
Body Builder's Guide

LOW CAB



Translation of the document

Imprint

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Validity

This document is only valid for the products listed in the table below:

Type	Model	Version
E-Truck	LOW CAB	MK2
E-Truck	LOW CAB	MK3

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1 Foreword

This electric truck is a product of power electronics with dangerous voltages and currents, we assume special expertise in handling.

Read this document carefully - especially the chapter "SAFETY NOTICES AND WARNINGS" - before using the product or carrying out any other work on it!

1.1 Purpose of the document

The body builder's guide explains the possibilities and obligations of the body builder of a Designwerk E-Truck.

2 Safety Notices and Warning

This chapter contains safety notices for this unit. These pertain to initial use and ongoing use in the vehicle. Please read and always observe these notices for safety reasons and to prevent loss of life and unit damage.

2.1 Symbols and their meanings

This manual uses various symbols. The following chart contains a list and their meanings:

2.1.1 Hazard and warning symbols

Symbol	Designation	Symbol	Designation
	General warning of a danger zone		Warns of high voltage
	Warns of fire hazard		Warns of hot surfaces

2.1.2 Commandment and information symbols

Symbol	Designation	Symbol	Designation
	Important information to avoid potential property damage		Important information

2.2 Safety notices and risk levels

	DANGER Danger Indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.
	WARNING Warning Indicates a hazardous situation that, if not avoided, could result in death or serious injury or damage to the product.
	CAUTION Caution Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or damage to the vehicle.
	NOTICE Notice Important information for labelling to avoid potential property damage
	INFORMATION Information For highlighting important information for the reader.

2.3 General safety notices

	DANGER High voltage / Danger to life • Work on the vehicle's high-voltage system may only be carried out by authorised personnel! • There is a danger to life if live parts are touched! • Do not unplug any high-voltage cables! • Do not open any covers of high-voltage components. • Damaged cables or housings must be inspected immediately by qualified personnel.
	WARNING Other road users may not hear you very well! Due to its electric powertrain, the E-Truck is much quieter than your conventional E-Truck. You can barely hear any noise, especially when the E-Truck is stationary or at walking speed. Other road users such as pedestrians or cyclists may not hear the E-Truck as well. Therefore, take extra care in traffic and pay close attention to other road users.
	INFORMATION Labelling of high-voltage components: • All high-voltage cables are orange in colour. • All high-voltage components are labelled with the appropriate warning.
	NOTICE Necessary qualifications for installation The work described in this document may only be carried out by trained personnel.
	INFORMATION The illustrations may differ slightly from the vehicle being serviced. However, the key components listed in this information are shown as accurately as possible.

