LiNX™

Systems Installation Manual

dynamic™

LiNX Systems Installation Manual
GBK54036 Issue 1

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1 Welcome

Welcome to the installation manual for the LiNX family wheelchair controller system.

This manual will help you to understand, install, test and operate the LiNX wheelchair controller system. Please read and understand this and all other relevant LiNX system manuals before installing and operating.

1.1 Using this manual

This manual uses the following information boxes to convey important and useful information:

Warning:
Warnings provide important information that must be followed in order to install, configure, and use the product safely and efficiently. Not following the instructions given in a warning can potentially lead to equipment failure, damage to surrounding property, injury or death.

Note:
Notes provide supporting information in order to install, configure, and use the product. Not following the instructions given in notes can lead to equipment failure.

See also:
The "See also" box provides cross-references to further information with clickable links to help you navigate the manual more easily.

1.2 Important information

Do not install, maintain or operate this equipment without reading, understanding and following this manual – including the Safety and Misuse Warnings – otherwise injury or damage may result. This manual contains integration, set up, operating environment, test and maintenance information needed in order to ensure reliable and safe use of the product.

The term ‘programming’ used in this manual refers to adjusting parameters and configuring options to suit an application and does not change or replace any firmware within the controller. When referring to upgrading the controller's firmware, the manual uses the term 'firmware upgrade'. Both programming and firmware upgrading are distinct functions and are performed using a controlled programming tool available only to authorised personnel.

The product(s) described in this manual is (are) not user-serviceable. Specialised tools are necessary for the repair of any component. Any attempt to gain access to or in any way abuse the electronic components and associated assemblies that make up the wheelchair controller system renders the manufacturer’s warranty void and the manufacturer free from liability.

Due to a policy of continuous product improvement, Dynamic Controls reserves the right to update this product and manual without notice. This issue of the manual supersedes all previous issues; previous issues must no longer be used.

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1.4 Contact

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1.5 Related documentation

A LiNX system comprises a number of modules (power module, remote module, etc.) depending on the application. Each LiNX module has its own installation manual, which describes the installation requirements for that particular module.

This manual (GBK54036) describes the installation of the LiNX system, and must be read in conjunction with:

- The LiNX Remote Module Installation Manual (GBK53599)
- The LiNX Power Module Installation Manual (GBK54999)

For programming and diagnostics:

- The LiNX Access iOS Programming and Diagnostic Tool User Manual (GBK54034)
- The LiNX Access PC Programming and Diagnostic Tool User Manual (GBK54033)

2 Contents

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3 Glossary

A

Access Key
A Bluetooth programming adaptor that plugs into the XLR connector of the Remote. See also: Pairing (Bluetooth) and Connection (Bluetooth).

C

Connection (Bluetooth)
The process of linking two Bluetooth devices together each time they are within range of each other and data is about to be exchanged between them. This process occurs after the devices have paired - see Pairing (Bluetooth).

CWD
Centre Wheel Drive.

E

EMC
Electromagnetic compatibility.

ESD
Electrostatic discharge.

F

FWD
Front Wheel Drive.

I

iOS
Operating system used by portable Apple devices such as iPhone, iPad, and iPod touch.

O

OBC
On-board charger - a battery charger that is permanently wired to the power module via the utility connector.

OEM
Original Equipment Manufacturer.

OONAPU
Out Of Neutral At Power Up - a safety condition to prevent the wheelchair driving if the Remote's joystick is not in the central/neutral position when the system is powered up.

P

Pairing (Bluetooth)

Pairing is the process of establishing a connection between two Bluetooth devices (e.g. a LiNX Access Key and an iPhone or a PC) for the FIRST time. Compare "Connection (Bluetooth)".

PIN

Personal Identification Number.

R

RWD

Rear Wheel Drive.

S

S-curve processing

This describes Dynamic Controls' software processing techniques to provide the user with a smooth and controllable response when changing speed input demands. S-curve processing is responsible for all soft start acceleration/deceleration, soft finish acceleration/ deceleration, including forward, reverse and turn movements.

4 LiNX wheelchair controller system

4.1 System overview

LiNX is Dynamic Controls' next generation of modular, wheelchair control systems, offering advanced differential drive control suitable for all wheelchair configurations: forward, centre and rear-wheel drive. All LiNX modules conform with global standards, and are intended for use with Class A and Class B wheelchairs, as defined in ISO7176 Part 5 and EN12184.

This installation manual describes two LiNX systems, namely:

- LiNX LE series
- LiNX 100 series

LiNX LE series

LiNX LE is an entry-level wheelchair control system, providing a simple sit and drive solution, ideally suited for lightweight indoor use.

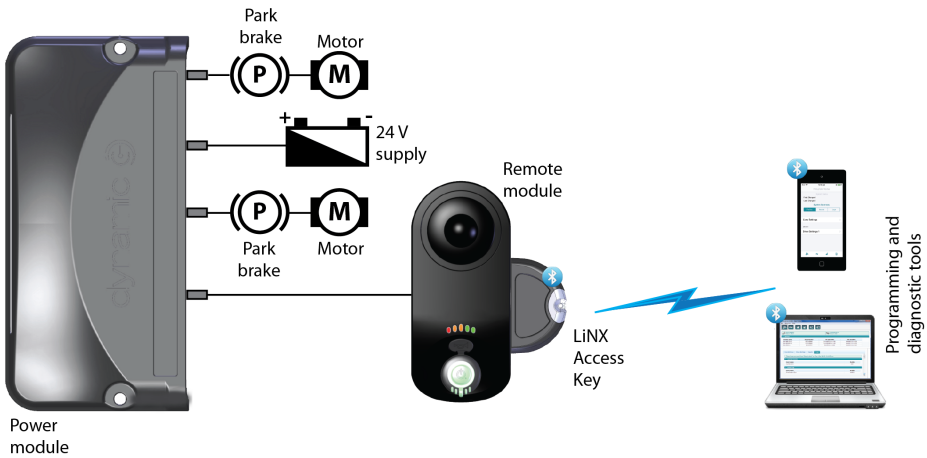


Figure 1: System overview - LiNX LE series

While being simple to install and operate, it benefits from a new technology platform, and state of the art programming system, resulting in a better drive and user experience. It is the preferred solution where simplicity, reliability and superb drive performance are most important.

The LiNX LE series includes both the unique, low-profile REM050 remote module, and the traditional style REM060 remote module. Power modules in this series are available with 40 A (PM40) and 50 A (PM50) ratings. The LiNX LE series is not expandable beyond these power modules.

LiNX 100 series

The LiNX 100 series builds on the simplicity and reliability of the LiNX LE series: the LiNX 100 series power modules share the same form-factor as the LiNX LE but provide extra features, functionality and power, including an extra communications bus port, connection for an on-board battery charger, and connection for a user switch to toggle between drive functions. The LiNX 100 series power modules include 60 A (PM60), 75 A (PM75) and 120 A (PM120) variants. The LiNX 100 series power modules operate with the LiNX LE remote modules: REM050 and REM060.

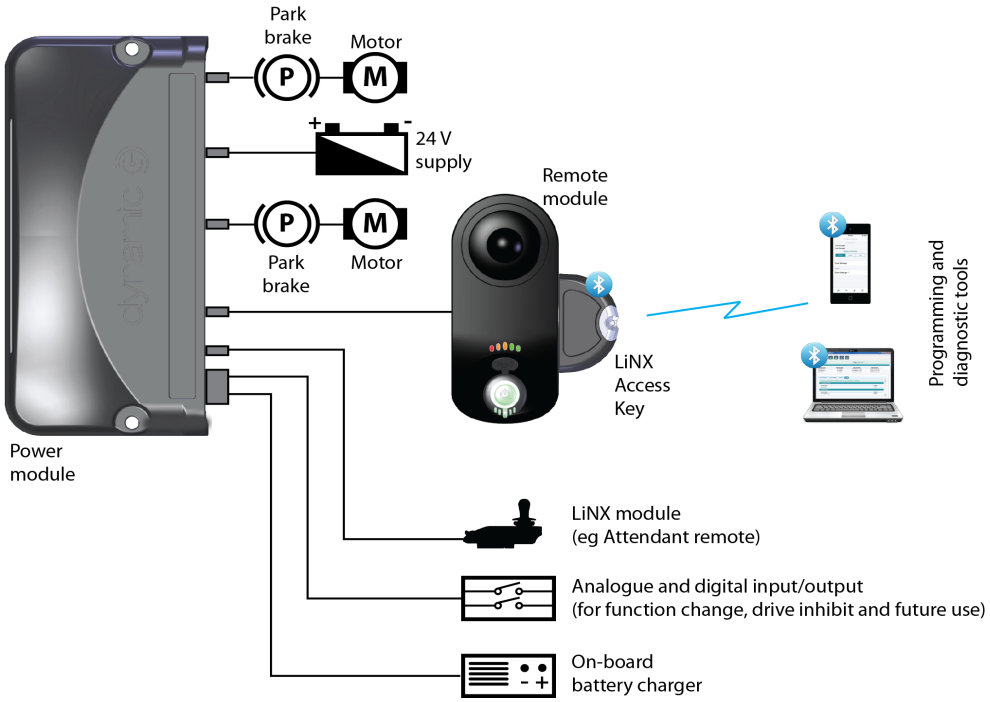


Figure 2: System overview - LiNX 100 series

Note:

LiNX has been designed to allow wheelchairs, in combination with controllers and applicable accessories, to conform with national and international performance and safety requirements such as ISO7176, EN12184, and ANSI/RESNA WC-2 wheelchair standards.

It is highly recommended the OEM manufacturers verify that their product conforms with the relevant standards for the market into which their vehicle is sold.

4.2 A note on core firmware versions

Both the LiNX LE series and the LiNX 100 series require core firmware to operate. Core firmware is programmed at the time of manufacture, and can also be upgraded, using one of the programming and diagnostic tools, as and when newer versions are made available.

The core firmware version is designated *MRx*, where *MR* is the abbreviation for *Market Release*, and the *x* is the version number. For example, the LiNX LE series was released with core firmware MR1 (market release 1).

This manual describes three core firmware versions of the LiNX system: MR1, MR2 and MR2.2. To differentiate between the versions, columns have been added to the parameter tables in the parameter section of this manual (see section *7 Parameters*). Only those parameters that have a check mark for all versions are available for all versions, otherwise, the parameter will only be available for the version that has been checked - see image below.

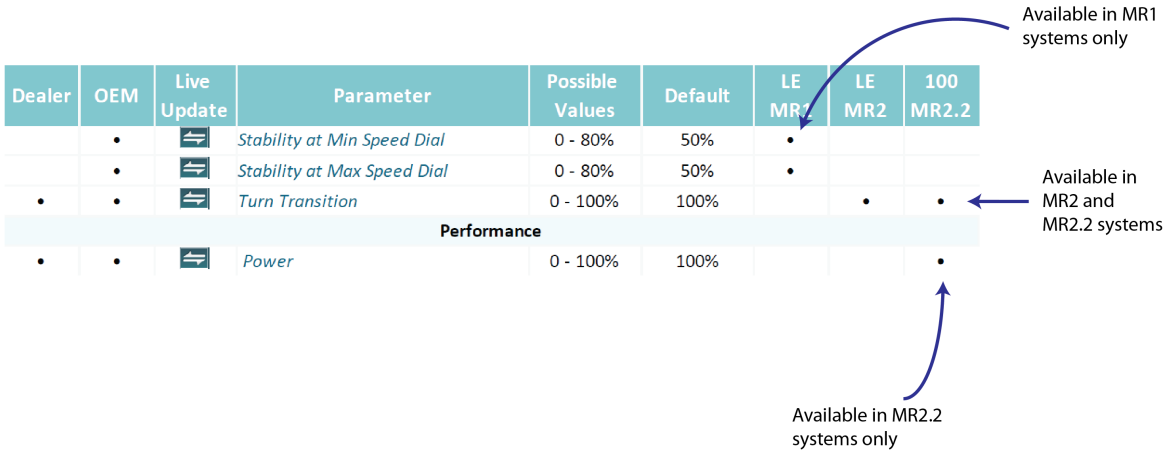


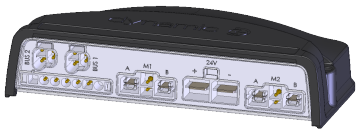
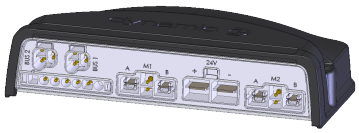
Figure 3: A section of the parameter table showing parameters available for the LiNX LE series and the LiNX 100 series with MR1, MR2 and MR2.2 core firmware

4.3 LiNX power modules

4.3.1 LiNX LE series

Product	Description	Part No.
	**40 A LiNX LE Series Power Module** • 43 A maximum current • 1 x bus socket • Works with DLX-REM050/060	DLX-PM40-A
	**50 A LiNX LE Series Power Module** • 53 A maximum current • 1 x bus socket • Works with DLX-REM050/060	DLX-PM50-A

4.3.2 LiNX 100 series

Product	Description	Part No.
	**60 A LiNX 100 Series Power Module** • 63 A maximum current • 2 x bus sockets • Utility connector for on-board charger, user-inhibit, and drive function control • Real-time clock • Works with DLX-REM050/060	DLX-PM60-A
	**75 A LiNX 100 Series Power Module** • 78 A maximum current • 2 x bus sockets • Utility connector for on-board charger, user-inhibit, and drive function control • Real-time clock • Works with DLX-REM050/060	DLX-PM75-A
	**120 A LiNX 100 Series Power Module** • 120 A maximum current • 2 x bus sockets • Utility connector for on-board charger, user-inhibit, and drive function control • Real-time clock • Works with DLX-REM050/060	DLX-PM120-A

4.4 LiNX remote modules

Product	Description	Part No.
	**LiNX REM050 remote module** • Front joystick • On/off power button • Status indicator • Battery gauge • Speed dial • Horn • Hand rest area	DLX-REM050-A
	**LiNX REM060 remote module** • Rear joystick • On/off power button • Status indicator • Battery gauge • Speed dial • Horn	DLX-REM060-A

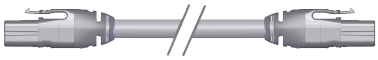
4.5 LiNX Access Keys

Product	Description	Part No.
	**LiNX Access Key - Dealer version** A Bluetooth programming adaptor suitable for dealers, therapists and wheelchair service agents.	DLX-HKEY01-A
	**LiNX Access Key - OEM version** A Bluetooth programming adaptor suitable for OEMs and certain service agents.	DLX-HKEY02-A

4.6 LiNX programming and diagnostic tools

Product	Description	Part No.
	**LiNX Access iOS programming and diagnostic tool** A programming and diagnostic tool for iOS devices only.	N/A
	**LiNX Access PC programming and diagnostic tool** A programming and diagnostic tool for PC/laptop devices only.	N/A

4.7 LiNX communications bus

Product	Description	Part No.
	**LiNX communications bus loom - standard** 1 m standard communication bus loom. 1.5 m standard communication bus loom.	 GLM-BUS100-A GLM-BUS150-A
	**LiNX communications bus loom - extension cable** 0.9 m extension communication bus loom. 0.64 m extension communication bus loom.	GLM-EXT090-A GLM-EXT064-A
	**Extension loom panel mounting clip** Panel-mount clip for extension loom.	GME80151

4.8 System features

This section highlights some of the features available with the LiNX LE and LiNX 100 series wheelchair controller systems.

4.8.1 Wireless programming

A LiNX system can be programmed wirelessly with one of two programming and diagnostic tools:

- the LiNX Access iOS tool (see section *6.1.1*)
- the LiNX Access PC tool (see section *6.1.2*)

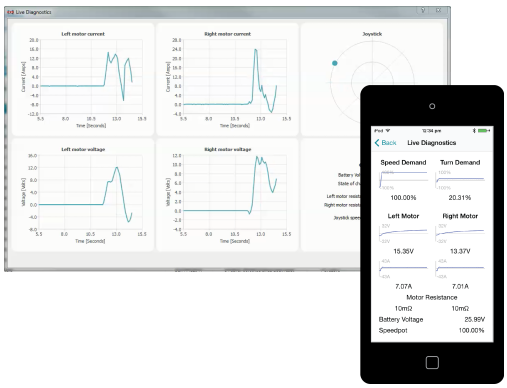
The programming and diagnostic tools communicate with a LiNX system over Bluetooth. The Bluetooth capability of a LiNX system is provided by a LiNX Access Key inserted into the remote module's XLR socket (see section *6.1.3*).

Both tools offer a Live Update mode that allows certain parameters to be programmed, and take effect immediately, while the system is live (e.g. while driving). For more information, see section *6.1.4 Live Update mode*.

4.8.2 Wireless diagnostics

Wirelessly monitor wheelchair performance and diagnose errors with the programming and diagnostic tools. Both the LiNX Access iOS tool and the LiNX Access PC tool can display the following historical and real-time data:

- Error indication (see *9.3 Error indication*)
- Battery usage (see *9.1.3.1 Battery usage* and *9.2.3.3 Battery usage*)
- Drive statistics (see *9.1.3.2 Drive statistics* and *9.2.3.4 Drive statistics*)
- Live diagnostics (see *9.1.4 Live diagnostics* and *9.2.4 Live diagnostics*)



4.8.3 HHP support

The DX-HHP (Hand-Held Programmer) has been used successfully on previous Dynamic Controls' products, and can be used with the LiNX system for programming a number of useful parameters.

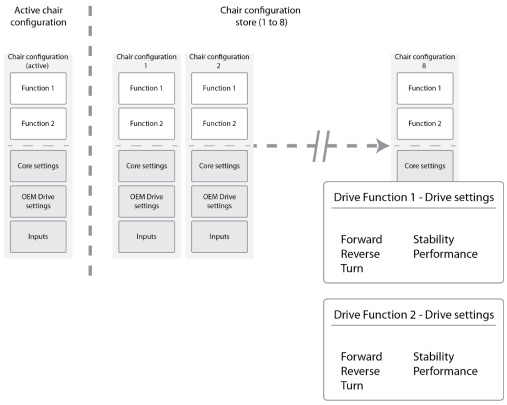
For more information about the DX-HHP programmer and the parameters that it can edit, see *6.5 DX-HHP Programmer*.

4.8.4 Drive functions and chair configurations

The LiNX 100 series supports multiple drive functions and chair configurations.

Together, drive functions and chair configurations provide:

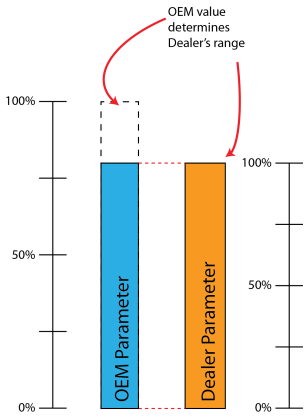
- the OEM with the ability to configure different wheelchair models;
- the dealer and wheelchair user with the ability to change the wheelchair's driving characteristics based on, for example, environment, speed requirements or driving ability.



The LiNX 100 series has eight chair configurations; each chair configuration supports two drive functions. For more information, see *6.3 Drive functions and chair configurations*.

To set up the drive functions, the utility port needs to be configured and a user switch installed. For more information, see sections *5.8 The utility connector*, and *5.8.4 Setting up and selecting additional drive functions*.

4.8.5 OEM-specific programming

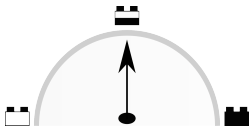


With the introduction of the MR2 firmware, the drive setting parameters have been separated into OEM-specific parameters and Dealer-specific parameters to better reflect the different tuning requirements between the OEM and the Dealer.

The OEM-specific parameters are used to set the effective range that the Dealer-specific parameters can use.

See *7.2.11 OEM Drive settings – forward* to *7.2.14 OEM Drive settings – stability*.

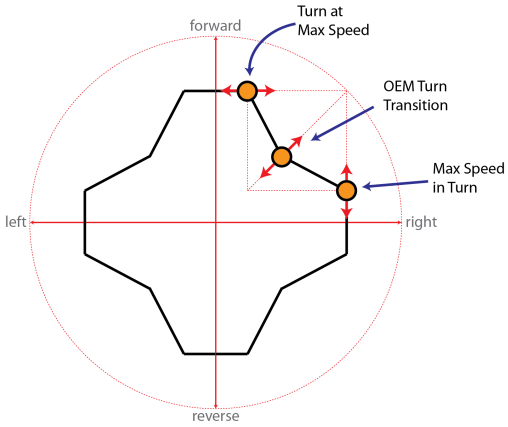
4.8.6 Battery gauge



Choose between a Traditional or Enhanced battery gauge with the new Battery Gauge Type parameter: the Traditional setting uses a standard algorithm suitable for most systems and is backwards compatible with existing Dynamic Controls products; the Enhanced setting uses an improved algorithm that better reflects the true state of charge on lead-acid batteries.

For more information, see sections *7.2.4.9 Battery Gauge Type* and *5.5.7 Battery gauges*.

4.8.7 Improved stability settings



With the introduction of the LiNX MR2 software, the stability functionality has been improved and simplified; the available stability parameters have been revised, and wheelchair stability is now easier to set up. For more information, see *7.2.9 Drive settings – stability settings for LiNX MR2 systems*.

The OEM has three parameters available to control the wheelchair's stability:

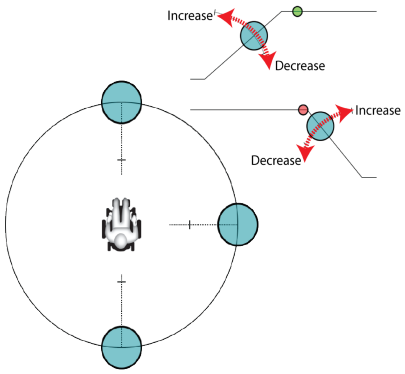
- Turn at Max Speed (see *7.2.14.1 Turn at Max Speed*)
- Max Speed in Turn (see *7.2.14.3 Max Speed in Turn*)
- OEM Turn Transition (see *7.2.14.2 OEM Turn Transition*)

A fourth parameter,Turn Transition (see *7.2.9.2 Turn Transition*) is available to the dealer to further tune the wheelchair for the end user.

See also:
For comparison, see 7.2.8 Drive settings – stability settings for LiNX MR1 systems.

4.8.8 Graphical input

Instead of editing values via the keyboard, a number of parameters can also be edited graphically with the LiNX Access iOS tool.

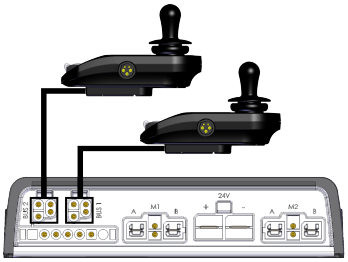


Editing parameters graphically makes wheelchair configuration quick and easy. There is no small or awkward keyboard, so input errors are minimised. Furthermore, parameters are grouped together, allowing for a better overview of how one parameter change can affect another parameter.

Changes can be made graphically to speed settings, acceleration settings and stability settings.

See also:
For more information, see GBK54034 LiNX Access iOS User Manual Issue 2

4.8.9 Dual remote modules



The LiNX 100 series power modules provide two communication bus connectors, allowing two remote modules to be connected at the same time. This is useful, for example, when a remote module is required for both an occupant and an attendant.

See section *5.4.6 Dual remote modules* for more information.

5 Installation and wiring

5.1 Installation procedure

1. First read and fully understand this manual, and all other relevant LiNX module manuals.
2. Mount all the electrical parts of the wheelchair system (motors, park brakes, batteries, power module, remote module) on the wheelchair. See the relevant module manuals for their physical dimensions and mounting recommendations.
3. Do not connect any cables before all the parts of the electrical system are mounted.
4. Connect the power module to the motors (see section *5.6 Motors*), the park brakes (see section *5.7 Park brakes*) and the remote module (see section *5.4.2 Installing the LiNX communications bus*).
5. Connect the power module to the batteries (see section *5.5 Batteries*).

Do not turn on the wheelchair yet.

Warning:
Do not connect the positive terminal (B+) of the battery to the power module until the wheelchair is completely wired and ready for testing as described in the Testing section (see section 8 Testing).

6. Lift the wheelchair off the ground and check the installation thoroughly.
7. Program the system to the requirements of a particular wheelchair or user (see section *6 Programming*).
8. Test the system for functionality and safety (see section *8 Testing*).

5.2 General wiring guidelines

Note:
The following notes apply to all wiring on the wheelchair. It is the installer's responsibility to ensure the finished wiring package is safe and fit for purpose.

To maximise performance, minimise EMC emissions, maximise EMC and ESD immunity, and to keep the cabling of the wheelchair safe and tidy, please observe the following guidelines.

- All wiring should comply with the requirements of ISO7176-14.
- Keep all cables as short as possible.
- All cables used should be resistant to fire to VW-1 (UL 1581) or similar.
- Avoid wire loops, especially loops of single wires instead of wire pairs.
- Try to run wires in pairs or bunches. For example, run the battery's positive and negative wires together, and the motor's positive and negative wires together. Bind wires together and fix them to the chassis.
- Do not route the cables (including the motor cable) near the motor case, where possible.
- Do not leave electrical connections unnecessarily exposed. Insulate exposed connections (for example with sleeving) to reduce the risk of short circuits, exposure to water and connection stress.
- Make sure that all vehicle sub-frames, particularly the motors and controller case, are electrically connected.
- Do not use the vehicle frame as the earth return. Any electrical low-resistance connection to the frame is a safety risk and is not allowed by international safety standards.
- To minimise electromagnetic emissions by the motor brushes, it may be necessary to fit capacitors between the brush holders and the motor case. Make sure that the leads are kept as short as possible. A suitable capacitor is 4n7, 2kV Ceramic.
- For best electrical performance, the wire size must be as large as possible, but no larger than what the crimp in the connector can withstand. Always use the correct tool for crimping.
- Recommended minimum wire sizes are shown in the wiring sections.
- For low-current signals, do not use wire sizes smaller than 0.5 mm^2/20 AWG, because smaller wires are physically not strong enough for this application.
- The type of cable used must be appropriate for the mechanical and environmental abuse it is likely to encounter.
- Do not use damaged or abused cables. A damaged cable can potentially produce localised heat, sparks or arcing, and as such it can cause a fire.
- Protect all cables against possible contact with flammable material.
- If an extension loom is fitted, mount it with the female connector facing horizontal or downwards, and protect it from direct splashing. If the extension loom is to be used for frequent disconnection, mount the female connector so that it faces downwards.

Warning:
Do not exceed the LiNX communications bus cable's recommended minimum bend radius.
Support cables that are subject to frequent bending by use of a cable chain or equivalent mechanism.
Thoroughly test the cabling system where frequent cable-flexing is part of the intended application, and especially, consider the loom operation at low temperatures.

Warning:
Only use the defined contacts, connectors and boots with the wiring looms.

Warning:
The installation must prevent and/or discourage the user from accessing any cable.

Warning:

1. *Route the cables and fasten all wheelchair components in a position so that the cables, the connectors and the connector sockets of the LiNX system are shielded from water splashes and water ingress, and are free from physical strain, abuse or damage, such as snagging, crushing, impact from external objects, pinching or abrasion. Take particular care on wheelchairs with movable structures such as a seat raise. Make sure that the cables do not extend beyond the wheelchair so that they cannot be caught or damaged by external objects. Adequate strain relief must be provided and the mechanical limits of the cables/looms must not be exceeded. Ensure connectors are fully mated.*
2. *Disconnect all the cables of the wheelchair at the powered end whenever units are replaced or moved. The Bus cables remain live when connected to the power module even when the system is off.*
3. *The user maintenance schedule and the service instructions of the wheelchair must include the appropriate inspection and maintenance requirements for the connectors and the cables.*
4. *It is the responsibility of the installer to make sure that the finished wiring package is safe and fit for purpose.*
5. *Before making any connections to the controller, disable the wheelchair by one of the following means to prevent accidental movement.*
   - *Place the battery circuit breaker in the open position.*
   - *Disconnect the motors or batteries and/or elevate the drive wheels.*
6. *To meet ISO requirements, the battery and motor connectors must be fixed in such a way that they cannot be swapped or transposed. Alternatively, theconnectors may be protected by a cover that cannot be removed without the use of tools.*

See also:
5.4.1 LiNX communications bus specifications

5.3 Typical cabling installation

5.3.1 LiNX LE series

A typical LiNX LE installation will comprise the following:

- A 24V battery supply and circuit breaker connected to the battery connector
- A motor and park brake connected to the M1 connector
- A motor and park brake connected to the M2 connector
- A LiNX remote module connected to the communications bus connector

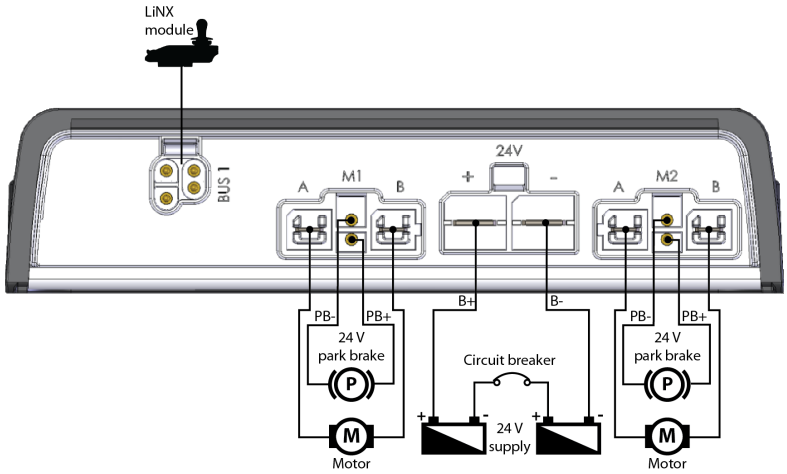


Figure 4: Typical cabling installation LiNX LE series

5.3.2 LiNX 100 series

A typical LiNX 100 series installation will comprise the following:

- A 24V battery supply connected to the battery connector
- A motor and park brake connected to M1 connector
- A motor and park brake connected to M2 connector
- A LiNX remote module connected to the communications bus connector
- An optional LiNX module connected to the communications bus connector
- An optional on-board battery charger connected via the utility connector
- An optional user input (switch) connected to the utility connector

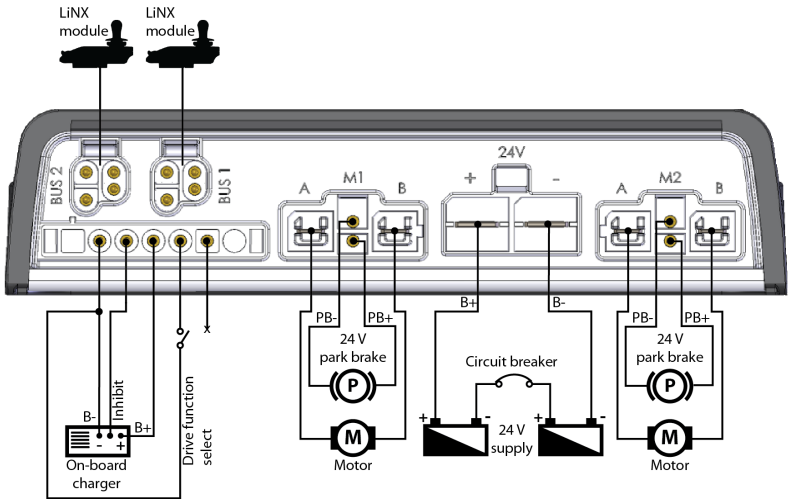


Figure 5: Typical cabling installation LiNX 100 series

5.4 LiNX communications bus

The LiNX communications bus looms provide communication and power distribution across the LiNX system. The looms have been designed to be robust and flexible, but wheelchair batteries are a high-energy source and so the following installation notes must be applied to ensure that the installation is safe and reliable. The installer shall also ensure that any additional risks are appropriately assessed.

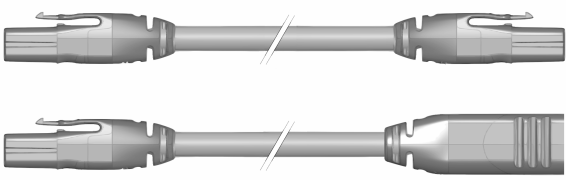


Figure 6: LiNX communications bus loom - standard (top) and extension versions (bottom)

There are two types of LiNX communication bus loom: standard (male-to-male connectors) and extension (male-to-female connectors) (see *Figure 6*). Both types of loom are available in different lengths. The extension loom can be panel mounted using the optional Extension Loom Panel Mounting Clip (GME80151) (see *Figure 7*).

The recommended panel cut-out for the clip is 21 mm x 16 mm. To use the clip, slide the extension loom into the mounting hole with the male end first, and then fit the clip over the male connector with the concave side of the clip facing the back of the mounting panel. Push the female end of the loom from outside the panel then push the clip down onto the inner surface of the panel.

Figure 7: Extension Loom Panel Mounting Clip

Warning:
Do not connect more than one power module to the LiNX communications bus at any one time. If more than one power module is connected to the bus and the battery at the same time, then the wiring protection circuits in each power module become ineffective and a short on the bus may lead to heat damage of the modules or interconnects.

Ensure that the LiNX communications bus connectors are protected from impacts.

5.4.1 LiNX communications bus specifications

Parameter	Description
Loom resistance (per loom)	Standard loom: 6.4 mΩ (contacts) + 17.24 mΩ /meter Extension loom: 3.2 mΩ (contacts) + 17.24 mΩ /meter
Extension loom panel mount thickness range	1.5 mm to 4.5 mm
Connector latch holding force	50 N minimum
Maximum cable strain	100 N (accidental, non-repetitive, no damage)
Cable bend radius	32.4 mm – fixed installation 64.8 mm – frequent flexing
Operating temperature	-25 °C to +50 °C (ambient, fixed installation). Note that the cable becomes less flexible at low temperatures, particularly below -10 °C.

5.4.2 Installing the LiNX communications bus

Connect the remote module to the power module using the LiNX communications bus loom. The connector is ‘keyed’ and can only be plugged in one way.

For safe and reliable operation, the installation of looms and cables used with LiNX system must follow the basic principles of power wiring.

The cable must be secured between the connector and any point of flexing so that flexing forces are not transferred to the connector.

***Warning**:*
Avoid routing the cable where it will come into continuous contact with the end user.

***Warning**:*
The cable should be adequately routed and secured to prevent pinching, cutting, crushing and chafing from both the mechanics of the wheelchair and external objects.

***Warning**:*
Routing must ensure that loose cables are adequately protected against snagging. The cable must be routed so that impact of the wheelchair with external objects does not cause the cable to be damaged.

***Warning**:*
The wheelchair user maintenance schedule and service instructions should include appropriate inspection and maintenance requirements for connectors, cables and wiring. It should also warn against the dangers of poor installation and maintenance of cables.

5.4.3 Bending and flexing

When installing LiNX communications bus looms, avoid undue straining of the cable and connection points. Flexing of the cable should be minimised wherever possible to extend service life and minimise the risk of accidental damage.

The specified bend / flex radii (see section *5.4.1 LiNX communications bus specifications*) are minimums. Use of a cable chain to support the cable, where the cable is subject to regular cyclic bending, is recommended. The force applied to flex the cable should never exceed 10 N. Appropriate life testing should be carried out to determine / confirm the expected service life and inspection and maintenance schedule.

***Warning**:*
Where frequent flexing is part of the intended application, the installer must ensure an appropriate bend / flex radius is maintained for the intended and foreseeable environmental conditions.

***Warning**:*
The flexibility of the bus loom can reduce at low temperatures, particularly below -10 °C. OEMs are recommended to check their installation is appropriate at low temperatures especially where flexing of the cable is required by the installation. For loom temperature details, see section 5.4.1 LiNX communications bus specifications.

5.4.4 Electrical protection

LiNX power modules provide electrical overload and short-circuit protection for the LiNX communications bus looms. A damaged, frayed, crushed or an otherwise abused loom can cause a partial short-circuit condition. This condition can cause a current within the normal LiNX communications bus operating range, and below the protection rating of the system.

Wheelchair users must be made aware of the appropriate inspection and maintenance requirements to minimise the risk of such a failure.

***Warning**:*
A damaged cable can potentially produce localised heat, sparks or arcing and become a source of ignition to surrounding flammable material. The installation must ensure that all power cables, including the LiNX communications bus loom, are protected against damage and potential contact with flammable materials.

5.4.5 Live cables

The LiNX communications bus distributes battery power to LiNX modules and accessories. The looms remain live when the battery is connected, even when the controller is switched off. Particular care should be taken where users may disconnect LiNX modules or looms. Where possible, the installation should discourage the wheelchair user from making a disconnection at the 'live end' of the LiNX loom.

***Warning**:*
Cables with live pins should be restrained.

5.4.6 Dual remote modules

The LiNX 100 series power modules provide two communication bus connectors, allowing two remote modules to be connected at the same time. This is useful, for example, when a remote module is required for both an occupant and an attendant.

When two remote modules are connected in the same system, both are capable of performing the same functions but only one of them will have control of the system at any one time. While one remote is in charge, the other will not respond to any commands except for its power button, which can always turn off the system.

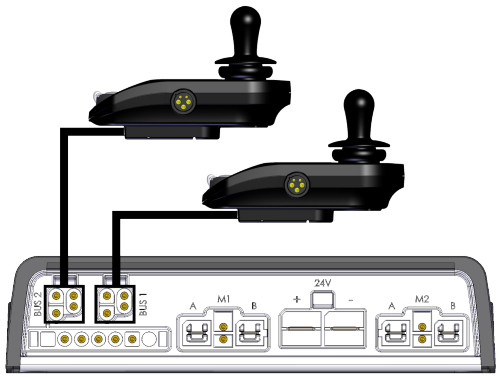


Figure 8: Dual remote modules

***Note**:*
The remote modules do not have to be the same type. The power module can connect to identical or different remote module types. For example, two REM050s will work together, as will one REM050 and one REM060.

The following sections detail the installation and general operation of the dual remote module feature.

5.4.6.1 Installation

The remote modules must be fixed and connected to the wheelchair according to the installation instructions in the LiNX Remote Module Installation Manual (GBK53599) and the installation and wiring sections in this manual, especially sections:

5.1 Installation procedure
5.2 General wiring guidelines

Connect the two remote modules to the power module's communication bus connectors. Despite the connector names (BUS1 and BUS2), it does not matter which remote module is attached to which connector.

***Note**:*
A REM050 with MR1 firmware will need a firmware upgrade to be able to work in dual remote mode.

5.4.6.2 Operation

Powering up

Either of the remote modules can power up the system with their own power button. The remote module that powers up the system will have control of the system (remote-in-charge). The other remote module (remote-not-in-charge) will have no control of the wheelchair except for its power button, which can still be used to switch off the system.

Note:
If a programming and diagnostic tool is responsible for a system powering up when it connects to a LiNX Access Key, the remote module that hosts the LiNX Access Key will be in charge of the system.

Powering down

No matter which remote module is in charge in the dual remote system, the wheelchair can be powered down by pressing the power button on either remote module.

Swapping the remote-in-charge

To swap which remote module is in charge, power down the system with either remote module, and then power the system on again with the remote module that requires the control.

Remote-in-charge indication

Dual remote systems indicate who's in charge with the battery gauge — all other indicators display normally.

Remote-in-charge	Remote-not-in-charge
All indicators, including the battery gauge will display as normal.	The battery gauge will be switched off and all other indicators will operate normally.
	
