SERVICE MANUAL

Invacare® Delta II

This manual includes instructions on
troubleshooting &
repair

CE

Version: 01.02

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Section **Page**

1 General Considerations

Before You Start

This service manual contains information and instructions required to service and repair the Invacare® Delta II.
You must comply with the instructions in this service manual when attempting any scooter service or repair. The general service and care instructions included in the operating manual apply.
Please observe the safety guidelines.
Please consult the spare part catalogue for information on ordering spare parts.

1.1 Service Technician Qualification

The Delta II may be serviced and repaired by qualified personnel only. Minimum requirements:

- Relevant training for instance as two-wheel or orthopaedic mechanic or extensive relevant experience.
- Competent handling of electrical measuring instruments (multimeter).

1.2 The Invacare® Service

If you have any problems or queries, please contact Invacare® Service:

Head Office:	Tel.:	05731-754-0
	Fax:	05731-754-111
Service Department:	Tel.:	05731-7545-(70-80)
	Fax:	05731-7542-(08-16)
Street Address:	Invacare® Deutschland GmbH TILLVERKARE Dehmer Str. 66 32549 Bad Oeynhausen	
Post Box:	Invacare® Deutschland GmbH Postfach 60 01 06 32527 Bad Oeynhausen	

- Any modifications of the Invacare® Delta II arising from improper or faulty service or repairs will lead to exclusion of liability from Invacare®.

1.3 Transport to the Manufacturer

If the Invacare® Delta II must be shipped to the manufacturer for major repairs, use the original packaging for shipping if at all possible.
Include a description of the fault which should be as accurate as possible.

2 Safety and Assembly Guidelines

The safety guidelines are essential for compliance with health and safety regulations and must be observed at all times.

2.1 Symbols used in this Service Manual

✓ **NOTE:**
This symbol indicates proper servicing procedures as well as particularities and simpler ways of disassembly/assembly.

⚠ **WARNING:**
The warning symbol indicates possible hazards either to the service technician or the Invacare® Delta II. It is imperative that you observe any safety instructions marked with this symbol. The word "Danger!" indicates that failure to heed the warning may result in significant personal injury or death.

2.2 Before any Inspection andRepair:

⚠ **WARNING:**
DANGER!
Consider the sometimes significant weight of the components. This is particular important when disassembling the drive units and batteries. Ensure that you can safely handle and store the components.

⚠ **WARNING:**
DANGER!
Personal injury may occur! Before you attempt any work on the batteries, remove your wristwatch and any metal rings, bracelets and chains. You may short the batteries or cables and components directly connected to the batteries. A short may cause severe injuries.

Before you attempt any work carefully study this Service Manual and the associated Operating Manual and comply with the instructions therein. Ensure that you meet the minimum qualification requirements (refer to "General Considerations" section).
Prior to disassembling any live components, ensure that the Invacare® Delta II has no power. To do this, first remove the negative and then the positive terminal connector from the batteries and lift out the batteries.
Use perfect, undamaged tools only.

Avoid shorting out contacts when taking readings on live components.

2.3 During Assembly / Disassembly

Prior to disassembly note and mark the current wheelchair settings (seat, armrest, back, etc.) and the associated cable connectors. This will simplify later re-assembly. This manual describes the disassembly procedure.. If no information is given in relation to assembly or mounting, re-assemble the components in reverse order of disassembly. You will find any differing assembly procedures or special assembly guidelines after the description of the disassembly procedure.

⚠ **WARNING:**
Before attempting any disassembly or re-assembly secure the lifted wheelchair with suitable supports.
Do not use "normal" nuts in place of self locking nuts.
Always use the correct size for washers or spacers.

✓ **NOTE:**
Connectors
All connectors are secured with mechanical locking mechanisms preventing the connector from working loose during operation.
To remove the connectors push in the locking mechanism. Squeeze the locking mechanism together on the top and bottom of the connector.
When re-assembling the components, ensure that the connector locking mechanisms are properly engaged.
Batteries:
If you need to place the Delta II on its side during service remove the batteries before doing so.
Orientation:
Any instructions involving directions such as "left" and "right" always refer to the direction of motion assuming the user is standing behind the Delta II.

2.4 Prior to Operation / After Completion of Service:

⚠ **WARNING:**
Ensure that all attaching hardware is tightened securely. Verify that all parts are locked correctly. Operate wheelchair with required tyre pressure (2.0 bar or 29 psi) only.
Upon completion of the service, verify proper functioning of the replaced components and test drive the vehicle.

2.5 Tool List

You will need a standard tool kit containing at least the following tools:

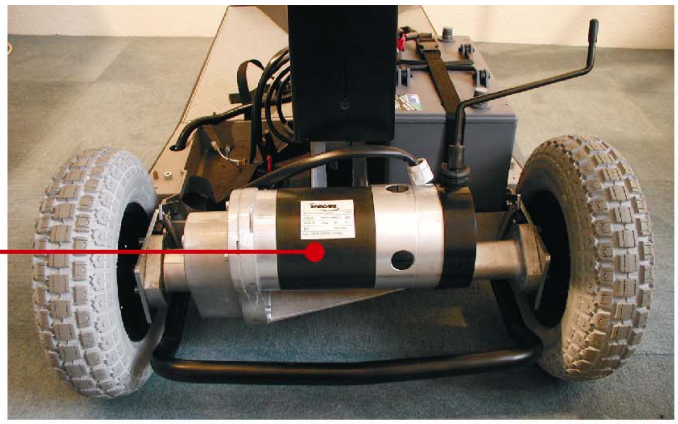
- Set of open-jawed and ring spanners
- Set of Allen keys
- Torque wrench (standard)
- Socket spanner set
- Set of screw drivers (flat tip, cross tip, torx)
- Side cutter
- Flat nose pliers
- Round nose pliers
- Pointed pliers
- Crimping tool
- Mallet or plastic mallet
- Tyre repair kit (standard)
- Tire gauge
- Tire pump
- Valve removal tool
- Puller and pressing or hitting tool for ball bearings
- Multimeter with probe tips and various cable clamps
- 30 W soldering iron
- Riveting tool

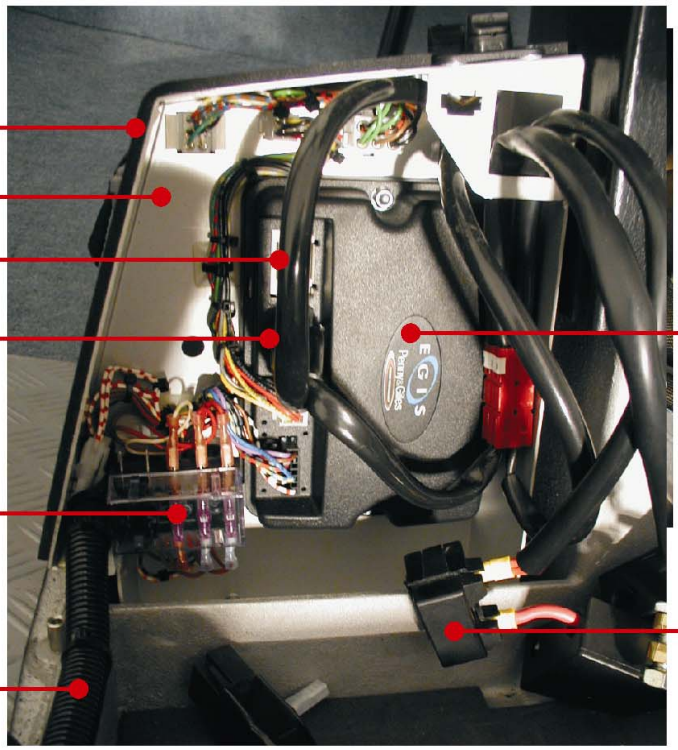
3 The Invacare® Delta II

3.1 Arrangement of Modules, Components and Operator Controls


Sitz, mit Armlehnen und Gleit-schienen
Sitzträger, mit Sitzträgersäule und Verkleidung
Elektronikbox
Batterieblöcke

