

6 Power sections for inverters - IndraDrive M

6.1 Overview of types

Inverter	Types	Features
HMS01.1N	W0020	Compact modular design Continuous currents up to 250 A
	W0036	
	W0054	
	W0070	
	W0110	
	W0150	
	W0210	
	W0300	
	W0350	
HMD01.1N	W0012	Compact modular design Continuous currents up to 20 A
	W0020	
	W0036	
HMS02.1N	W0028	Compact modular design Continuous currents up to 25 A Minor mounting dimensions than HMS01
	W0054	

Tab. 6-1: Inverters overview

6.2 HMS01 power sections

6.2.1 Brief description, use and design

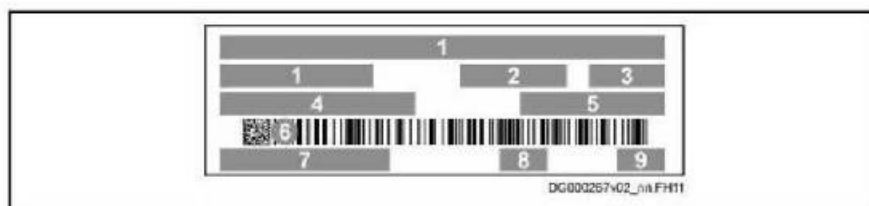
Brief description The HMS01 inverters are part of the Rexroth IndraDrive M product range and are used to operate single axes.

Use The different types are used as follows:

Type	Use
HMS01.1N-Wxxxx-NNNN	- Single-axis device - Operation of a three-phase a.c. motor (asynchronous or synchronous motor).

Tab. 6-2: Use of HMS01

Type plate



- 1 Type designation
- 2 Country of manufacture
- 3 Factory
- 4 Customer material number
- 5 Material number
- 6 Bar code, 2D code
- 7 Serial number
- 8 Production week; 18W23, for example, means year 2018, week 23
- 9 Hardware index

Fig. 6-5: Type plate (electrical equipment)

6.2.3 Scope of supply

- 1 × touch guard
- Connectors for the electrical connection points at the device
- 1 × Instruction Manual (in the English language)

6.2.4 Technical data

Ambient and operating conditions

General information

Conditions for transport and storage: See chapter 4.2 "Transport and storage" on page 23.

Installation conditions: See chapter 4.3 "Installation conditions" on page 24.

This chapter contains:

- Limit values for use in the scope of CSA / UL
- Applied standards (CE conformity, UL listing)

