User Guide
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Electrical converter
EC-C1700B-420



Revision history

Table of revisions

Date	Changed	Rev
June 2026	Section updated: Storage	0106
March 2026	Sections updated: General specifications, Safety features, Dismounting and disposal of the electric device	0105
August 2024	Section updated: Low voltage connections	0104
June 2024	New section added: Disposal of the electric device. Sections updated: Electrical connections and Storage	0103
October 2023	Section updated: Electrical installation	0102
June 2023	First edition	0101

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General information

Intended use of the user guide

This user guide contains the installation, operation and maintenance instructions for the EC-C1700B-420 electrical converter.

This user guide contains instructions necessary to safely and properly handle, install and maintain the electric device. They should be brought to the attention of anyone who installs or maintains the electric device or associated equipment.

All of the safety warnings and instructions in this user guide must be followed to prevent injury to personnel or damage to property. Only qualified and authorized personnel, familiar with health and safety requirements and national legislation, shall be permitted to handle, install and maintain the device.

This user guide must be kept for future reference during installation, operation and maintenance.

This user guide uses illustrations as examples only. Illustrations in this user guide may not necessarily reflect all system features.

Product naming convention

In this user guide, the EC-C1700B-420 electric converter is referred to as the electric device.

The following naming convention is used to refer to electric device type code and options:

- EC-C1700B-420-L-SW11+MC/+AFE/+UG

The rating plate of the electric device has the correct name of that particular electric device.

Part of the name	Explanation
EC	Electric Converter
C1700B	Product name part 1
420	Product name part 2
L	Hardware variant
SW11	Software version
+MC*	Motor Control software -option
+AFE*	Active Front End software -option
+UG*	Microgrid (µgrid) software -option

*Followed with number that represents the nominal current (A_{RMS}): 95, 130, 175, 210. These options are available on the same electric device or alone.

Options are presented in the Table below. Standard options are indicated by a star (*).

EC-C1700B-420 options

Variant	Code	Description	Additional information
Hardware variant	-L	Device internal components	Definition for isolation resistance, discharge resistor and y-capacitance sizing
Software version	-SW11	Software version 11.x	Software version of the unit is the latest version of 11-series software

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EC-C1700B-420 options (continued)

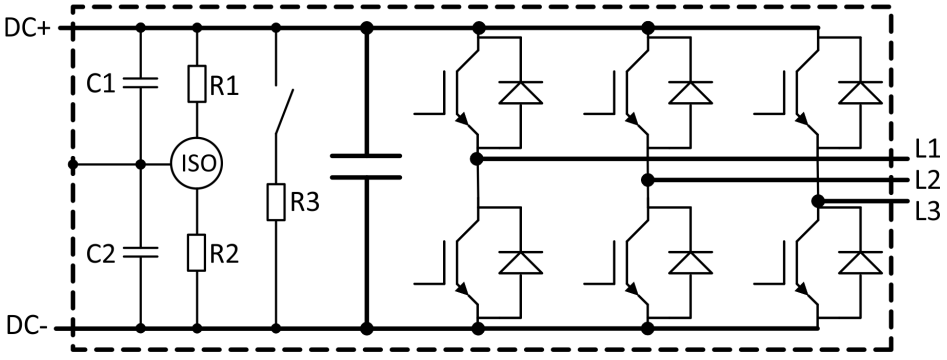
Variant	Code	Description	Additional information
Control	+MC95	Motor control, current limit 95 A	Converter for motor/generator applications
	+MC130	Motor control, current limit 130 A	Converter for motor/generator applications
	+MC175	Motor control, current limit 175 A	Converter for motor/generator applications
	+MC210	Motor control, current limit 210 A	Converter for motor/generator applications
	+AFE95	Active front end, current limit 95 A	Converter for active front end applications
	+AFE130	Active front end, current limit 130 A	Converter for active front end applications
	+AFE175	Active front end, current limit 175 A	Converter for active front end applications
	+AFE210	Active front end, current limit 210 A	Converter for active front end applications
	+UG95	Microgrid, current limit 95 A	Converter for microgrid applications
	+UG130	Microgrid, current limit 130 A	Converter for microgrid applications
	+UG175	Microgrid, current limit 175 A	Converter for microgrid applications
	+UG210	Microgrid, current limit 210 A	Converter for microgrid applications
Communication	*	CAN1939	EC-C with Standard SAE1939-communication
	+CO	CANopen	EC-C with CANopen-communication
Connections	*	Normal connections	EC-C with default HV connections
	+CE1	Connection extension 1	EC-C with double DC and AC connectivity with connection extension box 1 (double M25 cable gland threads) (Not compatible with +DCE option)
	+CE2	Connection extension 2	EC-C with M32 cable gland threads on AC connection with connection extension box 2 (choose also +DCE if double DC connection is required)
	+DCE	DC-extension	EC-C with double DC-connections: copper bushings for double connection (compatible with +CG4)

EC-C1700B-420 options (continued)

Variant	Code	Description	Additional information
Cable glands	*	No cable glands	EC-C with no cable glands or plugs
	+CG1	Default M25 cable glands	EC-C with 5x M25 cable glands and 2x M25 plugs
	+CG2	Default M25/M32 cable glands	EC-C with 2x M25 cable glands, 3xM32 cable glands and 3xM25 plugs (for +CE2 option)
	+CG3	Default M25 cable glands	EC-C with 10x M25 cable glands (for +CE1 option)
	+CG4	Default M25 cable glands	EC-C with 7x M25 cable glands (for +DCE option)
	+CG5	Default M25/M32 cable glands	EC-C with 4x M25 cable glands, 3xM32 cable glands and 3xM25 plugs (for combined +CE2 and +DCE options)
	+CG6	Default M25 cable glands	EC-C with 8x M25 cable glands and 2x M25 plugs (for +CE1 option with single DC-link connections)
Marine classification	*	No marine classification	
	+CL1		ABS American Bureau of Shipping
	+CL2		BV Bureau Veritas
	+CL3		DNV
	+CL4		LR Lloyd's Register
	+CL5		RINA
	+CL6		CCS China Classification Society
Customer specific	*	Default unit firmware-wise	EC-C with no pre-set parameters or application
	+CS	Customer specific parameters or application in FW	EC-C with separately specified application and/or parameters

Isolation measurement resistance, DC-link discharge resistor and Y-capacitor values are shown in the Figure and Table below.

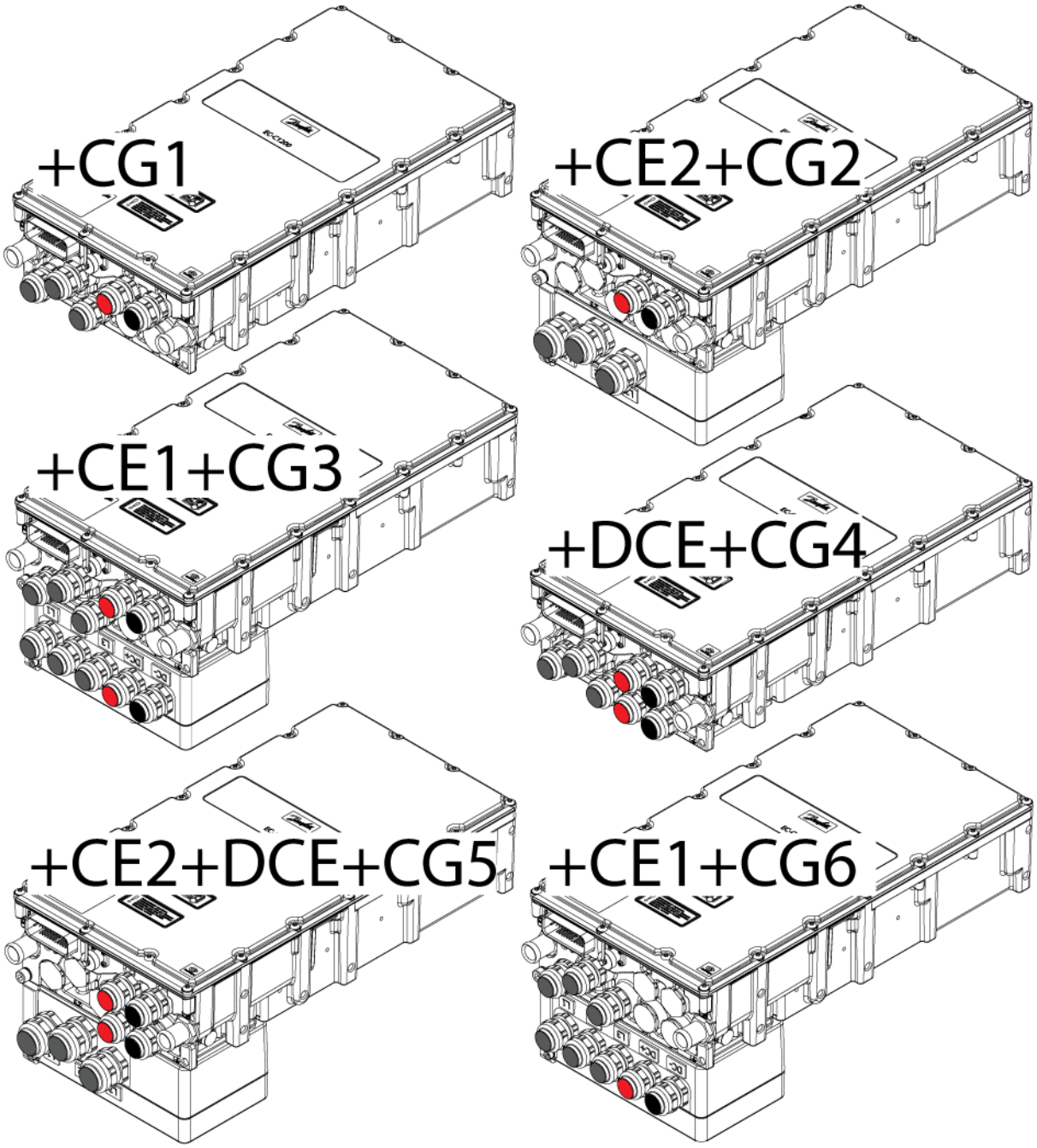
System schematics



System component values

System option	Component	Value
-L	Resistors R1 and R2 (isolation measurement)	240 MΩ
	Resistor R3 (discharge)	68 kΩ
	Capacitors C1 and C2 (Y-capacitors)	3.3 nF
	Capacitor C3	0.55 mF
	Isolation resistance from DC-link to enclosure	120 MΩ

Connection options



Color coding

Color	Meaning
Gray	Cable glands for phases
Red	Cable glands for DC+
Black	Cable glands for DC-

Conformity according to standards

The electric device has been designed in accordance with the essential parts of the following directives and to meet the requirements of the standards:

Applicable directives and standards

Directives / Standards	Explanation
Low Voltage Directive 2014/35/EU	The low voltage directive (LVD) (2014/35/EU) ensures that electrical equipment within certain voltage limits provides a high level of protection for European citizens, and benefits fully from the single market. It has been applicable since 20 April 2016.
The electromagnetic compatibility (EMC) Directive 2014/30/EU	EMC directive ensures that electrical and electronic equipment does not generate, or is affected by, electromagnetic disturbance.
EN 61800-5-1: 2007	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy.
EN ISO 13766-1:2018	Construction machinery. Electromagnetic compatibility of machines with internal electrical power supply – Part 1: General EMC requirements under typical electromagnetic environmental conditions.
UNECE R10 Revision 6	Uniform provisions concerning the approval of vehicles with regard to electromagnetic compatibility. Compliant with: • Immunity to surge on DC power lines • Immunity to EFT on DC power lines • Immunity to conducted transients • Immunity to electromagnetic radiation • Conducted emissions on network and telecommunication access • Conducted transient emissions • Radiated broadband and narrowband emissions

Warranty

Danfoss offers warranty against defects in workmanship and materials for its products. For more information, see General terms and conditions of sale at *https://www.danfoss.com/en/terms/sales-conditions/*.

Warranty validity requires adherence to the instructions in this document and all related materials, including product installation and maintenance guidelines, and compliance with all applicable national standards and regulations.

The warranty does not cover defects resulting from improper or negligent use, operation, or installation; failure to perform regular preventive maintenance; or damage caused by external factors or the use of non-Danfoss supplied/recommended equipment and components.

Any unauthorized repairs or modifications made without Danfoss' prior written consent will invalidate the warranty.

Terms and abbreviations

The following tables define symbols, terms, and abbreviations that may appear in this user guide.

Term/ Abbreviation	Explanation
AC	Alternating current
DC	Direct current
EMC	Electromagnetic compatibility

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Term/ Abbreviation	Explanation
EMI	Electromagnetic interference
GND	Ground in electrical connections
HV	High voltage
IMD	Insulation measurement device
I/O	Input / Output
LV	Low voltage
MCB	Miniature circuit breaker
RCD	Residual current device

Symbol	Variable	Unit
U_{DC}	DC link voltage	V
U_{ac}	AC output voltage	V
I_n	Rated current	A_{rms}
P_n	Rated power	kW
$f_{in/out}$	Input / Output frequency	Hz
f_{switch}	Switching frequency	kHz
I_{peak}	Overcurrent limit	A
Q_c	Rated coolant liquid flow	l/min
T_c	Rated coolant liquid input temperature	°C
T_{amb}	Rated ambient temperature	°C
R	Resistance	Ω

Responsibility of the manufacturer

Danfoss is responsible for the safety, reliability and performance of the electric device only if:

- Handling, mounting, installation, operation and maintenance are carried out by qualified and authorized service personnel.
- The installation of the system complies with the requirements of the appropriate regulations.
- The electric device is used in accordance with the instructions in this user guide.
- The electric device is installed, maintained and serviced in accordance with the instructions in this user guide.

Safety information

General safety statement

The electric device is intended for use as a component for industrial and commercial installations. The end product containing the electric device must conform with all related regulations.

The use of the electric device is prohibited in hazardous areas unless it is expressly designed for such use.

The electric device is intended for installation, use and maintenance by qualified personnel, familiar with health and safety requirements and national legislation. Ignoring these instructions may invalidate all applicable warranties.

These instructions must be followed to ensure safe and proper installation, operation and maintenance of the electric device. They should be brought to the attention of anyone who installs, operates or maintains the electric device or associated equipment.

High voltage and rotating parts can cause serious or fatal injuries. For the electric device covered by this user guide, it is important to observe safety precautions to protect personnel from possible injury.

Safety message signal words

Safety message signal words indicate the severity of a potential hazard.

DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. CAUTION may also alert against unsafe practices

NOTICE Indicates a potentially hazardous situation which, if not avoided, could result in property damage.

Safety symbols

The following safety and information related symbols may exist in this user guide and on the electric device.

	**Danger** **This symbol is identified by a yellow background, red octagonal band and a black STOP text. It indicates a hazardous situation that causes severe injury or death. Action indicated by this symbol may not be executed.**
	**General warning** **This symbol is identified by a yellow background, black triangular band, and a black exclamation point symbol. It indicates a general potentially hazardous situation.**
	**Electric shock warning** **The symbol is identified by a yellow background, black triangular band, and a black arrowhead symbol. It indicates dangerous electrical voltage that could cause an electric shock to a person.**
	**Burn warning** **The symbol is identified by a yellow background, black triangular band, and a black wavy lines- symbol. It indicates a hot device that could cause burns to a person.** **The symbol also indicates that the device should be placed and installed so that contact with its potentially hot surface is not possible.**
	**Magnet warning** **The symbol is identified by a yellow background, black triangular band, and a black magnet symbol. It indicates strong magnetic field that could cause harm to a person or property.**
	**Poison warning** **The symbol is identified by a yellow background, black triangular band, and a skull and crossbones symbol. It indicates a poisonous substance that could kill or cause an injury to a person.**
	**Electric shock warning - Read the instructions in the user guide.**

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	**General Information.**
	**Read the instructions in the manual.**

Personal protective equipment

Personal protective equipment shall be used when necessary during handling, installation and maintenance of the electric device to avoid injury.

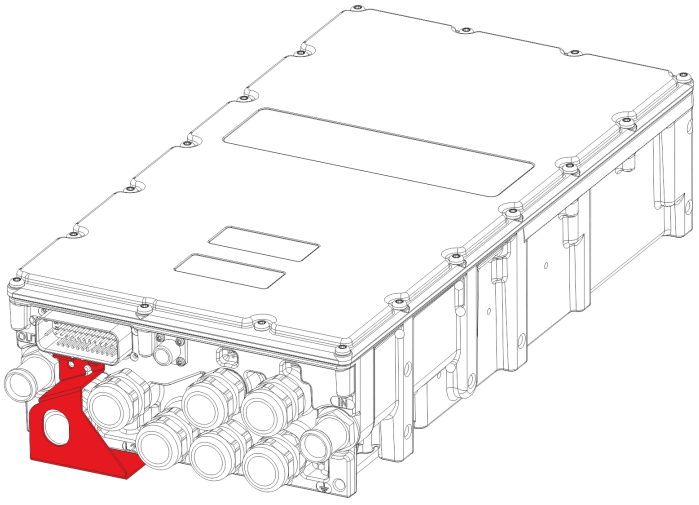
	**Use eye protective equipment like safety goggles or mask when you work with the electric device. Permanent damage to the eye could be caused by splashing fluids or other substances.**
	**Use hearing protective equipment when you work on the electric device. Hearing injuries can be caused by too loud noise (noise in excess of 85 dBA).**
	**Use head protective equipment like helmet when you lift the electric device! Head injuries can be caused by object impact.**
	**Use cut resistant gloves when you handle and maintain the electric device. There is a risk of cut injuries.**
	**Use protective footwear when you lift or move the electric device! Foot injuries could be caused if lifting system or lifting brackets fail.**

Safety features

Protection type	Built-in	Information
Overvoltage	Yes	1300 V_{DC}
Short circuit	Yes	-
Overspeed (+MC -option only)	Yes	Adjustable according to controlled motor
Overheat (electric device internal temperature)	Yes	Sophisticated thermal model that can lower the current if needed
Emergency stop	Yes	Hardware secured device switch OFF feature

In addition to the electrical protection features, the electric device has mechanical safety feature, a connector shield, which prevents direct entry to the power terminals, when the electric device is powered ON. The connector shield is a sheet metal component, which secures the power terminal cover and it cannot be released without disconnecting the control signal connector (X1-connector) first. When X1-connector is disconnected, it shuts down the electric device and starts electrical energy discharging process.