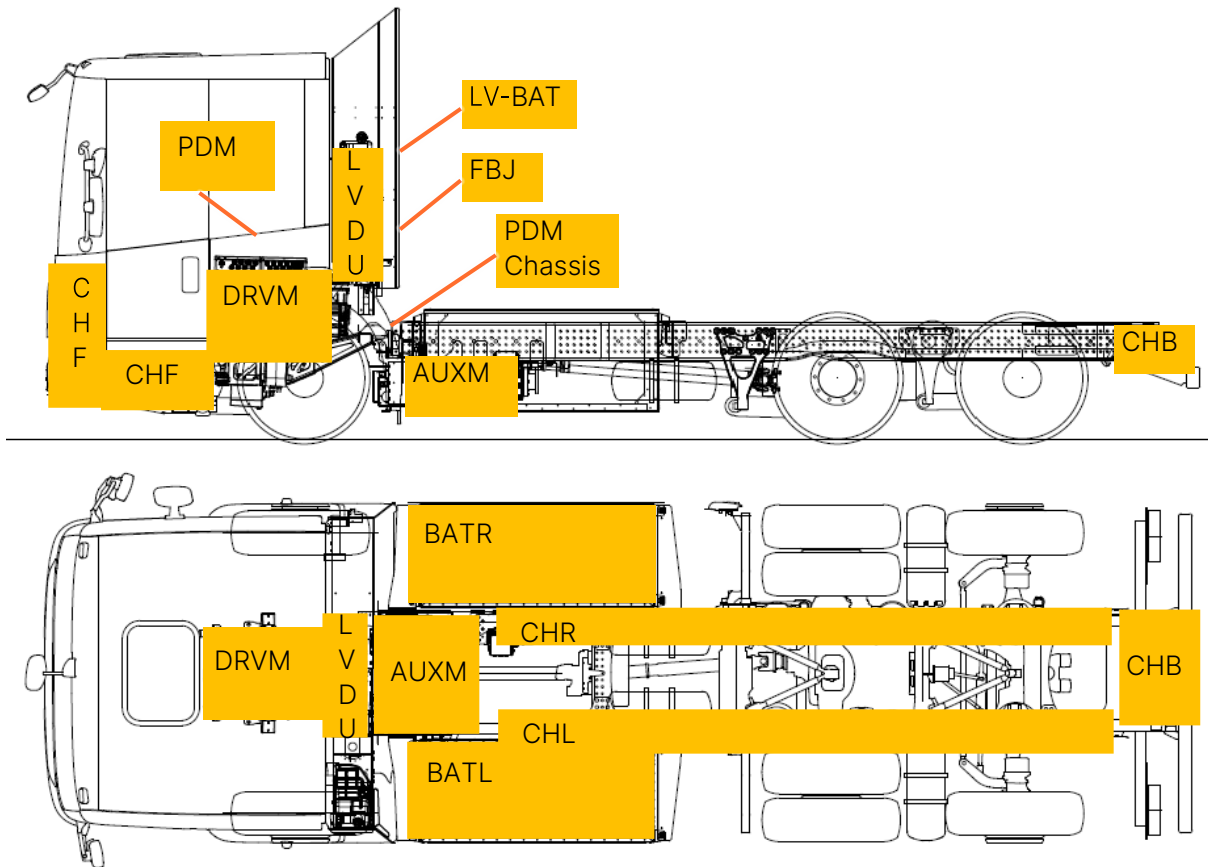
3 General

3.1 Abbreviations and terms

Abbreviation	Meaning
AI	Analogue input
AO	Analogue output
DI	Digital input
DO	Digital output
HMI	Human Machine Interface
HV	High Voltage (> 80 V)
LV	Low Voltage

3.2 Part location

Part locations	Location
AUXM	Auxiliary Module
BATL	Battery Left
BATR	Battery Right
CABB	Cabin Backside
CABL	Cabin Left
CABR	Cabin Right
CHB	Chassis Backside
CHF	Chassis Front
CHL	Chassis Left
CHR	Chassis Right
DRVM	Drive Module
FBS	Fuse Box Sub
FBM	Fuse Box Main
LVDU	LVDU

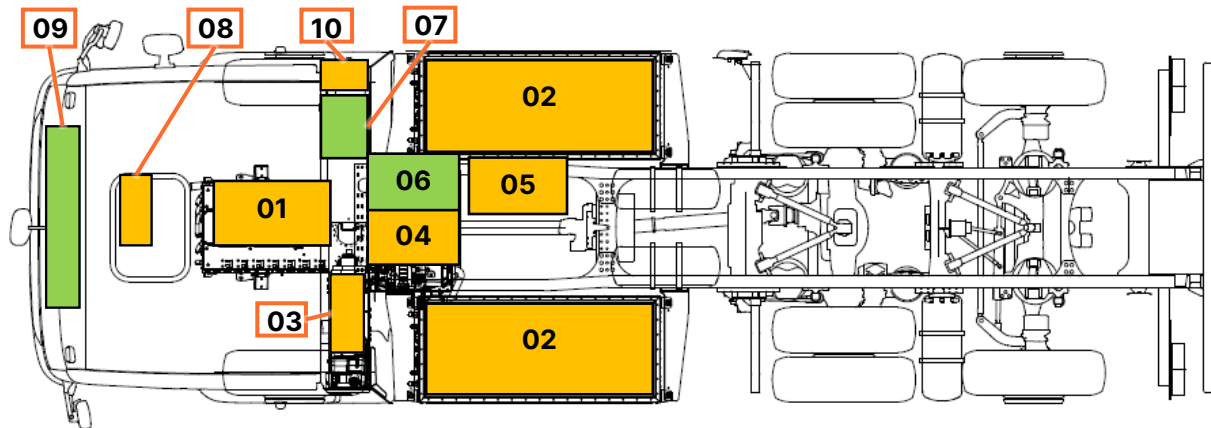


3.3 Device abbreviations

Device abbreviations	Device description	Versions (for multiple devices)
DCDC	400 V – 24 V DCDC converter	DCDC_400 V/DCDC_24 V/DCDC_12 V
FF-interface	Electrical interface driver cabin-chassis	
LVDU	Low voltage distribution unit	
PTO	Power Take Off	PTO_M -> Motor / PTO_I -> inverter
VBI	Vehicle Body Interface	

3.4 Versions and general description

The Designwerk vehicles are available in three different versions, FM, FMX and FH series.



Position	Meaning
01	Drive module
02	HV batteries, additional positions in the following figures.
03	AC and CCS charging port
04	HV air compressor
05	PTO
06	Power steering pump
07	24 V battery and fuse box
08	HV-air conditioning compressor
09	Fan unit
10	DC/DC converter 400 V – 24 V

4 Safety

4.1 Electrical safety

The Designwerk E-Trucks were developed based on UNECE R 100 requirements.

