



DURADrive Drive Controllers with degree of protection IP 65

Project Planning Manual

SYSTEM200

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1 Introduction to the system

1.1 DURADrive drive controller

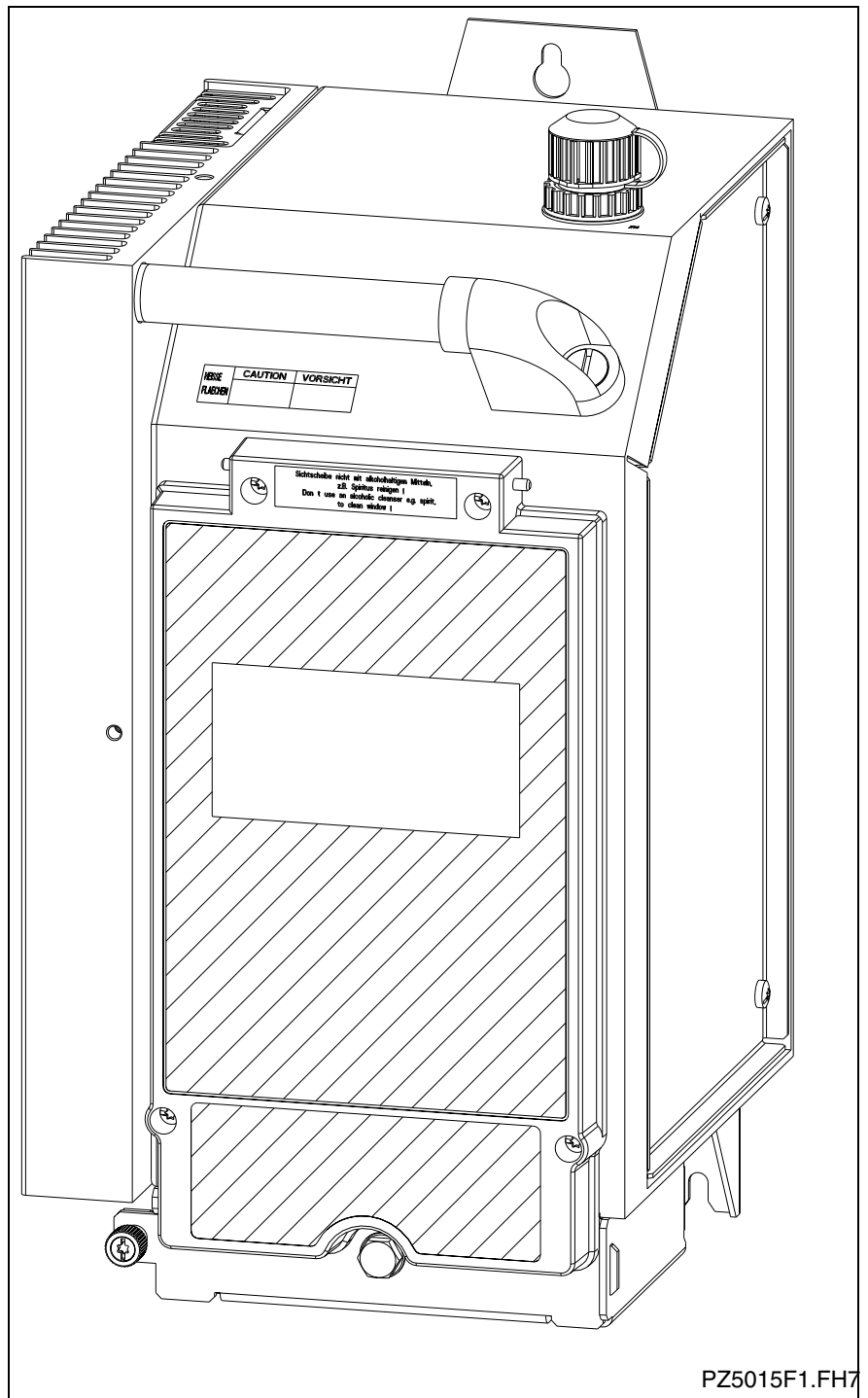


Fig. 1-1: DURADrive drive controller

The digital intelligent automation system **DURADrive** is the solution with a high degree of functionality for stand-alone drives under difficult ambient conditions.

DURADrive can be used to implement a variety of drive tasks in the most varied applications. Different device types are available with graduated drive power.

Typical application areas are:

- handling systems
- packaging machines
- assembly systems
- printing machines
- machine tools

1.2 An overview of individual components of the DURADRIVE family

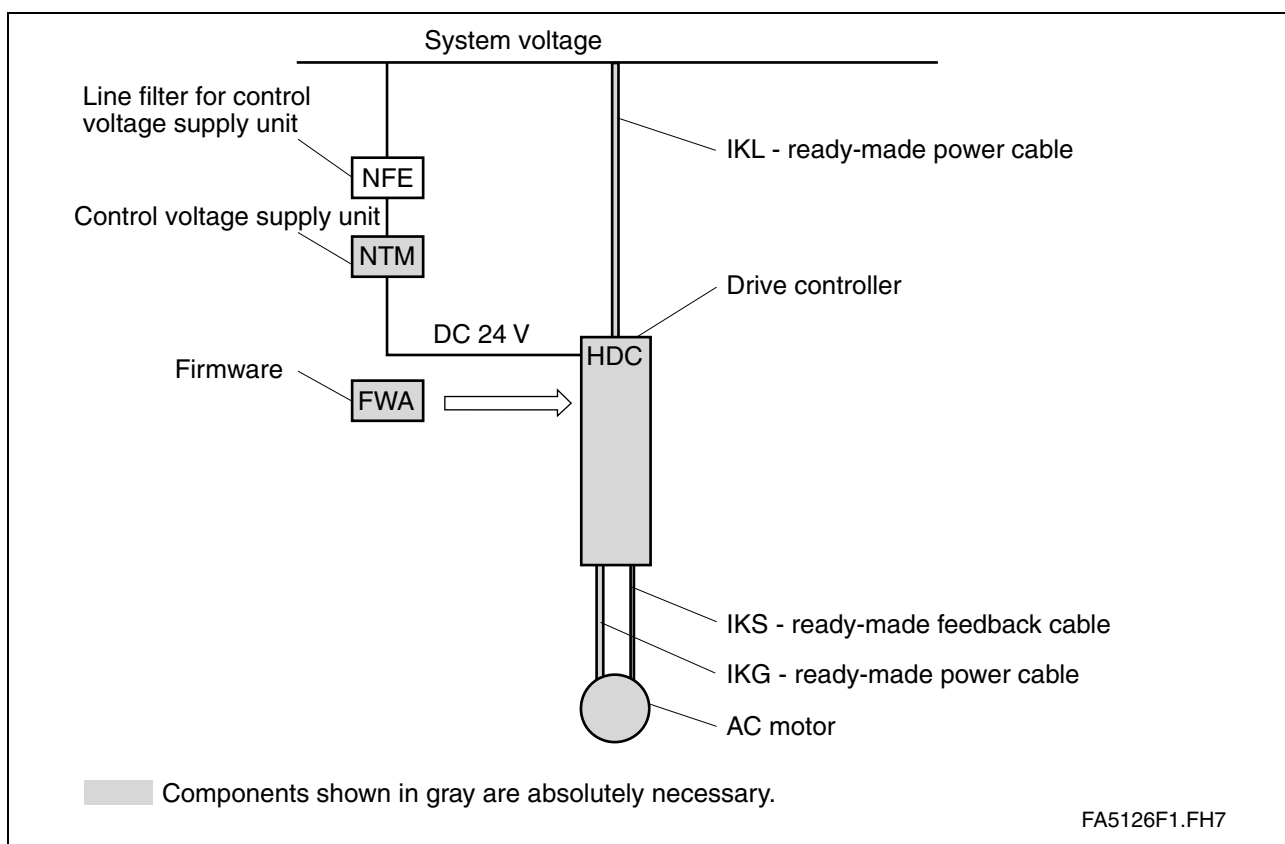


Fig. 1-2: Overview of individual components

1.3 An overview of the drive controllers

Type code for drive controller HDC

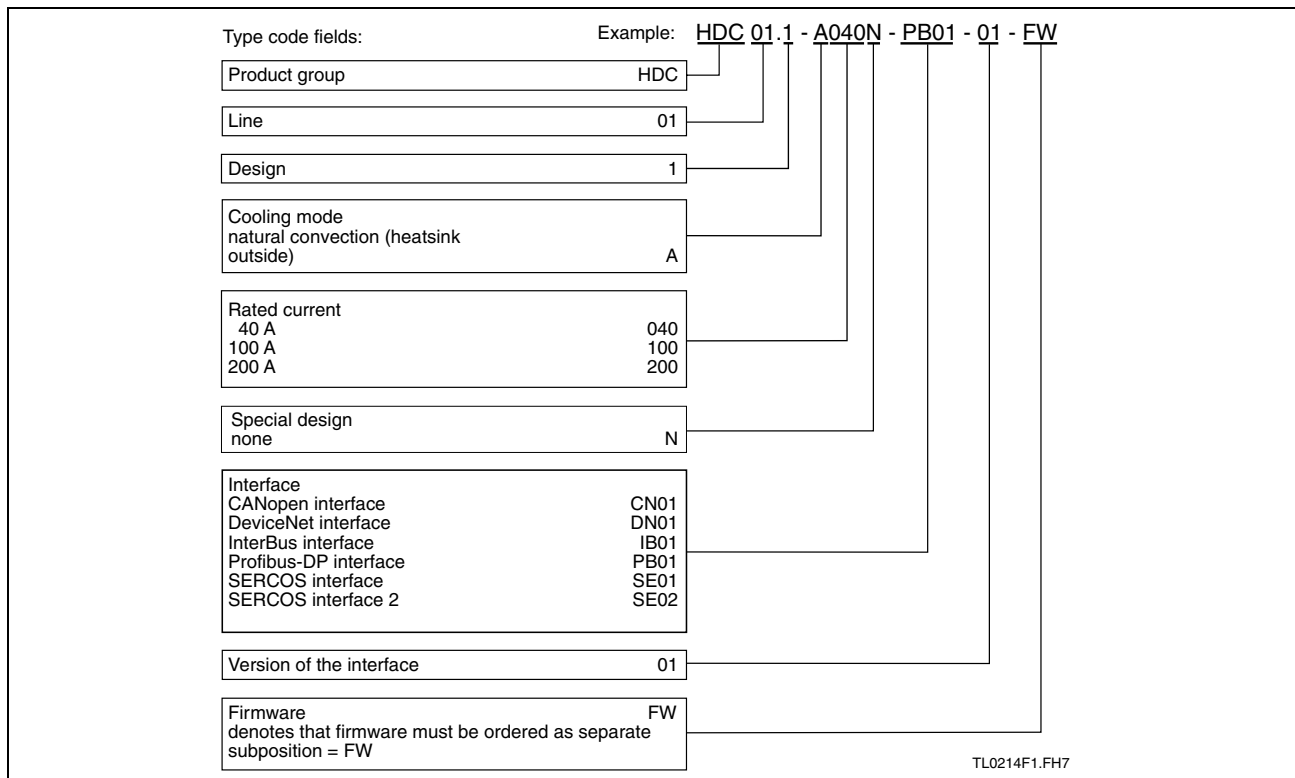


Fig. 1-3: Type code HDC

Type code for cooling fan unit

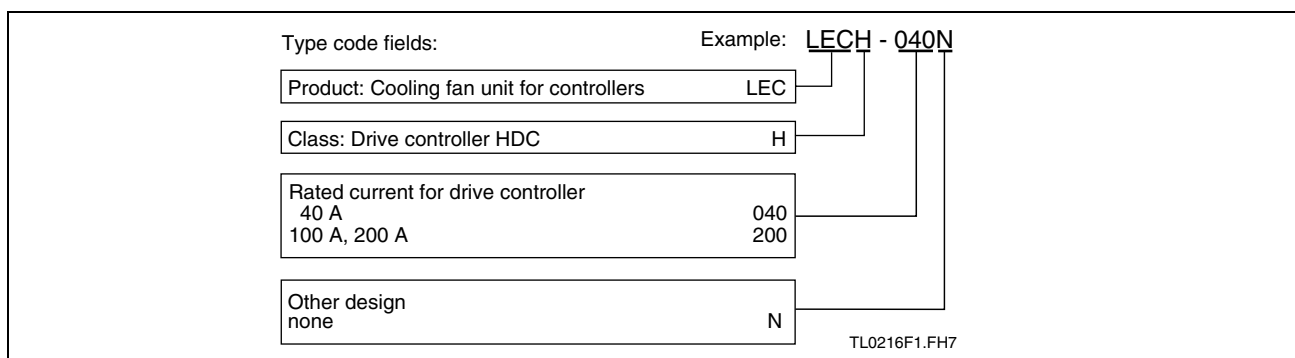


Fig. 1-4: Type code cooling fan unit

Note: The above illustrates how the type codes are put together. Your Sales rep will help with the current status of available versions.

An overview of the communications interfaces

interface	device type:						
	CN01	DN01	IB01	PB01	PL02	SE01	SE02
RS232 / 485	X	X	X	X	X	X	X
CANopen interface	X						
DeviceNet interface		X					
InterBus interface			X				
Profibus-DP interface				X			
SERCOS interface						X	
SERCOS interface 2							X

Fig. 1-5: An overview of interfaces

Note: Parallel interface 2 is only required in combination with the ELC control software.

An overview of measuring systems supported

Connecting the systems to the encoder inputs

Type of motor	Encoder 1 (plug X4)				Encoder 2 (plug X8)			
	Digital servo-feedback (1)		Resolver with FDS (2)	Resolver without FDS (3)	Sine encoder (4)	EnDat encoder (5)	Gear-type encoder with 1Vss signals (6)	Square-wave encoder with 5V TTL signals (7)
	DSF	HSF						
MKD		X	X					
MKE		X	X					
MHD		X						
2AD	X	X						X ^{*)}
ADF	X	X						X ^{*)}
1MB					X	X	X	X ^{*)}
MBW					X	X	X	X ^{*)}
LSF						X		
MBS				X	X	X		

Fig. 1-6: Connecting the measuring systems

- (1) : single-turn or multi-turn DSF / HSF
- (2) : resolver or multi-turn resolver (RSF) with feedback data storage (FDS)
- (3) : resolver or multi-turn resolver (RSF) without feedback data storage (FDS)
- (4) : incremental measuring system with sine signals (1Vss signals)
- (5) : absolute measuring system with EnDat interface
- (6) : gear-type encoder with 1Vss signals
- (7) : square-wave encoder with 5V TTL signals
-> *) not recommended (due to maximum input frequency of 200 kHz)!

Note: The cable type designations of the connecting cables required are listed in the motor project planning manual or "List of Connecting Cables for DIAX04 and ECODRIVE03".

See also the firmware functional description: "Setting the Measurement System".

1.4 Overview of the motors

MKD synchronous motor for standard applications

- Application**
- general automation technology
 - handling systems
 - axes that only need to approach fixed positions (no path operation)
 - applications with low-precision demands (accuracy of up to approx. 1/20000 of one motor revolution)
- Construction**
- motor in a chassis configuration
 - motor cooling method: natural convection
- surface cooling is optional for the MKD112



Fig. 1-7: An MKD motor

MHD synchronous motors for high-precision applications

- Application**
- Automated production with the highest demands for accuracy (up to 1/4000000 of a motor revolution)
 - high demands on dynamics
 - axes in path operation
- Construction**
- Motor in a chassis configuration
 - Motor cooling method: natural convection
surface cooling is optional for the MHD093, MHD112, MHD115
liquid cooling is optional for the MHD093, MHD115



Fig. 1-8: An MHD motor

MKE synchronous motor for potentially explosive areas

- Application**
- potentially explosive areas such as: painting installations, chemical industries in general automation engineering
 - applications with low-precision demands (accuracy of up to approx. 1/20000 of one motor revolution)

- Construction**
- motor in a chassis configuration
 - motor cooling method: natural convection



Fig. 1-9: An MKE motor

2AD asynchronous motor for standard applications

- Application**
- main spindle and servo axes in machine tools for drive tasks with high performance demands
 - highest demands on accuracy (up to 1/2000000 of a motor revolution)
 - axes in path operation

- Construction**
- motor in a chassis configuration
 - motor cooling method: surface cooled



Fig. 1-10: An 2AD motor

ADF asynchronous motor for standard applications

- Application**
- main spindle and servo axes in machine tools for drive tasks with high performance demands
 - highest demands on accuracy (up to 1/2000000 of a motor revolution possible)
 - axes in path operation
- Construction**
- motor in a chassis configuration
 - motor cooling method: liquid cooled



Fig. 1-11: An ADF motor

1MB asynchronous assembly motor

- Application**
- compact machine concepts for main spindles and servo axes in lathes, milling machines, grinding machines and processing centers
 - for main spindles in high-speed processing
 - for drive tasks with high performance demands
 - highest demands on accuracy (up to 1/4000000 of a motor revolution possible)
 - axes in path operation
- Construction**
- motor as assembly kit for integration into the machine components
 - motor cooling method: liquid cooled



Fig. 1-12: An 1MB motor

MBW asynchronous motor for printing roller applications

- Application**
- for printing roller applications with high demands for accuracy
- Construction**
- motor for mounting directly onto the printing roller
 - motor cooling method: liquid cooled

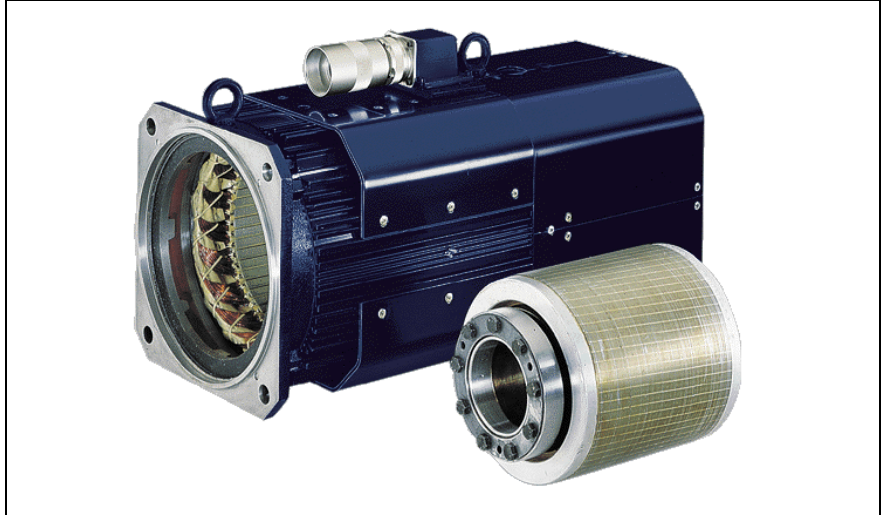


Fig. 1-13: An MBW motor

MBS synchronous assembly motor

- Application**
- compact machine concepts for main spindles and servo axes in lathes, milling machines, grinding machines and processing centers
 - for main spindles in high-speed processing
 - highest demands on accuracy
- Construction**
- motor as assembly kit for integration into machine components
 - motor cooling method: liquid cooled



Fig. 1-14: An MBS motor

LSF linear synchronous assembly motor

- Application**
- For precision applications in new compact machine concepts for main spindles and servo axes in lathes, milling machines, grinding machines and processing centers for use in high-speed processing
 - machine concepts in printing, packaging, and sheet metal processing machines
 - highest demands on accuracy (less than 0.5 μm possible)

- Construction**
- motor as assembly kit for integration into machine components
 - motor cooling method: liquid cooled

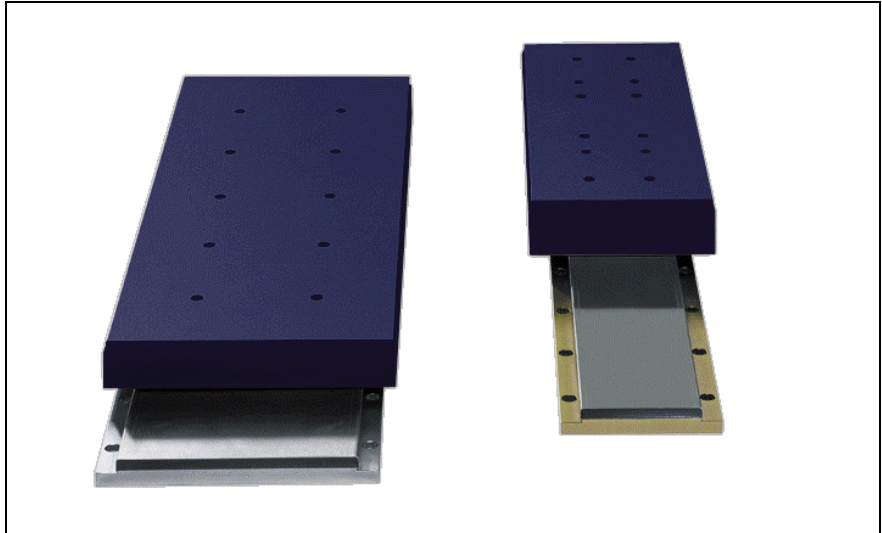


Fig. 1-15: An LSF motor

2 Important directions for use

2.1 Appropriate use

Introduction

Rexroth Indramat products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operating safety and reliability.

The products may only be used in the manner that is defined as appropriate. If they are used in an inappropriate manner, then situations can develop that may lead to property damage or injury to personnel.

Note: Rexroth Indramat, as manufacturer, is not liable for any damages resulting from inappropriate use. In such cases, the guarantee and the right to payment of damages resulting from inappropriate use are forfeited. The user alone carries all responsibility of the risks.

Before using Rexroth Indramat products, make sure that all the prerequisites for an appropriate use of the products are satisfied:

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with appropriate use.
- If the product takes the form of hardware, then they must remain in their original state, in other words, no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not mount damaged or faulty products or use them in operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.

Areas of use and application

Drive controllers made by Rexroth Indramat are designed to control electrical motors and monitor their operation.

Control and monitoring of the motors may require additional sensors and actors.

Note: The drive controllers may only be used with the accessories and parts specified in this document. If a component has not been specifically named, then it may not be either mounted or connected. The same applies to cables and lines.

Operation is only permitted in the specified configurations and combinations of components using the software and firmware as specified in the relevant function descriptions.

Every drive controller has to be programmed before starting it up, making it possible for the motor to execute the specific functions of an application.

The drive controllers of the ECODRIVE03 family are designed for use in single or multiple-axis drive and control applications.

To ensure an application-specific use, the drive controllers are available with differing drive power and different interfaces.

Typical applications of drive controllers belonging to the ECODRIVE03 family are:

- handling and mounting systems,
- packaging and foodstuff machines,
- printing and paper processing machines and
- machine tools.

The drive controllers may only be operated under the assembly, installation and ambient conditions as described here (temperature, system of protection, humidity, EMC requirements, etc.) and in the position specified.

2.2 Inappropriate use

Using the drive controllers outside of the above-referenced areas of application or under operating conditions other than described in the document and the technical data specified is defined as "inappropriate use".

Drive controllers may not be used if

- they are subject to operating conditions that do not meet the above specified ambient conditions. This includes, for example, operation under water, in the case of extreme temperature fluctuations or extremely high maximum temperatures or if
- Rexroth Indramat has not specifically released them for that intended purpose. Please note the specifications outlined in the general safety instructions!

3 Safety Instructions for Electric Servo Drives

3.1 Introduction

Read these instructions before the equipment is used and eliminate the risk of personal injury or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment contact your local Rexroth Indramat representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the product is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the product.



WARNING

Inappropriate use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in product damage, personal injury, severe electrical shock or death!

3.2 Explanations

The safety warnings in this documentation describe individual degrees of hazard seriousness in compliance with ANSI:

Warning symbol with signal word	Degree of hazard seriousness The degree of hazard seriousness describes the consequences resulting from non-compliance with the safety guidelines.
 DANGER	Bodily harm or product damage will occur.
 WARNING	Death or severe bodily harm may occur.
 CAUTION	Death or severe bodily harm may occur.

Fig. 3-1: Classes of danger with ANSI

3.3 Hazards by inappropriate use



DANGER

**High voltage and high discharge current!
Danger to life, risk of severe electrical shock
and risk of injury!**



DANGER

**Dangerous movements! Danger to life and risk
of injury or equipment damage by unintentional
motor movements!**



WARNING

**High electrical voltage due to wrong
connections! Danger to life, severe electrical
shock and severe bodily injury!**



WARNING

**Health hazard for persons with heart
pacemakers, metal implants and hearing aids in
proximity to electrical equipment!**



CAUTION

**Surface of machine housing could be extremely
hot! Danger of injury! Danger of burns!**



CAUTION

**Risk of injury due to inappropriate handling!
Bodily injury caused by crushing, shearing,
cutting and mechanical shock or improper
handling of pressurized systems!**



CAUTION

**Risk of injury due to inappropriate handling of
batteries!**

3.4 General Information

- Rexroth Indramat GmbH is not liable for damages resulting from failure to observe the warnings given in these documentation.
- Order operating, maintenance and safety instructions in your language before starting up the machine. If you find that due to a translation error you can not completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Trained and qualified personnel in electrical equipment:
Only trained and qualified personnel may work on this equipment or within its proximity. Personnel are qualified if they have sufficient knowledge of the assembly, installation and operation of the product as well as an understanding of all warnings and precautionary measures noted in these instructions.
Furthermore, they should be trained, instructed and qualified to switch electrical circuits and equipment on and off, to ground them and to mark them according to the requirements of safe work practices and common sense. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation on commercial machinery.

European countries: see directive 89/392/EEC (machine guideline).

- The ambient conditions given in the product documentation must be observed.
- Use only safety features that are clearly and explicitly approved in the Project Planning manual.
For example, the following areas of use are not allowed: Construction cranes, Elevators used for people or freight, Devices and vehicles to transport people, Medical applications, Refinery plants, the transport of hazardous goods, Radioactive or nuclear applications, Applications sensitive to high frequency, mining, food processing, Control of protection equipment (also in a machine).
- Start-up is only permitted once it is sure that the machine, in which the product is installed, complies with the requirements of national safety regulations and safety specifications of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
The instructions for installation in accordance with EMC requirements can be found in the INDRAMAT document "EMC in Drive and Control Systems".
The machine builder is responsible for compliance with the limiting values as prescribed in the national regulations and specific EMC regulations for the application.

European countries: see Directive 89/336/EEC (EMC Guideline).

U.S.A.: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.

- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

3.5 Protection against contact with electrical parts

Note: This section refers to equipment with voltages above 50 Volts.

Making contact with parts conducting voltages above 50 Volts could be dangerous to personnel and cause an electrical shock. When operating electrical equipment, it is unavoidable that some parts of the unit conduct dangerous voltages.



DANGER

High electrical voltage! Danger to life, severe electrical shock and severe bodily injury!

- ⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
- ⇒ Follow general construction and safety regulations when working on electrical installations.
- ⇒ Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
- ⇒ Do not operate electrical equipment at any time if the ground wire is not permanently connected, even for brief measurements or tests.
- ⇒ Before working with electrical parts with voltage potentials higher than 50 V, the equipment must be disconnected from the mains voltage or power supply.
- ⇒ The following should be observed with electrical drives, power supplies, and filter components:
Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage on the capacitors before beginning work to make sure that the equipment is safe to touch.
- ⇒ Never touch the electrical connection points of a component while power is turned on.
- ⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
- ⇒ A residual-current-operated protective device (r.c.d.) must not be used on an electric drive! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.
- ⇒ Equipment that is built into machines must be secured against direct contact. Use appropriate housings, for example a control cabinet.

European countries: according to EN 50178/1998, section 5.3.2.3.

U.S.A: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA) and local building codes. The user of this equipment must observe the above noted instructions at all times.

To be observed with electrical drives, power supplies, and filter components:



DANGER

**High electrical voltage! High leakage current!
Danger to life, danger of injury and bodily harm
from electrical shock!**

- ⇒ Before switching on power for electrical units, all housings and motors must be permanently grounded according to the connection diagram. This applies even for brief tests.
- ⇒ Leakage current exceeds 3.5 mA. Therefore the electrical equipment and units must always be firmly connected to the supply network.
- ⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this protective connection!
- ⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. High voltage levels can occur on the housing that could lead to severe electrical shock and personal injury.

European countries: EN 50178/1998, section 5.3.2.1.

USA: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must maintain the above noted instructions at all times.

3.6 Protection by protective low voltage (PELV) against electrical shock

All connections and terminals with voltages between 5 and 50 Volts on INDRAMAT products are protective low voltages designed in accordance with the following standards on contact safety:

- International: IEC 364-4-411.1.5
- EU countries: see EN 50178/1998, section 5.2.8.1.



WARNING

High electrical voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

- ⇒ Only equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) may be connected to all terminals and clamps with 0 to 50 Volts.
- ⇒ Only safely isolated voltages and electrical circuits may be connected. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.

3.7 Protection against dangerous movements

Dangerous movements can be caused by faulty control or the connected motors. These causes are be various such as:

- unclean or wrong wiring of cable connections
- inappropriate or wrong operation of equipment
- malfunction of sensors, encoders and monitoring circuits
- defective components
- software errors

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitors in the drive components make faulty operation almost impossible. Regarding personnel safety, especially the danger of bodily harm and property damage, this alone should not be relied upon to ensure complete safety. Until the built-in monitors become active and effective, it must be assumed in any case that some faulty drive movements will occur. The extent of these faulty drive movements depends upon the type of control and the state of operation.

**DANGER****Dangerous movements! Danger to life and risk of injury or equipment damage!**

- ⇒ Personnel protection must be secured for the above listed reason by means of superordinate monitors or measures.

These are instituted in accordance with the specific situation of the facility and a danger and fault analysis conducted by the manufacturer of the facility. All the safety regulations that apply to this facility are included therein. By switching off, circumventing or if safety devices have simply not been activated, then random machine movements or other types of faults can occur.

Avoiding accidents, injury or property damage:

- ⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:
- use protective fences
 - use protective railings
 - install protective coverings
 - install light curtains or light barriers
- ⇒ Fences must be strong enough to withstand maximum possible momentum.
- ⇒ Mount the emergency stop switch (E-stop) in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.
- ⇒ Isolate the drive power connection by means of an emergency stop circuit or use a start-inhibit system to prevent unintentional start-up.
- ⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.
- ⇒ Secure vertical axes against falling or slipping after switching off the motor power by, for example:
- Mechanically securing the vertical axes
 - Adding an external brake / clamping mechanism
 - Balancing and thus compensating for the vertical axes mass and the gravitational force

The standard equipment motor brake or an external brake controlled directly by the servo drive are not sufficient to guarantee the safety of personnel!

- ⇒ Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:
 - maintenance and repair work
 - cleaning of equipment
 - long periods of discontinued equipment use
 - ⇒ Avoid operating high-frequency, remote control and radio equipment near electronics circuits and supply leads. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special electromagnetic compatibility (EMC) test on the plant.
-

3.8 Protection against magnetic and electromagnetic fields during operations and mounting

Magnetic and electromagnetic fields generated by current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.



WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

- ⇒ Persons with pacemakers, metal implants and hearing aids are not permitted to enter following areas:
 - Areas in which electrical equipment and parts are mounted, being operated or started up.
 - Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
 - ⇒ If it is necessary for a person with a pacemaker to enter such an area, then a physician must be consulted prior to doing so. Pacemaker, that are already implanted or will be implanted in the future, have a considerable deviation in their resistance to interference. Due to the unpredictable behavior there are no rules with general validity.
 - ⇒ Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise health hazards will occur.
-

3.9 Protection against contact with hot parts



CAUTION

**Housing surfaces could be extremely hot!
Danger of injury! Danger of burns!**

- ⇒ Do not touch surfaces near the source of heat! Danger of burns!
- ⇒ Wait ten (10) minutes before you access any hot unit. Allow the unit to cool down.
- ⇒ Do not touch hot parts of the equipment, such as housings, heatsinks or resistors. Danger of burns!

3.10 Protection during handling and installation

Under certain conditions inappropriate handling and installation of parts and components may cause injuries.



CAUTION

**Risk of injury through incorrect handling!
Bodily harm caused by crushing, shearing,
cutting and mechanical shock!**

- ⇒ Observe general instructions and safety regulations during handling installation.
- ⇒ Use only appropriate lifting or moving equipment.
- ⇒ Take precautions to avoid pinching and crushing.
- ⇒ Use only appropriate tools. If specified by the product documentation, special tools must be used.
- ⇒ Use lifting devices and tools correctly and safely.
- ⇒ Wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- ⇒ Never stay under suspended loads.
- ⇒ Clean up liquids from the floor immediately to prevent personnel from slipping.

3.11 Battery safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or equipment damage.



Risk of injury through incorrect handling!

- ⇒ Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and corrosion).
- ⇒ Never charge batteries (danger from leakage and explosion).
- ⇒ Never throw batteries into a fire.
- ⇒ Do not dismantle batteries.
- ⇒ Handle with care. Incorrect extraction or installation of a battery can damage equipment.

Note: Environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other refuse. Observe the legal requirements given in the country of installation.

3.12 Protection against pressurized Systems

Certain Motors (ADS, ADM, 1MB etc.) and drives, corresponding to the information in the Project Planning manual, must be provided with and remain under a forced load such as compressed air, hydraulic oil, cooling fluid or coolant. In these cases, improper handling of the supply of the pressurized systems or connections of the fluid or air under pressure can lead to injuries or accidents.



Danger of injury when pressurized systems are handled by untrained personnel!

- ⇒ Do not attempt to disassemble, to open or to cut a pressurized system.
- ⇒ Observe the operation restrictions of the respective manufacturer.
- ⇒ Before the disassembly of pressurized systems, lower pressure and drain off the fluid or gas.
- ⇒ Use suitable protective clothing (for example protective eyewear, safety shoes and gloves)
- ⇒ Remove any fluid that has leaked out onto the floor immediately.

Note: Environmental protection and disposal! The fluids used in the operation of the pressurized system equipment is not environmentally compatible. Fluid that is damaging to the environment must be disposed of separate from normal waste. Observe the national specifications of the country of installation.

4 DURADrive HDC01.1 Drive Controller

4.1 Technical data

Dimensions

Drive Controller HDC01.1-A040N

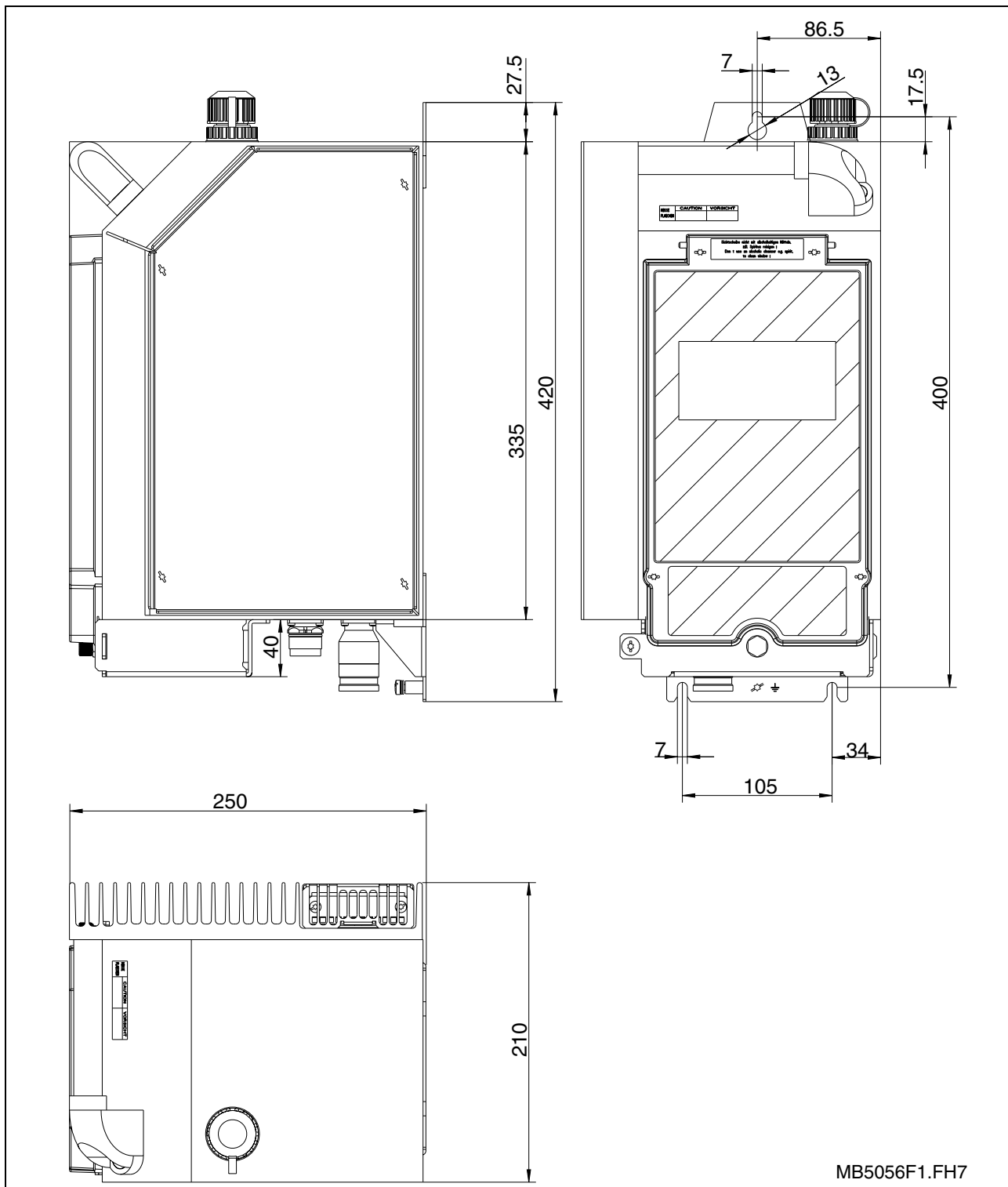


Fig. 4-1: Drive Controller HDC01.1-A040N

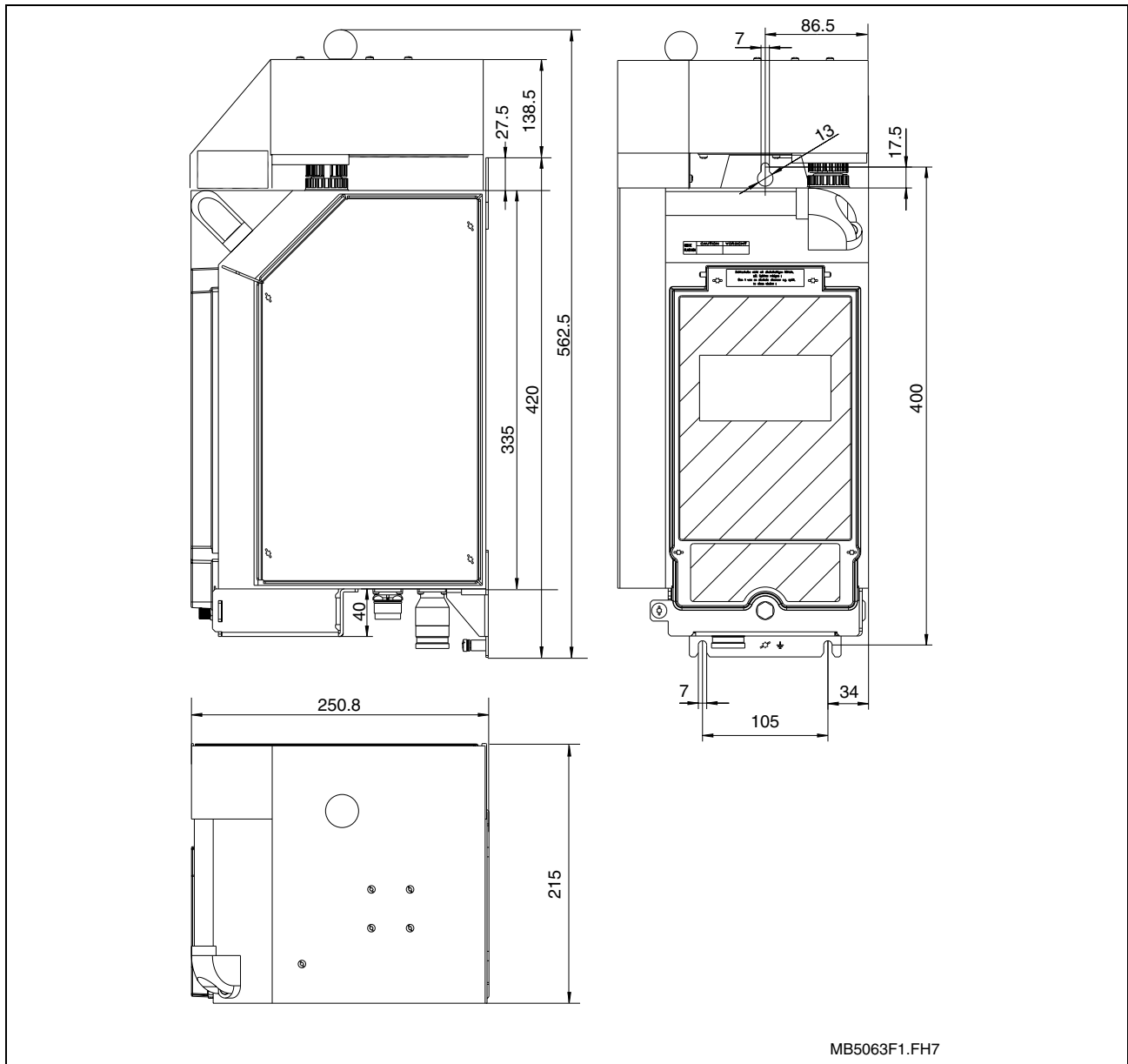
Drive Controller HDC01.1-A040N ventilated

Fig. 4-2: Drive Controller HDC01.1-A040N ventilated

Drive Controller HDC01.1-A100N, HDC01.1-A200N

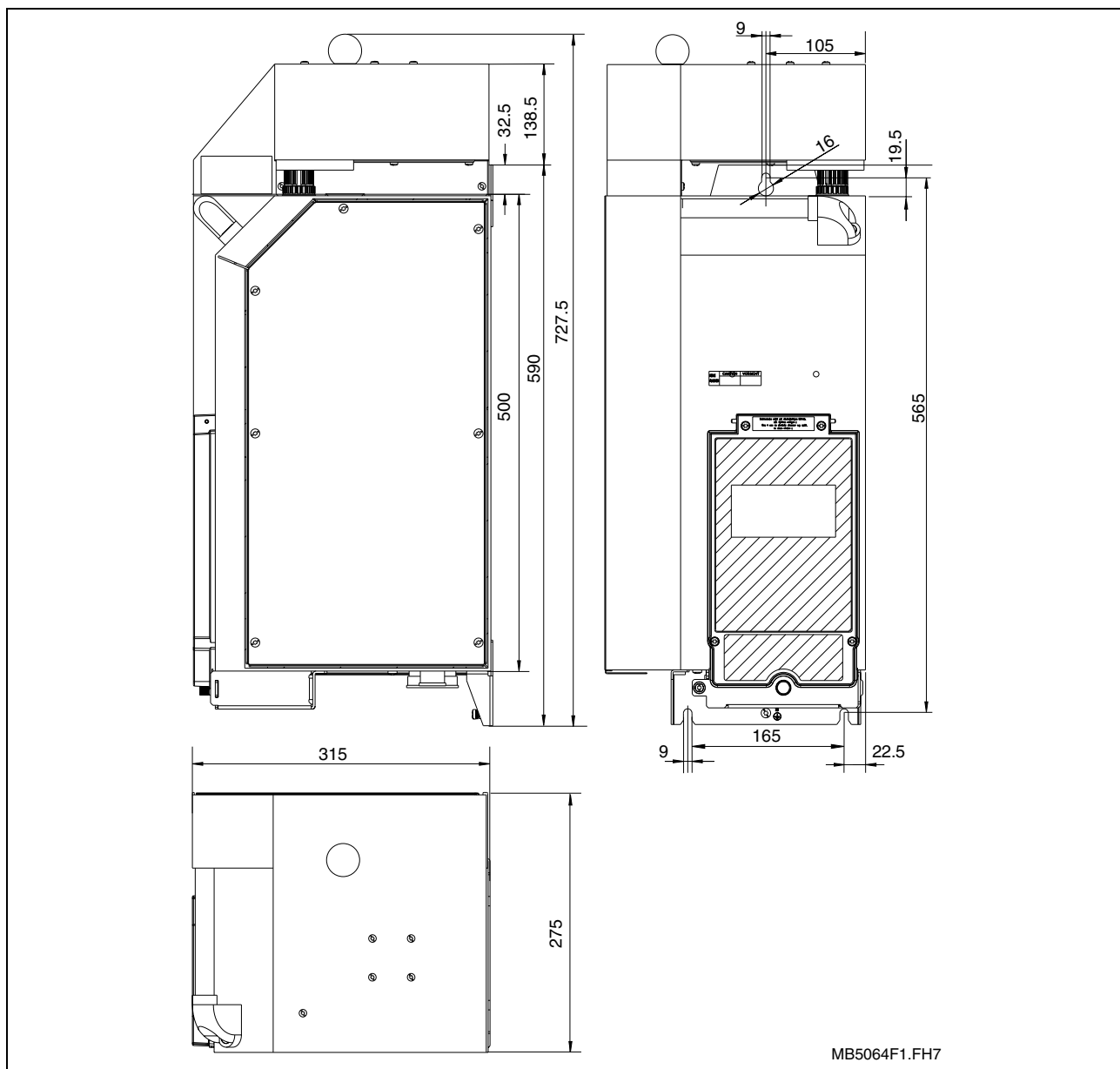


Fig. 4-3: Drive Controller HDC01.1-A100/200N ventilated

Ambient and operating conditions

Ambient temperature and installation altitude

Selection lists are specified for each motor/drive combination.