Connector shield (mechanical safety feature)



Electromagnetic compatibility (EMC)

	**When connecting to other equipment, ensure that only specified and compatible components of the system are used.**
	**Individuals with heart pacemakers, metal implants, or hearing aids should be aware that electric machines generate magnetic and electromagnetic fields that can be a health hazard.** **These individuals should consult a doctor due to the risks posed by current-carrying conductors and permanent magnets before entering the following areas:** • **Areas where electrical equipment and parts are operating** • **Areas where electrical equipment with permanent magnets is stored, assembled, operated, or repaired** **If necessary, perform a dedicated EMC test on the installation.**

Electromagnetic compatibility (EMC) is the ability of electrical equipment to function correctly in its electromagnetic environment without causing interference to other devices. Meeting EMC requirements is a legal obligation for all equipment used within the European Economic Area (EEA)

Our products are designed with high standards of EMC in mind. Connect the power cables and groundings along the instructions in this user guide to achieve the required level of electromagnetic interference (EMI) shielding.

The installer is responsible for ensuring that the equipment or system into which this product is integrated complies with the EMC legislation of the country where it will be used. Within the European Union, equipment incorporating this product must comply with the EMC Directive 2014/30/EU.

Installation safety

	**Only trained and qualified personnel familiar with the relevant safety requirements can install the electric device. If the electric device is installed incorrectly it may lead to safety hazard.**
	**Make sure of correct grounding connections. Do not run the electric device without correctly attached protective earth conductor. The grounding cable must be sufficient to carry the maximum supply fault current which is normally limited by the fuses or Miniature Circuit Breaker (MCB). Suitably rated fuses or MCB should be fitted in the mains supply of the electric device, by the local legislation and recommendations.**
	**Use only correct (type and rating) protective fuses with the high voltage DC-system.**

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	**Do not do any work on the electric device control cables when the power is applied to the electric device or to the external control circuits.**
	**The control input functions of the electric device – for example stop/start must be secured using independent channel protection in safety critical applications. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment and improve control signal protection if needed.**
	**Do not activate the automatic fault reset function on any system, where this may cause a potentially dangerous situation. Reason for every fault situation should be determined before resetting the fault.**
	**Make sure that the supply voltage corresponds to the specification of the electric device.**
	**Do not attempt to repair the electric device. In the case of suspected fault or malfunction, contact Danfoss or Danfoss authorized service center for further assistance.**
	**When you install the electric device, make sure that the cooling system and the used coolant meet the specifications of the manufacturer. Make sure that the cooling system is in use when the device is powered.**
	**If the control cabling is installed close with the power cabling, make sure that minimum separation distance is 100 mm and crossings are at 90 degrees. Make sure that all terminal connections are tightened correctly by the instructions.**
	**Electric device must not be opened (excluding the connection box lid). Any attempt causes loss of warranty.**
	**Within the European Union, all machinery in which this product is used must comply with Directive 98/37/EC, Safety of Machinery. In particular, the machine manufacturer is responsible for providing a main switch and ensuring the electrical equipment complies with EN60204-1.**
	**Use correct personal protective equipment when you are near the electric device.**
	**Read the instructions in this user guide before you start to install the electric device.**

Operation safety

	**Do not use the electric device without correctly dimensioned and operating cooling system.**
	**Maximum operation temperature must not be exceeded to avoid permanent damage to the electrical device.**
	**The requirements of this user guide and other related instructions and standards must be followed.**
	**Do not touch the electric device during operation. The surface of the electric device can be hot.**

	**This electric device is intended for professional use as a part of complete equipment or system. The electric device uses high voltages and currents, and it has large amounts of stored electrical energy. Close attention is required to system design and electrical installation to avoid hazards in either normal operation or in the event of equipment malfunction.**
	**The electric device can only be used in the applications it is intended for. The rated nominal values and operational conditions are shown in the rating plate.**

Product overview

General specifications

Electric device

The electric device is a heavy-duty converter designed especially for electric or hybrid drive trains for mobile work machines, buses or marine vessels. Depending on the options selected, it can act as a motor inverter (+MC option), active front end (+AFE option) or it can create a microgrid (+UG option).

The advantages and features of the electric device:

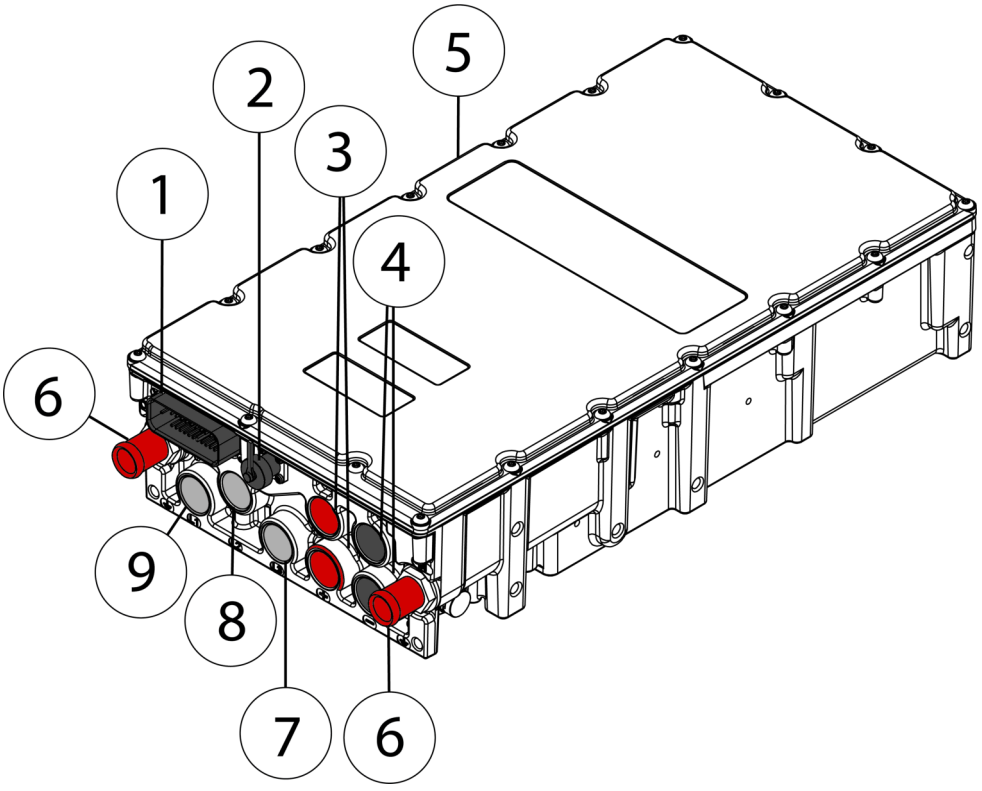
- Extremely compact structure, weight only 14 kg.
- Robust design withstanding high levels of mechanical vibrations and shocks.
- High protection class IP6K9K ensuring operation in extreme conditions.
- Wide ambient operating temperature range from -40°C...+85°C.
- Liquid cooling.
- Wide allowed coolant temperature range.
- Multiple mounting possibilities.
- Designed especially for highly cyclical loads typical in heavy mobile work machines.
- Controls both induction and permanent magnet motors with or without sensor.
- Speed and torque reference motor control.
- Generator control mode for DC-link voltage control.
- Flexible control interface – CAN, resolver, analog, digital inputs/outputs.
- PowerUSER PC-program for commissioning available.
- Various communication protocols, for example, CANopen, SAE J-1939.
- High performance vector control.
- Wide selection of protective safety functions.

These electric devices are designed for variety of applications:

- Converting alternating current (AC) from electrical generator to direct current (+MC option) for energy storage
- Active Front End for connecting to AC grid with regenerative power and low harmonic. (+AFE option)
- Creating standalone microgrid (+UG option)

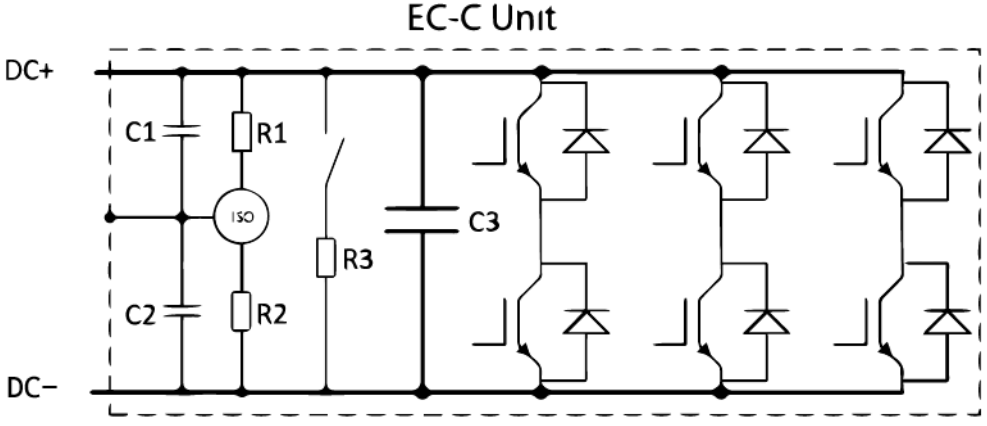
Note that +AFE and +UG options require an external LCL-filter unit or a transformer and LC-filter combination.

Main components



1	X1-connector (Low voltage connector for measurement data and control signals)
2	X2-connector (maintenance connector)
3	DC+
4	DC-
5	EC-C unit
6	Electric device cooling connections 2 x 20 mm
7	LV3
8	LV2
9	LV1

Electric device power connection diagram



Protections and limits for options:

The options for EC-C1700B-420 have certain protections and limits that affect their function. The difference between protections and limits is that protections stop all high voltage functions of the electric device immediately, whereas limits only limit the functions instead of stopping them.

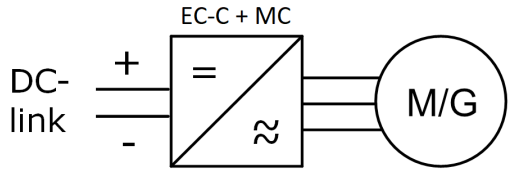
Overcurrent and short circuit trips protect the device from overcurrent and short circuits on the AC side of the device. First protection is a configurable software based overcurrent trip, where the trip level can be set by the user. Second protection is a hardware based overcurrent trip with fixed trip current level of 750 A_{peak} (reaction time <15µs). In most cases, the hardware overcurrent trip protects the device also from short circuits. In case even the hardware overcurrent trip fails, the final protection is a short circuit trip that has maximum current value of 3810 A_{peak} (self-limiting, reaction time <2µs).

In the following Sections, the protections and limits are listed for each option.

Motor Control (+MC option, motor and generator control)

Motor control option is used to control the speed and torque of electrical machines and also converting alternating current (AC) from electrical generator to direct current (DC) for energy storage.

Motor Control application example



Motor Control characteristics

Controllable motor types	• Synchronous permanent magnet motors • Asynchronous induction motors • Special features to control Danfoss synchronous reluctance assisted permanent magnet motors.
Control principle	• Rotor flux oriented current vector control
Reference types	• Torque reference motor control • Speed reference motor control • Generator control mode for regulating the DC-link voltage
Field weakening control	• Maximizes the field weakening performance by optimizing the use of inverter current and torque production capability of the motor.
Working point optimization	• Maximum torque per ampere working point optimization is used to improve efficiency of the motor.

Motor Control protections and limits

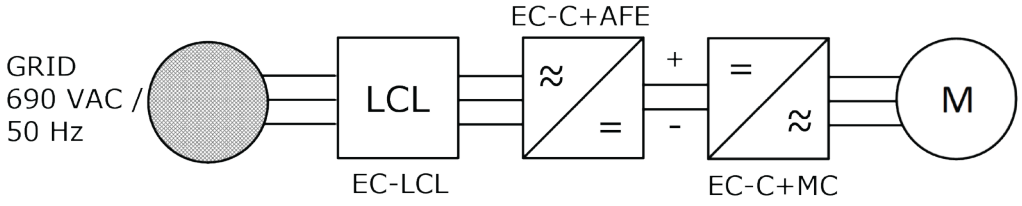
Protections
Software overcurrent trip (configurable)
Hardware overcurrent trip (fixed 750 A_{peak}, AC-side)
Short circuit trip
Software overvoltage trip (configurable)
Hardware overvoltage trip (fixed 1300 V_{DC}, DC-link voltage)
Inverter overtemperature trip (measured)
Inverter overtemperature trip (estimated)
Electric machine temperature surveillance and trip (configurable)
Over speed trip (configurable)
Undervoltage trip (configurable, DC-link voltage)
Earth fault trip
Phase loss trip

Limits
Speed limit positive
Speed limit negative
Torque limit positive
Torque limit negative
Mechanical power limit positive (motoring)
Mechanical power limit negative (generating)
DC current limit positive (motoring)
DC current limit negative (generating)
Overvoltage controller (DC-link voltage)
Undervoltage controller (DC-link voltage)
Electric machine configurable derating according to winding temperature
Back-emf max. value limit

Active Front End (+AFE option)

Active Front End is used for connecting to AC grid with regenerative power and low harmonic. In addition, it is used for bidirectional connection to AC grids.

Active Front End application example



Active Front End protections and limits

Protections
Software overcurrent trip (configurable)
Hardware overcurrent trip (fixed 750 A_{peak})
Short circuit trip
Software overvoltage trip (configurable)
Hardware overvoltage trip (fixed 1300 V_{DC})
Inverter overtemperature trip (measured)
Inverter overtemperature trip (estimated)
Over frequency trip
Under frequency trip
Grid loss trip

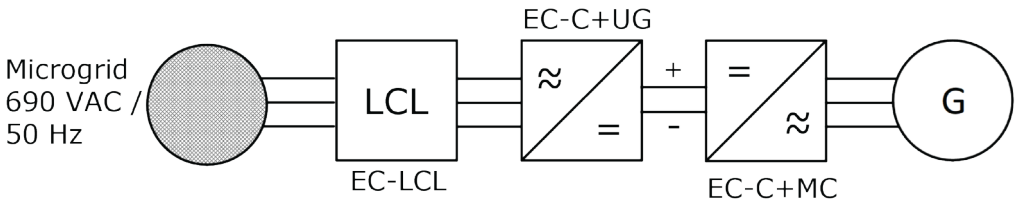
Limits
Electrical power limit positive (DC to AC)
Electrical power limit negative (AC to DC)
DC current limit positive (DC to AC)
DC current limit negative (AC to DC)
AC current limit (any direction)
Overvoltage controller (DC-link voltage)
Undervoltage controller (DC-link voltage)

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Microgrid (+UG option)

Microgrid (+UG) option is used for creating a stand-alone island grid.

Microgrid application example



Microgrid protections and limits

Protections
Hardware overcurrent trip (fixed 750A_{peak})
Short circuit trip
Software overvoltage trip (configurable)
Hardware overvoltage trip (fixed 1300 V_{DC})
Inverter overtemperature trip (measured)
Inverter overtemperature trip (estimated)

Limits
Output voltage reduction in overcurrent situation
Frequency reduction in overcurrent situation
Grid voltage reduction in low DC-link situation

Intended use of the electric device

	**The electric device is intended only for professional use. Installation, operation and maintenance of the electric device is permitted only for trained personnel and professionals.**
	**The electric device is intended for installation as a part of complete power generation equipment or system.**

Typical applications for the electric device:

- System component, functioning as a speed and torque controller for electric motors
- System component, functioning as a current converter, converting alternating current (AC) from electric generator to direct current (DC) for energy storage.

For product specific and up to date information see product data sheets at *https://www.danfoss.com/*.

Prohibited use of the electric device

It is prohibited to use, handle, maintain and store the electric device in the following ways (including but not limited to):

- Using the electric device for other purposes than defined in the user guide.
- Disregarding the obligation to comply with the user guide, safety signs and rating plate of the electrical device.
- Using the electric device, making adjustments and maintenance without first reading the user guide.
- Exceeding the designed limits during the operation.
- Using non-original service parts of wrong material causing corrosion problems and mechanical failures in time.
- Operating and performing maintenance on the electric device without appropriate personal protective equipment.
- Using the electric device for supporting other structures or indirect movements.

- Causing any kind of impact forces to the electric device (for example hitting or hammering or dropping objects).
- Operating the electric device with electric connections other than defined in the user guide.
- Operating the electric device with insufficiently tightened connections or cable glands.
- Operating the electric device with power cables routed against the instructions.
- Operating the electric device without properly dimensioned and operating cooling system.
- Accessing the connection box(es) of the electric device, performing maintenance or adjustment operations without securing that the electricity is disconnected and electric device is discharged as defined in the user guide.
- Lifting the electric device with additional load attached.
- Using the electric device in potentially explosive environment.
- Allowing dirt or liquid to enter into the electric device or connection box.
- Using cables that can not withstand the maximum current values of the electric device.
- Using dirty cable lugs or broken tools.
- Connecting power cables so that there is less than 10 mm air gap between the cable lug and other metallic structure (including the braid of the cable).
- Storing the electric device contrary to the guidelines presented in this user guide, for example, outdoors in wet or dusty conditions.
- Storing the electric device without proper support that prevents overturning and falling.