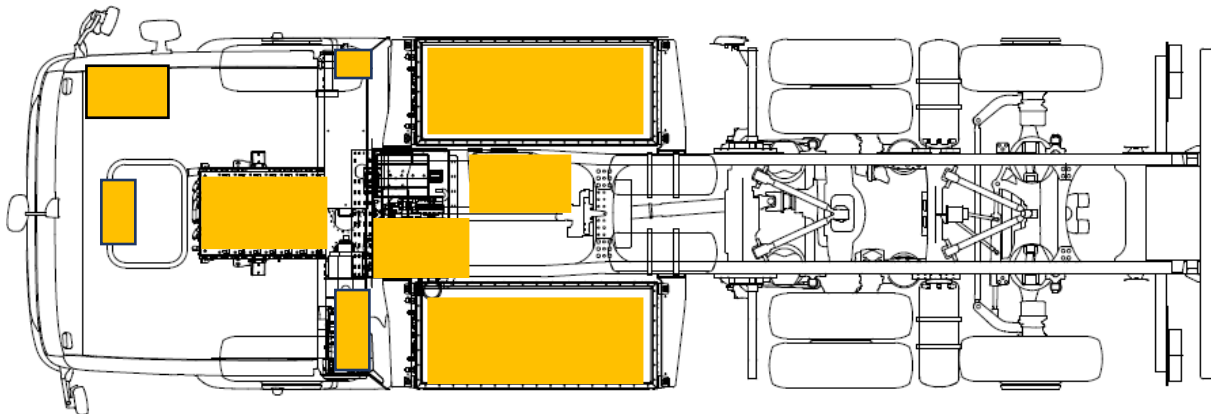
	DANGER
	High voltage/Danger to life! • Work on the vehicle's high-voltage system may only be performed by authorised personnel! • Danger to life when touching live parts! • Do not disconnect any high-voltage cables! • Do not open any covers of components carrying high voltage. Have damaged cables or housings inspected by qualified personnel immediately.

4.2 Electrical drive

The electrical drive and HV auxiliary drives are operated using a nominal rated voltage of 360 V; the above-mentioned guidelines must be observed.

All HV cables are orange or sheathed with orange corrugated tubing.

The illustration below highlights all HV components in orange:



4.3 “High voltage Off” switch

	NOTICE
	The “High voltage off” switch may only be used in emergencies!
	NOTICE
	In an emergency, the driver must be able to switch off the vehicle at any time by pressing the "High Voltage Off" switch. The driver assumes the function of the safety instance.



The driver can deactivate the power supply to the drive as well as the drive inverters and the charger via the emergency stop switch.

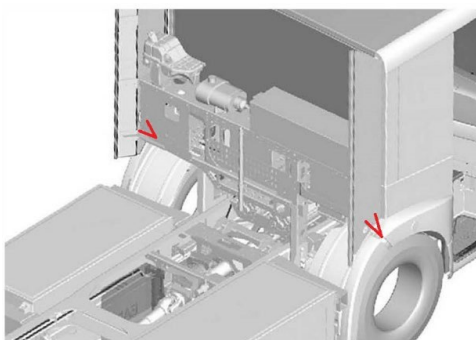
The emergency stop switch immediately interrupts the power supply to the HV contactors in the battery, without using software.

4.4 Emergency stop loop

Emergency stop loops accessible from the outside are provided at two designated points for disconnecting the power supply to the HV battery contactors.

These points can be used for rescue equipment to safely switch off the vehicle.

Care must be taken during assembly to ensure that the emergency stop loops are not damaged. The loops must remain freely accessible at all times.



4.5 24 V Battery disconnect switch

To interrupt the power supply to the Designwerk LVDU, the 24 V battery disconnect switch must be actuated.

The Mercedes-Benz components are not interrupted by actuating this switch.

The pictures below show the position of the battery disconnect switch.

To disconnect the 24 V power supply completely, the 24 V battery must be interrupted mechanically.

The Mercedes-Benz body builder's guide describe how the 24 V power supply to the Mercedes-Benz components is interrupted.

To disconnect the 24 V battery, proceed as follows:

- 1 Switch off the ignition.
- 2 Switch off other electric consumers.
- 3 Switch off the main switch.
- 4 First disconnect the earth cable from the battery pole.



4.6 Safety in the event of fire

	INFORMATION
	Information about safety in the event of fire can be found in the blue light instructions.

4.7 Safe working

	WARNING
	Any work done on the electrical vehicle must meet regional safety guidelines and EN 50110-1. This applies to: • Work on electrical components may only be implemented by personnel trained by Designwerk. • It is the responsibility of the trained person to assess risks in the bodywork. • Several types of work require decommissioning and commissioning of the vehicle (HV system inside the vehicle) by Designwerk Technologies AG. Consult the relevant instructions by Designwerk and EN 50110-1.

The vehicle body builder is responsible for meeting the guidelines. If no trained personnel is available, contact Designwerk Technologies AG.

5 Chassis

5.1 Welding

	INFORMATION
	Information about welding on the vehicle can be found in the Designwerk operating instructions.

5.2 Painting

	INFORMATION
	Information about paint work on the vehicle can be found in the Mercedes Benz operating instructions. Designwerk components and cables may not be painted.

5.3 Towing and manoeuvring

	INFORMATION
	Information about towing and manoeuvring can be found in the operating instructions.