3.2 Electronic Control Components, Electrics





3.3 Module Composition / Variants, Accessories

3.3.1 Module Composition, Variants

The Invacare® Delta II can be supplied with the following options:

- **Batteries (Section 6.4)**
  - 12V/50 AH (Sonnenschein)
  - 12V/70 AH (MK Batteries)
  - 12V/70 AH (Sonnenschein)
- **Throttle Control Lever (Section 6.8)**
  - Foot throttle
- **Driving Wheels (Section 7.2.1)**
  - "Wide" driving wheel 4.10 / 3,50 x 6"
  - "Narrow" rear wheel 3.00 x 8"
- **Anti-tip Wheels (refer to Operating Manual)**
- **Front Wheel (Section 7.2.2)**
  - Front wheel 4.10 / 3,50 x 6"
- **Lights (Sections 7.1.2 and 7.10)**
- **Electric Seat Height Adjustment (see Accessories)**
- **Back Elements**
  - Adjustable back element
- **Headrest (see Accessories)**
- **Legrests (see Accessories)**
  - Manually adjustable legrests with ergonomic length compensation
- **Cane Holder (see Accessories)**

3.3.2 Accessories

The following accessories are available for the Invacare® Delta II:

- **Chargers**
  - Charger 8 A
  - Charger 10 A (MEDICO)
  - Charger 12 A
- **Basket cpl.**
  - Basket
  - Basket holder
- **Cane holder cpl.**
  - Cane holder bottom
  - Cane holder top
  - Plug 30 x 15
  - Cane holder clamp
  - Elastic cord, D = 4 mm, L = 60 mm
  - Cane holder support, fender
- **Crutch Holder**
  - Seat mountable
  - Fender mountable
- **Hip Strap**
- **Headrest KAB, grey**
- **Legrest**
  - RH, LH
- **Mirror**

  - Basket-mountable
- **Hour Meter**
- **Spring Module, Standard, cpl.**
  - Spring module
  - Intermediate plate
  - Seat plate
- **Spring Module with Shock Absorber and Slide Rails**
  - Spring module
- **Self-adhesive Bags**
- **Programming Unit**
  - Standard, for customers
  - P & G, for technicians
- **Baby Seat**
- **Wide Angle Mirror**
- **Hand Brake**
- **Trailer**
  - Trailer coupling
- **Dust Cover**
- **Additional Horn**

4 Inspection Procedures

Component	Inspection	Action	Section	✓
Shrouds: Rear, Side, Seat Post Shroud	• Check for damage	⇒ Replace parts	**7.1, 7.6.5**	
	• Check shroud attachment	⇒ Tighten or replace screws		
Wheels: Driving Wheels, Front Wheel	• Check rear wheels for side movement and proper tension	⇒ Check mounting plate screws and locks	**7.11**	
	• Check front wheel for proper tension, side movement and that it is spinning freely.	⇒ Adjust or replace wheel, axle, wheel bearing or fork	**7.2.2**	
	• Check front wheel fork bearing	⇒ Replace bearing	**7.10**	
	• Check tyres	⇒ Re-mount	**7.2.3**	
Batteries	• Check for damaged batteries & corroded contacts	⇒ Clean contacts, replace batteries	**7.4, 7.5**	
	• Check contacts, terminals, cables and strip fuses	⇒ Tighten, replace if necessary		
	• Check battery voltage	⇒ Charge or replace batteries		
	• Check 50 A strip fuses and 15 A fuses (electronic box)	⇒ Replace fuses		
	• Check battery straps	⇒ Tighten or replace straps		
Electronics	• Console/keypad status indicator flashing	⇒ Identify flash code	**6.1**	
	• Check cable, cable ties, connectors	⇒ Tighten, replace		
	• Functions	⇒ Diagnostics	**6.1, 6.2**	
	• Voltage supply	⇒ Replace cable, connector or electronics	**7.4**	

	• Fuses	⇒ Replace	**7.5**	
	• P & G Electronics	⇒ Diagnostics, replace		
	• Delta II starts when started with depressed throttle control lever	⇒ Diagnostics, replace electronics	**6.2**	
Seat, Seat Plate, Seat Post and Armrests	• Check for damage. Check seams, seat angle adjustment	⇒ Repair, replace seat	**7.6.1**	
	• Check everything is secured properly	⇒ Tighten screws		
	• Check seat plate, lubricant	⇒ Lubricate	**7.6.4**	
	• Check gas pressure spring function	⇒ Replace gas pressure spring	**7.6.5**	
	• Check armrests are properly secured and not damaged.	⇒ Tighten screws, replace armrests	**7.6.3**	
Drive, Brake	• Check working order while driving or pushing	⇒ If necessary, replace motor	**6, 7.7**	
	• Check brake lever	⇒ Tighten screws, if necessary, adjust or replace lever		
	• Brake lever in “front” position: Delta II can be pushed	⇒ Check brake lever and drive, adjust or replace if required		
	• Brake lever in “rear” position: Delta II can be started or no error message in status indicator	⇒ Check electronics and replace if required		
Tiller, Console, Tiller Shaft and Shroud, Front Shroud	• Check for damage	⇒ If required, replace parts	**7.8**	
	• Check everything is secured properly	⇒ Tighten screws		
Lights	• Play/tiller shaft: Ball bearing/tiller shaft	⇒ Replace ball bearings, adjust or replace friction	**7.9**	

	Ball bearing/tiller shaft shroud, friction swivel joints	adjust or replace friction swivel joints		
	• Check function	⇒ If required replace light bulbs or cables	**7.1.2, 7.10**	
	• Check cabling	⇒ If required, replace cables		
	• Check fuse	⇒ Replace 3 A fuse	**7.5**	
Horn	• Check function	⇒ If necessary replace cable or horn	**7.10**	
	• Check cabling			
Chassis with Rubber Mat, Edge Strip, Battery Straps and Gas Pressure Spring Plate	• Damage	⇒ If required replace parts	**7.11**	
	• Check screws & nuts and battery straps	⇒ Tighten screws		
Reflectors	• Check hub cab reflector strips	⇒ Replace if necessary	**7.2**	
Accessories: Legrests, Anti-tip Wheels	• Check function	⇒ Replace if required	**3.3**	

