MSc DC/DC Converter
Product Overview

subject to changes without notice

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1 TECHNICAL INFORMATION

1.1 TECHNICAL DESCRIPTION

1.1.1 Introduction

MSc DC/DC Converter is a bidirectional DC/DC converter, which can be used to transfer energy between an Energy Source and a DC-Link. The MSc DC/DC Converter is designed **for industrial environments only**.

1.1.2 Technical data

MODEL	**80DCDC750DE**	**200DCDC750DE**
Topology		
Operation mode	Bidirectional	Bidirectional
Control method	DC-Link voltage reference Energy Source voltage reference Energy Source current reference	DC-Link voltage reference Energy Source voltage reference Energy Source current reference
Input (Energy Source)		
DC Input Voltage range	35-700Vdc	35-700Vdc
Nom. Input Current	80A	120A
Max. Input Current	80A	200A, 1 min./10 min.
Output (DC-link)		
DC Output Voltage Range	100-800Vdc	100-800Vdc
Nom. Output Current	80A	120A
Max. Output Current	80A	200A, 1 min./10 min.
Efficiency		
Max. Efficiency	97	97
Startup side quiescent power	< 100 W	< 100 W
I/O Connections		
Input signals	Digital/Analogue	Digital/Analogue
Output signals	Digital/Analogue	Digital/Analogue
General Data		
Dimensions (wxhxd) in mm	160 x 561 x 291	285 x 686 x 344
Weight (kg)	20	27
Cooling	air cooled	air cooled
Operation temperature	-10°C - +40°C	-10°C - +40°C
Degree of protection (IEC 60529)	IP 20	IP 20
Noise level	<80 dB	<80 dB
Standards		
EMC	EN 61800-3	
Electrical safety	EN 61800-5-1	

Protections	
Protections	Internal overtemperature DC-Link overvoltage Energy Source overvoltage Energy Source overcurrent
Limitations	DC-Link & Energy Source voltage

- **Startup from DC link side at voltage level of 360 Vdc or more**
- **Non-standard startup voltage side and level change upon request**
- **Control method is based on factory setting, which cannot be changed after the delivery.**

NOTE: The Energy Source voltage has to be lower than the DC link voltage all the time to avoid uncontrollable current flow! For stable performance it is advised to keep the Energy Source voltage at least 100 Vdc lower than the DC link voltage.
NOTE: MSc DC/DC Converter does not galvanically isolate the Energy Source from the DC-link. All voltages connected to the Energy Source terminals are also connected to the DC-link terminals!

1.1.3 Ambient conditions

The MSc DC/DC Converter is suitable for indoor wall-mount installation, in a well-ventilated area without dust and excessive aggressive gases where the ambient operating conditions do not exceed the following values:

Ambient operating temperature/Cooling air temperature	See chapter 1.1.2 Technical data
Storage/transportation temperature (in the protected package)	-40°C...+70°C
Relative humidity	0 - 95% RH, non-condensing, non-corrosive, no dripping water
Cooling air required	200DCDC750DE 425 m^3/h 80DCDC750DE 300 m^3/h
Air quality / chemical vapours	IEC 721-3-3, MSc DC/DC Converter in operation, class 3C2[(a)]
Air quality / mechanical particles	IEC 721-3-3, MSc DC/DC Converter in operation, class 3S2[(b)]
Altitude	100 % load capacity (no derating) 1000 m 1 % derating for each 100 m above 1000 m; max. 3000 m
Vibration	50 ... 150 Hz, EN50178 / EN60068-2-6
Shock	EN50178, EN60068-2-27. Storage and shipping max 15G/11ms (in the protected package).

Remarks:
[(a)] Locations with normal levels of contaminants, experienced in urban areas with industrial activities scattered over the whole area, or with heavy traffic.
[(b)] Locations without special precautions to minimize the presence of sand or dust, but not situated in proximity to sand or dust sources.

The MSc DC/DC Converter installation must be indoors and the degree of protection (IEC 60529), in chapter 1.1.2 Technical data, should be taken into account.