Figure 9: Remote-in-charge indication	Figure 10: Remote-not-in-charge indication

5.4.6.3 Fault handling and indication

If a fault exists on one of the remote modules in a dual remote system, then the fault is indicated on both modules.

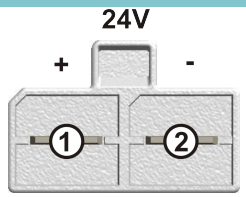
If one of the remote modules in a dual system is faulty, the system can be driven with the other remote module. If, however, the power button on the remote-not-in-charge has a fault, then the system will not operate.

If one of the remote modules is disconnected from the system when it is powered down, the remaining remote module will display an error (FC:2) when the system is powered up again to indicate that it was expecting two remote modules in the system. To remove the error, cycle the power with the power button.

5.5 Batteries

5.5.1 Battery connectors

The battery connector has two terminals: Battery Positive (B+) and Battery Negative (B-). Battery leads should be as short as possible; the heavier the gauge of the wire, the better the wheelchair performance will be.

Battery Connector (PM40, PM50, PM60, PM75, PM120)		
 Figure 11: Battery connector	Pin	Function
	1	Battery Positive (B+)
	2	Battery Negative (B-)

5.5.2 Battery cables

Min Wire Size	Recommended Loom Length	Notes
6 mm^2 / 10 AWG	400 mm	The recommended battery contacts (GCN8002) will crimp wires in the range 6 mm^2 / 10 AWG to 10 mm^2 / 8 AWG csa.

Warning:
The cable size, insulation and connectors should be selected to ensure that any temperature rise during a fault condition does not result in visible damage or temperatures in excess of the dry rated temperature.

5.5.3 Battery wiring

Warning:
The final connection to the Battery Positive (B+) terminal should not be made until the wheelchair is completely wired and ready for testing as described in the Testing section (see section 8 Testing).

Warning:
The LiNX system has been designed to perform optimally with either absorbed glass mat or Gel Cell 24 V deep cycle lead-acid batteries, rated between 20 - 120 Ah.

A thermal circuit breaker or fuse must be installed between the batteries and the power module — as close as possible to the batteries — to protect both the batteries and the system wiring. If the two batteries are permanently wired together (single battery box), the best position for the circuit breaker is between the two batteries. If the batteries are separated (individual battery boxes), each battery requires its own circuit breaker or fuse.

Note:
A slow-acting, thermal type circuit breaker is suggested for LiNX power modules. The thermal circuit breaker should have a trip rating no higher than the current limit of the power module.

The above suggestion is only a guideline. Check thoroughly to make sure that the circuit breaker provides adequate protection for the complete system, including wiring, motors and batteries.

Note:
The length of the battery leads should be as short as possible, and the gauge should be as heavy as possible to minimise the combined resistance of the battery wires and fuse, which in turn will help minimise the overall voltage drop under heavy load.

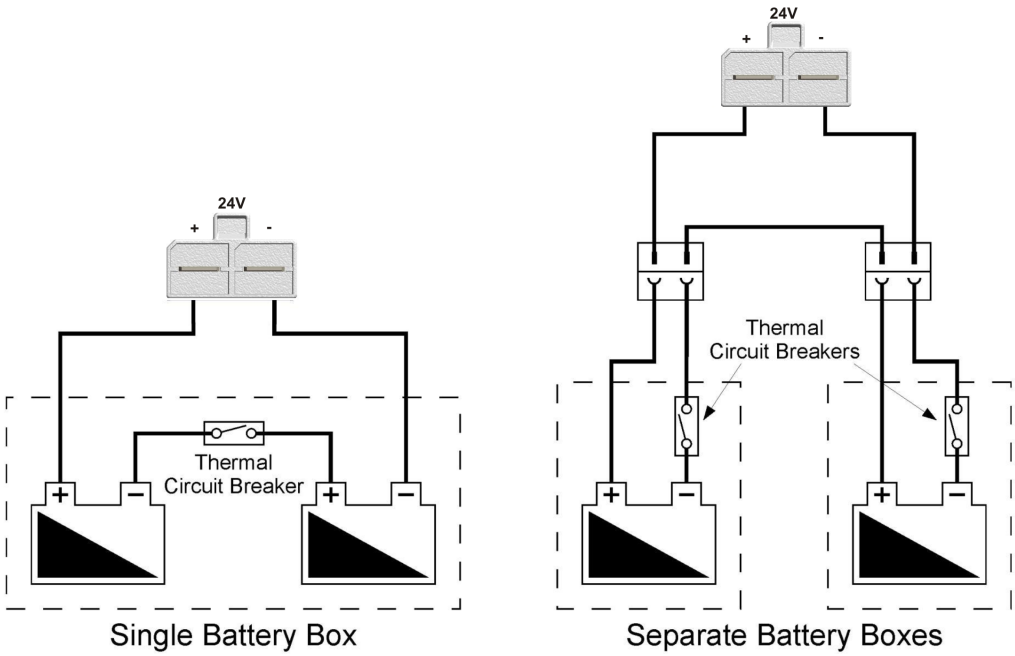


Figure 12: Thermal circuit breaker arrangements

5.5.4 Battery types

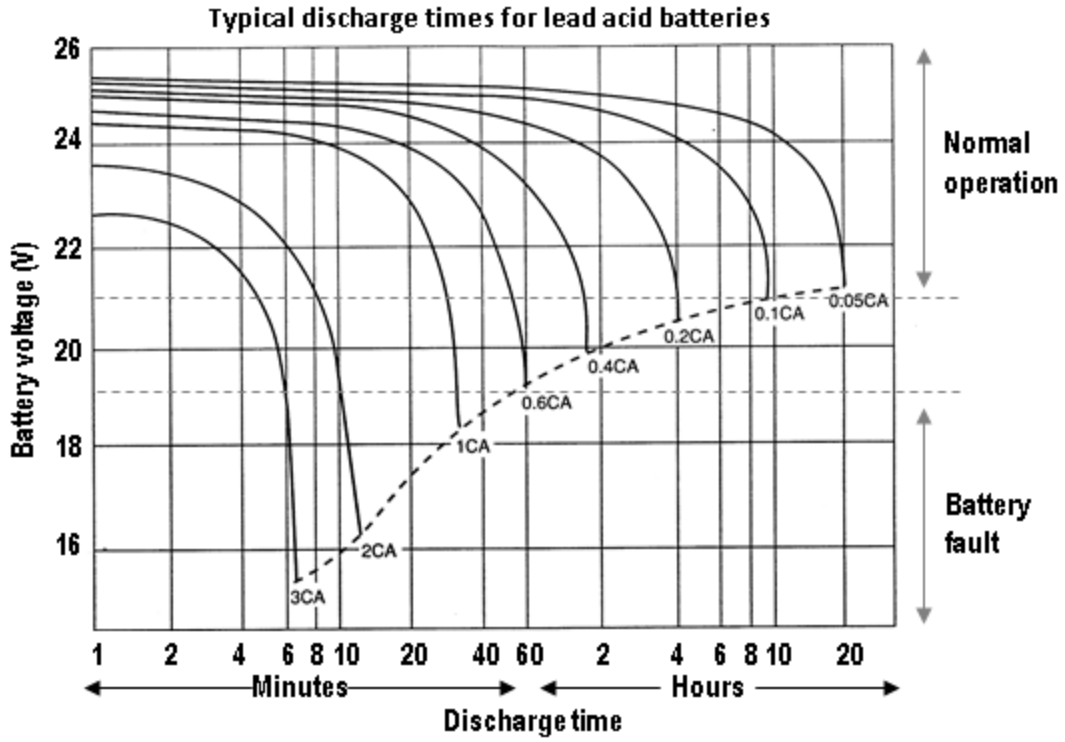
The batteries provide the energy for the wheelchair to drive. The batteries are connected to the LiNX power module via the battery connector. The LiNX power module distributes the energy of the batteries to the motors and to the other modules.

The batteries must be operated and maintained according to the instructions of the battery manufacturer. Typically, the specification for the batteries would be:

- 24 V (commonly 2 x 12 V)
- absorbed glass mat or Gel Cell 24 V deep cycle lead-acid
- rated capacity: 20 – 120 Ah (dependent on application and power module)

5.5.5 Battery capacity

Choose a battery capacity that is compatible with the intended use. This ensures that the required wheelchair range and operating time is achieved.



The rated capacity in Ampere-hours (Ah) of a battery is usually specified for a 20 hour discharge rate (or 0.05 CA, a current of 5% of the rated capacity). A higher continuous discharge current dramatically reduces the available battery capacity. As the graph shows, when the discharge current equals the rated capacity (1 CA), the battery does not last the expected one complete hour, but only 30 minutes, giving an actual available capacity of only 50%.

Rated capacity	Average discharge current	Actual capacity
20 Ah	40 A (2 CA)	5 Ah (25%)
20 Ah	20 A (1 CA)	10 Ah (50%)
20 Ah	12 A (0.6 CA)	12 Ah (60%)
20 Ah	8 A (0.4 CA)	15 Ah (75%)
20 Ah	1 A (0.05 CA)	20 Ah (100%)

Note:

1. *Dynamic Controls recommends using batteries with a capacity that is at least twice as high as the average discharge current.*
2. *New batteries often start with only 80% of their rated capacity. After a few charging cycles the capacity will increase to 100%.*
3. *Deep discharging or overcharging dramatically decreases the capacity of the battery. This damage is permanent; the battery will never return to its original capacity.*

5.5.6 Battery charging

The batteries on a LiNX LE series system can be charged via the remote module's XLR connector. The batteries on a LiNX 100 series system can be charged via the remote module's XLR connector or the power module's utility port.

The battery gauge will indicate the system is connected to the charger by cycling between a left-to-right chase sequence, and then displaying the approximate battery charge state at the end of the chase sequence.

The LiNX system does not have to be powered up when charging the battery, however, if it is not powered up, then the battery gauge will not display the charging state/ chase sequence.

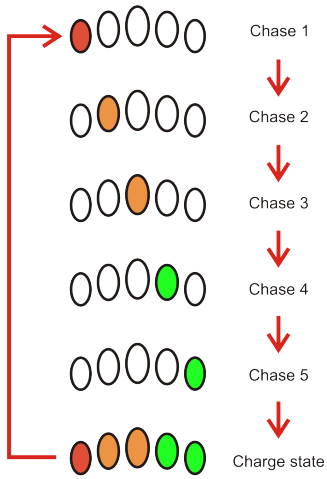


Figure 13: Battery charging chase sequence

5.5.6.1 Battery charging with an external charger

To charge the batteries with an external battery charger, use the 5-pin XLR type connector that is located on the LiNX remote module — see LiNX Remote Module Installation Manual (GBK53599) for locations.

To charge the wheelchair's batteries, plug the battery charger into the remote module's XLR socket. The battery charger's connector plug must be wired with a Drive Inhibit connection, as shown below.

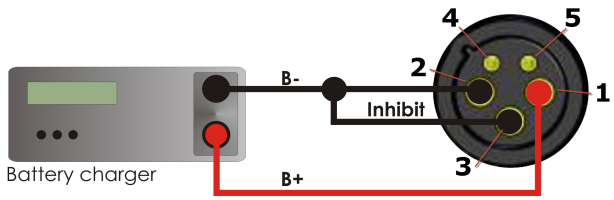


Figure 14: Charging via the XLR connector

Pin	Signal
1	Battery Positive (B+)
2	Battery Negative (B-)
3	Drive Inhibit
4	Communications bus High
5	Communications bus Low

The Drive Inhibit signal ensures that the wheelchair does not drive when connected to the charger. This signal must be provided within the battery charger plug as a connection between pin 2 and pin 3. Ensure that the battery charger is compatible with this configuration before connecting it to the charging socket.

Warning:

1. *The wheelchair manufacturer should comply with the requirements of ISO7176, Part 25 regarding batteries and chargers.*
2. *The maximum charging current for the LiNX wheelchair control system is:*
   - *6 A - with PM40 hardware version 1.x only*
   - *8 A - with PM40 hardware version 2.x and later*
   - *8 A - with PM50*
   - *12 A - with PM60, PM75 and PM120*
3. *The wheelchair manufacturer must specify an appropriate battery charger for the batteries used in the wheelchair.*
4. *The wheelchair manufacturer must also specify the maximum current of any battery chargers to be used with the controller and warn against using battery chargers of higher current ratings.*
5. *The battery charger must have over-current protection in the form of a non-resettable fuse, which does not self-reset until the fault is cleared. It is the responsibility of the wheelchair manufacturer to manage the*

risks of battery over-charging and any related gas emissions.

6. *To protect the wheelchair wiring from over-currents while charging the batteries, chargers must have the ability to reduce their current output when electrically shorted.*

5.5.6.2 Battery charging with an on-board charger

The LiNX 100 series power modules can be connected to an on-board charger (OBC) via the utility connector - see *5.8.2 Connecting an on-board battery charger*.

5.5.7 Battery gauges

The battery gauge can be configured using the *Battery Gauge Type* parameter (see *7.2.4.9 Battery Gauge Type*). This parameter sets the algorithm that is used for calculating the battery's state of charge to display on the remote module's battery gauge. There are two algorithms to choose from:

- **Traditional** - uses a standard algorithm suitable for most systems
- **Enhanced** - uses an improved algorithm that better reflects the true state of charge on lead-acid batteries

5.5.7.1 Traditional battery gauge algorithm

By default, the battery gauge algorithm is set to *Traditional*. Despite the benefits of the Enhanced gauge, the Traditional algorithm remains an option for the OEM for use by those that are familiar and comfortable with the Traditional's display and its behaviour.

The parameters relevant to the Traditional battery gauge are:

- Batt Gauge Dead Zone (see *7.2.4.3 Batt Gauge Dead Zone*)
- Batt Gauge Minimum (see *7.2.4.4 Batt Gauge Minimum*)
- Batt Gauge Maximum (see *7.2.4.5 Batt Gauge Maximum*)
- Batt Gauge Low Voltage Warning (see *7.2.4.6 Batt Gauge Low Voltage Warning*)
- Batt Gauge High Voltage Warning (see *7.2.4.7 Batt Gauge High Voltage Warning*)
- Cut Off Voltage (see *7.2.4.8 Cut-Off Voltage*)

5.5.7.2 Enhanced battery gauge algorithm

The Enhanced battery gauge algorithm offers an improved, more accurate battery state of charge reading. Improvements include:

- more accurate state of charge readings at low, normal and high battery voltages;
- optimised filtering (averaging) that gives a smoother, less erratic, gauge response;
- a reduction in false readings from, for example, regenerative braking;
- more accurate readings when determining state of charge during both charging and dis-charging;
- more accurate readings when determining state of charge while under both load and no load conditions.

The parameters relevant to the Enhanced battery gauge are:

- Batt Gauge Minimum (see *7.2.4.4 Batt Gauge Minimum*)
- Batt Gauge Maximum (see *7.2.4.5 Batt Gauge Maximum*)
- Batt Gauge Low Voltage Warning (see *7.2.4.6 Batt Gauge Low Voltage Warning*)
- Batt Gauge High Voltage Warning (see *7.2.4.7 Batt Gauge High Voltage Warning*)
- Cut Off Voltage (see *7.2.4.8 Cut-Off Voltage*)

5.5.7.3 Working with the Enhanced battery gauge

The Enhanced battery gauge algorithm uses stored data to calculate the current state of charge. Because of this, if the batteries are replaced or the *Battery Gauge Type* parameter is switched from

Traditional to Enhanced, this stored data will not be applicable any longer, and therefore the algorithm will not be able to calculate an accurate value for the battery gauge.

To ensure that the battery gauge displays an accurate value after a battery swap or when the *Battery Gauge Type* parameter is switched, charge the batteries fully. The batteries must be fitted to the wheelchair during charging (the controller does not have to be powered up) and the charging operation must go through a complete charge cycle.

After replacing the system's batteries, it is recommended that the battery usage statistics are reset as well. Resetting the battery usage statistics ensures that a date is recorded in the system's logs for when the battery was replaced, which, for example, can be useful for maintenance records.

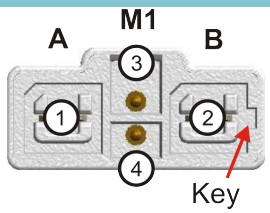
See also:
To reset the battery usage statistics on the LiNX Access iOS tool, see *9.1.3.1 Battery usage*
To reset the battery usage statistics on the LiNX Access PC tool, see *9.2.3.3 Battery usage*

For more information about the programming and diagnostic tools, see the LiNX Access iOS Tool User Manual and the LiNX Access PC Tool User Manual.

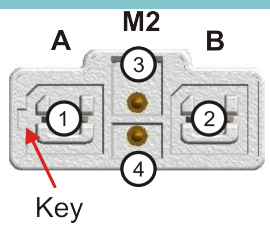
5.6 Motors

5.6.1 Motor connectors

LiNX power modules have two motor connectors: M1 and M2. Each motor connector has two motor pins (A and B), as well as two park brake pins (Positive and Negative). The motor connectors can be 'keyed' so they cannot be swapped or inserted incorrectly.

M1 Motor Connector (PM40, PM50, PM60, PM75, PM120)	
 Figure 15: M1 motor connector	

Pin	Function
1	Motor A
2	Motor B
3	Park Brake Negative (PB-)
4	Park Brake Positive (PB+)

M2 Motor Connector (PM40, PM50, PM60, PM75, PM120)	
 Figure 16: M2 motor connector	

Pin	Function
1	Motor A
2	Motor B
3	Park Brake Negative (PB-)
4	Park Brake Positive (PB+)

5.6.2 Motor cables

Motor leads should be as short as possible; the heavier the wire gauge, the better the wheelchair performance will be.

Min Wire Size	Max Length (at min wire size)	Notes
3 mm^2/12 AWG	400 mm	Wire length can be increased if wire gauge is increased. Increase 0.5 mm^2 csa for each additional 200 mm in additional length. The recommended motor contacts (GCN0781) will crimp wires in the range 3 mm^2 / 12 AWG to 6 mm^2 / 10 AWG csa. If your motor only has 2.5 mm^2 / 13 AWG wire, then double over the wire in the crimp contact to ensure a good crimp.

Warning:
The cable size, insulation and connectors should be selected to ensure that any temperature rise during fault conditions does not result in visible damage or temperatures in excess of the dry rated temperature.

5.6.3 Motor wiring

These notes are in addition to the "General Wiring Notes and Recommendations" described in section *5 Installation and wiring*.

1. M1 is typically connected to the right motor, and M2 to the left motor. To swap the left and right motor connection, set Swap (see section *7.2.2.6 Swap*) to 'On'.
2. It is recommended that the left and right motor harnesses, M1 and M2, are of equal length.

3. The length and gauge of wire affects its resistance. The Motor Resistance parameter (see section *7.2.2.3 Motor Resistance*) compensates for the resistance of the motor and the resistance of the motor wiring. If the motor wiring is changed, make sure that the wheelchair still drives safely using the tests that are described in the Motor configuration section (see section *5.6.4 Motor configuration*).
4. Left and right motor connectors must not be physically interchangeable. The preferred method to ensure this is to use the keyed motor connectors. However, alternative methods to prevent transposing the motor wiring can be used, such as cable tying the wiring in a suitable position.

If necessary, the motor connections can be swapped when programming the LiNX system. For this reason, the connectors are not labelled Left and Right, but M1 and M2.

5.6.4 Motor configuration

5.6.4.1 Setting motor resistance

Set the **Motor Resistance** parameter (see *7.2.2.3 Motor Resistance*) to the correct motor resistance value of the installed motors.

The **Motor Resistance** parameter affects the performance of all speed and acceleration parameters. For this reason, set **Motor Resistance** to the correct value before you program any of the speed and acceleration parameters. If **Motor Resistance** is changed after the wheelchair has been set up, the complete programming and testing procedure must be repeated. The table below shows typical wheelchair behaviour based on the **Motor Resistance** setting.

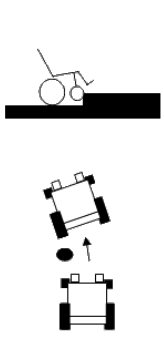
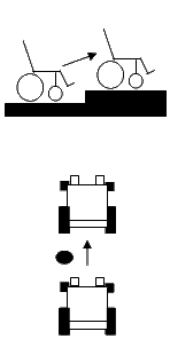
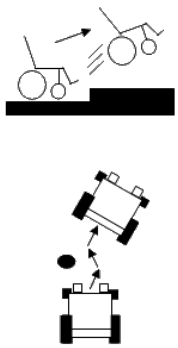
	Motor Resistance		
	Too low	**Correct**	**Too high**
Chair behaviour	• Drives like it is going through thick mud • Slows down when it goes up a sidewalk edge or up a ramp • Slows down with heavier users • Changes direction when it drives over a bump • Changes direction when the weight of the user shifts	• Drives smoothly • Keeps the speed reasonably constant. Only slightly slows down on a slope • Keeps the direction constant. Only slightly changes direction when it drives over a bump	• Drives very roughly, nervously • Hard to steer or control, vibrates • Swerves when it drives over a bump. • Motor becomes hotter than normal very easily, decreased motor life
			

Figure 17: wheelchair behaviour vs. motor resistance setting

If the wheelchair performs poorly on carpet or at low speeds, the most probable cause is a **Motor Resistance** value that is set too low.

Note:
*The LiNX system features **Dynamic Load Compensation**, a new patented drive technology that adjusts load compensation relative to current (Ampere) demand. For Dynamic Load Compensation to work effectively, it is important that you set up the **Motor Resistance** parameter accurately.*

5.6.4.2 Determining the correct motor resistance based on the wheelchair behaviour

Note:
It is important that both motors have approximately the same motor resistance and motor cable length. This is particularly important on front wheel drive chairs.

Tools needed

1. A wheelchair with a LiNX system controller fitted.
2. An iOS device with the LiNX Access iOS application or a laptop with the LiNX Access PC tool installed.
3. A slope that you can drive up and on to.

Procedure

- Set **Motor Resistance** to 20.
- Drive the wheelchair onto a slope and increase the **Motor Resistance** value until the wheelchair does not roll back after it has stopped on the slope.

Note:

1. *This test procedure causes the motor to become hot. For this reason, the resulting value for **Motor Resistance** will be too high. Reduce the found **Motor Resistance** by 20%, and perform a driving test when the motors are cold to make sure that the wheelchair is still comfortable to drive.*

2. *A new motor usually has a higher motor resistance than a motor that has been used for some time, because the motor brushes that are inside the motor do not make optimal contact until they are worn in. If possible, perform this procedure after the motor has been used for several hours.*

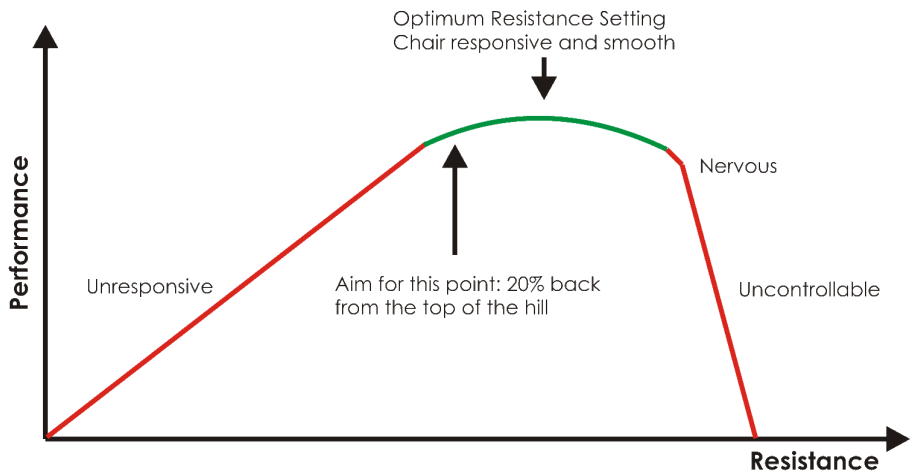


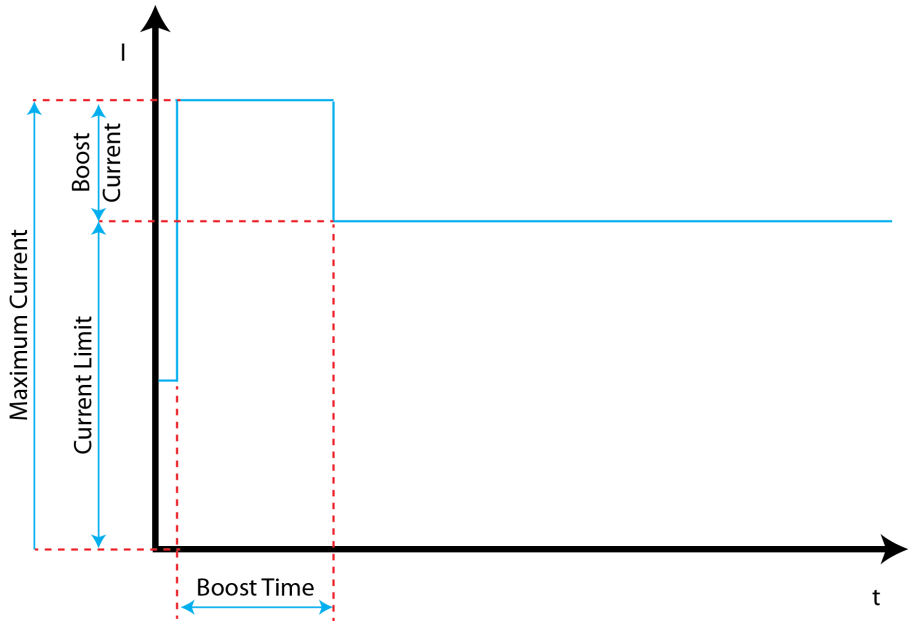
Figure 18: Optimum resistance setting

5.6.4.3 Setting output current

The OEM can configure the power module's output current with three programmable parameters:

- *Current Limit*
- *Boost Current*
- *Boost Time*

These parameters are shown in the graph below.



The power module's maximum current output is specified as the *Maximum Current* — for example, 43 A for PM40, or 53 A for PM50. The Maximum Current is the sum of the *Current Limit* and the *Boost Current* , where the Current Limit and Boost Current can have any value within their specified ranges (see section *7 Parameters*) as long as the sum of the two values does not exceed Maximum Current.

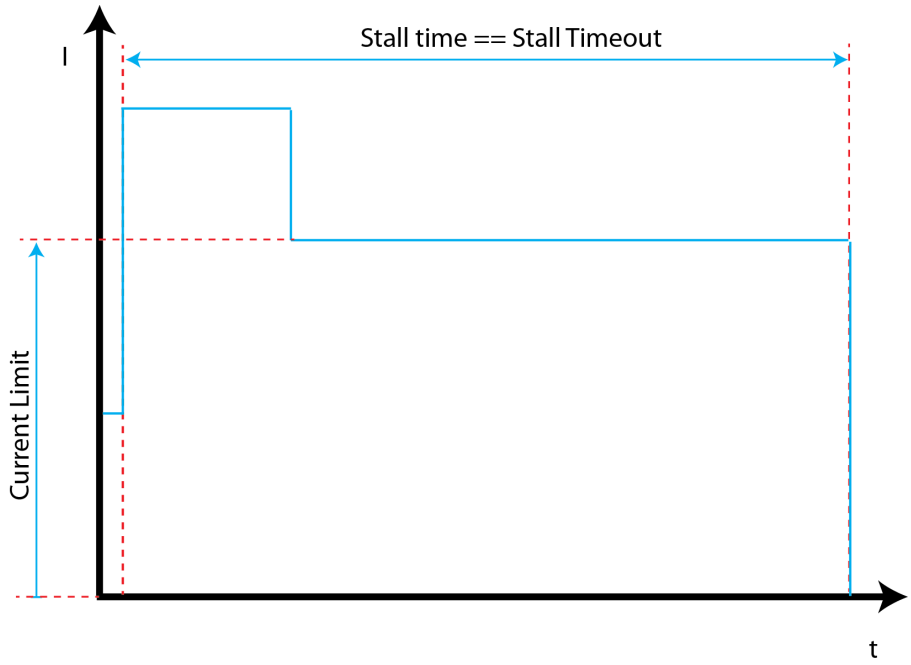
Note:
If Boost Current is set to zero, then the Maximum Current is equal to the Current Limit.

The Current Limit specifies the highest operating current that the power module can deliver to the motors under normal loads, while the Boost Current specifies an additional current that is applied to give the motors a boost to overcome transient loads such as starting on a hill, overcoming castor lock, or climbing obstacles.

The Boost Current is applied for a maximum time set by Boost Time. If a power module applies Boost Current for the time set by Boost Time, the power module's current output is reduced to the Current Limit setting — that is, the Boost Current is removed. Before Boost Current can be applied again, the motor current must stay below the value of Current Limit for at least twice the length of time that it was above the Current Limit.

To prevent motors from overheating if they stall (see note below), LiNX power modules will disable the drive after a specified time. The specified time is set by the *Stall Timeout* parameter and is triggered when the motor current reaches the Current Limit. If the current drawn by the motors remains at the Current Limit for the duration set by Stall Timeout, then the current to the motors will

be set to zero to prevent any further driving. However, if the motor current drops below the Current Limit before Stall Timeout expires, then the Stall Timeout timer is reset, and driving can continue.



Note:
Motor stalling can cause motor damage if the motor becomes too hot. Motor stalling occurs when the motors do not rotate and the maximum current (as set by the Current Limit parameter) is drawn by the motors continuously. Motor stalling can be caused by physical obstacles preventing the wheelchair from moving, or faults with the motor itself.

To protect the power module's electronic components, the output current will be reduced further if the power module becomes too hot, depending on the settings of the thermal rollback parameters (see section *7.2.2.11 Thermal Rollback* and *7.2.2.12 FET Thermal Rollback*).

5.7 Park brakes

5.7.1 Park brake connectors

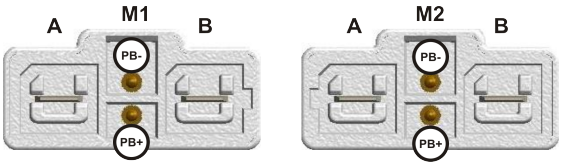


Figure 19: Park brake connections

The park brake connection pins are located within the motor connector sockets (M1 and M2) of the power module. The park brake negative (PB-) terminal is located centre-top, and the park brake positive (PB+) terminal is located centre-bottom.

The LiNX system supports both 24 V and 12 V park brake wiring, and can also be configured for dual and single operation, as described below.

5.7.2 Two 24 V park brakes – dual, M1 and M2

In the dual configuration, each park brake is driven from a separate output.

For this configuration, set the Dual Park Brake Test parameter (see section *7.2.3.1 Dual Park Brake Test*) to 'Dual'.

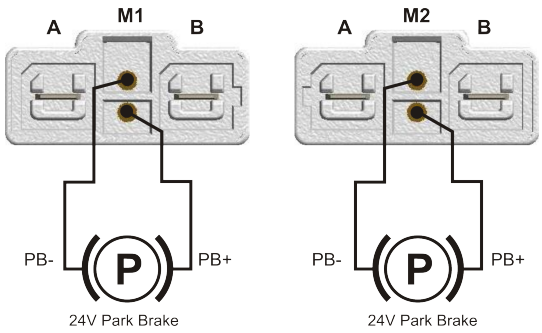


Figure 20: Two 24 V park brakes

5.7.3 One 24 V park brake – single, M1 only

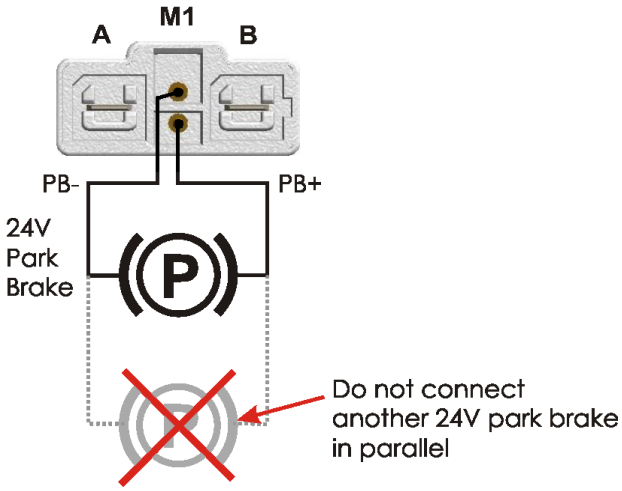


Figure 21: One 24 V park brake – single, M1 only

In the single configuration the park brake is driven from the M1 output only.

For this configuration, set the Dual Park Brake Test parameter (see section *7.2.3.1 Dual Park Brake Test*) to 'Single'.

Warning:
For 'Single' configurations, do not connect a second 24 V park brake in parallel to M1, because an open-circuit fault can only be detected if the fault occurs in both park brakes at the same time. Always use the 'dual' configuration for two 24 V park brakes.

Note:
1. *If in the 'Single' configuration and the park brake is connected to M2 instead of M1, a Left Park Brake Error (Flash code 5) will occur.*
2. *If the Dual Park Brake Test parameter is set to 'Dual' in this configuration (with no park brake connected to*

M2), a Right Park Brake Error (Flash Code 6) will occur. See section 9.3 Error indication.

5.7.4 Two 12 V park brakes

If the power wheelchair has two 12 V park brakes, both can be driven from a single 24 V output by connecting the 12 V park brakes in series. Alternatively, the 12 V park brakes can be connected across both park brake outputs. In the latter case, the park brakes will be driven from the PB+ output of M2.

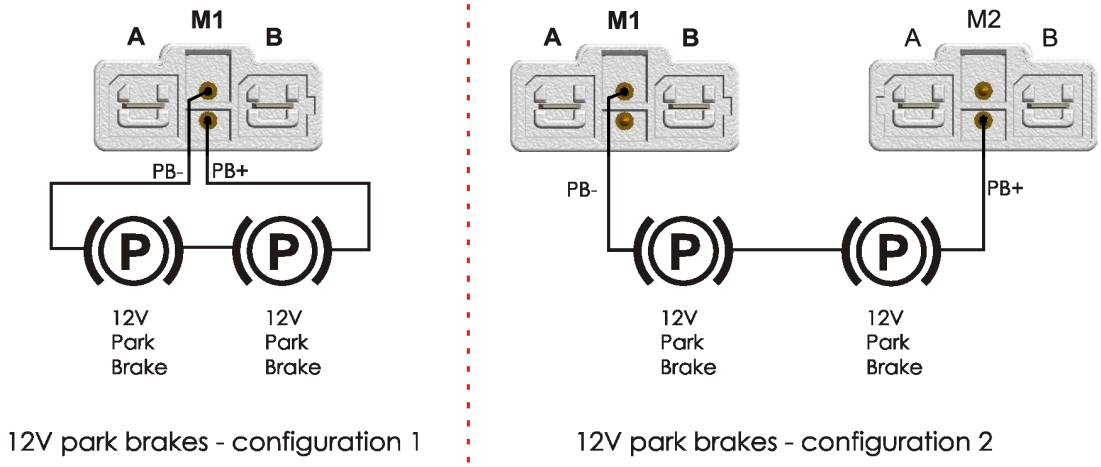


Figure 22: 12 V park brake configurations

For both these configurations, set the Dual Park Brake Test parameter (see section *7.2.3.1*) to 'Single'.

Note:
Configuration 1: if the park brakes are connected to M2 instead of M1, a Left Park Brake Error (flash code 5) will occur.

Configuration 2: if PB+ is connected to M1 instead of M2, a Left Park Brake Error (flash code 5) will occur.

Both configurations: if the Dual Park Brake Test parameter is set to 'Dual', a Right Park Brake Error (flash code 6) will occur. See section 9.3 Error indication.

5.7.5 Manual park brake release switch

If a manually operated park brake release switch is fitted, then a suitable suppression device should be placed across each park brake.

The suppression device prevents the generation of high voltage transients causing possible damage to the power module or to the park brake release switch itself. A list of suitable devices is shown in the table below.

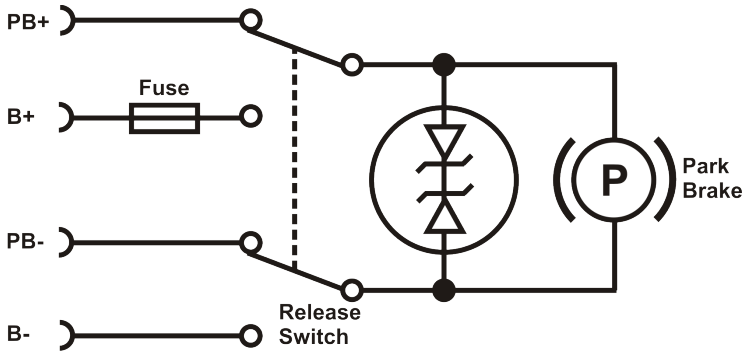


Figure 23: Manual park brake release switch

For safety, if the park brake is manually released, the wheelchair will not be able to drive.

Motorola	NXP
3EZ39D5	BZX70C36
3EZ36D5	BZX70C39
1N5365A	BZT03C36
1N5366A	BZT03C39

Warning:
The park brake release should not be operated on a slope.

5.7.6 Mechanical park brake release

To make it possible to manually push the wheelchair if the battery is flat, some form of mechanical clutch or park brake release is required. For safety, if the park brake is mechanically released, the wheelchair will not be able to drive.

One way to achieve this is to put a switch that disconnects the park brake from the power module in the mechanical park brake release. When the park brake is disconnected from the power module, a Park Brake Error will occur and the power wheelchair will not be able to drive.

Warning:
The park brake release should not be operated on a slope.

5.8 The utility connector

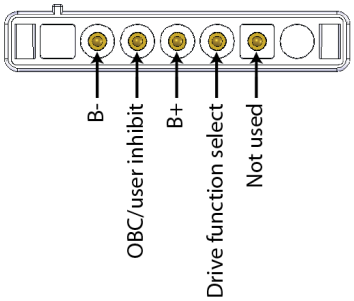


Figure 24: The utility connector

The utility connector is available on the LiNX 100 (and later) series power modules and can be used for:

- connecting an on-board battery charger
- connecting a user drive inhibit
- selecting additional drive functions

Note:
To disconnect the utility connector from the power module, disconnect the M1 motor connector first.

5.8.1 Cables and wire size

Min Wire Size	Max Length (at min wire size)	Notes
2.2 mm^2/ 14 AWG	1.5 m	The utility connector uses the following connector housing: DLX-PM 7W Utility CONN Housing: 54992 Suitable crimps for the connector are: GCN0794 / GCN0793 The Min Wire Size and Max Length values are specified here for the B- (pin 1) and B+ (pin 3) connections. The other connections are for low power circuits, and therefore the wire gauge for these connections can be lighter - 0.5 mm^2 is recommended as a minimum.

Warning:
The cable size, insulation and connectors should be selected to ensure that any temperature rise during fault conditions does not result in visible damage or temperatures in excess of the dry rated temperature.

5.8.2 Connecting an on-board battery charger

The LiNX 100 series power modules can be connected to an on-board charger (OBC) via the utility connector, as shown below.

