

Invacare® Leo

SERVICE MANUAL



This manual contains information on:

Troubleshooting

Maintenance

Repair

Edition: 22.05.07

A	Mobitec Mobilitätshilfen GmbH Herzog Odilostrasse 101 A-5310 Mondsee Austria	☎ Fax: @: @: WWW:	+43 - 6232 - 55 35 0 +43 - 6232 - 55 35 4 office@mobitec-austria.com austria@invacare.com www.mobitec-austria.com
B	Invacare® n.v. Autobaan 22 B-8210 Loppem (Brugge) Belgium	☎ Fax: @: WWW:	+32 - (0)50 - 83 10 10 +32 - (0)50 - 83 10 11 belgium@invacare.com www.invacare.be
CH	Mobitec Rehab AG Benkenstraße 260 CH-4108 Witterswil Switzerland	☎ Fax: @: @: WWW:	+41 - (0)61 - 48 77 08 0 +41 - (0)61 - 48 77 08 1 office@mobitec-rehab.ch switzerland@invacare.com www.mobitec-rehab.ch
D	Invacare Aquatec Alemannenstraße 10 88316 Isny Deutschland	☎ Fax: @: WWW:	0 75 62 / 7 00 - 251 08 00 / 6 73 81 72 info@invacare-aquatec.de www.invacare-aquatec.de
DK	Invacare® A/S Sdr. Ringvej 39 DK-2605 Brøndby Danmark	☎ (Kundeservice): Fax (Kundeservice): @: WWW:	+45 - (0)36 - 90 00 00 +45 - (0)36 - 90 00 01 denmark@invacare.com www.invacare.dk
E	Invacare® SA c/ Areny, s/n Poligon Industrial de Celrà 17460 Celrà (Girona) ESPAÑA	☎ : Fax: @: WWW:	+34 - (0)972 - 49 32 00 +34 - (0)972 - 49 32 20 contactsp@invacare.com www.invacare.es
F	Invacare® Poirier SAS Route de St Roch F-37230 Fondettes France	☎ : Fax : @: WWW:	+33 - (0)247 - 62 64 66 +33 - (0)247 - 42 12 24 contactfr@invacare.com www.invacare.fr
GB	Invacare® Ltd South Road Bridgend Industrial Estate Mid Glamorgan - CF31-3PY United Kingdom	☎ (Customer Service): Fax (Customer Service): @: @: WWW:	+44 - (0)1656 - 664 321 +44 - (0)1656 - 667 532 uk@invacare.com eire@invacare.com www.invacare.co.uk

I	Invacare Mecc San s.r.l.	☎	+39 - 0445 - 38 00 59
	Via Dei Pini, 62	Fax:	+39 - 0445 - 38 00 34
	I - 36016 Thiene (VI)	@:	italia@invacare.com
	ITALIA	WWW:	www.invacare.it

IE	Invacare Ireland	☎	+353 - 18 10 70 84
	Unit 5 Seatown Business Campus	Fax:	+353 - 18 10 70 85
	Seatown Rd, Swords	@:	eire@invacare.com
	Dublin		
	Ireland		

N	Invacare® AS	☎ (Kundeservice):	+47 - (0)22 57 95 10
	Grensesvingen 9	Fax (Kundeservice):	+47 - (0)22 57 95 01
	Postboks 6230	@:	norway@invacare.com
	N-0603 Oslo	WWW:	www.invacare.no
	Norge		

NL	Invacare® B.V.	☎ :	+31 - (0)318 - 69 57 57
	Celsiusstraat 46	Fax:	+31 - (0)318 - 69 57 58
	NL-6716 BZ Ede	@:	csede@invacare.com
	The Netherlands	WWW:	www.invacare.nl

P	Invacare® PORTUGAL Lda	☎ :	+351-225105946
	Rua Senhora de Campanhã 105	Fax:	+351-225105739
	P-4369-001 Porto	@:	portugal@invacare.com
	PORTUGAL	WWW:	www.invacare.pt

