DATASHEET

Integrated Motor Drive
IMD 100

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1 IMD Introduction

1.1 Application

The Integrated Motor Drive (IMD) is a robust microprocessor-based drive containing all necessary functions for functional safety, motor control, sensor input and distributed I/O.

The IMD is intended for wind turbine pitch systems interfacing to a Pitch Motion Controller or directly to wind turbine main controller. IMD 100 is a motor drive also perfect for yaw control or other motor drive related functions.

The IMD is designed to fulfil the functional safety standards ISO 13849 and Drive standard IEC/EN 61800. The IMD automatically carries out a cyclical self-test at start-up. If any errors are found during start up and operation, the IMD 100 will open the safety relay giving signal to the safety-chain/safety logic, status and errors will be displayed by the LED and the display.

1.2 Easy Setup

Setup is done easily using the USB service port PC connection and the IMD Manager, Windows based PC utility software.

The utility software offers additional features such as monitoring of all relevant information during test and commissioning, saving and downloading of parameter and settings.

1.3 Characteristics

The IMD 100 is available in two variants:

Variant name	Options	Continues/ peak current
122	Mounting frame, Intern 24 V supply, Safe energy charger, Wiring harness, Peak plus	50 A_{RMS} / 105 A_{RMS}
135	Mounting frame, Intern 24 V supply, Safe energy charger, Wiring harness, Peak plus	70 A_{RMS} / 225 A_{RMS}

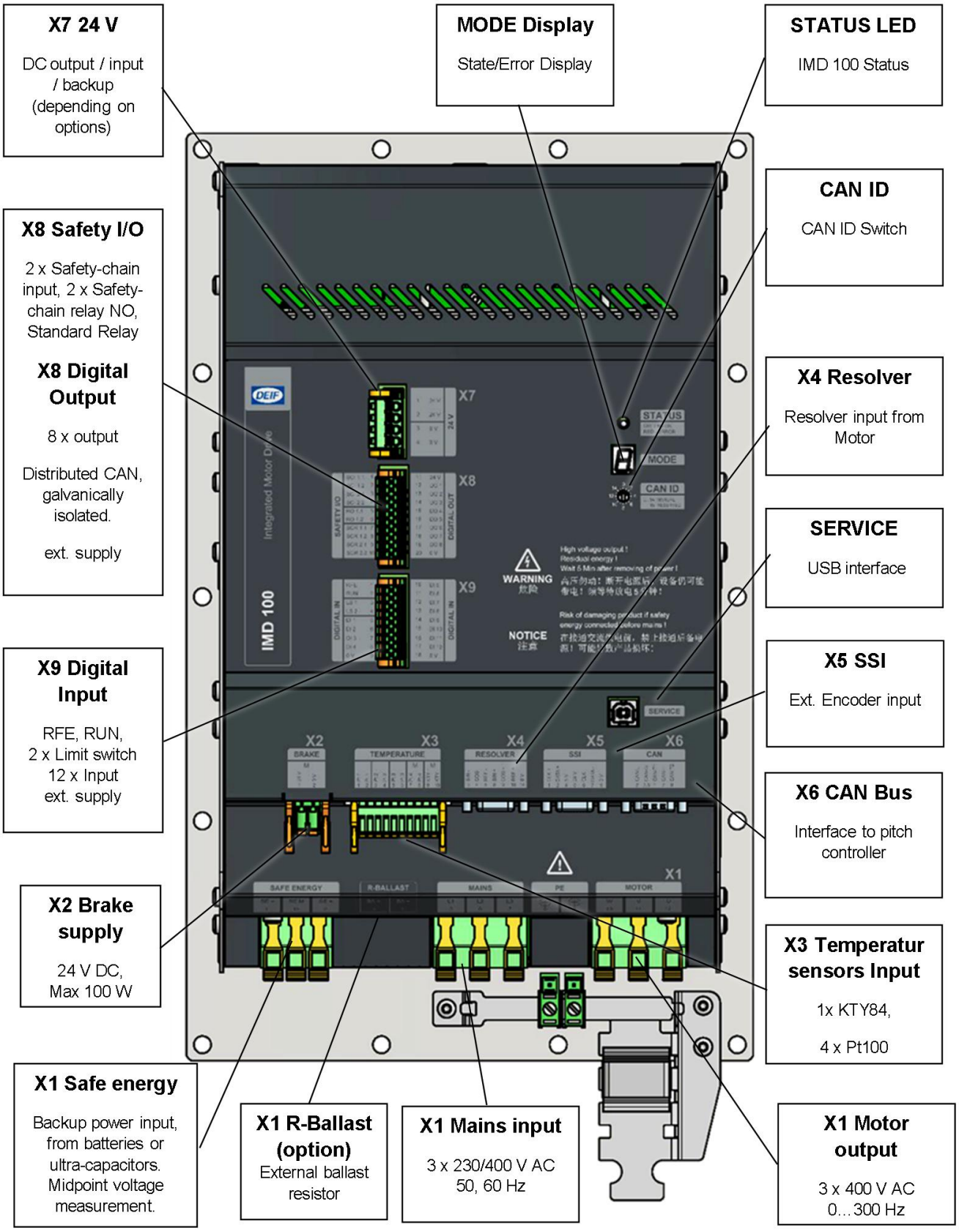
Common characteristics

- Robust construction with extended vibration and temperature spec.
- Up to 4000 metre altitude operation
- Through hole heat-sink with fan
- Built in EMC filter (No need of external line filter)
- USB service and CAN/CAN Open interfaces.
- Distributed I/O over CAN/CAN Open
  - 12 Digital inputs
  - 8 digital outputs
  - 1 relay output
- 4 x Pt100 and 1 x KTY84 Temperature sensors
- ISO 13849 Safety compliant
  - Double channel safety-chain I/O (2 x SCI, 2 x SCO)
  - Automatic Safety run function
  - 2 Limit Switch inputs
  - 1 RFE input (Output power enable)
  - 1 RUN input (Run enable)
- Position, speed and current control
- Incremental resolver input
- SSI encoder input
- Safe Energy measurement on DC input with midpoint voltage measurement
- Built in 400 V mains disconnect function
- Processor-independent safety by hardware (IGBT, Voltage, Short circuit, temperature)
- Motor brake control
- EMC-safe, all-steel and aluminium housing
- Elimination of external pitch system components such as EMC filter, Line Choke and so on
- 5 years product warranty
- Built-in power supply 168W, 24 V, internal and external use (Option)
- Built-in programmable multi stage charger 2500W, 200-500 VDC, for battery or ultra-capacitors (Option)
- The IMD can deliver 25 to 30% extra current above the standard peak current (Peak plus option)
- Built in ballast resistor with Processor-independent overcurrent protection (option for 122C, not available for 135)

