Invacare® Spectra Blitz
SERVICE INSTRUCTIONS

CE

Edition: 12.04.12

INVACARE

Yes, you can.

These instructions contain information about:
Testing work
Repair Instructions

This manual is part of the instructions for use.

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Chapter **Page**

1 Introduction

This manual provides basic details to enable the Invacare® ***Spectra Blitz***™ Wheelchair to be maintained. It is not intended to be a comprehensive maintenance guide/policy, but is intended for use by competent personnel to enable the chair to be adequately maintained.

The wheelchair is manufactured by:

INVACARE Ltd

South Road

Bridgend Industrial Estate

Bridgend

Mid Glamorgan

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For TECHNICAL ADVICE, repairs, servicing, contact Technical Services.

For SPARE PARTS orders contact Sales.

Quote the following details at all times:

- Part Number (see Spare Parts Catalogue)
- Description
- Quantity required
- Serial Number
- Chair Type

2 Policy

INVACARE Ltd Policy is as follows:

- Repairs to any component other than those detailed in this manual are not covered. Repairs to any tube metal work are not generally permitted without express permission of INVACARE Ltd. All fasteners i.e. bolts, nyloc nuts, and any fastener showing damage must be renewed.
- Under no circumstances attempt to repair a crash damaged chair. Contact Technical Services for further Information.
- Alterations to the wheelchair which occur as a result of incorrectly or improperly executed maintenance or overhaul work lead to the exclusion of all liability on the side of INVACARE.
- We reserve the right to make any alterations on the grounds of technical improvements.
- Information about operation or about general maintenance and care work should be taken from the wheelchair Operating Manual.

Failure to comply with the above absolves INVACARE Ltd of liability.

Note: Certain components will require removal to carry out maintenance. With the exception of fasteners, those components should be refitted.

3 Notes on Transport

If the wheelchair has to be shipped back to the manufacturer for major repairs, you should always use the original packaging for transport.

You should also include as accurate a fault description as possible.

4 Information Symbols

WARNING!

This symbol warns you of danger!

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

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

Requirements:

- This symbol identifies a list of various tools, components and items which you will need in order to carry out certain work. Please do not attempt to carry out the work if you do not have the listed tools available.

5 Safety and Assembly Instructions

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

5.1 Before any inspection or repair work

Read and observe this repair manual and the associated operating manual.

Caution

- *Please note the heavy weight of some components. This applies especially to the removal of drive units and batteries.*
- *The wheelchair must be switched off before removal of voltage-carrying components.*
- *To do this, disconnect the batteries or remove them.*
- *When making measurements on voltage-carrying components, avoid short-circuiting the contacts.*
- *Danger of fire and combustion!*

5.2 During dismantling / reassembly

Mark all current settings for the wheelchair (seat, armrests, backrest etc.), and the cable connecting plugs associated, before any removals. This makes reassembly easier.

Caution

- *Prop up the wheelchair with appropriate supports before starting any assembly or disassembly.*
- *Never use standard nuts where self-locking nuts have been used.*

NOTE:
All plugs are fitted with mechanical latches which prevent release of the connecting plugs during operation.

To release the connecting plugs the latches must be pressed in.

When reassembling, ensure that the latches are correctly engaged.

5.3 Before operation / after completion of work

Caution

- *Check all fixings for tight fit.*
- *Only operate wheelchair with correct tyre pressure.*
- *Check electrical components for correct functioning - incorrect polarity of cables can result in damage to the electronics.*
- *As a last check, always carry out a trial run.*

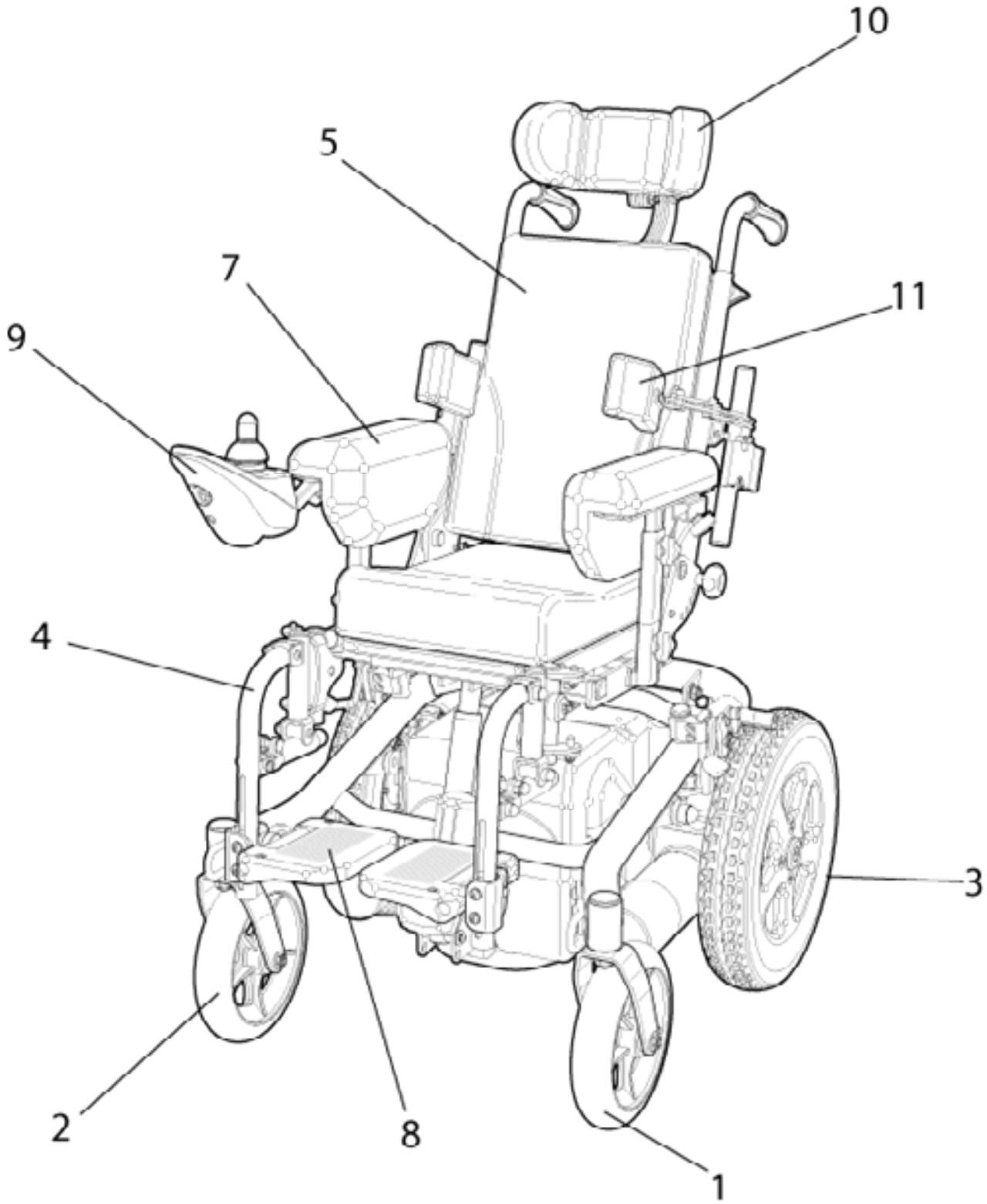
6 Tools Required

The following list gives the basic tools required to perform the maintenance procedures as illustrated in this manual.

Requirements:

- 1 - Open ended spanner (7 mm)
- 1 - Open ended spanner (8 mm)
- 1 - Open ended spanner (10 mm)
- 1 - Open ended spanner (11 mm)
- 2 - Open ended spanner (13 mm)
- 2 - Open ended spanner (17 mm)
- 1 - Combination spanner (19 mm)
- 1 - Socket / Wrench (Shallow) (19 mm)
- 1 - Socket / Wrench (17 mm)
- 1 - Cross point screwdriver (No 2)
- 1 - Cross point screwdriver (No 1)
- 1 - Flat bladed screwdriver (No 1)
- 1 - Nylon mallet
- 1 - Torque wrench
- 1 - Hex wrench - (3mm)
- 2 - Hex wrench - (4mm)
- 1 - Hex wrench - (5mm)
- 1 - Knife
- 1 - Pressure gauge
- 1 - Pump
- 1 - Drift
- 1 - Vice
- 1 - Valve remover
- 1 - Multimeter
- 1 - Soldering iron
- 1 - Pin hammer
- 1 - Punch
- 1 - Pair pliers
- 1 - Battery discharge tester
- 1 - HHP – Programmer
- 1 – Shark programming adapter
- 1 – Dynamics Wizard Programming Kit
- 1- Penny & Giles programming adapter
- 1- Penny & Giles hand held programmer
- 1 – Safety goggles

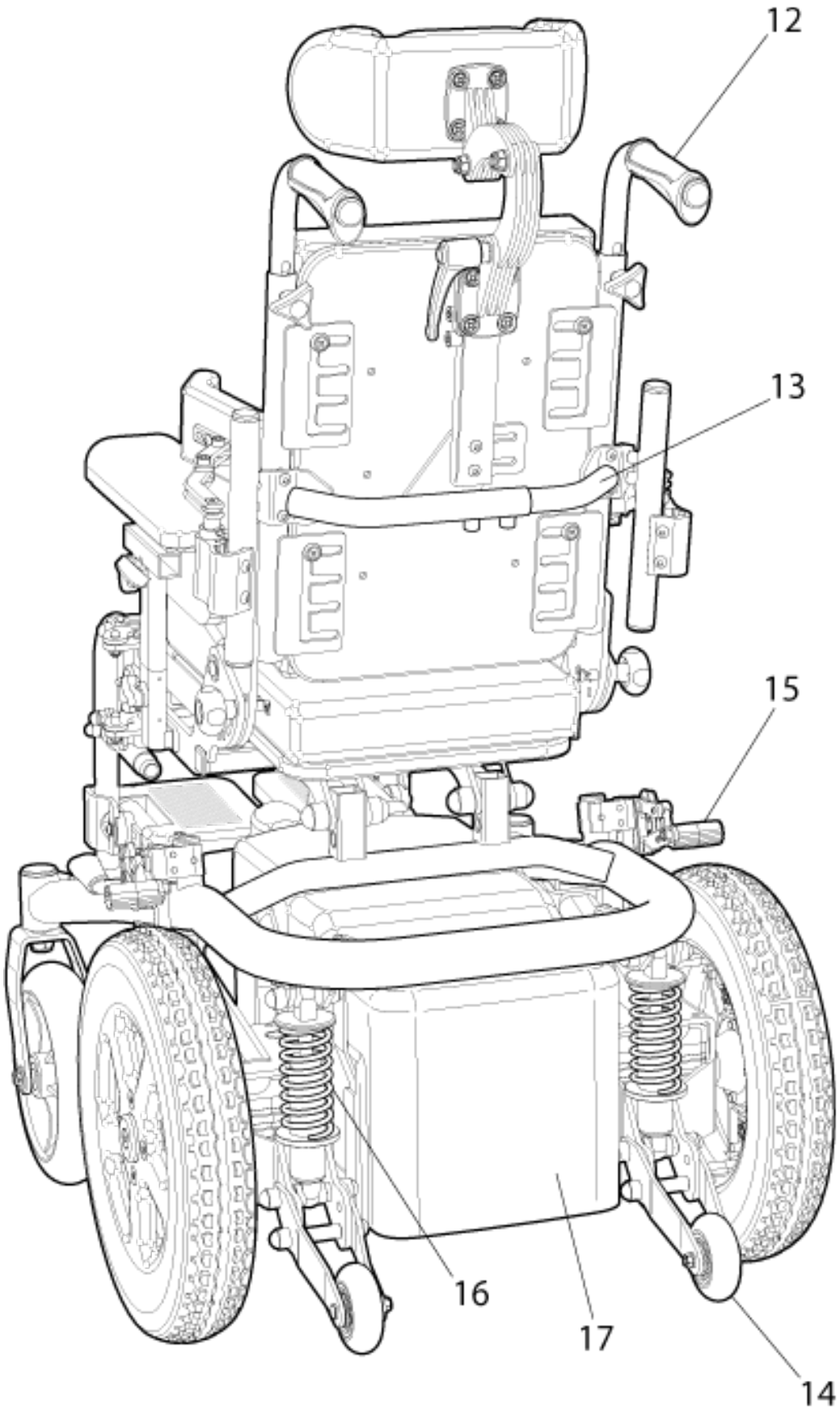
7 Layout of Modules, Components and Controls



Descriptions:

1 Motor Gearbox	5 Seat	9 Shark Remote
2 Front Castor Wheel	6 Backrest	10 Headrest
3 Rear Drive Wheel	7 Armrest	11 Lateral supports

4 Legrest 8 Footplate



Descriptions:

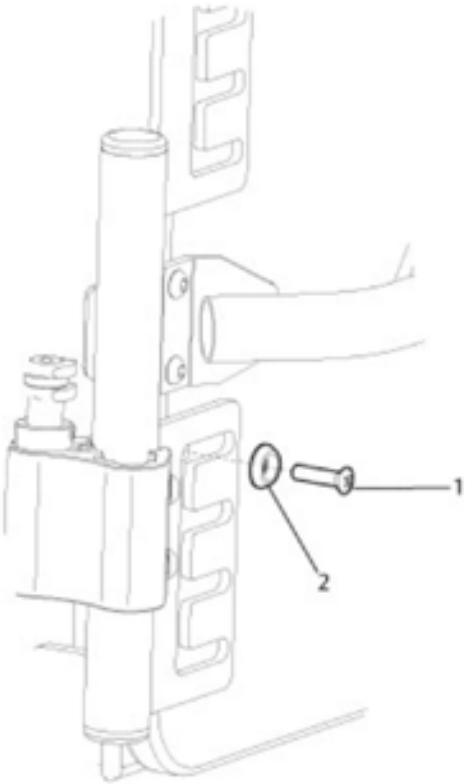
12 Push handle	14 Anti tipper assembly	16 Suspension
13 Back support bracket	15 Mechanical break	17 Battery covers

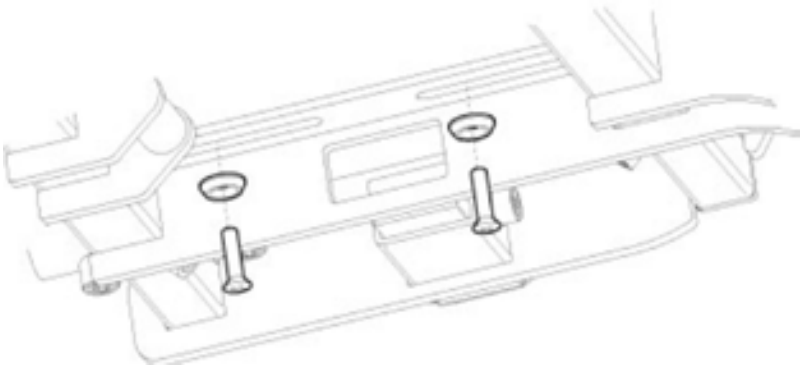
8 Seat and Back Boards

Descriptions:

1 Screws

2 Washers





Requirements:

· 1 – cross point screwdriver (No 1)

8.1 Inspection

· Check all screws (1) and washers (2) are present and screws fitted tightly.

8.2 Disassembly

- Remove screws (1) and remove seat/back board.

8.3 Assembly

- Place seat/back board in correct position and replace screws. Tighten until finger tight.
- Check the position of the seat/back board and then tighten screws securely.

NOTE:
The screws should not be tightened excessively. Excessive tightening could result in damaging the cross head screw.

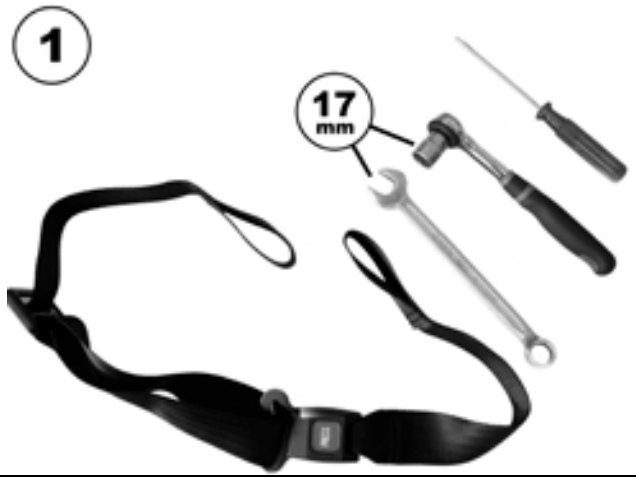
9 Installing the Postural Belt

Depending on the type of postural belt, you can install it in two different ways:

- A postural belt with loop endings is installed by putting the loops over the bars of the rear seat mounting. Refer to **How to Install the Postural Belt with Loop Endings** on page 14.
- A postural belt with mounting eyelets is installed by screwing it to the bars of the rear seat mounting. Refer to **How to Install the Postural Belt with Mounting Eyelets** on page 18.

9.1 How to Install the Postural Belt with Loop Endings

Requirements:
- 17 mm open ended spanner
- 17 mm socket spanner
- Flat bladed screwdriver



- Remove the plastic caps.

- Loosen the screws and the associated nuts with a 17 mm open end spanner and a 17 mm socket spanner.

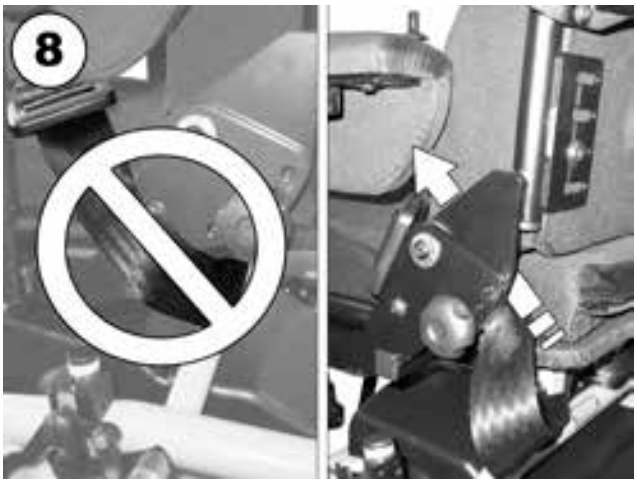
- Lift the seat upwards.

· Pull the loops of the postural belt over the bars of the rear seat mounting.

· Tighten the screws and the associated nuts.

· Refit the plastic caps.

- Make sure to put the postural belt between the seat and the perforated plates.



9.2 How to Install the Postural Belt with Mounting Eyelets

Requirements:

- Crosspoint screwdriver (No. 2)
- 2x M5x16 screws

- Screw the eyelets of the postural belt to the bars of the rear seat mounting.