**Aterförsäljare:****Invacare® AB**

Fagerstagatan 9

S-163 91 Spånga

Sverige

☎ (Kundtjänst): +46 - (0) 8 761 70 90

Fax (Kundtjänst): +46 - (0) 8 761 81 08

@: sweden@invacare.com

@: finland@invacare.com

WWW: www.invacare.se

Tillverkare:**Invacare® Deutschland GmbH**

Kleiststraße 49

D-32457 Porta Westfalica

Deutschland**MÖLNDAL**

☎ +46 - (0) 31 – 86 36 00

Fax: +46 - (0) 31 – 86 36 06

@: ginvacare@invacare.com

LANDSKRONA

☎ +46 - (0) 418 – 285 40

Fax: +46 - (0) 418 – 180 89

@: linvacare@invacare.com

OSKARSHAMN

☎ +46 - (0) 491 – 101 40

Fax: +46 - (0) 491 – 101 80

@: oinvacare@invacare.com

Table of Contents

Chapter	Page
1 INTRODUCTION	6
1.1 General information	6
1.2 Notes on transport	6
1.3 Important symbols in this manual	6
2 SAFETY AND ASSEMBLY INSTRUCTIONS	8
2.1 Before any inspection or repair work	8
2.2 General safety information and notes on assembly / disassembly	8
3 TIGHTENING TORQUES	10
4 SERVICE PLAN (1X ANNUALLY)	11
5 OPERATIONAL FAULTS	12
5.1 Operational faults	12
5.1.1 Drive fault diagnosis	12
5.2 Error Codes and Diagnostic Codes	13
6 REPAIR WORK	15
6.1 General warning information on installation work	15
6.2 Replacing the drive motor	15
6.3 Replacing the electronics	17
6.4 Updating software	19
6.5 Replacing the potentiometer	20
6.6 Replacing operating console	23
6.7 Replacing front axle	25

1 Introduction

1.1 General information

- All maintenance and overhaul work must be carried out in accordance with these repair instructions.
- Please observe all safety instructions.
- Information about operation or about general maintenance and care work should be taken from the electric vehicle Operating Manual.
- You can find information about ordering spare parts in the spare parts catalogue.
- Use only genuine Invacare® spare parts. Using parts from any other source will void the warranty!
- We reserve the right to make any alterations on the grounds of technical improvements.
- The electric vehicle may only be maintained and overhauled by qualified personnel.
- The minimum requirement for service technicians is relevant training, such as in the cycle or orthopaedic mechanics fields, or suitably long-term job experience.
 - Experience and knowledge of electrical measuring devices (Multimeter) is also a requirement.
 - Special Invacare training sessions are recommended.
- Alterations to the electric vehicle which occur as a result of incorrectly or improperly executed maintenance or overhaul work lead to the exclusion of all liability on the part of INVACARE.
- If you have any problems or questions please contact INVACARE SERVICE.

1.2 Notes on transport

- If the electric vehicle has to be shipped back to the manufacturer for major repairs, you should always use the original packaging for transport.
- You should also include as accurate a fault description as possible.

1.3 Important symbols in this manual



WARNING!

This symbol warns you of danger!

- *Always follow the instructions to avoid injury to the user or damage to the product!*
-



EXPLOSION HAZARD!

This symbol warns you of an explosion hazard, which can be caused by excessive tyre pressure in a pneumatic tyre!

- *Always follow the instructions to avoid injury to the user or damage to the product!*
-



BURN HAZARD!

This symbol warns you of burns due, for example, to leaking battery acid!

- *Always follow the instructions to avoid injury to the user or damage to the product!*
-



NOTE:

This symbol identifies general information which is intended to simplify working with your product and which refers to special functions.



Requirements:

- This symbol identifies a list of various tools, components and items which you will need in order to carry out certain work.
-

2 Safety and assembly instructions

These safety instructions are intended to prevent accidents during work and it is imperative that they are observed.

2.1 Before any inspection or repair work

- Read and observe this repair manual and the associated operating manual!
- Observe the minimum requirements for carrying out the work (see chapter entitled "General information")!

2.2 General safety information and notes on assembly / disassembly



Danger of injury by crushing!