The selection lists apply to motors and drives within the specified ambient and operating conditions (see "Fig. 4-5: Ambient and operating conditions").

Differing conditions reduce the performance data

- of the drive:
 - allowed DC bus continuous output
 - continuous bleeder output
 - continuous current

- of the motor:
 - output
 - continuous torque at standstill
 - S1 continuous torque
 - short-time operating torque M_{KB}

according to the diagrams (see "Fig. 4-4: Degree of utilisation as a value dependent on ambient temperature and installation altitude").

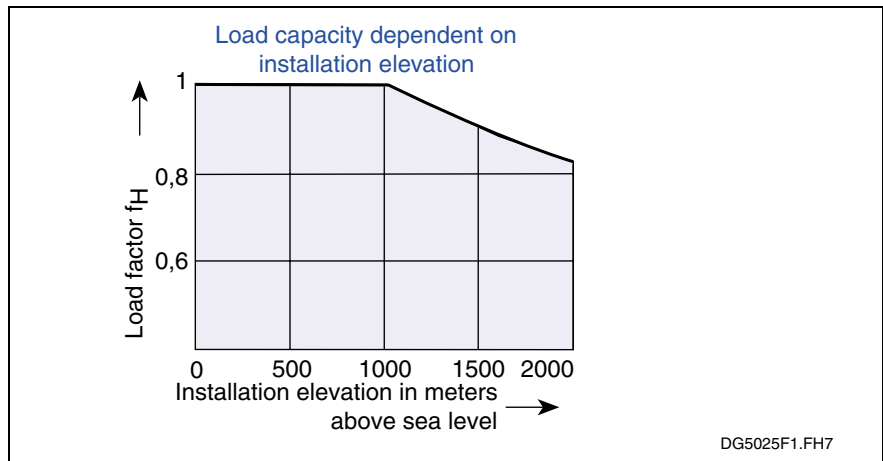


Fig. 4-4: Degree of utilisation as a value dependent on ambient temperature and installation altitude

Designation	Symbol	Unit	HDC01.1-AXXXN
Permissible ambient and air inlet temperature for the output ratings	T _A	°C	+5 ... +45
Storage and shipping temperatures	T _L	°C	-30 ... +85
Max. allowed installation altitude for the output ratings		m	1000
Max. allowed installation altitude		m	2000
Max. permissible relative humidity		%	95
Max. permissible absolute humidity		g/m³	25
Allowed degree of contamination	2, according to EN 50178 fine dust not allowed, no condensation		
Type of protection	IP20, according to EN 60529 = DIN VDE 0470-1-1992 (ICE 529-1989)		
EMI noise emission	Klasse A, Gruppe 2, according to DIN EN 61800-3		
EMI noise immunity	according to DIN EN 61800-3; section 5.2		
Vibration sinus in operation according to EN 60068-2-6			
Amplitude and Frequency			0.3 mm (peak-to-peak) at 5 ... 57 Hz 2 g at 57 ... 500 Hz
Tolerance		%	± 15
Vibration distortion (Random) in operation according to IEC 68-2-36			
Frequency		Hz	20 ... 500
Spectral acceleration density amplitude		g²/Hz	0.01
Tolerance		dB	± 3
Virtual value (r.m.s.) of the total acceleration		g	2.2
Shock check not in operation according to EN 60068-2-27			
Halve sine in 3 axis			15 g / 11 ms

Fig. 4-5: Ambient and operating conditions

Note: The user must check whether the ambient conditions, especially the temperature, are observed.

Electric Data of the Individual HDC01.1 Components

Mains connections, Power section HDC01.1-AXXXN

Designation	Symbol	Unit	40 A not ventilated	40 A ventilated	100 A ventilated	200 A ventilated
Operating mode at the mains			three phase			
Mains input voltage	U_{N1}	V	3 x AC (200 ... 480) $\pm$ 10%			
Mains frequency	f_{N1}	Hz	(50 ... 60) $\pm$ 2			
Rotating field			clockwise or counter-clockwise			
Connected load	S_{N1}	kVA	see page 7-1: "Mains Connections"			
Nominal charging current (dependent on mains input voltage)	I_{ON}	A	5 ... 12		24 ... 56	12 ... 28
soft-start resistor	$R_{Softstart}$	Ohm	60	60	12	24
continuous power soft-start resistor	$P_{Softstart}$	kW	0,075 ²⁾	0,15 ²⁾	0,5 ²⁾	1,5 ²⁾
Switching frequency (selectable)	f_S	kHz	4 or 8			
Type current = peak current 1	I_{PEAK1}	A	40 ¹⁾	40 ¹⁾	100 ¹⁾	200 ¹⁾
Peak current 2 for $f_S = 4$ kHz	I_{PEAK2} (4kHz)	A	10 ¹⁾	16 ¹⁾	40 ¹⁾	100 ¹⁾
Peak current 2 for $f_S = 8$ kHz	I_{PEAK2} (8kHz)	A	5 ¹⁾	12,5 ¹⁾	32 ¹⁾	68 ¹⁾
Continuous current 1 for $f_S = 4$ kHz	I_{CONT1} (4kHz)	A	7,5 ¹⁾	13 ¹⁾	32 ¹⁾	85 ¹⁾
Continuous current 2 for $f_S = 4$ kHz	I_{CONT2} (4kHz)	A	10 ¹⁾	16 ¹⁾	40 ¹⁾	100 ¹⁾
Continuous current 1 for $f_S = 8$ kHz	I_{CONT1} (8kHz)	A	3 ¹⁾	9 ¹⁾	21 ¹⁾	48 ¹⁾
Continuous current 2 for $f_S = 8$ kHz	I_{CONT2} (8kHz)	A	5 ¹⁾	12,5 ¹⁾	32 ¹⁾	68 ¹⁾
Max. Output frequency at $f_S=4$ kHz	f_{out}	Hz	400			
Max. Output frequency at $f_S=8$ kHz	f_{out}	Hz	400			
Device power dissipation without internal continuous bleeder power for I_{CONT2}	P_V	W	(see page 8-1: "Power dissipation")			
Peak bleeder power when $U_{ZW} = 830V$	P_{BS}	kW	11,5	11,5	57,4	115
Allowed load cycle	On Off		0,435 s 66,7 s	0,435 s 33,3 s	0,54 s 62 s	0,52 s 40 s
Continuous bleeder power HDC when $T_a \leq 45^\circ C$	P_{BD}	kW	0,075	0,15	0,5	1,5
Max. energy dissipation	$W_{R,MAX}$	kWs	5	5	31	60
Internal DC bus dynamic brake (ZKS)			not present		present	
Resistor for ZKS	R_{ZKS}	Ohm	not present		12	6

Designation	Symbol	Unit	40 A not ventilated	40 A ventilated	100 A ventilated	200 A ventilated
Storable energy of the DC bus capacitors	W_{ZW}	Ws	see diagram page 4-14: "Storable energy in the bus"			
nominal DC bus capacitance HDC	C_{ZW}	mF	0,585		2,35	4,7
DC bus voltage (dependent on mains input voltage)	U_{ZW}	V	DC 300 ... 800			
DC bus continuous power (dependent on mains input voltage)	P_{ZWD}		see diagram page 4-16 "Allowed DC bus continuous power"			
max. DC bus continuous power where $U_{N1} = 3 \times \text{AC } 400\text{V}$, at $T_a \leq 45^\circ\text{C}$	P_{ZWD}	kW	0,65	1,3	6,0	15,0
max. DC bus continuous power where $U_{N1} = 3 \times \text{AC } 480\text{V}$, when $T_a \leq 45^\circ\text{C}$	P_{ZWD}	kW	0,75	1,5	7,2	18,0
DC bus peak power	P_{ZWS}		see diagram page 4-16 "Allowed DC bus peak power"			
Cooling power section and bleeder resistor			natural convection	forced convection		

Fig. 4-6: Technical Data Mains connection and Power section

1) Sine threshold value

2) Softstart resistor is used after softstart as bleeder (R_B).

Block diagram of the HDC01.1 power section

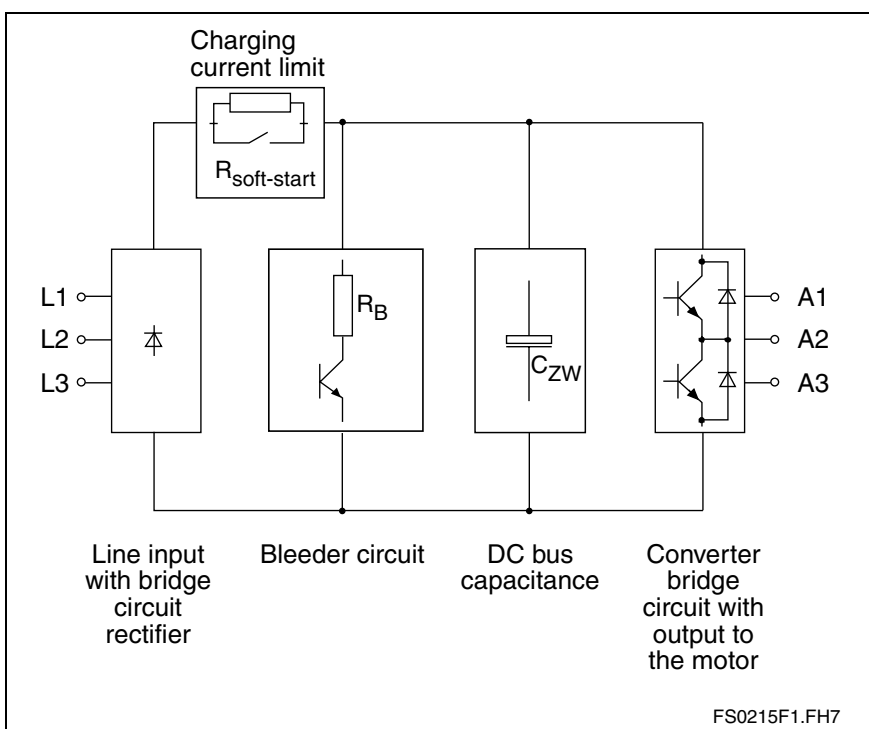


Fig. 4-7: Block diagram of the HDC01.1 power section

Control voltage connection for HDC

(Data applies to ambient temperature of 25°C)

Designation		Symbol	Unit	40 A not ventilated	40 A ventilated	100 A ventilated	200 A ventilated
Control voltage		U _{N3}	V	DC (21.6 ... 26.4) V ¹⁾			
max. ripple effect		w		may not exceed input voltage range			
max. allowed overvoltage		U _{N3max}	V	40 V for 1ms, non repetitive ²⁾			
max. charging current		I _{EIN3}	A	6.0	6.0	7.0	7.0
				(see diagram "Amplitude of the HDC control voltage charging current at startup, to selecting power ")			
max. pulse duration of I _{EINmax}		t _{N3Lade}	ms	12	12	17	17
				(see diagram "Amplitude of the HDC control voltage charging current at startup, to selecting power ")			
max. input capacitance		C _{N3}	mF	0.9 * 1.2			
Power input (at X1)		dependent on type of unit, without external load at control outputs and encoder interface 2					
	CN01	P _{N3}	W	26			
	DN01	P _{N3}	W	26			
	IB01	P _{N3}	W	27			
	PB01	P _{N3}	W	26			
	SE01	P _{N3}	W	25			
	SE02	P _{N3}	W	26			

Fig. 4-8: Control voltage connection for HDC

¹⁾ For motors with holding brake the minimum voltage required for the holding brake has to be taken into account (24V ± 10%, measured at motor).

²⁾ To be obtained by means of suitable power supply units and separate wire routing!

Note: The power consumption of the motor holding brake and the ventilator unit has to be added when computing the control voltage power.

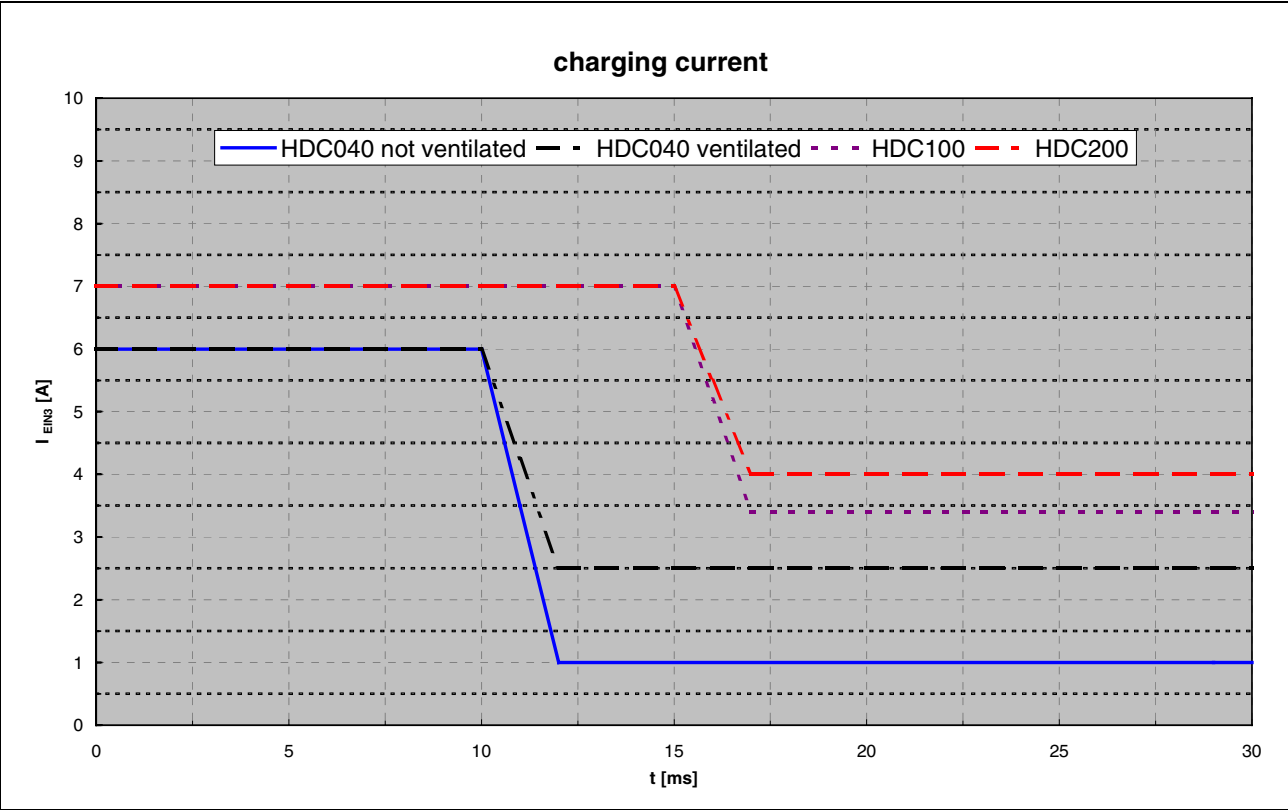
Note: Overvoltages higher than the 40 V indicated on the data sheet, have to be discharged by means of the appropriate electrical equipment of the machine or installation.

This means:

- Use 24 volt power supply units that reduce incoming overvoltages to the allowed value.
- Install control voltage supply units as close to the drive controller as possible.

- Do not install connecting leads in parallel with mains leads and power cables, in order to avoid overvoltages caused by inductive or capacitive coupling.
 - Use shielded connecting leads.
-

Amplitude of the HDC control voltage charging current at startup, to selecting power source



I_{N3}: Current consumption after charging current inrush
Fig. 4-9: Example of charging current inrush of control voltage

Voltage connection for holding brake

Designation	Symbol	Unit	40 A not ventilated	40 A ventilated	100 A ventilated	200 A ventilated
Input voltage	U _{HB}	V	depends on motor type, listed in motor project planning manual			
max. ripple effect	w	%				
Current	I _{HB}	A				

Fig. 4-10: Voltage connection for holding brake

Power consumption of cooling fan units

Cooling fan unit	Symbol	Unit	40 A not ventilated	40 A ventilated	100 A ventilated	200 A ventilated
LECH-040N	P	W	-	35	-	-
LECH-200N	P	W	-	-	45	45

Fig. 4-11: Power consumption of cooling fan units

Materials used, Mass

Designation	Symbol	Unit	40 A not ventilated	40 A ventilated	100 A ventilated	200 A ventilated
Mass	m	kg	12	15	35	40
materials used	-	-	Free of asbestos and silicone			

Fig. 4-12: Materials used, Mass

Output current characteristic curves for servo applications (acceleration times ≤ 400 ms)

Static profile illustrated:

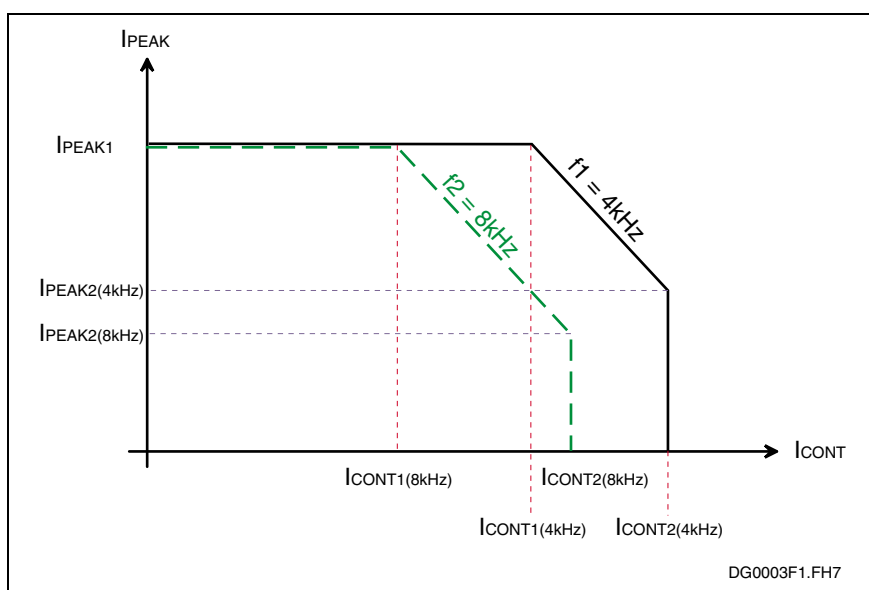


Fig. 4-13: Output current characteristic curves for servo applications

Output current characteristic curves for servo applications (acceleration times ≥ 400 ms)

The dynamic profile of the output current limit is illustrated using a temperature model **without** initial conditions, as a response to a sudden torque change at the motor.

Note: For electrical rotary field frequency < 3 Hz
(Mechanical speed * number of pole pairs)

- peak current available for only about 10% of shown time,
- output current tends to continuous current 1 (see table on page 4-6: "Electric Data of the Individual HDC01.1 Components").

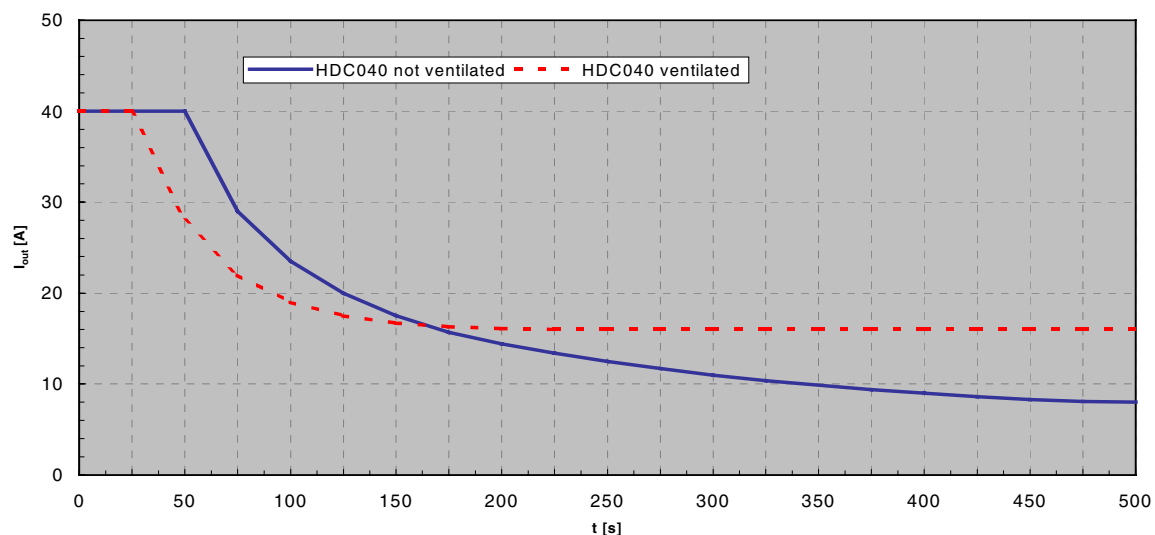


Fig. 4-14: Output current characteristics for HDC01.1-A040N at 4 kHz

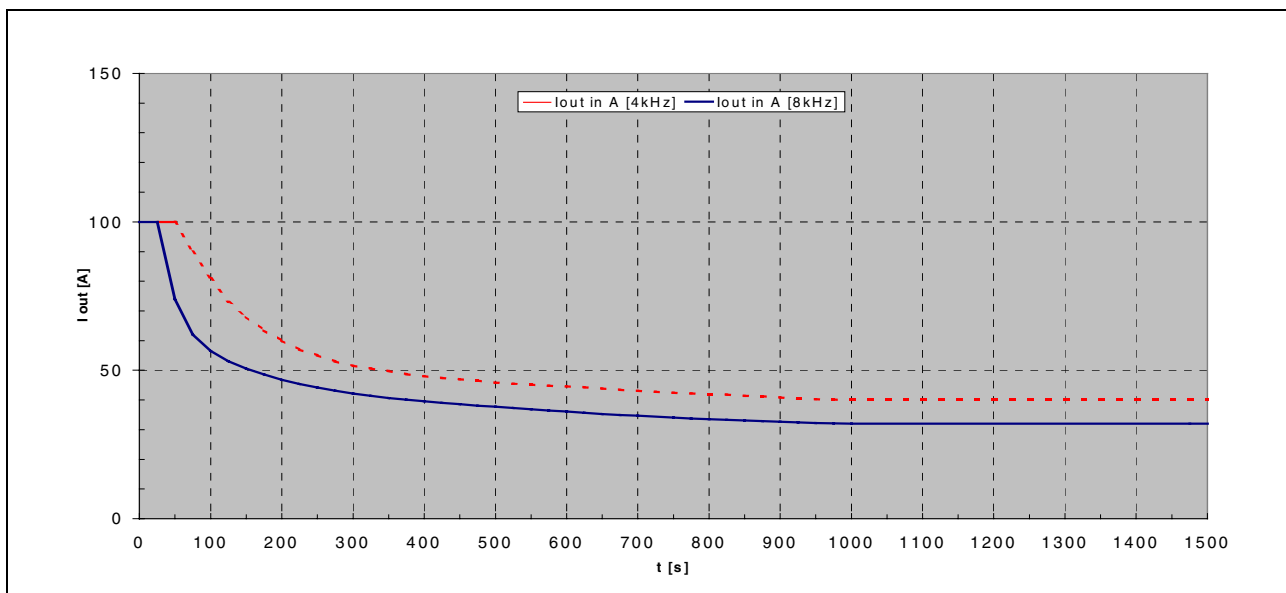


Fig. 4-15: Output current characteristics for HDC01.1-A100N at 4 resp. 8 kHz

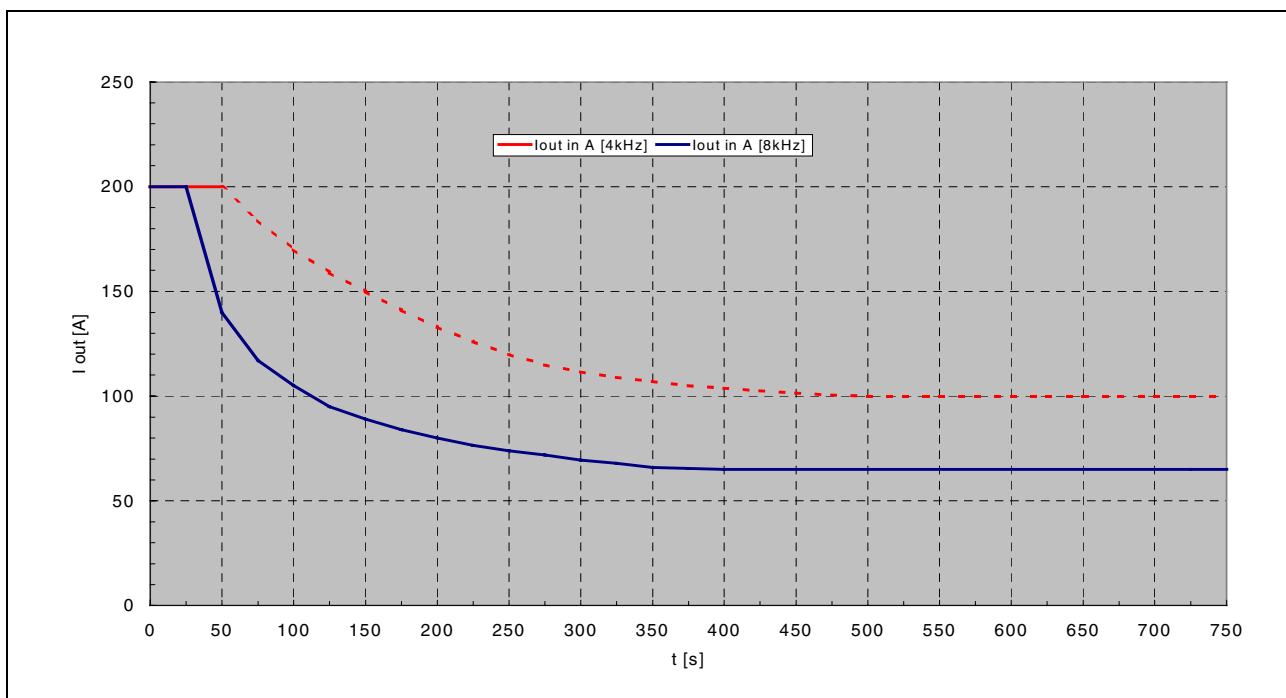
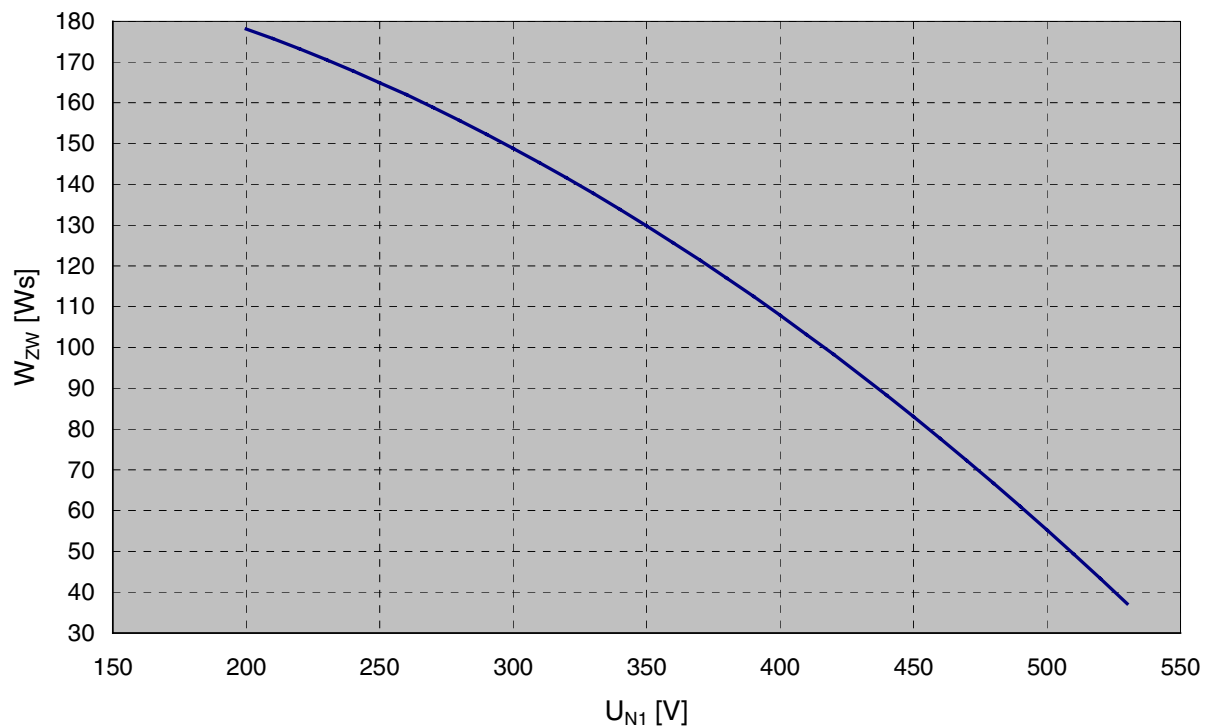


Fig. 4-16: Output current characteristics for HDC01.1-A200N at 4kHz

Storable energy in the bus

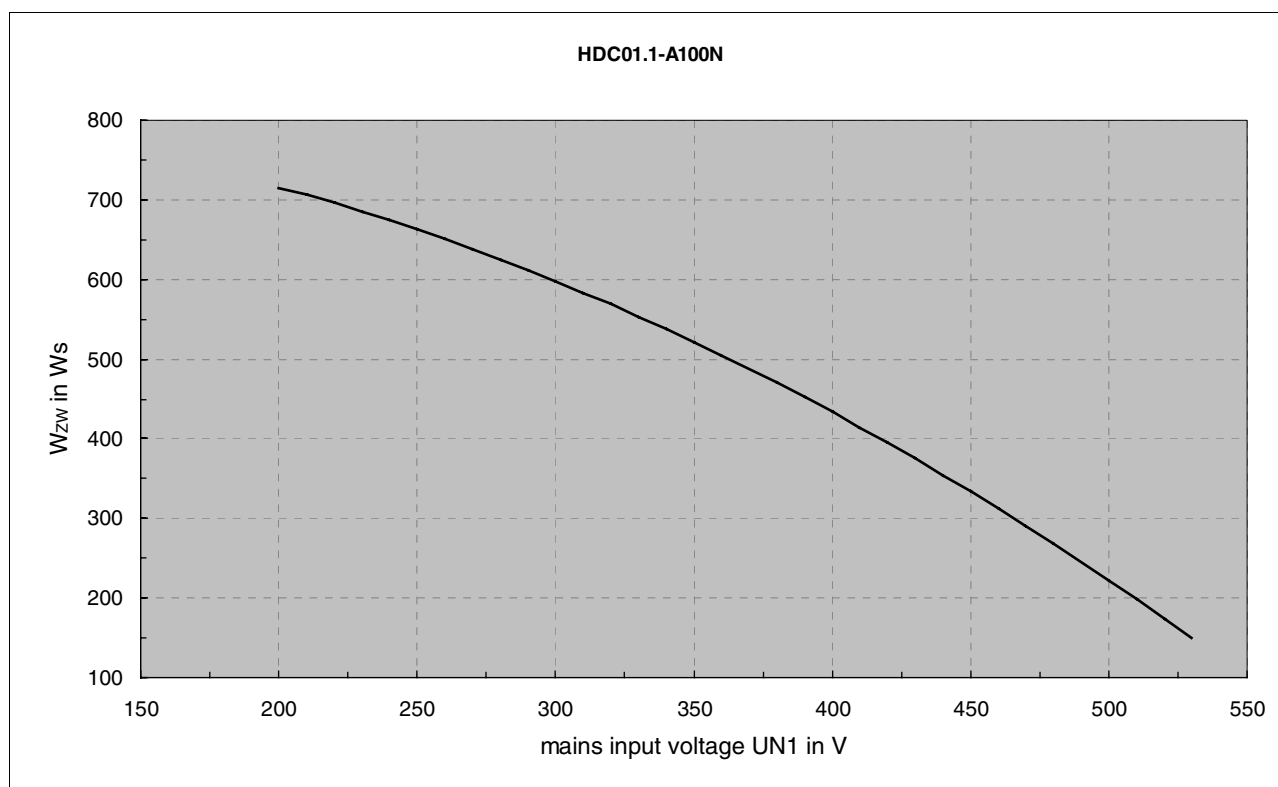
Note: The higher the connection voltage the lower the energy that can be stored in the DC bus as the differential voltage between bleeder threshold and DC bus voltage (threshold value of connecting voltage) decreases.



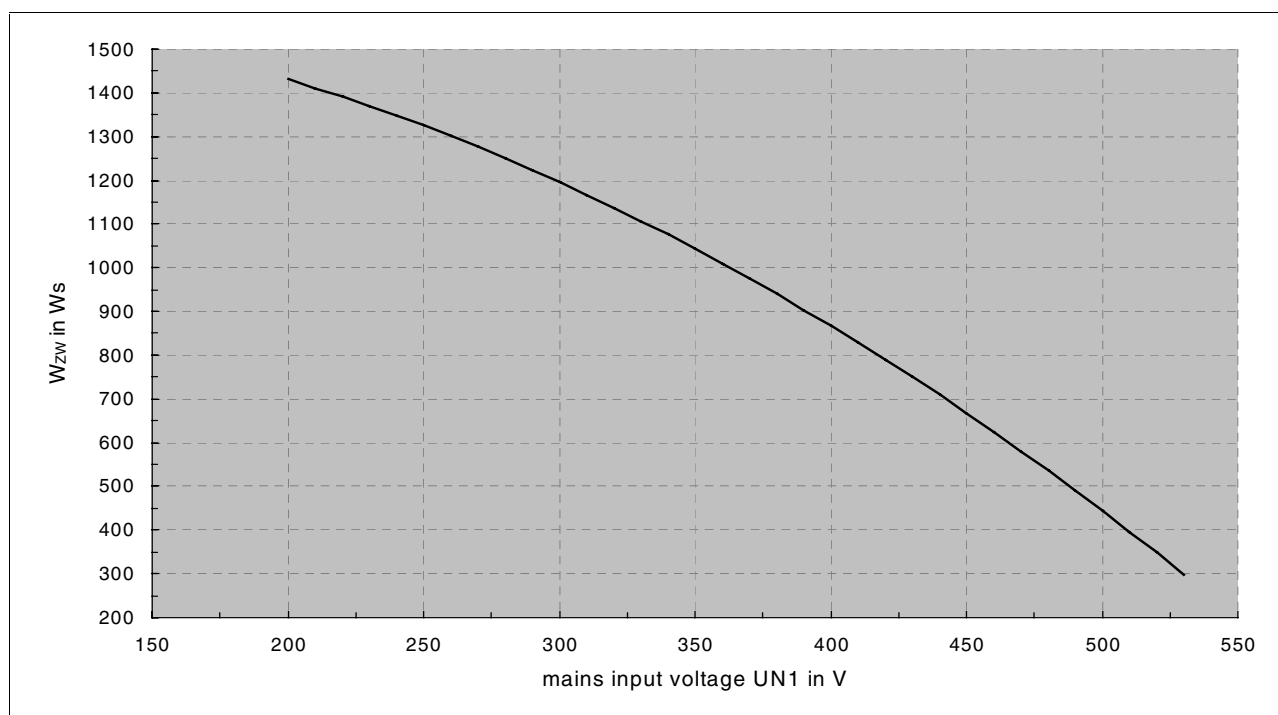
W_{ZW} : Storable energy of the DC bus capacitors

U_{N1} : Mains input voltage

Fig. 4-17: Storable energy in the bus HDC01.1-A040N



U_{N1} : Mains input voltage
 W_{ZW} : Storable energy of the DC bus capacitors
 Fig. 4-18: Storable energy in the bus HDC01.1-A100N



U_{N1} : Mains input voltage
 W_{ZW} : Storable energy of the DC bus capacitors
 Abb. 4-19: Storable energy in the bus HDC01.1-A200N

Allowed DC bus peak power

HDC01.1

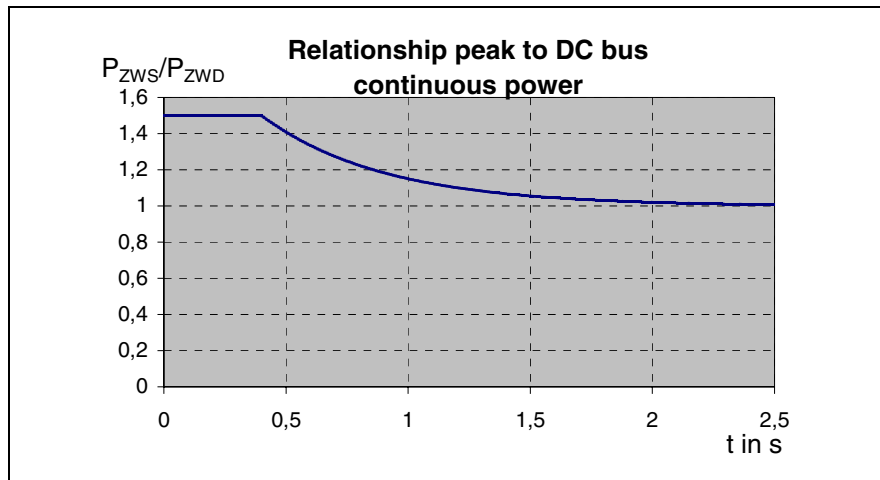


Fig. 4-20: Allowed peak power in DC bus of HDC01.1-A040N

HDC01.1-A040N are not suited for drive applications if the required intermittent operating power of the unit's nominal power exceeds 50%!

Allowed DC bus continuous power

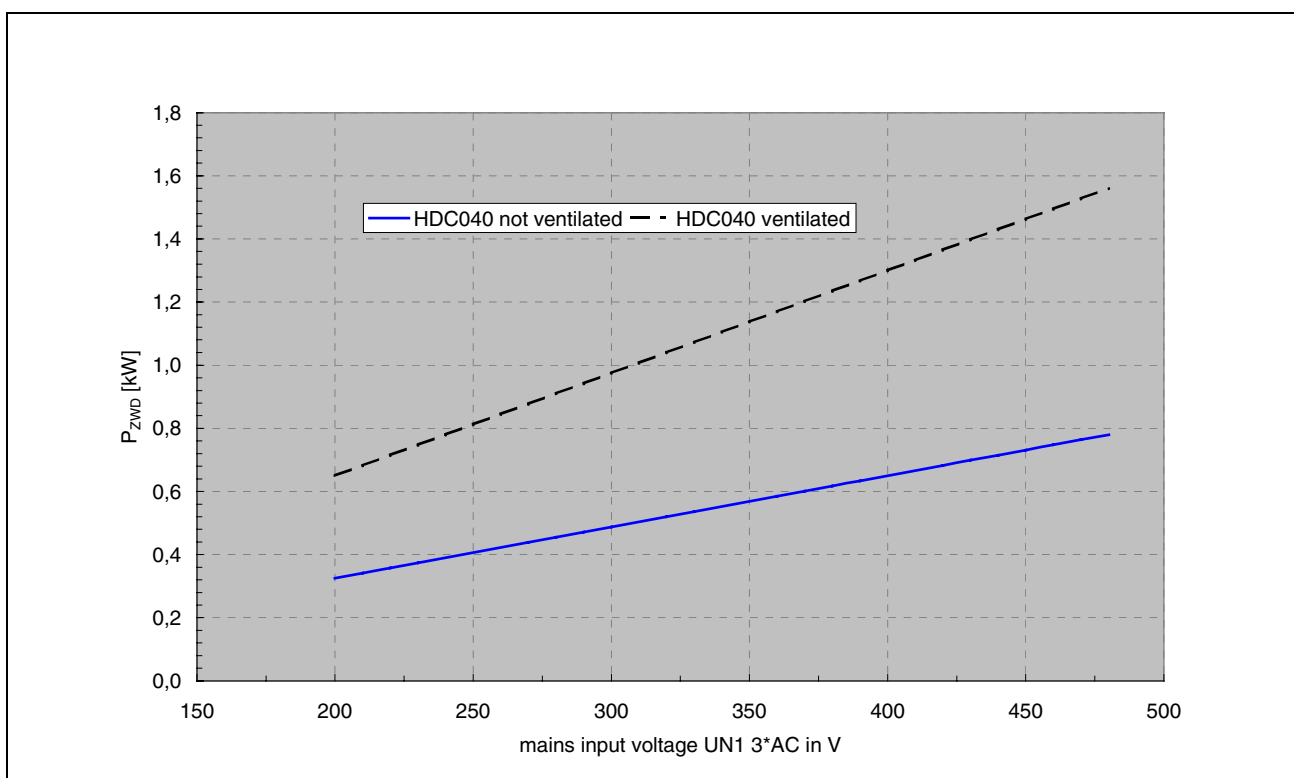


Fig. 4-21: Allowed DC bus continuous power of HDC01.1-A040N

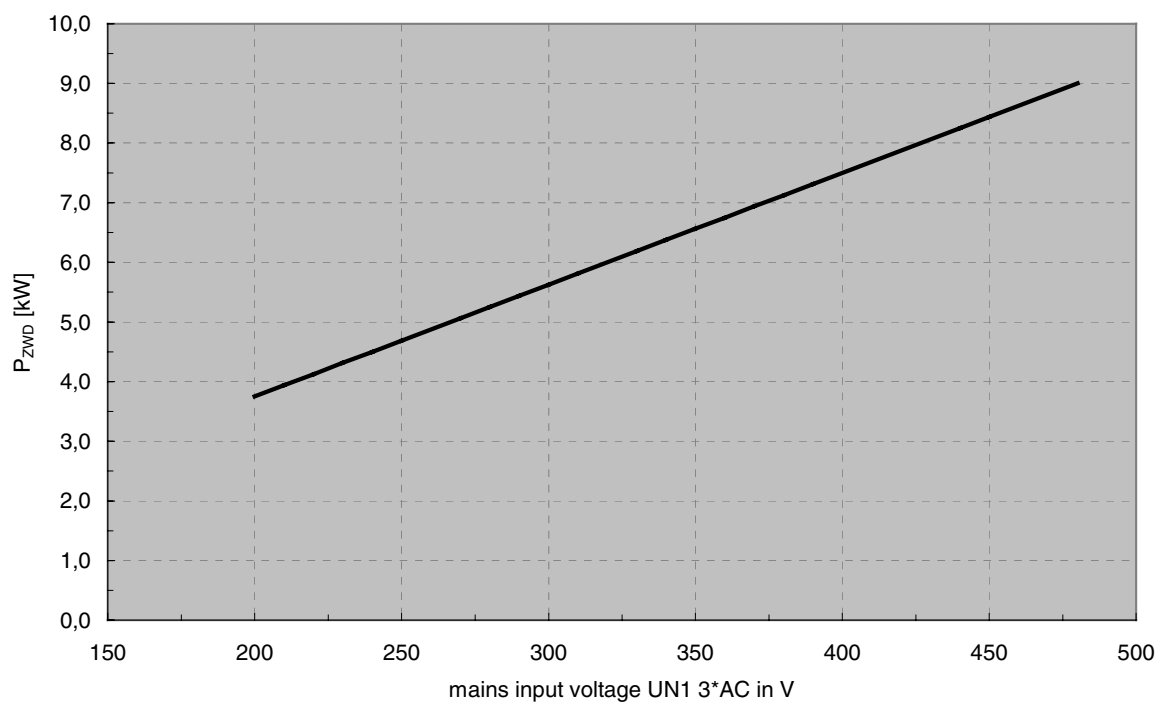


Fig. 4-22: Allowed DC bus continuous power of HDC01.1-A100N

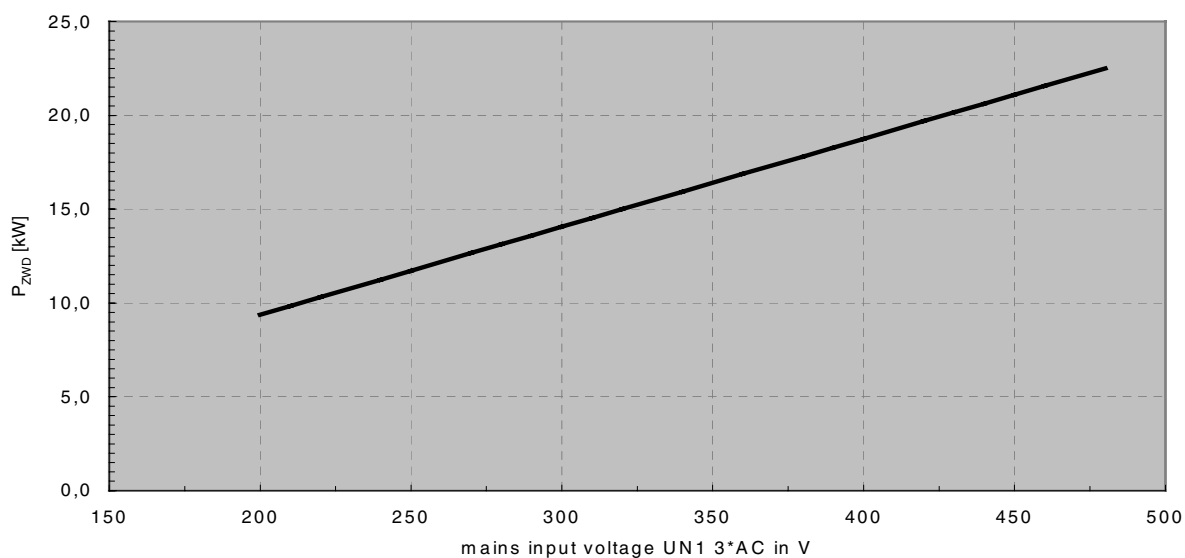


Fig. 4-23: Allowed DC bus continuous power of HDC01.1-A200N

Sizing components relevant to regeneration

With every application it has to be checked whether the stored

- regeneration continuous power
- regeneration peak power
- regenerated energy

can be absorbed by the internal bleeder (brake resistor).