- Make sure to put the postural belt between the seat and the perforated plates

10 Armrests

Descriptions:

1 Armpad assembly

2 Armrest support

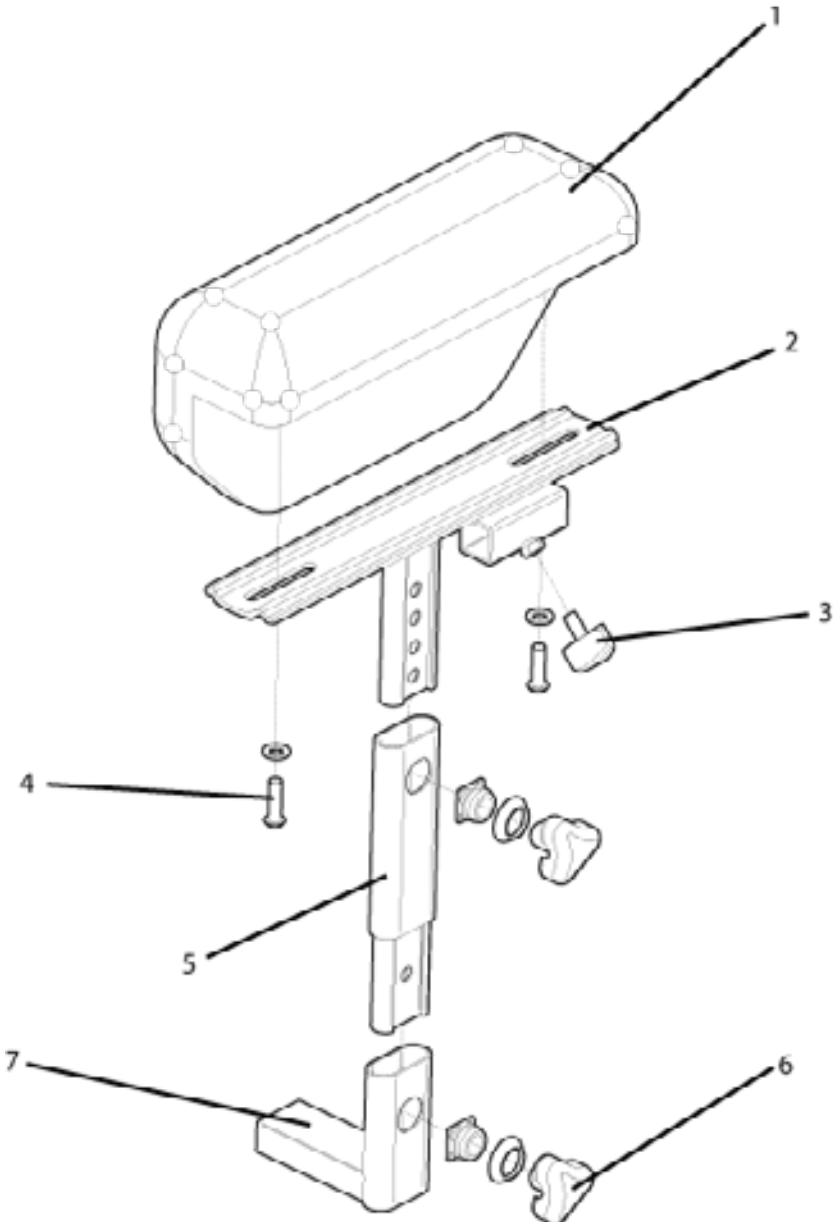
3 Handwheel

4 Armrest bolts

5 Height adjust support

6 Handwheel assembly

7 Width adjust assembly



Requirements:

· 4mm hex wrench

10.1 Inspection

· Check for armpad (1) wear or damage. Replace if necessary.

· Check for corrosion or paint damage to the brackets and replace affected parts where necessary.

10.2 Disassembly / Assembly

· Release the hand wheels (6) by rotating anti-clockwise.

· Remove the top and lower armrest assemblies.

10.2.1 Armrest Top Assembly

- Remove the hand wheel (6).
- Release the bolts (4) with a 4mm hex wrench to remove the armpad.

10.2.2 Armrest Lower Assembly

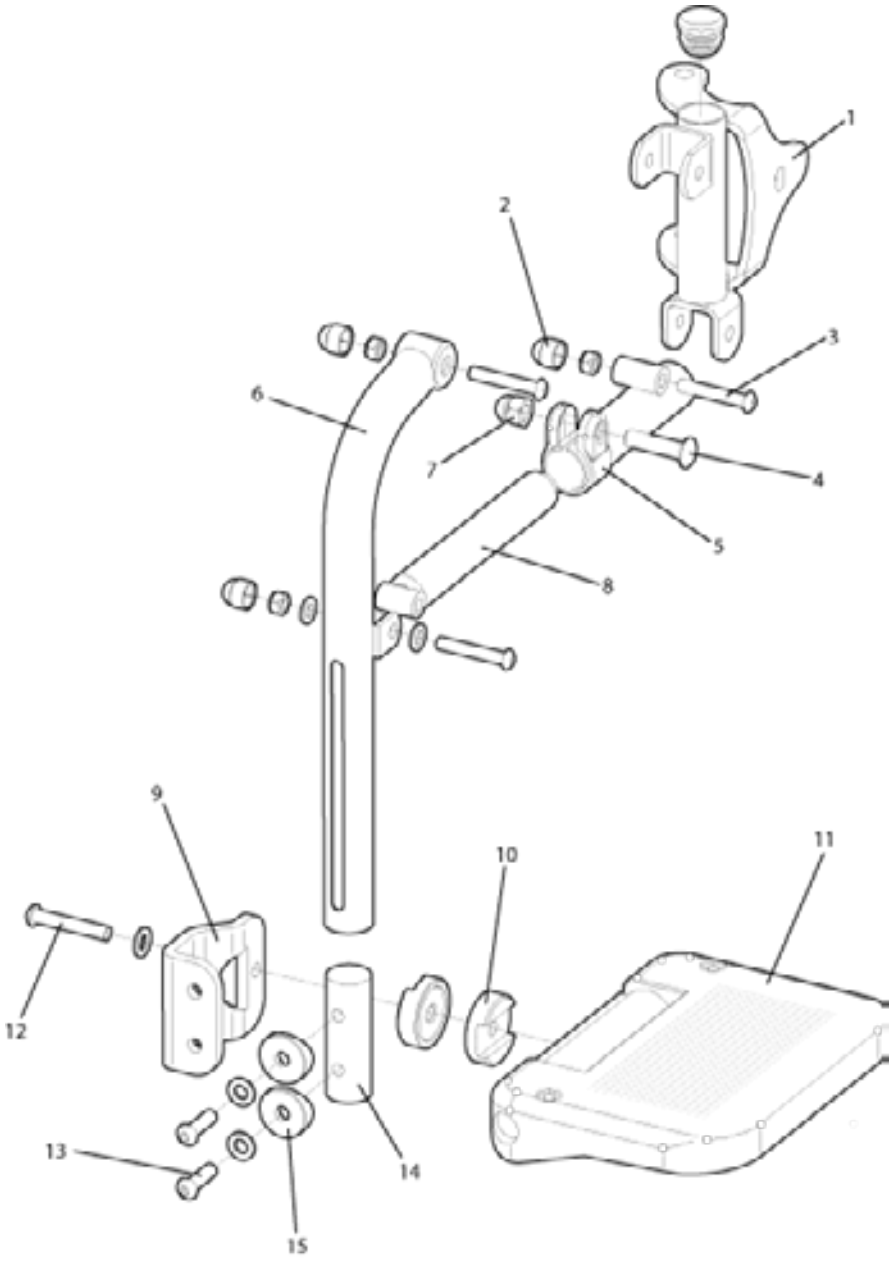
- Remove hand wheel (6).
- Push fixing nut into tube, to release plastic ring and remove both from armrest lower tube.
- Repeat step 3, for armrest socket fixing nut.

To re-assemble reverse the above steps taking care not to over tighten the fixing screws.

11 Legrests

Descriptions:

1 Hanger bracket
2 Cap
3 Bolt
4 Stud
5 Outer tube
6 Front leg
7 Domed nut
8 Inner tube
9 Footplate bracket
10 Footplate mount
11 Footplate
12 Bolt
13 Bolt
14 Insert
15 Mounting washers



Requirements:

- No 2 cross point screwdriver
- hex wrench (4mm)
- 10 mm open ended spanner
- Mallet

11.1 Inspection

- Check that the footplate fits securely and operates correctly.
- Check the operation of the footplate extension, clamping and adjustment screw (12).
- Check the legrest for damage.

11.2 Disassembly / Assembly

- Operate the legrest release mechanism and remove from the wheelchair.
- Release the height adjustment screws (13) and slide the threaded insert (14) from the hanger. Use a mallet to gently tap the footplate if the insert will not move.

11.2.1 Footplates

- Remove screw (12) using a 4mm hex wrench.
- Separate the footplate (11) from the footplate bracket (9).
- Take care not to damage the spacers (10).

11.2.2 Legrest Assemblies

- Remove all caps (2).
- Remove fixing screws (3) and nuts using a 4mm hex wrench and a10 mm spanner.
- Remove 8 mm stud (4) and domed nut (7).

To re-assemble reverse the above steps taking care not to over tighten the fixing screws.

12 Upholstery / Tension Adjustable Back

Descriptions:

1 Push handle

2 Backpost assembly

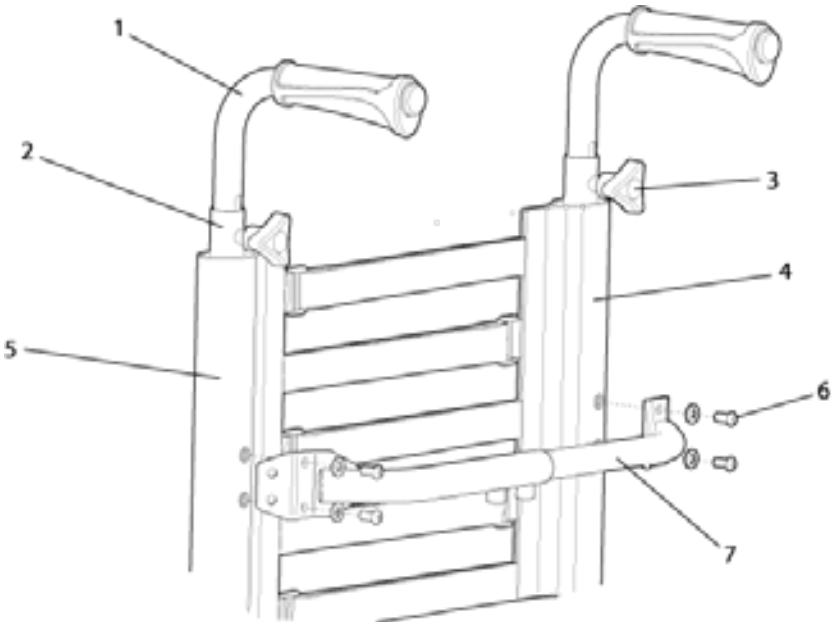
3 Turn handle

4 Tension adjustable back

5 Tension adjustable back

6 Bolt

7 Back support bracket



Requirements:

· 4mm hex wrench

12.1 Inspection

· Check that the upholstery does not excessively sag, is not unevenly stretched, worn or torn. Pay particular attention to buckles and straps inside tension adjustable back upholstery (4, 5).

· Check that all stitches are in good condition.

· Check that all screws and washers (6) are in good condition and are not burred.

12.2 Disassembly / Assembly

· Remove the back support bracket (7) assembly by removing the screws (6).

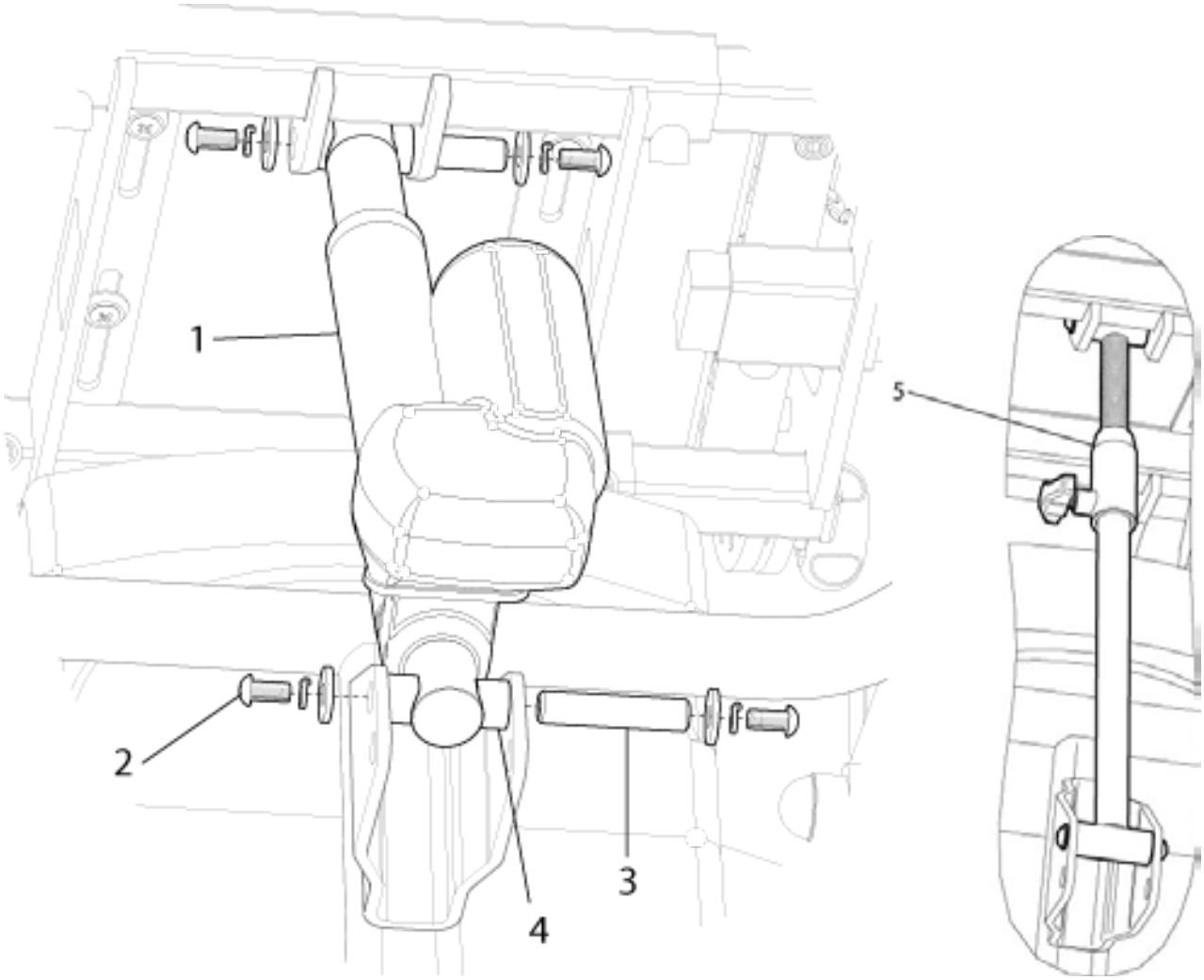
NOTE:
Wheelchair back must be rotated forward and pushed flat to ensure the threaded inserts do not fall out when hand wheels (3) are removed.

· Remove push handles (1), hand wheels (3) and threaded inserts.

· Slide the tension adjustable back upholstery (4, 5) off the back posts (2).

To re-assemble reverse the above steps, ensuring that the fixing holes in the upholstery and tubes are aligned. Take care not to over tighten the fixing screws.

13 Actuator Assembly / Manual Seat Tilt



Descriptions:

1 Actuator	4 Spacer
2 Screws	5 Collar and hand wheel
3 Bearing	

Requirements:
- 2 x 4mm hex wrench

13.1 Inspection

- Check all screws are present and fitted tightly.
- Run the actuator (1) through the full extent of its travel (max and min) to ensure there are no issues.
- Check there are no issues with the actuator cable, or cable connection.
- Check there is no damage to the actuator motor moulded housing.

13.2 Disassembly

- Ensure the weight of the chair assembly is supported. When the actuator is removed the chair will fall forward.
- Remove wire protecting sleeve and disconnect actuator.
- Remove screws (2) using 4mm hex wrench.
- Gently tap out the bearings (3) ensuring the spacers are gathered (4). The actuator (1) may need tapping lightly to remove.

13.3 Assembly

- To reassemble the actuator reverse steps 1-3.
- The assembly/disassembly process is the same for the manual seat angle adjustment assembly.

NOTE:
The screws should not be tightened excessively – the spring washers will ensure the screws do not work loose. Excessive tightening could result in a) the hex screw becoming rounded, or b) the sheet metal tightening applying excessive load on the actuator (friction).

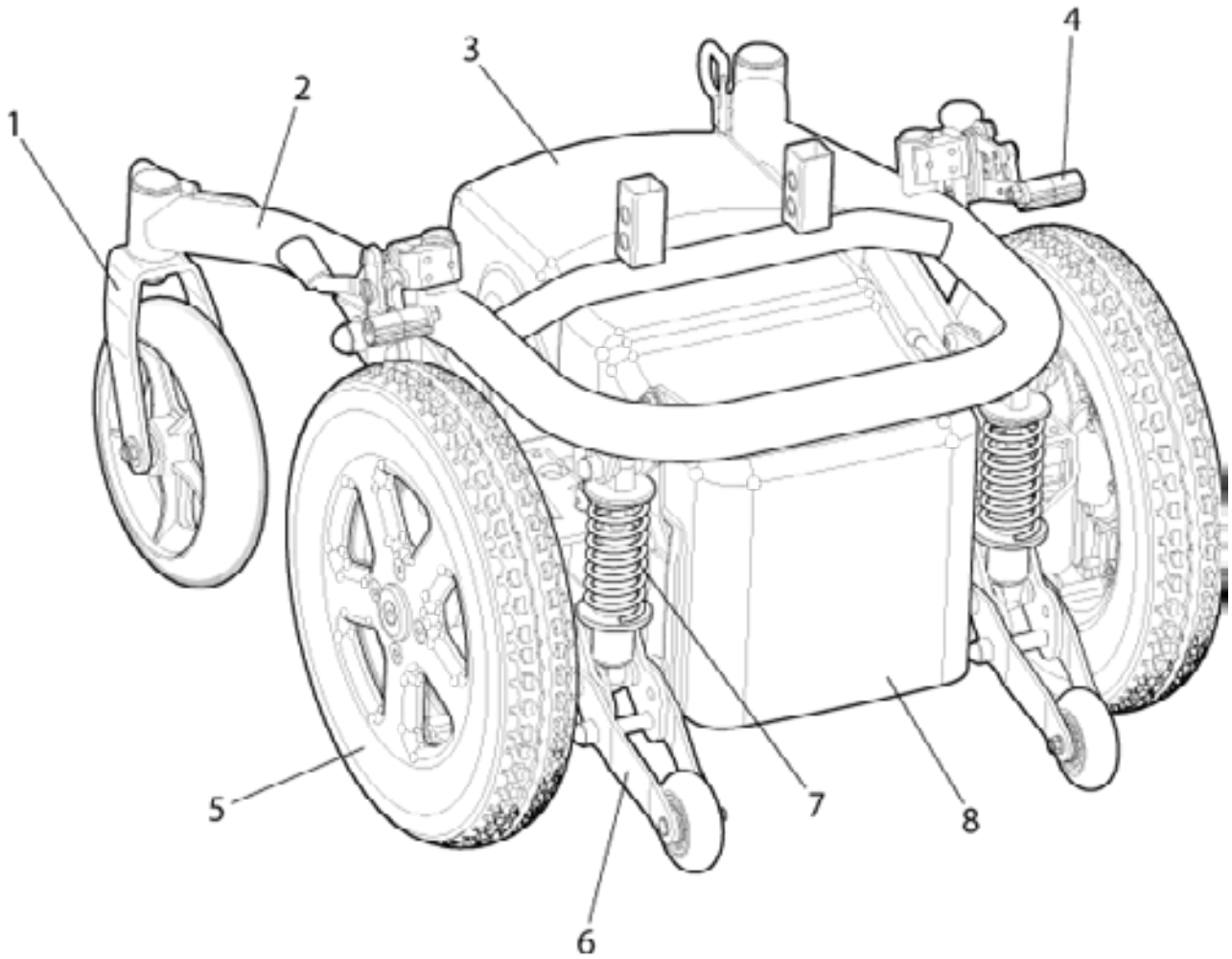
If using the manual seat tilt angle adjustment assembly, ensure the collar and hand wheel assembly (5) is sufficiently lubricated to ensure ease of angle adjustment.