- *Please note the heavy weight of some components. This applies especially to removal of drive units and batteries!*
 - *Prop up the lifted electric vehicle with appropriate supports before starting the disassembly or assembly!*
-



Danger of fire and burns due to electrical short-circuit!

- *The electric vehicle must be switched off before removal of voltage-carrying components! To do this, disconnect the batteries!*
 - *When making measurements on voltage-carrying components, avoid short-circuiting the contacts. Danger of fire and combustion!*
-



Danger of injury and damage to the vehicle can result from incorrect or incomplete maintenance!

- *Only ever use tools which are undamaged in good condition!*
 - *Some moving parts have Teflon bushings! These parts must never be lubricated with grease!*
 - *Never use standard nuts instead of self-locking nuts!*
 - *Always use correctly dimensioned washers or spacers!*
 - *Cable binders which have been cut off during disassembly should be replaced with new ones during reassembly!*
 - *After completing maintenance work and before operating the electric vehicle, make sure all fixations are correctly secured! Check all parts for correct interlocking!*
 - *Only operate the electric vehicle with correct tyre pressure (see Technical Specifications)!*
 - *Check electrical components for correct functioning, incorrect polarity of cables can result in damage to the electronics!*
 - *As a last check, always carry out a test-drive!*
-



Notes

Mark all current settings for the electric vehicle (seat, armrests, backrest etc.), and the cable connecting plugs associated, before any removals. This makes reassembly easier. All plugs are fitted with mechanical safety devices which prevent release of the connecting plugs during operation. To release the connecting plugs the safety devices must be pressed in. When reassembling, ensure that these safety devices are correctly engaged.



WARNING: Any alteration to the drive programme can influence vehicle handling and the tipping stability of the electric vehicle!

- *Alterations to the drive programme may only be carried out by trained Invacare® dealers!*
 - *Invacare® supplies all electric vehicles from the factory with a standard drive programme. Invacare® can only assume a warranty for the safe vehicle handling of the electric vehicle – in particular tipping stability - for this standard drive programme!*
-

3 Tightening torques

The tightening torques stated in the following table are dependent on the thread diameters for the nuts and bolts for which no special values are determined. All values apply to dry and grease-free threads.

Thread	M4	M5	M6	M8	M10	M12	M14	M16
Tightening torque in Nm $\pm 10\%$	3 Nm	6 Nm	10 Nm	25 Nm	49 Nm	80 Nm	120 Nm	180 Nm

Caution: All other nuts or plastic connectors not noted here must be tightened FINGERTIGHT!

4 Service plan (1x annually)

Component	Check	Remedy	Notes	✓
Seat:	<ul style="list-style-type: none"> Welded seams, fixings and upholstery 	<ul style="list-style-type: none"> Tighten screws, replace parts if damaged 		
Frames (chassis) / battery mounting	<ul style="list-style-type: none"> Check fixings, welded seams and battery mounting Check battery fixing straps 	<ul style="list-style-type: none"> Tighten screws, replace parts if damaged 		
Wheel suspension and wheels	<ul style="list-style-type: none"> Check drive wheels for tight fit 	<ul style="list-style-type: none"> Tighten hub nuts, replace if necessary 		
	<ul style="list-style-type: none"> Check steering wheels for tight fit, float and side play 	<ul style="list-style-type: none"> Adjust / replace 	See "Replacing front axle" on page 25	
	<ul style="list-style-type: none"> Pneumatic tyre 	<ul style="list-style-type: none"> Repair or replace if damaged 	See operating manual	
Drive units, coupling mechanism	<ul style="list-style-type: none"> Check functions in drive and push modes Check clutch mechanism 	<ul style="list-style-type: none"> Replace motor if necessary Tighten screws / nuts, adjust or replace if necessary 	See "Replacing the drive motor" on page 15	
Lighting	<ul style="list-style-type: none"> Check function Check cable 	<ul style="list-style-type: none"> Replace bulbs or cable if necessary 		
Batteries	<ul style="list-style-type: none"> Check batteries for damage 	<ul style="list-style-type: none"> Replace batteries if necessary 	See operating manual	
	<ul style="list-style-type: none"> Check battery voltage 	<ul style="list-style-type: none"> charge batteries 	See operating manual	
	<ul style="list-style-type: none"> Check contacts and terminals 	<ul style="list-style-type: none"> Clean contacts and terminals 		
Drive electronics	<ul style="list-style-type: none"> Status display flashing Fixing Cable, connecting plug Drive lever function Power supply 	<ul style="list-style-type: none"> Evaluate blinking code Tighten, replace Replace Replace drive lever Replace cable, connecting plug or console 		
Drive program	<ul style="list-style-type: none"> Check drive electronics program version Newer version available? 	<ul style="list-style-type: none"> Update software 	See "Updating software" on page 19	