If the stored power and energy from the mechanical system exceed the capacity of the bleeder in the drive controller, the next larger unit can be used, if possible.

Regenerative power

1. DC bus continuous power

$$P_{ZWD} \leq P_{ZWD, HDC}$$

$$P_{ZWD} = \frac{M \cdot \omega \cdot t}{t_z} \cdot \frac{1}{\eta} \quad \omega = 2 \cdot \pi \cdot n_i$$

2. DC bus peak power

$$P_{ZWS} \leq P_{ZWS, HDC}$$

$$P_{ZWS} = M_{\max} \cdot \omega_{\max} \cdot \frac{1}{\eta} \text{ (accelerate)}$$

3. regeneration continuous power

$$P_{RD} \leq P_{BD, HDC}$$

$$P_{RD} = \frac{W_{ROT} + W_{POT}}{t_z} \quad W_{ROT} = \frac{(J_{LAST} + J_M)}{2} \cdot (n_{NUTZ} \cdot \frac{2 \cdot \pi}{60})^2 \cdot z_{DEC}$$

$$W_{POT} = m_{LAST} \cdot g \cdot h \cdot z_{AB}$$

4. regeneration peak power

$$P_{RS} \leq P_{RS, HDC}$$

$$P_{RS} = \frac{M_{\max} \cdot n_{\max}}{9550}$$

5. regenerated energy (one-time braking in the case of emergency stop)

$$W_R \leq W_{R, HDC}$$

$$W_R = W_{POT} + W_{ROT}$$

P_{ZWD} :	required DC bus continuous power
$P_{ZWD, HDC}$:	allowed DC bus continuous power in HDC
P_{ZWS} :	required DC bus peak power
$P_{ZWS, HDC}$:	allowed DC bus peak power in HDC
P_{RD} :	required regeneration continuous power
$P_{BD, HDC}$:	allowed regeneration continuous power
P_{RS} :	required regeneration peak power
$P_{RS, HDC}$:	allowed regeneration peak power in HDC
W_R :	required regenerated energy
$W_{R, HDC}$:	allowed regenerated energy in HDC
W_{ROT} :	rotary energy
W_{POT} :	potential energy
t_z :	cycle time
J_{LAST} :	load torque
J_M :	motor inertia
m_{LAST} :	load weight
g :	9,81 ms ²
h :	lowering distance in meters or number of braking actions
n_{NUTZ} :	motor speed used in min-1
z_{AB} :	number of drops per cycle
z_{DEC} :	number of braking actions per cycle
$M_{\max}$:	maximum torque
$n_{\max}$:	max. speed
η :	Efficiency in drive components (converter, motor, gearbox)

Abb. 4-24: Regenerative power

CE label, C-UL listing, Tests

CE label



Fig. 4-25: CE label

C-UL listing

- Per UL508 C under file no. E134201.

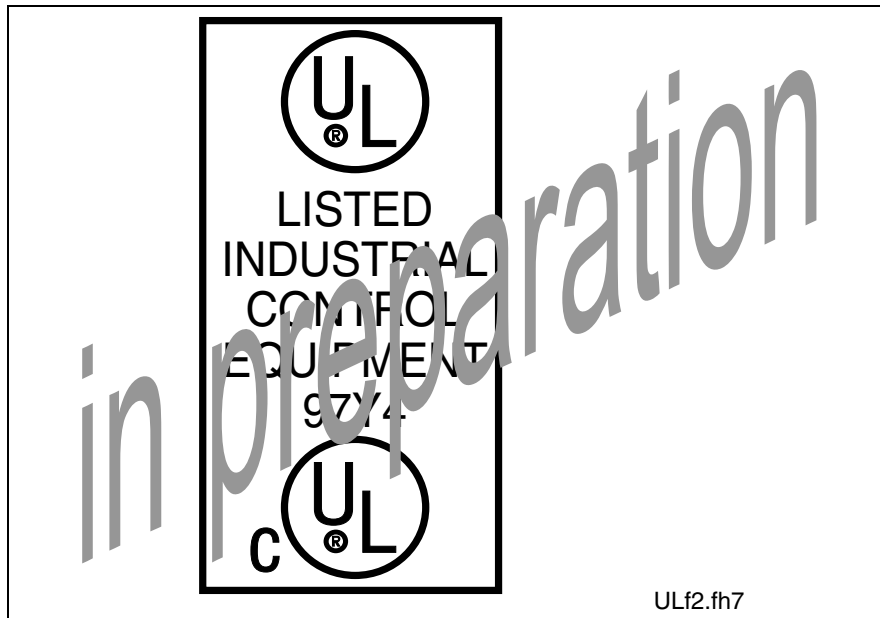


Fig. 4-26: C-UL listing

Tests

High-voltage test according to EN50178	Routine test with DC2100V	1s
Insulation test according to EN50178	Routine test with DC500	1s
Separation between the electrical circuits of the control and high voltage power	safe separation according to EN50178	
Clearances and creepage distances	according to EN50178	

Fig. 4-27: Tests

4.2 Electrical connections - independent of the drive controller type

A look at the drive controller and connector designations

Front view

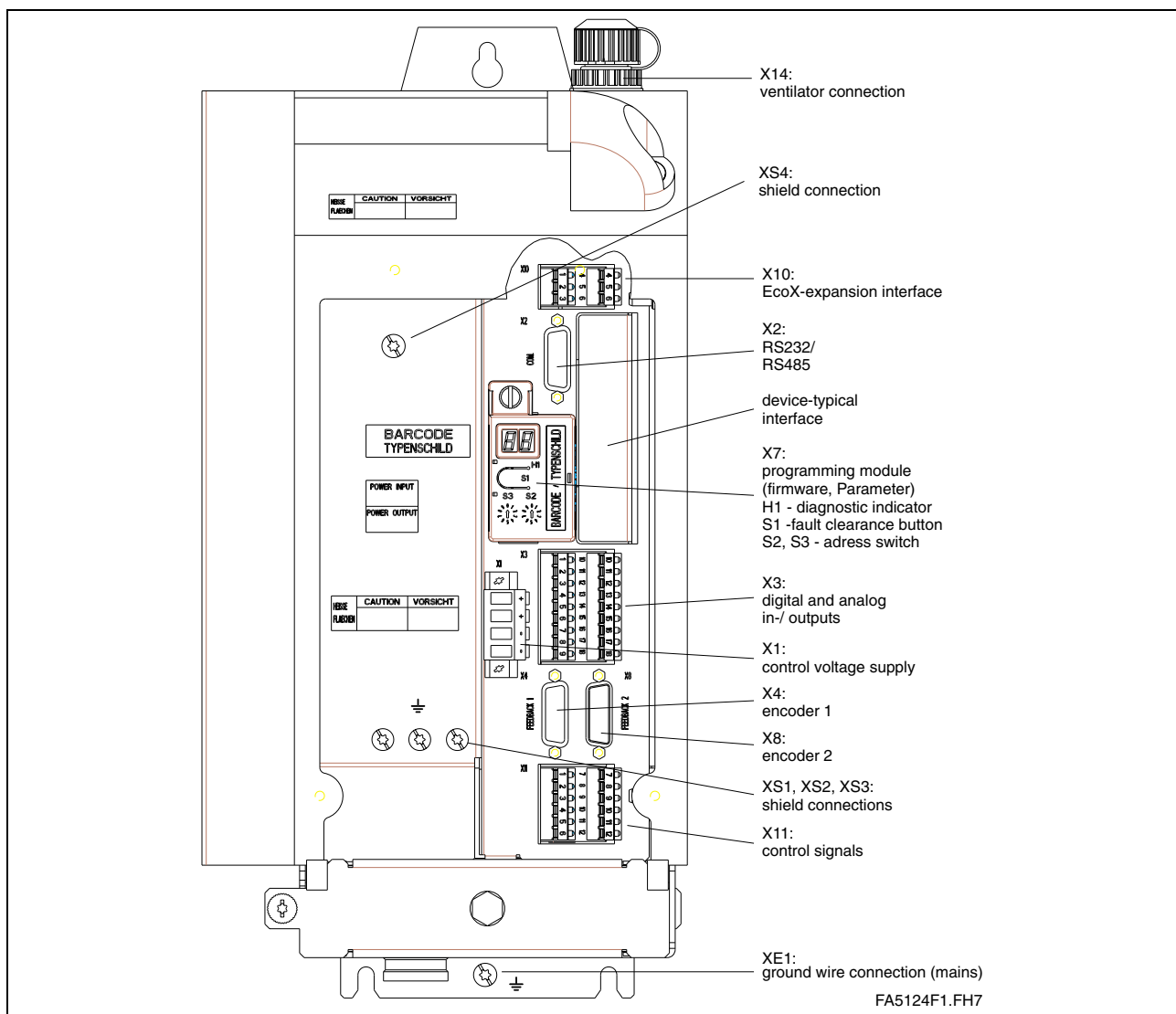


Fig. 4-28: Front view with Connectors

Connections on bottom of unit (HDC01.1-A040N)

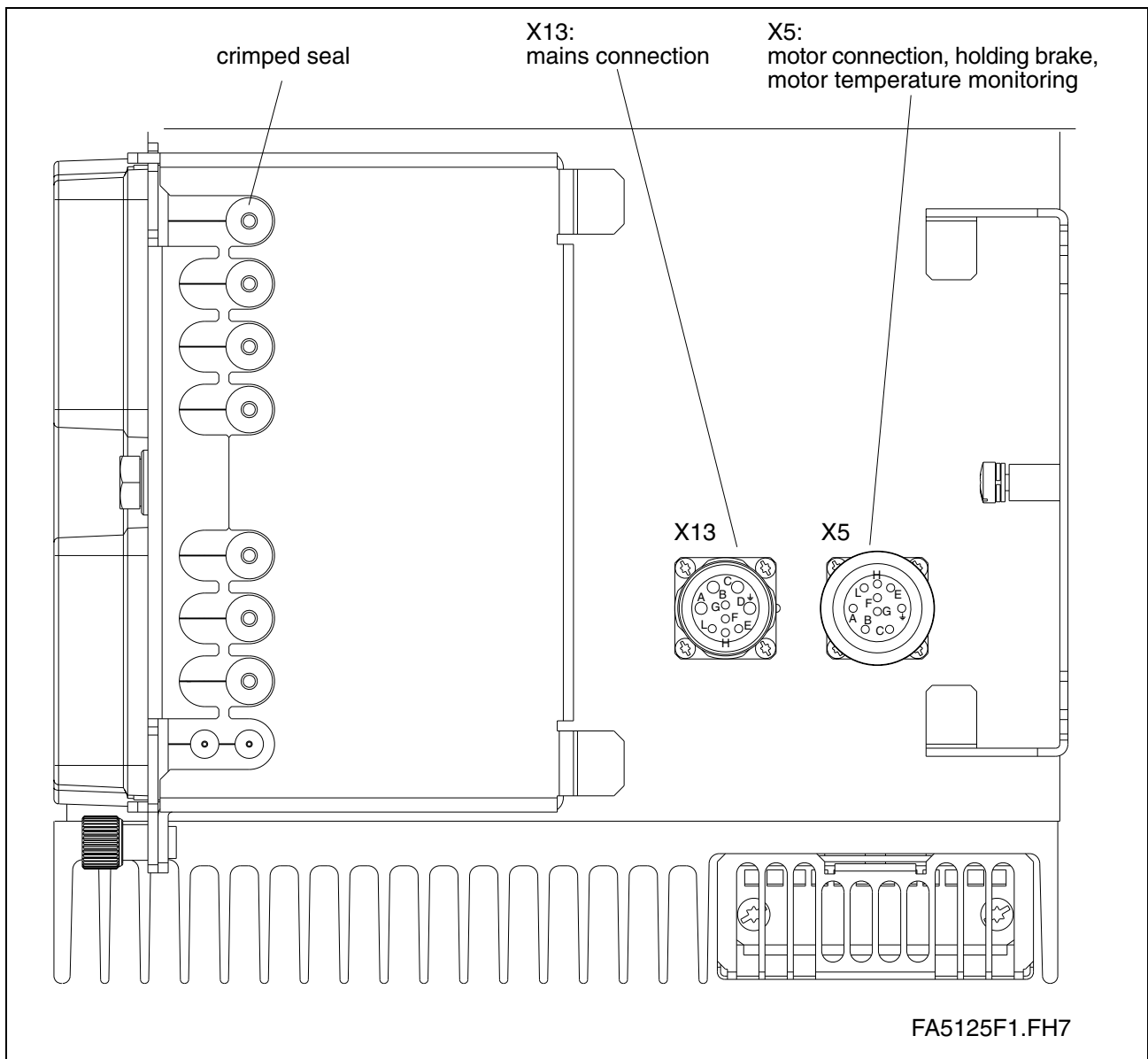


Fig. 4-29: Connections on bottom of unit for HDC01.1-A040N-xxxx-01-FW

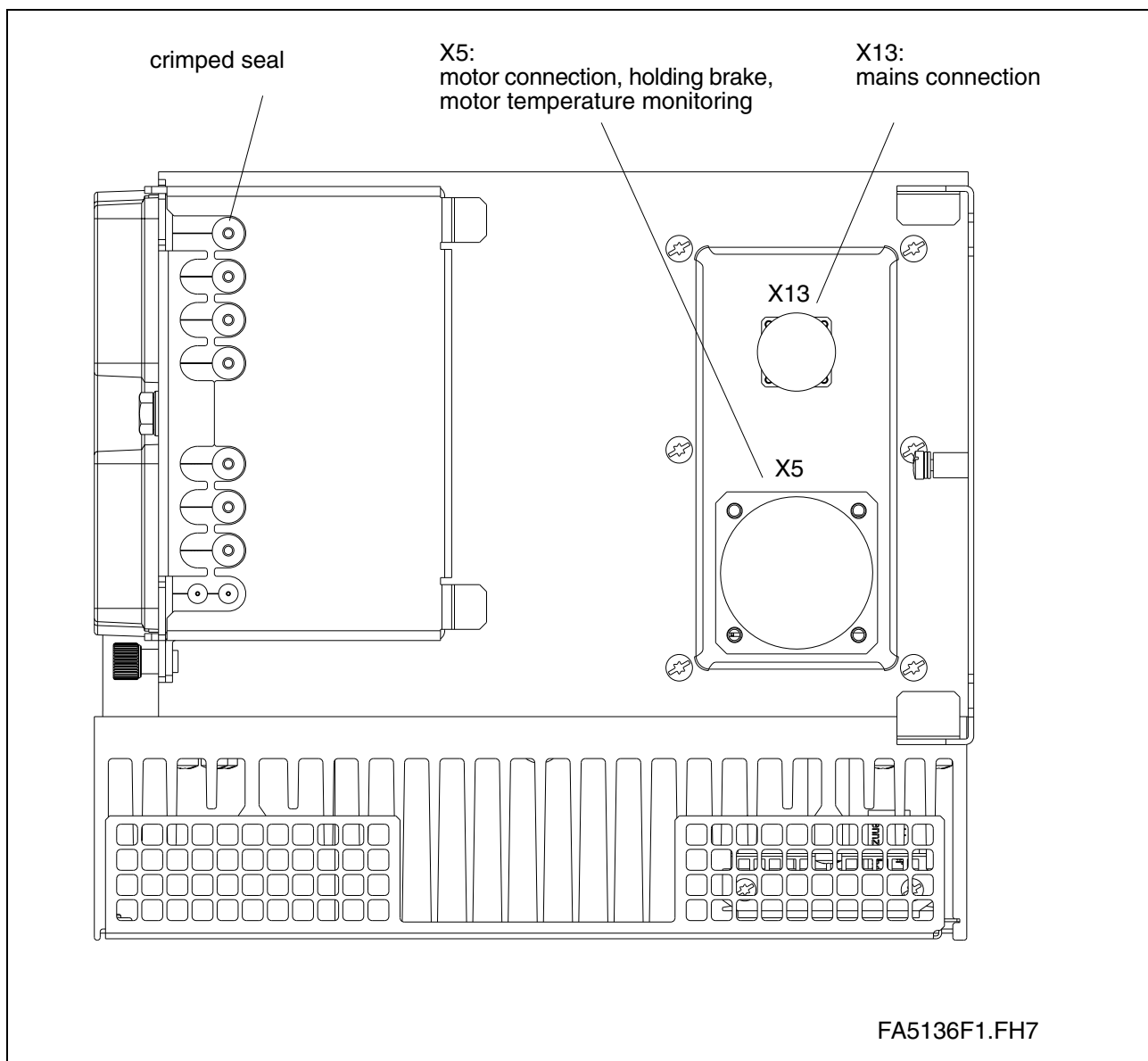
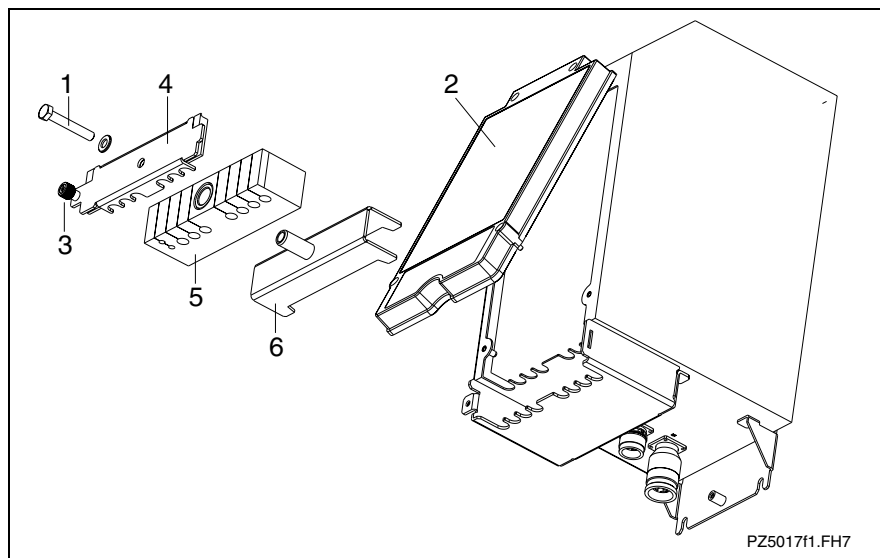
Connections on bottom of unit (HDC01.1-A100/200N)

Fig. 4-30: Connections on bottom of unit for HDC01.1- A100/200N -xxxx-01-FW

Mounting and dismounting of cable bushing (crimped seals)



1. Release screw **1**
2. Open protective cover **2**
3. Release knurled screw **3**
4. Remove cover plate **4**
5. Take out seal **5**; U-Track remains in the HDC **6**
6. Insert cable in seal **5**
7. For assembly use the reserve procedure
8. Firmly tighten screw **1**

Fig. 4-31: Installation guidelines for cable bushing

Cable diameter

Crimped seal	Sealing area / cable diameter	Filler plug	Application
small opening (2x)	3 - 7 mm	4,5 mm	for SERCOS optic fiber
large opening (7x)	6 - 11 mm	7,0 mm	feedback, control signals, etc.

Fig. 4-32: Cable diameter for crimped seals

Independent of the drive controller type – total connecting diagram

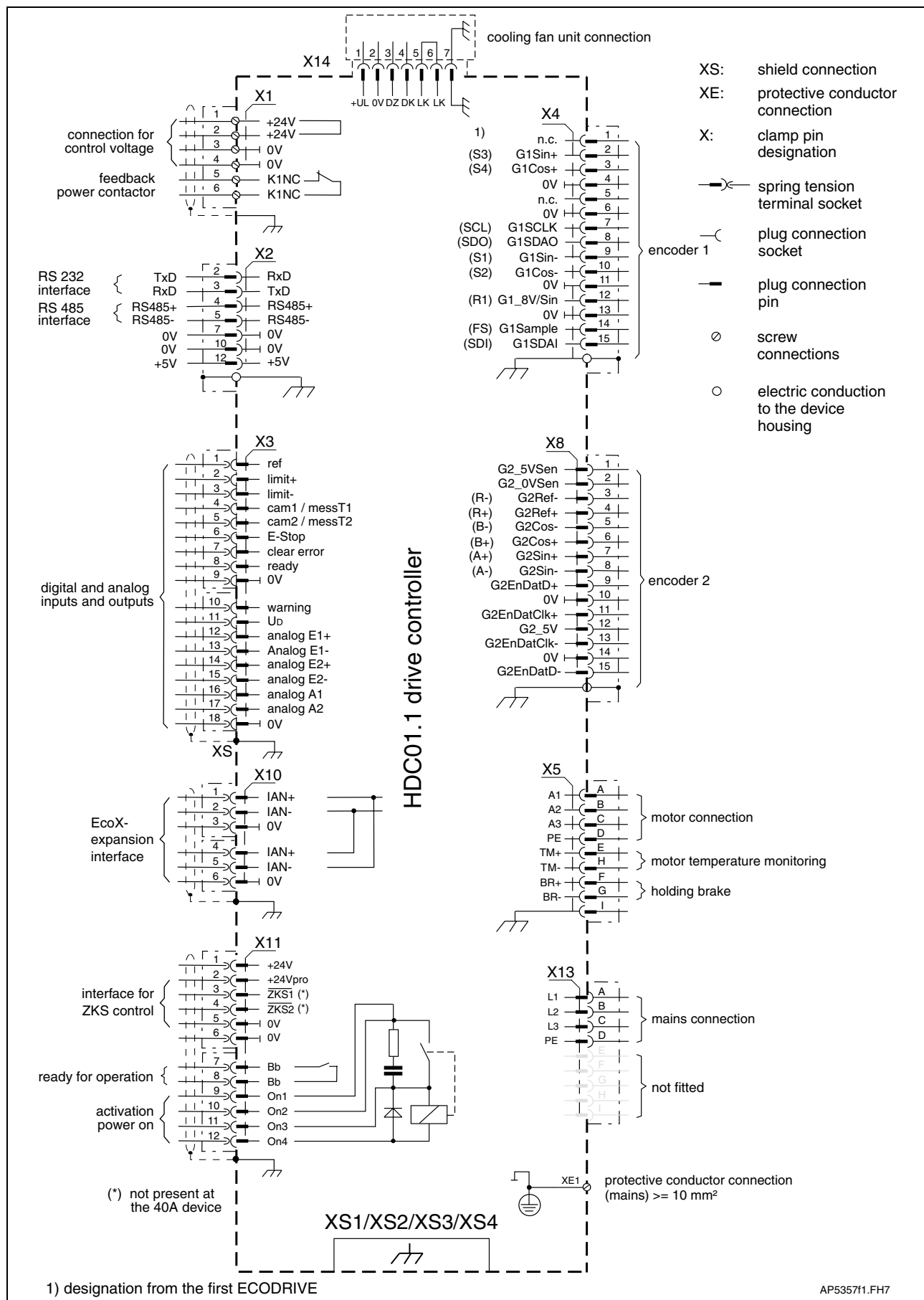


Fig. 4-33: Total connection diagram for HDC01.1

X1, Connections for Control voltage

Technical description of connector

Illustration

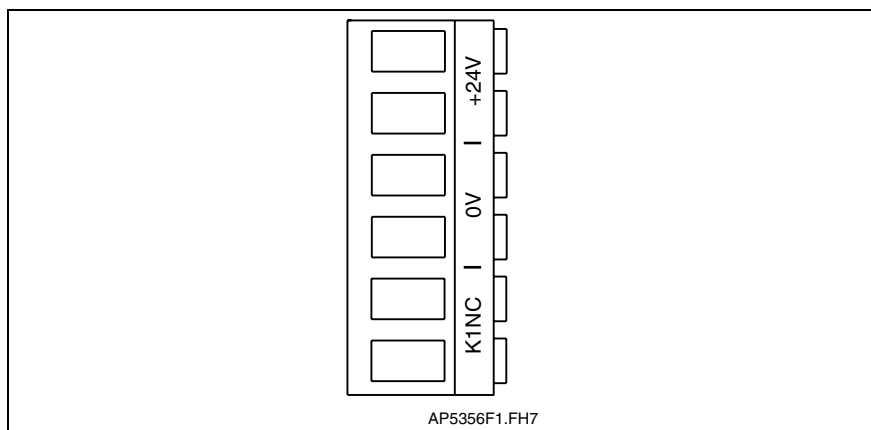


Fig. 4-34: connector X1

Design

Type	No. of pins	Design
Screw terminal	6	Bushing on connector

Fig. 4-35: Design

Connection cross section

Cross section single wire [mm ²]	Cross section multi core wire [mm ²]	Cross section in AWG Gauge no.:
0,2-4	0,2-4	24-10

Fig. 4-36: Connection cross section

24V control voltage supply (+24V and 0V)

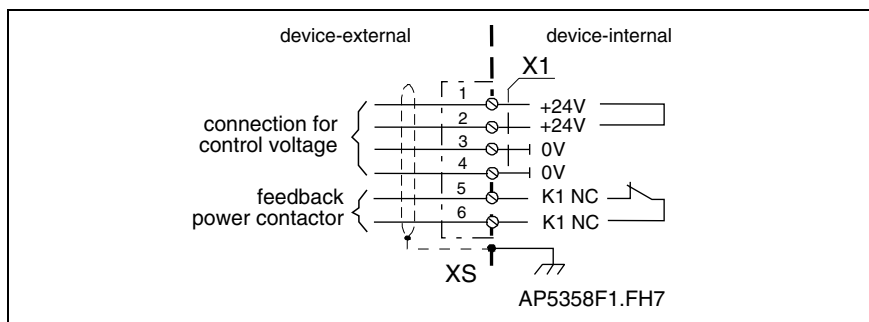
Connection
+24V and 0V

Fig. 4-37: Connections for control voltage

Connection loads
+24V and 0V

Voltage at X1/+ against X1/-:	DC +24 V (21,6...26,4)
Reverse voltage protection:	Via allowed voltage range using internal protection diodes
Current or power consumption X1/1:	see page 4-8: "Technical data → Control voltage connection for HDC"

Note: Always use a shielded cable for connection. Connect the shield to XS1, XS2 or XS3.

Note: The input 0V is connected directly to the device potential. The utilisation of an insulation monitoring for +24V and 0V against device is therefore not possible!

**wire
+24V and 0V**

wire cross section:	min. 1 mm ²
wire routing:	parallel if possible
Max. allowed inductance between 24V source and X1:	100µH (equals about 2 x 75m)

Note:

- Exceeding allowed control voltage generates error message "+24 volt error". (=> See also firmware functional description.).
 - Control voltage failure causes the running motor to coast torque-free (without brake).
-



Dangerous movements due to unbraked coasting of motor with control voltage failure!

- ⇒ Personnel should not remain within the area of the machine with moving parts. Possible preventive steps against unauthorized access are:
 - protective fencing
 - bars
 - covers
 - light barriers.
 - ⇒ The fences must be able to withstand the maximum possible force that the machine can generate.
-

X2, Serial interface

Note: Serial interfaces are generally used for programming, parameterization and diagnoses upon commissioning and during service. It can be operated either as RS 232 or RS 485.

Technical description of connector

Illustration

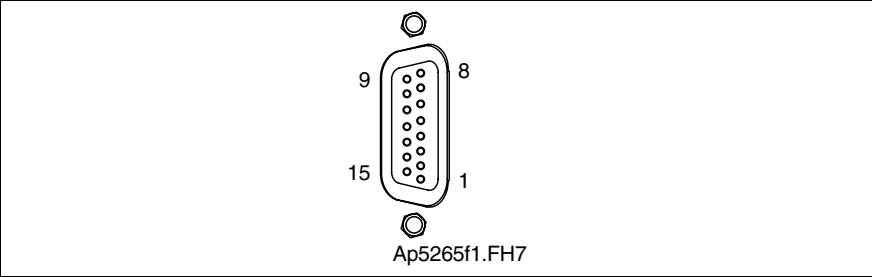


Fig. 4-38: Connector X2

Design

Type	No. of pins	Design
D-SUB	15	Bushings on unit

Fig. 4-39: Design

Connection cross section

Cross section single wire [mm²]	Cross section multi core wire [mm²]	Cross section in AWG gauge no.:
--	0.25-0.5	--

Fig. 4-40: Connection cross section

Short circuit protection

RS 232	pin 4, 5 against each other against 0 V	present
RS 485	pin 2, 3 against each other against 0 V	present

Fig. 4-41: short circuit protection

RS 232 interface

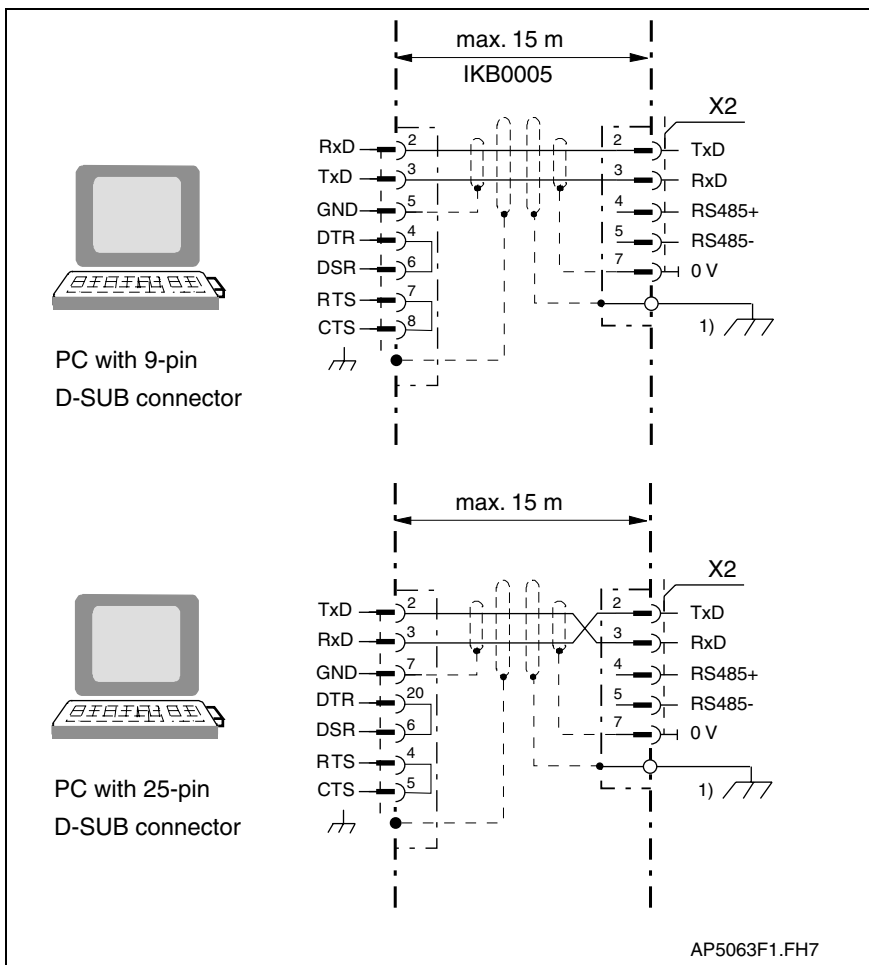
The RS 232 interface is used for programming, parametrization and diagnoses at start up and service.

It makes possible:

- a participant number of maximum 1
- a transmission length of up to 15 m
- transmission rates of 9600/19200 baud

Using an RS 232 interface only one drive at a time can be parametrized with the DriveTop start up program.

Connection RS232



- 1) Connect the metallic connector case with the device potential using the fastening screws of the connector

Fig. 4-42: Connecting a PC to the RS 232 interface on a HDC

RS 485 Interface

The RS 485 interface is used for programming, parameterization and diagnoses at start up and service.

It makes possible:

- the implementation of a serial bus with up to 31 participants connected via a two-wire cable (half duplex mode).
- A transmission length of up to 500 m
- Transmission rates of 9600/19200 baud.
- The use of a centrally PC supported visualization unit.

Using an RS 485 enables the commissioning of several HDCs with DriveTop without changing the interface cables is possible.

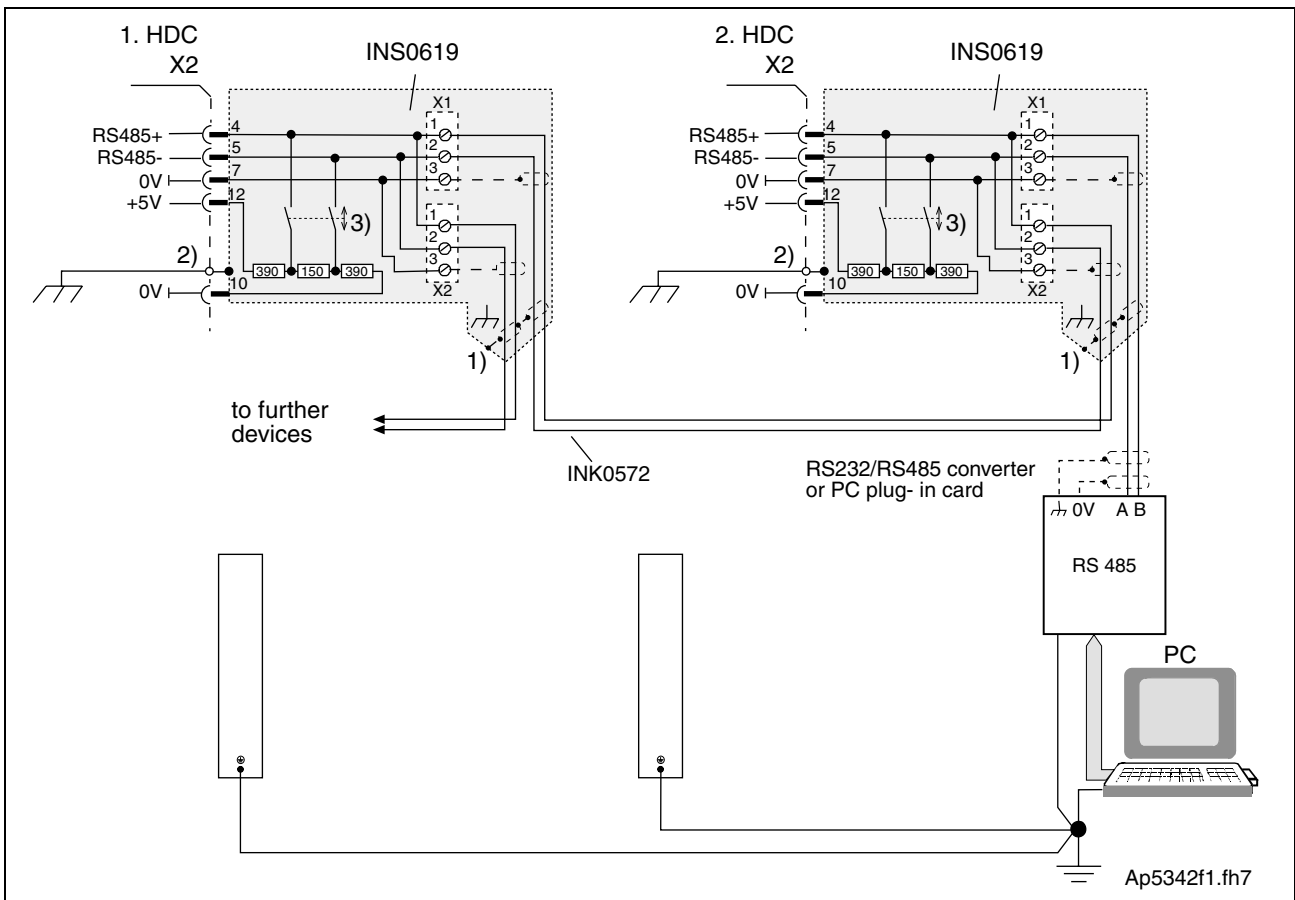
The following options for working with RS485 are available

- RS232/RS485 converter between PC and drives
- RS485 plug-in card in PC

Please contact your PC supplier to help find solutions.

Installation notes for RS485 – cables

Note: Details are listed in "Electromagnetic compatibility (EMC) and control systems", doc. Type DOK-GENERL-EMV*****-PRxx.

Connector for RS485 interface**Connection RS485:**

- 1): Connect outer screen to device potential on PC side and converter side (strain relief of metallic connector case)
- 2) Connect the metallic connector case with the device potential using the fastening screws of the connector
- 3) If the drive controller is fitted as the last participant of a RS- 485 bus, activate the bus termination. => Shift switch to "I".

Fig. 4-43: Connection example of RS485 interface

⇒ See also the firmware functional description: "Serial Communications"

X3, Digital and analog I/Os

Technical description of connector

Illustration

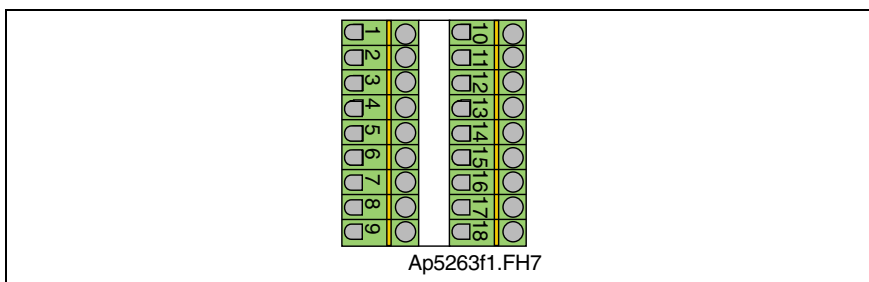


Fig. 4-44: Connector X3

Design

Type	No. of pins	Design
Spring contact	2 x 9	Bushing on connector

Fig. 4-45: Design

Connection cross section

Cross section single wire [mm ²]	Cross section multi core wire [mm ²]	Cross section in AWG Gauge no.:
0,2-2,5	0.2-1.5	24-16

Fig. 4-46: Connection cross section

Note: Always use a shielded cable for connection. Connect the shield to XS1, XS2 or XS3.

Digital Inputs (Ref, Limit+, Limit-, cam1/ MessT1, cam2/ MessT2, E-Stop and clear error)

Connection
Digital inputs

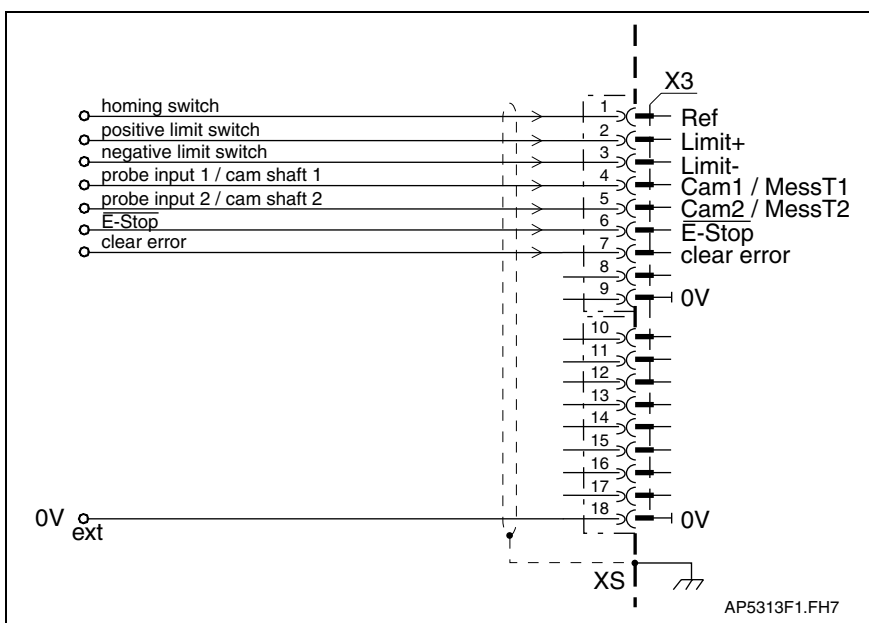
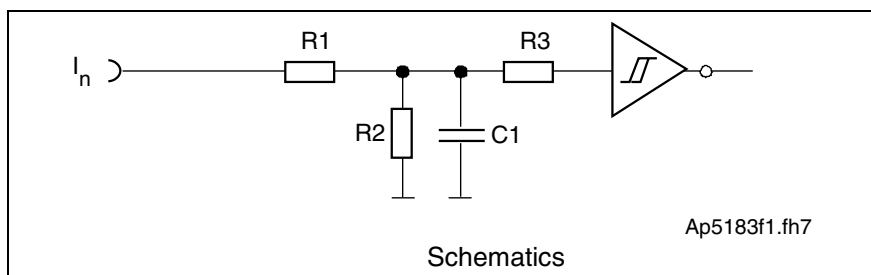


Fig. 4-47: Digital inputs

Input circuit
Digital inputs

R1: 10k
R2: 3k3
R3: 10k
C1: N/A.

Fig. 4-48: Input circuit

Inputs
Digital inputs

Input voltage:	min.	max.
High	16 V	30 V
Low	-0,5 V	3 V
Input resistance	13,3 kOhm $\pm$ 5%	
Reaction time	See firmware functional description	

Fig. 4-49: Inputs

Note: If the inputs are controlled by a power supply other than the DC24 volt supply of the HDC, then the reference lead of the other power supply must be connected to X3.18 (OV).

Homing switch

The positive edge of the homing switch is always evaluated.

Limit+, Limit-

End switches can be N/C or N/O depending on how the drive is parameterized. See firmware functional description.

Probes

Position and time measurements are read using two binary input signals.

Cams

Switching-signal dependent continuous block switching makes transition to the next block possible with the use of an external switching signal.

Note: If the functions probe and following block mode are simultaneously activated, then both functions evaluate the inputs independently of each other.

E-Stop

At delivery, the E-stop function is deactivated depending on what has been parameterized. See firmware functional description.

Clear error

With a positive edge at the input "clear error", all errors (up to four) are cleared. With the actuation of the S1 button (firmware module) only the error in the display is cleared and any other errors present are then shown.

Note: The errors entered in the back-up memory are not cleared with the "clear error" input.