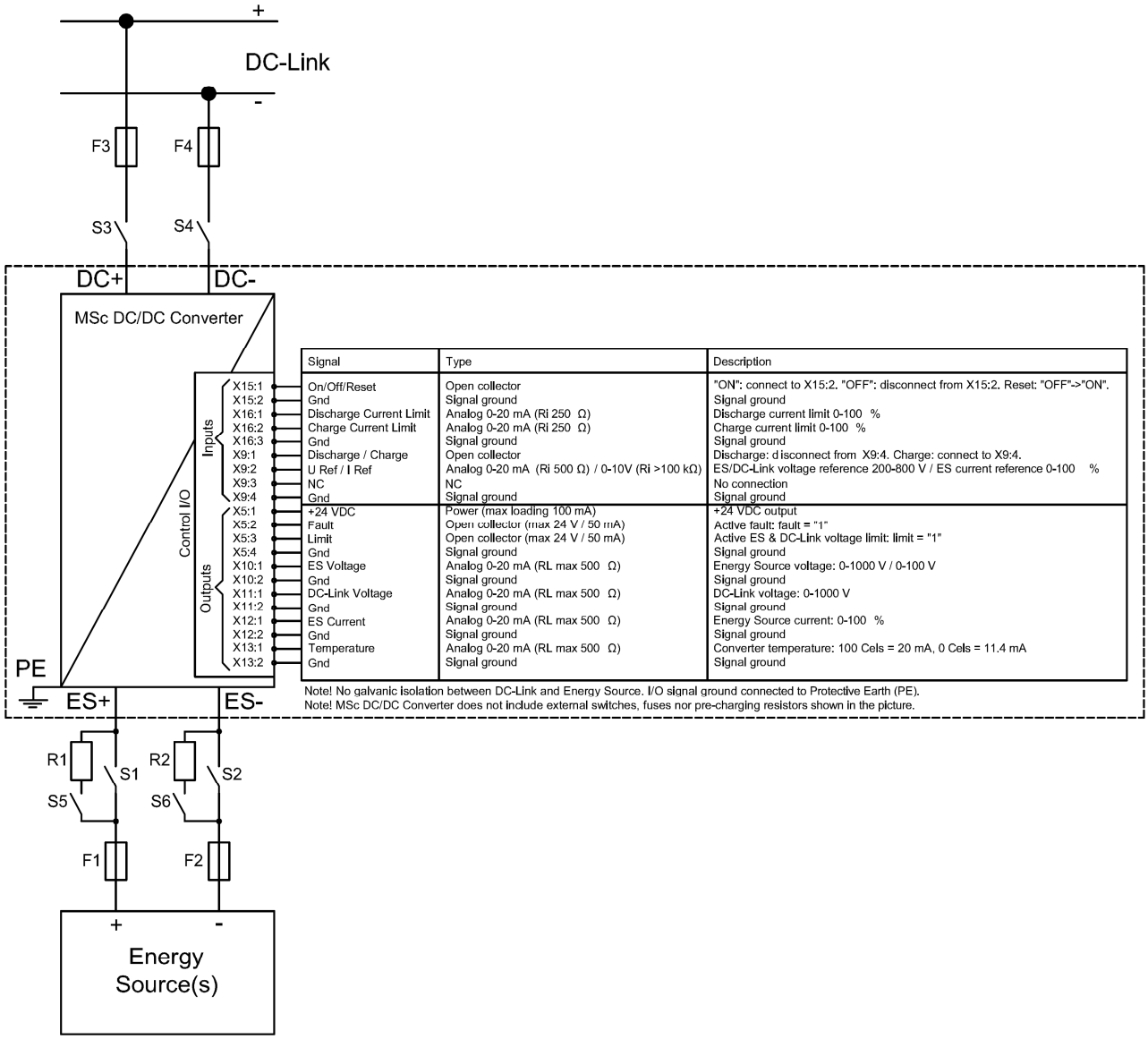
WARNING: Conductive dust may cause damage to this equipment. Ensure that the MSc DC/DC Converter is installed in a room where no conductive dust is present.

1.1.4 Operational description and functions

1.1.4.1 Overall functional description

MSc DC/DC Converter is bidirectional which means that when connected to an Energy Source it can be used both for charging and for discharging in turn. The control I/O can be seen in the block diagram below.

See relevant chapters below for more information about different control methods. Note! The control method is based on a factory setting, which cannot be changed after the delivery.



Signal	Type	Description
On/Off/Reset	Open collector	"ON": connect to X15:2. "OFF": disconnect from X15:2. Reset: "OFF"->"ON".
Gnd	Signal ground	Signal ground
Discharge Current Limit	Analog 0-20 mA (Ri 250 Ω)	Discharge current limit 0-100 %
Charge Current Limit	Analog 0-20 mA (Ri 250 Ω)	Charge current limit 0-100 %
Gnd	Signal ground	Signal ground
Discharge / Charge	Open collector	Discharge: disconnect from X9:4. Charge: connect to X9:4.
U Ref / I Ref	Analog 0-20 mA (Ri 500 Ω) / 0-10V (Ri >100 kΩ)	ES/DC-Link voltage reference 200-800 V / ES current reference 0-100 %
NC	NC	No connection
Gnd	Signal ground	Signal ground
+24 VDC	Power (max loading 100 mA)	+24 VDC output
Fault	Open collector (max 24 V / 50 mA)	Active fault: fault = "1"
Limit	Open collector (max 24 V / 50 mA)	Active ES & DC-Link voltage limit: limit = "1"
Gnd	Signal ground	Signal ground
ES Voltage	Analog 0-20 mA (RL max 500 Ω)	Energy Source voltage: 0-1000 V / 0-100 V
Gnd	Signal ground	Signal ground
DC-Link Voltage	Analog 0-20 mA (RL max 500 Ω)	DC-Link voltage: 0-1000 V
Gnd	Signal ground	Signal ground
ES Current	Analog 0-20 mA (RL max 500 Ω)	Energy Source current: 0-100 %
Gnd	Signal ground	Signal ground
Temperature	Analog 0-20 mA (RL max 500 Ω)	Converter temperature: 100 Cels = 20 mA, 0 Cels = 11.4 mA
Gnd	Signal ground	Signal ground

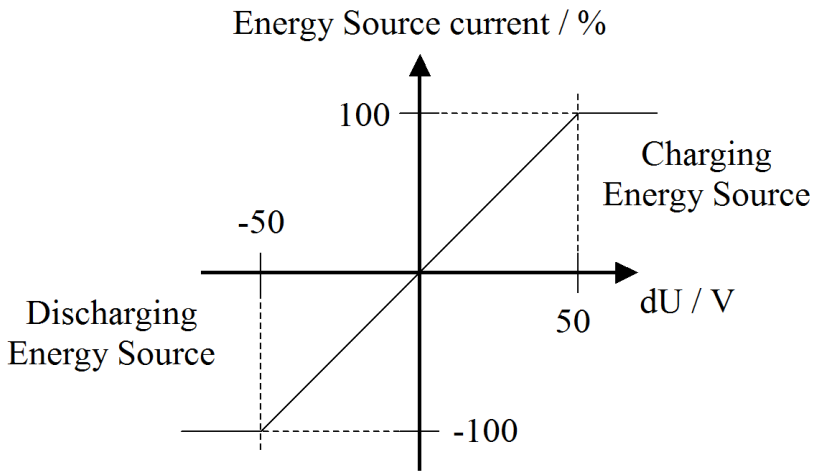
Note! No galvanic isolation between DC-Link and Energy Source. I/O signal ground connected to Protective Earth (PE).
Note! MSc DC/DC Converter does not include external switches, fuses nor pre-charging resistors shown in the picture.

