-based safety.

Safe parameter setting requires the service status. The service status means:

- The standard stop is active and the drive is safely switched to torqueless operation (STO).
- The communication via the safety bus is active but passivated.

About the service status:

- It can be activated by the Lenze »Engineer« PC software.
- It can be quit by reinitialising the drive-based safety, i.e. the communication via the safety bus is interrupted.

Note!

The service status also occurs if the parameter set in the memory module does not comply with the parameter set in the drive-based safety during initialisation.

4.7.1.1 Parameter setting with the Lenze »Engineer« PC software

Safe parameter setting is supported by the Lenze »Engineer« PC software as of version 2.10.

The parameter setting is described in the software manual of drive-based safety for 8400 protec controllers. In addition, the software provides comprehensive online help.

Password

To store a safe parameter set, a password is required. The standard password is: ”Lenze SM301”. The password can be changed and must have at least six characters.

Use ”General reset” to delete the safe parameter set in the memory module and the drive-based safety. The drive-based safety must be reparameterised.
The password is reset to the standard ”Lenze SM301”.

4.7.1.2 Parameter set transfer from the memory module

The safe parameter set transfer is supported by a safe parameter set saved to the memory module, e.g. when replacing the standard device or parameterising the drive-based safety, without the Lenze »Engineer« PC software via the memory module.

- A valid parameter set with a corresponding module ID must be stored.
- The drive-based safety must be in the service status.
- Open the service hatch on the standard device to be able to operate the ”T1” and ”T2” pushbuttons.

The transfer of the parameter set from the memory module must be acknowledged with the pushbuttons:

- the drive-based safety is in the service status
  – the ”S_State” LED is blinking
  – the ”S_Error” LED is lit
  – the ”S_Acknw” LED is lit
  – the ”S_Enable” LED is blinking
- press and hold the ”T1” and ”T2” pushbuttons at the same time
- the ”S_Acknw” LED starts blinking
- if the ”S_Acknw” LED goes out, release both pushbuttons immediately
- after a few seconds, the ”S_Acknw” LED is lit again
- press and hold the ”T1” and ”T2” pushbuttons at the same time again
- the ”S_Acknw” LED starts blinking
- if the ”S_Acknw” LED goes out, release both pushbuttons immediately
- The parameter set transfer is completed successfully.

If system-related response times (approx. 2.5 s) cannot be complied with, the parameter transfer is cancelled. The process must be started again.

In case of success, the parameter transfer is recorded in the logbook of the standard device and the service status is quit by a software restart.

If the parameter set is invalid, an error is indicated and the ”S_Error” LED is lit.

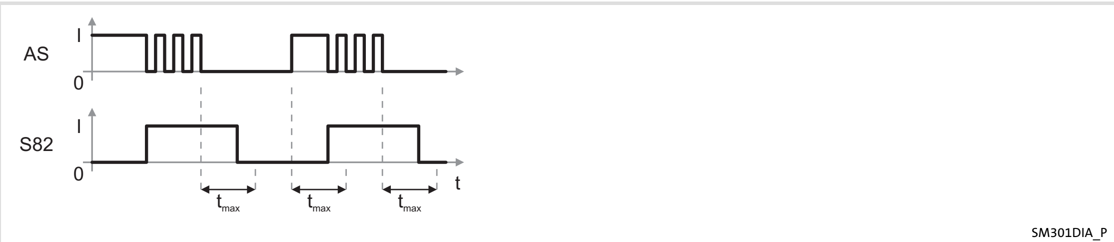


Fig. 4-2 Acknowledgement procedure

AS	”S_Acknw” LED
S82	”Left” and ”Right” pushbuttons at the same time
t	Time axis
t_{max}	Maximum permissible response time

4.7.2 Parameter sets and axes

The unambiguousness of an axis with safety functions in a drive system can be achieved by means of the safety address. In the safe parameter set a module ID is stored. This module ID is compared to the effective safety address (C15112) in the drive-based safety.

When a drive-based safety is initialised, e.g. when loading the parameter set, the compliance of the safety address will be checked. If no compliance exists, an initialisation error is reported.

Note!

- Clearly define the safety address in a drive system or plant.
- Document the address in circuit diagrams and labels.
- Ensure identical settings when replacing the standard device or the memory module.

In drive systems with activated safety bus the safety address is also used as the safety bus target address. The clear assignment of the safety address must be configured in the safety PLC.

In drive systems without activated safety bus, unambiguousness and correct assignment of the safety address must be checked. For this purpose, use the Lenze »Engineer« PC software or an EZAEBK200x diagnosis terminal.

4.8 Error management

4.8.1 Error states

Detected errors or maloperation of the drive are assigned to error states with definite reactions. The reaction can be co-ordinated with the complete drive via the error states.

Features	Error status		
	System error	Trouble	Warning
Event	Fatal internal error	Fault	Monitoring function
”S_State” LED	is lit	is lit	is lit
Status of drive-based safety	Lockout (CPU stopped)	Error status	Normal operation
The control category according to EN 954-1 ...	... has been abandoned	... has been abandoned	... has not been abandoned
Reaction	The motor immediately switches to torque-free operation via ● STO	The motor is stopped via ● STO or ● SS1	
Acknowledgement after deactivated event	● Connection and disconnection of the 24-V supply at the safety module	● Error acknowledgement (AIE) via X62 (positive signal pulse with a signal duration of 0.3 ... 10 s) ● Fault acknowledgement (AIE) via the safety bus (Bit ”PS_AIE”) ● Connection and disconnection of the 24-V supply at the safety module	

Tab. 4-1 Overview of error states

Note!
If the system fault also occurs after switching the 24-V supply, please contact the service.

When using PROFIsafe as safety bus:

- If faults occur in the PROFIsafe communication, the data is passivated by the PROFIsafe driver.
- After the PROFIsafe communication is reinitialised, the drive is automatically enabled again if no standstill function is selected.
- Events which cause an error status are sent as diagnostic telegram via the safety bus.

4.8.2 Logbook

Error states are saved in the logbook of the standard device. The following is entered:

- Type of response (e.g. trouble, warning, or information) to the event
- Module which has caused the event (e.g. MCTRL or TEMPCONTROL)
- Date/time (in case of memory module with real-time clock)
- Value of the power-on time meter

The available logbook entries can be displayed in the »Engineer« when an online connection has been established.

4.9 Response times

In order to detect the response time to a safety function the entire system must be considered. The following is relevant:

- Response time of the connected sensors.
- Input delay of the safety inputs.
- Internal processing time.
- When using PROFIsafe as safety bus:
  – Monitoring time for the cyclic service in the PROFIBUS/PROFINET.
  – Monitoring time of the PROFIsafe in the safety PLC.
  – Processing time in the safety PLC.
- Delay times due to further components.

