

SERVICE MANUAL

US

# *Permobil K450*

Power Wheelchair



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## Introduction

The Service Manual is intended for technical personnel who maintain and repair power wheelchairs. It is important that anyone who performs maintenance and repairs described in this manual reads and understands the content of this manual so that the work is performed professionally. Always state the chassis number when contacting Permobil to ensure that the correct information is provided.

### **Spare parts**

Spare parts must be ordered through your dealer.

### **Warranties**

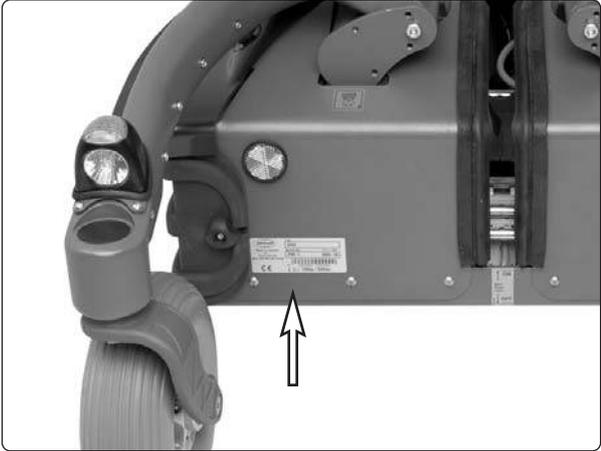
Contact your dealer or Permobil Inc. USA for information about the warranties for this chair.

### **Maintenance**

See the information in the Owner's Manual.

# Serial Number Plate

## Chassis



*Chassis ID number*

## Power Module



*Power Module ID number*

## Control panel



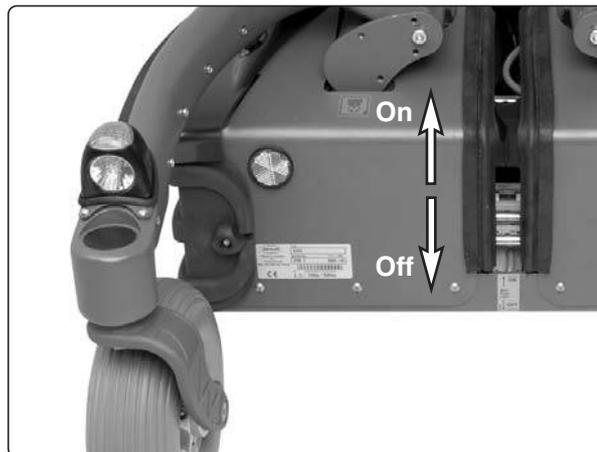
*Control panel ID number*

## Batteries

There are two batteries in the chassis, one on the left side and one on the right side. Removal/fitting is the same on both sides.

### Removal

1. Place the wheelchair on a level surface.
2. Switch off the main power switch on the control panel.
3. Switch the main fuse to OFF. See illustration.
4. Remove the upper and lower battery cover. See pages 8-9.



*Main fuse/battery isolator (On/Off)*

5. Use the battery belt to pull/lift the battery from the chassis.



*Lift/pull the battery out of the chassis.*



### WARNING

Be careful when using metal objects when working with batteries. A short-circuit can easily cause an explosion. Always use safety gloves and goggles.

6. Disconnect the battery connections. See also the sticker on the inside of the left lower battery cover.

### Fitting

Fit in the reverse order.



*Battery removed.*

## Covers

### Removing the upper battery cover

An upper battery cover is fitted to the right or left side of the chassis. Removal/fitting is the same on both sides.

1. Remove the knob located on top of the cover. See illustration.



*The upper battery cover is fitted with a knob on top of the cover.*

2. Unfold the cover and angle it outwards around 90°. Next lift the cover out from the chassis. See illustration.

### Fitting

Fit in the reverse order.



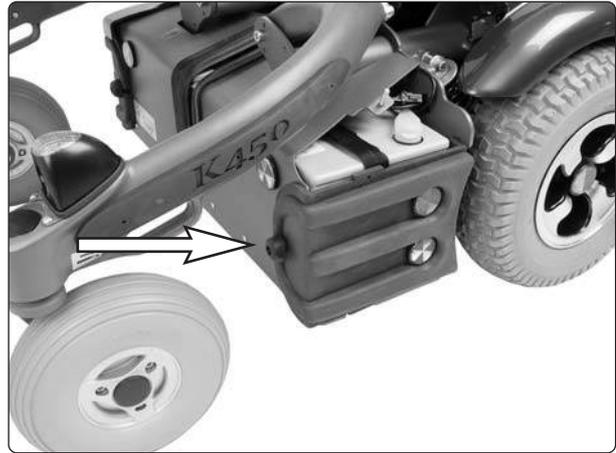
*Removing/fitting the upper battery cover.*

## Covers

### Removing the lower battery cover

A lower battery cover is fitted to the right or left side of the chassis. Removal/fitting is the same on both sides.

1. Loosen the knob on the front of the cover enough to ensure that the edge of the cover moves freely during removal.



*The lower battery cover is held in place with a knob on the front of the cover.*

2. Unfold the cover in front. Next pull it forward to release the cover at the rear.

### Fitting

Fit in the reverse order.



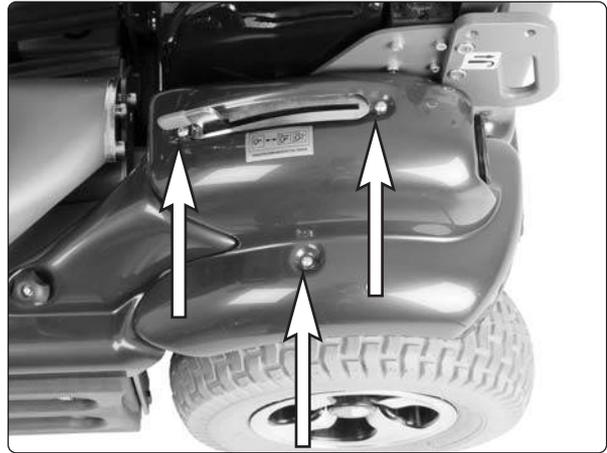
*Removing/fitting the lower battery cover.*

## Covers

### Removing the rear wings

A rear wing is fitted to the right or left side of the chassis. Removal/fitting is the same on both sides.

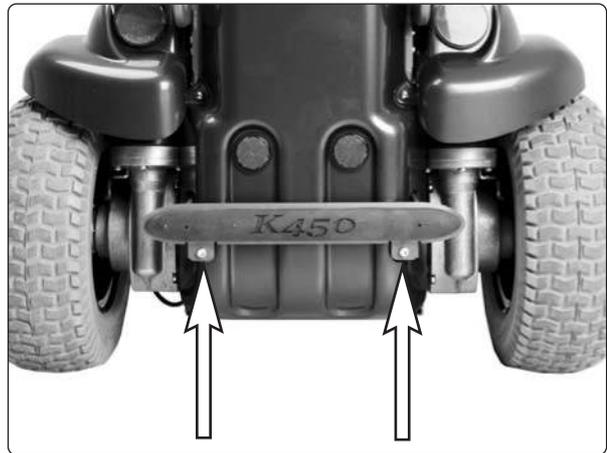
1. Remove the three screws that secure the cover. See illustration.
2. Remove the rear wing by lifting it straight up. When removing the left rear wing, place the brake release's release control in the released position to facilitate removal.



*Each of the rear wings is held in place with three screws.*

### Removing the chassis cover

1. Remove the bumper, which is held in place with two screws. See illustration.



2. Remove the two screws holding the chassis cover. See illustration.
3. Remove the chassis cover by pulling it straight back.



*The chassis cover is held in place with two screws.*

## Covers

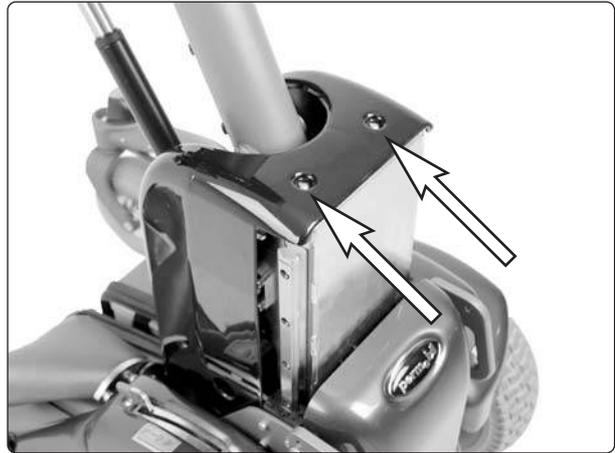
### Removing the seat lift cover

1. Raise the seat lift to its highest position. If the seat lift cannot be raised in the usual way, use the emergency operation cable. See page 36.
2. Remove the two screws on the right and left side of the cover. See illustration.



*Fixing screw on the left side of the cover.*

3. Remove the two screws on the top of the cover. See illustration.



*Fixing screws on the top of the cover.*

## Rear wheels

### Removal

1. Switch off the main power switch on the control panel.
2. Lift up and chock up the wheelchair chassis so that the wheel in question is free of the ground.
3. Loosen and remove the hub cap (5), the rubber seal (4) and the wheel bolt and washers (3). See illustration.
4. Remove the wheel (2) by pulling it straight out.

### Fitting

1. Check that the axle and rim are not damaged. If necessary, clean to remove any dirt and rust. Replace damaged parts.
2. Check that the parallel key is properly located and is not damaged. Fit a new parallel key if necessary.
3. Lubricate the axle with a thin layer of copper paste (Würth 0893800x, Art. no. 1820540)

#### WARNING

The threads on the wheel bolt and in the screw hole must not be lubricated. Clean the threads if necessary.

4. Fit the wheel on the axle using just your hands. Check that the wheel is fully located on the axle. If necessary, use a rubber mallet carefully.
5. Fit the wheel bolt and washers (3). Tighten the wheel. Fit the rubber seal (4) and hub cap (5). See illustration.

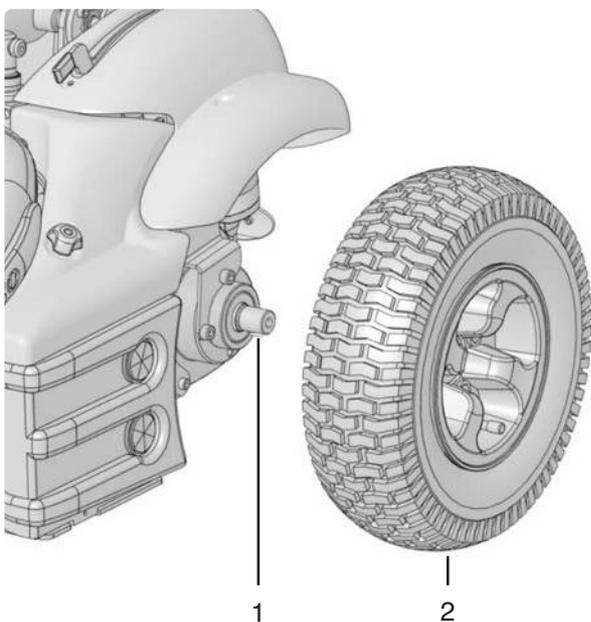
### Use a torque wrench to tighten the bolt to 24 ft-lbs (33Nm)

#### NOTE

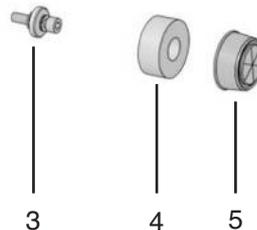
Do not use an impact wrench for the tightening torque.

#### WARNING

Wheel bolts must only be used once. Once removed, the wheel bolt must therefore never be refitted. No other type of screw or washer than those stated here may be used. No other type of lock coating or lock liquid may be used.



Item	Description
1	Parallel key DIN 6885A 6x6x22
2	Rear wheels
3	Screw, ISO 4762 M8x25 10.9 Fe/Zn 5 C2 / Locking coat DIN 267-28 Shims washer DIN 988 8 A2 (DB 8x14x0.5 Stainless steel) Washer, 8 HB 305 Fe/Zn 5 C2 (TBR SB 8.4x26x5)
4	Rubber seal
5	Hub cap



Fitting/removing rear wheels.

## Rear wheels

### Taking the rim apart

The rim can be taken apart to make it possible to fit/remove pneumatic tires. Solid tires can not be removed from the rim, on chassis with solid tires, remove the whole wheel incl. the rim, see page 12.

1. Remove the wheel in question from the wheelchair. See the previous page.
2. Let the air out of the tire.

#### WARNING

Ensure that tire is not pressurized before the rim is taken apart, otherwise there is a risk of personal injury.

3. Remove the four screws holding the two halves of the rim together (see illustration).
4. Take the rim apart.

### Fitting

Fit in the reverse order.

**Use a torque wrench to tighten the screws holding the rim halves in place to 17.7 ft-lbs (24 Nm)**

#### NOTE

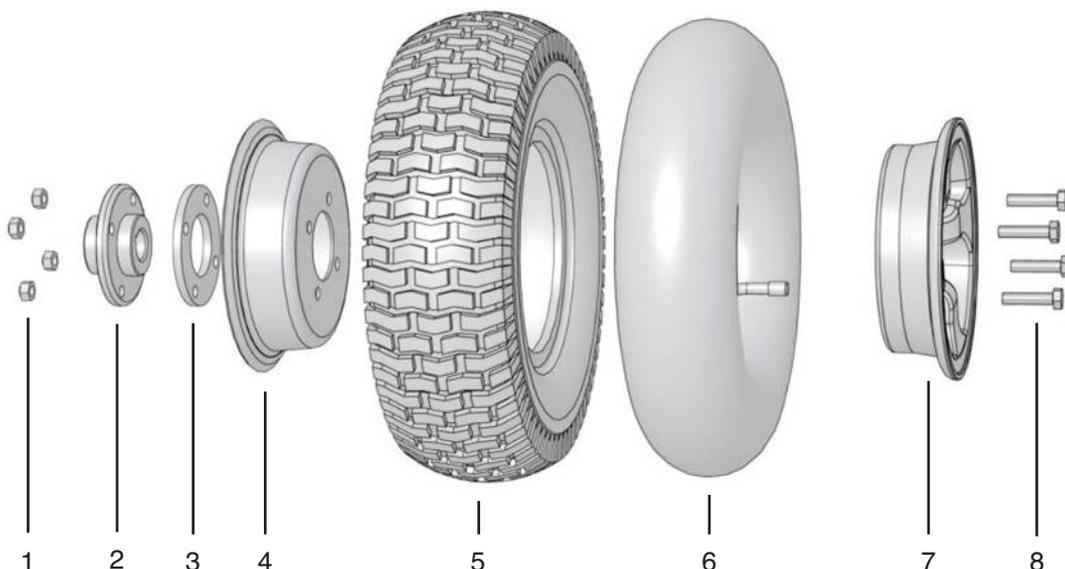
Do not use an impact wrench for the tightening torque.

#### WARNING

The recommended tire pressure for pneumatic tires is 17-29 psi (120-200 kPa). Overfilling entails a risk of explosion.

The incorrect tire pressure may result in lower stability and maneuverability. So check regularly that the tires have the correct pressure.

Item	Description
1	Locking nut, M8 6 Fe/Zn 5 C1
2	Hub, Ø22 x 38
3.	Adapter
4	Rim, interior. 5.00" x 6"
5	Tire, air 13" x 5.00" - 6" C165
6	Inner tube 13"x5.00"x6" TR87
7	Rim, exterior. 5.00" x 6"
8	Screw, M8x35 8.8 Fe/Zn 5 C1



*Fitting a pneumatic tire to a split rim.*

## Front wheels

### Removal

1. Switch off the main power switch on the control panel.
2. Lift up and chock up the wheelchair chassis so that the wheel in question is free of the ground.
3. Remove the hub cap (6).
4. Remove the nut (5). Apply pressure to the screw (1) using a suitable Allen key.
5. Remove the washer (4), wheel (3), axle (2) and the screw (1).

### Fitting

1. Check that the axle and rim are not damaged. If necessary, clean to remove any dirt and rust. Replace damaged parts.
2. Fit the wheel on the axle using just your hands. Check that the wheel is fully located on the axle.
3. Fit the screw (1) in the wheel fork.
4. Lubricate the axle (2) with a thin layer of copper paste (Würth 0893800x, Art. no. 1820540)
5. Fit the wheel (3) and axle (2), washer (4) and nut (5), and tighten the wheel.
6. Fit the hub cap (6).

**Use a torque wrench to tighten the bolt to 24 ft-lbs (33Nm)**

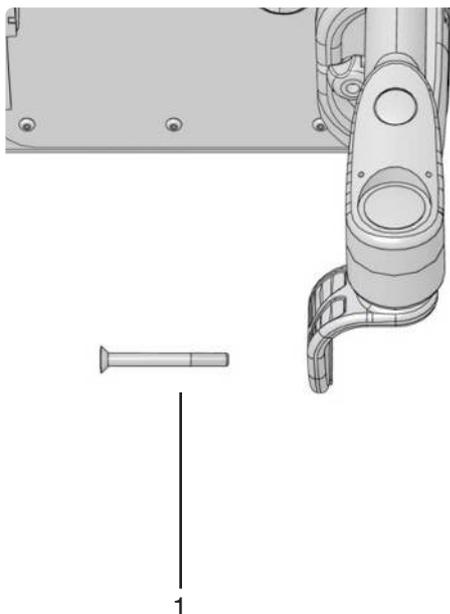
#### WARNING

The locking nut must only be used once. Once removed, it must therefore never be refitted. Do not use an impact wrench for the tightening torque.

#### WARNING

No type of screw, washer or nut other than those stated here may be used.

Item	Description
1	Screw, ISO 10642, M8x70, 10.9 Fe/Zn 5 C1
2	Axle, ISO 2768-m Ø15
3	Front wheel
4	Washer, ISO 2768-c, 8.5x23x3
5	Locking nut, ISO 7040 M6 8 Fe/Zn 5 Cl
6	Hub cap



*Rim mounting.*

## Front wheels

### Taking the rim apart

The rim can be taken apart to make it possible to fit/remove solid or pneumatic tires.