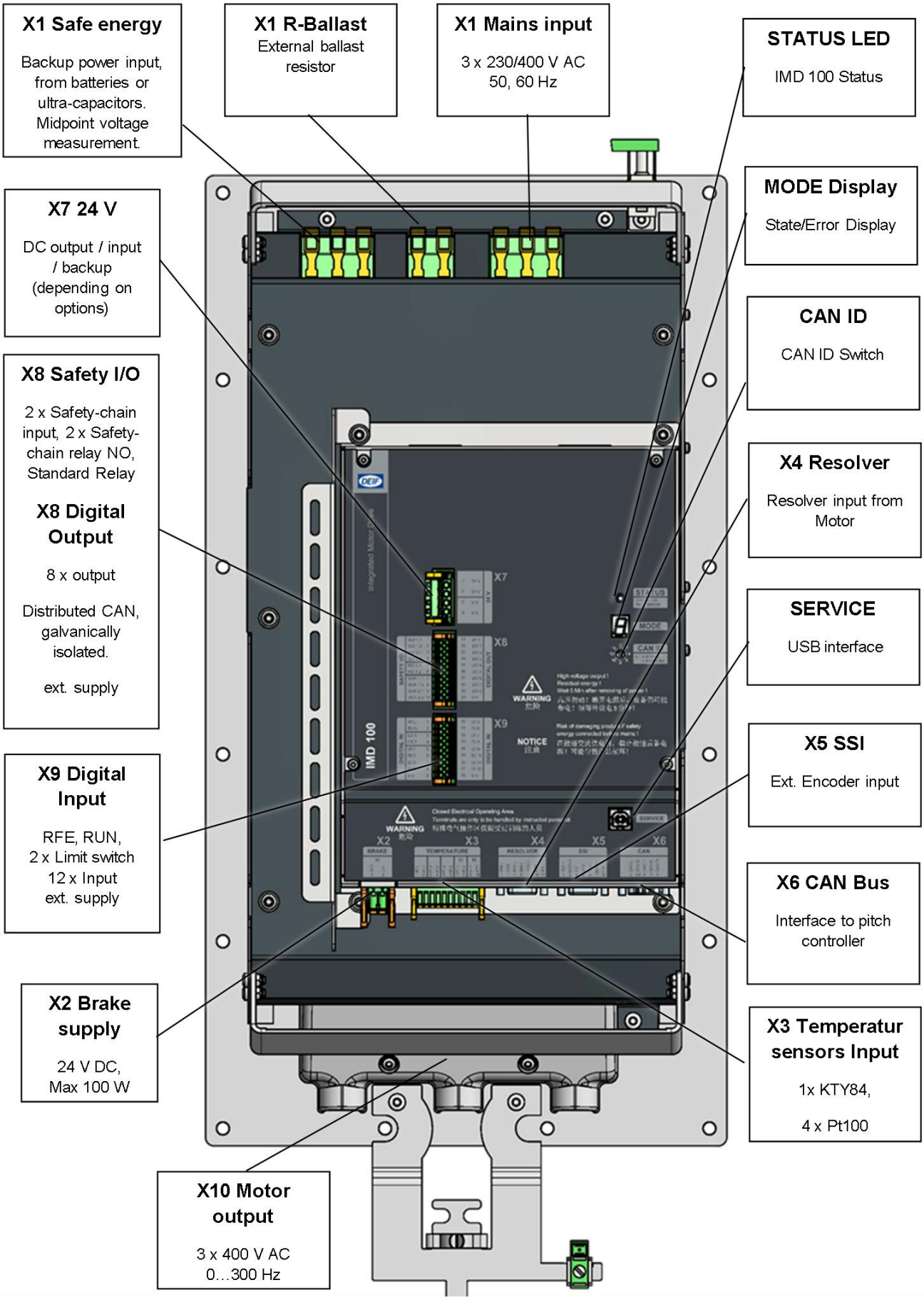
Info
This datasheet describes IMD versions 122 C and 135 C

2 Hardware overview

2.1 IMD 122



2.2 IMD 135


X1 Safe energy
Backup power input, from batteries or ultra-capacitors. Midpoint voltage measurement.
X1 R-Ballast
External ballast resistor
X1 Mains input
3 x 230/400 V AC 50, 60 Hz
STATUS LED
IMD 100 Status
X7 24 V
DC output / input / backup (depending on options)
MODE Display
State/Error Display
CAN ID
CAN ID Switch
X8 Safety I/O
2 x Safety-chain input, 2 x Safety-chain relay NO, Standard Relay
X8 Digital Output
8 x output
Distributed CAN, galvanically isolated.
ext. supply
X4 Resolver
Resolver input from Motor
SERVICE
USB interface
X9 Digital Input
RFE, RUN,
2 x Limit switch
12 x Input
ext. supply
X5 SSI
Ext. Encoder input
X6 CAN Bus
Interface to pitch controller
X2 Brake supply
24 V DC,
Max 100 W
X3 Temperatur sensors Input
1x KTY84,
4 x Pt100
X10 Motor output
3 x 400 V AC
0…300 Hz
IMD 100
X7
X8
X9
X2
X3
X4
X5
X6

3 Technical data

3.1 Standard drive data

This section lists the technical data for the standard drive without any options added.

3.1.1 Power Input and output

Input	Unit	Specifications		Note
Voltage	V AC	Nominal: 3 x 230 - 400 Continues Min: 3 x 207 Continues Max: 3 x 540 Overvoltage max 0.5s: 3 x 580		X1(5,6,7) connector. The given voltages are phase to phase voltages.
		IMD 122	IMD 135	
Current	A RMS	32	50	
Frequency	Hz	50/60 ± 10%		
Power	KVA	25	37	
Efficiency		0.95-0.98		

Output	Unit	Specifications				Note
Voltage	V AC	3 x (0 - 400)				X1(10,11,12) connector The given voltages are phase to phase voltages.
		IMD 122			IMD 135	
Motor power	kW	22			–	20 kW continuously
Motor power	kW	–			35	32 kW continuously
Current	A RMS	50ºC	60ºC	70ºC	Full temp. range	Derating in IMD 122 due to ambient temperature around heatsink. Linear distribution from 50º to 60º and 60º to 70º. The specified current can only be achieved at 4 kHz output frequency.
		50	45	25	70 (no derating due to temperature)	
Peak current (3 sec)	A RMS	105			225	Minimum 1 Hz output frequency. Standard data. See also Peak plus option in section 3.2.3 on page 14
Over current trip	A RMS	140			300	Standard data, SW and HW protected, se 3.2.3 on page 14 for options
Frequency	Hz	0 – 300				
Max motor cable length	m	10				

Output	Unit	Specifications	Note
Switching frequency	kHz	4	Optional 6, 8, or 12. Derating above 4 kHz.

DC-Link, R- Ballast, Safe Energy input	Unit	Specifications		Note
DC-Link voltage	V DC	150 - 800		
Level over voltage	V DC	860 ± 10		
R-Ballast cut in	V DC	Programmable. Max 814 VDC.		X1(3,4) connector
R-Ballast current	A	40 with internal resistor		IMD 122: Max 70 with external resistor IMD 135: Max 100 with external resistor
		IMD 122	**IMD 135**	
Ballast resistor		External Min. value: 12 Ω	External Min. value: 10 Ω	122: Internal resistor (20 Ω) is available as option.
Safe energy voltage	V DC	120-500		X1(1,2) connector
		IMD 122	**IMD 135**	
Safe energy current	A	50	70	Maximum continues current.
Safe energy current peak (2 sec)	A	80	100	

3.1.2 24 V control voltage

24 V external supply	Unit	Specifications	Note
Input Voltage	V DC	24 ± 10%	X7(1-4) connectors are internally connected to supply X2 Brake, X3 PT 100, X4 resolver and X5 SSI. Se section 3.2.1 on page 13 for option.
Brake output voltage	V DC	Same as input	
Brake current	A DC	Maximum 5 A	
Input Current	A	Maximum current through X7: 7 A DC. Minimum current calculated (sum) from the following consumptions: • IMD internal + fan: 1 A DC • SSI consumption • Brake consumption	

3.1.3 Safety I/O

Safety I/O and Relay	Unit	Specifications	Note
SCR relay contacts voltage	V DC	Max. 30	X8(7-10) connector, potential free relay, resistive load
SCR relay contact current	mA	Max. 250	
SCI input voltage	V DC	0 – 36	X8(1-4) connector, potential free, differential input