UL ratings

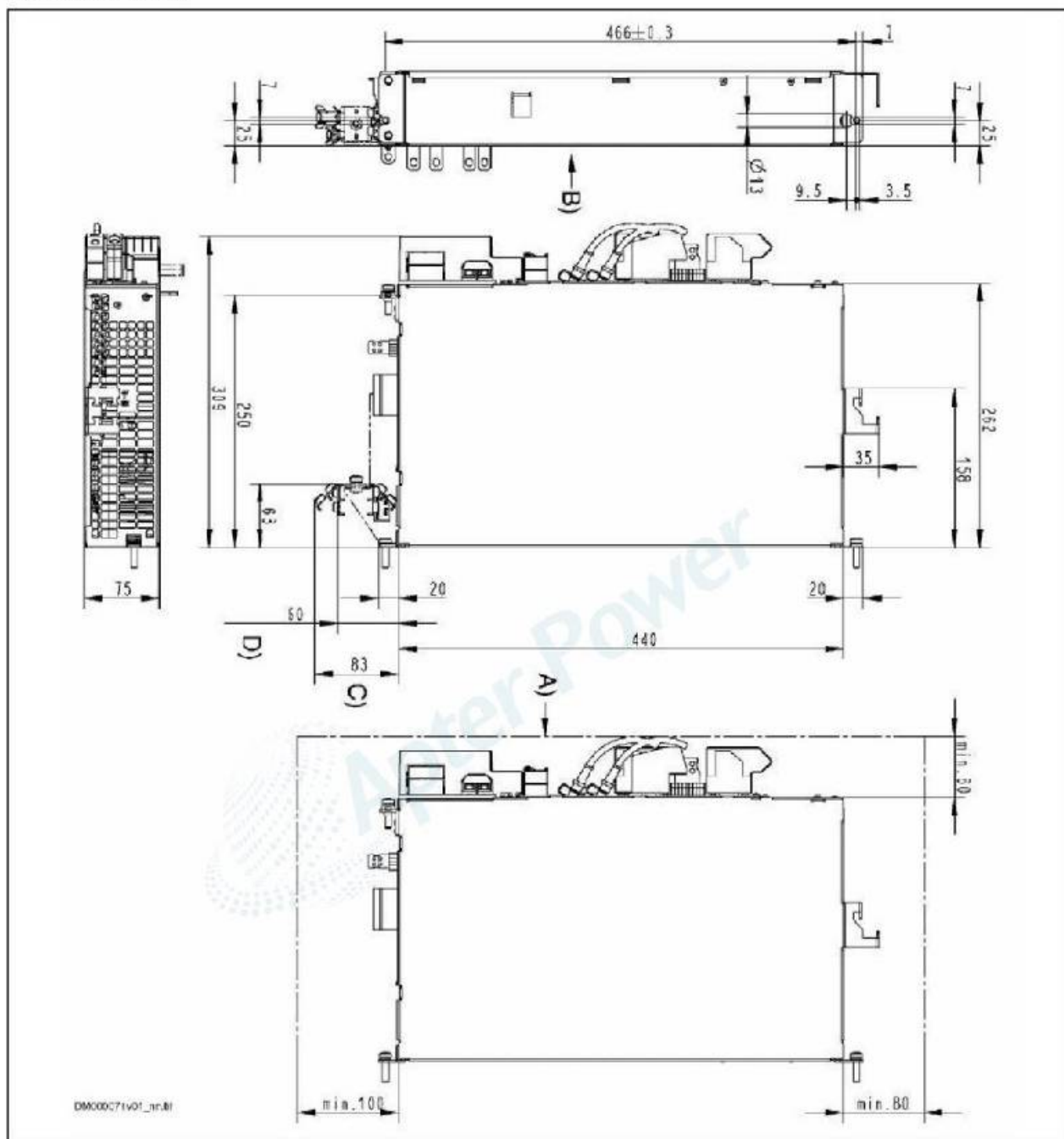
Ambient and operating conditions - UL ratings

Description	Symbol	Unit	HMS01.1N-W0020	HMS01.1N-W0036	HMS01.1N-W0054	HMS01.1N-W0070
Short circuit current rating	SCCR	A rms	42000			
Rated input voltage, power ¹⁾	U_{LN_nenn}	V	DC 254...750			
Rated input current	I_{LN}	A	14.0	24.5	40.0	49.0
Output voltage	U_{out}	V	3 x AC 0...500			
Output current	I_{out}	A	12.1	21.3	35.0	42.4
Latest amendment: 2009-01-28						

- 1) Mains input L1, L2, L3 (for HMV and HCS only); For use on a solidly grounded wye source only.

Tab. 6-3: HMS - Ambient and operating conditions - UL ratings

HMS01.1N-W0054



- A) Minimum mounting clearance (plus additional space for motor cable)
Note: Rexroth IndraDrive supply units require greater mounting clearance!
- B) Rear view!
- C) Dimensions for accessory HAS02.1 when motor cable run with 45°
- D) Dimensions for accessory HAS02.1 when motor cable run horizontally