1. Remove the wheel in question from the wheelchair. See the previous page.
2. If the tire is pneumatic, release the air.

**⚠ WARNING**

Ensure that pneumatic tires are not pressurized before the rim is taken apart, otherwise there is a risk of personal injury.

3. Remove the three screws holding the two halves of the rim together (see illustration).
4. Take the rim apart.

### Fitting

Fit in the reverse order.

**Use a torque wrench to tighten the screws holding the rim halves in place to 7.2 ft-lbs (9.8 Nm).**

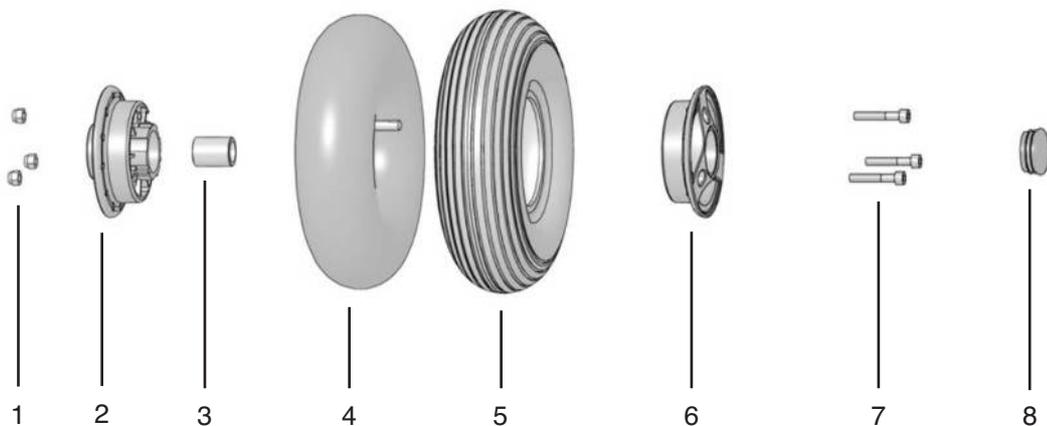
**⚠ NOTE**

Do not use an impact wrench for the tightening torque.

**⚠ WARNING**

The recommended tire pressure for pneumatic tires is 36 psi (250 kPa). Overfilling entails a risk of explosion.  
The incorrect tire pressure may result in lower stability and maneuverability. So check regularly that the tires have the correct pressure.

Item	Description
1	Locking nut, M6 8 Fe/Zn 5 C1
2	Rim, interior. 210x65
3.	Spacer
4	Inner tube 210x65 TR87 (Pneumatic tires only)
5	Tire, air 210x65 (2.50" x 3") Tire, Solid 210x65 (2.50" x 3")
6	Rim, exterior. 210x65
7	Rim, exterior. 210x65
8	Screw, M6x35 8.8 Fe/Zn 5 C1



*Fitting a tire to a split rim.*

## Wheel fork

### Removal

1. Switch off the main power switch on the control panel.
2. Lift and chock up the wheelchair chassis so that the wheel in question is free of the ground.
3. Remove the cap (1) from the top of the link arm. See illustration.
4. Remove the wheel fork, which is held in place with a nut (2) from above. See illustration.

### Fitting

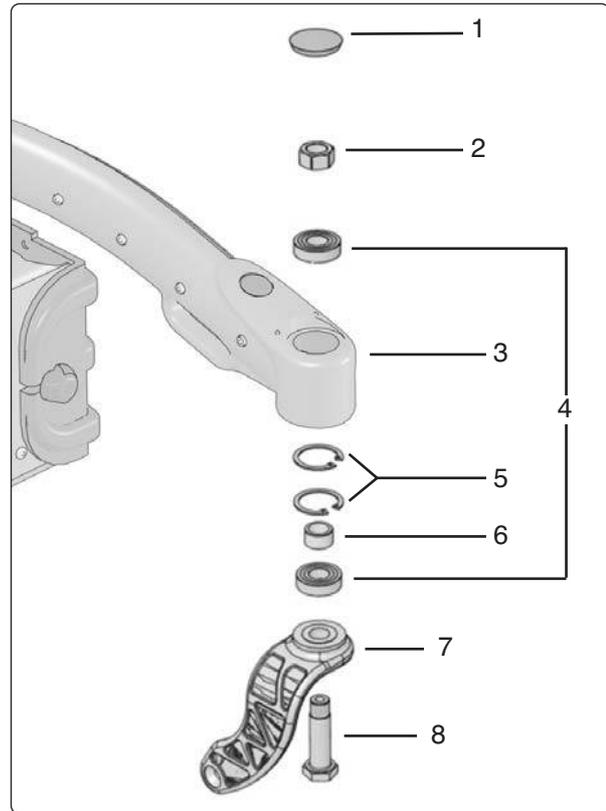
Fit in the reverse order. Lubricate the bolt (8) with a thin layer of copper paste (Würth 0893800x, Art. no. 1820540)

**Use a torque wrench to tighten the bolt to 51.6 ft-lbs (70 Nm)**



#### NOTE

Do not use an impact wrench for the tightening torque.



*Wheel fork.*

Item	Description
1	Cap
2	Nut DIN 934 M14x1.5 8 Fe/Zn 8 C1
3	Link arm
4	Bearings, 6002-2RS1 (15x32x9)
5	Circlips, DIN 472 Ø32
6	Spacer, SS-EN 10277-5 - 1.6582 QT+C (SS 2541-03)
7	Wheel fork
8	Bolt, ISO 2768-m Stainless

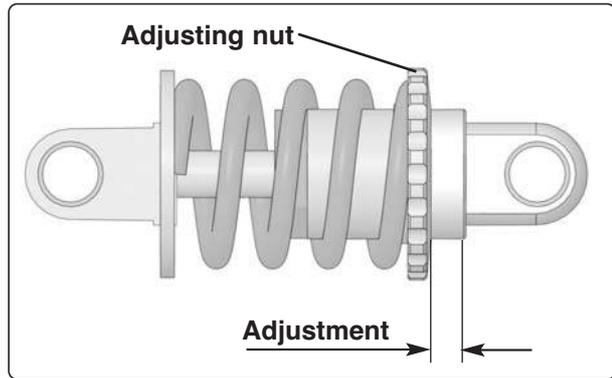
## Shock absorbers

The wheelchair chassis is equipped with shock absorbers in the rear wheel suspension.

### Adjusting shock absorber spring force

The spring force of the shock absorber must be adjusted to the correct value (see illustration). Adjustment can be performed with the shock-absorber mounted in the chassis.

The spring force can be adjusted to suit different body weights by means of the adjusting nut. Reduce the value for a softer suspension, and increase the value for a harder suspension.

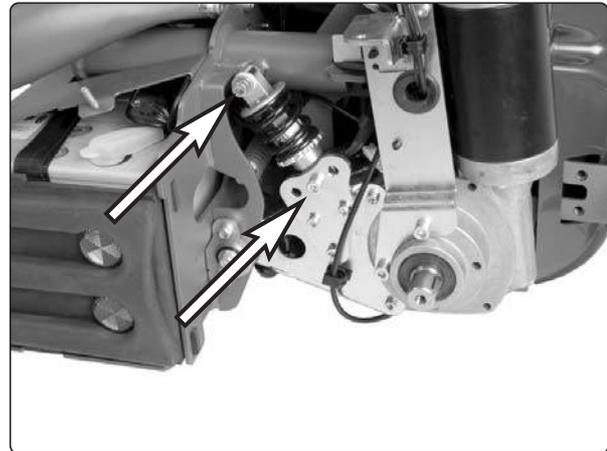


Adjusting the shock absorbers

Body weight	Adjustment
0 - 33 lbs	0.39" (10 mm)
33 - 66 lbs	0.43" (11 mm)
66 - 99 lbs	0.45" (11.5 mm)
99 - 125 lbs	0.47" (12 mm)

### Removing shock absorbers

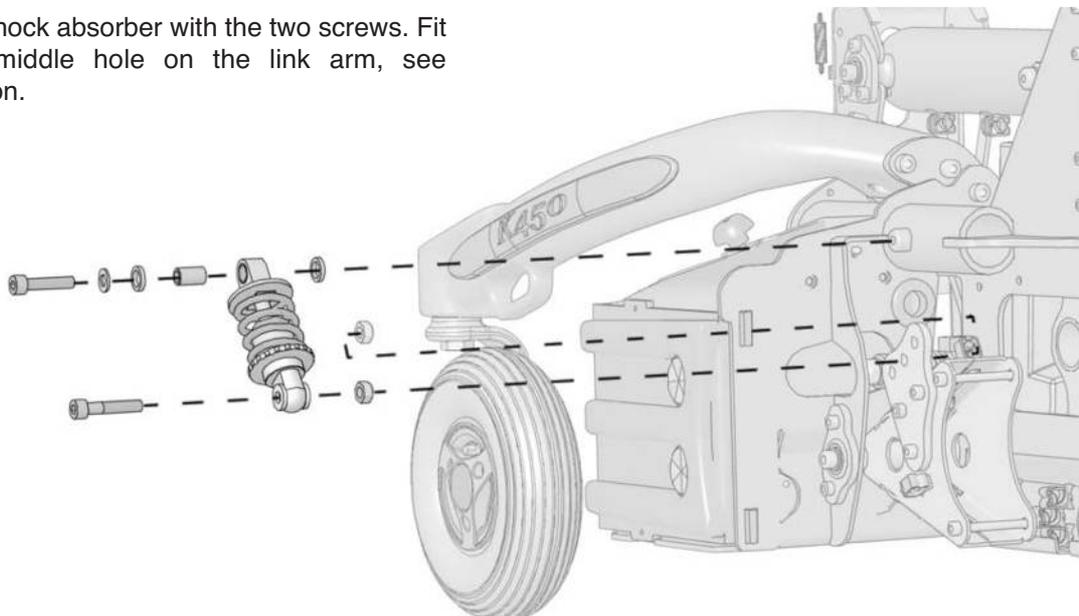
1. Switch off the main power switch on the control panel.
2. Lift up and chock up the wheelchair chassis so that the wheel in question is free of the ground.
3. Remove the upper battery cover and rear wing on the relevant side. See pages 8-10.
4. Remove the rear wheel on the relevant side. See page 12.
5. Remove the shock absorber, which is held in place with two screws. See illustration.



The shock absorber is held in place with two screws.

### Fitting

1. Adjust the spring force of the shock absorber before fitting. See above.
2. Lubricate the shock absorber's bearing points with grease.
3. Fit the shock absorber with the two screws. Fit in the middle hole on the link arm, see illustration.



Fitting/removing the shock absorbers.

## Suspension

The wheelchair's front wheel suspension is equipped with spring suspension.

### Removing the suspension mechanism

1. Switch off the main power switch on the control panel.
2. Lift up and chock up the wheelchair chassis so that both front wheels are free of the ground.
3. Remove the upper and lower battery covers on both sides of the chassis. See pages 8-9.
4. Use the battery belt to pull/lift the batteries out on both sides of the chassis.
5. Remove the two screws holding the suspension mechanism on both sides of the chassis. See illustration.
6. Move the suspension mechanism out of the chassis through the recess on the left or right side.



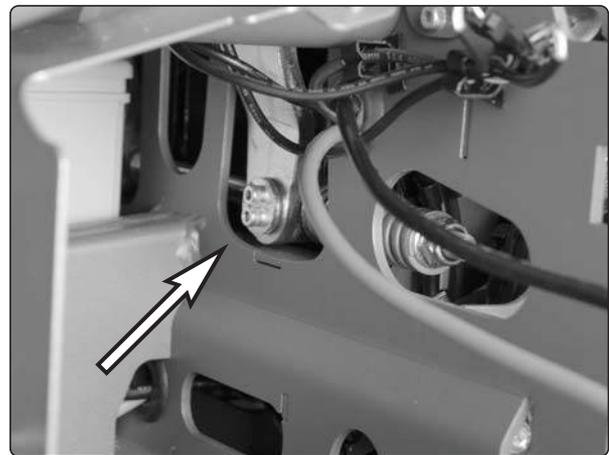
*The suspension mechanism is held in place with two screws on each side of the chassis.*

### Fitting the suspension mechanism

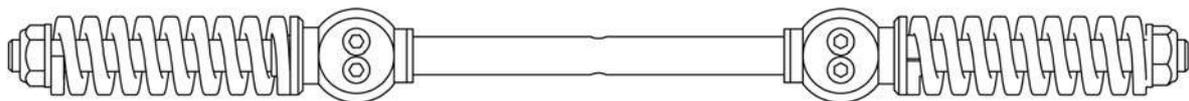
Fit in the reverse order.

**Use a torque wrench to tighten the screws to 4.2 ft-lbs (5.7 Nm)**

Adjust the spring force after fitting. See page 19.



*The suspension mechanism is held in place with two screws on each side of the chassis.*



## Suspension

### Adjusting the spring force

The spring force must be adjusted to the right value. See illustration.

The spring force can be adjusted to suit different body weights by means of the adjusting nut. Reduce the value for a softer suspension, and increase the value for a harder suspension. Use the attached box spanner for adjustment.

1. Place the wheelchair on a level surface.
2. Switch off the main power switch on the control panel.
3. Turn the adjustment nut clockwise for harder suspension and anti-clockwise for softer suspension. Hold the axle using a suitable tool, for instance a screwdriver, in the hole in the middle of the axle. See illustration.

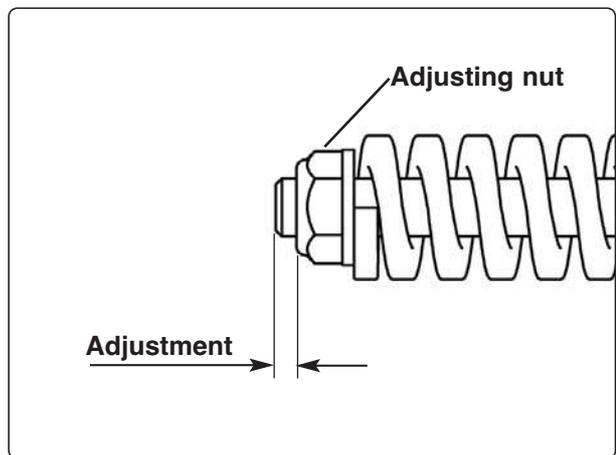


*Adjusting the spring force.*

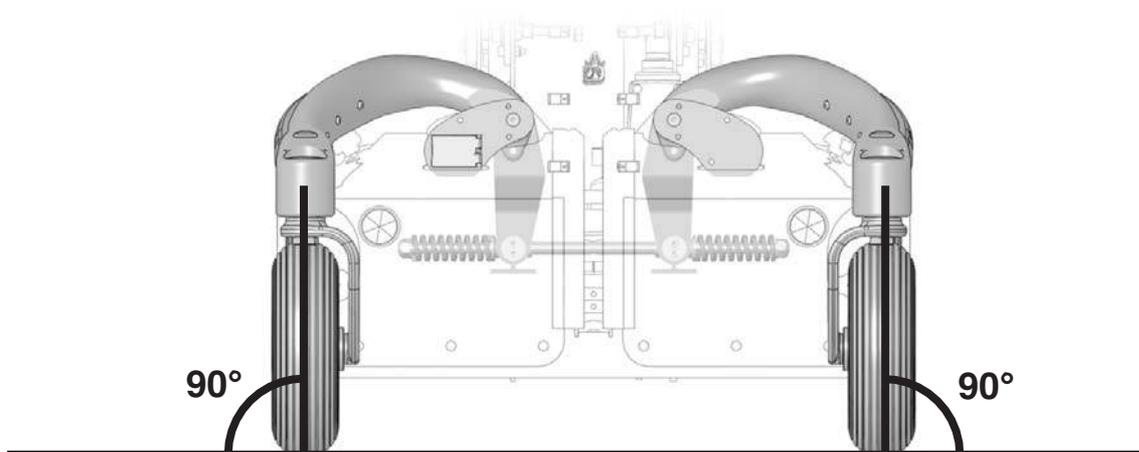
**NOTE**

It is important to adjust the suspension correctly. Remember that extra equipment and luggage on the wheelchair affect the weight and mean the suspension will need to be adjusted. The suspension always needs to be adjusted the same amount on the right and left side of the chassis.

Too soft or hard suspension mean that the wheelchair's pivot wheels will not be vertical, which will affect the operating properties of the wheelchair negatively.



Adjusting the suspension	
Body weight	Adjustment
0 - 33 lbs	0.22" (5.5 mm)
33 - 66 lbs	0.26" (6.5 mm)
66 - 99 lbs	0.33" (8.5 mm)
99 - 125 lbs	0.39" (10 mm)

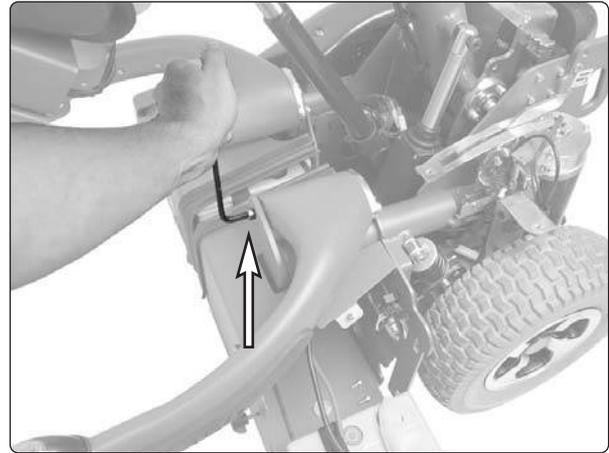


*The suspension must be adjusted so that the angle of the pivot wheels against the ground is 90° under normal load.*

## Link arms

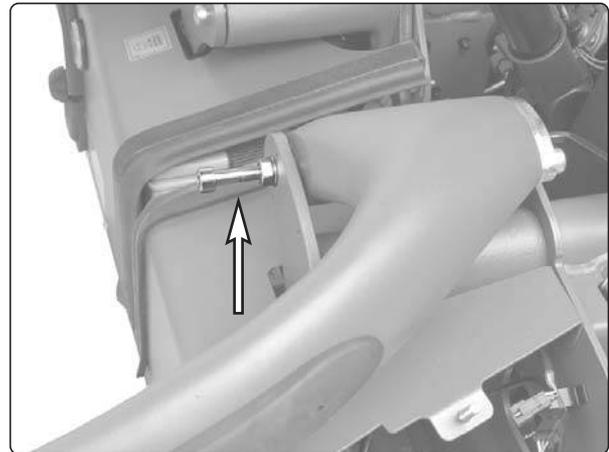
### Removing the front link arm

1. Switch off the main power switch on the control panel.
2. Lift up and chock up the wheelchair chassis so that both front wheels are free of the ground.
3. Remove the suspension mechanism on the relevant side. See page 18.
4. Remove the screw that holds the link arm in place at the front. See illustration.