3.1.4 Distributed inputs and outputs

Digital I/O, Sensors, interfaces	Unit	Specifications	Note
Resolver frequency	kHz	10	X4 connector, differential input
Resolver voltage	V AC	7 $_{RMS}$	
SSI encoder type	N/A	Absolute single-turn or multi-turn	
SSI encoder voltage	V DC	24 or 5 VDC	X5 connector
SSI encoder current	mA	Max. 200 @ 24 V Max. 500 @ 5 V	
SSI encoder input	V DC	> 3.6	
SSI encoder output	V DC	> 4.7	
Digital input voltage	V DC	Input High: 9 - 36 V Input Low: 0 - 5V	X9(5-18) connector, impedance approx. 2.4 kΩ
Digital output voltage	V DC	0 – 36	X8(11,20) connector supply
Digital output current	mA	Max. 250	
Pt100 temp. range	°C	-50 to 200	X3(1-10) connector
Pt100 temp. resolution	K	0.1	Accuracy given for 1 metre cable.
Pt100 temp. accuracy	K	± 1 at reference ambient temp (15..30°C) ± 2.5 at operation temp (-30..70°C)	KTY84 and Pt100.4 temperature terminals are present in both resolver input X4(7,12,6,11) and temperature input X3(7,8,9,10), and can be used as motor temperature sensors.
KTY 84 temp. range	°C	-50 to 300	
KTY 84 temp. resolution	K	1	
KTY 84 temp. accuracy	K	± 10	
PTC thermistor	N/A	Sensor must be according to DIN 44081/82, IEC60034-11:2004	PTC thermistor can be used instead of KTY sensor, up to 3 sensors in series.
CAN / CANopen	kbit/s	10, 20, 50, 125, 250, 500, 1000	X6 connector, proprietary CAN (ISO11898-2 compliant)
USB		2.0 compatible	

3.1.5 Environment

Environment	Specifications		Note
Temperatures	Reference: 15...30 °C Operating: -30...70 °C, free natural convection Storage: -40...85 °C		IEC 60068-2-1/2, IEC/EN 61800-5-1
Humidity	95% non-condensing		IEC/EN 61800-5-1
Altitude	Up to 4000 m above sea-level		It is assumed that ambient temperature at altitudes above 2000 m is lower than at sea level.
EMC/CE	Electrostatic discharge (ESD): Contact: 4.8 kV Air: 9.6 kV		EN/IEC 61800-3
	RF E-field (electric) immunity: 80MHz to 1GHz: 12 V/m 1.4 GHz to 2 GHz: 3.6 V/m 2.0 GHz to 2.7 GHz: 1.2V/m		
	Fast transients (burst): Power ports/Interfaces: 2.4 kVp Signal: 1.2 kVp Measurement and Control lines: 2.4 kVp		
	Slow transients (surge): AC power: DM 1.2 kVp, CM 2.4 kVp (Except DC power ports below 60Vdc) Signal and I/O: CM 1.2 kVp (Auxiliary DC power ports below 60Vdc)		
	RF conducted immunity 0.15 to 80 MHz: 12 VRMS		
	Radiated E-field emission (Category 2): 30 to 230 MHz: 40 dB (µV/m) 230 to 1.000 MHz: 47 dB (µV/m)		
	Conducted emission (Category 2): 0.15 to 0.5 MHz: QP 79 dBuV, AV 66 dBuV 0.5 to 5.0 MHz: QP 73 dBuV, AV 60 dBuV 5.0 to 30 MHz: QP 73 dBuV, AV 60 dBuV		
Vibration	**IMD 122**	**IMD 135**	
	10 – 57 hz 0.15 mmpp 57 -150 hz 1g	–	IEC 61800-5-1 & IEC61800-2
	3 – 13.2 hz 2 mmpp 13.2 – 100 hz 0.7g	–	DNV A
	3 – 13.2 hz 6 mmpp 13.2 – 50 hz 2.1	–	DNV C
	–	10 – 150 Hz 1g 40 sweeps pr. axis	IEC 60255-21-1, class 1

Environment	Specifications		Note
Shock	IMD 122	IMD 135	
	50 g, 11 ms, half sine. Tested with 3 impacts in each direction in all 3 axes. A total of 18 impacts per test.	–	IEC 60068-2-27, test Ea
	–	30 g, 11 ms, half sine. Non-operation. Tested with 3 impacts in each direction in all 3 axes. A total of 18 impacts per test	IEC 60255-21-2, class 2
	–	5 g, 11 ms, half sine. Operating Tested with 3 impacts in each direction in all 3 axes. A total of 18 impacts per test.	IEC 60255-21-2, class 1
Bump	25 g, 16 ms, half sine. Non-operating tested with 1000 bumps in each direction in all 3 axes. A total of 6000 bumps per test.	20 g, 16 ms, half sine. Non-operating tested with 1000 bumps in each direction in all 3 axes. A total of 6000 bumps per test.	IEC 60255-21-2, class 2
Surface protection	C4-M (Salt spray test 480 hours)	C5-H (Salt spray test 1440 hours)	ISO 9227
Protection	IP 20 inside cabinet, IP 55 outside cabinet		IEC/EN 60529
Safety			IEC/EN 61800-5-1
Lightning protection	IEC 60068-2-6 (Fc)		IEC 61400-24CDV
Functional safety	PL level = d, per channel PL level = e, per system SIL 3 $MTTF_d$ > 40(high)		ISO 13849 -1 + 2 IEC 62061

3.1.6 Physical data

Physical data	Specifications		Note
	IMD 122	IMD 135	
Weight: standard IMD	15.5 kg (34.17 lbs) Not including any options.	26.8 kg (59.08 lbs) Including internal power supply and SE charger	Applies for all variants, including shield bracket and clamp.

Physical data	Specifications		Note
Extra weight: mounting frame kit	1.5 kg (3.31 lbs)	Not available	Added to the standard IMD weight
Extra weight: mounting frame	1.4 kg (3.09 lbs)	0.725 kg (1.6 lbs)	Added to the standard IMD weight
Extra weight: Internal power supply 24 V DC	0.5 kg (1.10 lbs)	N/A	Added to the standard IMD weight
Extra weight: Safe energy charger and internal power supply	0.8 kg (1.76 lbs	Included in standard weight	Added to the standard IMD weight
Dimensions	IMD: in mm (inch): W: 250 (9.84) H: 405 (15.94) D: 246.4 (9.70) Cabinet hole size in mm (inch): W: 200 (7.87)) H: 338 (13.31)	IMD: in mm (inch): W: 300 (11.8) H: 555 (21.8) D: 300 (11.8) Cabinet hole size in mm (inch): W: 262 (10.3) H: 517 (20.4)	
Mounting	Heat sink mount (material 11 mm aluminium). Ø 7 mm holes for screws.	Dipped galvanised steel plate 3 mm. Ø 7.5 mm holes for screws	IMD must always be mounted in such a way that sufficient air circulation can be ensured through the heat sink
Installation			
Minimum distance from heat sink to any obstacle inside cabinet:	Top and bottom: 80 mm Left and right: 20 mm	Top 80 mm Bottom: 136 mm Left and right: 20 mm	
Minimum distance from heat sink to any obstacle outside cabinet:	Top and bottom: 80 mm Left and right: 25 mm Above: 100 mm	Top and bottom: 80 mm Left and right: 25 mm Above: 70 mm	

Physical data	Specifications		Note
Terminals	X1 (3,4, ballast): 2.5 mm^2 Spring-loaded push connector X1 (8,9, PE): B: M5 threaded rod for cable lugs 16 mm^2 screw terminal X1 (10-12, motor): 16 mm^2 Spring-loaded connector	X1 (3,4, ballast) 16 mm^2 Spring-loaded connector X1 (8, PE): 16 mm^2 screw terminal X10 (4, PE): M6 threaded rod for cable lugs X10 (1-3, W, V, U): M6 threaded rod for cable lugs	
	X1 (1-2, 5-7): 16 mm^2 spring-loaded connector X2: 2.5 mm^2 spring-loaded plug connector X3: 1.5 mm^2 spring-loaded plug connector X4: D-SUB DE15S female X5: D-SUB DE9S female X6: D-SUB DE9P male X7: 2.5 mm^2 spring-loaded plug connector X8: 1.5 mm^2 spring-loaded plug connector X9: 1.5 mm^2 spring-loaded plug connector		
Housing	Aluminium and steel		

3.2 Options

This section lists the technical data for options which can be added to the standard drive.