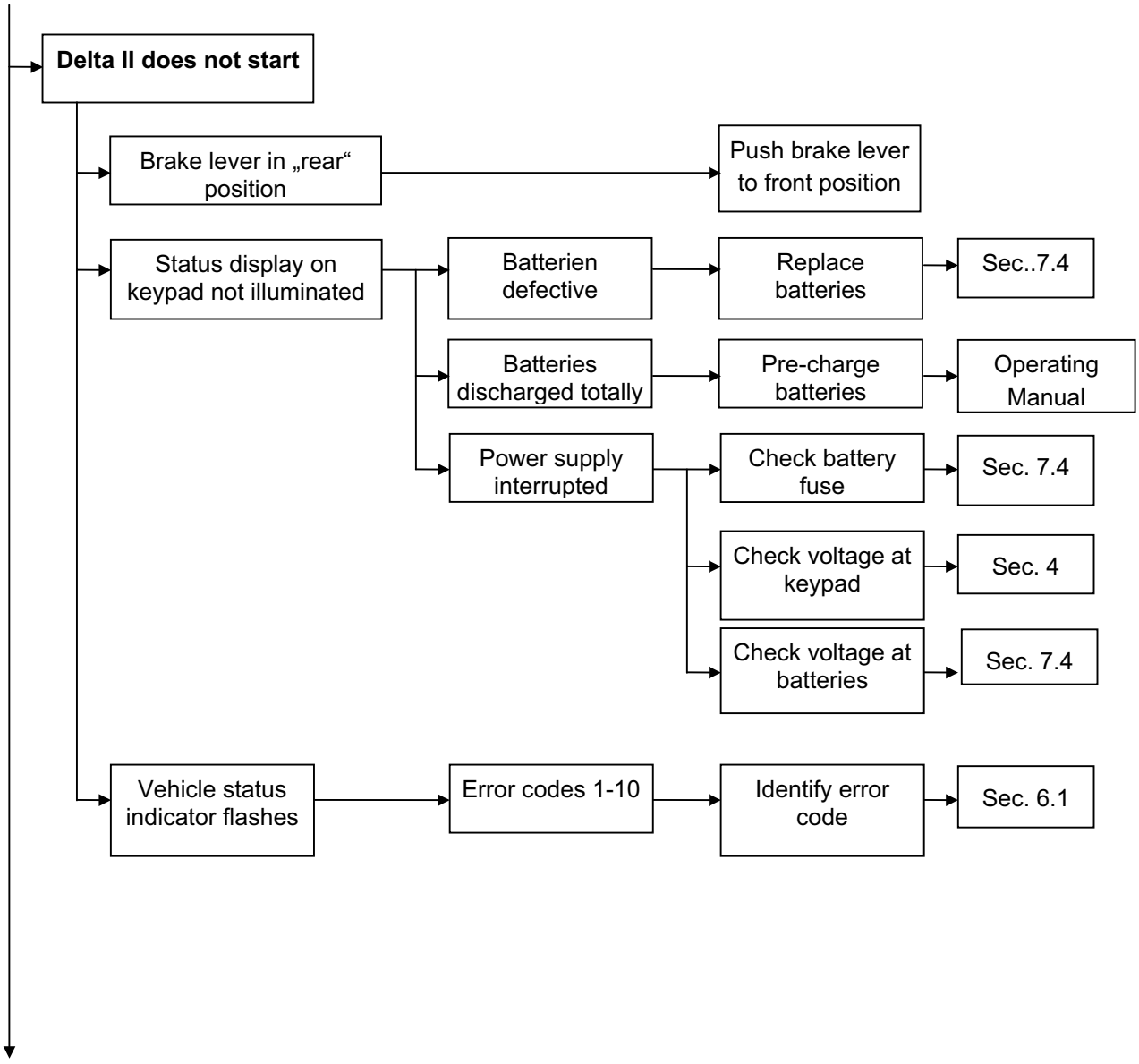
Troubleshooting

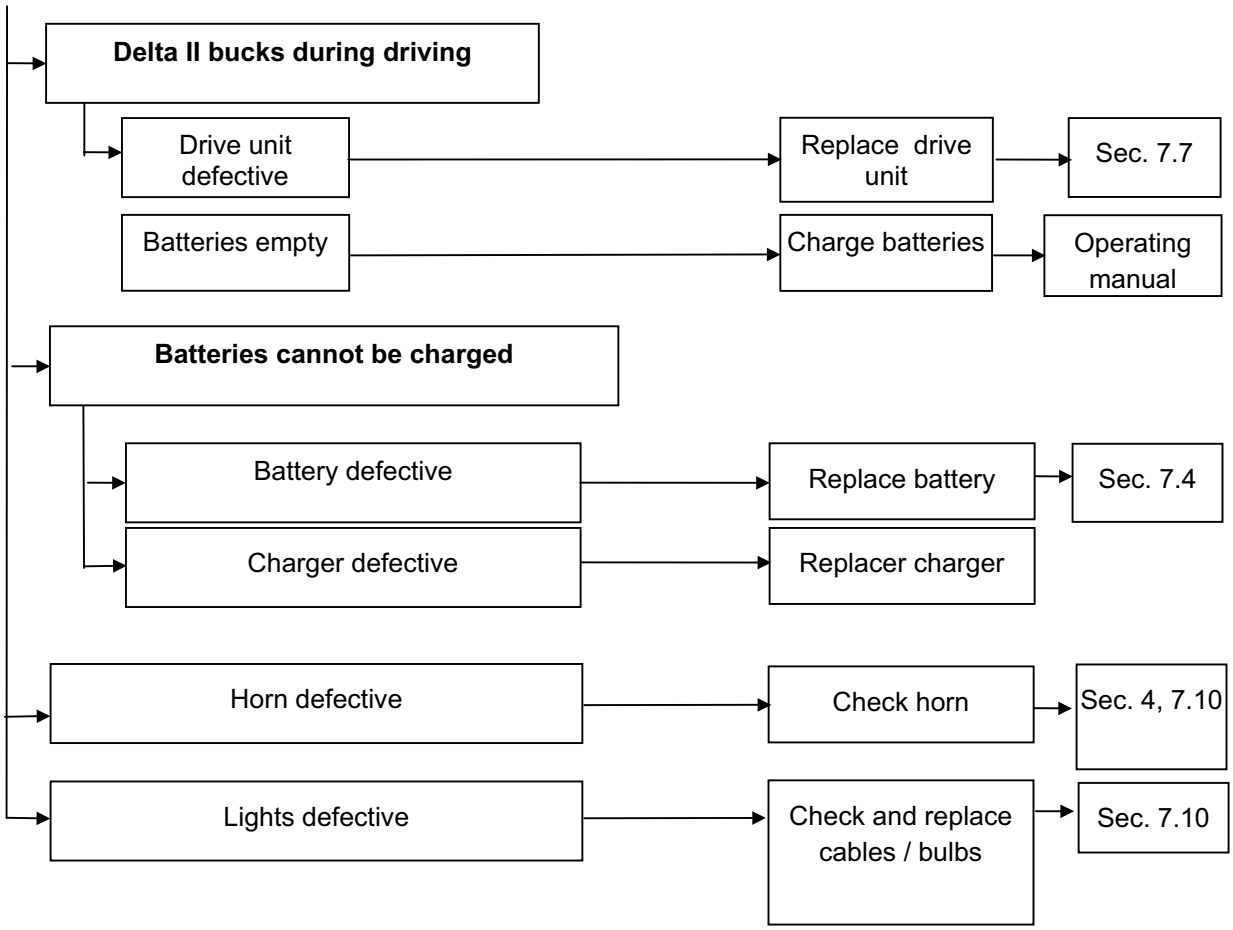
4.1 General Considerations

In case of driving or power supply related problems proceed as follows:

- First check the root causes described in section 6.2.
- Check the keypad status messages and, if required, identify the error codes as described in section 6.1.
- Carry out the required tests and/or repairs. Refer to and read the associated manual sections or documentation pointed out in the cross references.