For product specific and up to date information see product data sheets at *https://www.danfoss.com/*.

System introduction

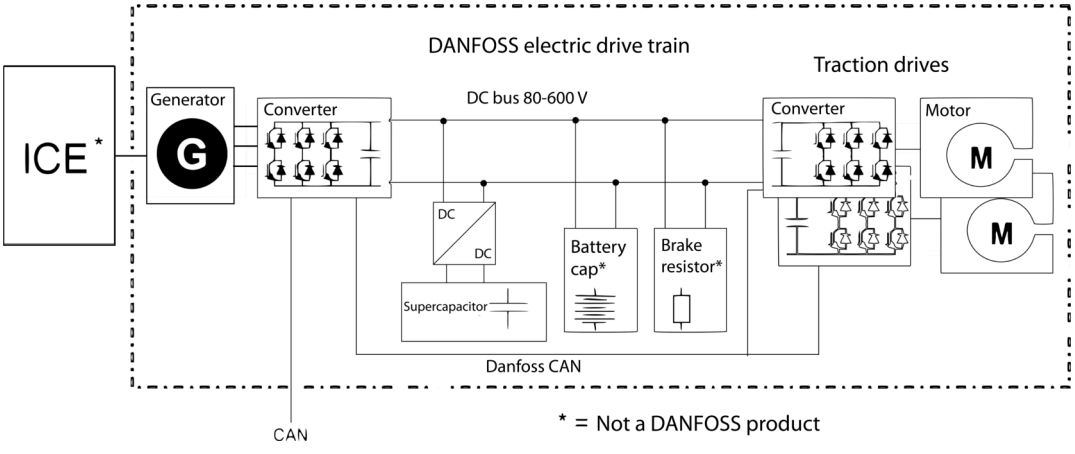
Danfoss provides electric drivetrains for applications in heavy mobile work machines, marine vessels and transportation vehicles. The drivetrains include all essential components for converting from traditional to hybrid electric (HEV) or electric vehicle (EV) solutions. This technology saves fuel and lowers emission and noise levels.

The electrical devices are an essential part of the electric drivetrain system. Typically they are used as a speed and torque controller for electric motors and as a current converter, converting alternating current (AC) from electric generator to direct current (DC) for energy storage.

The electric device is capable for supplying three-phase alternating current, powering and controlling electric machines, for example the EM-PMI product family electric machines.

Electric converter products are designed for controlling the flow of power in heavy-duty, marine and transportation applications.

Overview of the drivetrain system (for reference only).



Cooling

Cooling system requirements

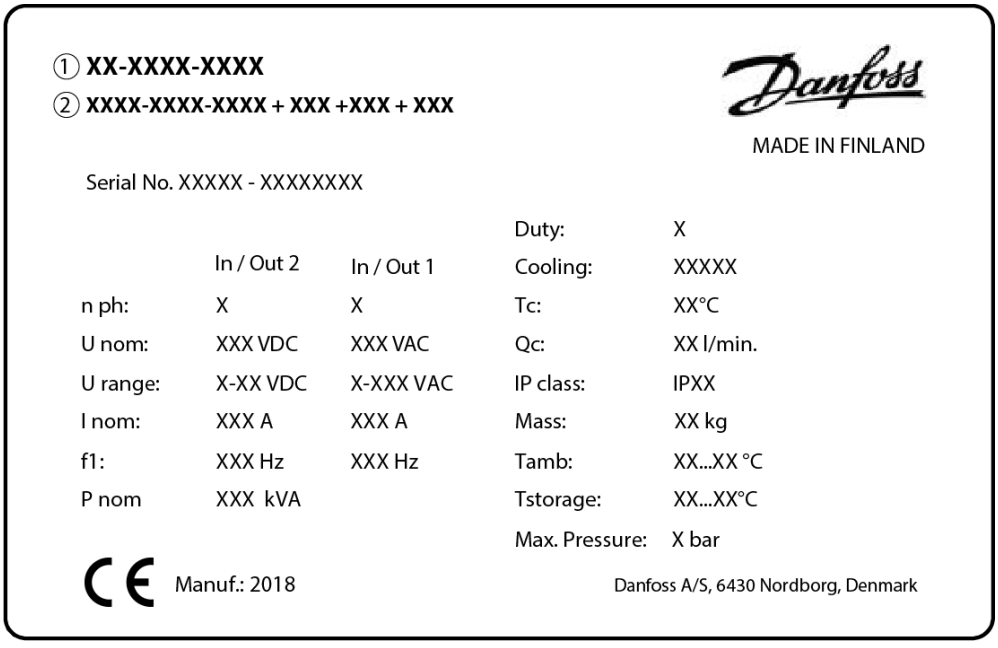
Cooling system properties	Specification
Cooling type	Liquid cooling
Coolant type	Water-glycol mixture (max. 50 % corrosive inhibitor)
Coolant temperature	-40°C…+65°C
Coolant flow minimum	10-20 l/min
Pressure drop	100-340 mbar with 20 l/min (+25°C coolant)

See detailed information and specifications from the product data sheet. Rated values can be found from the rating plate.

Rating plate

Each electric device has a rating plate (also called product label) which can be found on top of the electric device. The rating plate contains device rating and identification details. The figure below shows an example of a rating plate. For exact information, see the product-specific data sheet at *https://www.danfoss.com/* or the rating plate on the electric device.

Rating plate example



Rating plate fields

Field	Explanation	Unit
1	Electric device product family	
2	Electric device full type code including possible options	
Serial No.	Serial number	
n ph	Number of phases	
U nom	Nominal voltage	V
U range	Voltage range	V
f	Frequency	Hz
I nom	Nominal current	A
P nom	Nominal power	kVA
Manuf.	Manufacturing year	

Rating plate fields (continued)

Duty	Duty class	
Cooling	Cooling type	
T_C	Coolant temperature	°C
Q_C	Coolant flow	l/min
IP rating	Enclosure class according to IEC60034-5	
Mass	Total weight of the electric device	kg
T_{amb}	Ambient temperature limits	°C
$T_{storage}$	Storage temperature limits	°C
Max. pressure	Coolant maximum pressure	bar

The rating plate and its values shown here may not all be relevant for every electric device.

Tightening torques

For correct and safe operation, it is essential to use specified tightening torques for the electric device screws. Tightening torques (screw preloads) used in the electric device are shown in the Table below.



Tightening torque tolerance is +/- 5% of the specified tightening torque.

Tightening torques

Connection	Torque
Electric device mounting screws, M8	20 Nm
Electric device mounting screws, M6	10 Nm
Connection box lid (power terminal cover) mounting screws	4 Nm
Connector shield mounting screw, M4	2 Nm
Cable lug mounting screws	15 Nm
Grounding cable mounting screws, M8	15 Nm
Cable gland (tighten from the frame of the gland)	15 Nm

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Transportation and storage

Transportation

	**Do not apply any excess weight on the electric device during transportation.**
	**See the weight of the electric device from the product Data sheet.**

The electric device is shipped in first class condition. Products are inspected and packed correctly to prevent damage from ordinary handling during the transportation. Transportation conditions must be in accordance with the product specification and shocks of any kind must be avoided.

Plug and seal the cabling and cooling connections for transportation.

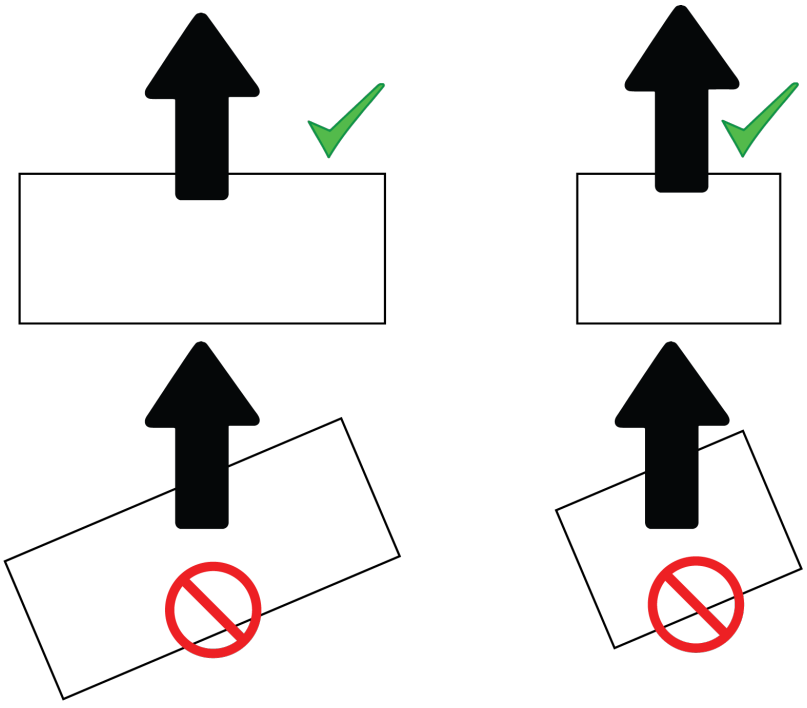
Receiving and unpacking

Inspect the electric device and the package immediately upon arrival. Ensure that the rating plate data in the cover letter complies with the purchase order. All external damage in the package or in the electric device must be photographed and reported to Danfoss immediately.

Lifting

	**Use correct, adequately dimensioned lifting devices and inspect them before lifting.**
	**Do not apply any excess weight on the electric device when lifting it.**
	**Use correct lifting slings. Use correct position and angle of lifting. The maximum permissible range of lifting angles is shown in lifting figures.** **Make sure that lifting slings are correctly routed so that they do not cause momentum on any of the signal connectors.**
	**See the rating plate and data sheets for weight information.**
	**Lift the electric device using the correct lifting lugs/eyes only. See the lifting Figures in this Chapter.**
	**Do not go under a lifted load.**

Correct lifting and incorrect lifting



Handling

⚠	**When turning or lifting the electric device, lift it in the air in order to prevent damage to the frame or other parts of the electric device.**

Although the electric device is designed to operate in harsh and demanding environment, any misuse or improper handling of the electric device is prohibited to avoid malfunctions later.

Storage

⚠	**When the device is dismounted and stored and packed for delivery, measure that there is no voltage and then install short circuit wire to the conductor rails to prevent charge from building up.**
⚠	**Heavy equipment. Store on appropriate base. Support the electric device to prevent accidental turning and falling.**
⚠	**Do not apply any excess weight on the electric device during storage.**

Always store the electric device indoors. The storage temperature should preferably be above -20°C and the relative humidity less than 60 %. Storage conditions must be dry and dust free.

Make sure that the cabling and cooling connections are plugged and sealed before storage.

Always dry the cooling circuit units before long storage.

The electric device must not be subjected to any external vibrations during storage to avoid possible hidden structural damages.

Extended storage

Follow these guidelines to optimize the lifetime of the unit during extended storage:

1. Ambient temperature: Ensure that the maximum ambient temperature does not exceed +40°C.
2. Annual power-up routine: Once per year, power up the low voltage side of the unit with 24 V_{DC} for 60 minutes. To ensure the entire device is activated, you **must** power both the **power_on** and **stop** signals during this time.

   Failing to power these signals will only partially activate the low voltage side, which is not sufficient for the required maintenance procedure.

Adhering to these guidelines will help ensure the unit's longevity and optimal performance during extended storage.

Installation

Required tools

	**Risk of electric shock during electrical installations. Use insulated tools.**
	**Measure voltage before working on the device.**

To install the electric device, the following tools are required:

- Ratchet torque wrench.
- Hex head wrench kit with different metric sizes.
- Socket wrench kit with different metric sizes.
- Heavy duty cable cutter for the power cables.
- Small wire cutters for trimming the cable shield wires.
- Cable gland tightening tool. Size according to cable glands.
- Cable skinning knife.
- Crimping tool for cable lugs.

For more detailed information, see appropriate sections in this user guide and product data sheets at *https://www.danfoss.com*.

Insulation resistance test

	**Before performing the insulation resistance measurement, disconnect all cables and connectors from the device under test.**
	**Do not touch the electric device during the test and make sure you discharge the electric device afterwards.**
	**Measure the insulation resistance of the electric device before and after the installation of the electric device.**

Measure the insulation resistance of the electric device before and after the installation of the electric device.

The reference value 100 MΩ has to be exceeded at reference ambient temperature +25°C (measured with 500 V_{DC} / 1 min insulation resistance test). Contact Danfoss Editron service if the reference value is not exceeded.

Measuring the insulation resistance

	**Insulation resistance testers generate lethal voltages. Only qualified personnel should perform insulation resistance measurements.**

The insulation resistance is measured between terminals and the converter enclosure. When measuring the main circuit, the auxiliary circuits are grounded. When measuring the auxiliary circuits, the main circuit is grounded.

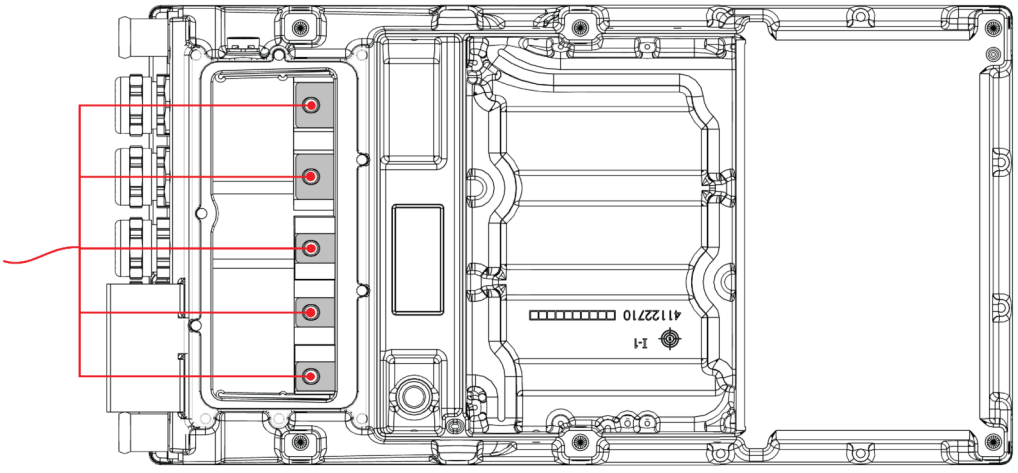
Main circuit

Test voltage	Test duration	Pass criteria
500 V_{DC}	60 s	> 100 MΩ

Measurement procedure:

1. Connect main circuits DC+, DC-, L1, L2 and L3 together.
2. Connect all pins of X1 connector to the converter enclosure.
3. Connect the measurement devices ground cable to the converter enclosure.
4. Connect the measurement probe to the main circuits.

Main circuit measurement



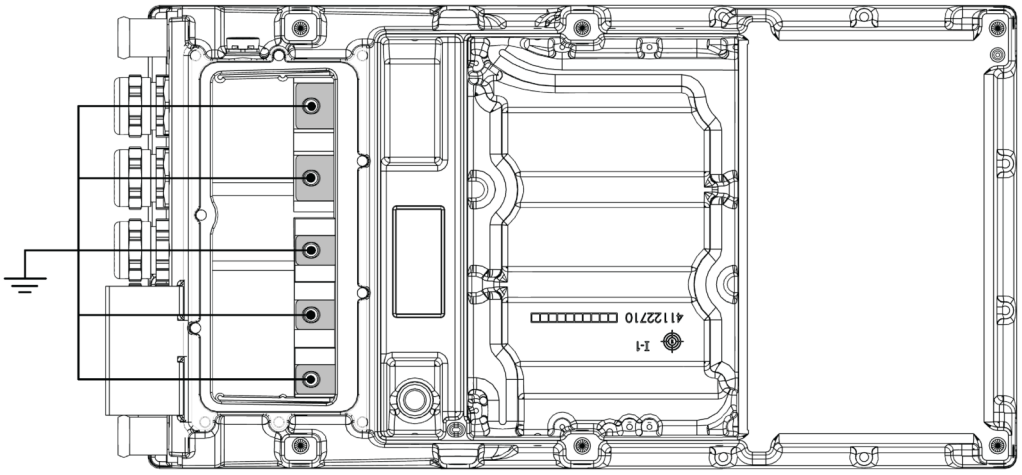
Auxiliary circuits

Test voltage	Test duration	Pass criteria
50 V_{DC}	60 s	> 10 MΩ

Measurement procedure:

1. Connect main circuits DC+, DC-, L1, L2 and L3 to the converter enclosure.
2. Connect all pins of X1 connector together, except pin 35 (enclosure ground).
3. Connect the measurement devices ground cable to the converter enclosure.
4. Connect the measurement probe to the connector X1 pins 1 - 34.