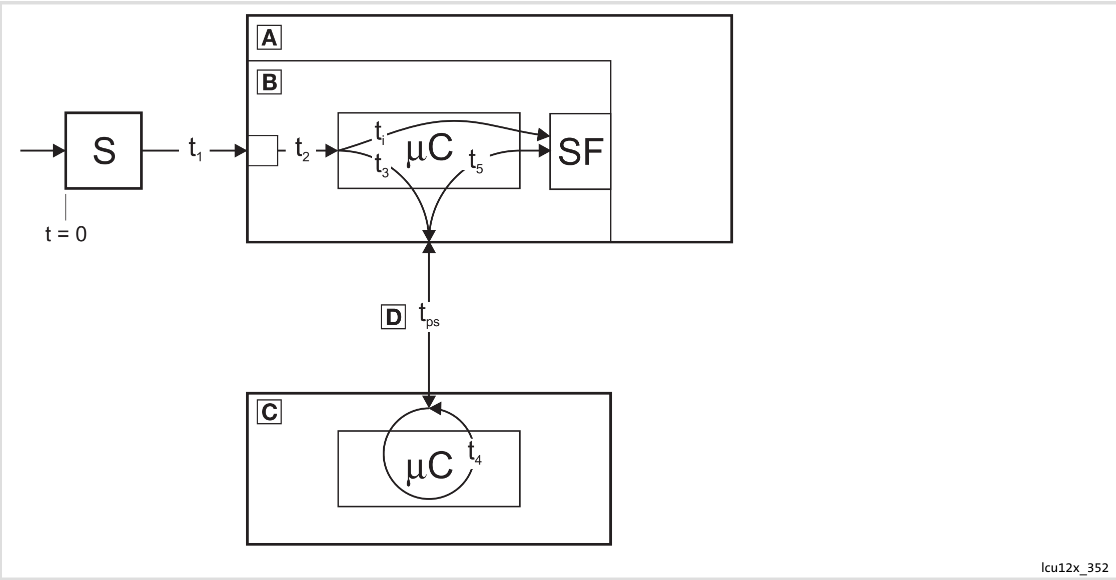


Fig. 4-3 Response times to the request of a safety function

A Standard device
B Drive-based safety
C Safety PLC
D Safety bus
μC Microcontroller
S Safety sensor technology
SF Activated safety function

4.9.1 Response times of the inputs

Response time to an event in the sensors			
Time interval (Fig. 4-3)			[ms]
t_1	Response time of the sensors		according to manufacturer information
t_2	Input delay of the safe inputs		
		C15034:	**0** ... 100
		Input error:	2
t_i	Processing time in drive-based safety		4
	Safety function starts after ...		Σ

Tab. 4-2 Response time to an event in the sensors

4.9.2 Response times of the safety bus

PROFIsafe

Response time to an event in the safety sensors (PROFIsafe input data)		
Time interval (Fig. 4-3)		[ms]
t_1	Response time of the sensors	according to manufacturer information
t_2	Input delay of the safe inputs	
	C15034:	**0** ... 100
	Input error:	2
t_3	Processing time in drive-based safety	24
	PROFIsafe input data ready for transmission to ...	Σ
t_{Ps}	PROFIsafe cycle time	according to manufacturer information
	PROFIsafe input data ready for processing in the safety PLC ...	Σ

Tab. 4-3 Response time to an event in the sensors

Response time to a PROFIsafe control word (PROFIsafe output data)		
Time interval (Fig. 4-3)		[ms]
t_4	Processing time in the safety PLC	must be calculated
t_{Ps}	PROFIsafe cycle time	according to manufacturer information
t_5	Processing time in drive-based safety	14
	Safety function starts after ...	Σ

Tab. 4-4 Response time in case of PROFIsafe request

Information on how to calculate the processing time and transmission time of the PROFIsafe can be found in the documentation of the safety PLC used.

Note!

If PROFIsafe communication is troubled, the fail-safe status will be reached after the PROFIsafe monitoring time (F_WD_Time) has expired. PROFIsafe communication is passivated.

Example

- ► After an event has occurred at a safe input, the message is fed back to drive-based safety via the safety PLC.
- ► Drive-based safety activates a safety function.
- ► Hence, the maximum response time to the event is calculated as follows:

  $t_{max\ response} = t_1 + t_2 + t_3 + \max\{t_{WD}; t_{PS} + t_4 + t_{Ps} + t_5\}$

When calculating the maximum response time, include the times of the safety functions, e.g. in case of SS1 the stopping time (30 s) until STO is active.

5 Safety option 30

5.1 Operating mode

5.1.1 Introduction

Due to safety option 30, the following safety functions can be used:

- Safe torque off (STO),
  formerly: safe standstill
- Safe stop 1 (SS1)
- Safe stop emergency (SSE)
- Safe operation mode selector (OMS)
- Safe enable switch (ES)

The safe disconnection of the drive is achieved through:

- a higher-level safety PLC via PROFIsafe/PROFINET
- connected active or passive sensors

The functions of the safety option must be parameterised via the »Engineer«.

The motion functions are continued to be executed by the controller. The drive-based safety monitors the safe compliance with the limit values. When the limit values are exceeded, the drive-based safety starts the control functions according to EN 60204-1 directly in the controller.

The safety functions are suitable for applications according to IEC 61508 to SIL 3 and achieve a performance level (PL) e and the control category 3 according to EN ISO 13849-1.

5.1.2 Disconnecting paths

The transmission of the pulse width modulation is safely switched (off) by the safety unit. After this, the power drivers do not generate a rotating field. The motor is safely switched to torqueless operation (STO).

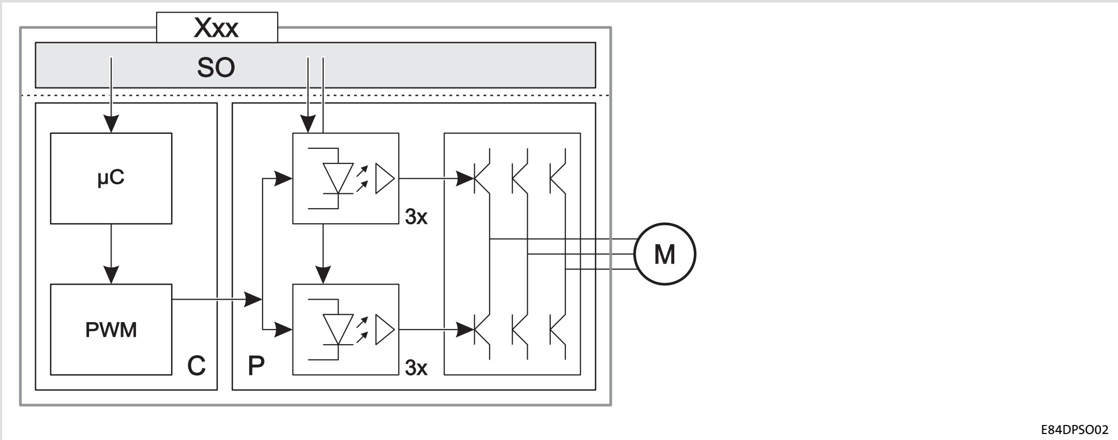


Fig. 5-1 Operating principle of safety unit

SO	Safety option 10, 20, or 30
xxx	Control terminals used in safety engineering systems or safety bus
C	Control section
µC	Microcontroller
PWM	Pulse width modulation
P	Power section
M	Motor

5.1.3 Safety status

When the controller is disconnected from the safety unit, the "Safe torque off" (STO) status is set (C00155 bit 10 = 1).

5.1.4 Fail-safe status

When internal errors of the safety unit are detected, the motor is safely switched to torqueless operation (fail-safe status).

