



# User and maintenance manual RiMO SiNUS models

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These operating instructions were created by dokupartner, http://www.dokupartner.de.



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# 1 About this operating manual

This operating manual (hereafter referred to as "the manual") has been devised to ensure safe operation, maintenance and repair of the SiNUS models iON, MiNi and TWiN (hereafter referred to as "the kart"). It also includes detailed descriptions of the karts manufactured by RiMO GERMANY GmbH & Co. KG (hereafter referred to as "RiMO").

- Please read this manual carefully.
- Observe all safety instructions!

# 1.1 Purpose of this manual

This manual has been devised for skilled technical personnel as a reference manual and guide regarding the technical aspects and features of the karts.

The technical information regarding settings, maintenance work and electrical equipment has been compiled for specialist technicians who are authorised to perform the respective tasks. Unauthorised personnel are prohibited from carrying out any of the work described in the relevant chapters (see Requirements for operator's personnel [> 52]).

# 1.2 Keep a copy near the karts

A copy of this manual must be keep near the karts. A copy of this document must be available at all times near the kart where it is accessible to technical personnel and drivers (operators).

# 1.3 About this manual

This section describes the signs and symbols used in this manual.

# 1.3.1 Safety instructions

The safety warnings and instructions in this manual are highlighted as follows:



# **▲** DANGER

## Warning regarding imminent risk of injury

This safety/warning instruction refers to an **imminent** danger of serious or even fatal injury.

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## **MARNING**

## Warning regarding a potential risk of injury

This safety warning/instruction refers to a **potential** danger of serious or even fatal injury.



## **⚠ CAUTION**

#### Warning regarding a potential risk of injury

This safety warning/instruction refers to a **potential** danger of minor or medium injury.



## **Attention**

## Warning regarding damage to property

These safety warnings highlight potential risks of damage to the kart.

A safety instruction contains the following information:

- Signal word
- Nature and source of danger
- Potential consequences
- Measures to avert the danger

#### Example



# **▲** DANGER

Risk of injury from high voltage (nature and source of danger)

Risk of electrocution! (potential consequences)

a) Wait at least 4 minutes before carrying out any work on the motor connections! (actions to avert danger)



# 1.3.2 Prohibition signs and symbols

A prohibition sign consists of a red circle and a diagonal red line on a white background containing a symbol. Example: cigarette with red diagonal bar: Smoking prohibited!

Symbol	Description
	Do not drive kart without safety helmet.
	Do not drive kart with long open hair.
	Do not wear scarf or headscarf. Wear tight-fitting clothes.
	Do not drive kart under the influence of alcohol (0 alcohol limit).

Tab. 1: Prohibition signs and symbols

# 1.3.3 Warning signs and symbols

The following warning are used in this manual: These symbols are designed to make the reader aware that the text to the left of the symbol contains important safety warnings and instructions.

Symbol	Description
	Warning! Danger!
A	Warning: Dangerous electric voltage

Tab. 2: Warning signs and symbols



# 1.3.4 Other symbols used in this manual

Important or helpful alerts, information, and tips are structured as shown below:



# **NOTICE**

#### **Notice**

This symbol indicates operating tips and information that help you operate the kart in the most efficient manner.

## 1.3.5 Directions

Directions are indicated as seen in driving direction from the driver seat.

## 1.3.6 Text marks

- Lists are identified by a bullet point (-).
- Text highlighted like this [▶ 10] contains a reference or hyperlink to related chapters, websites and additional information available in this document or online.
- Text highlighted in **bold print** indicates important information. Bold print is also used for subheadings.
- Menu items, tabs, buttons and switches are enclosed in brackets <...>, e.g. <Machine>.
- Sequences of such elements are also shown in brackets <...>, e.g. <Login/Semi-automatic mode/Start>.
- Keys on a keyboard are printed in square brackets, e.g. [Return].
- Text highlighted like this contains references to the enclosed glossary.



#### Work instructions

Work instructions are structured as follows:

#### Heading

- ✓ In this part, you might find preconditions that must be met before the individual steps can be performed.
- a) Operating step
- b) Another operating step
  - ⇒ (Partial) result of an operating step
- c) Another operating step
- ⇒ Final result of a work instruction

#### **Figures**

The figures in this manual are simplified images of the kart or schematic diagrams.

# 1.4 Revision log

Date	Index	Revision	Designation	page

Tab. 3: Revision log of this document

# 1.5 Other applicable documents

Document	Version	Author

Tab. 4: Table of other applicable documents:

# 1.6 Warranty and liability

The General Business Terms and Conditions of RiMO GERMANY GmbH & Co. KG apply. A copy of these terms and conditions is handed over to the buyer of the kart at the time of signing of the contract.

Warranty cover shall not apply to damage caused by improper use of the kart.



# 1.7 Contacting RiMO GERMANY GmbH & Co. KG

If you have any queries regarding the kart, please contact us with the following details (by phone, fax, letter or online):

- Your name and address
- Contact at your company
- Data found on the type plate: type, serial no. and year of manufacture.

Address: RiMO GERMANY GmbH & Co. KG

Amerikastraße 4 58675 Hemer

Phone: +49 2372 59 99 500

Fax: +49 2372 59 99 510

E-mail: info@rimo-germany.com

Internet: http://www.rimo-germany.com

Tab. 5: Main office



# 2 Product description

This chapter contains detailed descriptions of the kart and its main components.

# 2.1 Kart identification

Each kart is identified by a type plate attached to the kart frame.

## Type plate on kart frame



Fig. 1: Type plate near pedals

#### Data of type plate:

- Type
- Kart type
- ID no. (year of manufacture: digits 1-2 = month, digits 3-6 = year)
- Chassis no.

#### Other identification details on the vehicle



Fig. 2: Serial no. near charging plug

## Quality seal



Fig. 3: Quality seal near pedals



# 2.2 General description

The kart is a sports vehicle designed for driving on a kart track.

The kart must only be started:

- for the intended purpose
- when in proper working condition

Defects or faults that might impair the safety of the kart must be eliminated without delay. Never start a kart, if it is defective or faulty.

#### Functional principle

The kart is designed as a vehicle to be driven by a person (adult or child) after a brief instruction session by kart operator's personnel. The karts are available in different models (iON/MiNi or TWiN) to suit different body sizes. The person driving the kart must be able to control it safely.

The driver is given personal protective equipment (protective gloves, integral helmet) to be worn while driving the kart.

The driver takes place on the driver seat and adjusts the seat and pedals, if required. The final seat and pedal positions are examined by operator's personnel to ensure that they are suitable for the safe driving of the vehicle. The driver pulls out the drive switch of the kart. After the start signal is given, the driver puts the vehicle in motion to start driving on the track.

The track and all vehicles on it are continuously monitored by operator's personnel. If required, drivers might be requested by a signal to stop their vehicle.

After the agreed driving time has elapsed, the kart is driven by the driver to the dedicated stop zone. The driver pushes in the drive switch to switch off the kart and exists the vehicle.

#### See also

Intended use [▶ 15]



# 2.3 Driving kart

This chapter describes how the kart must be driven.

## 2.3.1 Intended use

The kart is designed for forward travel on a suitable kart track. It must be driven by a properly instructed person who is physically able to control the kart safely at all times.

Proper operation of the kart requires instruction of the driver in its handling and control. All track personnel must have read and fully understood the content of this manual. Proper use of the kart also includes adherence to all instructions contained in the manual. The kart must be regularly inspected and serviced!

The kart is intended for commercial use only.

Any other use is deemed improper.

#### See also

Technical data [▶ 43]

## 2.3.2 Improper use

Any operation other than the forward driving on a suitable kart track is deemed improper. Improper use can pose risks to persons and property.

- Improper use includes unauthorised interference with kart components that are relevant for its safety.
- Improper use is also given, if the specific limit parameters (e.g. temperature) are not adhered to, or if the kart is run with insufficient cooling.
- Never place or drive the car in an area where there is a potentially explosive atmosphere (Ex zone).
- Keep the kart away from flammable liquids and other substances.

#### See also

- Technical data [▶ 43]
- Safety devices [▶ 38]



# 2.3.3 Reasonably foreseeable misuse

RiMO has identified the following reasonably foreseeable misuses of the kart.

- Operation of the vehicle by a person who is not physically able to do so safely (due height, body size, age, consumption of alcohol, pacemaker, etc.).
- Actuation of drive switch when no driver is seated in the vehicle.
- Other use of the vehicle in contravention of the above stated intended use.

# 2.4 Kart design

## Diagram of kart

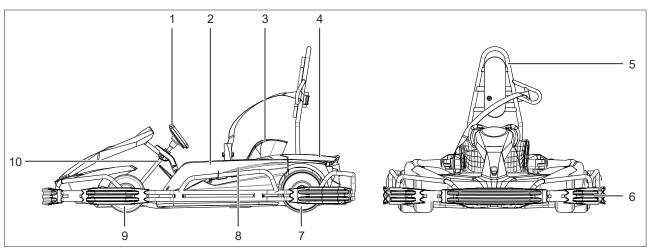


Fig. 4: Kart

1	Steering wheel	2	Panelling
3	Seat	4	Drive with powertrain
5	Rollbar	6	Surround protection
7	Rear wheel	8	Batteries (in special boxes)
9	Front wheel	10	Steering axle



# 2.4.1 Work, maintenance and danger areas

The diagram below shows the work, maintenance and danger areas of the kart.

The work area of the kart must only be accessed to drive it. The maintenance area must only be accessed to service the kart.

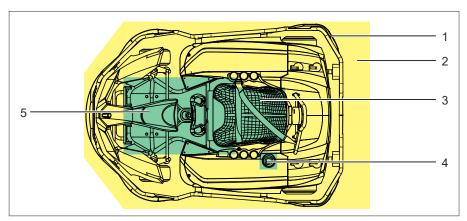


Fig. 5: Work and maintenance areas of kart

1	Kart	2	Maintenance area
3	Driver seat	4	Drive switch
5	Working area		

# 2.5 Kart components and functions

This chapters describes the components of the kart and its functions.

## 2.5.1 Vehicle frame with footboards

The footboards are attached together with the other components of the kart to the vehicle frame.

The frame is made from strong, welded steel tubes.

The footboards allow drivers to get in and out of the vehicle safely and also protect them during driving on the track.



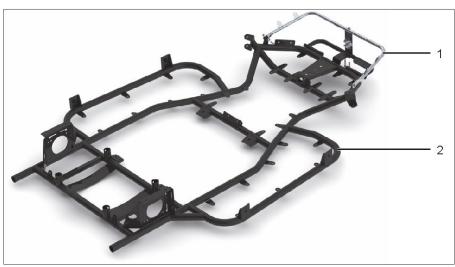


Fig. 6: Vehicle frame

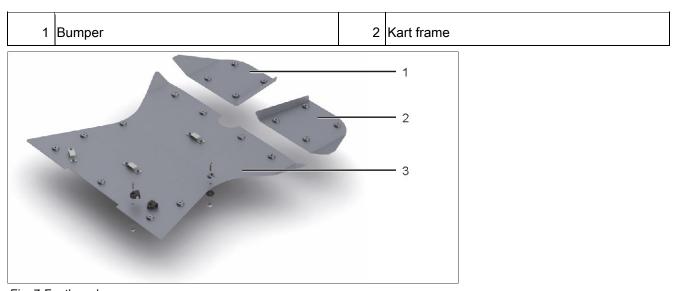


Fig. 7: Footboards

1	Front left footboard	2	Front right footboard
3	Rear footboard		

# 2.5.2 Steering system

The steering system enables drivers to steer the vehicle along the track. Its main components are the steering wheel, the steering column with steering column struts to protect it, the tie rods and the steering knuckles.

Depending on the model, the steering wheel might be equipped with various indicators and control buttons. The pit indicator flashes, if the battery charge has dropped below 20%. In this case, the driver should go to the charging station before starting the next round, as the kart needs to be recharged.

By pressing the boost button, the output power of the drive can be briefly increased, for example to overtake another vehicle. This function is only available for a short time and can only be reactivated after a preset interval has elapsed. The boost button is only ready for operation when it is lit.



The reverse button allows for the driving of the kart in reverse direction. This is done at reduced power and speed (approx. 10 km/h). This button can be pressed while the vehicle is still in forward motion. In this case, the kart first coasts to a halt before it accelerates in reverse direction.

During reverse motion, the driver must keep the button pressed. The moment the button is released, the kart is switched to forward motion. It first comes to a halt and then accelerates.

The reversing function and the reverse button can be activated/deactivated by means of the optional WLAN connection.

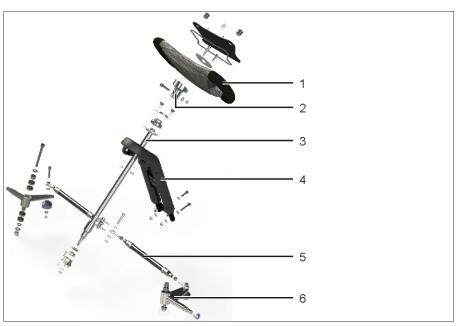


Fig. 8: Steering system

1	Steering wheel	2	Steering wheel mount
3	Steering column	4	Steering wheel struts
5	Tie rod	6	Steering knuckles



Fig. 9: Steering wheel

1	Pit indicator	2	Boost button
3	Reverse button		



## 2.5.3 Pedals

The pedals include a gas pedal and a brake pedal. The vehicle is shipped with a pedal extension for each pedal. The folding extensions can be mounted to reduce the distance between the pedals and the driver seat.

We also offer optional detachable pedal extension elements that make the above distance even shorter.

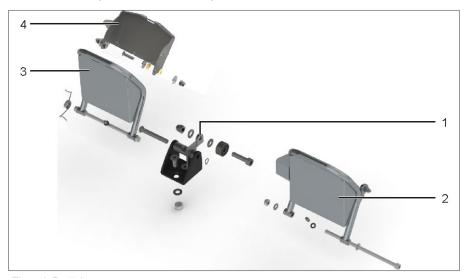


Fig. 10: Pedals

1	Brake pedal	2	Brake pedal
3	Gas pedal	4	Folding pedal extension bracket

# 2.5.4 Seat and seat adjustment

To drive the vehicle, the driver must take place on the seat. The seat is available in various sizes (L, XL, XXL) and designs (with/without padding). We also offer seat pads that can be customised to suit the driver and reduce the risk of injury in the event of side impact.

The seat adjustment mechanism allows for the repositioning of the seat in the seat frame to adjust the distance between the seat and the steering wheel.





Fig. 11: Seat and seat frame

1	Seat frame	2	Seat adjustment cable
3	Seat adjustment lever	4	Seat

## 2.5.5 Drive unit

The drive units transfer the output power of the motor through the transmission to the rear wheels of the kart. The kart is equipped with two drive units.

The transmission is connected to the motor through an adapter plate. The brake disc is attached to the wheel centre and decelerates the wheel when applied.

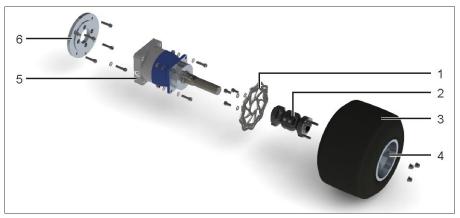


Fig. 12: Drive components

1	Brake disc	2	Wheel centre
3	Tyre	4	Wheel rim
5	Transmission	6	Motor adapter plate



## 2.5.6 Brake system

The two-circuit brake system is used to slow down the kart safely.

The brake cylinder unit includes two separate cylinders, each acting on one rear wheel. The brake fluid level in the brake circuits can be monitored through the oil sight glass. The brake system must be operated with a DOT 5 silicone brake fluid.

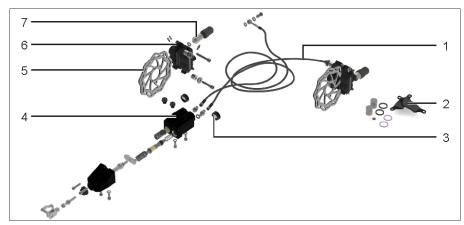


Fig. 13: Brake system

1	Brake line	2	Brake pad kit
3	Oil sight glass	4	Main brake cylinder
5	Brake disc	6	Brake calliper
7	Brake light switch		

# 2.5.7 Electric system with battery cells

The kart is powered by the electric system with 16 battery cells in series.

The battery cells can be recharged and are controlled by the battery management system (BMS). The BMS prevents overcharging or exhaustive discharging of the battery cells.

At the end of a drive run, the battery cells are cooled by fans to prevent overheating.

The battery cells are installed in special battery boxes to the side of the driver seat. The drive switch (EMER-GENCY-STOP switch) is connected directly to the left battery box. By pulling this switch, the kart is set to ready mode and the green indicator beside the drive switch is lit.

By actuating the BMS/main switch, the BMS and the WFM system (if installed) are switched on/off.

The battery powers the two motors installed in the rear of the kart to the right and left behind the driver seat.

The charging socket is located at the rear of the vehicle and is accessible without having to remove the bodywork.



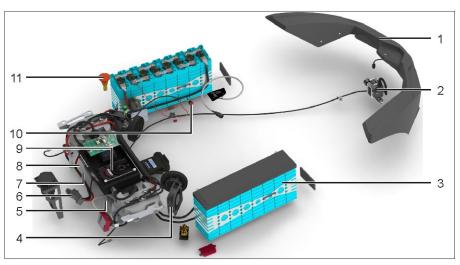


Fig. 14: Electrical equipment

1	Front spoiler with headlamp	2	Drive transducer
3	LiFeMnPO4 battery cell	4	Fan for kart battery
5	Right motor	6	Charging socket
7	Left motor	8	Control box
9	Sound generator (sound system)	10	BMS/main switch
11	Drive switch (EMERGENCY-STOP switch)		

## 2.5.8 Batteries

The RiMO SiNUS karts must be run with LiFeMnPo4 batteries.

Never use LiFeMnPo4 cells, as these produce discharge currents that are too high. The batteries are designed for a continuous load of 3.5 C<sup>1</sup> and a peak load of 10 C. At a load of 3.5 C, 95 % of the rated capacity is still available.

<sup>1</sup> In this context, C stands for what is known as the C rating. The current (in ampere) corresponds to the C rating multiplied with the capacity of the battery in ampere hours.

Example: A battery with a capacity of 4 Ah and a "load" of 3 C produces a current of 12 A. In contrast to conventional lithium ion cells, no metallic lithium is produced and no oxygen is released in the vent of overcharging. In such lithium ion batteries, there is a risk of thermal breakthrough, which, under unfavourable conditions, might even result in the explosion of the cell. This is not possible with LiFeMnPo4 batteries.

#### Battery monitoring

LiFeMnPo4 batteries are easily damaged by overcharging or exhaustive discharging. That is why such batteries must be monitored by a battery management system (BMS). The BMS controls the charging process and prevents overcharging or exhaustive discharging of the cells.



# 2.5.9 Battery management system (BMS)

This chapter describes the functions and parameters of the battery management system (BMS).

#### See also

BMS default thresholds [▶ 46]

## 2.5.9.1 Cable harness

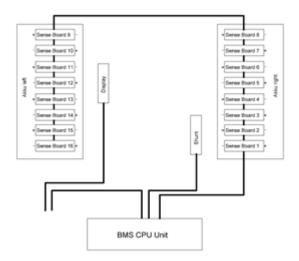


Fig. 15: Cable harness

# 2.5.9.2 Pin assignment

## Pin assignment of BMS CPU unit

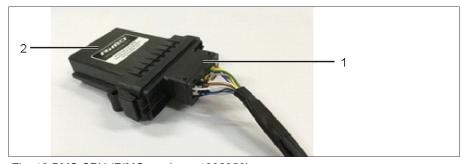


Fig. 16: BMS CPU (RiMO prod. no. 1382953)

1 BMS CPU plug	2 BMS CPU
----------------	-----------

The colours in the diagram below correspond to the actual wire colours.



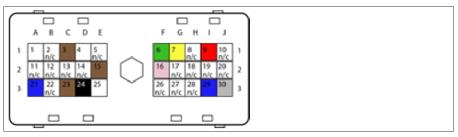


Fig. 17: Colour coding

No.	Pin	Colour code	Signal	No.	Pin	Colour code	Signal
1	1A	white	Battery +	16	2F	pink	Video
2	1B		not assigned	17	2G		not assigned
3	1C	brown	Shunt -	18	2H		not assigned
4	1D	white	Shunt +	19	21		not assigned
5	1E		not assigned	20	2J		not assigned
6	1F	green	CAN High	21	3A	blue	Sense Enable Out
7	1G	yellow	CAN Low	22	3B		not assigned
8	1H		not assigned	23	3С	brown	Sense 12 V +
9	11	red	12 V +	24	3D	black	Ground
10	1J		not assigned	25	3E	white	Sense Data -
11	2A		not assigned	26	3F		not assigned
12	2B		not assigned	27	3G		not assigned
13	2C		not assigned	28	3Н		not assigned
14	2D		not assigned	29	31	blue	Sense drive switch ON
15	2E	brown	Ground	 30	3J	grey	Motor enable ON



## Sense board pin assignment

The colours in the diagram below correspond to the actual wire colours.