13.4 Testing

Requirements:
- Multimeter

- Check the electrical resistance of the actuator. If it is close to infinite, then the motor is likely to be burnt out. If it is less than 1Ω, then the motor has a short circuit. In either case, the motor needs to be replaced.

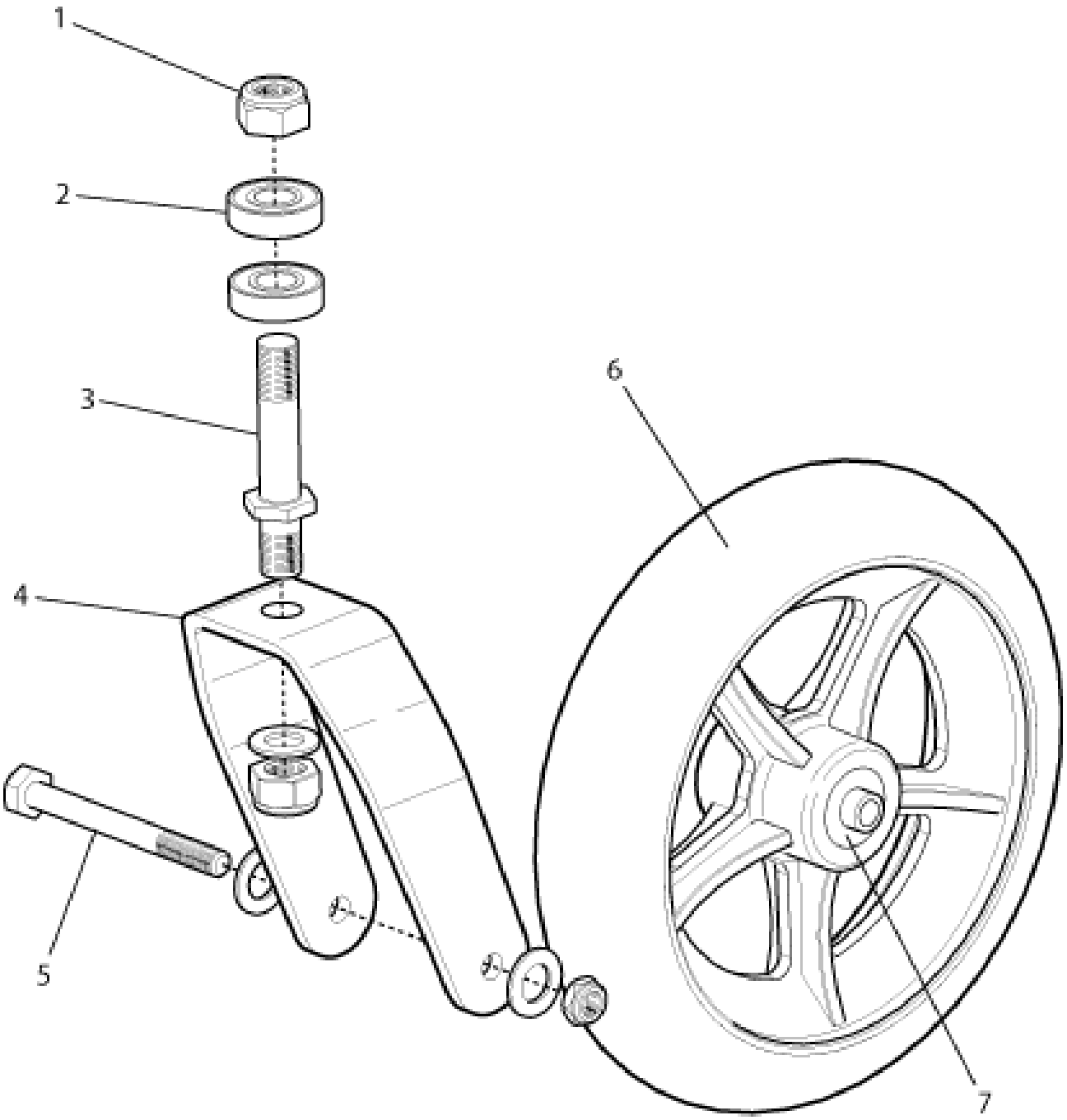
14 Frame and Chassis



Descriptions:

1 Front caster	5 Rear wheel
2 Main frame	6 Anti tipper
3 Front battery box	7 Suspension
4 Manual break	8 Rear battery box

15 Castor Wheels and Forks



Descriptions:

1 Nut	5 Axle bolt
2 Bearings	6 Castor wheel
3 Fork stem	7 Bearing
4 Castor fork	

Requirements:

- 19mm open ended spanner
- 19mm Socket / Wrench
- 13 mm open ended spanner x 2
- Flat Bladed screwdriver
- Mallet
- Pressure Gauge
- Pump
- Drift

15.1 Inspection

- Check castor wheels are not buckled or physically damaged. Replace if required.
- Check that the wheel bearings (7) run freely without excessive play.
- Check that the castor wheel and fork nuts (1) are tight.
- Check that the castor forks (4) are bent or damaged.
- Check the crown/castor fork bearings (2) for wear and correct adjustment.
- Check tyres for wear and correct inflation. Both wheels should show the same degree of wear (see side of tyre pressure rating). For tyre fitment see rear tyre section.

15.2 Disassembly

- Remove castor socket cap with flat bladed screw driver, hold the lower fork stem nut (2) secure with 19mm spanner and remove the upper fork stem nut (2).
- Gently tap the threaded end to the fork stem (3) with a mallet taking care not to damage the threads. Remove the castor fork assemblies.
- Lever out the top fork bearing (2) carefully, using the fork stem as a lever. Take care not to damage the threads.
- Remove the lower fork bearing (2) using a drift and a mallet, tapping gently to avoid damaging the bearing.
- To remove the castor wheels undo the axle bolt (5) with a 13 mm spanner using a second spanner at the other end of the axle nut to lock against rotation. Remove the axle bolt and remove the wheel from the fork.
- Remove the bearings (7) by hand.

15.3 Assembly

- To reassemble the wheel reverse step 5 & 6, but adjust tightness of nut until the wheel runs freely to a gradual halt.

NOTE:
If the wheel stops abruptly, loosen the castor axle nut.

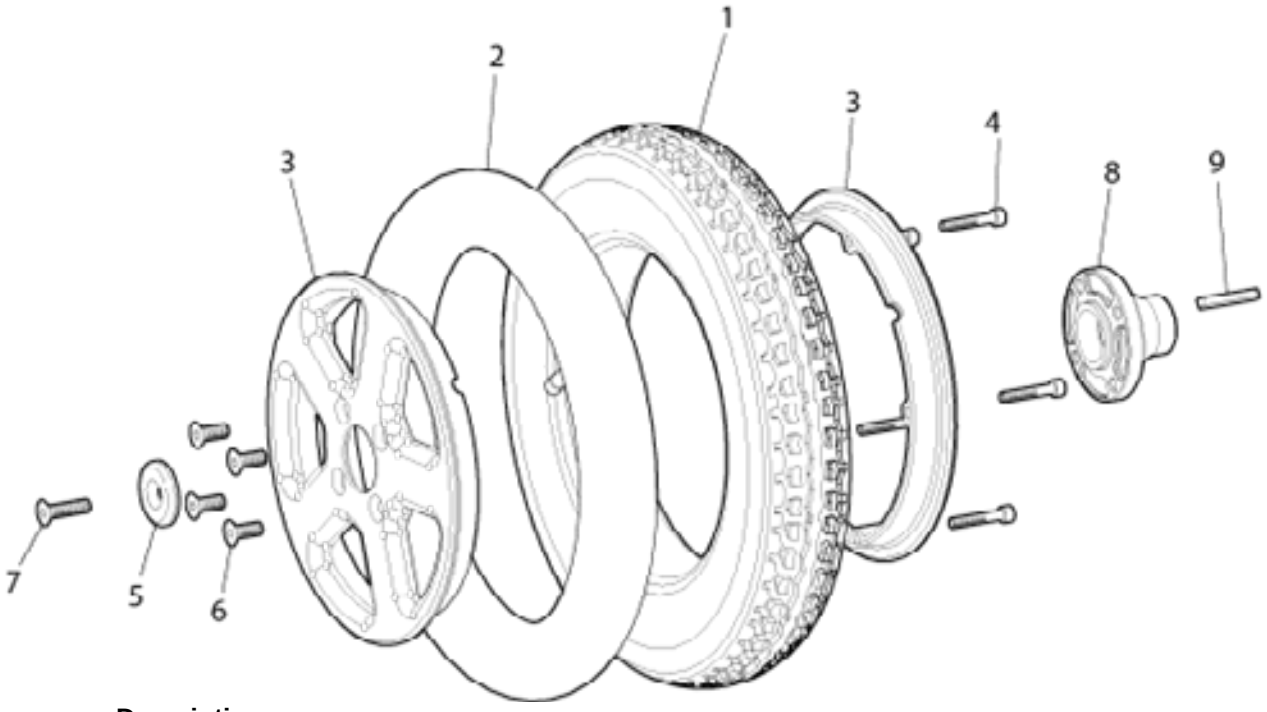
If the wheel wobbles (side play), tighten the castor axle nut enough to allow free spinning without side play.

- Insert the fork stem bearings (4) using a mallet and drift across the bearing to prevent damage.

- Start at the bottom and place the threaded end of the fork stem (3) through both bearings (2) and into the castor fork socket.
- Locate fork stem nut (1) on the threaded end of the stem and tighten with a 19mm spanner just enough to allow the fork to swivel freely.
- To check for correct tightness, perform the following test:
  - Tip chair backwards and rest the push handles on the floor (remove the battery boxes first).
  - Raise castor wheel towards ceiling, then gently push downward to either side. The wheel and fork should freely rotate down and hang straight towards the floor after a pendulum-type swing.

NOTE:
If the wheel stops angled to one side, loosen the fork stem nut slightly.
If the wheel continues to swing to both sides (like a pendulum), tighten the fork stem nut slightly.
Check the bearings for excessive play by gently rocking the fork assembly.

16 Rear Wheel



Descriptions:

1 Tyre	5 Washer
2 Inner tube	6 Wheel bolts
3 Inner rim	7 Motor shaft bolt
Outer rim	8 Wheel hub
4 Screws	9 Key

Requirements:

- 5mm hex wrench
- Mallet
- Pressure Gauge
- Pump
- Vice
- Valve Remover
- Flat Bladed screwdriver
- Torque Wrench

16.1 Inspection

- Check wheel is not buckled or physically damaged. Replace if required.
- Check tyres for wear and correct inflation, both wheels should allow the same degree of wear (see side of tyre for pressure rating).

16.2 Disassembly

Caution:

- *Take care while supporting the wheelchair in order to remove the wheel.*
- *The batteries should be removed before continuing with this procedure.*

- Jack up one of the gearboxes to lift one wheel off the floor.
- Remove the four Wheel Bolts (6) securing the Wheel to the Wheel Hub (8) using a 5mm hex wrench. Remove the Wheel.
- Deflate the inner tube (2), locate, loosen and remove Socket Head Cap Screws (4) securing the two halves of the Wheel Rims (3) together using a 5mm hex wrench.

Caution:

- *Ensure the tyre is fully deflated before attempting to separate to the two halves of the Wheel Rims.*

- Remove the tyre (1) and tube (2).
- To remove the Wheel Hub from the Axle Shaft locate loosen and remove the Motor shaft Bolt (7) and washer (5) that secures the Wheel Hub (8) to the Axle Shaft using a 5mm hex wrench.
- Gently tap the end of the Axle Shaft with a mallet and pull the hub (8) off the gear box shaft (take care not to lose the key (9) located in the gearbox shaft).

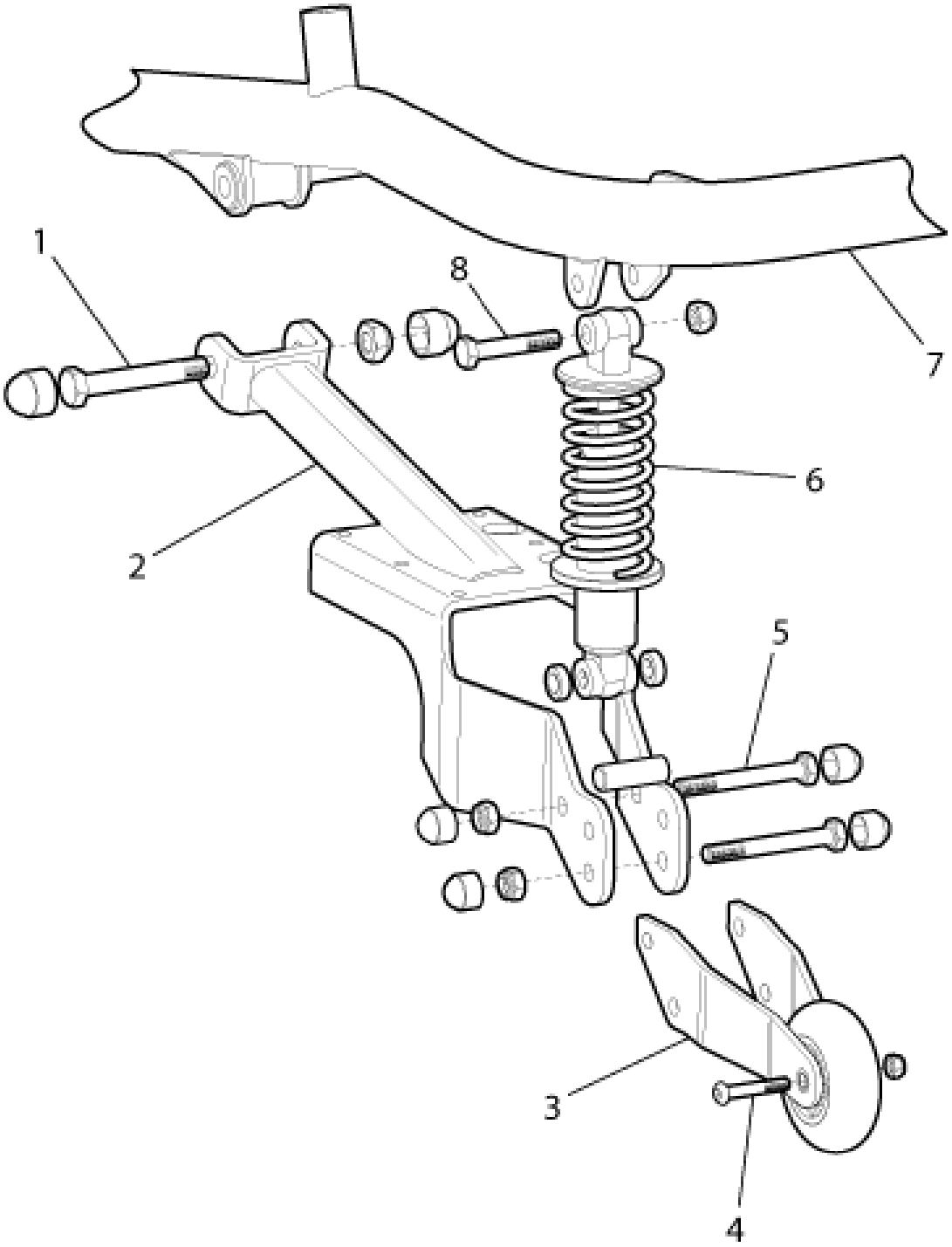
16.3 Assembly

- Re-fit the Wheel Hub (8) to the gearbox shaft ensuring alignment of the keyway of the wheel centre to the key (9) fitted to gearbox shaft. Gently tap the wheel centre with a mallet until the threads can be seen inside the shaft.
- Fit the motor shaft bolt (7) using a 5mm Hex Torque Wrench, ensuring that the washer (5) has been fitted, to the gearbox shaft.
- Locate tyre (1) and tube (2) to the face of the inside Rim (3) that has the hole for the valve to sit in, slightly inflate the tube.

- Locate the other half of the Wheel Rim (3) in position, insert Socket Cap Screws (4) in position and proceed to tighten the screws. Ensure the inner tube is not trapped between the Wheel Rim halves.
- Tighten securely Socket Head Cap Screws (4) using a 5mm hex wrench.
- Inflate to the correct pressure as indicated on the Tyre Side Wall.
- Position Wheel on Wheel Hub, locate and tighten the four Wheel Bolts (6) using a 5mm Torque hex wrench.

NOTE:
Torque rating of rear wheel bolt = 35 – 40Nm.

17 Swing Arm Assembly



Descriptions:

1 Bolt	4 Bolt	7 Main frame
2 Swing arm assembly	5 Bolt	
3 Anti tipper assembly	6 Suspension	

Requirements:

- 8 mm open ended spanner x 2
- 10 mm open ended spanner x 2
- 13 mm open ended spanner x 2
- 17 mm open ended spanner x 2
- 4mm hex wrench
- 5mm hex wrench
- Flat Bladed screwdriver
- Mallet

17.1 Inspection

- Check all tubing for misalignment, damage or bending of the frame.
- Check that no misalignment is present at the castor mount area (castor fork and socket).
- Check all brazed/welded joints for fractures or damage. Check the paint finish for damage.
- Check the swing arms are in correct alignment and that there is no damage to the suspension.

17.2 Disassembly

- Before disassembling the swing arm ensure the chassis is suitably supported. Removal of the swing arm will allow the chair/chassis to fall.
- Remove the bolt (8) first at the top of the suspension assembly (6) using two 13 mm open ended spanners.
- (To remove the suspension assembly (6) only continue to step 4. To completely remove swing arm assembly move onto step 5.)
- Remove the bolt (5) next at the base of the suspension assembly (6) using two 13 mm open ended spanners.
- Remove the bolt (1) connecting the swing arm assembly to the main frame using two 17 mm open ended spanners.
- To remove anti tipper (3) remove bolts (5) at the base of the swing arm assembly using two 17 mm open ended spanners. Ensure bolt caps and spacer are retained.
- To remove anti tipper wheel remove bolt (4) using 5mm hex wrench and 10 mm open ended spanner.