5.1.5 Safe inputs

Contact function test

Note!

Make sure that an internal contact function test is carried out at the safe inputs:

Safe input in the ON state

- ► A LOW level at **one channel** puts the input in the OFF state. The discrepancy monitoring starts simultaneously.
- ► A LOW level must be detected at **both channels** within the discrepancy time, otherwise a discrepancy error will be reported.
- ► To be able to acknowledge the discrepancy error, a LOW level must be detected before at **both channels**.

Safe input in the OFF state

- ► A HIGH level at **one channel** starts the discrepancy monitoring.
- ► A HIGH level must be detected at **both channels** within the discrepancy time, otherwise a discrepancy error will be reported.
- ► To be able to acknowledge the discrepancy error, a HIGH level must be detected before at **both channels**.

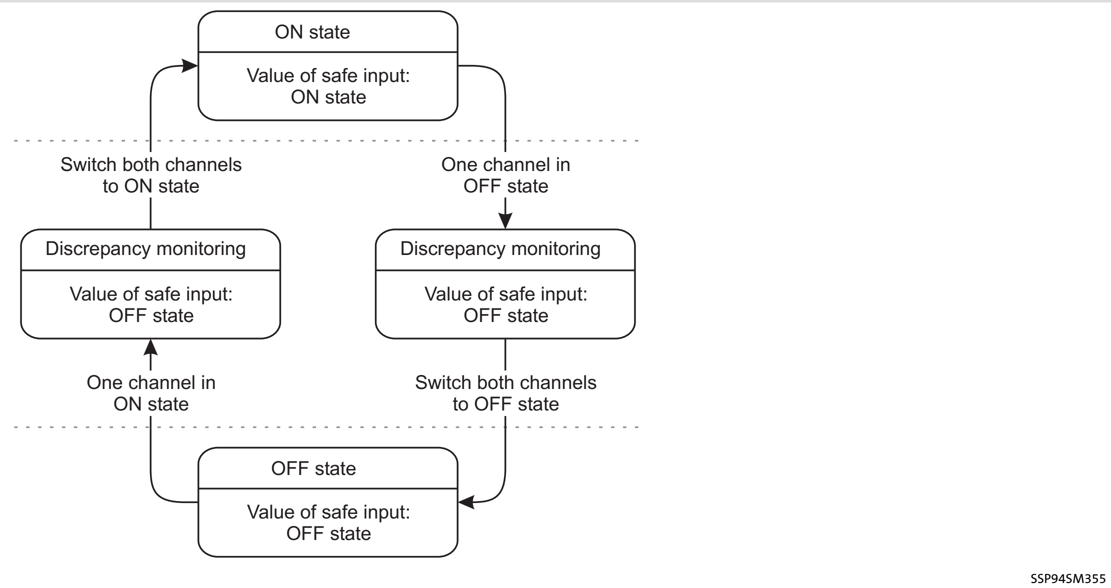


Fig. 5-2 Status behaviour - contact function test

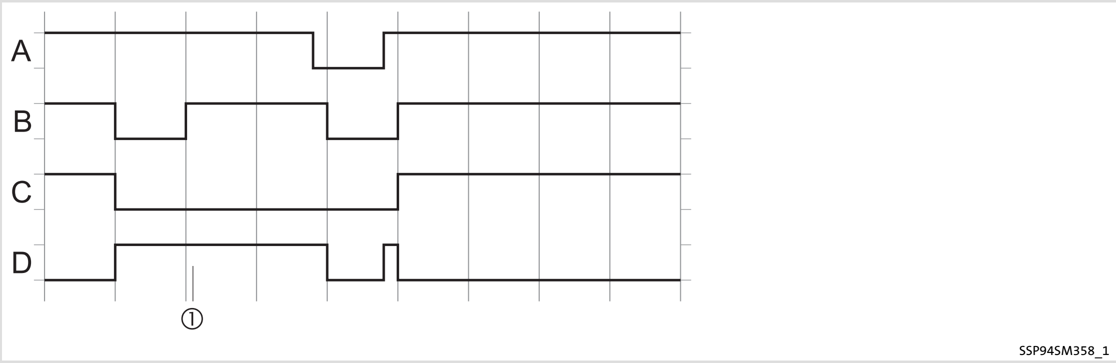


Fig. 5-3 Contact function test - error-free input signals

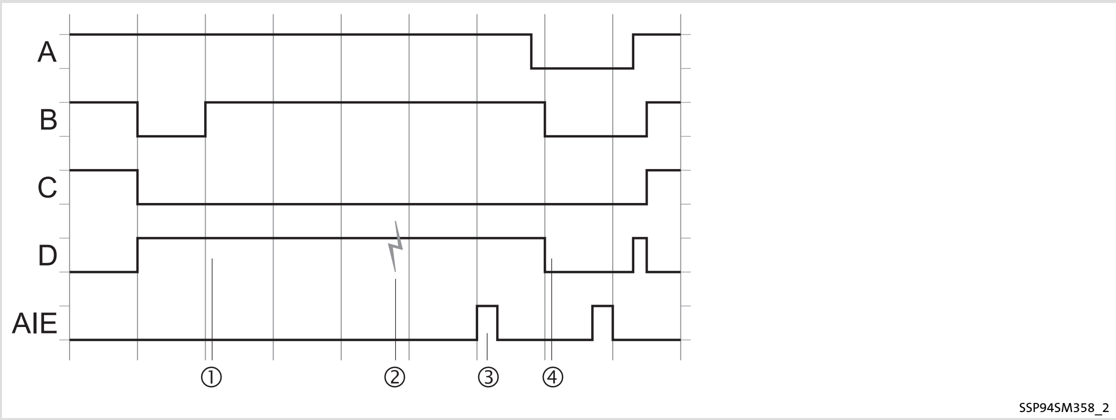
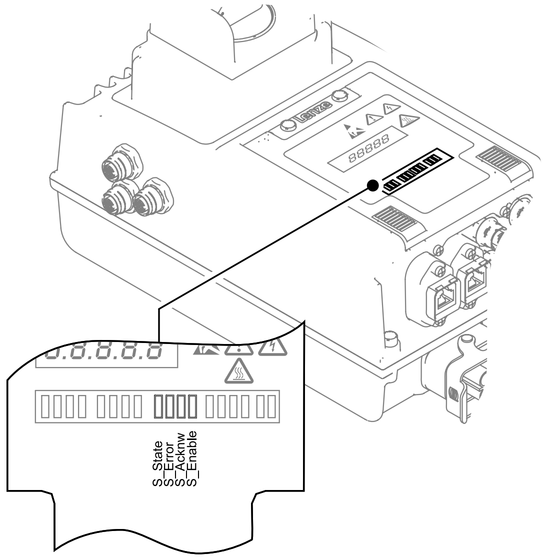


Fig. 5-4 Contact function test - faulty input signals

A, B	Safe input, channel A and channel B
C	Internal valuation of the safe input
D	Discrepancy monitoring
AIE	Fault acknowledgement
①	Discrepancy monitoring active
②	Discrepancy monitoring - time-out
③	Fault acknowledgement impermissible
④	Fault acknowledgement permissible

5.2 Status display

Light-emitting diodes (LED) on the front of the controller display the operating status of the safety engineering system.