4.2 Root Causes




Delta II bucks during driving
Drive unit defective
Replace drive unit
Sec. 7.7
Batteries empty
Charge batteries
Operating manual
Batteries cannot be charged
Battery defective
Replace battery
Sec. 7.4
Charger defective
Replacer charger
Horn defective
Check horn
Sec. 4, 7.10
Lights defective
Check and replace cables / bulbs
Sec. 7.10

5 Fault Diagnostics with the Status Indicator or the Penny & Giles SP1 Programming Unit

Before you diagnose faults with the P & G programming unit, check the electronics status indicator on Dellta II keypad, especially if the customer has not done this or is unable to do so.

5.1 Status Indicator Error Codes

Check the status indicator on the keypad. The following list identifies the faults by the number of flashing LED's:

1 LED flashing
Under-voltage / faulty battery or cable.
2 LED's flashing
Faulty cable/motor
3 LED's flashing
Faulty cable / motor: Short to battery
6 LED's flashing
Control stuck, maybe due to charger plug.
7 LED's flashing
Error / throttle control lever
8 LED's flashing
Error / control
9 LED's flashing
Error / brake
10 LED's flashing
Over-voltage / control caused by faulty cable / battery.

5.2 P & G Programming Unit Error Codes

WARNING:
Only service technicians with thorough knowledge of the programming device may attempt programming or fault diagnostics using the P & G programming unit. Otherwise you may impair safe operation of the Delta II due to incorrect programming or diagnosis.

You can identify the faults indicated by the SP1 Programming Unit (Penny & Giles) using the table below:

Error Code	Error Type	Description
0002	8	Possible control fault
0003	8	Possible control fault
0100	8	Possible control fault

0203	8	Possible control fault
0204	8	Possible control fault
0810	7	Error / throttle control lever
1400	3	Faulty cable / motor
1500	9	Fault / Brake
1501	8	Possible control fault
1502	9	Fault / Brake
1600	10	Over-voltage / Battery
1705	8	Possible control fault
1802	8	Possible control fault
1805 1	8	Possible control fault
1B20	8	Possible control fault
1D02	7	Fault / throttle control lever potentiometer
1E03	6	Control blocks drive
2102	8	Possible control fault
2C00	1	Battery voltage low
2C01	1	Battery voltage low
2D01	8	Possible control fault
3100	8	Possible control fault
3102	8	Possible control fault
3210	8	Possible control fault
3211	8	Possible control fault
3212	8	Possible control fault
3213	8	Possible control fault
3600	8	Possible control fault
3601	8	Possible control fault
3602	8	Possible control fault

3603	8	Possible control fault
3604	8	Possible control fault
3605	8	Possible control fault
3606	8	Possible control fault
3607	8	Possible control fault
3608	8	Possible control fault
3609	8	Possible control fault
360A	8	Possible control fault
360B	8	Possible control fault
360C	8	Possible control fault
360D	8	Possible control fault
360E	8	Possible control fault
3B01	2	Motor / broken connection
7000	4	Brake
001	4	Brake

Once you have identified the error type, consult the sections below for information on the possible root causes.

5.3 Fault Types and their possible Root Causes

Should the information and fault type description fail to rectify the problem it may be possible that the P & G programming unit itself is faulty. If you suspect this to be the case, please contact your Penny and Giles Service Partner.

WARNING:
Any manipulation of the P & G Programming Unit will void the warranty. In addition, the safety of the Delta II can no longer be guaranteed which may give rise to serious liability claims against the person or organisation who caused the defects.

Fault Type 1 – Battery Voltage Low

Occurs when the battery voltage is below 18 V.
Check the condition of battery and connecting cables.

Fault Type 2 – Motor / Connection Faulty

The connection to the motor is faulty.
Check motor and cable connections.
Check the brake lever position.

Fault Type 3 – Motor / Faulty Cable

There is a fault in the motor power supply. This is often caused by a short with a battery cable.
Check motor and cable connections.

Fault Type 4 - Brake

This fault occurs if the brake lever is engaged during driving or if the brake lever is still in the incorrect position (rear) when the Delta II is started. Check the brake lever position.
If the brake lever position is correct, check the input voltage with a suitable instrument. If the voltage readings are not OK as shown below, check the cable connection to the brake:

Voltage for brake / battery earth:	0V±0.5V in free-wheeling position (rear)
	5V±0.5V in driving position (front)

Fault Type 5 – Not Assigned

Fault Type 6 – Control Blocks Drive

This fault occurs if the controller detects activation of the lock. Locking is mainly used to stop the vehicle drive when the charger is connected. Verify that no charger is connected.
For detailed information on this fault type refer to the Solo and Egis Controller manual („SP1b Programmer for Solo and Egis Controllers – Programming and Fault Finding“), pages 17f and 31f.

Fault Type 7 – Throttle Control Lever

Possible defect of the throttle control lever potentiometer or of the cable connections. Check working order of the potentiometer, in particular return to 0.
Check the following voltage readings for a rocker throttle control lever or a unidirectional throttle control lever. Ensure that the throttle control lever is in 0 position and the Delta II is set to maximum speed. The nominal voltage readings should be as follows:

Rocker throttle control lever	Max against battery earth:	4.75 V
	Grinder against battery earth:	2.5 V
	Min against battery earth:	0.25 V
Unidirectional throttle control lever	Max against battery earth:	4.75 V
	Grinder against battery earth:	0.25 V*
	Min against battery earth:	0.25 V,

* the nominal value is 0.188 V for a 10 kOhm test resistance
Fault code 1805 refers in particular to the Egis controller which detects conductive deposits on the throttle control lever potentiometer connections.

Fault Type 8 – Possible Control Fault

P & G Programming Unit fault Have the device checked by an authorised service partner.

Fault Type 9 - Brake

Brake or cable connections faulty. Check the brake and associated cable connections. If the brake functions correctly, you should get the following voltage readings:

Brake + after brake -:	0V ± 0.5 V in free-wheeling position
	battery voltage ± 1 V in parking position

6 Repair and Replacement

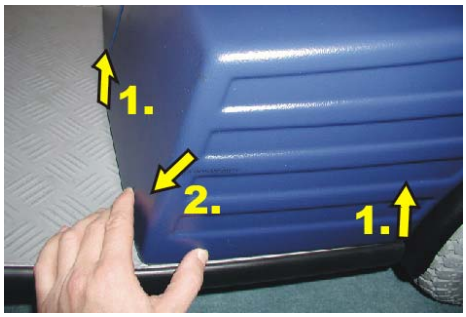
6.1 Replacing Shrouds

6.1.1 Side Shroud

Disassembling the Side Shroud

1. Turn the two turn-lock fasteners in direction of motion and lift the shroud from the fasteners. The recess (see arrow) eases lifting the shroud.

2. A bolt (1.) connects to each lower side of the shroud through a recess. . Lift the shroud in those locations and pull off in direction of the corner (2.).

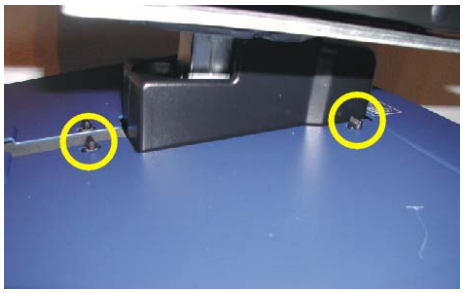


Assembling the Side Shroud

1. Position the side part to align the shroud corner recess with the locking screw (see arrow).

2. Insert the rear edge of the side part under the mud guard plate. At the same time ensure that the lower bolts are connected correctly to the side part and align the top recesses with the turn-lock fasteners.