Auxiliary circuit measurement



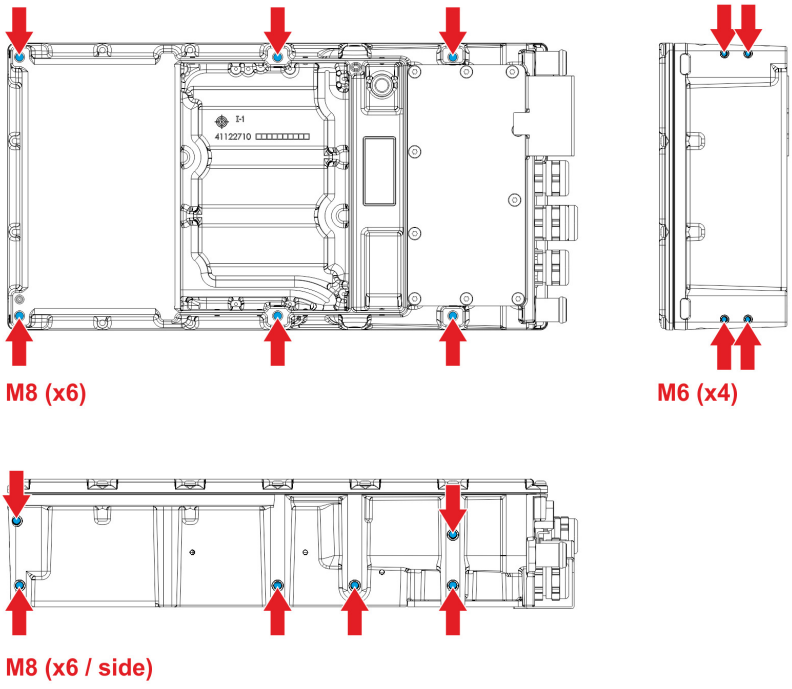
Mechanical installation

Allowed mounting position

⚠	**Do not place the electric device on the ground without proper mounting or protective structure.**
⚠	**The electric device must be mounted in a way that no other object or structure, which can cause compression, pull, torsion, rotation etc., touches the enclosure of the electric device. In addition, the electric device should not be used to support any other structure of the system.**

- The electric device must be mounted on a flat, heat- and flame-resistant mounting place (for example on a bracket).
- The electric device can be mounted in any direction. Mount the electric device permanently from the mounting points.
- To fulfill the mechanical and environmental standards, for example vibration and shock, it is recommended to mount the electric device from the bottom side, with at least 6 pcs of M8 screws.

Location of the mounting points



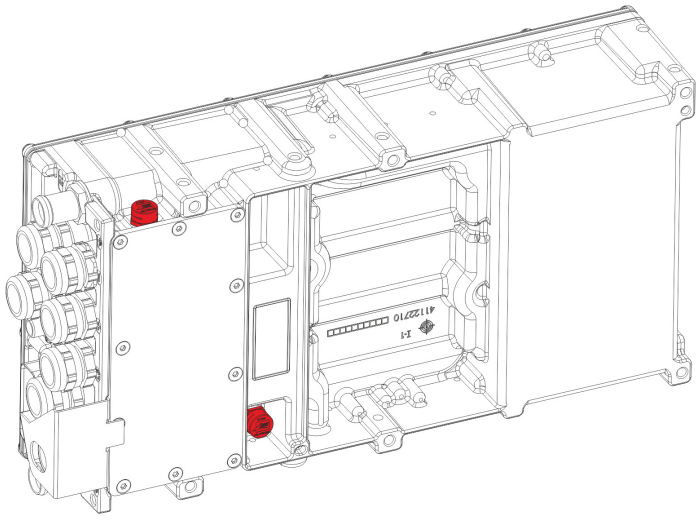
Breather plug

Make sure that the breather plugs (2 pcs) are clean and the selected installation place and mounting direction do not allow water, dust or dirt to block them.

The purpose of breather plugs is to equalize the pressure between the inside of the device enclosure and the surrounding environment. Do not remove the breather plug(s) under any circumstances.

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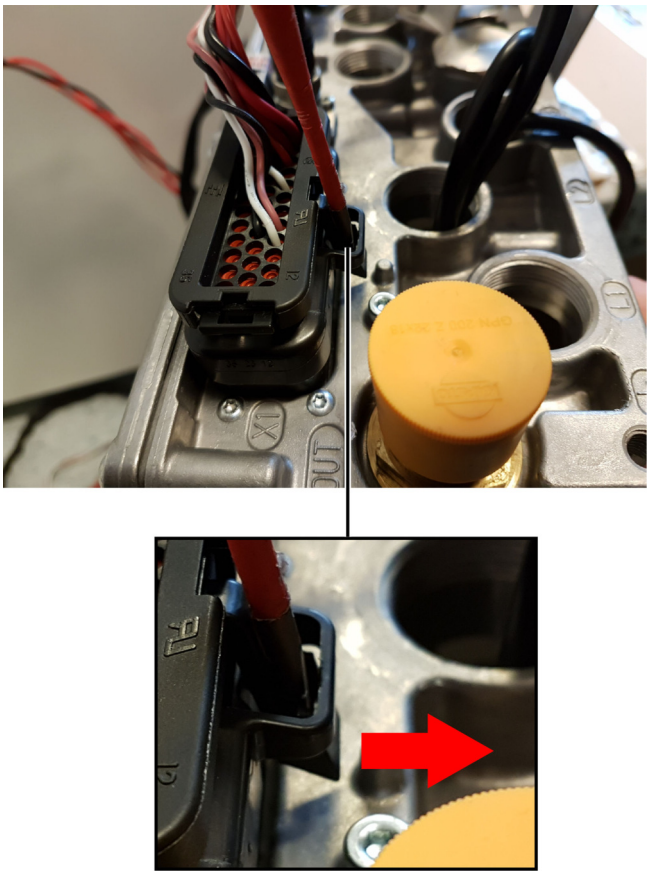
Location of the breather plug(s)



Installation procedure

⚠	**Risk of electric shock when the connection box lid is open. Make sure that the electric device is discharged; measure the voltage to make sure of safety.**
⚠	**Heavy electric device. Handle with care. Handle the electric device correctly when you install it to the correct mounting position. See Chapter *Handling* on page 25.**
⚠	**When installing the connection box lid, make sure there are no foreign particles between the connection box lid and the insulation and that all connection box fasteners are in place. Missing or loose screws can compromise the insulation.**
⚠	**Do not use excessive force when installing and removing the X1-connector because the plastic housing of the X1-connector can break. See the Figure below for more information.**
⚠	**Always check the compatibility of the X1-connector and the counterpart. Never alter the connector in any way.**

Removing the X1-connector



Preparations

- Make sure that the chosen installation place fulfills the environmental requirements specified for the electric device.
- Protect the electric device against corrosive gases, liquids, conductive contaminants (such as condensation, carbon dust, and metallic particles) and sprays or splashing water from all directions.
- Protect the electric device from excess humidity, salt and chemicals with suitable additional enclosure.
- The mounting place and mounting interfaces should be sufficient to carry the weight of the electric device.
- Make sure that the electric device has sufficient mounting and operating clearances for maintenance work.
- Measure the insulation resistance of the electric device before and after the installation of the electric device. For more information, see *Insulation resistance test* on page 27.
- Installation procedure may vary from that shown in this user guide. All steps must be included in the procedure, although the order of the steps can be different.

Installation procedure

1. Prepare the installation place and make sure that it meets the requirements for the product.

2. Lift and support the electrical device for the mounting. Refer to Chapter *Lifting* on page 24.

3. Install all appropriate mounting screws, do not tighten the screws until they are aligned and pre-installed. See the tightening torques from Chapter *Tightening torques* on page 23.

4. Connect the cooling system. See Chapter *Cooling connections* on page 33 or the *Main dimension drawing* for connection details. Make sure that there are no air pockets in the cooling channels and that the coolant goes freely in and out. Coolant flow direction is shown next to the coolant inlet/outlet. Make sure that the cooling system operates correctly.

5. Make sure that the devices and machines you will connect to the electric device have no voltage.

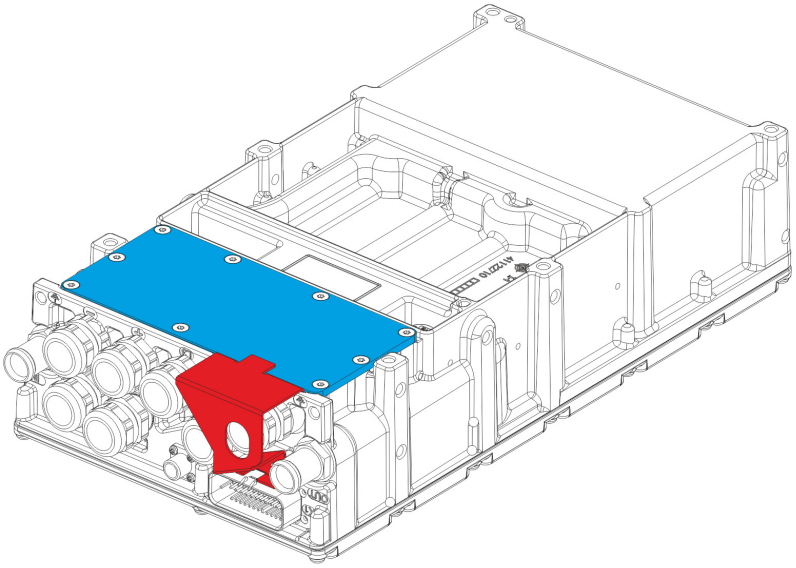
6. Make the grounding of the frame of the electric device by direct contact between it and the metal bracket and / or from the protective earth contacts. The grounding and mounting contacts must be paint-free. See Chapter *Grounding* on page 39.

7. Uninstall the connector shield (mechanical safety component, sheet metal part).

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8. Dismount the connection box lid (power terminal cover).

Connection box lid



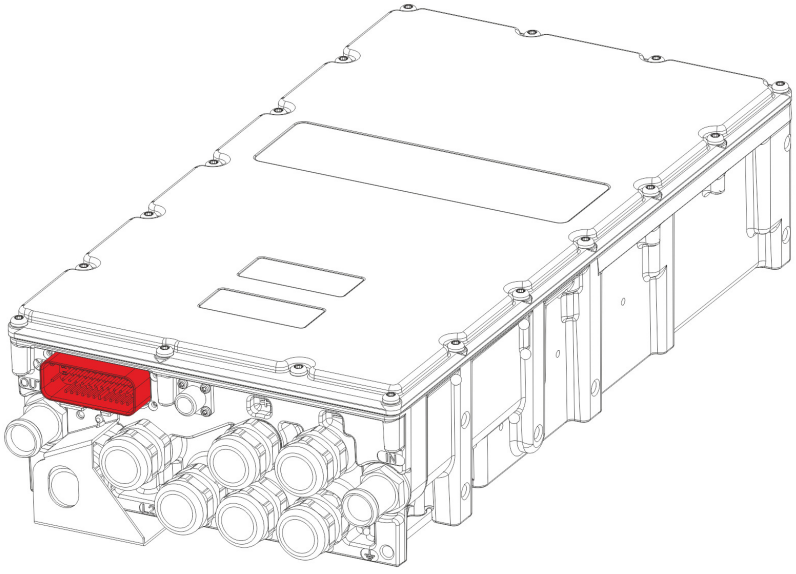
9. Connect the power cabling. Refer to Chapter *Electrical connections* on page 33.

10. Install the connection box lid.

11. Install the connector shield.

12. Connect the X1-connector (control signal connector).

X1-connector



Cooling connections

	**Make sure that cooling liquid runs freely in and out from the electric device.**

- Connect the electric device directly to the cooling circuit.
- Make sure that the coolant flow is equal or higher than rated and the coolant temperature at the inlet of the electric device is lower or equal to the rated temperature.
- For more information, see Chapter *Recommended coolants* on page 33 and product data sheets. Rated values can be found on the rating plate of the electric device.
- Coolant connections: 2 x 20 mm (for 19 mm hose).
- It is recommended to fix the hose on the coolant connection with a hose clamp or a hose clip after the protection cap has been removed.
- Use water-glycol mixture with appropriate corrosion inhibitor as coolant.

It is possible for the electric device to monitor and control the temperatures of the Danfoss PMI family electric machines. Connect the temperature signal to the temperature monitoring pin of the electric machine and activate the temperature protection feature.

Recommended coolants

	**Ethylene glycol is a toxic compound. Avoid exposure to the coolant.**
	**Handle with care. Use appropriate personal protective equipment when you handle the coolant.**
	**Make sure that the coolant used is compatible with the materials in the coolant circuit. See the product data sheet for more information on the main materials.** **Follow the instructions of the coolant manufacturer.**

The electric device works correctly with water based coolant. Plain water and glycol mixture with appropriate corrosive inhibitor is acceptable, for example, plain water with 50 % glycol coolant content. Maximum allowed glycol content is 52 %. For more information, see the product data sheet.

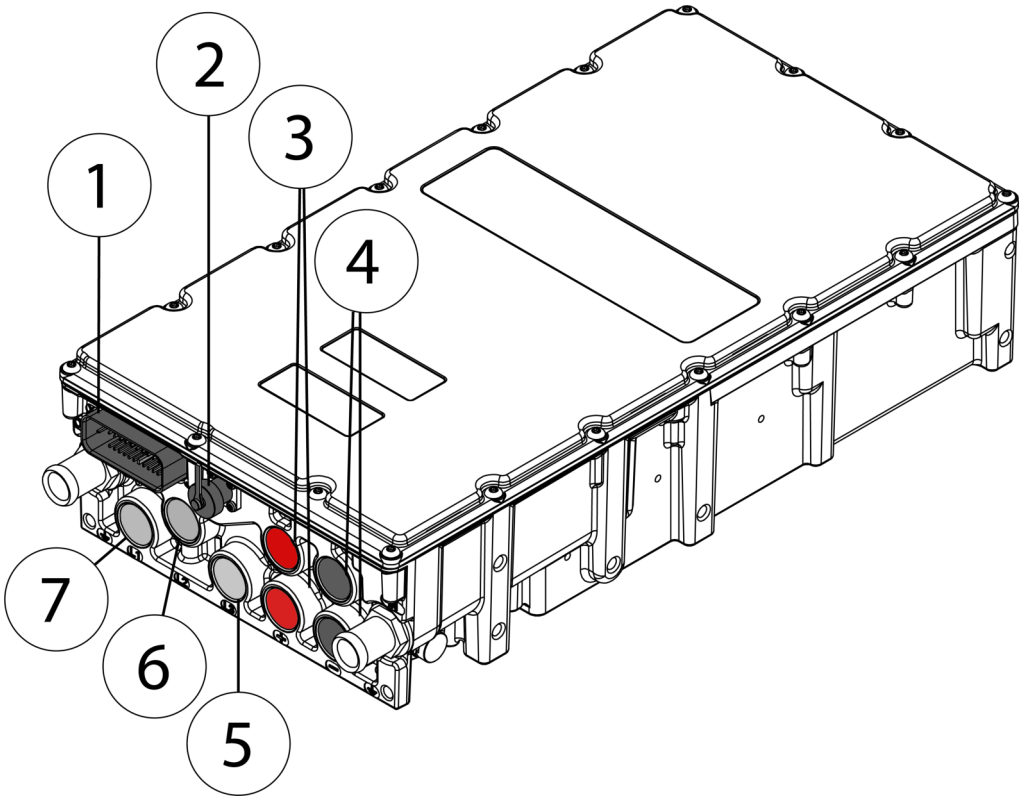
Ethylene glycol based Glysantin® G48® (includes also corrosion inhibitors) or similar can be used. Propylene glycol based coolants, like Splash® RV&Marine antifreeze, can also be used. Propylene glycol is a relatively safe compound for humans and the environment.

Electrical installation

Electrical connections

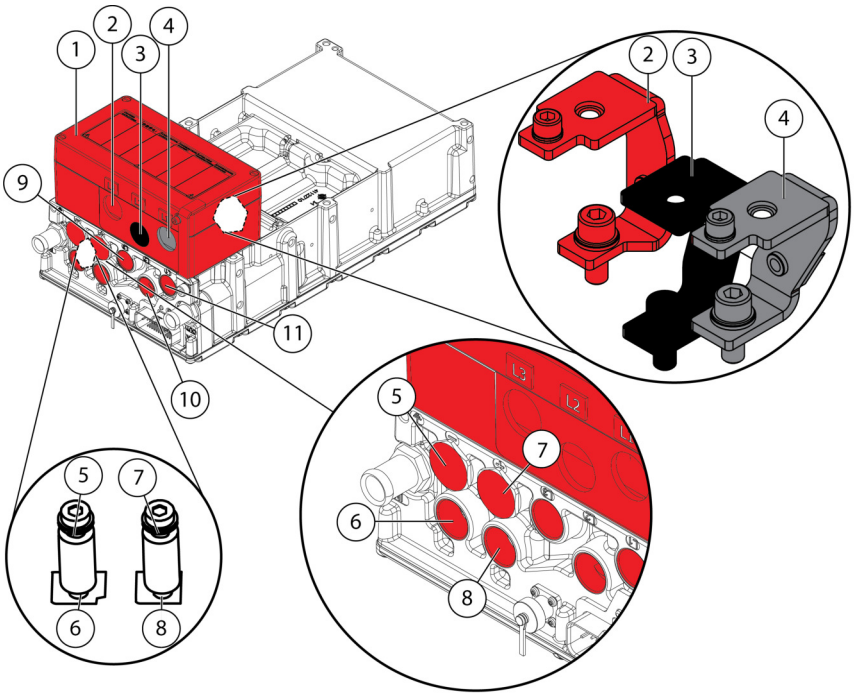
	**Before you start the electrical installation, make sure that the frame of the electric device is grounded correctly. Refer to Chapter *Grounding* on page 39.**
	**Risk of electric shock when power terminal cover is open. Before working with the power connections make sure that electricity has been disconnected and the electric device has discharged.**
	**Before you start the electrical installation, make sure that the environment is dry and free from conductive dust particles.**
	**Cable lugs are not included in the delivery.**

Electrical connections



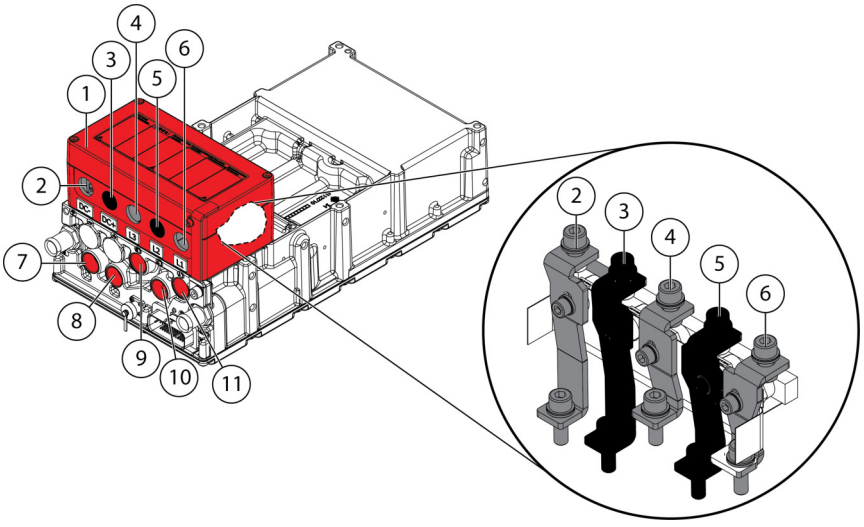
1	X1-connector (Low voltage connector for measurement data and control signals)
2	X2-connector (maintenance connector)
3	DC+
4	DC-
5	L3
6	L2
7	L1

Electrical connections with +CE2 option and +DCE option



1	External connection box
2	L3 connection, external
3	L2 connection, external
4	L1 connection, external
5	DC- connection (+DCE)
6	DC- connection (+DCE)
7	DC+ connection (+DCE)
8	DC+ connection (+DCE)
9	Not in use
10	Not in use
11	Not in use

Electrical connections with +CE1 option



1	External connection box
2	DC- connection, external

3	DC+ connection, external
4	L3 connection, external
5	L2 connection, external
6	L1 connection, external
7	DC- connection
8	DC+ connection
9	L3 connection
10	L2 connection
11	L1 connection

Before attaching the cable lugs (1), loosen the busbar fixing bolts (2). Use all cable lug locations. After attaching the cable lugs, tighten the busbar fixings to torque.