E84DPSO06 SO30

Pos.	Colour	State	Description
S-State	green	on	Communication between standard device and safety system is running
		blinking	Drive-based safety is in service status
		off	Communication between standard device and safety system is not possible
S-Error	red	on	Fault, trouble or warning
		blinking	Drive-based safety is not accepted by the standard device
		off	Error-free operation
S-Acknw	yellow	on	A parameter set acceptance must be acknowledged
S-Enable	yellow	on	Controller is enabled
		blinking	Safety function is active (non-safe display)

5.3 Technical data

24 V supply

The safety option 30 component does not require an external supply voltage.

Inputs and outputs

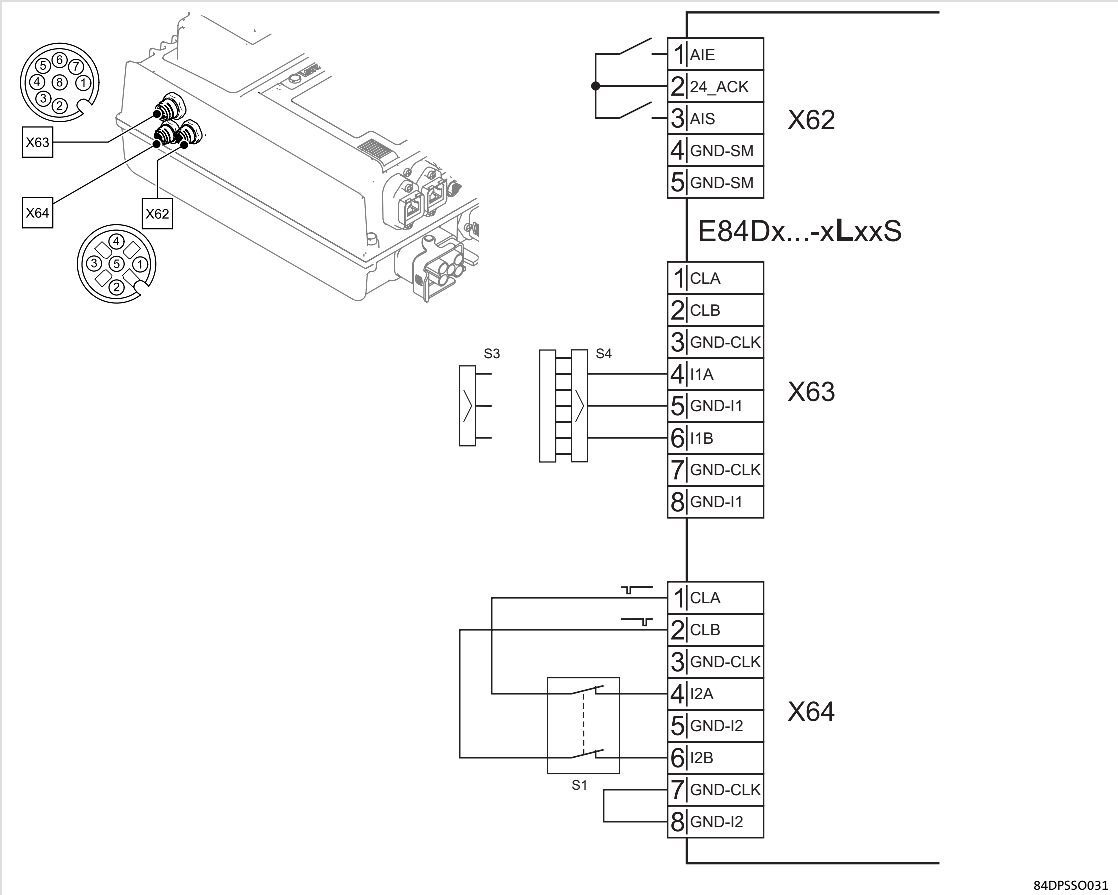
The inputs are isolated and designed for a low-voltage supply of 24 V DC.

Detailed features of the safe inputs					
Terminal	Specification	[Unit]	min.	typ.	max.
I1A, I1B I2A, I2B AIE, AIS	PLC input, IEC-61131-2, 24 V, type 1				
	Low signal input voltage	V	-3	0	5
	Input current at low signal	mA			15
	High signal input voltage	V	15	24	30
	Input current at high signal	mA	2		15
	Input capacitance	nF			3.5
	Repetition rate of the test pulses	ms	50		
AIE, AIS	Input delay (operating time)	s	0.3		10
24I	Voltage supply only for AIE and AIS	V		24	
CLA, CLB	PLC output, IEC-61131-2, 24 V DC, 50 mA				
	Low signal output voltage	V		0	0.8
	High signal output voltage	V	17	24	29
	Output current	mA			60
	Cable capacity	nF			100
	Cable resistance of a passive sensor	Ω			200

Safety option 30 does not provide any safe outputs.

5.4 Electrical installation

Principle circuit diagram



E84DxWT...	8400 protec controller with safety option 30
S1	Passive sensor with channel A and B (at X64 in our example)
S3	Higher-level safety control (active sensor)
S4	Lightgrid (active sensor) (at X63 in our example)

Terminal assignment

Danger!

Danger to life through improper installation

Improper installation of the safety engineering systems can cause anuncontrolled starting action of the drives.

Possible consequences:

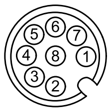
- ► Death or severe injuries

Protective measures:

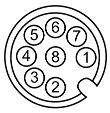
- ► The installation of the cables between X62, X63, and X64 and the connected components must be shielded:
  - – Attach the shield at least in the connector shell.
  - – Also attach the shield to the connected component if possible.

X62 - connection of safety engineering system ”Safety Option 30”			
Pin	**Connection**	**Description**	**Data**
	84DPSO05_5	M12, 5-pole sockets, A-coded	
1	AIE	Error acknowledgement	
2	24_ACK	24-V supply voltage for reset button	max. 300 mA
3	AIS	Restart acknowledgement	
4	GND_SM	GND potential	
5	GND_SM		

X63 - connection of the ”Safety Option 30” safety engineering system

Pin	Connection	Description	Data
	84DSO05_8	M12, sockets 8-pole, A-coded	
1	CLA	Clock output, channel A	
2	CLB	Clock output, channel B	
3	GND_CLK	GND potential - clock output, channel A	
4	I1A	Safe input 1, channel A	
5	GND_I1	GND potential - input 1, channel A	
6	I1B	Safe input 1, channel B	
7	GND_CLK	GND potential - clock output, channel B	
8	GND_I1	GND potential - input 1, channel B	

X64 - connection of the ”Safety Option 30” safety engineering system

Pin	Connection	Description	Data
	84DSO05_8	M12, sockets 8-pole, A-coded	
1	CLA	Clock output, channel A	
2	CLB	Clock output, channel B	
3	GND_CLK	GND potential - clock output, channel A	
4	I2A	Safe input 2, channel A	
5	GND_I2	GND potential - input 2, channel A	
6	I2B	Safe input 2, channel B	
7	GND_CLK	GND potential - clock output, channel B	
8	GND_I2	GND potential - input 2, channel B	

5.5 Certification

Tip!
The ”TÜV Rheinland Group” certificate is available on the Internet under:
http://www. Lenze.com