Fig. 6-7: Dimensions HMS01.1N-W0054

Dimensions, mass, insulation, sound pressure level

Data for mass, sound pressure level, insulation

Description	Symbol	Unit	HMS01.1N- W0020-A-07- NNNN	HMS01.1N- W0036-A-07- NNNN	HMS01.1N- W0054-A-07- NNNN	HMS01.1N- W0070-A-07- NNNN
Mass	m	kg	5.27		6.68	7.94
Device height ¹⁾	H	mm	440			
Device depth ²⁾	T	mm	262			
Device width ³⁾	B	mm	50		75	100
Insulation resistance at 500 V DC	R _{is}	Mohm	> 50			
Capacitance against housing	C _Y	nF	2 x 68			
Average sound pressure level (accuracy class 2) at P _{DC,cont} ⁴⁾	L _p	dB (A)	tbd			
Latest amendment: 2007-07-18						

1) 2) 3) Housing dimension; see also related dimensional drawing
4) According to DIN EN ISO 11205; comparative value at 1 m distance, out of cabinet; HCS types in -L*** design: load-dependent

Tab. 6-7: HMS - Data for mass, sound pressure level, insulation

Data for mass, dimensions, sound pressure level, insulation

Description	Symbol	Unit	HMS01.1 N-W0110	HMS01.1 N-W0150	HMS01.1 N-W0210	HMS01.1 N-W0300	HMS01.1 N-W0350
Mass	m	kg	11.06	12.74	16.44		31.70
Device height ¹⁾	H	mm	440				
Device depth ²⁾	T	mm	262				
Device width ³⁾	B	mm	125	150	200		350
Insulation resistance at 500 V DC	R _{is}	Mohm	> 50				
Capacitance against housing	C _V	nF	2 x 100				
Average sound pressure level (accuracy class 2) at P _{DC_cont} ⁴⁾	L _p	dB (A)	76	tbd			80
Latest amendment: 2013-11-15							

1) 2) 3) Housing dimension; see also related dimensional drawing
4) According to DIN EN ISO 11205; comparative value at 1 m distance, out of cabinet; HCS types in -L*** design: load-dependent

Tab. 6-8: HMS - Data for mass, dimensions, sound pressure level, insulation

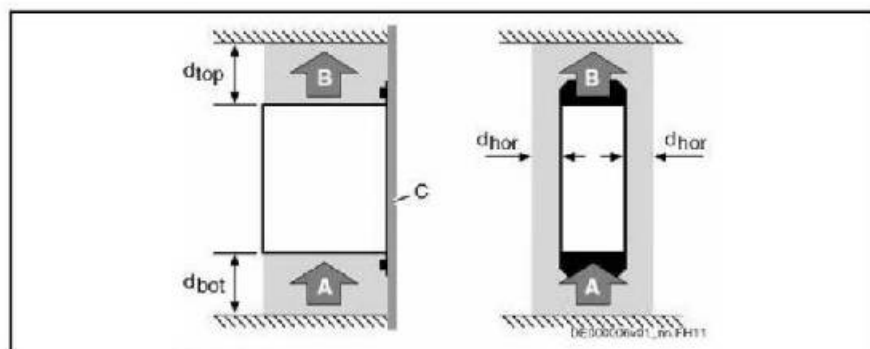
Power dissipation, mounting position, cooling, distances

Cooling and power dissipation data

Description	Symbol	Unit	HMS01.1N- W0020-A-07- NNNN	HMS01.1N- W0036-A-07- NNNN	HMS01.1N- W0054-A-07- NNNN	HMS01.1N- W0070-A-07- NNNN
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0...40			
Ambient temperature range for operation with reduced nominal data	$T_{a\_work\_red}$	°C	0...55			
Derating of P_{DC_cont} ; P_{BD} ; I_{out_cont} when $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2.0			
Allowed mounting position			G1			
Cooling type			Forced ventilation			
Volumetric capacity of forced cooling	V	m³/h	27.00	44.00	56.00	80.00
Allowed switching frequencies ¹⁾	f_s	kHz	4, 8, 12, 16			
Power dissipation at $I_{out\_cont} = 0$ A; $f_s = f_s$ (min.) ²⁾	$P_{Diss\_0A\_fs\_min}$	W	60	40	90	110
Power dissipation at $I_{out\_cont} = 0$ A; $f_s = f_s$ (max.) ³⁾	$P_{Diss\_0A\_fs\_max}$	W	120	130	260	330
Power dissipation at continuous current and continuous DC bus power respectively ⁴⁾	P_{Diss_cont}	W	165.00	210.00	420.00	485.00
Minimum distance on the top of the device ⁵⁾	d_{top}	mm	80			
Minimum distance on the bottom of the device ⁶⁾	d_{bot}	mm	100			
Temperature increase with minimum distances d_{bot} ; d_{top} ; P_{BD}	ΔT	K	40	50	40	50