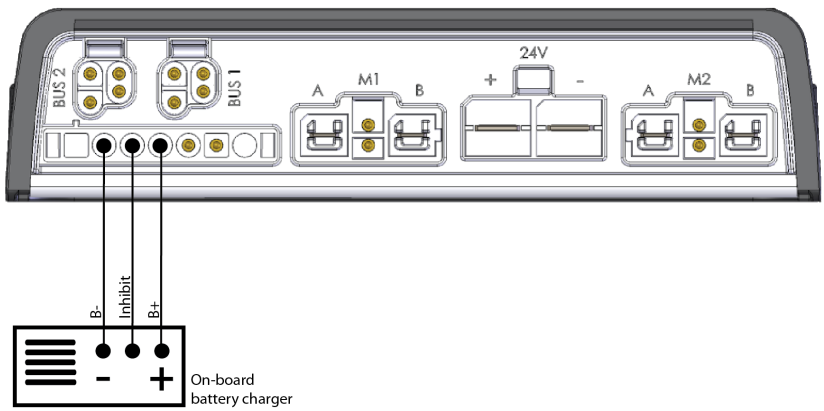


Figure 25: Battery charging with an on-board charger

Connect the utility connector to the OBC as follows:

Utility connector	OBC	Function
Pin 1 (B-)	B-	Battery negative
Pin 2 (inhibit)	Drive Inhibit	Drive inhibit when charging
Pin 3 (B+)	B+	Battery positive

The OBC must be wired with a Drive Inhibit connection, as shown in *Figure 25*, to prevent the wheelchair driving whenever the OBC is powered up. The OBC's Drive Inhibit signal must be capable of shorting or opening the inhibit signal on pin 2 of the utility connector with respect to Battery Negative (B-).

***Note**:*
It is the OEM's responsibility to ensure that any configurable interface pin that is to be used as a Battery Charger Inhibit pin is correctly configured and tested.

Set the *User Input Inhibit Mode* parameter to either **N/O OBC (Normally Open)** or **N/C OBC (Normally Closed)** depending on the type of inhibit on the OBC.

If the OBC's Drive Inhibit can short the inhibit signal to B- when the OBC is powered up, then set User Input Inhibit Mode to **N/O OBC (Normally Open)**.

If the OBC's Drive Inhibit can open the inhibit signal with respect to B- when the OBC is powered up, then set User Input Inhibit Mode to **N/C OBC (Normally Closed)**.

5.8.3 Connecting a user drive inhibit

Pin 2 on the utility connector can be used for either an on-board charger inhibit (see *5.8.2 Connecting an on-board battery charger*) or a general purpose user inhibit. When using as a general purpose user inhibit, the user inhibit circuit can use a normally open switch or a normally closed switch, as shown below.

Figure 26: Connecting a user drive inhibit using a normally open switch (left) and a normally closed switch (right)

Before the user inhibit is used, the *User Input Inhibit Mode* parameter has to be configured for this type of input. With a LiNX programming tool, set the User Input Inhibit Mode parameter to either

N/O Drive Inhibit (Normally Open) or **N/C Drive Inhibit (Normally Closed)** depending on the type of user inhibit switch used.

If the user inhibit circuit uses a normally open (NO) switch, then set User Input Inhibit Mode to **N/O Drive Inhibit (Normally Open)**.

If the user inhibit circuit uses a normally closed (NC) switch, then set User Input Inhibit Mode to **N/C Drive Inhibit (Normally Closed)**.

5.8.4 Setting up and selecting additional drive functions

Wheelchairs using the LiNX 100 (and later) series systems can be programmed with additional drive functions. A drive function is a configuration of parameters that gives a user an alternative way a wheelchair will drive. This means that a user can select a drive function that suits, for example, their environment (indoors, outdoors, carpet etc.), or their ability (learner, accomplished etc.) or their speed (fast drive, slow drive etc).

See also:
For more information about drive functions, see section 6.3 Drive functions and chair configurations.

To select a different drive function, the user toggles a switch that is connected to the Drive Function Select input on the power module's utility connector (see *Figure 27*).

To set up an additional drive function, you will need to carry out the following tasks:

1. Install a drive function selection switch
2. Set up the utility connector
3. Configure the drive function with one of the programming tools

These tasks are described below.

5.8.4.1 Install a drive function selection switch

Install a drive function selection switch for the user to toggle between drive functions.

Connect a normally-open switch between pin 4 (function select) and pin 1 (B-) on the utility connector, as shown in the diagram right.

When the switch is open, drive function 1 will be selected. When the switch is closed, drive function 2 will be selected.

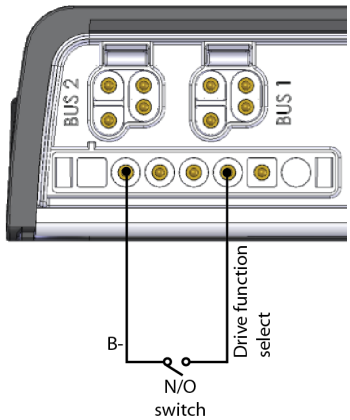


Figure 27: Drive function selector switch

5.8.4.2 Set up the utility connector

Pin 4 on the utility connector (see *Figure 28*) is used for the Drive Function Selection input.

To use this input pin, set the Function Controller Mode parameter to **Control I/O Enabled** - see *7.2.1.11 Function Controller Mode*.

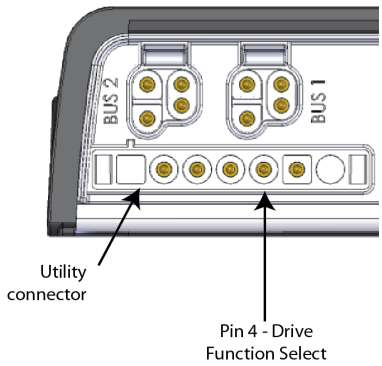


Figure 28: Drive Function Select on the utility connector

If this input pin is **disabled**:

- Drive 1 parameters will always be selected for the drive function.

If this input pin is **enabled**, Drive 1 function will be selected if:

- the user switch is open, or
- the state of the pin cannot be determined, or
- an error is detected on the input.

If this input is **enabled**, Drive 2 function will be selected if:

- the user switch is closed.

5.8.4.3 Configure the drive function

The LiNX 100 series has two drive functions available for programming: Drive Function 1 and Drive Function 2; both drive functions have identical settings by default at the time of manufacture. These can be programmed using either the LiNX Access PC or the LiNX Access iOS tools. This is detailed in section *6.3 Drive functions and chair configurations*.

See also:
See the LiNX Access iOS Programming and Diagnostic tool manual and the LiNX Access PC Programming and Diagnostic tool manual for more details on programming drive functions.

6 Programming

Warning:
Performance adjustments must only be made by healthcare professionals or by persons who completely understand the adjustment process and the capabilities of the wheelchair user.

Before upgrading the firmware of the system, or a module in the system, always ensure that the battery charge level is sufficient and the park brakes are not manually or electronically released.

Incorrect settings, or programming in a location that is not safe, can cause injury to the user and bystanders, or damage to the wheelchair and surrounding property.

After you have configured the wheelchair, check to make sure that it performs to the specifications entered in the programming procedure. If the wheelchair does not perform to specifications, reprogram it. Repeat this procedure until the wheelchair performs to specifications. If the wanted operation cannot be reached, contact your service agent.

Ensure that the deceleration parameters are always higher than the acceleration parameters for a safe response.

It is the responsibility of the health care professional to make sure that the user is capable of both cognitively understanding and physically operating the programmed features and functions.

With inappropriate programming settings, certain features and options may not be accessible or perform as expected.

Where any inconsistencies about wheelchair status occur between the LiNX system and that reported by a programming tool, the user should take the status as reported by the LiNX system as correct.

6.1 Programming tools

The LiNX system is programmed during manufacture with default settings. These settings can be modified with a programming tool to suit the end user.

The LiNX system can be programmed with one of three programming and diagnostic tools:

- The LiNX Access iOS tool (see section *6.1.1*)
- The LiNX Access PC tool (see section *6.1.2*)
- The DX-HHP (hand-held programmer) (see section *6.5*)

The programming and diagnostic tools communicate with a LiNX system over Bluetooth. The Bluetooth capability of a LiNX system is provided by a LiNX Access Key inserted into the remote module's XLR socket.

Both the iOS and PC programming tools offer a **Live Update** mode that allows certain parameters to be programmed, and take effect, while the system is live (e.g. while driving). For more information, see section *6.1.4 Live Update mode*.

6.1.1 The LiNX Access iOS tool

LiNX Access iOS is the programming and diagnostics tool used with Apple's iPhone, iPad and iPod touch.

The LiNX Access iOS tool connects wirelessly via Bluetooth to a LiNX controller to read and write programs, and view diagnostic information.

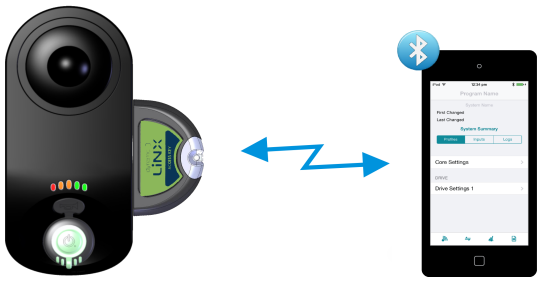


Figure 29: Programming and diagnostics with the LiNX Access iOS tool

A LiNX Access Key (see section *6.1.3 LiNX Access Key*), connected to the XLR socket of a remote module, is required to allow the LiNX Access iOS to communicate via Bluetooth with a LiNX controller.

See also:
Visit the Dynamic Controls website for more information on the LiNX product range, the LiNX Access iOS tool, and the LiNX Access Key: www.dynamiccontrols.com

6.1.2 The LiNX Access PC tool

LiNX Access PC is the programming and diagnostics tool used with Windows-based PCs or laptops.

The LiNX Access PC tool connects wirelessly, via Bluetooth, to a LiNX system to read and write programs, and view diagnostic information. If your PC does not have built-in Bluetooth, then a Bluetooth adaptor plugged into a spare USB port can be used instead.

The LiNX LE and 100 series require a LiNX Access Key (see section *6.1.3 LiNX Access Key*) to communicate with the LiNX Access PC tool.

The LiNX Access Key, which provides the Bluetooth connection, is inserted into the remote module's XLR socket, as shown in *Figure 30*.

Figure 30: Programming and diagnostics with the LiNX Access PCtool using a LiNX Access Key

See also:
Visit the Dynamic Controls website for more information on the LiNX product range, the LiNX Access PC tool, and the LiNX Access Key: www.dynamiccontrols.com

6.1.3 LiNX Access Key

The LiNX Access Key provides the Bluetooth connection for a programming tool to communicate with a LiNX system.

Figure 31: The DLX-HKEY01-A (orange), DLX-HKEY02-A (green)

There are two versions of the LiNX Access Key. The version determines the level of access you have to programming. It is restricted for supply to:

- **Distributors**: Dealers, therapists and wheelchair service agents (DLX-HKEY01-A)
- **Manufacturers**: OEMs and certain service agents (DLX-HKEY02-A)

The LiNX Access Key plugs directly into the remote module's XLR connector (as shown below).

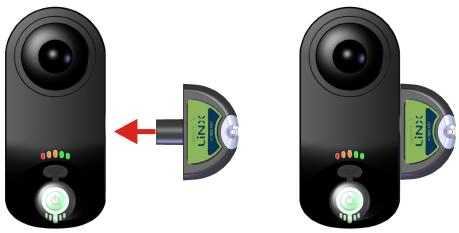


Figure 32: Inserting the LiNX Access Key into the REM050

Figure 33: Inserting the LiNX Access Key into the REM060

***Note**:*
The LiNX Access Key has a blue status indicator to show you when it is:

1. *powered up, but not connected (indicator flashes slowly),*
2. *connecting (indicator flashes quickly) or*
3. *connected (indicator permanently on).*

If the blue status indicator turns completely off while you are trying to connect, or while you are connected, remove the LiNX Access Key from the remote module, wait for 5 seconds, and then reinsert it into the remote module before trying to connect again.

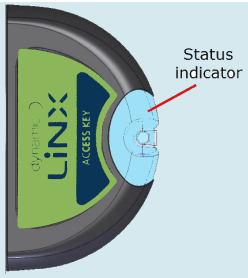


Figure 34: The LiNX Access Key's status indicator

Before the programming tools can be used for programming and diagnostics, you will need to pair the devices, which is the process of connecting the devices via Bluetooth (see section *6.1.3.1 Pairing*). The pairing process differs depending on the programming tool that is used.

Figure 35: Communicating via Bluetooth

Note:

- the LiNX Access PCtool runs on a laptop or PC.
- the LiNX Access iOS tool runs on an iOS device, such as iPhone or iPod touch.

***Warning**:*

- *The LiNX Access Key is recommended for indoor use only.*
- *The LiNX Access Key must not be plugged in when in radio frequency (RF) sensitive environments (for example, inside hospitals).*
- *Always inspect the LiNX Access Key for damage before using it.*
- *Ensure that the LiNX Access Key is fully inserted into the XLR socket before use.*
- *Confirm that the connection is made to the wheelchair that is to be programmed by checking the LED on the LiNX Access Key.*
- *Take care while driving around during tuning of the wheelchair not to damage the LiNX Access Key by hitting a solid object. Always keep a clear distance from any objects that could damage the LiNX Access Key.*
- *The surface of the LiNX Access Key can get hot if left in direct sunlight for long periods.*
- *Do not leave the LiNX Access Key connected to the system when it is to be stored for a long time, as the Access Key will continue to draw power from the batteries when the system is off. If left in place, the expected storage life of the system will not be met and the batteries may be damaged.*

***Note**:*
If the LiNX Access Key is plugged into the remote module's XLR connector but the LiNX Access Key's blue LED remains off, then unplug it from the remote module and then plug it back in again.

6.1.3.1 Pairing

Pairing is the process of establishing a Bluetooth connection between the LiNX Access Key and the programming tool (LiNX Access iOS or LiNX Access PC). Generally, you will only need to pair the LiNX Access Key with your programming tool once. When you have successfully paired the Access Key, the programming tool will recognise the Access Key whenever it is inserted into an XLR port.

To pair the LiNX Access Key with an iOS device (before iOS 6):
From the iOS device's home screen, select:

Settings→General→Bluetooth

From the Bluetooth screen, switch on Bluetooth. Your iOS device will start searching for nearby Bluetooth devices. Select the appropriate LiNX Access Key when it is displayed in the Bluetooth list.

After selecting your LiNX Access Key, your iOS device will ask you to enter a PIN number. Enter **1234**, and then press the **Pair** button.

To pair the LiNX Access Key with an iOS device (iOS 6 and later):
For devices with iOS 6 and later, pairing is performed automatically with the LiNX Access iOS tool when you attempt to connect to a controller.

To pair the LiNX Access Key with a PC or laptop:
Pairing is performed automatically with the LiNX Access PC tool when you attempt to connect to a controller.

6.1.4 Live Update mode

Both programming tools offer a **Live Update** mode that allows certain parameters to be programmed "on the go", taking immediate effect. This is useful for speeding up the process of, for example, setting up or testing various applications and scenarios.

Warning:
When in Live Update mode, changes to parameters will take immediate effect and therefore, the performance of the wheelchair is changed immediately.

Warning:
There is no function to undo a change in Live Update mode, so make sure you save a copy of the existing program so that you can restore settings if you need to.

Not all parameters can be updated in Live Update mode. The parameters that can be updated in Live Update mode are identified in the parameter list (see section *7.1 Parameter list*) with the symbol shown right.

Figure 36: Live Update mode

By default, Live Update mode is enabled when either programming tool is started.

To toggle the Live Update mode on the LiNX Access iOS tool, tap on the **Live Update** button, shown below.

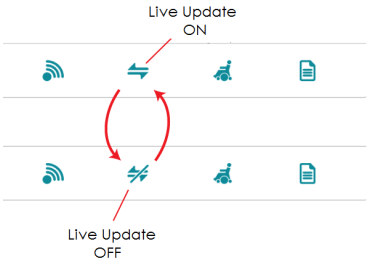


Figure 37: Toggling Live Update mode with the LiNX Access iOS tool

To toggle the Live Update mode on the LiNX Access PC tool, click on the toolbar's **Live Update** mode button (shown below), or click on the **Wheelchair** menu, and then select **Enable Live Update Mode**.

Figure 38: Toggling live update mode with the LiNX Access PC tool

***Note**:*

Parameters that do not have the Live Update feature will only become effective in the system after:

1. *they have been written to the system, and*
2. *the system has been power-cycled (that is, the system is powered down and then powered up).*

Therefore, the LiNX Access programming and diagnostic tools will automatically initiate a system power-cycle after a write command.

Note that previous versions of the LiNX Access iOS tool did not support automatic power-cycling after a write command, and therefore, the user was responsible to perform the power-cycle.

6.2 Firmware Upgrade

Warning:
Before powering up in Firmware Upgrade mode, ensure that the battery level is not low, and the wheelchair is in a safe and stable state by, for example, placing it on blocks to elevate it from the ground.

***DO NOT** power up the wheelchair in Firmware Upgrade mode when the wheelchair is on a slope, or when the park brakes are disengaged.*

The firmware in the power module, remote module and Access Key can be upgraded when new firmware is available, and if the Firmware Upgrade parameter is enabled (see section *6.2 Firmware Upgrade*).

Note:
The Firmware Upgrade parameter is set by the wheelchair manufacturer, so the firmware upgrade feature may not be available to all LiNX Access tool users. If this is the case, and one or more modules require firmware upgrading, then the modules should be returned to the manufacturer or a Dynamic Controls' service centre.

The firmware upgrade function is performed with one of the programming and diagnostic tools:

- The LiNX Access iOS tool (see section *6.2.1 Firmware upgrading with the LiNX Access iOS tool*)
- The LiNX Access PC tool (see section *6.2.2 Firmware upgrading with the LiNX Access PC tool*)

6.2.1 Firmware upgrading with the LiNX Access iOS tool

To enter Firmware Upgrade mode, tap on the **wheelchair** icon, and then tap on the **Upgrade** menu button. The screen will display "Entering Firmware Upgrade Mode. Please Wait…"

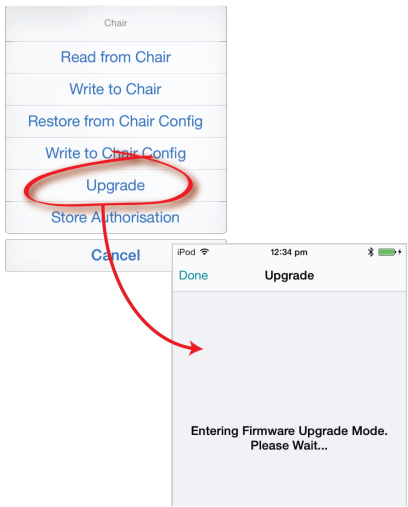


Figure 39: Selecting Upgrade Mode

Warning:
Do not power down the remote module or disconnect the LiNX Access Key during a firmware upgrade. An incomplete firmware upgrade will require the recovery sequence to be performed. See section 6.2.3 Incomplete firmware upgrade recovery sequence.

Note:
If firmware upgrade is not permitted, the 'Upgrade' menu button will not be available.

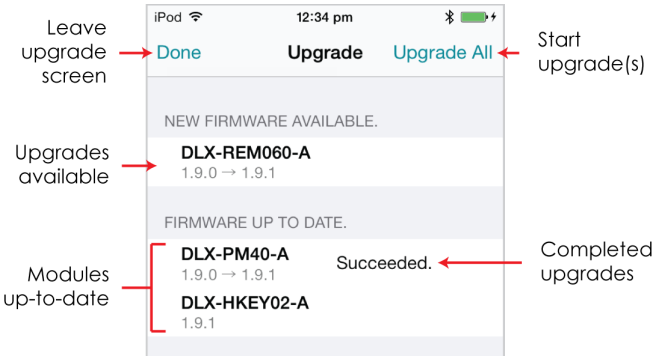


Figure 40: Firmware Status

If the connected modules are up to date, the screen will display "Firmware Up to Date" and a list of the connected modules and their respective versions – tap on the **Done** button at the top-left of the screen.

If one or more modules need upgrading, then either select the modules individually, or tap on the **Upgrade All** button on the top-right of the screen.

Note:
If any module upgrade fails for any reason, the upgrade process will abort immediately, without upgrading any other remaining modules.

During a module upgrade, a progress bar is displayed. Once the upgrade has completed, a notification is displayed (succeeded or failed) to the side of the module name. Press the **Done** button and the system will revert from Firmware Upgrade mode, to normal operating mode.

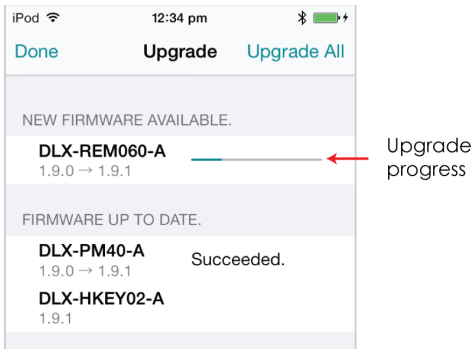


Figure 41: Module Upgrade Progress

6.2.2 Firmware upgrading with the LiNX Access PC tool

To enter Firmware Upgrade mode, click on the **Wheelchair** drop-down menu, and then select **Firmware Upgrade**.

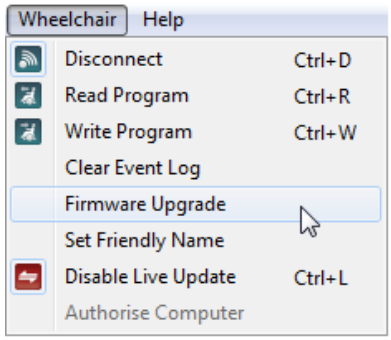


Figure 42: PC Firmware Upgrade mode

Warning:
Do not power down the remote module or disconnect the LiNX Access Key during a firmware upgrade. An incomplete firmware upgrade will require the recovery sequence to be performed. See section 6.2.3 Incomplete firmware upgrade recovery sequence.

Note:
If firmware upgrade is not permitted, an error message is displayed and the upgrade aborted.

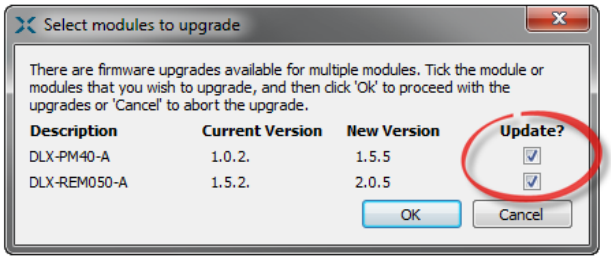


Figure 43: Select modules to upgrade dialogue box

After selecting 'Firmware Upgrade', the 'Select modules to upgrade' dialogue box is displayed (shown left). If one or more modules need upgrading, then select the modules by checking the check box next to their name. Press the **OK** button to start upgrading, or **Cancel** to abort the process.

Note:
If any module upgrade fails for any reason, the upgrade process will abort immediately, without upgrading any other remaining modules.

Once the upgrade has completed, a notification is displayed, and the system will revert from Firmware Upgrade mode to normal operating mode.

6.2.3 Incomplete firmware upgrade recovery sequence

If a firmware upgrade has been interrupted by powering down the system, removing the LiNX Access Key, or via a dropped Bluetooth connection before the upgrade has been completed, then the following recovery sequence will need to be performed.

1. Reconnect to the system
2. Select **Firmware Upgrade**
3. The current firmware will show as 0.0.0.0
4. Select the module to upgrade and click the **OK** button
5. Wait 3 seconds and if the upgrade does not begin then **Disconnect** from the system
6. Reconnect to the system again (before the system times out after 60 seconds)
7. Select **Firmware Upgrade**, select the module to upgrade and click the **OK** button

6.2.4 LiNX MR1 to MR2 Conversion

There are two core software versions for the LiNX system: Market Release 1 (MR1) and Market Release 2 (MR2). The MR2 version, while retaining most of the MR1's features, has a number of improvements on the MR1 system; most noticeable are the changes and additions to the programmable parameters. Because of these improvements, Dynamic Controls recommends that MR1 systems are converted to MR2 systems.

Converting a system from MR1 to MR2 is an automated process that is triggered after a firmware upgrade is performed.

Note:
With the introduction of Manufacturer-level and Distributor-level parameters with MR2, some Distributor-level parameter values may appear to change when converting a system from MR1 to MR2. For example, an MR1 Acceleration value of 25% may be converted to an MR2 Distributor level setting of 50%, but the actual acceleration rate applied to the wheelchair will be the same. This is because MR2 allows Manufacturers to select the maximum adjustable range at Distributor access level, typically a 0-100% range. For more information on how Manufacturer and Distributor levels work see section 6.2.

6.2.4.1 Converting with the LiNX Access iOS tool

If there is an MR1 module in your system, the LiNX Access iOS tool will display the following warning:

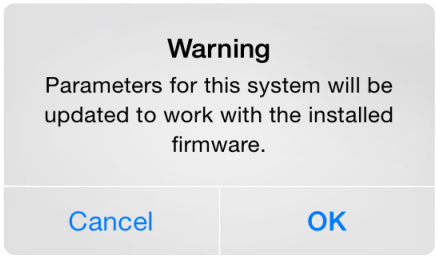


Figure 44: Parameter update required for MR1 to MR2 conversion

Tap on the **OK** button to convert the module from MR1 to MR2.

Tap on the **Cancel** button if you do not want to convert the module from MR1 to MR2.

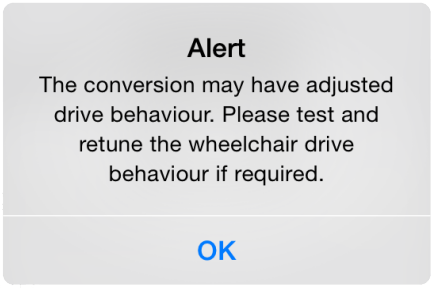


Figure 45: Alert to retune drive behaviour

It is possible that the conversion process may not be able to preserve the wheelchair's drive behaviour as defined by the original MR1 settings, so it is important that the wheelchair is fully tested and, if necessary, retuned after a conversion. If this is the case, the message of *Figure 45* will be displayed - tap the **OK** button to continue.

6.2.4.2 Converting with the LiNX Access PC tool

If there is an MR1 module in your system, the LiNX Access PC tool will display the following warning:

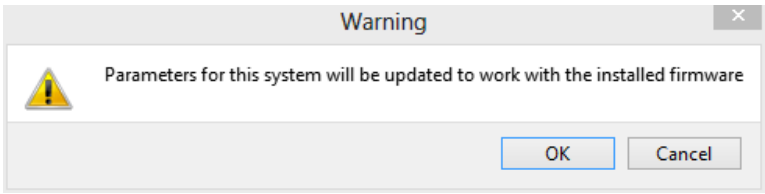


Figure 46: MR1 to MR2 conversion with LiNX Access PC tool

Click on the **OK** button to convert the module from MR1 to MR2.

Tap on the **Cancel** button if you do not want to convert the module from MR1 to MR2.

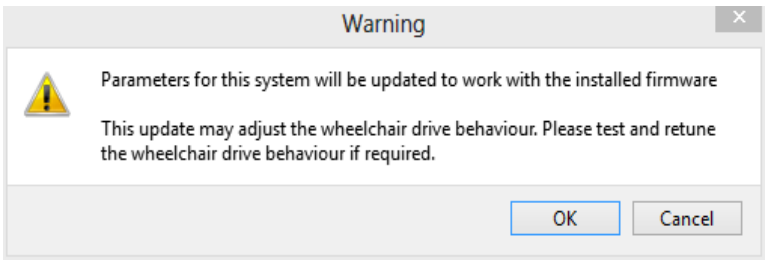


Figure 47: Alert to retune drive behaviour - LiNX Access PC

It is possible that the conversion process may not be able to preserve the wheelchair's drive behaviour as defined by the original MR1 settings, so it is important that the wheelchair is fully tested and, if necessary, retuned after a conversion. If this is the case, the message shown in *Figure 47* will be displayed - tap the **OK** button to continue.

Note:
After the conversion, ensure that the wheelchair is fully tested.

6.3 Drive functions and chair configurations

6.3.1 Overview

The LiNX 100 series supports multiple drive functions and chair configurations. The following sections describe how drive functions and chair configurations provide:

- the OEM with the ability to easily configure different wheelchair models, and
- the dealer and user with the ability to change the wheelchair's driving characteristics based on, for example, environment, speed requirements or driving ability.

The LiNX 100 series has eight chair configurations; each chair configuration supports two drive functions.

6.3.2 Drive functions

A drive function defines a wheelchair's driving characteristics based on the *Drive Settings* parameters.

The LiNX 100 series has two drive functions available — Drive Function 1 and Drive Function 2 (*Figure 48*) — that can be selected by the user via a switch. This gives a user the flexibility to adjust the driving behaviour of the wheelchair to suit their needs. For example, the user may want to switch drive functions:

- when changing environments such as when travelling indoors to outdoors, or from polished floor to carpet, or
- to match their ability (e.g. learner, accomplished), or
- to alter their overall speed requirements (e.g. fast drive, slow drive).

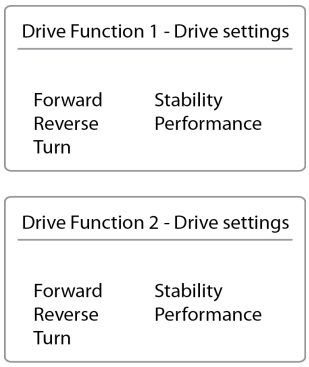


Figure 48: Drive functions

6.3.2.1 Selecting a drive function

Drive functions are selected by the user via a switch connected to the utility port. See section *5.8.4 Setting up and selecting additional drive functions* for more details.

6.3.2.2 Programming the drive functions

The drive functions can be programmed with either the LiNX Access iOS tool or the LiNX Access PC tool. A drive function is configured with the *Drive settings* parameters (see sections *7.2.5* to *7.2.10*):

- Forward
- Reverse
- Turn
- Stability
- Performance

Each drive function has its own version of these parameters and so each drive function can be programmed differently to cater for different users' requirements.

Drive Function 1 is the default drive function, and the one that the system will revert to if there is a problem detected with the drive function switch input on the utility connector.

Note:
It is recommended that Drive Function 1 is programmed with conservative values, so that if there is a fault with the switch input on the utility port, and the system reverts to Drive Function 1, then the wheelchair will operate in a safe, controlled manner and the user will be able to continue driving safely.

To program the drive functions using the LiNX Access PC tool, open the *Drive Settings* tab, and then edit the values under the *<Drive 1>* and *<Drive 2>* columns.

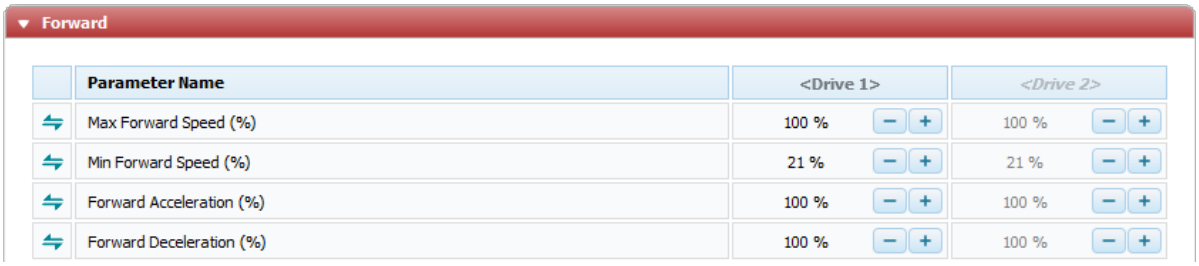


Figure 49: Programming drive functions on the LiNX Access PC tool

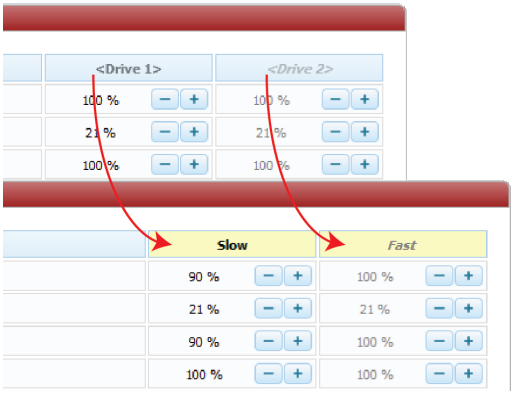


Figure 50: Changing the name of the drive function columns

The default names for the drive functions are <Drive 1>, <Drive 2>, which can be changed to something more suitable if required: click on one of the names at the top of the column (<Drive 1>, <Drive 2>) and edit the name as appropriate. In the example in *Figure 50*, *Drive 1* has been changed to *Slow*, and *Drive 2* has been changed to *Fast*.

To program the drive functions using the LiNX Access iOS tool, tap on the **Profiles** tab, select either Drive 1 or Drive 2, and then edit the parameters as required.

The default names for the drive functions are Drive 1, and Drive 2, which can be changed to something more suitable if required: tap on **Edit** at the top of the screen, and then tap on one of the names (Drive 1, Drive 2); edit the name as appropriate. In the example below, *Drive 1* has been changed to *Indoor*.

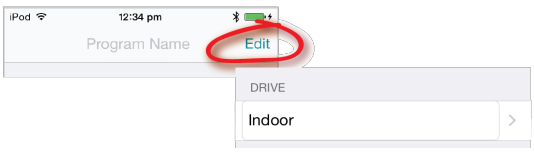


Figure 51: Changing the name of the drive function

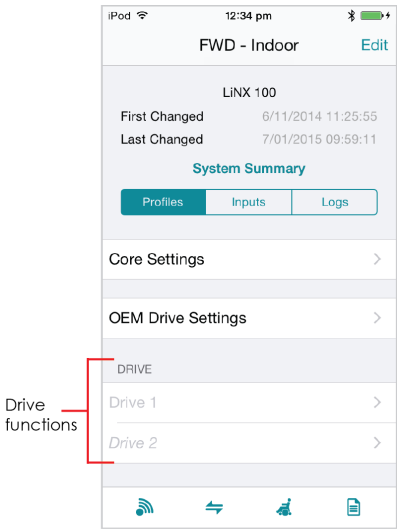


Figure 52: Programming drive functions on the LiNX Access iOS tool

See also:
See the LiNX Access iOS Programming and Diagnostic tool and LiNX Access PC Programming and Diagnostic tool manuals for more details on programming drive functions.

6.3.3 Chair configurations

A chair configuration is created by the OEM and groups together the drive functions and other programmable parameters (core settings, OEM drive settings and inputs) to define a complete and unique wheelchair configuration - see *Figure 53*.

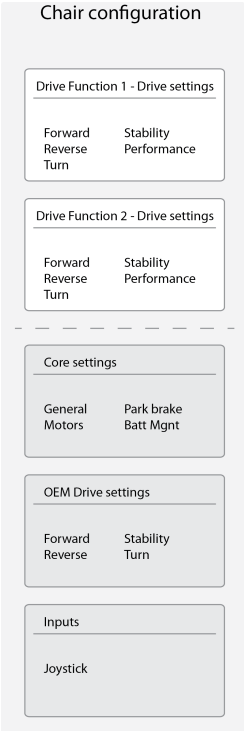


Figure 53: A chair configuration

For the LiNX 100 series, a single chair configuration will comprise:

- Drive Function 1
- Drive Function 2 (optional)
- Core Settings
- OEM Drive settings
- Inputs

The OEM can store up to eight unique chair configurations on a single power module. This is useful, for example, when the same power module is used over a range of wheelchair models (such as front- and rear-wheel drives).

The chair configurations are divided between the active chair configuration and the chair configuration store (see *Figure 54*). Only one chair configuration can be active at any one time, while there can be up to eight chair configurations in the chair configuration store.

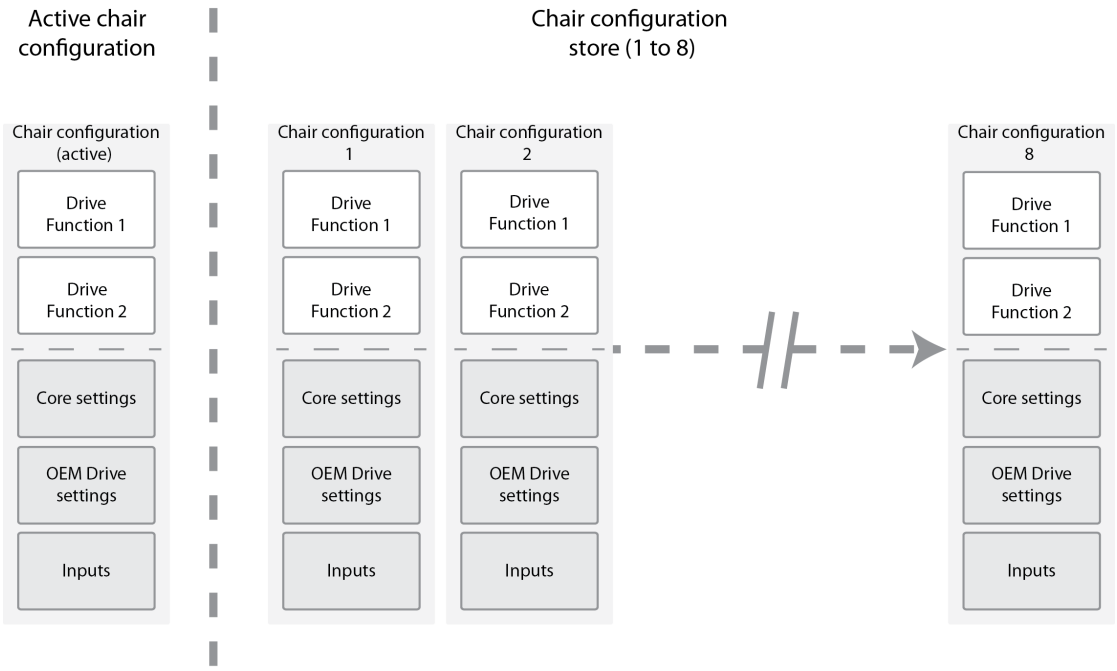


Figure 54: Active and stored chair configurations

The OEM is responsible for placing the chair configurations in the chair configuration store (see *6.3.4.1*) and setting the initial active chair configuration.

The dealer, who is responsible for configuring the wheelchair for the end user, can use or reconfigure the active chair configuration as set by the OEM, or, if preferred, select a different chair configuration from the chair store.

***Note**:*
The dealer cannot save chair configurations to the chair configuration store - only the OEM can save chair configurations to the chair configuration store.

6.3.4 Working on chair configurations with the LiNX Access PC tool

Chair configuration operations are performed in the *Chair Configurations* window (*Figure 55*). To open this window, click on the **Wheelchair** menu and select **Chair Configurations** (*Figure 56*). The Chair Configurations window will open as shown below, displaying eight "slots" where configurations can be stored.

In the example in *Figure 55*, configurations are stored in six of the eight available slots (slots 1 - 6). The final two slots (slots 7 and 8) remain free to store extra configurations.