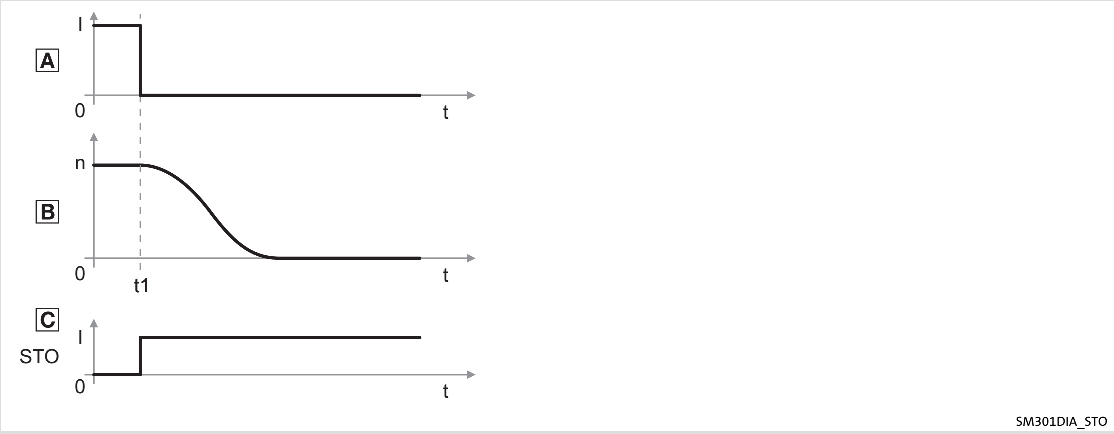
5.6 Safety functions

5.6.1 Safe torque off

Safe **T**orque **O**ff/STO

This function corresponds to a "Stop 0" according to EN 60204.

When this function is used, the power supply of the motor is immediately (t1) safely interrupted. The motor cannot create a torque and thus no dangerous movements of the drive can occur. Additional measures, e.g. mechanical brakes are needed against movements caused by external force.



A	Input signal of the request of a safety function
I	ON state
O	OFF state
B	Speed characteristic n of the motor
t	Time axis
tx	Action instant
C	Feedback(s)

The restart behaviour can be set (C15300/1). Function sequence and error response have no adjustable parameters.

Danger!

If the request for the safety function is cancelled, the drive will restart automatically.

You must provide external measures which ensure that the drive only restarts after a confirmation (EN 60204).

Activation

How to activate the function:

- ”OFF state” at a safe input, the function of which has been assigned by parameter setting.
- Via a safety bus data telegram with corresponding content.
- As response to the error stop request.
- As response to the emergency stop request if the function has been parameterised as emergency stop function (C15205).

5.6.2 Safe stop 1

Safe **S**top **1** / SS1

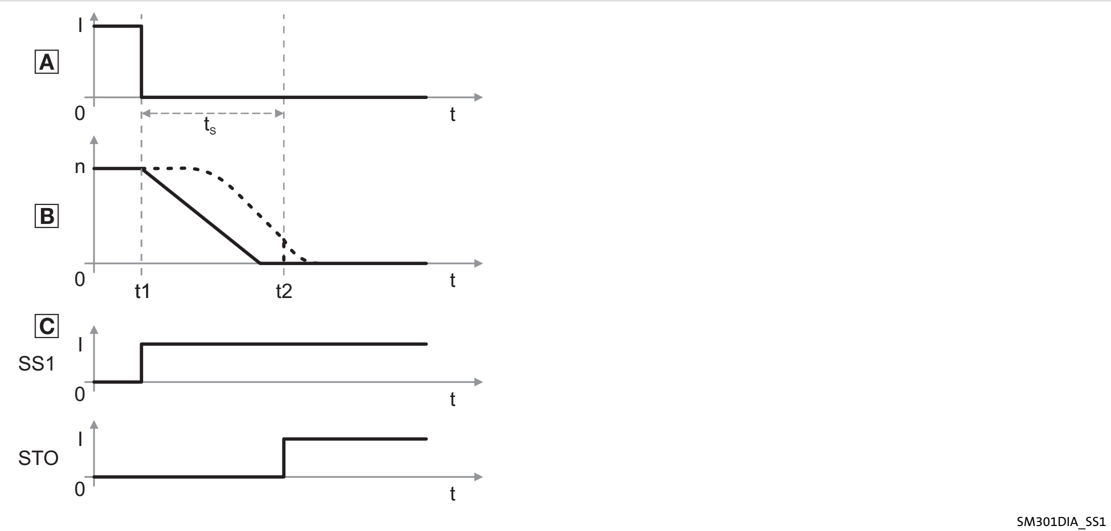
This function corresponds to a ”Stop 1” according to EN 60204.

The function monitors the reaching of the speed n = 0 (C15310) within an adjustable stopping time (C15305). The speed is calculated from the encoder data (safe speed measurement). Without encoder the function evaluates the speed status n = 0 from the standard device. For this, the monitored stopping time parameterised in the safety module must be 0.5 s longer than the stopping time in the controller.

When the stopping time (t2) has elapsed, the power supply of the motor is immediately safely interrupted (STO). The motor cannot create a torque and thus no dangerous movements of the drive. If a standstill was not reached, an error message is caused additionally.

Additional measures, e.g. mechanical brakes are needed against movements caused by external force. The time for a brake to be applied must be considered when defining the stopping time.

A restart is only possible after the stopping time has elapsed.



A	Input signal of the request of a safety function
I	ON state
0	OFF state
B	Speed characteristic n of the motor
t	Time axis
tx	Action instant
t_S	Monitored stopping time
—	Normal operation
---	Incorrect operation
C	Feedback(s)

Activation

How to activate the function:

- ”OFF state” at a safe input, the function of which has been assigned by parameter setting.
- Via a safety bus data telegram with corresponding content.
- As response to the error stop request.
- As response to the emergency stop request if the function has been parameterised as emergency stop function (C15205).

5.6.3 Emergency stop

Safe **S**top **E**mergency/SSE

The emergency stop function activates STO or SS1. The function to be executed can be adjusted (C15205). In special operation, the emergency stop cannot be avoided.

Note!

Connect the emergency stop buttons which must not be overruled by a special operation to the emergency stop function. For this purpose, parameterise the safe input as ”emergency stop” (C15031).

The emergency stop function can also be requested with SSE bit via the safety bus.

The activation of the function is reported internally to the standard device and via the safety bus of the higher-level control.

Activation

How to activate the function:

- ”OFF state” at a safe input, the function of which has been assigned by parameter setting.
- Via a safety bus data telegram with corresponding content.

5.6.4 Safe operation mode selector

Operation **M**ode **S**elector / OMS

The function provides a special operation of the drive. In the special operation the drive is stopped (status 2). The drive can be traversed in the special operation via an enable switch (status 3).

For the stop status in the special operation, the STO or SS1 functions can be parameterised.

For motion functions in the special operation, the free movement can be parameterised. The parameterised monitoring function will be automatically activated with the transition to the special operation.

The special operation enables an override of the simple STO and SS1 stop functions by the enable switch.

An active emergency stop function is also executed in special operation.

The special operation can also be selected via the safety bus by the F-PLC, unless a safe input is parameterised as operation mode selector.