*Link arm mounting*

5. Fit a longer screw with nut and washer in the same screw hole. Tighten the screw around 15 mm in the hole and then tighten the link arm using the nut. See illustration.



6. Remove the screw that holds the link arm in place at the rear. See illustration.
7. Remove the longer screw at the front by first holding onto the screw and loosening the nut. Then loosen the screw fully.



*Remove the screw holding the link arm in place at the rear.*

## Link arms

8. Remove the link arm by pulling it out of the chassis. See illustration.

To remove the wheel forks and wheel, see the relevant chapter.

### Fitting

Fit in the reverse order.

**Use a torque wrench to tighten the screws holding the link arm in place to 17.7 ft-lbs (24 Nm).**



#### NOTE

Do not use an impact wrench for the tightening torque.

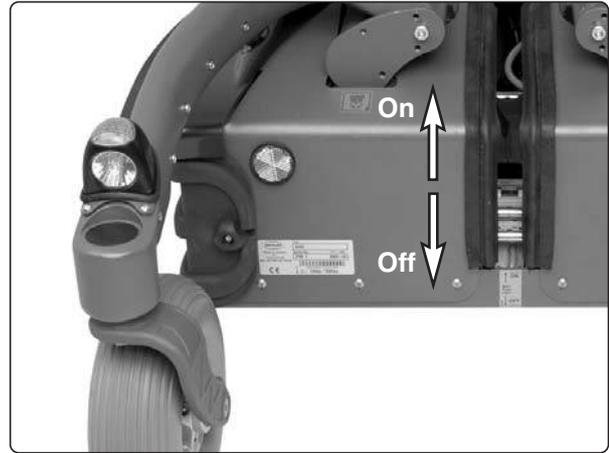


*Removing the link arm.*

## Brake release cables

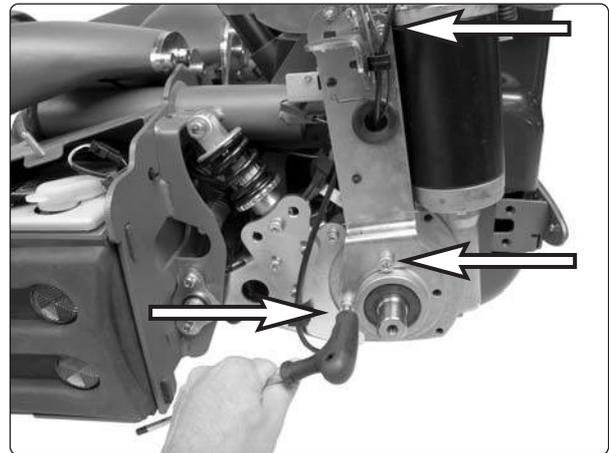
### Removal

1. Place the wheelchair on a level surface.
2. Switch off the main power switch on the control panel.
3. Switch the main fuse to OFF. See illustration.
4. Remove the left rear wing. When replacing the right brake release cable, remove the rear wing on both the left and right sides. See page 10.



*Main fuse/battery isolator (On/Off)*

5. Remove the protective plate, which is held in place with three screws. See illustration.



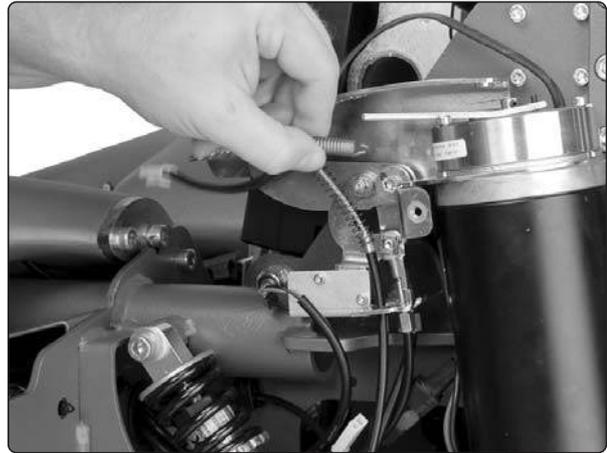
*The protective plate is held in place with three screws.*

6. Loosen the brake release cable in question from the magnetic brake by pulling the cable sheath down and pulling the cable out through the cable holder groove. See illustration.



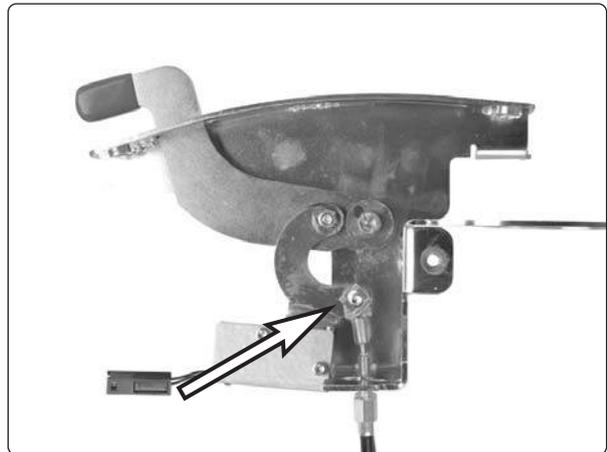
## Brake release cable

- Unhook the brake release cable spring from the magnetic brake.



*Unhook the brake release cable spring.*

- Remove the cable from the release control. Both the left and right cables are held in place in the same cotter and are secured with the same lock loop.



The cables are secured to the cotter with a lock loop.

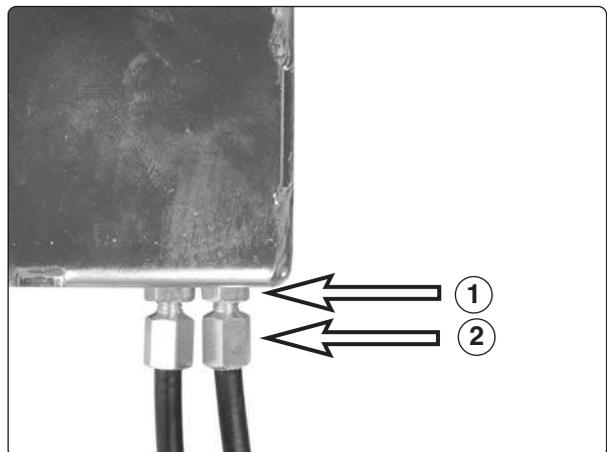
- Loosen the locking nut (1) on the cable in question.
- Fully unscrew the adjustment screw (2) on the cable in question.

### Fitting

Fit in the reverse order.

#### NOTE

Check the function of the brake release after fitting. When the brakes are disconnected, it should not be possible to drive the wheelchair.

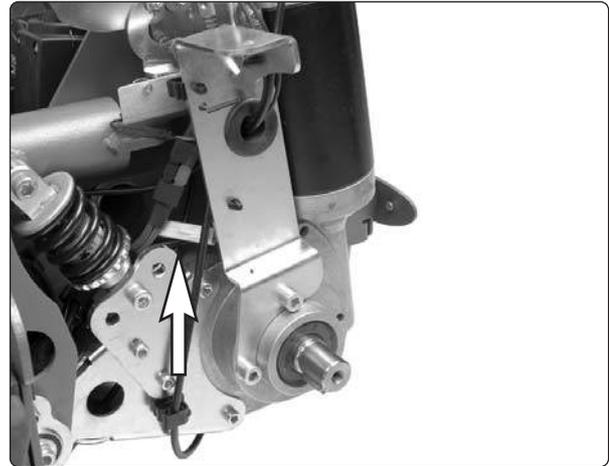


*Locking nut (1) Adjusting screw (2).*

## Magnetic brake

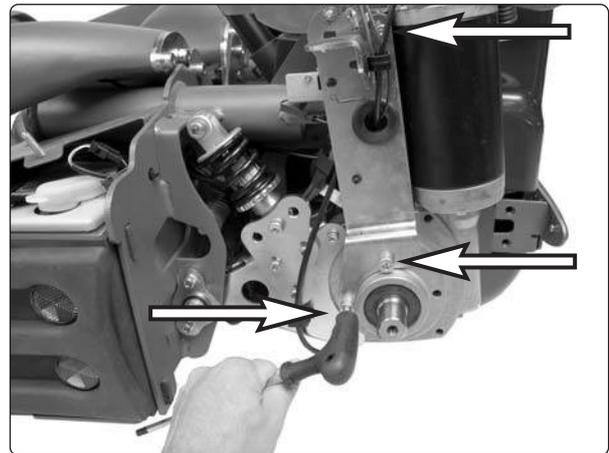
### Removal

1. Place the wheelchair on a level surface.
2. Switch off the main power switch on the control panel.
3. Switch the main fuse to OFF. See page 42.
4. Remove the rear wing on the relevant side. See page 10.
5. Unplug the magnetic brake cable at the contact on the cable. See illustration.



*The contact on the magnetic brake cable.*

6. Remove the protective plate, which is held in place with three screws. See illustration. Thread the magnetic brake cable and, on chassis with lights, the light cabling through the plate's cable duct. Note the cable layout for subsequent fitting.



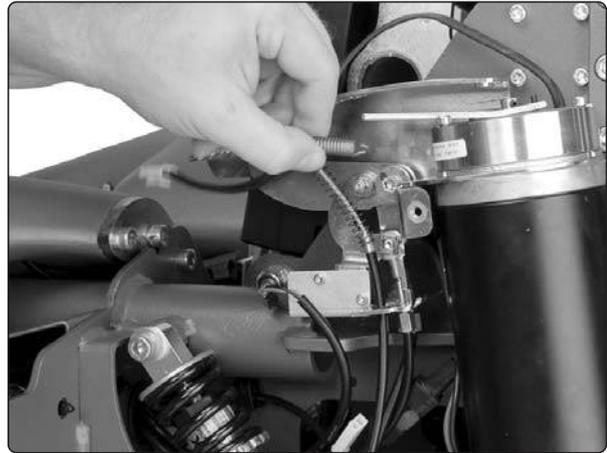
7. Loosen the cable from the magnetic brake by pulling the cable sheath down and pulling the cable out through the cable holder groove.



*Pull the cable sheath down and pull the cable out through the cable holder groove.*

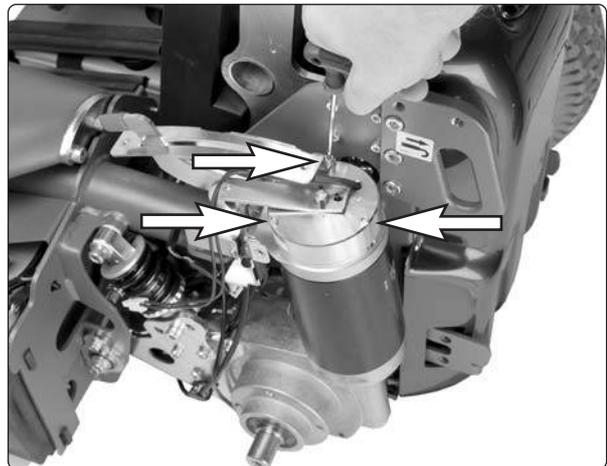
## Magnetic brake

8. Unhook the brake release cable spring from the magnetic brake.



*Unhook the brake release cable spring.*

9. Remove the magnetic brake, which is held in place with three screws. See illustration. There is also the release control on the left side of the chassis, held in place with the same screws.



*The magnetic brake is held in place with three screws.*

### Fitting

Fit in the reverse order.

**Use a torque wrench to tighten the screws holding the magnetic brake in place to 2.1 ft-lbs (2.9 Nm).**

#### NOTE

Check the function of the brake release after fitting. When the brakes are disconnected, it should not be possible to drive the wheelchair.

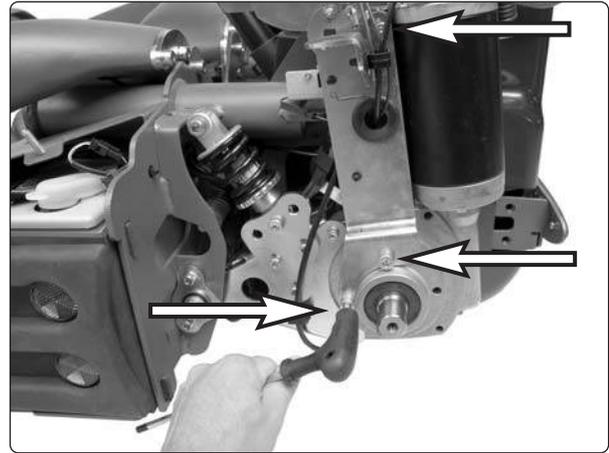


*Magnetic brake*

## Brake release switch

### Removal

1. Place the wheelchair on a level surface.
2. Switch off the main power switch on the control panel.
3. Switch the main fuse to OFF. See illustration.
4. Remove the left rear wing. See page 10.
5. Remove the protective plate, which is held in place with three screws. See illustration.

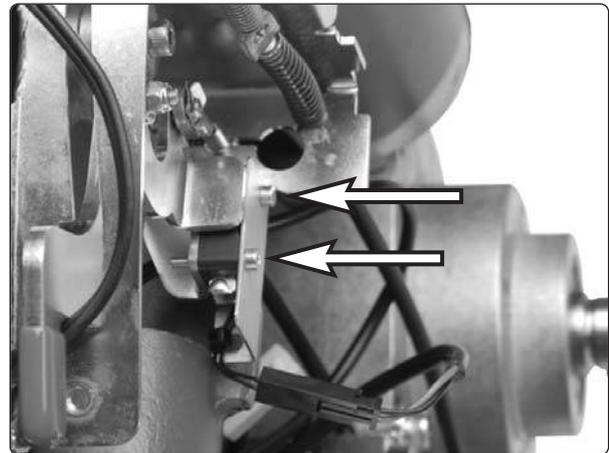


*The protective plate is held in place with three screws.*

6. Unplug the switch cable at the contact on the cabling.
7. Remove the brake release switch, which is held in place with two screws. See illustration.
8. Cut the cable tie holding the cable in place.

### Fitting

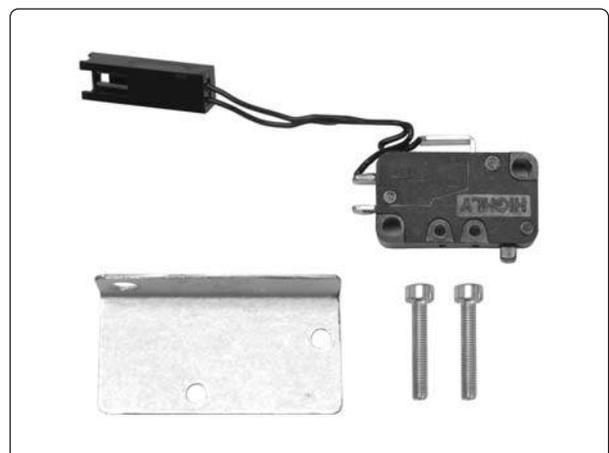
Fit in the reverse order.



*The brake release switch is held in place with two screws on the brake release mechanism.*

### NOTE

Check the function of the brake release after fitting. When the brakes are disconnected, it should not be possible to drive the wheelchair.



*Brake release switch.*

## Brake release control

### Removal

1. Place the wheelchair on a level surface.
2. Switch off the main power switch on the control panel.
3. Switch the main fuse to OFF. See illustration.
4. Remove the left rear wing. See page 10.
5. Remove the protective plate, which is held in place with three screws. See illustration.
6. Unplug the brake release switch at the contact on the cable. See illustration.
7. Remove the magnetic brake and the release control held in place with three screws. See illustration below.
8. Remove the brake release cables from the release control. Both the left and right cable are held in place in the same cotter and are secured with the same lock loop. See illustration below.
9. Loosen the locking nuts and fully unscrew the adjustment screws.

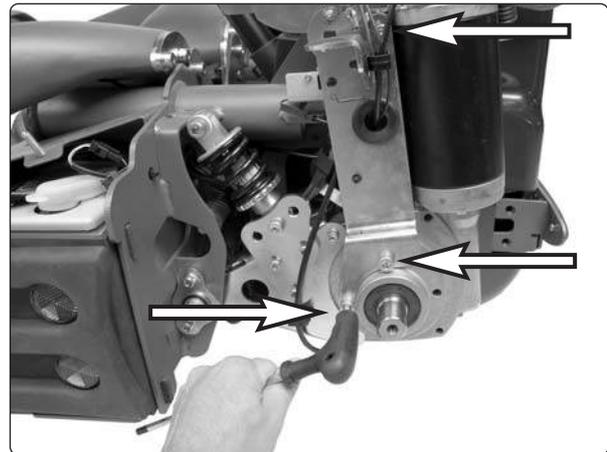
### Fitting

Fit in the reverse order.