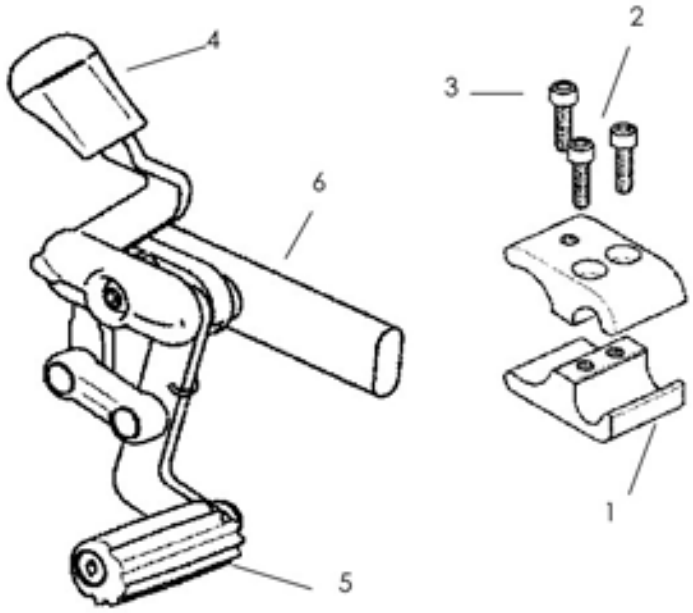
17.3 Assembly

- To re-assemble reverse the above steps. Take care not to over tighten any bolts.

18 Mechanical Brakes

Descriptions:

1 Clamp
2 Screws
3 Anti-rotation screw
4 Handgrip
5 Brake shoe
6 Brake fixing rail



Requirements:
- 5mm hex wrench
- 4mm hex wrench

18.1 Inspection

- Check that the brake mechanism has no excessive looseness, is not worn or damaged.
- Check that the brake shoe is positioned correctly to provide maximum surface area contact on the tyre tread, and gives the positive brake hold.

NOTE:
The distance between the brake shoe and tyre should be 30-35mm approximately.

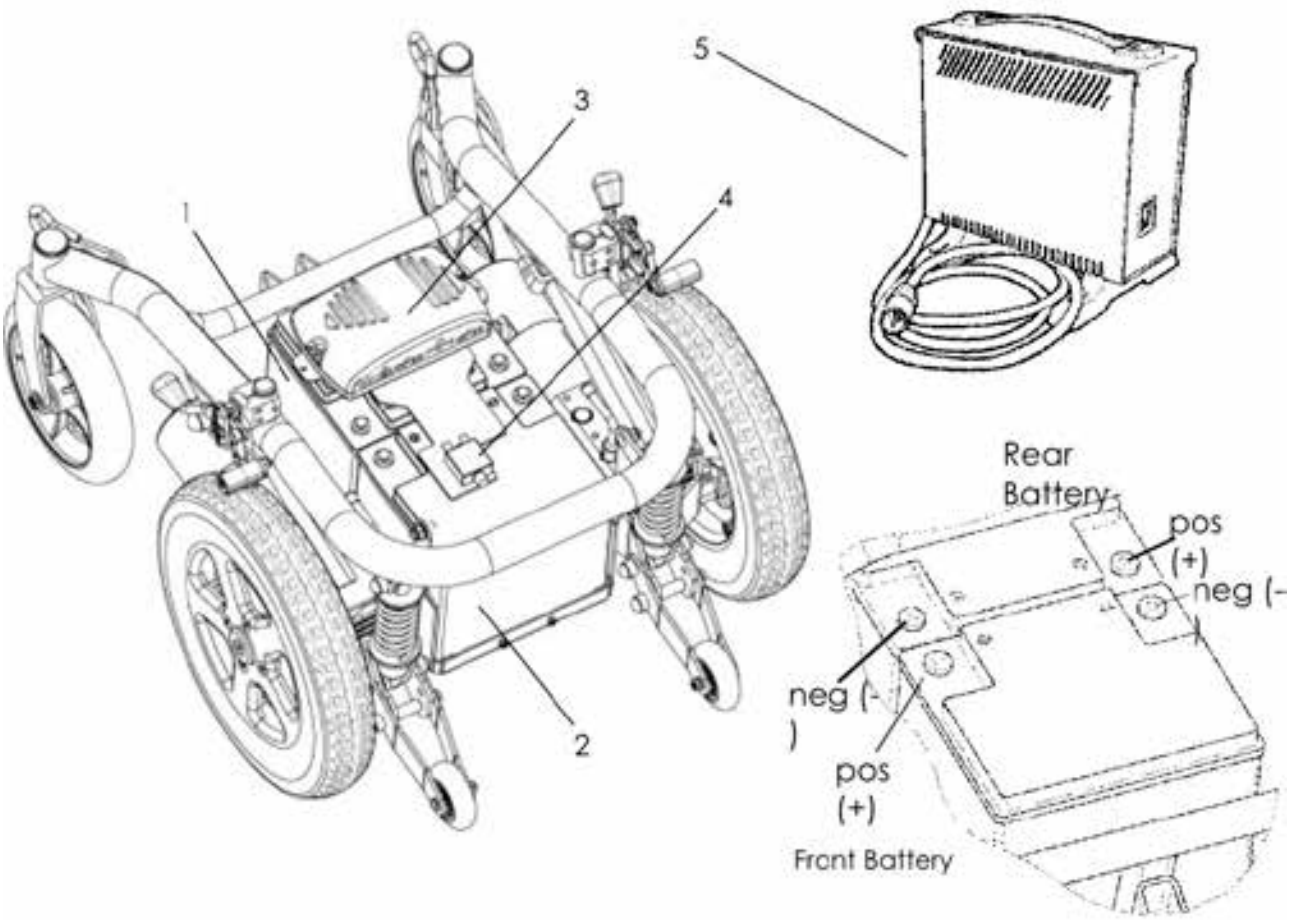
18.2 Disassembly

- Loosen and remove the anti rotation screw (3) with a 4mm hex wrench.
- Remove the Brake and Clamp (1) by loosening the clamp screws (2) with a 5mm hex wrench.
- Remove the Brake from the clamp and frame post.
- Use a 5mm hex wrench to remove the brake shoe (5) from the brake assembly.
- Use a 4mm hex wrench to remove the brake assembly from the brake fixing rail (6).
- To remove the handgrip (4), pull upwards firmly.

18.3 Assembly

- To re-assemble reverse steps 1 to 6 above.
- Ensure the brakes give a positive hold on the tyre. If the handgrip (4) has been removed, refit it with a suitable adhesive.

19 Batteries and Charger



Parts:

1 Front Battery
2 Rear Battery
3 Power Module & Fixing Plate
4 Circuit Breaker
5 Charger

Requirements:

- Pliers
- Flat Bladed screwdriver
- 11mm Open ended Spanner
- Safety Goggles
- No 2 cross point screwdriver
- Multimeter
- Battery Discharger

19.1 Inspection – Battery

Caution:

- *Safety goggles should be worn at all times while working on batteries*
- ***Shock Hazard** – take care not to allow any metallic items such as tools or jewellery touch between the battery terminals.*

- Remove the Plastic Cover from the rear of the chassis. The cover is attached with hook and loop fasteners. Pull firmly rearwards and slightly upwards to detach.
- Using the Cross point screwdriver, remove the 2 screws holding the front plastic cover. Remove the plastic cover by sliding upwards. The batteries are now accessible.

NOTE:
You will have more room to work if you remove the seat. See the relevant section in this manual for further information on seat removal.

- Disconnect the battery wiring using the 11mm ring spanner.
- Measure the battery voltages, the values must be the same +/- 0.2 V. If not replace the batteries.
- For the battery charger operate, the battery voltage must be shown above 8 V each. If not the batteries must be removed and charged with an unregulated charger until the voltage reaches 9 V. Re-connect the batteries and charge through a complete charge cycle (this may or may not recover the batteries, if not replace the batteries).
- Reconnect the batteries, and ensure the terminal covers are fitted.
- On completion of charge the battery voltage must read 14.20 V (+/-) at 20°C or combined 28.4 V.

NOTE:
Should the batteries become suspect, use battery discharge tester by Astra-Tech (Model DC39) to test capacity and runtime.

19.2 Disassembly

- Access batteries as described in the first two steps in Inspection on page 35.
- Undo the internal battery restraint strap.
- Unplug all connectors from the power module which is fitted.
- Remove the battery caps, and with an 11mm spanner, undo the battery terminals. Remove the battery wiring harnesses.
- Grasp the power module & fixing plate (3) and firmly pull upwards to dislodge the hook and loop faster strip. Remove this assembly, noting its position.
- The batteries may now be removed individually from the wheelchair chassis.

19.3 Assembly

- To re-assemble, reverse steps 1 to 6 and charge the battery fully.

Caution:
- *Take care of the battery polarities. Never cross polarities and always refit battery caps. If any wires or insulation is damaged, ALWAYS replace before use.*

19.4 Inspection – Battery Charger

- Check the charger case for physical damage.
- Check the input and output leads and plugs for damage, cuts and wear.
- Check that the “charging”, “charge complete” and “power on” lamps are operating correctly.

- With an ammeter or a multimeter set to amp (range 10 A) test the charging current.

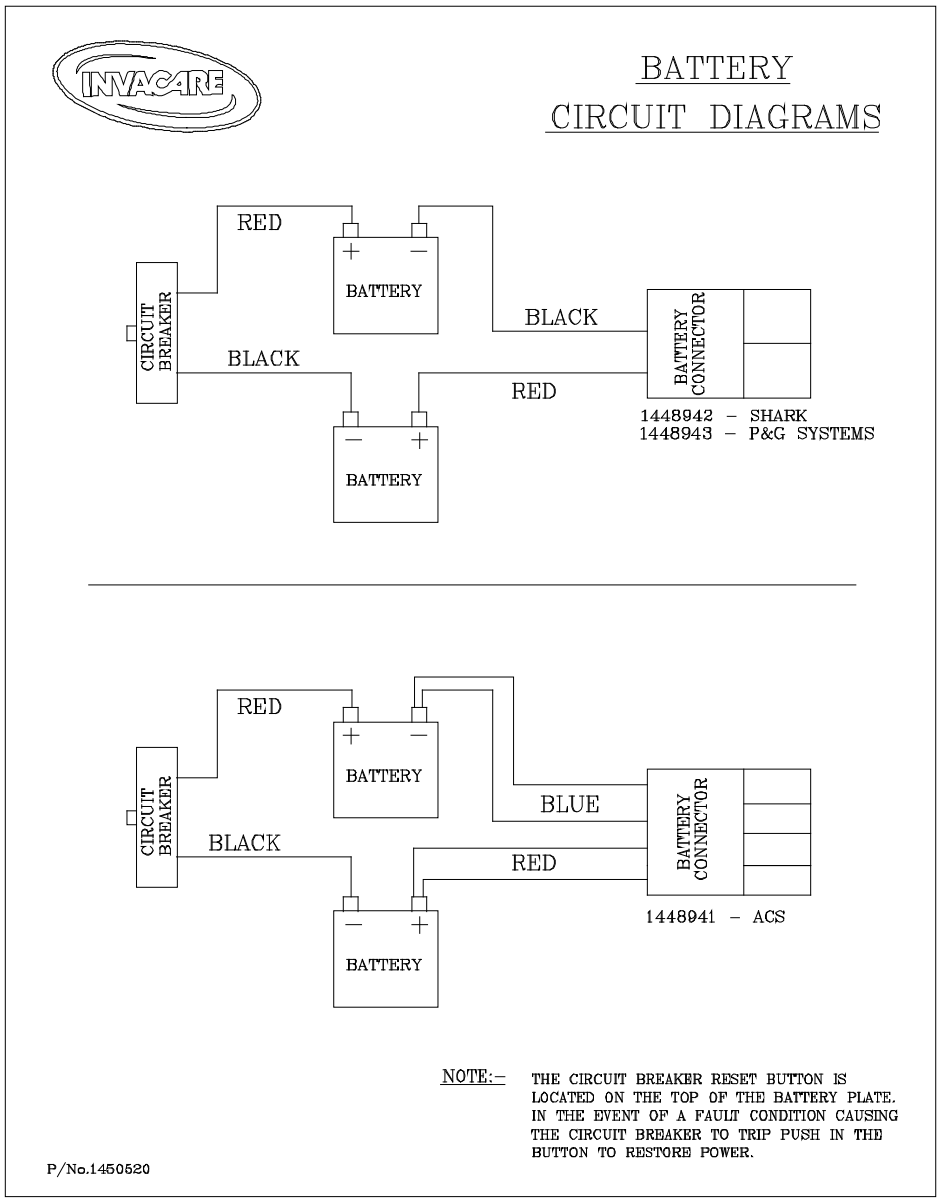
NOTE:
Ammeters must be connected in series with the battery circuit.
The current reading should read approximately 7 A at charge start and 0.2 A at complete charge.

- With a voltmeter or a multimeter, set to volts (range 30 V) test the charging voltage at the battery supply (red + blue - ve wires). The reading should increase to 28.4 V during charging.

NOTE:
The battery charger is a sealed unit. Under no circumstances should it be opened.

19.5 Battery Wiring Diagram

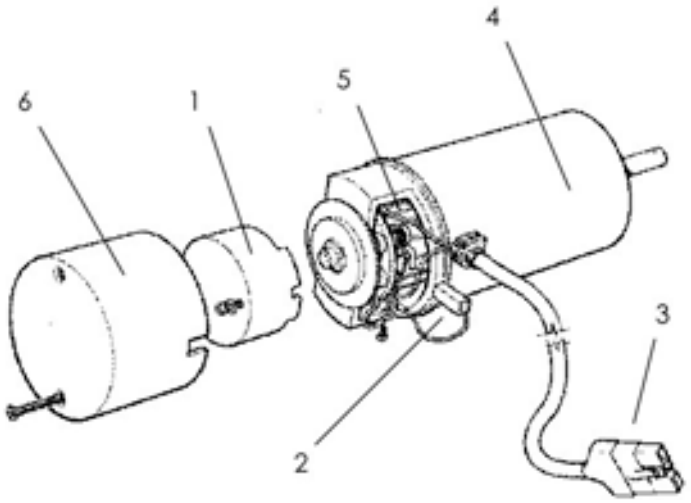
The following label is fitted inside the rear plastic battery cover for future service reference.



20 Motor Assembly

Description:

1 Electro Magnetic Brake
2 Brush
3 Connector
4 Motor Complete
5 Commutator
6 Motor End Cap



Requirements:
- No 1 cross point screwdriver
- Flat Headed screwdriver
- Soldering Iron
- Multimeter
- 3mm hex wrench

20.1 Inspection

- Check motor assembly for damage.
- Set multimeter to continuity test. Test continuity of motor leads (3) and electro-magnetic brake leads (3). Brake resistance should read 50 Ω - 80 Ω.
- Check all joints for bad connection, cracked or dry solder joints and oxidation.
- Check that all the brushes (2) can move freely in the brush guides with no obstruction (this can be easily done by pulling on the free brush feeder wire).
- Check that all the brushes (2) are not chipped, cracked or worn.
- Check that the brush (2) spring is positioned to the centre of the brush body to apply even force. Also check the brush spring tensions.
- Check the condition of the brush (2) feeder wire and check that the termination screws are secure.
- Visually inspect the commutator (5) for carbon deposits and remove with a soft brush.

NOTE:
Ensure all the segments of the commutator are not bridged with conductive materials (i.e. Carbon or Copper).

20.2 Disassembly

Caution:
- *Disconnect the battery and the motor from the power module before proceeding with this instruction.*

- Remove the motor end (6) via the two cross point screws using a No 1 cross point screw driver.
- Remove the two/three electro magnetic brake (1) fixing screws and remove the brake.
- Remove the brush (2) feeder wire termination screws, release the brush springs and remove the brushes (2).

20.3 Assembly

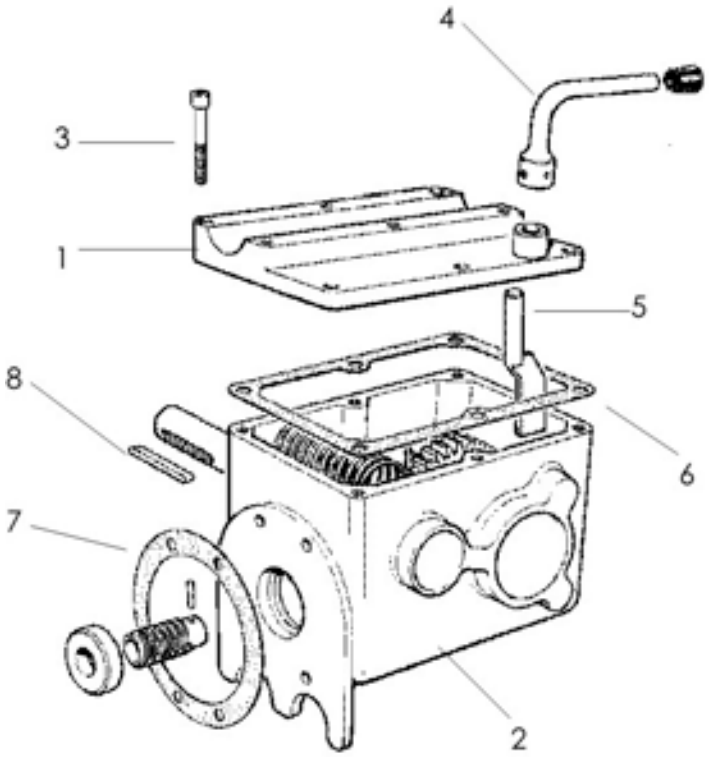
To reassemble reverse the steps 1 to 3, taking care not to damage the brushes and ensuring correct alignment of the electro-magnetic brake.

- Should there be fitting, scoring or wear then replace the Motor Unit.

21 Gearbox Assembly

Description:

1 Gearbox Top
2 Gearbox Housing
3 Screws
4 Clutch Lever Upper
5 Clutch Lever Lower
6 Gearbox Top Gasket
7 Motor / Gearbox Gasket
8 Key



Requirements:

- 5mm hex wrench
- 8 mm open ended spanner
- Pin Hammer
- Punch
- Pliers
- Vice

21.1 Inspection

- Check casing for cracks or damage or leakages.
- Check gearbox for noises (gears and bearings).
- Check the declutching lever (4) and mechanism engages and disengages correctly.

- Check that the output shaft of the gearbox is not damaged or bent. Remove the rear wheel and inspect the key (8) and keyway for wear and correct fitting.

21.2 Disassembly

Caution:
- *Before proceeding with this instruction, remove the batteries from the wheelchair.*
- *Remove the rear wheel from the gearbox (see **Rear Wheel** on page 29).*

- Unplug the motor from the power module. Loosen and remove the six screws (3) which hold the motor gearbox to the side frames of the wheelchair using a 5mm hex wrench.
- Remove the motor gearbox and then locate and remove the remaining two screws (3) from gearbox lid (1). The lower housing of the gearbox (2) will now detach from gearbox top.
- To dismantle the declutching lever upper (4) and lower (5) parts, knock out the fixing pin using a pin hammer and punch, separate the two halves.
- To detach the gearbox from the motor, degrease the gearbox, remove the four fixing screws with an 8 mm spanner, taking care not to deface or damage any gear teeth. Separate the gearbox and motor assembly.