The return to normal operation is only possible in the stop status. Since the drive is stopped in status 2, the AIS acknowledgement is required for restart. The parameters for the restart STO/SS1 are used.

Note!

When returning to normal operation, the automatic restart is not permissible. If ”automatic restart” is parameterised, this can be prevented by special measures, e.g. programming in the higher-level control.

Note!

The ”safe enable switch” function serves to directly cancel/complete the stopping times assigned to the stop functions.

Note!

If an error (e.g. a discrepancy error) occurs at a safe input to which the OMS function has been assigned, normal operation will be selected. This corresponds to the OFF state. The ”S_Error” LED is lit and STO is not activated. The special operation can only be selected again when the error has been eliminated and acknowledged.

Preconditions

A safe input must be parameterised and interconnected as operation mode selector. You can only connect and parameterise an operation mode selector. The OMS bit of the safety bus must be deactivated (C15113).

The special operation can also be selected via the safety bus with the OMS bit, unless a safe input is set as operation mode selector.

The plausibility check rejects ambiguous settings until they are parameterised correctly.

Note!

The ”free traversing” setting for the special operation (C15201) motion function must be suitable for the application!

Activation

How to activate the function:

- Via a safe input which has been assigned to the function by parameterisation. In addition, the requested operating mode depends on OMS: Function at LOW level (C15202).

  Example:

  Normal operation at LOW level

  The special operation is activated via a key-operated switch. The ”Special operation with LOW level” function is not permissible for a key-operated switch which uses the special operation for short-circuiting purposes. An open circuit in the cable of the switch would activate the special operation which is otherwise only possible with a key.

  Special operation at LOW level

  The special operation is active if a safety grid (safety door) is openend, i.e. the safe input provides a LOW level and executes the parameterised stop function.

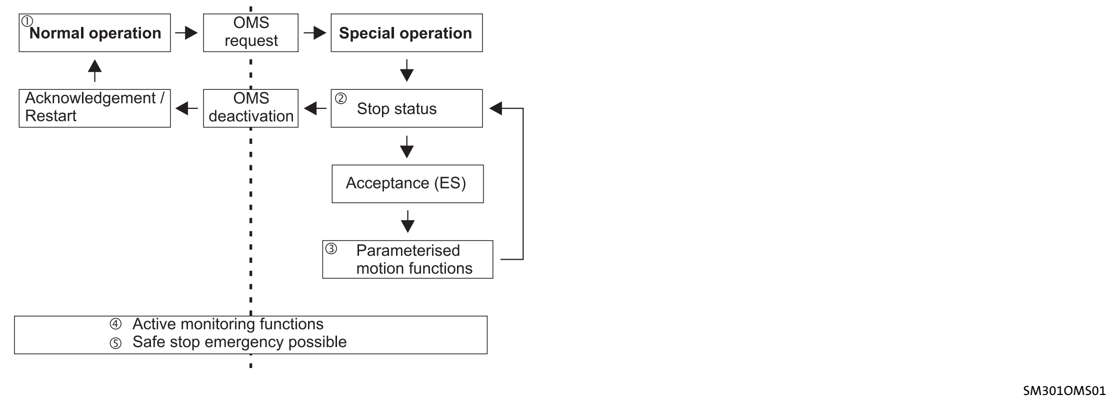
Only if no safe input is used, the function can only be activated via the safety bus:

- A data telegram with corresponding contents must be transmitted to the standard device.

5.6.5 Safe enable switch

Enable Switch / ES

The drive can be traversed in special operation using an enable switch (see operation mode selector).



Operating mode	Normal	Special
Event	Impact	Impact
-	Status ①	-
Request - OMS special operation via ...		
... safe input	Change →	Status ② Stop function ... ● STO ● SS1 ... is executed Activated monitoring functions remain active.
... safety bus	same response - only possible as an alternative to the safe input	
Request - ES confirmation via ...		
... safe input	No function	Status ③ ● Free movement
... via safety bus	same response - only possible as an alternative to the safe input	
Stop request	Status ④ parameterised function ... ● STO ● SS1 ... is executed	is not executed
Emergency stop	Status ⑤ parameterised function ... ● STO ● SS1 ... is executed	

Preconditions

A safe input must be parameterised and interconnected as enable switch. You can only connect and parameterise one enable switch. The ES bit of the safety bus must be deactivated (C15113).

The enable switch function can also be selected via the safety bus with the ES bit, unless a safe input is parameterised as enable switch.

The special operation must be activated.

The plausibility check rejects ambiguous settings until they are parameterised correctly.

Activation

How to activate the function:

► Via a safe input which has been assigned to the function by parameterisation. In addition, the requested operating mode depends on OMS: Function at LOW level (C15202).

  Example:

  Normal operation at LOW level

  The special operation is activated via a key-operated switch. The ”Special operation with LOW level” function is not permissible for a key-operated switch which uses the special operation for short-circuiting purposes. An open circuit in the cable of the switch would activate the special operation which is otherwise only possible with a key.

  Special operation at LOW level

  The special operation is active if a safety grid (safety door) is openend, i.e. the safe input provides a LOW level and executes the parameterised stop function.

Only if no safe input is used, the function can only be activated via the safety bus:

► A data telegram with corresponding contents must be transmitted to the standard device.

5.7 Safe parameter setting

> **Note!**
> Safety-relevant parameters can exclusively be transmitted to the drive-based safety by safe parameter setting using the »Engineer«.
> The parameter set is saved to the memory module and the drive-based safety with a definite module ID which must comply with the effective safety address in the drive-based safety.

The following is required for the parameterisation and configuration of the safety option:

- A computer with a Windows® operating system (XP or 2000)
- The Lenze »Engineer« PC software
- Connection with the controller via an interface.
  – diagnostic interface X70 with diagnostic USB adapter
  – PROFINET
  – Ethernet

Further information and help can be found in:

- the online help of the controller with safety option
- the 8400 protec software manual, integrated safety system ..., order designation: EDS84DWTSO

5.7.1 Parameter setting

Safety-relevant parameters can exclusively be transmitted to the drive-based safety by safe parameter setting. The parameter set is saved to the memory module and the drive-based safety with a definite module ID which must comply with the effective safety address in the drive-based safety.

Safe parameter setting requires the service status. The service status means:

- The standard stop is active and the drive is safely switched to torqueless operation (STO).
- The communication via the safety bus is active but passivated.

About the service status:

- It can be activated by the Lenze »Engineer« PC software.
- It can be quit by reinitialising the drive-based safety, i.e. the communication via the safety bus is interrupted.

> **Note!**
> The service status also occurs if the parameter set in the memory module does not comply with the parameter set in the drive-based safety during initialisation.

5.7.1.1 Parameter setting with the Lenze »Engineer« PC software

Safe parameter setting is supported by the Lenze »Engineer« PC software as of version 2.10.

The parameter setting is described in the software manual of drive-based safety for 8400 protec controllers. In addition, the software provides comprehensive online help.

Password

To store a safe parameter set, a password is required. The standard password is: "Lenze SM301". The password can be changed and must have at least six characters.

Use "General reset" to delete the safe parameter set in the memory module and the drive-based safety. The drive-based safety must be reparameterised.
The password is reset to the standard "Lenze SM301".