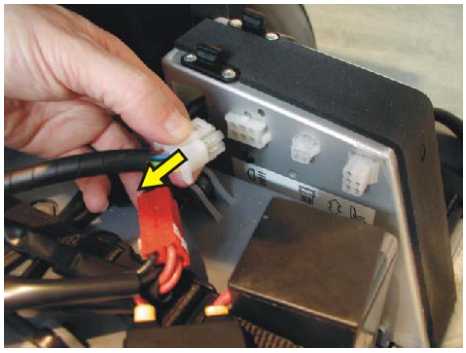
3. Secure the side part by turning the turn-lock fasteners by 90 degrees.



6.1.2 Rear Shroud, Cable Harness/Lights

Disassembling the Rear Shroud

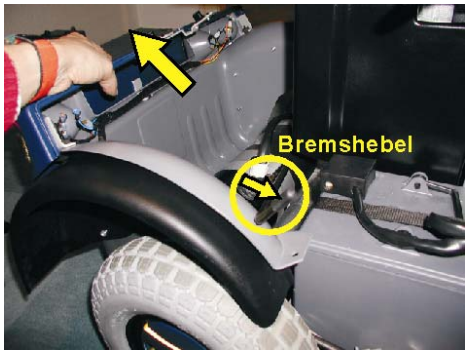
1. Disengage the rear light connector safety on the electronic box and pull the remove the connector.



2. Remove the thumb screws on both sides of the rear shroud.

3. Put brake lever into front position.

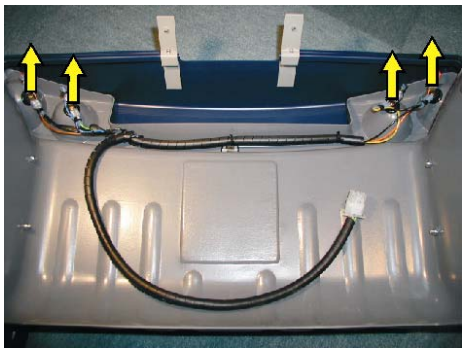
4. Carefully lift the rear shroud from the driving wheels and pull off backwards.



Disassembling the Cable Harness

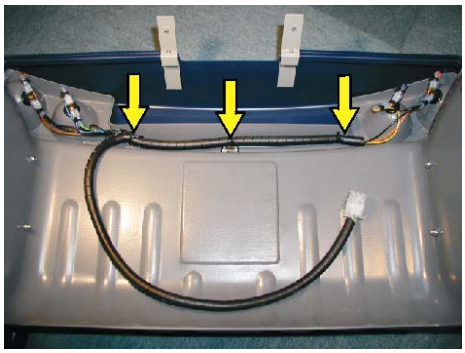
1. Mark the individual wires in the cable harness and take note of their positions.

2. Pull off the rear light and direction indicator lamp cap connectors.



3. Remove cable ties.

4. Lift out cable harness and place next to the rear shroud as indication how the new cable routing should look like.



Assembling the Cable Harness

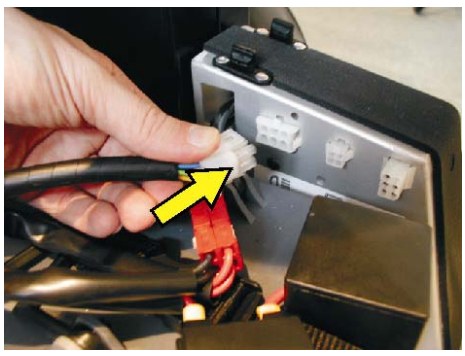
1. Install the new cable harness with the cable ties guided by the old cable harness and your notes.

Colour coding?
Replacing lamps described in BDA?

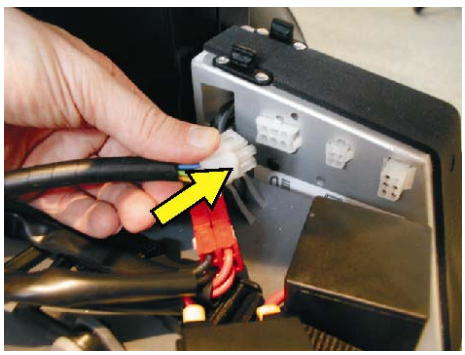
Assembling the Rear Shroud

1. Install the rear shroud as shown ensuring that the shroud is positioned between the drive mounting plates.
Check fit.

2. Attach rear shroud with the thumbscrews.



3. Route cable under the brake leaver to the electronic box and plug in connector until you hear the safety lock engage.



4. Insert side parts (see above).

6.2 Wheels

6.2.1 Driving Wheels

WARNING:
Prepare the vehicle by putting it on its side onto a support (which shouldn't be too soft) or securely jack up the vehicle so that no load applies to the driving wheels.

Disassembling the Wheel

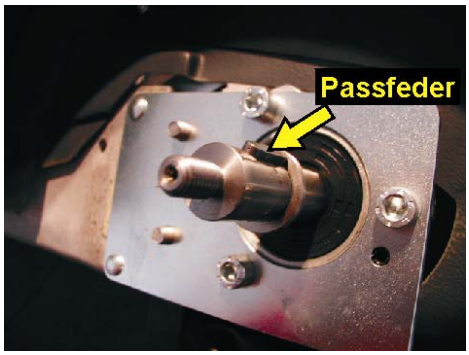
1. Remove the hexagon nut.

2. Take off wheel (wheel may sit very tightly!)

Assembling the Wheel

1. Place wheel cut-out onto the feather key.

2. Screw in hexagon nut (including washer) and tighten with torque wrench (25 –30 Nm?).



6.2.2 Front Wheel

WARNING:
Prepare the vehicle by putting it on its side onto a support (not too soft) so that no load applies to the front wheel and it can be easily accessed from both sides or, alternatively, jack up vehicle securely.

Disassembling the Front Wheel

1. Loosen the left Allen screw on the front wheel, but do not yet remove it completely.
2. Loosen the right Allen screw, applying counter-pressure to the shaft with a spanner.
3. Now remove the right and then the left screw and take the wheel out of the fork.
4. Take off hub cabs.

Assembling the Front Wheel

1. Place hub cab on the new wheel.
2. Install front wheel and tighten screws.

6.2.3 Cover, Tube

WARNING:
Prepare the vehicle by putting it on its side onto a support (not too soft) so that no load applies to the front wheel / the driving wheels and they can be easily accessed from both sides or, alternatively, jack up vehicle securely. You must remove the front wheel first in order to replace the cover or tube (see above).

WARNING:
DANGER!
Before you take off the wheel, take off the valve cap and relieve the pressure by pressing the valve lifter.

Disassembling the Tube

1. Take off wheel.
2. Unscrew the hexagon screws.
3. Remove rim from the cover.
4. Remove tube.

6.3 Front Wheel Axle-tree

⚠ **WARNING:**
Prepare the vehicle by putting it on its side onto a support (not too soft) so that no stress applies to the front wheel and it can be easily accessed from both sides or jack up vehicle securely.

Removing the Front Wheel Axle-tree

1. Take off front wheel.
2. Take off the hub cabs from the removed front wheel.
3. Remove the axle locking rings.
4. Carefully take out the axle using a rubber mallet.