1.1.4.2 ES/DC-link voltage reference control

In the voltage reference control method either the Energy Source voltage or the DC-Link voltage is regulated by the internal P-controller. The direction of the power flow and the amount of Energy Source current is determined by the voltage difference between the reference value and the measured voltage. The maximum current value is reached at a voltage difference of 50 volts as shown in the picture below. Current limitation inputs are used to limit the maximum value of discharging and charging current set by the internal P-controller.

DC-Link voltage reference control: The Energy Source will be charged when the DC-Link voltage is higher than the reference value. The Energy Source will be discharged when the DC-Link voltage is lower than the reference value.

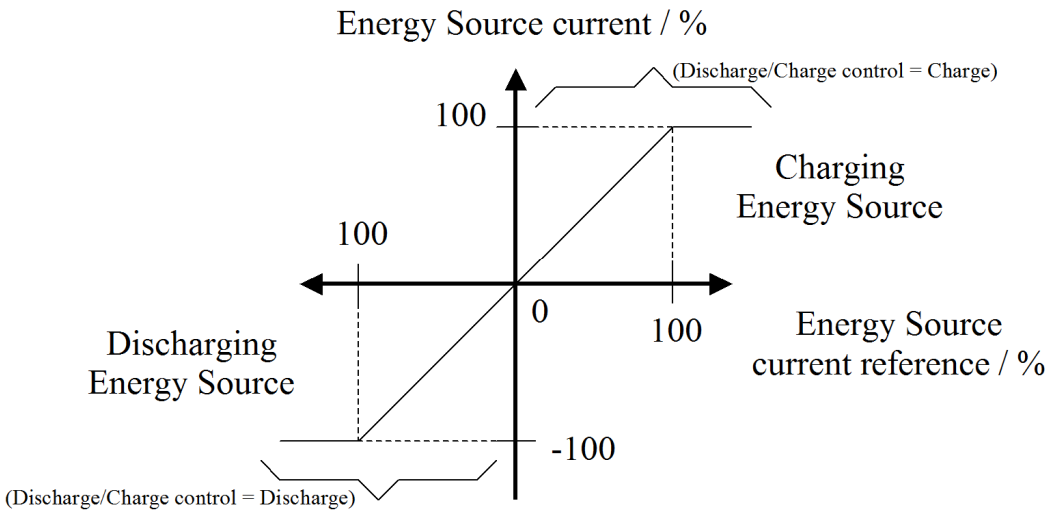
Energy Source voltage reference control: The Energy Source will be charged when the Energy Source voltage is lower than the reference value. The Energy Source will be discharged when the Energy Source voltage is higher than the reference value.



DC-Link voltage reference model: dU = measured voltage - voltage reference)
Energy Source voltage reference model: dU = voltage reference - measured voltage

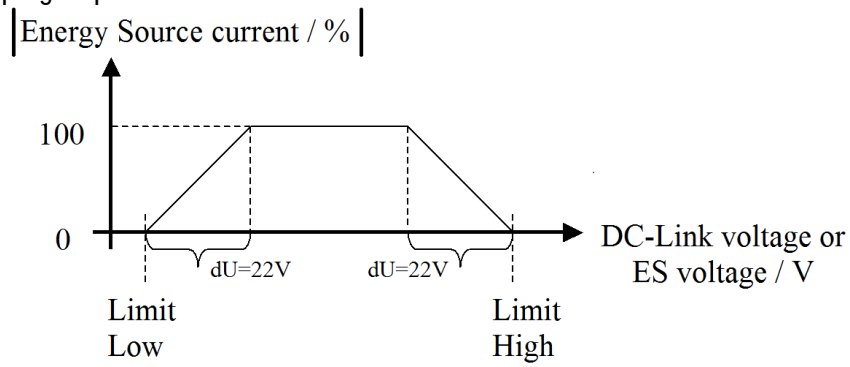
1.1.4.3 Energy Source current reference control

The Energy Source current is controlled directly with the Energy Source current reference. The direction of the current flow is controlled with the Discharge/Charge command. Current limitation inputs are used to limit the maximum value of discharging and charging current set by the current reference input.



1.1.4.4 Voltage drooping

The voltage drooping function limits the Energy Source current when the DC-Link voltage or the Energy Source voltage is getting close to the voltage limits as shown in the picture below. The factory-set default value for the drooping slope value is 22 Vdc.



1.1.4.5 Control functions, input I/O

The MSc DC/DC Converter ON/OFF/RESET states are controlled by the ON/OFF/RESET input. Faults can be reset by changing the ON/OFF/RESET input from ON to OFF to ON. The reset happens when the input turns from OFF to ON.

See block diagram in chapter 1.1.4.1 for electrical characteristics of control I/O.

1.1.4.6 Output I/O, indicator LEDs

The DC-Link voltage, the Energy Source voltage, the Energy Source current and the MSc DC/DC Converter temperature can be monitored via analogue outputs.