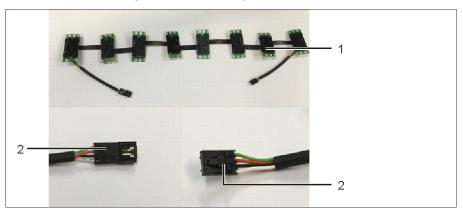


Fig. 18: Sense board pin assignment

1 Sense board	2 Sense board plug
---------------	--------------------

Colour code	Signal
white	Sense Data -
black	Ground
red	Sense 12 V +
green	Sense Enable
	Out

## Shunt plug assignment

The colours in the diagram below correspond to the actual wire colours.

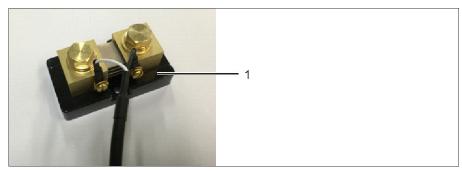


Fig. 19: Shunt plug assignment

4	Christ		
1	iShunt		
-		I	

Colour code	Signal		
white	Shunt +		
black	Shunt -		



## Display plug assignment

The colours in the diagram below correspond to the actual wire colours.



Fig. 20: Display plug assignment

1	Display plug	2	Display
	Diopiay piag	_	Diopiay

Colour code	Signal
white	+5 V
black	Ground
green	CAN High
yellow	CAN Low
brown	Pit LED
leer	Not assigned

# 2.5.9.3 Description of display unit

The BMS display is located in the left battery box. The pit LED is mounted on the steering wheel (in some models, it is within the range of vision of the driver on the front panel).



Fig. 21: Display unit

1 BMS display 2 Pit LED	
-------------------------	--



## 2.5.9.4 Warning and error signals

#### SOC indicator

The yellow LEDs on the display shows the SOC (state of charge) value. If all LEDs are lit, the kart battery is fully charged.

#### Pit LED

The pit LED on the steering wheel or on the front panel flashes when the SOC drops below 20%. In this case, the kart must be recharged without delay. If the pit LED is continuously lit, the SOC value of one or more battery cells has reached 0 or an error occurred. In this case, at least one of the red fault indicators (LEDs) on the display is also lit.

#### Fault indicators

The "Undervoltage" LED is lit, if the voltage measured at one or more cells is below 2.6 V. Possible causes:

- Cell voltage below 2.6 V (cell is discharged and must be recharged without delay)
- Cell defective (cell must not be recharged but replaced without delay)
- Sense board defective (indicated values do not correspond to actual values; replace sense boards)
- BMS CPU unit defective (replace)

The "Undertemperature" LED is lit, if the temperature measured at one or more cells is below -10 °C. Possible causes:

- Low ambient air temperature (do not drive the kart if the cell temperature is below -10 °C)
- Sense board defective (indicated values do not correspond to actual values; replace sense boards)
- BMS CPU unit defective (replace)

The "Overtemperature" LED is lit, if the temperature measured at one or more cells is above 60 °C. Possible causes:

- High ambient air temperature (do not drive the kart if the cell temperature is above 60 °C)
- Fan, fan control defective/faulty (at high temperatures, the fans are unable to cool the battery adequately)
- Cell defective (cell must not be recharged but replaced without delay)
- Sense board defective (indicated values do not correspond to actual values; replace sense boards)
- BMS CPU unit defective (replace)

The "System error" LED is lit, if a component of the BMS is defective or not correctly connected. Check the cables and crimping contacts for damage and proper connection. Replace defective components without delay. For advice, contact the manufacturer.



## 2.5.9.5 System conditions and safe operation

#### Charging

Charging is only enabled by the BMS if the following conditions are met:

- Kart is switched on (main switch set to ON)
- Drive switch is pushed in (OFF)
- No fault/error is pending (see above chapter)
- At least 1 cell has a voltage below 3.56 V.

## Driving

Driving is only enabled by the BMS if the following conditions are met:

- Kart is switched on (main switch set to ON).
- Drive switch is pulled out (ON)
- No fault/error is pending (see above chapter)
- No cell has a voltage of below 2.6 V

## **Attention**



## Damage of cells by undertemperature

If a cell is charged while its temperature is below 5 °C, it might become damaged.

Before charging the battery, ensure that the temperature of all cells is greater than  $5\,^{\circ}\text{C}$ .

## **⚠** CAUTION



## Extremely short driving time (< 40 % of guaranteed driving time)

Defective cells must never be used but replaced without delay. If the capacity of the battery and the driving time are significantly reduced, monitor the cells during charging and discharging. If there are cells that reach the battery full voltage extremely quickly and that are equally quickly discharged during driving, these cells are likely to be defective and must be replaced without delay. For advice, contact the manufacturer.







#### Overtemperature

If certain cells are extremely hot (> 20 % above average battery temperature), they are likely to be defective and must be replaced without delay. For advice, contact the manufacturer.

## **NOTICE**



#### Driving at low ambient temperature

At temperatures below 5 °C, the power performance of the cells is markedly reduced. This means that the capacity and driving time are also significantly reduced.

We recommend completing a few slow rounds on the track to heat up the cells.

## 2.5.9.6 BMS LCD display

The monitor shipped with the kart (RiMO Shop prod. no. 1389227 LCD screen RiMO SiNUS) shows the actual values for a range of parameters monitored by the BMS.

The monitor can be connected to the kart in the control box (see Electric system with battery cells [ 22]).

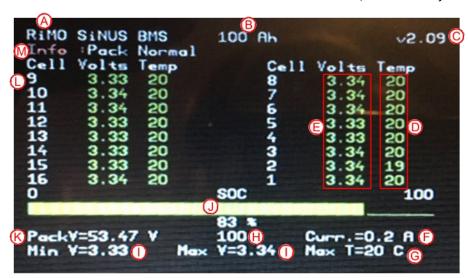


Fig. 22: BMS LCD display

Item	Description
Α	Name of BMS software
В	Rated capacity of cells
С	BMS firmware version



Item	Description
D	Current cell temperature
E	Current cell voltage
F	Measured current in ampere; negative value during charging - positive value during driving
G	Highest measured cell temperature in battery
Н	Max. permissible percentage rate for charging as determined by BMS  Example 1: The rated cell capacity is 100AH; the permissible charging rate determined by the BMS is 100  > the charger can load with 100A  Example 2: The rated cell capacity is 60AH; the permissible charging rate determined by the BMS is 100  > the charger can load with 60A  Example 3: The rated cell capacity is 60AH; the permissible charging rate determined by the BMS is 50 > the charger can load with 30 A
I	Min. max cell voltage measured in battery
J	SOC value chart; the respective percentage value is shown below the chart
K	Total battery voltage measured by BMS
L	Assigned cell numbers; The cells are numbered according to their arrangement in the kart (seen in travel direction)
М	Error/fault:
	Warn: (warning; problem does not affect drive operation)
	Alarm: (fault/error; potentially resulting in a shutdown)
	- Fault: (critical fault/error; charging and driving disabled)
	Information re. pack status:
	<ul><li>Pack normal = no fault/error signal</li></ul>
	Pack has unmanaged cells = one or more sense boards not working properly
	<ul> <li>Cell temp is too high / low = temperature problems at one or more cells, or sense board defective</li> </ul>
	Cell voltage is too high / low = voltage problem at one or more cells, or sense board defective

## See also

Warning and error signals [▶ 28]



# 2.5.10 Charger

The charger is equipped with advanced high-frequency charging technology for extra high efficiency. Its energy consumption is up to 20% lower than that of a conventional single-phase charger.

The charger is configured for operation with the RiMO BMS, ensuring fast yet careful charging without causing damage to the battery.

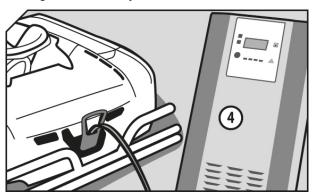


Fig. 23: Charger

4	Charger	

## 2.5.11 ACD controller

The ACD motor controller controls and monitors the motor.



Fig. 24: ACD motor controller

1 Status LED of ACD motor controller		
--------------------------------------	--	--

- The ACD motor controller has been specially devised for PMS motors.
- It is a sturdy device in a splash-proof housing and can be parameterised according to the actual requirements.
- The integrated operating hours counter can be read with the monitoring software or through the optional WFM.



#### Status LED

The status LED indicates the operating status of the ACD motor controller.

Signal	Description
LED off	Controller not in operation
LED continuously on	Controller activated and ready
Flashing slowly (1 Hz)	Warning pending
Flashing quickly (10 Hz)	Error pending; motor current interrupted

## Setup and parameterisation

The controller is configured and parameterised (power, speed) by a RiMO specialist technician in cooperation with the kart operator to optimise the motor for the actual driving track.



# **NOTICE**

#### Parameterisation with WFM

If the operator has opted for WFM, he can adjust certain parameters within a preset range.

## 2.5.12 Motor

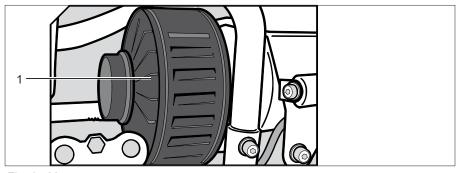


Fig. 25: Motor

1	Motor	
'	IVIOLOI	

All RiMO SiNUS kart models are driven by brushless disc motors. This type of motor is extremely durable and maintenance-free as commutation is performed electrically and not mechanically. Other advantages are its compact and flat size, low weight and excellent efficiency within a broad speed range. In addition, disc motors can be flexibly configured as regards their speed / power ranges.

Thanks to the brushless design, there are no fine dust emissions as would be the case with carbon brushes.



## 2.5.13 Transmission

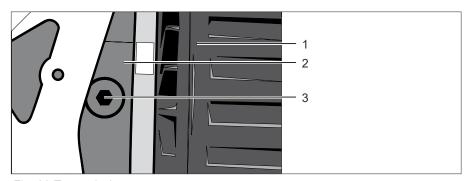


Fig. 26: Transmission

1	Motor	2	Planetary gear
3	Clamping hub		

The power from the motor is transmitted to the wheel by means of a backlash-free planetary gear with a transmission ratio of 1:7.

Other transmission ratios (e.g. 1:5) are available on request. The gear system is lubricated for life and requires no maintenance. During normal operation (gear system temperature ≤ 80 °C), there is no need to ever change the oil.

## 2.5.14 Gas sensor

The gas sensor converts the mechanical movement of the gas pedal into an electrical signal. This signal (0-5 VDC) is used by the motor controller to accelerate the kart.

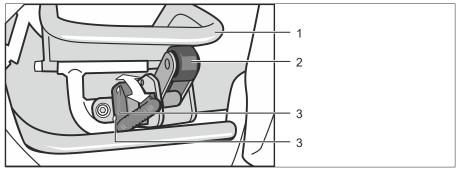


Fig. 27: Drive transducer

1	Gas pedal	2	Gas sensor with contact roller
3	Securing screws		



## 2.5.15 Control box

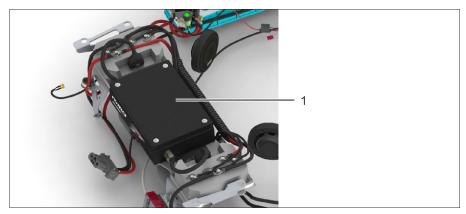


Fig. 28: Control box

1	Control box	

The control box contains the main cables for electrical components and provides mechanics with a wellorganised board for fault location and measurements. The control box also contains the main fuses.

The terminals in the control box are numbered, and the individual cables are equally identified with numbers or colour-coded. Based on the wiring and connection diagrams, the connections to the various components can be easily identified.

In vehicles with an optional sound system, this system is also installed in the control box.

# 2.5.16 Bodywork

The bodywork protects the main kart components. It dampens impacts from all directions and thus provides some protection to the driver.

The side boxes can be used to add extra weights for weight compensation with regard to the body weight of the driver.

One section of the axle cover can be removed by pulling it from the four squeeze fasteners.

The front spoiler can be equipped with an optional headlamp.



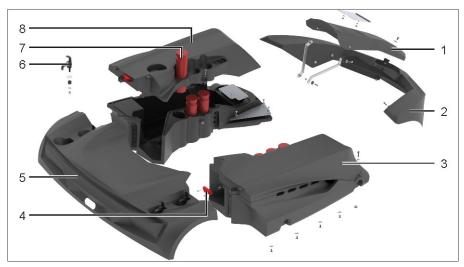


Fig. 29: Bodywork

1	Front panel	2	Front spoiler
3	Right side box (top and bottom part)	4	Brake light
5	Axle cover	6	Bodywork squeeze fastener
7	Extra weight (5 kg per unit)	8	Left side box

## 2.5.17 Side box

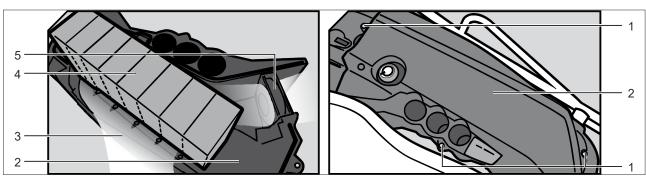


Fig. 30: Side box

1	Screw fittings	2	Side box
3	Cooling air flow channel	4	Cells
5	Fan		

The side box is made from HDPE. Thanks to its sturdy design, it provides excellent protection for the battery cells and the electrical components. The side box is customised to fit the kart and the LiFeMnPo4 cells. Each side box provides space for up to eight 100 Ah cells. The side box also houses the BMS and the cables, and provides space for the extra weights (max. 15 kg per side).



Each side box is equipped with a fan that cools the battery cells, should this be necessary. Cool air is taken in at the outside of the cells and flows through channels between the cells. Heat dissipates from the cells to the air, which is then extracted by the fan and released at the rear of the side box. The exhaust air thereby flows along the drive unit, cooling the drive components.

## 2.5.18 Surround protection

The surround protection protects all assemblies of the kart and the driver against damage from impact. The surround protection also prevents the kart from "diving" into the track barriers.

The surround protection is float mounted with silent blocks to the vehicle frame. The *surround protection front mount* absorbs the energy in the event of a collision and is therefore equipped with predetermined break points to protect the vehicle frame against damage.

The optional plastic pads further reduce the risk of damage to the surround protection and the track side barriers. They are shaped to fit the surround protection, thus reducing the risk that, in the event of a collision, a kart is pushed onto another kart of the same model.



Fig. 31: Surround protection

1	Surround protection	2	Surround protection pad
3	Silent block	4	Surround protection, plastic
5	Impact protection bracket	6	Surround protection front mount



## 2.5.19 Rollbar

The rollbar protects the driver in the event of a collision or when the kart rolls over. Various types of safety belts can be attached to the rollbar.

The head pad protects the driver from hitting his/her head on the rollbar tube.

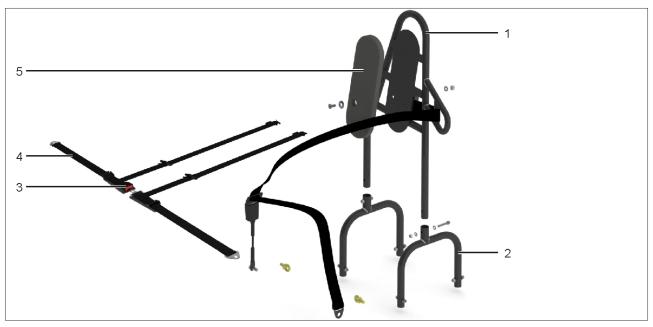


Fig. 32: Rollbar

1	Rollbar	2	Bottom part of rollbar
3	Safety belt buckle	4	Safety belt
5	Head pad		

# 2.6 Safety devices

## 2.6.1 Overview

The kart is equipped with safety devices at all relevant danger points.

If these safety devices are not correctly installed and adjusted, there is a risk of serious or even fatal injury to persons driving, or working with or on the kart. The safety devices must not be modified, dismantled or disabled in any way. All safety devices must be freely accessible at all times.

Familiarise yourself with all safety devices so that you are in a position to prevent or minimise the risk of injury to persons and damage to property.



## 2.6.2 Safety devices

The safety devices protect the danger areas of the kart. They do not affect the movement of the vehicle.

#### Guards

Guards include:

- Protective covers
- Safety panelling

Guards protect prevent or obstruct direct access to rotating/moving kart parts. They must only be removed, if this is required for maintenance or repair and must be re-mounted before the kart is restarted.

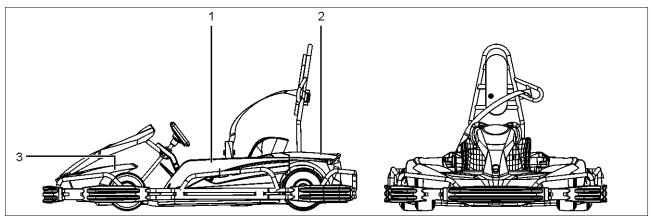


Fig. 33: Guards

1	Safety panelling of side box	2	Rear safety panelling
3	Front safety panelling		

#### Other safety devices

Other safety devices include:

- Seat
- Safety belt
- Rollbar
- Surround protection
- Brake light switch

These safety devices protect the driver in the event of a collision. They must only be removed, if this is required for maintenance or repair and must be re-mounted before the kart is restarted.

The signal of the gas pedal is fed through the brake light switch. When the brake is actuated, the accelerator signal is interrupted, so that the drive is shut down.



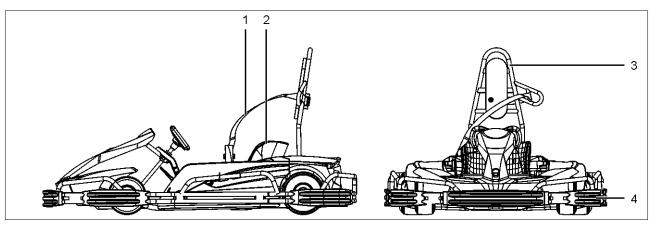


Fig. 34: Other safety devices

1	Safety belt (optional)	2	Seat
3	Rollbar	4	Surround protection

# 2.6.3 Signalling devices

## Indicators of switches

Both the drive switch and the main switch are equipped with an indicator.

If the green indicator is lit continuously, the respective switch is on. If the indicator is off, the switch is off.

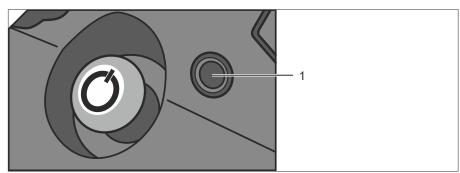


Fig. 35: Indicators

1	Main switch indicator	
<u>'</u>	Iviairi Switch indicator	



#### Indicators on steering wheel

Depending on the model, the steering wheel might be equipped with various indicators and control buttons.

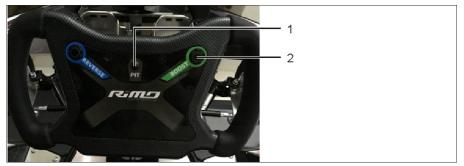


Fig. 36: Indicators on steering wheel

## 2.6.4 EMERGENCY-STOP devices

The drive switch acts as an EMERGENCY-STOP switch. When the drive switch is off, the kart is safety switched off.

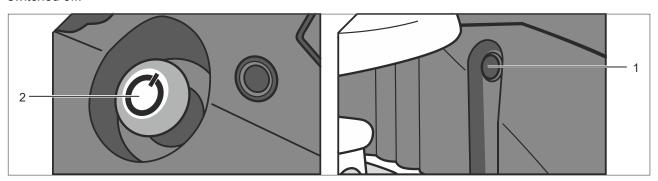


Fig. 37: Drive switch and main switch

1 Main switch	2 Drive switch
---------------	----------------

The kart is equipped with the following EMERGENCY-STOP devices:

- Drive switch, located on top of the left side box, beside the driver seat.
- Main switch, located between the left side box and the driver seat.

## 2.6.5 Warning signs

#### Warning signs

Hazard zones on the kart are identified with warning signs.

Warning and other signs on the kart must be kept in good repair so that they are at all times visible and legible. Illegible safety signs must be replaced without delay.



Symbol	Description
	Warning: Dangerous electric voltage

Tab. 6: Warning signs

## Prohibition signs

Symbol	Description
	Do not drive kart without safety helmet.
	Do not drive kart with long open hair.
	Do not wear scarf or headscarf. Wear tight-fitting clothes.
	Do not clean the car with a high-pressure jet.
	Do not drive kart under the influence of alcohol (0 alcohol limit).