3.2.1 24 VDC out option

With this option the IMD generates its own 24 VDC supply from either Mains or safe energy inputs.

24 V internal	Unit	Specifications	Note
X7 connector function	N/A	Output or input	X7 may be used as input for backup purpose
Output Voltage	V DC	24 ± 2%	X7(1-4) connector is internally connected to supply X2 Brake, X3 Pt100, X4 resolver and X5 SSI.
Output Current	A	Max output current = 6 A – Brake current – SSI encoder current	Calculated based on: The used motor brake and SSI encoder currents must be used to calculate the available current.

3.2.2 Safe energy source charger

With this option the safe energy is charged directly from safe energy terminals without the need for extra wires. The charger is a three-stage programmable charger for optimized, life prolonging charging:

Safe energy source charger (Option)	Unit	Specifications	Note
Supported safe energy types	N/A	Lead Acid batteries, Ultra-capacitors	Lithium-Ion battery type support upon request
Output voltage	V DC	200 to 500	Programmable for each stage
Output voltage setpoint resolution	V DC	0.12	Set parameter resolution is 0.1% of nominal voltage
Output voltage accuracy		± 1%	
Voltage measurement resolution	V DC	0.12	
Output current setpoint	A DC	Max 5	Programmable for each stage
Output current resolution	A DC	0.02 - 0.06	Set parameter resolution is 0.1% of Charge current parameter
Output current accuracy	A DC	0 – 5: Max +7%	Full Scale.
Current measurement resolution	A DC	0.01	
Temperature compensation	mV/cell/	Bat. Temperature > 25: -	Lead acid batteries only

Safe energy source charger (Option)	Unit	Specifications	Note
coefficient	ºC	3 Bat. Temperature < 25: +3	

3.2.3 Peak plus option

With this option the IMD can deliver extra current for a short time:

Output	Unit	Specifications		Note
		IMD 122	IMD 135	
Peak current (3 sec)	A_{RMS}	135	280	
Over current trip	A_{RMS}	145	310	SW and HW protected

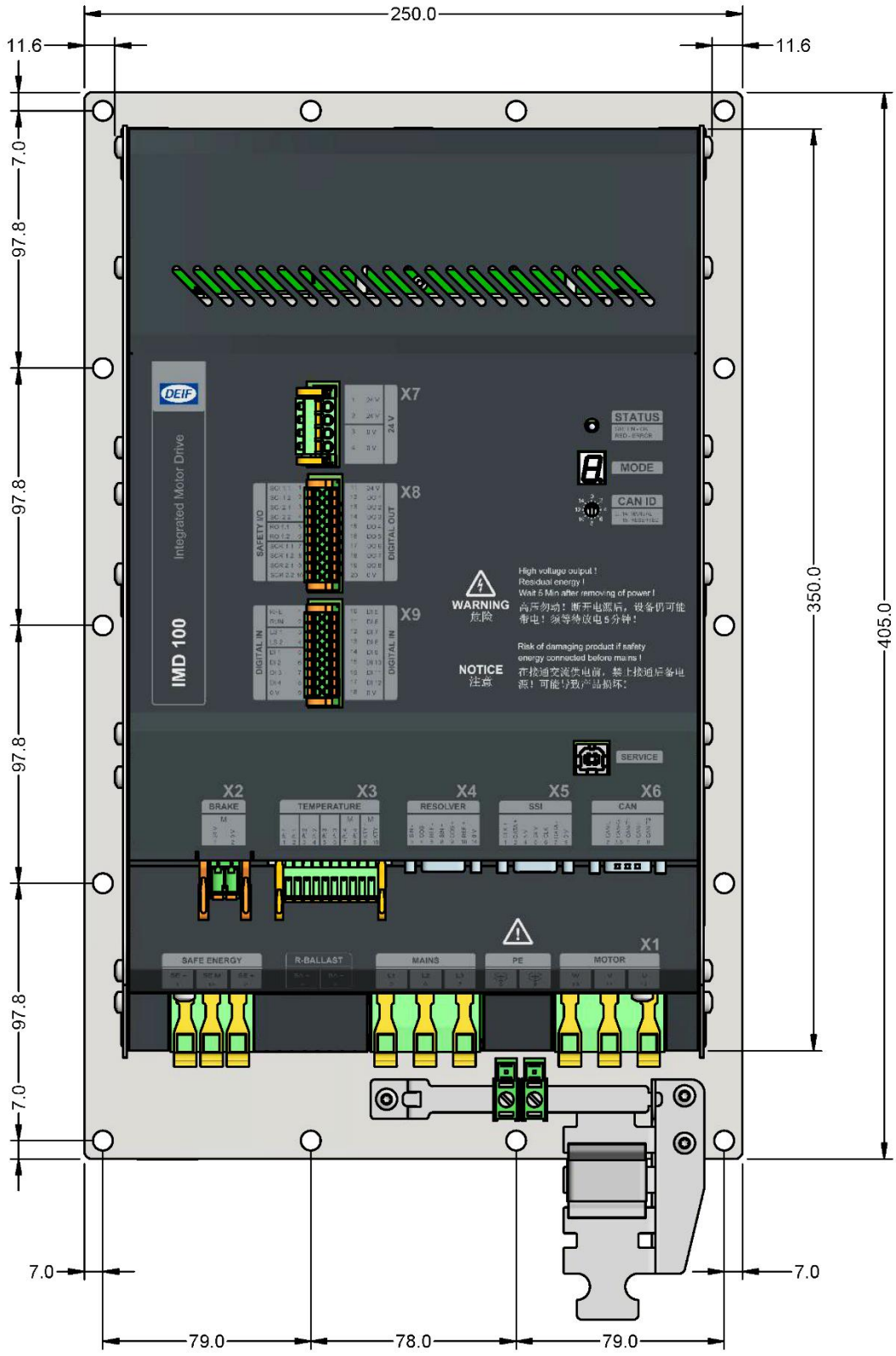
3.2.4 Internal ballast option (IMD 122 only)

With this option an internal ballast resistor is mounted and connected internally in the IMD. Connectors for external ballast resistors are not available.