When the Energy Source voltage limit low level or the DC-Link voltage limit high level is reached, the discharging of the Energy Source is prevented and the Limit output activated. When the Energy Source voltage limit high level or the DC-Link voltage limit low level is reached, the charging of the Energy Source is prevented and the Limit output activated. Voltage limitation has 25 Vdc hysteresis on default setting, which requires the voltage to change 25 Vdc towards normal operational area before the limitation is deactivated and discharging/charging permitted. These voltage limits have default factory settings that can be found on the type designation label attached to the MSc DC/DC Converter.

When a fault occurs the “Fault” output is activated.

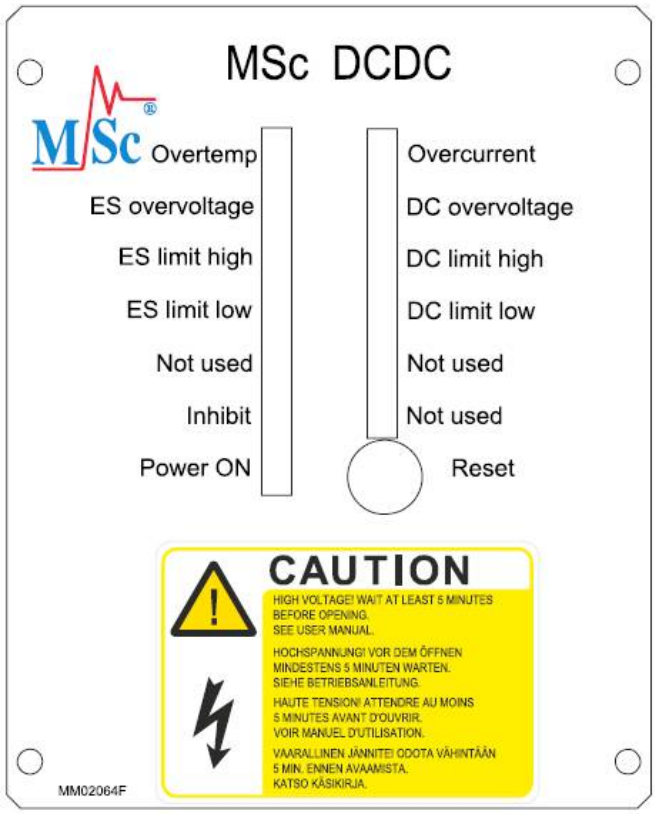
Active voltage limitation and faults light up one or more LEDs on the front cover. The causes and effects on the operational state are explained in chapter 1.2.1 LED indicators.

See block diagram in chapter 1.1.4.1 for electrical characteristics of control I/O.

1.2 CONTROL

1.2.1 LED indicators

The LED indicators give you information on both fault and normal situations. For corrective actions and more detailed information see user manual.

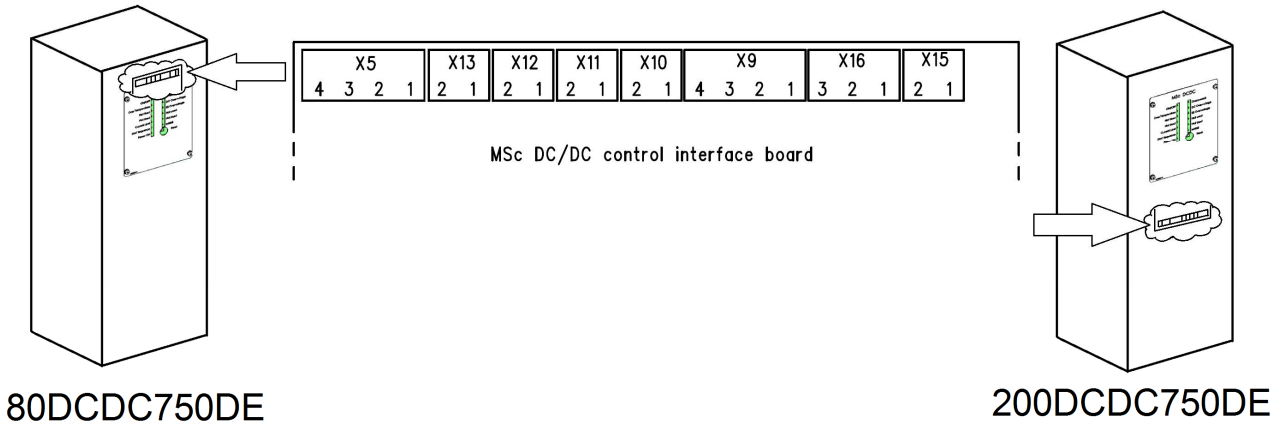


LED indication	LED status and colour	Operational status	Meaning
Overtemp	On (red)	Stopped	Internal temperature limit exceeded
ES overvoltage	On (red)	Stopped	Energy Source overvoltage limit exceeded
ES limit high	On (red)	ES charging prevented	Energy Source voltage has reached maximum limit
ES limit low	On (red)	ES discharging prevented	Energy Source voltage has reached minimum limit
Inhibit	On (yellow)	Stopped	Indication of operational status “Stopped”. Possible cause: ON/OFF/RESET in OFF-state, fault or no auxiliary power.
Power ON	On (green)	ON	Normal operation
	Off	Stopped	No auxiliary power
Overcurrent	On (red)	Stopped	Energy Source overcurrent limit exceeded

LED indication	LED status and colour	Operational status	Meaning
DC overvoltage	On (red)	Stopped	DC-link overvoltage limit exceeded
DC limit high	On (red)	ES discharging prevented	DC-link voltage has reached maximum limit
DC limit low	On (red)	ES charging prevented	DC-link voltage has reached minimum limit

1.2.2 Control interface - inputs and outputs

The physical location of the control connections can be seen in the picture below. The control interface board is located under the cover. The description of the control connections can be seen in the block diagram in chapter 1.1.4.