Tab. 7: Prohibition signs

# 2.7 Kart operation

The kart is operated and controlled by the driver sitting on the driver seat.

The control elements of the kart (steering wheel, pedals, drive switch) are located in front and to the left of the seated driver. The kart is controlled manually.



# 2.8 Scope of delivery

The scope of delivery consists of:

- Kart, including chosen extras and accessories (see purchase contract)
- Operating manual

The scope of delivery also includes the optional add-on services chosen by the customer

- Safety belt (3-point or 4-point)
- Rollbar
- Charging station
- OEM kit (tools)

Not include in the scope of delivery are:

- Assembly paste for wheels
- DOT 5 silicone brake fluid
- Brake bleeder kit
- Wheel alignment device
- Tools, lubricants, cleaners and other chemicals required for maintenance and repair work

#### Please note:

- The kart is delivered as a fully assembled vehicle as specified in the purchase contract.
- For the scope of the delivery, see the delivery docket.
- Check the delivery upon receipt of the kart.
- Any detected transport damage and/or missing parts must be reported immediately in writing.

## 2.9 Technical data

#### General information

Designation	Electric kart of the SiNUS series, model iON, MiNi or TWiN
Year of manufacture	from 2016

Tab. 8: Kart



## Mechanical equipment

#### **Dimensions**

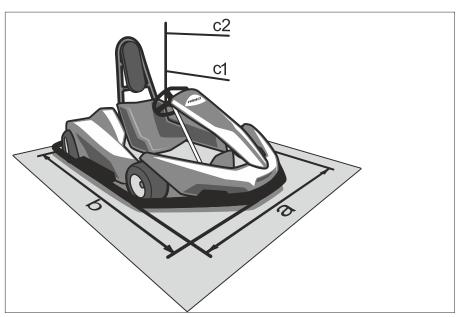


Fig. 38: Dimensions

Kart model	Length b [mm]	Width a [mm]	Height c1 [mm]	Height c2 [mm]
Sinus iON	2035	1455	600	1100
Sinus Mini	1760	1280	-	860
Sinus Twin	1900	1530	600	1100

Tab. 9: Kart dimensions

210 x 6 mm brake disc (prod. no. 1383067) [mm]	4
210 x 8 mm brake disc (prod. no. 1383015) [mm]	5
RiMO 160 x 4 mm brake disc (prod. no. 1383424) [mm]	3

Tab. 10: Brake disc wear limit

SiNUS iON [kg]	186
SiNUS MiNi [kg]	170
SiNUS TWiN [kg]	210

Tab. 11: Weight of standard model, without optional extras



Transmission ratio	1:7
Oil filling	For-life grease lubrication

Tab. 12: Transmission

## Electric charger

Supply power	400 VAC ± 10 % 50 Hz, 3-phase, N + PE
Fuse [A]	16 A per phase
Max. power consumption [kVA]	7.5

Tab. 13: Large charger, 100 A

Supply power	230 VAC ± 10 % 50 Hz, 1-phase	
Fuse [A]	16 A	
Max. power consumption [kVA]	3.7	

Tab. 14: Small charger, 50 A

## **Ambient conditions**

Operating temperature [°C]	+5 to +45
Storage temperature [°C]	+0 to +50
Rel. humidity, operation [%]	30 % to 75 %, non-condensing
Rel. humidity, storage [%]	10 % to 90 %, non-condensing
Atmospheric pressure [hPa]	700 to 1060

Tab. 15: Ambient conditions

## Noise emission

Continuous sound pressure level [dB(A)]	max. 70
---	---------

Tab. 16: Noise emission



# 2.9.1 BMS default thresholds

Designation	Value	Description
Final charging voltage	3.65 V	The moment the first cell reaches this voltage, charging is temporarily suspended.
Final discharge voltage	2.60 V	The moment the first cell reaches this voltage, SOC is set to zero; the vehicle stops.
Final battery charge	3.56 V	As soon as all cells reach this voltage, charging is terminated.
Balanced start voltage	3.54 V	As soon as one cell exceeds this limit, the electrical energy fed to that cell during charging is converted into heat.
Minimum temperature	-10 °C	As soon as the temperature at one temperature sensor reaches this limit, error "Undertemperature" is triggered. Driving and charging is no longer permitted.
Minimum temperature for charging	0°C	As soon as the temperature at one temperature sensor reaches this limit, charging is no longer permitted.
Maximum temperature	60 °C	As soon as the temperature at one temperature sensor reaches this limit, error "Overtemperature" is triggered. Driving and charging is no longer permitted.



# 3 Safety

The kart has been designed according to the latest state of technology and in compliance with the relevant safety regulations and rules. Improper use of the kart can however cause serious or even fatal injury to the driver or other persons, or serious damage to the kart or other equipment.

The kart must only be used:

- for the intended purpose
- when in proper working condition

After a fault or error that might compromise the safety of the kart, do not restart the vehicle until the cause of the problem has been eliminated.

## 3.1 General safety instructions

## 3.1.1 Avoiding dangerous situations

Dangerous situations during kart operation can normally be prevented, if the driver, operator's personnel and persons in charge of the track work with safety in mind.

The following instructions apply to all persons involved in work with or on the kart (operator's personnel):

- Keep a complete copy of this manual near the kart track where it is at all times accessible to personnel.
- Only use the kart for its intended use.
- Before starting the kart, ensure that it is in proper working order. Carefully inspect the kart at regular intervals and before starting it.
- When working on or with the kart, wear tight-fitting clothes.
- Ensure that kart parts cannot cause injury to persons.
- If you detect any defects, malfunctions or unusual operating behaviour, notify your supervisor without delay.
- Always adhere to the statutory and internal accident prevention regulations.

## 3.1.2 Operating instructions

The following general rules apply to the kart operation:

- The kart must be operated by one person only.
- While the kart is in operation, it must be constantly monitored by a member of the operator's personnel
- The safety devices of the kart must not be modified, dismantled or disabled in any way. Regularly check and test the safety devices of the kart.
- Ensure that all guards, panels, covers and hoods are properly mounted and secured.



- It is forbidden to make any modifications to the kart. If you detect any modifications, immediately notify your supervisor.
- All danger areas must be kept clear. Do not place any objects in the danger area of the kart. Before allowing any person to enter the danger area, switch off the kart and disable it.

## 3.1.3 Troubleshooting instructions

The following general rules apply to all fault location and troubleshooting work:

- All maintenance and repair work must be performed by suitably qualified personnel.
- Switch off the kart.
- Attach a warning sign to the kart to prevent inadvertent starting.
- If the kart must be run for fault location or troubleshooting, have a second person stand by to switch of the kart in an emergency.
- Ensure that the kart is safely propped up and that its wheels can turn freely.
- Wait until all components have cooled down.

Proceed with identifying the cause of the problem and eliminating it.

## 3.1.4 Maintenance and repair instructions

The following general rules apply to all maintenance and repair work:

- All maintenance and repair work must be performed by suitably qualified personnel.
- Switch off the kart.
- Attach a warning sign to the kart to prevent inadvertent starting.
- Ensure that the kart is safely propped up and that its wheels can turn freely.
- Wait until all components have cooled down.

## 3.1.5 General notes and instructions re. electrical equipment

The following general rules apply to all work on the electrical equipment of the kart:

- The kart is powered electrically. If the electrical equipment is incorrectly installed or if its insulation fails,
   there is a risk of fatal injury.
- The electrical equipment of the kart must only be accessed by electricians or personnel trained by RiMO.
   Keep all control cabinets locked at all times.
- Changes to the control system of the kart might impair its safety. All planned modifications must be approved in writing by the manufacturer of the kart.
- After completion of the work, test the safety devices to ensure that they work properly.



 Unauthorised modifications to the kart are prohibited. All planned modifications must be approved in writing by the manufacturer of the kart.

## 3.1.6 Electromagnetic compatibility (EMC)

If operated correctly and for the intended purpose, the electrical equipment of the kart conforms to the statutory regulations regarding electromagnetic compatibility. These regulations define the permissible electromagnetic interference and immunity limits for electronic equipment.

Radio signals from high-frequency transmitters, such as mobile phones or similar mobile transmission equipment might interfere with the kart electronics, if they are operated near the kart and with relatively high transmission power. Such interference might even occur with devices that conform to the relevant EMC standards. We therefore strongly recommend not operate such devices near the electronic equipment of the kart.



#### **NOTICE**

Ensure that there are no electromagnetic fields near the kart.

## 3.1.7 Environmental protection

Personnel must keep the environment in mind when working with or on with the kart, to prevent any negative impact.

This can be achieved by adhering to the following general rules:

- Never dispose of hazardous substances through the sewerage system or directly into the ground.
- Strictly adhere to all regulations regarding the prevention, disposal and recycling of waste material.
- Store hazardous substances in suitable containers.
- Mark containers containing hazardous substances as such.

# 3.2 Inadmissible operating conditions

Under certain operating conditions, it might not be safe to operate the kart. Such operating conditions must therefore be avoided under any circumstances.

The kart must under no circumstance be operated if any of the following apply:

- The kart is used for a purpose other than the intended.
- The kart or any of any of its parts are damaged, the insulation is defective, or the electrical system is incorrectly installed.
- Safety devices are missing, defective, incorrectly installed or not working properly.
- The kart is not working properly.



- A foreign object or a person is inside the kart's danger zone.
- The kart has been modified without prior authorisation by the manufacturer.
- The control system has been modified without authorisation.
- Operating parameters have been changed without prior authorisation by the manufacturer.
- Tools that have not been approved are being used.
- The prescribed maintenance intervals have not been adhered to.

It is strictly forbidden to disable, bypass or override limit switches or other control components, and in particular safety-relevant components!

The kart must not be operated or services by persons who are physically not able to do so, or who are under the influence of alcohol, illegal or legal drugs.

Only persons who are in good physical health are permitted to drive the kart or to carry out any work on it.

# 3.3 Duties of the kart operator

It is the responsibility of the operator of the kart to plan, implement and enforce safety measures and other preventive actions.

All persons involved in work with or on the kart must be specially trained by the kart operator. They must have read and fully understood the operating manual. This must be confirmed in writing with signature.

These signatures must be collected in a list by the kart operator. This list thus serves as a list of authorised kart operators and maintenance staff.

## 3.3.1 Minimising risk of injury

To minimise the risk of injury, adhere to the following general rules:

- All work with and on the kart must be carried out by qualified personnel.
- Persons working with or on the kart must be specifically authorised by the kart operator for the respective task(s).
- Before starting work with or on the kart, the respective staff member must familiarise himself/herself with all safety devices.
- The kart operator must ensure that safety devices are not overridden or disabled. The kart operator must enforce the above rules through regular checks!
- If a safety device has failed or is defective, immediately notify your supervisor who will decide on what to do next.
- Before starting work with or on the kart, familiarise yourself with its control elements.
- The kart, the adjacent area and the servicing and repair workplaces must be kept uncluttered, clean and tidy.
- The driver and operator's personnel must wear the prescribed personal protective equipment. For details
  regarding the prescribed personal protective equipment, see work instruction. Supervisors must ensure that
  staff wear the prescribed personal protective equipment.



- During kart operation, qualified first aiders must be present on site so that first aid can be provided, if necessary.
- There must be clarity as regards the procedures, processes and responsibilities regarding the kart and its operation. All staff members must know what to do in the event of a malfunction, failure or emergency. Personnel must be regularly instructed in the handling of malfunctions, failures or emergencies.
- Warning and other signs on the kart must be kept in good repair so that they are at all times visible and legible. Warning and other signs must be regularly cleaned. Missing signs must be replaced without delay.

## 3.3.2 Assigning tasks to personnel

It is the responsibility of the kart operator to clearly define the duties of each staff member with regard to any work on the kart. The kart operator must make sure that these persons are suitably qualified to perform the assigned tasks.

#### See also

## 3.3.3 Personnel training

Knowledge of the relevant general statutory health and safety regulations and best practice are an important requisite for the safe driving, operation and maintenance of the kart. Best practice includes the wearing and use of personal protective equipment.

The kart must only be operated by persons who are familiar with the general safety rules and other instructions in this manual and strictly adhere to them. It is the responsibility of the kart operator to ensure that all authorised personnel undergoes regular refresher training in the safe operation and servicing of the kart. This training must cover the general handling and operation of the kart, work on its electrical equipment and all work in connection with installation, configuration and maintenance.

#### **NOTICE**



## Regular training of operator's personnel

The operator of the kart is obliged to ensure that all personnel carrying out work with and on the kart undergoes regular safety training, covering general work practices, specific hazards and safety measures. This ensures that all authorised personnel have the necessary knowledge to prevent incidents and to ensure the safe operation of the kart.



## 3.3.4 Driver instruction

Knowledge of the relevant general statutory health and safety regulations are an important requisite for the safe driving and operation of the kart. Best practice includes the wearing and use of personal protective equipment by all drivers.

The kart must only be operated by persons who are familiar with the general safety rules and other instructions in this manual and strictly adhere to them. It is the responsibility of the kart operator to assess whether a person is fit to drive the kart, taking into account the age, height and weight of the person as well any medical concerns (see Requirements to be met by drivers [> 56]). Before driving the kart, the driver must be instructed in its safe handling and operation.

## **NOTICE**



#### **Driver instruction**

The kart operator must instruct the drivers in the safe handling of the vehicle, proper operating procedures, potential hazards and safety measures. This ensures that all authorised drivers have the necessary knowledge to prevent incidents and to ensure the safe operation of the kart.

## 3.3.5 Personal protective equipment

The kart operator must ensure that all drivers and authorised personnel are given the prescribed personal protective equipment (integral helmet, tight-fitting clothes, closed footwear, etc.) and wear it while driving the kart or carrying out work on it.

# 3.4 Requirements for operator's personnel

This chapter describes the skills and knowledge that operating and maintenance personnel must have to perform their tasks safely and properly.

#### 3.4.1 Qualification

All work with and on the kart requires special technical skills and knowledge.

All persons working on or with the kart must fulfil the following requirements:

- They must be suitable for respective task(s).
- They must be qualified to perform the assigned task(s).
- They must have been instructed in the operation and handling of the kart.
- They must be familiar with the safety devices and their functions.



- They must have read and fully understood this operating manual, in particular the safety instructions and the chapters that are relevant for their work.
- They must be familiar with the relevant occupational and accident prevention regulations.

As a rule, all personnel working on or with the kart must have the following minimum qualifications:

- Skilled worker, able to carry out work on the kart without supervision.

Kart life phase	Examples of tasks	Qualification criteria for operator's personnel <sup>1</sup>		
		Lay- person	Trained/instructed person <sup>2</sup>	Skilled worker <sup>3</sup>
Transport	<ul><li>Lifting</li><li>Loading</li><li>Unloading</li></ul>			Х
Assembly and installation Commissioning	<ul> <li>Assembly of kart - skilled worker</li> <li>Connection to power supply (electric power)-skilled worker</li> <li>Filling gear motor with lubricant - trained/instructed person</li> </ul>		X	X
Setup teach- in/programming and/or retool- ing/reconfiguration	<ul> <li>Setup/retooling for other workpieces/test pieces</li> <li>Data input/change</li> <li>Testing of programs</li> </ul>		X	
Operation	<ul><li>Switching on</li><li>Control</li><li>Monitor</li><li>Switching off</li></ul>		х	



Kart life phase	Examples of tasks	Qualification criteria for operator's personnel <sup>1</sup>		
		Lay- person	Trained/instructed person <sup>2</sup>	Skilled worker <sup>3</sup>
Cleaning Maintenance	<ul> <li>Cleaning - trained/instructed person</li> <li>Topping up transmission oil - trained/instructed person</li> <li>Disconnection from power supply - skilled worker</li> <li>Dismantling/removal of components - skilled worker</li> </ul>		X	X
Fault location and troubleshooting	<ul> <li>Disconnection from power supply</li> <li>Troubleshooting</li> <li>Dismantling/removal of components</li> <li>Repair</li> </ul>			X
Dismantling Decommissioning	<ul> <li>Permanent disconnection from power supply</li> <li>Dismantling</li> <li>Lifting</li> <li>Loading</li> <li>Unloading</li> </ul>			Х

Tab. 17: Qualification of operator's personnel

<sup>&</sup>lt;sup>1</sup> **Operator's personnel** refers to persons responsible for the installation, setup, operation, maintenance, cleaning, repair and transport of machines.

<sup>&</sup>lt;sup>2</sup> **Trained or instructed personnel** refers to persons who have been instructed in the proper and safe completion of the tasks assigned to them and have been informed about potential dangers arising improper operation. They have also been instructed on the purpose and use of safety devices and other safety measures. Trainees and other persons who have not yet been fully instructed in the operation of the machine must be supervised at all times when working with or on machines.

<sup>&</sup>lt;sup>3</sup> **Skilled workers** refers to persons who, due to their training, knowledge and experience, are able to perform the work assigned to them and are also able to identify any potential dangers arising in connection with the machine. Skilled workers are also familiar with all relevant regulations, rules and standards.



## 3.4.2 Skills and knowledge for drive operation

Operator's personnel on the race track should have the following skills and knowledge:

- Personal safety
- Driver instruction, covering all relevant topics
- Safety inspection of kart
- Special safety precaution for children
- Driver safety/seat position
- Safety zones along race track
- Fire safety measures and fire-fighting equipment
- First aid and accident reporting procedures
- Handling of serious incidents
- Contents of operating manual

## 3.4.3 Operator's personnel groups

In this manual, a clear distinction is made between two groups of persons working on the kart, namely operator's personnel and maintenance personnel:

Personnel	Qualification
Operator's personnel	Suitable training and instruction in:
	- Kart functions
	Operating steps and procedures
	Knowledge of:
	Authorisations and responsibilities
	- Emergency procedures
Maintenance personnel	In-depth knowledge in the fields of:
	- Machine engineering
	Electrical engineering
	Authorisation for tasks (in accordance with technical safety standards):
	- Commissioning of devices
	- Earthing of devices
	- Labelling of devices
	In-depth knowledge of kart design and functions

Tab. 18: Operator's personnel groups



## 3.4.4 Specific skills and knowledge

The following tasks must only be performed by personnel who have specialist skills and knowledge:

Task	Qualification
Work on electrical equipment	Electrician
Work on mechanical equipment	Industrial mechanic
	or
	other technician under the supervision of an industrial mechanic;
	all work must be performed according to best practice.

Tab. 19: Tasks and skills/knowledge

# 3.5 Requirements to be met by drivers

The operator must assess whether a person is fit to drive the kart, taking into account the age, height and weight of the person as well any medical concerns. The operator must instruct the driver in the safe operation of the kart.

## 3.5.1 Clothing and physical fitness

Operator's personnel must ensure that a driver is physically fit to drive the vehicle and wears appropriate clothing.

#### Clothing

Kart drivers must never wear any of the following clothing:

- Scarf of headscarf risk of entanglement at rotating kart parts
- Long open hair protruding from the helmet risk of entanglement at rotating kart parts
- Loose or long clothing (e.g. dress, skirt, trousers, hood, jacket, coat, etc.)
- Open footwear (sandals, flip-flops, etc.), shoes with high heels, or shoes with long laces

#### Physical fitness

The physical fitness of the kart driver must not be impaired by:

- Illness of disability (e.g. cardio-vascular conditions, nerve disorders, pregnancy, etc.)
- Consumption of alcohol or illegal drugs; effect of prescription drugs or challenging behaviour



# 3.6 Personal protective equipment

Personal protective equipment is designed to protect drivers and operator's personnel against hazards that might impair their safety or health when working on or driving the kart.

When driving or carrying out work on the kart, the driver and the operator's personnel must wear personal protective equipment. The relevant requirements are highlighted in the individual chapters of this manual. Personal protective equipment includes:

- The personal protective equipment specified in the various chapters of this manual must be worn at all times when driving the kart and for carrying out work on the kart.
- All signs and instructions in the operating area or working area of the kart relating to personal protective equipment must be adhered to.

#### Personal protective equipment for drivers

Integral helmet	CE-approved, of suitable size, with chin strap and closed visor
clothes	The clothing must be suitable to protect the driver against propelled vehicle parts and other objects and is a prerequisite for the safe operation of the gas and brake pedals.
Closed footwear	The closed footwear must be suitable to protect the driver against propelled parts and other objects and is a prerequisite for the safe operation of the gas and brake pedals.

Tab. 20: Personal protective equipment Driver

Balaclava	Worn under the integral helmet. Recommended for reasons of hygiene.
Racing suit	With tight-fitting wrist and ankle straps
Kart racing gloves	Optimum protection for hands.
Neck brace	Should be worn depending on driver seat design.
Rib protection vest	Optimum protection against side impact.
Waterproof clothing	With waterproof closure to protect against rain/water on kart track.