Digital outputs (ready, warning and U_D-message)

Connection
Digital outputs

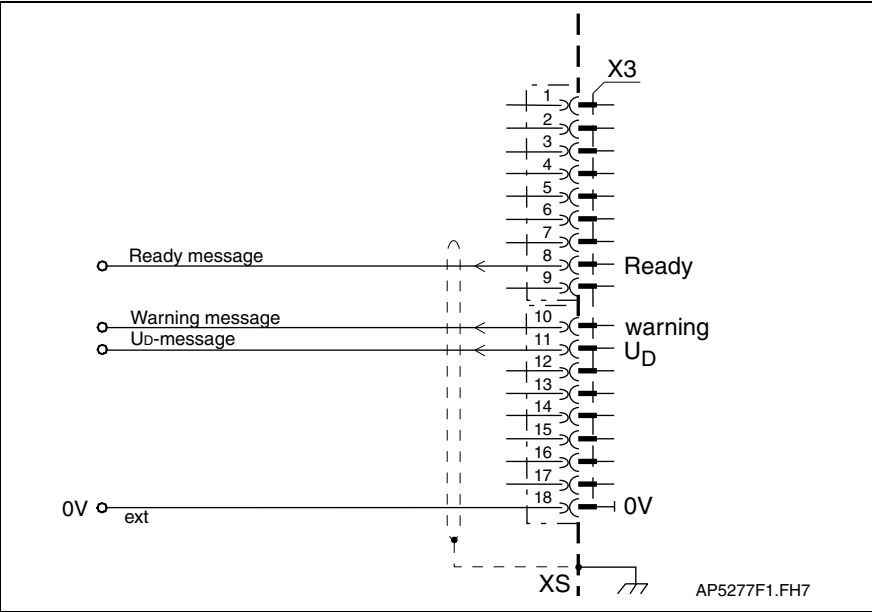
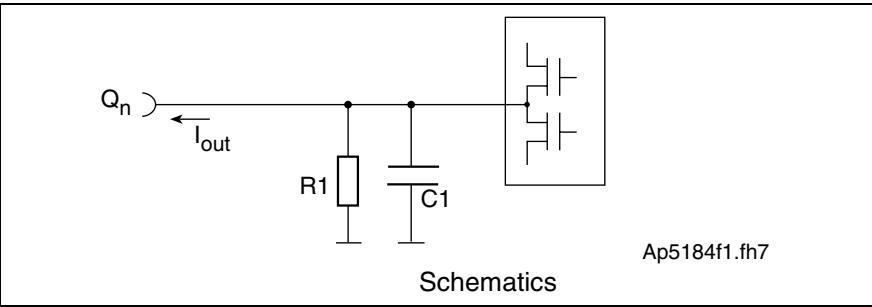


Fig. 4-50: Control outputs

Output circuit connection
Digital outputs



R1: 20k
C1: N/A.
Fig. 4-51: Output circuit

Output connections
Digital outputs

Output voltage:	min.	max.
High	16 V	U _{ext} (an X1.1-1V)
Low	-0.5 V	1.5 V
Output current I _{out}	80 mA	
Rise and drop time	about < 600 ns	
Overload protection	- short circuit protection At I _{out} > 300 mA the outputs switch off . Thermal shutdown	

Fig. 4-52: Outputs

Warnings Depending on operating mode and parameter programming a number of monitoring functions are conducted. If a condition is detected that still allows for correct operations but would eventually lead to an error, then the warning is set to high.

⇒ See also firmware functional description.

Ready If the unit is ready for the drive enable, then the output ready is set to high.

The output is set to low

- with a pending error
- with DC bus voltage < (0.75 x threshold value of applied mains voltage)
- with lacking control voltage

U_D-message Once the minimum voltage in the power DC bus is reached, then the controller is ready to output power and the U_D output is set to high.

Delay time t_d from applying mains voltage to the setting of the UD signal is

$$t_d = R_{\text{softstart}} * 1.2 * C_{\text{ZW}} * 3 + 50\text{ms}$$

Fig. 4-53: Delay time

Analog inputs 1 and 2

Connection
Analog inputs

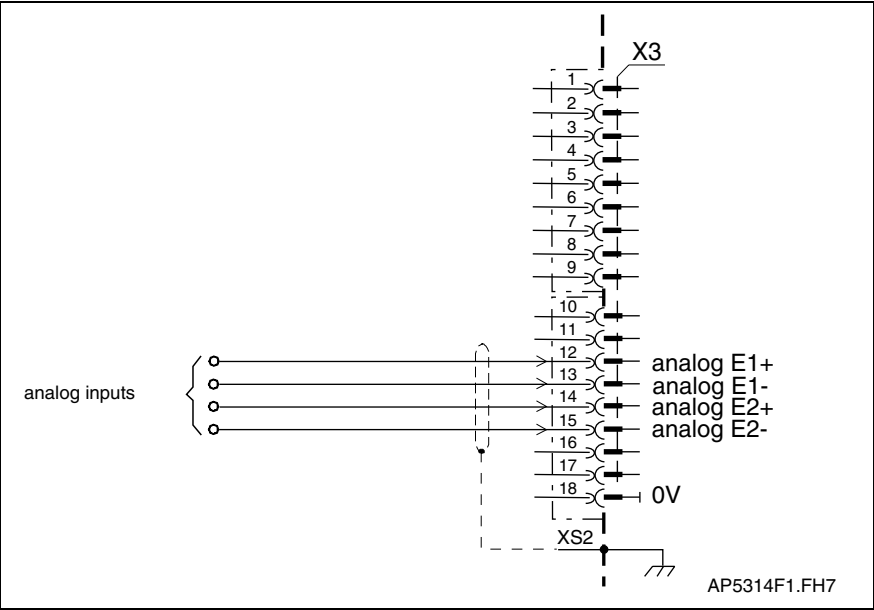
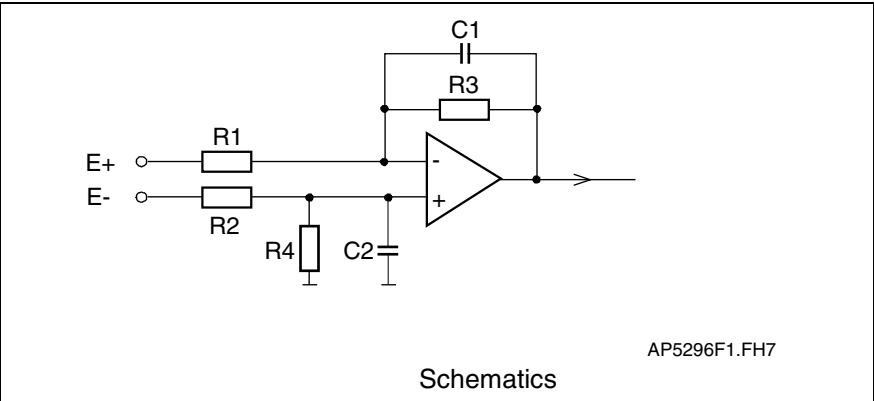


Fig. 4-54: Analog inputs

Input circuit
Analog inputs



- R1: 20k
- R2: 20k
- R3: 20k
- R4: 20k
- C1: N/A.
- C2: N/A.

Fig. 4-55: Input circuit

Inputs
Analog inputs

Input voltage range	Working range	max.
between E+ & E-:	$\pm 10\text{ V}$	$\pm 15\text{ V}$
between E+ & 0 V:	$\pm 10\text{ V}$	$\pm 15\text{ V}$
between E- & 0 V:	$\pm 10\text{ V}$	$\pm 15\text{ V}$
Input current	N/A.	
Input resistance for differential signal	$40\text{ k}\Omega \pm 5\%$	
AD converter	12 Bit	
Resolution per bit	4,88 mV	
Limit frequency	800 Hz	
Probe	See firmware function description	

Fig. 4-56: Inputs

Analog inputs The analog differential inputs 1 and 2 can be parameterized as needed and can be used, for example, as an analog speed command value inputs, override inputs or for analog torque reduction.

⇒ See also firmware function description: "Analog inputs".

Analog outputs 1 and 2

Connection
Analog outputs

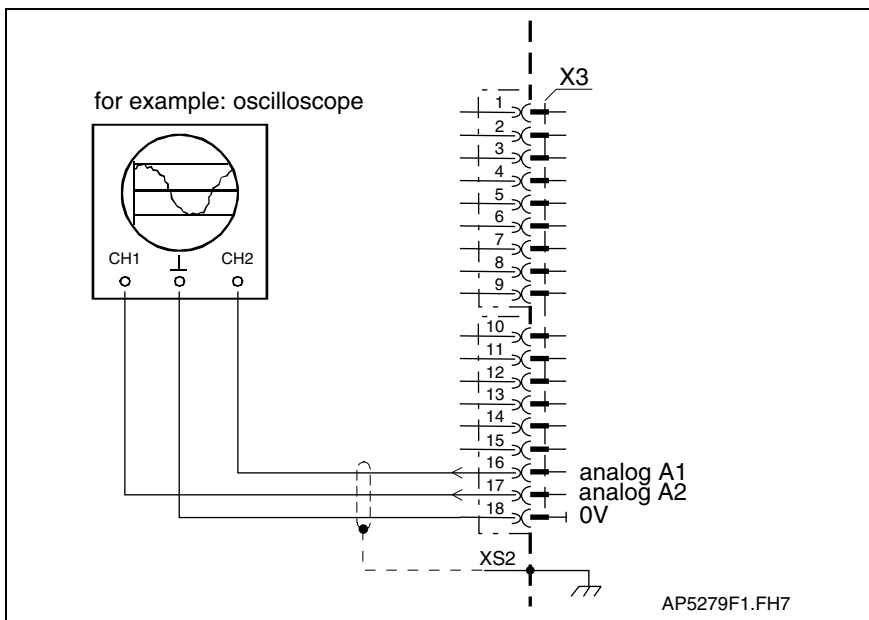


Fig. 4-57: Connection example of outputs A1 and A2

Outputs
Analog output

Output voltage	min	max.
between A1 & 0 V:	- 10 V	+ 10 V
between A2 & 0 V:	- 10 V	+ 10 V
output current	max. 2 mA	
output resistance	150R	
DA converter	8 Bit	
Resolution per bit	78 mV	
short-circuit and overload protection	not present	
Probe	See firmware functional description	

Fig. 4-58: Outputs

Analog outputs Analog outputs 1 and 2 can be freely parameterized and used for diagnostics or implementation of master/slave mode.

⇒ See also firmware functional description: "Analog outputs".

X4, Encoder 1

Technical description of connector

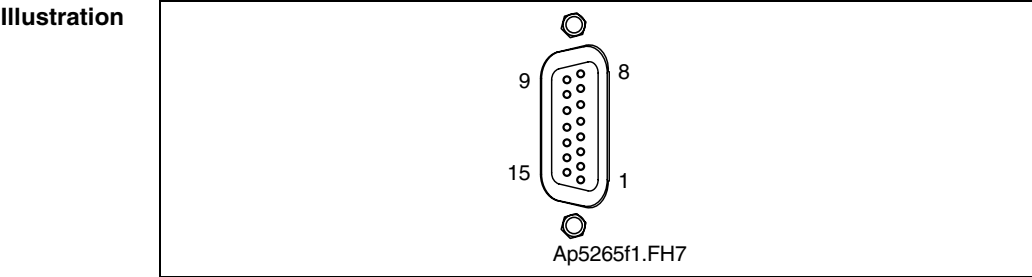


Fig. 4-59: Connector X4

Design

Type	No. of pins	Design
D-SUB	15	bushing on unit

Fig. 4-60: Design

Connection cross section

Cross section single wire [mm²]	Cross section multi core wire [mm²]	Cross section in AWG gauge no.:
--	0.25-0.5	--

Fig. 4-61: Connection cross section

Encoder 1

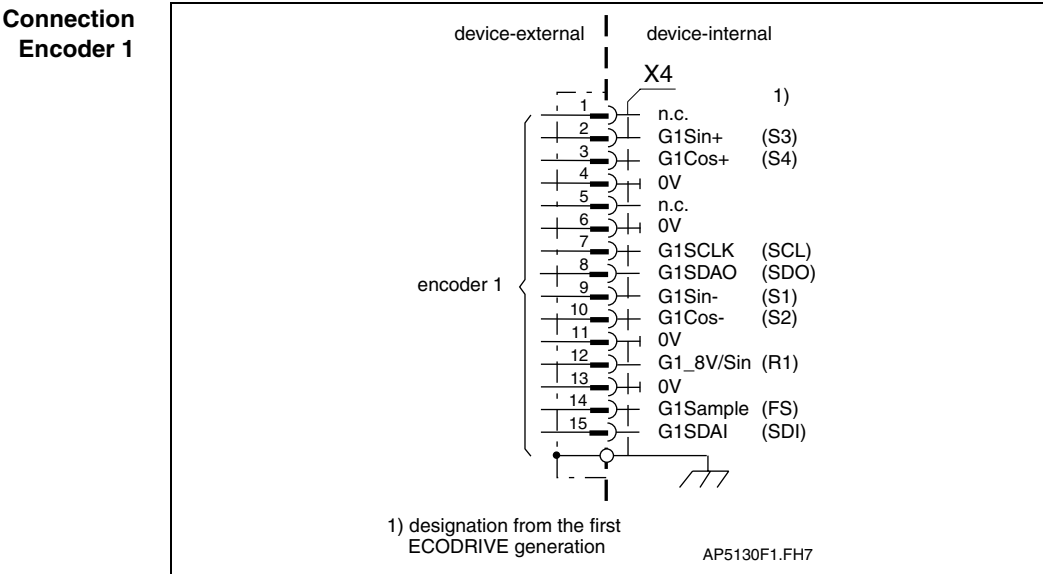


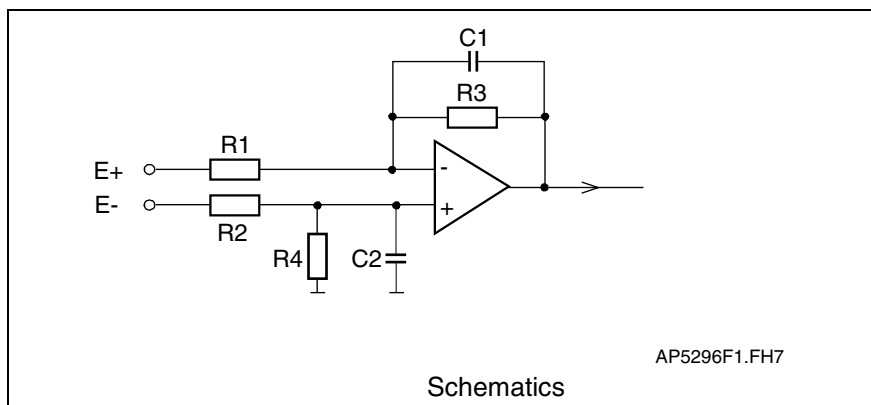
Fig. 4-62: Encoder 1

Shield connection Via D-subminiature mounting screws and metal connector housing.

G1SCLK Clock lead for I²C interface

G1SDA0, G1SDAI Data lead for I²C interface

G1Sample Control signal for encoder initialization

G1Sin+ (S3), G1Sin- (S1) Input circuit G1Sin+ (S3), G1Sin- (S1):

R1: 10k
 R2: 10k
 R3: 20k
 R4: 20k
 C1: N/A.
 C2: N/A.

Fig. 4-63: Input circuit

Features of the differential input circuit G1Sin+ (S3), G1Sin- (S1):

	Digital servo feedback	Resolver
max. allowed amplitude encoder signal	(1,0 + 0,1) V _{ss}	9,0 V _{ss}
Evaluation AD converter	12 Bit	12 Bit
Limit frequency	75 kHz	--
Input resistance	20k ± 5%	

Fig. 4-64: Features of the differential input circuit

G1Cos+ (S4), G1Cos- (S2) see G1Sin+ (S3), G1Sin- (S1)

G1_8V/Sin Features of the encoder output amplifier stage G1_8V/Sin:

	Digital servo feedback	Resolver
Output voltage	8 V _{DC} ± 0,2V	18,2 V _{ss} (sine with 4 kHz)
max. output current	250 mA	70 mA

Fig. 4-65: Features of the encoder output amplifier stage

Signal allocation to the actual position value

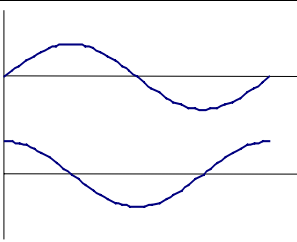
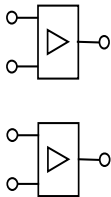
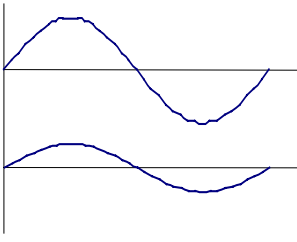
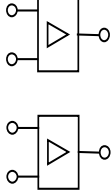
Signal allocation (X4)	signal designation	signal form	actual position value (with default setting)
	G1Sin+(S3) G1Sin- (S1) G1Cos+(S4) G1Cos- (S2)	 DSF (sine 1Vss without 120 Ohm matching resistor, I²C-Bus)	increasing
 amplitude-modulated signal	G1Sin+(S3) G1Sin- (S1) G1Cos+(S4) G1Cos- (S2)	 Resolver	increasing

Fig. 4-66: Signal allocation to the actual position value

Connecting the measuring system

See page 1-6: "An overview of measuring systems supported".

X5, Motor connections, motor temperature monitoring and holding brake

Technical description of connector

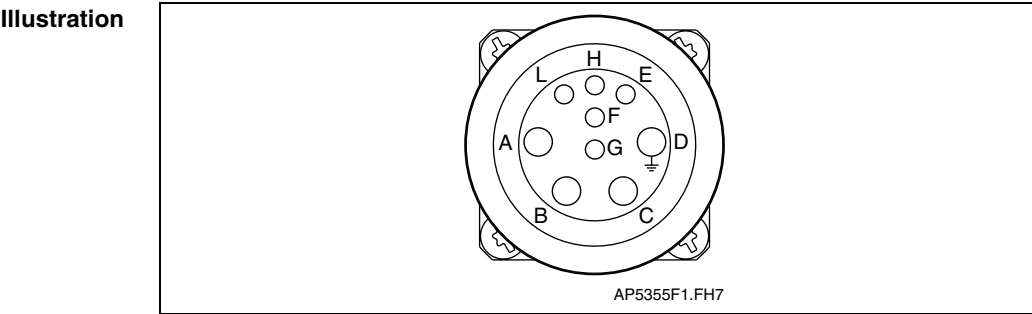


Fig. 4-67: HDC01.1-A040N Connector X5

Design

Type	No. of pins	Design
Circular connector	4 + 5	Bushing on connector

Fig. 4-68: Design

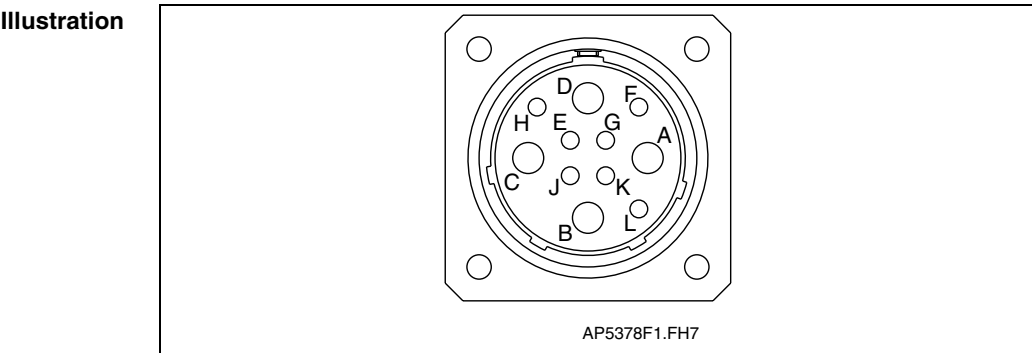


Fig. 4-69: HDC01.1-A100/200 N Connector X5

Design

Type	No. of pins	Design
Circular connector	4 + 5	Bushing on connector

Fig. 4-70: Design

Motor connections

Connection Motor

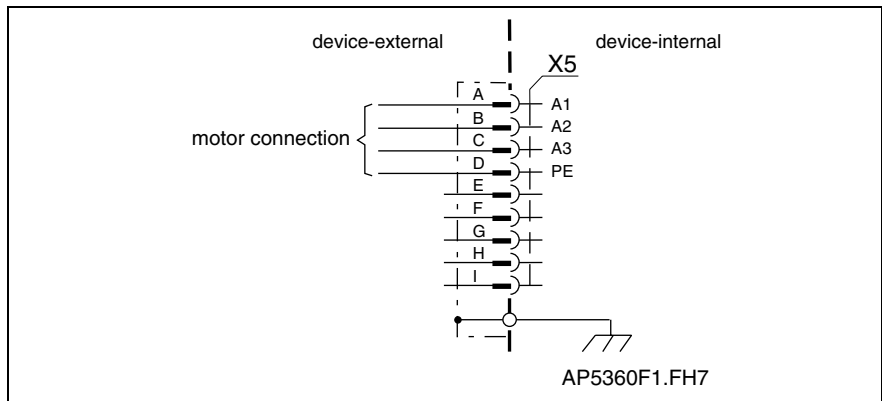


Fig. 4-71: Motor connections

Cable Motor

Use Rexroth Indramat motor power cables to connect motor and controller.

Note: For technical data on connections and cross sections, see the motor project planning manual.

Cable length:

Maximum length equals 25 m:

- standard cables from Rexroth Indramat and
- ambient temperatures of $\leq 45^\circ \text{C}$ per EN 60 204

Note: If third party cables are used, then the guarantee is forfeited for the entire system. Use Rexroth Indramat cables!

Motor temperature monitoring

Connections TM+ and TM- are used to evaluate the temperature of connected Rexroth Indramat motors. These are equipped with a temperature-dependent resistor (either PTC or NTC dependent on the motor type) to monitor temperature. The connection leads are in the motor power cable.

Connection monitoring TM+, TM-

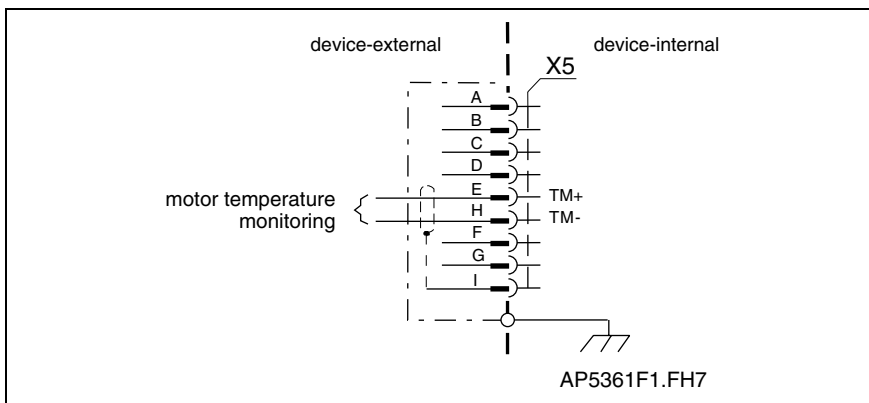
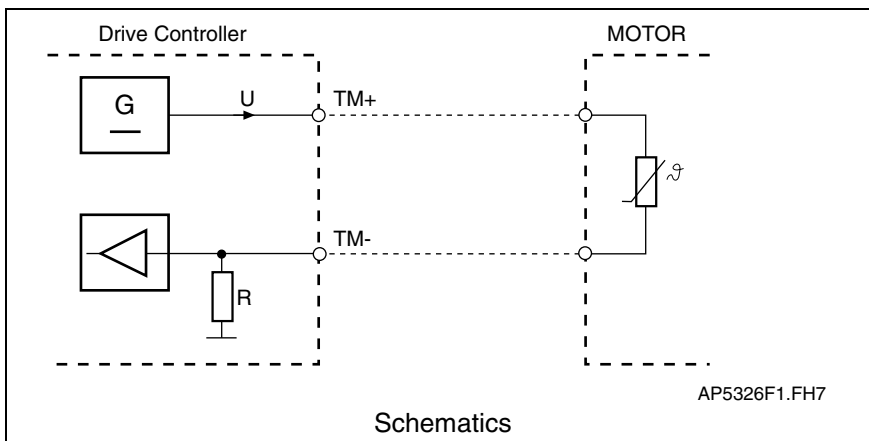


Fig. 4-72: Motor temperature monitoring

Motor temperature evaluation



U: approximately 5 V
R: approximately 2 k

Fig. 4-73: Motor temperature evaluation

Note: Connections TM+ and TM- are only to be used with Rexroth Indramat motors.

⇒ See also firmware functional description : "Temperature monitoring".

Holding brake (BR+, BR-)



Dangerous movements! Danger to personnel from falling or dropping axes!

- ⇒ The standard equipment motor brake or an external brake controlled directly by the servo drive are not sufficient to guarantee the safety of personnel!
- ⇒ Personnel safety must be acquired with higher-ranking procedures:
 Dangerous areas should be blocked off with fences or grids.
 Secure vertical axes against falling or slipping after switching off the motor power by, for example:
 - Mechanically securing the vertical axes
 - Adding an external brake / clamping mechanism
 - Balancing and thus compensating for the vertical axes mass and the gravitational force

These control the holding brakes in the connected motors.

For the switching performance, see function description.

Connection BR+, BR-

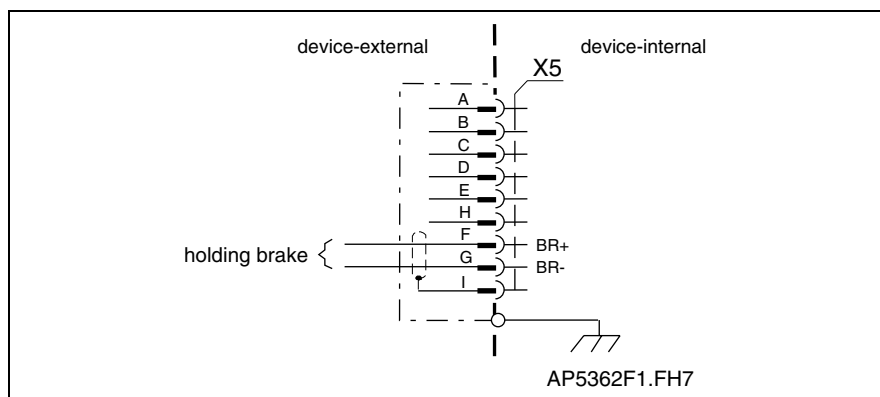


Fig. 4-74: Holding brake and voltage connection

Loadability of connections BR+, BR-:

Units	HDC01.1-A040N
max. switching voltage:	DC 40 V
max. switching current:	DC 4 A
max. continuous current:	DC 4 A
Minimum contact load:	100 mA
Guaranteed number of switches at max. time constant of load <50ms ($L_{\text{Bremsel}}/(24V/I_{\text{Bremsel}})$):	250.000
Short-circuit and overload protection in the row to the contact	present

Note: The motor holding brake is supplied by the drive controller. The supply voltage of the holding brake must be $24\text{ V} \pm 10\%$ on the motor side.

Motor holding brake**Controlling the motor holding brake**

The controller controls the holding brake.

**Technical data
Motor holding brake**

Supply voltage, current consumption, linking, separating time, holding torque, etc. see motor manual.

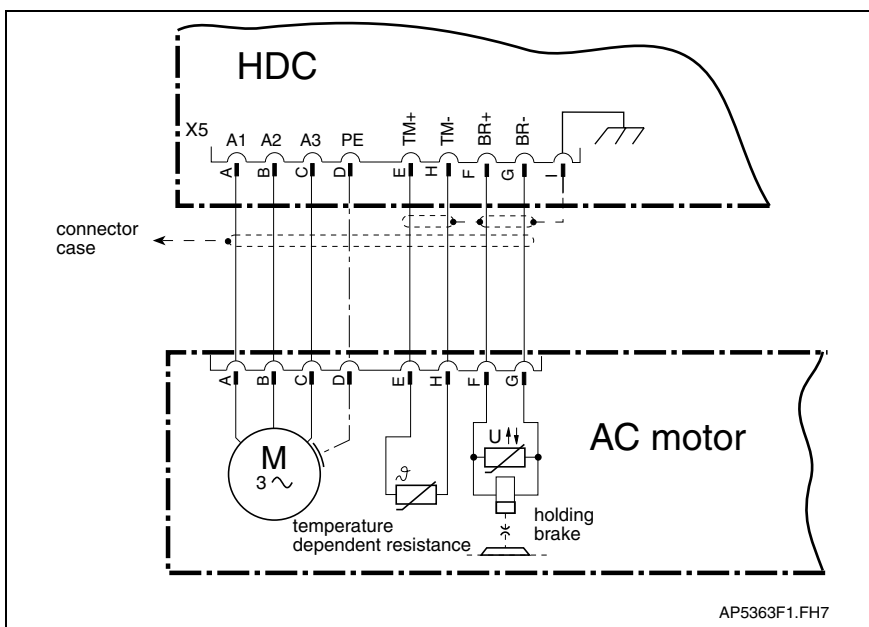
Basic connection of motor power, holding brake and motor temperature monitoring

Fig. 4-75: Connection of motor cable, holding brake and temperature monitor for motors with connectors

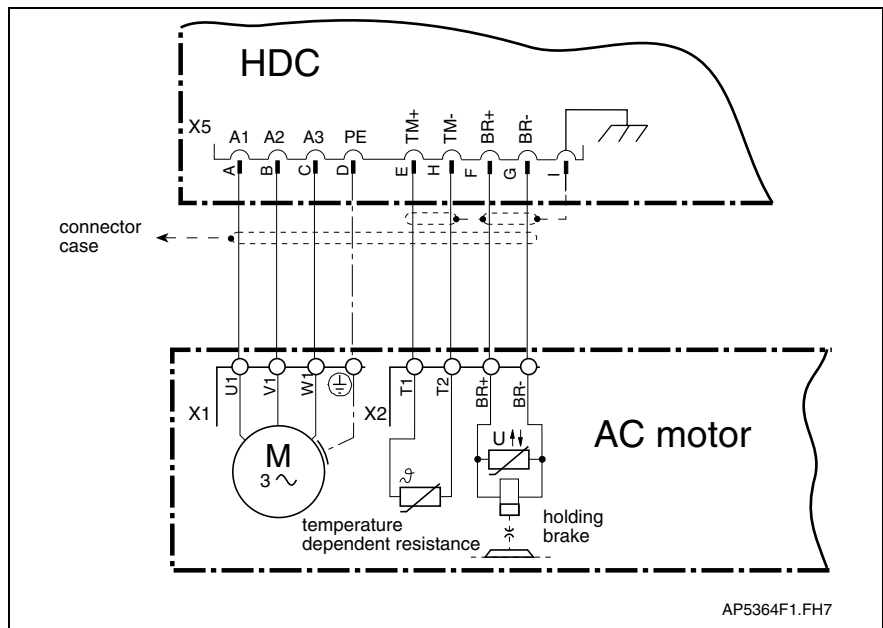


Fig. 4-76: Connection of motor cable, holding brake and temperature monitor for motors with connector box

Note: The cable designations and all details on making cables are outlined in the cable or motor document.

X7, Connection for programming module

Programming module

The programming module can be broken down into

- Parameter module for user-specific parameters
- Firmware modules for unit-specific firmware

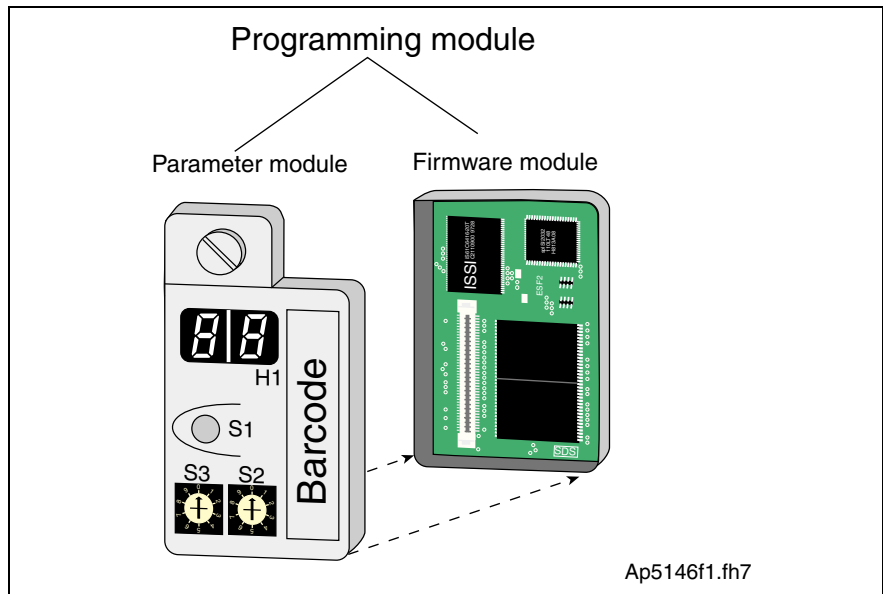


Fig. 4-77: X7, programming module

H1:	Diagnostic display
S1:	Reset key
S2,S3.	Address switch

Setting the drive address

Switch S2, S3 drive address

Two decade switches are used to set the drive address. It can be set to any number between 1 and 99.

Example:

Switch setting S3 = 9 (value of tens)

Switch setting S2 = 1 (value of ones)

Drive address = $9 * 10 + 1 = 91$

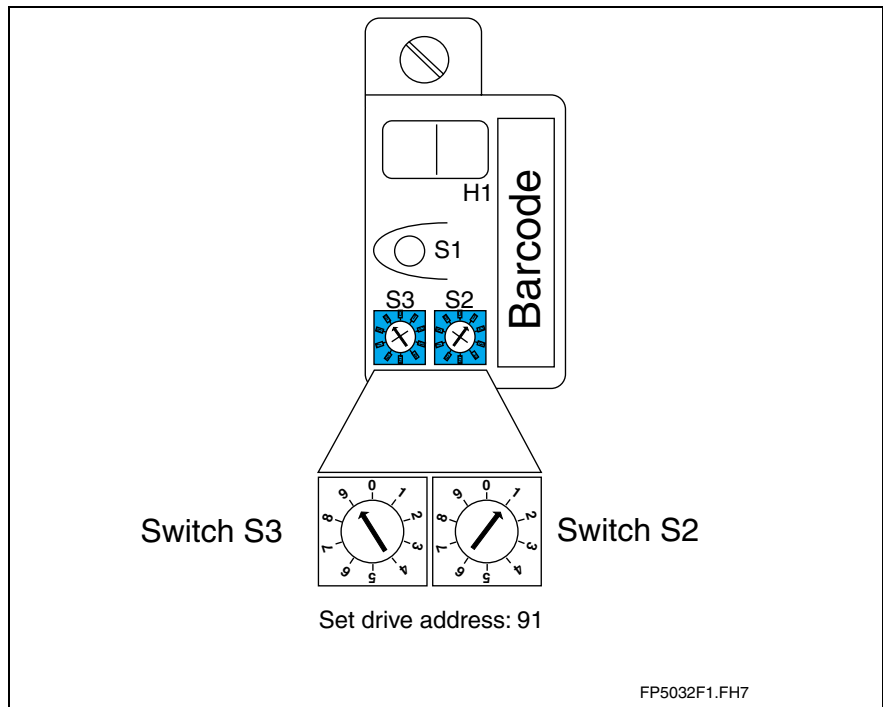


Fig. 4-78: Setting the drive address using a decade switch

Note: The unit is supplied with the address not being pre-set.
The setting of switches S2 and S3 depends on the type series, the firmware which is used or the desired drive address.

⇒ See firmware functional description.

X8, Encoder 2

Technical description of connector

Illustration

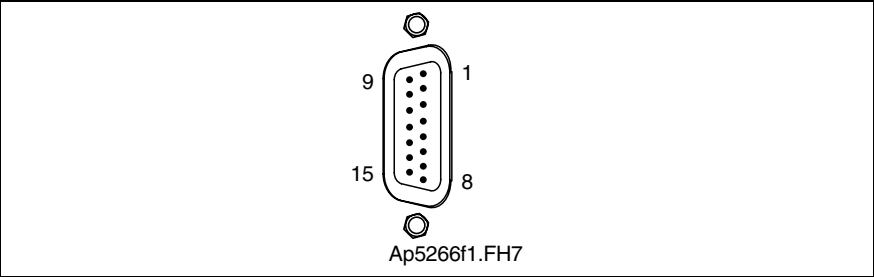


Fig. 4-79: Connector X5

Design

Type	No. of pins	Design
D-SUB	15	Pins on unit

Fig. 4-80: Design

Connection cross section

Cross section single wire [mm²]	Cross section multi core wire [mm²]	Cross section in AWG gauge no.:
--	0.25-0.5	--

Fig. 4-81: Connection cross section

Encoder 2

Connection Encoder 2

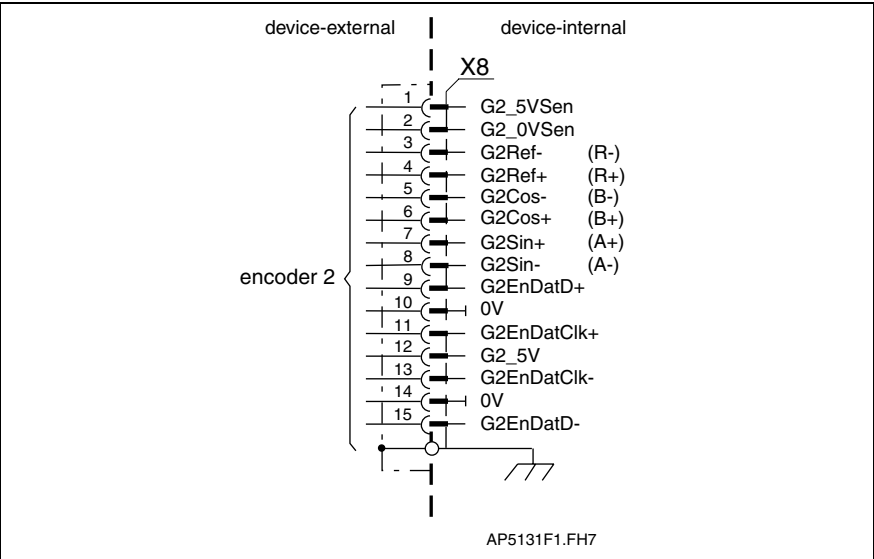
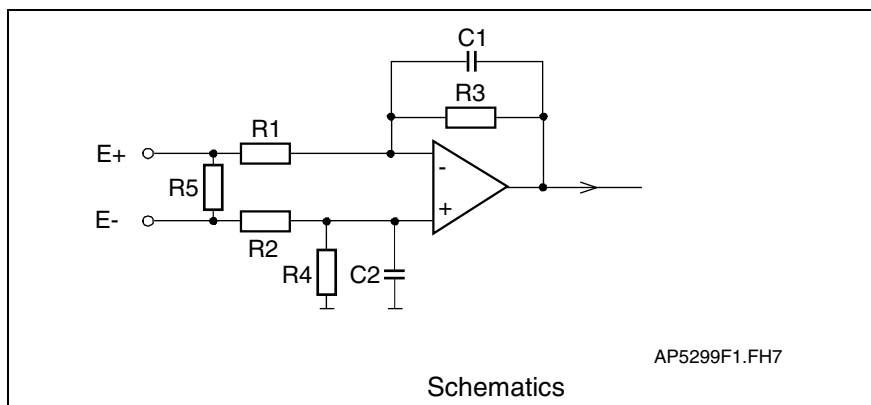


Fig. 4-82: Encoder 2

Shield connection Via D-subminiature mounting screws and metal connector housing.

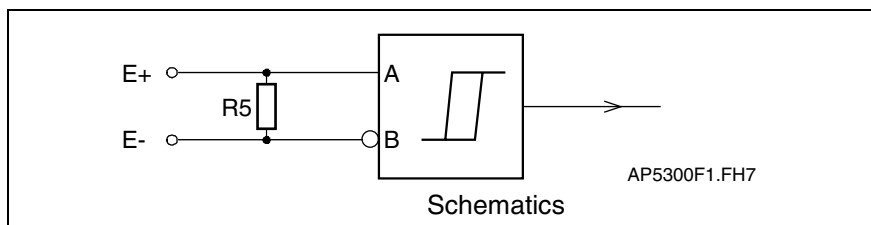
G2EnDat+, G2EnDat- Differential signal of the EnDat Data lead.

G2EnDatClk+, G2EnDatClk- Differential signal of the EnDat Pulse lead.

G2Sin+ (A+), G2Sin- (A-) Input circuit for sine signals G2Sin+ (A+), G2Sin- (A-):

R1: N/A.
 R2: N/A.
 R3: N/A.
 R4: N/A.
 R5: 120R
 C1: N/A.
 C2: N/A.

Fig. 4-83: Input circuit for sine signals

Input circuit for square-wave signals G2Sin+ (A+), G2Sin- (A-):

R5: 120R

Fig. 4-84: Input circuit for square-wave signals

Features of the differential input G2Sin+ (A+), G2Sin- (A-):**Sine encoder**

	Input voltage
max. allowed amplitude encoder signal ($U_{SS\text{encoder signal}}$)	(1,0 + 0,2) V _{SS}
Evaluation AD converter	12 Bit
Limit frequency	200 kHz
Input resistance	120 R
Resolution over a encoder cycle	See the following note

Fig. 4-85: Features of the differential input (Sine encoder)

Note: Resolution over a period under the assumption of the following conditions:

- Differential signal 1.0V_{SS}
- Reference voltage for the differential signal 2.7 V

$$\frac{\text{Position resolution}}{\text{Encoder cycle}} = \frac{2^{12}}{1,2V_{SS}} \cdot U_{SS\text{encodersignal}}$$

Example: If $U_{SS\text{encoder signal}} = 1 \text{ V}_{SS}$

$$\frac{\text{Position resolution}}{\text{Encoder cycle}} = \frac{2^{12}}{1,2V_{SS}} \cdot 1V_{SS} = 6826$$

=> see also firmware functional description "Optional encoder" (Encoder 2)

Square-wave encoder

	Input voltage	
Signal amplitude nominal: (referencing unit ground)	min.	max.
High	>2.4 V	5 V
Low	0 V	<0,8 V
Limit frequency	200 kHz	
Input resistance	120 R	

Fig. 4-86: Features of the differential input (Square-wave encoder)

G2Ref+ (R+), G2Ref- (R-) See "G2Sin+ (A+), G2Sin- (A-):"

G2Cos+ (B+), G2Cos- (B-) See "G2Sin+ (A+), G2Sin- (A-):"

G2_5VSen, G2_0VSen Returning encoder supply to amplifier so that encoder cable can be regulated and 5V are pending at the encoder independent of cable length.

G2_5V Features of the encoder output amplifier stage G2_5V:

Output voltage:	5 V _{DC}
max. output current:	300 mA

Fig. 4-87: Features of the encoder output amplifier stage

Signal allocation to the actual position value

Signal allocation (X8)	signal designation	signal form	actual position value (with default setting)
	G2Sin+(A+) G2Sin- (A-) G2Cos+(B+) G2Cos- (B-) G2Ref+(R+) G2Ref- (R-)	sine (1Vss) without absolute value (e.g. gearwheel encoder)	reducing
	G2Sin+(A+) G2Sin- (A-) G2Cos+(B+) G2Cos- (B-) G2Ref+(R+) G2Ref- (R-)	square (TTL) without absolute value	reducing
	G2Sin+(A+) G2Sin- (A-) G2Cos+(B+) G2Cos- (B-)	sine (1Vss) with absolute value (e.g. EnDat)	increasing

Fig. 4-88: Signal allocation to the actual position value

Allowed encoder cable lengths

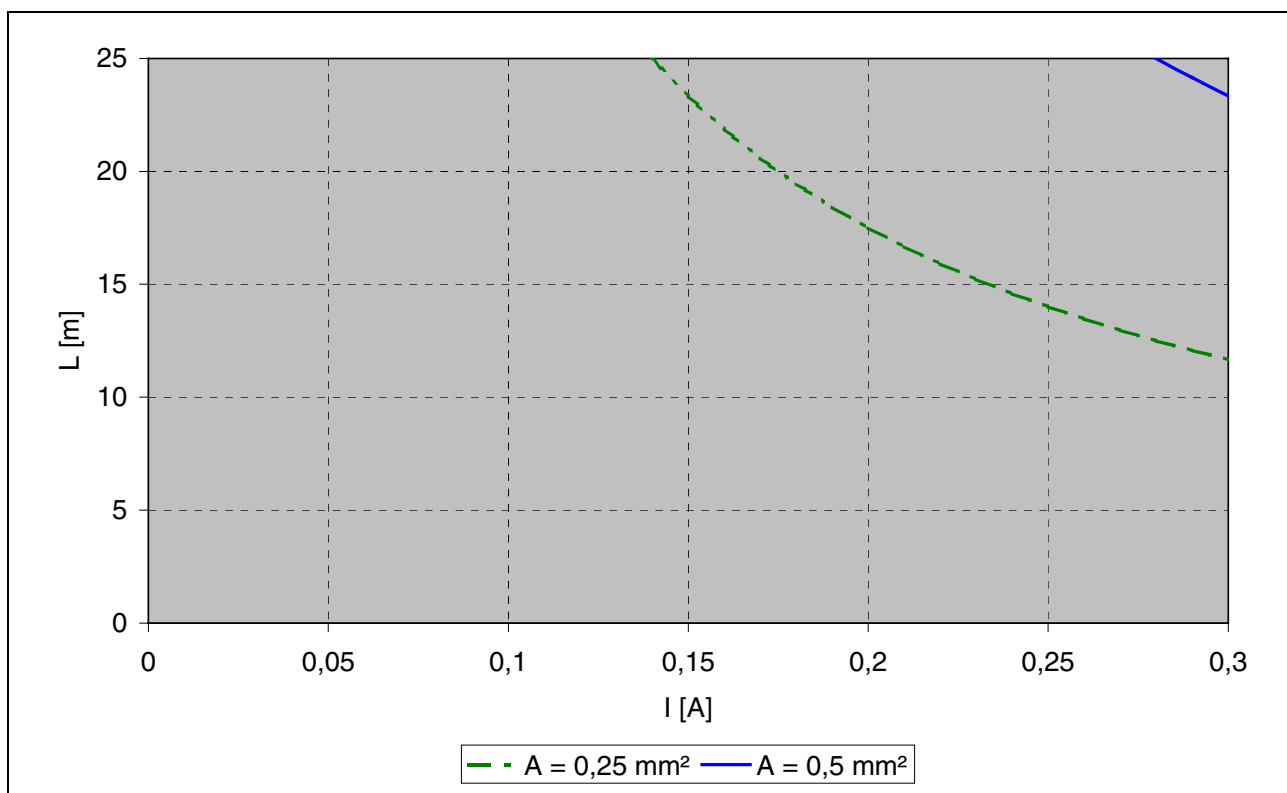
Selecting wire cross sections.