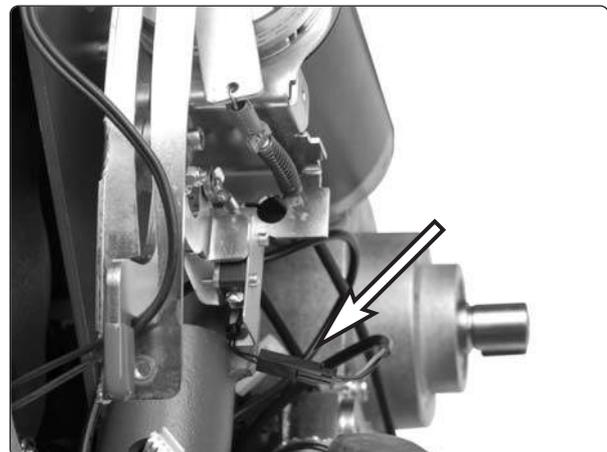
**Use a torque wrench to tighten the screws holding the magnetic brake in place to 2.1 ft-lbs (2,9 Nm)**

#### NOTE

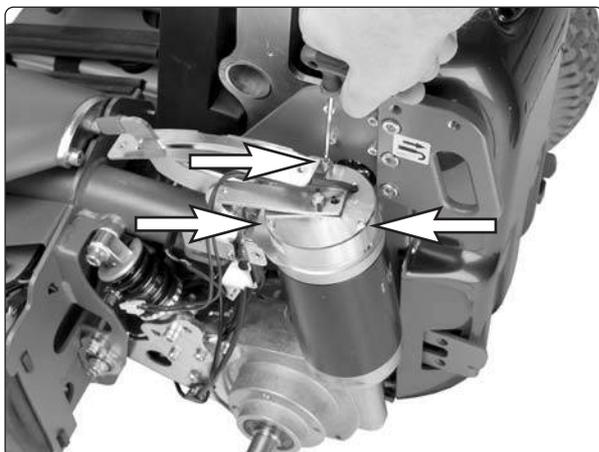
Check the function of the brake release after fitting. When the brakes are disconnected, it should not be possible to drive the wheelchair.



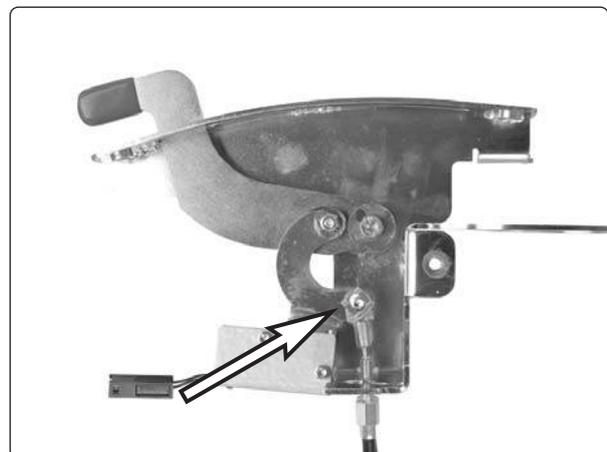
*The protective plate is held in place with three screws.*



*Unplug the brake release switch cable at the contact on the cable.*



*The left magnetic brake and the release control are held in place with three screws.*

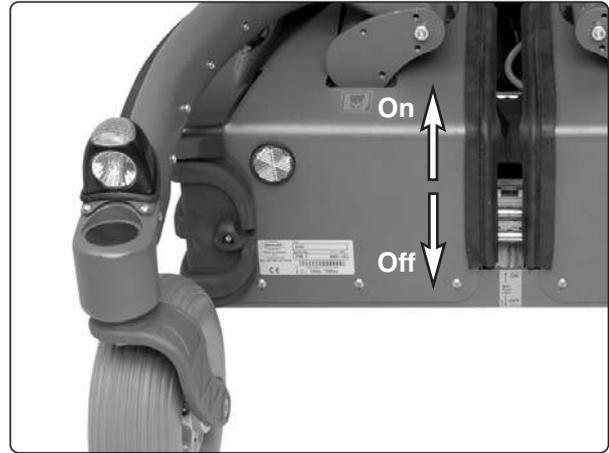


*The cables are secured to the cotter with a lock loop.*

## Drive motor

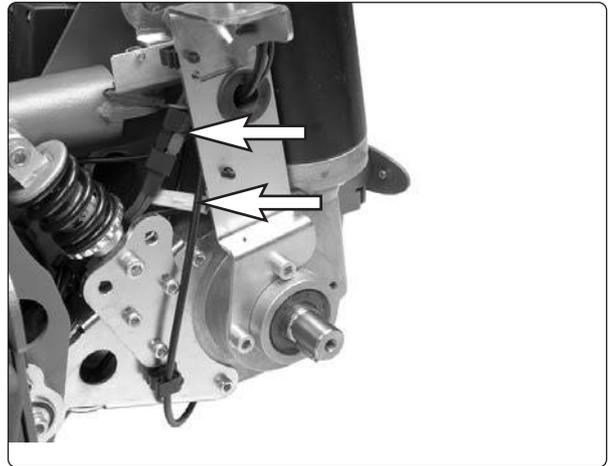
### Removal

1. Place the wheelchair on a level surface.
2. Switch off the main power switch on the control panel.
3. Switch the main fuse to OFF. See illustration.
4. Remove the rear wing on the relevant side. See page 10.



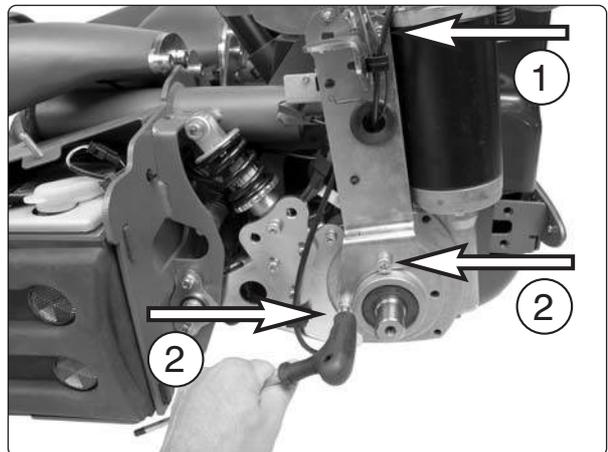
*Main fuse/battery isolator (On/Off)*

5. Unplug the magnetic brake and the drive motor's cable at the contact on the cable. See illustration.



*Cabling for magnetic brake and drive motor.*

6. Remove the protective plate, which is held in place with three screws. See illustration.
7. Remove the magnetic brake. See page 24.

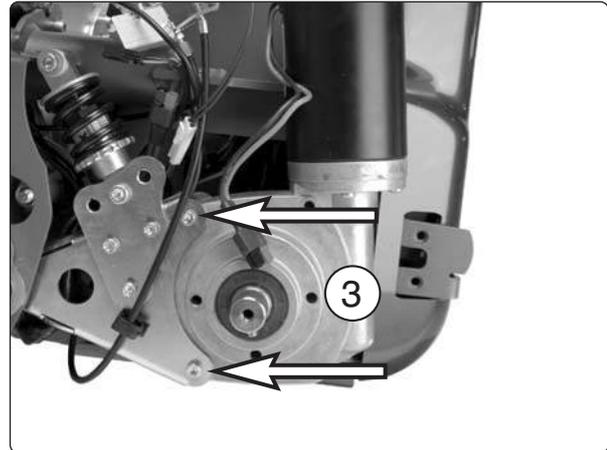


- Remove the two screws holding the drive motor and gear housing in place. See illustration.

### Fitting

Fit in the reverse order.

**Use a torque wrench to tighten the screws holding the drive motor and gear housing in place to 7.2 ft-lbs (9.8 Nm)**



*The drive motor and gear housing are held in place with two screws.*

**NOTE**

Check the function of the brake release after fitting. When the brakes are disconnected, it should not be possible to drive the wheelchair.

Item	Description
1	Hexagon socket head cap screw M5x12 8.8 Fe/Zn 5 C1
2	Hexagon socket head cap screw M8x25 8.8 Fe/Zn 5 C1 TAPTITE
3	Hexagon socket head cap screw M6x60 8.8 Fe/Zn 5 C1

**WARNING**

No other type of screws than those stated here may be used.



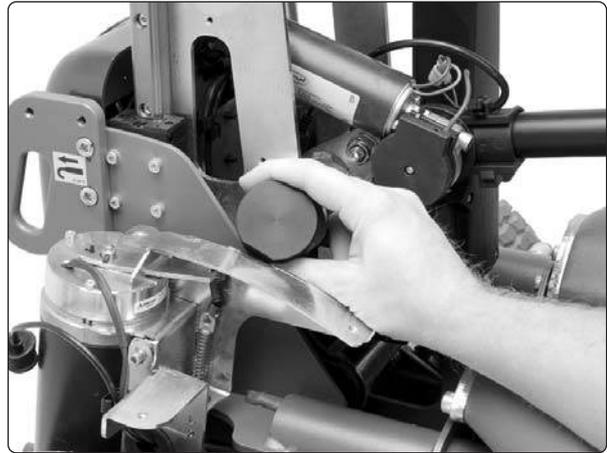
*Drive motor and gear housing.*

## Actuators

### Fitting service tools

When removing the actuator, the work is made easier if you use a service tool that holds the seat function in place when the actuator is removed.

1. Place the wheelchair on a level surface.
2. Raise the seat lift and the seat-to-floor function to its highest position. Move the seat angle function to its minimum angle. If any of the electrical seat functions cannot be moved in the usual way, the function can be moved manually using the accompanying emergency operation cable. See pages 36-37.
3. Fit the seat lift lock, turn the lock so that the beveling on its edge is facing down to the left and facilitates fitting. See illustration.
4. With the seat lift lock in place, turn the lock 180° to secure its fitting. See illustration.

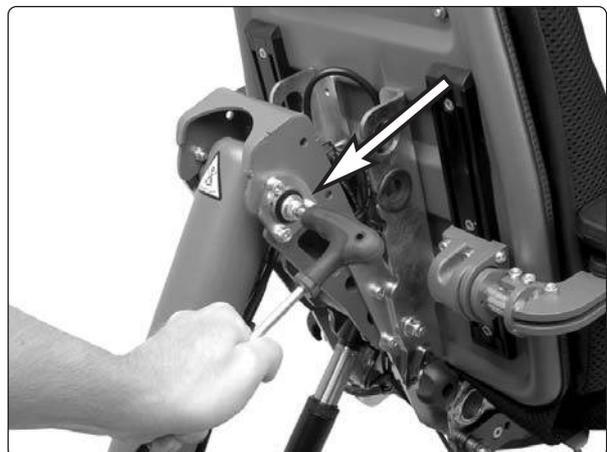


*Fitting the seat lift lock.*



*Turn the seat lift lock 180° to secure its fitting.*

5. Remove the screw on the right of the handle behind the seat. See illustration.



*Remove the screw on the right of the handle behind the seat.*

## Actuators

6. Fit the service tool using the screw previously removed (1). See illustration.
7. Carefully adjust the seat-to-floor function and the seat angle, so that the service tool's support points (2-4) move freely, but is still so close to the material of the seat structure, around 1-10 mm that the tool "catches" the seat structure when removing the actuator.

### WARNING

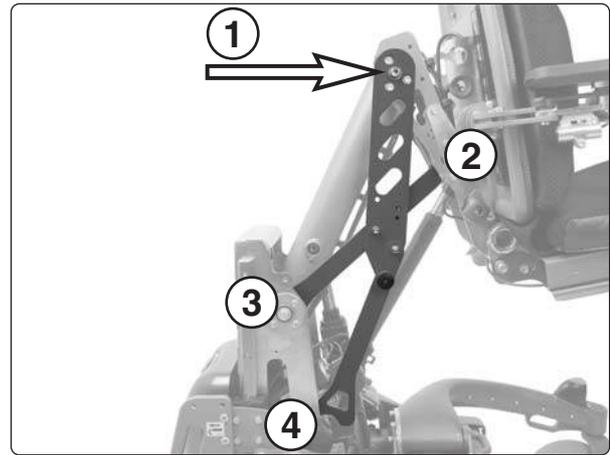
Be particularly careful when adjusting the service tool. Careless operation of the actuator with the service tool fitted may damage the seat structure as well as the tool.

Take great care when working with the seat and its actuators, there is always a risk of personal injury caused by crushing or pinching.

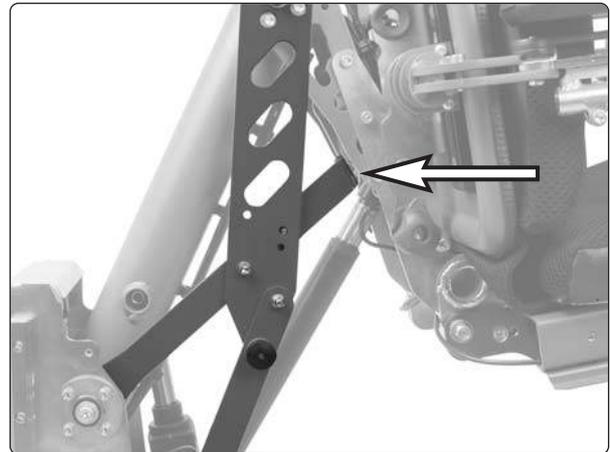
8. Switch off the main power switch on the control panel.
9. Switch the main fuse to OFF. See illustration.

## Removal

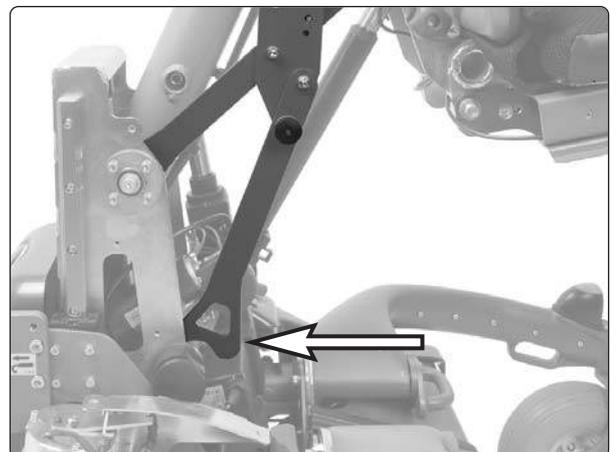
Remove in the reverse order.



*The service tool is fitted with the screw in the handle on the right behind the seat.*



*Support point for the seat angle function.*



*Support point for the seat-to-floor function*

## Actuators

### Removing the actuator for the seat angle function.

1. Place the wheelchair on a level surface.
2. Fit the service tool. See pages 30-31.
3. Switch off the main power switch on the control panel.
4. Switch the main fuse to OFF. See illustration.

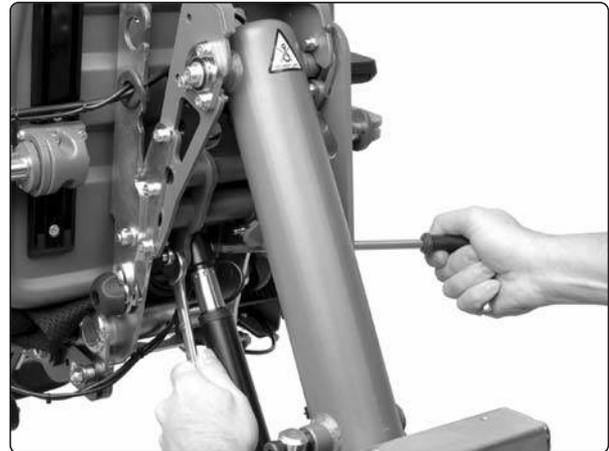
**⚠ WARNING**

Take great care when working with the seat and its actuators, there is always a risk of personal injury caused by crushing or pinching.



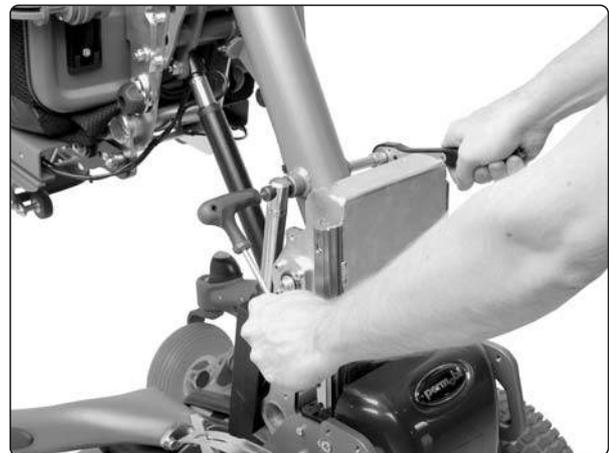
*The seat angle function's actuator*

5. Remove the actuator's upper fixing screw. See illustration.



*Upper fixing screw of the seat angle function actuator.*

6. Remove the upper fixing screw for the seat-to-floor function actuator. See page 34. Next, move the upper part of the seat-to-floor function actuator forward and out of the way. This provides access to the seat angle function actuator's lower fixing screw.



*The actuator for the seat-to-floor function's upper fixing screw.*

## Actuators

7. Remove the seat angle function actuator's lower fixing screw. See illustration.
8. Unplug the actuator's cable at the contact on the cabling.

### Fitting

Fit in the reverse order.

**Use a torque wrench to tighten the screws holding the actuator in place to 35 ft-lbs (47Nm)**



*Lower fixing screw of the actuator*



#### WARNING

The actuator must be calibrated after fitting. Detailed information on calibration is available in the technical manual for the ICS control system.

## Actuators

### Removal of the actuator for the seat-to-floor function.

1. Place the wheelchair on a level surface.
2. Fit the service tool. See pages 30-31.
3. Switch off the main power switch on the control panel.
4. Switch the main fuse to OFF. See illustration.

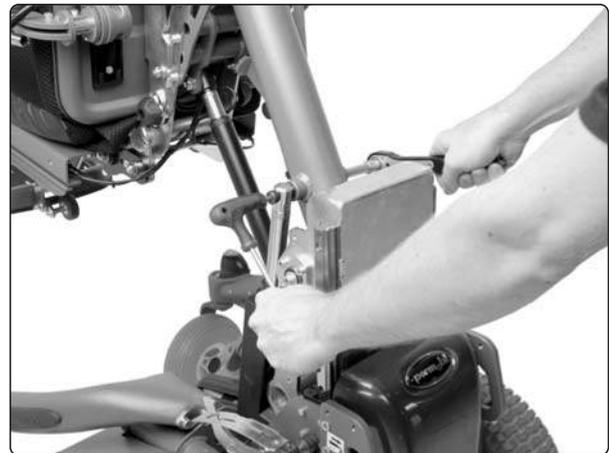
**⚠ WARNING**

Take great care when working with the seat and its actuators, there is always a risk of personal injury caused by crushing or pinching.



*The seat-to-floor function's actuator.*

5. Remove the actuator's upper fixing screw. See illustration.



*Upper fixing screw of the actuator*

6. Remove the actuator's lower fixing screw. See illustration.
7. Unplug the actuator's cable at the contact on the cabling.