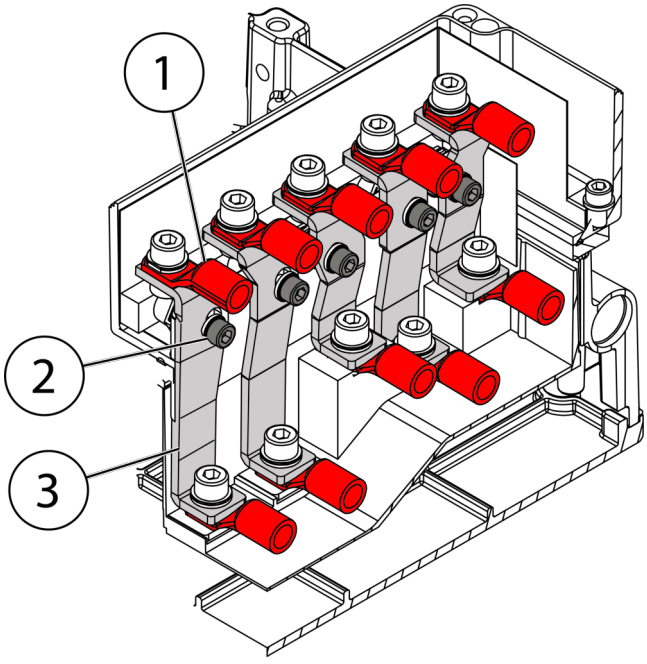
Not using all cable lugs could lead to overheating.

With the lower device connections 7-11, attach the cable lugs *between* the device terminals and +CE1 connection box busbars. The cable lugs do not fit on top of the +CE1 busbars in these positions!

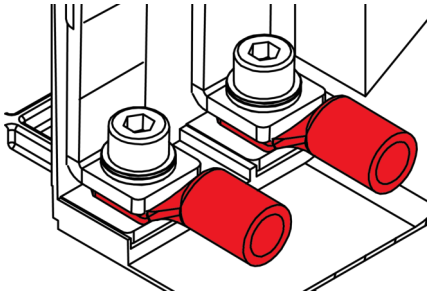
However, with the upper connections 2-6 on the external connection box, attach the cable lugs *on top* of the busbars. For more information, see the figures below.

1	Cable lug
2	Busbar fixing bolt
3	Busbar

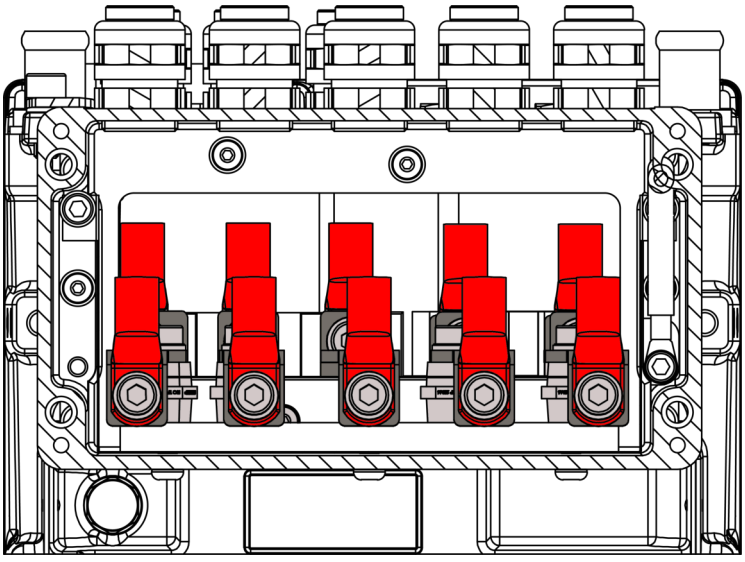
Cable lug position with +CE1 option



Cable lug position in lower device connections

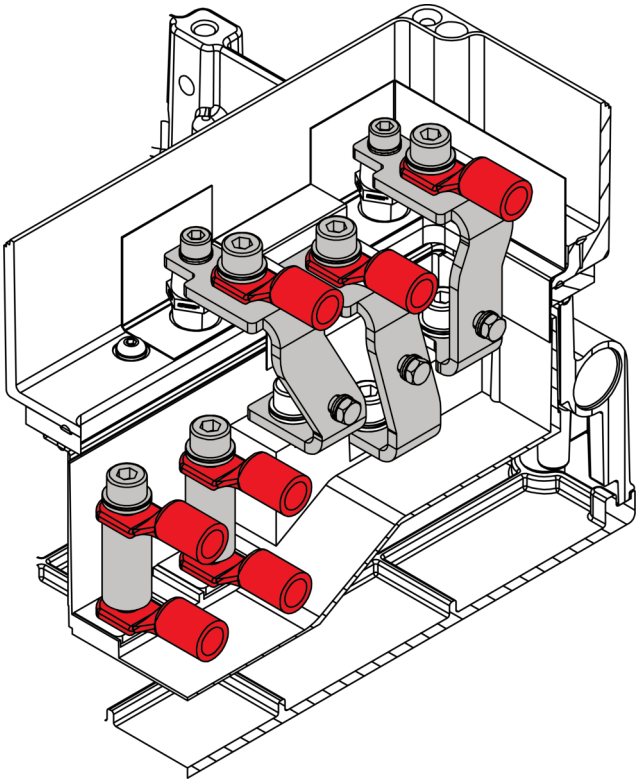


Cable lug position with +CE1 option, top view

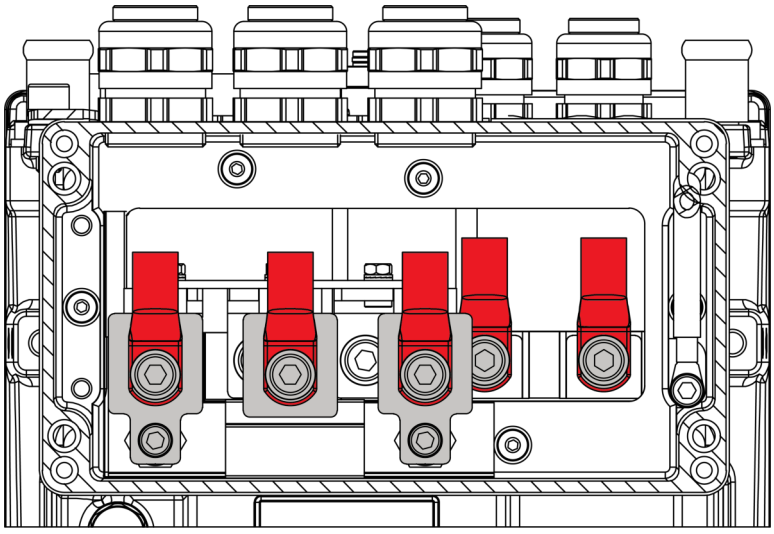


When using option +CE2, do not loosen the busbar attachment screws of connection points 9-11 as they are tightened to the correct torque at the factory. Loose connections raise the risk of overheating.

Cable lug position with +CE2+DCE options

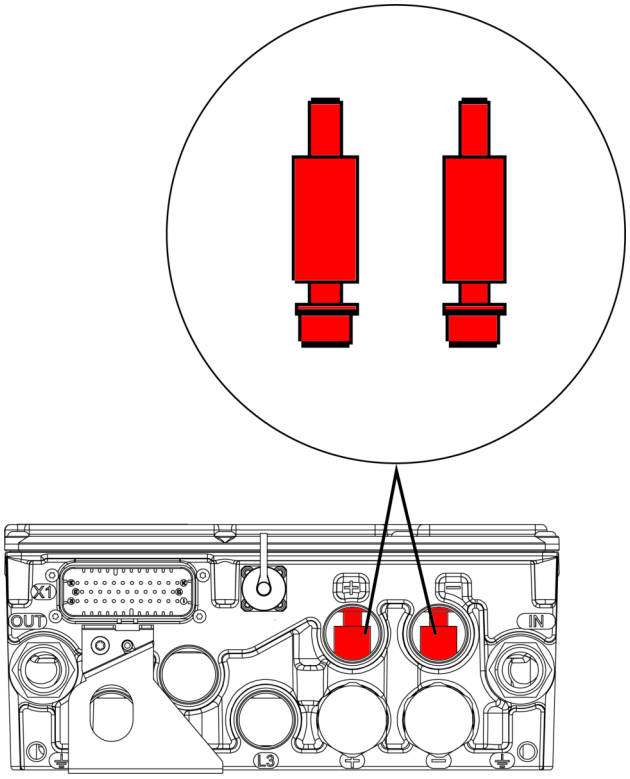


Cable lug position with +CE2 and +DCE options, top view



⚠	**Use all connections when you install an electric device with +CE1 option. Using only connections in the connection extension box can cause overheating of the electric device. Note that +CE1 and +CG6 option combination is an exception where only connections 2 and 3 are in use and connections 7 and 8 are not.**
⚠	**+DCE should only be used when connecting double cables per DC connection. Otherwise, overheating is possible.**

Electrical connections with +DCE option



Maximum cable lug width and length

Measurements L1, L2 and L3 are illustrated in Figure *Cable lug length and width* below the tables.

EC-C

Description	Converter connection box
Cable lug width max., L1	17.5 mm
Cable lug length L2	11.5 mm
Cable lug length max., L3	55 mm

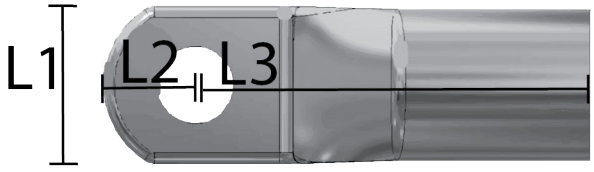
EC-C+CE1

Description	Converter connection box	CE1 connection box
Cable lug width max., L1	17.5 mm	21 mm
Cable lug length L2	11.5 mm	17 mm
Cable lug length max., L3	55 mm	60 mm

EC-C+CE2

Description	Converter connection box (for DC-link connection only)	CE2 connection box
Cable lug width max., L1	17.5 mm	30.5 mm
Cable lug length L2	11.5 mm	15 mm
Cable lug length max., L3	55 mm	60 mm

Cable lug length and width



Grounding

	**Make sure that the electric device is correctly grounded. Do not operate the electric device without correctly attached protective earth conductor. Obey the installation instructions and the guidelines for component selection given in this user guide.**
	**The grounding cable must be able to carry the maximum supply fault current which normally will be limited by the fuses or the Miniature Circuit Breaker (MCB). Put correctly rated fuses or MCB in the mains supply of the electrical device: obey the local legislation and recommendations.**
	**Obey the installation instructions and the guidelines for component selection given in this user guide.**
	**Make sure that the safety grounding is correct. Refer to Chapter Mechanical installation.**

Generic grounding guidelines

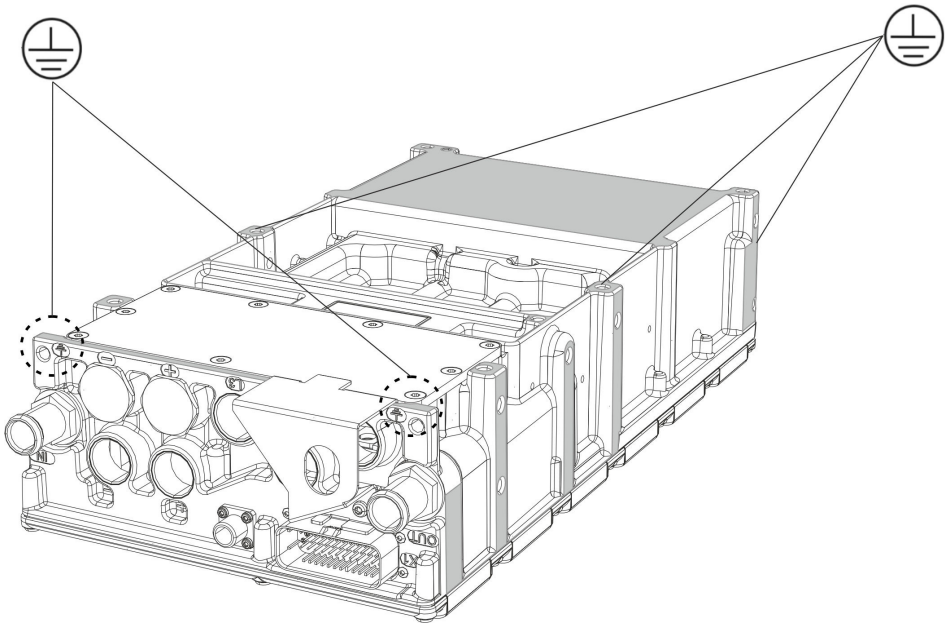
- Connect the ground terminal of each electric device individually to the site grounding bus bar.
- The grounding connections cannot loop from one electric device to another electric device, or to any other piece of equipment, or from any other piece of equipment.
- Ground impedance must be compliant with local industrial safety regulations.
- The protective ground of the unit must be connected to the system ground. Ground impedance must meet with the requirements of national and local industrial safety regulations and electrical requirements. The condition of the grounding connections must be checked periodically.
- Make sure that all grounding surfaces are clean and remove paint from the contact areas.
- For detailed information, see appropriate Chapters in this user guide.

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Main frame

The best grounding is achieved when the main frame of each electric device is directly connected to the ground. If this is not possible, the electric device must be grounded at least from one of the safety grounding points with an appropriate grounding cable. For good functional grounding use wide flat grounding braid. Round grounding wires are adequate for safety grounding but it does not provide very good functional grounding because of its higher impedance at high frequencies. The grounding points are marked to the electric device.

Grounding point(s)



Safety grounding points and protective earth conductor

	Touch current in the protective earth conductor exceeds 3,5 mA AC and 10 mA DC.
	The cross sectional area of the protective earth conductor must be at least equal to that of the incoming supply conductor.

One of the safety groundings must be connected to an appropriate grounding point. Grounding points must comply with national and local industrial safety regulations and/or electrical codes.

Cabling and wiring

To make sure that the electric device functions correctly and to minimize the radiated emissions, all connected cables and wires must be EMC-shielded. Shieldings must be connected to the ground at both ends of the cable or wire. All power connections must be secured with cable lugs and cable glands. EMC-shielded cable glands are used in all Danfoss products for the power connections. Make sure that the low voltage cable (control signal cable) shield is also grounded from the both ends.

Cable gland assembly and power line connection

	Risk of electric shock when the connection box lid is not installed.
	When you work with the power connections make sure that electricity has been disconnected and the electric device has discharged. Measure the level of the remaining voltage before you touch the power terminals.

Blueglobe cable gland tightening torques

Metric thread	Nominal torque
M10 x 1.0	3.0 Nm
M12 x 1.5	5.0 Nm
M16 x 1.5	8.0 Nm
M20 x 1.5	10.0 Nm
M25 x 1.5	15.0 Nm
M32 x 1.5	15.0 Nm
M40 x 1.5	20.0 Nm
M50 x 1.5	30.0 Nm
M63 x 1.5	35.0 Nm
M75 x 1.5	80.0 Nm
M85 x 2.0	100.0 Nm

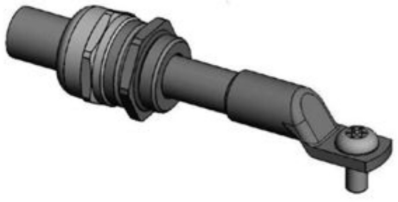
All electrical connections must be done according to instructions. It is essential to make sure that all terminal connections are installed properly and the and the intended application is suitable for the product in terms of electrical requirements/ characteristics.

The cable harness for electric connections needs to be terminated with cable lugs and cable glands. It is recommended to use IP67/68 rated, 360º shielded cable glands and single core automotive rated screened cable.

The cable gland has three functions, it works as a stress relief, it seals the connection against water and dirt and provides appropriate EMI shielding. Advanced cable glands could achieve high EMI attenuation over a wide frequency range.