Note: The current consumption of the connected encoder systems generates a voltage drop due to the resistivity (dependent upon the wire cross sections and lengths) of the wire. This reduces the signal at the encoder input.

To compensate the voltage drop, the HDC can influence the encoder power source. Using a voltage sensor, the available voltage at the encoder is known.

⇒ For a given wire length and encoder current consumption, a minimum cross section becomes necessary. This relationship is illustrated below.

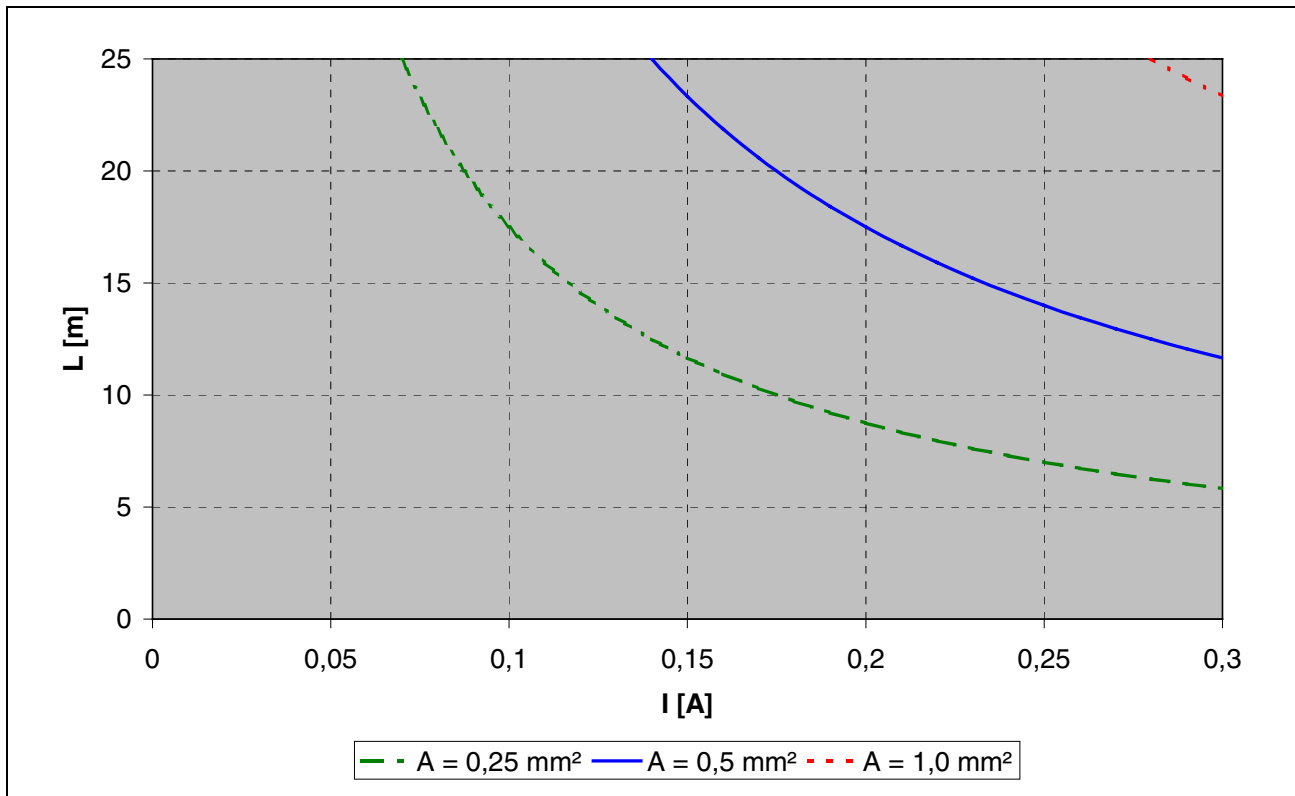
1. With sensor connection in the encoder lead



L: cable length
I: current
A: wire cross sections

Fig. 4-89: With sensor connection

2. Without sensor connection in the encoder lead



L: cable length
 I: current
 A: wire cross sections

Fig. 4-90: Without sensor connection

Measuring systems connections

See page 1-6: "An overview of measuring systems supported".

X10, EcoXexpansion interface

Note: EcoX allows:

- synchronization of drives and I/O modules
- connection of up to 2 modules with 16 digital inputs and outputs each per drive controller
- transmission of a command value from one drive controllers to a maximum of three other drive controllers.

Technical data of connector

Illustration

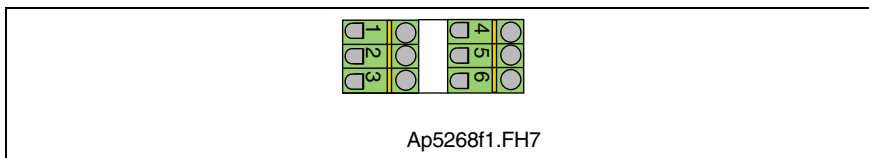


Fig. 4-91: Connector X10

Design

Type	No. of pins	Design
Spring contact	2 x 3	Bushing on connector

Fig. 4-92: Design

Connection cross section

Cross section single wire [mm ²]	Cross section multi core wire [mm ²]	Cross section in AWG gauge no.:
0.2-2.5	0.2-1.5	24-16

Fig. 4-93: Connection cross section

Note: Always use a shielded cable for connection. Connect the shield to XS1, XS2 or XS3.

Expansion interface

Connection of expansion interface

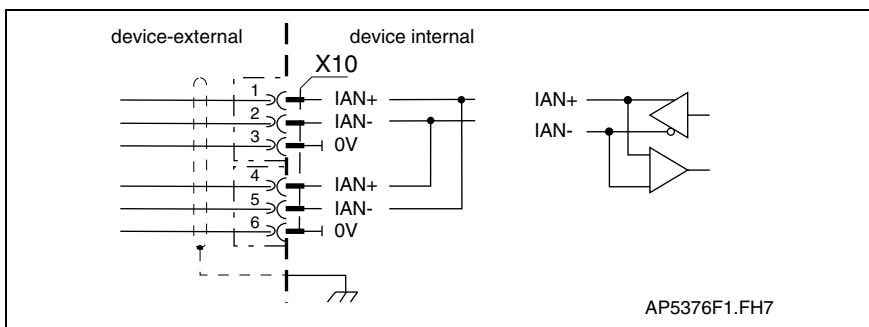


Fig. 4-94: Expansion interface

EcoX bus

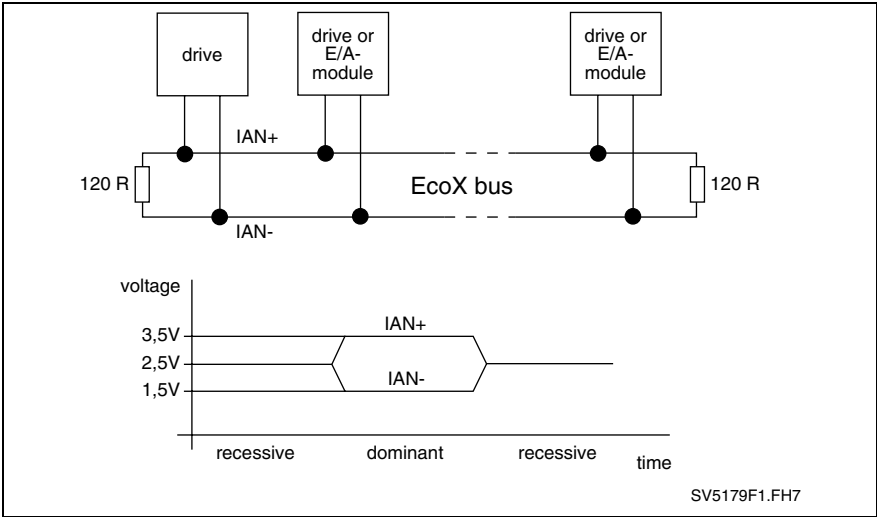


Fig. 4-95: EcoX interface

Bus cable	max. bus length l:	20 m
	Terminating resistor at both ends of the bus cable	2 x 120 R / 250 mW

X11, Ready to operate contact Bb, activation power ON

Technical description of connector

Illustration

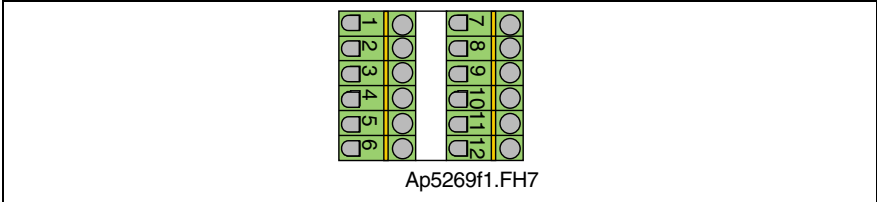


Fig. 4-96: Connector X11

Design

Type	No. of pins	Design
Spring contact	2 x 6	Bushing on connector

Fig. 4-97: Design

Connection cross section

Cross section single wire [mm²]	Cross section multi core wire [mm²]	Cross section in AWG Gauge no.:
0.2-2.5	0.2-1.5	24-16

Fig. 4-98: Connection cross section

Note: Always use a shielded cable for connection. Connect the shield to XS1, XS2 or XS3.

ZKS control supply

Note: Internal DC bus dynamic brake setup (ZKS) not included in 40 A units.

The fast discharge of the power DC bus when switching off the control voltage is only carried out automatically, if the internal 24 V power supply is used for controlling the ZKS.

Connection
+24Vpro and 0V

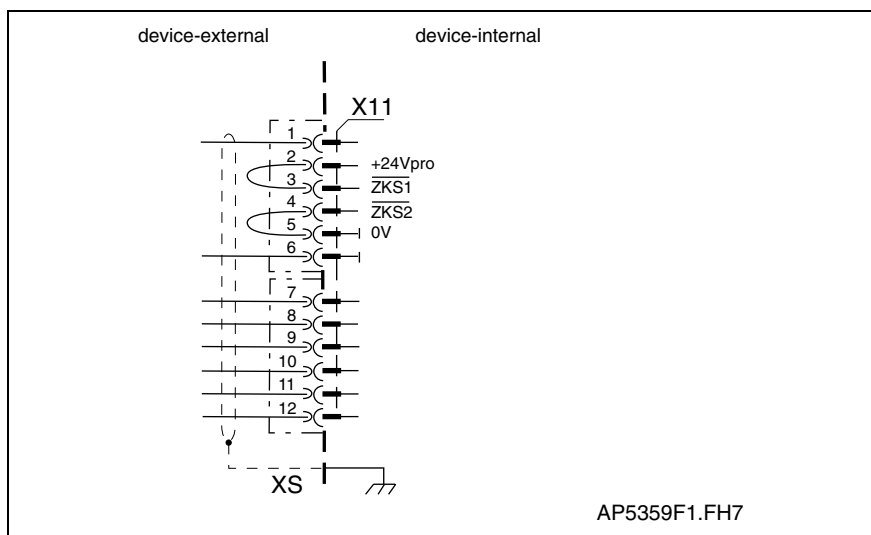
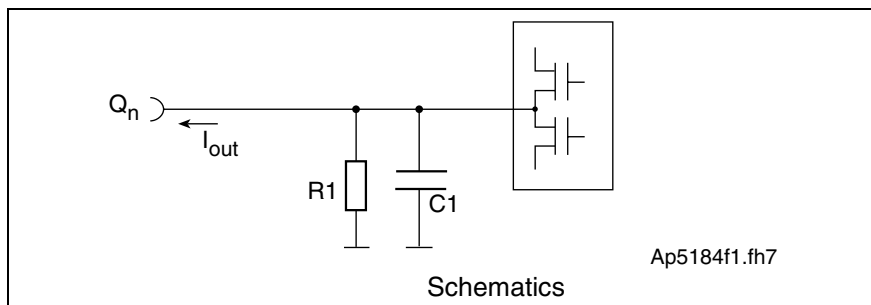


Fig. 4-99: DC bus dynamic brake control

At delivery: with bridges at:

X11.2 to X11.3
X11.4 to X11.5

Output
+24Vpro



R1: approximately 12 R

C1: 470 μ F

Fig. 4-100: Voltage source from X2.1

Loadability of the connection
+24Vpro

max. output voltage (dependent of control voltage an X1.1)	DC (19.2...28.8) – 2V
max. allowed output current:	DC 0.1 A
Thermal overload protection	via charging current limiter behind X1.1
max. short circuit current	2.4 A

Application
+24Vpro

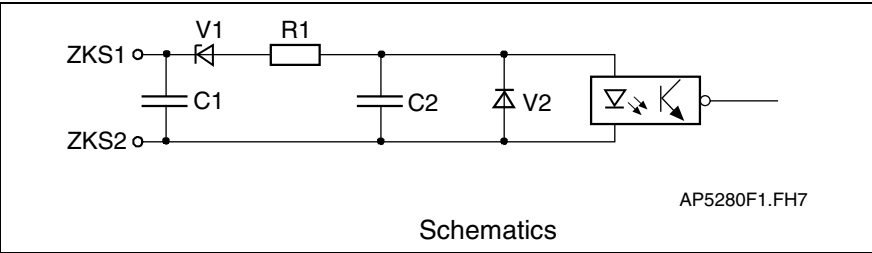
The connections supported the ZKS inputs.

ZKS control input

Connection
ZKS1 and ZKS2

See page 4-57: "ZKS control supply".

Input circuit
ZKS1 and ZKS2



R1: 2k2
V1: 10V
V2: 0.7V
C1: 0.1µF
C2: 0.1µF
Fig. 4-101: Input circuit

Inputs
ZKS1 and ZKS2

Input voltage:	min.	max.
High	15 V	28.8 V
Low	0 V	4 V
trigger delay t_d due to contactor drop delay	min. 40 ms	max. 80 ms
Input resistance	about 2 kOhm	
Potential isolation	to 50Veff	
Polarity protected within allowed input voltage range.		

Fig. 4-102: Inputs

Use
ZKS1 and ZKS2

The connections supply the ZKS input and permit potential free control of DC bus dynamic brake setup via a relay contact.

Trigger behavior of DC bus
setup

Mains voltage at X5	DC input	DC bus setup
not applied	no current	active
not applied	current	not active
applied	not current	not active
applied	current	not active

Fig. 4-103: Trigger behavior of ZKS setup

Protecting the ZKS setup with mains voltage applied

Note: If mains voltage applied at X5 then DC bus dynamic brake not executed!

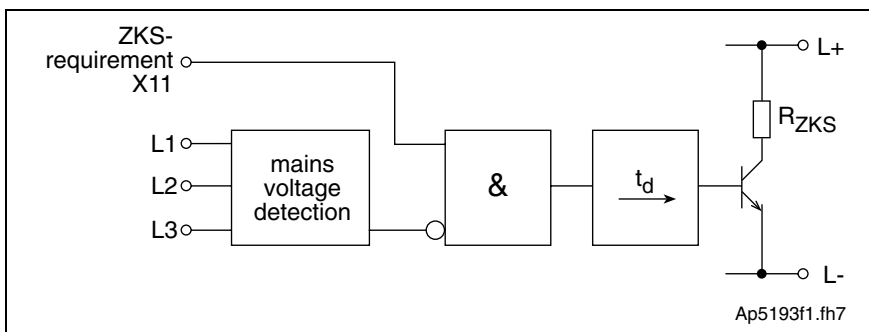


Fig. 4-104: Block diagram interlock ZKS/Mains

Ready to operate contact Bb

Connection Bb

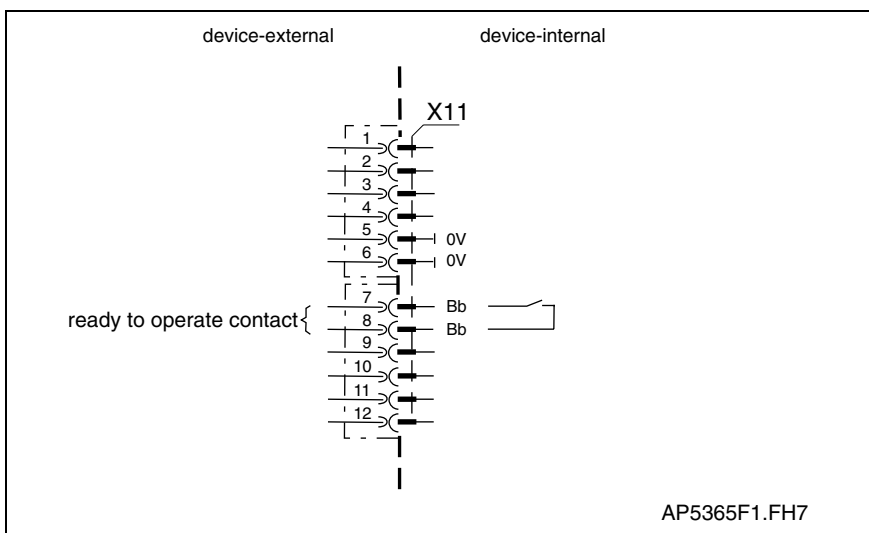


Fig. 4-105: Connections for ready to operate contact

Loadability of the connection Bb:

max. switching voltage:	DC 40 V
max. switching current:	DC 1 A
max. continuous current:	DC 1 A
minimum contact load:	10 mA
guaranteed number of switching operations at max. time constant of load <50ms:	250,000

Switching states

The Bb contacts opens:

Bb

- if control voltage for HDC is not applied
- if 24 volts not present at the emergency stop input when the E-stop function is activated (depends on parameterization, see function description).
- With an error in the drive (depends on parameterization, see firmware functional description: "Power off on error").

How to use the contact, see page 7-2: "Control circuits for the mains connection"

**WARNING****Damage possible if Bb contact not connected !**

The ready to operate contact Bb acknowledges the drive is ready for mains voltage.

⇒ Integrate Bb contact as per "Control Circuits for the Mains Connection".

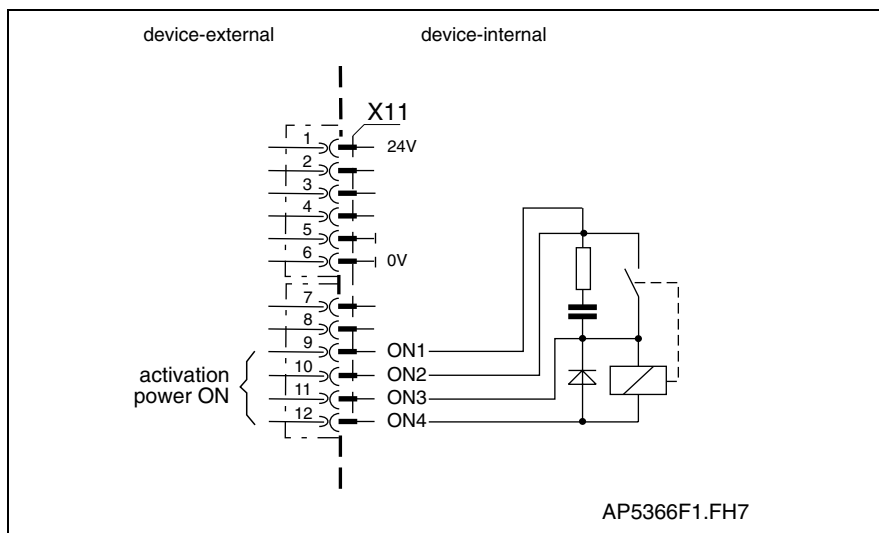
Activation power ON**Connection
Power ON
(schematics)**

Fig. 4-106: ON1, ON2, ON3, ON4

Technical data of the contactor

	40 A	100 A	200 A
Control voltage	DC 24 V $\pm$ 10 %		
Charging and holding power	3,3 W	5,4 W	13,3 W
Charging and holding current	138 mA	225 mA	555 mA

X13, Mains connection

Technical description of connector

Illustration

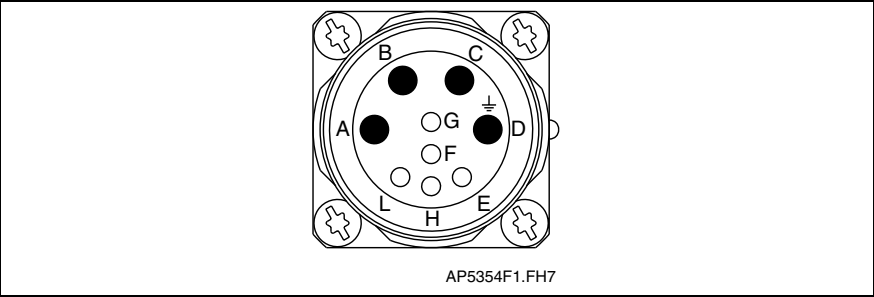


Fig. 4-107: Connector X13 (HDC01.1-A040N)

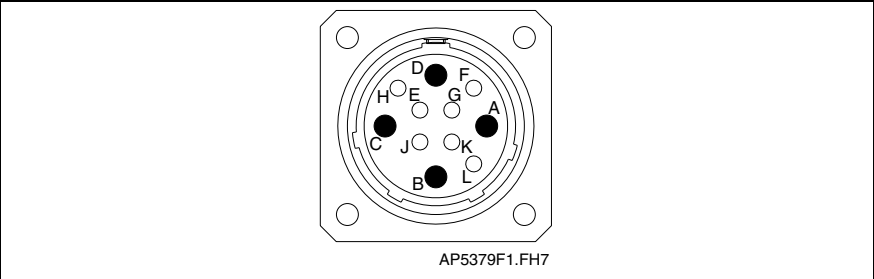


Fig. 4-108: Connector X13 (HDC01.1-A100/200N)

Design

Type	No. of pins	Design
Circular connector	4	Pins on unit

Fig. 4-109: Design

Mains connection

The mains connector serves as the connection of the drive controller with the power supply.

Connection
Mains

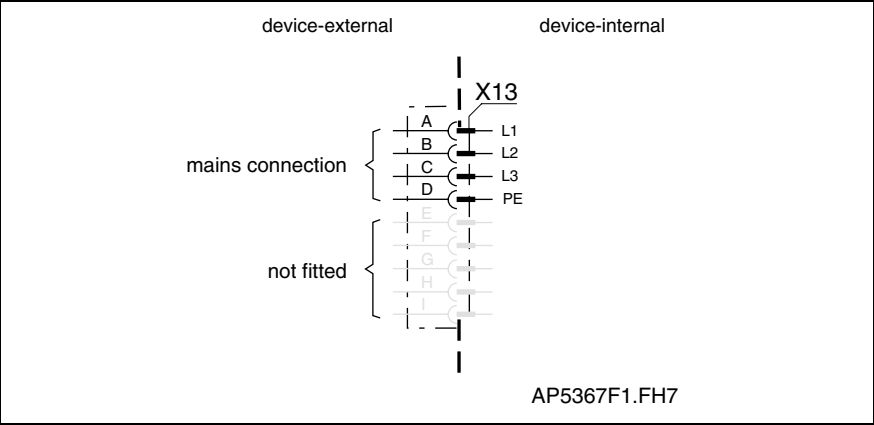


Fig. 4-110: Mains connection

See also page 7-1: "Mains Connections"

X14, Ventilator connection

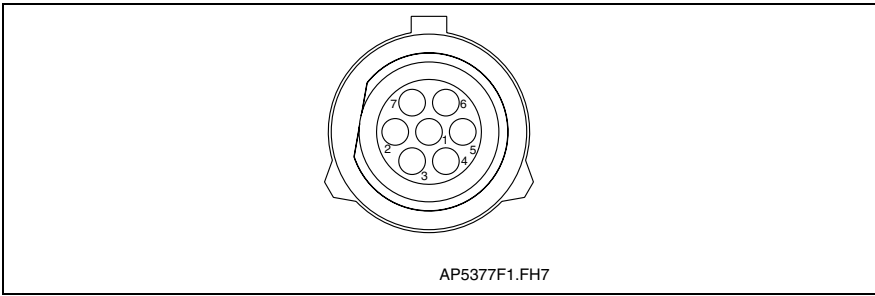


Fig. 4-111: Ventilator connection

Design

Type	No. of pins	Design
Circular connector	7	Pins on unit

Fig. 4-112: Design

XE1, Protective conductor connections for mains

Technical description of connector

Illustration See page 4-21: "A look at the drive controller and connector designations".

Design

Type	No. of pins	Design
screw-in connection	1	screw-in connection for ring terminals M5

Fig. 4-113: Design

Tightening torque

min. tightening torque [Nm]	max. tightening torque [Nm]
2.5	3.0

Fig. 4-114: Tightening torque

Connection cross section

Cross section single wire [mm ²]	Max. connectable cross section in mm ²	Max. cross section in AWG gauge no.:
--	25	--

Fig. 4-115: Connection cross section

XE1, protective conductor connection for mains



Personal danger caused by large leakage current!

⇒ The DURADrive drive controller is equipped with an integrated power line filter. In order to prevent danger, the connection cross section of the ground wire connector XE1, in principle, must be at least 10 mm² (EN 50178/1998, section 5.3.2.1).

XS1, XS2, XS3, XS4 shield connections

Technical description of connector

Illustration See page 4-21: "A look at the drive controller and connector designations".

Design

Type	No. of pins	Design
screw-in connector	1	screw-in connector for ring terminals M5

Fig. 4-116: Design

Tightening torque

min. in Nm	max. Nm
2,5	3,0

Fig. 4-117: Tightening torque

Connection cross section

Cross section single wire [mm ²]	Max. connectable cross section in mm ²	Max. cross section in AWG gauge no.:
--	25	--

Fig. 4-118: Connection cross section

XS1, XS2, XS3, XS4

Connection for shields of cables at X1, X3, X10, X11 and those for the command communication interfaces.

4.3 Electrical connections – dependent on the drive controller type

HDC01.1-***N-SE01-01-FW – SERCOS interface

View of command communication interface

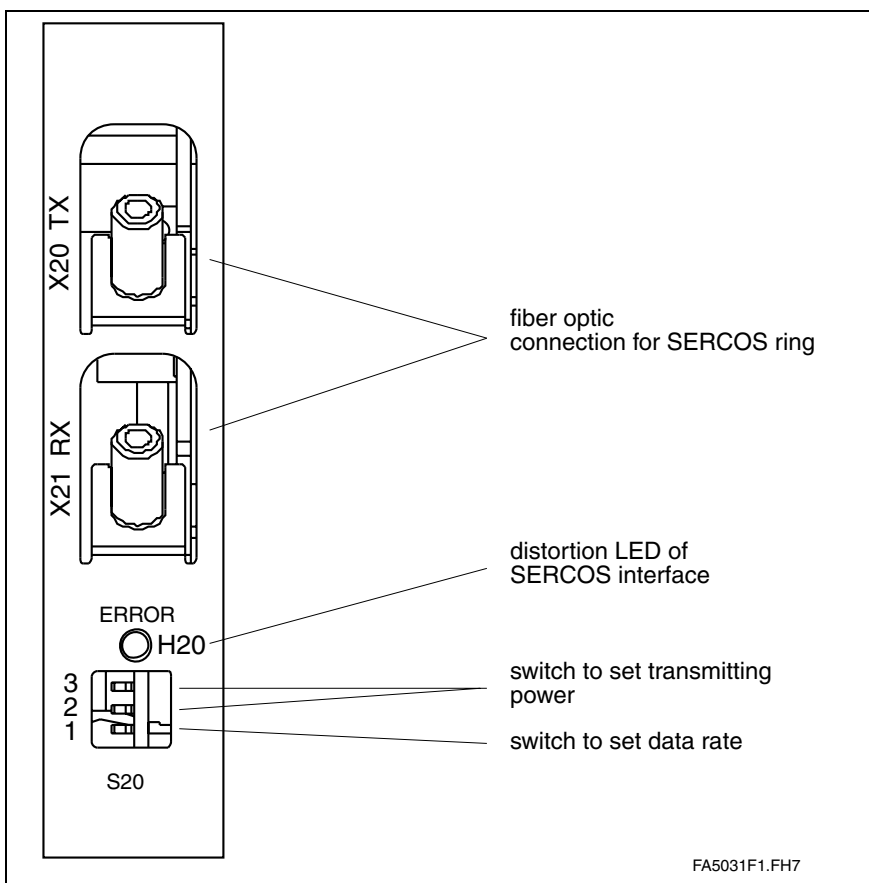


Fig. 4-119: View of command communication interface

Connection diagram for SERCOS interface

Connection
SERCOS interface

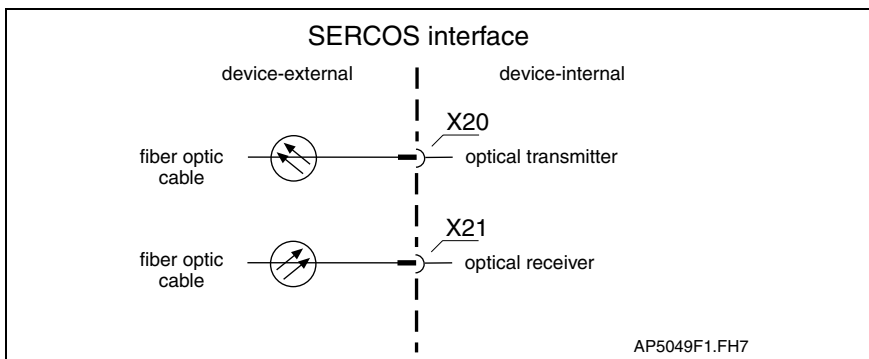


Fig. 4-120: I/O connection allocations

Switch S20

Data rate, transmitter power

The transmitter power and the data rate for the SERCOS interface are set with the switch S20.

The HDC is factory set to an average transmitter power (-4.5 dBm) and the lowest data rate (2 Mbit/s).

Position of switch

The switches are in OFF position if the switch lever is facing the rear (rear panel). Switch S20/1 is down (see marking on the unit).

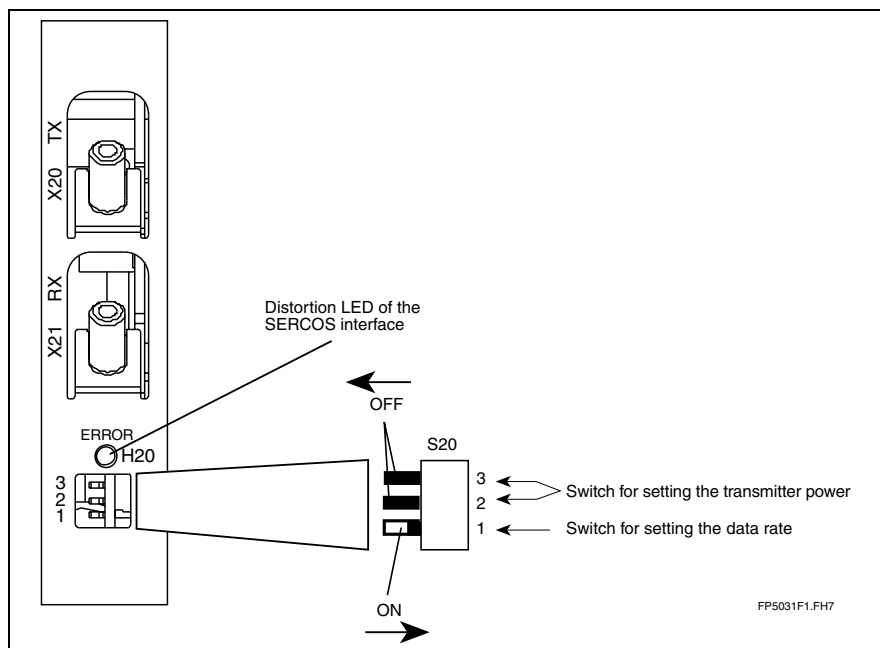


Fig. 4-121: Position of the switch for data rate and transmitter power demonstrating how to switch it ON and OFF

Data rate

The data rate is set with the switch S20/1.

Position of switch S20/1	Data rate in Mbit/s
OFF	2
ON	4

Fig. 4-122: Relationship between switch position S20/1 and the data rate

Transmitter power The transmitter power is set with the switches S20/2 and S20/3.
The following table demonstrates the relationship between switch position and transmitter power.

Switch position S20/2	Switch position S20/3	Transmission power at optimum high level in dBm	Transmission power at optimum high level in μ W	Maximum length with plastic fiber optic (*1)	Maximum length with glass fiber optic (*1)
OFF	OFF	-7	200	0..15 m	--
ON	OFF	-4,5	350	15..25 m	--
OFF	ON	-1	800	25..35m	--
ON	ON	0	1000	35..50m	0..500m

Fig. 4-123: Relationship between switch position S20/2, S20/3 and the data rate

(*1): The data for the maximum lengths of the fiber optic cable only apply if the following preconditions have been met:

- Rexroth Indramat fiber optic cables IKO 982, IKO985 or IKO 001 are used
- Connection without separation. If couplings are used, the maximum length for plastic fiber optic cables is reduced by about 10 meter, 100 meters for glass fiber optic cables.

Fiber optic cables

Drives with a SERCOS interface are connected to higher-level controls with a fiber optic cable.

The fiber optic cables (cables, connectors or complete leads) must be ordered separately.

For more information, see "Fiber optic cables" in application description "LWL - Handling" (DOK-CONNEC-CABLE*LWL-AWxx-EN-P).

"LWL- Handling" discusses:

- Fiber optics in general
- Basic plans for optical transmission systems
- Routing guidelines for fiber optic cables
- Attenuation readings of standard fiber optic cables
- Available fiber optic-FSMA plug-in connectors and fiber optic cables
- Guidelines on making an FSMA connector
- Tools for making fiber optic cables

Use the following illustration to find out which fiber optic cable to order.

Selecting fiber optic connections

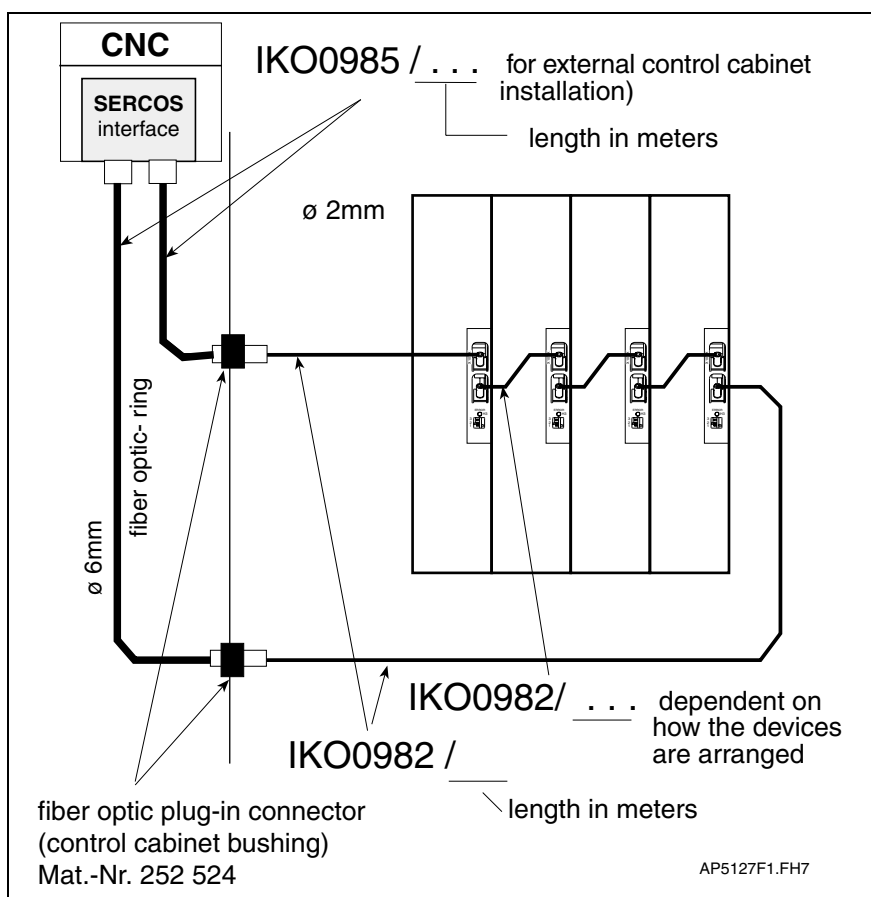


Fig. 4-124: Selecting standard fiber optic cables

HDC01.1-***N-PB01-01-FW – Profibus-DP Interface

View of command communication interface

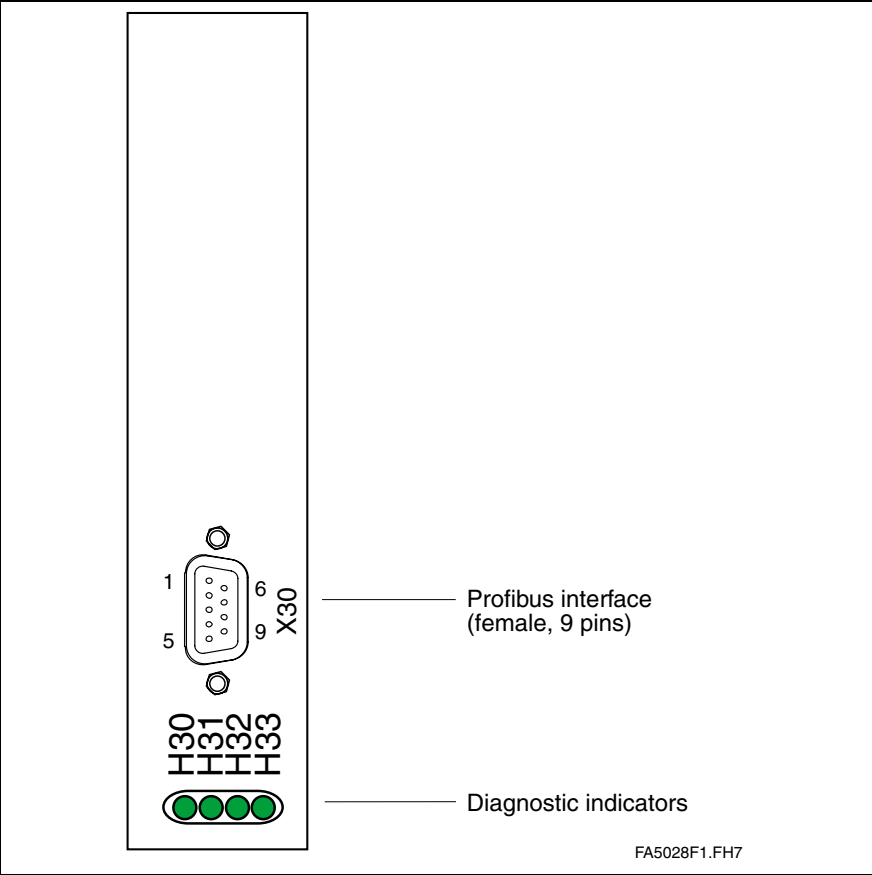


Fig. 4-125: View of command communication interface

Technical description of connector

Design	Type	No. of pins	Design
	D-SUB	9	Bushing on the unit

Fig. 4-126: Design

Connection cross sections	Cross sections single wire [mm²]	Cross sections multi core wire [mm²]	Cross sections in AWG gauge no.:
	--	0.08-0.5	--

Fig. 4-127: Connection cross sections

Connection diagram for Profibus-DP Interface

Connection
Profibus-DP interface

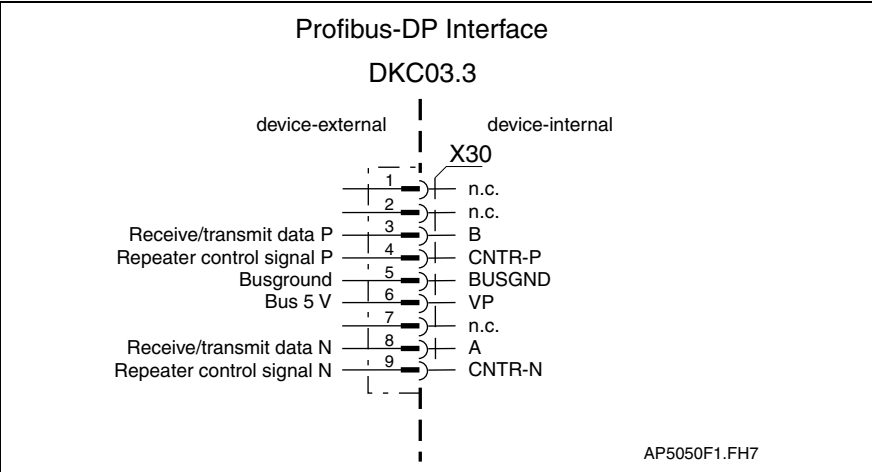


Fig. 4-128: Profibus-DP interface

Interface compatibility As per DIN EN 50 170

Recommended cable type as per DIN EN 50 170 – 2, cable type A

Plug-in connector assignment
X30

Pin	DIR	Signal	Function
1		--	n.c.
2		--	n.c.
3	I/O	RS485+	receive/transmit data plus
4	O	CNTR-P	Repeater control signal
5		0V	0 V
6	O	+5V	Repeater supply
7		--	n.c.
8	I/O	RS485-	receive/transmit data minus
9		0V	0V

Fig. 4-129: Signal assignment of connector X30

Shield connection Via D-subminiature screws and metal connector housing.

Signal specification

Signal	Specification
+5V Repeater supply	+5V ($\pm 10\%$) max. 75 mA
Repeater control signal	TTL compatible 1: transmit 0: receive Output resistance: 350 Ω $V_{OL} \leq 0.8$ V at $I_{OL} \leq 2$ mA $V_{OH} \geq 3.5$ V at $I_{OH} \leq 1$ mA
Receive/send data	EIA-RS-485 standard

Fig. 4-130: Signal specification

**CAUTION**
**Danger of destroying output
"+5V Repeater supply" with overload!**

- ⇒ do not short
⇒ do not exceed maximum current

**Diagnostic display
H30 – H33**

The definition of the displays are in the firmware functional description.

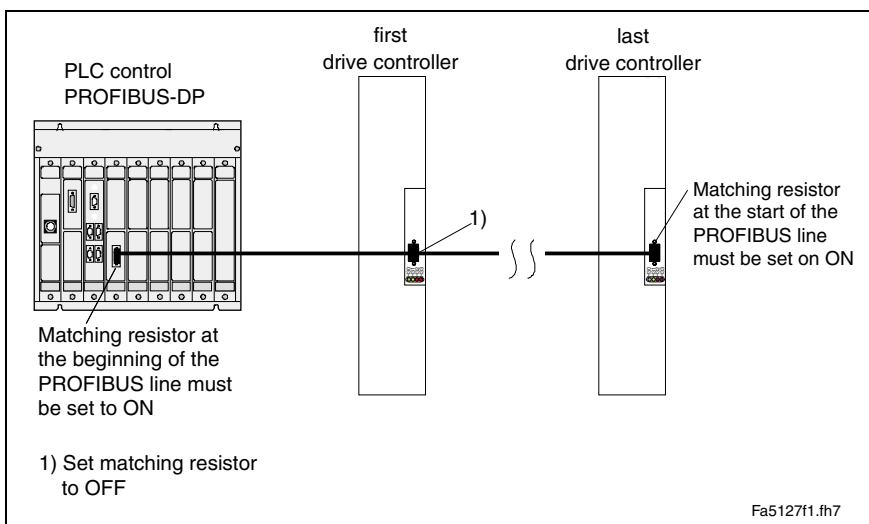
Bus Connector


Fig. 4-131: An example of connecting a drive controller to the PLC control via the PROFIBUS-DP

The PROFIBUS connectors each have a connectable terminating resistor. The terminating resistor must always be active at both the first and last bus stations. Do not interchange the A and B wires. Perform the connection as shown in the figures below.