5.4 Cleaning

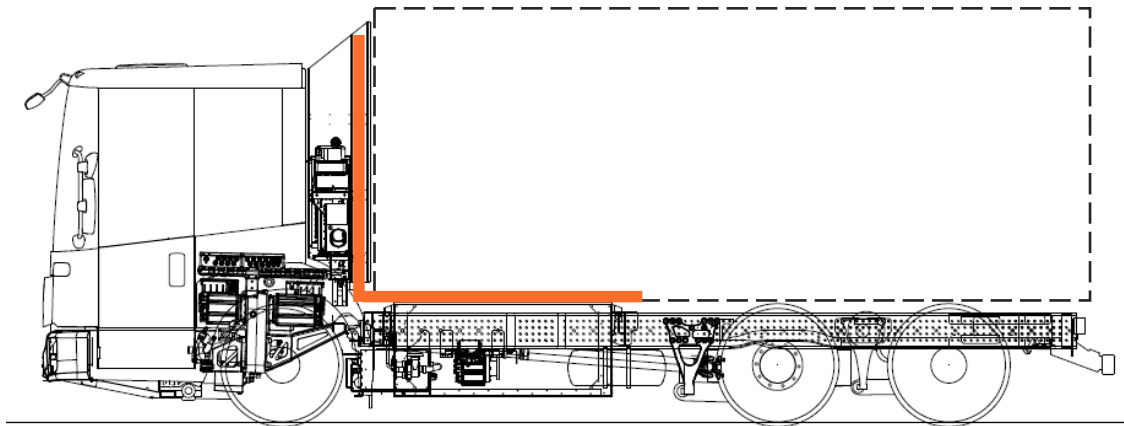
	CAUTION
	Beware of damage to the plug connections Designwerk HV and LV components, particularly electrical plug connections may NOT be cleaned using a pressure washer or powerful hose.

	INFORMATION
	Information about cleaning can be found in the Mercedes Benz operating instructions.

5.5 Subframe height and installation space for superstructures

It may only be built up to 50 mm from the drive module. $X \& Y = \min. 50 \text{ mm}$

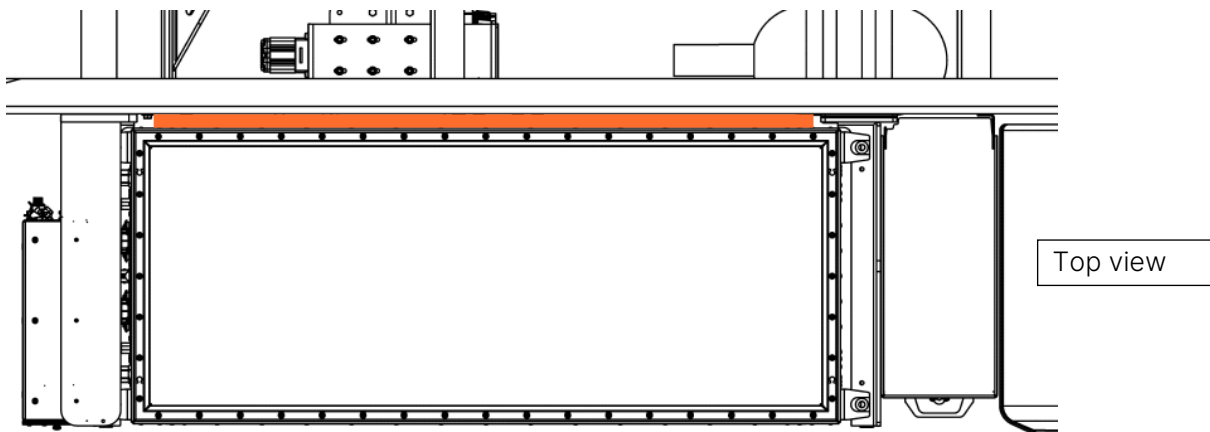
The area of 50 mm above the HV battery may not be installed. Because the entire battery is raised by 50 mm during removal, this restriction also includes mounting brackets and screws.



5.6 Chassis attachment parts

	INFORMATION
	Further information on bodies and equipment can be found in the Mercedes-Benz Body/Equipment Mounting Directives for trucks of the corresponding series (Econic). In particular, the chapters «Subframe» and «Design of bodies» must be observed.

Leave a space of at least 15 mm between the battery and screw heads on the chassis. If this is not possible, use countersunk screws.



5.7 Lateral underride protection

	NOTICE
	Transfer of responsibility for any modifications No changes may be made to the side underrun bars! If modifications are made, responsibility for the side underrun protection devices is transferred to the relevant body builder.

The lateral underride protection complies with international regulations in accordance with UNECE R73.

The corresponding test was carried out successfully. The test report only applies to the original, unmodified underrun bars.

Modifications, conversions or cut-outs must not be made.

If this is done anyway, the validity of the test report expires. Responsibility for the lateral underride protection now lies with the body builder.

The body builder is responsible for a new inspection. He must record this in his documents.

6 Turn-off assistant

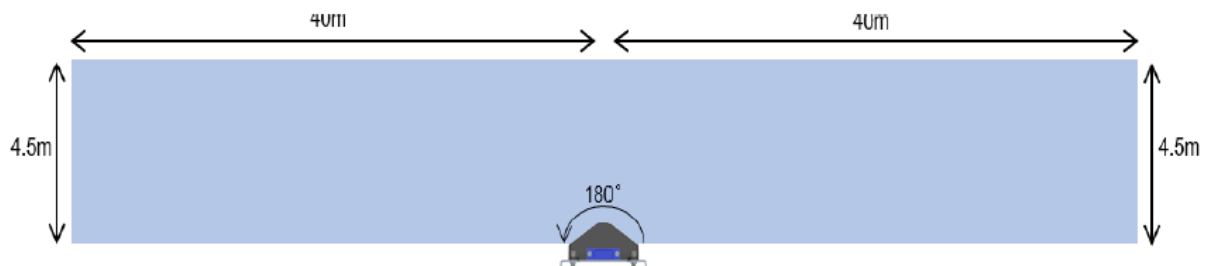
Vehicles with a wheelbase of 3450 can be equipped with a turn-off assistant at the customer's request.