The cable lug and cable gland must be assembled according to instructions. For correct assembly of the cable gland, it is recommended to use a torque key with a turnkey head and a key to adapt the cable gland. The cable lug is connected to terminal with a M8 screw. Shielding of the power cable must be connected to the electric device body by the cable gland. Recommendations for the tightening torques must be followed. See the manufacturer's instructions on how to install the cable glands and the cable lugs. The following instructions may not apply to every type of connection this electric device has.

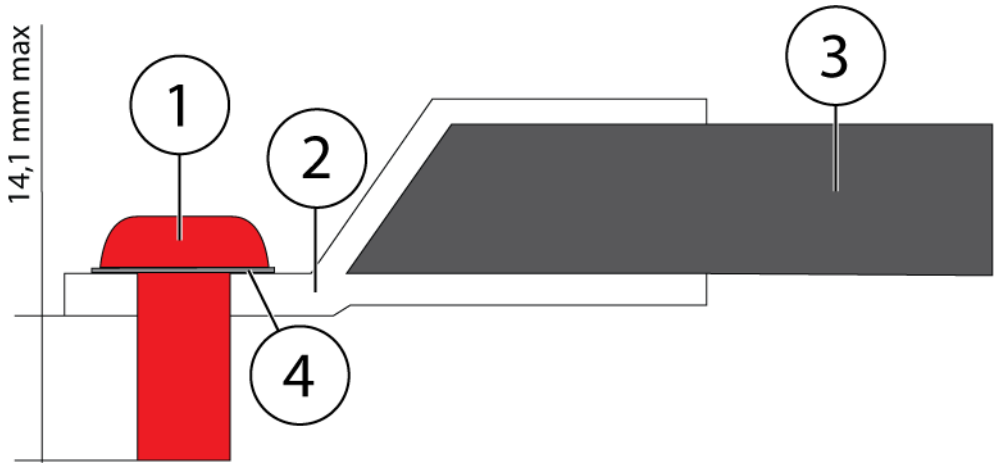
Cable harness connection with the cable lug and the cable gland (for illustration only)





It is recommended to use screw size M8 x 16 and a washer combination of wave and regular washers.

Maximum protrusion of the screw through washer and cable lug



	Desription
1	Screw
2	Cable lug
3	Cable
4	Washer

Pflitsch BlueGlobe-series cable glands and HUBER+SUHNER Radox Elastomer S, screened, single core, automotive cables are recommended.

The information below describes how to assemble screened power cables to the electric device.

Cable gland assembly instruction can also be found from Pflitsch cable gland catalogue available at *https://www.pflitsch.de*.

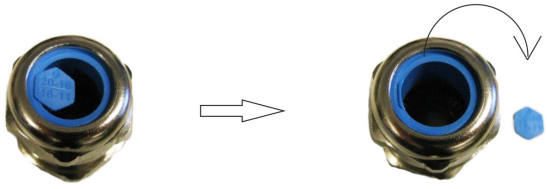
Correct cable gland type for the high voltage cables is Pflitsch blueglobe TRI bg XXXms tri (depending on option 225ms tri max. cable Ø 20 mm, max. screen Ø 16 mm or 232ms tri max. cable Ø 25 mm, max. screen Ø 20 mm).

Cable lug and cable gland assembly steps

Note that these instructions apply only for components that are recommended for this product.

1. Remove the small hexagonal piece from the BlueGlobe-sealing insert as shown in Figure below.

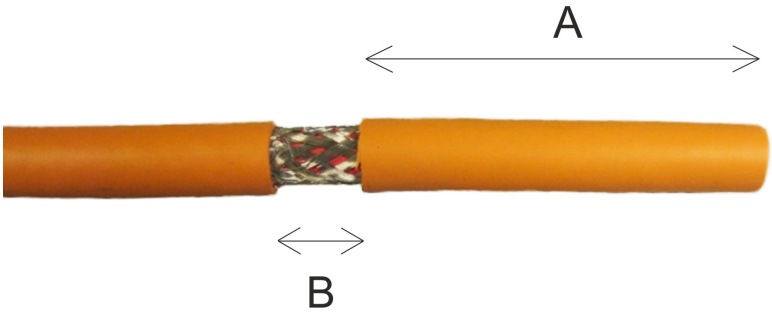
   BlueGlobe-sealing



2. Cut the cable sheath at the distance A from the end of the cable, see Figure below. Pull the cut part of the sheath partly (length B is from 10 to 15 mm) off the cable as shown in the figure. Distance A depends of the length of the used cable lug. Measure with the cable lug that is used and cut to suitable length.

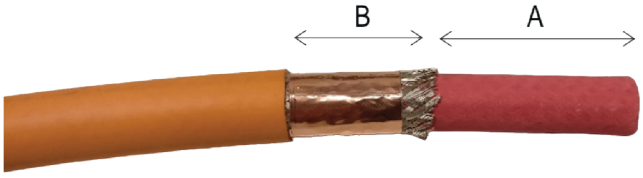
⚠	**Do not remove the cable sheath completely at this point and do not cut the braid screen of the cable.**

Cut length of the cable sheath



3. Wrap two layers of copper tape on the cable so that the distance B is covered. Use 3M™ Copper Foil Tape 1181 or similar. Contrary to the image below and depending on the cable and the cable gland size, you can leave the length A sheath in place for the next step to help the placement of the cable gland and remove the sheath only after the next step.

Cover the cable with copper tape



4. Insert the cable to the cable gland with slight turning motion. This helps the cable go through the spring inside the cable gland. Push the cable gland against the sheath of the cable as shown in Figure below.

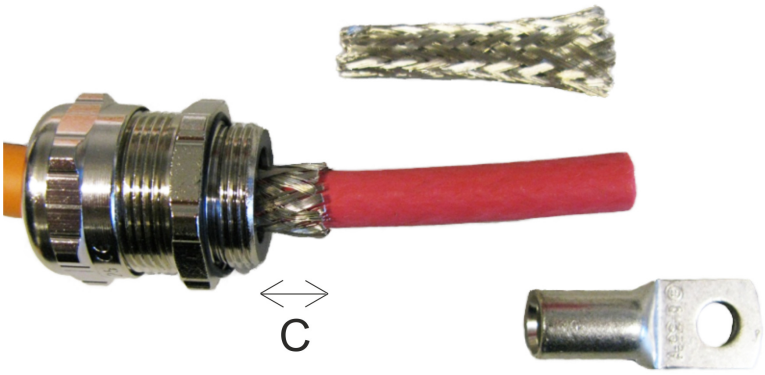
Cable to the gland assembly



5. After the cable gland is in place remove the length A piece of the sheath and cut the braid screen (cover) from 10 mm (distance C) from the gland bottom as shown in Figure below.

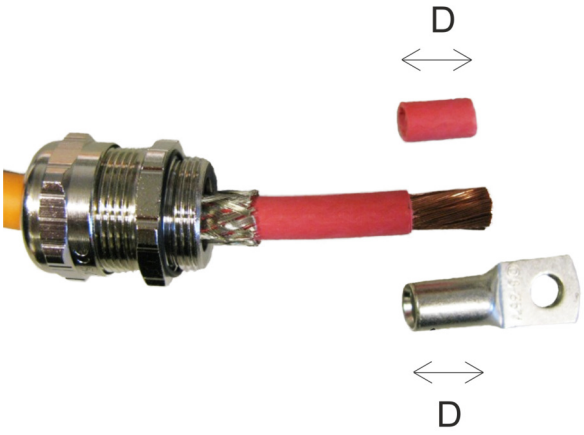
⚠	**Make sure that the cable gland spring is against the cable sheath (that is protected with copper tape) before cutting the braid screen.**

Cut the braid screen



6. Cut a piece of length D of the inner sheath shown in Figure below. The length D must be equal to the length of the cable lug body.

Cutting the inner sheath



7. a) Make sure that the conducting strands of the cable are completely free of silicone and other impurities. Insert cable conductors fully into cable lug. Make sure that the cable lug is not too loose and that all conductors fit inside the lug. If not, check from the part list that you are using the correct cable lugs.

b) Always use the crimping tool of the cable lug manufacturer. Before crimping, check the cable lug size from the lug (e.g. 35-8 is 35 mm^2) and select the same size dies for the crimping tool. Use hexagonal dies.

c) Crimp the cable lug at least twice in different places starting as near to the flat part of the lug as possible and towards the barrel part of the lug. Make sure that the cable does not slip out from the lug while crimping.

d) Remove any excess compound emerging from the sides of the cable lugs after the crimping. Verify that the cable lug is evenly compressed with clear hexagonal crimps and that no conductors are broken. See Figure below.

Connecting cable lug



8. Cut piece of shrink tube and shrink it over the cable lug and braid screen as shown in Figure below. This is done to keep the braid screen in place and for extra insulation.

The shrink tube must be specified for operating temperature range from -40°C to +150°C. Self adhesive shrink tube is recommended.

Shrink tube



9. Insert the cable through the corresponding hole in the electric device frame and connect the cable lug to the power terminal with the correct screw. Use spring washer between the cable lug and the connection screw or nut. Do not tighten the cable lug screw at this point to ensure fitting of the cable gland.

Make sure that there is at least 10 mm air gap between the cable lug and other metallic structures including the braid of the cable. If the air gap is smaller, use extra insulation shrink tube to cover the lug.

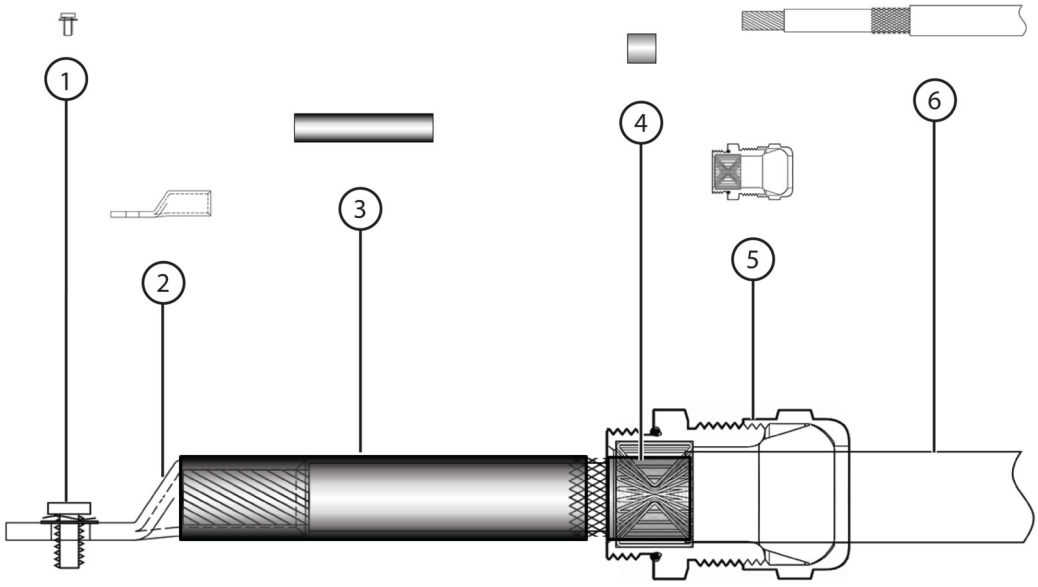
10. Attach the cable gland to the threaded holes on the electric device according to the instructions. Tighten the cable gland with the specified torque.

Tighten the cable gland from the cable gland body to enclosure with torque 15 Nm. Then tighten the cap of the cable gland according to the instructions provided by cable gland manufacturer (recommendation Pflitsch).

11. Tighten the cable lug using the specified torque.
12. Repeat the procedure to the other cables and connections.
13. Close the power terminal cover and install the connector shield.
14. Make sure that the power cable shields are grounded properly.

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Cable lug and cable gland assembly cross section



1	Cable lug bolt
2	Cable lug
3	Shrink wrap
4	Copper tape
5	Cable gland
6	Cable

Example of the equipment needed for the assembly

	Description	Manufacturer's homepage	Art.No./Part No.
Assembly equipment (example)	Torque key and turnkey head	*http://www.pflitsch.de*	730N/10-50
	Key	*http://www.pflitsch.de*	SE30
Assembly example for a 70 mm^2 cable	Cable with nominal cross-section of 70 mm^2	*http://www.hubersuhner.com*	HUBER+SUHNER Radox Elastomer S, screened, single core, automotive cable (FHLR4GC13X)
	Cable lug	*http://www.druseidt.de*	Druseidt with narrow flange 03906
	Cable gland	*http://www.pflitsch.de*	Pflitsch blueglobe TRI bg 225ms tri Or depending on option (see option list) Pflitsch blueglobe TRI bg 232ms tri
	Screw	-	DIN 912 M8x16
	Washer	-	DIN 2093, 8,2 x 16 x 0,9
	Washer	-	DIN 125 D8
Assembly example for a 50 mm^2 cable	Cable with nominal cross-section of 50 mm^2	*http://www.hubersuhner.com*	HUBER+SUHNER Radox Elastomer S, screened, single core, automotive cable (FHLR4GC13X)
	Cable lug	*http://www.druseidt.de*	Druseidt with narrow flange 03903
	Cable gland	*http://www.pflitsch.de*	Pflitsch blueglobe TRI bg 225ms tri Or depending on option (see option list) Pflitsch blueglobe TRI bg 232ms tri
	Screw	-	DIN 912 M8x16
	Washer	-	DIN 2093, 8,2 x 16 x 0,9
	Washer	-	DIN 125 D8

Cabling and wiring

	**Route the power cables as far from the control signal wires as possible. The minimum separating distance is 100 mm. The crossings must be in an angle of 90°. Power cables and control wires should be routed near the frame of the application. Make sure that all terminal connections are tightened correctly.**

Install the electric device following the instructions. Make sure that all the applications of the system, for example, the batteries are connected to the electric device according to the instructions in this user guide and the product specific guidelines.

High voltage connections

	**The high voltage connections have a common ground connector. Check connector manufacturer's instructions for plugging in, unplugging and locking the connectors. Incorrect procedure can damage the connectors or reduce their lifetime.**
	**$U_{HV} \geq U_{LV}$ The voltage on the LV side (U_{LV}) of the device cannot be higher than the HV side voltage (U_{HV}). If a higher voltage is applied to the LV side, current will immediately flow through the diodes of device and the HV side voltage will increase to the same level as the LV side voltage.**
	**Make sure the power cables exit straight from the terminals and do not rub against the sharp cable through-holes or other sharp edges which could wear out the cable insulation over time.**
	**Do not place any excess weight on the connection box lid(s)**.

- The electric device must be installed and connected according to the instructions.
- Make sure that all the connected applications are connected to the electric device according to the product specific operating voltage.
- The electric device is delivered with the power terminal cover mounted. To access the power connections, remove the mechanical safety feature and the connection box lid.

DC connection specifications (+MC, +AFE, +UG options)

DC-connection	
DC link voltage range	0-1200 V_{DC}
DC link nominal voltage	1050 V_{DC}

AC connection specifications (+MC, +AFE, +UG -options)

AC connection	
AC output voltage	0-700 V_{EFF} (U_{DC} = xxx V_{DC})
Output frequency	400 Hz
Switching frequency	4 kHz
Maximum power	250 kVA

AC connection specifications by product type (+MC, +AFE, +UG -options)

AC connection				
Option	+MC95, +AFE95, +UG95	+MC130, +AFE130, +UG130	+MC175, +AFE175, +UG175	+MC210, +AFE210, +UG210
Nominal current	95 A_{RMS}	130 A_{RMS}	175 A_{RMS}	210 A_{RMS}
Nominal power	100 kVA	150 kVA	200 kVA	250 kVA

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Product types

Basic product type	Nominal power [kVA]	Nominal current [A_{RMS}]
EC-C1700B-420-L+MC95+AFE95+UG95	100	95
EC-C1700B-420-L+MC130+AFE130+UG130	150	130
EC-C1700B-420-L+MC175+AFE175+UG175	200	175
EC-C1700B-420-L+MC210+AFE210+UG210	250	210

For more information, see appropriate chapters in this user guide and the product data sheets.

Low voltage connections

	**The durability of the X1-connector is limited to 10 installations / removals by the connector manufacturer.**
	**Always check the compatibility of the X1-connector and the counterpart. Never try to alter the connector in any way. Contact Danfoss Service if unsure.**
	**Make sure that the electric device is not in run state when removing low voltage connections or power supply.**
	**When powering OFF the electric device, use the POWER_ON input. The power supply (VIN_N and/or VIN_P) can be disconnected, if desired, after time t_{min} has elapsed from the deactivation of POWER_ON (see Figure *Disconnecting the power supply* in this Chapter). A safe value for t_{min} is 5 seconds.**
	**See the correct signal connections and product specific pin-layout from product data sheets at** *http://www.danfoss.com*.
	**For information about the assembly of the control signal connectors, see the manufacturer's web page.**

Control signals and X1 connector assembly

The control signals of the electric device are operated via the signal interfaces in the X1 connector. To ensure stable operation, always use a proper mating connector and pins, appropriate shielded wiring, and the correct tools for installation, as indicated in the tables below.

Control signal connector information

Description	Part number	Supplier example
X1-Control signal connector (in the enclosure) Tyco Electronics/AMPSEAL, 35-pin (male)	1-776163-1	*http://www.te.com/usa-en/product-1-776163-1.html*
X1-Cable connector (mating connector) Tyco Electronics/AMPSEAL, 35-pin (female)	Case:776164-1	*http://www.te.com/usa-en/product-776164-1.html*
	Pins: 770854-3 (wire 0.5-1.25mm^2)	*http://www.te.com/usa-en/product-770854-3.html*

When ordering the parts, note the full part number and make sure it is identical with the number indicated above, including the last number after the dash (e.g. -1).