5 Operational Faults

5.1 Operational faults

Please proceed as follows if you have any problems:

- First assess the possible cause of the problem using the following table.
- Check the drive console status display. Evaluate the blink error code.
- Carry out the necessary checks and repairs as recommended in the following table.

5.1.1 Drive fault diagnosis

PROBLEM	OTHER SYMPTOMS	POSSIBLE CAUSE	SOLUTION	Documentation
Scooter will not start	Status display on operating console does not illuminate	Batteries possibly defective	<ul style="list-style-type: none"> • Replace batteries 	See operating manual
		Batteries possibly over-discharged	<ul style="list-style-type: none"> • Pre-charge batteries 	See operating manual
		Power supply to operating console possibly interrupted	<ul style="list-style-type: none"> • Check master fuse 	See operating instructions for main fuse position
			<ul style="list-style-type: none"> • Check cable between modules for loose connections or damage 	See "Replacing the electronics" on page 17
	Operating console possibly defective	<ul style="list-style-type: none"> • Replace operating console 	See " Replacing operating console " on page 23	
Operating unit status display blinking	Various causes	<ul style="list-style-type: none"> • Assess error code 	See " Error Codes and Diagnostic Codes " on page 13	

PROBLEM	OTHER SYMPTOMS	POSSIBLE CAUSE	SOLUTION	Documentation
Scooter judders in drive mode	None	Drive motor(s) possibly defective	<ul style="list-style-type: none"> Replace motor(s) 	See " Replacing the drive motor " on page 15
		Drive lever potentiometer possibly defective	<ul style="list-style-type: none"> Replacing the potentiometer 	See "Replacing the potentiometer" on page 20
Batteries not being charged	None	Batteries possibly defective	<ul style="list-style-type: none"> Replace batteries 	See operating manual
	LEDs blinking on charging unit	Charging device possibly defective	<ul style="list-style-type: none"> Replace charging unit 	See charging unit operating manual
Scooter runs too slowly	None	Operating console possibly defective	<ul style="list-style-type: none"> Replace operating console 	See " Replacing operating console " on page 23
		Batteries possibly defective	<ul style="list-style-type: none"> Replace batteries 	See operating manual

5.2 Error Codes and Diagnostic Codes

Blink code	Fault	Consequence for the Scooter	Comments
1	Battery must be charged	Continues to drive	<ul style="list-style-type: none"> The batteries are discharged. Charge the battery as soon as possible.
2	Battery voltage too low	Stops driving	<ul style="list-style-type: none"> The batteries are depleted. Charge batteries. If you switch the Scooter off for a few minutes, the battery can often recuperate to such a stage that a short journey is still possible. You should only do this in emergency, however, because this causes the batteries to become excessively discharged!
3	Battery voltage too high	Stops driving	<ul style="list-style-type: none"> The battery voltage is too high. If the battery charger is connected, disconnect it from the Scooter. The electronic system charges the batteries when running downhill and when braking. This fault is caused when the battery voltage becomes too high during this process. Switch the Scooter off and on again. Switch on the lights to use up some power.