5.7.1.2 Parameter set transfer from the memory module

The safe parameter set transfer is supported by a safe parameter set saved to the memory module, e.g. when replacing the standard device or parameterising the drive-based safety, without the Lenze »Engineer« PC software via the memory module.

- ► A valid parameter set with a corresponding module ID must be stored.
- ► The drive-based safety must be in the service status.
- ► Open the service hatch on the standard device to be able to operate the ”T1” and ”T2” pushbuttons.

The transfer of the parameter set from the memory module must be acknowledged with the pushbuttons:

- ► the drive-based safety is in the service status
  – the ”S_State” LED is blinking
  – the ”S_Error” LED is lit
  – the ”S_Acknw” LED is lit
  – the ”S_Enable” LED is blinking
- ► press and hold the ”T1” and ”T2” pushbuttons at the same time
- ► the ”S_Acknw” LED starts blinking
- ► if the ”S_Acknw” LED goes out, release both pushbuttons immediately
- ► after a few seconds, the ”S_Acknw” LED is lit again
- ► press and hold the ”T1” and ”T2” pushbuttons at the same time again
- ► the ”S_Acknw” LED starts blinking
- ► if the ”S_Acknw” LED goes out, release both pushbuttons immediately
- ► The parameter set transfer is completed successfully.

If system-related response times (approx. 2.5 s) cannot be complied with, the parameter transfer is cancelled. The process must be started again.

In case of success, the parameter transfer is recorded in the logbook of the standard device and the service status is quit by a software restart.

If the parameter set is invalid, an error is indicated and the ”S_Error” LED is lit.

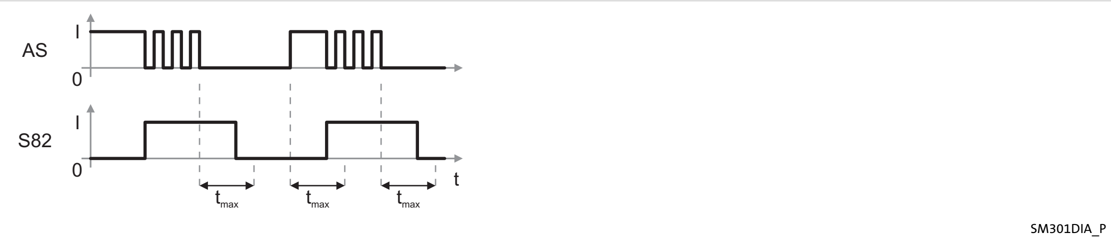


Fig. 5-5 Acknowledgement procedure

AS	”S_Acknw” LED
S82	”Left” and ”Right” pushbuttons at the same time
t	Time axis
t_{max}	Maximum permissible response time

5.7.2 Parameter sets and axes

The unambiguousness of an axis with safety functions in a drive system can be achieved by means of the safety address. In the safe parameter set a module ID is stored. This module ID is compared to the effective safety address (C15112) in the drive-based safety.

When a drive-based safety is initialised, e.g. when loading the parameter set, the compliance of the safety address will be checked. If no compliance exists, an initialisation error is reported.

Note!

- ► Clearly define the safety address in a drive system or plant.
- ► Document the address in circuit diagrams and labels.
- ► Ensure identical settings when replacing the standard device or the memory module.

In drive systems with activated safety bus the safety address is also used as the safety bus target address. The clear assignment of the safety address must be configured in the safety PLC.

In drive systems without activated safety bus, unambiguousness and correct assignment of the safety address must be checked. For this purpose, use the Lenze »Engineer« PC software or an EZAEBK200x diagnosis terminal.

5.8 Error management

5.8.1 Error states

Detected errors or maloperation of the drive are assigned to error states with definite reactions. The reaction can be co-ordinated with the complete drive via the error states.

Features	Error status		
	System error	Trouble	Warning
Event	Fatal internal error	Fault	Monitoring function
"S_State" LED	is lit	is lit	is lit
Status of drive-based safety	Lockout (CPU stopped)	Error status	Normal operation
The control category according to EN 954-1 ...	... has been abandoned	... has been abandoned	... has not been abandoned
Reaction	The motor immediately switches to torque-free operation via ● STO	The motor is stopped via ● STO or ● SS1	
Acknowledgement after deactivated event	● Connection and disconnection of the 24-V supply at the safety module	● Error acknowledgement (AIE) via X62 (positive signal pulse with a signal duration of 0.3 ... 10 s) ● Fault acknowledgement (AIE) via the safety bus (Bit "PS_AIE") ● Connection and disconnection of the 24-V supply at the safety module	

Tab. 5-1 Overview of error states

Note!
If the system fault also occurs after switching the 24-V supply, please contact the service.

When using PROFIsafe as safety bus:

- If faults occur in the PROFIsafe communication, the data is passivated by the PROFIsafe driver.
- After the PROFIsafe communication is reinitialised, the drive is automatically enabled again if no standstill function is selected.
- Events which cause an error status are sent as diagnostic telegram via the safety bus.

5.8.2 Logbook

Error states are saved in the logbook of the standard device. The following is entered:

- Type of response (e.g. trouble, warning, or information) to the event
- Module which has caused the event (e.g. MCTRL or TEMPCONTROL)
- Date/time (in case of memory module with real-time clock)
- Value of the power-on time meter

The available logbook entries can be displayed in the »Engineer« when an online connection has been established.

5.8.3 Module error messages

Entries

Range Error number		Description	Error type/response/ Note
Communication - standard device			
16	0x10	Communication error - standard device (communication between standard device and SM301 cancelled)	Warning/STO
17	0x11	Synchronisation error - standard device	No error status Logbook entry/info
PROFIsafe			
34	0x22	PROFIsafe communication error	PROFIsafe passivated/- No error status No diagnostic telegram via PROFINET
35	0x23	F_WD_Time exceeded (PROFIsafe monitoring time activated)	
36	0x24	PROFIsafe deactivated	
37	0x25	PROFIsafe has quit Data Exchange	
38	0x26	PROFIsafe invalid data	
39	0x27	Error - F parameter (Wrong parameter setting of the F PLC)	PROFIsafe parameter setting/STO No error status
Inputs			
49	0x31	Error - discrepancy or functional test SD-In1	Trouble/- OFF state for the affected input
50	0x32	Error - discrepancy or functional test SD-In2	
53	0x35	Internal error AIS	
54	0x36	Internal error AIE	
55	0x37	Internal error - module switch	
57	0x39	Deactivated SD-In1 = high (Initialisation error, input in ON state)	Trouble/STO
58	0x3A	Deactivated SD-In2 = high	
PROFIsafe			
64	0x40	F_Dest_Add does not equal F address	PROFIsafe parameter setting/STO No error status
65	0x41	F_Dest_Add = 0 or FFFFhex	
66	0x42	F_Source_Add = 0 or FFFFhex	
67	0x43	F_WD_Time is 0 msec	
68	0x44	F_SIL exceeds technical SIL	
69	0x45	F_CRC_Length error	
70	0x46	F parameter version incorrect	
71	0x47	PROFIsafe CRC1 error	
72	0x48	reserved (PS standard)	-
73	0x49	reserved (PS standard)	-
74	0x4A	reserved (PS standard)	-
Test functions			
81	0x51	Error SD-Inx/CLx (internal short circuit in one of the inputs)	Trouble/- OFF state for all SD-In
93	0x5D	Error - internal disconnecting path (internal error of the safe switch-off logic)	Trouble/STO OFF state for all SD-In
94	0x5E	Test pulse error - internal switch-off path (internal error of the safe switch-off logic)	Trouble/STO
Safety functions			
97	0x61	SS1: Stopping time exceeded (The drive has not reached zero speed within the stopping time.)	Warning/STO