Tools and accessories

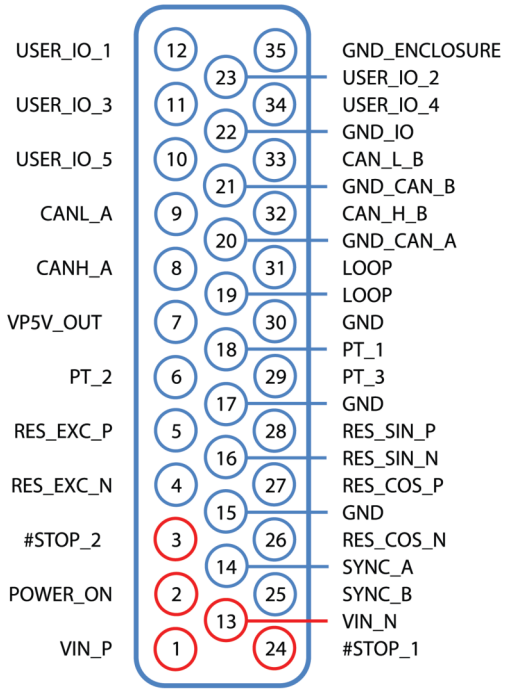
Description	Part number	Supplier example
Crimping Tool Assembly 58529-1 with Die Assembly 58529-2	58529-1	*http://fi.mouser.com/ProductDetail/TE-Connectivity/58529-1/?qs=Xf%252b3Aw93yEM%2FQReWIgzu%252bw%3D%3D*
Connector seal plug (for storage and transportation)	770678-1	*http://www.te.com/usa-en/product-770678-1.html*
35 position strain relief	2389807-1	*https://www.te.com/en/product-2389807-1.html*

Detailed and up to date information can be found on the manufacturer's website. **Always perform the connector assembly according to the manufacturer's installation instructions.**

Low voltage power supply connection

Minimum wiring and connections needed for powering up the electric device are shown below, marked with red. If any of these signals are not connected, the electric device will not be switched on, or it will be in a tripped state and cannot be used to control the high voltage power circuit. See the product data sheet for a full specification of all the available low voltage signal connections.

Low voltage signals of the X1 connector (minimum connections needed for powering the electric device are marked in red)



Minimum wiring and connections

Pin	Signal name	Description
13	VIN_N	Power supply negative
1	VIN_P	Power supply positive (continuous). Typically 12-24 V, see data sheets.
2	POWER_ON	Power supply positive (from on/off key). Typically the same voltage as VIN_P.
24	STOP_1	Stop input 1. Needs to be pulled up (same range as VIN_P) for the converter to run. Disconnecting the STOP input or pulling it low externally causes the power semiconductor switch drivers to be disabled, which makes the converter a diode bridge. Stopping the converter with one of the STOP inputs causes also a fault, which needs to be cleared before continuing operation.
3	STOP_2	Stop input 2. Identical to stop input 1. Both need to be pulled up in order to be able to run.

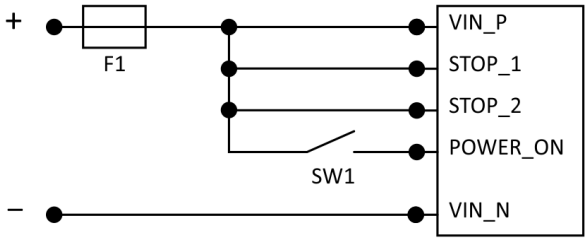
To power up the device, a suitable low voltage DC power supply must be connected to the X1 connector. Connect VIN_P (pin 1) to the positive power supply, and VIN_N (pin 13) to the negative power supply. POWER_ON (pin 2) and STOP_1/2 (pins 3 & 24) are usually connected to the positive power supply, either directly or through a switch.

If a physical emergency stop switch is required, connect the switch between either of the STOP inputs and the positive power supply. The STOP signal inputs should receive power at the same time or before the POWER_ON pin is energized, as otherwise the inverter will register an active emergency stop fault and will be in a tripped state after booting up. The emergency stop trip can be cleared using the regular fault clear commands after both STOP pins have been energized again.

An example of a minimal wiring scheme for the device's low voltage power supply is shown in the figure below. Always ensure that the device is not in running state when it is powered off, that is, IGBT modulation should be inactive when powering down. In particular, shutdown by disconnecting VIN_N or VIN_P may in some circumstances result in the corruption of the parameters of the electric device or other data.

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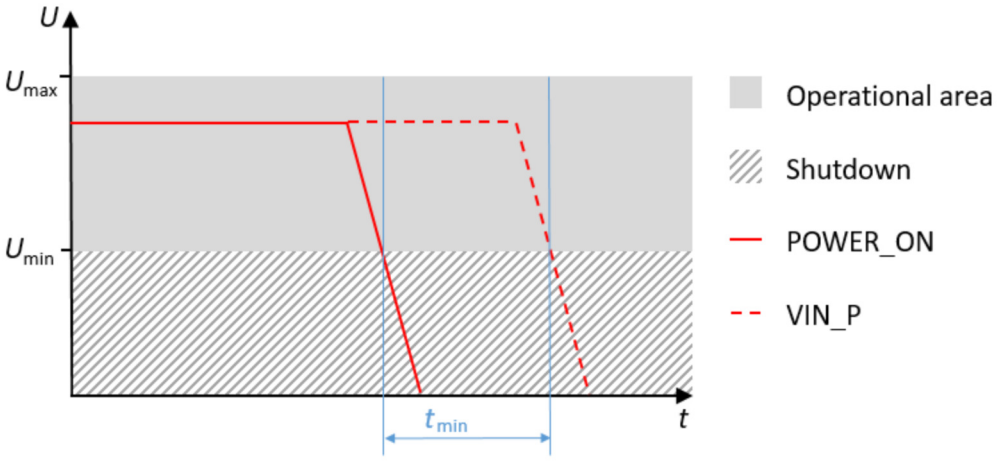
Example of the minimum power supply connections



In the example above, the switch (SW1) is used to power on and off the converter. VIN_P and VIN_N are continuously connected to the power supply. Always use an appropriate low voltage DC fuse (F1) for protection. See the device data sheet for more information about the low voltage power supply specifications and power consumption.

POWER_ON pin is used to shut down the device. Sufficient time (t_{min}) should elapse between shutting off power to the POWER_ON pin and shutting off the main power to the VIN_P pin, as indicated in the figure below. Recommended time for t_{min} is ≥ 5 s.

Disconnecting the power supply



Use of the grounding pins

In addition to the low voltage power supply connections, there are also various ground (GND) pins in the signal connector. Each ground connection has a specific function, and care must be taken to pair the ground connections to the corresponding signal functions.

The signal GND pins (15, 17 & 30) are used as ground potential with all other signal functions except the CAN buses and I/O connections. A common mode choke is connected between the internal signal GND pins and the VIN_N connection for filtering of conducted emissions. Connecting the signal GND and VIN_N together externally effectively disables the common mode choke. POWER_ON and STOP signals use the device signal GND as their reference. If, externally, they are produced with respect to VIN_N, a high level of common mode disturbance may throw POWER_ON and STOPs out of their operating range and cause the converter to stop or reboot. In case the converter stops or reboots due to high electromagnetic interference, increase filtering on low voltage connections to reduce EMI.

The CAN bus and I/O connections each feature their own, separate GND pins (20, 21 & 22) since they are galvanically isolated from the other signal circuitry. These pins should be used to create/connect the ground potential of each respective function to ensure the stability and functionality of the CAN buses and I/O connections and maintain a high resistance for EMI.

Finally, there is an enclosure ground pin (35) which is connected to the enclosure (cast aluminum frame) of the converter and can be used to connect signal cable shields.

CAN bus protocols and wiring

The following CAN communication protocols are available for the device:

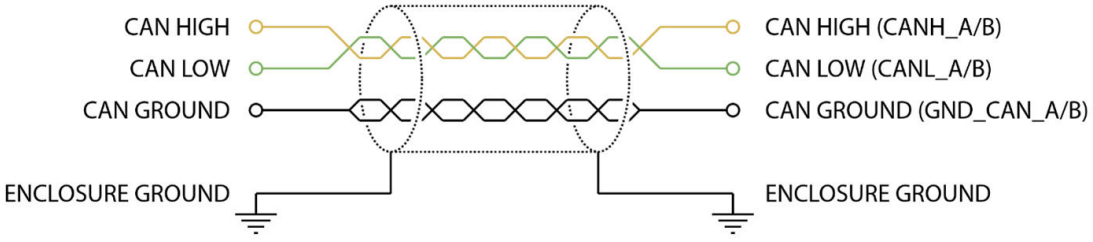
- CANopen (+CO option)
- SAE J-1939 (default option)

Only one protocol can be chosen, and the choice should be made when placing an order for the device. It is not possible to change the protocol afterwards without sending the device back to Danfoss Editron. For more information regarding the CAN bus protocols, see user guide *EC-C Software* and communication manuals.

The electric device provides two galvanically isolated and individually configurable CAN bus connections, labeled CAN A (pins 8, 9 & 20) and CAN B (pins 21, 32 & 33). The functionality and messaging of each bus can be configured in the device parameters by using the PowerUSER program. In a typical usage scenario, CAN A will be used for the main system bus, which is connected to a controller or PLC. This main bus is used for sending commands to the device and receiving status information and data from the device. Meanwhile, CAN B could be used for additional features such as redundancy or a backup control setup. It is not necessary to connect or use CAN B if all relevant features and functions are configured to CAN A, and vice versa.

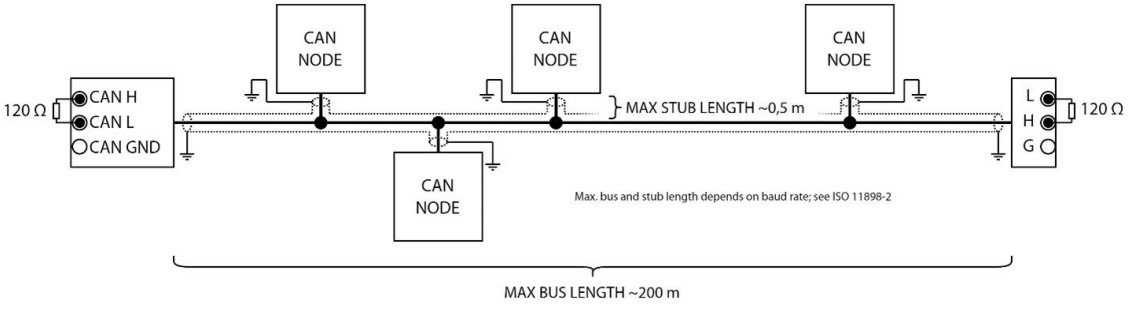
CAN bus wiring should be done using a shielded twisted pair cable to minimize EMI in the CAN signals. The shield of the cable cannot be used as the CAN bus ground, as this will increase interference dramatically. Instead, there should be a separate wire for the CAN ground, as shown in the figure below. This generally requires the use of a 2x2 STP fieldbus cable for the CAN wiring. If the CAN bus connects to devices which do not have a separate ground for the CAN bus, the CAN ground wire should be connected to the low voltage power supply negative terminal in these devices.

CAN bus wire construction and grounding



Always follow the relevant specifications and instructions for the wiring given in the high-speed CAN bus related technical specifications such as the ISO 11898-2 standard. The CAN bus should be a single bus structure with short stubs for each device, and the bus must be terminated from each end point with a 120 Ω terminating resistor, as illustrated below.

CAN bus structure



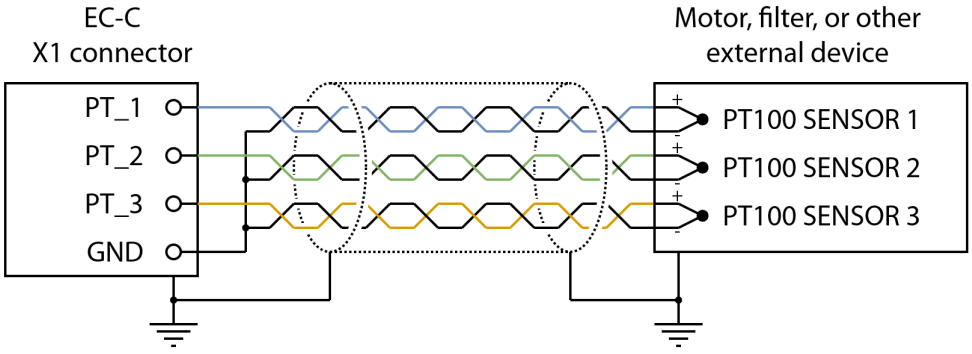
External temperature measurement connections

The electric device has three PT100/PT1000 external temperature sensor inputs (pins 6, 18 & 29) that can be used to measure the temperature of the connected motor, filter, or other device. These inputs can also be configured to automatically derate the output power by reducing the maximum allowed output current in order to prevent overheating of the connected device. This derating functionality is available for +MC, +AFE and +DCDC options. Additionally, there are configurable temperature limits that can be used to generate warnings or trips in the device.

The external temperature sensors can be connected to the device's X1 connector using suitable shielded and twisted pair wires. The sensors are connected between the measurement input pins and the signal ground. In case there are not enough signal ground pins available in the connector, the temperature sensor ground wires can be spliced together near the X1 connector and connected to one signal ground pin, as shown in the figure below.

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Connecting the external temperature sensors



General-purpose user I/O connections

Before connecting anything to the I/O of the device, check the maximum allowed voltage and current of the connections from the product data sheet. Ensure that the attached components do not exceed these allowed values, as otherwise the I/O circuits in the device can be damaged permanently.

The five galvanically isolated user I/O pins in the X1 connector can be used for general-purpose digital or analog input and output functionality. For example, they can be used to attach external control switches, buttons and indicator lights directly to the device. USER_IO_1, 2, 3, 4, and 5 connections (pins 10, 11, 12, 23 & 34) can be configured for the input and output functions, and the GND_IO (pin 22) should be connected to the relevant ground potential which is used to feed the I/O circuit. If the VP5V sensor output pin (7) is used to feed power to the user I/O connections, a connecting wire between the GND_IO and one of the signal ground pins must be added. Likewise, if the system's main LV DC power supply is used to power the I/O, a wire between the GND_IO and the VIN_N must be connected.

By default, the I/O inputs are not configured to activate any functions in the software of the device. It is necessary to perform a configuration of the functionality before the I/O can be used to control the inverter or activate any functions. This setup and configuration can be done by setting the parameters in the device via the PowerUSER program. See user guide *EC-C Software* for more information.

High voltage interlock loop (HVIL)

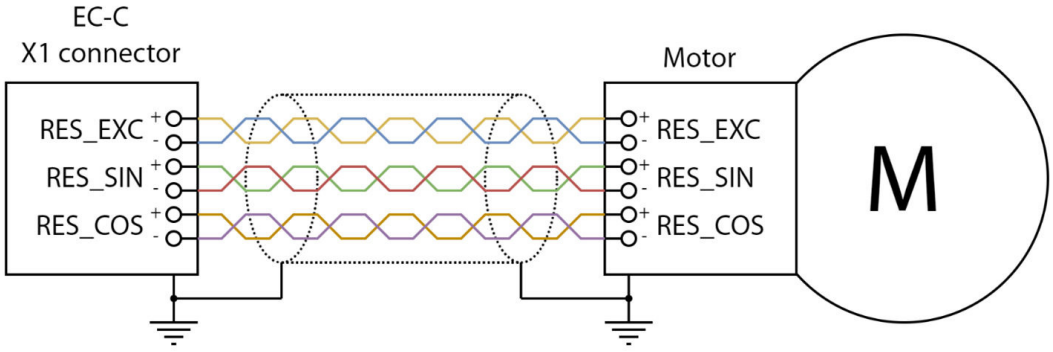
The LOOP pins (19 & 31) in the X1 connector can be used for an external HVIL loop monitoring system. Internally these pins are connected directly to each other inside the device. When the X1 connector is attached, monitoring current can be fed through the pins, indicating that the connector is attached. When the connector is disconnected, the loop is broken and the high voltage power in the system can be quickly disconnected to prevent danger. The device does not have any internal software functionality or monitoring for these pins.

Resolver connection

The electric device features a connection for a resolver. The resolver is an optional sensor which is installed inside a motor and used in a motor control application to allow the inverter to accurately measure the orientation of the motor shaft. This improves the behavior of the motor, especially at a low motor RPMs.

The resolver connection requires a 3 x 2 shielded twisted pair cable, where each pair of wires carries one of the three resolver signals, namely excitation (EXC), sine (SIN) and cosine (COS) of the measurement. The resolver cable should be connected directly between the motor and the motor control inverter, as illustrated in the figure below.

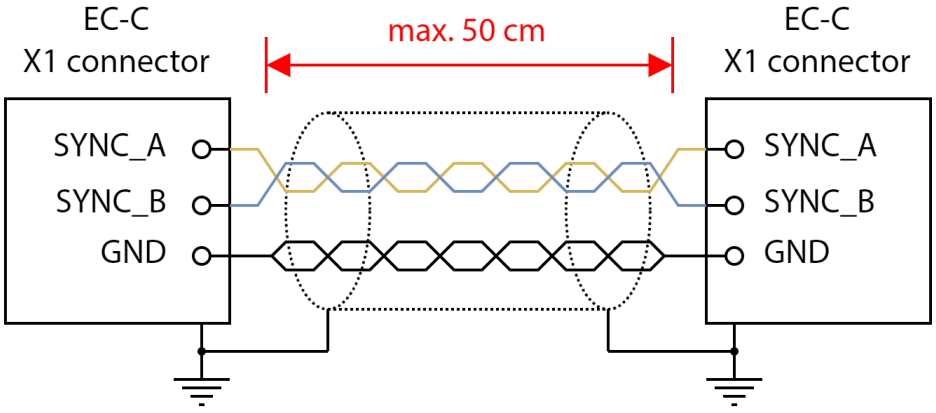
Connecting the resolver



SYNC connection

When two motor control inverters are used with a dual winding motor and a single resolver, the SYNC connection can be used to relay the resolver signal between the devices. See the resolver configuration manual for more information regarding the SYNC connection and resolver signal sharing.