The turn-off assistant is on the right in the direction of travel.

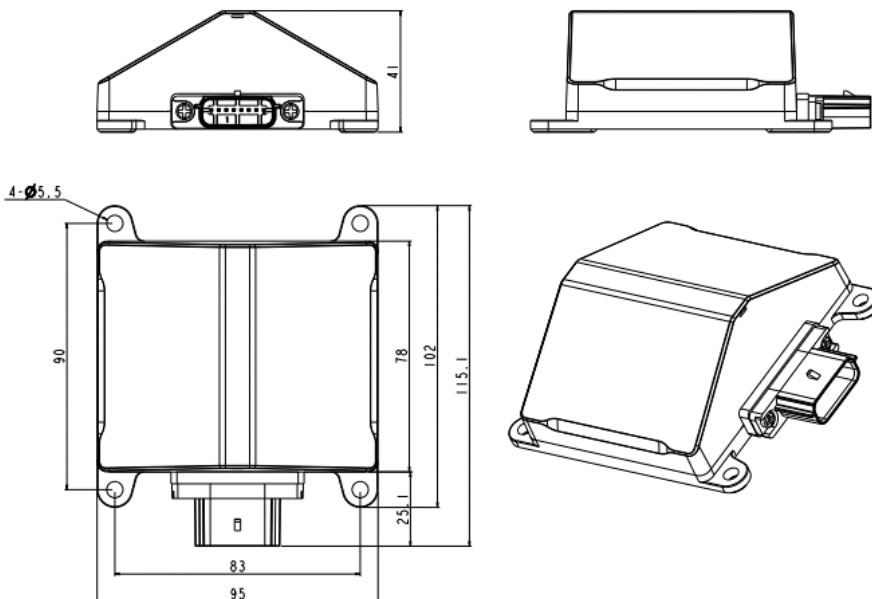


If the turn-off assistant option is installed, the corresponding clearances to the sensors must be maintained.

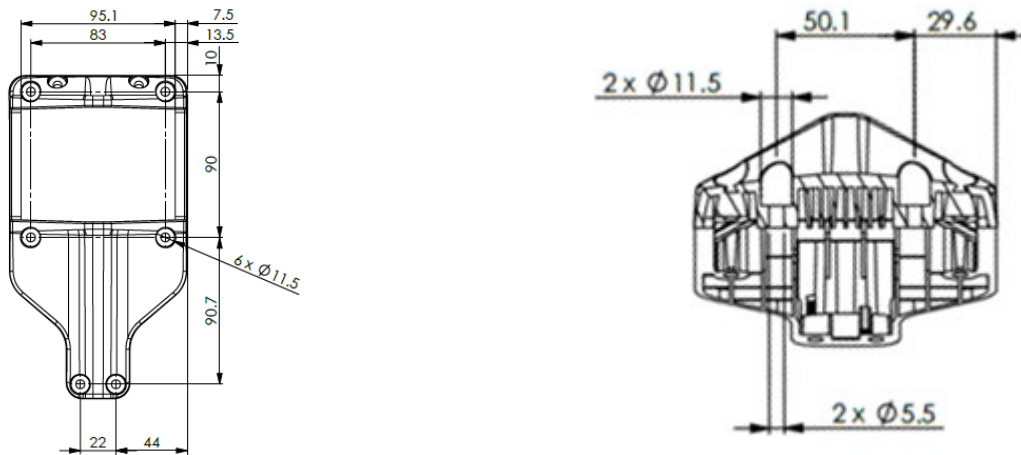
The lateral zone of surveillance is 80 x 4.5 m and covers a radius of 0°-180°.



The dimensions of the sensor are 78 x 95 x 41 mm.



The sensor cover dimensions are 200 x 110 x 46.7 mm.



6.1 Performance parameters

Maximum detection range		±80 m (vehicle) ±40 m (pedestrian/bike)	
Operating mode	Low speed		High speed
Minimum detection range	0,25 m		0,9 m
Distance resolution	0,31 m		0,96 m
Speed range	±60 km/h		±150 km/h
Horizontal angle		180 °	
Angular accuracy		±0,8 °	

6.2 General parameters

Energy consumption	6,5 W
Operating cycle	60 ms

6.3 Display turn-off assistant



The screen is located on the right-hand A-pillar.

The screen is activated automatically when the ignition key is turned.

7 Cooling system

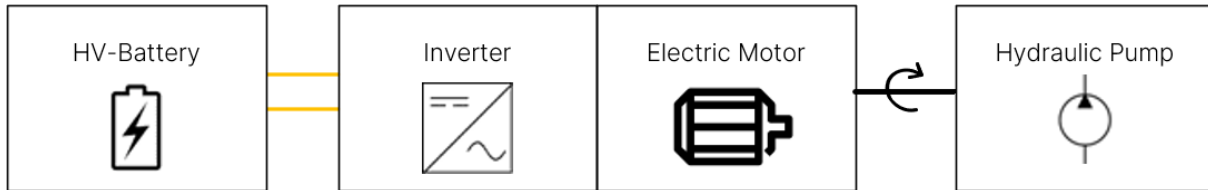
No additional components may be integrated into the cooling system of the Designwerk E-Truck. Contact us if you have any questions in this regard.