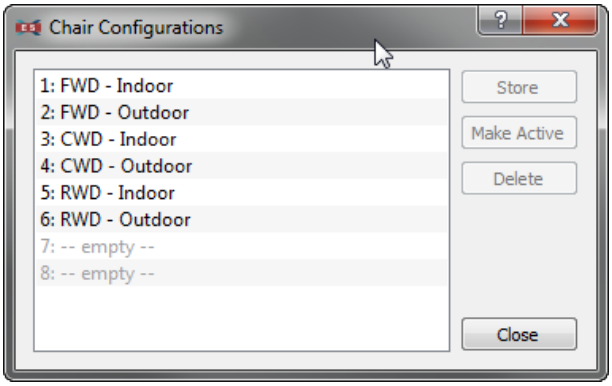


Figure 55: Chair configurations window

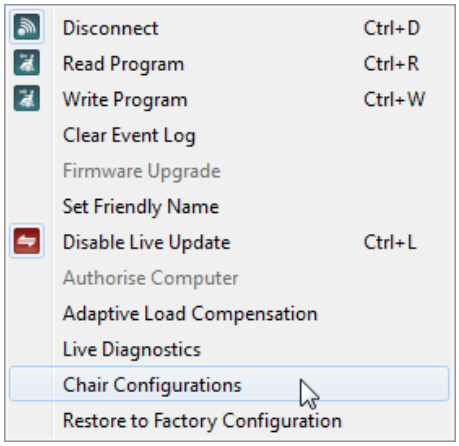


Figure 56: Selecting chair configurations

The following sections show how chair configurations are stored and retrieved. All chair configurations are stored from the active program and use the active program's name.

6.3.4.1 Storing a chair configuration

To store a chair configuration, click on a slot (1 - 8) and then press the **Store** button. The active program will be stored in the selected slot with the active program's name.

A chair configuration can be stored in an empty slot or in an occupied slot. Storing a configuration in an occupied slot will overwrite the existing configuration. If you attempt to store a configuration in an occupied slot, a message will be displayed asking you to confirm the overwrite operation. Press **Yes** to overwrite the configuration in the occupied slot, or **Cancel** to stop the process.

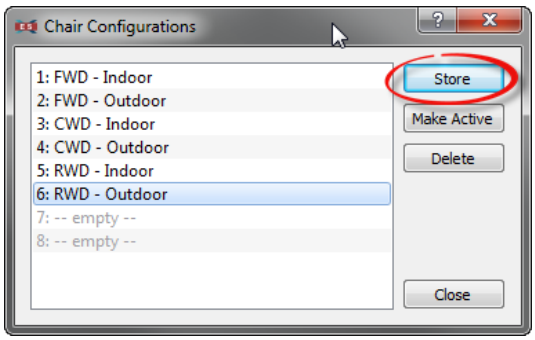


Figure 57: Storing a chair configuration

6.3.4.2 Activating a chair configuration

To make one of the stored chair configurations into the active configuration, select a named (occupied) slot in the Chair Configurations window, and then press the **Make Active** button.

A message will be displayed asking you to confirm the operation. Press **Yes** to restore the configuration from the slot, or **Cancel** to stop the process.

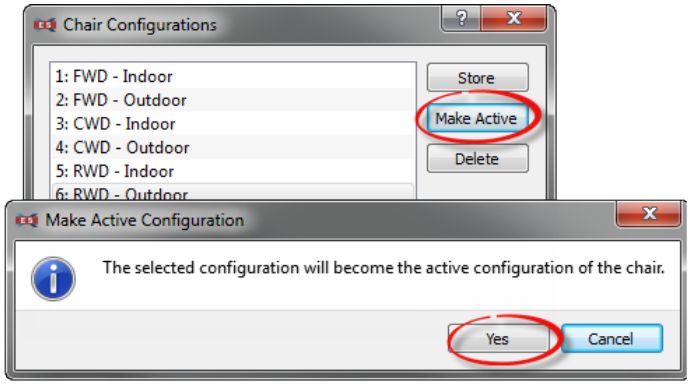


Figure 58: Restoring a configuration

6.3.4.3 Deleting a stored chair configuration

To delete a chair configuration from the chair configurations store, select a named (occupied) slot and then press the **Delete** button.

A message will be displayed asking you to confirm the delete operation. Press **Yes** to delete the configuration from the slot, or **Cancel** to stop the process.

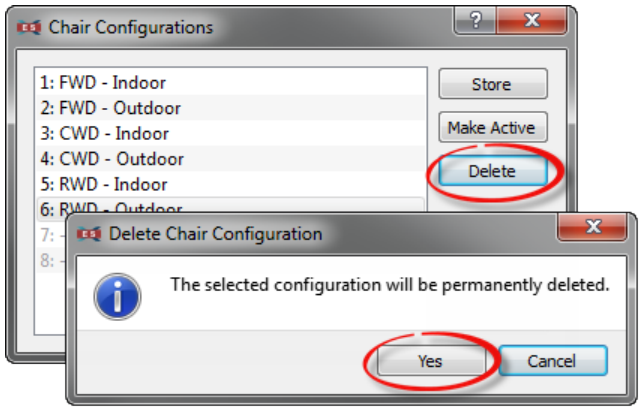


Figure 59: Deleting a stored configuration

6.3.4.4 Restoring to factory configuration

For a quick and easy way to reset an active configuration back to the stored version, dealers can use the *Restore to Factory Configuration* menu item in the Wheelchair menu.

This operation overwrites the active configuration with the chair configuration that was last used in a restore operation. A *Restore to Factory Configuration* alert will be displayed, warning the user that the existing configuration will be overwritten. Press **Yes** to restore the configuration from the slot, or **Cancel** to stop the process.

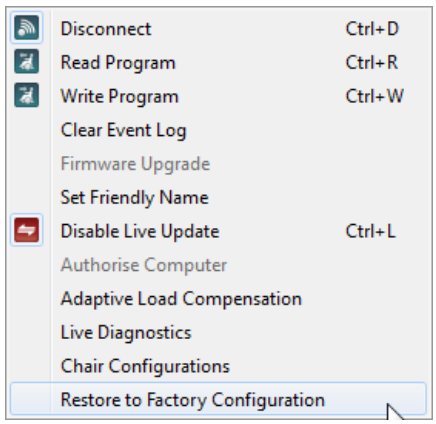


Figure 60: Restoring OEM defaults

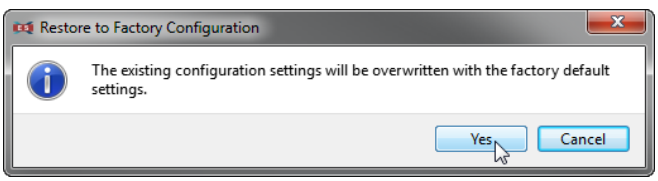


Figure 61: Confirming restore to OEM defaults

6.3.5 Working on chair configurations with the LiNX Access iOS tool

There are three chair configuration menu items available on the LiNX Access iOS tool. They are:

- Store Active Configuration (see *6.3.5.1*)
- Make Active Configuration (see *6.3.5.2*)
- Restore to Factory Configuration (see *6.3.5.4*)

To access these menu items, tap on the wheelchair icon at the bottom of the screen - the Chair menu will be displayed, as shown in *Figure 62*.

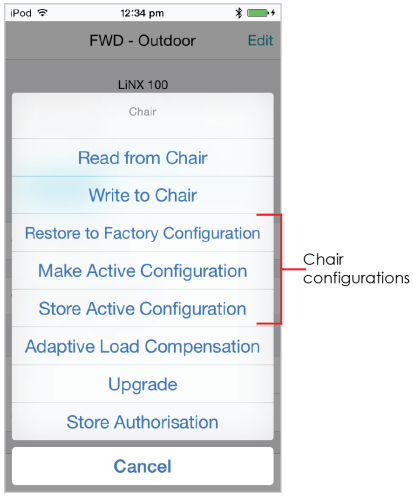


Figure 62: Chair menu with chair configuration options

The following sections show how chair configurations are stored and retrieved. All chair configurations are stored from the active program and use the active program's name.

6.3.5.1 Storing the active chair configuration

To store a chair configuration from the active configuration to a slot in the chair configuration store, tap on the *Store Active Configuration* menu option in the Chair menu and then choose a slot in the *Store Active Configuration* screen (*Figure 64*).

A chair configuration can be stored in an empty slot or in an occupied slot. Storing a configuration in an occupied slot will overwrite the existing configuration. If you attempt to store a configuration in an occupied slot, a message will be displayed asking you to confirm the overwrite operation. Tap **Overwrite** to overwrite the configuration in the occupied slot, or **Cancel** to stop the process.

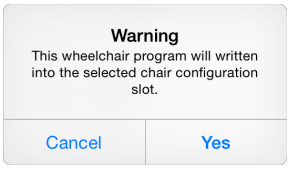


Figure 63: Overwrite chair configuration slot

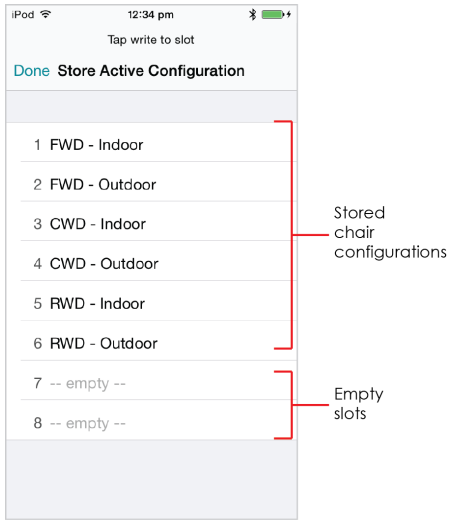


Figure 64: Storing a chair configuration

6.3.5.2 Making a chair configuration active

To make a chair configuration active, tap on the *Make Active Configuration* menu option in the Chair menu and then select a named (occupied) slot in the *Make Active Configuration* window.

Because this operation will overwrite the active program, a warning message will be displayed asking you to confirm the operation. Press **Yes** to continue, or **Cancel** to stop the process.

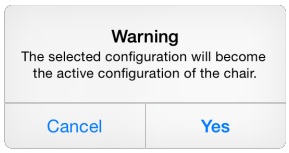


Figure 65: Overwrite active chair configuration

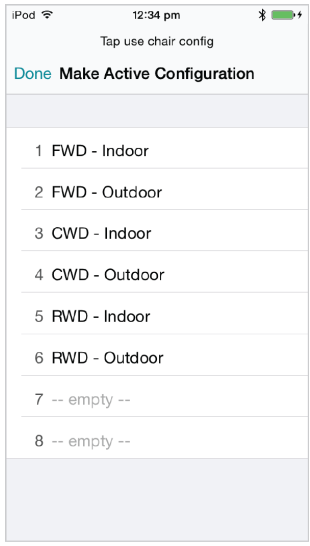


Figure 66: Restoring a chair configuration

6.3.5.3 Deleting a stored chair configuration

To delete a stored chair configuration, tap on a configuration name and swipe it to the left. A *Delete* button will appear on the right-hand side of the name. Tap on **Delete** to remove the configuration from the store (see *Figure 67*).

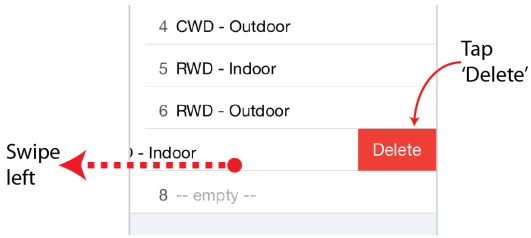


Figure 67: Delete stored configuration

6.3.5.4 Restore to factory default settings

Dealers who want a quick and easy way to reset an active configuration back to the stored version can use the *Restore To Factory Configuration* menu item in the chair menu.

This operation overwrites the active configuration with the chair configuration that was last used in a restore operation. A warning will be displayed alerting the user that the existing configuration will be overwritten. Press **Yes** to restore the factory default configuration, or **Cancel** to stop the process.

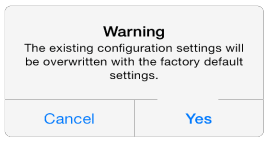


Figure 68: Overwrite warning when restoring factory settings

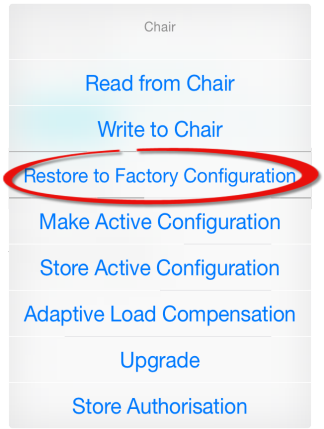


Figure 69: Restore to factory settings

6.4 Programming procedure

***Warning**:*
Perform the following procedure in a large open environment, preferably outdoors. Make sure that the wheelchair cannot crash into objects.

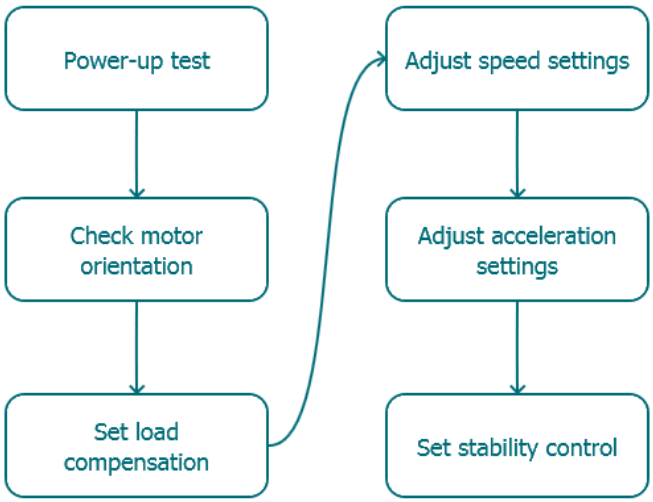
Be prepared for unexpected wheelchair movement in the event of a faulty installation.
If the wheelchair becomes uncontrollable, turn the LiNX system off for an emergency stop.

6.4.1 Introduction

This section outlines a "suggested" programming procedure for setting up the LiNX system; it is not prescriptive, and should be used as a guideline only. Furthermore, it does not elaborate on all of the parameters available to the OEM, merely those that can provide a good starting point, and can contribute to a safe, stable and comfortable ride for the user.

This section shows the preferred order in which to program these parameters, what effects the parameters have on the wheelchair, and also how the various parameters interact with each other.

6.4.2 Suggested programming procedure – overview



6.4.3 Suggested programming procedure – detailed

6.4.3.1 Step 1 – Power-up test

Before programming, ensure that the system powers up successfully. Press and release the power button on the remote module; the status indicator should light green.

Figure 70: Power button

Note: if the battery cable or loom has not been correctly connected, the status indicator will not turn on.

If the status indicator flashes red, check the motors and park brakes as they may not have been connected properly. For more information on errors, see section *9 System and diagnostic information*.

6.4.3.2 Step 2 – Check motor orientation

This section ensures that the motors are configured correctly.

Check for Motor Inversion

To detect motor inversion, deflect the joystick slightly forwards.

- If the wheelchair moves backwards instead of forwards, toggle both the left motor invert and right motor invert parameters (see section *7.2.2.5 Left / Right Motor Invert*).
- If the wheelchair turns on the spot, then only one motor is inverted. To begin with, just toggle the left motor invert parameter and deflect the joystick forwards again. If the wheelchair moves backwards, the wheelchair now has both motors inverted; toggle the left motor invert and right motor invert parameters to fix this issue.

Before continuing, make sure that the wheelchair moves forwards when the joystick is deflected forwards, and backwards when the joystick is deflected backwards.

Check for Motor Swap

To detect motor swap, deflect the joystick to the left. If the wheelchair moves to the right, toggle the *Swap* parameter (see section *7.2.2.6 Swap*).

Before continuing, ensure the wheelchair moves correctly forwards, backwards, left and right.

6.4.3.3 Step 3 – Set Motor Resistance

The *Motor Resistance* parameter is responsible for how much load compensation the wheelchair will apply; the optimum setting is directly related to the resistance of the motors and the motors' cables. A conservative value of 100 mΩ is recommended to begin with.

Note:
*The LiNX system features **Dynamic Load Compensation**, a patented drive technology that adjusts load compensation relative to current (Ampere) demand. For Dynamic Load Compensation to work effectively, it is important that you set up the Motor Resistance parameter accurately.*

To tune the load compensation, find a ramp with a slope of at least 5°. Ideally carry out this tuning on the steepest slope the wheelchair will be used on.

1. Set the wheelchair's speed dial to the lowest setting.
2. Drive up the ramp at a steady speed and then release the joystick.
3. Observe the amount of rollback — that is, the distance the wheelchair travels back down the slope after coming to a halt. The goal is to have zero rollback on a moderate slope, and minimal rollback on the steepest slope.
4. From a parked position on the ramp, and facing up the ramp, slightly deflect the joystick forwards, just enough to disengage the park brakes.
5. Observe whether the wheelchair holds its position, creeps forwards, or creeps backwards. The goal is to have the wheelchair creep forwards on a moderate slope, hold on a steep slope, and only just creep backwards on the very steepest slopes.
6. If the wheelchair rolls backwards on the slope, increment the *Motor Resistance* parameter by 50 mΩ and repeat steps 2 - 5 until the wheelchair no longer shows any rollback on the ramp.
7. Drive the wheelchair on a flat surface at the slowest steady speed possible. Observe whether the wheelchair surges at all. Surging indicates that the *Motor Resistance* parameter is set too high. If the wheelchair surges, reduce the *Motor Resistance* parameter further.

8. These tests can cause the motors and controller to become hot. Allow the motors and the controller to cool down before repeating the tests.

The wheelchair should now be capable of slow and controlled driving on thick carpet.

6.4.3.4 Step 4 – Adjust speed settings

Adjust Turn Speed
Set the speed dial to maximum, and then deflect the joystick either left or right to turn the wheelchair on the spot. Wait until the wheelchair reaches a steady turning speed. This rotation is controlled by the *Max Turn Speed* parameter. Adjust until the turn speed seems like a comfortable maximum.

Set the speed dial to the minimum position and adjust the *Min Turn Speed*

Note that minimum turn speed sometimes indicates an under compensated system. Try turning the wheelchair slowly on carpet, and increase the *Motor Resistance* parameter if the wheelchair does not move.

Adjust Reverse Speed
There is nothing physically preventing the motors from driving at the same speed in reverse as forward, so use the parameter *Max Reverse Speed* to adjust how fast the wheelchair will reverse for a comfortable and safe ride. The default is 50% of the maximum forward speed.

Adjust Forward Speed
The top speed of the wheelchair can be reduced if desired. Drive the wheelchair forward with the speed dial at maximum, adjusting the parameter *Max Forward Speed* (see section *6.4 Programming procedure*) until satisfied with the speed reached.

Adjust Minimum Drive Speeds
Adjust *Min Forward Speed* until the desired minimum forward speed is reached. Adjust this parameter with the joystick fully deflected and the speed dial set at its lowest setting.

Adjust *Min Reverse Speed* until the desired minimum reversing speed is reached. Adjust this parameter with the joystick fully deflected and the speed dial set at its lowest setting.

Adjust Veer Compensation
If the wheelchair's motors do not perform exactly the same as each other, then the wheelchair will not drive in a straight line. To compensate for the differences between the motors, you can adjust the *Veer Compensation* parameter.

6.4.3.5 Step 5 – Adjust acceleration settings

Adjust Turn Acceleration
Set the speed dial to maximum, and then deflect the joystick either left or right to turn the wheelchair on the spot. Wait until the wheelchair reaches a steady turning speed. Adjust the *Turn Acceleration* parameter if the wheelchair gets up to the steady turning speed too quickly or too slowly. Repeat the above until the acceleration feels comfortable and safe.

Adjust Turn Deceleration
To set the deceleration rate when turning, release the joystick to the neutral position once the wheelchair has reached a steady turning speed. Adjust the *Turn Deceleration* parameter if the

wheelchair slows down too quickly or too slowly. Repeat the above until the deceleration feels comfortable and safe.

Adjust Forward Acceleration
Set the speed dial to maximum, and then deflect the joystick fully forward and wait until the wheelchair reaches a steady speed. Adjust the *Forward Acceleration* parameter if the wheelchair gets up to the steady speed too quickly or too slowly. Repeat the above until the acceleration feels comfortable and safe.

Adjust Forward Deceleration
To set the deceleration rate in the forwards direction, release the joystick to the neutral position once the wheelchair has reached a steady forwards speed. Adjust the *Forward Deceleration* parameter if the wheelchair slows down too quickly or too slowly. Repeat the above until the deceleration feels comfortable and safe.

Adjust Reverse Acceleration
Set the speed dial to maximum, and then deflect the joystick fully reverse and wait until the wheelchair reaches a steady speed. Adjust the *Reverse Acceleration* parameter if the wheelchair gets up to the steady speed too quickly or too slowly. Repeat the above until the acceleration feels comfortable and safe.

Adjust Reverse Deceleration
To set the deceleration rate in the reverse direction, release the joystick to the neutral position once the wheelchair has reached a steady reverse speed. Adjust the *Reverse Deceleration* parameter if the wheelchair slows down too quickly or too slowly. Repeat the above until the deceleration feels comfortable and safe.

6.4.3.6 Step 6 – Set stability control

Warning:
The following procedures may cause the wheelchair to spin out of control. Proceed with caution.

Note:
The following instructions are for the LiNX MR1 parameters only. See section 7.2.9 Drive settings – stability settings for LiNX MR2 systems for more information about MR2 Stability parameters.

Adjust Turn Response
On a smooth surface, make the wheelchair turn on the spot at full speed by deflecting the joystick fully left or right. When the wheelchair is up to full turning speed, move the joystick to the full forward position. If the wheelchair fails to move forwards successfully (it may spin out at this point), adjust the value of *Turn Response*, as appropriate: the lower the value, the greater the traction and stability.

Adjust Turn at Max Speed
On a smooth surface, drive the wheelchair at full speed, and then deflect the joystick towards the left or right (note: be careful at this point. If you deflect the joystick fully left or fully right (that is 90°) then it may cause the wheelchair to become unstable, or lose balance. Try turning the wheelchair at a smaller angle for the first few tests, say 30°, or 45°). If the wheelchair becomes unstable during this test, reduce the value of *Turn at Max Speed*.

Adjust Turn Boost at Max Speed

This parameter adjusts the overall response of the joystick when turning at speed and is particularly useful on rear wheel drive chairs where it can be used to overcome the inherent stability of that configuration. You may have noticed that this parameter belongs in the Drive/Turn group of parameters, but to get maximum benefit from this parameter, it needs to be set after *Turn Response* and *Turn at Max Speed* have been set. Note, also, that this parameter has very little effect if *Turn Response* is set too low.

When a wheelchair is travelling slowly, it is normal for the wheelchair to respond quickly to a joystick turn demand. Similarly, when a wheelchair is moving quickly, it is normal for the wheelchair to respond less quickly to the joystick turn demand, thus helping the wheelchair maintain its course. However, when the wheelchair is moving in a straight line quickly, and a quick turn response is required (to avoid an obstacle, for instance), increasing the value of *Turn Boost at Max Speed* can improve the response of the joystick.

To set this parameter for optimal performance, you will need a long straight test track, and a few markers — we recommend using something small and light so that if the wheelchair hits the marker, the wheelchair and its user will remain safe and unhurt. Place the markers in a straight line, spaced out as far as possible. Drive the wheelchair, at full speed, towards the markers. When the wheelchair approaches a marker, steer around the marker as quickly and safely as possible, repeating this for as many markers as you have laid out. As you steer around the markers, you will get a feel of the joystick's response at speed. Adjust the value of *Turn Boost at Max Speed* to either speed up or slow down the response of the joystick as necessary.

6.5 DX-HHP Programmer

The LiNX system can also be programmed using the legacy DX-HHP programmer. The DX-HHP (Hand-Held Programmer) has been used successfully on previous Dynamic Controls' products, and can be used with the LiNX system for programming a number of useful parameters.

Figure 71: The DX-HHP

Note:
1. The DX-HHP can only program a subset of the available parameters, of which the access level is set to 'dealer'. To access all the parameters, use the LiNX Access iOS or the LiNX Access PC tool with the appropriate LiNX Access Key - see section 6.5.2 Available parameters for more details.

2. If you intend to connect to either a LiNX Access iOS or a LiNX Access PC tool after using the DX-HHP, you will need to ensure that you save your changes, or power-cycle the wheelchair system, otherwise you will not be able to connect to these programmers.

The following sections detail how to connect the DX-HHP to the LiNX system, which parameters are available (section *6.5.2 Available parameters*), their display name (if different from the parameter list in section *6.5.2 Available parameters*), a link to the relevant parameter description within this manual, and a screen map for navigating the DX-HHP screens (see section *6.5.3 Navigating the DX-HHP screens*).

6.5.1 Connecting the DX-HHP to the LiNX system

Use the Dynamic Wizard Programming Adaptor (order part number: DWIZ-ADAPT) to connect the DX-HHP to the LiNX system. Fit the programming adaptor to the DX-HHP connector, and then plug the programming adaptor into the remote module's XLR connector, as shown below.

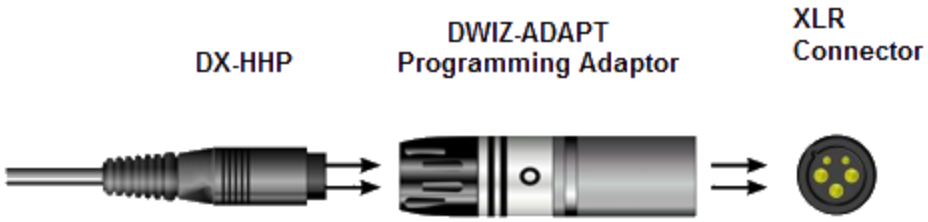


Figure 72: Connecting the DX-HHP

Warning:
1. Do not use the SHARK programming adaptor (DK-ADAPT) to connect the DX-HHP to the LiNX system.

2. Do not use the DX-HHP or MKx-series programmers (MK4.5, 5 or 6) if your LiNX modules (power module and remote module) have software version 1.1 or lower; the programmer will not operate, and the wheelchair system may go into drive inhibit. This will not cause any damage to the programmer or LiNX system, but you will need to unplug the DX-HHP and switch the LiNX system off and on to remove the drive inhibit.

6.5.2 Available parameters

The parameters that can be edited with the DX-HHP are listed in the table below.

Parameter	Name in manual	Reference in manual
	Drive Settings	
Max Forward Speed	Max Forward Speed	*7.2.5.1 Max Forward Speed*
Min Forward Speed	Min Forward Speed	*7.2.5.2 Min Forward/Reverse Speed*
Forward Acceleration	Forward Acceleration	*7.2.5.3 Forward Acceleration*
Forward Deceleration	Forward Deceleration	*7.2.5.4 Forward Deceleration*
Max Reverse Speed	Max Reverse Speed	*7.2.6.1 Max Reverse Speed*
Min Reverse Speed	Min Reverse Speed	*7.2.6.5 Min Reverse Speed*
Reverse Acceleration	Reverse Acceleration	*7.2.6.2 Reverse Acceleration*
Reverse Deceleration	Reverse Deceleration	*7.2.6.3 Reverse Deceleration*
Max Turn Speed	Max Turn Speed	*7.2.7.1 Max Turn Speed*
Min Turn Speed	Min Turn Speed	*7.2.7.2 Min Turn Speed*
Turn Acceleration	Turn Acceleration	*7.2.7.3 Turn Acceleration*
Turn Deceleration	Turn Deceleration	*7.2.7.4 Turn Deceleration*
Turn Boost at MaxSpeed	Turn Boost at Max Speed	*7.2.7.5 Turn Boost at Max Speed*
Turn Transition	Turn Transition	*7.2.9.2 Turn Transition*
Power	Power	*7.2.10.1 Power*
	Inputs	
Joystick Throw	Joystick Throw	*7.2.15.2 Joystick Throw*
Tremor Dampening	Tremor Dampening	*7.2.15.3 Tremor dampening*
	Core Settings	
Veer Compensation	Veer Compensation	*7.2.2.1 Veer Compensation*
Resistance	Motor Resistance	*7.2.2.3 Motor Resistance*
	Diagnostics	
Battery State	[information only]	
Active Errors	[information only]	
Software Version	[information only]	
Hardware Version	[information only]	

6.5.3 Navigating the DX-HHP screens

6.5.3.1 The group screens

This is the top-level display, showing the **group** screens. Use the **Next** and **Prev** (previous) buttons to navigate through this list. Use the **Edit** button to select the group, and the **Back** button to return to this list.

Select a group to drill-down to the next set of menu options. As outlined above, use the **Next** and **Prev** buttons to navigate through the available options, and the **Edit** button to drill-down further.

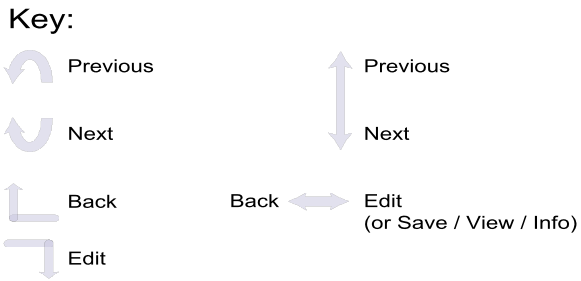


Figure 73: Key

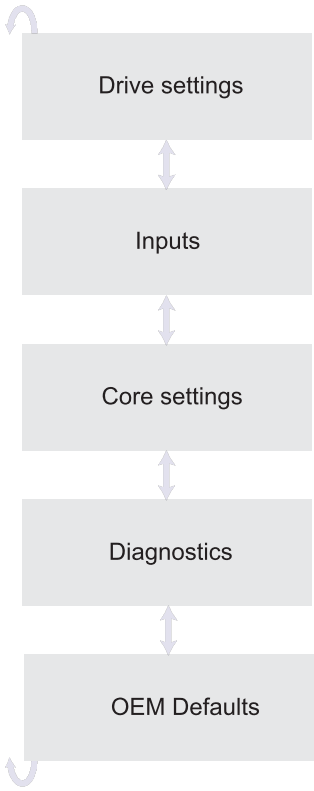
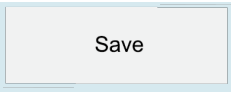


Figure 74: The group screens

The menu map for each group is shown in the sections following. The key to the maps is shown in *Figure 73* and refers to the button press action for each screen.

Note:

1. *The **Save** option, which is displayed at the end of each menu level, only becomes visible when a parameter has been changed.*
2. *The **Save** option saves **ALL** parameter changes that you have made, not just the parameter from the menu level.*
3. *When you change a parameter, the effect will be implemented immediately, but will only be retained by the module if you save your changes. If you power-cycle the wheelchair system before saving your changes, you will lose your changes and the previous parameter values will be used.*



6.5.3.2 Drive settings

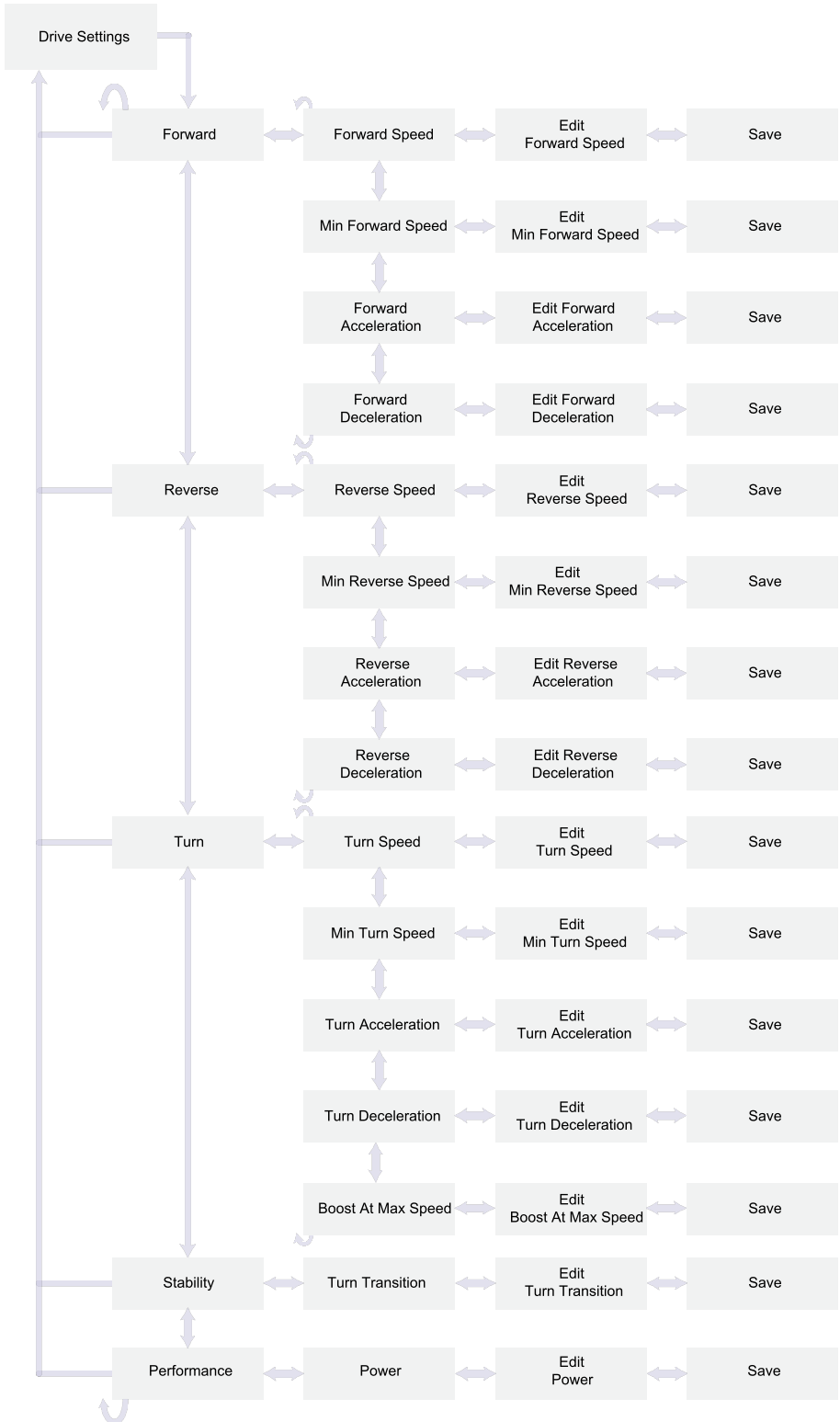


Figure 75: Drive settings

6.5.3.3 Inputs

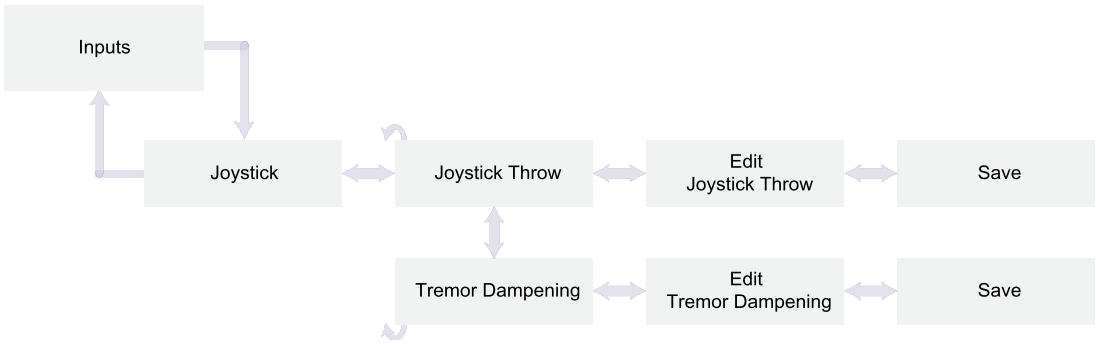


Figure 76: Inputs

6.5.3.4 Core settings

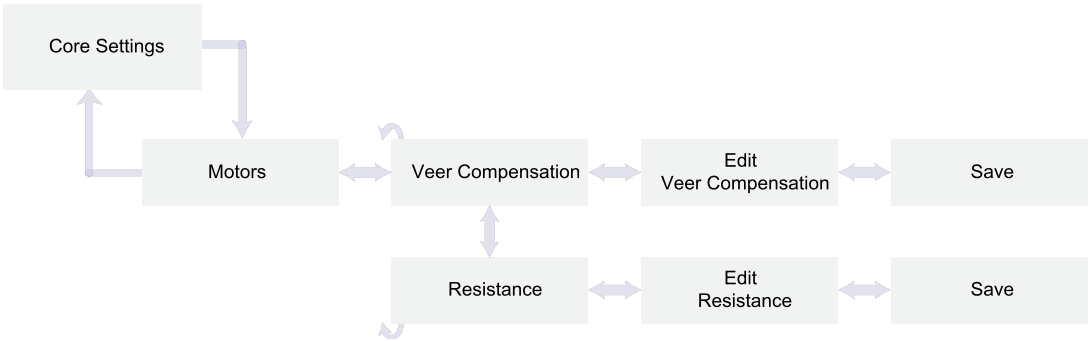


Figure 77: Core settings

6.5.3.5 Diagnostics

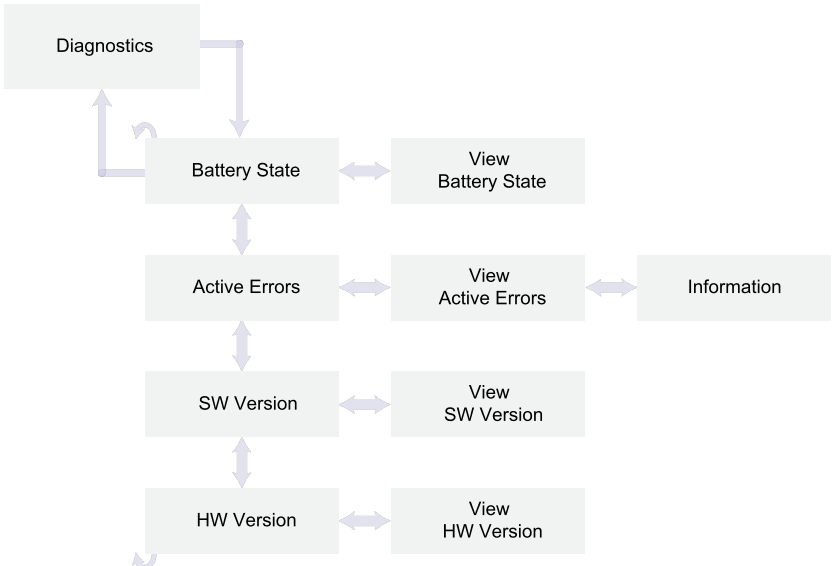


Figure 78: Diagnostics

6.5.3.6 OEM Defaults

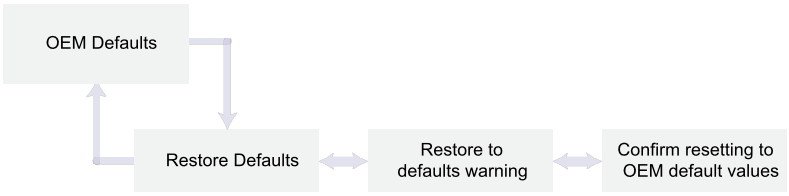


Figure 79: OEM Defaults

7 Parameters

Warning:
Performance adjustments must only be made by healthcare professionals or by persons who completely understand the adjustment process and the capabilities of the wheelchair user.

Before upgrading the firmware of the system, or a module in the system, always ensure that the battery charge level is sufficient and the park brakes are not manually or electronically released.

Incorrect settings, or programming in a location that is not safe, can cause injury to the user and bystanders, or damage to the wheelchair and surrounding property.