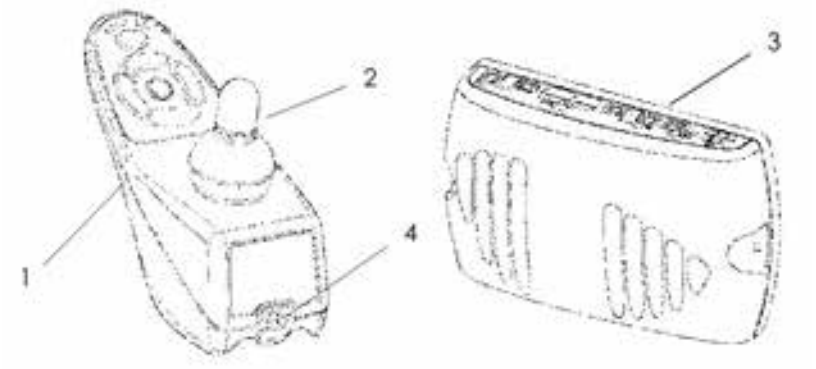
21.3 Assembly

- To reassemble reverse steps 2 to 5 ensuring correct motor to gearbox alignment is achieved.
- Replace both gaskets (6 and 7) and re-pack the gearbox with ‘Shell Albida’ Grease (approx. 200 g)

NOTE:
To aid assembly it may be necessary to hold the gearbox housing (2) or gearbox top (1) in a vice. Take care not to damage the parts.

22 Control Systems (All Systems)

22.1 Shark Control System



Description:

1 Shark Remote	3 Shark Power Module
2 Joystick Knob	4 Bus Cable

Requirements:
- 7 mm open ended spanner
- 8 mm open ended spanner
- No 2 cross point screwdriver

22.1.1 Inspection

- Check for any physical damage to the outer case of remote (1).
- Access the power module (3) as described in the batteries section of this user guide and inspect for physical damage.
- Inspect the rubber gaiter around the joystick knob (2) for any cracks, splits or perishing. This would enable water or moisture to access the unit. This may cause damage to the controller.
- Check the keypad is in good condition with no small tears or cracks.
- Check the bus cable (4) and connectors from the joystick remote (1) are free from damage.

22.1.2 Disassembly

Caution:
- *Before any work is carried out on the control system, ensure the power module (3) is unplugged from the batteries, and the batteries are disconnected.*

22.1.2.1 Remote

- Unplug the shark remote (1) from shark power module (3) and remove bus cable (4).
- Depending on the type of control arm bracket fitted to the wheelchair, remove the screws using either the screw driver or 8 mm open ended spanner. Remove remote
- Remove the joystick knob (2) by firmly pulling upwards (if required). To access the gaiter.

22.1.2.2 Power Module

- Gain access to the power module as described in the Battery section of this manual
- Unplug the remaining connectors from the power Module.
- Grasp the power module (3) & fixing plate and firmly pull upwards to dislodge the hook and loop faster strip. Remove this assembly, noting its position.
- Remove the two screws using a screw driver and a 7 mm open ended spanner in one position. The power module is now free and can be removed from the fixing plate.

22.1.3 Assembly

- To re-assemble reverse the above steps, ensuring that all fixing holes are aligned. Take care not to over tighten the fixing screws.

NOTE:
When fitting the joystick remote screws (2) be sure not to use a torque in excess of 2 Nm.

22.1.4 Shark Power Module Connector Orientation

Position:

A M2 Motor Cable (LH Motor)

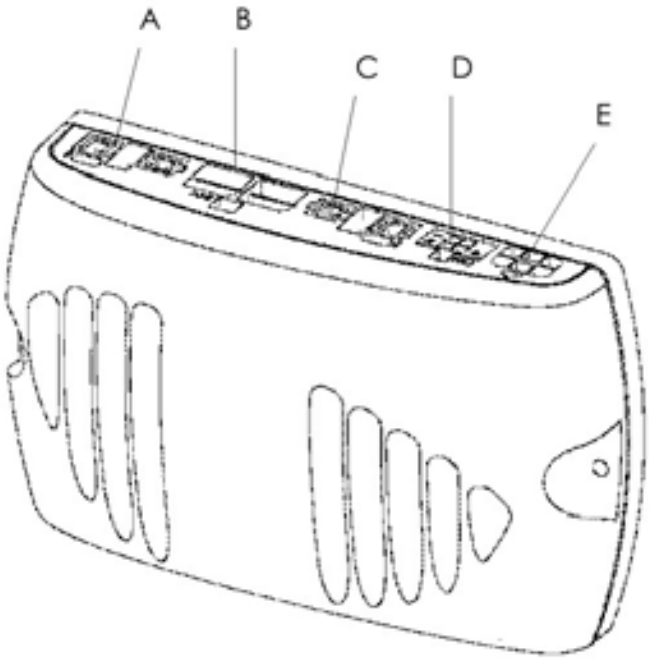
B Battery Cable

C M1 Motor Cable (RH Motor)

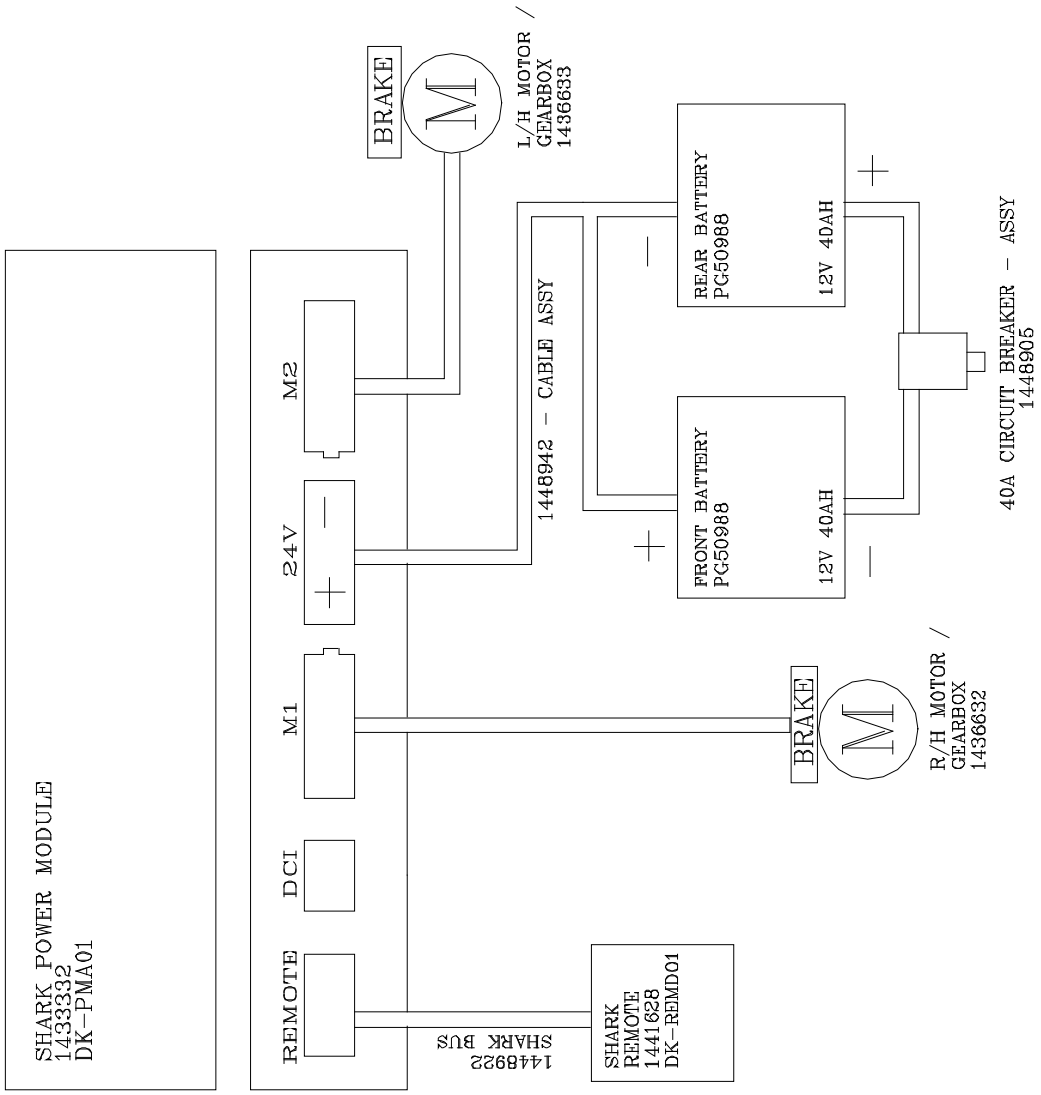
D DCI / Shark Port.

E Shark Remote Cable

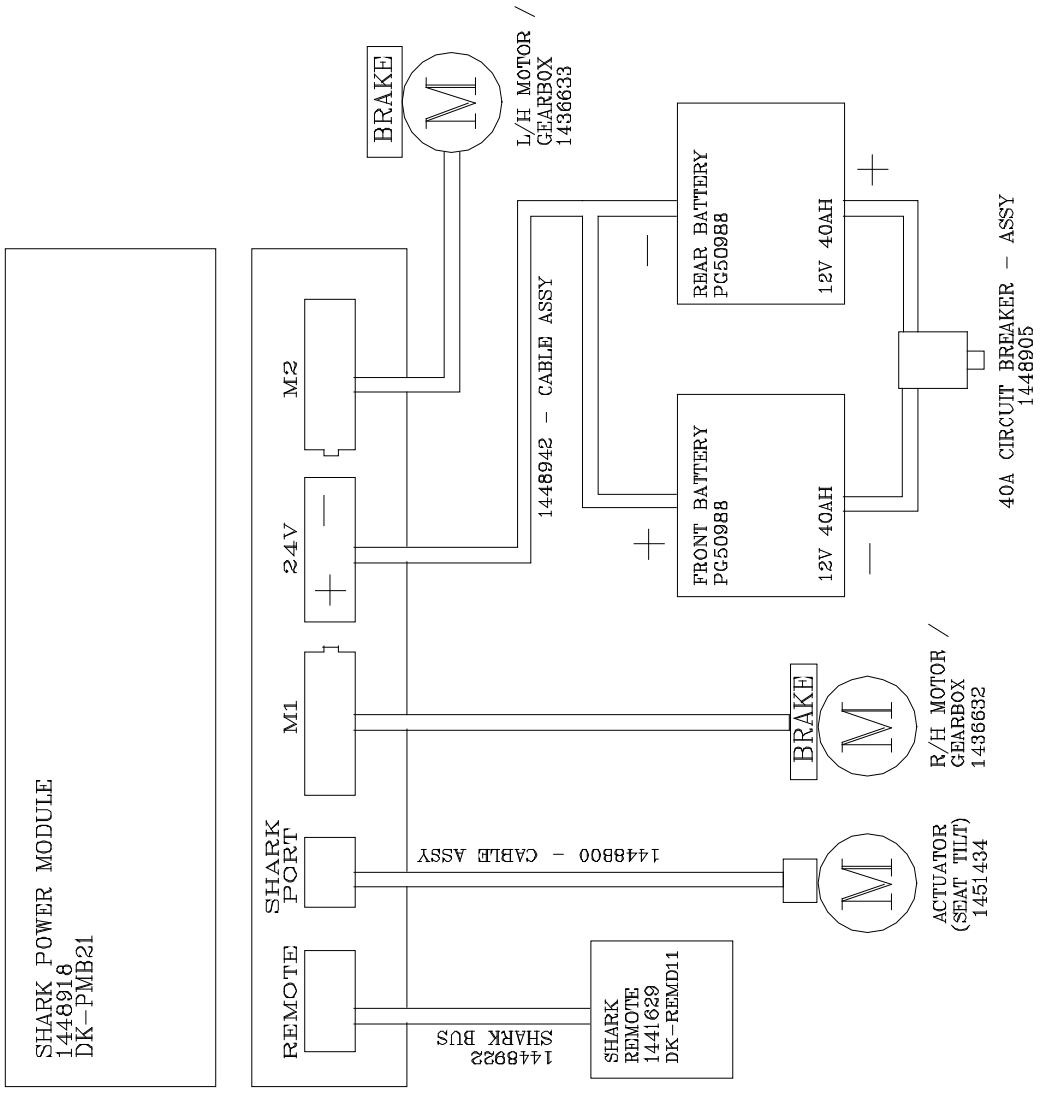
All connectors are polarized and can only be fitted in one possible position.



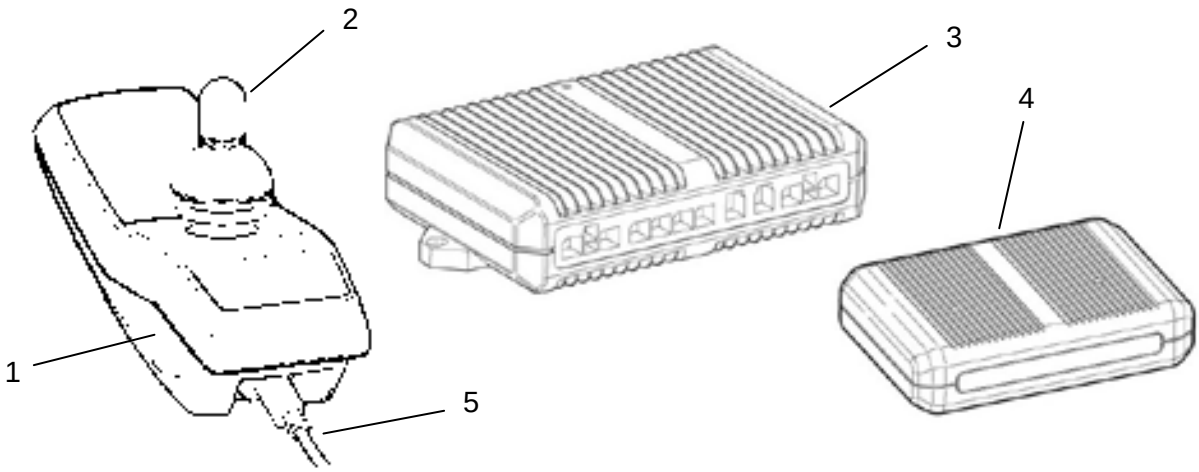
22.1.5 Schematic Diagram - Shark Drive Only Control System



22.1.6 Schematic Diagram - Shark Drive & Actuator Control System



22.2 ACS Control System



Description:

1 ACS Remote
2 Joystick Knob
3 ACS Power Module
4 Actuator Module
5 Bus Cable

Requirements:

- 7 mm open ended spanner
- 8 mm open ended spanner
- No 2 cross point screwdriver
- Flat blade screwdriver

22.2.1 Inspection

- Check for any physical damage to the outer case of remote (1).
- Access the power module (3) and actuator module (4) as described in the batteries section of this user guide and inspect for physical damage.
- Inspect the rubber gaiter around the joystick knob (2) for any cracks, splits or perishing. This would enable water or moisture to access the unit. This may cause damage to the controller.
- Check the keypad is in good condition with no small tears or cracks.
- Check the bus cable (5) and connectors from the joystick remote (1) are free from damage.

22.2.2 Disassembly

Caution:

- *Before any work is carried out on the control system, ensure the power module (3) is unplugged from the batteries, and the batteries are disconnected.*

22.2.2.1 Remote

- Unplug the ACS remote (1) from the power module (3) removing bus cable (5).
- Depending on the type of control arm bracket fitted to the wheelchair, remove the screws using either the screw driver or 8 mm open ended spanner. Remove remote

- Remove the joystick knob (2) by firmly pulling upwards (if required). To access the gaiter.

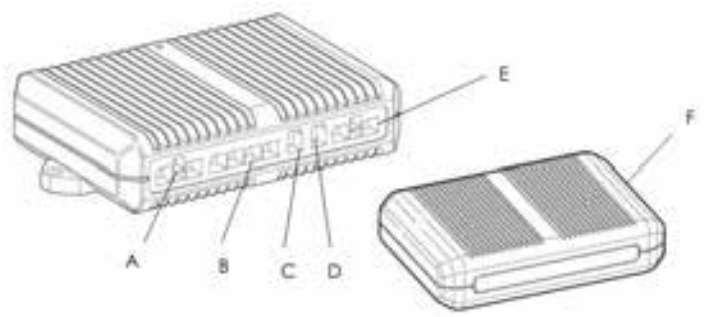
22.2.2.2 Power Module and Clam

- Gain access to the power module as described in the Battery section of this manual
- Unplug the remaining connectors from the power Module.
- Unplug the actuator module (4) connectors.
- Grasp the power module (3) & fixing plate and firmly pull upwards to dislodge the hook and loop faster strip. Remove this assembly, noting its position.
- Remove the two screws using a screw driver and a 7 mm open ended spanner in one position. The power module is now free and can be removed from the fixing plate.
- Locate the actuator module fixing plate nuts, and using the 8 mm spanner undo the two nuts and remove the actuator module and plate.
- Turn the plate over. The actuator module can be removed from the plate by using a cross point screwdriver.

22.2.3 Assembly

- To re-assemble reverse the above steps, ensuring that all fixing holes are aligned. Take care not to over tighten the fixing screws.

NOTE:
When fitting the joystick remote screws (2) be sure not to use a torque in excess of 2 Nm.