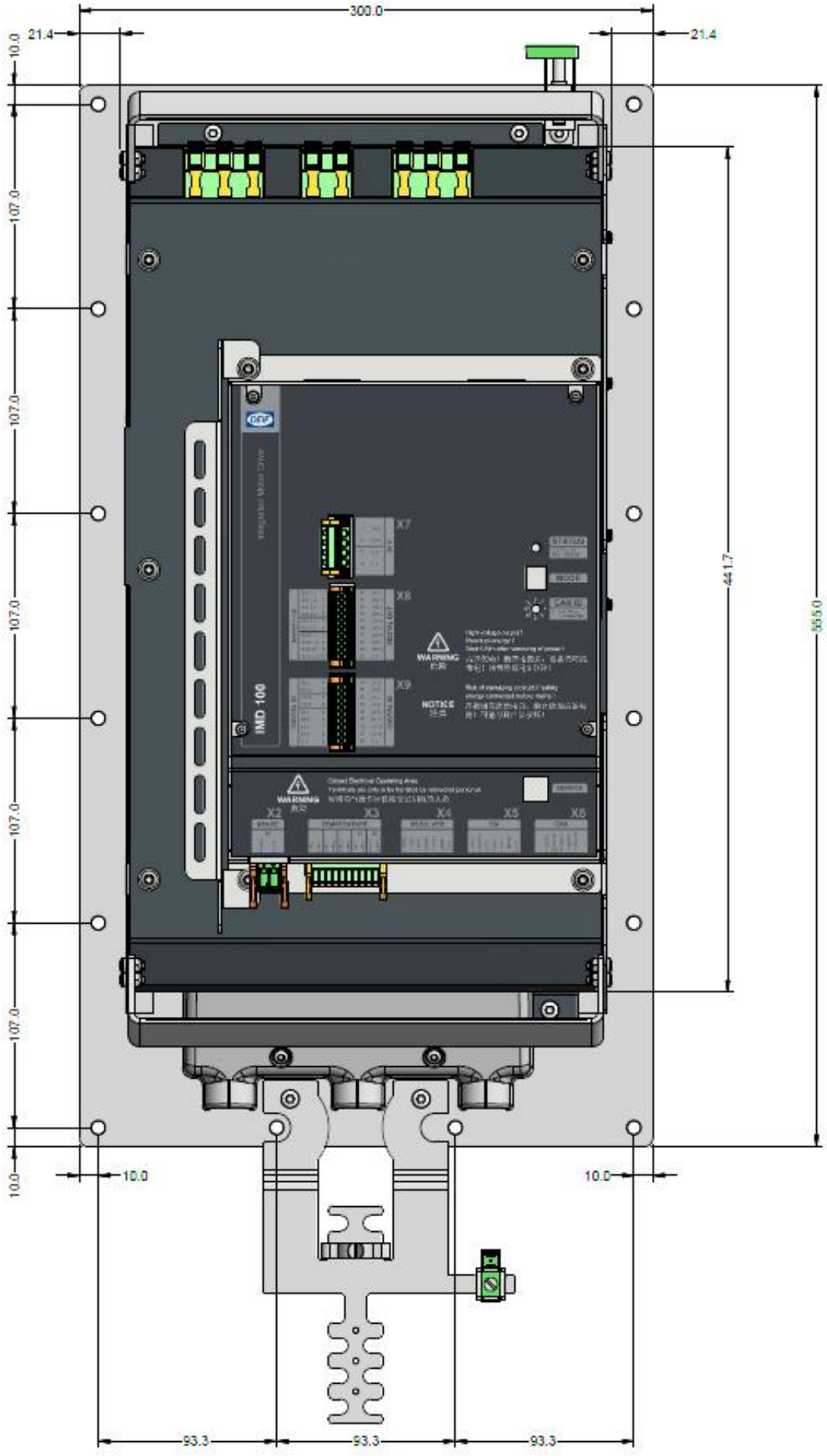
4 Dimensions and Layout

4.1 Front

4.1.1 IMD 122



4.1.2 IMD 135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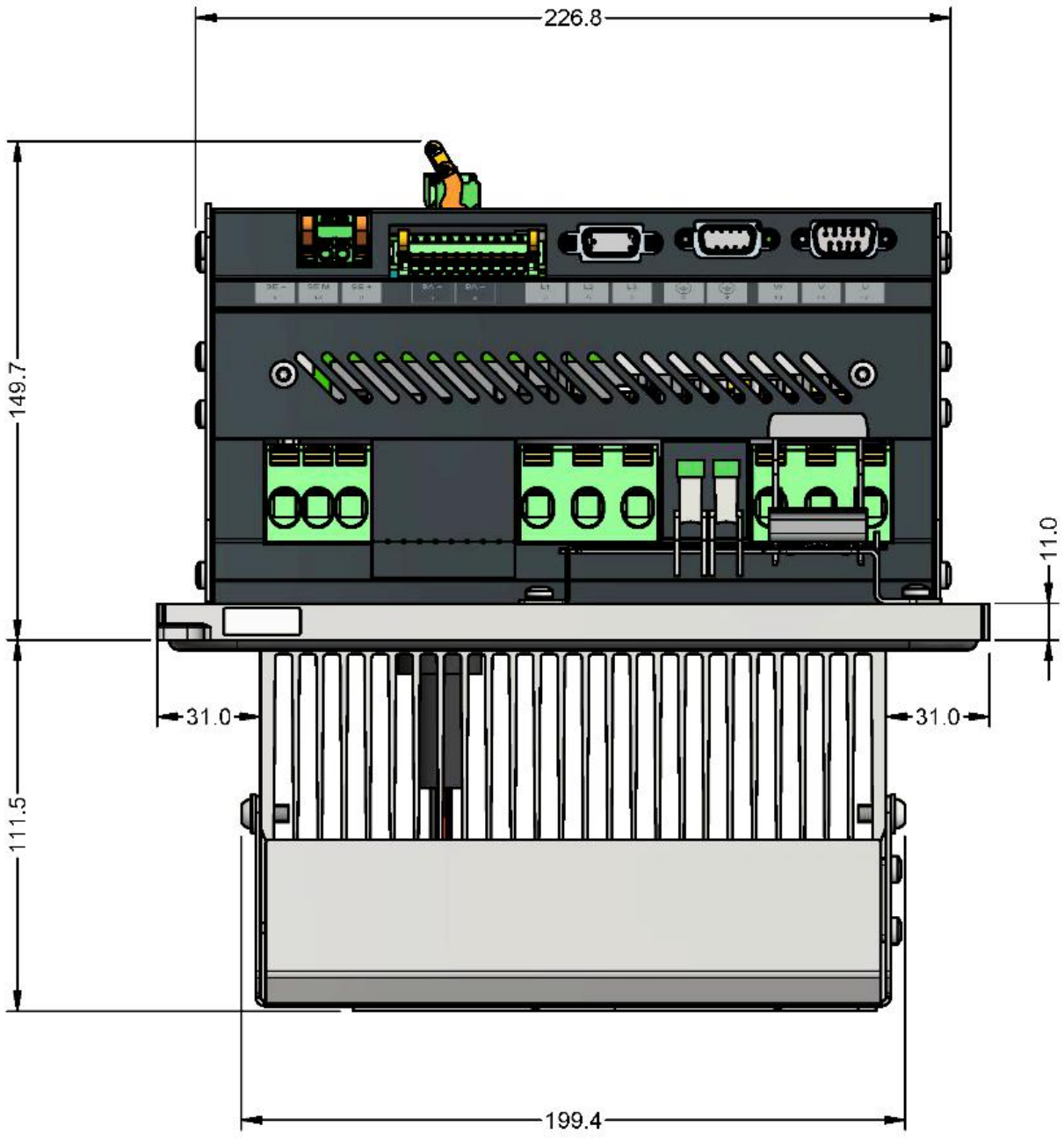