1.2.3 Optional control interface – CAN bus

1.2.3.1 General information

CAN connection	Interface	M12 male connector
	Data transfer method	CAN 2.0 A/B, ISO 11898
	Transfer cable	2 wire twisted shielded cable
	Electrical isolation	No
Communication	Protocol	CANopen • CiA DS 301 version 4 • CiA DS 401 version 1.4
	Baud rate	20 kBit/s 50 kBit/s 100 kBit/s 125 kBit/s 250 kBit/s *(default option)* 500 kBit/s

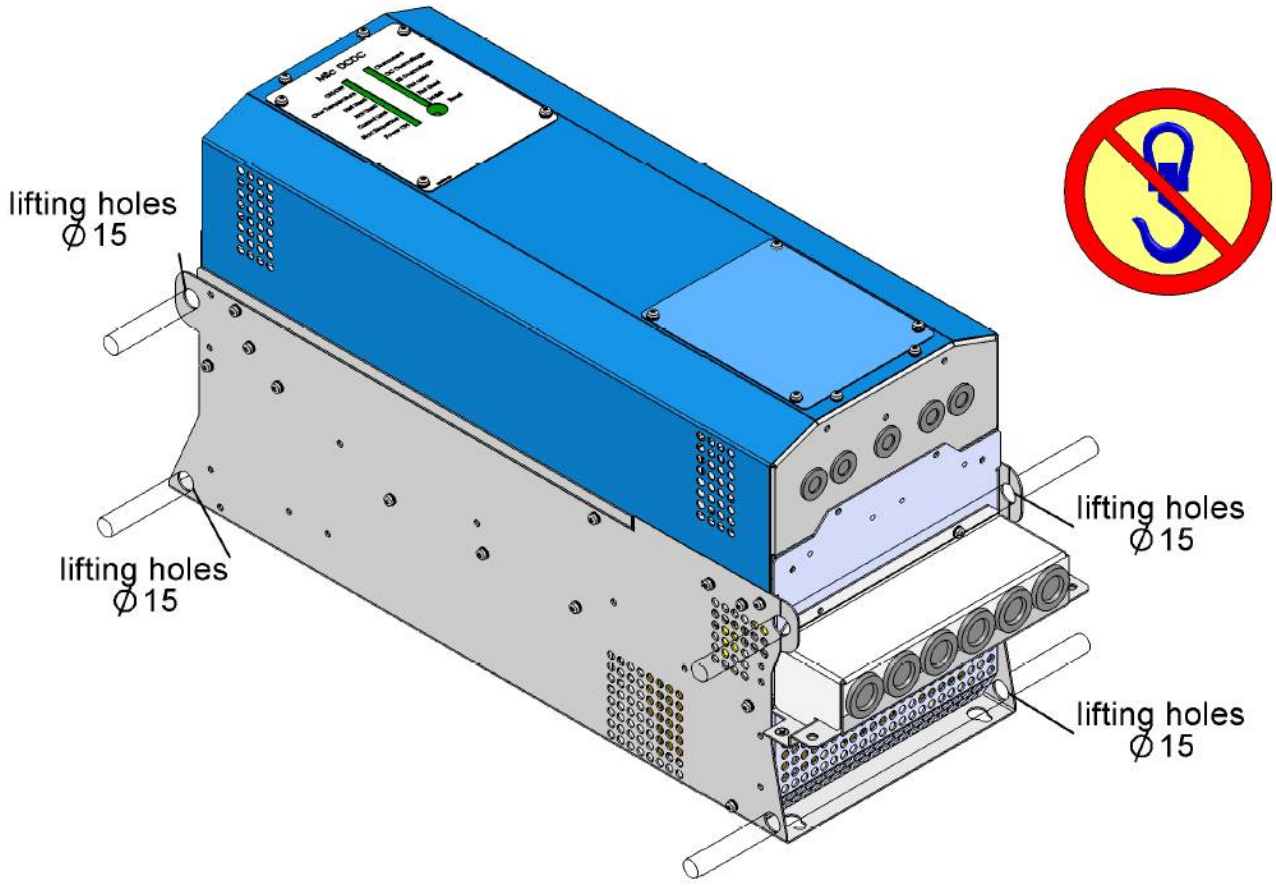
1.2.3.2 Default CANopen PDO-mapping

PDO	COB-ID	Byte	Type	Bit	Name	Description
TPDO1	180h + Node ID	1	Uint8	0	Fault	Fault = 1
				1	Limit	Limit = 1
				2 - 7	*Empty*	
TPDO2	280h + Node ID	1 – 2	Uint16		ES Voltage	1) 0-1000 V = 0-1000 2) 0-100 V = 0-1000
		3 – 4	Uint16		DC Voltage	0-1000 V = 0-1000
		5 – 6	Uint16		ES Current	0-100 % = 0-1000
		7	Int8		Temperature	-10C - +100C = -10 - 100
RPDO1	200h + Node ID	1	Uint8	0	On/off/reset	On = 1, Off = 0, Reset = 0→1
				1	Discharge/Charge	Discharge = 1, Charge = 0
				2 - 7	*Empty*	
		2 – 3	Uint16		U Set / I Set	1) 200-800V = 200-800 2) 0-100 % = 0-1000
		4 – 5	Uint16		Current limit charge	0-100 % = 0-1000
		6 – 7	Uint16		Current limit discharge	0-100 % = 0-1000

2 MECHANICAL INSTALLATION

Please note the weight of the MSc DC/DC Converter equipment, see chapter 1.1.2 Technical data. Care should be taken to ensure that correct handling facilities are used. The MSc DC/DC Converter may only be lifted with a steel bar as shown in the picture below. The steel bar (cross section 15 mm) must be put through the holes on top of the MSc DC/DC Converter. The MSc DC/DC Converter may NOT be lifted with hooks but only with the steel bar (otherwise risk of deformation/bending). Also NEVER lift the MSc DC/DC Converter using the front cover, only the grey structure and its lifting holes are designed for lifting.