Blink code	Fault	Consequence for the Scooter	Comments
4	Power time exceeded	Stops driving	<ul style="list-style-type: none"> The Scooter has used up too much power for a long period, probably because the motor has been overloaded or the Scooter has attempted to work against insurmountable resistance. Switch off the Scooter, wait a few minutes and then switch it on again. The electronic system has determined a motor short-circuit. Check the wiring harness for short-circuits and check the motor
5	Brake failure	Stops driving	<ul style="list-style-type: none"> Ensure that the disengaging lever is in the engaged position. There is a defect in the braking coil or in the cabling. Check the wheel lock and cabling for open or short-circuited circuitry.
6	No neutral position when switching Scooter on.	Stops driving	<ul style="list-style-type: none"> Drive lever is not in neutral when the keyswitch was turned. Put the drive lever in neutral, turn the power off and then turn on again. It may be necessary to recalibrate the drive lever.
7	Fault in speed potentiometer	Stops driving	<ul style="list-style-type: none"> The drive lever electronics could be faulty or incorrectly connected.
8	Motor voltage error	Stops driving	<ul style="list-style-type: none"> The motor or its cabling is defective
9	Miscellaneous internal fault	Stops driving	<ul style="list-style-type: none"> The electronic system may have an internal error. Check all cables and connections.
10	Push/freewheel mode error	Movement braked	<ul style="list-style-type: none"> The Scooter has exceeded the permissible maximum speed during pushing or freewheeling. Switch the electronics system off and on again.

6 Repair Work

6.1 General warning information on installation work



CAUTION: Risk of damage to the vehicle! Collisions can be caused if shim rings are removed from the drive wheels during installation work!

- *Shim rings are frequently placed between the drive shaft and the wheel hub to compensate tolerances. Collisions can be caused if these shim rings are removed and not re-installed! Please install all shim rings in exactly the same positions they were in before dismantling.*

6.2 Replacing the drive motor



NOTE:

When disassembling, note the position of small parts such as screws and washers. Put small parts down so that they can be reassembled in the right sequence.



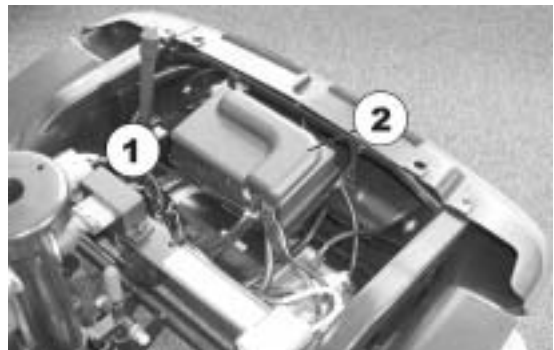
Note:

When connecting the motor cable, ensure that the plug is in the right position. The motor rotation direction will be reversed if the connection is wrong.



Requirements:

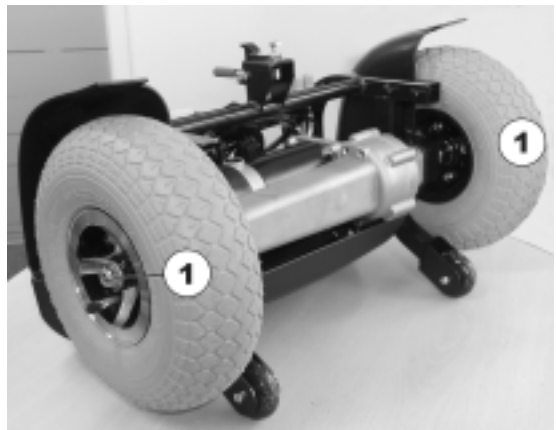
- Open spanner, 10 mm.
 - Open spanner, 17 mm.
 - oblique pliers
 - Cable binder
 - Rubber hammer
-
- **From the operating manual:**
 - Loosen rear wheel fixing bolts.
 - Remove the seat
 - Remove batteries.
 - Remove the drive unit.
-
- **Further work:**
 - Cut through cable ties (1) and remove.
 - Fold up electronics cover (2).



- Remove motor cable plug (1) from electronic system.
- Remove motor cable.



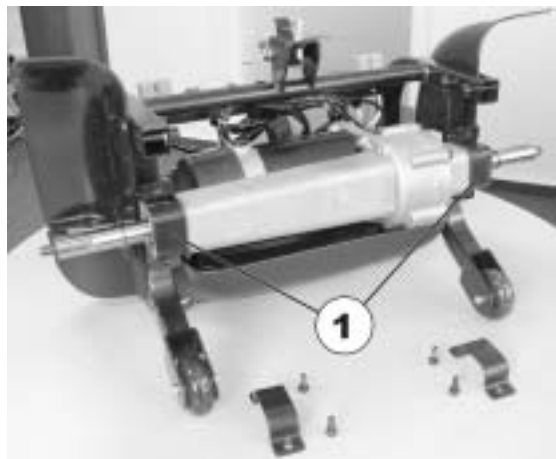
- Fold the drive to the rear onto the enclosure and the antitipper.
- Remove wheels (1).