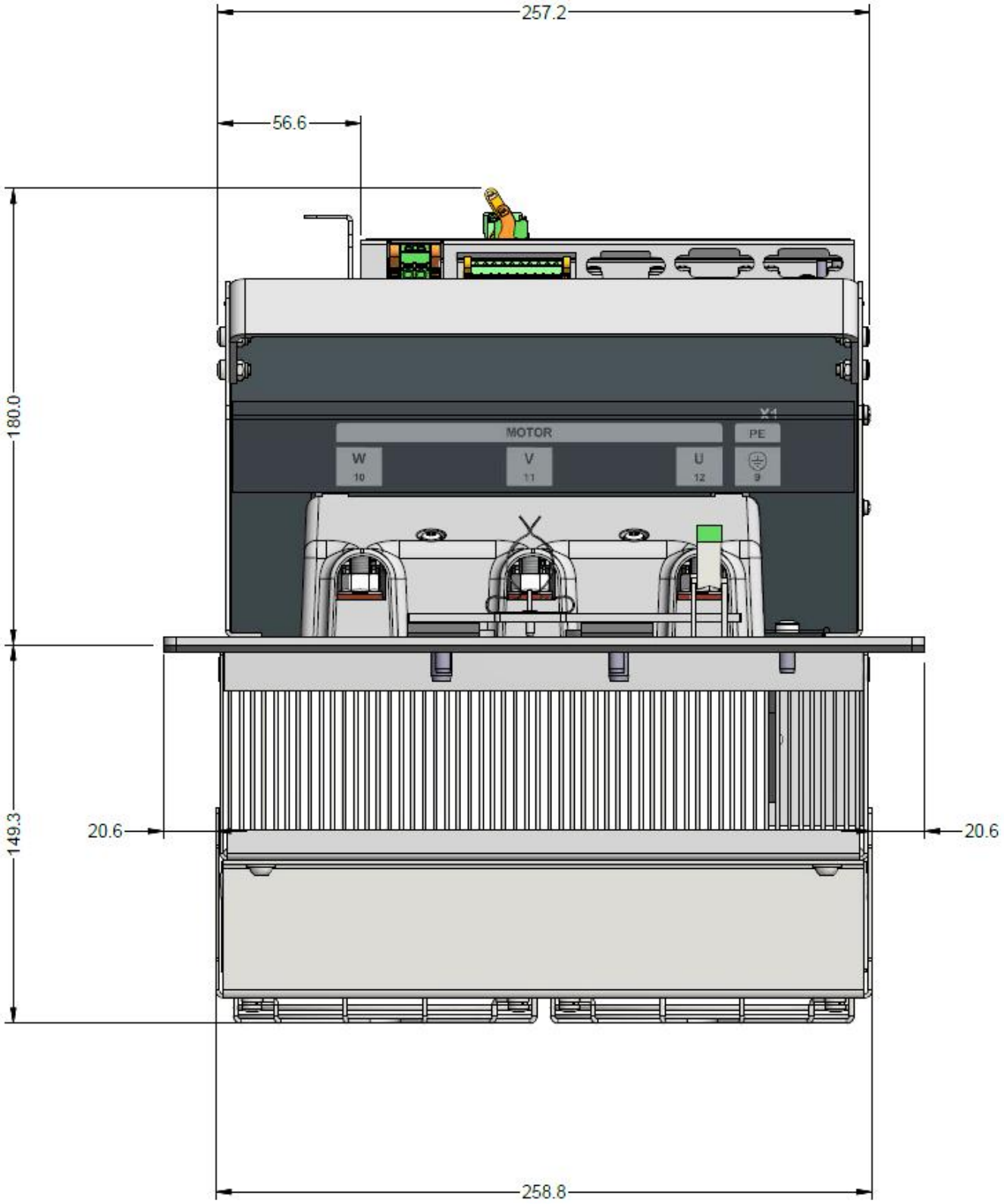
21.4
21.4
10.0
107.0
107.0
107.0
107.0
107.0
10.0
441.7
555.0
10.0
10.0
93.3
93.3
93.3
IMD 100
X7
X8
X9
X2
X3
X4
X5
X6
WARNING
NOTICE