Tab. 21: Recommend personal protective equipment Driver



#### Personal protective equipment for operator's personnel

Symbol	Description
	Safety goggles  Eye protection against propelled vehicle parts and other objects.
	Hearing protection  To protect the hearing against excessive noise.
E	Protective gloves  To protect the hands against grazing, abrasion, punctures, cuts, etc. and against burns from hot surfaces.
	Safety footwear  Safety footwear protects the feet against dropping vehicle parts and tools, and pointed objects on the ground.

Tab. 22: Personal protective equipment Operator's personnel

## 3.7 Residual risks

The following residual risks cannot be eliminated by design measures:

- Risk of feet being lifted from the pedals while driving and coming into contact with the front wheels.
- Risk of person unfit to control the kart driving the vehicle.
- Risk of unauthorised or unqualified person carrying out maintenance or repair work on the kart.
- Risk of vehicle rolling over.
- Risk of collision with other karts or track barriers.

The kart operator must ensure that only authorised and qualified personnel have access to the kart and its control elements.



## 3.8 Action in the event of an accident



## **NOTICE**

## General rules regarding accidents

Remove casualties from danger area!

Provide first aid and alert the

emergency services by telephone! Notify supervisor!

When calling the emergency services relay the following information:

- What happened?
- Where did it happen?
- Who is making the emergency call?
- Number of casualties?
- Listen to questions asked by emergency services and answer them.



## **NOTICE**

#### Provide first aid

Complete a first aid training course so that you are in a position to provide first aid in the event of an accident.



# 4 Transport and installation

Prior to delivery, the kart has been assembled, configured and tested at the factory. For transport, the kart might have been disassembled.

In order to prevent serious or even fatal injury or damage to property during transport and installation, adhere to the following instructions:

- All work in connection with the transport of the kart must be performed by qualified and authorised personnel.
- All lifting gear and lashing devices must conform to the applicable accident prevention regulations.
- The lifting gear and lashing devices must be suitable for the weight of the kart (see Technical data [▶ 43]).
- Ensure that the transport paths are sufficiently large for safe manoeuvring. Door and gate openings must be at least 5 cm wider and higher than the transport unit including the transport vehicle.
- Have the transport path secured by a third person.

For safest and fastest installation, following the installation procedure described in this manual.

The chapters below describe the steps to be completed for the safe and proper transport and installation of the kart.

#### Safety instructions for transport and installation

- All work on the electrical system must be carried out by qualified electricians.
- Reading this manual is no substitute for proper training!

## 4.1 Required tools

The following tools are required for the installation of the kart:

- Spanners (of various sizes)
- Screwdrivers (of various sizes)

If special tools are required, these are specified in the relevant section of this manual.

# 4.2 Lashing points

The kart is shipped on a special transport pallet. The lashing points are clearly labelled.



# 4.3 Transport by forklift truck

## **⚠ WARNING**



#### Risk of injury from lifted loads

Lifted loads might suddenly drop or topple over, posing a risk to life and limb.

- a) Never stand under suspended loads!
- b) Ensure that, during transport, the kart is always fully placed on the fork arms of the forklift truck.
- c) Observe the centre of gravity of the load!

When transporting the kart with a forklift truck, observe the following instructions:

- a) Use a forklift truck with suitably long forks.
- b) Pick up the transport pallet at the side marked for this purpose.
- c) If required, place timber beams under the transport pallet.
- d) Transport the pallet with the fork arms aligned horizontally.

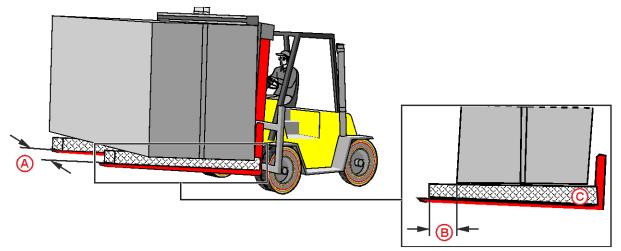


Fig. 39: Transport by forklift truck

А	Distance between fork arms	W	Fork arms longer than load
С	Place timber beams under transport pallet		

# 4.4 Removing and disposing of packaging

- a) Remove the transport packaging from the side marked with OPEN HERE.
- b) Dispose of the packaging according to the applicable statutory waste disposal regulations.



## 4.5 Installation

This chapter describes the conditions and procedures for proper installation of the kart.

## 4.5.1 Location of operation and local infrastructure

The location of operation of the kart must meet the following conditions:

- The surface on which the kart is to be placed must be level and strong enough to carry the weight of the kart.
- The minimum load-bearing capacity of the floor must be 1.5 times of the total kart weight.
- The kart is not approved for operation in potentially explosive atmospheres.

Before installing the kart, observe any additional conditions regarding the location of operation and the infrastructure contained in the technical data.

#### See also

Technical data [▶ 43]

## 4.5.2 Installation and connection

## **⚠ CAUTION**



#### Tripping hazard

Risk of injury from tripping hazards.

- a) Pay attention to tripping hazards on the ground.
- b) When installing cables and hoses, prevent tripping hazards.
- c) Use cable ducts, bridges, etc.
- a) Using suitable transport gear, move the kart to the location of installation.
- b) Lift the kart from the transport pallet and place it on the ground.

#### See also

Transport by forklift truck [▶ 61]



## 4.5.3 Installing mechanical components

Place the kart at the location of operation, taking into account the following:

- √ The location must conform to all statutory requirement that might apply.
- √ The kart track must conform to all statutory ground, space and safety requirements.
- ✓ The kart must be assembled, commissioned and/or put into storage by specially trained technicians.
- a) There must be sufficient space around the kart for maintenance and repair access.

#### Mounting wheels

Depending on the transport requirements, the wheels might have been removed from the kart prior to shipping. After unloading the kart, mount the wheels.

## **MARNING**



#### Risk of accident from non-approved wheel rims or tyres

Non-approved wheel rims and tyres can cause damage to the bodywork of the kart. The road adhesion of the tyres might not be suitable for the kart. This can result in serious injury.

a) Use only wheel rims and tyres that have been approved by RiMO.

## **NOTICE**



## Mounting wheels on front and rear axle

The front wheels are secure with one hexagon nut each. The rear wheels are secured with three hexagon nuts each.

When mounting the wheel, adjust the bearing play of the front axle wheel bearing.

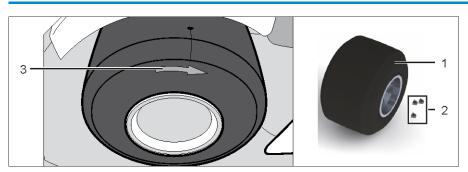


Fig. 40: Mounting wheel

1	Wheel	2	Hexagon nuts
3	Arrow: direction of rotation of wheel		



- a) Position the kart safely at an ergonomically suitable height (e.g. with KHB 250 lifting platform).
- b) Apply assembly paste to the front axle steering knuckles.
  - NOTICE! The assembly paste is not included in the scope of delivery and can be purchased separately from RiMO. Contact RiMO service department for advice. Product no.: 1892036 HSP 1400 lubrication, disassembly and corrosion protection paste
- c) Slide the rear wheels onto the wheel centre. Slide the front wheels onto the steering knuckles. Ensure that the wheels do not become jammed or misaligned and prevent damage to the threads.
  - NOTICE! The narrow wheels are the front wheels. The wide wheels are the rear wheels. If the wheels feature a direction mark arrow, observe it.
- d) Rear axle: Mount the three hexagon nuts and tighten them with the prescribed torque (see Tightening torques [\* 129]).
- e) Front axle: Mount the hexagon nut and tighten it a little. Turn the wheel to check whether it rotates freely. If the wheel rotates freely, tighten the hexagon nuts further and check again for free rotation. If the wheel does not rotate freely, the hexagon nut has been tighten too far. In this case, increase the axial bearing play (max. permissible axial bearing play: 0.5 mm). Loosen the hexagon nut and check against for free rotation.
- f) Adjust the hexagon nut so that the wheel rotates freely.
- ⇒ Proceed accordingly to mount the second wheel.

#### Mounting steering wheel

Depending on the transport requirements, the steering wheel might have been removed from the kart prior to shipping. After unloading the kart, mount the steering wheel.



Fig. 41: Steering wheel installation

1	Screws of steering wheel cover	2	Steering wheel
3	Steering wheel cover	4	Steering wheel mount
5	Securing screws of steering wheel		

- ✓ The kart is placed the ground.
- ✓ Depending on the steering wheel model, a signal cable might need to be fed through the steering column to the steering wheel. The plug of the steering cable must protrude from the steering column prior to mounting the steering wheel.



- a) Position the kart safely at an ergonomically suitable height (e.g. with KHB 250 lifting platform).
- b) Remove the steering wheel cover from the steering wheel.
- c) Thread the signal cable through the hub of the steering wheel and place the steering wheel on the steering wheel mount.
- d) Connect the signal cable to the steering wheel.
- e) Insert the steering wheel screws and tighten them with the prescribed torque to secure the steering wheel to the steering wheel mount (see Tightening torques [> 129]).
  - ⇒ The steering wheel is now properly secured to the steering column.
- f) Secure the steering wheel cover with the screws to the steering wheel.
- ⇒ The steering wheel is now properly installed.

## 4.5.3.1 Mounting rollbar

The rollbar protects the driver in the event of a collision or when the kart rolls over. Various types of safety belts can be attached to the rollbar.

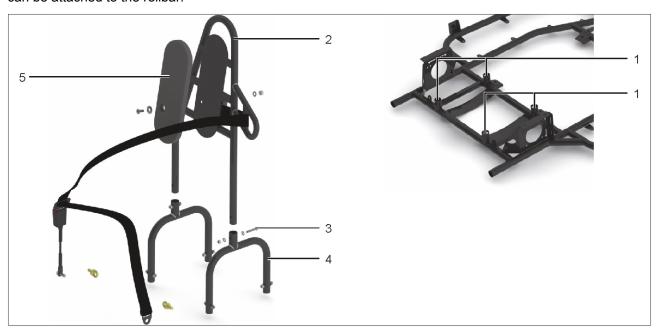


Fig. 42: Mounting rollbar

1	Rollbar mounts	2	Top part of rollbar
3	Allen head screw	4	Bottom part of rollbar
5	Head pad		

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height (e.g. by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).



- b) Remove the cover on the rear bodywork (axle cover).
  - ⇒ The bottom parts of the rollbar are now freely accessible.
- c) Insert the *top part of the rollbar* into the *bottom part of the rollbar* and secure it with the *Allen head screws* (see Tightening torques [> 129]).
- d) Replace the bodywork cover.
- ⇒ The rollbar is now properly installed.

#### 4.5.3.2 Mounting plastic pads

The optional plastic pads protect the surround protection as well as the track barriers in the event of a collision.

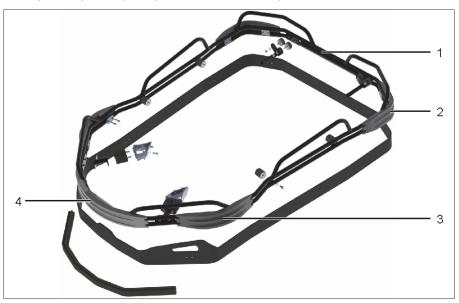


Fig. 43: Mounting plastic pads

1	Surround protection	2	Rear plastic pad
3	Side front plastic pad	4	Centre front plastic pad

- ✓ Switch off the kart and secure it against inadvertent start-up.
- a) Position the kart safely at an ergonomically suitable height (e.g. by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Identify the matching plastic pads for the various positions around the surround protection (centre front, side front, rear). Align the bores in the plastic pads the threads in the surround protection.
- c) Secure the pad with the countersunk screws, the washers and the self-locking nuts to the surround protection (see Tightening torques [▶ 129]).
- d) Proceed accordingly to mount all other plastic pads.
- ⇒ The plastic pads are now properly installed.



## 4.5.3.3 Installing safety belt

Various types of safety belts can be attached to the rollbar. Install the belts according to the instructions in the documentation of the manufacturer:

- 3-point safety belt: manufacturer: Carpoint
- 4-point safety belt: manufacturer: Schroth Safety Products GmbH

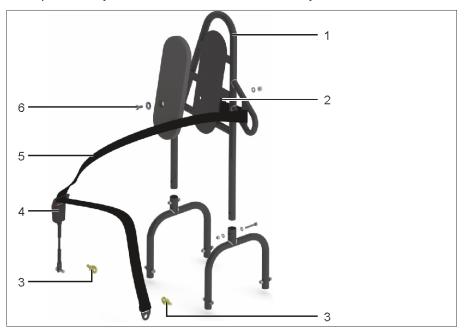


Fig. 44: Installing safety belt

1	Rollbar	2	Safety belt mechanism
3	Safety belt eye bolt	4	Safety belt buckle
5	Safety belt	6	Hex head screw of safety belt mechanism

## 3-point safety belt

For detailed instructions, see original operating manual of Carpoint.

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height (e.g. by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Secure the safety belt at the fixture provided to the vehicle frame, using the *hex head screw and the spacer sleeve* (see also Tightening torques [▶ 129]).
- c) Test the safety belt mechanism, the tab and the buckle. To do this, pull out the safety belt and engage the tab in the buckle. Pull the belt firmly to check whether the mechanism engages. Open the buckle to release the tab.
- d) Mount the cover on the rear bodywork.
- ⇒ The 3-point safety belt is properly installed.



#### 4-point safety belt

For detailed instructions, see original operating manual of Schroth Safety Products GmbH.

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height (e.g. by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Attach the upper fixture of the belt on the rollbar. To do this, thread the belt around the strut of the rollbar and through the belt adjuster.
  - For detailed instructions, see original operating manual of the belt manufacturer.
- c) Attach the fittings of the two safety belts in the *eye bolts* on the vehicle frame (see also Tightening torques [> 129]).
- d) Test the safety belt mechanism, the tabs and the buckle. To do this, engage the tabs in the belt buckle. Open the buckle to release the tabs.
- ⇒ The 4-point safety belt is properly installed.

## 4.5.4 Installing electrical components

#### **⚠** CAUTION

# Risk of injury when coming into contact with powered electrical components of the kart



Electric shock can cause serious injury.

- a) All work on the electrical system of the kart must be carried out by qualified electricians.
- b) Before carrying out any work on the electrical system, disconnect the kart from the power supply.
- c) Check the system for residual voltage.
- d) Cover or otherwise insulate adjacent kart parts that remain powered.



## **A** CAUTION



#### Risk of injury from electric shock

Electric shock can cause serious or even fatal injury.

- a) Before carrying out any work on the electrical system, disconnect the kart from the power supply.
- b) Check the system for residual voltage.
- c) Cover or otherwise insulate adjacent kart parts that remain powered.

Connect the following components:

- Connect the plug of the charger to a suitable power socket.

## 4.5.4.1 Positioning charger

#### **Attention**



#### Damage due to wrong charger

Charging with an unsuitable charger can cause damage to kart components and/or the charger.

- a) Use only chargers that are suitable for the kart and have been approved by RiMO.
- b) For details, contact RiMO service department.

The charger must be installed in a dry place. Protect the charging cable against mechanical damage (from chaffing, friction, kinking, pulling).

The charging cable must not:

- Be placed on the track
- Come into contact with the operator or the kart
- Be driven over

# 4.5.5 Installing safety devices and guards

a) Install all safety devices and guards that have been removed for commissioning.



# 4.5.6 Final inspection

# 0

## **NOTICE**

The following inspections and checks must be performed by specially trained technicians.

RiMO provides detailed training for final inspections performed as part of the commissioning process.

Before starting the kart for the first time, complete the following safety checks:

- Are all guard properly installed?
- Are all safety systems working properly?

## 4.5.7 Adjusting kart setup

The torque and power settings of the drive must be adjusted to suit the kart track, limiting the kart's maximum speed.

RiMO will assist you in adjusting the kart setup.

During the kart run-in (first 10 operating hours), the performance of the drive gradually increases, so that the kart accelerates faster. It might therefore be necessary to readjust the kart setup after the run-in phase.

## **A** CAUTION



#### Safety risk arising from insufficient setup

During the run-in, the performance of the drive increases. This can lead to uncontrolled vehicle movements, accidents and injury.

a) If required, readjust the setup after the run-in phase.

This ensures the operational safety of the kart.



# 5 Start-up

Before starting the kart for the first time, check the following in the prescribed sequence:

- Have all components and assemblies been installed and has the final inspection been completed successfully?
- Are all safety device installed?

Safety notes and instructions for commissioning

## **⚠ WARNING**



#### Risk of accident kart starting up

Uncontrolled start-up of the kart can cause serious injury.

a) Switch off the kart by pressing the drive switch and secure it against inadvertent switching on.

## **MARNING**



## Risk of accident missing safety devices

Missing guards can cause serious injury.

- a) Mount all guards before starting the kart.
- b) Before starting the kart, check all safety devices.

# 5.1 Checking kart and safety devices

#### Checking kart

Check the following components for damage and test their function:

- Tie rods, steering knuckles, steering column, steering wheel
- Wheels (including tyre pressure)
- Brake system (also for leakage), brake mechanism
- Drive unit
- Electrical components and cable connections (including cable installation)
- Panelling
- Surround protection

Should you detect any damage or technical defect, eliminate it without delay and inform the manufacturer.



#### Testing safety devices

- a) Test the safety devices to ensure that they are in proper working order:
- Prior to commissioning
- Prior to start-up after prolonged standstill
- Every day prior to first start-up

## **Testing EMERGENCY-STOP function**

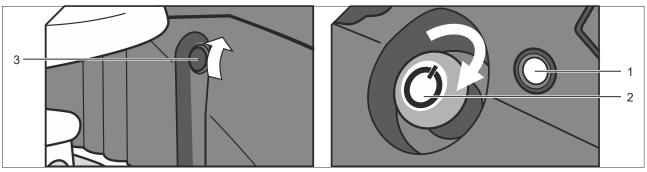


Fig. 45: Switching on drive switch and main switch

1	Drive switch indicator	2	Drive switch
3	Main switch		

- ✓ The kart is fully assembled and set up.
- ✓ The kart is properly propped up so that its wheels turn freely
- a) Switch on the main switch.
  - ⇒ The LEDs of the BMS display are lit.
- b) Turn the *drive switch* by about 1/8 revolution clockwise until the switch pops up.
- c) The green drive switch indicator is lit.
  - ⇒ The kart is switched on and ready for operation.
- d) Push in the drive switch to switch off the kart.
  - ⇒ The *drive switch indicator* is off.
  - ⇒ The kart is switched off. The motor must no longer respond when the gas pedal is actuated.
- ⇒ The emergency-stop button test is completed.



# 5.2 Commissioning

## **NOTICE**



Before switching on the kart, carefully read the instructions in chapter Safety [> 47] in this manual.

Ensure that all mechanical electrical work has been completed and that no persons are standing inside the danger area of the kart.

All safety devices are installed, tested and ready for operation.

## Checking battery charge and charging batteries

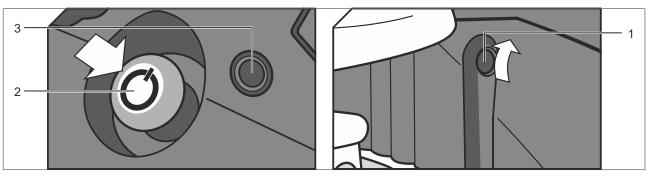


Fig. 46: Drive switch and main switch

1	Main switch	2	Drive switch
3	Drive switch indicator		



Fig. 47: BMS LCD display and charger

1	Charger status display	2	Charger
3	Charging plug	4	BMS LCD display

- √ The kart has been inspected for damage and technical defects and is in proper working order.
- a) Prop up the kart so that it drive wheels can turn freely.

#### WARNING! Ensure that nobody can become injured by rotating parts.

b) Ensure that the *drive switch* is pushed in (OFF position).



- c) Switch on the main switch.
  - ⇒ The LEDs of the BMS display are lit.
- d) Before driving the kart for the first time, the batteries must be fully charged. To do this, switch on the charger and connect the charging plug to the kart. Ensure that the plug is fully inserted to the stop into the socket. For more information, see Charger [> 32] or contact RiMO service department.

## **NOTICE**



#### Charging time

The charging time for the first few charging cycles is slightly longer than normal. After about five to ten charging cycles, the battery cells become balanced so that charging will take less time. The normal charging time for a full charge is about one hour.

- ⇒ When the batteries are fully charged (100 %), LEDs 1 and 3 are lit in green, and message "END" is displayed on the charger display.
- e) Disconnect the charging plug from the kart.

#### CAUTION! Do not disconnect the charging plug while the kart is being charged.

⇒ The batteries are fully charged.