Latest amendment: 2009-09-24

- 1) Also depending on firmware and control section; see parameter description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"; for supply units the switching frequency is 4.2 kHz
- 2) 3) Plus dissipation of braking resistor and control section; find interim values by interpolation to P_{Diss_cont}
- 4) Plus dissipation of braking resistor and control section
- 5) 6) See fig. "Air intake and air outlet at device"
- Tab. 6-9: HMS - Data for cooling and power dissipation



- A Air intake
B Air outlet
C Mounting surface in control cabinet
 d_{top} Distance top
 d_{bot} Distance bottom
 d_{hor} Distance horizontal

Fig. 6-14: Air intake and air outlet at device

Basic data of HMS01 power section

General information

This chapter contains:

- Data for control voltage supply
- Data of DC bus
- Data of inverter



The order of the data tables below follows the energy flow in the drive controller - from mains connection to motor output.

Control voltage

Control voltage supply data

Description	Symbol	Unit	HMS01.1N- W0020-A-07- NNNN	HMS01.1N- W0036-A-07- NNNN	HMS01.1N- W0054-A-07- NNNN	HMS01.1N- W0070-A-07- NNNN
Control voltage input ¹⁾	U _{N3}	V	24 ± 20 %			
Control voltage when using motor holding brake with motor cable length less than 50 m (HCS01 less than 40 m) ²⁾	U _{N3}	V	24 ± 5 %			
Control voltage when using motor holding brake with motor cable length more than 50 m (HCS01 more than 40 m) ³⁾	U _{N3}	V	26 ± 5 %			
Max. inrush current at 24 V supply	I _{Ein3_max}	A	4.20			
Pulse width of I _{Ein3}	t _{Ein3Lade}	ms	5			
Latest amendment: 2007-07-17						

Description	Symbol	Unit	HMS01.1N- W0020-A-07- NNNN	HMS01.1N- W0036-A-07- NNNN	HMS01.1N- W0054-A-07- NNNN	HMS01.1N- W0070-A-07- NNNN
Input capacitance	C_{N3}	mF	0.47			
Rated power consumption control voltage input at U_{N3} ⁴⁾	P_{N3}	W	10	15	10	16
Latest amendment: 2007-07-17						

- 1) 2) 3) Observe supply voltage for motor holding brake
4) See information on "Rated power consumption control voltage input at U_{N3} "

Tab. 6-11: HMS - Control voltage supply data



Rated power consumption control voltage input at U_{N3}

Plus motor holding brake and control section, plus safety option

Control voltage supply data

Description	Symbol	Unit	HMS01.1 N-W0110	HMS01.1 N-W0150	HMS01.1 N-W0210	HMS01.1 N-W0300	HMS01.1 N-W0350
Control voltage input ¹⁾	U _{N3}	V	24 ± 20%				
Control voltage when using motor holding brake with motor cable length less than 50 m (HCS01 less than 40 m) ²⁾	U _{N3}	V	24 ± 5 %				
Control voltage when using motor holding brake with motor cable length more than 50 m (HCS01 more than 40 m) ³⁾	U _{N3}	V	26 ± 5 %				
Max. inrush current at 24 V supply	I _{EIN3_max}	A	8.50	4.20			Less than 10
Pulse width of I _{EIN3}	t _{EIN3Lade}	ms	6			-	
Input capacitance	C _{N3}	mF	1.00			1.05	
Rated power consumption control voltage input at U _{N3} ⁴⁾	P _{N3}	W	34	23	75	100	218
Latest amendment: 2013-11-15							