### Fitting

Fit in the reverse order.

**Use a torque wrench to tighten the screws holding the actuator in place to 35 ft-lbs (47Nm)**

**⚠ WARNING**

The actuator must be calibrated after fitting. Detailed information on calibration is available in the technical manual for the ICS control system.



*Lower fixing screw of the actuator*

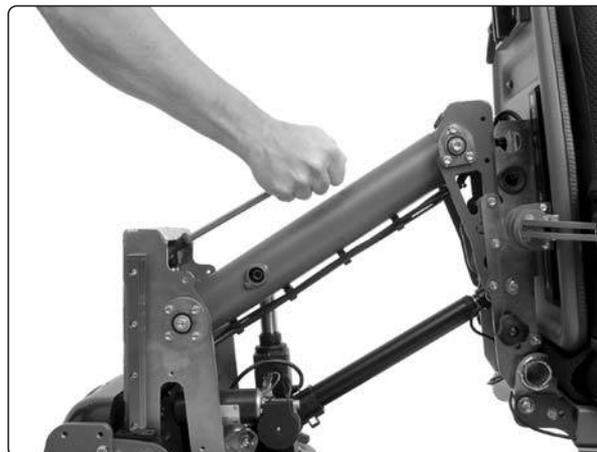
## Actuators

### Removing the seat lift's actuator.

1. Place the wheelchair on a level surface.
2. Fit the seat lift lock. See page 30.
3. If required, move the seat-to-floor function down a little to allow better access to the actuator's upper fixing screw. See illustration.
4. Switch off the main power switch on the control panel.
5. Switch the main fuse to OFF. See page 42.

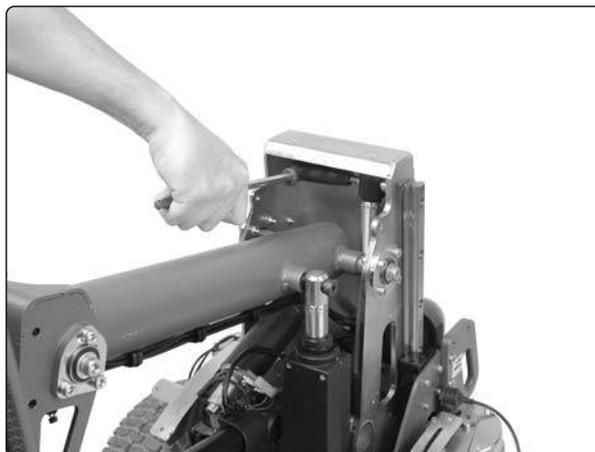
#### WARNING

Take great care when working with the seat and its actuators, there is always a risk of personal injury caused by crushing or pinching.



*Move the seat-to-floor function down a little to allow better access to the actuator's upper fixing screw.*

6. Remove the actuator's upper fixing screw. See illustration.



*Upper fixing screw of the actuator*

7. Remove the actuator's lower fixing screw. See illustration.
8. Unplug the actuator's cable at the contact on the cabling.

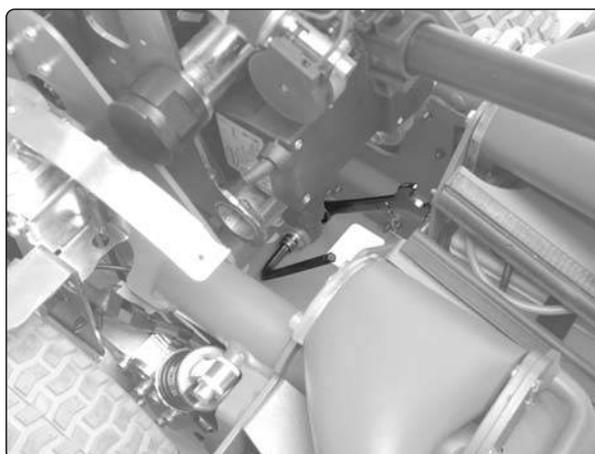
### Fitting

Fit in the reverse order.

**Use a torque wrench to tighten the screws holding the actuator in place to 35 ft-lbs (47Nm)**

#### WARNING

The actuator must be calibrated after fitting. Detailed information on calibration is available in the technical manual for the ICS control system.



*Lower fixing screw of the actuator*

## Emergency operation of seat functions

If any of the electric seat functions cannot be operated in the normal way because of a fault other than discharged batteries or a faulty actuator, the function can be operated manually using the emergency operation cable supplied.



### Connecting the emergency operation cable

**⚠ WARNING**

Emergency operation must only be used in emergencies, and then with great care. When the seat is operated in the emergency mode, all safety functions in the control system are bypassed. There is a risk of crushing and a risk of damage to the wheelchair.

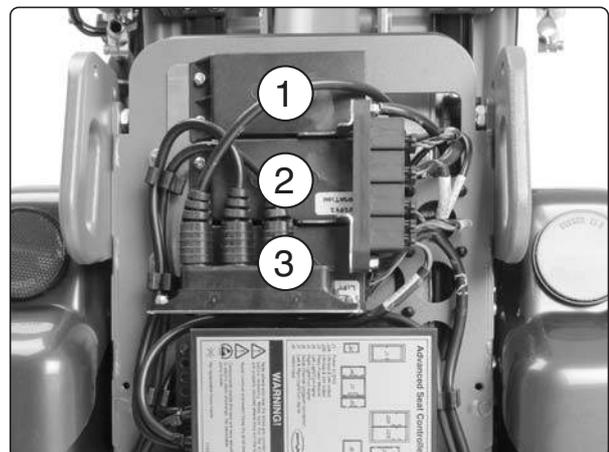
Never drive the wheelchair and use the emergency operation cable at the same time.

Following emergency operation, the relevant actuator must be recalibrated. Detailed information on calibration is available in the technical manual for the ICS control system.



*Connecting the emergency operation cable to the charging socket.*

1. Remove the chassis cover. See page 10.
2. Connect the emergency operation cable to the charging socket. See illustration.



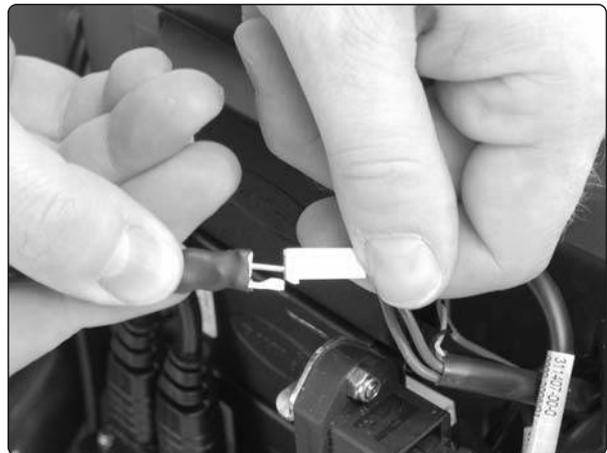
1. General Module for "Seat angle".
2. General Module for "Seat-to-floor function".
3. General Module for "Seat lift".

3. Remove the cables associated with the relevant actuator from the General Module. See illustration.



*Remove the cables associated with the relevant actuator from the General Module.*

4. Connect the cables from the actuator with the emergency operation cable. See illustration.
5. Use the control lever on the emergency operation cable to operate the function you have chosen to connect to one of the holes. See illustration below.



*Connect the cable from the actuator with the emergency operation cable.*

**⚠ WARNING**

Following emergency operation, the relevant actuator must be recalibrated. Detailed information on calibration is available in the technical manual for the ICS control system.

### Disconnecting the emergency operation cable

1. Disconnect the emergency operation cable from the actuator's cable and from the charging socket.
2. Reconnect the actuator cable to the general module.
3. Refit the chassis cover. See page 10.

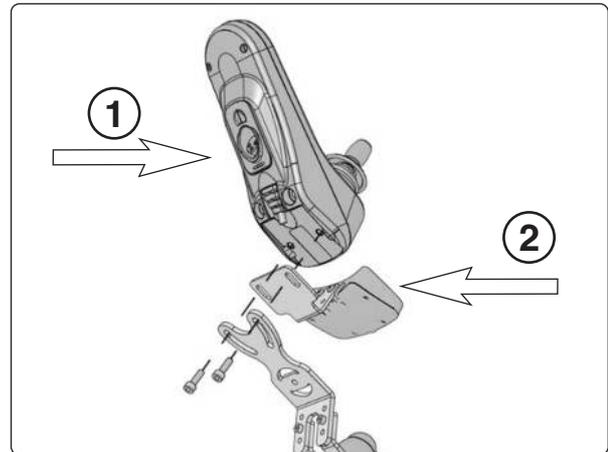


*Maneuvering using the emergency operation cable's control lever.*

## Control panel

### Removal

1. Switch off the main power switch on the control panel.
2. Remove the cable ties holding the control panel cable in place under the arm rest. Note the positions of the cable ties for subsequent fitting.
3. Unplug the control panel cable at the contact on the cable.
4. Remove the control panel (1), which is held in place with two screws underneath (see illustration). These two screws also hold the bracket for the ICS control panel (2), if there is one fitted (see illustration).



*The control panel is held in place with two screws.*

### Fitting

Fit in the reverse order.

### Removal incl. bracket

1. Switch off the main power switch on the control panel.
2. Remove the cable ties holding the control panel cable in place under the arm rest. Note the positions of the cable ties for subsequent fitting.
3. Unplug the control panel cable at the contact on the cable.
4. Loosen and remove the screw locking the panel bracket's position. See illustration.
5. Remove the control panel incl. bracket by pulling it straight forward.



*The position of the control panel's bracket is locked with a screw.*

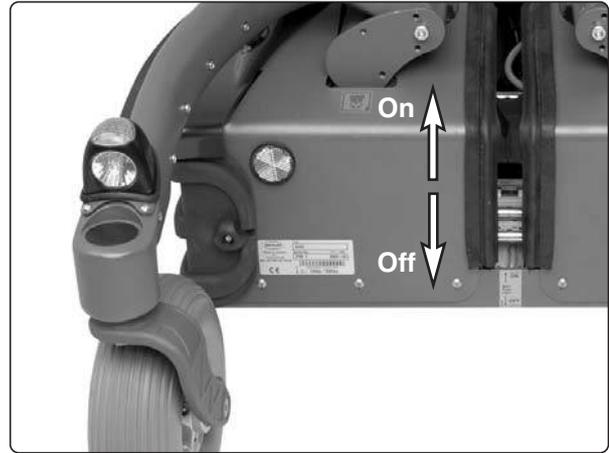
### Fitting

Fit in the reverse order.

## Power Module

### Removal

1. Switch off the main power switch on the control panel.
2. Switch the main fuse to "OFF". See illustration.
3. Remove the chassis cover. See page 10.
4. Disconnect the electrical connections from the power module. Note their positions (see illustration below).

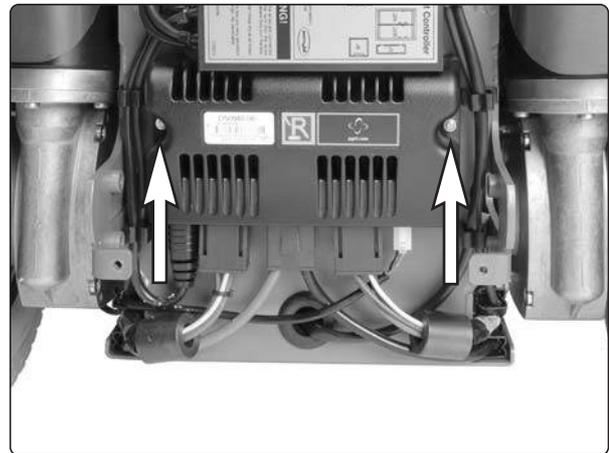


Main fuse/battery isolator (On/Off)

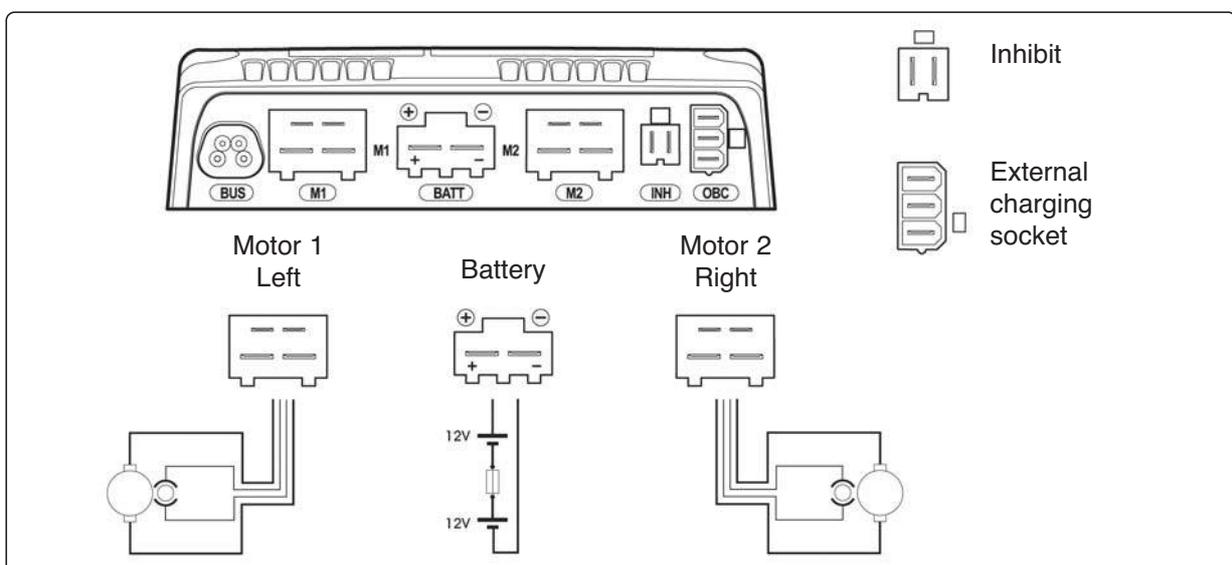
5. Remove the power module by unscrewing its two fixing nuts. See illustration.

### Fitting

Fit in the reverse order.



The power module is fitted with two nuts.



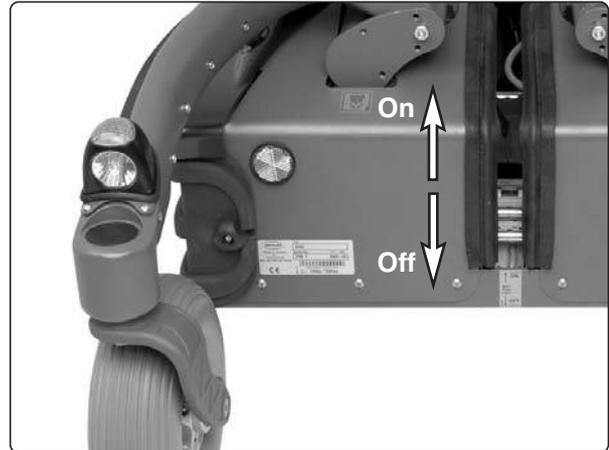
Power Module cable connections

## ICS Master Module

The wheelchair is equipped with an ICS control system. The seat is controlled from the system's "ICS Master Module". This is fitted in the wheelchair chassis.

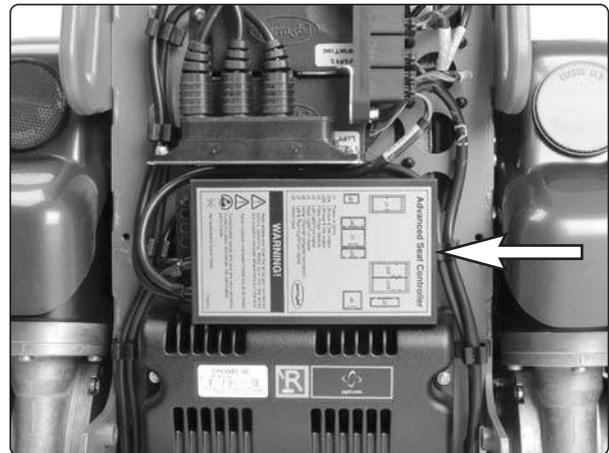
### Removal

1. Switch off the main power switch on the control panel.
2. Switch the main fuse to "OFF". See illustration.
3. Remove the chassis cover. See page 10.



Main fuse/battery isolator (On/Off)

4. ICS Master Module is fitted with Velcro. Remove it by pulling it straight out of the chassis.



The ICS Master Module stage is fitted with Velcro.

5. Pull the cover off.
6. Cut off the cable ties that hold the cables in place and detach the electrical connections. Note their positions for subsequent fitting.

### Fitting

Fit in the reverse order.



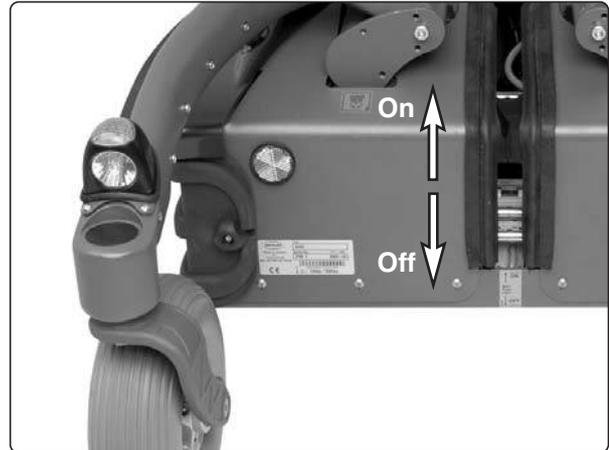
ICS Master Module with cover removed

## General Module

The seat's actuators are all controlled via their own General Module. These are held in place with two nuts each on the rear of the chassis.