#### Testing accelerator and brake functions

- ✓ The kart is placed on the track.
- ✓ One person has taken place on the kart seat to operate the vehicle.
- ✓ The area around the kart is cordoned off to prevent unauthorised access.
- a) Pull out the drive switch to switch on the kart.
- b) The green drive switch indicator is lit.
  - ⇒ The kart is switched on and ready for operation.
- c) Carefully push down the gas pedal to accelerate the kart.
- d) Press down the brake pedal to stop the wheels.
- e) Carefully push down the gas pedal again.
- f) Push down the gas pedal and the brake pedal at the same time.
  - ⇒ The wheels must come to an instant standstill, even if the pedals are pushed down only slightly.
  - ⇒ If the test is not successful and for more information, see Fault list [▶ 94] or contact RiMO service department.



- g) Push in the drive switch to switch off the kart.
  - ⇒ The *drive switch indicator* is off.
- h) Switch off the main switch.
- i) Exit the kart.
- ⇒ The accelerator and brake function tests have been successfully completed.

#### Checking wheels

See Checking wheels [> 80].

#### Checking safety elements

See Checking safety elements [ 81].

## **NOTICE**

#### Running in brakes

Running in or bedding in the brakes describes the process by which the brake pads and brake discs are carefully bedded in so that they fit properly for maximum brake effect. Bedding in the brakes prolongs the service life of the brake pads and discs.

#### Performing first test run

- √ The accelerator and brake function tests have been successfully completed.
- a) Place the kart on a suitable, approved kart track.
- b) Take place on the driver seat.
- c) Switch on the main switch and then pull out the drive switch.
  - ⇒ The green indicators of the *main switch* and the *drive switch* are lit.
- d) Carefully accelerate the vehicle and then drive a constant speed of approx. **10 km/h**. Test the braking behaviour (including full braking), the steering and the general vehicle behaviour and response.
  - ⇒ If you encounter any problems and for more information, see Fault list [▶ 94] or contact RiMO service department.
- ⇒ The first test run has been successfully completed.

#### See also

- Technical documents/appendices [▶ 141]
- Battery management system (BMS) [▶ 24]



# 5.3 Daily start-up

Before starting the kart, ensure that the batteries are fully charged. Normally, operators charge the karts after the track has been closed or prior to opening the track.

# **Attention**



#### Faults during charging

When the kart is being charged, keep an eye on it. In the event of a fault, immediately terminate the charging process.

a) Do not charge the kart unsupervised during the night.

#### Charging batteries

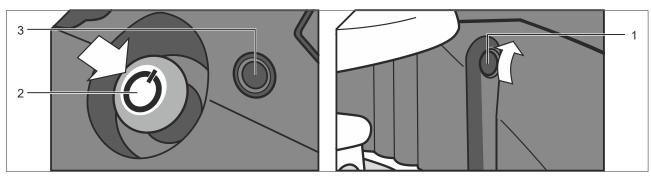


Fig. 48: Drive switch and main switch

1	Main switch	2	Drive switch
3	Drive switch indicator		



Fig. 49: Charge indicator

	1	Battery charge status		
--	---	-----------------------	--	--



- ✓ The kart is standing still.
- a) Ensure that the *drive switch* is pushed in (OFF position).
- b) Switch on the main switch.
- c) Switch on the charger and connect the charging plug to the kart. Ensure that the plug is fully inserted to the stop into the socket. For more information, see Charger [ > 32] or contact RiMO service department.
  - ⇒ The charging process is started automatically.
  - ⇒ When the batteries are fully charged (100 %), LEDs 1 and 3 are lit in green, and message "END" is displayed on the charger display.
- d) Disconnect the charging plug from the kart.

CAUTION! Do not disconnect the charging plug while the kart is being charged. Do not disconnect the charging plug by pulling the cable.

⇒ The batteries are fully charged.





#### Reducing or interrupting charging current

Towards the end of the charging process, the charging current might be gradually reduced or interrupted for short periods of time. This behaviour is known as "toggling" and helps balancing the cells, thus enhancing the capacity of the batteries.

#### Disconnecting charge from mains power

When not in use, disconnect the charger from the mains power supply.

#### Checking kart and safety devices

Inspect and test the kart and the safety devices as described in Checking kart and safety devices [> 71].

#### See also

Commissioning [▶ 73]



## 5.3.1 Checking brake system

## **⚠ WARNING**

# Risk of accident from defective brake system



A defective or leaking brake system poses a risk of accident and serious injury.

- a) Before starting the kart, test the brake function.
- b) Always test the brake function after the kart has been exposed to a high external force
- c) During commissioning and after the replacement of parts, the brake system must be bedded in.

#### **NOTICE**



#### Running in brakes

Running in or bedding in the brakes describes the process by which the brake pads and brake discs are carefully bedded in so that they fit properly for maximum brake effect. Bedding in the brakes prolongs the service life of the brake pads and discs.

- During commissioning and after a brake system component has been replaced, the kart must be run in carefully.
- After a high impact on the kart, immediately inspect the brake system of the kart and perform a brake test.
- The brake system of the kart must always generate the necessary braking force to stop the kart.
  When the brake pedal is actuated, the kart must slow down without delay. The driver must be able to perform a full brake manoeuvre, irrespective of the kart's speed.
- Check the two brake lights.
- Inspect all components and connections of the brake system for proper installation and perform a function test.
- The brake lines must never come into contact with the track surface, or with rotating, sharp-edged or hot vehicle parts.
- Ensure that the brake lines are not kinked or under stress (e.g. because they are too short).
- Defective or damaged screw fittings and lines must be replaced without delay.
- Defective or worn parts must be replaced with RiMO original parts.
- Karts with defective brake components or showing loss of brake fluid must be removed from the track and switched off.



# 5.3.2 Checking steering system

#### **⚠ WARNING**



#### Risk of accident from defective steering system

Incorrect installation or fixture of the steering components or incorrect tracking can result in accidents and serious injury.

- a) Before starting the kart, test the steering function.
- b) After an impact on the front axle/steering system, inspect all parts of the steering system and test their functions. Also check the steering alignment/tracking.
- Ensure that all components of the steering system<sup>1</sup> are in proper working order.
- Deformed or damaged parts (e.g. tie rods, steering knuckles) must be replaced with RiMO original parts without delay.
- After an impact on the front axle/steering system, check all parts of the steering and tracking system for damage. Also check the steering alignment/tracking.
- Check and tighten all screw connections. Steering play often indicates that there are loose screw connections.
  - If necessary, tighten the screw connections (see Tightening torques [▶ 129] and Maintenance of steering system [▶ 111]).
- Test the steering movement along the entire steering range for stiffness.
- <sup>1</sup> The steering system includes the following components: steering wheel, steering wheel mount, steering column, top and bottom steering column bearings, tie rods, steering knuckles, steering column struts and all screw connections of the components.

# 5.3.3 Checking pedals



#### **⚠ WARNING**

#### Risk of accident from defective pedals

Incorrect installation or fixture of the pedals can result in accidents and serious injury.

a) Before starting the kart, test the pedal functions.



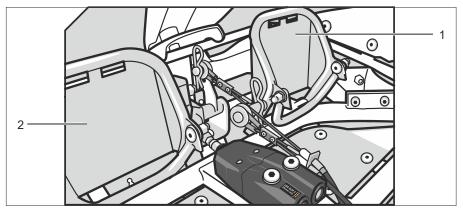


Fig. 50: Checking pedals

1 Gas pedal	2 Brake pedal
-------------	---------------

- Inspect the brake pedal and the gas pedal for damage.
- Actuate the brake pedal and the gas pedal and check whether they return to their initial position when released.
- Check whether the folding pedal extensions can be moved without obstruction.
- Check the brake fluid level.
- Check the screw connections of the pedals.

## 5.3.4 Checking wheels

# **⚠ WARNING**



#### Risk of accident from defective pedals

Defective or worn wheels can lead to accidents and serious injury.

a) Check the wheels for damage and wear. Ensure that they are properly mounted.

Observe the instructions of the manufacturer.

#### ⚠ WARNING



#### Risk of accident non-conforming tyre dimensions

Only use tyres and wheel rims of the size specified by RiMO. Wheels or tyres with other dimensions can cause damage to the vehicle and lead to unexpected drive behaviour, resulting in accidents.



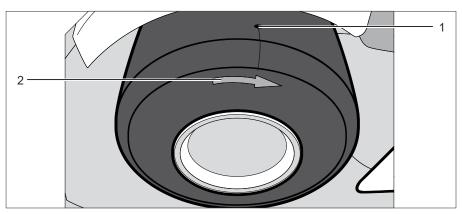


Fig. 51: Checking wheels

1 Wear mark	2 Arrow: direction of rotation of wheel
-------------	---

- Check the tyre pressure. For correct pressures, refer to the manufacturer documentation of your tyres.
- Adjust the tyre pressure to the kart track conditions.
   Normally, the ideal tyre pressure is between 1.2 and 2 bar. For other tyre pressures, contact the manufacturer.
- Check the wear marks.
   Tyres whose wear mark is no longer visible must be replaced without delay.
- Check the tyres for correct direction of rotation. Observe the direction arrows on the tyres.
- Check the wheels for axial play (see Maintenance/change of wheels [▶ 115]).
- When the kart is switched off, the rear wheels must rotate freely.
   If this is not the case, contact RiMO service.

# 5.3.5 Checking safety elements

The panelling/bodywork and the surround protection are crucial safety devices, protecting both the kart and the driver. Ensure that these parts are undamaged and work properly.

# **MARNING**



#### Risk of injury from defective panelling/bodywork

Defective panelling/bodywork does not properly protect the driver against contact with moving or hot kart components. When driving the kart, there is a risk of serious injury, especially in the event of an accident.

a) Inspect the panelling/bodywork and replace defective components without delay.





Fig. 52: Panelling/bodywork

1 Bodywork	2 Surround protection
------------	-----------------------

- Inspect the bodywork for cracks, deformation and loose fixtures. Eliminate all damage without delay.
- Inspect all mounts and the surround protection front mount for damage and proper fixture. Eliminate all damage without delay.

# 5.4 Start-up after prolonged storage

To recommission the kart after prolonged storage, proceed as described for commissioning, with initial battery charging/discharging as follows:

- a) Check all components for stiffness and make the necessary adjustments.
- b) Fully charge the kart batteries (100 %) until message "END" is displayed on the charger.
- c) Then discharge the batteries to approx. 70 % ± 5 %, for instance by driving the kart.
- d) Repeat this charging/discharging procedure.
- e) Then proceed as described for commissioning of the kart.

#### See also

Commissioning [▶ 73]



# 6 Kart operation and control

The following general rules apply to the operation of the kart:

- The operator's personnel must assess whether a person is fit to drive the kart, taking into account the age, height and weight of the person as well any medical concerns. If required, the driver must be instructed by operator's personnel in the safe operation/control of the vehicle (see also Requirements to be met by drivers [> 56]).
- The kart must only be driven by suitably instructed and authorised drivers. The kart must only be driven, if all safety devices are correctly installed and working properly.
- Check the kart to ensure that all its systems, and in particular its safety devices, are working properly.
   If you detect any problem with a safety device (failure, malfunction), immediately notify your supervisor.
- Before switching on the kart, make sure that no persons are standing in its danger area.
- To drive the kart, the driver must wear the prescribed personal protective equipment (see Personal protective equipment [▶ 56]).
  - It is the responsibility of the operator's personnel to ensure that the driver wears the personal protective equipment.
- Disabling or bypassing safety devices while driving the kart is strictly prohibited.
- Smoking and the use of naked flames near the kart is strictly prohibited.
- Never eat or drink while performing maintenance or repair work.
- Drivers and personnel carrying out maintenance or repair work on the kart must not be under the influence of alcohol or drugs.
- If a person has taken medication, he/she is not permitted to drive the kart or carry out any work on the kart, unless his/her doctor has been consulted.

#### Safety instructions for kart operation



#### **⚠ WARNING**

#### Risk of injury from missing guards

Missing guards can cause serious injury.

a) Mount all guards before starting the kart.

#### See also

Safety [▶ 47]



# 6.1 Description of kart controls for drivers

The kart controls for drivers are located on the driver seat, the steering wheel, around the drive switch and the pedals.

#### See also

Work, maintenance and danger areas [▶ 17]

# 6.2 Operating modes

The kart can only be operated in manual mode.

#### Manual mode.

The manual mode is activated with the main switch and the drive switch. These two switches switch on/off all kart systems (drive, brake system, etc.).



#### **NOTICE**

Before starting the kart, the driver must make sure that no persons are standing within its danger area.

# 6.3 Driver instruction by operator's personnel

The operator's personnel must assess whether a person is fit to drive the kart, taking into account the age, height and weight of the person as well any medical concerns. The kart operator must instruct personnel in how to make the above assessments and in any statutory regulations that might apply.

#### Instruction

- All safety instructions (including posters, signs, videos, etc.) must be clearly visible.
- Before starting the kart, the driver must be instructed as follows:
  - Functions of brake and gas pedal, correct position of hands on steering wheel (10:10 o'clock position)
  - Correct entry and exit to prevent injury and/or damage to kart
  - Adjustment and engagement of seat/pedal extension (if installed)
  - Safe driving without simultaneous operation of gas and brake pedal
  - Rules for overtaking
  - Flags, signals, track posts and signs
  - Consequences of non-compliance with rules, in particular in connection with dangerous driving



#### During driving on track

- The kart operator must enforce compliance with the safety rules, signs and posts along the track, flags and/or signal lights.
- Drivers who show aggressive or dangerous driving behaviour must be reminded of the rules or even excluded from driving the kart.
- Drivers that do not adhere to the above safety rules and regulations during a race must be disqualified and ordered to leave the track immediately.

# 6.4 Adjusting seat position

If required, the seat position and the pedals must be adjusted to suit the driver.

#### Seat

Position the seat so that the driver can reach the steering wheel with bent arms. The arms must never be stretched, even when the steering wheel is turned to the maximum steering angle.

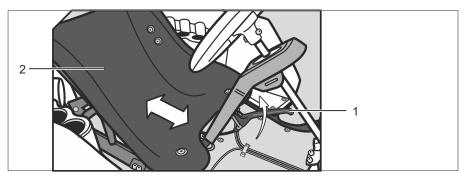


Fig. 53: Seat adjustment

1	Adjusting lever	2	Seat
	,		

- ✓ The kart is switched off.
- ✓ The driver is sitting on the driver seat.
- a) Pull the adjusting lever and slide the seat into the desired position, keeping the free hand on the steering wheel.
- b) Release the adjusting lever and move the seat a little until it engages with an audible click in the locking mechanism.
- ⇒ The seat is now correctly positioned.



## **MARNING**

#### Risk of accident from unsuitable seat position



If the seat is not positioned correctly, the driver might be unable to reach certain control elements (brake/gas pedal), especially when driving along bends. This can result in accidents and serious injury.

- a) Before starting the kart, the operator's personnel must check whether the seat is correctly adjusted to suit the driver.
- b) If required, readjust the seat position.
- c) The lock bolt of the seat locking mechanism must be properly engaged.

#### Seat adjustment range insufficient for driver

If the seat adjustment range is not sufficient for the driver, as the driver is small (140-150 cm), adjust the pedal position and/or install a booster seat (SRS) (RiMO prod. no. 1387042, available from RiMO online shop at www.rimo.de/shop).

#### **Pedals**

The driver must be able to reach the pedals easily while keeping the legs slightly bent.

To shorten the distance to the pedals, fold down the extension brackets at the pedals.

## **⚠ WARNING**



#### Risk of accident from incorrect pedal operation

If the pedal extension bracket is used, there is a risk that the foot of the driver is caught between the pedal and the extension bracket. This can lead to incorrect pedal operation, resulting in accidents and serious injury.

a) The feet of the driver must always be positioned on the extension brackets.

We also offer optional detachable pedal extension elements that make the above distance even shorter and enable the driver to put his/her feet flat onto the element surface.

#### Safety belt (optional)

The kart might be equipped with a 3-point or a 4-point safety belt. If a safety belt is installed, it must be worn.

Before starting the vehicle, ensure that the safety belt is properly worn and locked.



## **MARNING**



#### Risk of injury from unlocked safety belt buckle

If the safety belt buckle is not properly locked, or if the belt is incorrectly positioned/fitted, it might not protect the driver in the event of a collision. This can result in serious injury.

a) The belt tab must fully engage in the belt buckle.

#### 3-point safety belt

- ✓ The driver is sitting on the driver seat.
- a) Place the safety belt over the driver's chest and stomach and engage the tab in the buckle.

#### 4-point safety belt

- ✓ The driver is sitting on the driver seat.
- a) Adjust the 4-point safety belt to the driver's torso. This can be down with the adjusting elements positioned at the height of the driver's shoulder/chest and pelvis.

## **MARNING**



#### Risk of injury from loose safety belt straps

Loose safety belt straps might become entangled in rotating vehicle parts or slide along the track surface.

- a) Secure any loose belt straps. This is particularly necessary with small or slim drivers.
- b) Engage the two belt tabs in the buckle and ensure that they are properly engaged.

# 6.5 Switching on/off sequence

# 6.5.1 Switching kart on

#### Before switching on the kart

Perform the following tasks and checks:

a) Inspect the kart and all its components for visible damage (see Daily start-up [▶ 76], Maintenance schedule [▶ 100]).



- b) Check the ground around and under the kart for escaped liquids.
  - ⇒ If you detect any damage or liquid, identify the problem and eliminate it.
- ⇒ The kart can now be switched on.

#### Switching on kart

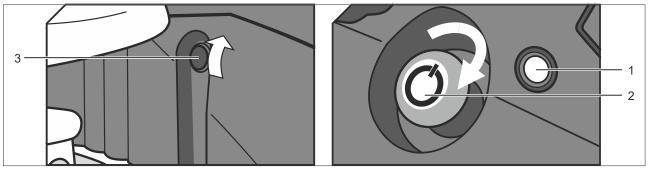


Fig. 54: Main switch and drive switch

1	Drive switch indicator	2	Drive switch
3	Main switch indicator		

- a) Take place on the driver seat.
- b) Switch on the main switch.
- c) Turn the *drive switch* by approx. 1/8 revolution clockwise to switch on the kart.
- d) The green drive switch indicator is lit.
- ⇒ The kart is switched on and ready for operation.

# 6.5.2 Switching kart off

#### Switching off kart for short period of time

To change driver, etc. the kart must be switched off for a short period of time.

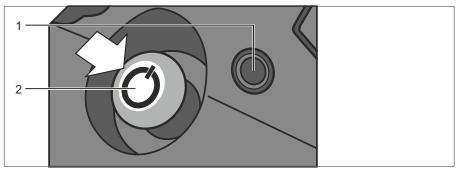


Fig. 55: Drive switch

1 Drive switch indicator	2 Drive switch
--------------------------	----------------



- ✓ The kart is in a suitable position for temporary switch-off (box lane, etc.)
- ✓ The driver is sitting on the driver seat.
- a) Push in the drive switch to switch off the kart.
  - ⇒ The *drive switch indicator* is off.
- b) Exit the kart.
- ⇒ The kart is switched off.

#### Switching off kart for prolonged shutdown

At the end of the shift or to carry out maintenance work, the kart must be fully shut down.

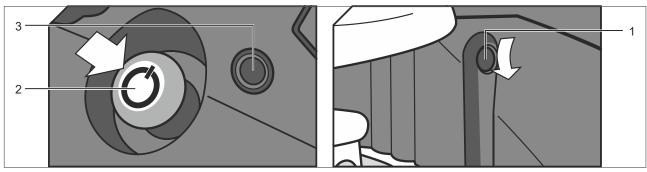


Fig. 56: Drive switch and main switch

,	Main switch	2	Drive switch
3	Drive switch indicator		

- √ The kart is in a suitable position for shut down (box lane, etc.)
- ✓ The driver is sitting on the driver seat.
- a) Push in the drive switch to switch off the kart.
  - ⇒ The *drive switch indicator* is off.
- b) Switch off the main switch.
- c) Exit the kart.
- ⇒ The kart is switched off.



# 6.6 Drive functions

#### **Pedals**

To accelerate the kart, push down the gas pedal. To decelerate the kart, push down the brake pedal.

If the two pedals are pushed down simultaneously, the kart is decelerated.

#### Steering wheel

To steer the kart in a different direction, turn the steering wheel.

# **⚠ WARNING**



#### Risk of collision

During normal operation, the kart must always travel in forward direction. Reversing on the track can cause accidents and serious injury.

- a) Reversing during normal track driving is prohibited.
- b) Reversing is only permitted in the event of an emergency.

#### See also

Steering system [▶ 18]

# 6.7 Safe driving

For safe driving, the following rules must be strictly adhered to:

- The kart must only be started when a member of the operator's personnel has given the go-ahead to do so.
- The kart must only be stopped in the box lane or another specially marked area.
- If the kart comes to a halt on the track, do not exit the vehicle.
- Before exiting the vehicle, switch off the drive switch and make sure that the green indicator is off.
- Only exit the kart when a member of the operator's personnel has given the go-ahead to do so.