After you have configured the wheelchair, check to make sure that it performs to the specifications entered in the programming procedure. If the wheelchair does not perform to specifications, reprogram it. Repeat this procedure until the wheelchair performs to specifications. If the wanted operation cannot be reached, contact your service agent.

Ensure that the deceleration parameters are always higher than the acceleration parameters for a safe response.

It is the responsibility of the health care professional to make sure that the user is capable of both cognitively understanding and physically operating the programmed features and functions.

With inappropriate programming settings, certain features and options may not be accessible or perform as expected.

Where any inconsistencies about wheelchair status occur between the LiNX system and that reported by a programming tool, the user should take the status as reported by the LiNX system as correct.

7.1 Parameter list

***Note**:*
Parameters that are updatable in Live Update mode are marked .

The parameters are divided into the following four sections:

Core settings
- General
- Motors
- Park brake
- Battery management

Drive settings
- Forward
- Reverse
- Turn
- Stability
- Performance

OEM Drive settings
- Forward
- Reverse
- Turn
- Stability

Inputs
- Joystick

The table comprises the following columns:

Dealer	If this column is checked, the parameter can be set with the Distributor-level LiNX Access Key (DLX-HKEY01-A).
OEM	If this column is checked, the parameter can be set with the Manufacturer-level LiNX Access Key (DLX-HKEY02-A).
Live Update	If this column shows this icon , the parameter can be updated in Live Update mode.
Parameter	The name of the parameter.
Possible Values	Shows the range and units for the parameter.
Default	Shows the factory-programmed setting for the parameter.
LE MR1	If this column is checked, the parameter is available for the LiNX LE series with Market Release version 1 core firmware.
LE MR2	If this column is checked, the parameter is available for the LiNX LE series with Market Release version 2 core firmware.
100 MR2.2	If this column is checked, the parameter is available for the LiNX 100 series with Market Release version 2.2 core firmware.

7.1.1 Core settings

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
			General					
•	•		*Drive Delay At Startup*	0 - 10 s	0 s	•	•	•
	•		*Emergency Deceleration*	20 - 100%	50%	•	•	•
	•		*Stall Timeout*	0 - 30 s	15 s	•	•	•
	•		*Firmware Upgrade*	Off/On	On	•	•	•
•	•		*System Name*	Text		•	•	•
•	•		*Program Name*	Text		•	•	•
•	•		*Enable Lock*	Off/On	Off		•	•
•	•		*Enable Sleep Timeout*	Off/On	Off		•	•
•	•		*Sleep Timeout Duration*	1 - 60 mins	5 mins		•	•
•	•		*Enable Joystick Wakeup*	Off/On	On		•	•
	•		*Function Controller Mode*	Disabled/ enabled	Disabled			•
	•		*User Input Inhibit Mode*	Multiple - see description	Control I/O Disabled			•
	•		*Anti-Rollaway max speed*	15 - 100%	50%		•	•
	•		*Anti-Rollaway (no battery) max*	50 - 100%	50%		•	•

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
			speed					
	•		*Anti-rollaway holding current*	0 - power module current limit A	2 A		•	•
Motors								
•	•	⇆	*Veer Compensation*	-10 to +10%	0%	•	•	•
	•	⇆	*Motor Resistance Upper Limit*	10 - 1000 mΩ	1000 mΩ			•
•	•	⇆	*Motor Resistance*	10 - 1000 mΩ	20 mΩ	•	•	•
	•		*Motor Resistance Profile*	Traditional/ Dynamic	Dynamic		•	•
•	•		*Right Invert*	Off/On	Off	•	•	•
•	•		*Left Invert*	Off/On	Off	•	•	•
•	•		*Swap*	Off/On	Off	•	•	•
	•		*Max No Load Voltage*	5 - 30 V	26 V	•	•	•
	•		*Current Limit*	Depends on power module - see specifications	Depends on power module - see specifications	•	•	•
	•		*Boost Current*	0 to (power module's specified current rating — Current Limit) A	0 A	•	•	•
	•		*Boost Time*	0 - 5 s	0 s	•	•	•
	•		*Thermal Rollback Start*	40 - 70 °C	60 °C	•	•	•
	•		*Thermal Rollback End*	40 - 75 °C	70 °C	•	•	•
	•		*FET Thermal Rollback Start*	40 - 90 °C	70 °C	•	•	•
	•		*FET Thermal Rollback End*	40 - 90 °C	80 °C	•	•	•
	•		*Open Circuit Test*	Off/On	On	•	•	•
	•		*Short Circuit Test*	Off/On	On	•	•	•
Park brake								
	•		*Dual Park Brake Test*	Single/Dual	Dual	•	•	•
	•		*Release Delay*	0 - 500 ms	50 ms	•	•	•
Battery management								
	•		*Low Batt Rollback End*	17 - 26 V	19 V	•	•	•
	•		*Low Batt Rollback Start*	17 - 26 V	21 V	•	•	•
	•		*High Batt Rollback Start*	26 - 34 V	28 V	•	•	•
	•		*High Batt Rollback End*	26 - 34 V	32 V	•	•	•
	•		*Batt Gauge Dead Zone*	0 - 6 V	3.5 V	•	•	•
	•		*Batt Gauge Minimum*	20 - 36 V	22.5 V	•	•	•
	•		*Batt Gauge Maximum*	20 - 36 V	25.5 V	•	•	•
	•		*Batt Gauge Low Voltage Warning*	17 - 36 V	22.5 V	•	•	•
	•		*Batt Gauge High Voltage Warning*	20 - 36 V	29 V	•	•	•
	•		*Cut-Off Voltage*	17 - 24 V	21 V	•	•	•
	•		*Battery Gauge Type*	Traditional/ Enhanced	Traditional			•

7.1.2 Drive settings

Note:
With the introduction of MR2, new OEM parameters have been introduced to allow OEM's to define the adjustable range of a parameter that a Distributor can adjust. See sections 7.2.11 to 7.2.14 for details.

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
			Forward					
•	•	⇆	*Max Forward Speed*	5 - 100%	100%	•		
•	•	⇆	*Min Forward/Reverse Speed*	5 - 100%	20%	•		
•	•	⇆	*Forward Acceleration*	0 - 90%	30%	•		
•	•	⇆	*Forward Deceleration*	15 - 100%	40%	•		
	•	⇆	*Forward Speed Scalar*	0 - 100%	95%	•		
•	•	⇆	*Max Forward Speed*	0 - 100%	100%		•	•
•	•	⇆	*Min Forward Speed*	0 - 100%	10%		•	•
•	•	⇆	*Forward Acceleration*	0 - 100%	100%		•	•
•	•	⇆	*Forward Deceleration*	5 - 100%	100%		•	•
	•	⇆	*Soft Start Acceleration*	0 - 5 s	0.3 s	•	•	•
	•	⇆	*Soft Finish Acceleration*	0 - 100%	30%	•	•	•
	•	⇆	*Soft Start Deceleration*	0 - 1 s	0.1 s	•	•	•
	•	⇆	*Soft Finish Deceleration*	0 - 100%	40%	•	•	•
			Reverse					
•	•	⇆	*Max Reverse Speed*	0 - 100%	50%	•		
•	•	⇆	*Reverse Acceleration*	0 - 90%	30%	•		
•	•	⇆	*Reverse Deceleration*	15 - 100%	40%	•		
•	•	⇆	*Max Reverse Speed*	0 - 100%	100%		•	•
•	•	⇆	*Min Reverse Speed*	0 - 100%	10%		•	•
•	•	⇆	*Reverse Acceleration*	0 - 100%	100%		•	•
•	•	⇆	*Reverse Deceleration*	5 - 100%	100%		•	•
			Turn					
•	•	⇆	*Max Turn Speed*	0 - 100%	60%	•		
•	•	⇆	*Min Turn Speed*	5 - 100%	20%	•		
•	•	⇆	*Turn Acceleration*	0 - 90%	30%	•		
•	•	⇆	*Turn Deceleration*	15 - 100%	40%	•		
•	•	⇆	*Turn Boost at Max Speed*	100 - 300%	200%	•	•	•
•	•	⇆	*Max Turn Speed*	0 - 100%	100%		•	•
•	•	⇆	*Min Turn Speed*	0 - 100%	10%		•	•
•	•	⇆	*Turn Acceleration*	0 - 100%	100%		•	•
•	•	⇆	*Turn Deceleration*	5 - 100%	100%		•	•
	•	⇆	*Soft Start Turn*	0 - 2 s	0 s	•	•	•
	•	⇆	*Soft Finish Turn*	0 - 100%	30%	•	•	•
			Stability					
	•	⇆	*Turn Response*	0 - 100%	50%	•		
	•	⇆	*Turn At Max Speed*	0 - 100%	25%	•		
	•	⇆	*Stability at Min Speed Dial*	0 - 80%	50%	•		
	•	⇆	*Stability at Max Speed Dial*	0 - 80%	50%	•		
•	•	⇆	*Turn Transition*	0 - 100%	100%		•	•

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
			Performance					
•	•	⇆	*Power*	0 - 100%	100%			•

7.1.3 OEM Drive settings

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
			Forward					
	•	⇆	*OEM Forward Speed*	0 - 100%	95%		•	•
	•	⇆	*OEM Forward Acceleration*	0 - 100%	30%		•	•
	•	⇆	*OEM Forward Deceleration*	15 - 100%	40%		•	•
			Reverse					
	•	⇆	*OEM Reverse Speed*	0 - 100%	50%		•	•
	•	⇆	*OEM Reverse Acceleration*	0 - 100%	40%		•	•
	•	⇆	*OEM Reverse Deceleration*	15 - 100%	54%		•	•
			Turn					
	•	⇆	*OEM Turn Speed*	0 - 100%	30%		•	•
	•	⇆	*OEM Turn Acceleration*	0 - 100%	40%		•	•
	•	⇆	*OEM Turn Deceleration*	15 - 100%	53%		•	•
			Stability					
	•	⇆	*Turn at Max Speed*	0 - 100%	15%		•	•
	•	⇆	*OEM Turn Transition*	0 - 100%	50%		•	•
	•	⇆	*Max Speed in Turn*	0 - 100%	50%		•	•

7.1.4 Inputs

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
			Joystick					
•	•		*Neutral Window*	10 - 100%	10%	•	•	•
•	•	⇆	*Joystick Throw*	10 - 100%	90%	•	•	•
•	•	⇆	*Tremor dampening*	0 - 100%	0%		•	•

7.2 Parameter descriptions

Warning:
- *Any given starting point settings in this section must be used as a guideline only.*
- *It is the responsibility of the wheelchair manufacturer to make sure that the program is safe and suitable for a particular wheelchair configuration.*
- *It is the responsibility of the dealer or therapist to check and make sure that the settings of a wheelchair for a particular user are safe and appropriate for that user.*

7.2.1 Core settings – general

7.2.1.1 Drive Delay At Startup

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Drive Delay At Startup	0 - 10 s	0 s	•	•	•

Allows a time delay to be set up between power-up and driving.

For values greater than zero, this parameter will ensure that the wheelchair will ignore all joystick deflections (and, therefore, not drive) from the time the wheelchair powers up until the time set by *Drive Delay At Startup*. The status indicator will display drive inhibit until the programmed delay has elapsed.

7.2.1.2 Emergency Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Emergency Deceleration	20 - 100%	50%	•	•	•

Sets how quickly the wheelchair will stop when an emergency stop is performed.

The *Emergency Deceleration* parameter sets how quickly the wheelchair will stop when the user, or a critical fault, powers down the system while driving.

The higher the *Emergency Deceleration* parameter value, the quicker the wheelchair will stop. The optimum value depends on the wheelchair type, the preference of the manufacturer and the regulations that apply in the country of use.

To test this parameter, press the on/off button while driving.

Warning:
If this parameter is set too high, the user can lose balance or fall out of the wheelchair.

7.2.1.3 Stall Timeout

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Stall Timeout	0 - 30 s	15 s	•	•	•

Sets the maximum time the system will deliver maximum current to the motors.

If the joystick is deflected but the wheelchair cannot drive because of an obstacle, the maximum current (as set by the *Current Limit* parameter) will be drawn by the motors continuously, because the motors are still trying to drive. This situation is called motor stalling.

Motor stalling can cause motor damage if the motor becomes too hot. To prevent motor damage, the power module disables drive after *Stall Timeout* seconds of current exceeding the programmed current limit.

If a stall timeout occurs, the wheelchair will not drive and Flash Code 7 will be shown on the system Status LED. To return to driving, release the joystick back to its centre position. If the Flash Code is not being displayed, driving can commence.

Warning:
*Do not set **Stall Timeout** to 0s. This will disable the stall timer and the motors will not be protected in a stall situation.*

7.2.1.4 Firmware Upgrade

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Firmware Upgrade	Off/On	On	•	•	•

Enables firmware upgrade.

If this parameter is set to **On**, then the firmware in the individual modules of the LiNX system can be upgraded via the LiNX Access Key programming tools. See section *7.2.1 Core settings – general*.

7.2.1.5 System Name

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		System Name	Text		•	•	•

Name for the system, e.g. Model ABC.

Set the *System Name* to correspond to the wheelchair system. The parameter accepts alpha-numeric text up to 56 characters.

7.2.1.6 Program Name

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Program Name	Text		•	•	•

Name for the current program e.g. Bob's wheelchair.

Personalise the program by setting the *Program Name* to correspond to the wheelchair user. The parameter accepts alpha-numeric text up to 56 characters.

7.2.1.7 Enable Lock

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Enable Lock	Off/On	Off		•	•

Determines whether the system can be locked.

If this parameter is set to **Yes**, then the system can be locked with the Power button.

See also:
For more information on locking the system, see "The lock function" in the LiNX Remotes Installation Manual.

7.2.1.8 Enable Sleep Timeout

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Enable Sleep Timeout	Off/On	Off		•	•

Determines whether the system goes to sleep after a period without user activity.

If this parameter is set to On, then the system will go into sleep mode after the system has been inactive for the duration set by *Sleep Timeout Duration*.

The transition to sleep mode is indicated by the remote module's LEDs dimming gradually. During the transition, the joystick, horn, speed dial and power button will continue to operate.

The system can be woken from sleep mode by pressing the power button, or, if enabled, by deflecting the joystick - see *Enable Joystick Wakeup*.

7.2.1.9 Sleep Timeout Duration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Sleep Timeout Duration	1 - 60 mins	5 mins		•	•

Sets the amount of time without user activity before the system goes to sleep, if sleep is enabled.

If *Enable Sleep Timeout* is set to On, then the system will go into sleep mode after the system has been inactive for the duration set by this parameter.

7.2.1.10 Enable Joystick Wakeup

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Enable Joystick Wakeup	Off/On	On		•	•

Determines whether deflecting a joystick can wake the system from sleep.

If this parameter is enabled, then any deflection of the joystick will wake the system if it is in sleep mode.

Note:
Pressing the power button will also wake the system from sleep mode.

7.2.1.11 Function Controller Mode

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Function Controller Mode	Disabled/ enabled	Disabled			•

Enables or disables the selection of a drive function via a control input.

This parameter determines if the Drive Function Select input (pin 4 on the utility connector) can be used to select different drive functions.

If this is set to **enabled**, then:

1. an open-circuit on pin 4 of the utility connector will select Drive Function 1,
2. a closed-circuit on pin 4 of the utility connector will select Drive Function 2.

If this is set to **disabled**, only Drive Function 1 will be used.

See also:
5.8.4 Setting up and selecting additional drive functions

7.2.1.12 User Input Inhibit Mode

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		User Input Inhibit Mode	Multiple - see table below	Control I/O Disabled			•

Enables the monitoring of inhibiting factors via a control input, according to either of two modes (Normally Open / Normally Closed). The parameter also has an option to disable the feature.

This parameter is used to inform the system of the type and purpose of the drive inhibit switch circuit that is connected to the User Input Inhibit pin (pin 2) of the utility connector. The options allow for:

type: a normally open or normally closed switch circuit
purpose: a user drive inhibit, or an on-board charger (OBC) inhibit

If the User Input Inhibit pin is not used, then the parameter can be set to **disabled**. The possible values for all scenarios are shown in the table below.

User Input Inhibit Mode	Function
Control I/O Disabled	Pin 2 on the utility connector has no function.
N/O Drive Inhibit (Normally Open)	Set if the user inhibit circuit uses a normally open (NO) switch.
N/C Drive Inhibit (Normally Closed)	Set if the user inhibit circuit uses a normally closed (NC) switch.
N/O OBC (Normally Open)	Set if using an on-board charger and the OBC's Drive Inhibit can short the User Input Inhibit pin to B- when the OBC is powered up.
N/C OBC (Normally Closed)	Set if using an on-board charger and the OBC's Drive Inhibit can open the User Input Inhibit pin with respect to B- when the OBC is powered up.

See also:
5.8 The utility connector
5.8.3 Connecting a user drive inhibit
5.8.2 Connecting an on-board battery charger

7.2.1.13 Anti-Rollaway max speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Anti-Rollaway max speed	15 - 100%	50%		•	•

Sets the roll-away speed as a percentage of the wheelchair's maximum speed (not settable with any parameter), at which the controller will start to apply dynamic braking.

This feature stops the wheelchair if rolling away on a slope when:

1. the controller is powered down, and
2. the park brakes have been released manually.

If the wheelchair moves at a higher speed than *Anti-Rollaway max speed*, the controller will automatically power-up and then slow the wheelchair down, using dynamic braking, until it stops.

When the wheelchair has come to a stop, the controller can be turned on with the power button and normal driving is possible.

7.2.1.14 Anti-Rollaway (no battery) max speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Anti-Rollaway (no battery) max speed	50 - 100%	50%		•	•

Roll-away speed as a percentage of the wheelchair's maximum speed (not settable with any parameter), at which the system will provide dynamic braking if a battery is not present in the system.

This feature limits the wheelchair to a **safe speed** if rolling away on a slope when:

1. the controller is powered down, and
2. the park brakes have been released manually, and
3. the battery is disconnected.

If the wheelchair moves at a higher speed than *Anti-Rollaway (no battery) max speed*, the controller will automatically power-up and then slow the wheelchair down, using dynamic braking.

7.2.1.15 Anti-rollaway holding current

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Anti-rollaway holding current	Up to power module current limit	2 A		•	•

Sets the holding current above which the anti-rollaway electronic braking is maintained.

The *Anti-rollaway holding current* defines the minimum amount of motor current required to hold the wheelchair on a slope using dynamic braking. This value will depend on the wheelchair's specifications and the steepness of the slope, and therefore should be determined through testing.

Note:
*Because of the way in which the anti-rollaway parameters (**Anti-Rollaway max speed**, **Anti-Rollaway (no battery) max speed**, and **Anti-rollaway holding current**) are stored internally, the LiNX system has to be power-cycled twice (that is, powered off and then powered on, two times) for the parameters to become effective after any adjustments are made to them.*

7.2.2 Core settings – motors

7.2.2.1 Veer Compensation

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Veer Compensation	-10 to +10%	0%	•	•	•

Correction for a wheelchair that does not drive in a straight line.

If the two motors of the wheelchair do not perform exactly the same (mismatched motors), or the wheelchair user tends to lean heavily to one side of the wheelchair, the wheelchair may not drive in a straight line; the wheelchair will turn slightly (veer) when it drives forward. *Veer Compensation* calculates how much the wheelchair must correct its direction to drive in a straight line.

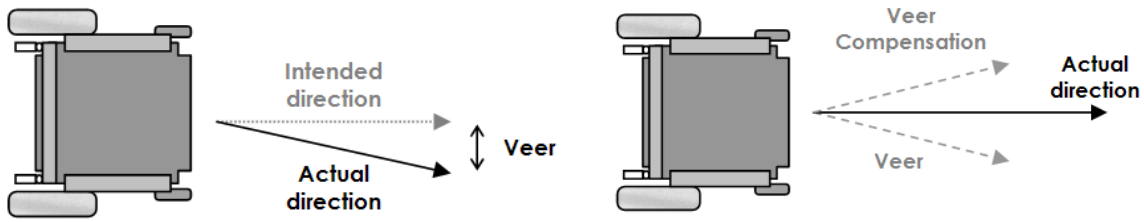


Figure 80: Veer compensation

Note:

1. *Adjust this parameter every time a motor is replaced if the wheelchair does not drive in a straight line.*
2. *Factors other than motor performance can cause wheelchair veer, for example bent frames, a user leaning on one side only, flat tyres or faulty castor wheels. Correct or minimise these at the source before using **Veer Compensation**.*
3. *Do not use **Veer Compensation** to compensate for out-of-centre joystick deflection by the user.*
4. *Veer compensation can compensate for small differences in left/right motor performance. It cannot compensate for severely mismatched motors.*

7.2.2.2 Motor Resistance Upper Limit

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Motor Resistance Upper Limit	10 - 1000 mΩ	1000 mΩ			•

OEM parameter that sets the upper bound of the *Motor Resistance* parameter.

This parameter allows an OEM to set the upper limit of the *Motor Resistance* parameter so that there is less likelihood of the wheelchair being over-compensated when the *Motor Resistance* parameter is set.

7.2.2.3 Motor Resistance

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Motor Resistance	10 - 1000 mΩ	20 mΩ	•	•	•

Configures the system for the motors used (load compensation).

The *Motor Resistance* parameter is used to prevent changes in motor speed when the wheelchair drives over loads such as sidewalks, curbs or slopes, by setting the resistance value for the motors in milli-ohms (mΩ).

The maximum value for this parameter is limited by the OEM using *Motor Resistance Upper Limit* parameter.

See also:
For information on how to set the Motor Resistance parameter, see 5.6.4 Motor configuration.

7.2.2.4 Motor Resistance Profile

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Motor Resistance Profile	Traditional/ Dynamic	Dynamic		•	•

Selection between traditional and dynamic load compensation.

With the introduction of the LiNX MR2 core firmware, the OEM can now choose the resistance profile to better suit the characteristics of the wheelchair's motors.

Set this parameter to **Traditional** for use with motors that have an insignificant increase in resistance at low current and high speed.

Set this parameter to **Dynamic** for use with motors that have a significant increase in resistance at low current and high speed.

7.2.2.5 Left / Right Motor Invert

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Left Invert	Off/On	Off	•	•	•
•	•		Right Invert	Off/On	Off	•	•	•

Left Invert
Inverts the direction of the left motor.

Right Invert
Inverts the direction of the right motor.

If these parameters are set to Inverted, the polarity of the motor outputs will be swapped: the positive pin ('+') will become negative ('–') and the negative pin ('–') will become positive ('+'). The effect of inverting the polarity means that a forward command will cause the motor to drive in the reverse direction, and vice versa.

Note:
*M1 and M2 refers to either the left motor or the right motor, and is dependent on the **Swap** parameter setting (see below).*

7.2.2.6 Swap

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Swap	Off/On	Off	•	•	•

Swaps the left and right motor outputs.

If this parameter is set to On, the power module swaps the left and right motor outputs. Swapping the motor outputs allows the cabling between the power module and the motors to be optimised for particular mounting orientations of the power module.

	Swap = "Off"	Swap = "On"
Motor connection	Left motor = M2 Right motor = M1	Left motor = M1 Right motor = M2

7.2.2.7 Max No Load Voltage

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Max No Load Voltage	5 - 30 V	26 V	•	•	•

Sets the maximum possible speed of the wheelchair.

This parameter can be used to set a speed limit for a particular wheelchair type (that is, for specific motors, and specific wheel diameters). This can be useful where, for example, local regulations require that the speed of a powered wheelchair is limited to a specific value.

If the momentary battery voltage is less than the programmed Max No Load Voltage value (for example when the battery is almost empty), then the battery voltage itself is the maximum applied voltage at 100% speed demand.

The actual voltage output from the LiNX controller may at times be higher than this setting due to load compensation (see section *7.2.2.3 Motor Resistance*).

7.2.2.8 Current Limit

Dealer	OEM	Live Update	Parameter	Possible Val-ues	Default	LE MR1	LE MR2	100 MR2.2
	•		Current Limit	Depends on power module - see specifications	Depends on power module - see specifications	•	•	•

Sets the maximum current that the controller can deliver to the motors.

The Current Limit is the maximum current that the power module is programmed to deliver to the motor.

To protect the power module's electronic components, the maximum current will be reduced further if the power module becomes too hot, depending on the setting of the thermal rollback parameters (see section *7.2.2.11 Thermal Rollback* and *7.2.2.12 FET Thermal Rollback*).

7.2.2.9 Boost Current

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Boost Current	0 to (power module's specified current rating — Current Limit) A	0 A	•	•	•

Sets how much extra current can be applied during *Boost Time*.

The power module can deliver an additional *Boost Current* for *Boost Time* seconds, to overcome transient loads such as starting on a hill, overcoming castor lock, climbing obstacles, etc.

The maximum possible value of *Boost Current* is dependent on the *Current Limit*. The sum of *Current Limit* and *Boost Current* cannot exceed the specified current rating of the power module — for example, 43 A for PM40, or 53 A for PM50.

If the *Boost Time* is reached, the current is limited to *Current Limit*. Before the current can reach the *Boost Current* value again, the motor current must stay below the value of *Current Limit* for at least twice as long as it was above the *Current Limit*.

7.2.2.10 Boost Time

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Boost Time	0 - 5 s	0 s	•	•	•

Sets how long the *Boost Current* can be applied.

The power module can deliver an additional *Boost Current* for *Boost Time*, to overcome transient loads such as starting on a hill, overcoming castor lock, climbing obstacles, etc. If the *Boost Time* is reached, the current is limited to *Current Limit*. Before the current can reach the *Boost Current* value again, the motor current must stay below the value of *Current Limit* for at least twice as long as it was above the *Current Limit*.

7.2.2.11 Thermal Rollback

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Thermal Rollback Start	40 - 70 °C	60 °C	•	•	•
	•		Thermal Rollback End	40 - 75 °C	70 °C	•	•	•

Thermal Rollback Start
Sets the temperature when the thermal rollback starts to reduce the speed of the wheelchair.

Thermal Rollback End
Sets the temperature when the thermal rollback limits the speed of the wheelchair to 10%.

The thermal rollback feature is used by the system to reduce the maximum speed that the user can demand from the wheelchair.

The drive speed is reduced, but the maximum possible current (or torque) is not reduced. This means that the wheelchair will drive slower but should still be able to climb small obstacles, such as kerbs.

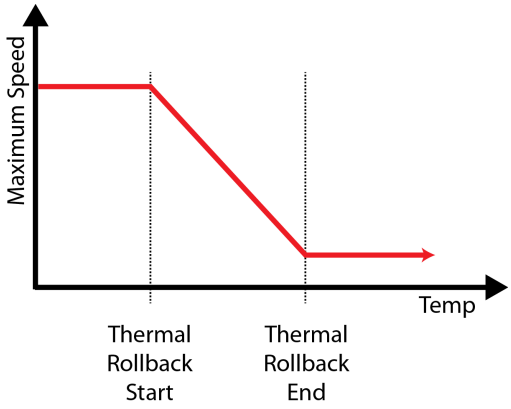


Figure 81: Thermal rollback

7.2.2.12 FET Thermal Rollback

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		FET Thermal Rollback Start	40 - 90 °C	70 °C	•	•	•
	•		FET Thermal Rollback End	40 - 90 °C	80 °C	•	•	•

FET Thermal Rollback Start
Sets the temperature when the FET thermal rollback starts to reduce the speed to protect the controller from overheating.

FET Thermal Rollback End
Sets the temperature when the FET thermal rollback reduces the speed to zero.

To protect the power module from overheating, an additional thermal rollback algorithm reduces the output current when the power module becomes too hot.

FET Thermal Rollback Start sets the temperature at which the thermal rollback starts.

FET Thermal Rollback End sets the temperature at which the thermal rollback limits the output current to zero, and driving is not possible.

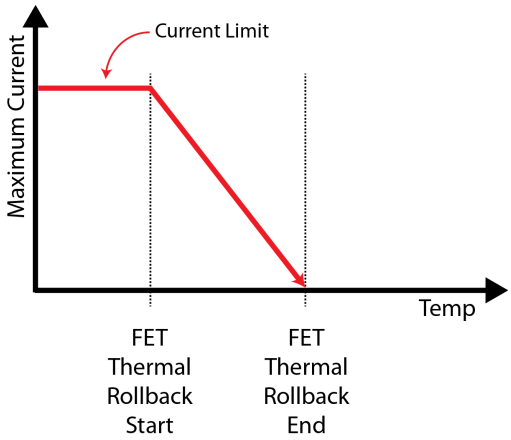


Figure 82: FET Thermal rollback

7.2.2.13 Open Circuit Test

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Open Circuit Test	Off/On	On	•	•	•

Check for motor open-circuit faults before starting to drive.

Before driving, the LiNX system tests the motors to make sure that they do not have an open-circuit fault.

Warning:
*Always set this parameter to **On**, except if motor faults occur because:*
- *the motor brushes frequently lose contact after the motor has stopped, or*
- *the motor resistance is higher than (approximately) 1 ohm, which the power module interprets as an open circuit.*

7.2.2.14 Short Circuit Test

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Short Circuit Test	Off/On	On	•	•	•

Check for short-circuit faults before starting to drive, and during driving.

Before driving and during driving, the LiNX system tests the motors to make sure that they are not short-circuited. Some special motors may fail this test even though they are healthy.

Warning:
*This parameter should always be set to **On**, unless the motors are failing this test and they have been fully tested to make sure that they are healthy.*

7.2.3 Core settings – park brake

7.2.3.1 Dual Park Brake Test

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Dual Park Brake Test	Single/Dual	Dual	•	•	•

Sets the park brake testing to both M1 and M2 (Dual) or M1 only (Single).

This parameter sets the park brake testing configuration. The LiNX system will periodically test the park brakes on the selected outputs.

Single – Only the M1 park brake output is tested. Do not use the M2 park brake output.

Dual – The M1 and M2 park brake outputs are both tested.

See section *5.7 Park brakes* for more information on how to connect the park brakes.

This parameter only affects the testing of the park brakes. The Left and Right outputs will still both operate any connected park brake, regardless of the value of the *Dual Park Brake Test* parameter.

7.2.3.2 Release Delay

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Release Delay	0 - 500 ms	50 ms	•	•	•

Sets the duration between when the park brakes are released and the wheelchair begins driving.

The *Release Delay* is the interval between when the park brake is released and when the wheelchair starts driving.

When the wheelchair is stopped and the joystick is deflected, the park brake is released immediately, but the wheelchair will not start driving until the *Release Delay* has expired. This is useful for park brakes that have a slow mechanical release.

Set the *Release Delay* to suit the mechanical release speed of the park brake: set the value high for slow releases, and low or zero for fast releases.

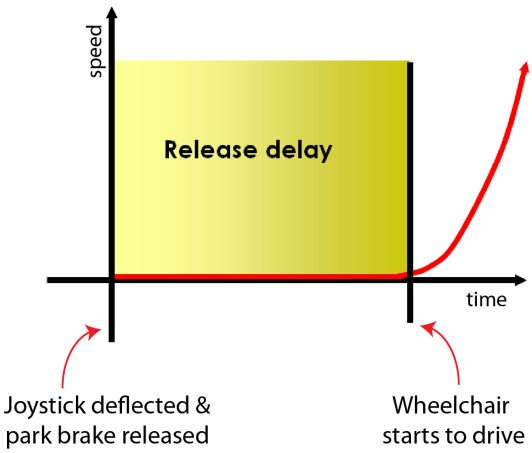


Figure 83: Release delay

Warning:
*If the park brake **Release Delay** value is set too high, the wheelchair may begin rolling before the motors start driving. If the value is set too low, the park brakes may still be engaged when the wheelchair starts driving, causing excessive wear of the park brakes and a jerky start to the drive.*

7.2.4 Core settings – battery management

Note:
Different battery makes and types may require parameter adjustment to optimise wheelchair performance and battery gauge accuracy; this section describes these adjustments. It is highly recommended that battery manufacturer's requirements are complied with.

7.2.4.1 Low Batt Rollback Start/End

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Low Batt Rollback Start	17 - 26 V	21 V	•	•	•
	•		Low Batt Rollback End	17 - 26 V	19 V	•	•	•

Low Batt Rollback Start
Sets the voltage at which the controller **starts** reducing the speed of the wheelchair to prevent battery damage.

Low Batt Rollback End
Sets the voltage at which the controller **stops** driving the wheelchair to prevent damage to the battery.

These two parameters are used to protect the battery when the wheelchair is being driven and the battery voltage falls below a level that could damage it.

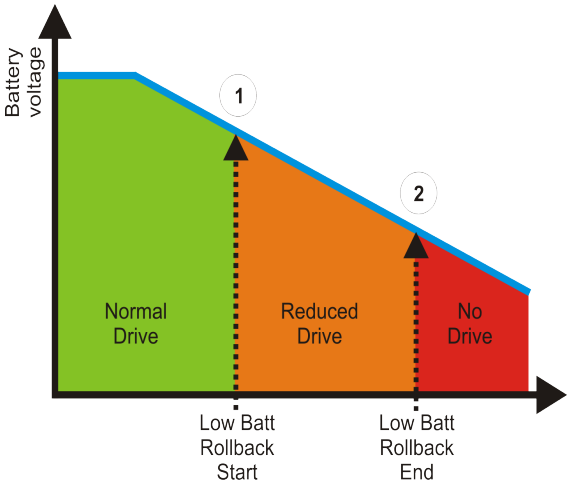


Figure 84: Low Batt Rollback Start/End

When the battery voltage starts getting too low, as set by *Low Batt Rollback Start* (level 1 in image, left), the voltage applied to the motors is reduced (which reduces the wheelchair's speed) to prevent battery damage. If the battery voltage continues to decrease, the voltage applied to the motors is decreased further. This voltage reduction to the motors continues until the battery voltage reaches the *Low Batt Rollback End* voltage (level 2 in image, left). When the battery voltage reaches the *Low Batt Rollback End* setting, the controller will stop the wheelchair from driving any further.

Note:
If the wheelchair is not driving and the battery voltage is lower than 18.0 volts, driving will be inhibited and a Flash Code 7 is generated. This value is not configurable.

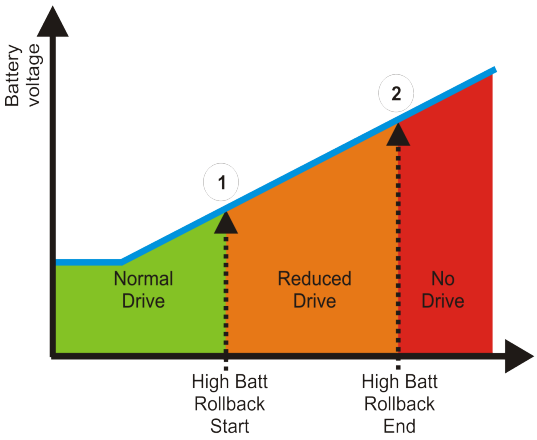
7.2.4.2 High Batt Rollback Start/End

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		High Batt Rollback Start	26 - 34 V	28 V	•	•	•
	•		High Batt Rollback End	26 - 34 V	32 V	•	•	•

High Batt Rollback Start
Sets the voltage at which the controller **starts** reducing the speed of the wheelchair to prevent battery damage.

High Batt Rollback End
Sets the voltage at which the controller **stops** driving the wheelchair to prevent damage to the battery.

These two parameters are used to protect the battery when the wheelchair is being driven and the battery voltage rises above a level that could damage it.



When the battery voltage starts getting too high, as set by *High Batt Rollback Start* (level 1 in image, left), the voltage applied to the motors is reduced (which reduces the wheelchair's speed) to prevent battery damage. If the battery voltage continues to increase, the voltage applied to the motors is decreased further. This voltage reduction to the motors continues until the battery voltage reaches the *High Batt Rollback End* voltage (level 2 in image, left). When the battery voltage reaches the *High Batt Rollback End* setting, the controller will stop the wheelchair from driving any further.

Figure 85: High Batt Rollback Start/End

7.2.4.3 Batt Gauge Dead Zone

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Batt Gauge Dead Zone	0 - 6 V	3.5 V	•	•	•

Sets a voltage range (dead zone) to prevent the battery gauge responding to false battery levels.

Batt Gauge Dead Zone prevents the battery gauge from increasing when the battery voltage recovers after driving. If the wheelchair is driving, the battery voltage will be lower than when the wheelchair stands still. However, the actual charge of the battery does not increase during standstill, even though the voltage has increased. This can cause the battery gauge to increase as well, showing a charge that is too high during standstill.

Batt Gauge Dead Zone makes sure that the battery gauge only shows a higher charge when the battery is actually being charged. Any increase in battery voltage that is lower than the value of *Batt Gauge Dead Zone* is ignored.

Note:
This parameter is only used when the Battery Gauge Type is set to "traditional". If the Battery Gauge Type is set to "enhanced", Batt Guage Dead Zone is not used.

7.2.4.4 Batt Gauge Minimum

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Batt Gauge Minimum	20 - 36 V	22.5 V	•	•	•

Sets the battery voltage at which the battery gauge displays its lowest level.

The battery gauge displays the voltage range between *Batt Gauge Minimum* and *Batt Gauge Maximum*. *Batt Gauge Minimum* is indicated on the battery gauge with the left-most LED lit and signifies that the battery level is between 0 and 20% of full capacity.

Figure 86: Battery Gauge Minimum

7.2.4.5 Batt Gauge Maximum

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Batt Gauge Maximum	20 - 36 V	25.5 V	•	•	•

Sets the battery voltage at which the battery gauge displays its highest level.

The battery gauge displays the voltage range between *Batt Gauge Minimum* and *Batt Gauge Maximum*. *Batt Gauge Maximum* is indicated on the battery gauge with all LEDs lit and signifies that the battery level is between 81 and 100% of full capacity.

Figure 87: Battery Gauge Maximum

7.2.4.6 Batt Gauge Low Voltage Warning

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Batt Gauge Low Voltage Warning	17 - 36 V	22.5 V	•	•	•

Sets the battery voltage at which point the system will generate a low battery warning.

A low battery warning is generated when the battery voltage falls below the *Batt Gauge Low Voltage Warning* set-point. This is indicated on the battery gauge with the red (left-most) LED flashing.

Figure 88: Battery Gauge Low Voltage Warming

7.2.4.7 Batt Gauge High Voltage Warning

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Batt Gauge High Voltage Warning	20 - 36 V	29 V	•	•	•

Sets the battery voltage at which point the system will generate a high battery warning.

A high battery warning is generated when the battery voltage goes above the *Batt Gauge High Voltage Warning* set-point. This is indicated on the battery gauge with all LEDs lit and the two green (right-most) LEDs flashing.

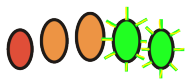


Figure 89: Battery Gauge High Voltage Warning

7.2.4.8 Cut-Off Voltage

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Cut-Off Voltage	17 - 24 V	21 V	•	•	•

Sets the cut-off voltage, as defined by the battery manufacturer, and generates a deep-discharge warning if the battery voltage falls below this value.

The *Cut-Off Voltage* specifies the voltage at which the battery is empty and battery damage will occur if the battery is discharged any further. If the battery voltage falls below this value, the status indicator will flash (Flash code 2), the horn will beep once every 10 seconds and the left-most, red LED on the battery gauge will flash.

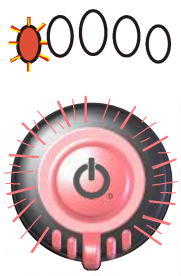


Figure 90: Cut-off Voltage

Set *Cut-Off Voltage* to the value as specified by the battery manufacturer in the battery specifications. The cut-off level for lead-acid batteries is normally 21 V. To avoid false battery warnings during high-load conditions, such as when driving up a slope, the *Cut-Off Voltage* may need to be set slightly lower than the default value.