4.2 Bottom side

4.2.1 IMD 122

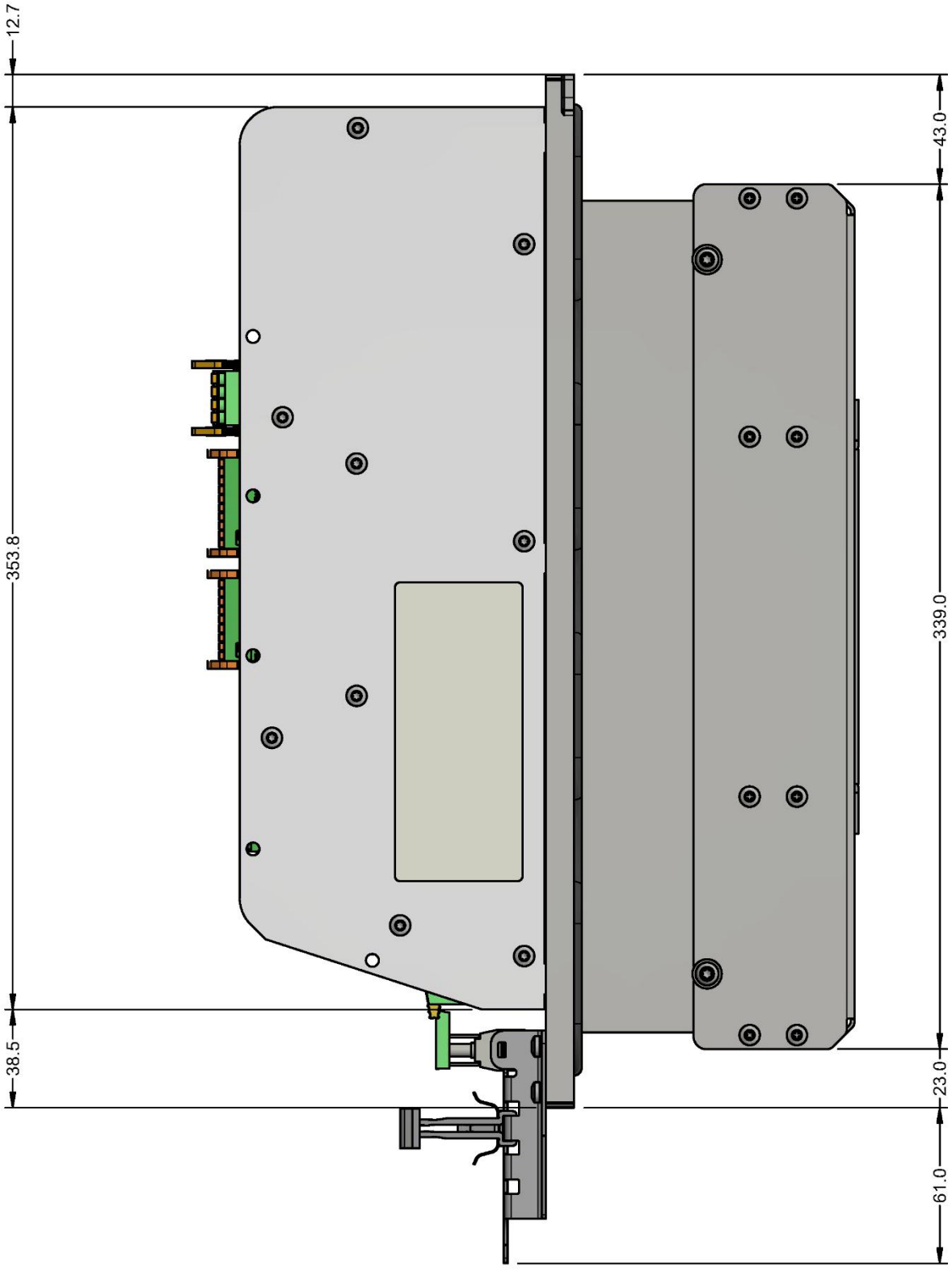


4.2.2 IMD 135

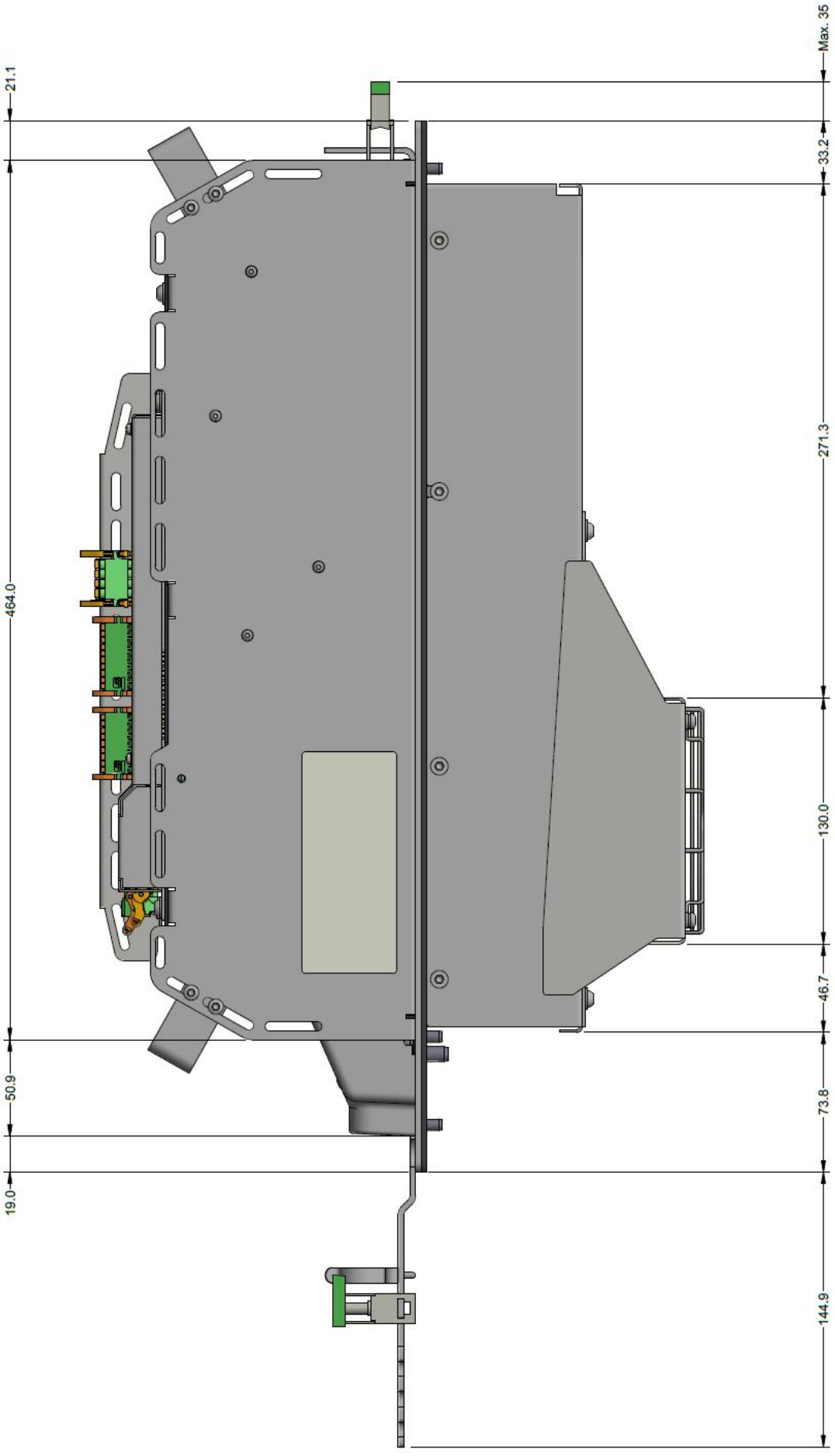


4.3 Right Side

4.3.1 IMD 122

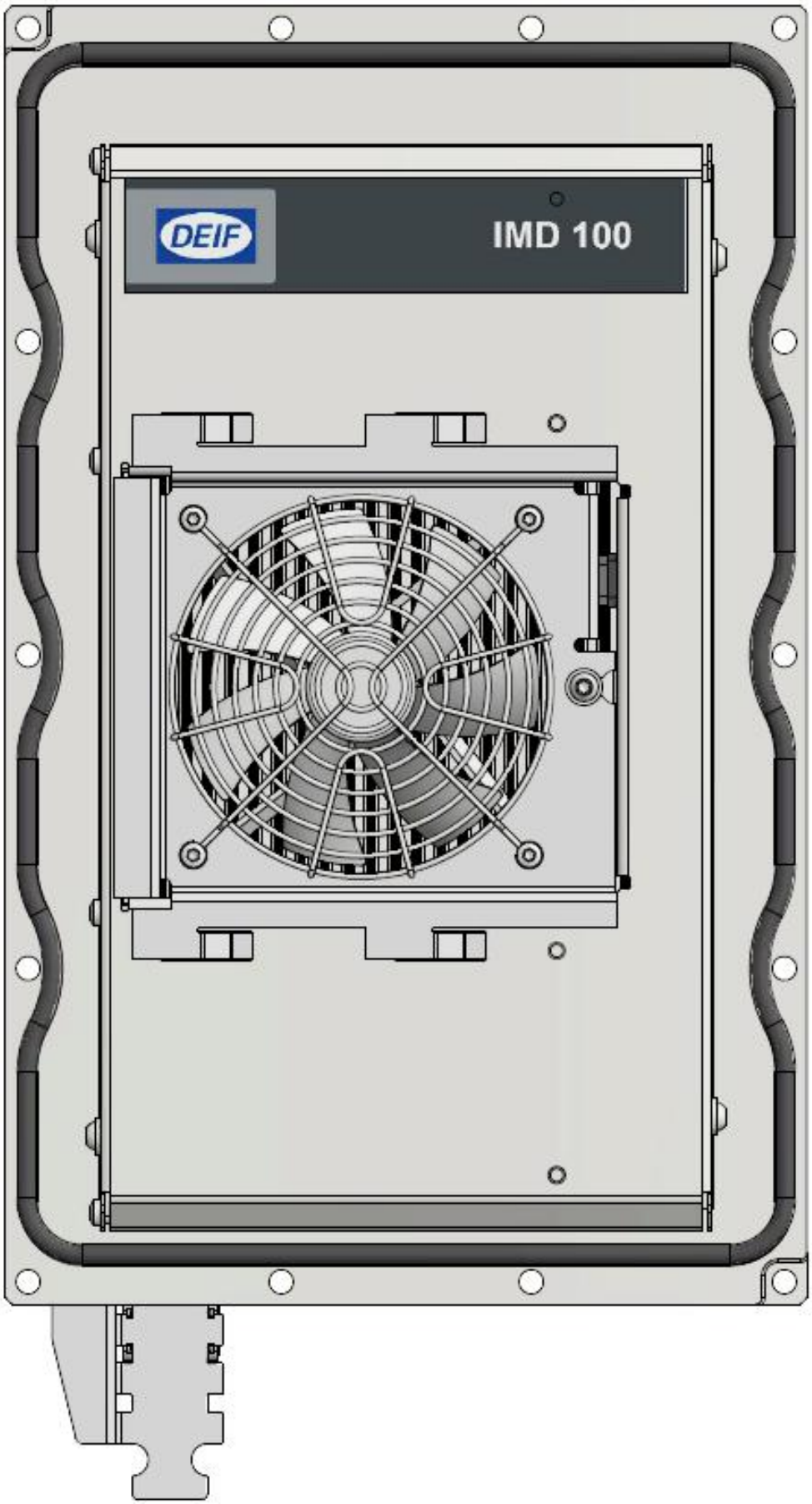


4.3.2 IMD 135

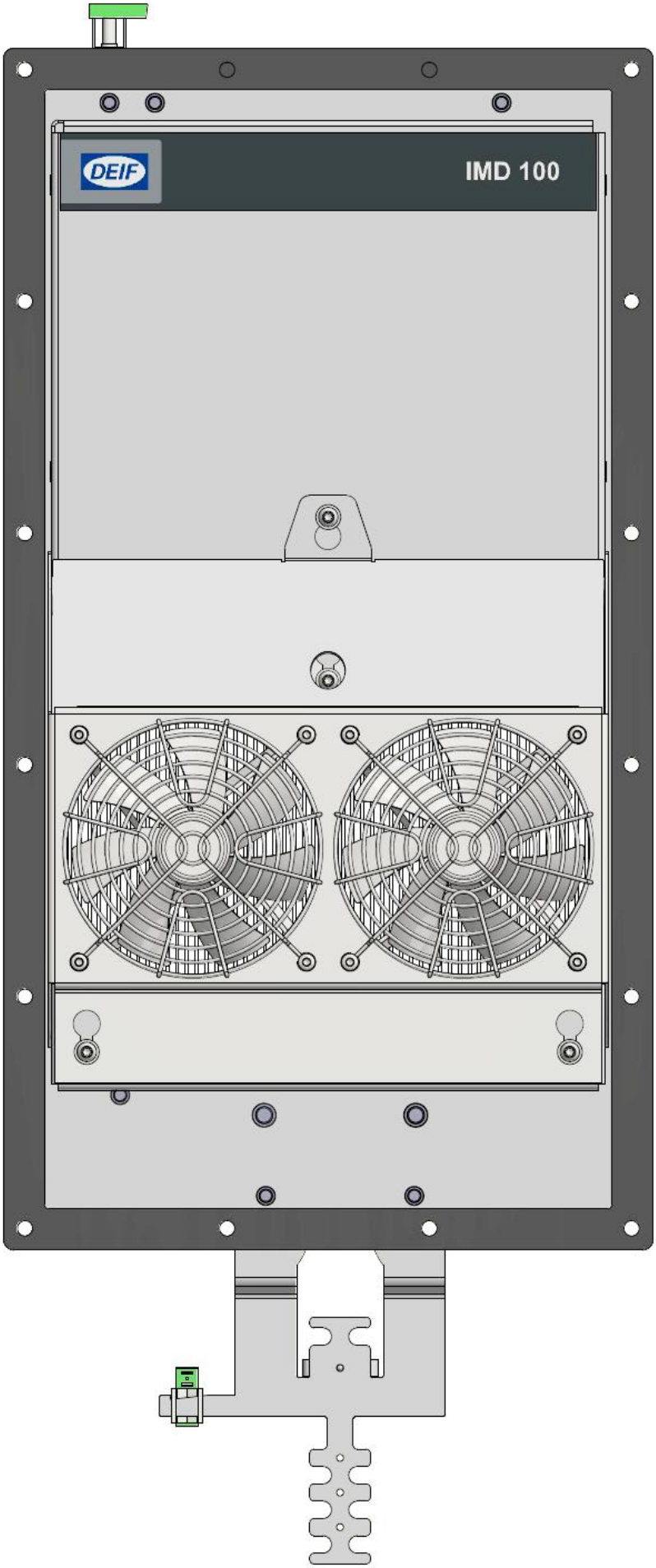


4.4 Back

4.4.1 IMD 122

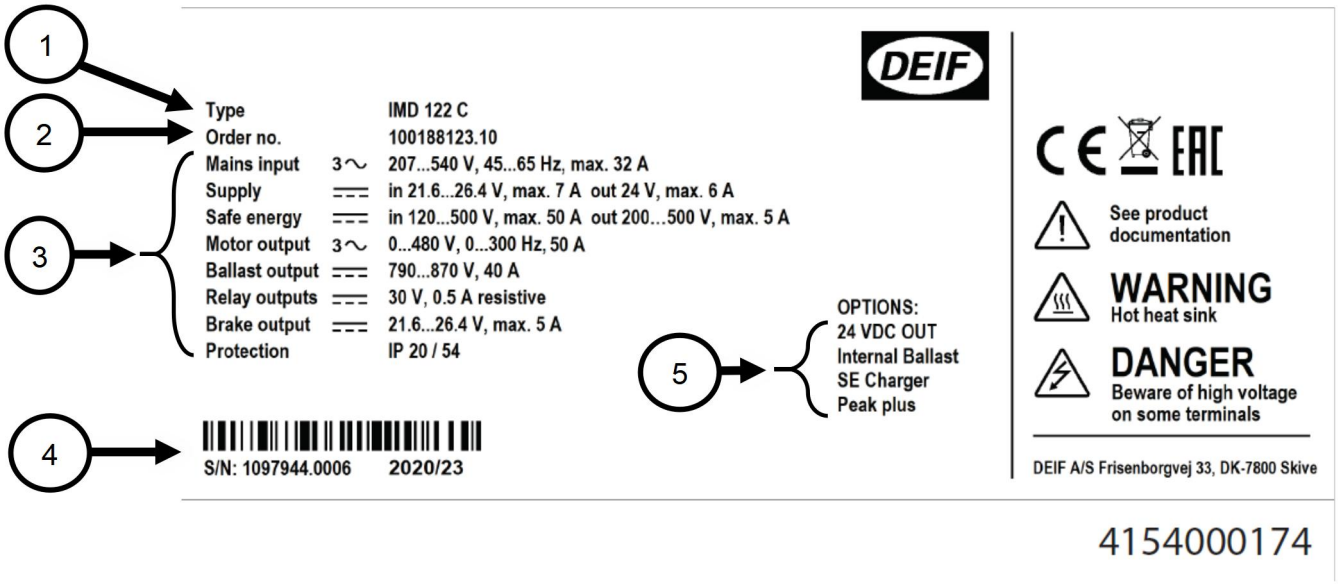


4.4.2 IMD 135



4.5 Label

The label of the IMD contains both general and unique information about the IMD:



1. The type of the IMD.
2. Customer order no. followed by line no within the order (after the dot).
3. Product main data from the data sheet, relevant for the specified IMD type.
4. Serial no. in readable characters and barcode, production year/week.
5. Options mounted in the IMD. If an option is not mounted/selected it is not shown.
   Example of an IMD with internal power supply, no internal ballast, SE charger and Peak plus options:

   OPTIONS:
   24 VDC OUT

   SE Charger
   Peak plus

5 Order specifications

5.1 Platform variants

IMD 100 platform ordering no. and variants		
2911221070	**Variant**	**Output current**
	IMD 122	Nominal 50 A_{rms}, Peak 105 A_{rms}
	IMD 135	Nominal 70 A_{rms}, Peak 225 A_{rms}

5.2 Options

The following option are available for the different variants:

Option	Description	IMD 122	IMD 135
M-frame	Mounting frame with Ø7 mm holes	✓	✓
M-frame kit IMD 122	Mounting frame with M6 threading and bolts	✓	✗
Peak plus	Extended peak current (3 sec.)	✓	✓
24 VDC out	Internal 24 VDC / 7 A power supply	✓	✓ *
SE charger	Safe Energy charger, 200 VDC – 500 VDC / 5A. *This option must be bundled with 24 VDC out.*	✓	✓ *
Internal ballast	Internal ballast resistor is mounted.	✓	✗

* IMD 135 always contains 24VDC out and SE charger

6 Legal notice

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