# 6.8 Collisions/accidents

After a collision or accident during driving, the kart must undergo a number of checks before it can resume driving on the track.

- a) Inspect the surround protection and the bodywork for damage.
- b) Inspect and test the brake and the steering system.
- c) For vehicles with safety belt:

  After an accident, always check the safety belt to ensure that it is not damaged and works properly.
- ⇒ If you detect any damage, do not drive the kart. Eliminate all damage without delay.



# 7 Malfunctions and faults

For troubleshooting, adhere to the following rules:

All tasks described below must be performed by specially trained and authorised skilled workers.

- a) Before starting work, allow hot parts to cool down.
- b) Wear suitable protective clothing.
- c) Before restarting the kart, re-install all safety devices.
- d) Test the safety devices to ensure that they are working properly.
- e) After all work is completed, remove the tools and other implements from the danger area of the kart.

Safety notes and instructions regarding malfunctions and errors

## **MARNING**

#### Risk of injury from disabled safety devices during troubleshooting



When troubleshooting the kart, it might be necessary to temporarily switch on the kart and/or disable safety devices or guards. There is thus a risk of inadvertent contact with rotating or hot components, which can lead to serious injury.

- a) All tasks described below must be performed by authorised skilled workers.
- b) Before setting a part of the kart in motion, ensure that nobody is standing in the danger area.
- c) Cordoning off the danger area.

## **MARNING**



#### Risk of accident kart starting up

Uncontrolled start-up of the kart can cause serious injury.

a) Switch off the kart by pressing the drive switch and secure it against inadvertent switching on.



# **MARNING**



#### Risk of accident missing safety devices

Missing guards can cause serious injury.

- a) Mount all guards before starting the kart.
- b) Before starting the kart, check all safety devices.

# 7.1 Restart after unplanned stop

#### Prior to switching on

- a) Identify and eliminate the cause of the unplanned stop.
- b) Inspect the kart and all components for damage.
  - ⇒ Clean the kart and eliminate any damage.
- ⇒ The kart can now be switched on again.

## Resetting EMERGENCY-STOP

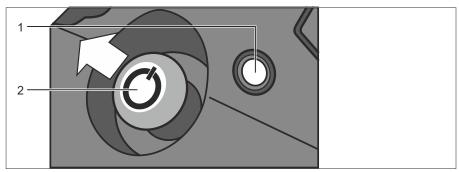


Fig. 57: Switching on drive switch

1 Drive switch indicator	2 Drive switch
--------------------------	----------------



- a) Take place on the driver seat.
- b) Check whether the main switch is switched on.
- c) If necessary, switch on the main switch.
- d) Turn the drive switch.
- e) The green drive switch indicator is lit.
- ⇒ The kart is switched on and ready for operation.



# **NOTICE**

If you are unable to reset the emergency-stop function, leave the kart switched off. Do not carry out any work on the kart. Contact RiMO service department for advice.

# 7.2 Faults and malfunction during operation

#### 7.2.1 Fault list



# **NOTICE**

#### **Troubleshooting**

All tasks described below must be performed by authorised technicians or skilled workers. If you are unsure how to proceed, contact RiMO service department.

Fault	Possible cause	Remedy	Person responsible*
Kart cannot be started (no	Fuse defective	Check fuse F1 (BMS)	ОР
power)		Check all cables (+ and -) for damage	os
Kart not charged Charging plug/socket defective		Check charging plug, socket and cable	OP
	Main switch actuated	Check main switch	ОР
	Temperature outside permissible range (min./max.)	Check temperatures of BMS and cells	os
	BMS fault	Check BMS	os



Fault	Possible cause	Remedy	Person responsible*
	Charge release cable disconnected/wire break	Check cable from BMS to charging socket	os
	Wire break	Check load cable	ОР
	Charger defective	Check charger	os
	No mains power	Check power mains	ОР
Kart fails to drive	SOC value 0	Check charge status	os
	Drive sensor defective or not connected	Check cable connections from drive sensor	os
	Temperature outside permissible range (min./max.)	Check temperatures of BMS and cells	os
	BMS fault	Check BMS	os
	No control connection to main switch solenoid	Check cable from BMS to main switch solenoid	os
	Fuse defective	Check fuses F4, F5, F6 in control cabinet	os
	Main switch defective	Check main switch and solenoid	os
	Wire break	Check load cable	ОР
	Shutdown transponder defective or not connected correctly	Check shutdown transponder and cable connections	os
	No ENPO start connection	Check ENPO cable connection	os
Motor fails to run	Fuse defective	Check fuse in control cabinet	os
	Motor temperature sensor defective	Check temperature sensor	os
	Cable disconnected/wire break	Check cable connections of motor	os
	Engine sensor defective	Check engine sensor by replacing it	os
	Controller defective	Check controller by replacing it	os



Fault	Possible cause	Remedy	Person responsible*	
	Motor defective	Check motor by replacing it	os	
	No ENPO start connection	Check ENPO cable connection	os	
Kart moves inadvertently	Drive sensor incorrectly set	Adjust drive sensor	os	
	Ground conductor of controller defective	Check ground conductors	os	
	Pedal bent or incorrectly set	Check pedal; replace, if necessary	os	
* OP = operator's personnel, OS = operator's skilled worker, M = manufacturer				

Tab. 23: Fault list

# 7.2.2 Eliminating faults

# NOTICE Troubleshooting



If you have any queries, contact  $\ensuremath{\mathsf{RiMO}}$  service department.

Faults must only be rectified by authorised skilled workers and other qualified personnel.

#### 7.2.2.1 Control box

The control box contains the main cables for electrical components and provides mechanics with a wellorganised board for fault location and measurements. The control box also contains the main fuses.

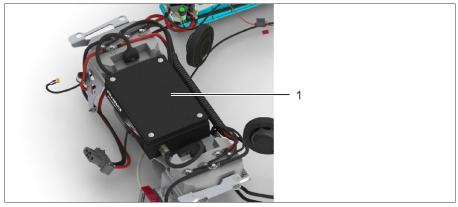


Fig. 58: Control box



#### Troubleshooting example

## **MARNING**

#### Risk of injury from disabled safety devices during troubleshooting



When troubleshooting the kart, it might be necessary to temporarily switch on the kart and/or disable safety devices or guards. There is thus a risk of inadvertent contact with rotating or hot components, which can lead to serious injury.

- a) All tasks described below must be performed by authorised skilled workers.
- b) Before setting a part of the kart in motion, ensure that nobody is standing in the danger area.
- c) Cordoning off the danger area.

The kart fails to start, or does not accelerate when the pedal is pushed down. Otherwise, it appears to work properly. This problem might be caused by the drive sensor.

To check the drive sensor, measure the signal sent by the drive sensor to the controller, using a multimeter. To identify the terminal for the measurement, refer to the pin assignment schedule and the wiring diagram. The terminal can then be identified from the terminal assignment schedule. In our case, it is slot 7 at plug "Right motor" or "Left motor" (drive potentiometer signal). If no voltage is measured when the gas pedal is pushed down (normal voltage in this case: approx. 5 V), the cable to the drive sensor is faulty or the drive sensor is defective.

# 7.2.3 Warning and fault signals at charger

If the kart cannot be charged and LED 4 is lit (red), proceed according to the checklist below.

- Is the charging plug correctly plugged in?
- Is the drive switch on?
- Is charging enabled by the BMS?
- Are the plugs and CAN bus lines correctly connected?
- Are all CAN bus lines OK?
- Is the charger powered through all three phases?
   WARNING! High voltage! This check must be performed by a qualified electrician!
- ✓ The charger fails to work properly, but none of the above checks revealed any problem.
- a) If you need assistance or if the charger is still not working properly, contact RiMO service department.



All additional troubleshooting steps must be performed by a RiMO service technician. In order to deal with your problem quickly and efficiently, the RiMO service department needs the following information:

- Serial number of charger
- LED display signal
- Description of problem
- Location of charger

# 7.3 Troubleshooting assistance

Contact RiMO service department.

#### See also

□ Technical documents/appendices [▶ 141]



# 8 Checks and servicing during operation

The following general rules apply to the checking and servicing of the kart:

All tasks described below must be performed by specially trained and authorised skilled workers.

- a) Switch off the kart by pressing the drive switch and secure it against inadvertent switching on.
- b) Before starting work, allow hot parts to cool down.
- c) Wear suitable personal protective equipment.
- d) Cordon off the working area with a red/white chain to keep unauthorised persons away from the kart.
- e) Position the kart safely at an ergonomically suitable height (e.g. with KHB 250 lifting platform).
- f) Some of the kart components are very heavy. Use suitable lifting gear and attachments.
- g) Before restarting the kart, re-install all safety devices.
- h) Test the safety devices to ensure that they are working properly.
- i) After all work is completed, remove the tools and other implements from the kart.

Observe the safety instructions for checks and servicing during operation.

#### **⚠ WARNING**



#### Risk of accident kart starting up

Uncontrolled start-up of the kart can cause serious injury.

a) Switch off the kart by pressing the drive switch and secure it against inadvertent switching on.

#### **⚠ WARNING**



#### Risk of accident missing safety devices

Missing guards can cause serious injury.

- a) Mount all guards before starting the kart.
- b) Before starting the kart, check all safety devices.



## **A** CAUTION

# Risk of injury when coming into contact with powered electrical components of the kart



Electric shock can cause serious injury.

- a) All work on the electrical system of the kart must be carried out by qualified electricians.
- b) Before carrying out any work on the electrical system, disconnect the kart from the power supply.
- c) Check the system for residual voltage.
- d) Cover or otherwise insulate adjacent kart parts that remain powered.



# **NOTICE**

#### Service the kart regularly.

Regular servicing is an integral part of proper use and crucial for the safe and efficient operation of the kart.

# 8.1 Maintenance schedule

The following chapters describe the maintenance tasks and intervals for the various kart assemblies.

# 8.1.1 Daily tasks

Component	Task*		To be carried out
Entire kart	I	Visual inspection for wear and damage	ОР
Entire kart	Т	Test function of all safety devices	ОР
Batteries	Т	Charging batteries [▶ 126]	ОР
Safety elements/silent blocks	I, T	Visual inspection for wear and damage	OP
Brake system	Ι, Τ	Visual inspection for wear and damage; function test (test drive)	OP



Component	Task*	Description of task	To be carried out
Steering system	I, T	Visual inspection of all steering components for wear and damage; function test	ОР
Tracking	I, T	Visual inspection for wear and damage [▶ 115]; function test	
Steering knuckles	I, T	Visual inspection for wear and damage [▶ 115]; function test	
Steering wheel	Т	Visual inspection for wear and damage	ОР
Pedals	I, T	Visual inspection for damage; function test	ОР
Seat and seat ad- justment	I, T	Visual inspection for damage; function test	ОР
Tyres	Т	Check tyre pressure	OP
Wheels	I, T	Visual inspection for wear and damage [▶ 115]; function test	ОР
Screw connections	I, T	Visual inspection for wear and damage [▶ 115]; check for proper fixture [▶ 121]	ОР
Drive switch	I, T	Visual inspection for wear and damage [▶ 115]; OP function test	
WLAN (if installed)	Т	Test shutdown function	ОР
* I = visual inspection	; T = test/chec	k; R = replace; C = clean	<u>'</u>
** OP = operator's pe	ersonnel; OS =	operator's skilled worker; M = manufacturer	

Tab. 24: Daily maintenance schedule

# 8.1.2 Weekly tasks

Component	Task*	'	To be carried out
Entire kart		Remove dust and rubber residue from kart body parts and mechanical components, using compressed air	OP
Bodywork, drive system	С	Remove dirt [▶ 104].	OP



Component	Task*	Description of task	To be carried out	
Vehicle frame		Visual inspection for damage	OP	
Front bumper		Visual inspection for damage	OP	
Tracking	Т	Check tracking	OP	
Steering knuckles	Т	Check bearing play [▶ 119]	OP	
Brake pads	I	Visual inspection for wear [▶ 106]	OP	
Driver seat	I	Visual inspection for damage OP		
Wheel bearings	Т	Check bearing play [▶ 119]	OP	
Electrical connections	I	Visual inspection for damage		
* I = visual inspection; T = test/check; R = replace; C = clean				
** OP = operator's personnel; OS = operator's skilled worker; M = manufacturer				

Tab. 25: Weekly maintenance schedule

#### See also

- Maintenance of steering alignment system [▶ 113]
- Checking steering knuckles [▶ 113]

# 8.1.3 Monthly tasks

Component	Task*	Description of task	To be carried out	
Brake system	Т	Lubricate mechanical brake components [▶ 110]	os	
Brake discs	l	Visual inspection for wear and damage (grooves, cracks, etc.)	OP	
Side boxes and bat- teries	С	Clean inside of side boxes and remove batteries	os	
Seat/seat adjustment	Т	Function test.	OP	
* I = visual inspection; T = test/check; R = replace; C = clean				
** OP = operator's personnel; OS = operator's skilled worker; M = manufacturer				

Tab. 26: Monthly maintenance schedule



# 8.1.4 Tasks to be completed every 6 months / 200 operating hours

Component	Task*		To be carried out	
Electrical connections, switchgear and connecting cables		Visual inspection for damage; check electrical connections for proper contact	os	
* I = visual inspection; T = test/check; R = replace; C = clean  ** OP = operator's personnel; OS = operator's skilled worker; M = manufacturer				

Tab. 27: Semi-annual maintenance schedule

# 8.1.5 Tasks to be completed once, after first 10 operating hours

Component	Task*	•	To be carried out	
Drive components	Т	Check setup; adjust (reduce), if necessary	os	
* I = visual inspection; T = test/check; R = replace; C = clean				
** OP = operator's personnel; OS = operator's skilled worker; M = manufacturer				

Tab. 28: Maintenance after first 10 operating hours

# 8.2 Maintenance tasks

The following chapters describe the individual maintenance tasks.

# 8.2.1 Visual inspection

Perform the following visual inspections:

- a) Inspect the kart and all its components for visible damage (Daily start-up [> 76]).
- b) Inspect all safety devices for visible damage.
  - ⇒ If you detect any damage or dirt, eliminate it or have it eliminated.
- ⇒ The visual inspection is completed.



# 8.2.2 Cleaning

To clean the drive systems and its components (with the exception of the brake system), use a product that cleans, degreases and protects. Always use a cleaning product that is moisture-repellent.

## **MARNING**



#### Loss of brake power

If oily or greasy substances enter the brake system, the brakes might not be as effective as they should for some round, or even fail completely.

a) When cleaning the kart, make sure that no cleaning agent enters the brake system.

## **Attention**



#### Damage caused by unsuitable cleaning agents or methods

Unsuitable cleaning agents can cause damage to the kart or its components.

- a) Wear protective gloves and safety goggles.
- b) Wherever possible, use only mild cleaning agents.
- c) Do not use high-pressure devices or aggressive or corrosive chemicals.
- Test the cleaning agent on a hidden spot for compatibility with the kart material.
- Spray the cleaning agent over the entire kart and let it work in. Wipe the kart clean, using a dry cloth.

Component	Method	Cleaning agent	Comment
Surfaces/bodywork	Spray on cleaning agent, wipe off with dry cloth	Solvent-free cleaning agent	Observe instructions of clean-ing product manufacturer!
Drive system	Spray on cleaning agent, wipe off with dry cloth		Observe instructions of clean-ing product manufacturer!
Safety belts			Observe instructions of safety belt manufacturer!

Tab. 29: Cleaning



## 8.2.3 Checking and servicing mechanical parts

If you detect any damage to mechanical parts, immediately remove the kart from the track and have it repaired by a qualified workshop, using original spare parts.

#### **Attention**



#### Damage to kart due to insufficient maintenance

Insufficient or inappropriate maintenance can cause excessive wear, resulting in high repair costs.

- a) Perform all maintenance tasks according to the instructions of the manufacturer.
- b) For the servicing of mechanical components, observe the maintenance instructions of the manufacturer.

#### See also

Contacting RiMO GERMANY GmbH & Co. KG [▶ 12]

## 8.2.3.1 Maintenance of brake system

#### Observe the following:

- After a brake system component has been replaced, the kart must be run in carefully.
- For the assembly of the components, strictly adhere to the specified tightening torques (seeTightening torques [▶ 129]).
- Use only DOT 5 Silicone brake fluid (prescribed by RiMO). Otherwise, the brake system might be damaged, resulting in brake failure.
- The brake discs and pads must never come into contact with substances containing oil or grease, as this
  would lead to a significant reduction of the brake power.

#### Testing brake system

a) Before putting the kart into operation, complete a test run to check whether the brake system works properly.

For this test, press down the brake pedal for minimum 10 seconds.

- ⇒ The brake effect must remain unchanged during this time.
- b) Check the brake fluid level.
- c) The wear marks on the brake pads must be clearly visible.
- d) Check the brake hoses and all connections of the brake system for leakage.
- e) Control cables and sleeves must be free of damage.



- f) Check the lubrication of the mechanical brake components. In karts used outdoors, the lubrication intervals must be adjusted depending on the weather conditions.
- ⇒ If you detect any damage or unusual behaviour, eliminate the defect or have it eliminated by a qualified workshop.
- Make sure that the brake fluid is clean. If this is not the case, change it. (Do not forget to bleed the system!)
   The brake fluid can be inspected through the sight glasses. Clean brake fluid is clear and purple in colour.
   Dirty brake fluid shows dark discolouration.

#### 8.2.3.1.1 Testing brake pads

Regularly check the wear marks of the brake pads.

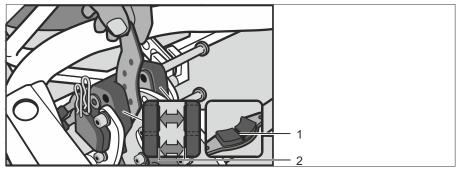


Fig. 59: Testing brake pads

1 Wear mark 2	Brake pads
---------------	------------

- ✓ The kart is switched off.
- a) The brake pad surface must be higher than the groove of the wear mark.
  - ⇒ If the brake pad surface and the wear mark groove are at the same level, replace the brake pad.
- ⇒ The brake pad has been checked.

#### See also

Changing brake pads of RiMO hydraulic brake [▶ 108]



# 8.2.3.1.2 Bleeding RiMO hydraulic brake system

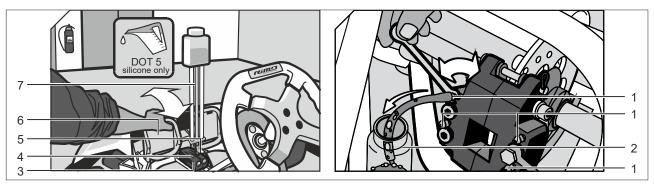


Fig. 60: Hydraulic brake system

1	Bleeder screw	2	Collecting vessel
3	Main brake cylinder	4	Screw plug
5	Shut-off valve	6	Brake pedal
7	Brake bleeder kit		

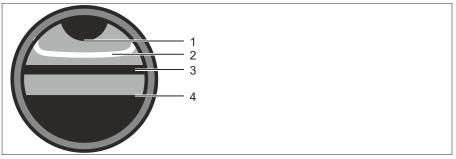


Fig. 61: Oil sight glass

1	Max. filling level		Filling level upon delivery and after brake pad change
3	Recommended filling level	4	Min. filling level

## **⚠ CAUTION**



#### Risk of injury from contact with DOT 5 Silicone

The maximum permissible workplace concentration of the brake fluid is 2.5 mg/m<sup>3</sup>.

- a) Wear protective gloves and safety goggles.
- b) Do not ingest brake fluid.
- c) Work with great caution.
- d) Observe the safety instructions in the safety data sheet of the fluid.



#### Proceed as follows:

- a) Secure the kart in a horizontal position.
- b) Remove the screw plugs of the brake circuits at the main brake cylinder.
- c) Screw the brake bleeder kit (prod. no.1086) into the filling nozzle and fill the system with **DOT 5 Silicone** brake fluid.
- d) Open the shut-off valve and repeatedly push down the brake pedal to bring the fluid level in the main brake cylinder to the min. filling mark in the sight glass.
- e) Place the collecting vessel under the rear bleeder screw of the brake circuit.
- f) Open the first bleeder screw, push down the brake pedal and close the bleeder screw before releasing the brake pedal.
  - Repeat this procedure until the escaping brake fluid is free of bubbles (ensure that there is a sufficient brake fluid supply).
- g) Complete the same procedure with the other three bleeder screws.
- h) The brake circuits must be bleed twice.
  - ⇒ After the second bleeding procedure at all bleeder screws, the brake system is properly bled.
- i) When the first brake circuit has been bled, close the shut-off valve, remove the brake bleeder kit and seal the brake circuit with the screw plug.
- j) Bleed the second brake circuit.