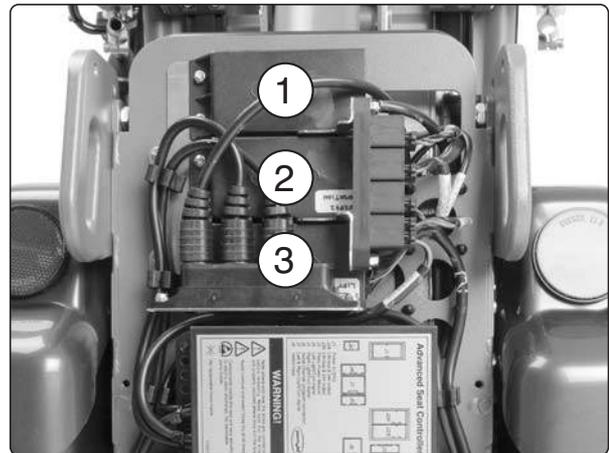
### Removal

1. Switch off the main power switch on the control panel.
2. Switch the main fuse to "OFF". See illustration.
3. Remove the chassis cover. See page 10.



*Main fuse/battery isolator (On/Off)*

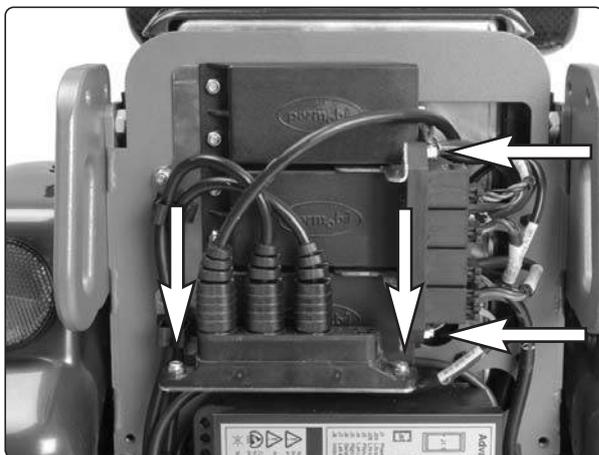
4. Remove the General Module in question. It is held in place with two nuts on the left side (see illustration). Removing nos. 2 and 3 is easier if the contact blocks are removed. These are held in place with two nuts each. See illustration below.
5. Remove the actuator's cable from the General Module in question.
6. Remove the General Module's cable from the contact block.



1. General Module for "Seat angle".
2. General Module for "Seat-to-floor function".
3. General Module for "Seat lift".

### Fitting

Fit in the reverse order.



*The contact blocks are fixed in place with two nuts each.*



*General Module*

## Fuses

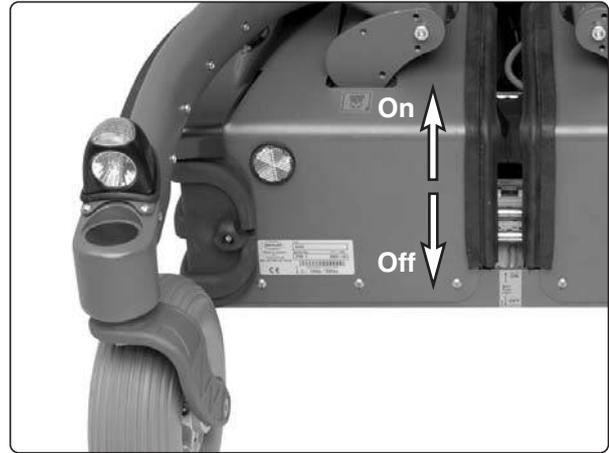
### Resetting the main fuse

The main fuse also functions as a battery isolator but it is usually called the main fuse.

It is not normally necessary to replace the main fuse as it is automatic and can be reset when it has been tripped. It is accessible through a recess in the center front of the chassis. It is reset by switching the switch to “ON”. See illustration.

**NOTE**

If the main fuse is tripped, there is often a major electrical fault. The cause of the fault should be checked carefully before the fuse is reset.



*Main fuse/battery isolator (On/Off)*

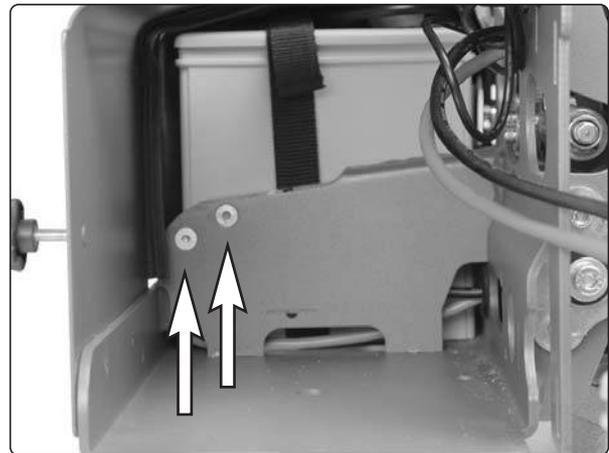
### Replacing the main fuse

1. Switch the main fuse to “OFF”. See illustration.
2. Remove the batteries. See page 7.

**NOTE**

Fold the battery connection cables under so they cannot come into contact with the battery terminals.

3. Remove the two screws and spacers fitted on both sides of the chassis. See illustration.

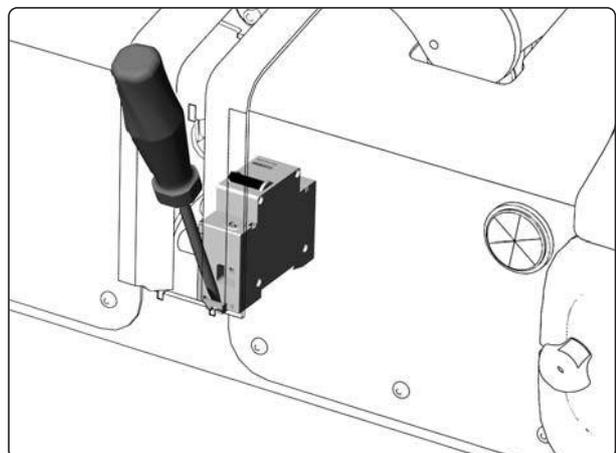


*Remove the two screws on both sides of the chassis.*

4. Remove the main fuse from its bracket. This is done by pulling out the plastic clip on the side of the fuse using a screwdriver. See illustration.

**NOTE**

Note the direction in which the fuse is installed for subsequent fitting. The ON/OFF position must match the appropriate sticker on the chassis.



*Main fuse bracket*

## Fuses

5. Remove the cables from the main fuse by unscrewing the screws. See illustration.
6. Switch the new main fuse to "OFF".
7. Fit the cables to the new main fuse.

**NOTE**

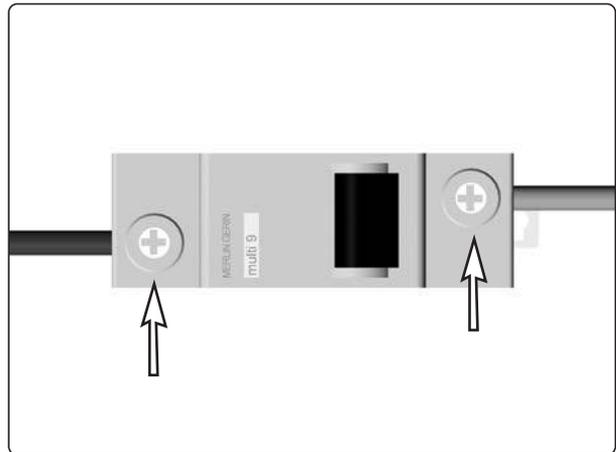
Check that the cables are firmly attached.

8. Fit the new main fuse in place in the chassis.

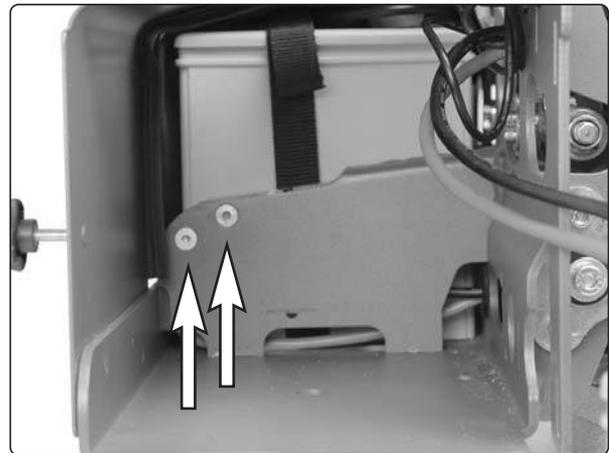
**NOTE**

Note the direction in which the fuse is installed. The ON/OFF position must match the appropriate sticker on the chassis.

9. Refit the two screws and spacers fitted on both sides of the chassis. See illustration.
10. Refit the batteries. See page 7.
11. Switch the main fuse to "ON".



*Main fuse cable connection*

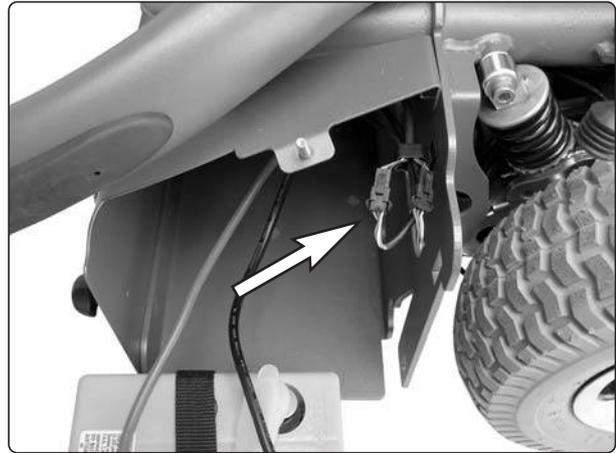


*Refit the two screws on both sides of the chassis.*

## Lights (accessories)

### Removing the front lights

1. Switch off the main power switch on the control panel.
2. Remove the battery on the relevant side of the chassis, see page 7.
3. Unplug the light's cable at the contact on the cable, which is above the battery. See illustration.
4. Loosen the cable from the cable brackets in the chassis. Note the cabling layout for subsequent fitting.



*The contact on the front light's cable.*

5. Remove the two screws that hold each of the lights in place. These are on top of the link arm. See illustration.



*The front lights are fixed in place with two screws on each link arm.*

6. Lift the light straight up and pull the cable from the link arm.

#### NOTE

Fitting a new light on the same link arm is made easier if a piece of string is tied to the cable at its contact before removal. The string is then pulled through the link arm when removing the light. Then tie the string to the new light's cable and pull the cable through the link arm using the string.



*Removing/fitting the front light.*

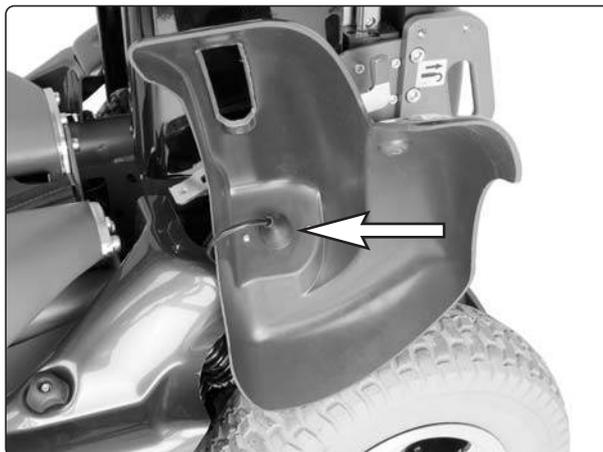
### Fitting

Fit in the reverse order.

## Lights (accessories)

### Removing rear light

1. Switch off the main power switch on the control panel.
2. Remove the rear wing on the side in question, see page 10.
3. Unplug the cable at the contact on the rear of the light. See illustration.



4. Remove the two screws that hold the light in place. These are located on the inside of the rear wing. See illustration.

### Fitting

Fit in the reverse order.



*The light is held in place with two screws inside the rear wing.*

### Removing the cable for the rear light

1. Remove the battery on the relevant side of the chassis, see page 7.
2. Remove the light, see above.
3. Unplug the light cable at the contact on the cable. See illustration.
4. Undo the cable at the binding clips and pull the cable out of the chassis ducts. Note the cabling layout for subsequent fitting.



*The contact on the rear light's cable.*

### Fitting

Fit in the reverse order.

## Seat

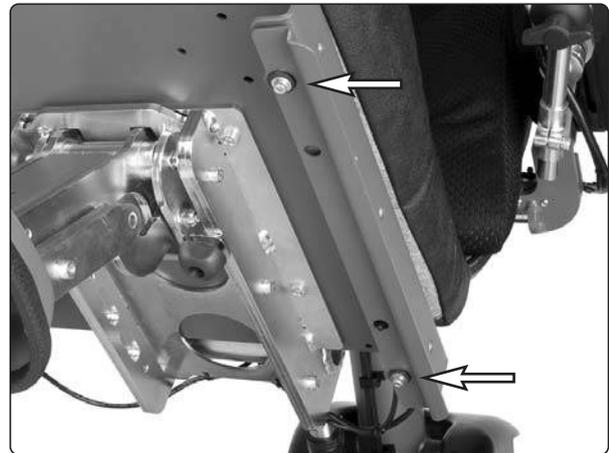
### Removing the seat plate

1. Switch off the main power switch on the control panel.
2. Remove the two crush guard sensors held in place underneath the seat plate with two screws and nuts on both the left and right side. See illustration.



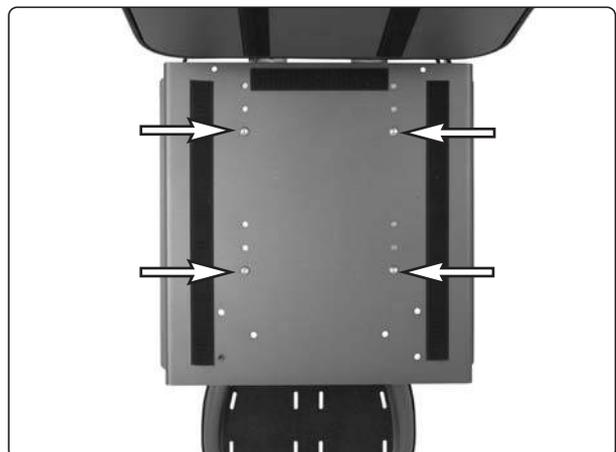
*The crush guard sensors are held in place with two screws and nuts each.*

3. Remove the crush guard held in place underneath the seat plate with two screws and nuts on both the left and right side. See illustration.
4. Remove the seat cushion by lifting it straight up until the Velcro on the back releases it.



*The crush guard is held in place with two screws each.*

5. Remove the seat plate, which is held in place by four screws. See illustration.
6. Remove the cable ties that hold the cables at the back of the seat plate.



*The seat plate is held in place with four screws.*

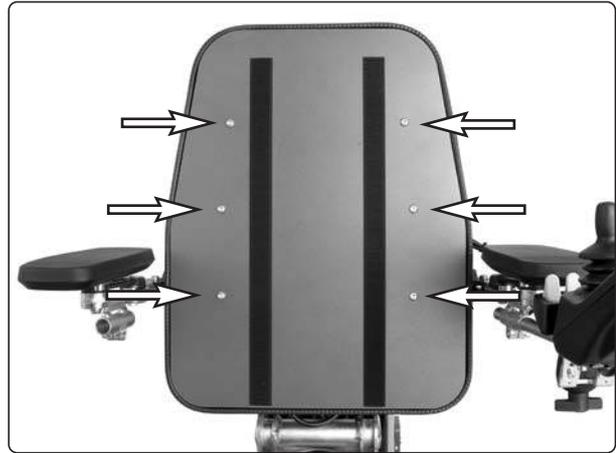
### Fitting

Fit in the reverse order.

## Seat

### Removing the back rest plate

1. Switch off the main power switch on the control panel.
2. Remove the back rest cushion by pulling it straight up until the Velcro on the back releases it.
3. Remove the front back rest plate, which is held in place with six screws. See illustration.

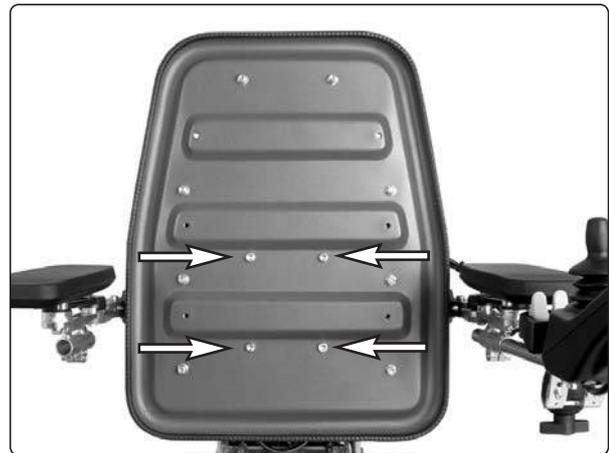


*The front back rest plate is held in place with six screws.*

4. Remove the rear back rest plate, which is held in place by four screws. See illustration.

### Fitting

Fit in the reverse order.

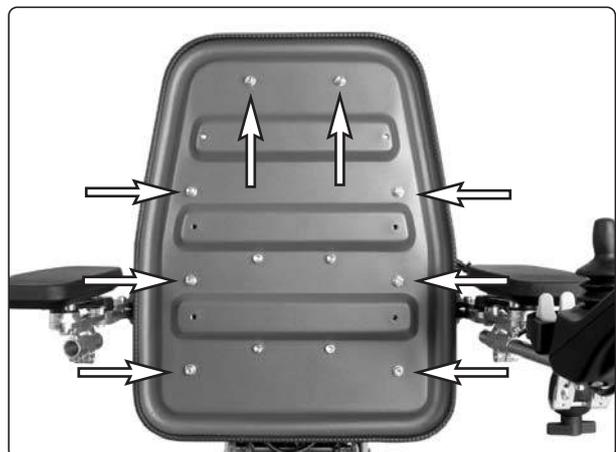


*The rear back rest plate is held in place with four screws.*

### Removing accessory rails

There are three rails on the rear of the back rest for fitting an arm rest and accessories such as a head rest. When changing the back rest plate, move the rails over to the new back rest plate.

1. Remove the front back rest plate as described above.
2. Remove the accessory rails, which are held in place with a screw and a nut. See illustration.



*The accessory rails are held in place with a screw and nut.*

### Fitting

Fit in the reverse order.

## Seat

### Removing the crush guard sensor

1. Switch off the main power switch on the control panel.
2. Remove the crush guard sensor in question, which is held in place with two screws under the seat. See illustration.