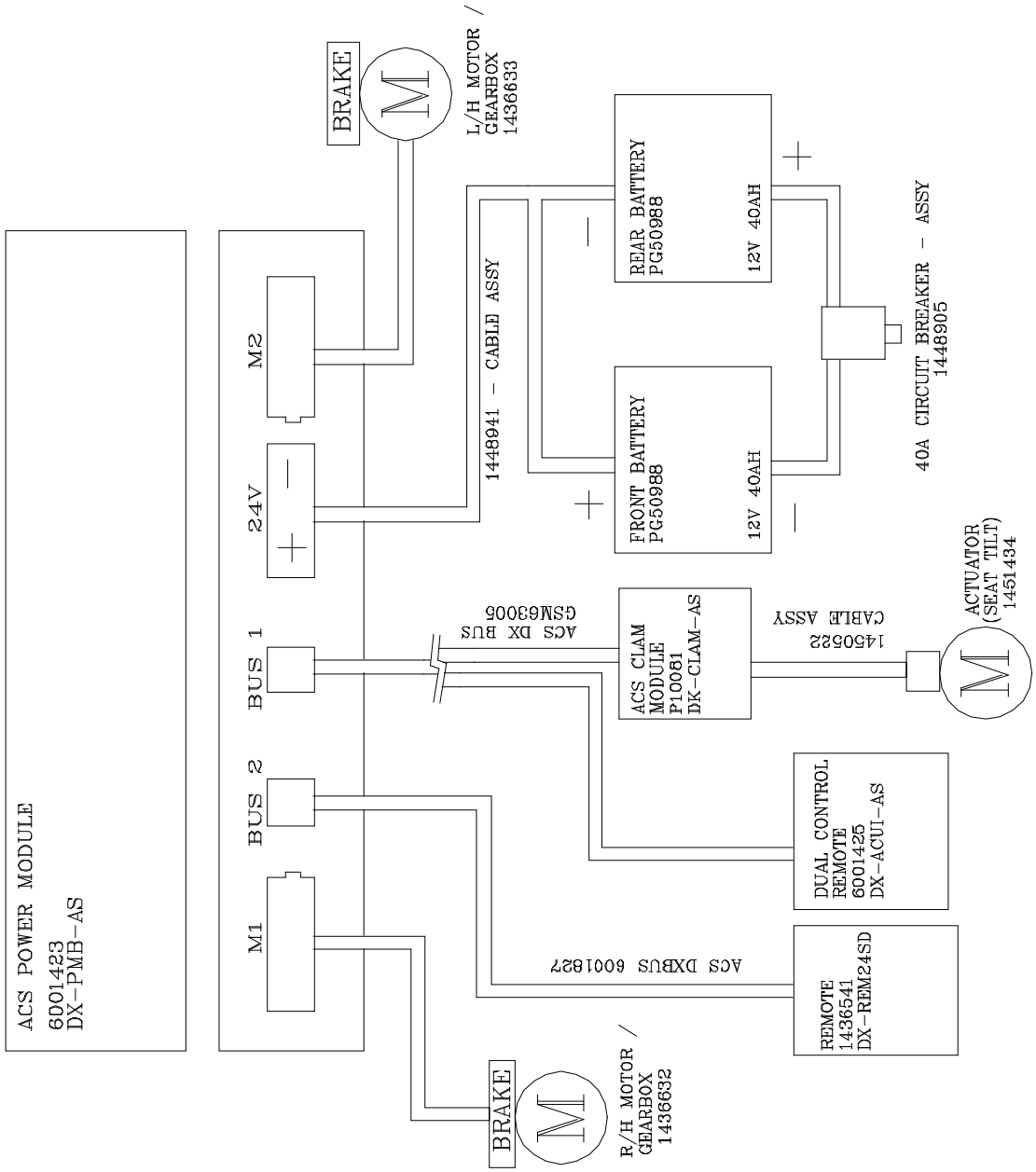


Position:

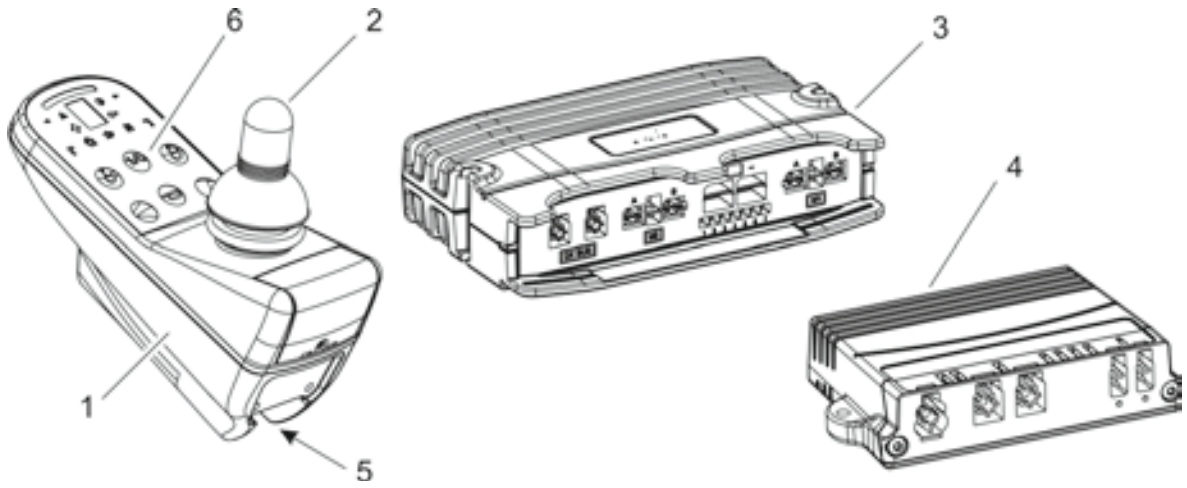
A M2 Motor Cable (LH Motor)	D Bus Cable Port
B Battery Cable	E M1 Motor Cable (RH Motor)
C Bus Cable Port	F Actuator / Lighting and Bus Cable Port

All connectors are polarized and can only be fitted in one possible position

22.2.4 Schematic Diagram - DX ACS Control System (Including dual and attendant options)



22.3 ACS2 Control System



Description:

1 ACS Remote	2 Joystick Knob
3 ACS Power Module	4 Actuator Module
5 Bus Socket	6 Keypad

Requirements:

- 7 mm open ended spanner
- 8 mm open ended spanner
- No 2 cross point screwdriver
- Flat blade screwdriver

22.3.1 Inspection

- Check for any physical damage to the outer case of Remote (1).
- Access the power module (3) and actuator module (4) as described in the batteries section of this user guide and inspect for physical damage.
- Inspect the rubber gaiter around the joystick knob (2) for any cracks, splits or perishing. This would enable water or moisture to access the unit. This may cause damage to the controller.
- Check the keypad is in good condition with no small tears or cracks.
- Check the bus cable (5) and connectors from the joystick remote (1) are free from damage.

22.3.2 Disassembly

Caution:
· *Before any work is carried out on the control system, ensure the power module (3) is unplugged from the batteries, and the batteries are disconnected.*

22.3.2.1 Remote

- Unplug the ACS remote (1) from the power module (3) removing bus cable (5).
- Depending on the type of control arm bracket fitted to the wheelchair, remove the screws using either the screw driver or 8 mm open ended spanner. Remove remote
- Remove the joystick knob (2) by firmly pulling upwards (if required). To access the gaiter.

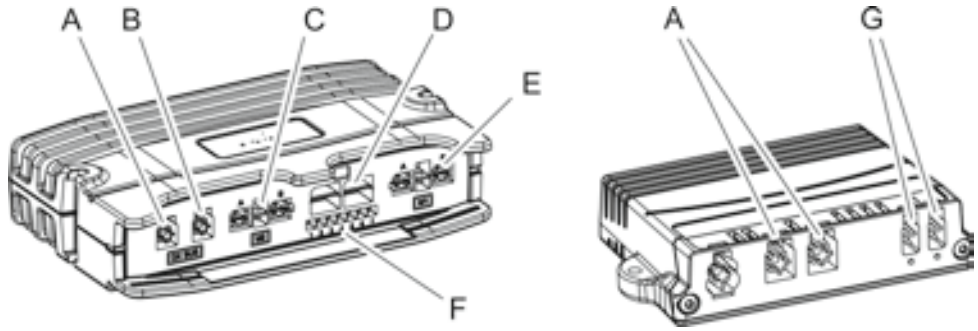
22.3.2.2 Power Module and Actuator Module

- Gain access to the power module as described in the Battery section of this manual
- Unplug the remaining connectors from the power module.
- Unplug the actuator module (4) connectors.
- Grasp the power module (3) & fixing plate and firmly pull upwards to dislodge the hook and loop faster strip. Remove this assembly, noting its position.
- Remove the two screws using a screw driver and a 8 mm open ended spanner in one position. The power module is now free and can be removed from the fixing plate.
- Locate the actuator module fixing plate nuts, and using the 7 mm spanner undo the two nuts and remove the actuator module and plate.

22.3.3 Assembly

- To re-assemble reverse the above steps, ensuring that all fixing holes are aligned. Take care not to over tighten the fixing screws.

NOTE:
When fitting the joystick remote screws (2) be sure not to use a torque in excess of 2 Nm.

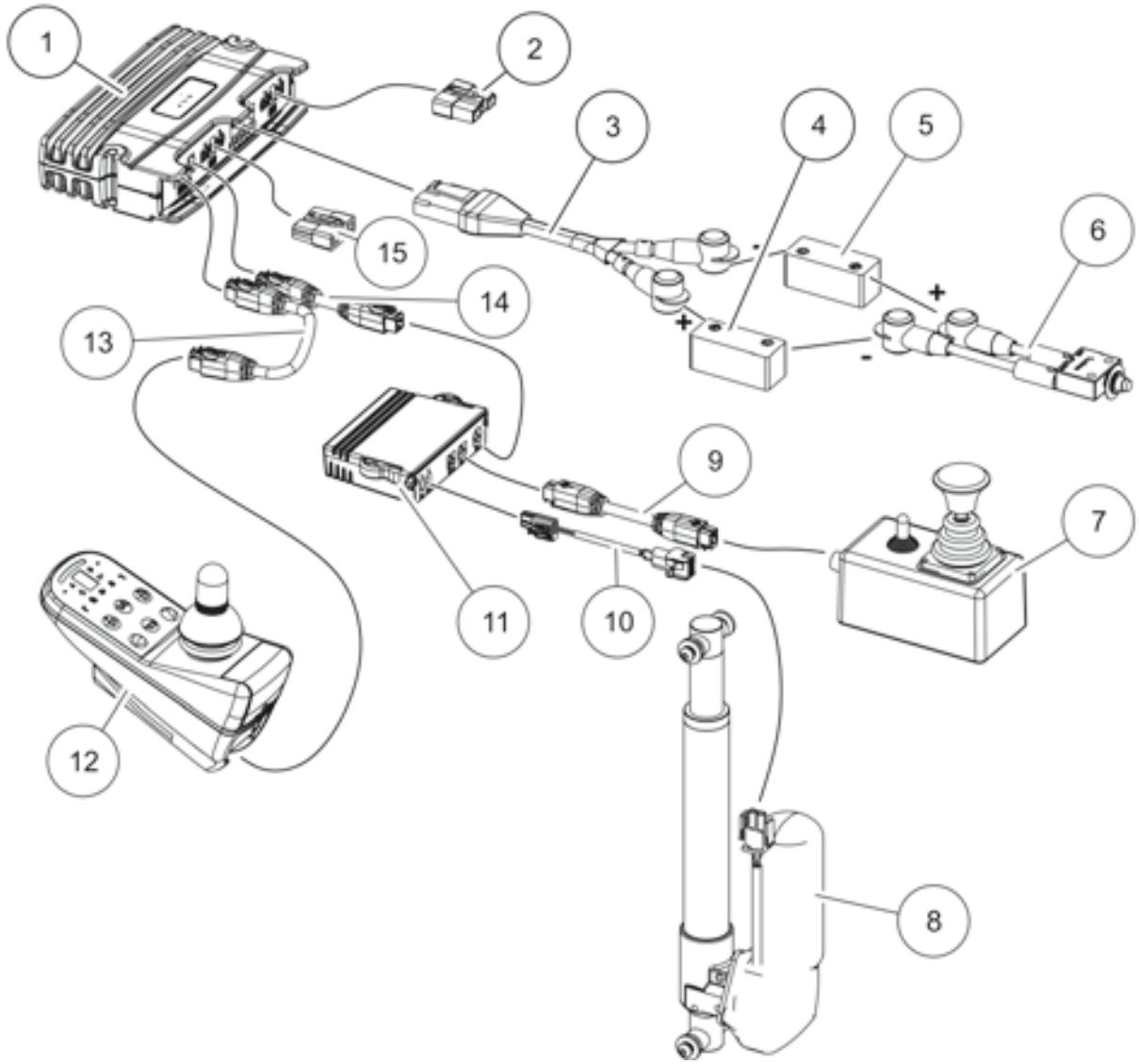


Position:

A Bus Cable Port
B Bus Cable Port
C M2 Motor Cable (RH Motor)
D Battery Cable
E M1 Motor Cable (LH Motor)
F Lighting Cable
G Actuator Ports

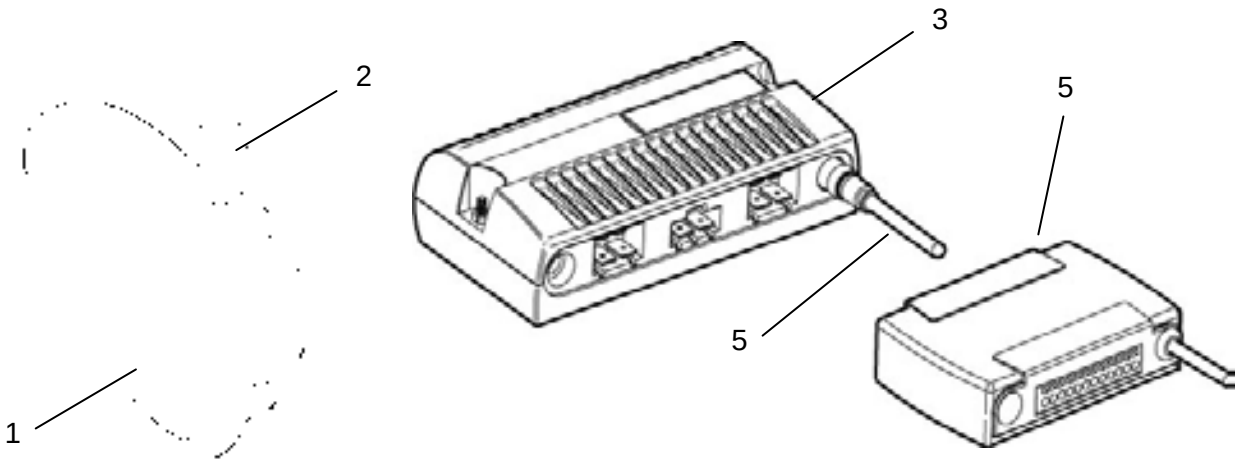
All connectors are polarized and can only be fitted in one possible position

22.3.4 Overview of the Electronic Modules



1	Power module PMA 70	6	Battery cable with circuit breaker	11	ACT module
2	To the M1 motor (LH)	7	Attendant control	12	Remote
3	Battery cable	8	Actuator	13	Bus cable
4	Battery	9	Bus cable	14	Bus cable
5	Battery	10	Actuator cable	15	To the M2 motor (RH)

22.4 Pilot Plus Control System



Description:

1 Pilot + Remote
2 Joystick Knob
3 Pilot + Power Module
4 ALM Module
5 Bus Cable

Requirements:

- 7 mm open ended spanner
- 8 mm open ended spanner
- No 2 cross point screwdriver
- Flat blade screwdriver
- Terminal screwdriver

22.4.1 Inspection

- Check for any physical damage to the outer case of remote (1).
- Access the power module (3) and ALM module (4) as described in the batteries section of this user guide and inspect for physical damage.
- Inspect the rubber gaiter around the joystick knob (2) for any cracks, splits or perishing. This would enable water or moisture to access the unit. This may cause damage to the controller.
- Check the keypad is in good condition with no small tears or cracks.
- Check the bus cable (5) and connectors from the joystick remote (1) are free from damage.

22.4.2 Disassembly

Caution:

- *Before any work is carried out on the control system, ensure the power module (3) is unplugged from the batteries, and the batteries are disconnected.*

22.4.2.1 Remote

- Unplug the Pilot Plus remote (1) from the power module (3) removing bus cable (5).

- Depending on the type of control arm bracket fitted to the wheelchair, remove the screws using the cross point screwdriver. Remove remote
- Remove the joystick knob (2) by firmly pulling upwards (if required). To access the gaiter.

22.4.2.2 Power Module and ALM

- Gain access to the power module as described in the Battery section of this manual
- Unplug the remaining connectors from the power Module.
- Unplug the ALM module (4) connectors. Use the terminal screwdriver to release the wires where required.
- Grasp the power module (3) & fixing plate and firmly pull upwards to dislodge the hook and loop faster strip. Remove this assembly, noting its position.
- Remove the two screws using a screw driver and a 7 mm open ended spanner in one position. The power module is now free and can be removed from the fixing plate.
- Locate the ALM Fixing plate nuts, and using the 8 mm spanner undo the two nuts and remove the ALM and plate.
- The ALM is removed from the plate by using a screwdriver and 8 mm open ended spanner

22.4.3 Assembly

- To re-assemble reverse the above steps, ensuring that all fixing holes are aligned. Take care not to over tighten the fixing screws.

NOTE:
When fitting the joystick remote screws (2) be sure not to use a torque in excess of 2 Nm.

22.4.4 Pilot Plus Power Module Connector Orientation

Position:

A Bus Cable Port

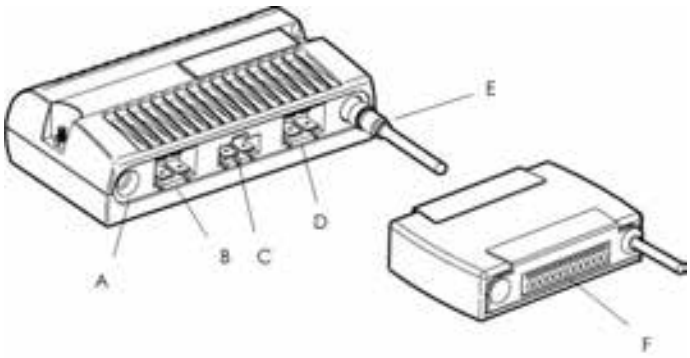
B M1 Motor Cable (RH Motor)

C Battery Cable

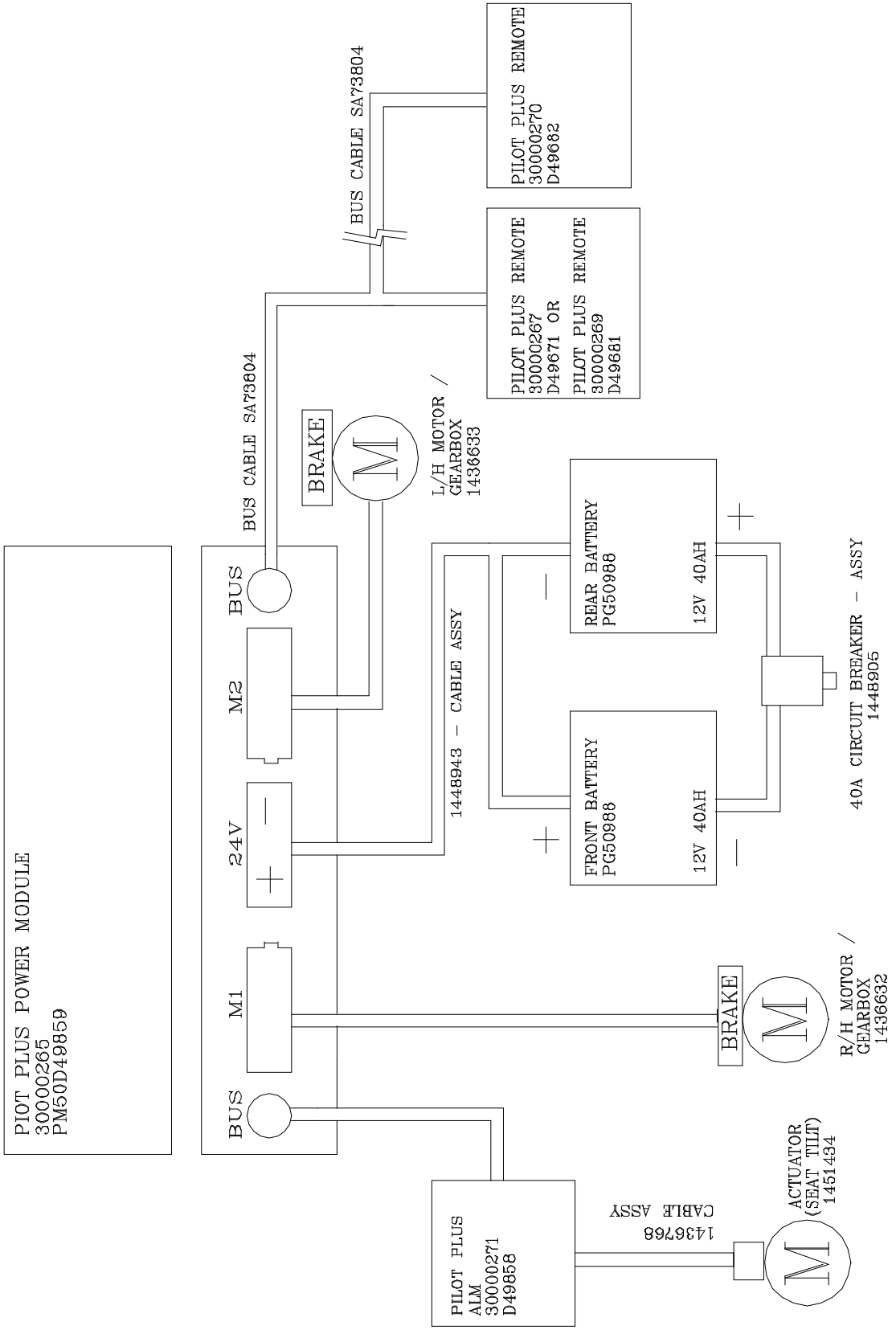
D M2 Motor Cable (LH Motor)

E Bus Cable Port.