- 1) 2) 3) Observe supply voltage for motor holding brake
4) See information on "Rated power consumption control voltage input at U_{N3} "

Tab. 6-12: HMS - Control voltage supply data



Rated power consumption control voltage input at U_{N3}

Plus motor holding brake and control section, plus safety option

Power section - DC bus

Power section data - DC bus

Description	Symbol	Unit	HMS01.1N- W0020-A-07- NNNN	HMS01.1N- W0036-A-07- NNNN	HMS01.1N- W0054-A-07- NNNN	HMS01.1N- W0070-A-07- NNNN
DC bus voltage	U_{DC}	V	254...750			
Capacitance in DC bus	C_{DC}	mF	-			
DC resistance in DC bus (L+ to L-)	R_{DC}	kohm	approx. 1000			
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900			
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	254			
Latest amendment: 2013-08-02						

Tab. 6-13: HMS - Power section data - DC bus

Power section data - DC bus

Description	Symbol	Unit	HMS01.1 N-W0110	HMS01.1 N-W0150	HMS01.1 N-W0210	HMS01.1 N-W0300	HMS01.1 N-W0350	
DC bus voltage	U_{DC}	V	254...750					
Capacitance in DC bus	C_{DC}	mF	-					4.90
DC resistance in DC bus (L+ to L-)	R_{DC}	kohm	approx. 1000					approx. 50
Monitoring value maximum DC bus voltage, switch-off threshold	$U_{DC\_limit\_max}$	V	900					
Monitoring value minimum DC bus voltage, undervoltage threshold	$U_{DC\_limit\_min}$	V	254					
								Latest amendment: 2013-11-15

Tab. 6-14: HMS - Power section data - DC bus

Power section - inverter

Power section data - inverter

Description	Symbol	Unit	HMS01.1N- W0020-A-07- NNNN	HMS01.1N- W0036-A-07- NNNN	HMS01.1N- W0054-A-07- NNNN	HMS01.1N- W0070-A-07- NNNN
Allowed switching frequencies ¹⁾	f _s	kHz	4, 8, 12, 16			
Output voltage, fundamental wave in V/Hz (U/f) control	U _{out_eff}	V	~ UDC x 0.71			
Output voltage, fundamental wave in closed-loop operation	U _{out_eff}	V	~ UDC x 0.71			
Latest amendment: 2013-09-02						

Description	Symbol	Unit	HMS01.1N- W0020-A-07- NNNN	HMS01.1N- W0036-A-07- NNNN	HMS01.1N- W0054-A-07- NNNN	HMS01.1N- W0070-A-07- NNNN
Rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-phase (10-90%) ²⁾	dv/dt	kV/ μ s	5.00			
Rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-ground (10-90%) ³⁾	dv/dt	kV/ μ s	5.00			
Output frequency range when $f_s = 2$ kHz	f_{out_2k}	Hz	-			
Output frequency range when $f_s = 4$ kHz	f_{out_4k}	Hz	0...400			
Output frequency range when $f_s = 8$ kHz	f_{out_8k}	Hz	0...800			
Output frequency range when $f_s = 12$ kHz	f_{out_12k}	Hz	0...1200			
Output frequency range when $f_s = 16$ kHz	f_{out_16k}	Hz	0...1600			
Output frequency threshold to detect motor standstill ⁴⁾	f_{out_still}	Hz	2...4			
Maximum output current when $f_s = 2$ kHz	I_{out_max2}	A	-			
Maximum output current when $f_s = 4$ kHz	I_{out_max4}	A	20.0	36.0	54.0	70.7
Maximum output current when $f_s = 8$ kHz	I_{out_max8}	A	20.0	36.0	54.0	70.7
Maximum output current when $f_s = 12$ kHz	I_{out_max12}	A	16.0	31.0	45.0	65.0
Maximum output current when $f_s = 16$ kHz	I_{out_max16}	A	11.0	24.0	35.0	51.0
Continuous output current when $f_s = 2$ kHz	I_{out_cont2}	A	-			
Continuous output current when $f_s = 4$ kHz	I_{out_cont4}	A	12.1	21.3	35.0	42.4
Continuous output current when $f_s = 8$ kHz	I_{out_cont8}	A	8.3	15.0	20.0	24.1
Continuous output current when $f_s = 12$ kHz ⁵⁾	I_{out_cont12}	A	5.0	9.5	12.0	14.4
Continuous output current when $f_s = 16$ kHz ⁶⁾	I_{out_cont16}	A	2.7	6.0	7.5	9.3
Latest amendment: 2013-09-02						