This process might take longer, as the pedal travel is shorter after the first brake circuit has been bled.

- ⇒ Both brake circuits are now bled.
- k) Repeatedly actuate the brake pedal until there is a discernible brake pressure.
- I) Check the filling level and top up brake fluid, if necessary.
  With new brake pads, the level should be halfway between the recommended and the maximum filling level.
  Never let the brake fluid level drop below the minimum filling mark.
- ⇒ The brake system is now bled.



### 8.2.3.1.3 Changing brake pads of RiMO hydraulic brake

If the brake pads have reached the wear limit or are defective, they must be replaced without delay.

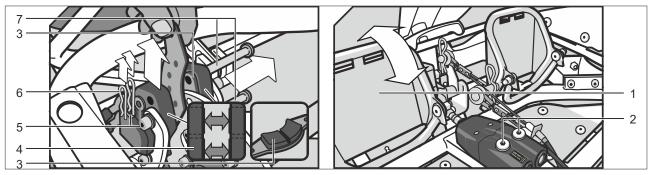


Fig. 62: Changing brake pads

1	Brake pedal	2	Screw plug
3	Brake pads	4	Brake piston
5	Washers	6	Safety cotter pins
7	Bolts		

#### Proceed as follows:

a) Push the brake pads to be replaced back so that the brake pistons are retracted.

### **Attention**



### Damage to brake piston caused by tool

Hard, sharp-edged objects can cause damage to the brake piston (splintering, fracture).

- a) Before replacing the old brake pads, push them back.
- b) Do not use hard, sharp-edged objects to push back the pistons.
- b) Remove the safety cotter pins and the washers.
- c) Pull out the bolts and remove the old pads.
- d) Mount the new pads and push in the bolts.
- e) Mount the safety cotter pins and the washers.
- f) Repeatedly actuate the brake pedal until there is a discernible brake pressure.
- g) Tighten the screw plugs.
- h) Carefully run in the brakes.
- ⇒ The brake pads have now been replaced.







### Running in brakes

Running in or bedding in the brakes describes the process by which the brake pads and brake discs are carefully bedded in so that they fit properly for maximum brake effect. Bedding in the brakes prolongs the service life of the brake pads and discs.

### 8.2.3.1.4 Lubricating mechanical brake parts

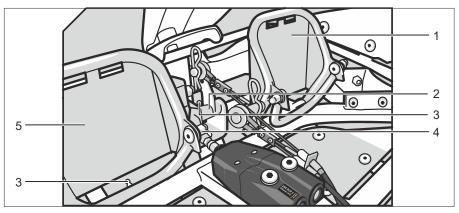


Fig. 63: Lubricating mechanical brake parts

1	Gas pedal	2	Brake pedal
3	Lubrication nipple	4	Knuckle joint
5	Brake pedal		

#### Proceed as follows:

- ✓ The kart is switched off.
- a) Lubricate the brake lever by pushing grease into the lubrication nipple, using a grease gun.
- b) Lubricate the knuckle joint with oil spray (1892089 HHS 2000 adhesive lubricant). Inspect all components to be lubricated for wear.
  - ⇒ If a part is worn so that the diameter or the wall thickness is more than 2 mm below that of a new part, replace it.
- ⇒ The mechanical brake parts are now lubricated.



### 8.2.3.2 Maintenance of pedals

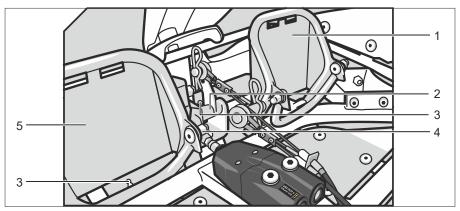


Fig. 64: Checking pedals

1	Gas pedal	2	Brake pedal
3	Lubrication nipple	4	Knuckle joint
5	Brake pedal		

The pedals and screws must not show any sign of wear or damage. The pedals must move easily and return automatically to their initial position when released. Deformed or damaged pedals must be replaced with RiMO original parts. The pedals must be regularly lubricated through the lubrication nipples.

### 8.2.3.3 Maintenance of seat

Check the screws of the seat adjustment, the anti-friction bearings and the silent blocks for damage and ensure that they are properly secured.

Check the levers of the cables and the sleeves for damage. The retaining bolt must properly engage in all seat positions.



### 8.2.3.4 Maintenance of steering system

Deformed or defective steering components must be replaced without delay.

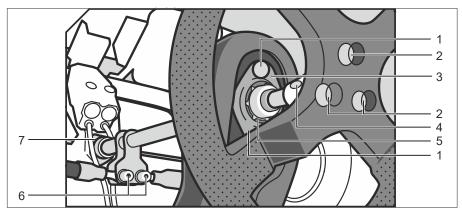


Fig. 65: Maintenance of steering system

1	Screws of steering bearing holder	2	Screws of steering wheel
3	Steering bearing holder, top	4	Screws of steering wheel mount
5	Steering bearing	6	Screws of tie rods
7	Steering column bearing, bottom		

### Replacement of steering system components

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height, for instance by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Remove the screws at the steering wheel.
- c) If necessary, disconnect all electronic connections from the steering wheel.
- d) Loosen the screw of the steering wheel mount and remove the steering wheel mount.
- e) Unscrew the screw of the *steering bearing holder, top* and remove the upper shell of the steering bearing holder.
- f) Open the lock ring at the top of the steering bearing and loosen the clamping ring.
- g) Loosen the bearing by taping the edge of the bearing slightly with a rubber mallet from the bottom. Remove the bearing.
- h) Remove the screws of the tie rods.
- i) Remove the screws of the steering knuckles.
- j) Remove the nut and the brass washer of the steering column bearing, bottom from the steering column.
- k) Replace all parts that need to be changed with original RiMO spare parts.



I) Assemble and mount the dismantled components following the above instructions in reverse order. Observe the prescribed tightening torques for the screws:

Screws of steering wheel = 10 Nm Screw of steering wheel mount = 30 Nm

Screws of steering bearing holder, top = 25 Nm Screws of tie rods = 30 Nm

Steering column, bottom = 20 Nm Screws of steering knuckles = 45 Nm

For all other tightening torques, refer to chapter Tightening torques [▶ 129].

### 8.2.3.5 Maintenance of steering alignment system

#### See also

- Maintenance/change of wheels [▶ 115]
- ☐ Tightening torques [► 129]

### 8.2.3.5.1 Checking tracking alignment

The tracking alignment must be checked with a tracking alignment tool.

#### See also

Tracking realignment [▶ 113]

### 8.2.3.5.2 Checking steering knuckles

 Inspect the steering knuckles for damage and excess play on a weekly basis. The steering knuckles must not be bent or cracked. The steering knuckles must not be stiff, and the bearings must not show any play in any direction when the steering knuckles are under load.



### 8.2.3.5.3 Tracking realignment

If a component of the steering system has been replaced, or if the steering alignment of the kart is poor, it must be adjusted.

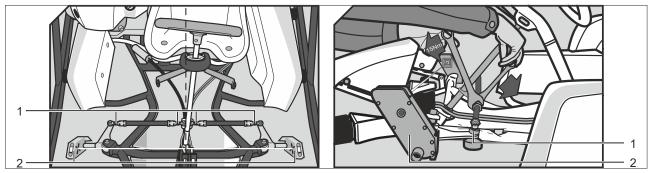


Fig. 66: Aligning steering

1 Wheel alignment tool 2 Locknuts at tie rods
---

#### Proceed as follows:

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height, for instance by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Remove the wheels (see Maintenance/change of wheels [ 115]).
- c) Position the laser wheel alignment tool (prod. no. 1391018) with the integrated spirit level in a horizontal position and attach it to the steering knuckles, using the centring screws (figure left).
- d) Loosen the locknuts of the tie rods.
- e) Position the steering column so that the tie rod mount (figure to the left) is aligned to the longitudinal axis of the kart.
- f) Turn the tie rods to adjust the tracking zero point. Tracking zero is reached when both laser beams touch the vertical zero line (during adjustment, observe the positions of the steering column and the spirit level and adjust them, if necessary).
- g) Turn all tie rod heads back (figure to the right).
- h) Lock the tie rod heads with 15 Nm (figure right).

### **Attention**



### Damage to tie rod heads due to incorrect tightening torque

If the locknuts are tightened too much, they might weaken the material, which can lead to facture in the tie rod heads. If the locknut tightening torque is insufficient, the tie rods might shift or lose their steering effect.

a) Tighten and lock the tie rod heads with the prescribed torque.



- i) Remove the tracking alignment tool.
- j) Mount the wheels (see Maintenance/change of wheels [ 115]).
- ⇒ The steering alignment is now adjusted.

### Steering stop

When the steering wheel is turned to the very left or right, it must reach the steering stop attached to the frame. In every steering position, the tie rod heads must be moving without stiffness, allowing for turning with minimum effort.

Bent of broken components of the steering system must be replaced without delay with original RiMO spare parts.

#### See also

☐ Tightening torques [► 129]

### 8.2.3.6 Maintenance/change of wheels

Tyres that are worn or damaged must be replaced without delay.

When replacing tyres, observe the following:

- Replace tyres, if the wear mark is no longer visible or if the tread/carcase is damaged.
- Always replace tyres in pairs, i.e. replace both tyres of the front or of the rear axle, or replace all four tyres together. Dispose of worn tyres according to the statutory waste disposal regulations.
- Observe the direction mark on the tyres (if any).
- Only use tyres and wheel rims of the size specified by RiMO. Wheels or tyres with other dimensions can cause damage to the vehicle and lead to unexpected drive behaviour, resulting in accidents.
- When mounting the tyres on the wheels, do not inflate them to more than 4 bar, as there is otherwise a risk that the wheel become damaged or the tyre bursts.
  - The tyre pressure for normal driving operation is between 1.2 and 2 bar. For other tyre pressures, contact the manufacturer.
- Poor tracking alignment can cause excessive tyre wear. Use only tyres that are suitable for your vehicle and your track.



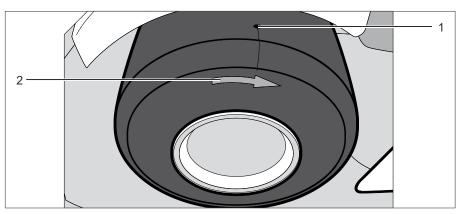


Fig. 67: Checking wheels

1 Wear mark	2 Arrow: direction of rotation of wheel
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### Removing wheels



### **NOTICE**

### Mounting wheels on front and rear axle

The front wheels are secured with one hexagon nut each. The rear wheels are secured with three hexagon nuts each.

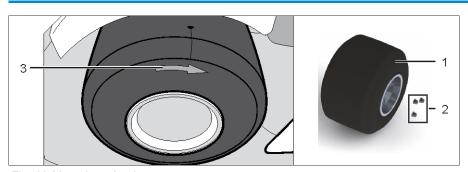


Fig. 68: Mounting wheel

1	Wheel	2	Hexagon nuts
3	Arrow: direction of rotation of wheel		

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height, for instance by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Remove the wheel nut at the front wheel or the three wheel nuts at the rear wheel.
- c) Pull the wheel from the wheel centre or the steering knuckles.
- ⇒ The wheel is removed from the kart.



### Removing tyre

- ✓ The wheel is removed from the kart.
- a) Push the tyres from the wheel flanks, using a tyre removal machine.

  Observe the operating instructions for the tyre removal machine.
  - ⇒ The tyre is removed from both wheel flanges.
- b) Remove the tyre from the wheel, using a tyre removal machine and a removal iron.
- ⇒ The tyre is removed from the wheel.

### Mounting tyre

### **⚠ WARNING**



### Risk of accident from non-approved wheel rims or tyres

Non-approved wheel rims and tyres can cause damage to the bodywork of the kart. The road adhesion of the tyres might not be suitable for the kart. This can result in serious injury.

- a) Use only wheel rims and tyres that have been approved by RiMO.
- ✓ The old tyre has been removed from the wheel.
- a) Apply mounting paste onto the sealing faces of the new tyre.
- b) Mount the new tyre on the wheel, using the tyre removal machine. If required, observe the running direction. Observe the operating instructions for the tyre removal machine.
- c) After mounting, inflate the tyre (max. 4.0 bar) until the tyre flange is tightly pressed against the flange. The tyre pressure for normal driving operation is between 1.2 and 2 bar. For other tyre pressures, contact the manufacturer.
- d) Release the tyre pressure to the level recommended by the tyre manufacturer.
- ⇒ The new tyre is mounted.



### Mounting wheels and adjusting wheel bearings

### **⚠ WARNING**



#### Risk of accident from non-approved wheel rims or tyres

Non-approved wheel rims and tyres can cause damage to the bodywork of the kart. The road adhesion of the tyres might not be suitable for the kart. This can result in serious injury.

a) Use only wheel rims and tyres that have been approved by RiMO.

### **NOTICE**



#### Mounting wheels on front and rear axle

The front wheels are secured with one hexagon nut each. The rear wheels are secured with three hexagon nuts each.

When mounting the wheel, adjust the bearing play of the front axle wheel bearing.

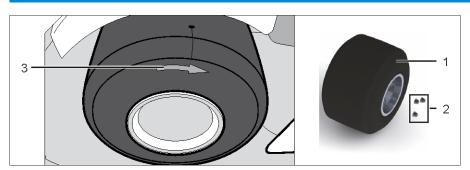


Fig. 69: Mounting wheel

1	Wheel	2	Hexagon nuts
3	Arrow: direction of rotation of wheel		

- ✓ The new tyres are mounted.
- a) Position the kart safely at an ergonomically suitable height (e.g. with KHB 250 lifting platform).
- b) Apply assembly paste to the front axle steering knuckles.

NOTICE! The assembly paste is not included in the scope of delivery and can be purchased separately from RiMO. Contact RiMO service department for advice. Product no.: 1892036 - HSP 1400 lubrication, disassembly and corrosion protection paste

c) Slide the rear wheels onto the wheel centres. Slide the front wheels onto the steering knuckles. Ensure that the wheels do not become jammed or misaligned and avoid damage to the treads.

NOTICE! The narrow wheels are the front wheels. The wide wheels are the rear wheels. If the wheels feature a direction mark arrow, observe it.



- d) Rear axle: Mount the three hexagon nuts and tighten them with the prescribed torque (see Tightening torques [\* 129]).
- e) Front axle: Mount the hexagon nut and tighten it a little. Turn the wheel to check whether it rotates freely. If the wheel **rotates freely**, tighten the hexagon nut further and check again for free rotation. If the wheel **does not rotate freely**, the hexagon nut has been tighten too far. In this case, increase the axial bearing play (max. permissible axial bearing play: 0.5 mm). Loosen the hexagon nut and check against for free rotation.
- f) Adjust the hexagon nut so that the wheel rotates freely.
- g) Proceed accordingly to mount the second wheel.

### 8.2.3.6.1 Checking and adjusting wheel bearings

When mounting the wheel, adjust the bearing play of the front axle wheel bearing.

### Checking wheel bearing

- ✓ The kart is switched off.
- a) Prop up the kart and check whether the front wheels rotated freely.
- b) Turn the wheels to check whether they rotate freely.
- c) Front axle: Mount the hexagon nut and tighten it a little. Turn the wheel to check whether it rotates freely. If the wheel **rotates freely**, tighten the hexagon nut further and check again for free rotation. If the wheel **does not rotate freely**, the hexagon nut has been tighten too far. In this case, increase the axial bearing play (max. permissible axial bearing play: 0.5 mm). Loosen the hexagon nut and check against for free rotation.
- d) Adjust the hexagon nut so that the wheel rotates freely.
- ⇒ The bearing play has been checked and adjusted.

### 8.2.3.7 Replacing safety elements

Damaged bodywork parts and other safety elements must be replaced without delay.

### **MARNING**



Risk of injury from sharp-edged bodywork parts or defective surround protection

Vehicles whose bodywork or surround protection is defective do not meet the statutory safety standard and must be removed from the track without delay. Sharp-edged bodywork components can cause serious injury.

a) Replace damaged safety elements without delay.





Fig. 70: Safety elements/bodywork

1 Bodywork	2 Surround protection and rubber silent blocks
------------	--

### Replacing bodywork

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height, for instance by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Remove the defective bodywork.
- c) Mount the new bodywork. Tighten the screws with the prescribed tightening torque (see Tightening torques [> 129]).
- ⇒ The bodywork has been replaced.

### Replacing surround protection

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height, for instance by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Remove the entire surround protection.
- c) Mount the new surround protection. Tighten the screws with the prescribed tightening torque (see Tightening torques [> 129]).
- ⇒ The surround protection is now replaced.



### 8.2.3.8 Maintenance of screw connections

### **MARNING**



#### Risk of accident from defective screw connections

Defective screw connections can result in accidents and serious injury.

a) Before starting the kart, check the screw connections on the kart for proper fixture.

#### Check the following screw connections:

- Screw connections of steering knuckles
- Screw connections of wheel bearings
- Screw connections of tie rods
- Screw connections of steering bearing, top
- Screw connections of seat fixture
- Screw connections of motor and clamping device
- Screw connections of rear axle bearing
- Screw connections of front and rear pinion
- Screw connections of wheel centres and wheel fixtures
- Screw connections of brake system

Screws and bolts that show damage or defects must be replaced without delay with original RiMO parts or DIN ISO EN standard parts with identical strength properties.



### 8.2.3.9 Maintenance of safety belts

For best operational safety of the vehicle, it should be equipped with a rollbar and a three-point or four-point safety belt. These safety devices must be inspected for damage and tested on a daily basis.

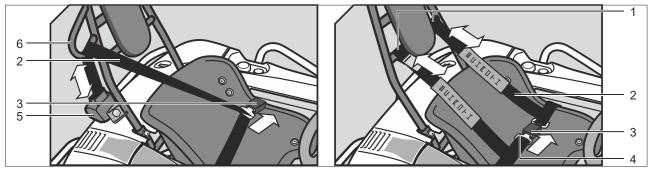


Fig. 71: Safety belts

1	Belt fixture	2	Belt
3	Belt buckle	4	Belt tab
5	Belt tensioner	6	Belt deflector

### 3-point safety belt

- Inspect the belt for frayed edges, broken strands, torn seams, cuts of damage from chemicals. Check both belt faces for defects.
- Check whether all fixtures are firmly secured and the belt buckle is in working order.
- Test the belt tensioner. Pull out the belt to the stop and release it to check whether it fully retracts. Pull the belt firmly to check whether the belt tensioning mechanism engages.
- Check whether the belt tab fits into the belt buckle and engages properly.
- Open the buckle and check whether the tab is properly released.

### 4-point safety belt

- Inspect the belt for frayed edges, broken strands, torn seams, cuts of damage from chemicals. Check both belt faces for defects.
- Check whether all four points of fixture of the four-point belt are properly secured.
- Check whether the belt tab fits into the belt buckle and engages properly.
- Open the buckle and check whether the tab is properly released.
- If there is a loose belt end, it must be secured so that it does not touch the ground or any rotating kart parts.



### Cleaning safety belts

### **Attention**



### Damage to belt from cleaning agent

Chemicals in cleaning products can cause damage to the safety belts. As a result, the belts might not work properly, which can cause serious injury.

a) Clean the belts only with cleaning products approved by the belt manufacturer.

### 8.2.3.10 Maintenance of ACD controller

### Operating status

The status LED indicates the operating status of the ACD motor controller.

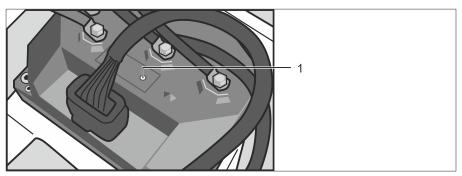


Fig. 72: ACD motor controller

1	Status LED of ACD motor controller	

Signal	Description
LED off	Controller not in operation
LED continuously on	Controller activated and ready
LED flashing slowly (1 Hz)	Warning pending
LED flashing quickly (10 Hz)	Error pending; motor current interrupted

#### Cable connections

Regularly check the cable connections. Make sure that there are no loose cable connections, as they might lead to overheating.

When securing the cables to the controller, do not exceed the maximum permissible tightening torque of 8 Nm. The contacts at the controller might otherwise break off, and/or the controller could be damaged.



### 8.2.3.11 Maintenance of gas sensor

When the gas pedal is in its zero position, the gas sensor must not be actuated.