*The crush guard sensor is held in place with two screws.*

3. Unplug the switch cable at the contact on the cabling.

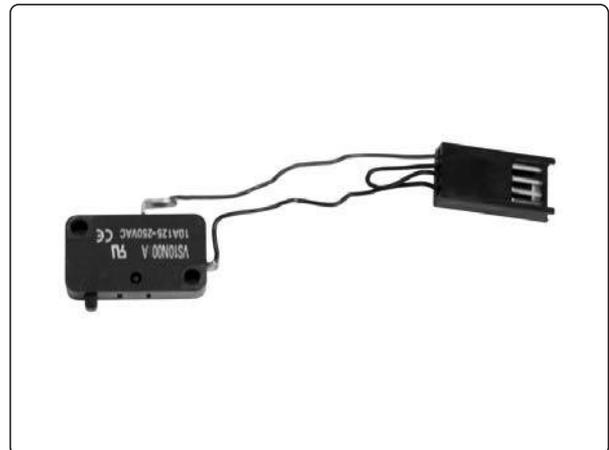
### Fitting

Fit in the reverse order.



#### NOTE

Check the function of the crush guard after fitting.

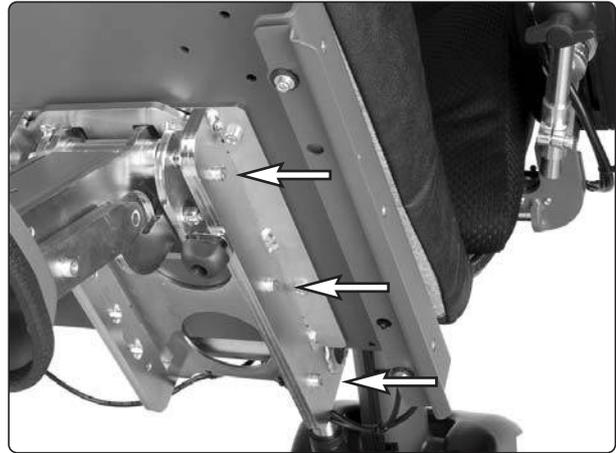


*Crush guard sensor.*

## Seat

### Removing the leg support

1. If possible, raise the seat lift to its highest position and angle the seat back to the maximum position for easier access.
2. Switch off the main power switch on the control panel.
3. Remove the leg support in question held in place with three screws on each side under the seat. See illustration.



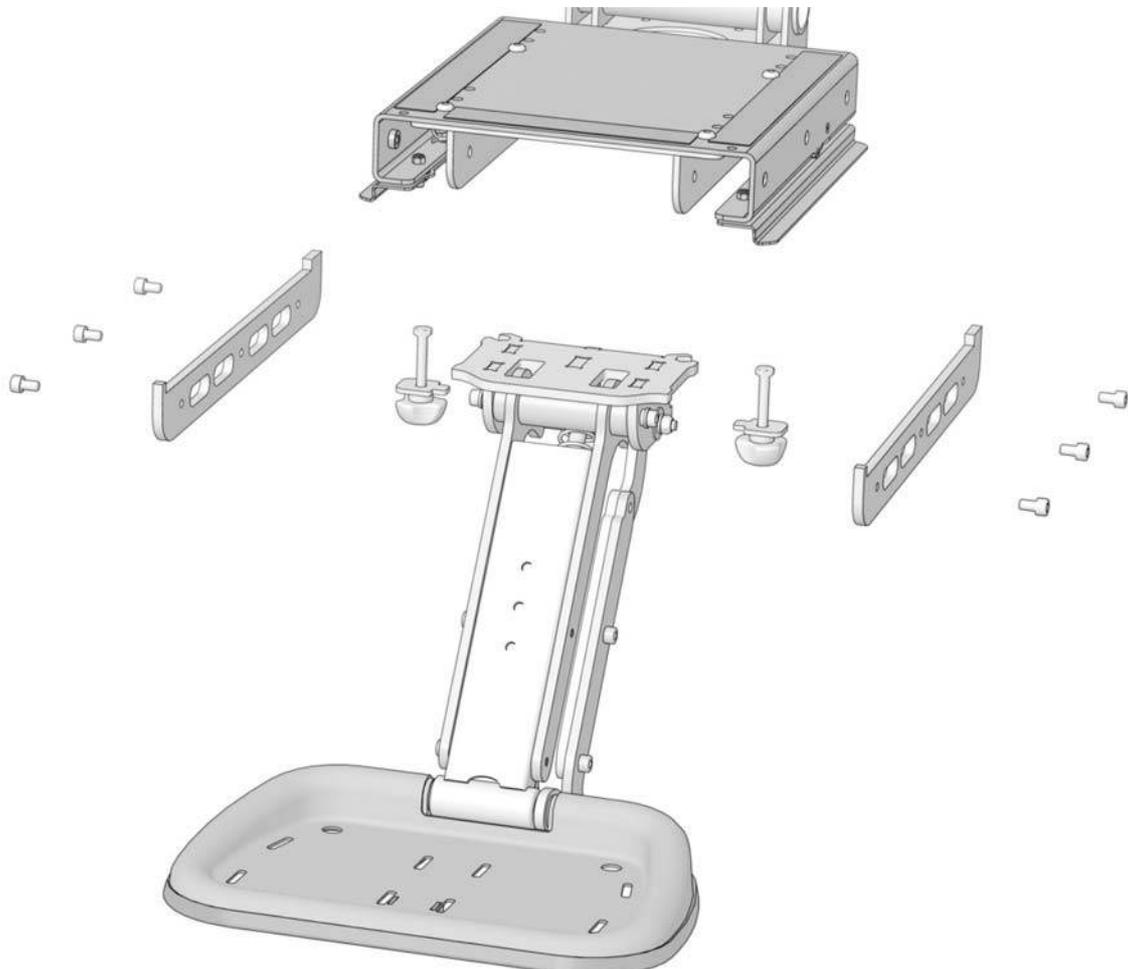
*The leg support is held in place with three screws on each side.*

#### NOTE

The leg support is heavy. Once the screws have been removed, loosen the leg support's mounting rails and locking knob. This should be done by two people.

### Fitting

Fit in the reverse order.



## Seat

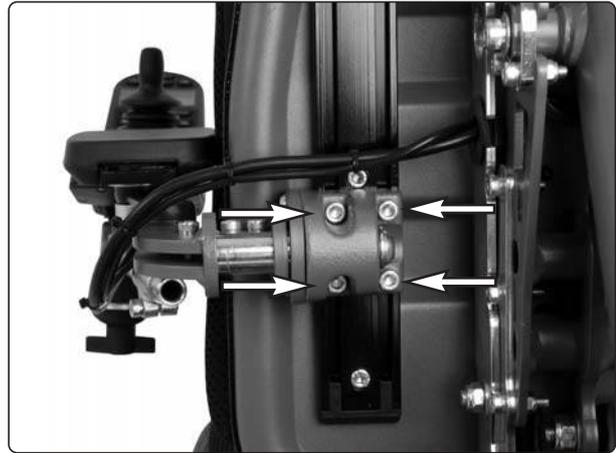
### Removing the arm rest

1. Switch off the main power switch on the control panel.
2. Remove the four screws holding the arm rest in place. See illustration.

For removal of the control panel, see page 38.

### Fitting

Fit in the reverse order.



*The arm rest is held in place with four screws.*

### Removing the arm rest cushion

1. Switch off the main power switch on the control panel.
2. Remove the two screws underneath the arm rest that are holding the arm rest cushion in place. See illustration.

### Fitting

Fit in the reverse order.



*The arm rest cushion is held in place with two screws underneath.*

## Troubleshooting

The following troubleshooting guide describes a number of faults and events which may occur when you use your wheelchair, together with suggested remedies. Note that this guide cannot describe all the problems and events which may occur and you should always contact your service contact or Permobil in case of doubt.

EVENT	POSSIBLE CAUSE	REMEDY
The wheelchair cannot be started.	Batteries discharged.	Charge the batteries.
	The cable connection to the control panel has come loose.	Insert the cable in the control panel.
	Main fuse blown.	Check possible causes carefully before resetting/replacing the main fuse. See page 42.
The wheelchair cannot be driven.	Battery charger connected.	Stop charging and disconnect the charging cable from the wheelchair's charging socket.
	Brake release activated.	Reset the brake release.
	The wheelchair is locked.	Unlock the wheelchair. See user manual
An exclamation mark on the control panel display is flashing rapidly and the wheelchair cannot be driven.	Electronics fault.	See pages 52-65.
The wheelchair can only be driven at reduced speed.	Seat lift raised too high.	Lower seat lift.
The wheelchair cannot be charged.	Main fuse blown.	Check possible causes carefully before resetting/replacing the main fuse. See page 42.
The wheelchair switches itself off" after a certain period of inactivity.	The electronics' energy-saving mode has been activated.	Switch the wheelchair on again using the start key on the control panel.

## Troubleshooting

### R-net diagnostics

When an error or a fault occurs in the wheelchair's electronics, information on it is displayed in the control panel's display. This information can then be used to diagnose where the error/fault occurred and its cause.

Troubleshooting and repairs must always be performed by competent personnel with good knowledge of the wheelchair's electronics. More information on troubleshooting and remedies can be found in the Service Manual for this wheelchair model.

### Diagnostic screens

#### Current diagnostic screen

When the control system's integrated protection circuits have been triggered so that the control system can no longer operate the wheelchair, a diagnostic screen is displayed in the control panel's display.

This indicates a system fault, i.e. R-net has detected a problem somewhere in the wheelchair's electrical system.

**NB!** *If the fault is in a module that is not currently being used, it will still be possible to drive the wheelchair, but the diagnostic screen will be displayed occasionally.*

Switch the wheelchair off and leave it off for a few minutes. Then restart the wheelchair. If the fault persists, you must switch off the wheelchair and contact your service contact. Write down the information displayed in plain text in the control panel's display and pass it on to your service contact.

Do not use the wheelchair until the problem has been remedied or you have received other instructions from your service contact.

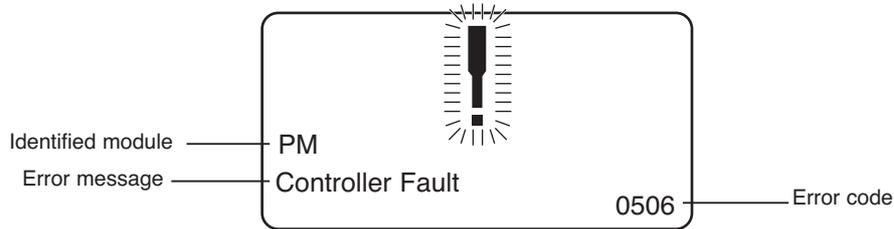


#### WARNING

Diagnostics should only be performed by persons with sound knowledge of the wheelchair's electronic control system. Incorrect or poorly performed repair work may make it dangerous to use the wheelchair. Permobil accepts no liability for any personal injury or damage to the wheelchair and its surroundings that may occur on account of incorrect or poorly performed repair work.

# Troubleshooting

## Example of a screen showing a system fault



### Identified module

This indicates the control system module that detected the problem.

**PM** = Power module

**JSM** = Joystick module

### Error message

The error message provides a brief description of the error type.

### Error code

The four-digit code indicates which protection circuit has been triggered.

### 2.1.4 Example

The screen example shown below displays the following information:

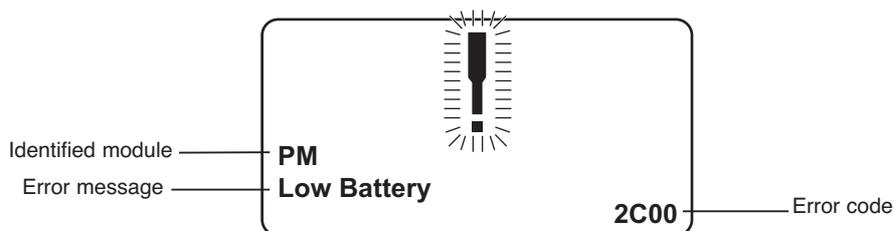
**Identified module:** Power module error

**Error message:** Low Battery

**Error code:** 2C00

This means that the battery needs charging or that the battery has not been connected properly.

- *Check the battery connections. Attempt to charge the battery if it is properly connected.*



# Troubleshooting

## 2.2 System log

All errors are saved in the system log regardless of whether they have been remedied or are still active. The system log saves the error messages and the number of times they arise. The errors are saved in their respective modules within the system.

The system log is accessed by means of programming directly in the system (On Board Programming, OBP).

Contact Permobil or your repair engineer for more information on OBP.

### Go to OBP mode

- Select System from the menu.
- Select Diagnostics from the menu.
- The diagnostics screen will now appear, showing the connected modules and version history. See the illustration below.
- If a module has experienced no errors, the message No Entries will be displayed, otherwise something similar to the screenshot below will be displayed.

Diagnostics	
JSM	1.9
PM	1.9
ISM	1.9

PM 1.9	
M1 Brake Error	6
System Error	1

# Troubleshooting

## 3. Definitions of diagnostics messages

When an error message has been displayed and the defective module has been identified, you can use the following definitions to determine the possible cause of the error and what remedial action is required to correct it.

Error message	Description
Joystick Error	Go to section 3.1.
Low Battery	Go to section 3.2.
High Battery	Go to section 3.3.
M1 Brake Error	Go to section 3.4.
M2 Brake Error	Go to section 3.4.
M1 Motor Error	Go to section 3.5.
M2 Motor Error	Go to section 3.5.
Inhibit Active	Go to section 3.6.
Jstick Cal Error	Go to section 3.7.
Latched Timeout	Go to section 3.8.
Brake Lamp Short	Go to section 3.9.
Left Lamp Short	Go to section 3.10.
Right Lamp Short	Go to section 3.10.
L Ind Lamp Short	Go to section 3.11.
R Ind Lamp Short	Go to section 3.11.
L Ind Lamp Failed	Go to section 3.12.
R Ind Lamp Failed	Go to section 3.12.
DIME Error	Go to section 3.16.
Memory Error	Go to section 3.17.
PM Memory Error	Go to section 3.18.
Bad Cable	Go to section 3.19.
Bad Settings	Go to section 3.20.
Module Error	Go to section 3.21.
System Error	Go to section 3.22.
Gone to Sleep	Go to section 3.23.
Charging	Go to section 3.24.

## Troubleshooting

### 3.1 Joystick Error

The commonest cause for this error is that the joystick was moved away from its central position before and during the time at which the control system was switched on. The screen for a shifted joystick is displayed for 5 seconds. If the joystick is not released during this time, a joystick error is registered. Even if an error screen is not displayed, the error and the number times it arises is registered in the system log.

- *Ensure that the joystick is in the central position and start up the control system.*

If the error persists, the joystick or joystick module may be defective. Read more in section 5.

### 3.2 Low Battery

This occurs when the control system detects that the battery voltage is lower than 16 V.

- *Check the batteries and their connection to the control system.*

If the error persists after the batteries and connections have been checked, the power module may be defective. Read more in section 5.

### 3.3 High Battery

This occurs when the control system detects that the battery voltage is lower than 35 V. The commonest causes for this error are that the battery has been overcharged or a poor connection between the control system and the batteries.

- *Check the batteries and their connection to the control system.*

If the error persists after the batteries and connections have been checked, the power module may be defective. Read more in section 5.

### 3.4 Brake Error

This occurs when the control system detects a problem in the solenoid brakes or the connections to them.

1505 - M1 Brake Error  
1506 - M2 Brake Error

- *Check the solenoid brakes, their cables and the connections to the control system.*

If the error persists after the checks listed above, the power module may be defective. Read more in section 5.

### 3.5 Motor Error

This occurs when the control system detects that a motor has been disconnected.

3B00 - M1 Motor Error  
3C00 - M2 Motor Error

- *Check the motors, their cables and the connections to the control system.*

If the error persists after the checks listed above, the power module may be defective. Read more in section 5.

### 3.6 Inhibit Active

This occurs when one of the inhibit signals is active and is in blocked mode.

The last two digits of the error code indicate the active inhibit signal. The code is hexadecimal.

1E01 - For inhibit signal 1.  
1E09 - For inhibit signal 9.  
1E0A - For inhibit signal 10.

- *Cycle the voltage. This will deactivate the block mode, which may remedy the error.*
- *Check all connections and switches for the indicated inhibit signals.*

## Troubleshooting

### 3.7 Joystick Calibration Error

This occurs when joystick calibration has been unsuccessful.

- *Go to OBP mode and recalibrate.*

If the error persists, the joystick module may be defective. Read more in section 5.

### 3.8 Latched Timeout

This occurs when the control system detects that the programmed block time has been exceeded. This can, for example, be due to the signal units (joystick, main steering device, suction and blowing device, etc.) not having been used frequently enough.

The error reference provides information on why the control system has left block mode.

- *Cycle the voltage.*
- *Activate block mode.*

If the error persists after the checks listed above, the signal unit may be defective. Read more in section 5.

### 3.9 Brake Lamp Short

This occurs when the control system detects a short circuit in the brake lamp electrical circuit. Read more about connectors in section 2.3.

- *Check the brake lamps, their cables and the connections to the control system.*

### 3.10 Lamp Short

This occurs when the control system detects a short circuit in the electrical circuit of one of the lamps.

- 7205 - Short circuit left-hand lamp.
- 7209 - Short circuit right-hand lamp

- *Check the lamps, their cables and the connections to the control system.*

### 3.11 Indicator Lamp Short

This occurs when the control system detects a short circuit in the electrical circuit of one of the indicators.

- 7206 - Short circuit left indicator.
- 720A - Short circuit right indicator.

- *Check the indicators, their cables and the connections to the control system.*

### 3.12 Indicator Lamp Failed

This occurs when the control system detects an error in the electrical circuit of one of the indicators. This usually means the indicator needs replacing.

- 7207 - Error in left indicator.
- 7208 - Error in right indicator.

- *Check the indicators, their cables and the connections to the control system.*

## Troubleshooting

### 3.16 DIME Error

This occurs when the control system detects an ID conflict between two modules in the system.