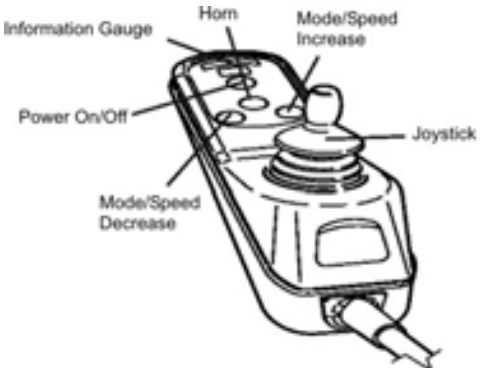
F Actuator / Lighting Ports



22.4.5 Schematic Diagram - Pilot Plus Control System (Including dual and attendant options)



22.5 VSI Control System



Requirements:
- 8 mm open ended spanner
- No 2 cross point screwdriver
- Flat blade screwdriver

22.5.1 Inspection

- Check for any physical damage to the outer case of Joystick remote (1).
- Inspect the rubber gaiter around the joystick knob (2) for any cracks, splits or perishing. This would enable water or moisture to access the unit. This may cause damage to the controller.
- Check the keypad is in good condition with no small tears or cracks.
- Check the wire harness (3) from the joystick remote (1) is free from damage.

22.5.2 Disassembly

Caution:
- *Before any work is carried out on the control system, ensure the power module (3) is unplugged from the batteries, and the batteries are disconnected.*

22.5.2.1 Remote

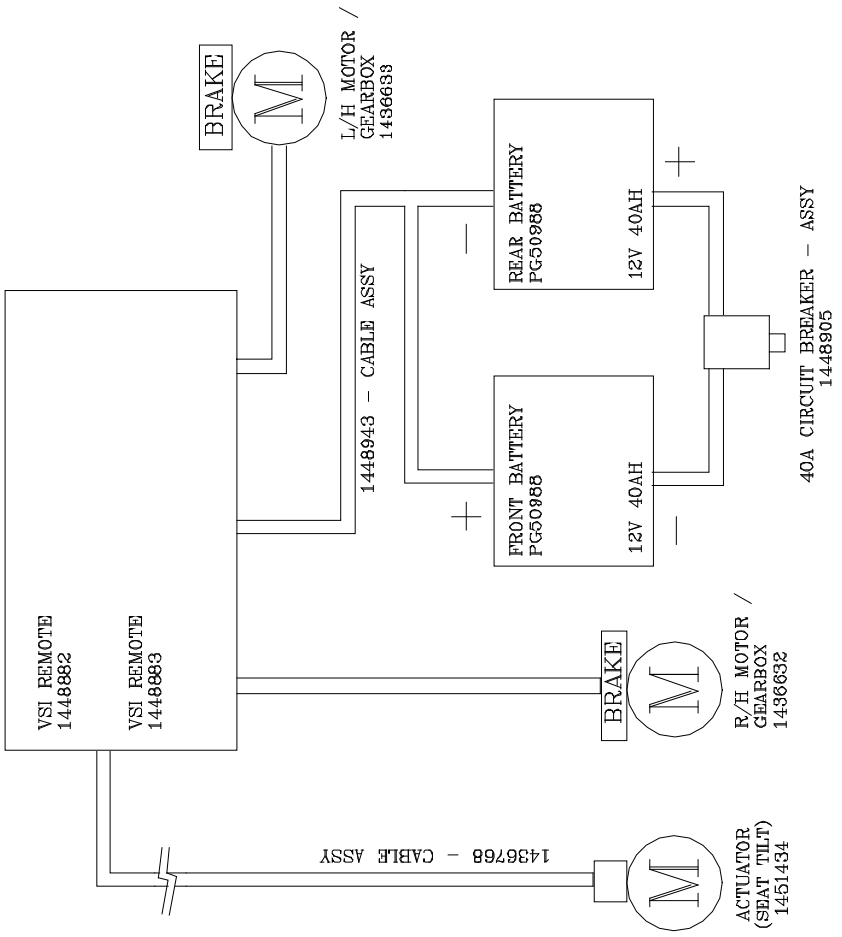
- Gain access to the power module as described in the battery section of this manual.
- Unplug the VSI unit (1) from the wheel chair wire harness.
- Depending on the type of control arm bracket fitted to the wheelchair, remove the screws using the cross point screwdriver or 8 mm spanner. Remove remote.
- Remove the joystick knob (2) by firmly pulling upwards (if required). To access the gaiter.

22.5.3 Assembly

- To re-assemble reverse the above steps, ensuring that all fixing holes are aligned. Take care not to over tighten the fixing screws.

NOTE:
When fitting the joystick remote screws (2) be sure not to use a torque in excess of 2 Nm.

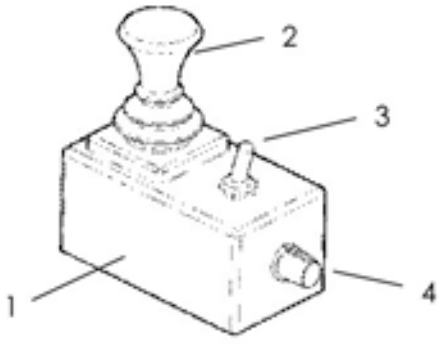
22.5.4 Schematic Diagram - VSI Drive only and Actuator Control System



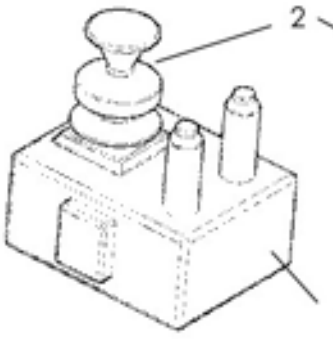
22.6 Attendant / Dual Control Units

The control systems used on the Spectra Blitz may be configured and supplied with an attendant / dual control option. Occasionally, the master remote is mounted at the rear and used as an attendant only configuration.

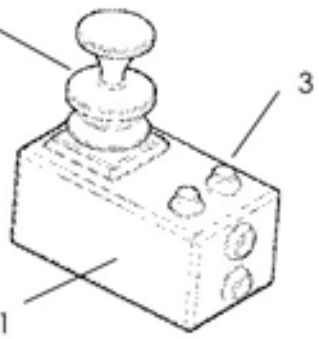
In all other instances for dual or dual attendant control, the following units are fitted.



ACS Dual Control Unit



Pilot + Attendant Control Unit



Pilot + Dual Control Unit

Description:

1 Remote unit 2 Joystick Knob

3 User / Attendant Switch 4 External Speed Pot

Requirements:
- 10 mm open ended spanner
- 8 mm open ended spanner
- No 2 cross point screwdriver
- Flat blade screwdriver

22.6.1 Inspection

- Check for any physical damage to the outer case of remote (1).
- Check the Mounting bracket is well adjusted and functional.
- Inspect the rubber gaiter around the joystick knob (2) for any cracks, splits or perishing. This would enable water or moisture to access the unit. This may cause damage to the controller.
- Check the keypad is in good condition with no small tears or cracks.
- Check the bus cable and connectors from the joystick remote (1) are free from damage.

22.6.2 Disassembly

Caution:
- *Before any work is carried out on the control system, ensure the power module (3) is unplugged from the batteries, and the batteries are disconnected.*

22.6.2.1 Remote

- Unplug the remote (1) from the system by removing the bus cable.
- Depending on the type of control arm bracket fitted to the wheelchair, remove the screws using the screw driver or 10 mm / 8 mm open ended spanner. Some units are fitted with a hand wheel for quick removal.
- Remove the joystick knob (2) by firmly pulling upwards (if required). To access the gaiter.
- The main brackets (with Push Handles) can be removed from the wheelchair by undoing the hand wheels (1) or using a 10 mm open ended spanner if fitted.
- Brackets may be removed from the hand grips by using a 10 mm or 13 mm open ended spanner.

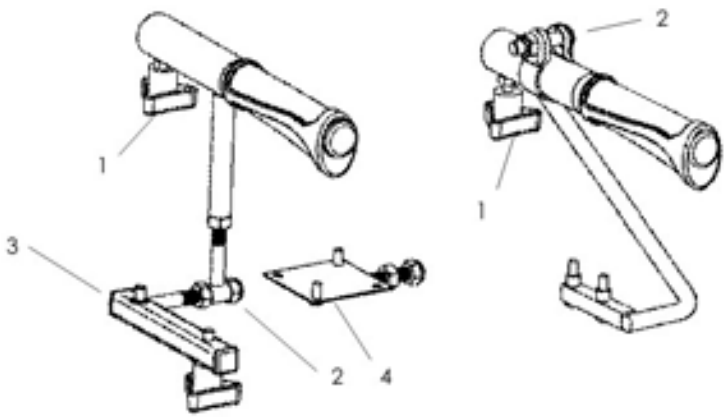
Description:

1 Removal Hand wheel

2 Bracket Nut

3 ACS Fitting

4 Pilot Plus Fitting



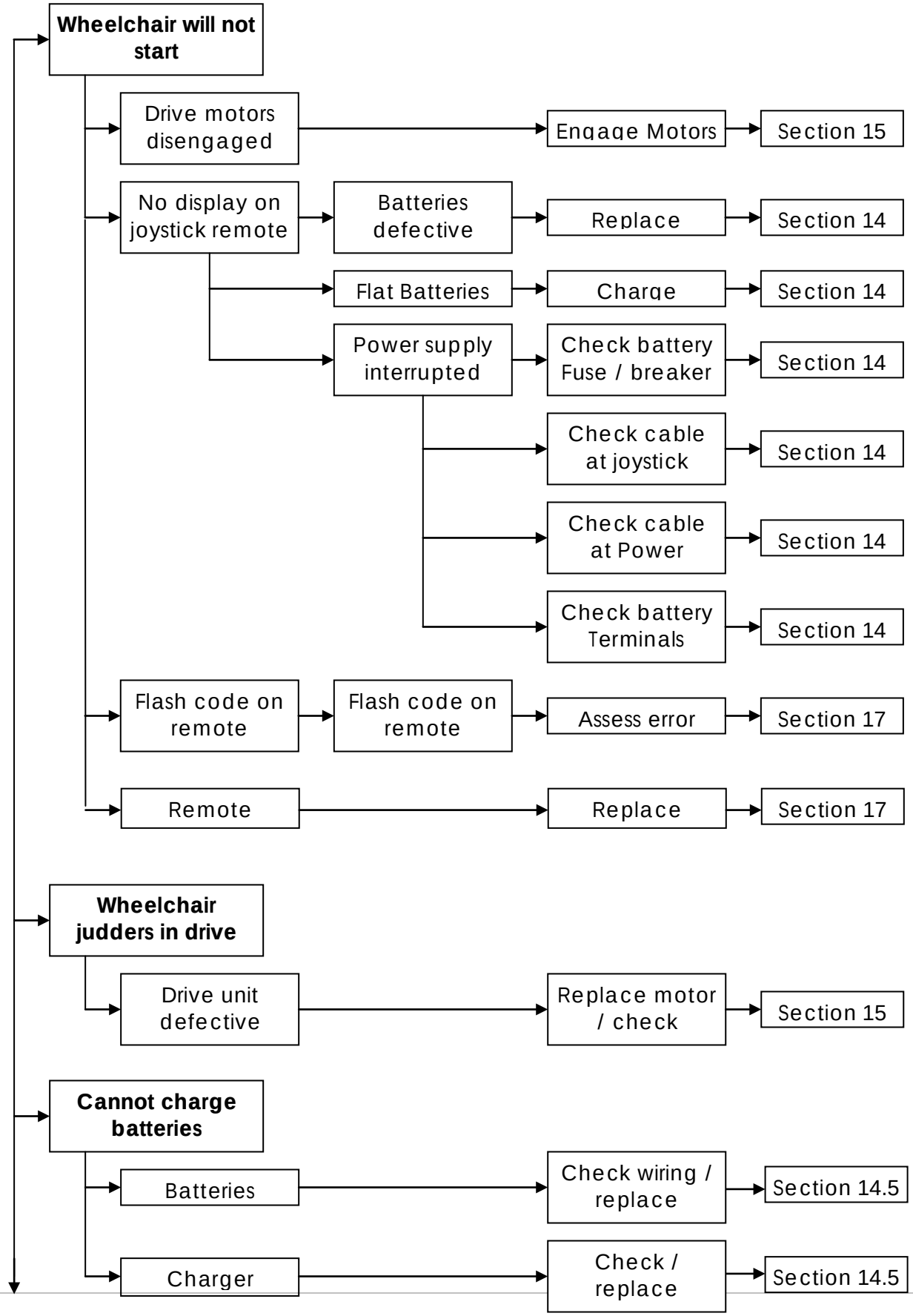
22.6.3 Assembly

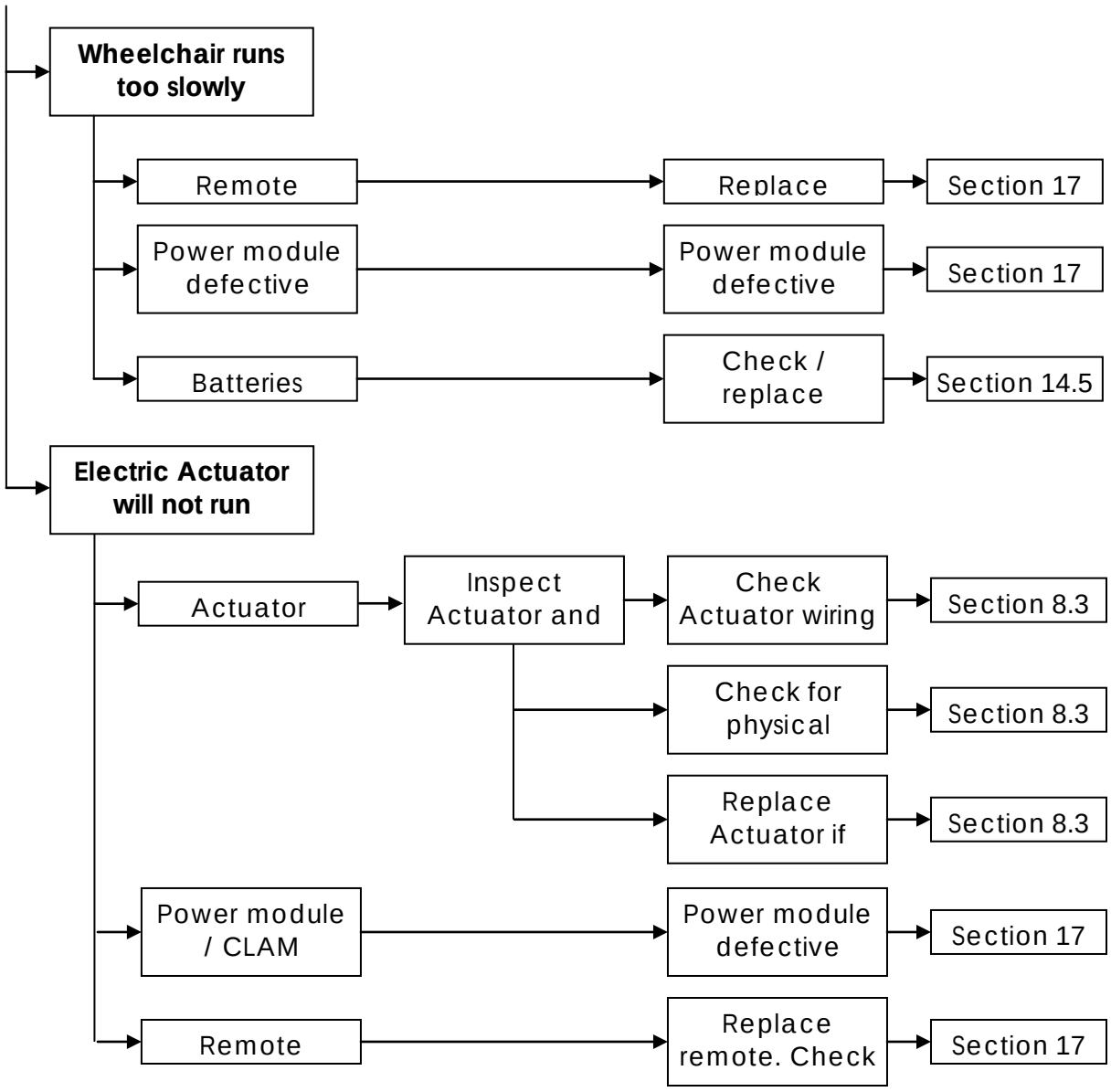
- To re-assemble reverse the above steps, ensuring that all fixing holes are aligned. Take care not to over tighten the fixing screws.

NOTE:
When fitting the joystick remote screws (2) be sure not to use a torque in excess of 2 Nm.

23 Fault Diagnostics

23.1 General and Electrical Related Drive Faults





23.2 General Trouble Shooting

Symptom		Check / Action
ON/OFF button pressed to ON, Joystick lights do not light up wheelchair does not move.		· Are the battery cables connected? · Is the joystick cable connected? · Are the batteries disconnected? · Are the batteries completely flat? · Is the fuse / circuit breaker open?
ON/OFF lights up, wheelchair does not move or behaves erratically.		· Are one or both motors disengaged (freewheel mode)? · Is the remote in Lock Mode? (See user guide).
Battery Charge indicator shows low battery. Wheelchair moves slowly and does not respond well to joystick movement.		· Are the batteries discharged to the critical level?