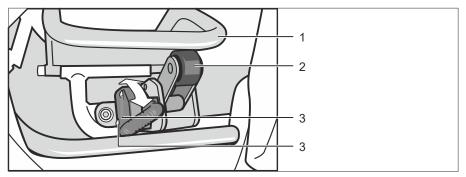


Fig. 73: Gas sensor

1	Gas sensor	2	Gas pedal
3	Securing screws		

### Adjusting gas sensor

- ✓ The kart is switched off.
- a) Position the kart safely at an ergonomically suitable height, for instance by placing it on an assembly trolley or a lifting platform (e.g. KHB 250 EH, prod. no.1397002).
- b) Loosen the securing screws of the gas sensor and adjust it so that the sensor is not actuated when the gas pedal is in its zero position, but the kart is accelerated at the maximum rate when the gas pedal is pushed to the stop.
- c) Tighten the screws with a tightening torque of < 1 Nm. When tightening the screws, ensure that the gas sensor is not turning.
- d) After tightening the screws, test the gas pedal and gas sensor functions again.
- e) If necessary, repeat the above adjusting procedure.
- ⇒ The gas sensor is now correctly set.

### 8.2.4 Checking and servicing electrical parts

- a) Regularly inspect the electrical components for damage.
- b) If you detect any damage to electrical parts, immediately remove the kart from the track and have it repaired by a qualified workshop, using original spare parts.

### See also

Repairs [▶ 132]



### 8.2.4.1 Testing EMERGENCY-STOP function

- ✓ Switching on the kart.
- a) Actuate the EMERGENCY-STOP button.
  - ⇒ Actuating the EMERGENCY-STOP button must result in an immediate halt of all kart movements.
- ⇒ Repeat this test with all installed EMERGENCY-STOP devices.

### 8.2.4.2 Maintenance of safety devices

To ensure that the kart is safe to drive at all times, certain safety-relevant components must be replaced when they reach the end of their service life.

To prevent damage to or failure of the safety system, replace these components without delay and perform a function test of the respective safety circuit. In certain cases, additional components might need to be replaced.

Contact RiMO service department for advice.

### See also

Contacting RiMO GERMANY GmbH & Co. KG [▶ 12]

### 8.2.4.3 Maintenance of battery cells/side box

### Closing side box

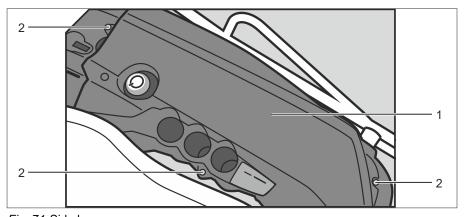


Fig. 74: Side box

1 Side box 5 Screw fittings
-----------------------------

When closing the box, ensure that no cables are caught by the sharp edges or can come into contact with rotating parts. Tighten the screws of the lid with a torque of maximum 2 Nm.



### 8.2.4.4 Maintenance of drive switch

The drive switch is an EMERGENCY-STOP switch designed for the switching of high direct currents.

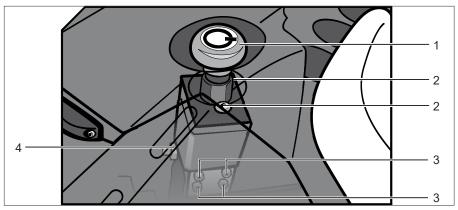


Fig. 75: Drive switch

1	Drive switch	2	M5 securing screws
3	Screws at bracket	4	Screws at load cable

When mounting the drive switch, ensure that the M5 securing screws are tightened with max. 1.5 Nm. The screws at the bracket in the side box must be secured **WITH** screw locking compound (e.g. Loctite). The connection to the side box top section must be made **WITHOUT** screw locking compound. Tighten the load cable screws with 7-8 Nm.



### **NOTICE**

### Mounting spring washers

Spring washers prevent nuts and screws from becoming loose.

### 8.2.4.5 Charging batteries

### Charging

Charging is only enabled by the BMS if the following conditions are met:

- Kart is switched on (main switch set to ON).
- Drive switch is pushed in (OFF).
- No error is pending (see Warning and error signals [▶ 28]).
- At least 1 cell has a voltage below 3.56 V.

Should the charging process take longer than usual, the cells carry very different charges, or at least one cell is no longer OK.

The charging and discharging process must be monitored at the LCD monitor or WFM.



As soon as only LED 1 and LED 3 on the charger are lit in green and message END is displayed, the cells of the kart are fully charged. We recommend connecting the charger to the kart at least once a day until the cells are fully charged. This ensures that the cells are better balanced and that their maximum capacity can be utilised. The cells cannot be overcharged.

### Charging batteries

### **Attention**



### Faults during charging

When the kart is being charged, keep an eye on it. In the event of a fault, immediately terminate the charging process.

a) Do not charge the kart unsupervised during the night.

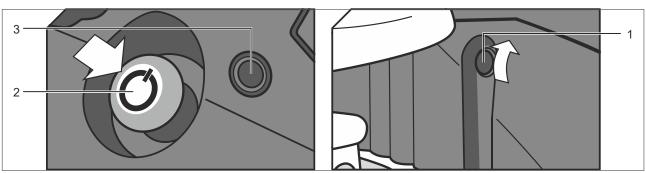


Fig. 76: Drive switch and main switch

1	Main switch	2	Drive switch
3	Drive switch indicator		

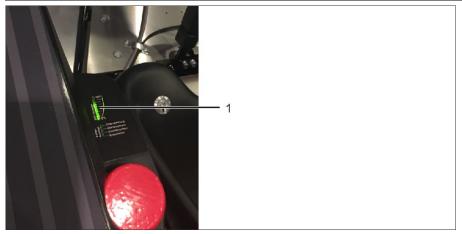


Fig. 77: Charge indicator

1 Battery charge status
-------------------------



- ✓ The kart is standing still.
- a) Ensure that the *drive switch* is pushed in (OFF position).
- b) Switch on the main switch.
- c) Switch on the charger and connect the charging plug to the kart. Ensure that the plug is fully inserted into the socket. For more information, refer to Charger [▶ 32] or contact RiMO service department.
  - ⇒ The charging process starts automatically.
  - ⇒ When the batteries are fully charged (100 %), LED 1 and LED 3 are lit in green and message "END" is displayed on the charger display. Also, the battery charge indicator in the kart indicates that 100% charge is reached.
- d) Disconnect the charging plug from the kart.

CAUTION! Do not disconnect the charging plug while the kart is being charged. Do not disconnect the charging plug by pulling the cable.

⇒ The batteries are fully charged.





#### Reducing or interrupting charging current

Towards the end of the charging process, the charging current might be gradually reduced or interrupted for short periods of time. This behaviour is known as "toggling" and helps balancing the cells, thus enhancing the capacity of the batteries.

### Disconnecting charger from mains power

The charger is powered through a mains lead. Disconnect the charger from the mains power supply, if:

- The charger is not regularly in use.
- The charging electronics are to be reset, e.g. following a fault message.

#### See also

- Exchanging/replacing battery cells [▶ 132]
- Warning and error signals [▶ 28]



## 8.2.5 Replacing wear parts

a) Replace all wear parts such as brake pads when they have reached the end of their service life.

For more information, contact RiMO service department.

#### See also

- Contacting RiMO GERMANY GmbH & Co. KG [▶ 12]
- Technical documents/appendices [▶ 141]

# 8.3 Tightening torques

Location of screw connection	Tightening torque
Steering knuckles - frame	45 Nm
Adapter plate transmission / motor - motor	25 Nm
Adapter plate transmission / motor - transmission	25 Nm
Adapter plate transmission / motor - frame	20 Nm
Adapter plate - frame	20 Nm
Safety belt securing points	30 Nm
Brake lever mechanism - frame	45 Nm
Brake calliper - frame	25 Nm
Brake disc - wheel centre	25 Nm
Gas sensor - frame	25 Nm
Transmission - frame	25 Nm
Motor controller mounting plate - frame	20 Nm
Main brake cylinder -frame	12 Nm
Rear wheels - wheel centres	25 Nm
Motor controller cable connections	8 Nm
Motor clamping flange - transmission connection	35 Nm
Charger plug - frame	3 Nm
Load cable (25mm²) - drive switch (EMERGENCY-STOP button)	7 Nm



Location of screw connection	Tightening torque
Steering wheel - steering wheel mount	10 Nm
Steering wheel mount - steering column	30 Nm
Steering column - steering column bearing, bottom	20 Nm
Steering column bearing holder, bottom - frame	4 Nm
Steering column bearing shell, top - steering column brace	25 Nm
Steering column brace - frame	30 Nm
Motor controller - motor controller mounting plate	6-7 Nm
Pad - surround protection	10 Nm
Wheel centres - drive shaft	30 Nm
Surround protection - silent rubber elements	35 Nm
Side box top part - drive switch (EMERGENCY-STOP button)	2 Nm
Side box top part - side box bottom part	3-4 Nm
Tie rod (locknuts) - tie rod heads	15 Nm
Tie rod heads - steering knuckles / steering column	30 Nm
Tank - left base plate	20 Nm
Rollbar top part - rollbar bottom part	30 Nm
Rollbar bottom part - frame	30 Nm
Connecting plates - cell poles	5 Nm
Brake calliper screw plugs	12 Nm
Main brake cylinder screw plugs	5 Nm

If you have any questions, contact RiMO service department.

### See also

Contacting RiMO GERMANY GmbH & Co. KG [▶ 12]



# 8.4 Wear and spare parts

All spare parts must meet the technical specifications laid down by RiMO. Original RiMO spare parts meet this requirement and undergo stringent inspections.

RiMO shall not be liable for damage caused by the use of third-party spare parts.

For queries and to order wear and spare parts, please contact RiMO, providing the following information:

- Type
- Product number
- Year of manufacture
- Part designation
- Quantity
- Shipping method

### Wear and spare parts list

For more information, contact RiMO service department.

#### See also

- Contacting RiMO GERMANY GmbH & Co. KG [▶ 12]
- Technical documents/appendices [▶ 141]

### 8.4.1 Storage of tyres

As there are flammable chemicals present, we recommend storing as few tyres as possible along the kart track or its vicinity.

### 8.5 RiMO customer service

If you have any questions, contact RiMO service department.

#### See also

Contacting RiMO GERMANY GmbH & Co. KG [▶ 12]



# 9 Repairs

This chapter describes the repairs that can be carried out on site. It also provides information on who is authorised to carry out repairs.



### **NOTICE**

During the warranty period, do not carry out any repairs on the kart without first consulting RiMO.

#### See also

Contacting RiMO GERMANY GmbH & Co. KG [▶ 12]

# 9.1 Repair tasks to be performed by operator

Repairs can be carried out by the operator, provided that he/she has the necessary technical knowledge and skills. Repairs are excluded from the RiMO warranty.

If you have any questions regarding repairs, contact RiMO service department.

### 9.1.1 Exchanging/replacing battery cells

When a LiFeMnPo4 cell has come to the end of its service life, it must be replaced. Observe the following instructions:

### Identifying defective cell

A cell is deemed defective, if:

- The cell fails to reach a final charge voltage of 3.57 V and
- the same cell, due to its undervoltage of 2.55 V, switches off after a drive time that is much shorter than the average drive time.

The voltage of the cell is displayed on the BMS LCD display. Alternatively, it can be read with the WFM.



### Removing defective cell

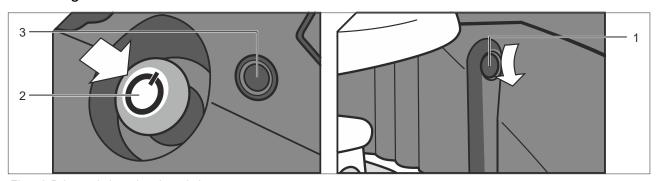
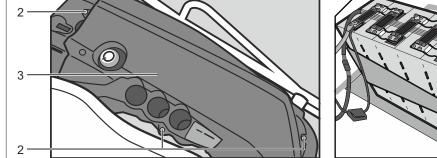


Fig. 78: Drive switch and main switch

1	Main switch	2	Drive switch
3	Drive switch indicator		
2			



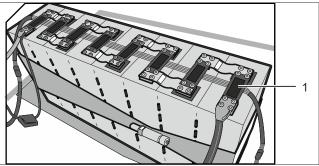


Fig. 79: Cells in side box

1	Sense boards	2	Side box screws
3	Side box		

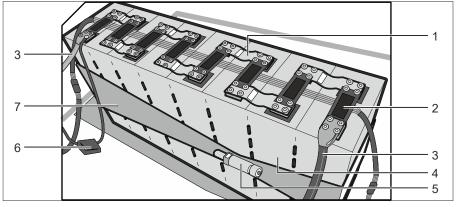


Fig. 80: Disconnecting cells

1	Cell connector	2	Sense board
3	Load cable	4	Cell connector
5	Brace screws	6	Main power cable
7	Brace		



- ✓ The kart is in a suitable position for charging (box lane, etc.) and is switched off.
- a) Fully charge the kart (100 %) (seeCharging batteries [ 126]).
- b) Disconnect the charging plug.
- c) Push in the drive switch to switch off the kart.
  - ⇒ The *drive switch indicator* is off.
- d) Switch off the main switch.
- e) Remove the screws at the side box and lift off the lid.
- f) Disconnect the sense boards from BMS.

### **A** CAUTION



### Risk of injury from short circuit

When disconnecting the load and main power cables, there is a risk of a short circuit. This can result in serious injury.

- a) When disconnecting the load and main power cables from the cells, insulate them.
- g) Disconnect and insulate the load and main power cables.
- h) Lift the cell pack from the side box.
- i) Remove the cell connector and the sense boards from the cell you wish to replace. Write down the cell numbering sequence.
- j) Loosen the screws at the brace and remove the brace.

### **A** CAUTION



### Risk of injury from short circuit

When removing defective cells from the cell pack, there is a risk of a short circuit. This can result in serious injury.

- a) Make sure that the cell contacts never touch each other.
- k) Remove the defective cell from the pack.
- ⇒ The defective cell has now been removed.



### Installing new cell

### Attention



### Risk of damage to battery from unsuitable cells

The installation of cells that have not been approved by RiMO can cause serious damage to the kart battery.

a) Therefore only install cells approved by RiMO.

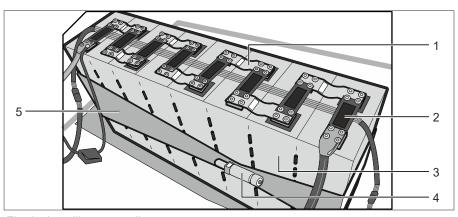


Fig. 81: Installing new cell

1	Cell connector	2	Sense board
3	Cell pack	4	Brace screws
5	Brace		

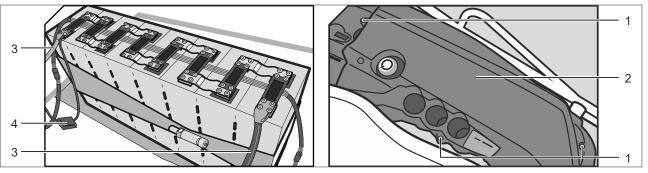


Fig. 82: Installing cell pack

1	Side box screws	2	Side box
3	Load cable	4	Main power cable

- ✓ The new cell is fully charged (100 %).
- a) Place the new, charged cell anywhere in the cell pack.

### NOTICE! Observe cell polarity (+/-).



- b) Mount the brace and secure the cell pack by tightening the screws. Make sure that the temperature sensors are in the same positions as before and that they cannot be come squeezed or otherwise damaged.
- c) Mount the sense boards and cell connectors.
- d) Lift the cell pack into the side box. Ensure that none of the cables and components is damaged in the process. Observe the pack polarity.
- e) Connect the load cable and the main power cable.
- f) Connect the sense boards to the BMS.
- g) Replace the side box lid and secure it with the screws. Ensure that none of the cables and components is damaged in the process.
- ⇒ The new cell is now installed.

### Starting the kart

The kart can now be started (see Daily start-up [▶ 76]).

Should the new cell not be automatically detected by the BMS, connect the charger and fully charge the kart (100 %).

This charging process might take a bit longer than usual, as the new cell is balanced by the BMS with the existing cells.

### 9.1.2 Replacing transmission

When replacing the transmission, make sure that the clamping hub between the motor and the transmission is tightened with a torque of 35 Nm. When inserting the motor shaft into the transmission, ensure that the clamping hub, the clamping sleeve and the motor shaft are free from grease.

The slots of the clamping hub and the clamping sleeve must be aligned to the groove in the motor shaft.

If you need to replace the transmission, contact RiMO service department.

## 9.2 Repairs to be carried out by RiMO

All welding and alignment work on the frame and attached components must be carried out by RiMO.

Repairs on defective or faulty components are not admissible. These components must be replaced with new ones.



# Decommissioning, storage and disposal

The following general rules apply to the decommissioning, storage and disposal of the kart:

All tasks described below must be performed by specially trained and authorised skilled workers.

- a) Switch off the kart by pressing the drive switch and secure it against inadvertent switching on.
- b) Before starting work, allow hot parts to cool down.
- c) Wear suitable personal protective equipment.
- d) Cordon off the working area with a red/white chain to keep unauthorised persons away from the kart.
- e) Some of the kart components are very heavy. Use suitable lifting gear and tackle.

Safety instructions for decommissioning, storage and disposal

### 

### Risk of injury when coming into contact with powered electrical components of the kart



Electric shock can cause serious injury.

- a) All work on the electrical system of the kart must be carried out by qualified electricians.
- b) Before carrying out any work on the electrical system, disconnect the kart from the power supply.
- c) Check the system for residual voltage.
- d) Cover or otherwise insulate adjacent kart parts that remain powered.

#### 10.1 Decommissioning

Before putting the kart into storage or otherwise decommission it for prolonged standstill (longer than one month), proceed as follows:

- a) Drive the kart for minimum 10 minutes.
- b) Fully charge the kart batteries (100 %) until message "END" is displayed on the charger.
- c) Then discharge the batteries to approx. 70 % ± 5 %, for instance by driving the kart.
- d) Push in the *drive switch* to switch off the kart.
  - ⇒ The *drive switch indicator* is off.



- e) Switch off the main switch.
- f) Place the kart in a suitable location and cover it, if required.

### NOTICE! Do not disconnect any cables and do not remove any kart components.

⇒ The kart has been decommissioned.

### Performing recharging cycles

When not in use, the kart must be regularly serviced by performing two recharging cycles. This is necessary to retain the battery performance.

attery capacity Recharging cycles after	
100 AH	12 months
60 AH	8 months
40 AH	6 months

- a) Fully charge the kart batteries (100 %) until message "END" is displayed on the charger.
- b) Then discharge the batteries to approx. 70 % ± 5 %, for instance by driving the kart.
- c) Repeat this charging/discharging procedure.
- ⇒ The kart can now be returned to storage.

## 10.2 Dismantling

- ✓ The kart has been decommissioned.
- a) If necessary, remove the wheels (see Maintenance/change of wheels [> 115]).
- b) Remove the steering wheel (see Maintenance of steering system [ 111]).
- ⇒ The kart is now disassembled.

# 10.3 Packaging kart

- ✓ The kart is fully disassembled.
- a) Package the kart so that it is protected against moisture and dust.
- $\Rightarrow$  The kart is now packed.



## 10.4 Storing the kart

Store the kart and its components under the conditions specified in the technical data.

#### See also

Technical data [▶ 43]

# 10.5 Disposal

Most components of the kart are made from recyclable materials. When handled properly, the kart does not pose a hazards to operators or the environment. Operating the kart requires the use of lubricants and other chemicals that may be harmful to the environment and that must therefore be disposed of according to the applicable regulations. The safety data sheets of factory-applied substances are available from RiMO.

Dismantle the kart and dispose of the various components (e.g. batteries, motors, metal components, etc.) according to the statutory waste disposal regulations. To dispose of karts without dismantling it, contract a specialist waste disposal company.

Always observe the statutory waste disposal regulations.



### **NOTICE**

If you have any queries regarding the disposal of your kart, contact RiMO service department.

### See also

- Technical documents/appendices [▶ 141]
- Contacting RiMO GERMANY GmbH & Co. KG [▶ 12]



### 10.5.1 Changing batteries and disposal

Should you need to replace the batteries, RiMO offers you the following options:

courses with certification for safe battery handling and cell replacement.

- 1. Spent batteries are replaced on site by a RiMO technician. Spent cells can be returned to RiMO for disposal free of charge.
- 2. The operator sends the cell systems including the plastic box to RiMO. RiMO places new cells in the box and sends the cell system back to the operator. Spent cells can be returned to RiMO for disposal free of charge.
- 3. The operator replaces the spent cells on site and returns them to RiMO for disposal.
  Spent cells can be returned to RiMO for disposal free of charge. With the last option, you must provide evidence to RiMO that the person to replace the cells is suitably qualified to do this. RiMO offers training



# 11 Technical documents/appendices



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# 14 Glossary

#### **BMS**

Battery management system

С

Coulomb, unit for electric charge.

### C rating

C rating indicates the maximum safe continuous discharge rate of a battery under certain ambient conditions.

#### **EMC**

Electromagnetic compatibility

### **PMS**

Permanent magnet synchronous

#### WFM

Wireless fleet management



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