Disassembling the Wheel Bearings

1. Pull off wheel bearing with a puller.

Assembling the Wheel Bearings

1. Drive in wheel bearing with a metal tube (D = diameter of the outer ring/wheel bearing) or press in using a press.

Assembling the Front Wheel Axle-tree

1. Re-insert the axle using the rubber mallet.
2. Secure axle with **new** locking rings.

6.4 Batteries

⚠ **WARNING:**
Observe the safety guidelines (refer to section 2). Do not short-out the battery terminals; otherwise you may cause a short. Be careful when lifting the battery to avoid injury. Remove any rings and metal jewellery from hands and wrists.
Always take off and remove the battery's negative connector before the positive connector.
Charging the Batteries: Refer to Notes/Operating Manual.

6.4.1 Checking Batteries, Battery Cables and Strip Fuse

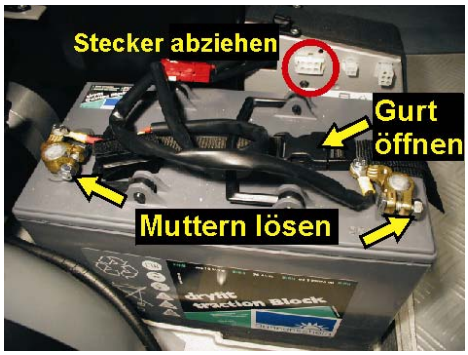
1. Verify total voltage with a multimeter at the console's charger port.
   Voltage below 24V: Charge batteries.
2. Voltage below 18 V: Check the individual battery voltage.
3. Disconnect battery terminals.
4. Check voltage at the battery terminals.
5. Battery voltage below 9 V: Charge relevant battery. If charging does not rectify undervoltage: replace relevant battery.

✓ **NOTE:**
If the individual voltage readings at the battery terminals are correct, however, the total voltage at the charger port is not, check cables and strip fuses.

6. Open the strip fuse holder carefully with a small screw driver.
7. Remove two nuts and take out the 50 A strip fuses.
8. Replace the faulty strip fuse.

6.4.2 Disassembling the Batteries

1. Remove the side shrouds (refer to section 7.1.1).
2. Remove connector on the electronic box.
3. Lift plastic caps from the battery terminals and remove the hexagon nuts.
4. Remove the terminal clamps from the battery terminals.
5. Loosen battery straps and lift battery from the frame.



6.4.3 Assembling the Batteries

1. Insert new battery.
2. Plug in the removed connectors on the electronic box (the plastic safeties must engage).
3. Close strap and tighten.
4. Attach terminal clamps to the battery terminals. Ensure that polarity and cone of the terminal clamps is correct.
5. Tighten hexagon nuts and put on plastic caps.

✓ **NOTE:**
Ensure that you do not over-tighten the terminal clamp hexagon nuts to prevent damage to the battery terminals.

6. Re-install the side shrouds (refer to section 7.1.1).

6.5 Electronic Box and Components

WARNING:
Remove Batteries.

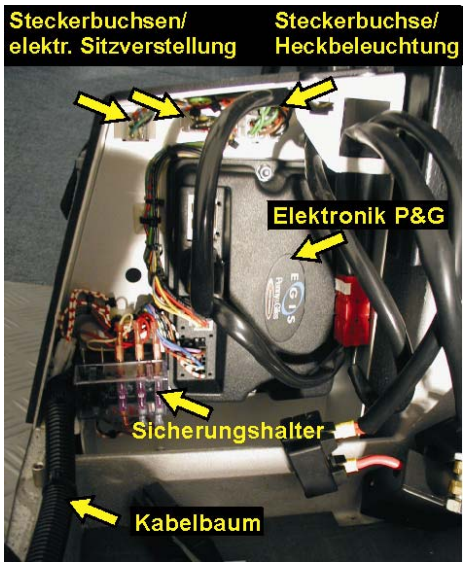
WARNING:
Prepare the vehicle by putting it on its side onto a support (not too soft) so that the underbody under the electronic box can be easily accessed or, alternatively, jack up vehicle securely.

6.5.1 Disassembling the Electronic Box

1. Remove all connectors from the electronic box.
2. Remove the screws securing the box to the underbody (4 Allen screws).

6.5.2 Disassembling the Components

1. Before removing any components, mark and take note of the connections of the components to be replaced.
2. Remove P & G Electronics
   a) Remove the two Allen screws at the rear panel of the casing.
3. P & G Cable Set with jacks
   a) Remove cable ties and connectors.
   b) Route the new cable harness (also refer to overview in section 2.2) and secure with cable ties.
4. Fuse holder
   a) Take note of fuse position and specifications.
   b) Take off fuse holder cover.
   c) Take out 3 A (lights, indicators) or 15 A



(charging) fuses.

d) Remove two hexagon socket nuts at the casing rear panel and lift out fuse holder including the two spacers.

6.6 Seat Unit

6.6.1 Seat

WARNING:
Fold back fully to the front onto the seat to prevent tipping after removing the screws.

Disassembling the Seat

1. Remove the two front Allen screws. To be able to remove the rear nuts you must push the seat to the very front.
Take note of the number and position of the washers for later reassembling.

2. Lift the seat from the seat plate and place on a stable support.

Assembling the Seat

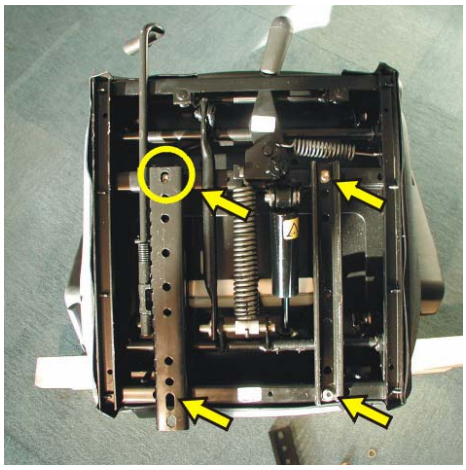
1. Take note of the number and type of washers. Use **new** self-locking nuts only.

6.6.2 Slide Rails

WARNING:
Take care when handling slide rails, adjusting levers and springs to prevent injury.

Disassembling the Slide Rail

1. Turn over the removed seat with folded back.
2. Remove four Allen screws.
3. You can loosen the top screw in the slide rail through the cut-out in the rail (see picture, circle), however, this screw cannot be fully removed.

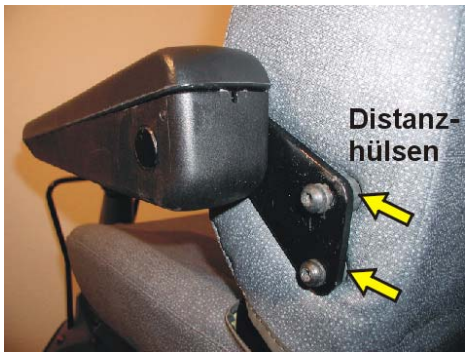


Assembling the Slide Rail

1. Secure screws additionally with Loctite.

6.6.3 Armrests

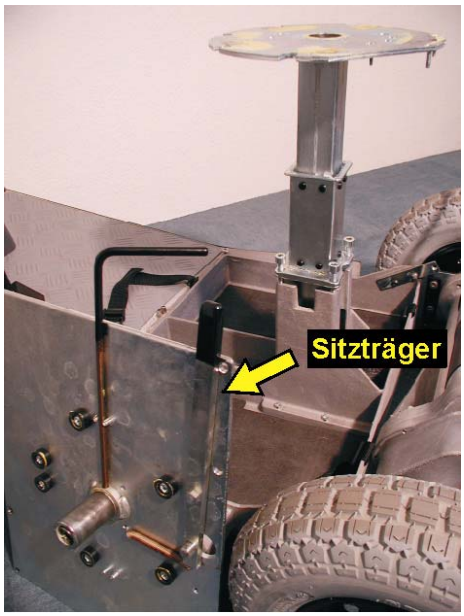
1. Disassembling the Armrests
Remove two Allen screws and lift off armrest together with spacers.