Check your battery data sheet or contact your battery manufacturer for the best cut-off setting given your application and current requirements.

See also:
9 System and diagnostic information
9.3 Error indication

7.2.4.9 Battery Gauge Type

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		Battery Gauge Type	Traditional/ Enhanced	Traditional			•

Selection between different algorithms to calculate the battery gauge.

This parameter sets the algorithm used for calculating the battery's state of charge to display on the remote module's battery gauge. The *Traditional* setting uses a standard algorithm suitable for most systems. The *Enhanced* setting uses an improved algorithm that better reflects the true state of charge on lead-acid batteries.

Note:
To ensure that the battery gauge displays the correct value after a battery swap or when the Battery Gauge Type parameter is switched from Traditional to Enhanced, charge the batteries fully — the charging operation must go through a complete charge cycle.

See also:
5.5.7 Battery gauges

7.2.5 Drive settings – forward

Note:

1. *Many of the parameters in this section are checked as MR1-only, or MR2-only. If the system being tuned is MR1-based, then only the MR1-checked parameters can be used to tune the wheelchair. If the system is MR2-based, then only the MR2-checked parameters can be used to tune the wheelchair.*
2. *The LiNX Access iOS tools have a new graphical programming interface to allow users to interact with pictorial representations of the drive and stability settings. See the LiNX Access iOS Tool User Guide for more information.*

With the introduction of the MR2 firmware, the drive setting parameters have been separated into OEM-specific parameters and Dealer-specific parameters to better reflect the different tuning requirements between the OEM and the Dealer: OEMs set up the wheelchairs generically; dealers tune the wheelchairs for the end-user.

The OEM-specific parameters set the effective range that the Dealer-specific parameters can use. The OEM-specific parameters are detailed in sections *7.2.11 OEM Drive settings – forward* to *7.2.14 OEM Drive settings – stability*.

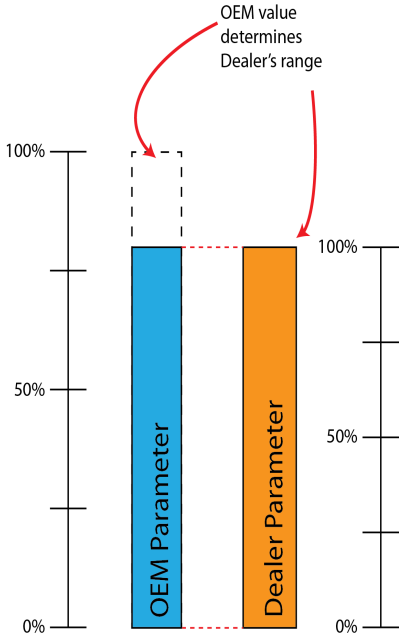


Figure 91: OEM value determines Dealer's range

7.2.5.1 Max Forward Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Max Forward Speed	5 - 100%	100%	•		

Sets the maximum forward speed available when the joystick is fully deflected and the speed dial is set to its **highest** position.

To set the speed dial to its highest position, turn the speed dial fully to the right.

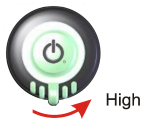


Figure 92: Max Forward Speed

7.2.5.2 Min Forward/Reverse Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Min Forward/Reverse Speed	5 - 100%	20%	•		

Sets the maximum forward and reverse speed available when the joystick is fully deflected and the speed dial is set to its **lowest** position.

To set the speed dial to its lowest position, turn the speed dial fully to the left.

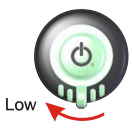


Figure 93: Min Forward/Reverse Speed

7.2.5.3 Forward Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Forward Acceleration	0 - 90%	30%	•		

Sets how quickly the wheelchair will increase its speed when the wheelchair is travelling forwards.

0% results in a very slow increase, 90% results in a very quick increase.

7.2.5.4 Forward Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Forward Deceleration	15 - 100%	40%	•		

Sets how quickly the wheelchair will decrease its speed when the wheelchair is travelling forwards.

A value of 15% results in a slow stop; a value of 100% results in an almost instant stop. Be careful when setting this parameter below 30%, as this can cause the wheelchair to drive a long way after the joystick has been released.

Warning:
Do not set this value too high as the user may lose balance or fall out of the wheelchair if it stops too quickly. Make sure that the deceleration parameters are always higher than the acceleration parameters for a safe response.

7.2.5.5 Forward Speed Scalar

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Forward Speed Scalar	0 - 100%	95%	•		

Limits the forward speed as a percentage of the maximum deliverable speed.

Forward Speed Scalar is used to slow down the forward speed. The demand will be scaled by this factor before S-curve processing (see section *3 Glossary*). Ideally, this should be set high enough so that the wheelchair speed is not lost while travelling uphill and low enough so that wheelchair speed does not increase when travelling downhill.

Note: If set to zero, the wheelchair cannot move forward.

7.2.5.6 Max Forward Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Max Forward Speed	0 - 100%	100%		•	•

Sets the maximum forward speed of the wheelchair.

This parameter sets the maximum forward speed available to the user when the joystick is fully deflected and the speed dial is set to its **highest** position.

To set the speed dial to its highest position, turn the speed dial fully to the right.

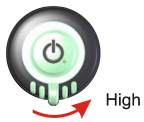


Figure 94: Max Forward Speed

***See also**:*
This parameter's effective range is set with OEM Forward Speed.

7.2.5.7 Min Forward Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Min Forward Speed	0 - 100%	10%		•	•

Sets the maximum forward speed of the wheelchair when speed dial is at minimum.

This parameter sets the maximum forward speed available when the joystick is fully deflected and the speed dial is set to its **lowest** position.

To set the speed dial to its lowest position, turn the speed dial fully to the left.

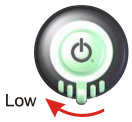


Figure 95: Min Forward Speed

7.2.5.8 Forward Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Forward Acceleration	0 - 100%	100%		•	•

Sets the maximum forward acceleration of the chair.

This parameter sets how quickly the wheelchair will increase its speed when the wheelchair is travelling forwards.

A value of 0% results in a very slow increase; a value of 100% results in a very quick increase.

***See also**:*
This parameter's effective range is set with OEM Forward Acceleration.

7.2.5.9 Forward Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Forward Deceleration	5 - 100%	100%		•	•

Sets the maximum forward deceleration of the wheelchair.

This parameter sets how quickly the wheelchair will decrease its speed when the wheelchair is travelling forwards.

Setting this value to 5% results in a slow stop; 100% results in an almost instant stop. Be careful when setting this parameter below 30%, as this can cause the wheelchair to drive a long way after the joystick has been released.

***Warning**:*
Do not set this value too high as the user may lose balance or fall out of the wheelchair if it stops too quickly. Make sure that the deceleration parameters are always higher than the acceleration parameters for a safe response.

***See also**:*
This parameter's effective range is set with OEM Forward Deceleration.

7.2.5.10 Soft Start/Finish Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Soft Start Acceleration	0 - 5 s	0.3 s	•	•	•
	•	⇆	Soft Finish Acceleration	0 - 100%	30%	•	•	•

Soft Start Acceleration
Sets the length of time to smoothly ramp up to the forward/reverse acceleration setting.

Soft Finish Acceleration
Reduces the acceleration as the wheelchair approaches the desired speed.

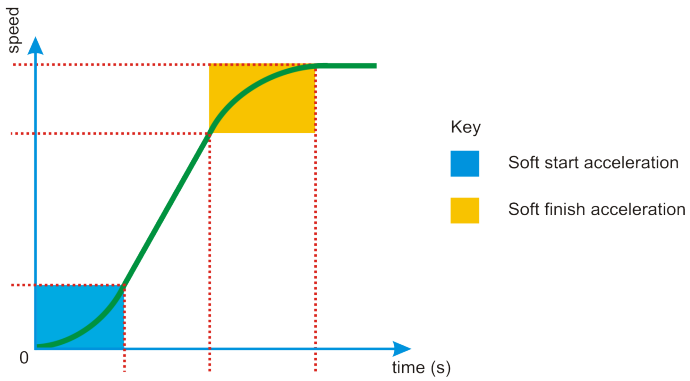


Figure 96: Defining soft start and soft finish acceleration

Soft Start Acceleration Whenever there is an increase in speed demand, the Soft Start Acceleration function temporarily reduces the acceleration rate during the time that is set with Soft Start Acceleration (the blue section in *Figure 96*). This makes the acceleration smoother, especially with high acceleration rates.

Higher values give a softer start, while lower values give a more direct and harsh start.
To disable soft start completely, set *Soft Start Acceleration* to zero.

Soft Finish Acceleration When the wheelchair almost reaches its desired speed during acceleration, the acceleration rate is slowly decreased to zero (the yellow section in *Figure 96*). This prevents a sudden change in acceleration once the desired speed is reached.

Use the *Soft Finish Acceleration* parameter to adjust the point where the soft transition starts.

0%: Direct and harsh transition (no soft finish at all)

100%: Very smooth transition

For most applications, the default value of 30% works well.

7.2.5.11 Soft Start/Finish Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Soft Start Deceleration	0 - 1 s	0.1 s	•	•	•
	•	⇆	Soft Finish Deceleration	0 - 100%	40%	•	•	•

Soft Start Deceleration
Sets the length of time to smoothly ramp down to the forward / reverse deceleration settings.

Soft Finish Deceleration
Reduces the deceleration as the wheelchair ramps down to a stop.

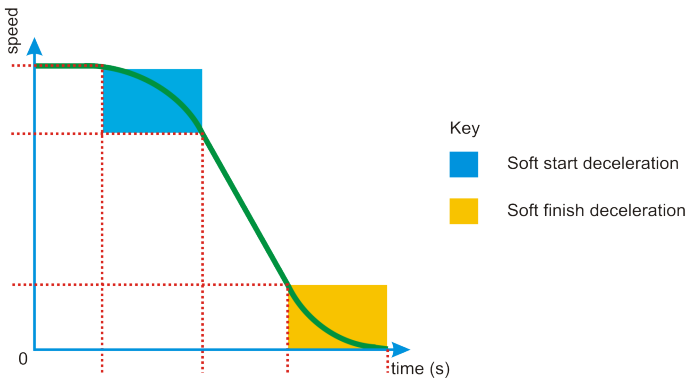


Figure 97: Defining soft start and soft finish deceleration

Soft Start Deceleration Whenever there is a decrease in speed demand, the Soft Start Deceleration function temporarily reduces the deceleration rate during the time that is set with Soft Start Deceleration (the blue section in *Figure 97*). This makes the deceleration smoother, especially with high deceleration rates.

Higher values give a softer deceleration start, while lower values give a more direct and harsh start. To disable soft start deceleration completely, set *Soft Start Deceleration* to zero.

Soft Finish Deceleration When the wheelchair almost reaches its desired speed during deceleration, the deceleration rate is slowly decreased to zero (the yellow section in *Figure 97*). This prevents a sudden change in deceleration once the desired speed is reached.

Use the *Soft Finish Deceleration* parameter to adjust the point where the soft deceleration transition starts.

0%: Direct and harsh transition (no soft finish at all)

100%: Very smooth transition

For most applications, the default value of 40% works well.

Warning:
High values for Soft Start/Finish Deceleration will extend the wheelchair's stopping distance and stopping time. Ensure that the stopping distance and time is safe and suitable for both the wheelchair and the user.

7.2.6 Drive settings – reverse

***Note**:*
Many of the parameters in this section are checked as MR1-only, or MR2-only. If the system being tuned is MR1-based, then only the MR1-checked parameters can be used to tune the wheelchair. If the system is MR2-based, then only the MR2-checked parameters can be used to tune the wheelchair.

7.2.6.1 Max Reverse Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Max Reverse Speed	0 - 100%	50%	•		

Sets the maximum reverse speed available to the user at full joystick deflection and when the speed dial is set to its highest position. Note that this parameter cannot be set below *Min Forward/Reverse Speed*.

To set the speed dial to its highest position, turn the speed dial to its right-most position.

When *Max Reverse Speed* is set to 0%, the controller will prevent any reverse motion.

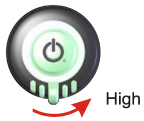


Figure 98: Max Reverse Speed

7.2.6.2 Reverse Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Reverse Acceleration	0 - 90%	30%	•		

Sets how quickly the wheelchair will increase its speed when the wheelchair is travelling in reverse.

A value of 0% results in a very slow increase; a value of 90% results in a very quick increase.

7.2.6.3 Reverse Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Reverse Deceleration	15 - 100%	40%	•		

Sets how quickly the wheelchair will decrease its speed when the wheelchair is travelling in reverse.

A value of 15% results in a very slow stop; a value of 100% results in an almost instant stop.

***Warning**:*
Do not set this value too high as the wheelchair may tip over if it stops too quickly when reversing down a slope.

7.2.6.4 Max Reverse Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Max Reverse Speed	0 - 100%	100%		•	•

Sets the maximum reverse speed of the wheelchair.

This parameter sets the maximum reverse speed available to the user when the joystick is fully deflected and when the speed dial is set to its highest position.

Note that this parameter cannot be set below *Min Forward/Reverse Speed*.

To set the speed dial to its highest position, turn the speed dial fully to the right.

When *Max Reverse Speed* is set to 0, the controller will prevent any reverse motion.

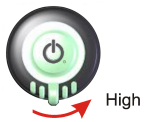


Figure 99: Max Reverse Speed

See also:
This parameter's effective range is set with OEM Reverse Speed.

7.2.6.5 Min Reverse Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Min Reverse Speed	0 - 100%	10%		•	•

Sets the maximum reverse speed of the wheelchair when speed dial is at minimum.

This parameter sets the maximum reverse speed available when the joystick is fully deflected and the speed dial is set to its **lowest** position.

To set the speed dial to its lowest position, turn the speed dial fully to the left.

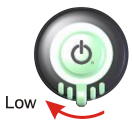


Figure 100: Min Reverse Speed

7.2.6.6 Reverse Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Reverse Acceleration	0 - 100%	100%		•	•

Sets the maximum reverse acceleration of the wheelchair.

This parameter sets how quickly the wheelchair will increase its speed when the wheelchair is travelling in reverse.

A value of 0% results in a very slow increase; a value of 100% results in a very quick increase.

See also:
This parameter's effective range is set with OEM Reverse Acceleration.

7.2.6.7 Reverse Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Reverse Deceleration	5 - 100%	100%		•	•

Sets the maximum reverse deceleration of the chair.

This parameter sets how quickly the wheelchair will decrease its speed when the wheelchair is travelling in reverse.

Setting the value to 5% results in a very slow stop, 100% results in an almost instant stop.

Warning:
Do not set this value too high as the wheelchair may tip over if it stops too quickly when reversing down a slope.

See also:
This parameter's effective range is set with OEM Reverse Deceleration.

7.2.7 Drive settings – turn

***Note**:*
Many of the parameters in this section are checked as MR1-only, or MR2-only. If the system being tuned is MR1-based, then only the MR1-checked parameters can be used to tune the wheelchair. If the system is MR2-based, then only the MR2-checked parameters can be used to tune the wheelchair.

7.2.7.1 Max Turn Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Max Turn Speed	0 - 100%	60%	•		

Sets the maximum speed of turn when the joystick is fully deflected in the turn direction and the speed dial is set to its **highest** position. Note that this parameter cannot be set below *Min Turn Speed*.

7.2.7.2 Min Turn Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Min Turn Speed	5 - 100%	20%	•		

Sets the maximum speed of turn when the joystick is fully deflected in the turn direction and the speed dial is set to its **lowest** position.

Note that this parameter cannot be set above *Max Turn Speed*.

7.2.7.3 Turn Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Turn Acceleration	0 - 90%	30%	•		

Sets how quickly the wheelchair will increase its turn speed when the wheelchair is turning.

A value of 0% results in a very slow increase; a value of 90% results in a very quick increase.

7.2.7.4 Turn Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Turn Deceleration	15 - 100%	40%	•		

Sets how quickly the wheelchair will decrease its turn speed when the wheelchair is turning.

A value of 15% results in a very slow stop; a value of 100% results in an instant stop.

***Warning**:*
Do not set this value too high as the user may lose balance or fall out of the wheelchair if it stops too quickly.

7.2.7.5 Turn Boost at Max Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Turn Boost At Max Speed	100 - 300%	200%	•	•	•

Boosts *Turn Acceleration* proportional to speed.

This parameter adjusts the overall response of the joystick when turning at speed. When a wheelchair is travelling slowly, it is desirable for the wheelchair to respond quickly to a joystick turn demand. Similarly, when a wheelchair is moving quickly, it is desirable for the wheelchair to respond less quickly to the joystick turn demand, thus helping the wheelchair maintain its course. However, when the wheelchair is moving in a straight line quickly, and a quick turn response is required (to avoid an obstacle for instance), increasing the value of *Turn Boost at Max Speed* can improve the response of the joystick.

For more information on setting this parameter, see step 6 in section *7.2.5 Drive settings – forward*.

7.2.7.6 Max Turn Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Max Turn Speed	0 - 100%	100%		•	•

Sets the maximum turn speed of the wheelchair.

This parameter sets the maximum speed of turn when the joystick is fully deflected in the turn direction and the speed dial is set to its **highest** position. Note that this parameter cannot be set below *Min Turn Speed*.

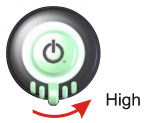


Figure 101: Max Turn Speed

To set the speed dial to its highest position, turn the speed dial fully to the right.

See also:
This parameter's effective range is set with OEM Turn Speed.

7.2.7.7 Min Turn Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Min Turn Speed	0 - 100%	10%		•	•

Sets the minimum turn speed of the wheelchair when speed dial is at minimum.

This parameter sets the maximum reverse speed available when the joystick is fully deflected and the speed dial is set to its **lowest** position. Note that this parameter cannot be set above *Max Turn Speed*.

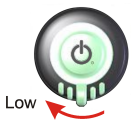


Figure 102: Min Turn Speed

To set the speed dial to its lowest position, turn the speed dial fully to the left.

7.2.7.8 Turn Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Turn Acceleration	0 - 100%	100%		•	•

Sets the maximum turn acceleration of the chair.

This parameter sets how quickly the wheelchair will increase its turn speed when the wheelchair is turning. Setting the value to 0% results in a very slow increase; 100% results in a very quick increase.

***See also**:*
This parameter's effective range is set with OEM Turn Acceleration.

7.2.7.9 Turn Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Turn Deceleration	5 - 100%	100%		•	•

Sets the maximum turn deceleration of the chair.

This parameter sets how quickly the wheelchair will decrease its turn speed when the wheelchair is turning. Setting the value to 5% results in a very slow stop, 100% results in an instant stop.

***Warning**:*
Do not set this value too high as the user may lose balance or fall out of the wheelchair if it stops too quickly.

***See also**:*
This parameter's effective range is set with OEM Turn Deceleration.

7.2.7.10 Soft Start Turn

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Soft Start Turn	0 - 2 s	0 s	•	•	•

The time to apply the soft start to a turn.

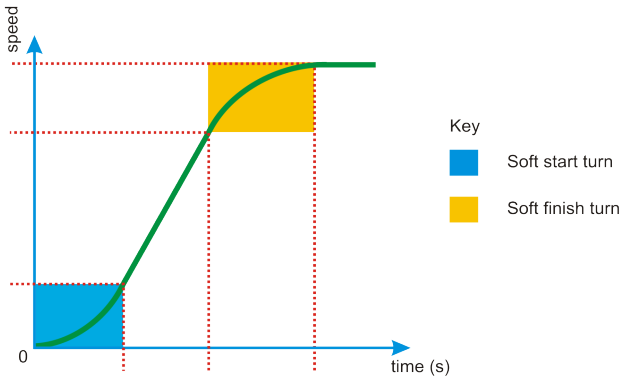


Figure 103: Defining soft start turn and soft finish turn

Whenever there is an increase in turn speed demand, the soft start turn function temporarily reduces the acceleration rate during the time that is set with *Soft Start Turn* (the blue section in *Figure 103*). This makes the acceleration smoother, especially with high acceleration rates.

Higher values give a softer start, while lower values give a more direct and harsh start. To disable soft start completely, set *Soft Start Turn* to zero.

***Note**:*
*The value of **Soft Start Turn** is used for both turn acceleration and turn deceleration.*

7.2.7.11 Soft Finish Turn

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Soft Finish Turn	0 - 100%	30%	•	•	•

Reduces the acceleration as the wheelchair approaches the desired turn speed.

This parameter determines the region in which to apply soft finish to a turn. When the wheelchair almost reaches its desired speed during turning acceleration, the acceleration rate is slowly decreased to zero (the yellow section in *Figure 103*). This prevents a sudden change in acceleration once the desired speed is reached.

Use the *Soft Finish Turn* parameter to adjust the point where the soft transition starts.

0%: Direct and harsh transition (no soft finish at all)
100%: Very smooth transition

For most applications, the default value of 30% works well.

***Note**:*
*The value of **Soft Finish Turn** is used for both turn acceleration and turn deceleration.*

7.2.8 Drive settings – stability settings for LiNX MR1 systems

Note:
The stability parameters for LiNX MR1 systems are different to those of LiNX MR2 systems.

The stability parameters for LiNX MR1 systems are detailed in this section 7.2.8 Drive settings – stability settings for LiNX MR1 systems.

The stability parameters for LiNX MR2 systems are described in section 7.2.9 Drive settings – stability settings for LiNX MR2 systems and section 7.2.14 OEM Drive settings – stability.

7.2.8.1 Turn Response

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Turn Response	0 - 100%	50%	•		

Balances the turning performance of a wheelchair between low speed traction out of a tight turn and the ability to respond to turn demand at full speed.

Note that the *Turn Response* parameter does not limit the physical joystick position, but it does limit the wheelchair response, depending on speed.

If *Turn Response* is set to a low value, stability when exiting from a turn at low speed will be effective, but the steering response at high speed may be poor.

Similarly, if *Turn Response* is high, stability when exiting from a turn at low speed may be poor, but the steering response at high speed will be effective.

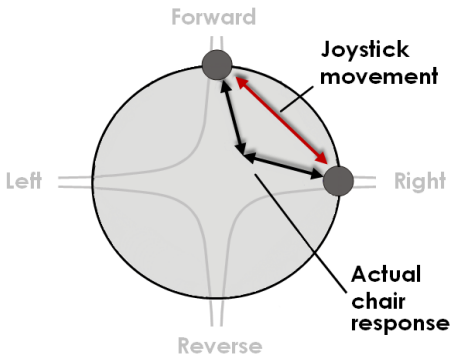


Figure 104: Turn Response – wheelchair response

The value of *Turn Response* is also dependent on the type of wheelchair. Front-wheel drive (FWD) wheelchairs will generally require lower values than rear-wheel drive (RWD) wheelchairs.

Note:
*It is highly recommended to set **Turn Response** before setting **Turn at Max Speed**. If **Turn at Max Speed** is set before **Turn Response**, the effect of **Turn at Max Speed** becomes limited.*

7.2.8.2 Turn at Max Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Turn at Max Speed	0 - 100%	25%	•		

Sets how fast the wheelchair will turn when travelling at maximum speed.

Note that this parameter is more effective when *Turn Response* has been optimised first.
The speed limiting does not limit the physical joystick position, but it limits the wheelchair response. For example, with a 5% *Turn at Max Speed* value, if a wheelchair travels at full speed forward and the joystick suddenly demands a sharp right turn, the wheelchair will first slow down before it starts to turn.

Note:
The actual wheelchair response can be limited by other factors or parameters (for example the acceleration parameters, and other wheelchair stability parameters), and therefore the actual response path can be inside the limit curves. The path will never go outside the limit curve, however.

7.2.8.3 Stability at Min Speed Dial

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Stability at Min Speed Dial	0 - 80%	50%	•		

Adjusts the effect of stability settings at slow speeds to prevent stalling or slow response to input demand.

Physical grip is the amount of contact that the drive wheels have with the surface that they drive on. With little physical grip, the drive wheels slip easily. If the wheels slip, the wheelchair is uncontrollable.

The *Stability at Min Speed Dial* parameter works with the *Stability at Max Speed Dial* parameter to define the overall effect of the stability parameters:

- *Turn Response*
- *Turn at Max Speed*

The stability parameters are used by the wheelchair manufacturer to:

- provide a stable wheelchair
- prevent the drive wheels from slipping.

A high value of *Stability at Min Speed Dial* increases the effect that the stability parameters have so that the wheelchair will become more stable on a surface with little physical grip (that is, the wheelchair will have more traction on that surface).

Stability Control Value	Use	Result
0%	Good physical grip. No adjustment needed	The stability parameters have their actual OEM programmed value
80%	Very little physical grip. Maximum stability needed	The effect of the stability parameters is increased to provide better stability

For example:

- A wheelchair on a non-slip surface has a high physical grip, so the *Stability at Min Speed Dial* parameter can be set to 0%.
- A wheelchair on a slippery surface has a low physical grip, so the *Stability at Min Speed Dial* parameter must be set higher.

Note:
*If the wheelchair will be used mostly indoors, set **Stability at Min Speed Dial** to a high value to prevent skid marks on the floor.*

Warning:
*The correct value for the **Stability at Min Speed Dial** parameter is dependent on the value of the stability parameters. Testing is required to verify suitability for individual wheelchair designs and/or users.*

7.2.8.4 Stability at Max Speed Dial

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Stability at Max Speed Dial	0 - 80%	50%	•		

Adjusts the effect of stability settings at high speeds to prevent oversteering and instability.

The *Stability at Max Speed Dial* parameter works with the *Stability at Min Speed Dial* parameter to define the overall effect of the stability parameters:

- *Turn Response*
- *Turn at Max Speed*

The stability parameters are used by the wheelchair manufacturer to:

- provide a stable wheelchair
- prevent the drive wheels from slipping.

A high value of *Stability at Max Speed Dial* increases the effect that the stability parameters have so the wheelchair will become more stable on a surface with little physical grip (that is, the wheelchair will have more traction on that surface).

7.2.9 Drive settings – stability settings for LiNX MR2 systems

Note:
The stability parameters for LiNX MR1 systems are different to those of LiNX MR2 systems.
The stability parameters for LiNX MR1 systems are detailed in section 7.2.8 Drive settings – stability settings for LiNX MR1 systems.
The stability parameters for LiNX MR2 systems are described in this section 7.2.9 Drive settings – stability settings for LiNX MR2 systems and section 7.2.14 OEM Drive settings – stability.

The LiNX Access iOS tools have a new graphical programming interface to allow users to interact with pictorial representations of the drive and stability settings.

7.2.9.1 Overview of stability settings for LiNX MR2 systems

With the introduction of the LiNX MR2 core software, the stability functionality has been improved and simplified; the available stability parameters have been revised, and wheelchair stability is now easier to set up.

The wheelchair's turn response, driving into a turn, or driving out of a turn, depends on many factors, including the wheelchair's forward (or reverse) speed, speed demand, turning speed and turn demand.

Using the stability settings below, the shape of the response (smooth, sharp, fast and slow) can be changed to suit the wheelchair and prospective users.

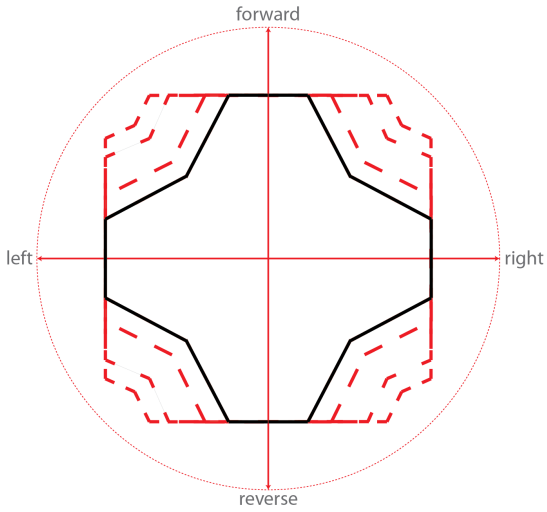


Figure 105: Wheelchair's turn response shape

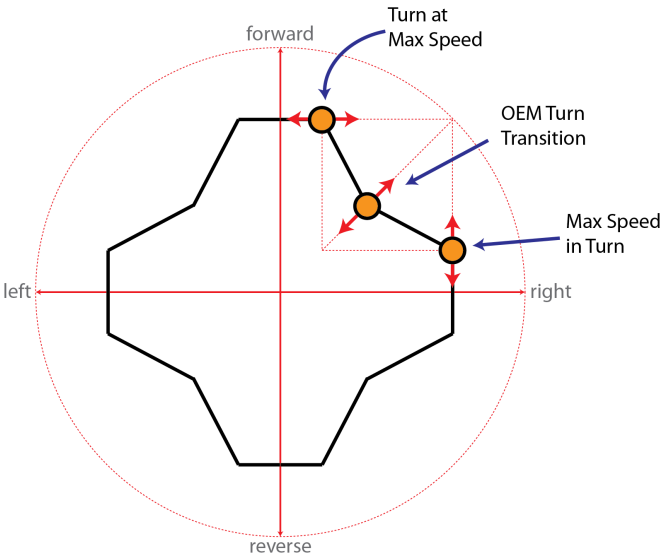


Figure 106: Changing the turn response shape

The three parameters that control the wheelchair's stability are:

- *Turn at Max Speed*
- *Max Speed in Turn*
- *OEM Turn Transition*

Note that there is a fourth parameter, Turn Transition (see *7.2.9.2 Turn Transition*) available to the dealer to further tune the wheelchair for the end user.

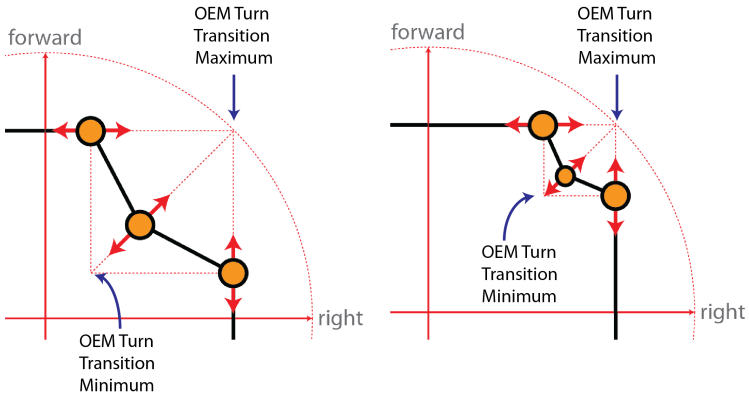
Changing any of these parameters will change the shape of the wheelchair's turn response.

Use *Turn at Max Speed* to limit the speed into the turn when the wheelchair is travelling at maximum speed, forwards or reverse. Higher values result in higher turn speeds at maximum forward speed. Lower values offer greater stability.

Use *Max Speed in Turn* to limit the speed coming out of a turn, forwards or reverse. Higher values result in higher forward speeds at maximum turn speed. Lower values offer greater stability.

Use *OEM Turn Transition* to change the shape of the transition between the points defined by *Turn at Max Speed* and *Max Speed in Turn*. Higher values create faster transitions, while lower values provide slower transitions.

The *Turn at Max Speed* and *Max Speed in Turn* parameters can be set independently from each other, but any change in one or both of these parameters, results in a change to the effect of *OEM Turn Transition*.



For example, as shown left, increasing the values of both *Turn at Max Speed* and *Max Speed in Turn* decreases the effect of *OEM Turn Transition*.

Figure 107: OEM Turn Transition depends on Turn at Max Speed and Max Speed in Turn

The turn response shape can be further modified by changing the magnitude of the speeds in any of the directions (forward, left, right and reverse) with:

- *Max Forward Speed*
- *Max Reverse Speed*
- *Max Turn Speed*

Because the forward and reverse speeds can be set independently of each other, the forward direction can be configured to have a different response shape to the reverse direction.

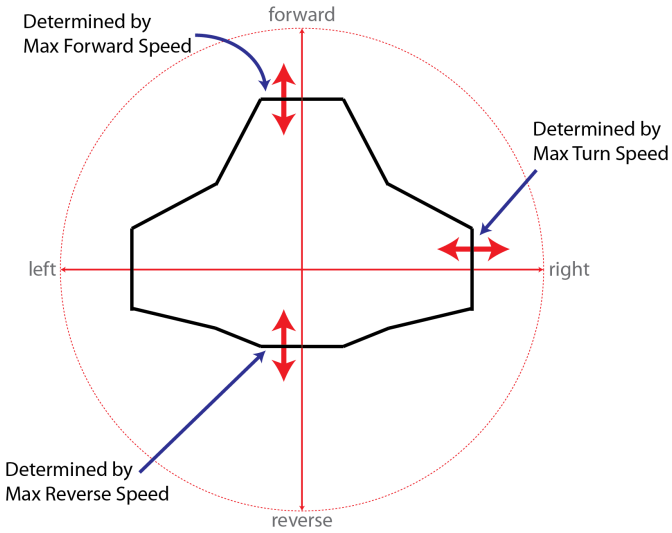


Figure 108: Modifying the turn response with maximum speeds

7.2.9.2 Turn Transition

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Turn Transition	0 - 100%	100%		•	•

Adjusts the available forward speed for a given turn, i.e. the shape of the speed transition from *Turn at Max Speed* to *Max Speed in Turn*.

Use *Turn Transition* to change the shape of the transition between the points defined by *Turn at Max Speed* and *Max Speed in Turn*. Higher values create faster transitions, while lower values provide slower transitions.

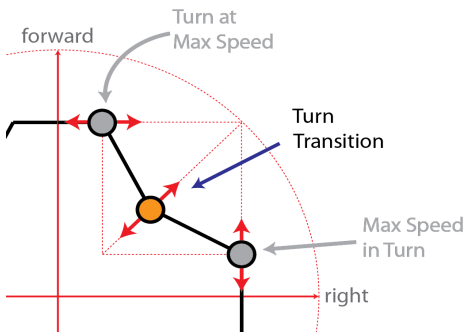


Figure 109: Using Turn Transition

See also:
This parameter's effective range is set with OEM Turn Transition.

7.2.10 Performance

7.2.10.1 Power

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Power	0 - 100%	100%			•

Sets the power available in this function as a percentage of the maximum allowable power.

This parameter provides the dealer with the ability to limit the maximum allowable power of the wheelchair by scaling the Current Limit parameter.

The maximum allowable power is set by the OEM and is the sum of the Current Limit and Boost Current parameters.

If the Power parameter is set to 100 % (default), then the power module can deliver the maximum power set by the sum of Current Limit and Boost Current.

However, if Power is set to less than 100 %, then:

- the Boost Current element is removed from the maximum allowable power, and
- the Current Limit is scaled proportionally.

For example:
1) If Power = 100 %, the power module will deliver up to Current Limit + Boost Current.
2) If Power = 75 %, the power module will deliver up to 75% of Current Limit.

The Power parameter is available for each drive function.

7.2.11 OEM Drive settings – forward

Note:

1. *Many of the parameters in this section are checked as MR1-only, or MR2-only. If the system being tuned is MR1-based, then only the MR1-checked parameters can be used to tune the wheelchair. If the system is MR2-based, then only the MR2-checked parameters can be used to tune the wheelchair.*
2. *The LiNX Access iOS tools have a new graphical programming interface to allow users to interact with pictorial representations of the drive and stability settings. See the LiNX Access iOS Tool User Guide for more information.*

With the introduction of the MR2 core firmware, the drive setting parameters have been separated into OEM-specific parameters and Dealer-specific parameters to better reflect the different tuning requirements between the OEM and the Dealer: OEMs set up the wheelchairs generically; dealers tune the wheelchairs for the end-user.

The OEM-specific parameters set the effective range that the Dealer-specific parameters can use.

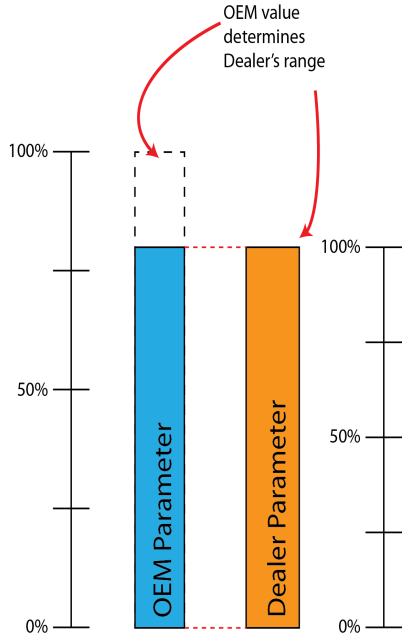


Figure 110: OEM value determines Dealer's range

7.2.11.1 OEM Forward Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•		OEM Forward Speed	0 - 100%	95%		•	•

Sets the maximum wheelchair forward speed that a dealer will be able to adjust.

The *OEM Forward Speed* parameter is used by the OEM to set the **effective range** of the *Max Forward Speed* parameter. Setting *OEM Forward Speed* to any value lower than 100% will scale the *Max Forward Speed* parameter, which reduces the available forward speed.

For example,

- if *OEM Forward Speed* is set to 100%, then the *Max Forward Speed* range (0 - 100%) is not limited.
- if *OEM Forward Speed* is set to, say, 80%, then the *Max Forward Speed* is scaled so that setting *Max Forward Speed* to 100% will only permit the wheelchair to travel at 80% of the maximum forward speed.

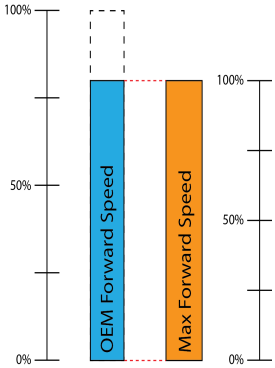


Figure 111: OEM Forward Speed determines Max Forward Speed range

7.2.11.2 OEM Forward Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Forward Acceleration	0 - 100%	30%		•	•

Sets the maximum wheelchair forward acceleration that a dealer will be able to adjust.

The *OEM Forward Acceleration* parameter is used by the OEM to set the effective range of the *Forward Acceleration* parameter. Setting *OEM Forward Acceleration* to any value lower than 100% will scale the *Forward Acceleration* parameter, which reduces the available forward acceleration.

For example,

- if *OEM Forward Acceleration* is set to 100%, then the *Forward Acceleration* range (0 - 100%) is not limited.
- if *OEM Forward Acceleration* is set to, say, 80%, then the *Forward Acceleration* is scaled so that setting *Forward Acceleration* to 100% will only permit 80% of the maximum forward acceleration.

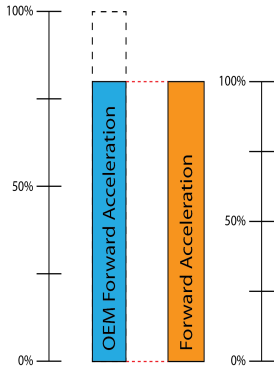


Figure 112: OEM Forward Acceleration determines Forward Acceleration range

7.2.11.3 OEM Forward Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Forward Deceleration	15 - 100%	40%		•	•

Sets the maximum wheelchair forward deceleration that a dealer will be able to adjust.

The *OEM Forward Deceleration* parameter is used by the OEM to set the effective range of the *Forward Deceleration* parameter. Setting *OEM Forward Deceleration* to any value lower than 100% will scale the *Forward Deceleration* parameter, which reduces the available forward deceleration.