If a new module has been added:

- *Disconnect the new module and cycle the voltage.*
- *If no error occurs, connect the new module to the system and cycle the voltage.*
- *If the error recurs, the new module must be the cause of the problem.*

If no new modules have been added:

- *Disconnect one module at a time and cycle the voltage.*

If the error persists after the checks listed above have been performed, consult your service contact or Permobil.

### 3.17 Memory Error

This is a non-specific memory error that may be caused by any of the system modules.

- *Check all cables and connections.*
- *Cycle the voltage.*

If the error persists and the system includes third-party modules:

- *Disconnect all modules that do not come from PGDT and cycle the voltage.*

If this has dealt with the error:

- *Connect one third-party module at a time and cycle the voltage each time.*
- *If the error recurs after one of the voltage cycles, the last module to be connected must be defective.*

If the error persists after the checks listed above, the power module may be defective. Read more in section 5.

### 3.18 PM Memory Error

This is a specific error in the power module.

- *Check all cables and connections.*
- *Reprogram the control system with the help of R-net's PC programmers.*

This should be done with either the latest specific program file for the wheelchair or Permobil's original program file.

If the error persists after the checks listed above, the power unit may be defective. Read more in section 5.



#### NOTE

Programming should only be performed by persons with sound knowledge of control systems from PGDT. Incorrect programming can mean that the wheelchair is not safe to use. Permobil cannot be held responsible for losses of any kind if the control system factory settings are altered by programming.

## Troubleshooting

### 3.19 Bad Cable

This occurs when the control system detects a connection error in the communication cables between the modules.

- *Check all cables and connections to ensure there is no stoppage.*
- *Replace any cables with visible damage. Then cycle the voltage.*
- *Disconnect one cable at a time from the system and cycle the voltage after each disconnection.*

If the error persists after the checks listed above, the power unit may be defective. Read more in section 5.

### 3.20 Bad Settings

This occurs when the control system detects incorrect or invalid program settings.

- *Check all parameter settings and then reprogram the control system with the help of R-net's PC programmers.*
- *Make a note of the current parameter settings and then reset the control system to the standard settings.*
- *Reprogram the required settings in small groups and cycle the voltage after each group to see if the error recurs.*

If the error persists after the checks listed above, the power unit may be defective. Read more in section 5.

### 3.21 Module Error

This occurs when the control system detects an error in a specific module. The module is displayed on the diagnostics screen according to the description in section 2.

- *Check all cables and connections.*
- *Cycle the voltage.*

If the error persists after the checks listed above, the module specified may be defective. Read more in section 5.

## Troubleshooting

### 3.22 System Error

This occurs when the control system detects an error that cannot be ascribed to a specific module.

- *Check all cables and connections.*
- *Cycle the voltage.*

If the error persists and the system includes third-party modules:

- *Disconnect all modules that do not come from PGDT and cycle the voltage.*

If this has dealt with the error:

- *Connect one third-party module at a time and cycle the voltage each time.*
- *If the error recurs after one of the voltage cycles, the last module to be connected must be defective.*

If the error persists after the checks listed above, the system from PGDT may be defective. Read more in section 5.

### 3.23 Gone to Sleep (energy saving mode)

This occurs when the system has not been used for a period that exceeds the Sleep Timer parameter used for setting the energy saving mode. Each time this occurs it is registered in the system log.

### 3.24 Charging

This occurs when the control system detects that a charger has been connected to either inhibit contact 1 or inhibit contact 3. Read more about connectors in section 2.3.

The screen for battery charging is displayed when a charger is connected.

Each time this occurs it is registered in the system log.

When using an integral charger:

- *Disconnect the charger from the mains.*

When using an external charger:

- *Disconnect the charger from the power wheelchair.*

If the error persists after the charger has been disconnected, the joystick module may be defective. Read more in section 5.

## Troubleshooting

### 4. Basic test

After a repair has been completed, the following test should be performed. These are minimum recommendations. Depending on what the original error source was, further tests may be necessary.

 **WARNING**

The tests described are minimum recommendations. It is the responsibility of the repair engineer(s) to perform other tests on the basis of the original error source and the wheelchair model. The necessary information on other tests is available in the wheelchair service manual. Permobil cannot be held responsible for losses of any kind that may arise when these tests are conducted, or that arise as a consequence of further relevant tests not being conducted.

 **WARNING**

These tests should be conducted in an open space, and some kind of clamping device, such as a safety belt, should always be used. Permobil cannot be held responsible for losses for any kind arising due to these recommendations not being observed.

#### 4.1 Basic inspection

Check that all contacts are properly connected.

- *Check all cables and contacts to ensure there is no visible damage.*
- *Check that the rubber gaiter around the base of the joystick is not damaged. Inspect the gaiter visually. It should not be subjected to manual handling.*
- *Ensure that all components of the control system are securely installed.*
- *Do not over-tighten the fixing screws.*

## Troubleshooting

### 4.2 Brake test

These tests should be carried out on an even surface with at least one yard of free space around the wheelchair.

- *Switch on the control system.*
- *Check that the screen remains on after start-up.*
- *Bring the joystick slowly forwards until you hear the parking brakes functioning. In some cases the wheelchair may begin to move.*
- *Release the joystick immediately. You must hear both parking brakes functioning within 2 seconds.*
- *Repeat the test three times, bringing the joystick slowly backwards, to the left and to the right.*

### 4.3 Test run

Set the highest permitted speed to the lowest value and run the wheelchair in all directions while checking that it runs smoothly and is easy to maneuver.

Repeat the test with the speed control set to the highest possible value.

### 4.4 Gradient test

 **WARNING**

When this test is conducted, an additional person must be present in order to prevent the wheelchair tipping over backwards.

Run the wheelchair forwards up its steepest permitted gradient. Release the joystick when the wheelchair is on the upward slope and check that the wheelchair stops and that the brakes function as they should without the front wheels lifting from the ground.

Bring the joystick forwards and continue to run up the slope. Check that the wheelchair moves gently forwards.

Stop the wheelchair and reverse down the slope. Release the joystick when the wheelchair is on the upward slope and check that the wheelchair stops and that the brakes function as they should without the front wheels lifting from the ground.

## Troubleshooting

### 4.5 Test of lights, indicators and warning lights

If the wheelchair is equipped with lights:

- *Check that all bulbs light up as they should.*
- *Check that all bulbs light up as they should and that the flashing frequency is  $1.5 \text{ Hz} \pm 0.5 \text{ Hz}$ .*
- *Remove the bulbs in turn and check that the remaining bulb on the same side flashes at a frequency of  $3 \text{ Hz} \pm 0.5 \text{ Hz}$ .*

If the wheelchair is equipped with warning lights:

- *Check that all bulbs light up as they should and that the flashing frequency is  $1.5 \text{ Hz} \pm 0.5 \text{ Hz}$ .*

### 4.6 Test of actuator

If the wheelchair is equipped with an actuator:

- *Check that all motors move in the right direction.*
- *Make sure that the mechanical end stops are secured and that they stop the actuator motors, and thus use the automatic end stop tracking that is in the seat and light module (ISM).*

### 4.7 Test of inhibit signal

Connect a suitable battery charger or equivalent inhibit connecting device in the charging contact on the joystick module and check that the wheelchair is prevented from running.

If inhibit contacts 2, 3, 4 and 5 are used for inhibiting or speed restriction, an appropriate test should be performed in order to check that they are functioning as they should.

## 5. Repairing defective units

Apart from specific OEM-approved spare parts (contact Permobil for further information on these), there are no replaceable parts in the R-net control system. Consequently, defective units must be sent to Permobil or a Permobil-approved repairer for repair.



#### NOTE

If any part is replaced without Permobil's approval, the control system's warranty lapses.



#### NOTE

Permobil cannot be held responsible for losses of any kind arising as a result of a component of the R-net control system being opened, adjusted or modified without permission.

# Troubleshooting

## R-net diagnostics

When an error or a fault occurs in the wheelchair's electronics, information on it is displayed in the control panel's display. This information can then be used to diagnose where the error/fault occurred and its cause.

Troubleshooting and repairs must always be performed by competent personnel with good knowledge of the wheelchair's electronics. More information on troubleshooting and remedies can be found in the Service Manual for this wheelchair model.

## Diagnostic screens

### Current diagnostic screen

When the control system's integrated protection circuits have been triggered so that the control system can no longer operate the wheelchair, a diagnostic screen is displayed in the control panel's display.

This indicates a system fault, i.e. R-net has detected a problem somewhere in the wheelchair's electrical system.

**NB!** *If the fault is in a module that is not currently being used, it may still be possible to drive the wheelchair, but the diagnostic screen will be displayed occasionally.*

Switch the wheelchair off and leave it off for a few minutes. Then restart the wheelchair. If the fault persists, you must switch off the wheelchair and contact your service contact. Write down the information displayed in plain text in the control panel's display and pass it on to your service contact.

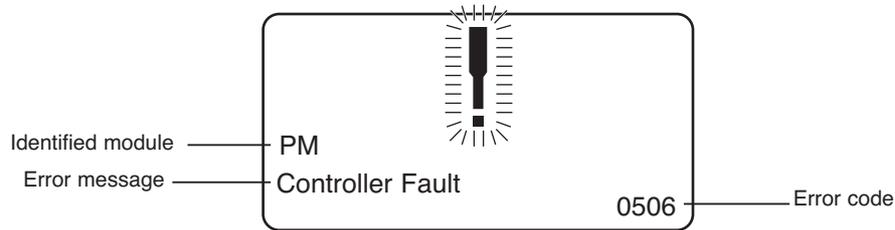
Do not use the wheelchair until the problem has been remedied or you have received other instructions from your service contact.

### WARNING

Diagnostics should only be performed by persons with sound knowledge of the wheelchair's electronic control system. Incorrect or poorly performed repair work may make it dangerous to use the wheelchair. Permobil accepts no liability for any personal injury or damage to the wheelchair and its surroundings that may occur on account of incorrect or poorly performed repair work.

## Troubleshooting

### Example of a screen showing a system fault



#### Identified module

This indicates the control system module that detected the problem.

**PM** = Power module

**JSM** = Joystick module

#### Error message

The error message provides a brief description of the error type.

#### Error code

The four-digit code indicates which protection circuit has been triggered.

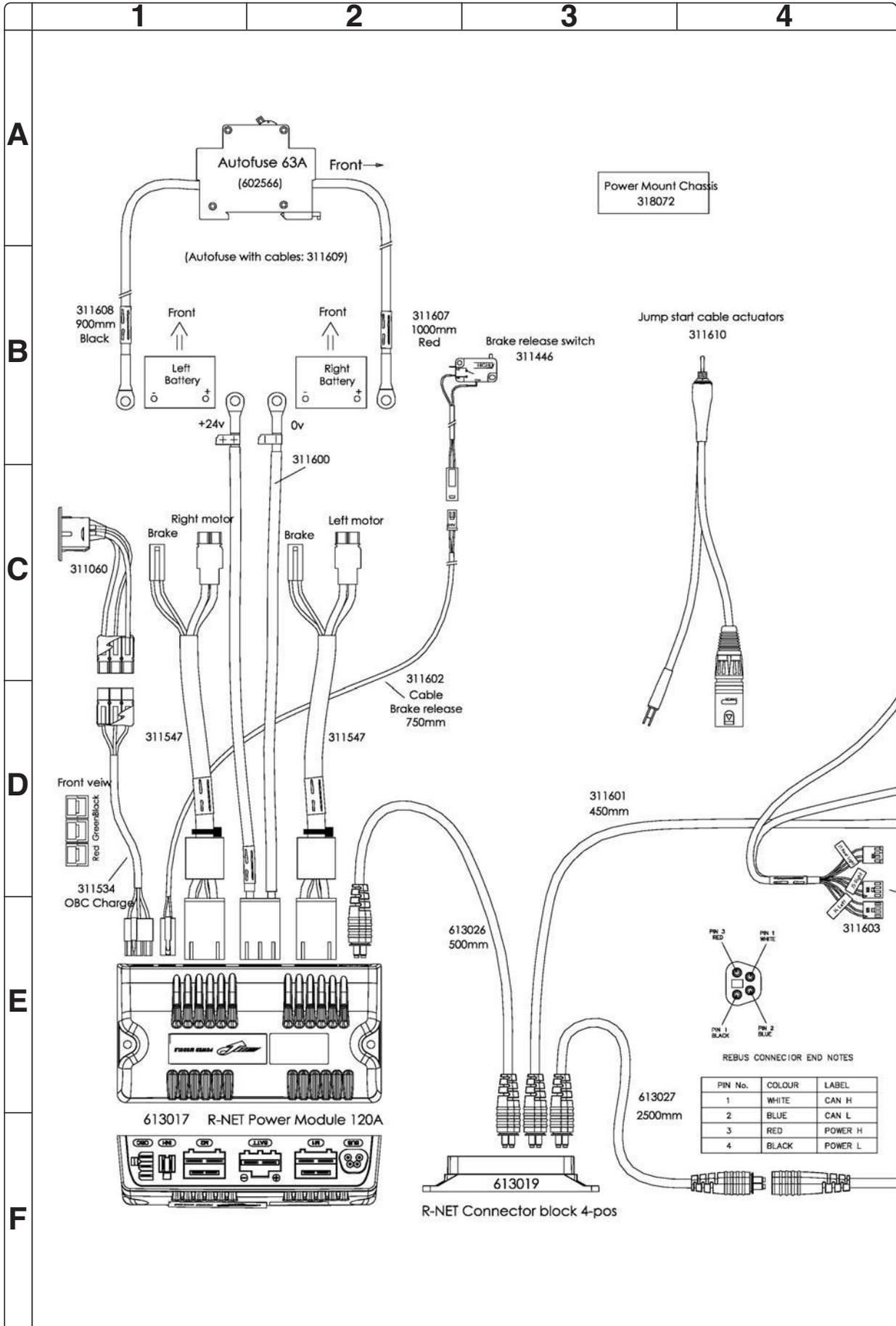
### Repair of defective units

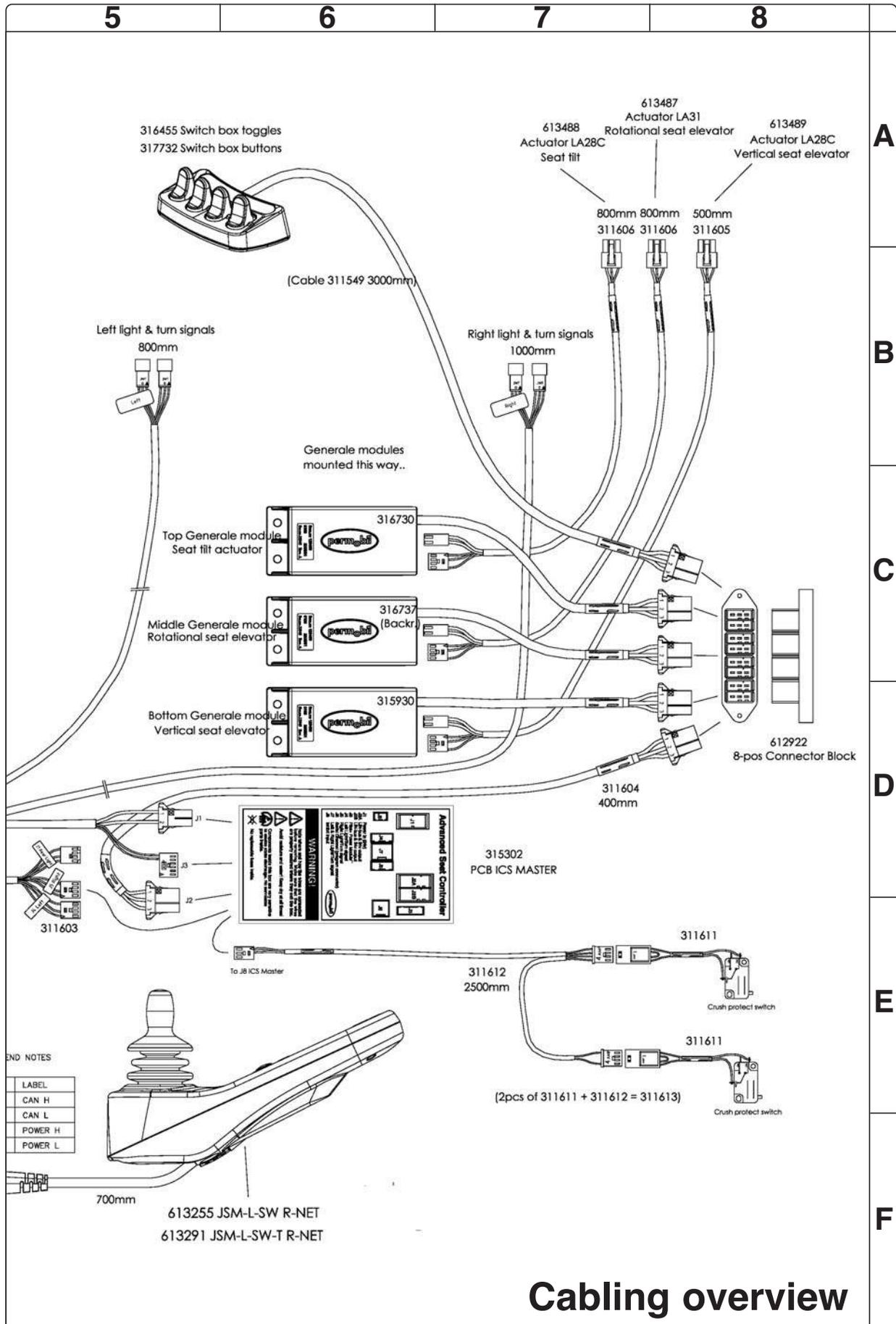
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#### NOTE

If any part is replaced without Permobil's approval, the wheelchair's warranty lapses. Permobil cannot be held responsible for losses of any kind arising as a result of a component of the R-net control system being opened, adjusted or modified without permission.

# Cabling overview





## Control system

The wheelchair's control system can be programmed in order to optimize the performance of the wheelchair while also maintaining a high level of safety regardless of the wheelchair's other settings and options of the wheelchair. The control system can also be programmed in order to make adjustments needed for a specific user.

To get more information about standard parameter files, contact your dealer, or Permobil Inc. USA.

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