8 Power Take Off (PTO)

A LOW CAB with wheelbase 3450 is supported with ONE PTO.

A LOW CAB with wheelbase 3900 can be supported with TWO PTOs.

Unlike conventional PTOs, each PTO in the LOW CAB is driven by its own electric motor and is not tapped from the drive train. This means that the PTO can be operated independently of the drive motor.



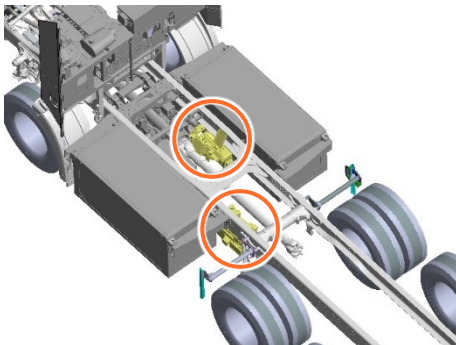
Due to the performance requirements in the PTO, a variety of electric motors are available, which in turn can be combined with various hydraulic pumps.

The hydraulic pumps used by Designwerk are powered using higher rotational speeds than standard versions.

The components should be selected in collaboration with Designwerk Technologies AG.

	Low speed torque (Nm)	Rated Power (kW)	Nominal speed (rpm)	Low speed peak torque (Nm)	Peak Power (kW)	Maximum speed (rpm)
PTO 62 kW	110	30	2600	220	62	7500
PTO 120 kW	135	70	3900	300	120	7500

8.1 PTO positioning /variants



By default, PTOs are positioned in the chassis behind the aux module (yellow).

8.2 Control



NOTICE

Speed and direction of rotation

The speed and direction of rotation are set by Designwerk before the vehicle is handed over in accordance with the requirements and in consultation with the body builder.

- Min. 2000 rpm
- Max. 7500 rpm



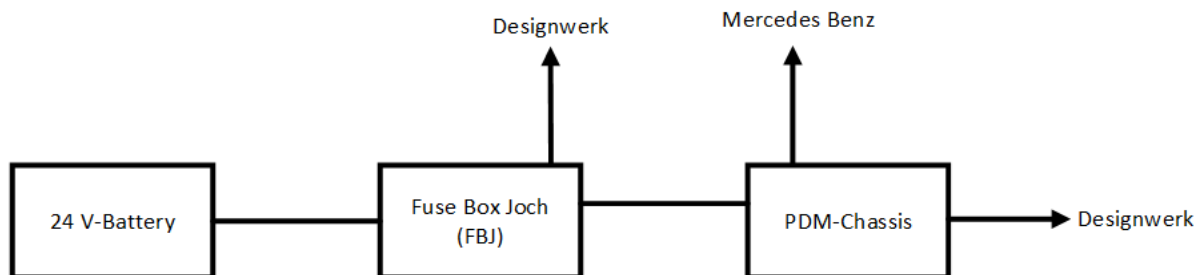
Control is via the PTO switches in the cab. The switches for the PTOs can be attached in different positions on the dashboard. If a PTO is switched on, this is indicated in the Mercedes Benz display.

Depending on the requirement, the PTO motor does not immediately run once the switch is pressed, but rather, it requires a signal from the body.

9 Information on electrical installations

9.1 24 V fuse box

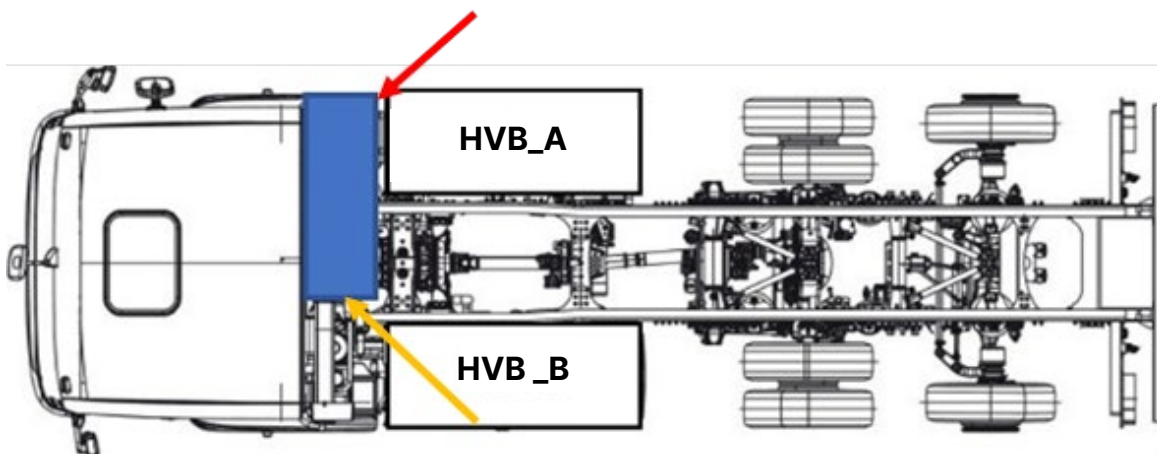
	WARNING
	Maximum load When calculating the additional equipment, ensure that the loads do not exceed 80 % of their rated current in the fuses.