For example,

- if *OEM Forward Deceleration* is set to 100%, then the *Forward Deceleration* range (0 - 100%) is not limited.
- if *OEM Forward Deceleration* is set to, say, 80%, then the *Forward Deceleration* is scaled so that setting *Forward Deceleration* to 100% will only permit 80% of the maximum forward deceleration.

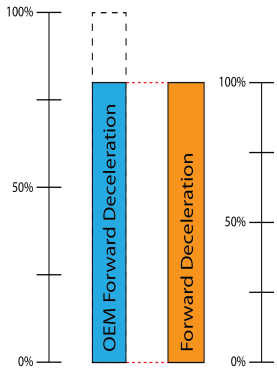


Figure 113: OEM Forward Deceleration determines Forward Deceleration range

7.2.12 OEM Drive settings – reverse

Note:
Many of the parameters in this section are checked as MR1-only, or MR2-only. If the system being tuned is MR1-based, then only the MR1-checked parameters can be used to tune the wheelchair. If the system is MR2-based, then only the MR2-checked parameters can be used to tune the wheelchair.

7.2.12.1 OEM Reverse Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Reverse Speed	0 - 100%	50%		•	•

Sets the maximum wheelchair reverse speed that a dealer will be able to adjust.

The *OEM Reverse Speed* parameter is used by the OEM to set the effective range of the *Max Reverse Speed* parameter. Setting *OEM Reverse Speed* to any value lower than 100% will scale the *Max Reverse Speed* parameter, which reduces the available reverse speed.

For example,

- if *OEM Reverse Speed* is set to 100%, then the *Max Reverse Speed* range (0 - 100%) is not limited.
- if *OEM Reverse Speed* is set to, say, 80%, then the *Max Reverse Speed* is scaled so that setting *Max Reverse Speed* to 100% will only permit the wheelchair to travel at 80% of the maximum reverse speed.

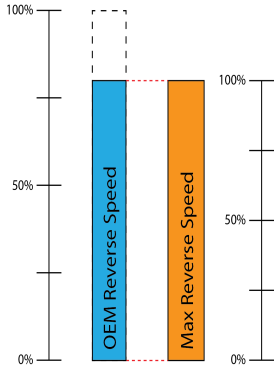


Figure 114: OEM Reverse Speed determines Max Reverse Speed range

7.2.12.2 OEM Reverse Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Reverse Acceleration	0 - 100%	40%		•	•

Sets the maximum reverse acceleration that a dealer will be able to adjust.

The *OEM Reverse Acceleration* parameter is used by the OEM to set the effective range of the *Reverse Acceleration* parameter. Setting *OEM Reverse Acceleration* to any value lower than 100% will scale the *Reverse Acceleration* parameter, which reduces the available reverse acceleration.

For example,

- if *OEM Reverse Acceleration* is set to 100%, then the *Reverse Acceleration* range (0 - 100%) is not limited.
- if *OEM Reverse Acceleration* is set to, say, 80%, then the *Reverse Acceleration* is scaled so that setting *Reverse Acceleration* to 100% will only permit 80% of the maximum reverse acceleration.

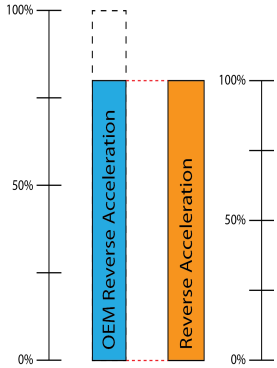


Figure 115: OEM Reverse Acceleration determines Reverse Acceleration range

7.2.12.3 OEM Reverse Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Reverse Deceleration	15 - 100%	54%		•	•

Sets the maximum reverse deceleration that a dealer will be able to adjust.

The *OEM Reverse Deceleration* parameter is used by the OEM to set the effective range of the *Reverse Deceleration* parameter. Setting *OEM Reverse Deceleration* to any value lower than 100% will scale the *Reverse Deceleration* parameter, which reduces the available reverse deceleration.

For example,

- if *OEM Reverse Deceleration* is set to 100%, then the *Reverse Deceleration* range (0 - 100%) is not limited.
- if *OEM Reverse Deceleration* is set to, say, 80%, then the *Reverse Deceleration* is scaled so that setting *Reverse Deceleration* to 100% will only permit 80% of the maximum reverse deceleration.

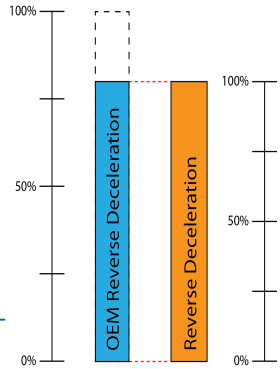


Figure 116: OEM Reverse Deceleration determines Reverse Deceleration range

7.2.13 OEM Drive settings – turn

Note:
Many of the parameters in this section are checked as MR1-only, or MR2-only. If the system being tuned is MR1-based, then only the MR1-checked parameters can be used to tune the wheelchair. If the system is MR2-based, then only the MR2-checked parameters can be used to tune the wheelchair.

7.2.13.1 OEM Turn Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Turn Speed	0 - 100%	30%		•	•

Sets the maximum wheelchair turn speed that a dealer will be able to adjust.

The *OEM Turn Speed* parameter is used by the OEM to set the effective range of the *Max Turn Speed* parameter. Setting *OEM Turn Speed* to any value lower than 100% will scale the *Max Turn Speed* parameter, which reduces the available turn speed.

For example,

- if *OEM Turn Speed* is set to 100%, then the *Max Turn Speed* range (0 - 100%) is not limited.
- if *OEM Turn Speed* is set to, say, 80%, then the *Max Turn Speed* is scaled so that setting *Max Turn Speed* to 100% will only permit the wheelchair to travel at 80% of the maximum turn speed.

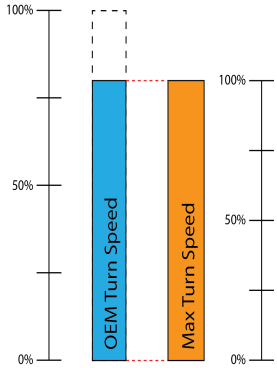


Figure 117: OEM Turn Speed determines Max Turn Speed range

7.2.13.2 OEM Turn Acceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Turn Acceleration	0 - 100%	40%		•	•

Sets the maximum wheelchair turn acceleration that a dealer will be able to adjust.

The *OEM Turn Acceleration* parameter is used by the OEM to set the effective range of the *Turn Acceleration* parameter. Setting *OEM Turn Acceleration* to any value lower than 100% will scale the *Turn Acceleration* parameter, which reduces the available turn acceleration.

For example,

- if *OEM Turn Acceleration* is set to 100%, then the *Turn Acceleration* range (0 - 100%) is not limited.
- if *OEM Turn Acceleration* is set to, say, 80%, then the *Turn Acceleration* is scaled so that setting *Turn Acceleration* to 100% will only permit 80% of the maximum turn acceleration.

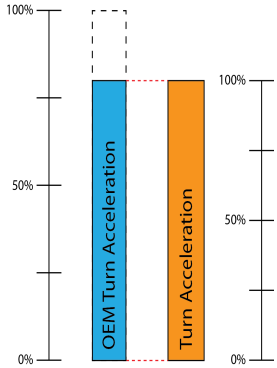


Figure 118: OEM Turn Acceleration determines Turn Acceleration range

7.2.13.3 OEM Turn Deceleration

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Turn Deceleration	15 - 100%	53%		•	•

Sets the maximum wheelchair turn deceleration that a dealer will be able to adjust.

The *OEM Turn Deceleration* parameter is used by the OEM to set the effective range of the *Turn Deceleration* parameter. Setting *OEM Turn Deceleration* to any value lower than 100% will scale the *Turn Deceleration* parameter, which reduces the available turn deceleration.

For example,

- if *OEM Turn Deceleration* is set to 100%, then the *Turn Deceleration* range (0 - 100%) is not limited.
- if *OEM Turn Deceleration* is set to, say, 80%, then the *Turn Deceleration* is scaled so that setting *Turn Deceleration* to 100% will only permit 80% of the maximum turn deceleration.

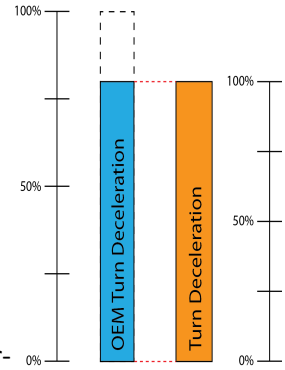


Figure 119: OEM Turn Deceleration determines Turn Deceleration range

7.2.14 OEM Drive settings – stability

7.2.14.1 Turn at Max Speed

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Turn at Max Speed	0 - 100%	15%		•	•

Maximum turn speed available at the wheelchair's maximum linear speed.

Use *Turn at Max Speed* to limit the speed into the turn when the wheelchair is travelling at maximum speed, forwards or reverse. Higher values result in higher turn speeds at maximum forward or reverse speeds. Lower values offer greater stability.

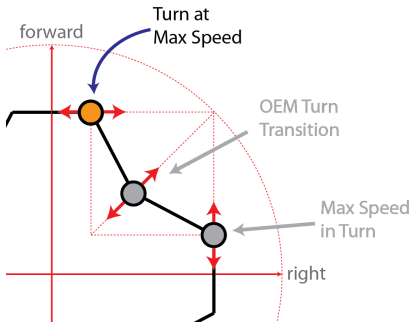


Figure 120: Using Turn at Max Speed

7.2.14.2 OEM Turn Transition

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	OEM Turn Transition	0 - 100%	50%		•	•

OEM level parameter which sets the maximum forward speed for a given turn, i.e. the shape of the speed transition from *Turn at Max Speed* to *Max Speed in Turn*.

The *OEM Turn Transition* parameter is used by the OEM to set the effective range of the *Turn Transition* parameter. Setting *OEM Turn Transition* to any value lower than 100% will scale the *Turn Transition* parameter, which reduces the available turn transition.

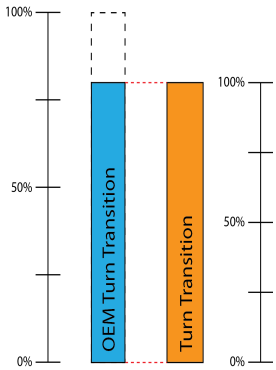


Figure 121: OEM Turn Transition determines Turn Transition range

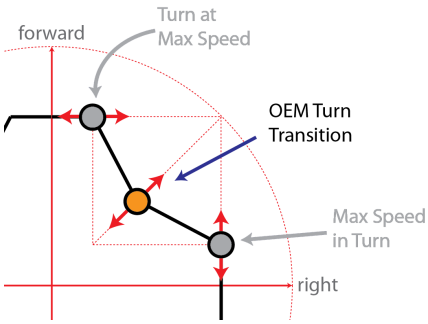


Figure 122: Using OEM Turn Transition

For example,

- if *OEM Turn Transition* is set to 100%, then the *Turn Transition* range (0 - 100%) is not limited.
- if *OEM Turn Transition* is set to, say, 80%, then the *Turn Transition* is scaled so that setting *Turn Transition* to 100% will only permit the wheelchair to transition at 80% of the maximum turn transition.

7.2.14.3 Max Speed in Turn

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
	•	⇆	Max Speed in Turn	0 - 100%	50%		•	•

Maximum linear speed the wheelchair can exhibit coming out of a full turn.

Use *Max Speed in Turn* to limit the speed coming out of a turn, forwards or reverse. Higher values result in higher forward speeds at maximum turn speed. Lower values offer greater stability.

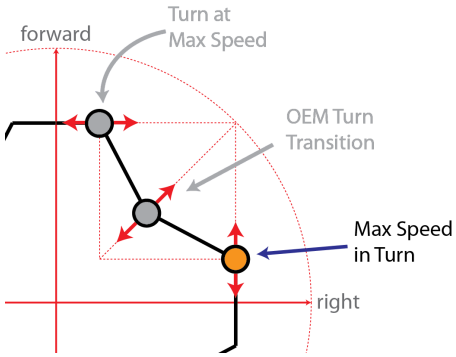


Figure 123: Using Max Speed in Turn

7.2.15 Inputs

7.2.15.1 Neutral Window

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•		Neutral Window	10 - 100%	10%	•	•	•

Sets how far the joystick needs to be deflected before the wheelchair starts to drive.

The *Neutral Window* sets how far the joystick must be moved out of neutral before the wheelchair will begin to drive. The speed demand from the joystick remains at zero while the joystick deflection from the neutral position is less than half of the programmed *Neutral Window* setting. As the joystick is deflected beyond this point and up to the programmed *Neutral Window* setting, the speed demand increases smoothly from zero so that there is no abrupt change in speed as the joystick moves out of neutral.

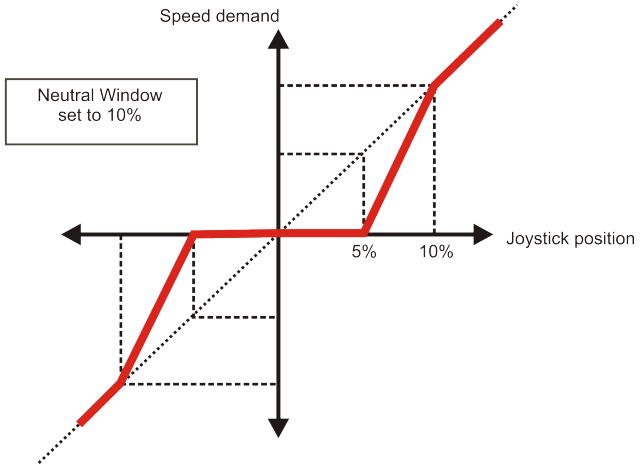


Figure 124: Neutral window setting

For a joystick deflection greater than the programmed *Neutral Window* setting, the speed demand is proportional to the joystick deflection.

7.2.15.2 Joystick Throw

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Joystick Throw	10 - 100%	90%	•	•	•

Sets how far the joystick needs to be deflected to reach full speed.

Normally the LiNX system controller will drive at full speed only when the joystick is pushed as far as it can mechanically go.

Joystick Throw increases the sensitivity of the joystick so that less movement of the joystick is required to generate full speed. This can be useful to allow users with very little hand movement, full proportional control.

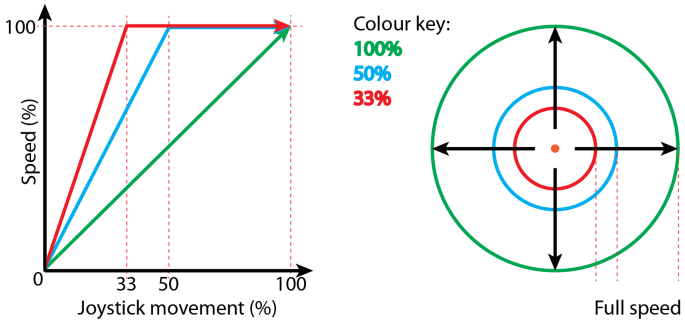


Figure 125: Joystick throw

Warning:
*Setting **Joystick Throw** to low values can introduce a safety risk, because the joystick is not mechanically restricted anymore before full forward or turn speeds are achieved. It may be possible to demand full forward speed and full turn speed at the same time. This can be dangerous.*

7.2.15.3 Tremor dampening

Dealer	OEM	Live Update	Parameter	Possible Values	Default	LE MR1	LE MR2	100 MR2.2
•	•	⇆	Tremor dampening	0 - 100%	0%		•	•

Sets the amount of tremor that is dampened.

Use this parameter to reduce the effect of hand tremors on the joystick. Low values are suitable for low frequency (slow) tremors; higher values will suit higher frequency (fast) tremors. Setting the parameter value to 0% results in no tremor dampening.

8 Testing

Perform the testing procedure to make sure that the wheelchair meets a minimum level of safety.

Warning:
Do not connect the battery positive (B+) terminal of the battery to the LiNX system until the wheelchair is lifted off the ground.

To prevent the risk of injury, Dynamic Controls recommends the use of a lifting device when lifting the wheelchair off the ground.

8.1 Before testing

- Check that all cables are connected correctly. Check especially that the polarities of the batteries, the motors and the park brakes are connected correctly and that the polarities are not swapped.
- To make sure that the wheelchair does not suddenly start to drive away when you turn it on, put blocks under the frame to lift the wheels off the ground. Check that the wheels can turn freely.
- Make the final connection to the battery positive (B+) terminal and close the circuit breakers.
- Turn on the LiNX system with the power button on the remote module and program the LiNX system for the appropriate wheelchair application.
- Turn off the LiNX system with the power button.

8.2 Testing procedure

1. Turn on the LiNX system with the power button. Make sure that the controller turns on correctly. Check that all battery gauge LEDs turn on one by one, and that after the LiNX system has started up successfully, the battery gauge indicates the charge of the battery.

Note:
Ensure that the battery has been through a complete charge cycle before using with the 'enhanced' battery gauge,otherwise an incorrect state of charge may be displayed.

2. Press the power button again to turn the LiNX system off. Check that it turns off correctly. Press the power button again to turn the controller on again.
3. Press the horn button. Check that the horn operates correctly.
4. Turn the LiNX system ON and OFF several times and listen. Check that the park brakes do not click. Leave the LiNX system ON.
5. Try to turn each drive wheel by hand to check that the park brakes are applied. It must not be possible to turn the wheels.
6. Push the joystick slightly out of the centre position. Check that the park brakes disengage (they will click when they disengage).
7. Move the joystick in all directions. Check that the wheels move smoothly in the correct direction.
8. Release the joystick back into the centre position. Check that the park brakes engage again (they will click when they engage).
9. Turn off the LiNX system and remove the blocks from under the wheelchair.

Warning:
Perform the following procedure in a large open environment, preferably outdoors. Make sure that the wheelchair cannot crash into objects.

Be prepared for unexpected wheelchair movement in the event of a faulty installation.
If the wheelchair becomes uncontrollable, turn the LiNX system off for an emergency stop.

10. Turn on the LiNX system. Select the slowest speed with the Speed Dial.
11. Sit in the wheelchair and drive it SLOWLY (small joystick deflection) in all directions. Check for precise, smooth and progressive control.
12. Drive the wheelchair QUICKLY (large joystick deflection) in all directions. Check for smooth and progressive control.
13. Select the highest speed with the Speed Dial and repeat steps 11 and 12.
14. Drive the wheelchair at full speed, FORWARD. Check that the wheelchair drives forward in a straight line (the wheelchair does not veer to the left or to the right).
15. Drive the wheelchair at full speed in REVERSE and check that the wheelchair drives backwards in a straight line.

Warning:
Rear wheel drive chairs often are unstable in reverse, which can cause the wheelchair to drive in circles even when the joystick is central, reverse.

16. Drive at full speed, FORWARD, and move the joystick from left to right along the front edge of the joystick restrictor plate, to check that you can still steer the wheelchair.
17. Drive at full speed, FORWARD, and then release the joystick to the centre. Check that the wheelchair decelerates smoothly and in a straight line. Check that the park brakes switch on when the wheelchair stops.
18. Drive at full speed in REVERSE, and then release the joystick into the centre. Check that the wheelchair decelerates smoothly and in a straight line. Check that the park brakes switch on when the wheelchair stops.
19. Drive at full speed, FORWARD, and move the joystick into full reverse. Check that the wheelchair decelerates smoothly and in a straight line before it moves in reverse.
20. Drive full speed in REVERSE, and move the joystick into the straight, forward position. Check that the wheelchair decelerates smoothly and in a straight line before it moves in a forward direction. Note: Deceleration in reverse is slower.
21. Drive forward SLOWLY and switch the LiNX system OFF. Check that the wheelchair stops quickly.
22. Push the joystick a little bit forward, and switch the LiNX system ON. Check that the wheelchair does not drive and OONAPU is indicated. Release the joystick to the centre. Check that the wheelchair drives normally.
23. Move the joystick forward just enough to release the park brake and check the creep speed. Repeat in reverse.
24. Drive the wheelchair up a 1 : 6 ramp. Check for normal power, smoothness and parking.
25. Reverse down the ramp and release the joystick when you are still on the ramp. Check that there is no rollback and that the park brakes switch on.
26. Accelerate up the ramp again, and reverse down the ramp to test for good control.
27. Repeat testing and programming of the LiNX system until the performance of the wheelchair is as expected.
28. Park the wheelchair in a safe location and turn off the LiNX system controller.

9 System and diagnostic information

Standard system and diagnostic information for LiNX wheelchair systems is obtained using the LiNX Access iOS or LiNX Access PC programming and diagnostic tools.

The methods for obtaining system and diagnostic information are described below.

9.1 The LiNX Access iOS tool

The LiNX Access iOS tool provides access to system and diagnostic information from the home screen.

To view information on connected modules such as their firmware and hardware versions, tap on *System Summary* from the home screen.

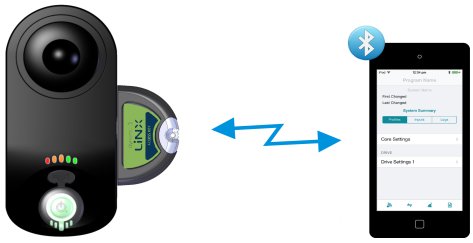


Figure 126: LiNX Access iOS diagnostics

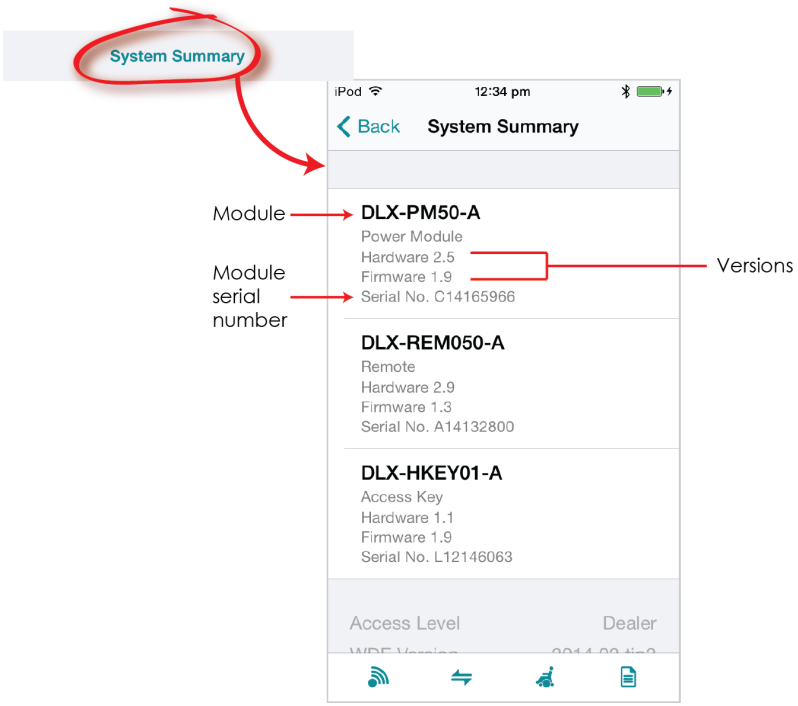


Figure 127: System Summary screen

To view diagnostic information, from the main screen tap on **Logs** and then select:

- Active Errors,
- Event Log,
- Chair Statistics or
- Real Time Diagnostics (only available when connected to a LiNX system).

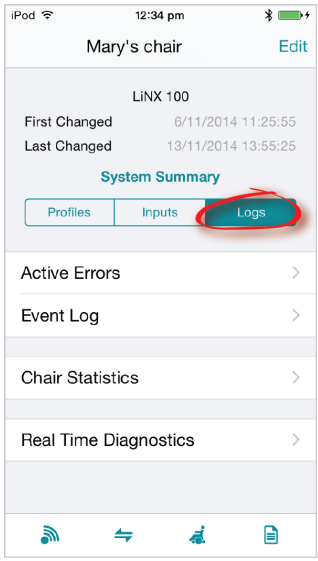


Figure 128: Logs screen

9.1.1 Active errors

The Active Errors screen shows which errors, if any, are current. Each entry in this log displays the error, its flash code (e.g. FC5), and the component where the error is. Tap on the error entry to read more helpful information about the error.

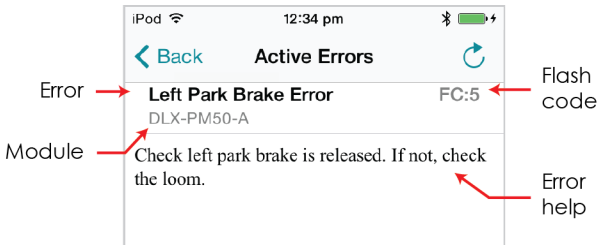


Figure 129: Active Errors screen

9.1.2 Event log

The Event Log screen displays a historical view of all previous envents and errors.

For convenience, the logs are split into two:

- events for the current power up;
- events for previous power ups.

Each entry in this log displays the event or error. For errors, it also displays its flash code (e.g. FC5), and the component where the error occurred. Tap on the error entry to read more helpful information about the event.

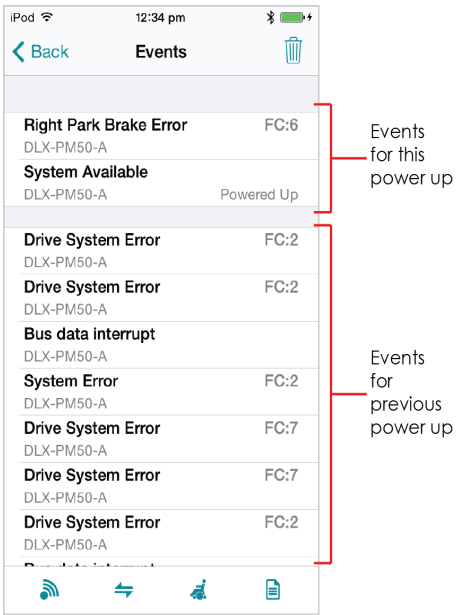


Figure 130: Event Log

9.1.3 Chair statistics

The chair statistics are divided into the following sections:

- Battery usage
- Drive statistics

9.1.3.1 Battery usage

To view battery usage, tap on *Chair Statistics* from the *Log* screen.

To view more information about a battery statistic, click on a statistic, and a helpful description will be displayed in the local help panel.

To reset the statistics, click on the *Reset Battery Usage* button at the bottom of the panel.

The available statistics are detailed in the following table.

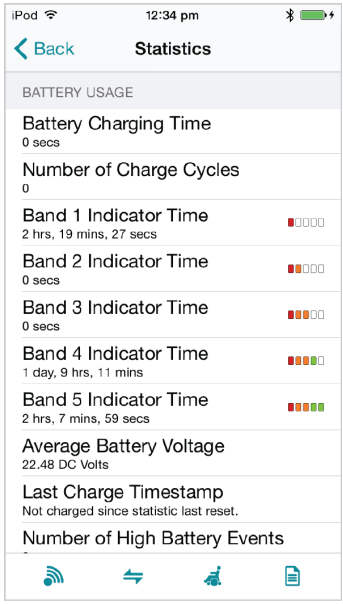


Figure 131: Battery Statistics

See also:
5.5.7 Battery gauges

Battery usage statistics	Display	Details
Battery Charging Time	Time (hh:mm:ss)	The time that the batteries have been charged for.
Number of Charge Cycles	Number	The number of times the batteries have been charged.
Band 1 Indicator Time	Time (hh:mm:ss)	The total time the LiNX system is operated with the state of charge between 0 and 20%.
Band 2 Indicator Time	Time (hh:mm:ss)	The total time the LiNX system is operated with the state of charge between 20% and 40%.
Band 3 Indicator Time	Time (hh:mm:ss)	The total time the LiNX system is operated with the state of charge between 40% and 60%.
Band 4 Indicator Time	Time (hh:mm:ss)	The total time the LiNX system is operated with the state of charge between 60% and 80%.
Band 5 Indicator Time	Time (hh:mm:ss)	The total time the LiNX system is operated with the state of charge between 80% and 100%.
Average Battery Voltage	Volts	The average battery voltage over the last 31 days.
Last Charge Timestamp	Date/time	The date and time when the batteries were last put on charge.
Number of High Battery Events	Number	The number of high battery warnings.
Number of Low Battery Events	Number	The number of low battery warnings.
Number of Deep Discharge Warnings	Number	The number of deep discharge warnings.
Battery Usage Last Reset	Date/time	Date when these statistics were last reset.

9.1.3.2 Drive statistics

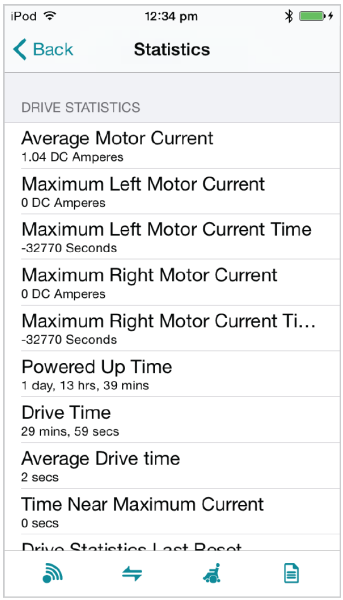


Figure 132: Drive Statistics

To view drive statistics, tap on *Chair Statistics* from the *Log* screen. Drive statistics are located below the battery statistics.

To view more information about a drive statistic, click on a statistic, and a description will be displayed in the local help panel.

To reset the statistics, click on the *Reset Drive Statistics* button at the bottom of the panel.

The available statistics are detailed in the following table.

Drive statistic	Display	Details
Average Motor Current	Amperes	The average current drawn across all motors while driving.
Maximum Left Motor Current	Amperes	The peak measured motor current.
Maximum Left Motor Current Time	Time (hh:mm:ss)	Time spent drawing the "Maximum Drive Current Draw"
Maximum Right Motor Current	Amperes	The peak measured motor current.
Maximum Right Motor Current Time	Time (hh:mm:ss)	Time spent drawing the "Maximum Drive Current Draw"
Powered Up Time	Time (hh:mm:ss)	The total time that the wheelchair controller is powered up.
Drive Time	Time (hh:mm:ss)	The total time that the wheelchair has been driven.
Average Drive time	Time (hh:mm:ss)	Average drive time over a 24 hour period, and averaged over previous 24 hour periods.
Time Near Maximum Current	Time (hh:mm:ss)	The duration the current was within 20% of maximum threshold.
Drive Statistics Last Reset	Date/time	Date when these statistics were last reset.

9.1.4 Live diagnostics

To view live diagnostics, tap on the *Real Time Diagnostics* button from the *Log* screen.

The Live Diagnostics screen shows the following graphs and data in real time:

- Speed Demand (%)
- Turn Demand (%)
- Left Motor
  - Voltage (V)
  - Current (A)
  - Resistance (mΩ)
- Right Motor
  - Voltage (V)
  - Current (A)
  - Resistance (mΩ)
- Battery Voltage (V)
- Speed Dial (%)

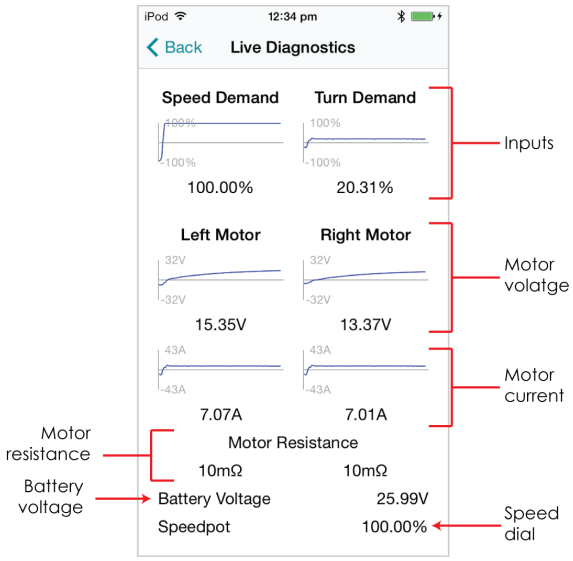


Figure 133: Live Diagnostics screen

9.2 The LiNX Access PC tool

System and diagnostic information is displayed on the PC tool's System screen — see *Figure 135*.

Figure 134: LiNX Access PC diagnostics

Available information includes:

- Program information
- Program modification details
- System modules
- Logs
  - Active errors
  - Event logs
  - Battery usage
  - Drive statistics

Detailed, real-time, live diagnostic information is also available — see *9.2.4 Live diagnostics*.

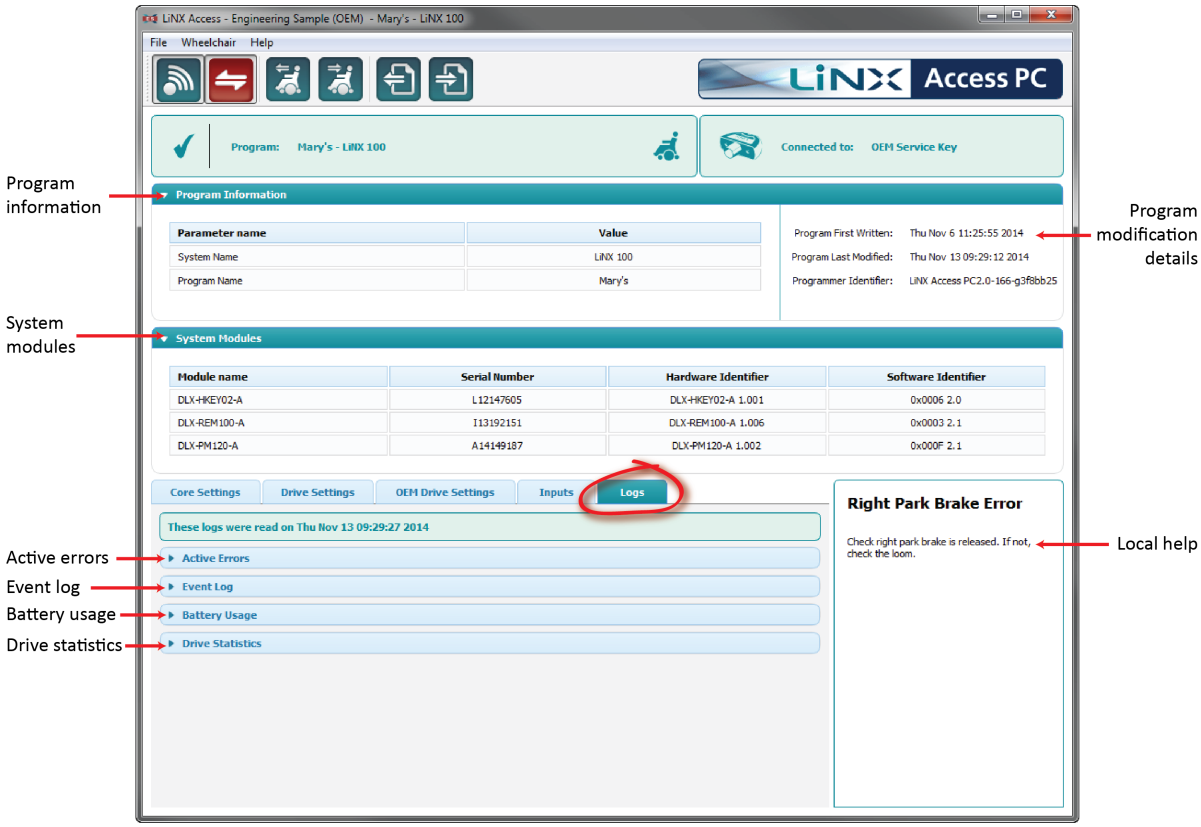


Figure 135: System and diagnostic information on the System screen

9.2.1 Program information

Information specific to the program is shown in the Program Information panel. This panel can be expanded and collapsed by clicking on the Program Information panel bar.

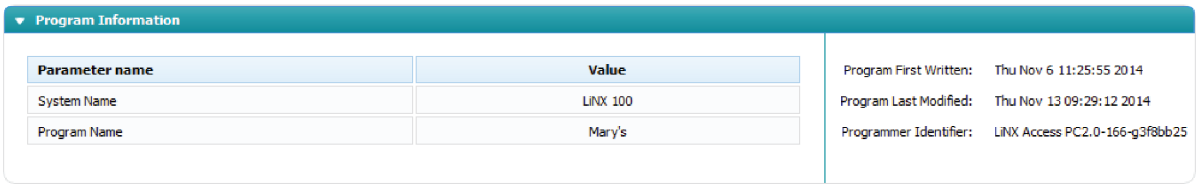


Figure 136: Program information

On the left-hand side, the system and program name are displayed. These parameters can be edited by clicking in the *Value* field and typing in a new value.

On the right-hand side, program modification details are shown - these details are not editable:

- Program First Written - displays the time and date that the loaded program was saved on the computer for the first time.
- Program Last Modified - displays the time and date that the loaded program was last modified.
- Programmer Identifier - identifies the programmer that last modified the program.

9.2.2 System modules

The individual modules that are used in the LiNX system are shown in the System Modules panel. This panel can be expanded and collapsed by clicking on the System Modules panel bar.

The System Modules panel displays the following information for each module in the system:

- Module name
- Serial number
- Hardware identifier
- Software identifier

The System Module panel provides information only - the information cannot be edited.

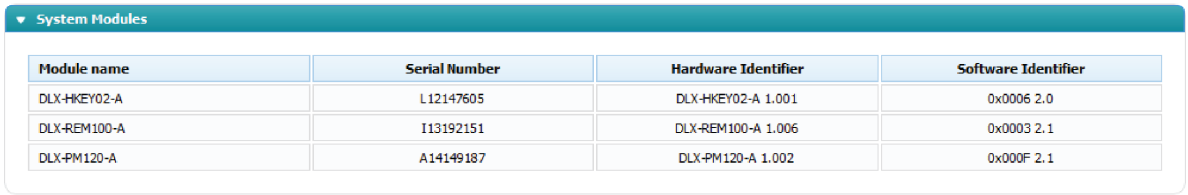


Figure 137: System Modules

9.2.3 Logs

There are a number of logs available that provide current and historical data for a connected system. To view the logs, click on the Logs tab. The logs are grouped into the following four sections:

- Active Errors - see *9.2.3.1 Active errors*
- Event Log - see *9.2.3.2 Event log*
- Battery Usage - see *9.2.3.3 Battery usage*
- Drive Statistics - *9.2.3.4 Drive statistics*

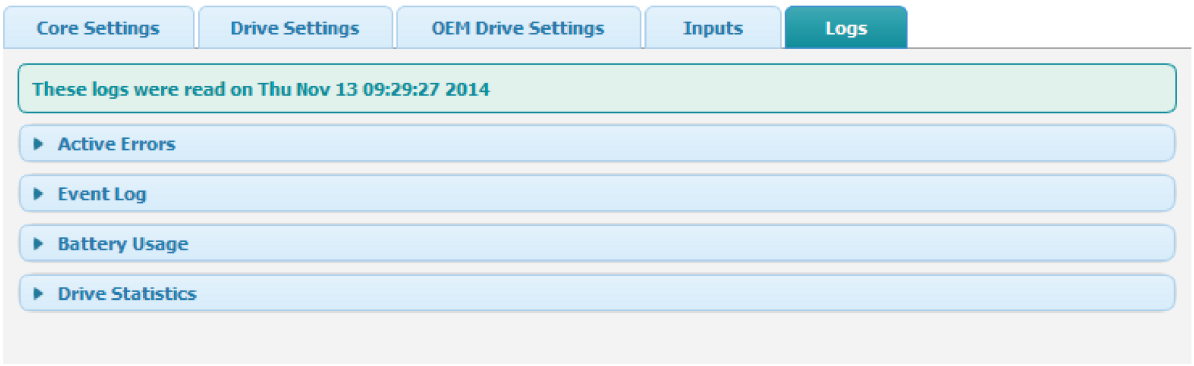


Figure 138: System logs

9.2.3.1 Active errors

Active errors are shown in the Active Errors panel. This panel can be expanded and collapsed by clicking on the Active Errors panel bar. Active Errors display which faults, if any, are current on the connected LiNX system.