200DCDC750DE

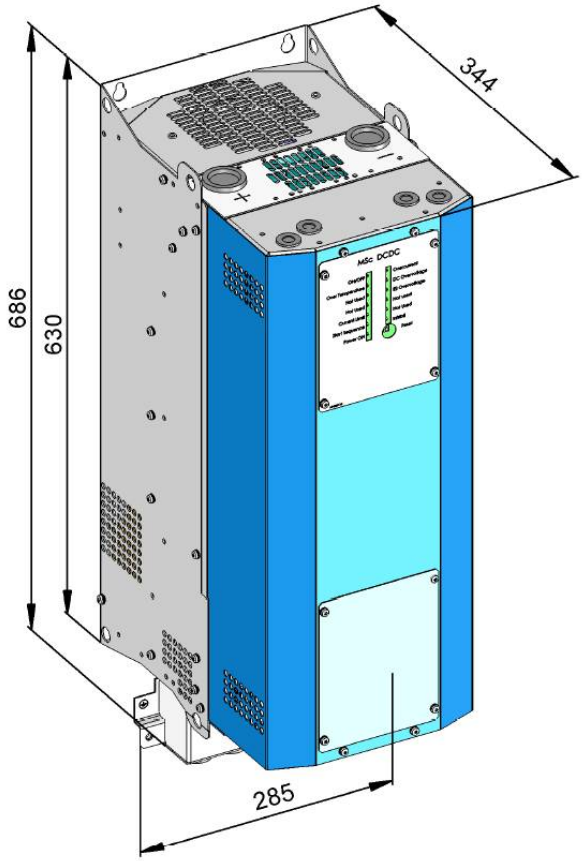


Lifting

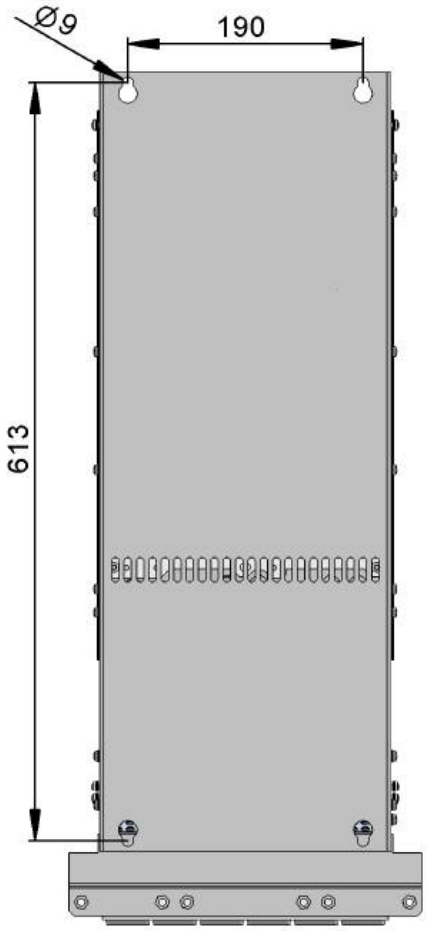
2.1 MOUNTING

The MSc DC/DC Converter must be mounted in vertical position on the wall or on the back plane of a cabinet. The wall on which the MSc DC/DC Converter unit is mounted must be able to support the weight of the MSc DC/DC Converter, see chapter 1.1.2 Technical data. Enough free space must be reserved around the MSc DC/DC Converter in order to guarantee proper cooling (see chapter 2.2). Also the MSc DC/DC Converter identification tag should always remain readable to ensure proper identification during the life of the MSc DC/DC Converter. To ensure safe mounting, the use of an even mounting plane is required. Fastening must be done with four M8 (steel 8.8) bolts. The dimensions of the MSc DC/DC Converter with its enclosure are shown in the picture below:

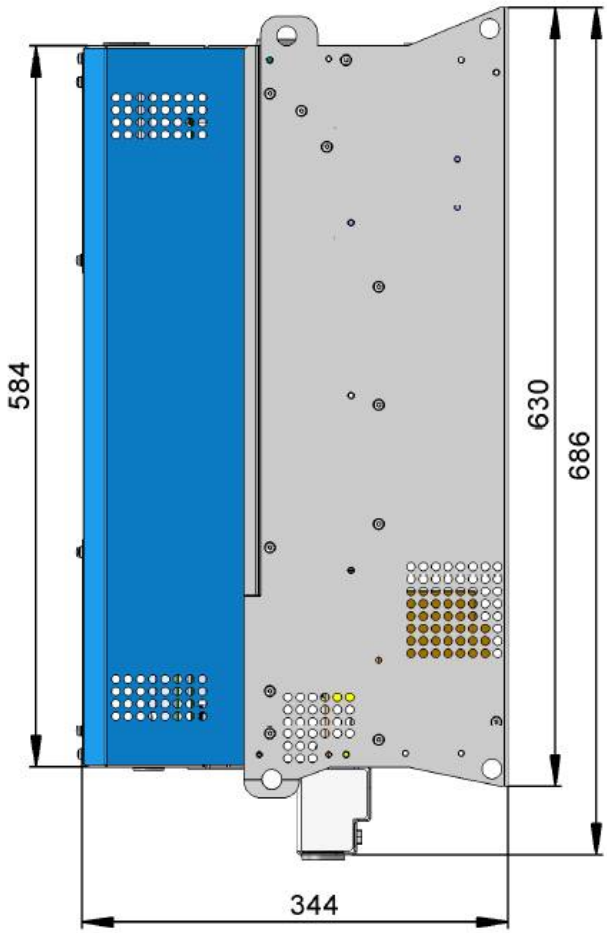
200DCDC750DE



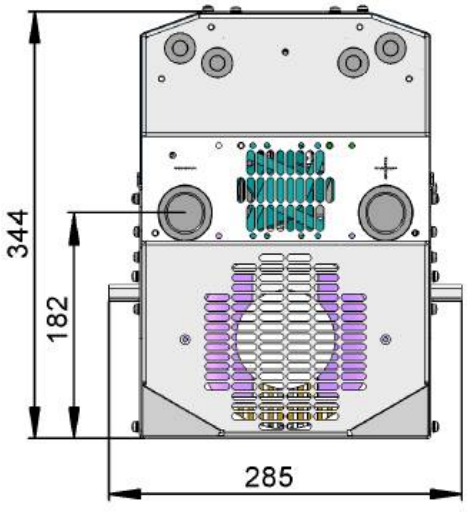
Main dimensions



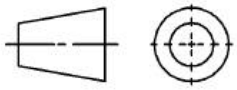
back



side



top



Wall mounting

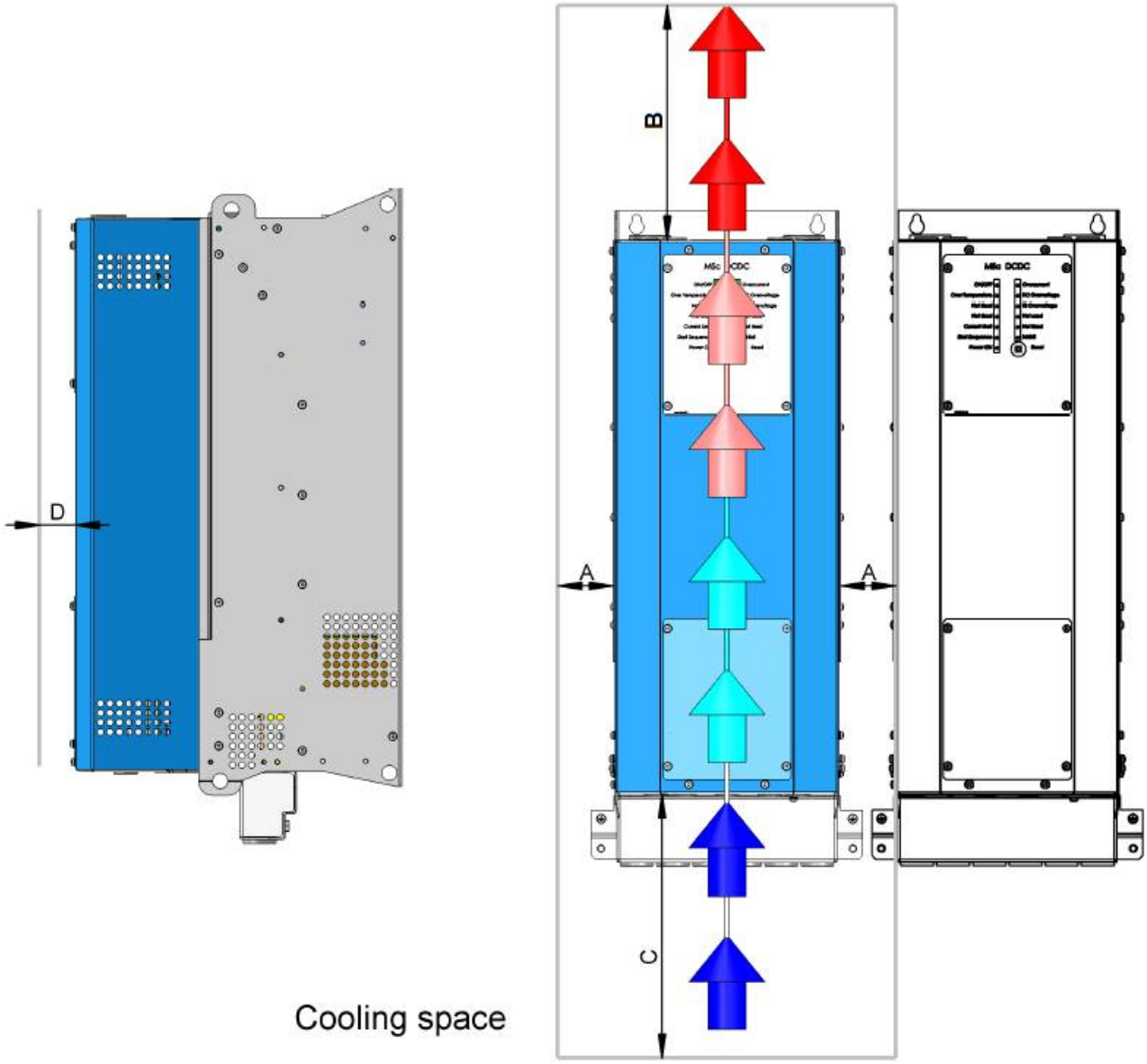
2.2 COOLING

Enough free space shall be left around the MSc DC/DC Converter to ensure sufficient air circulation, cooling as well as maintenance. You will find the required dimensions for free space in the picture and table below.