Batteries will not accept charge.		· Possible charger fault? · Batteries are no longer serviceable?

23.3 Shark Remote Battery Gauge Diagnostics

Display Description	This Means That …..	Notes
All LED's off	Power is off	
All LED's on steady	Power is ON	Less LED's imply a reduced battery charge/
Left red LED flashing	Battery charge is low	Charge batteries as soon as possible.
Right to Left LED chase	Shark is being brought out of lock mode	To unlock shark, press the horn button twice within 10 seconds.
Left to right LED chase alternating with steady display	Shark is in programming, inhibit or charge mode	The steady LED's indicate the current state of battery charge.
All LED's flashing slowly	Out of neutral at power up condition detected	Release the joystick back to neutral
All LED's / SERVICE indicator LED flashing quickly	FAULT mode	See table below.

23.4 Shark Diagnostics Display

The Flash code from the Shark information gauge is shown below. The number of flashes are indicated with all LED's on for the relevant number of flashes followed by a pause, then Flash again.

Flash Code	Description	Notes
1	User Fault	Possible stall timeout or user error Release the joystick and try again
2	Battery fault	Check the batteries and cabling Try charging the batteries Batteries may require replacing
3	Left Motor Fault (M2)	Check the left motor connections and cabling.
4	Right Motor Fault (M1)	Check the right motor connections and cabling.
5	Left Park Brake Fault	Check the left park brake connections and cabling.
6	Right Park Brake Fault	Check the right park brake connections and cabling
7	Shark Control Unit Fault	Check the Shark communications bus wiring. Replace the control unit
8	Shark Power Module Fault	Check Shark connections and wiring Replace the power module
9	Shark Communications Fault	Check Shark connections and wiring Replace the Shark control unit
10	Unknown Fault	Check all connections and wiring Consult a service agent
11	Incompatible Control Unit	Wrong type of control unit connected. Ensure the branded power module matches that of the control unit.

For further details and in depth information refer to the Shark Installation Guide **GBK80258.**

23.5 Hand Held Programmer (HPP) Diagnostics

Fault Code	Description	Sub Code	Notes
1	User Fault	00	Possible stall timeout or user error Release the joystick and try again
2	Battery fault	00	Batteries are too low to drive with or voltage is too high or low
3	Left Motor Fault (M2) ***Note :*** *00 & 01 change motor* *02 – 08 change power module*	00	Left motor short circuit
		01	Left motor open circuit
		02	Left motor connection fault (short to B-)
		03	Motor terminal connected to B+
		04	Left motor voltage consistency fault (probably fault with power module electronics).
		05	Left motor bridge fault (probably fault with power module electronics).
		06	Too many hardware current limit events
		07	Current measurement offset out of range.
		08	Hardware current limit fault
4	Right Motor Fault (M1) ***Note :*** *00 & 01 change motor* *02 – 08 change power module*	00	Right motor short circuit
		01	Right motor open circuit
		02	Right motor connection fault (short to B-)
		03	Motor terminal connected to B+
		04	Right motor voltage consistency fault (probably fault with power module electronics).
		05	Right motor bridge fault (probably fault with power module electronics).
		06	Too many hardware current limit events
		07	Current measurement offset out of range.
		08	Hardware current limit fault
5	Left Park Brake Fault	00	Left park brake-drive time test failed
		01	Left park brake output enabled when chair idle
		02	Left park brake output did not enable when entering drive
		03	Left park brake fault during power up test
		04	Left park brake feedback low during drive (park brake short circuit)
6	Right Park Brake Fault	00	Right park brake-drive time test failed
		01	Right park brake output enabled when chair idle
		02	Right park brake output did not enable when entering drive
		03	Right park brake fault during power up test
		04	Right park brake feedback low during drive (park brake short circuit)
7	Shark Control Unit Fault	00	Local remote fault (electronics, power button fault etc).
		01	Joystick fault at remote
		02	Speed pot fault at remote.
8	Power Module Fault	00	Power Module Fault
		01	RAM fault
		02	ROM fault
		03	CPU fault
		04	EEPROM fault
		05	Watchdog fault
		06	Stack fault

		07	Software fault
		08	Power up testing fault
		09	Relay fault or Pre-charge fault
		0A	Bridge fault or Disable all fault
		0B	Electronics fault
		0C	Calibration settings fault
9	Shark Communications Fault	00	Loss of communications between remote and power module
		01	Limp mode due to unreliable communications
10	Unknown Fault	00	Catch all fault output
11	Incompatible Control Unit	00	Wrong type of control unit connected.

23.6 ACS Error / Diagnostic Codes

The ACS drive electronics are capable of rectifying some errors automatically. In this case, the status display will stop flashing. Switch the remote on and off several times, pausing for about 5 seconds in the off condition. The following table details the flash codes for ACS system errors.

Flash Code	Description	Notes
1	Power Module Fault	Possible Programming Error. Check Program. Faulty power module or Bus Cable. Check and replace. User Error. Joystick out of Neutral at startup.
2	Accessory Fault	Faulty Accessory Module Faulty Actuator Circuit.
3	M1 Motor Fault	Check the Right motor, connections and cabling.
4	M2 Motor Fault	Check the Left motor, connections and cabling.
5	M1 Park Brake Fault	Check the Right park brake, connections and cabling.
6	M2 Park Brake Fault	Check the Left park brake, connections and cabling
7	Low Battery Fault	Battery Voltage is below 17V – recharge / replace batteries. Connections in Battery circuits may be loose. Inspect and replace.
8	Over Voltage Fault	Battery charge has exceeded 32V due to over-charging. Replace battery charger. Connections in Battery circuits may be loose. Inspect and replace.
9	(CANL) Communications Fault	Faulty Bus cable – check and replace Faulty DX system component. Consult a service agent
10	(CANH) Communications Fault	Faulty Bus cable – check and replace Faulty DX system component. Consult a service agent
11	Stall timeout Fault	Wheelchair has continued to be driven whilst in a stall condition. Powering the DX System off and on should remove this condition
12	Module MisMatch Fault	There is a compatibility problem between DX Modules in the system, or the programming in the master remote

		has been corrupted. Try re-programming the system or replace the master remote.

23.7 Pilot Plus Remote Battery Gauge Diagnostics

Display Description	This Means That …..	Notes
All LED's off	Power is off	
All LED's on steady	Power is ON	Less LED's imply a reduced battery charge/
Battery Gauge LED's flash slowly	Battery charge is low	Charge batteries as soon as possible.
Battery Gauge LED's step upwards	Charging or programming mode	The steady LED's indicate the current level of battery charge.
Battery Gauge flashes once every 2.5 seconds	The control system has entered sleep mode after a period of inactivity	Turn control off then back on again to clear.
Battery Gauge LED's flash rapidly	Fault Mode or abnormal condition has been encountered	See the following tables.

23.8 Pilot Plus Diagnostics Display

The Flash code from the Pilot Plus battery gauge are shown below. The number of flashes is indicated by the number of LED's illuminated.

Flash Code	Description	Notes
1	Low Battery Voltage Fault	Check the connections to the battery. If the connections are good. Charge the batteries.
2	Left Motor (M2) Bad connection Fault	Check the connections to the left hand motor and the power module.
3	Left Motor (M2) Short Circuit Fault	Left Hand Motor has a Short Circuit Fault. Check the connections to the left hand motor and the power module. Check wire harness Insulation. Check Battery Connection and wiring
4	Right Motor (M1) Bad connection Fault	Check the connections to the right hand motor and the power module.
5	Right Motor (M1) Short Circuit Fault.	Right Hand Motor has a Short Circuit Fault. Check the connections to the Right hand motor and the power module. Check wire harness Insulation. Check Battery Connection and wiring
6	External Inhibit Fault	Check the battery charger is disconnected. Check external control modules are wired and programmed correctly.
7	Joystick Module Trip	Check that the joystick is in the center position before switching on the control system.

		Replace the Joystick unit
8	Power Module Trip	Check all connections are secure and wiring is correct. Replace the power module
9	Parking Brake Fault	Check the parking brake and motor connections. Make sure the control system connections are secure.
10	Over Voltage Fault	Check all connections and wiring to the batteries. Replace Charger and Batteries.

For further details and in depth information refer to the Pilot Plus Technical Guide **SK74328/4.**

23.9 Pilot Plus Hand Held Programmer Diagnostic Codes

The following table should be used in conjunction with the Penny and Giles Hand Held Program unit.

You should also refer to Penny and Giles Publication **SK73747/9** for further information.

Fault Code	Trip Type	Notes
0A00	Blink	Sleep Mode. Turn controller on and off again to clear
1504	9	General Solenoid brake Fault.
1505	9	Left Solenoid Break Trip
1506	9	Right Solenoid Break Trip
1600	10	High Battery Voltage Fault.
1E03	6	Off board charger is connected, causing a drive inhibit fault
1E04	6	Inhibit Fault. System is in Inhibit mode. Probably due to an onboard charger or system switch (seat riser / tilt etc).
1F01	2	Left Motor Feedback fault. Only used on brushless motor module.
1F02	2	Left Motor Feedback fault. Only used on brushless motor module.
2001	4	Right Motor Feedback fault. Only used on brushless motor module.
2002	4	Right Motor Feedback fault. Only used on brushless motor module.
2C00	1	Low Battery Voltage. Voltage is below 16V
3B00	2	Left Hand Motor Disconnected.
3C00	4	Right Hand Motor Disconnected.
3D00	3	Left Hand Motor wiring fault. Possibly short circuit related.
3D01	3	Left Hand Motor wiring fault. Possibly short circuit related
3E00	5	Right Hand Motor wiring fault. Possibly short circuit related.
3E01	5	Right Hand Motor wiring fault. Possibly short circuit related
5400	8	Communications Error. Possibly Bus cable fault
7100	7	Communications Error. Possibly Bus cable fault
7101	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
7102	7	Power Loss Fault. Check for faulty bus cable or joystick
710A	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
710B	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
710C	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
710D	User	Joystick Displaced at power up. Allow joystick to re-center then switch off and on again to clear.
710E	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
710F	7	Joystick Trip / Fault. Check for faulty bus cable or joystick

7110	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
7111	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
7113	7	Communications Error. Possibly Bus cable fault
7114	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
7115	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
7117	7	Joystick Trip / Fault. Check for faulty bus cable or joystick
7124	7	Communications Error. Possibly Bus cable fault
7125	7	Omni + trip error. The Omni + unit is faulty. Replace.
7126	7	Communications Error. Possibly Bus cable fault
7127	7	Omni + trip error. The Omni + unit is faulty. Replace.
7128	7	Omni + trip error. The Omni + unit is faulty. Replace.
7129	7	Omni + trip error. The Omni + unit is faulty. Replace.
712A	Sip / Puff	Omni + Out of Calibration. The Sip / Puff input of the unit needs to be calibrated.
712B	7	Omni + is not receiving a valid signal for user input device.
712C	7	Omni + is not receiving a valid signal for user input device.
712D	7	Omni + is not receiving a valid signal for user input device.
712E	7	Omni + is not receiving a valid signal for user input device.
712F	7	Omni + is not receiving a valid signal for user input device.
7130	7	Omni + trip error. The Omni + unit is faulty. Replace.
7131	7	Omni + trip error. The Omni + unit is faulty. Replace.
7132	7	Omni + trip error. The Omni + unit is faulty. Replace.
7133	7	Communications Error. Possibly Bus cable fault
7134	7	Omni + is not receiving a valid signal for user input device.
7135	7	Omni + is not receiving a valid signal for user input device.
7136	7	Omni + Out of Calibration. The Analogue input of the unit needs to be calibrated.
7137	7	Omni + trip error. The Omni + unit is faulty. Replace.
7140	7	Dual Communications Trip. There is an error between the joystick and dual control unit. Check cables.
7142	7	Dual Communications Trip. There is an error between the joystick and dual control unit. Check cables.
7146	User	Joystick Displaced at power up. Allow joystick to re-center then switch off and on again to clear.
714A	7	Dual Attendant Module Trip. The unit is defective.
714B	7	Dual Attendant Module Trip. The unit is defective.
714C	7	Dual Attendant Module Trip. The unit is defective.
714D	User	Dual Joystick Displaced at power up. Allow joystick to re-center then switch off and on again to clear.
714E	7	Dual Attendant Module Trip. The unit is defective.
714F	7	Dual Attendant Module Trip. The unit is defective.
7150	7	Dual Attendant Module Trip. The unit is defective.
7151	7	Dual Attendant Module Trip. The unit is defective.
7152	7	Dual Attendant Module Trip. The unit is defective.
7155	7	Dual Attendant Module Trip. The unit is defective.
7157	7	Dual Attendant Module Trip. The unit is defective.
All other Codes	8	Possible power module Trip.

23.10 VSI Remote Battery Gauge Diagnostics

The Flash code from the VSI battery gauge is shown below. The number of flashes is indicated by the number of LED's illuminated

Display Description	This Means That …..	Notes
All LED's off	Power is off	
All LED's on steady	Power is ON	Less LED's imply a

		reduced battery charge/
Battery Gauge LED's flash slowly	Battery charge is low	Charge batteries as soon as possible.
Battery Gauge LED's step upwards	Charging or programming mode	The steady LED's indicate the current level of battery charge.
Battery Gauge flashes once every 2.5 seconds	The control system has entered sleep mode after a period of inactivity	Turn control off then back on again to clear.
Battery Gauge LED's flash rapidly	Fault Mode or abnormal condition has been encountered	See the following tables.

23.11 VSI Diagnostics Display

The Flash code from the VSI battery gauge is shown below. The number of flashes is indicated by the number of LED's illuminated.

Flash Code	Description	Notes
1	Low Battery Voltage Fault	Check the connections to the battery. If the connections are good. Charge the batteries.
2	Left Motor Bad connection Fault	Check the connections to the left hand motor and the power module.
3	Left Motor Short Circuit Fault	Left Hand Motor has a Short Circuit Fault. Check the connections to the left hand motor and the power module. Check wire harness Insulation. Check Battery Connection and wiring
4	Right Motor Bad connection Fault	Check the connections to the right hand motor and the power module.
5	Right Motor Short Circuit Fault.	Right Hand Motor has a Short Circuit Fault. Check the connections to the Right hand motor and the power module. Check wire harness Insulation. Check Battery Connection and wiring
6	External Inhibit Fault	Check the battery charger is disconnected. Check external control modules are wired and programmed correctly.
7	Joystick Fault	Check that the joystick is in the center position before switching on the control system. Replace the Joystick unit
8	Control System Fault	Check all connections are secure and wiring is correct. Replace the power control unit.
9	Parking Brake Fault	Check the parking brake and motor connections. Make sure the control system connections are secure.
10	Over Voltage Fault	Check all connections and wiring to the batteries. Replace Charger and Batteries.

For further details and in depth information refer to the VSI Technical Guide **SK76145/3.**

23.12 VSI Hand Held Programmer Diagnostic Codes

The following table should be used in conjunction with the Penny and Giles Hand Held Program unit.

You should also refer to Penny and Giles Publication **SK73747/9** for further information.

Fault Code	Trip Type	Notes
0A00	Blink	Sleep Mode. Turn controller on and off again to clear
1500	9	General Solenoid brake Fault.
1501	9	Short Circuit in Solenoid Brake Circuit
1502	9	Open Circuit in Solenoid Brake Circuit
1600	10	High Battery Voltage Fault.
1E03	Charging	Off board charger is connected, causing a drive inhibit fault
1E04	6	Inhibit 2 is Active. Check for program error or wiring / switch connection.
1E05	6	Inhibit 3 is Active. Check for program error or wiring / switch connection
2C00	1	Low Battery Voltage. Voltage is below 16V
2F00	User	Joystick Displaced at power up. Allow joystick to re-center then switch off and on again to clear.
3000	7	Dual Joystick Displaced at power up. Allow joystick to re-center then switch off and on again to clear.
3B00	2	Left Hand Motor Disconnected.
3C00	4	Right Hand Motor Disconnected.
3D00	3	Left Hand Motor wiring fault. Possibly short circuit related.
3D01	3	Left Hand Motor wiring fault. Possibly short circuit related
3E00	5	Right Hand Motor wiring fault. Possibly short circuit related.
3E01	5	Right Hand Motor wiring fault. Possibly short circuit related
7163	8	Dual Attendant Module Trip. The unit is defective.
7164	8	Dual Attendant Module Trip. The unit is defective.
716B	8	Dual Attendant Module Trip. The unit is defective.
716C	8	Dual Attendant Module Trip. The unit is defective.
716E	8	Dual Attendant Module Trip. The unit is defective.
716F	8	Dual Attendant Module Trip. The unit is defective.
7170	8	Dual Attendant Module Trip. The unit is defective.
7173	8	Dual Attendant Module Trip. The unit is defective.
7174	8	Dual Attendant Module Trip. The unit is defective.
7175	8	Dual Attendant Module Trip. The unit is defective.
7A00	8	Actuator Motor is disconnected. Check wiring.
7A02	8	Actuator Motor Wiring Trip. Possible short circuit.
7A03	8	Actuator Motor Wiring Trip. Possible short circuit.
All other Codes	7 or 8	Joystick or Power section Trip / Fault. Replace Joystick.

24 Servicing Requirements

INVACARE recommends that routine servicing be carried out at six monthly intervals. The routine service consists of the following:

24.1 Motors ü

	· Inspect plugs for physical damage.		O
	· Inspect insulation for cracks and splits.		O
	· Check and clean brake. Resistance = Approx. 50 - 80 Ohms.		O
	· Inspect and clean brushes and commutator.		O
	· Check action and operation of clutch mechanism.		O

24.2 Controller and Remote ü

	· Check for physical damage to outer casings.		O
	· Inspect joystick shroud and gaiter for cracks and splits.		O
	· Check all function of control system.		O
	· Check bus cables for signs of cracks, wear or physical damage.		O
	· Check diagnostics to assure no faults present on systems.		O

24.3 Frame and Chassis ü

	· Inspect all fixtures and fittings for tightness and integrity.		O
	· Check front and rear wheel/axle bolts are tight.		O
	· Adjust hand operated parking brakes if required.		O
	· Check for signs of damaged or chipped paint and corrosion.		O

24.4 Seating ü

	· Inspect all fixtures and fittings and Adjustment screws for tightness and integrity.		O
	· Ensure that all upholstery surfaces are not ripped or damaged. Clean seat and back upholstery where required.		O
	· Check function of headrest and trunk supports where fitted.		O
	· Ensure the Lap belt is in good condition and functional. Otherwise replace.		O

24.5 Legrests and Armrests ü

	· Inspect all fixtures and fittings for tightness and integrity.		O
	· Check footplates are in working order.		O

24.6 Actuator / Seat Tilt ü

	· Check Function of set tilt		O
	· Check Actuator wiring.		O

24.7 Batteries ü

	· Check batteries and terminals for any signs of physical damage, cracks or corrosion.		O
	· Check Battery Charge.		O

24.8 Battery Charger ü

	· Check for physical damage of casing.		O
	· Check all LED's are operational.		O
	· Check Mains voltage supply cable. Replace IMMEDIATELY if damaged.		O

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