- Loosen motor fixing bolts (1) on both sides and remove.
- Remove motor downwards out of the vehicle frame.



- Check rubber bearing (1) on motor suspension. Replace damaged rubber bearings.
- Reassembly of the motor takes place in reverse order
- Secure motor cable with cable tie.
- Complete reassembly of vehicle.
- Check all functions (trial run).



6.3 Replacing the electronics



CAUTION! Burn and scald hazard if power cable is short-circuited!

- *Interrupt the power supply by removing the battery plugs before you start work on the electronic system.*
-

**NOTE:**

The electronic system is supplied with a standard drive program. If you have carried out customer-specific modifications to the drive program, you will have to make these changes again after installing the new electronics module.

**CAUTION: Any modifications made to the drive program can affect the drive behaviour and tipping stability!**

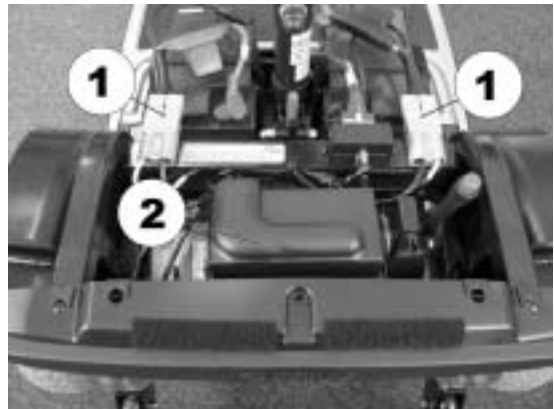
- *Changes to the drive program may only be carried out by trained Invacare® specialist dealers!*
 - *Invacare can only provide a guarantee for safe driving - especially tipping stability - for unmodified standard drive programs.*
-

**Requirements:**

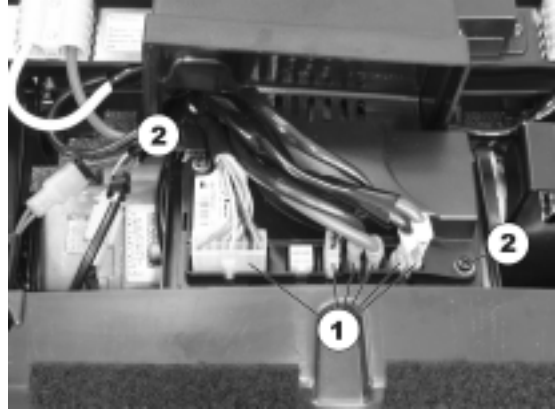
- Phillips screwdriver
 - To adapt the drive program: programming software or hand programming device and electronics system installation manual, available from Invacare®.
-

- **From the operating manual:**
- Remove the seat
- Remove the battery and motor compartment cover.

- **Further work:**
- Remove battery plug (1).
- Remove cover (2) from electronics system.



- Remove all plugs (1) from electronic system.
- Remove screws (2) on both sides of the electronics system.
- Replace the electronics system.
- Reassembly takes place in the reverse order.
- Modify the drive program.
- Complete reassembly of vehicle.
- Check all vehicle functions (trial run).



6.4 Updating software

Invacare is continuously carrying out further development and improvements to drive programs for electric vehicles. For this reason, you should always check whether the drive program version number is up-to-date when carrying out any repairs or regular maintenance. If a newer version is available, the drive program must be updated. The procedure for updating the drive program is described in the wizard software operating manual.



NOTE:

The electronic system is supplied with a standard drive program. If you have carried out customer-specific modifications to the drive program, you will have to make these changes again after installing the new electronics module.



CAUTION: Any modifications made to the drive program can affect the drive behaviour and tipping stability!