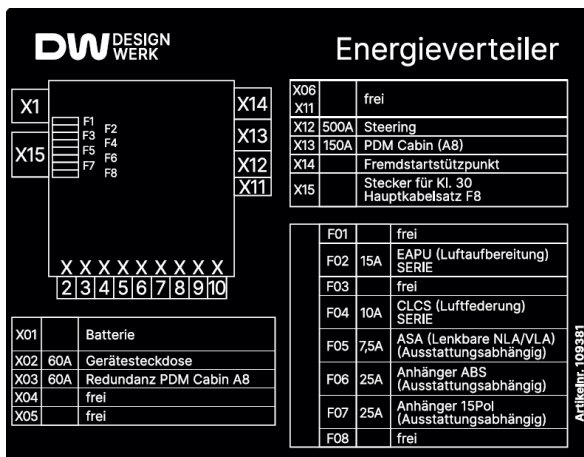
The PDM chassis is located underneath the 12 V battery (red arrow).

The fuse box (FBJ) is located at the 24 V battery box (yellow arrow).

If additional customers are connected, the free fuse slots on the PDM chassis can be used. Please refer to the Mercedes-Benz installation guidelines to find out how high the fuse rating can be.



	INFORMATION
	For further information, please refer to the Body Builder's Guide of Mercedes-Benz.



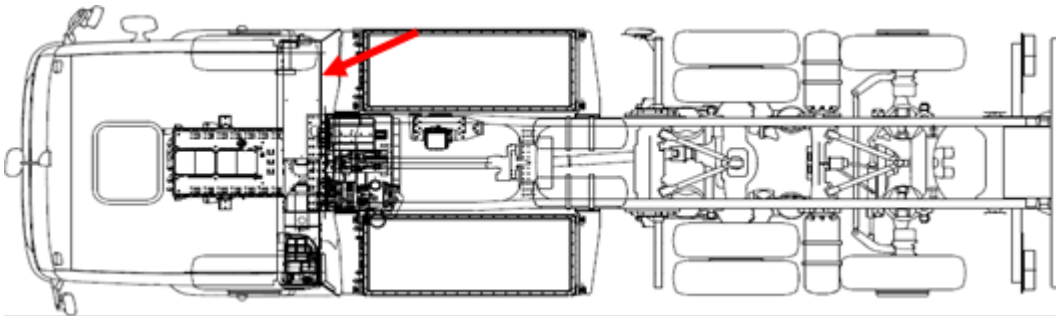
The remaining fuses are assigned according to the Mercedes-Benz Driver's Manual.

	INFORMATION
	The vehicle can be bridged and charged via the external starting point on the PDM chassis X14. The earth for bridging must be disconnected at the GBC box.
	NOTICE
	Load the batteries regularly The 12 V batteries must be charged regularly. The vehicle must be charged after 7 days at the latest. Otherwise the battery must be disconnected.

9.2 24 V supply

	WARNING Fuses The original fuses may not be replaced by fuses rated for higher currents.
	INFORMATION Further information and an overview of the fuse positions and the standard fuse assignment can be found in the Mercedes Benz Body Builder's Guide.

Position of the 24 V battery:



9.3 Earthing points

	INFORMATION The earth tap can be made on the GBC. However, it must be ensured that there are no more than two cable lugs under one cable gland and that the fixing nut can still be fitted with all threads.
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The earthing points can be found in the Mercedes Benz Body Builder's Guide.

Additional earthing points may only be attached to the earth distribution box on the right-hand yoke rail.



9.4 Body builder's interface

The LOW CAB has various interfaces to the vehicle's electronic system, e.g. the body builder/manufacture interface in the E-compartment of the cab (FF interface) from Mercedes-Benz and the VBI interface from Designwerk.

The table below provides an overview of the functions prepared by Mercedes Benz and those newly solved by Designwerk.

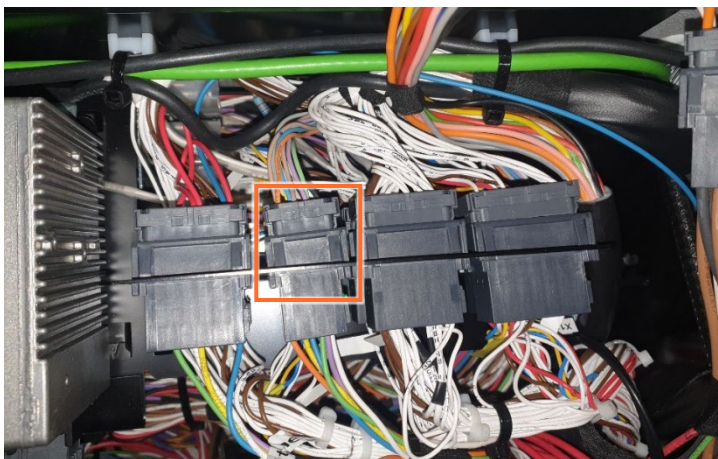
Some functions are also only possible in cooperation between Mercedes-Benz and Designwerk and require additional clarification.