6.6.4 Seat Plate

1. Remove the seat (see 7.6.1)

2. Take off the seat plate.



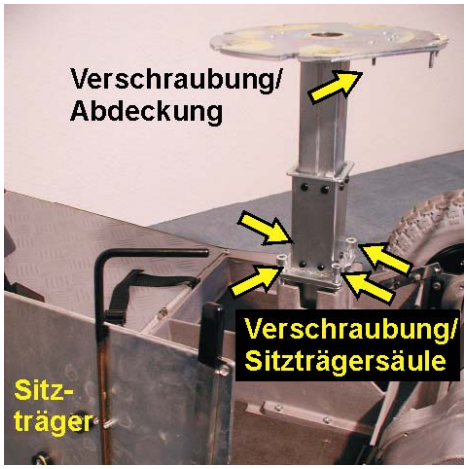
6.6.5 Seat Post

WARNING:
DANGER!
Before you disassemble the seat post ensure that the seat is fully extended. If this is not the case the gas pressure spring will be pressurised.

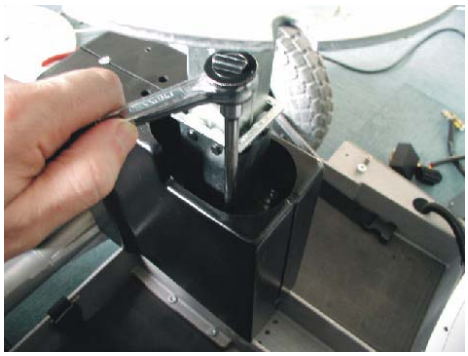
NOTE:
In any case, the gas pressure spring will retain some pressure to give a lift of a few millimetres which is required for its proper function. It will be easier to remove the seat post if the electronic box has been taken out first.

Disassembling the Seat Post

1. Remove the seat (see 7.6.1)
2. Take off the seat plate.
3. Unscrew the cover screws.



4. Remove the seat post screws, 4 Allen screws.



Assembling the Seat Post

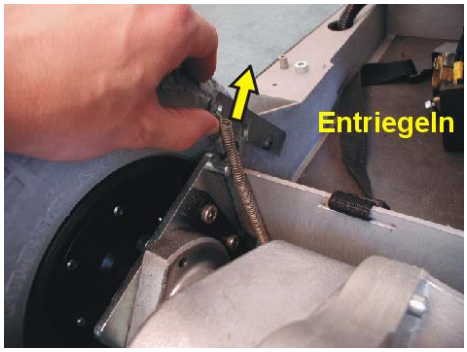
1. Before installing the seat post, put back the cover.
Ensure tight fit of the seat post screws.

6.7 Drive

WARNING:
Jack up vehicle securely. In order to be able to remove the drive you must have a ground clearance of at least 150 mm. Be aware of the drive unit weight, otherwise personal injury may occur. Once servicing has been completed, carry out a function test and test drive the vehicle. Danger of Accident!

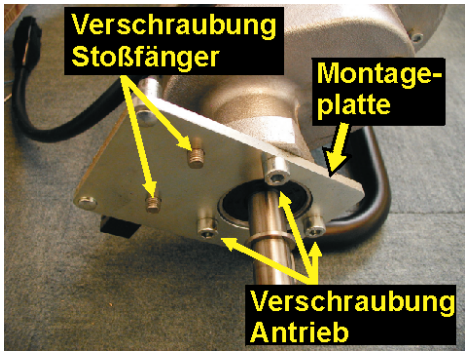
6.7.1 Disassembling the Drive Unit

1. Remove rear shroud.
2. Disconnect drive connectors.
3. Unlock drive unit (if necessary ask for assistance) and lower.
4. Press the lower mounting plate bolts down through the frame.



6.7.2 Disassembling the Components

1. Fender
   a) Remove two Allen screws each on the right and on the left hand side.
2. Drive
   a) Remove the driving wheels (see section 7.2.1)
   b) Remove three Allen screws each on the right and left securing the mounting plates.
3. Handle for brake
   a) Remove two Allen screws.



6.8 Tiller, Console, Keypad

WARNING:
Upon completion of service on the throttle control lever or keypad carry out function test and test drive the vehicle. Danger of Accident!

Disassembling the Tiller, Console & Keypad

1. Throttle Control Lever

   a) Remove two Philips screws.

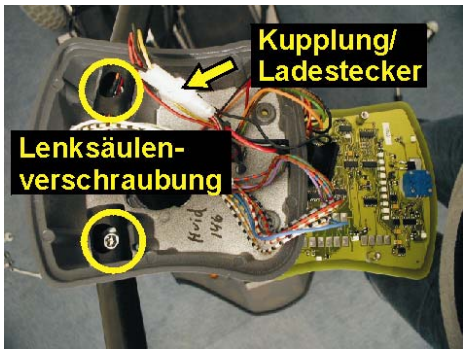
   b) Unlock the connector and disconnect.

2. Keypad

   a) Remove four Allen screws.

   b) Lift off connector strip.

   c) Separate charger port connector coupling.



3. Tiller

   a) Work tiller plug from the left and right steering pillar tubes.

   b) Unscrew throttle control lever (see above) and throttle control lever dummy.

   c) Pull off steering pillar pad.

   d) Unscrew keypad.

   e) Remove steering pillar screws (see figure above).

4. Console

a) Disassemble tiller and keypad (see above)

b) Remove cable ties.

c) Remove screws connecting the console to the tiller shaft (see figure)

d) Pull console from the tiller shaft, carefully lift out connector strips.

Assembling the Tiller, Console & Keypad

1. Ensure that you do not pinch or damage the cable harness when guiding the screw through the tiller shaft.

6.9 Tiller Shaft Shroud, Tiller Shaft

Disassembling the Tiller Shaft Shroud and the Tiller Shaft

1. Turn and pull the shock absorber holder off the tiller shaft.
2. Pull off top and bottom shock absorber.
3. Tilt the tiller shaft backwards and remove the 4 friction swivel joint torx screws with tool T 30.
4. Remove the shroud from the tiller shaft, if necessary use a rubber mallet.
5. Remove the inner lock ring with round nose pliers.
6. Take out ball bearing with puller.
7. Unscrew friction swivel joint.

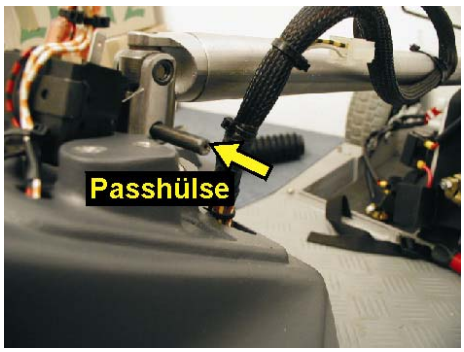
Disassembling the Friction Swivel Joints

✓ **NOTE:**
Disassembly is possible without first removing the tiller shaft shroud..