- *Changes to the drive program may only be carried out by trained Invacare® specialist dealers!*
 - *Invacare can only provide a guarantee for safe driving - especially tipping stability - for unmodified standard drive programs.*
-



Requirements:

- Dynamic® Wizard software
 - Operating manual for Wizard software
 - Further requirements, such as a minimum system configuration for the PC used for programming, required programming cables etc. can be taken from the Wizard software operating manual.
-

6.5 Replacing the potentiometer



CAUTION! Burn and scald hazard if power cable is short-circuited!

- *Interrupt the power supply by removing the battery plugs before you start work on the electronic system.*
-

**CAUTION! Risk of accidents!**

- *The new potentiometer must be set to the middle position before inserting. Potentiometers which are not in the middle position can result in dangerous driving situations!*
-

**Requirements:**

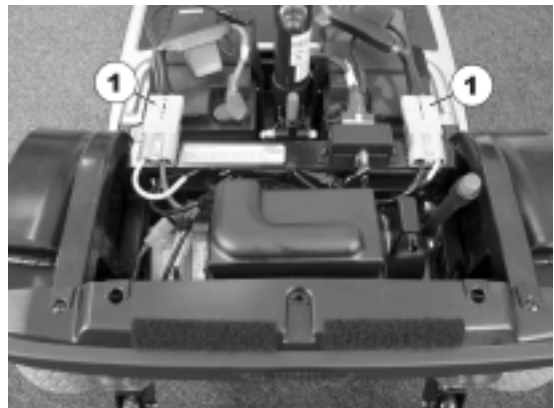
- Phillips screwdriver
 - Allen key – open-ended spanner 2 mm
 - Digital multimeter
-

- **From the operating manual:**

- Remove the seat
- Remove the battery and motor compartment cover.
- Disconnect battery plug.

- **Further work:**

- Remove battery plug (1).



- Remove plugs from rear mirror fixing (1) or rear mirror, depending on fittings.



- Remove screws (1) below operating console.



- Pull the operating console upwards out of the front fixing (1).

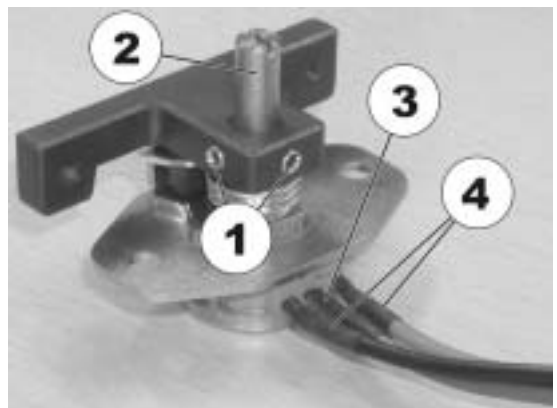


- Remove drive lever (1).
- Remove potentiometer plug (2) from the operating console.
- Remove potentiometer (3).
- Set the potentiometer to the middle position (see below).
- Reassembly takes place in the reverse order.
- Complete reassembly of vehicle.
- Check all operating console displays.



- **Setting the potentiometer to the middle position:**

- Loosen the bolts (1) on the drive lever mounting.
- Twist the potentiometer shaft (2) until the same resistance (approx. 5kOhm) is measured between the central connection cable (3) and both outputs (4).
- Retighten the bolts on the drive lever mounting.
- Check settings and repeat the adjustment if necessary.



6.6 Replacing operating console



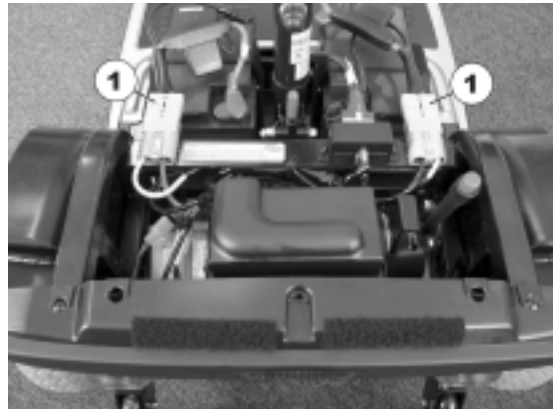
CAUTION! Burn and scald hazard if power cable is short-circuited!