	INFORMATION
	For further information on the FF-interface, please refer to the Mercedes-Benz instructions.

	Mercedes-Benz	Designwerk	Combined
Switch (driver's cab)	✓		
PTO			✓
Lower chassis	✓		
Speed limitation device		✓	
Gear selection lock			✓
Lighting	✓		
Body builder CAN	✓	on request	

9.4.1 Vehicle body interface (VBI)

	INFORMATION
	There is a body interface to the Designwerk vehicle control unit. The interface is located in the E-compartment behind the driver's seat (see figure below).



9.4.1.1 Physical properties of the VBI plug

The Vehicle Body Interface (VBI10) serves as an interface with the vehicle control. Digital in- and outputs are available. These may only be configured in cooperation with Designwerk.

- 5 digital inputs (VBI_DI_0...VBI_DI_4)
- 6 digital outputs (VBI_DO_0...VBI_DO_5)

9.4.1.2 List of abbreviations for inputs, outputs and signals

Abbreviation	Designation
DI H	Digital input, high level +24 V
DO H	Digital output, high level +24 V
DO L	Digital output low level (mass, if active)

9.4.1.3 VBI 10-plug assignment (VBI10.X1.12/«Pin no.»):

Pin	Pin-Type	Signal	Voltage class	Load
1	DI H	DI_VBI_0	8-32 V	-
2	DI H	DI_VBI_1	8-32 V	-
3	DI H	DI_VBI_2	8-32 V	-
4	DI H	DI_VBI_3	8-32 V	-
5	DI H	DI_VBI_4	8-32 V	-
6	DO H	DO_VBI_0	24 V	4 A
7	DO H	DO_VBI_1	24 V	4 A
8	DO H	DO_VBI_2	24 V	4 A
9	DO H	DO_VBI_3	24 V	4 A
10	DO H	DO_VBI_4	24 V	4 A
11	DO L	DO_VBI_5	mass	3 A
12	-	-	-	-

Mating connector for body builder: 1-967627-5 and 967632-1.

9.4.1.4 Programmable basic functions

There are functions for the digital inputs and outputs that were already required in the previous setups.

The assignment must be agreed with Designwerk in advance. If additional functions are required, a request must be made to Designwerk. Additional functions are not always possible.

Signal name	Type	Active level	Function
PTO A Speed 1 Request	DI	8-32 V	PTO A rotates at a preset speed (maximum 5000 rpm.)
PTO A Speed 2 Request	DI	8-32 V	PTO A rotates at preset speed (maximum 7500 rpm.)
PTO B Speed 1 Request	DI	8-32 V	PTO B rotates at preset speed (maximum 5000 rpm.)
PTO B Speed 2 Request	DI	8-32 V	PTO B rotates at preset speed (maximum 7500 rpm.)
Footboard	DI	24 V	Limits forward speed to a defined value and locks reverse gear if required.
Footboard inverted	DI	GND	Limits forward speed to a defined value and locks reverse gear, if desired. Active, when no 24 V is applied.
Emergency Stop	DI	GND	Emergency stop input for the PTOs. 35 V must be present for the PTO to be operated.
5 km/h	DI	GND	Speed limit 5 km/h. 24 V must be applied so that more than 5 km/h can be driven.
9 km/h	DI	GND	Speed limit 9 km/h. 24 V must be applied so that more than 9 km/h can be driven.
Enable body A	DO	24 V	PTO A is activated (PTO is ready but not yet turning.)
Enable body B	DO	24 V	PTO B is activated (PTO is ready but not yet turning.)
Gear D	DO	24 V	Vehicle is in Drive/Automatic gear.
Gear N	DO	24 V	Vehicle is in neutral gear.

Signal name	Type	Active level	Function
Gear R	DO	24 V	Vehicle is in reverse gear.
Park Brake	DO	24 V	Spring mechanism is activated (handbrake.)
Rolling backwards	DO	24 V	Vehicle is rolling/driving backwards.
KL 15	DO	24 V	Control is active, terminal 15.

9.4.2 Body Builder CAN interface

	INFORMATION
	Mercedes-Benz offers a Body Builder CAN. This is described in the Mercedes Benz Body Builder's Guide.

Various conditions can be read out.

Most messages work as in the original Mercedes Benz system. However, certain messages were adjusted by Designwerk. To prevent misunderstandings, the CAN interface must always be coordinated with Designwerk.

If a body builder interface via CAN is desired, the CAN messages must also be partially adjusted on part of the body builder.

9.4.3 Switch

Information on the switches on the dashboard can be found in the Mercedes Benz Body Builder's Guide.

10 Display Designwerk

In the additional vehicle display, performance and temperature data can also be reviewed, as well as basic vehicle information.

11 Chassis

The setting options on the chassis or air suspension can be found in the Mercedes Benz Body Builder's Guide.

- Lowering the chassis when PTO is activated.

12 Speed limiter

The speed limiter can be switched on and off via a digital input on the Vehicle Body Interface (VBI).

The pin assignment at the VBI and the maximum speed are configured in consultation with the body builder from Designwerk.

13 Lighting

Additional information on lighting can be found in the Volvo body builders guide.