If an MSc DC/DC Converter system consists of more than one MSc DC/DC Converter unit, the units should be installed next to each other. If several units are mounted above each other the required free space equals B + C. Moreover, the outlet air used for cooling by the lower unit must be directed away from the air intake of the upper unit. The amount of cooling air required is indicated in chapter 1.1.3 Ambient conditions.

Also make sure that the temperature of the cooling air does not exceed the maximum ambient temperature of the MSc DC/DC Converter. Please ensure that the air used for cooling does not contain conductive particles, significant amounts of dust, or corrosive or otherwise harmful gases. The cooling air intake temperature must not exceed the operating temperature.

200DCDC750DE



80DCDC750DE	200DCDC750DE	Letter in picture	Description
50 mm	80 mm	A	free space to both sides of the MSc DC/DC Converter / free space between two MSc DC/DC Converters
100 mm	300 mm	B	free space above the MSc DC/DC Converter
50 mm	150 mm	C	free space underneath the MSc DC/DC Converter
30 mm	30 mm	D	free space in front of MSc DC/DC Converter

3 ELECTRICAL INSTALLATION

WARNING: The MSc DC/DC Converter does not incorporate protective power line fuses. Hence the customer has to ensure that the feeding cables to each MSc DC/DC Converter are adequately protected taking into account the MSc DC/DC Converter rating and the cable section used.

3.1 POWER CONNECTIONS

In the block diagram in chapter 1.1.4 you see the power connections and the location of the fuses and DC-circuit breakers that need to be installed. Further details are given in the following chapters.

3.1.1 Selection of the power cable size

Several types of power cable can be used to connect the MSc DC/DC Converter to an Energy Source and a DC-Link. Local regulations and habits often determine the user's choice.

3.1.2 Making the power connections

Remember to use contact treatment grease in aluminium power connections, e.g. electrolube CG70.

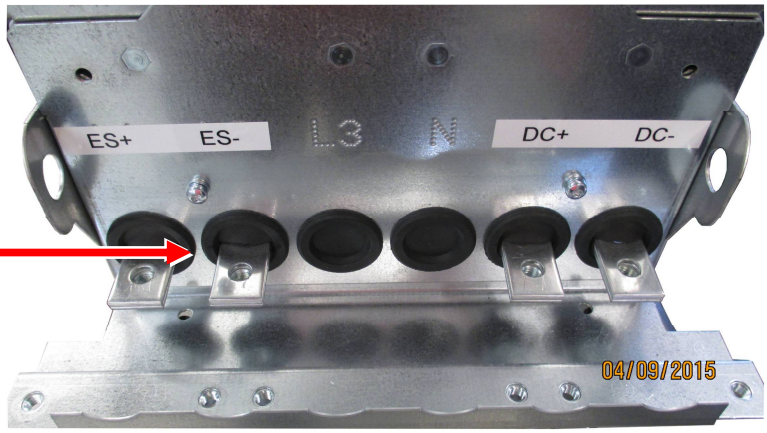
Warning

Before starting the installation, check that none of the ES/DC-Link cables and control cables to be connected to the MSc DC/DC Converter is live.

The connections are shown below. You need to lift the cover marked with the red arrow:

200DCDC750DE

Torx T20 max. 2 Nm



4 aluminium busbars (including M8 nut) max. 24 Nm.
Protective earth (PE) point (including M6 nut) max. 10 Nm.
Only use tools on the bolt heads.

The cable and fuse sizes are listed below:

	80DCDC750DE	200DCDC750DE
Energy Source and DC-Link cabling	recommended cross section 25 mm^2/Cu (heat resistance at least +70°C) MCMK, NKCABLE or similar	recommended cross section 50 mm^2/Cu (heat resistance at least +70°C) MCMK, NKCABLE or similar
Earthing cable	min. 16 mm^2 Cu	min. 25 mm^2 Cu
Energy Source and DC-Link fuse ampere rating and type (F1-F4)	100A / 690V aR	250A / 690V aR
DC-Circuit breakers (S1-S4)	100A / 690V	250A / 690V

3.2 CONTROL CONNECTIONS

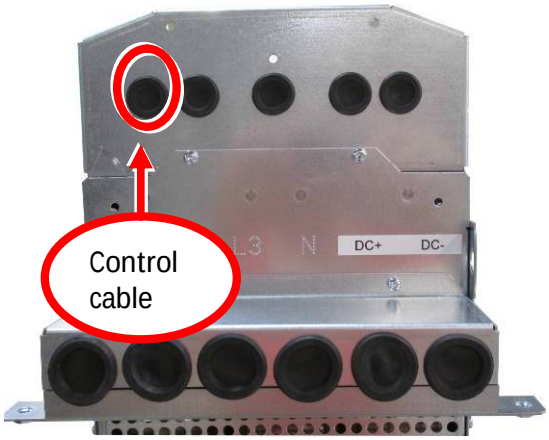
The control cable sizes and types are listed below:

Control connectors and cross sections	Connection method: screw terminals, torque 2 Nm Cross section: 0.25 mm² - 2.5 mm²
PE connectors for control cable shield grounding	Clamp connection
Cable type for control cable	Screened cable equipped with low impedance shield and grounded from both ends

Proceed as follows:
The control cable terminals are located under the front cover. Remove the four M4 Torx T20 screws shown in the picture below in order to lift the front cover towards you and to remove it. The location of the control terminals can be seen in the picture in chapter 1.2.2. Grounding of the control cable shield is done to PE clamp terminal shown in the picture below.

200DCDC750DE

Torx T20 max. 2 Nm



PE clamp connection for cable shield