Description	Symbol	Unit	HMS01.1N- W0020-A-07- NNNN	HMS01.1N- W0036-A-07- NNNN	HMS01.1N- W0054-A-07- NNNN	HMS01.1N- W0070-A-07- NNNN
Continuous output current when $f_s = 2$ kHz; output frequency f_{out} less than f_{out_still}	$I_{out\_cont0Hz\_2}$	A	-			
Continuous output current when $f_s = 4$ kHz; output frequency f_{out} less than f_{out_still}	$I_{out\_cont0Hz\_4}$	A	8.1	14.2	23.4	28.3
Continuous output current when $f_s = 8$ kHz; output frequency f_{out} less than f_{out_still}	$I_{out\_cont0Hz\_8}$	A	5.5	10.0	13.4	16.1
Continuous output current when $f_s = 12$ kHz; output frequency f_{out} less than f_{out_still} ⁷⁾	$I_{out\_cont0Hz\_12}$	A	3.3	6.4	8.2	9.6
Continuous output current when $f_s = 16$ kHz; output frequency f_{out} less than f_{out_still} ⁸⁾	$I_{out\_cont0Hz\_16}$	A	1.8	4.0	5.1	6.2
Assigned output filters at nom. data; $f_s = 4$ kHz			-			
Latest amendment: 2013-09-02						

- 1) Also depending on firmware and control section; see parameter description "P-0-0001, Switching frequency of the power output stage"; see "P-0-4058, Amplifier type data"; for supply units the switching frequency is 4.2 kHz
- 2) 3) Guide value, see following note
- 4) See following note regarding output current reduction
- 5) 6) 7) 8) See parameter description "P-0-0556, Config word of axis controller", load-dependent reduction of switching frequency f_s