Sync connection



Signals for monitoring, diagnostics, and set-up

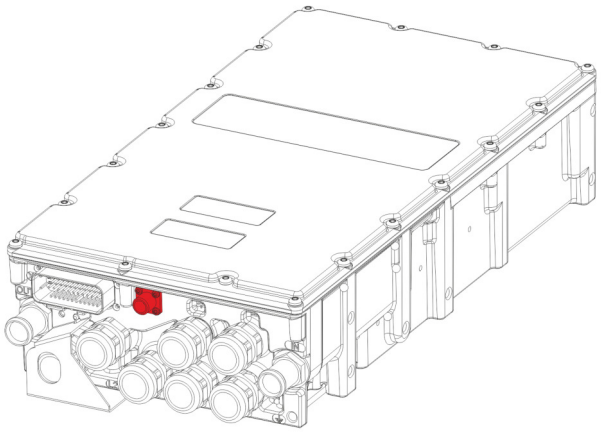
A USB to RS485 converter can be used to establish a connection between the electric device and a PC via the M12 service connector (X2 connector). This service connection enables monitoring, diagnostics and setting up of the electric device by using the freely downloadable **PowerUSER** application.

A reliable connection between the PC and the electric device can be ensured by using the Power Series Service Cable (PSSC), available from Danfoss Editron. The PSSC is a galvanically isolated and shielded USB-to-RS485 converter cable, designed for demanding environments. It is available with a 3-meter (PSSC-3M) or 10-meter cable (PSSC-10M). The PSSC cable can be used to connect with all Editron products which have an M12 service connector.

The service cable is ordered separately. PowerUSER application can be downloaded for free from *http://www.danfoss.com/*.

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Maintenance connector



Operation

Operation conditions

The electric device should be used for its intended purpose only and within limits specified by the manufacturer, concerning:

- Loading.
- Cooling.
- Service interval.
- Ambient conditions such as temperature and moisture.

The electric device is designed for these conditions:

- Ambient operating temperature limits: -40°C...+85°C.
- Maximum altitude 3000 m above sea level.
- Maximum coolant liquid temperature at the inlet of the coolant circuit, see product data sheets.
- Coolant liquid must be a mixture of water and glycol with maximum of 52% glycol content. See chapter *Recommended coolants* on page 33.

The electric device must be pre-charged, see chapter *Pre-charging* on page 55.

If the operation limits are exceeded and the electric device is damaged, please contact local Danfoss representative.

Pre-charging

	**Do the pre-charging correctly, or the high inrush current may break external electrical components of the electric device.**
	**The electric device DC-link capacitance can be found from the data sheet.**

Pre-charging of the DC-link is mandatory before connecting to another DC-source, for example, a high voltage battery, if the voltage difference between the DC-link and the DC-source is higher than 20 V_{DC}. Pre-charging charges the DC-link in a controlled manner, limiting the inrush current going to DC-link capacitor before the DC-source is connected directly to the DC-link.

Condition monitoring during operation

	**Risk of permanent damage to the electric device. Use the electric device only if the technical guidelines and ambient conditions given in this user guide and in the data sheet are met.**
	**Risk of permanent damage to the electric device. If you notice deviations from the normal operation (for example: high temperatures or noise), stop the electric device. Find the reason for the deviation and refer to Chapter *Troubleshooting* on page 61 for more information.**
	**Electrical safety of the system and the end application have to be guaranteed using appropriate methods, like external insulation resistance or residual current monitoring, depending on the application.**

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Monitor the electric device regularly during operation to make sure of reliable operation, to foresee possible upcoming failures and to help to reach the designed lifetime of the product.

Maintenance

Regular maintenance

	**Do not disassemble the electric device. You can do only procedures described in this user guide. For further information contact Danfoss representative.**
	**Only trained and qualified personnel that are familiar with the relevant safety requirements can do any maintenance to the electric device.**
	**Risk of electric shock when the connection box lid is removed.**
	**Inspect the electric device at regular intervals. Use the regular maintenance checklists in the inspections.**
	**Do not attempt to tighten or release any screws, nuts or joints which are not shown in this user guide and that are not involved in the normal installation and maintenance procedures.**
	**Use correct personal protective equipment when you are near the electric device.**
	**Read the instructions in the user guide before you install the electric device. To ensure safe and reliable operation of the electric device, obey the maintenance instructions.**

Maintenance intervals

Object		Check/Task	Weekly	Monthly	Yearly
General construction	Operation	Abnormal phenomenon, for example noise or heating. If clearly increased, contact Danfoss representative.	X		
	Mounting	Tightness of the screws. Tighten to proper value if necessary. Applies to screws that are presented in this user guide. See Chapter *Tightening torques* on page 23.			X
	Enclosure and connected parts	Check cleanliness. Clean if necessary. See Chapter *Cleaning* on page 58.		X	
Electrical system	Cables	Visual check, for example wear. Replace if necessary.		X	
	Electrical connections	Check connections. Ensure that sufficient tightening torque is applied to cable glands and lugs. See Chapter *Tightening torques* on page 23.			X
	Groundings (earthings)	Check groundings (earthings). Ensure that the connection resistance is valid. Re-connect if necessary.			X

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Maintenance intervals (continued)

Object		Check/Task	Weekly	Monthly	Yearly
Cooling system	Operation	Functioning. Cooling system functions as specified.	X		
	Tubing and connection tightness	No visible leakage. If leaking, tighten connections appropriately, or replace parts.		X	
	Ventilation plug	Cleanliness. Clean if necessary. See Chapter *Cleaning* on page 58.		X	
	Coolant quality	Use the coolant as specified (water-glycol mixture appropriate). Refill if necessary. See Chapter *Recommended coolants* on page 33 and *Cooling system maintenance* on page 58.			X

Cooling system maintenance

The cooling system of the electric device requires regular observation and maintenance activities. Observe weekly that the cooling system operates correctly and check monthly that there are no leakages in the cooling system. The quality of the coolant must be checked yearly. The mixture of water and glycol as well as the type of the glycol used must be as specified. See Chapter *Recommended coolants* on page 33.

Cleaning

	**Do not use pressure washer for cleaning. High water pressure may damage the gaskets allowing water to go in to the electric device.**
	**Never open or remove the watertight breather plugs. Clean them only from the outside.**
	**Risk of electric shock if the electric device is cleaned against instructions allowing water to go in to the electric device.**

Keep the electric device clean. For cleaning, use non-abrasive and non-corrosive cleaning products. Make sure that the detergent can be used for aluminum.

Dismounting and disposal of the electric device

	**Risk of electric shock if dismounting steps are continued before the electric device is discharged and a safe voltage level has been measured.**
	**Do not touch the electric device or continue to work with the electric device until it cools down.**
	**Do not use excessive force when you disconnect the connector, because the plastic housing of the connector can break. Release the retaining clip of the connector before you disconnect the connector.** **Do not try to unplug the X1 or X2 connectors by pulling from their wires.**
	**Support the electric device during dismounting, handle it with care.**
	**When the device is dismounted and stored and packed for delivery, measure that there is no voltage and then install short circuit wire to the conductor rails to prevent charge from building up.**
	**Refer to Chapter *Installation procedure* on page 30 for additional information.**

Dismounting procedure

1. Switch off the electric device.
2. Make sure that the cooling system remains operational.
3. Release the retaining clip of the X1-connector (control signal connector, low voltage, 35-pin) and disconnect the connector.
4. Wait until the electric device has fully discharged. Always measure that no voltage is present on the power terminals before you proceed.
5. Wait until the temperature of the electric device and cooling liquid has decreased below +40°C.
6. Remove the mounting screws and dismount the electric device from the mounting base.
7. Dismount the connector shield (mechanical safety component).
8. Dismount the connection box lid (power terminal cover).
9. Disconnect the power terminal cabling and the grounding cables (protective earth).
10. Disconnect the liquid cooling system.
11. Install the connection box lid and other parts and plug all electrical and cooling connections for longer storage.
12. Lift off the electric device according to Chapter *Lifting* on page 24.

Disposal of the electric device

Dispose of the electric device and any of its parts by appropriate means in accordance with local laws and regulations.

	**Electric device must not be opened (excluding the connection box lid). Any attempt causes loss of warranty.**

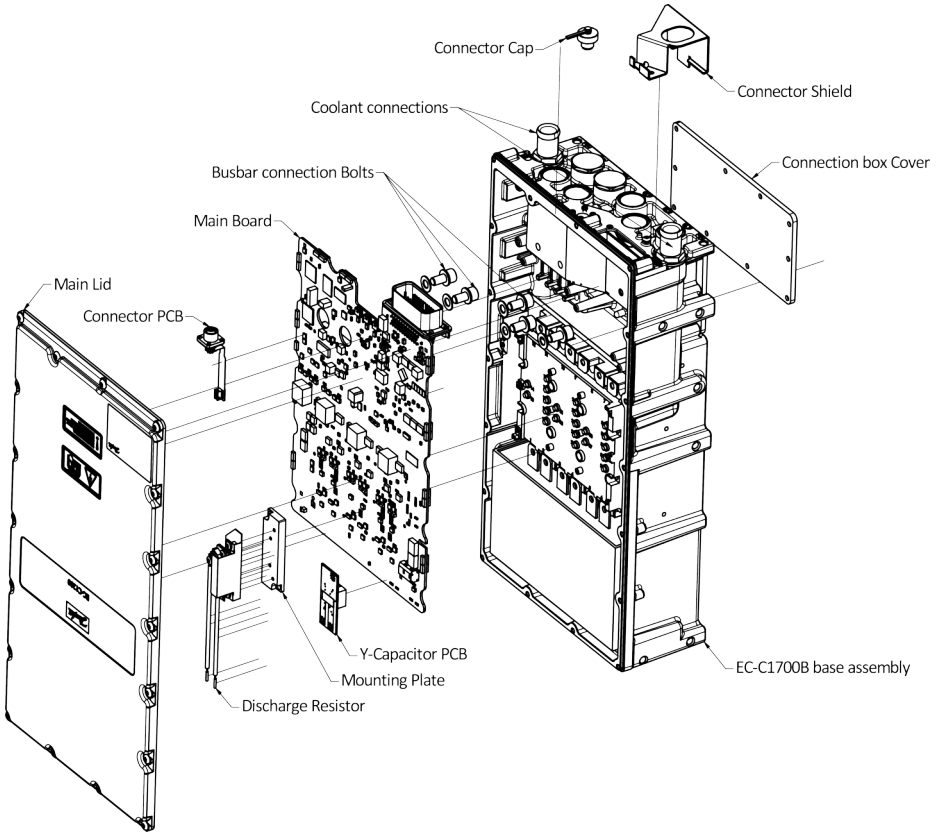
Main material content for EC-C1700B

Components	Material class	Weight (kg)	(% wt)
EC-C1700B base assembly	Metal, electrical, plastic, miscellaneous	11.66	82.871
Lid and connection box cover	Aluminum	1.43	10.163
Coolant connections	Brass	0.204	1.45

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Components		Material class	Weight (kg)	(% wt)
Misc. plastic (M12 connector cap, insulation films etc.)		Plastic, miscellaneous	0.03	0.213
Misc. metal (screws, etc.)		Metal, miscellaneous	0.082	0.582
PCBAs	Main board (with plastic insulator)	Electrical	0.504	3.582
	Y-capacitor PCB	Electrical	0.01	0.071
	Connector PCB	Electrical	0.018	0.128
Discharge resistor assembly	Discharge resistor	Electrical	0.016	0.114
	Mounting plate	Aluminum	0.042	0.3
Connector shield		Stainless Steel AISI 304/ 1.4301	0.074	0.526

3D exploded view (For disposal purposes only. Device is non-repairable and the warranty is void if opened.)



Troubleshooting

	**Do not activate the automatic fault reset function on any system where it can be the cause of a potentially dangerous situation.**
	**Do not try to repair the electric device. In the case of suspected fault or malfunction, contact Danfoss or authorized service centre for further assistance.**
	**For the reason of general safety and correct operative actions, read the instructions carefully before you start any analyses or work with the electric device**.
	**Use correct personal protective equipment when you are near the electric device.**

Some unexpected situations may occur while operating the electric device. Some of the possible causes and actions are given in table below. If an unexpected situation occurs, it should be corrected as soon as possible.

These instructions do not cover all details or variations in the equipment nor provide information for every possible condition to be met in connection with installation, operation or maintenance.

Troubleshooting

Fault description	Possible cause	Action
Electric device overheating	Cooling system failure.	Inspect the cooling system operation and functionality, especially possible leaks, flow rate and fluid temperature. Change the cooling flow direction to flush the cooling system from sediment possibly accumulated.
	Leakage in the cooling system.	Inspect the cooling system circuit and connections.
	Rigid particle inside the cooling channel of the electric device.	Try to pulsate coolant to open the channels. Contact Danfoss representative.
Significant coolant leak	Loose connection in the cooling system.	Inspect, clean and tighten the connections. Replace them if necessary.
	Broken cooling hose.	Replace the cooling hose.
Electric device does not work correctly or the performance is poor	Poor powerline contacts (high voltage)	Inspect, clean and tighten the contacts.
	Poor control signal contacts (low voltage)	Inspect the X1-connector mounting.

Fault history and fault reset

When an unusual operating condition is detected by the control diagnostics, the electric device gives a notification. The notifications vary depending on the consequences and required action:

- Fault- type of notification stops the electric device and requires reset.
- Warning- type of notification informs of unusual operating conditions, but the electric device stays operative (power on).

When a fault appears and stops the electric device, the root cause of the fault must be defined before any further actions. All faults are stored in to Fault history- menu.

After the root cause is defined and the electric device is inspected and recovered according to instructions, the fault can be reset. Fault resetting can be done with the reset signal through the fieldbus or by using maintenance connection and PowerUSER application.

For more information about the fault history and fault reset, see product data sheets.

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Aftersales

Service policy

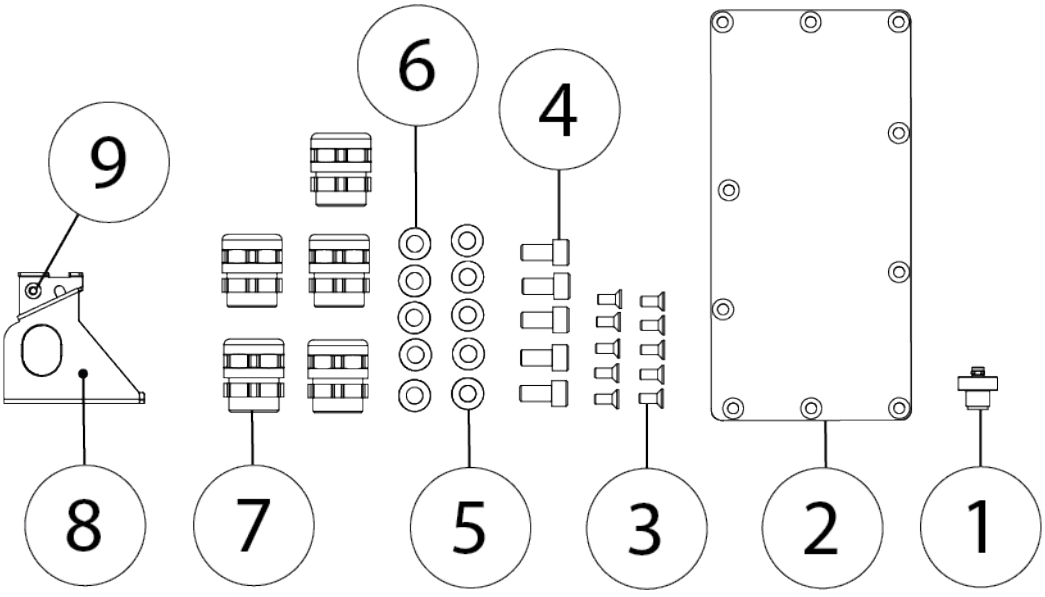
Maintenance and service of the electric device is limited to the procedures described in this user guide. See chapter *Service parts* on page 62 for available accessory and service parts.

For further information, go to *https://danfosseditron.zendesk.com/hc/en-gb* or send email to editron.service@danfoss.com.

Service parts

The recommended service kits are presented below. Contact Danfoss representative for more information and purchasing.

Item kit



Item kit

Inverter Item KIT Order number 11286812		
Number	**Part**	**Quantity (pcs)**
1	CONNECTOR, BINDER 08-2616-000-000	1
2	PLATE 41117400	1
3	BOLT. COUNTERSUNK- M5 x 12, DIN 965 A2]	10
4	BOLT. SOCKET HEAD-, M8 X 16 (ISO 4762) Z	5
5	SPRING.DISC-, D8, DIN 2093, 8,2 X 16 X 0,9	5
6	WASHER, D8 DIN 125	5
7	CABLE GLAND, M25 X 1.5, BG 225MS TRI PFLIT	5
8	HVIL SHEET T=1,5	1
9	BOLT, M4 x 8-4.8, ISO 14583, A2K OR A2F	1

+DCE kit

EC-C+DCE KIT Order number 11273429	
Part	**Quantity (pcs)**
MODULE. DC CONNECTIONS, EC-C+DCE	1
WASHER, D8 DIN 125	2
BUSBAR, OD=16, ID=8,3, L=32	2
BOLT. SOCKET HEAD-, M8 X 55, DIN 912, ZI	2
SPRING.DISC-, D8, DIN 2093, 8,2 X 16 X 0,9	2
CABLE GLAND, M25 X 1.5, BG 225MS TRI PFLIT	2

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Additional product literature is available at *powersource.danfoss.com*.

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