- *Interrupt the power supply by removing the battery plugs before you start work on the electronic system.*
-

**Requirements:**

- Phillips screwdriver
-

- **From the operating manual:**
 - Remove the seat
 - Remove the battery and motor compartment cover.
- **Further work:**
 - Remove battery plug (1).



- Remove plugs from rear mirror fixing (1) or rear mirror depending on fittings.



- Remove screws (2) below operating console.



- Pull the operating console upwards out of the front fixing.



- Remove all plugs (3) from operating console.
- Replace operating console.
- Reassembly takes place in the reverse order.
- Complete reassembly of vehicle.
- Check all operating console displays.



6.7 Replacing front axle



CAUTION! Crushing and tipping hazard!

- *The front part of the chassis is placed upright to simplify work! Please use suitable measures to secure the chassis against falling over!*



Requirements:

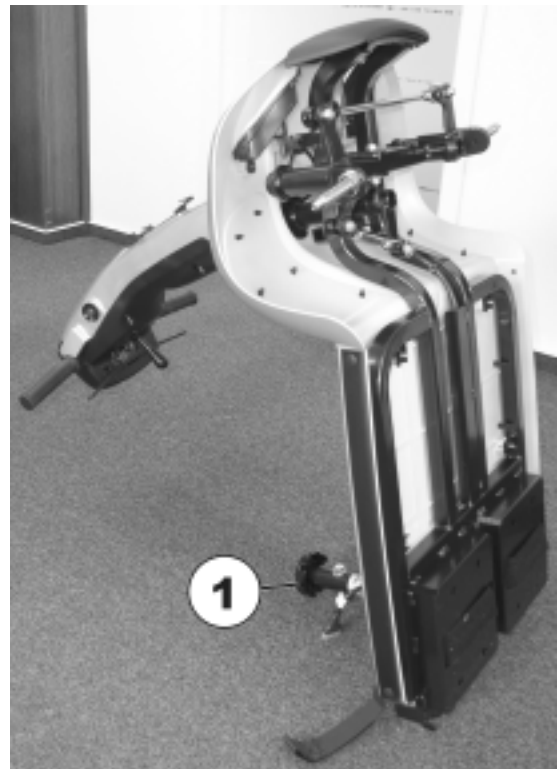
- Open spanner, 9 mm.
- Open spanner, 12 mm.
- Open spanner, 13 mm.
- Open spanner, 17 mm.



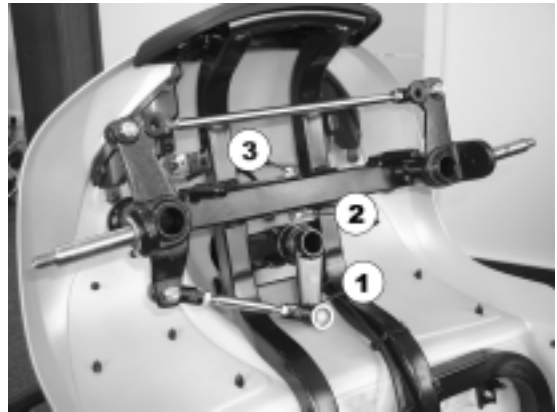
NOTE:

When disassembling, note the position of small parts such as screws and washers. Put small parts down so that they can be reassembled in the right sequence.

- **From the operating manual:**
 - Remove the seat
 - Remove batteries.
 - Remove the drive unit.
 - Remove front wheels.
- **Further work:**
 - Place the chassis upright on the seat attachment (1).



- Loosen the steering link nut (1) and remove it (note information below).
- Remove the steering link from the stub axle.
- Loosen the axle suspension nut (2) and remove it.
In doing so, secure the axle suspension bolts (3) against turning using an open-ended spanner.
- Pull the bolts (3) out and remove the axle casing.



- When loosening the nuts (1), secure the steering link head against turning using an open-ended spanner.



- Reassembly of the axle takes place in reverse order
- Complete reassembly of vehicle.