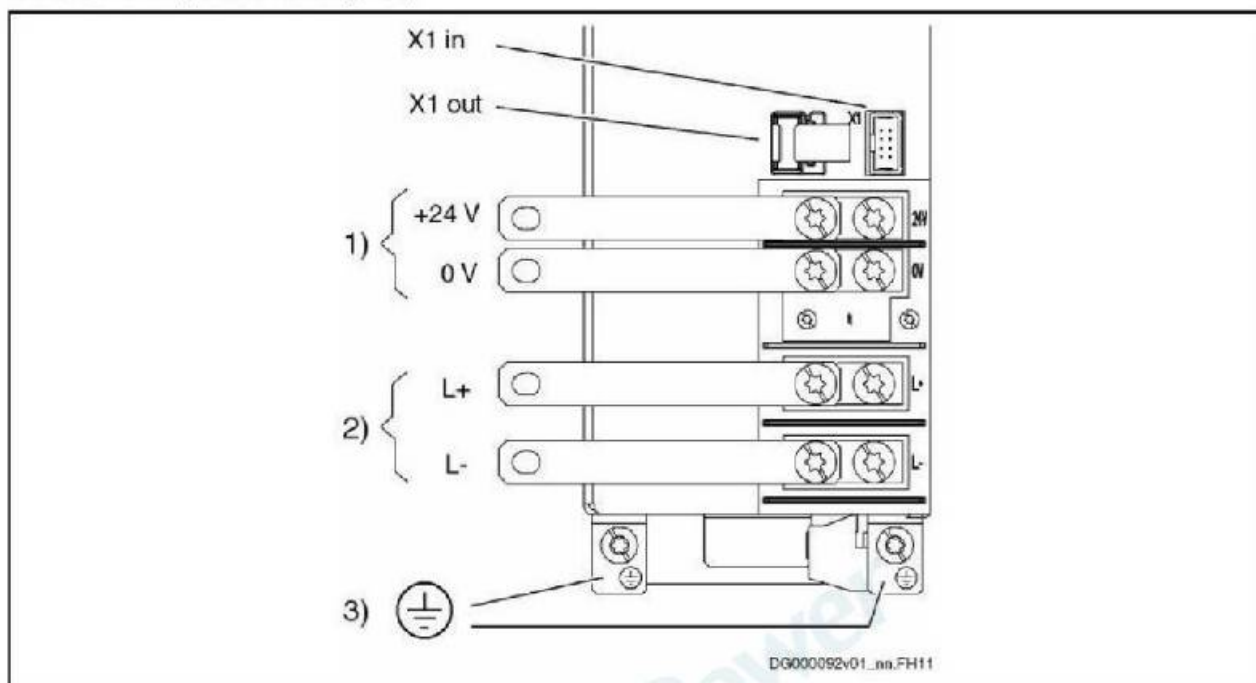
Tab. 6-15: HMS - Power section data - inverter

Power section data - inverter

Description	Symbol	Unit	HMS01.1 N-W0110	HMS01.1 N-W0150	HMS01.1 N-W0210	HMS01.1 N-W0300	HMS01.1 N-W0350
Allowed switching frequencies ¹⁾	f _s	kHz	4, 8, 12, 16				4, 8, 12
Output voltage, fundamental wave in V/Hz (U/f) control	U _{out_eff}	V	~ UDC x 0.71				
Output voltage, fundamental wave in closed-loop operation	U _{out_eff}	V	~ UDC x 0.71				
Rise of voltage at output with U _{LN_nenn} and 15 m motor cable length phase-phase (10-90%) ²⁾	dv/dt	kV/μs	5.00				
Rise of voltage at output with U _{LN_nenn} and 15 m motor cable length phase-ground (10-90%) ³⁾	dv/dt	kV/μs	5.00				
Latest amendment: 2013-11-15							