1. Slide the lower shock absorber onto the tiller shaft shroud.
2. Loosen the side screws & nuts of the inner or outer swivel joint somewhat (Allen screw and nut).
3. Tilt the tiller shaft shroud backwards and remove the screws attaching the friction swivel joints to the front shroud with the torx driver T 30.
4. Right the tiller shaft shroud You will need an angled T 30 tool to remove the screws securing the friction swivel joints to the tiller shaft cover

✓ **NOTE:**
Adjust the movability of the friction swivel joints after completion of assembly by twisting the side screws of the inner and outer joints (see picture above).

Disassembling the Tiller Shaft



1. Remove the console and tiller shaft shroud (see above)
2. Drive out the spacer with a spike (D = 5mm).
3. Remove cable ties and pull cable out of the tiller shaft.

Assembling the Tiller Shaft

1. Position tiller shaft on the forked axle and fit spacer.
2. Secure cable harness with cable ties.

✓ **NOTE:**
Ensure that the cable harness has enough play,

adjust with the tiller shaft in vertical position.

Assembling the Tiller Shaft Shroud and the Tiller Shaft

1. Screw the friction swivel joints to the tiller shaft shroud and install the shroud.

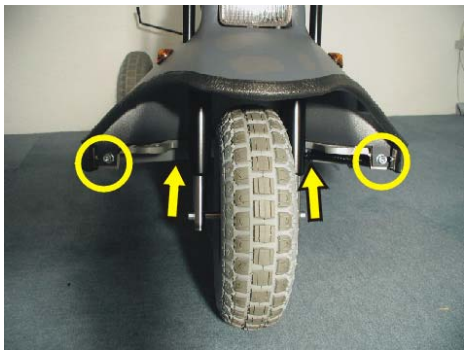
2. Screw the friction swivel joints to the front shroud (see picture).

3. Insert ball bearing and inner locking ring.

4. Insert top and bottom shock absorber and shock absorber holder.

6.10 Front Shroud, Front Wheel Fork, Lights, Horn

Disassembling the Front Shroud



1. Remove console, tiller shaft shroud and tiller shaft (refer to sections 7.8 and 7.9).
2. Unplug connector from headlight and indicator lights.
3. Remove cable tie and pull cable harness out of the front shroud..
4. Remove the vertical screws at the underbody (see picture, arrows).
5. Remove the upper locking ring from the forked axle.
6. Remove the front wheel fork with a spike (< 20 mm) from the ball bearings.
7. Remove the lower locking ring.
8. Disassemble ball bearing with a puller.
9. Remove the horizontal front shroud screws (see picture, circles). If required, support chassis.
10. Remove lights and horn (see below).

Disassembling the Front Wheel Fork

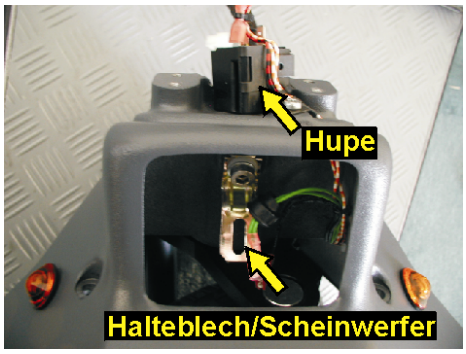
⚠ **WARNING:**
Jack up vehicle securely.

1. Remove front wheel (section 7.2.2)
2. Disassemble the front wheel fork as described above (section on front shroud, see also picture).

✓ **NOTE:**
In order to install the ball bearings and the front wheel fork it might be beneficial to put the vehicle on its side. Decide whether this is the case in your situation.

Disassembling the Light Components

1. Unplug headlight and indicator light connectors.
2. Pull off **indicator lights**.
3. Unscrew the **headlights** from the plate (see figure).



4. **Replacing the Bulbs**
   a) Unscrew the lamp reflectors.
   b) Pull the indicator light socket from the rubber sleeve.
5. **Horn**
   a) Remove the connector from the horn and untie the cable tie at the plate.
   b) Remove torx screw with T 25 tool.

6.11 Chassis

WARNING:
Prepare this job by jacking up the vehicle securely at the front and rear end allowing sufficient ground clearance (min. 150 mm). Ensure that the lower (vertical) screws attaching the front shroud to the frame remain accessible. It is imperative to disassemble the parts in the order stated; otherwise the vehicle might tip.

Disassembling the Chassis

1. Remove **batteries** (Section 7.4)
2. Remove **drive** (Section 7.7)
3. Remove **electronics box** (Section 7.5)
4. Disconnect all connectors and remove the cable harness up to the front shroud.
5. Support front wheel and remove front **shroud screws** (s. picture in section 7.10 and picture below).
6. Lift front shroud with electronics box cable harness.
7. Remove **seat**, **seat plate** and **seat post** (s. sections

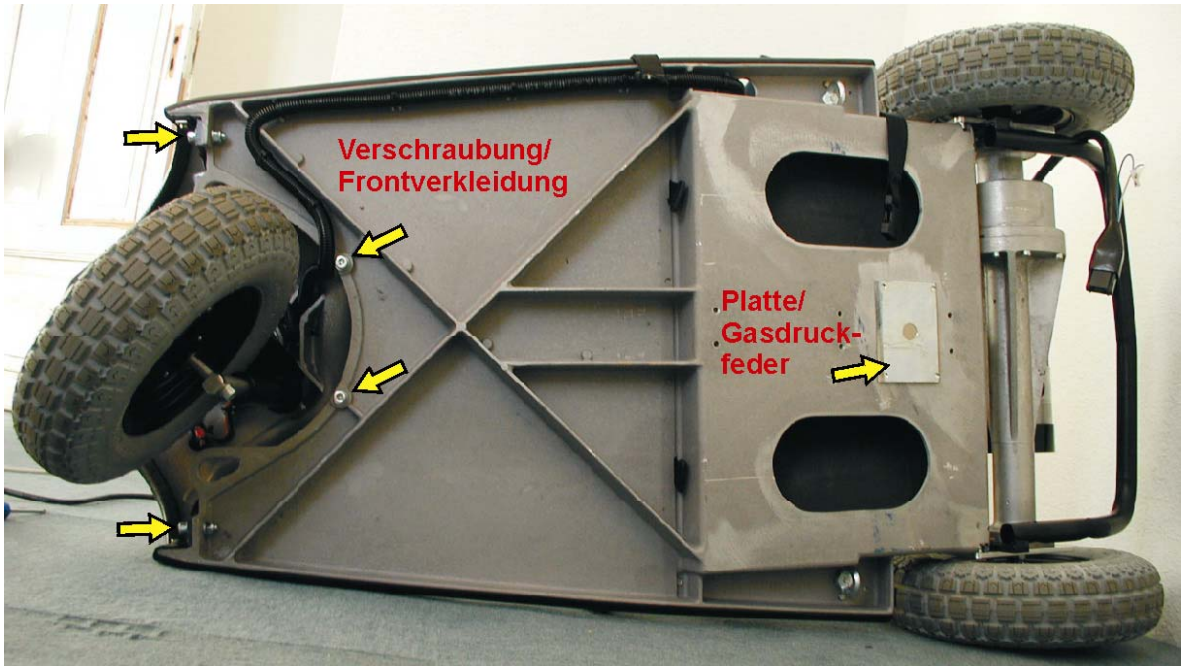
7.6.1, 7.6.4 and 7.6.5).

8. Remove 4 Allen screws and unscrew **gas pressure spring** plate (see picture).

9. Loosen **battery straps**.

10. Remove the drive locking **springs**.

11. Unscrew the **drive locks**.



7 Appendix:

7.1 Circuit Diagram