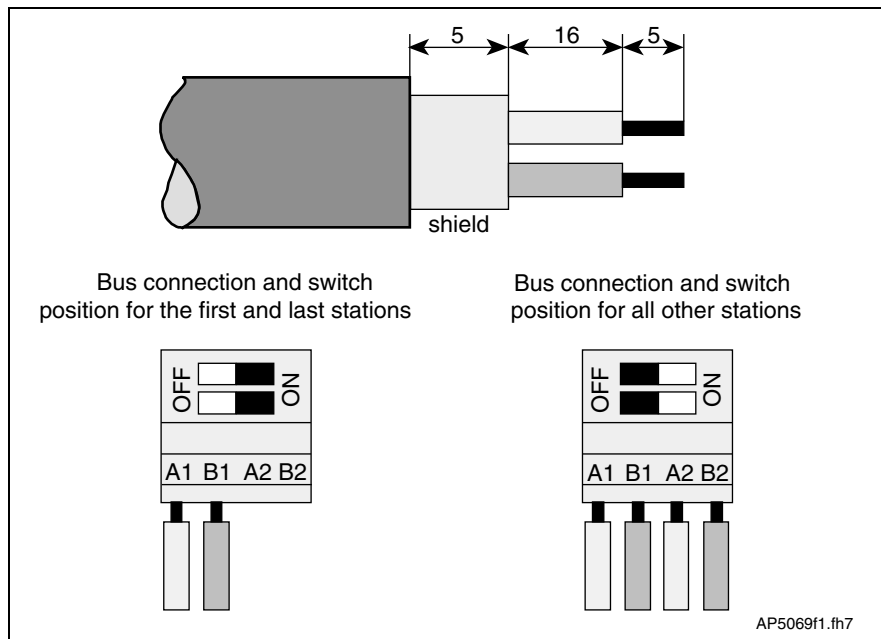


Fig. 4-132: Preparing a cable for connecting a bus connector

To prepare a bus cable, proceed as follows:

- Use cable DIN EN50170 / 2 edition 1996
- Strip cable (see previous illustration)
- Insert both cores into screw terminal block

Note: Do not switch A and B.

- Press cable sheath between both clamps
- Screw both strands into screw terminals

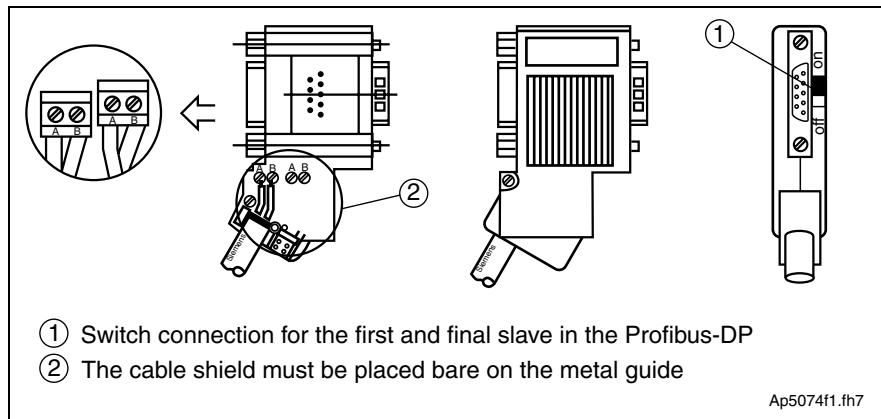


Fig. 4-133: Bus links for the first and last slave, bus connector with 9-pin D-SUB socket, INS 0541

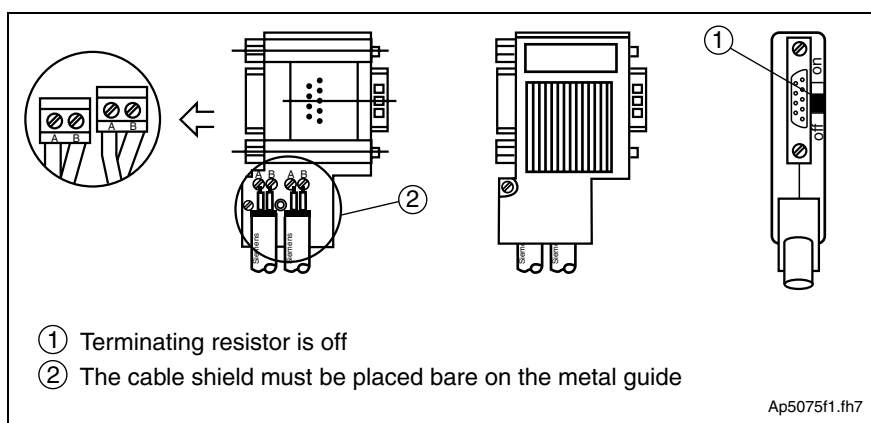


Fig. 4-134: Bus link for all other slaves, bus connector with 9-pin D-SUB socket, INS 0541

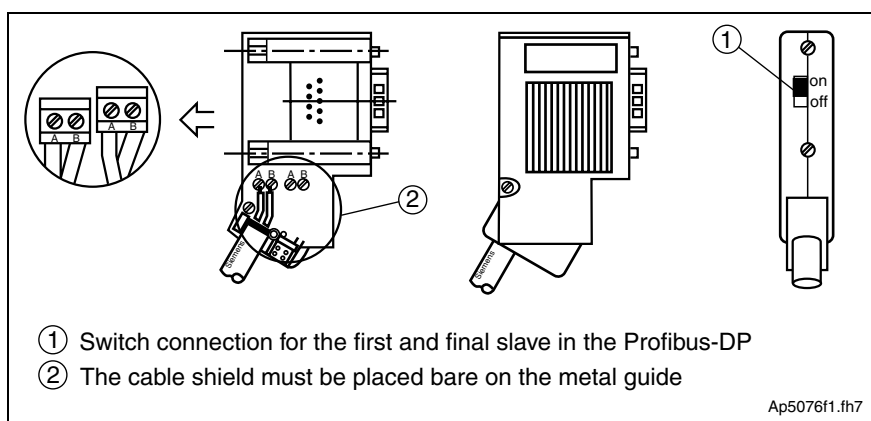


Fig. 4-135: Bus link for the first and last slave without 9-pin D-SUB socket, INS 0540

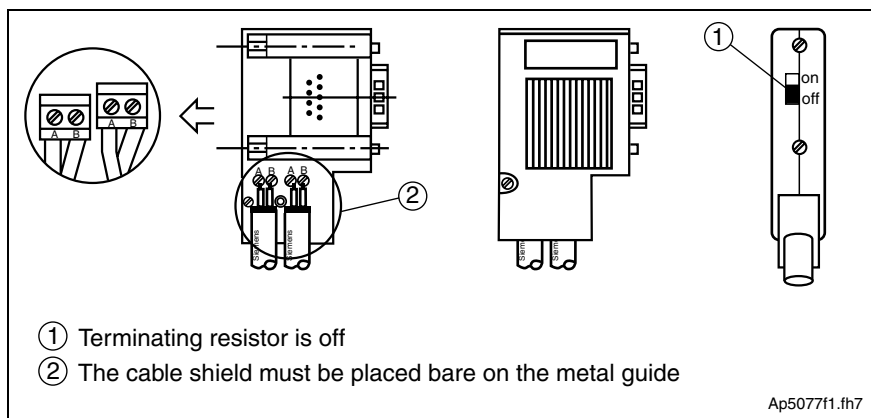


Fig. 4-136: Bus link for all other slaves without 9-pin D-SUB socket, INS 0540

Connect the drive controller to a control unit using a shielded two-wire conductor in accordance with DIN 19245/ section 1.

HDC01.1-***N-IB01-01-FW – InterBus Interface

View of command communication interface

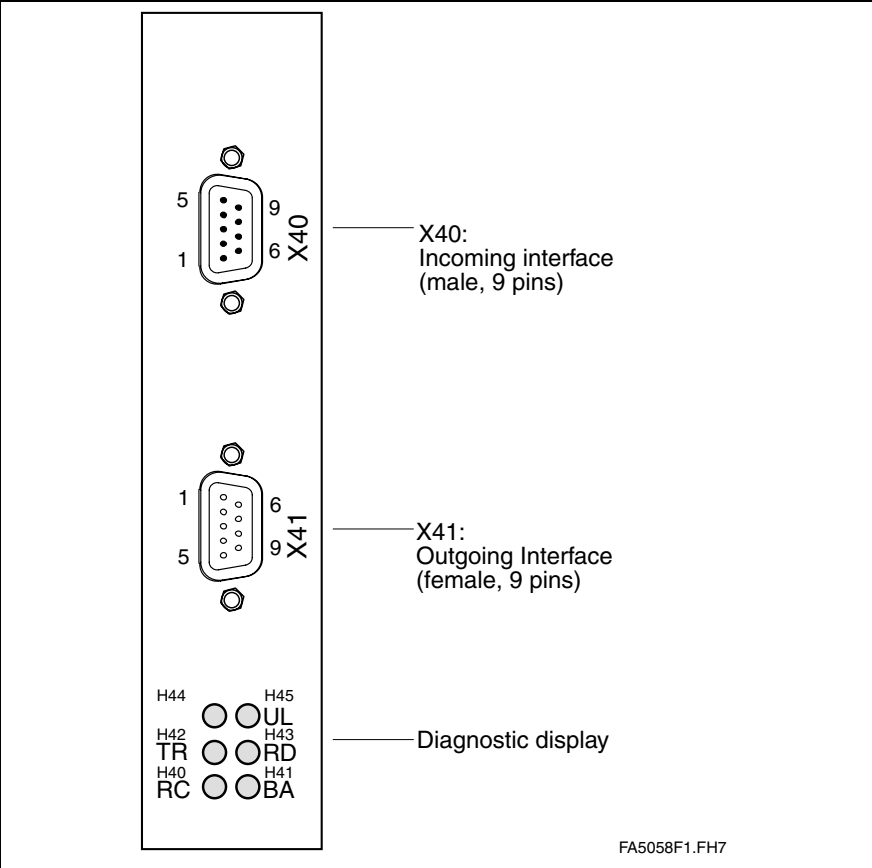


Fig. 4-137: View of command communication interface

Technical description of connector

Design	Type	No. of pins	Design
X40	D-SUB	9	Bushing on the unit
X41	D-SUB	9	pins on the unit

Fig. 4-138: Design

Connection cross section	Cross sections single wire [mm²]	Cross sections multi core wire [mm²]	Cross sections in AWG gauge no.:
	--	0.08-0.5	--

Fig. 4-139: Connection cross sections

Connection diagram for InterBus Interface

Connection InterBus Interface

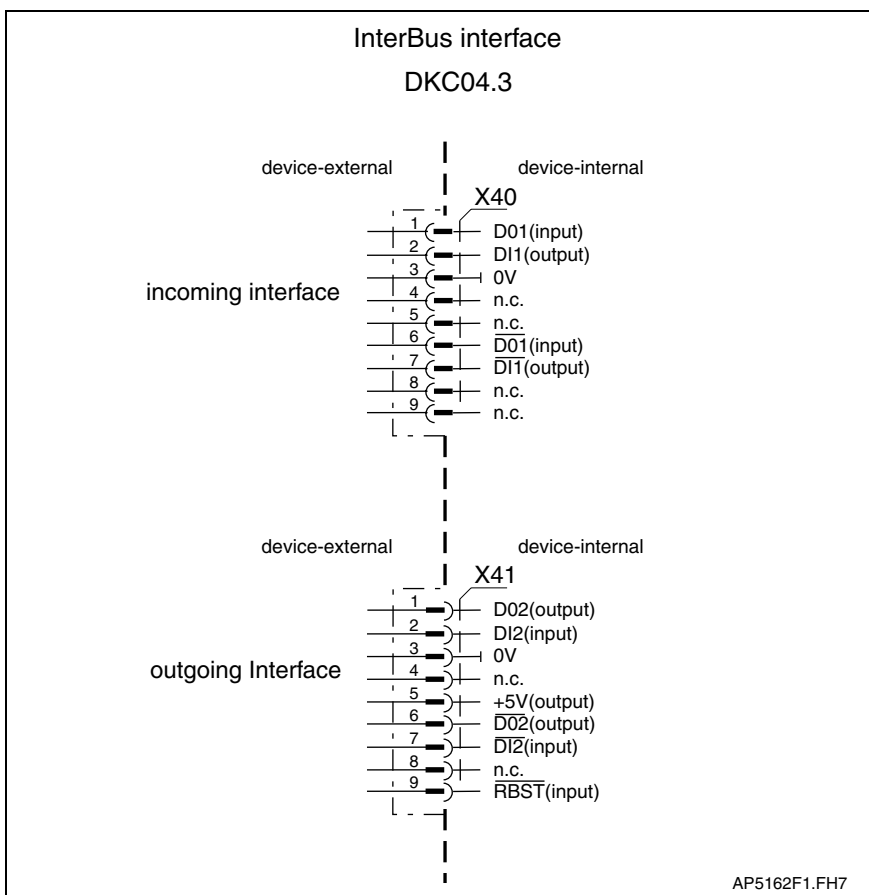


Fig. 4-140: InterBus Interface

Interface compatibility as per DIN EN 50 254 - 1

Signal specification as per DIN EN 50 254 - 1

Lead length as per DIN EN 50 254 - 1

Recommended cable as per DIN EN 50 254 – 2

Plug-in connector assignment X40 Incoming interface

Pin	DIR	definition
1	I	DO1
2	O	DI1
3	O	0V
4	--	n.c.
5	--	n.c.
6	I	/DO1
7	O	/DI1
8	--	n.c.
9	--	n.c.

Fig. 4-141: Allocation of interface signals X40, Incoming interface

**Plug-in connector assignment
X41
outgoing interface**

Pin	DIR	definition
1	O	DO2
2	I	DI2
3	O	0V
4	--	n.c.
5	O	+ 5V
6	O	/DO2
7	I	/DI2
8	--	n.c.
9	I	/RBST

Fig. 4-142: Allocation of interface signals X41, outgoing interface

Shield connection	Via D-subminiature mounting screws and metal connector housing.
Signal specification	as per DIN EN 50 254 - 1 Incoming and outgoing interfaces must be isolated from each other and galvanically from the controller.
Diagnostics display H40 – H45	The definition of the displays are in the firmware function description.

HDC01.1-***N-CN01-01-FW – CANopen Interface

View of command communication interface

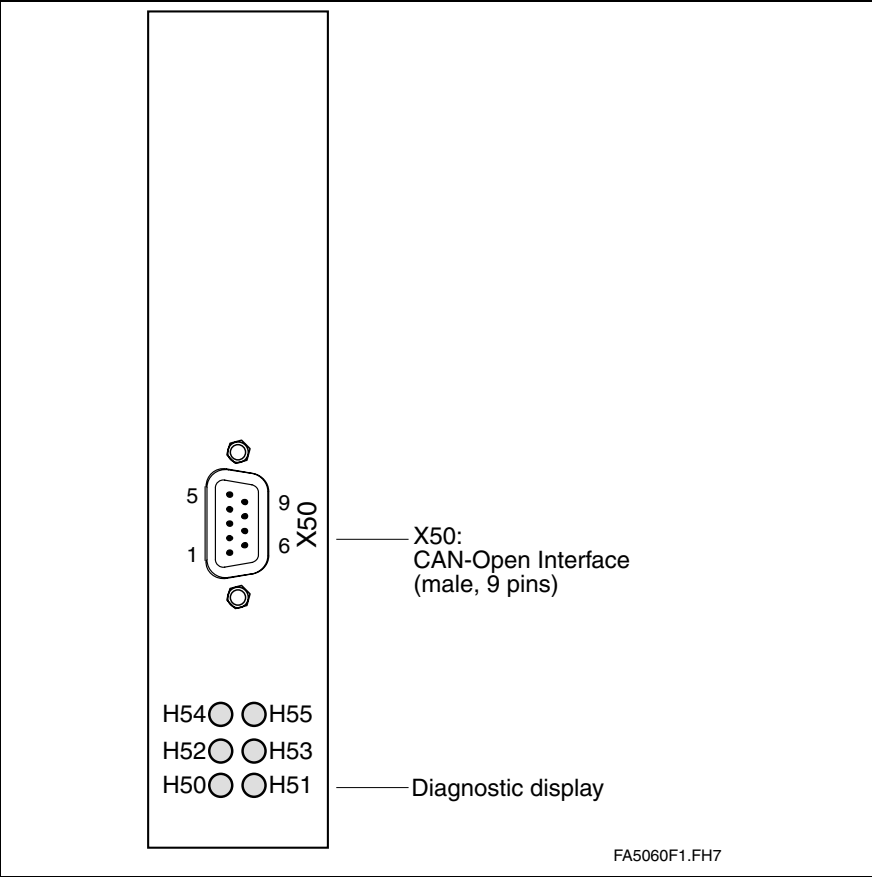


Fig. 4-143: View of command communication interface

Technical description of connector

Design	Type	No. of pins	Design
	D-SUB	9	pins on the unit

Fig. 4-144: Design

Connection cross sections	Cross sections single wire [mm²]	Cross sections multi core wire [mm²]	Cross sections in AWG gauge no.:
	--	0.08-0.5	--

Fig. 4-145: Connection cross sections

Connection diagram for CANopen Interface

Connection
CANopen interface

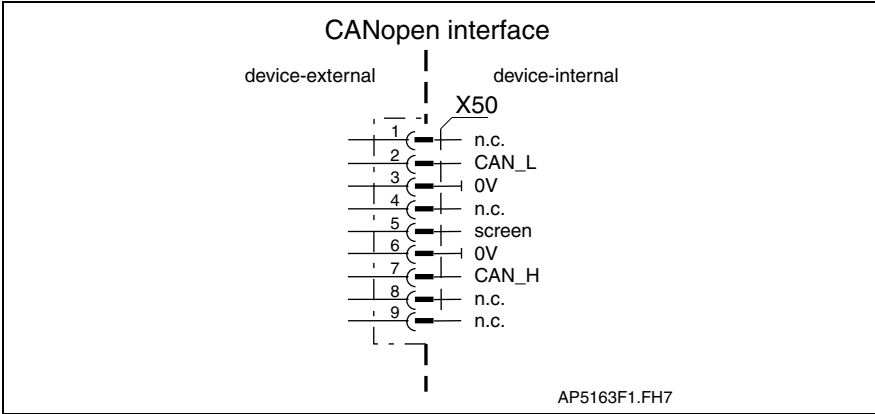


Fig. 4-146: CANopen interface

Interface compatibility as per ISO 11 898

Recommended cable as per ISO 11 898

Plug-in connector assignment
X50

Pin	Definition	
1	n.c.	n.c.
2	CAN_L	Differential signal
3	0V	Gnd
4	n.c.	n.c.
5	shield	Shield connection
6	0V	0V
7	CAN_H	Differential signal
8	n.c.	n.c.
9	n.c.	n.c.

Fig. 4-147: Interface signal allocation

Shield connection Via D-subminiature mounting screws and metal connector housing.

Diagnostic display
H50 – H55 The definition of the diagnostic displays are in the firmware function description.

HDC01.1-***N-DN01-01-FW – DeviceNet Interface

View of command communication interface

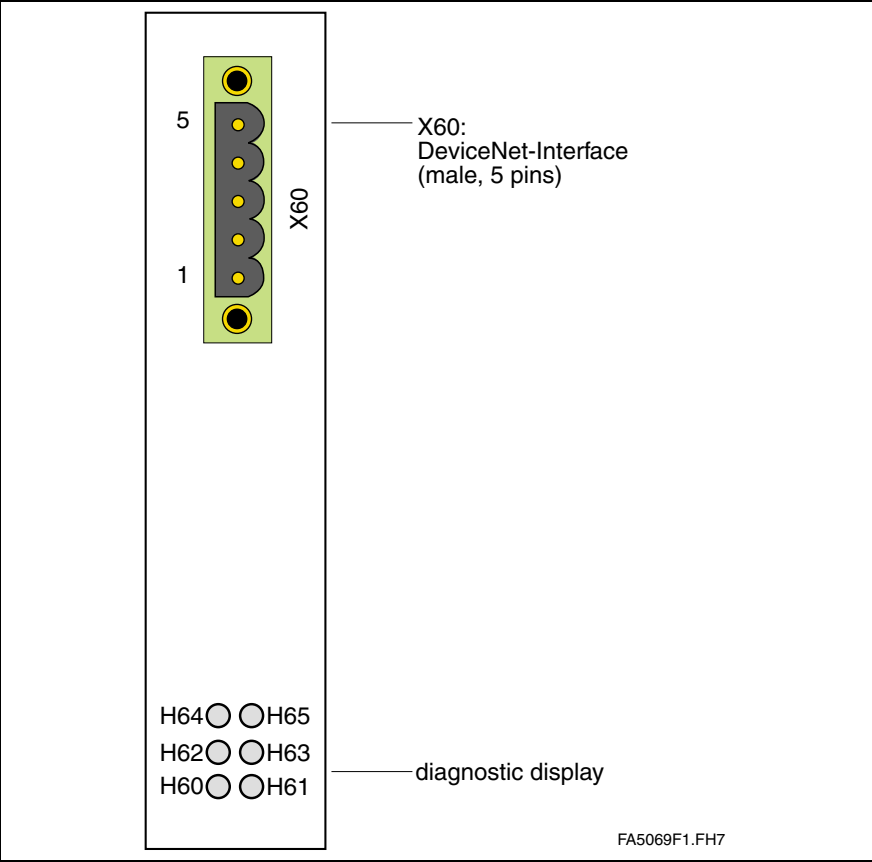


Fig. 4-148: View of command communication interface

Technical description of connector

Design	Type	No. of pins	Design
	COMBICON	5	Bushing on the connector

Fig. 4-149: Design

Connection cross sections	Cross sections single wire [mm²]	Cross sections multi core wire [mm²]	Cross sections in AWG gauge No.:
	0.2-2.5	0.2-1.5	24-16

Fig. 4-150: Connection cross sections

Note: Always use a shielded cable for connection. Connect the shield to XS4.

Connection diagram for DeviceNet-Interface

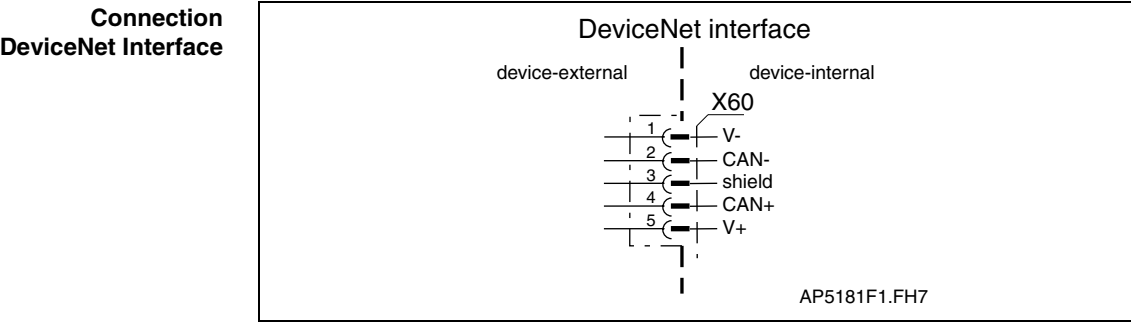


Fig. 4-151: DeviceNet Interface

Interface compatibility as per DeviceNet Specification 2.0 Vol. 1
Open Screw Connector

Recommended cable as per DeviceNet Specification 2.0 Vol. 1, Appendix B

Bus participant connections as per DeviceNet specification 2.0 Vol. 1, Appendix B
end resistance: 121 Ohm, 1%, ¼ W

Baudrate and cable length as per DeviceNet specification 2.0 Vol. 1,

Plug-in connector assignment X60	Pin	Definition	
	1	V-	0V
	2	CAN-	Differential signal
	3	shield	Shield connection
	4	CAN+	Differential signal
	5	V+	Interface supply

Fig. 4-152: Interface signal allocation

Maximum bus voltage +30 V

Current feed at bus	Bus voltage	Current feed
	11V	70 mA
	18	45 mA
	24	35 mA
	32V	28 mA

Fig. 4-153: Current feed via bus connector

Diagnostic display H60 – H65 The definition of the diagnostic displays is in the firmware function description.

HDC01.1-***N-SE02-01-FW – SERCOS interface 2

View of command communication interface

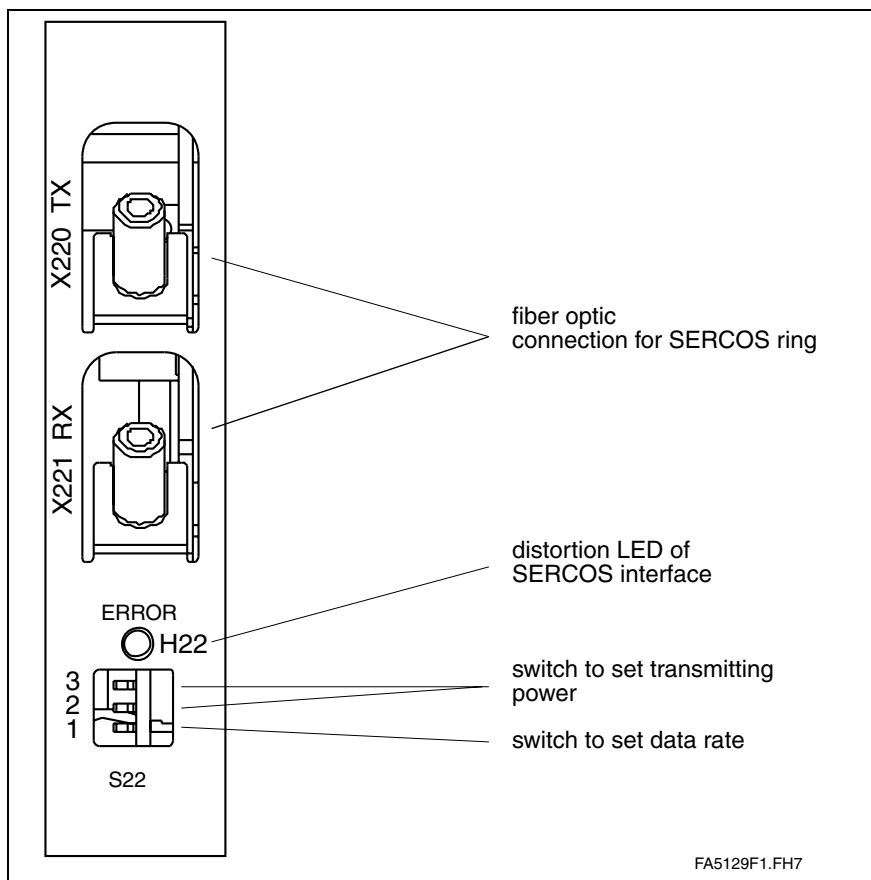


Fig. 4-154: View of command communication interface

Connection diagram for SERCOS interface 2

Connection SERCOS Interface 2

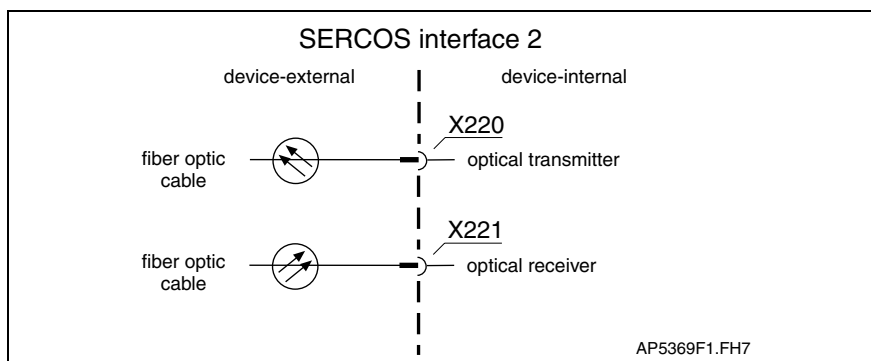


Fig. 4-155: I/O connection allocations

Switch S22

See page 4-67: "Switch S20".

Fiber optic cables

See page 4-68: "Fiber optic cables".

Notes

5 DC24V NTM power supplies

5.1 Application recommendations

If there is no external DC24V control voltage available, then Rexroth Indramat recommends the use of NTM power supply units.

- Features**
- The power supplies contain an overvoltage safety switch with automatic shutdown. After the automatic shutdown device has responded, operation can be resumed by switching the power supply off, briefly, and on again.
 - The power supplies always function with a starting current limiter. However, if you switch off and on again within a period of 10 s, the starting current limit do not work!
 - The NTM01.1-024-004 and NTM01.1-024-006 power supplies make it possible to measure the voltage applied to the load via cable sensor. If there is a voltage drop, the power supply will increase the output voltage accordingly.
 - Installation in enclosed control cabinet required.

Fuse protector Q2 Rexroth Indramat recommends a 10A automatic circuit breaker with tripping characteristics C for DC24V NTM power supplies.

Line filter

Note: Mains filters are available to comply with EMC-limits. For a selection of information see project planning manual "Electromagnetic Compatibility (EMC) in Drive and Control Systems", doc.-type DOK-GENERL-EMV*****-PRxx.

5.2 Technical data

Designation	Symbol	Unit	NTM01.1-24-002	NTM01.1-24-004	NTM01.1-24-006
Rate current of the 24V output for 45°C ambient temperature	I _N	A	2.1	3.8	5.5
Output power for 45°C ambient temperature	P _{OUT}	VA	50	100	150
input current at 230 (115) V	I _{IN}	A	0.61 (1.2)	1.2 (2.2)	1.9 (3.2)
inrush current for 230 (115) V at the power input line when the NTM is switched on. Size the back-up fusing accordingly	I _{EIN}	A	32 (16)	32 (16)	32 (16)
Input voltage	U _N	V	Standard AC 170...265 by changing the bridge circuit setting AC 85...132		
Degree of protection	installation in enclosed control cabinet required				

Fig. 5-1: Technical data for DC24V NTM power supply units

5.3 Dimensional sheets and installation dimensions

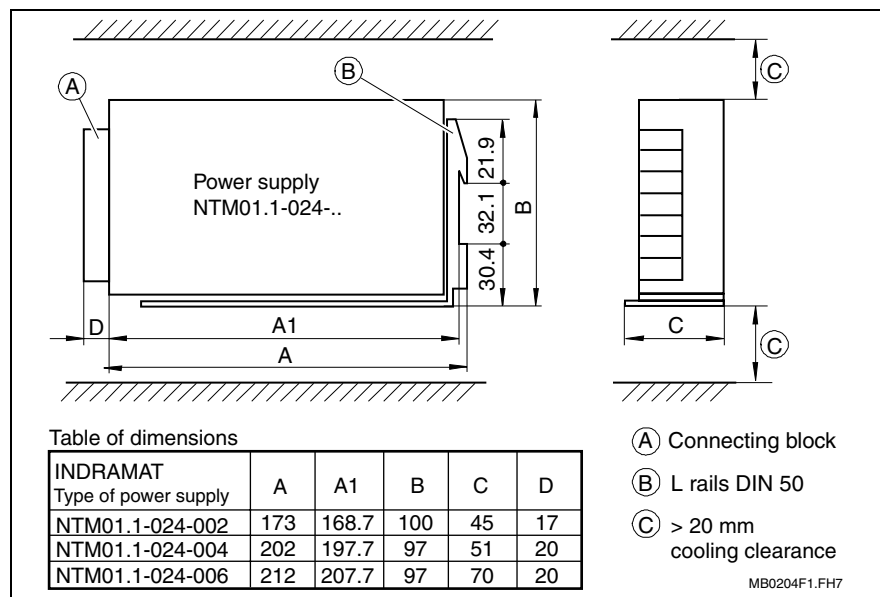


Fig. 5-2: Dimensional sheet DC24V – NTM power supplies

5.4 Front views

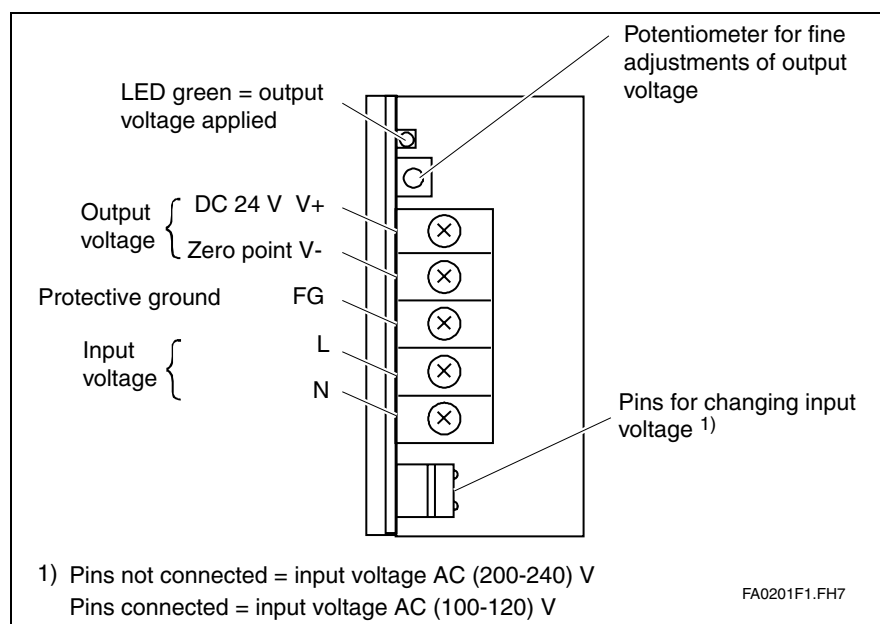


Fig. 5-3: Front view and terminal designations of the power supply NTM01.1-024-002

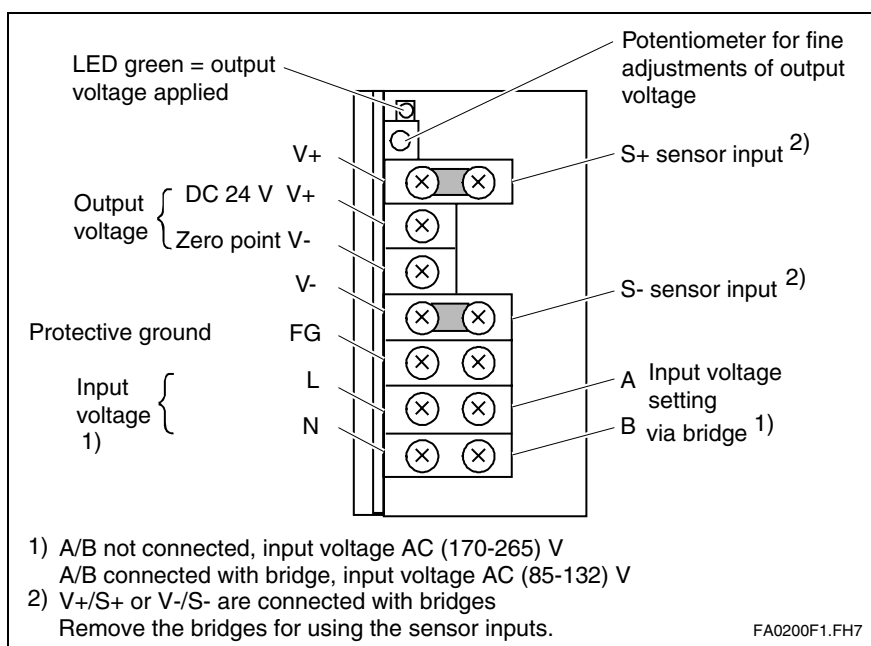


Fig. 5-4: Front view and terminal designation of the power supplies NTM01.1-024-004 and NTM01.1-024-006

5.5 Electrical connection

Note: Always use the NTM together with the line filter NFE01.1-250-006. For further information on NFE, see project planning manual "Electromagnetic Compatibility (EMC) in Drive and Control Systems", doc.-type DOK-GENERL-EMV*****-PRxx.

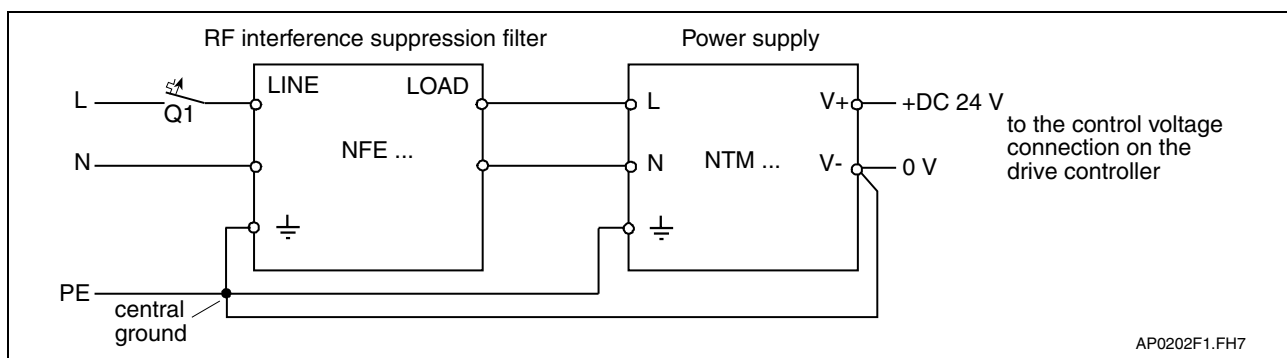


Fig. 5-5: Connecting the power supply to a line filter

Note: The contact bridge between V+/S+ and V-/S- must be removed if sensor inputs are used.

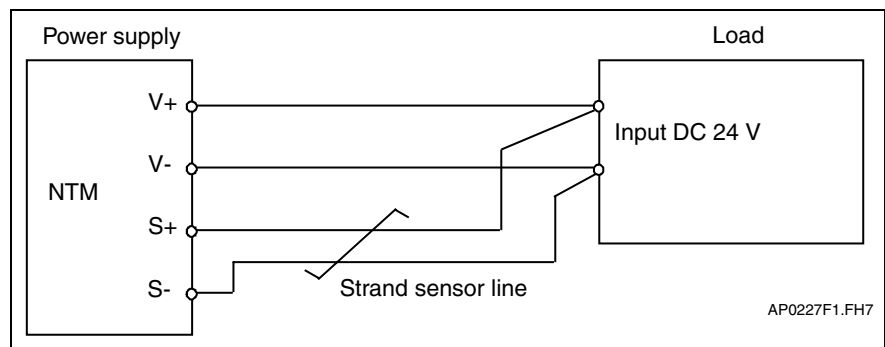


Fig. 5-6: Connecting the sensor cables NTM01.1-024-004 and NTM01.1-024-006

5.6 Type code

Abbrev.	Column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5	6	7	8	9	4	0
	Example:	N	T	M	0	1	.	1	-	0	2	4	-	0	2																														

1. Product group

1.1 NTM = NTM

2. Line

2.1 1 = 01

3. Design

3.1 1 = 1

4. Nominal output voltage

4.1 DC 24 = 024

5. Nominal output current

5.1 2,1 A = 02

5.2 4,2 A = 04

5.3 6,3 A = 06

Fig. 5-7: Type code

6 DST transformers

6.1 Selection

Transformers are only needed if the systems voltage exceeds the rated voltage of the drive controller.

Grounded power supply lines

For grounded power supply lines, the line voltage is matched to the rated voltage of the units using autotransformers which are suited to **one specific output voltage range**.

Ungrounded power supply lines

To match the voltage for ungrounded power supply lines, always connect isolating transformers to prevent excess phase to ground voltages.

6.2 Autotransformers for Drive Controllers

Select an autotransformer suited to both the line voltage and the power requirements of the system.

Proceed with the selection as follows:

- ⇒ Determine the rating group using the required rated line voltage range in the diagram "Classification of the three-phase alternating current autotransformers and then locate the transformer ratio "i".
- ⇒ Calculate the actual transformer output voltage using the rated line voltage and the transformation ratio "i".
- ⇒ Check the drive data. The output voltage of the transformer has an effect on the drive data.
- ⇒ Select a three-phase autotransformer corresponding to the required connected load.

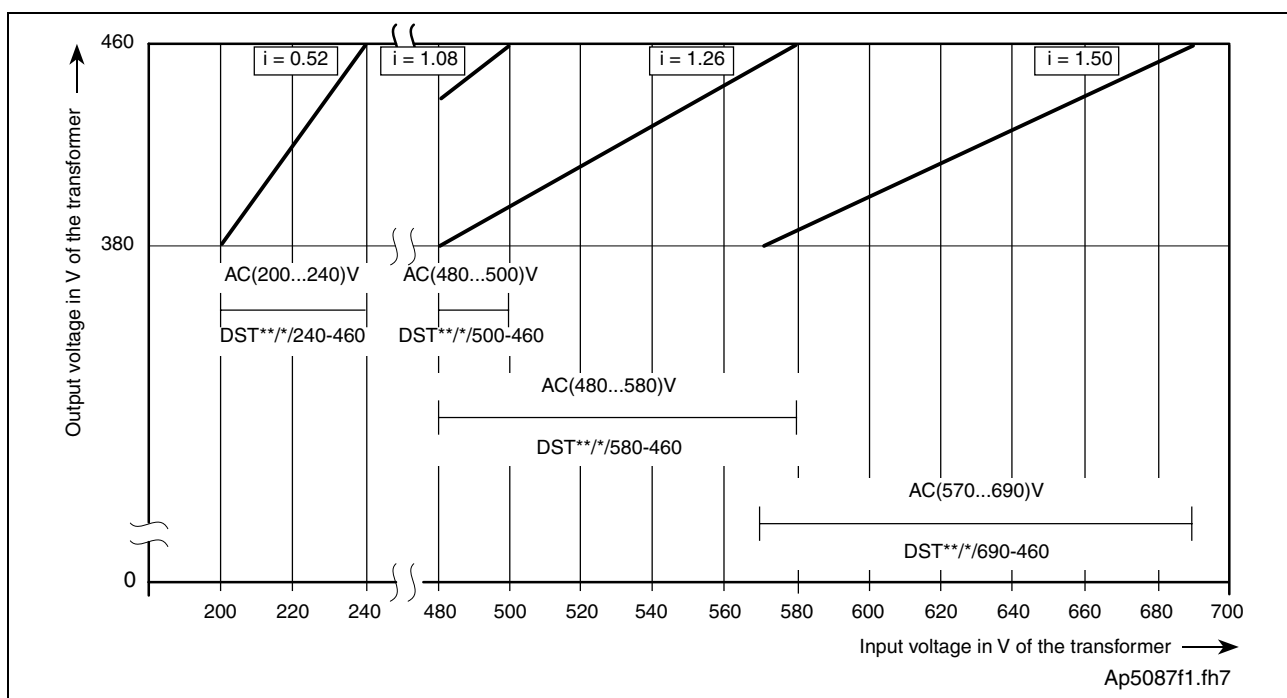
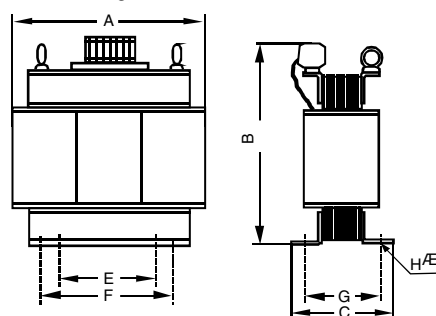


Fig. 6-1: Classification of three-phase autotransformers in rating groups

DST autotransformer with secondary or output voltage AC (380 to 460) V

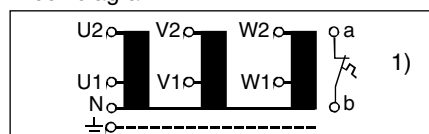
Standing version for mounting with base: DST.../S



Rating plate (example)

INDRAMAT GmbH D 97816 Lohr a. M.	
Type	DST 20/S/580 - 480 Bj. 1993
Prim.	480 580 V
Sec.	380 460 V 30 25 A
S	20 kVA YNa0 T 40/B f 50/60 Hz

Block diagram



1) Temperature switch max. load:
DC 24V/1A; AC 230V/1A

Type designation DST...	Conn. output in KVA	Trans- mission ratio	Dimensions in mm							Power loss in W	max. cross section in mm ²	Weight in kg
			A	C	B	F	E	G	H $\varnothing$			
Input voltage: AC (200...240) V $\pm$ 10%												
4/S/240-460	4		240	150	260	170	110	120	11	120	10	24.5
7,5/S/240-460	7.5		335	175	365	230	160	145	11	225	10	55
12,5/S/240-460	12.5	0.52	360	190	395	250	170	160	11	310	10	70
25/S/240-460	25		480	195	500	356	-----	158	13	500	35	135
50/S/240-460	50		580	265	540	400	270	215	18	750	70	195
Input voltage: AC (480...500) V $\pm$ 10%												
4/S/500-460	4		180	105	190	125	80	75	7	160	4	8.5
7,5/S/500-460	7.5		205	130	210	145	95	95	7	260	4	13
12,5/S/500-460	12.5	1.08	240	140	260	170	110	110	11	440	10	22
25/S/500-460	25		300	155	325	210	140	125	11	750	16	36
50/S/500-460	50		335	175	365	230	160	145	11	1050	35	53
Input voltage: AC (480...580) V $\pm$ 10%												
4/S/580-460	4		240	130	260	170	110	100	11	140	4	18
7,5/S/580-460	7.5		240	140	260	170	110	110	11	260	4	22
12,5/S/580-460	12.5	1.26	300	155	325	210	140	125	11	375	10	37
25/S/580-460	25		360	190	395	250	170	160	11	625	10	72
50/S/580-460	50		420	215	450	280	190	155	14	1000	35	95
Input voltage: AC (570...690) V $\pm$ 10%												
4/S/690-460	4		240	140	260	170	110	110	11	140	10	22
7,5/S/690-460	7.5		300	155	325	210	140	125	11	225	10	37
12,5/S/690-460	12.5	1.5	335	175	365	230	160	145	11	375	10	57
25/S/690-460	25		420	205	450	280	190	145	14	500	16	88
50/S/690-460	50		480	222	500	356	-----	185	13	750	35	178

MB5007f1.fh7

Fig. 6-2: DST autotransformers for drive controllers to match the line voltage

7 Mains Connections

7.1 General

Note: An DURADrive drive controller must be permanently connected to the power supply network.