Range	Error number	Description	Error type/response/ Note
Test functions - inputs			
144	0x90	Stuck at High SD-In1, channel A (Short circuit (High)	Trouble/- SD-In1: OFF state
145	0x91	Stuck at High SD-In1, channel B	
146	0x92	Stuck at High SD-In2, channel A	Trouble/- SD-In2: OFF state
147	0x93	Stuck at High SD-In2, channel B	
154	0x9A	CLA/CLB short circuit Short circuit between the CLA and CLB clock outputs	Trouble/- SD-In: OFF state
Safe parameterisation			
160	0xA0	New parameter set deleted (by the safe parameter setting in the Engineer)	-/- Logbook entry: Info
161	0xA1	New safe parameter set loaded (by the safe parameter setting in the Engineer or the procedure with the module switch)	
162	0xA2	Memory module parameter set - access error (Error while accessing the parameter set of the memory module.)	Trouble/STO OFF state for all SD-In
163	0xA3	Different parameter sets (within the memory module and the drive-based safety)	
164	0xA4	No safe parameter set in the drive-based safety (drive-based safety does not have a parameter set)	
165	0xA5	Defective SM301 parameter set (parameter set of the drive-based safety is defective)	
166	0xA6	Parameter set in memory module - format error (Format error in parameter set of memory module)	
167	0xA7	Parameter set - plausibility error	
168	0xA8	Parameter set - communication error (Communication error when loading the parameter set)	
169	0xA9	Module ID does not equal effective safety address (Module ID in the parameter set does not equal the effective safety address)	Warning/STO OFF state for all SD-In
Test functions - internal module			
192	0xC0	Reference voltage error	Trouble/STO OFF state for all SD-In
193	0xC1	6 V voltage error	
194	0xC2	5 V voltage error	
195	0xC3	2.6 V voltage error	

Tab. 5-2 Description of the numerical entries

5.9 Response times

In order to detect the response time to a safety function the entire system must be considered. The following is relevant:

- Response time of the connected sensors.
- Input delay of the safety inputs.
- Internal processing time.
- When using PROFIsafe as safety bus:
  – Monitoring time for the cyclic service in the PROFIBUS/PROFINET.
  – Monitoring time of the PROFIsafe in the safety PLC.
  – Processing time in the safety PLC.
- Delay times due to further components.

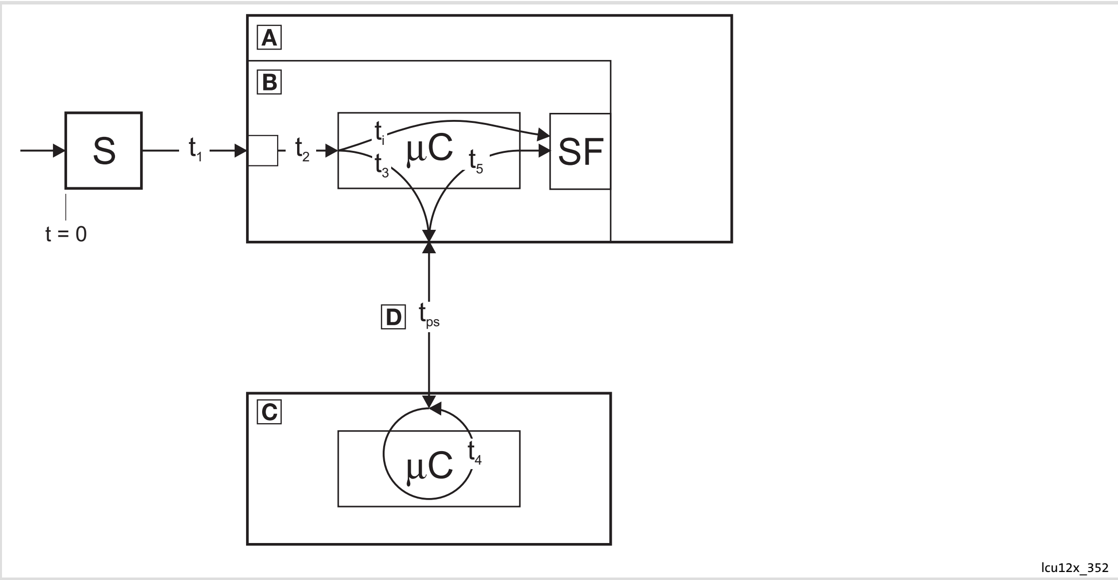


Fig. 5-6 Response times to the request of a safety function

A Standard device
B Drive-based safety
C Safety PLC
D Safety bus
µC Microcontroller
S Safety sensor technology
SF Activated safety function

5.9.1 Response times of the inputs

Response time to an event in the sensors			
Time interval (Fig. 5-6)			[ms]
t_1	Response time of the sensors		according to manufacturer information
t_2	Input delay of the safe inputs		
		C15034:	**0** ... 100
		Input error:	2
t_i	Processing time in drive-based safety		4
	Safety function starts after ...		Σ

Tab. 5-3 Response time to an event in the sensors

5.9.2 Response times of the safety bus

PROFIsafe

Response time to an event in the safety sensors (PROFIsafe input data)			
Time interval (Fig. 5-6)			[ms]
t_1	Response time of the sensors		according to manufacturer information
t_2	Input delay of the safe inputs		
		C15034:	**0** ... 100
		Input error:	2
t_3	Processing time in drive-based safety		24
	PROFIsafe input data ready for transmission to ...		Σ
t_{PS}	PROFIsafe cycle time		according to manufacturer information
	PROFIsafe input data ready for processing in the safety PLC ...		Σ

Tab. 5-4 Response time to an event in the sensors

Response time to a PROFIsafe control word (PROFIsafe output data)		
Time interval (Fig. 5-6)		[ms]
t_4	Processing time in the safety PLC	must be calculated
t_{PS}	PROFIsafe cycle time	according to manufacturer information
t_5	Processing time in drive-based safety	14
	Safety function starts after ...	Σ

Tab. 5-5 Response time in case of PROFIsafe request

Information on how to calculate the processing time and transmission time of the PROFIsafe can be found in the documentation of the safety PLC used.

Note!

If PROFIsafe communication is troubled, the fail-safe status will be reached after the PROFIsafe monitoring time (F_WD_Time) has expired. PROFIsafe communication is passivated.

Example

- After an event has occurred at a safe input, the message is fed back to drive-based safety via the safety PLC.
- Drive-based safety activates a safety function.
- Hence, the maximum response time to the event is calculated as follows:
  $t_{max\ response} = t_1 + t_2 + t_3 + \max\{t_{WD}; t_{PS} + t_4 + t_{PS} + t_5\}$

When calculating the maximum response time, include the times of the safety functions, e.g. in case of SS1 the stopping time (30 s) until STO is active.

6 Appendix

6.1 Total index

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