For all errors, the following is recorded:

- event name - describes the active error
- module - displays the location of the error
- event code - displays the flash code (see *9.3 Error indication*).

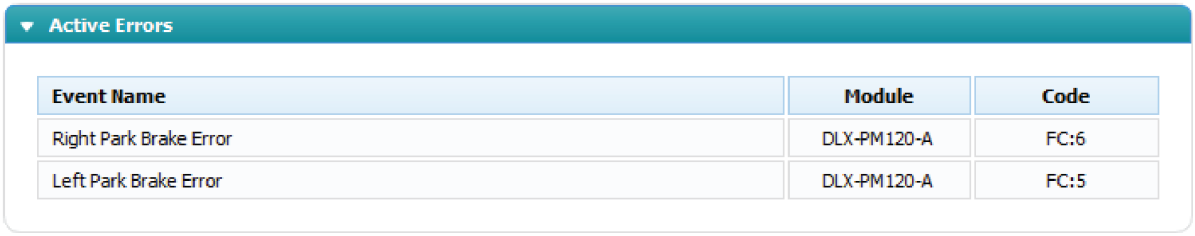


Figure 139: Active Errors

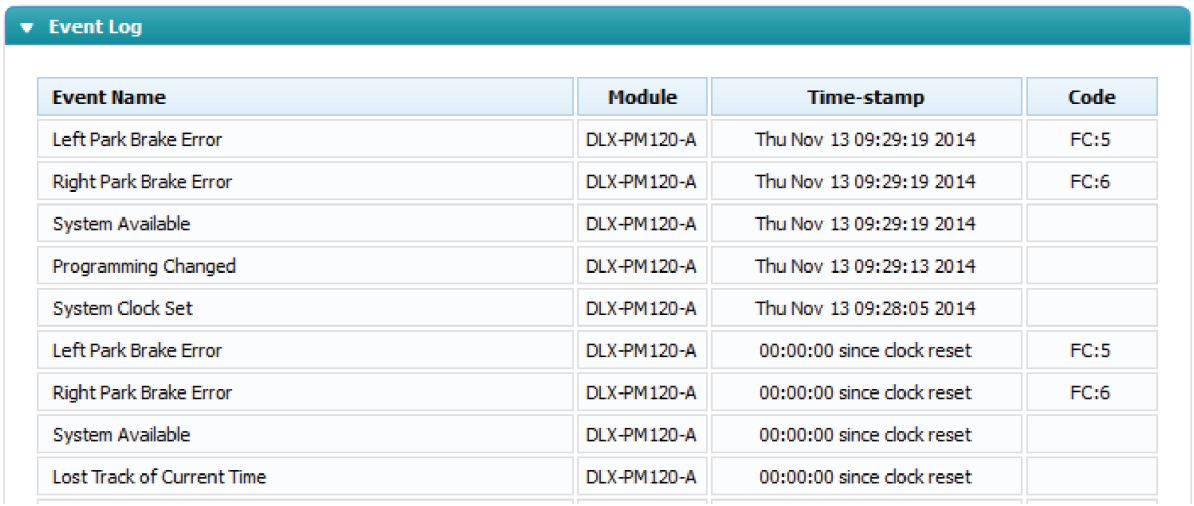
To view more information about an error displayed in Active Errors, click on the error, and a description of the error will be displayed in the local help panel.

9.2.3.2 Event log

System events are shown in the Event Log panel. This panel can be expanded and collapsed by clicking on the Event Log panel bar.

For all events, the following is recorded:

- event name - describes the event
- module - displays the location of the event
- event code - displays a relevant code - for errors, this will be the flash code
- time stamp - date and time that event occurred.



Event Log

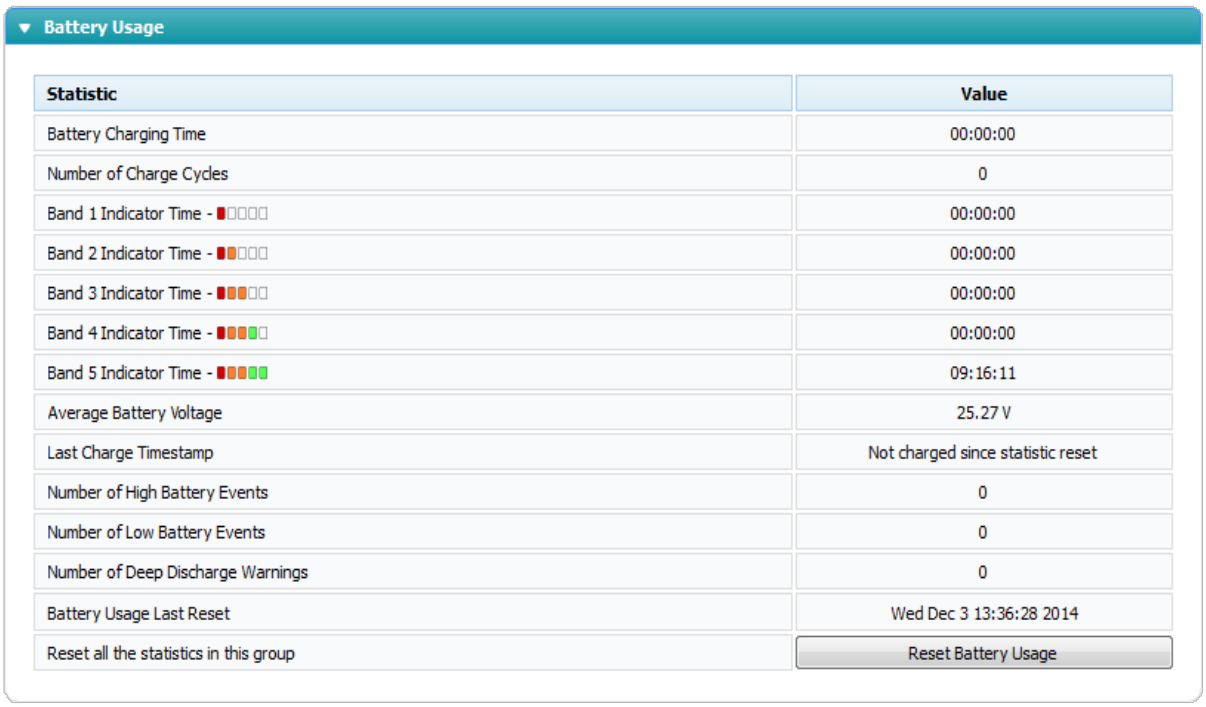
Event Name	Module	Time-stamp	Code
Left Park Brake Error	DLX-PM120-A	Thu Nov 13 09:29:19 2014	FC:5
Right Park Brake Error	DLX-PM120-A	Thu Nov 13 09:29:19 2014	FC:6
System Available	DLX-PM120-A	Thu Nov 13 09:29:19 2014	
Programming Changed	DLX-PM120-A	Thu Nov 13 09:29:13 2014	
System Clock Set	DLX-PM120-A	Thu Nov 13 09:28:05 2014	
Left Park Brake Error	DLX-PM120-A	00:00:00 since clock reset	FC:5
Right Park Brake Error	DLX-PM120-A	00:00:00 since clock reset	FC:6
System Available	DLX-PM120-A	00:00:00 since clock reset	
Lost Track of Current Time	DLX-PM120-A	00:00:00 since clock reset	

Figure 140: Event Log

To view more information about an event displayed in the Event Log, click on the event, and a description of the event will be displayed in the local help panel.

9.2.3.3 Battery usage

Battery usage is shown in the Battery Usage panel. This panel can be expanded and collapsed by clicking on the Battery Usage panel bar.



Battery Usage

Statistic	Value
Battery Charging Time	00:00:00
Number of Charge Cycles	0
Band 1 Indicator Time -	00:00:00
Band 2 Indicator Time -	00:00:00
Band 3 Indicator Time -	00:00:00
Band 4 Indicator Time -	00:00:00
Band 5 Indicator Time -	09:16:11
Average Battery Voltage	25.27 V
Last Charge Timestamp	Not charged since statistic reset
Number of High Battery Events	0
Number of Low Battery Events	0
Number of Deep Discharge Warnings	0
Battery Usage Last Reset	Wed Dec 3 13:36:28 2014
Reset all the statistics in this group	Reset Battery Usage

Figure 141: Battery Usage

The available statistics are detailed in the following table.

Battery usage statistics	Unit	Details
Battery Charging Time	Seconds	The time that the batteries have been charged for.
Number of Charge Cycles	Number	The number of times the batteries have been charged.
Band 1 Indicator Time	Seconds	The total time in seconds the LiNX system is operated with

Battery usage statistics	Unit	Details
		the state of charge between 0 and 20%.
Band 2 Indicator Time	Seconds	The total time in seconds the LiNX system is operated with the state of charge between 20% and 40%.
Band 3 Indicator Time	Seconds	The total time in seconds the LiNX system is operated with the state of charge between 40% and 60%.
Band 4 Indicator Time	Seconds	The total time in seconds the LiNX system is operated with the state of charge between 60% and 80%.
Band 5 Indicator Time	Seconds	The total time in seconds the LiNX system is operated with the state of charge between 80% and 100%.
Average Battery Voltage	Volts	The average battery voltage over the last 31 days.
Last Charge Timestamp	Date/time	The date and time when the batteries were last put on charge.
Number of High Battery Events	Number	The number of high battery warnings.
Number of Low Battery Events	Number	The number of low battery warnings.
Number of Deep Discharge Warnings	Number	The number of deep discharge warnings.
Battery Usage Last Reset	Date/time	Date when these statistics were last reset.

To view more information about a battery statistic displayed in the Battery Usage panel, click on a statistic, and a helpful description will be displayed in the local help panel.

To reset the statistics' values, click on the *Reset Battery Usage* button at the bottom of the panel.

9.2.3.4 Drive statistics

Drive statistics are shown in the Drive Statistics panel. This panel can be expanded and collapsed by clicking on the Drive Statistics panel bar.

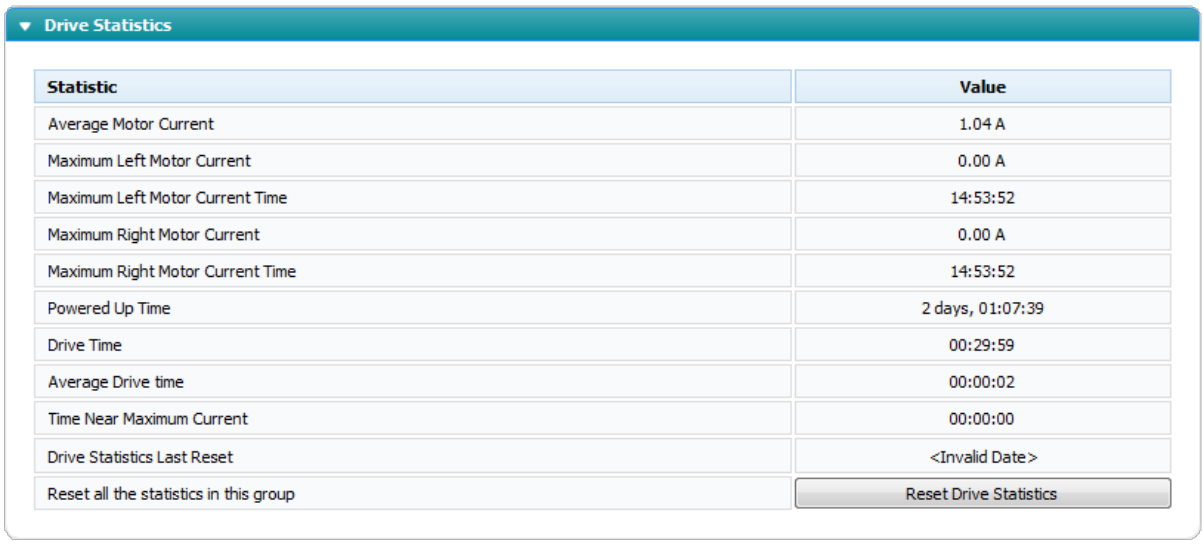


Figure 142: Drive Statistics

The available statistics are detailed in the following table.

Drive statistic	Unit	Details
Average Motor Current	Amperes	The average current drawn across all motors while driving.
Maximum Left Motor Current	Amperes	The peak measured motor current.
Maximum Left Motor Current Time	Seconds	Time spent drawing the "Maximum Drive Current Draw"

Drive statistic	Unit	Details
Maximum Right Motor Current	Amperes	The peak measured motor current.
Maximum Right Motor Current Time	Seconds	Time spent drawing the "Maximum Drive Current Draw"
Powered Up Time	Seconds	The total time in seconds that the wheelchair controller is powered up.
Drive Time	Seconds	The total time in seconds that the wheelchair has been driven.
Average Drive time	Seconds	Average Drive Time in Seconds
Time Near Maximum Current	Seconds	The duration the current was within 20% of maximum threshold.
Drive Statistics Last Reset	Date/time	Date when these statistics were last reset.

To view more information about a drive statistic displayed in the Drive Statistics panel, click on a statistic, and a helpful description will be displayed in the local help panel.

To reset the statistics' values, click on the *Reset Drive Statistics* button at the bottom of the panel.

9.2.4 Live diagnostics

To view live diagnostics, click on the Real Time Diagnostics button from the Log screen.

The Live Diagnostics screen shows the following graphs and data in real time:

- Left Motor
  - Voltage (V)
  - Current (A)
  - Resistance (mΩ)
- Right Motor
  - Voltage (V)
  - Current (A)
  - Resistance (mΩ)
- Joystick position
- Battery Voltage (V)
- State of charge (%)
- Remote module's speed dial position

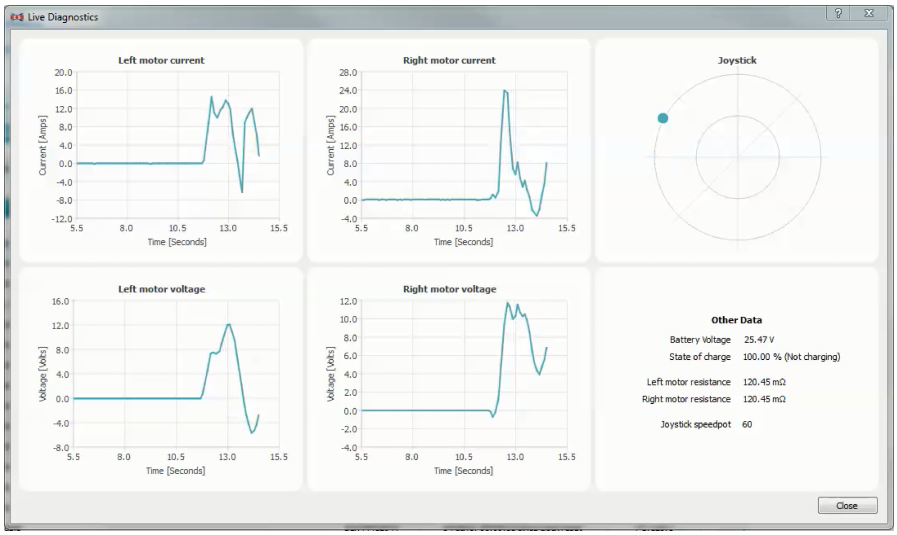


Figure 143: Live diagnostics

9.3 Error indication

Figure 144: The status indicator

If there is an error with the system when it is powered up, then the status indicator will flash red; the number of flashes will indicate the type of error.

The table below describes the error indication, and a few possible actions that can be taken to rectify the problem. The actions listed are not in any particular order and are suggestions only; the intention is that one of the suggestions may help you clear the problem. If in doubt, consult your supplier.

Flash code	Error description	Possible action
1	Remote / joystick error	Check cables and connectors Replace Remote
2	Network or configuration error	Check cables and connectors Check Bluetooth pairing Reconfigure the system Recharge the battery Check charger Replace modules Contact supplier
3	Left motor error	Check cables and connectors Replace power module Check and/or replace left motor
4	Right motor error	Check cables and connectors Replace power module Check and/or replace right motor
5	Left park brake error	Check cables and connectors Check left park brake is released
6	Right park brake error	Check cables and connectors Check right park brake is released
7	Module error (other than remote module)	Check cables and connectors Check modules Replace LiNX Access Key Replace power module Recharge battery If the chair stalled, reverse away or remove obstacles, or if the chair was moved while turned off, cycle the power.

The error indicator may continue to flash after an error has been rectified. To clear the error indication, cycle the system's power.

For more information about the error, and what to do about it, open and view the logs within one of the programming and diagnostic tools (see *9.1 The LiNX Access iOS tool* and *9.2 The LiNX Access PC tool*).

10 Appendices

10.1 Accessories and parts list

The LiNX system is available to order under the following system part numbers:

10.1.1 Systems

Description	Part number	Modules included
LiNX system with REM050 remote module, 40 A power module and 1 m communications bus cable	DLX050-40-10	DLX-REM050-A DLX-PM40-A GLM-BUS100-A
LiNX system with REM050 remote module, 40 A power module and 1.5 m communications bus cable	DLX050-40-15	DLX-REM050-A DLX-PM40-A GLM-BUS150-A
LiNX system with REM050 remote module, 40 A power module, 1 m communications bus cable, and 0.9 m extension cable	DLX050-40-10-09	DLX-REM050-A DLX-PM40-A GLM-BUS100-A GLM-EXT090-A
LiNX system with REM050 remote module, 40 A power module, 1 m communications bus cable, and 0.64 m extension cable	DLX050-40-10-06	DLX-REM050-A DLX-PM40-A GLM-BUS100-A GLM-EXT064-A
LiNX system with REM050 remote module, 50 A power module, and 1 m communications bus cable	DLX050-50-10	DLX-REM050-A DLX-PM50-A GLM-BUS100-A

Description	Part number	Modules included
LiNX system with REM050 remote module, 50 A power module, and 1.5 m communications bus cable	DLX050-50-15	DLX-REM050-A DLX-PM50-A GLM-BUS150-A
LiNX system with REM060 remote module, 40 A power module, and 1 m communications bus cable	DLX060-40-10	DLX-REM060-A DLX-PM40-A GLM-BUS100-A
LiNX system with REM060 remote module, 40 A power module, and 1 m communications bus cable	DLX060-40-15	DLX-REM060-A DLX-PM40-A GLM-BUS150-A
LiNX system with REM060 remote module, 50 A power module, and 1 m communications bus cable	DLX060-50-10	DLX-REM060-A DLX-PM50-A GLM-BUS100-A
LiNX system with REM060 remote module, 50 A power module, and 1.5 m communications bus cable	DLX060-50-15	DLX-REM060-A DLX-PM50-A GLM-BUS150-A

10.1.2 Programming

Description	Part number	Qty/Unit
LiNX Access Key (Dealer version)	DLX-HKEY01-A	1
LiNX Access Key(OEM version)	DLX-HKEY02-A	1

10.1.3 Connectors

Description	Part number	Qty/Unit
Connector kit	**DX2LOOM-PM1**	-
• DX INNERGY CON FEM AMP U	GCN0781	4
• DX POSITRON CONTACT FMALE SML	GCN0794	4
• DX-PM MOTOR CON HOUSING V3	GCN60325	2
• DX-PM CONNECTOR KEY	GCN60323	2
• DX2 BATT/MOTOR CONN BOOT	GCN65129	3
• DK-PM Batt spade recpt 6-10mm	GCN8002	2
• DX2-PM Battery Conn Housing	GME65146	1

10.1.4 Miscellaneous

Description	Part number	Qty/Unit
Extension Loom Panel Mounting Clip	GME80151	1
LiNX REM Mounting Adapter	GME53642	1

10.2 Intended use and regulatory statement

10.2.1 Intended use

The LiNX system is a microprocessor based system, intended for drive control of powered wheelchairs.

The LiNX system typically comprises a power module and an interconnected user remote module.

The LiNX system is intended to drive powered wheelchairs fitted with 24 V motors with integrated park brakes.

10.2.2 Device classification

Europe

The LiNX system is a component of a Class I medical device as detailed in the Council Directive 93/42/EEC concerning Medical Devices.

USA

The LiNX system is a component of a Class II medical device (Powered Wheelchair) as detailed in 21 CFR § 890.3860.

10.2.3 Compliance and conformance with standards

The LiNX system has been designed such that the combination of the wheelchair and controller, along with accessories as applicable, complies with the Essential Requirements of EU Directive 93/42/EEC (and amendments) by adopting relevant clauses of harmonised standards EN12184 and EN12182, and relevant parts of the FDA Recognized Consensus Standard ANSI / RESNA WC-2 for performance.

10.2.4 LiNX Access Key

The LiNX DLX-HKEYxx-A is a physical adaptor for use with the LiNX Remote family. It is used in conjunction with the LiNX Programming and Diagnostic Tools and is intended to allow the configuration, programming or diagnosis of LiNX wheelchair or scooter controller systems. Access level is controlled by the variant used (indicated by the value of 'xx').

The intended environment is indoors or outdoors in dry conditions.

10.3 Service life

If the product has not been abused and all maintenance instructions as described in the maintenance section have been properly followed, the expected service life (i.e. minimum serviceable life expectancy) of the product is five (5) years. After this period, product reliability can no longer be guaranteed and Dynamic Controls recommends the product be replaced for safety reasons. Dynamic Controls accepts no responsibility/liability for product failure if the product is continued to be used after the expected service life period has expired.

It is the OEM's responsibility to state the expected service life, as well as the inspection and maintenance schedules for all cables including the LiNX communications bus loom.

10.4 Maintenance

The following instructions must be passed on to the operator before use of the product:

- Keep all Dynamic Controls electronic components free of dust, dirt and liquids. To clean the product, use a cloth dampened with warm soapy water. Do not use chemicals, solvents or abrasive cleaners, as this may cause damage to the product.
- Once a month, check all vehicle components for loose, damaged or corroded components, such as connectors, terminals or cables. Ensure that all connectors are fully mated. Restrain all cables to protect them from damage. Replace damaged components. Check for and remove any foreign objects or material.
- Every 6 months, test all switchable functions on the Dynamic Controls electronics system to ensure they function correctly.

- There are no user-serviceable parts in any Dynamic Controls electronic component. Do not attempt to open any case or undertake any repairs, else warranty will be voided and the safety of the system may be compromised.
- Where any doubt exists, consult your nearest service centre or agent.

Warning:
It is the responsibility of the end user to maintain the unit in a state of good repair at all times. If any component is damaged in any way, or if internal damage may have occurred, have it checked by qualified personnel before operating.

10.5 Warranty

All equipment supplied by Dynamic Controls is warranted by the company to be free from faulty workmanship or materials. If any defect is found within the warranty period, the company will repair or, at its discretion, replace the equipment without charge for materials or labour.

This warranty is subject to the provisions that the equipment:

- has been correctly installed.
- has been thoroughly checked upon completion of installation, and all programmable options correctly adjusted for safe operation prior to use.
- has been used solely in accordance with this manual and all other manuals of the Dynamic Controls electronic components that are used on the wheelchair.
- has been properly connected to a suitable power supply in accordance with this manual.
- has not been subjected to misuse or accident, or been modified or repaired by any unauthorised personnel.
- has been used solely for the driving of electrically powered mobility wheelchairs in accordance with the intended use and the recommendations of the wheelchair manufacturer.
- has not been connected to third party devices without the specific approval of Dynamic Controls.

10.6 Safety and misuse warnings

10.6.1 Warnings to be included in the user manual

The following warnings are applicable to the installer and must be passed on to the end user before use of the product.

- Do not install, maintain, or operate this equipment before you have read and understood all the instructions and all the manuals for this product and all the other products that you use or install together with this product. Follow the instructions of the manuals. If you do not follow all instructions, injury or damage can be the result.
- Do not try to open or disassemble any case — there are no user-serviceable parts inside.
- The operator has the responsibility to keep the vehicle in a good safe operating condition. To protect all the components (for example the cables) from damage, the operator must fasten them in optimum positions.
- Do not touch the connector pins. If you touch the pins, they can become dirty or they can be damaged by electrostatic discharge.
- Immediately turn the controller off and consult your service agent if the vehicle:
    - Is damaged
    - Does not behave the same every time
    - Does not respond normally, the way you expect it to
    - Becomes hotter than normal
    - Smokes

  - Arcs
  - Does not change its speed when you adjust the speed dial
  - Displays a fault on its fault indicator and the controller does not perform normally.
- Turn the controller off:
  - When you do not use it
  - Before you get in or get out of the vehicle
  - Before you use a mobile phone or a portable communications device near the vehicle
  - If your vehicle drives by itself or against your will. When you turn the controller off the vehicle will halt.
- In the case of an emergency while the vehicle is driving, press the On/Off button to perform an emergency stop and turn the controller off.
- If there is a risk of collision with a person or object in close proximity, use the Joystick and/or speed dial to reduce the speed of the wheelchair.
- Do not drive the vehicle if the controller indicates that the battery is low, since the wheelchair may stop operating and the user may become stranded. If the battery becomes completely empty, the vehicle will stop suddenly and the battery may be damaged.
- Make sure that the battery charger that is used with the vehicle has a drive inhibit function that is correctly connected for use with the controller. This drive inhibit feature is intended to prevent the chair from driving while the battery is being charged. If you are not sure, ask your dealer or vehicle manufacturer.
- Specify the maximum current of any battery chargers to be used with the controller and warn against using battery chargers of higher current ratings.
- If operators of the vehicle are left with limited or no mobility for any reason (for example, because the vehicle loses electric power or breaks down), it is important that they can seek assistance from wherever they may be.
- Go downhill slowly. When the vehicle drives downhill, the motors act as a dynamo and generate energy. The controller sends the generated energy from the motor to the battery. This charges the battery. However, if the battery is fully charged, it cannot accept the generated energy any more. When this happens, there is a risk of damage to the battery or an explosion. To prevent this risk, the controller forces the vehicle to slow down until the battery can accept more energy. After this, it allows the vehicle to speed up again. The result of this will be sudden speed changes of the vehicle. To prevent these speed changes with fully charged batteries, decrease the speed of the vehicle when going downhill.
- The controller can cause the vehicle to come to a sudden stop. If this can be dangerous to the operator, the installer must install a seat belt, and the operator must wear this seat belt.
- Operation of a vehicle on steep slopes can be dangerous. Before you drive up or down a slope, make sure that the slope does not exceed the capability of the vehicle.
- Do not use the park brake release on a slope.
- Make sure that the controller does not become colder or hotter than the minimum and maximum temperatures specified in this manual.
- Most electronic equipment is influenced by Radio Frequency Interference (RFI). Be careful when portable communications equipment is used in the area around such equipment. Dynamic Controls has made every effort to make sure that RFI does not change the behaviour of the controller, but very strong signals could still cause a problem. The vehicle manufacturer has the responsibility to make sure that the vehicle is tested according to local EMC regulations.
- Performance adjustments must only be made by healthcare professionals, or by persons who completely understand the programming parameters, the adjustment process, the configuration of the vehicle, and the capabilities of the driver. Wrong settings can make the vehicle uncontrollable or unstable. An uncontrollable or unstable vehicle can cause an unsafe situation

such as a crash, with the risk of serious injury to the driver or bystanders, or damage to the vehicle or surrounding property.
- Performance adjustments must only be made indoors or outdoors in dry conditions.
- If the wheelchair has not been fitted with a hand guard for the remote module, the user should be made aware that their hand will not be protected from crushing, when, for example, manoeuvring towards a table.
- Users should be aware that the surface of the remote module can potentially get hot when exposed to strong sunlight for long periods.
- The XLR connector on the remote module is to be used exclusively for the intended purpose of charging the battery and/or programming the controller. Warranty will be voided if any unauthorised device is connected to this port.
- Depending on the installation, controls may be intended for the wheelchair occupant, attendant, or both. The manufacturer must state the intended user.

10.6.2 Service and configuration warnings

The following warnings are applicable to the installation technician and the dealer or the therapist who supplies the vehicle to the end user.

- It is the responsibility of the installer to make sure that accessories that are connected to the vehicle do not interfere with the operation of the controller.
- Do not use the vehicle frame as the earth return. Any electrical low-resistance connection to the frame is a safety risk and is not allowed by international safety standards.
- If the vehicle loses electric power, it is important that an attendant is able to move the vehicle easily.
- After you have completed the installation, check it thoroughly. Correctly adjust all programmable options to suit the user before the vehicle is used.
- After you have configured the vehicle, check to make sure that the vehicle performs to the specifications entered in the programming procedure. If the vehicle does not perform to specifications, reprogram it. Repeat this procedure until the vehicle performs to specifications. If the desired operation cannot be achieved, contact Dynamic Controls.
- The dealer, therapist or other agent who supplies the vehicle to the end user has the responsibility to make sure that the vehicle is correctly configured for the needs of that user.
- For each individual user, the vehicle set up and configuration should take into consideration his or her:
    - technical knowledge, experience and education, and
    - medical and physical condition, including the level of disability and capability (where applicable).
- It is the responsibility of the OEM and installer to make sure that the maximum driving speed of the vehicle is limited as appropriate when the vehicle is in a mechanically unstable position, for example when the seat is raised.
- It is the responsibility of the therapist/installer to minimise all risks of use error, including those arising from ergonomic features and/or the environment in which the device is intended to be used.
- Prior to handing over the vehicle, make sure that users are fully able to operate the product by providing them appropriate training on functionality and safety features, and having them test-drive the vehicle in a safe area in the presence of their agent.
- The controller can cause the vehicle to come to a sudden stop. If this can be dangerous to the operator, the installer must install a seat belt and the operator must wear this belt.
- Where any inconsistencies about chair status occur between the LiNX system and that reported by a programming tool, the user should take the status as reported by the LiNX system as correct.

- A LiNX Access Key is an intentional radio frequency (RF) transmitter. Before entering an RF-sensitive environment (e.g. a hospital), unplug the LiNX Access Key from the remote module. Do not plug in the LiNX Access Key when in an RF-sensitive environment.

10.7 Electromagnetic compatibility

Dynamic Controls Electronic Controllers have been tested on typical, representative vehicles to confirm compliance with the following appropriate EMC standards:

USA: ANSI/RESNA WC-2:2009 Sec 21
Europe: EN12184:2009, ISO7176 - 21:2009

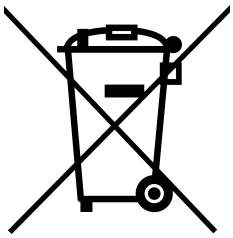
National and international directives require confirmation of compliance on particular vehicles. Since EMC is dependent on a particular installation, each variation must be tested. The guidelines in this section are written to assist with meeting EMC requirements in general.

10.7.1 Minimising emissions

To minimise emissions and to maximise the immunity to radiated fields and ESD, follow the wiring recommendations in section *5.2 General wiring guidelines*.

10.8 Environmental statement

Dynamic Controls confirms that the product variants specified in this manual, as sub-assemblies of electronic and electrical equipment supplied for further integration by a medical device manufacturer, conform to applicable requirements of Directive 2011/65/EU, recast of Directive 2002/95/EC - Restriction of the use of certain Hazardous Substances in electrical and electronic equipment.



This product has been supplied from an environmentally aware manufacturer.

Please be environmentally responsible and recycle this product at the end of its life through your local recycling facility.

This product may contain substances that could be harmful to the environment if disposed of into a landfill.

Do not dispose of this product in fire.

See also:
http://www.dynamiccontrols.com/designers-and-manufacturers/compliance

10.9 Symbols and labelling

The following sections highlight the symbols and labels that can be found on the LiNX modules.

10.9.1 Product label - power modules

This label can be found on the underside of the power module.

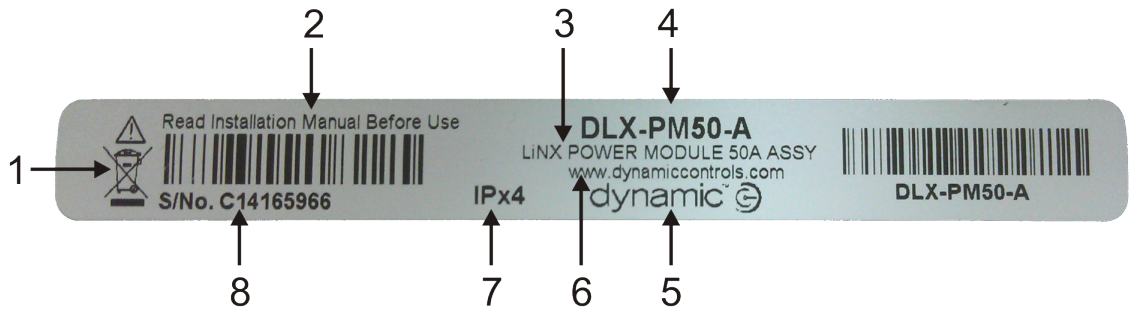


Figure 145: Product label - power module

Key:

1. WEEE symbol	5. Dynamic Controls logo
2. Warning "Read Installation Manual before use"	6. Dynamic Controls website
3. Part description	7. The module's IP rating
4. Part number	8. Serial number

10.9.2 Product label - remote modules

This label can be found on the underside of the remote modules.

Figure 146: Product label - remote modules

Key:

1. Part number	4. Dynamic Controls website
2. Dynamic Controls logo	5. Serial number
3. Part description	

10.9.3 Product label - LiNX Access Keys

This label can be found on the underside of the LiNX Access Key.

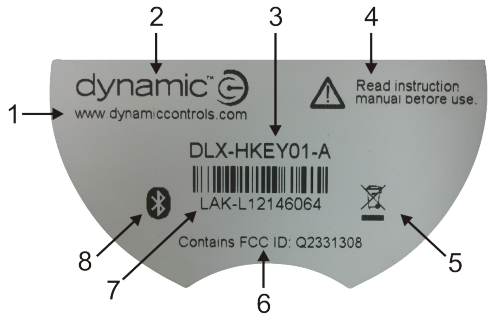


Figure 147: Product label - LiNX Access Key

Key:

1. Dynamic Controls website	5. WEEE symbol
2. Dynamic Controls logo	6. Contains FCC ID
3. Part number	7. Serial number
4. Warning "Read instruction manual before use"	8. Bluetooth

10.9.4 Tamper evident seal

This label can be found on the underside of a module.

Figure 148: Tamper evident seal

10.9.5 Other symbols and labels found on LiNX modules

Label	Purpose
IPx4	This is the enclosure's ingress protection rating.
	This is the WEEE symbol (Waste Electrical and Electronic Equipment Directive).
	The petrol pump indicates the battery charger input (on REM060).
 Read instruction manual before use	Warning to read the instruction manual before using the module.
	Speed control (REM050) - indicates the direction for increasing/decreasing speed.
	Speed control (REM060) - indicates the direction for increasing/decreasing speed.
	The horn button (REM050).
	The horn button (REM060).
	Power button / emergency stop.

10.9.6 Serial number and date of manufacture

The serial number on a LiNX product provides both the date of manufacture as well as a unique serial number for the particular module.

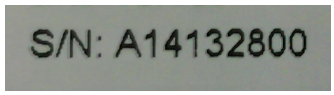


Figure 149: Serial number example

The format, as shown in *Figure 149*, is **MYYnnnnnn**, where:

M is the month of manufacture, using the letters A to L (A = Jan, B = Feb, C = Mar, etc.),
YY is the year of manufacture,
nnnnnn is a unique 6 digit sequential number.

For example, the module's serial number, as shown in *Figure 149*, begins with A14 indicating that it was manufactured in January 2014, and its unique, sequential value is 132800.

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V

W

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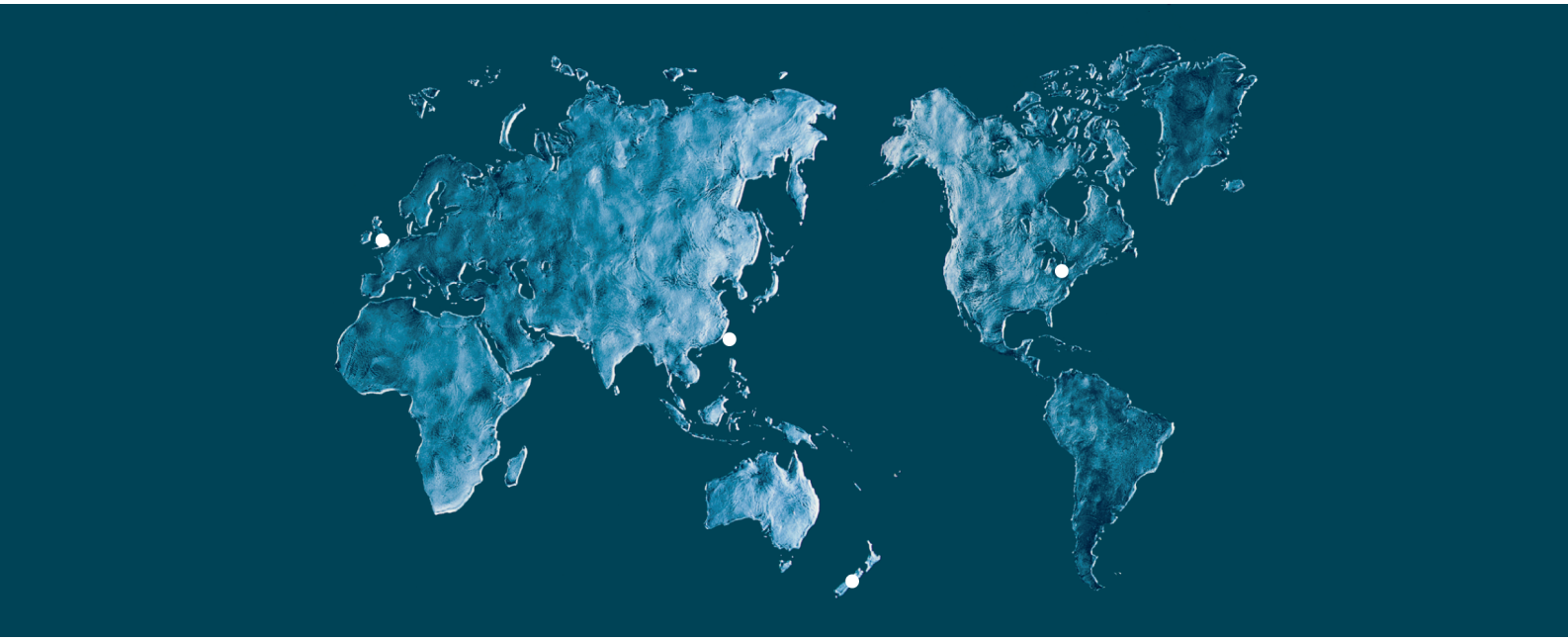

Dynamic Controls is the world's leading manufacturer of electronic controls for power wheelchairs and scooters.
Dynamic Controls was established in 1972 and is headquartered in New Zealand.
Regional centres are located in Europe, United States, Asia, and Australasia.

ISO 13485 certified – Dynamic Controls goes above and beyond industry standard expectations to ensure customers receive the best products possible.

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