Connection see page 4-24: "X5, Motor connections".

Line filter

Note: A line filter has been integrated in the DURADrive drive controller. The unit complies with EN 61800-3, class A.

7.2 Grounding conditions of the power supply network

Grounded three-phase current networks

Drive controllers of the DURADrive family can be operated on three-phase current networks with grounded star point or external conductors without potential isolation.

Ungrounded three-phase networks

Ungrounded networks (IT networks) present the increased danger of unallowed phase to ground overvoltages occurring. Drive controllers of the DURADrive family can be protected against overvoltages

- By connecting them via an isolating transformer (the star point of the output side and the PE connection of the power supply unit are linked on a shared ground rail)

- or -

- If the facility is protected via an overvoltage suppressor.

Connecting DURADrive drive controllers via an isolating transformer offers the best protection against overvoltage as well as the greatest operating safety.

Overvoltage

The periodic overvoltage of DURADRIVES between phase (L1, L2, L3) and ground may not exceed 1000 V (threshold value).

Transient overvoltage (< 50µs) may, as per EN61800-3/1996, equal a max value of 1000V phase to phase and 2000V phase to ground.

Note: If higher overvoltages occur, then they must be limited with the use of overvoltage suppressors.

Note: Mains voltages exceeding the specified range require the use of a step-down transformer.

7.3 Earth-leakage circuit breaker

It is not possible to use a earth-leakage circuit breaker in DURADrive drive controllers (EN 50178/1994, section: 5.3.2.3).

Protection against indirect contact is implemented by the protective grounded housing of the components of the drive system.

7.4 Control circuits for the mains connection

The control circuits recommended by Rexroth Indramat specify the functional principle.

Note: The choice of the control and its effects depend on the extent of the functions and the operating sequence of the installation or machine. It is therefore the responsibility of the manufacturer of the installation or machine.

Signal contact Bb ready to operate

The ready to operate message is output via a relay contact (N/O). If the Bb contact closes, then the drive is ready to receive power. The contact is thus a precondition for connecting the mains contactor.



Danger of damage !

⇒ The effectiveness of the separation of the mains connection via signal contact "Ready to operate Bb" of the DURADrive drive controller supplied by the mains must be ensured!

Switching states

Also see page 4-40: Ready to operate contact Bb

⇒ See also firmware functional description: "Power shutdown with fault".

Note: Load limits of the Bb contacts must be maintained. Contactors with AC excitation or those that exceed the load limits of the effected contact elements (Bb contacts, etc.) can be controlled with the use of auxiliary contactors.

Control circuits with E-Stop

Pre-requisite:

The E-stop input is available if the E-stop function has been activated in the software (see firmware functional description).

Use the E-Stop function if drive-internal error reactions must be activated as quickly as possible as a result of the following events:

- The emergency off button is pressed.
- Power is shut down.
- Error message from control (lag error monitor, emergency off actuated by the control).

If the E-Stop function is not used, then the drive-internal error reaction is not triggered until the K1 contactor opens and, as a result, "undervoltage in DC bus" is detected in the controller.

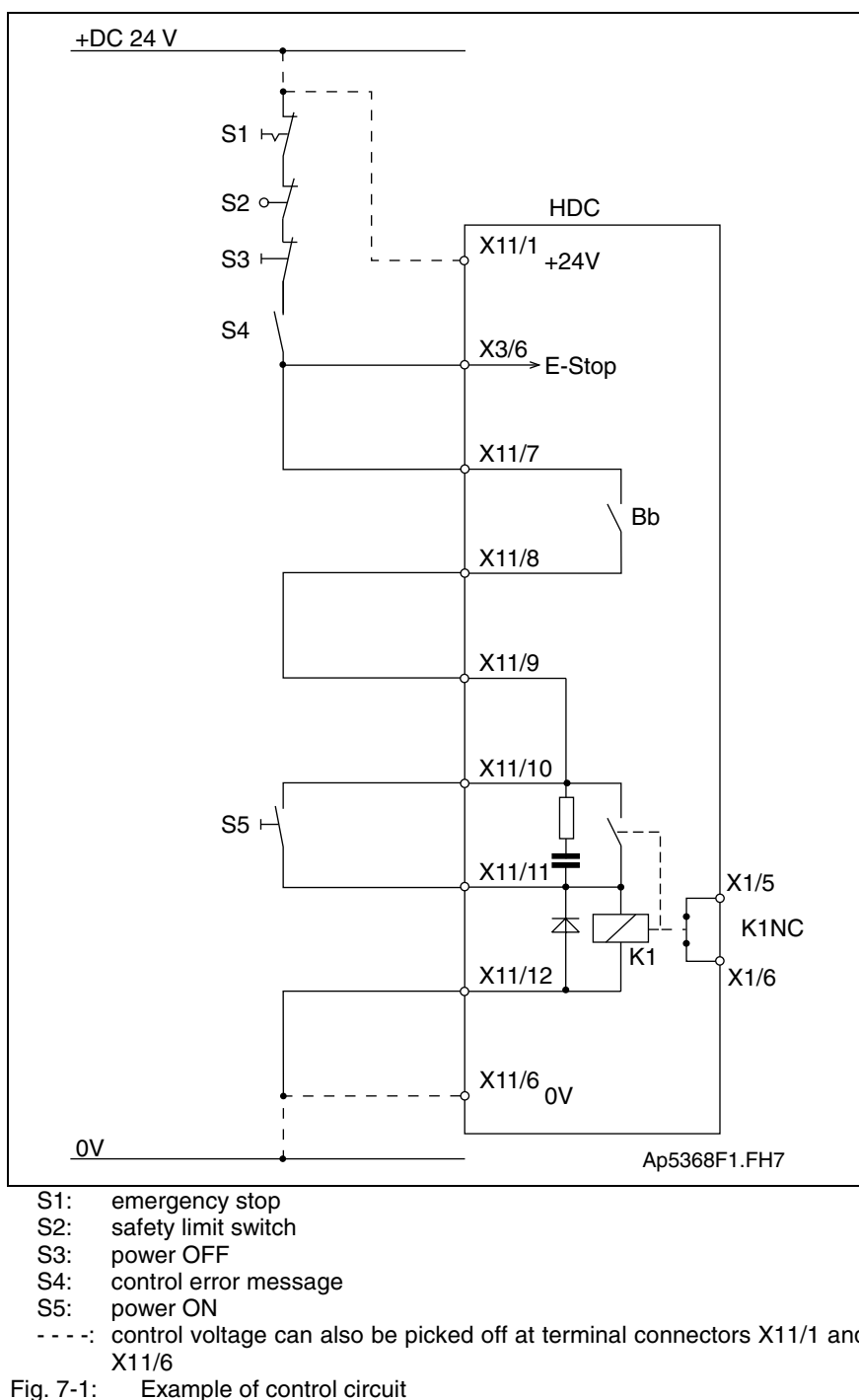


Fig. 7-1: Example of control circuit

Note: The control voltage can be picked off at unit connectors X11/1 and X11/6 or at an external power supply unit.

Do not pick off the E-Stop signal after the Bb contact.

If the safety end switches illustrated also function as a travel range limit, then a separate set-up must be created in case of actuation, which makes it possible to move back out of the end position!

=> See also firmware functional description: "Travel range limits".

7.5 Fuses

Computing phase current on the mains

To select a suitable fuses for the power connections it is necessary to first compute the phase current I_N at the mains.

The mains-side phase current I_N is determined out of the mains connecting power S_{AN} .

Select the mains connecting power in the list or compute it according to the following formula. With multiple controllers, add the individual powers.

$$P_{ZWD} = \frac{M_{EFF} \cdot n_{MITTEL} \cdot 2 \cdot \pi}{60} \cdot k$$

P_{ZWD} : required DC bus continuous power in W
 M_{EFF} : rms torque in Nm
 n_{MITTEL} : mean speed in min-1
 k : factor for motor and controller efficiency = 1.25 (MKD, MHD)
 Fig. 7-2: Computing DC bus power

$$S_{N1} = P_{ZWD} \cdot F$$

S_{N1} : connected load in VA
 P_{ZWD} : DC bus continuous power in W
 F : connected load factor
F=2.8 for single-phase feed
F for three-phase feed see page 7-6:
"Factor F for computing the connected load"
 Fig. 7-3: Computing mains connected load

$$I_{N1} = \frac{S_{N1}}{U_{N1} \cdot \sqrt{3}}$$

I_{N1} : mains-side phase current in A
 S_{N1} : connected load in VA
 U_{N1} : voltage between phases of the mains in V
 Fig. 7-4: Computing mains-side phase current

Computing charging current inrush

$$I_{EIN} = \frac{U_{N1} \cdot \sqrt{2}}{R_{Softstart}}$$

I_{EIN} : charging current inrush of unit in A
 U_{N1} : mains input voltage
 $R_{Softstart}$: softstart resistance of unit (see relevant technical data)
 Fig. 7-5: Computing charging current inrush

Factor F for computing the connected load

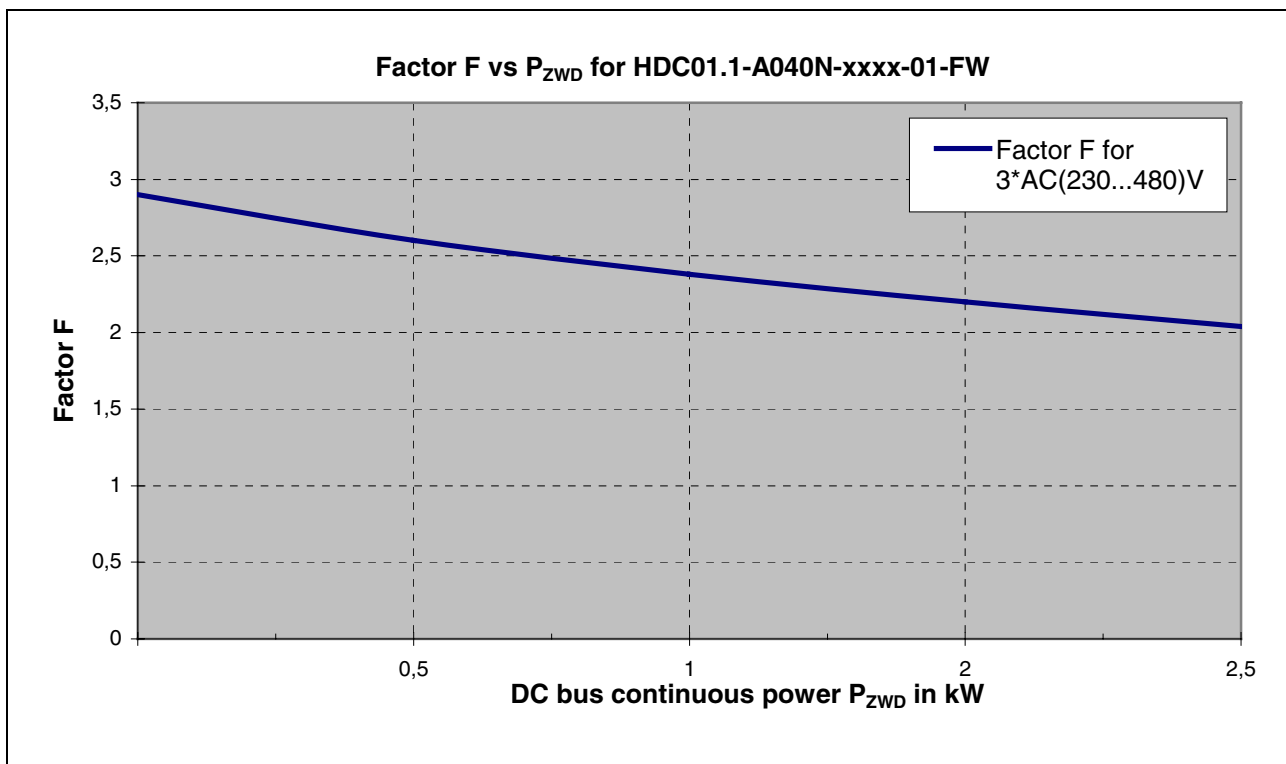


Fig. 7-6: Connected load factor for HDC01.1-A040N-xxxx-01-FW

Selecting fusing Q1

When selecting the fuses, the current in the supply leads of the drive controller must be taken into account. Several controllers can be operated on a single fuse. The supply-side phase currents and inrush currents computed for the individual drives must then simply be added up. If transformers are used, then the fuses must be installed on the primary side.

The Siemens type fuses and contactors in the selection table below are only examples. Products of equal rating from other manufacturers can be used.

Phase current	Lead cross sections	Fuses; (triggering characte. C)	Power fuses	Fusible links (operating class gl)
in A	(1) mm ²	(2) current in A	(3) Siemens Typ	(2) current in A
9	1,0	10	3VU1300- .ML00 oder 3RV1011-1JA10	10
12	1,5	16	3VU1300- .MM00 oder 3RV1021-4AA10	16
16	2,5	20	3VU1300- .MM00 oder 3RV1021-4AA10	20
22	4,0	25	3VU1300- .MP00 oder 3RV1021-4DA10	25
32	6,0	32	3VU1600- .MP00 oder 3RV1031-4EA10	35
1. Lead cross sections per EN 60204 – Installation B1 – correction factors not taken into account. 2. With recommended fuses short-term operating loads can be used by the drive for two minutes. If this is needed for extended periods, then use a bigger fuse.				

Fig. 7-7: Selecting table for Q1 fuses

Notes

8 Constructing the control cabinet

8.1 Power dissipation

Power dissipation is determined by the current load and the regenerated power. The actual generated power dissipation depends on the relevant load cycle, which is limited by the servo motor being used.

On the average, the maximum continuous standstill current I_{dN} of the motor flows through the drive controller

Determining power dissipation

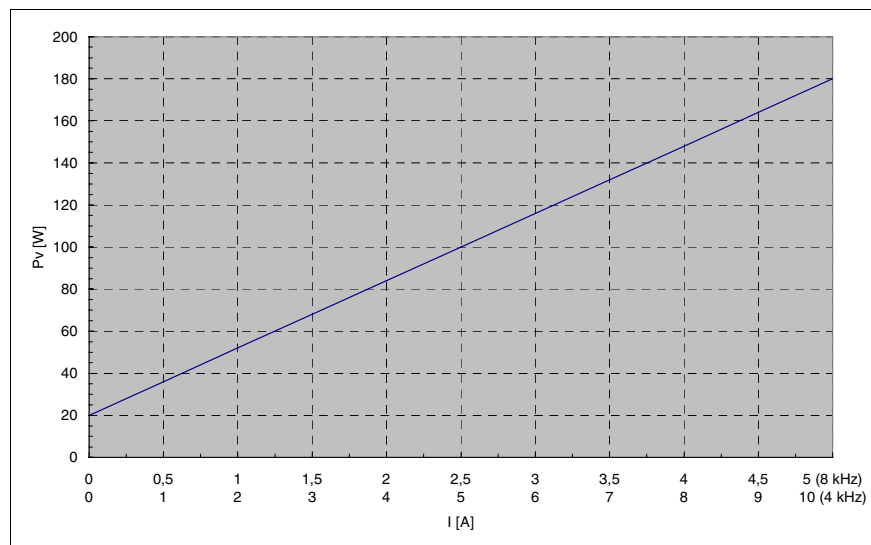
- ⇒ Look up in the relevant motor document both the continuous standstill current I_{dN} and torque M_{dN} .
- ⇒ Determine rms torque M_{eff} of the application (see motor document).
- ⇒ Determine the following relationship current I

$$I = \frac{I_{dN} * M_{eff}}{M_{dN}}$$

Fig. 8-1: Determining current I

- ⇒ Using current I , find the corresponding value of the current-dependent power dissipation $P_{V,HDC}$, using the diagrams "Determining Power Dissipation in the control cabinet".
- ⇒ Add both power losses ($P_{V,HDC}$ and $P_{V,Bleeder}$).

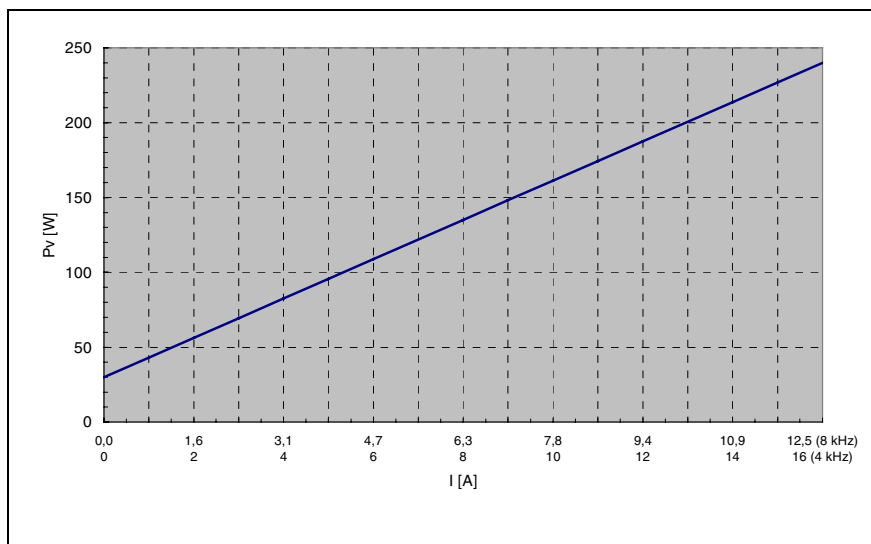
HDC01.1-A040N (not ventilated):
4 kHz and 8 kHz



P_V : Power dissipation
 I : Current (sine peak value)

Fig. 8-2: Determining power dissipation in the control cabinet for each drive controller HDC01.1-A040N (ventilated) with 4 kHz and 8 kHz

HDC01.1-A040N (ventilated):
4 kHz and 8 kHz

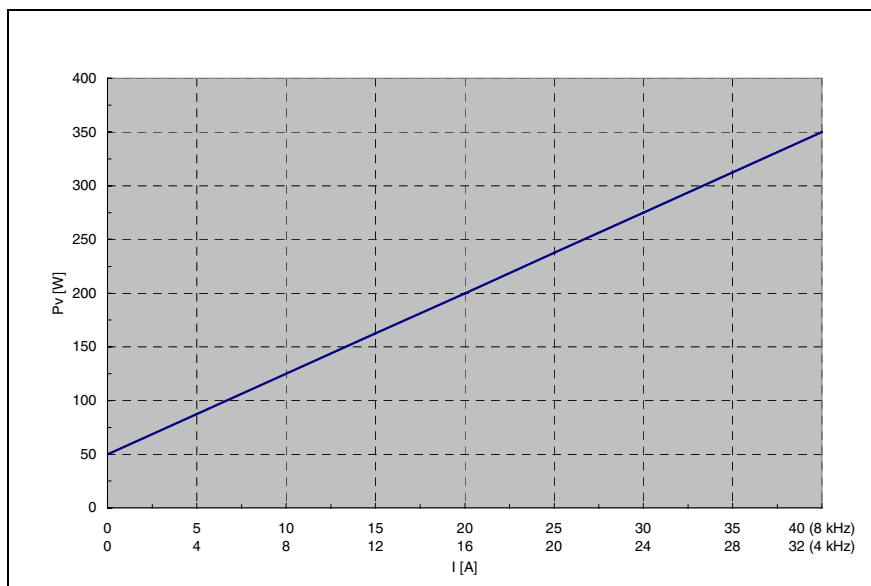


P_v: Power dissipation

I: Current (sine peak value)

Fig. 8-3: Determining power dissipation in the control cabinet for each drive controller HDC01.1-A040N (ventilated) with 4 kHz and 8 kHz

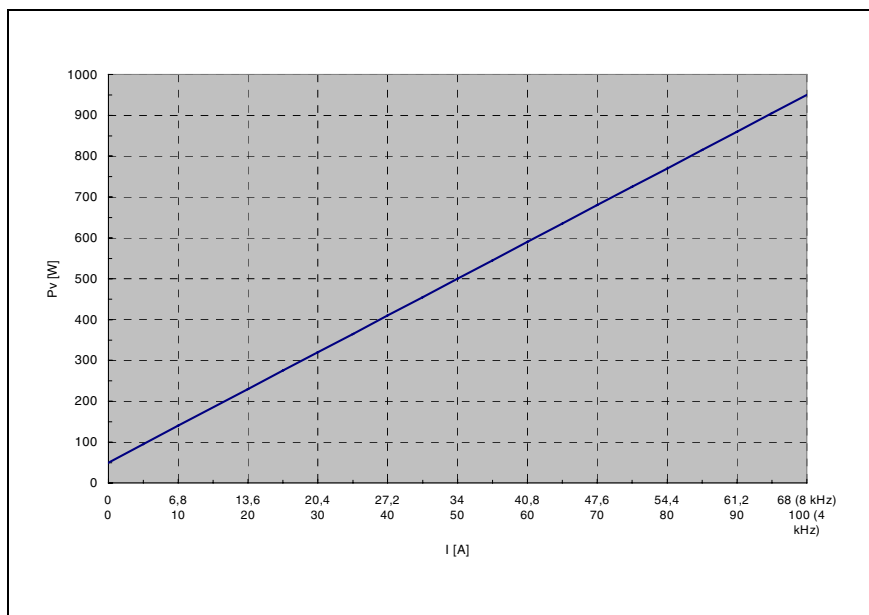
HDC01.1-A100N:
4 kHz and 8 kHz



P_v: Power dissipation

I: Current (sine peak value)

Fig. 8-4: Determining power dissipation in the control cabinet for each drive controller HDC01.1-A100N with 4 kHz and 8 kHz

**HDC01.1-A200N:
4kHz and 8kHz**


P_v : Power dissipation

I : Current (sine peak value)

Fig. 8-5: Determining power dissipation in the control cabinet for each drive controller HDC01.1-A200N with 4 kHz and 8 kHz

Temperature rise of the cooling air in DURADrive

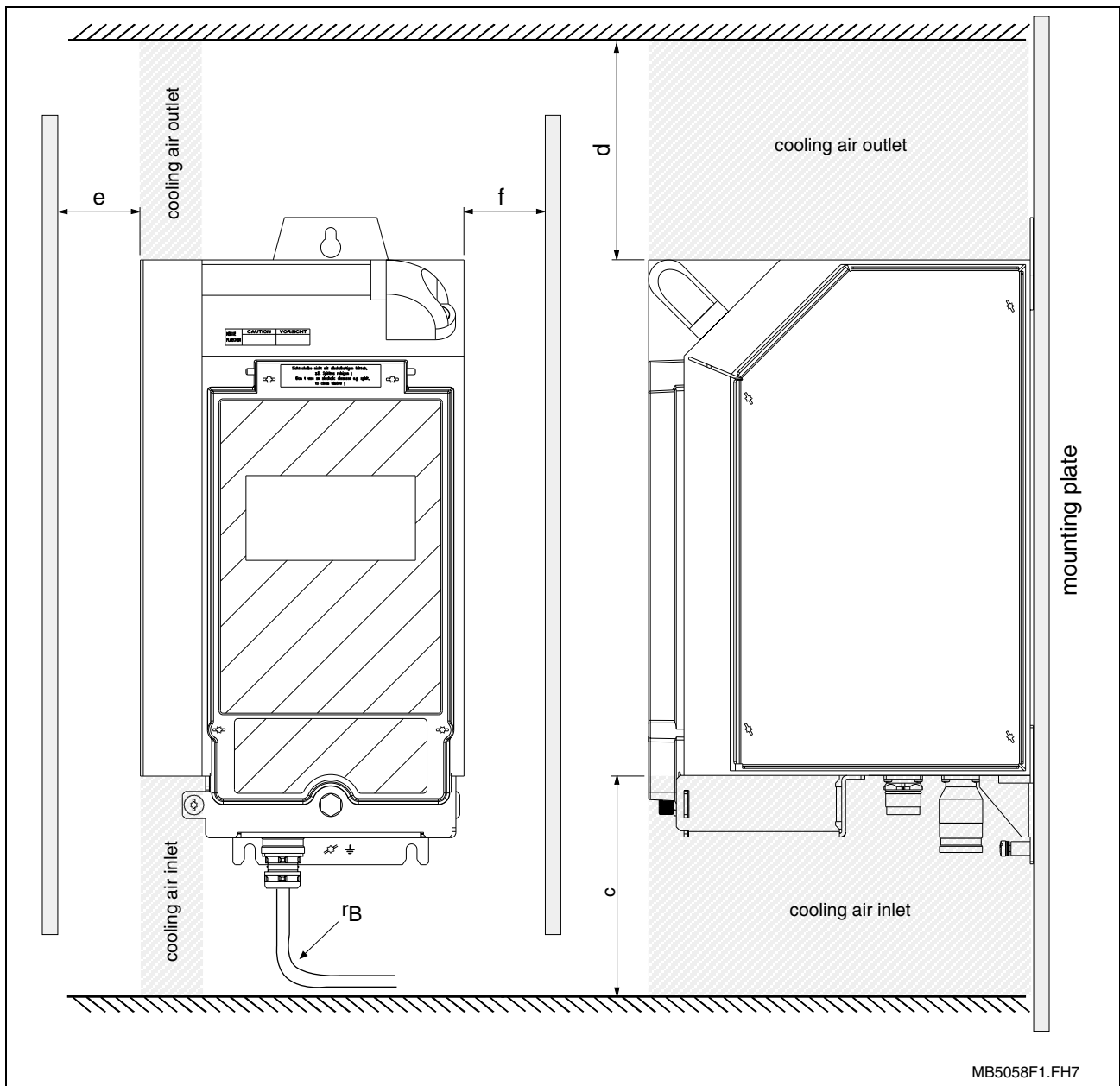
Owing to power dissipation the temperature of the cooling air, from its inlet on the downside of the unit to the outlet on the top sides of the unit, is rising.



WARNING

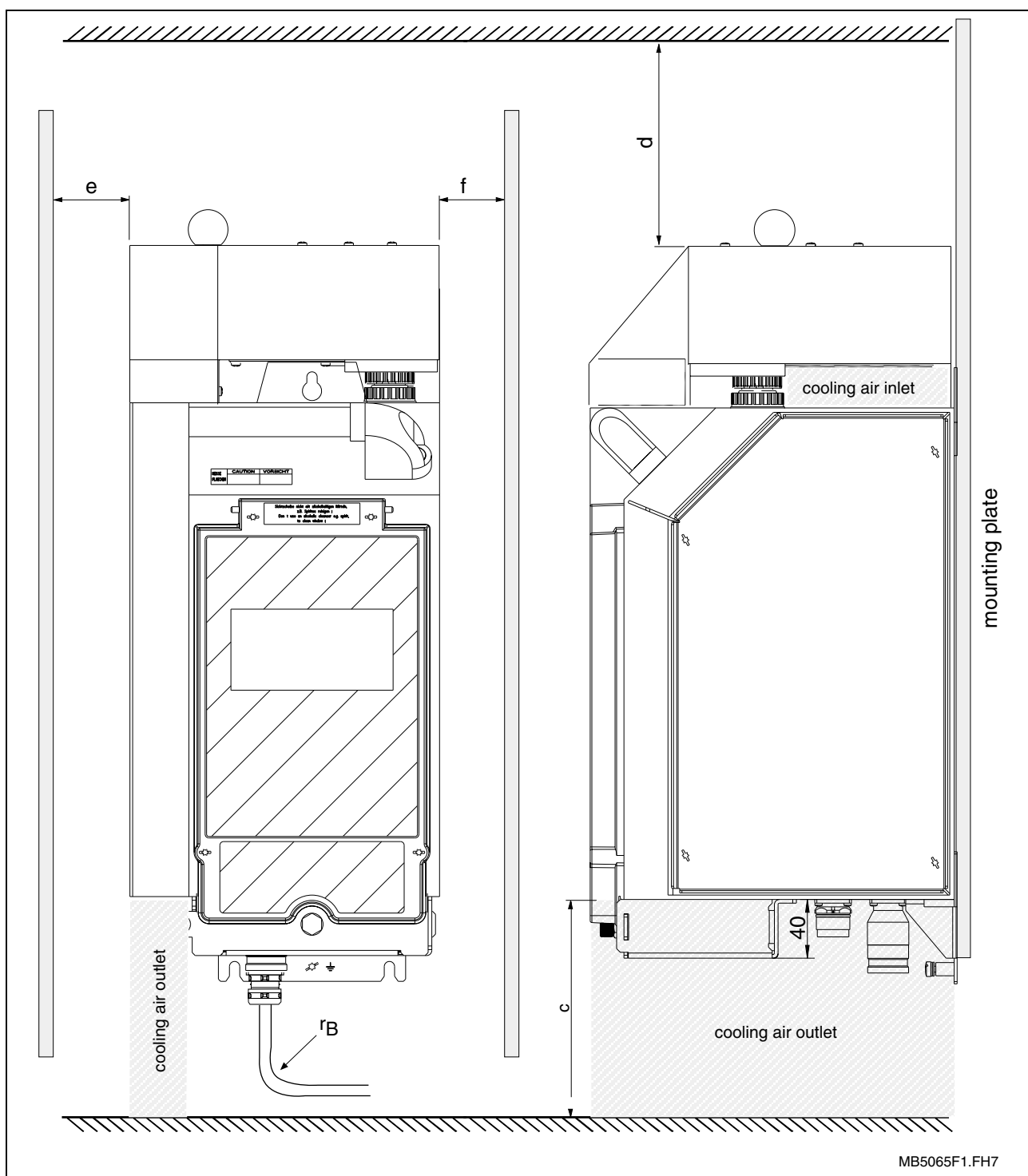
Burns caused by hot parts with temperatures of more than 30°C!

⇒ Depending on the work load of the unit and the ambient conditions, the housing and the power heatsink can be very hot. Before starting to work at the unit, allow it to cool down and measure the temperature.



- c: minimum distance cooling air inlet
- d: minimum distance cooling air outlet
- e: minimum distance to adjacent unit or housing
- f: minimum distance to adjacent unit or housing
- r_B: minimum bending radius

Fig. 8-6: Cooling air inlet and cooling air outlet (HDC01.1-A040N)



- c: minimum distance cooling air inlet
- d: minimum distance cooling air outlet
- e: minimum distance to adjacent unit or housing
- f: minimum distance to adjacent unit or housing
- r_B: minimum bending radius

Fig. 8-7: Cooling air inlet and cooling air outlet (HDC01.1-A100/200N)

- Minimum bending radius r_B** When using ready-made Rexroth Indramat cables, the following minimum bending radiuses have to be observed:
- fixed routing: $r_B = 6 \times \text{diameter of cable}$
 - flexible routing: $r_B = 10 \times \text{diameter of cable}$

Distances

	Measures	Minimum distance [mm]
on the sides	e and f	80
cooling air inlet	c	80
cooling air outlet	d	80

Fig. 8-8: Minimum distances

8.2 General notes

Electrostatic discharge from persons and/or tools can damage the controller or printed circuits boards (PCB's). Please note the following:



CAUTION

Damage to electronic components and interference with their safety of operation caused by electrostatic charges!

⇒ Objects coming into contact with components and circuit boards must be discharged by means of grounding. Otherwise errors may occur when triggering motors and moving elements.

Such objects can be:

- The soldering iron when soldering
- The human body (ground by touching a conductive, grounded object).
- Parts and tools (place on conductive surface)

Parts at risk may only be stored and shipped in conductive packaging.

Note: The diagrams of Rexroth Indramat should only be used by a Machine Manufacturer to create terminal diagrams for a facility. When wiring a facility, an End user should only use the diagrams of the Machine Manufacturer.

General notes

- Route signal lines separately from load lines to avoid interference.
- Conduct analog signals (e.g., command/actual values) via shielded leads.
- Mains, DC bus and power lines should not be connected to low voltages or come into contact with them.
- When conducting a high voltage test or external voltage capacity test of the electrical components of the machine, disconnect or remove all connections of the units. This protects the electronic components (allowed as per EN 60204-1). Rexroth Indramat drive components are high-voltage and insulation tested as per EN 50178.



CAUTION

Potential damage of the controller device by connecting and disconnecting the connections with mains power on.

⇒ Do not connect and disconnect connections if the mains power is on.

8.3 Wire routing in the cable duct

- A distance of at least 100 mm between power and control or signal cables (e.g., feedback cables) must be maintained or
- Separate cable duct with metal divider.

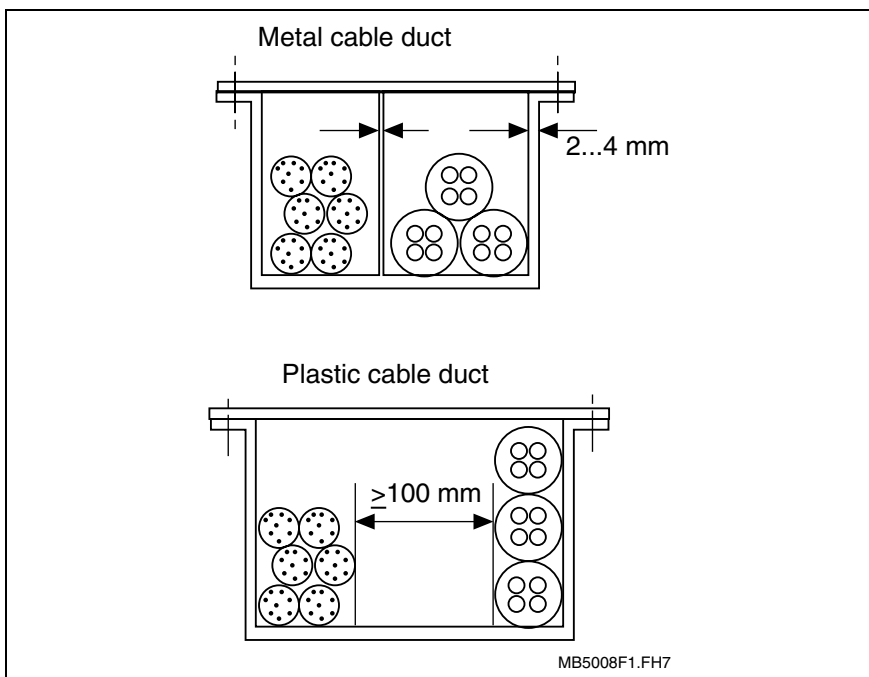


Fig. 8-9: Cable duct variant

Note: Details are specified in the project planning manual "Electromagnetic compatibility (EMC) or AC drives", doc. Type DOK-GENERL-EMV*****-PRxx.

9 State of Delivery of the Drive Components

9.1 Packaging

- Units** DURADrive components come in separate units.
- Material** Rexroth Indramat takes the packaging material back free of charge. The customer is charged for the return transport.
- Sticker** The barcode sticker on the packaging lists the contents of the components and the order number.



Fig. 9-1: Barcode sticker on the packaging - breakdown

9.2 Papers

There is an envelope on one of the packages which contains two copies of the delivery slip. There are no more papers.

On the delivery slip or freight papers, the entire number of transport containers is specified.

9.3 Extent of Delivery

Included in the delivery:

- **The controller HDC01.1**
 - With firmware module
 - with connectors according to the following table

Type	Connectors - type independent X..									Connectors - type dependent X..									
	1	2	3	4	5	8	10	11	13	20	21	30	40	41	50	60	210	220	221
CN01	X		X				X	X											
DN01	X		X				X	X								X			
IB01	X		X				X	X											
PB01	X		X				X	X											
PL02	X		X				X	X											
SE01	X		X				X	X											
SE02	X		X				X	X											

Fig. 9-2: In the delivery contained connectors

9.4 Ordering

Replacement Parts

- Firmware module ESM 2.*
- Power connector
- D-subminiature connector for encoder and field bus interfaces
- Cooling fan unit

Additional Accessories

- Standard interface cables IKB0005/ four different lengths for RS232 (2m, 5m, 10m or 15m)
- Interface cable RS485 INK0572/ length

Mounting Accessories

A Torx screw driver TX30 with a 400mm long blade is available.

- Torx screw driver TX30 M6 400 lg (MN00282391)

Commissioning Aids

- DriveTop (Software for start-up)

Notes

10 Identifying the Components

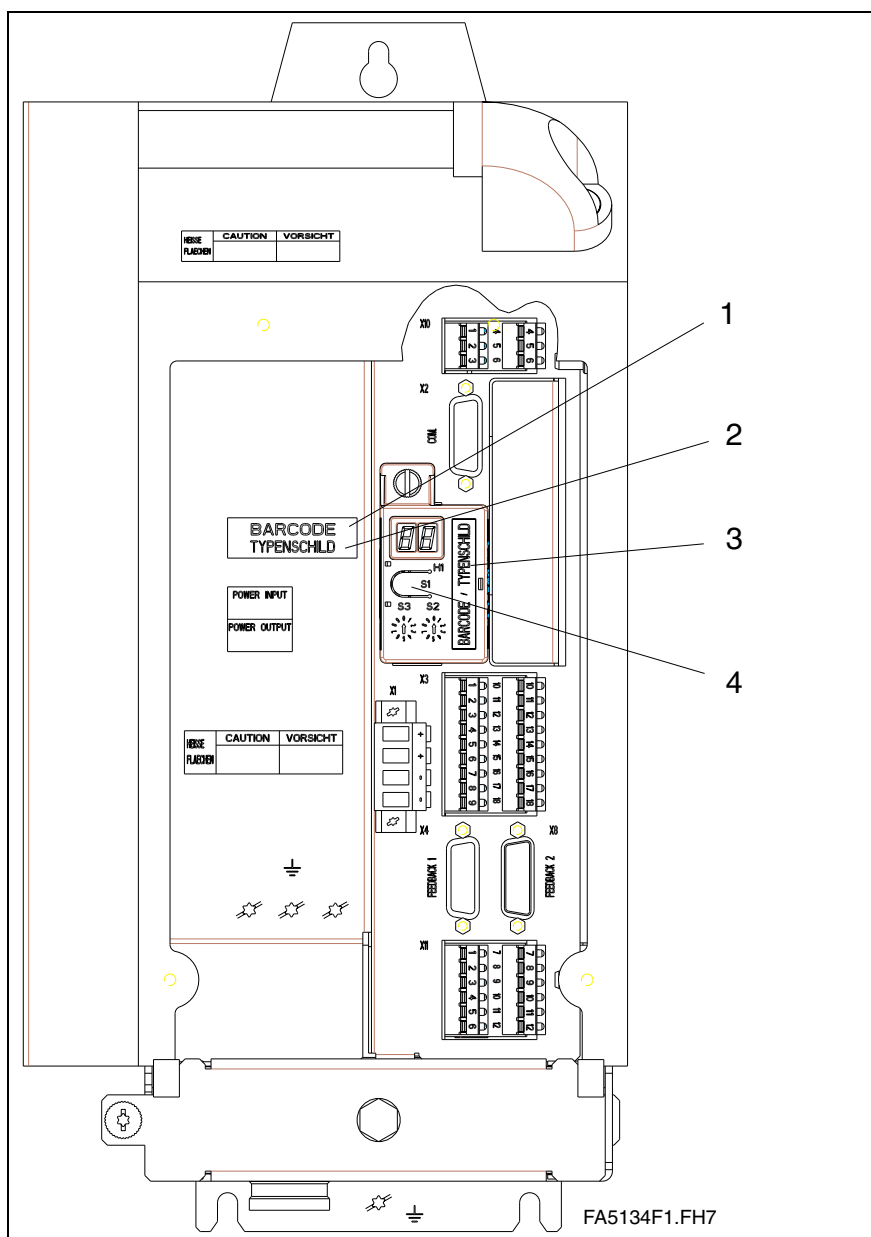
10.1 Component designations

Every drive component is labelled with a type designation.

There is a type plate on every unit including the motor.

There is a label around the standard cable (cable brand). Type designation and length is on this label. (The designation of the actual cable without connector is printed on the cable sheath.)

The accessories in the bags are either identified with their ID on the bag or there is a packaging slip.



- 1: Basic unit – type plate
- 2: Unit design – type plate
- 3: Firmware – type plate
- 4: Programming module – type plate

Fig. 10-1: Type plates

Type Plates

(1) Basic Unit

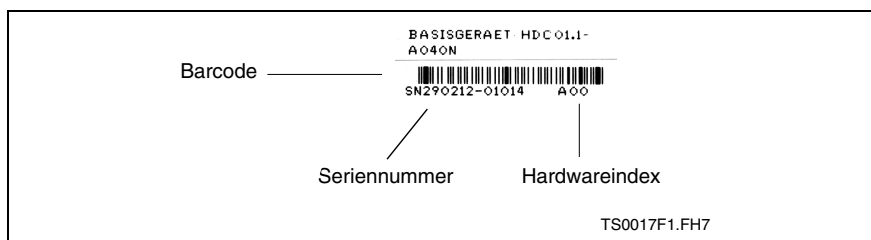


Fig. 10-2: Type plate

(2) Unit type

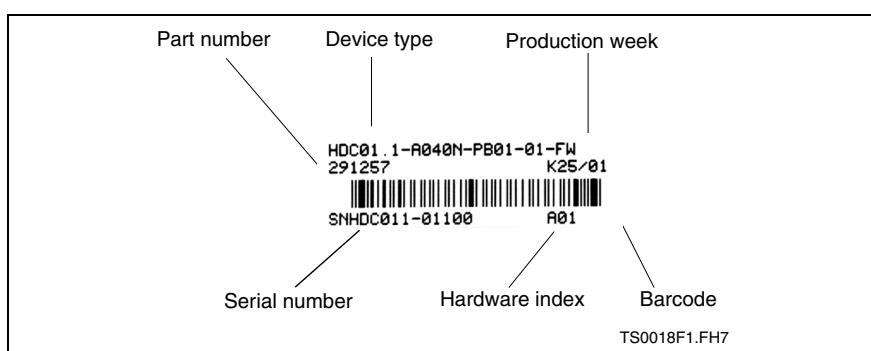


Fig. 10-3: Type plate – DKC example

Note: The type plates for units BZM, CZM, NTM, NFD/NFE is the same.

(3) Firmware

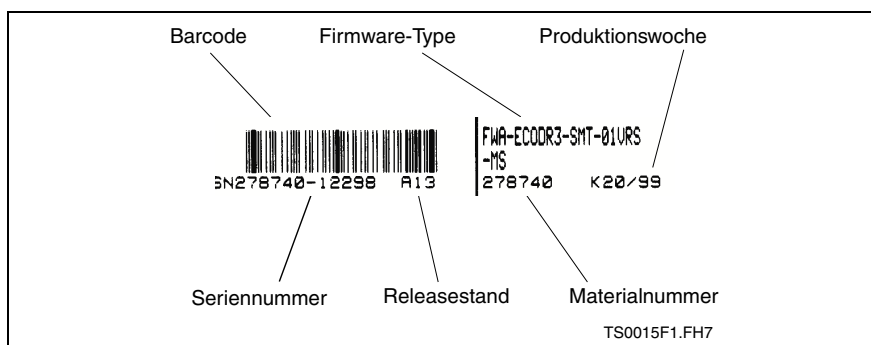


Fig. 10-4: Type plate

(4) Programming Module

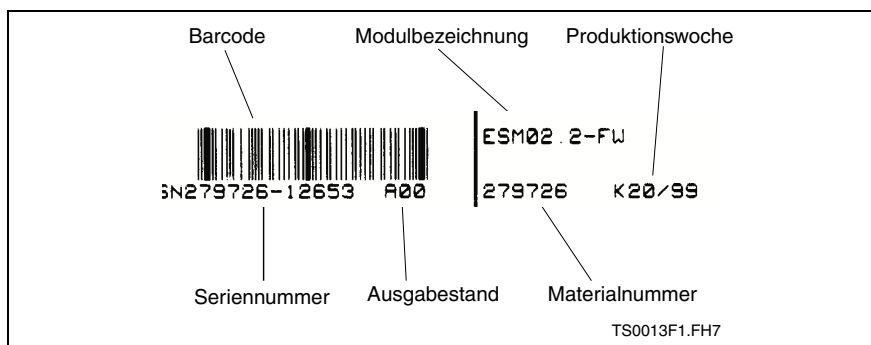


Fig. 10-5: Type plate

DST/DLT

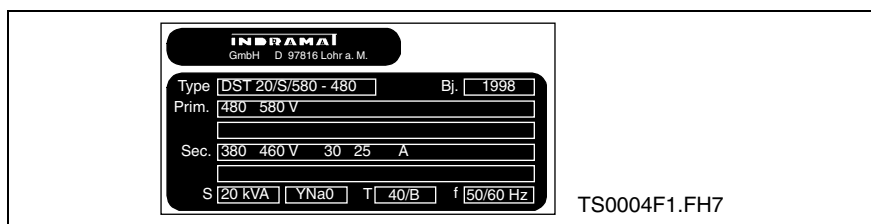


Fig. 10-6: Type plate DST/DLT

Notes

11 Replacing or Exchanging Drive Components

11.1 General

The diagnostic display of DURADrive enables an aimed and effective problem search in order to:

- avoid production downtimes due to extensive searches in individual units and repairs of units on the machine
- assume operations without extensive assembly and adjustments
- to quickly eliminate the problem, and replace the defective component

When returning a defective unit to Indramat Customer Service, please complete the Fault Report in its entirety. This fault report is at the end of this section and may be copied for your convenience.