Connection points at HMS01.1N-W0054 and HMS01.1N-W0070

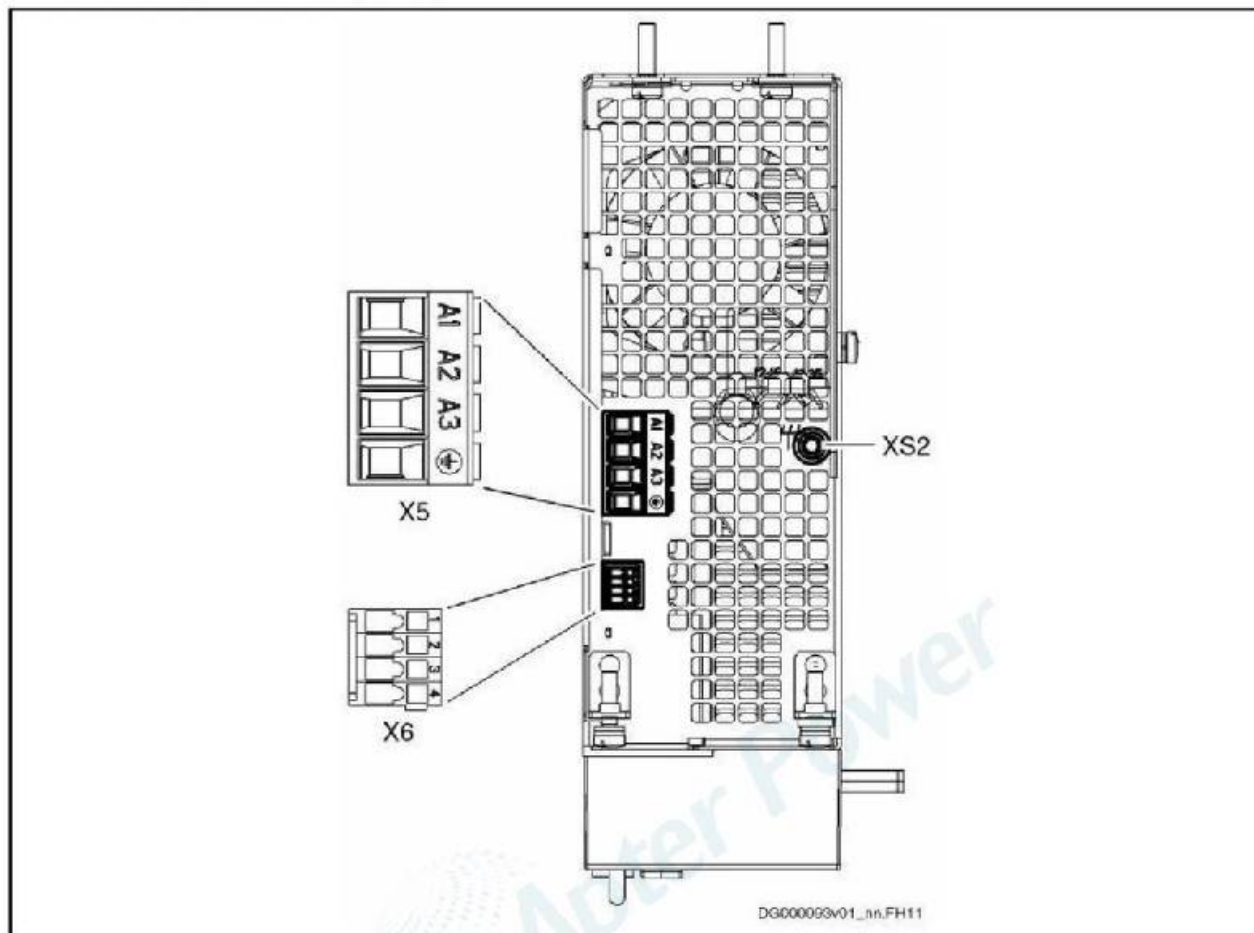
Connections at power section (front)



- 1) Control voltage
- 2) DC bus
- 3) Equipment grounding conductor
- X1 in, X1 out Module bus

Fig. 6-18: Connections at power section (front) HMS01.1N-W0054 and -W0070

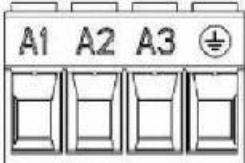
Connections at power section (bottom)



- X5 Motor connection
- X6 Motor temperature monitoring and motor holding brake
- XS2 Thread for mounting the HAS02 accessories to connect the shield of the motor power cable

Fig. 6-19: Connections at power section (bottom) HMS01.1N-W0054 and -W0070

8.6.3 X5, motor connection HCS02.1E-W0054, -W0070 and HCS03.1E-W0070 and HMS01.1N-W0054, -W0070 and HMS02.1N-W0054

View	Identification	Function	
 DA000173v01_en.FH11	A1	For power connection U1 at motor	
	A2	For power connection V1 at motor	
	A3	For power connection W1 at motor	
		For equipment grounding conductor of motor	
Screw connection at connector	Unit	Min.	Max.
Tightening torque	Nm	1.5	1.7
Connection cable	mm ²	1.5	16
Stranded wire	AWG	16	6
Occurring current load and minimum required connection cross section	A	See technical data of device used (I_{out})	
Occurring voltage load	V	See technical data of device used (U_{out})	
Short circuit protection		A1, A2, A3 against each other and each of them against ground	

Tab. 8-15: Function, pin assignment, properties