Note: The new drive components must have the same type designations as the old! To ensure this, register the entire type designation when requesting a replacement part.

Position of the type plates:

The type plate of the DURADrive controller is situated behind the protective cover at the housing. It lists all significant data.

The cooling fan units of the DURADrive controllers have their own type plates.

The type plate of the MKD resp. MHD motors on the right side of the motor (when looking onto the drive shaft, terminal box of the motor cable on top).

Standard cables are labelled (cable mark). It bears the order number and the length of the cable.

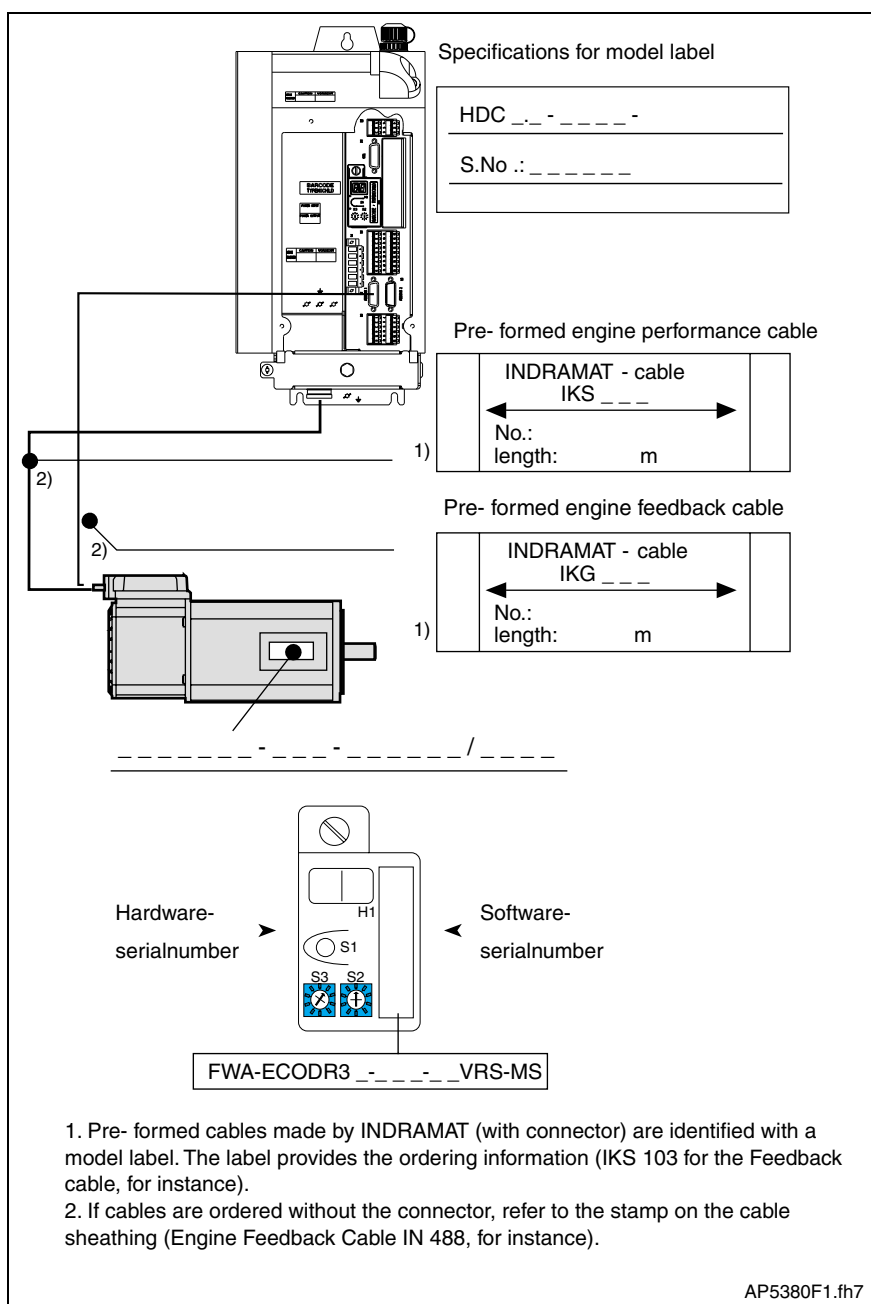


Fig. 11-1: Type designations of the drive components

11.2 Procedure on Replacing the Unit

Note: Note the safety instructions in section 2 when exchanging any parts!

Replacing the drive controller:

- Make sure the drive controller is completely de-energized.
- Switch main switch off.
- Secure against being switched back on.



DANGER

Lethal electric shock caused by charged capacitor!

⇒ Prior to touching bear connecting cables and terminals, wait for the capacitor to discharge! Only then work on the cables!

- Open cable bushing (see page 4-7) and loosen cable at the drive controller.
- Remove contact protection and separate connecting line from the drive controller.
- Release screws on top and bottom of housing.
- Remove the drive controller.
- Insert programming module from defective drive controller into new one. This eliminates the reloading of parameter files. If the programming module is defective, see section "Replacing Firmware".
- Hand new drive controller into place and tighten screws.
- If existing, replace cooling fan unit (see chapter 9-3).
- Connect drive controller as specified in the machine terminal diagrams.
- Close cable bushing (see page 4-7).
- Start up installation.

Replacing the cooling fan unit

Mounting

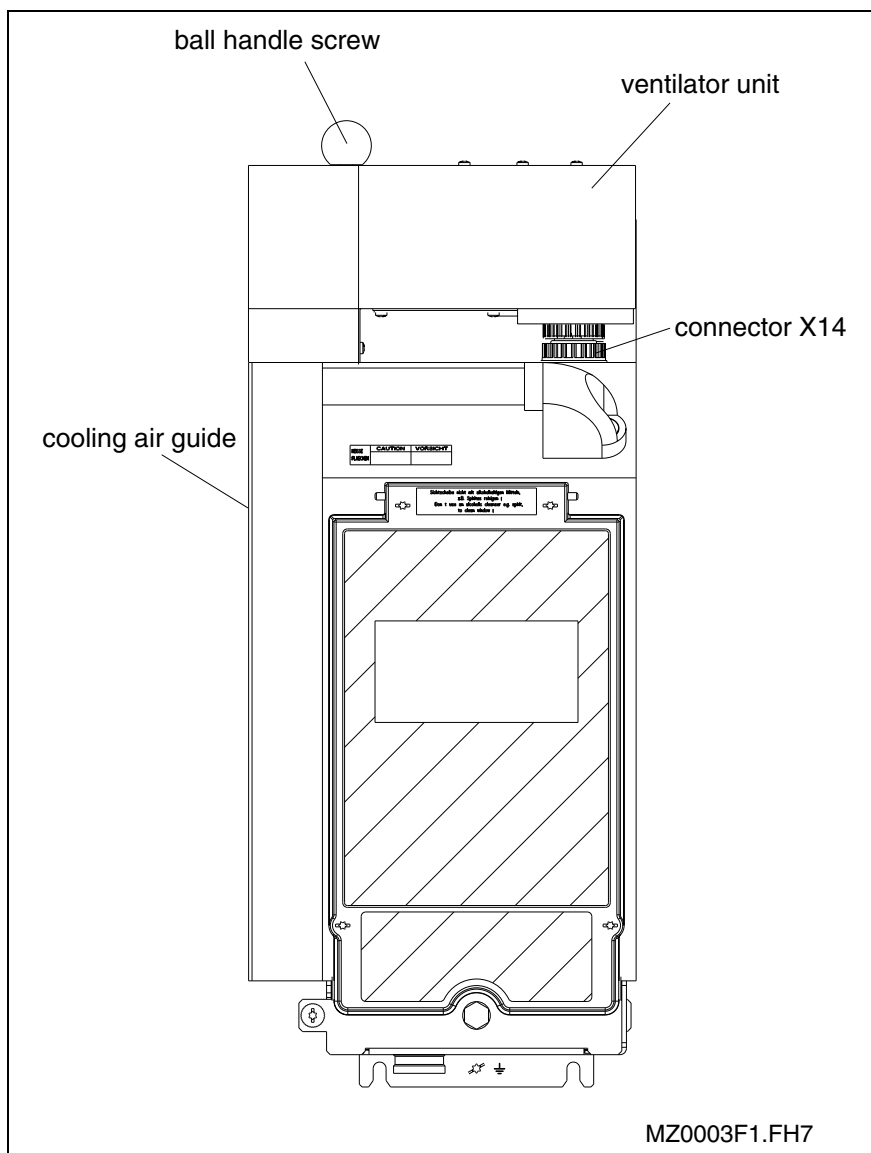


Fig. 11-2: Drive controller with cooling fan unit

The cooling fan unit should only be mounted after the drive controller has been mounted.

Mounting the cooling air guide

The cooling air guide only needs to be mounted with the HDC01.1-A040N drive controller.

Note: The cooling fan unit only works correctly when the cooling air guide has been mounted.

- Put both hooks of the cooling air guide in the slots of the cover of the left housing side.
- Screw on the cooling air guide at the front side of the drive controller.

Mounting the cooling fan unit

- Loosen the cover of connector X14.

- Put the cooling fan unit on the drive controller and turn the connector in such a way that it fits into connector X14 at the drive controller.
- Close the bayonet joint of connector X14.
- By turning the ball handle screw, screw the cooling fan unit down to the drive controller.

Note:

- The cooling fan unit is monitored by the drive controller. If the number of revolutions falls below a minimum value, there is an alarm message.
 - Drive controller HDC01.1-A040N: After the cooling fan unit has been mounted and the drive controller switched on again, the respective parameters of the drive controller are switched automatically.
 - Drive controllers HDC01.1-A100N and HDC01.1-A200N: If the ventilator has not been mounted, there is an error message.
-

Dismounting

Note: Only dismount the cooling fan unit when the drive controller has been switched off.

- Switch off the drive controller completely.
- Loosen the ball handle screw.
- Open the bayonet joint of the connector.
- Remove the cooling fan unit.
- Put the cover on connector X14.

Replacing the Motor

- Switch main switch off.
- Secure against being switched back on.
- Disconnect plug-in connectors.

Note: When replacing the motor, cap open connector ends particularly if there might be the change that coolant or grease could be sprayed or splashed in their vicinity (allowable level of dirt contamination is V2).

- Replace motor.

Note: To mechanically replace the AC servo motor, note the instructions of the machine manufacturer.

- Connect plug-in connectors.



⇒ Danger of unwanted movements. Servo axes with an indirect path measuring systems via a motor encoder will lose the reference dimension if the motor is replaced! This reference to machine coordinate system must therefore be reestablished.

- Servo axes with absolute motor encoder:
Reestablish the absolute reference

Replacing cables



Danger from high-voltage levels.

⇒ Power connector of the cables may only be inserted or separated if power in the installation has been shutdown!

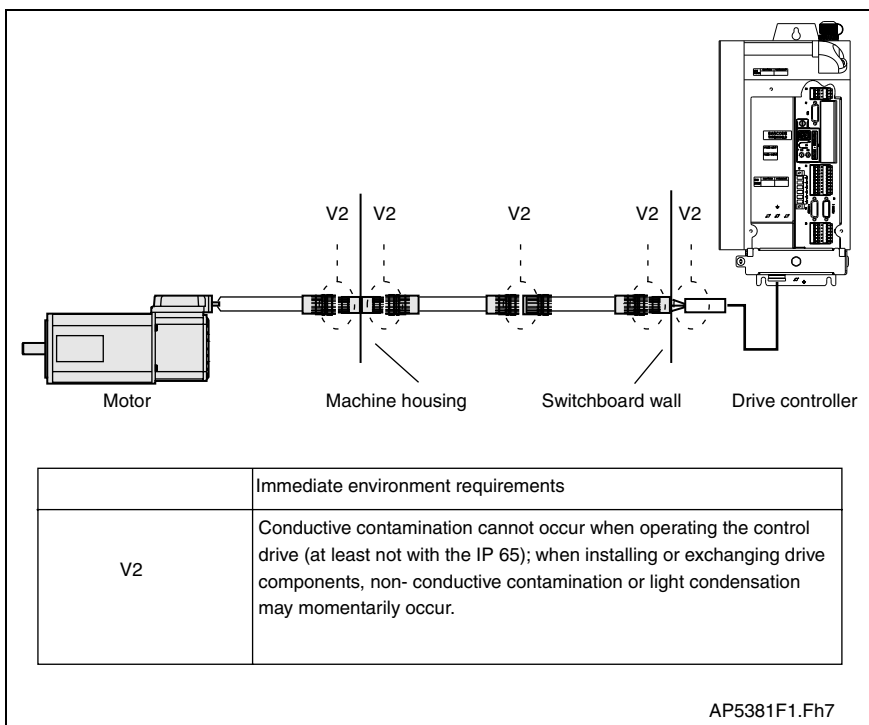
Note: When replacing cables, note the instructions of the machine manufacturer.

If a standard cable from INDRAMAT is not used, then check to ensure that the cable agrees with the terminal diagram of the machine manufacturer!

- Switch main switch off.
- Secure against being switched back on.
- Disconnect plug-in connectors.

Note: When replacing the motor, cap open connector ends particularly if there might be the change that coolant or grease could be sprayed or splashed in their vicinity (allowable level of dirt contamination is V2).

- Replace cables
- Connect plug-in connectors



Fif. 11-3: Dirt contamination per DIN VDE 0160


ATTENTION

Property damage caused by bad power connectors!

⇒ Connect power connections only when they are dry and clean.

Fault Report for digital AC Servo Drives DURADRIVE			
This fault report is intended to clarify problems and their causes. It is absolutely necessary for finding and eliminating hidden, sporadic or application-related problems. - Always include a Fault report with any parts returned for repair. - Otherwise, send Fault Reports to your Rexroth Indramat representative or to the address of the Quality Department printed on the reverse side of this page.			
Fault Report dated:	Co.: _____ Dept.: _____	Loc.: _____ Name: _____	Date: _____ Tel.: _____
Information about the drive:			
Data on rating plate Enter display data at time problem occurred H1 Hardware-S.N. _____ HDC _____ S.N.: _____ FWA-DRIVE_____ VRS Software-S.N. _____ Info about motor: Motor type: _____ S. No.: _____			
Information about machine at which problem occurred:			
Machine manuf. _____ Type: _____ Oper. hours: _____			
Machine number: _____ Comm. date: _____			
Manufacturer and type of machine control: _____			
Designation of the machine axis in which fault occurred: _____			
Describe the problem: 			
Additional data:			
Problem: ☐ always present ☐ at startup ☐ occurs sporadically ☐ occurs after _____ hrs. ☐ with vibrations ☐ temperature dependent	Causes: ☐ unknown ☐ connection error ☐ external causes ☐ mechanical damage ☐ loose leads/cables ☐ moisture in unit ☐ foreign object in unit	Auxiliary problems: ☐ problem with mechanics ☐ mains sec. failure (24 V _{ext.}) ☐ control failure ☐ motor failure ☐ cable break ☐ blower defective ☐ Feedback defective	Is there an air conditioner in the cabinet ? Y / N ☐ Have there been previous problems at this machine ? How often: _____ Did the problems occur on the same day or the same time of the day ? _____ _____
☐ Additional data: _____ _____ _____			
Rexroth Indramat GmbH Bgm.-Dr.-Nebel- Straße 2 Abt. QSP D-97816 Lohr am Main			
Pi6006d1.fh7			
Rexroth Indramat GmbH • Bgm.-Dr.-Nebel-Straße 2 • D-97816 Lohr • Telefon 09352 / 404-0 • Tx 689 421 • Fax 09352 / 404-885			

Fig. 11-4: Fault report

11.3 Replacing Firmware

Replacing the Parameter Module

- Secure parameters (DriveTop)
- Switch drive controller off
- Remove programming module
- Open the lock on the back

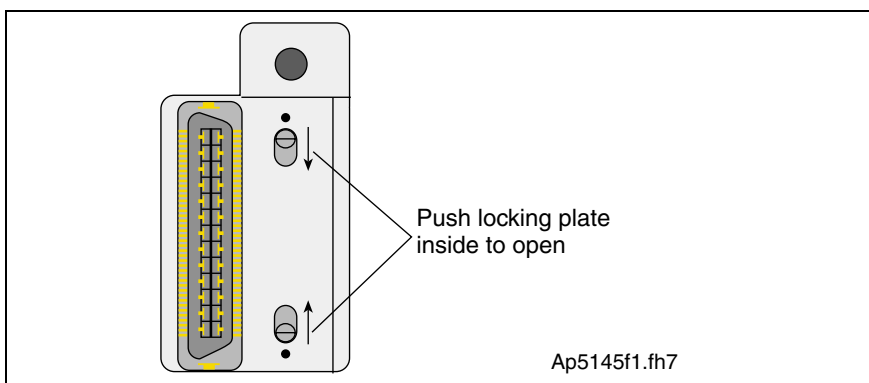


Fig. 11-5: Locking the programming module

- Open the programming module

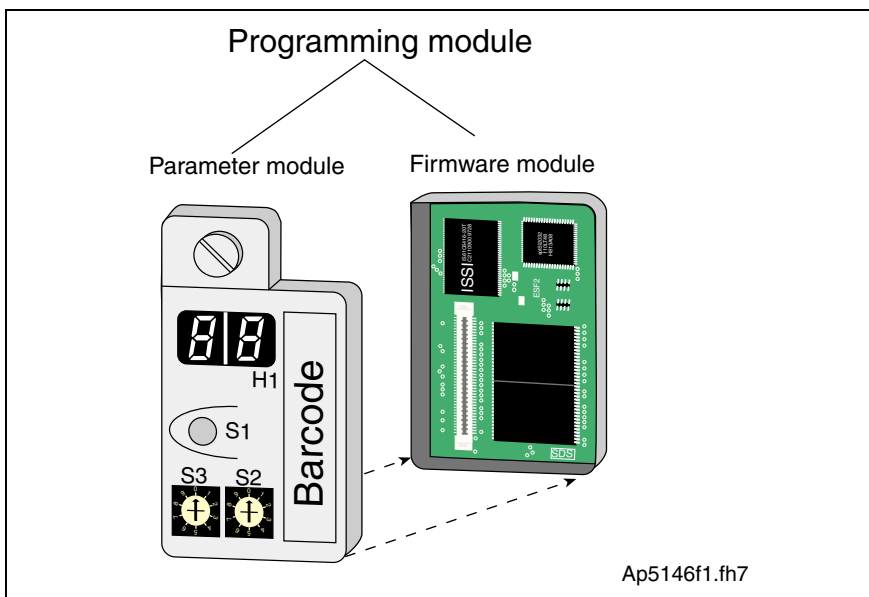


Fig. 11-6: Programming module

- Connect new parameter module and old firmware module
- Close lock (switch outward)
- Insert programming module
- Switch drive controller on
- Load parameters (DriveTop)

Replacing the Firmware Module

- Switch drive controller off
- Dismount protective cover
- Loosen screw at programming module and pull programming module out
- Pull programming module out
- Open the lock on the back of the programming module
- Open the programming module
- Insert old parameter module into new firmware module
- Close lock (lock must be pushed outward)
- Insert programming module and screw on
- Mount protective cover
- Switch drive controller on

Replacing the Programming Module (complete module)

- Secure parameters (DriveTop)
- Switch drive controller off
- Dismount protective cover
- Loosen screw at programming module and pull programming module out
- Insert new programming module
- Mount protective cover
- Switch drive controller on
- Load parameters

12 Attachment

12.1 Wire routing and wiring of the drive controller

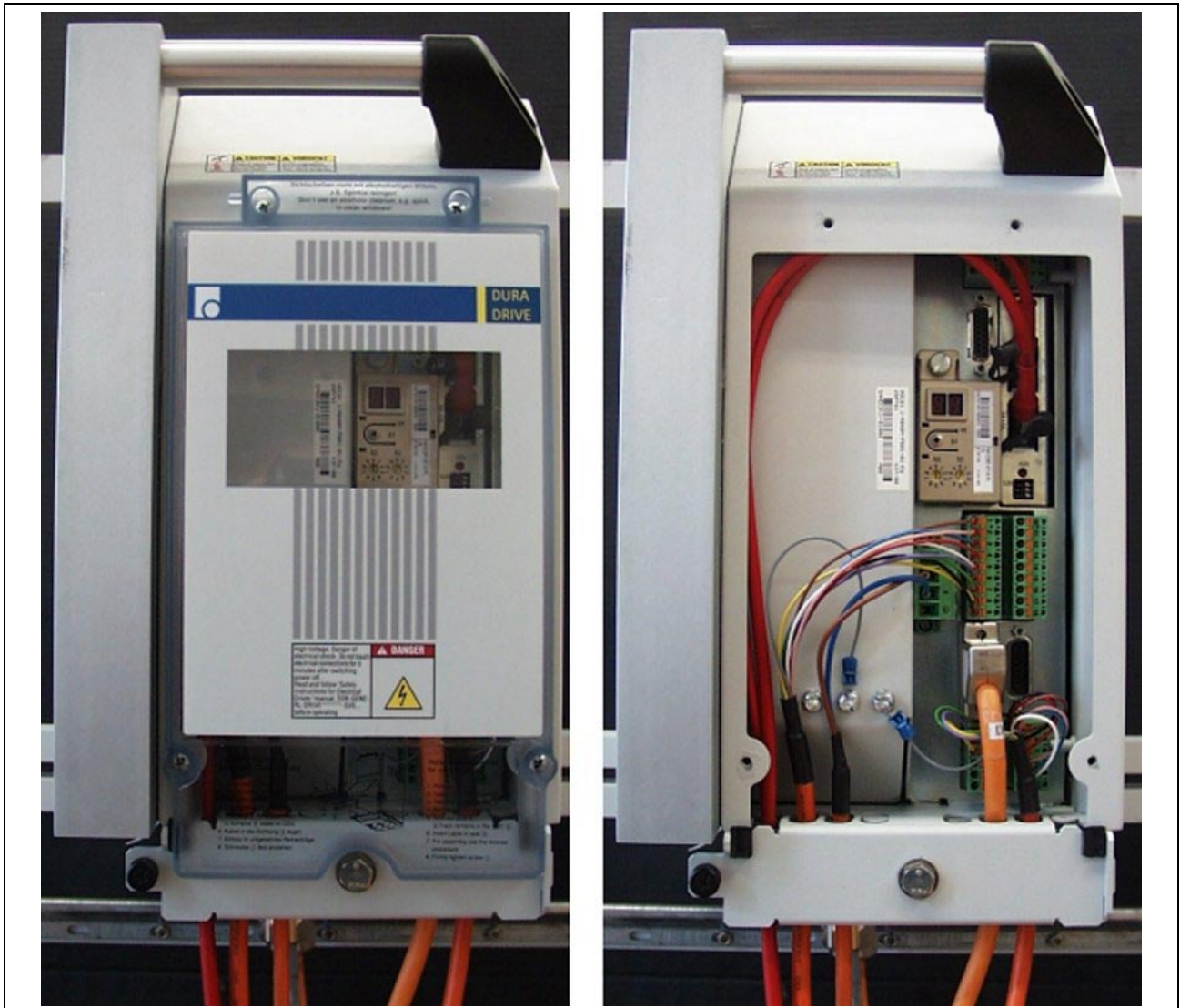


Fig. 12-1: Example: Wire routing and wiring of the drive controller with SERCOS interface

RS485 connector

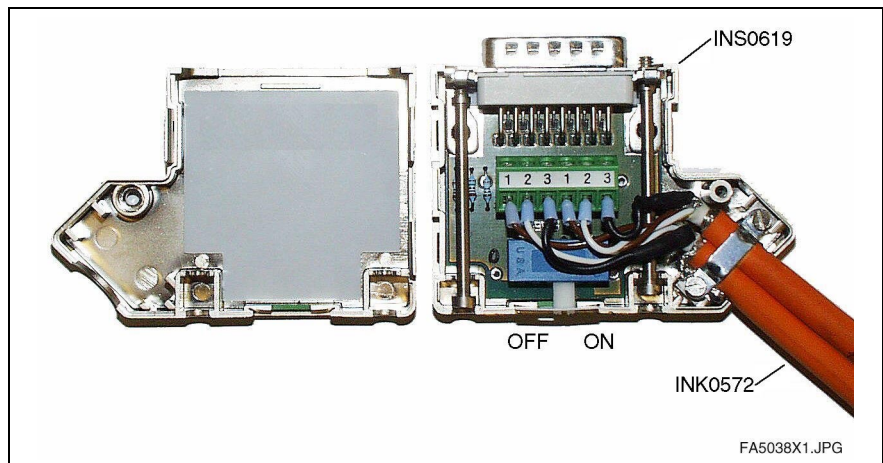


Fig. 12-2: Connecting the RS485 connectors

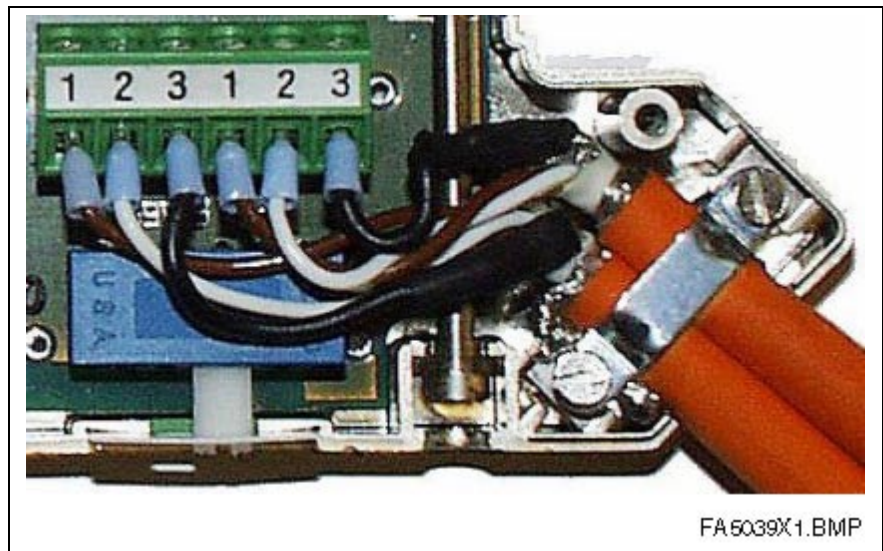


Fig. 12-3: Connecting the RS485 connectors

12.2 What is needed to prepare to start-up

To start up an drive system, the following is needed:

- Measuring equipment
- A PC
- Linking cables (PC-drive controller)

Measuring devices To be able to read off torque, current and velocity in the form of analog signals at the analog outputs, the following measuring equipment is needed:

- Multimeter to take voltage readings (suffices with a serial start-up)
- Oscilloscope or plotter (only needed to record signal paths when commissioning a prototype)

Personal computer (PC) The PC is needed to program, parameterize and diagnose when starting up and servicing.

Hardware requirements:

- IBM compatible
- min. 80486 microprocessor (Pentium 166 or higher recommended)
- at least 16 MB RAM memory
- hard drive with at least 25 MB available memory
- CD-ROM drive
- A free serial RS232 interface on the PC (COM 1 or COM 2)

Software pre-requisites:

- Windows 95/98, NT4.0
- DriveTop start-up program

Link cables (PC-drive controller) 4-11, X2, Serial interface

12.3 Signal sequence HDC01.1

Recommended switching on sequence

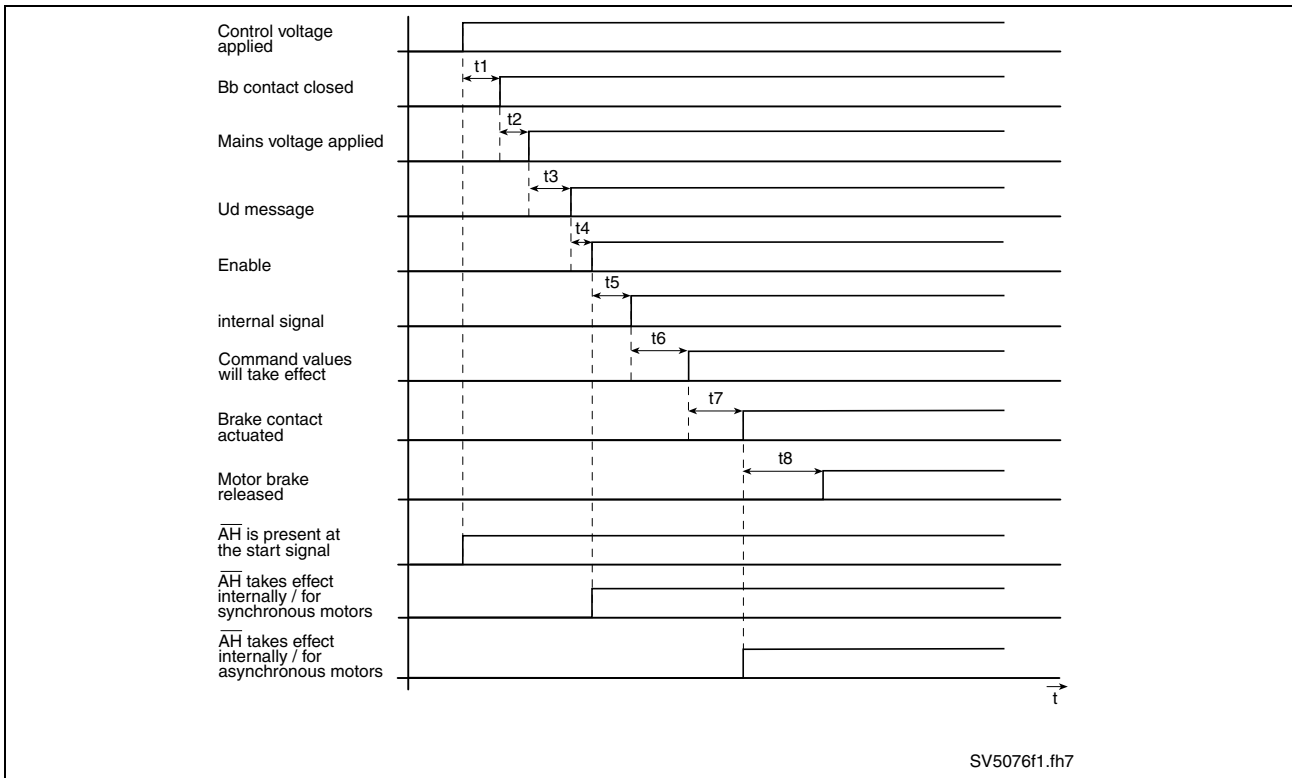


Fig. 12-4: Recommended switching on sequence

- t1: Depends on functions and configuration.
- t2: Made up of "Slow operation of mains contactor K1" and "PLC times".
- t3: See page 4-17, Digital outputs (ready, warning and UD-message)
- t4: Apply signal Enable after signal U_D-Signal.
- t5: Internal delay time 8 ms.
- t6: 300 ms due to field built up in asynchronous motors, not applicable to synchronous motors.
- t7: Internal delay time due to brake relay:
330 ms with asynchronous
30 ms with synchronous motors
- t8: Separation time of brake used, listed in relevant motor project planning manual.

Explanation of chronological sequence

"Control voltage applied"
DC24V – supply at X1

"Bb contact closed"
Bb contact in HDC at X11

"Mains voltage applied"
Power supply at X5,
Start of DC bus discharge procedure

"U_D - Signal"
Signal output at X3

"Enable"
Signal Enable provided by user via field bus.

"Actual brake contact"
Brake contact in HDC at X5 is triggered.
Brake contact parameterized as N/C or N/O (see firmware functional description)

"Motor brake released"
Brake controlled via motor contact has been released.

" $\overline{AH}$ provided"
Signal $\overline{AH}$ (starting signal provided via field bus (see firmware functional description)).

" $\overline{AH}$ is working internally"
Internal signal sequence depends on motor used.

Recommended off sequence

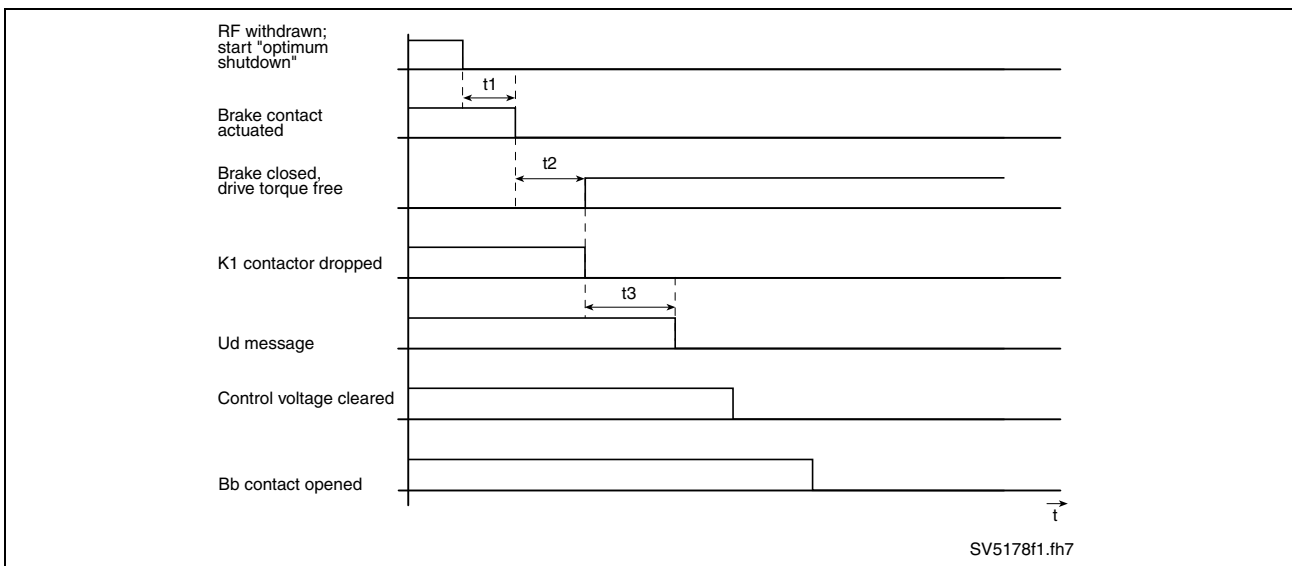


Fig. 12-5: Recommended off sequence

- t1: Brake time of drive
Maximum value parameterizable (see firmware functional description).
- t2: (see firmware functional description)
Brake delay time parameterizable with link time of brake (see relevant motor project manual),
cannot be parameterized in MKDs and MHDs, fixed at 150 ms
- t3: Can be shortened by activating DC bus dynamic brake.

Explanation of chronological sequence

"RF removed"; start "Best possible standstill"
with removal of RF signal the recommended off sequence starts and
"best possible standstill" (see firmware functional description).

"Brake contact actuated":
Brake contact in HDC actuated at X5,
Brake contact parameterizable as N/C or N/O contact (see firmware
functional description)

"Brake closed":
brake connected via brake contact is closed.

"Contactor K1 removed":
start DC bus discharge

"U_D-Signal":
Signal output at X3

"Control voltage removed"
DC24V supply at X1

"Bb contact open":
without DC24V at X1 the Bb relay in HDC is brought into home
position (N/O opened).

Note: Removing the DC24V at X1 causes the Bb contact to open,
the removal of the U_D signal and the loss of the diagnosis
displayed at H1 despite the existing DC bus voltage.

12.4 Cleaning the drive controller



DANGER

High electrical voltage!

⇒ Prior to cleaning switch off the drive controller.
Secure it against switching back on.



WARNING

Burns caused by hot parts with temperatures of more than 30 °C!

⇒ Depending on the work load of the unit and the ambient conditions, the housing and the power heatsink can be very hot. Before starting to work at the unit, allow it to cool down and measure the temperature.



CAUTION

Danger of damages!

⇒ Do not use cleaning tools with sharp edges.
⇒ Do not use aggressive cleaning agents like alcohol.

- Drive controllers with cooling fan unit only: Clean the cooling air inlet using a brush or compressed air.
- Drive controllers with cooling fan unit only: Dismount the cooling air guide (see page 11-4).
- Clean the heatsink and the air guides using a brush or compressed air.
- Drive controllers with cooling fan unit only: Remount the cooling air guide (see page 11-4).

12.5 Directory of standards and guidelines

Standards	Edition	Title
		Principles for computers in safety-related systems
prEN 1921	1995	Industrial automation systems - Safety of integrated manufacturing systems - Basic requirements (ISO 11161:1994 modified)
EN 50170/2	1996-12	"General purpose field communication system; English version EN 50170:1996 Volume 2/3 PROFIBUS"
EN 50254	1998-12	High efficiency communication subsystem for small data packages
EN 60204-1	1997-12	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:1997 + Corrigendum 1998)
EN 60529 + EN 60259/A1	1991-10 2000-02	Degrees of protection provided by enclosures (IP code) (IEC 60529:1989 + A1:1999)
EN 292-1	1991	"Safety of machinery; basic concepts, general principles for design; part 1: basic terminology, methodology"
prEN 292-1	2000-04	"Safety of machinery; basic concepts, general principles for design; part 1: basic terminology, methodology (Identical with ISO/DIS 12000-1); Revision of EN 292-1:1991"
EN 292-2 EN 292-2/A1	1991-09 1995-03	"Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications; German version EN 292-2:1991 + A1:1995"
prEN 292-2	2000-04	"Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications (Identical with ISO/DIS 12000-2); Revision of EN 292-2:1991 and EN 292-2:1991/A1:1995"
EN 61941	1998-08	Electrical equipment of industrial machines - Serial data link for real-time communication between controls and drives (IEC 61491:1995, modified)
EN 954-1	1996-12	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
EN 1037	1995-12	Safety of machinery - Prevention of unexpected start-up
EN 12415	1996-05	Machine tools - Safety - Small numerically controlled turning machines and turning centres
EN 12417	1996-05	Machine tools - Safety - Machining centres
EN 775	1992-10	"Manipulating industrial robots; safety (ISO 10218:1992, modified)"
ISO 11898	1993-11	"Road vehicles - Interchange of digital information - Controller area network (CAN) for high-speed communication; identical with ISO 11898:1993 (Status as of 1994)"
EN 50178	1997-10	Electronic equipment for use in power installations
EN 61800-3	1996-10	Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods (IEC 61800-3:1996)
73/23/EEC	1973-02-19	"Council Directive of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits"
93/68/EEC	1993-07-22	93/68/EEC: COUNCIL DIRECTIVE 93/68/EEC of 22 July 1993 amending Directives 87/404/EEC (simple pressure vessels), 88/378/EEC (safety of toys), 89/106/EEC (construction products), 89/336/EEC (electromagnetic compatibility), 89/392/EEC (machinery), 89/686/EEC (personal protective equipment), 90/384/EEC (non-automatic weighing instruments), 90/385/EEC (active implantable medicinal devices), 90/396/EEC (appliances burning gaseous fuels), 91/263/EEC (telecommunications terminal equipment), 92/42/EEC (new hot-water boilers fired with liquid or gaseous fuels) and 73/23/EEC (electrical equipment designed for use within certain voltage limits)

89/336/EEC	1989-05-03	COUNCIL DIRECTIVE of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC)
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Fig. 12-6: Standards and guidelines

Norm	Ausgabe	Titel
DIN V VDE 0801	1990-01	Grundsätze für Rechner in Systemen mit Sicherheitsaufgaben
E DIN EN 1921	1995-10	Industrielle Automatisierungssysteme - Sicherheit von integrierten Fertigungssystemen - Grundlegende Anforderungen (ISO 11161:1994, modifiziert)
DIN EN 50170/2	1997-07	"Universelles Feldkommunikationssystem; Englische Fassung EN 50170:1996 Band 2/3 PROFIBUS"
DIN EN 50254	1999-07	Kommunikationssystem mit hoher Effizienz für kleine Datenpakete
DIN EN 60204-1, VDE 0113 Teil 1	1998-11	Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen - Teil 1: Allgemeine Anforderungen (IEC 60204-1:1997 + Corrigendum 1998)
DIN EN 60529, VDE 0470 Teil 1	2000-09	Schutzarten durch Gehäuse (IP-Code) (IEC 60529:1989 + A1:1999)
DIN EN 292-1	1991-11	"Sicherheit von Maschinen; Grundbegriffe, allgemeine Gestaltungsleitsätze; Teil 1: Grundsätzliche Terminologie, Methodik"
E DIN EN 291-1	2000-06	"Sicherheit von Maschinen; Grundbegriffe, allgemeine Gestaltungsleitsätze; Teil 1: Grundsätzliche Terminologie, Methodik (Identisch mit ISO/DIS 12100-1); Überarbeitung von EN 292-1:1991"
DIN EN 292-2	1995-06	"Sicherheit von Maschinen - Grundbegriffe, allgemeine Gestaltungsleitsätze - Teil 2: Technische Leitsätze und Spezifikationen; Deutsche Fassung EN 292-2:1991 + A1:1995"
E DIN EN 292-2	2000-06	"Sicherheit von Maschinen - Grundbegriffe, allgemeine Gestaltungsleitsätze - Teil 2: Technische Leitsätze und Spezifikationen (Identisch mit ISO/DIS 12100-2); Überarbeitung von EN 292-2:1991 + EN 292-2:1991/A1:1995"
DIN EN 61941	1999-11	Elektrische Ausrüstung von Industriemaschinen - Serielle Datenverbindung für Echtzeit-Kommunikation zwischen Steuerungen und Antrieben (IEC 61491:1995, modifiziert)
DIN EN 954-1	1997-03	Sicherheit von Maschinen - Sicherheitsbezogene Teile von Steuerungen - Teil 1: Allgemeine Gestaltungsleitsätze
DIN EN 1037	1996-04	Sicherheit von Maschinen - Vermeidung von unerwartetem Anlauf
DIN EN 12415	1996-08	Werkzeugmaschinen - Sicherheit - Kleine numerisch gesteuerte Drehmaschinen und Drehzentren
DIN EN 12417	1996-08	Werkzeugmaschinen - Sicherheit - Bearbeitungszentren
DIN EN 775	1993-08	"Industrieroboter; Sicherheit (ISO 10218:1992, modifiziert)"
DIN ISO 11898	1995-08	Straßenfahrzeuge - Austausch digitaler Informationen - Steuergerätenetz (CAN) für schnellen Datenaustausch (ISO 11898:1993) (Stand 1994)
DIN EN 50178 VDE 0160	1998-04	Ausrüstung von Starkstromanlagen mit elektronischen Betriebsmitteln
DIN EN 61800-3	1997-08	Drehzahlveränderbare elektrische Antriebe - Teil 3: EMV-Produktnorm einschließlich spezieller Prüfverfahren (IEC 61800-3:1996)
73/23/EWG	1973-02-19	Richtlinie des Rates vom 19. Februar 1973 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen
93/68/EWG	1993-07-22	Richtlinie 93/68/EWG des Rates vom 22. Juli 1993 zur Änderung der Richtlinien 87/404/EWG (einfache Druckbehälter), 88/378/EWG (Sicherheit von Spielzeug), 89/106/EWG (Bauprodukte), 89/336/EWG (elektromagnetische Verträglichkeit), 89/392/EWG (Maschinen), 89/686/EWG (persönliche Schutzausrüstungen), 90/384/EWG (nichtselbsttätige Waagen), 90/385/EWG (aktive implantierbare medizinische Geräte), 90/396/EWG (Gasverbrauchseinrichtungen), 91/263/EWG (Telekommunikationsendgeräte), 92/42/EWG (mit flüssigen oder gasförmigen Brennstoffen beschickte neue Warmwasserheizkessel) und 73/23/EWG (elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen)

89/336/EWG	1989-05-03	Richtlinie des Rates vom 3. Mai 1989 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit
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14 Service & Support

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über Service-Call Entry Center Mo-Fr 07:00-18:00
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- per e-Mail: **service@indramat.de**

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

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Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

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After helpdesk hours, contact our service department directly at

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14.3 Internet

Weitere Hinweise zu Service, Reparatur und Training finden Sie im Internet unter

www.indramat.de

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit Ihrem lokalen Ansprechpartner auf. Die Adressen sind im Anhang aufgeführt.

Additional notes about service, repairs and training are available on the Internet at

www.indramat.de

Please contact the sales & service offices in your area first. Refer to the addresses on the following pages.

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2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel./Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

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