No. 63824, Issue 2. July 1998

DYNAMIC™

DX™ Modular Mobility System

DX Power Module (PMB, PMB1, PMB2, PMB-S) Installation Manual

Order/Part Number for this Manual : GBK63824 issue 2

Important Notes

1. Read this Manual carefully before installing or operating your DX control system.

2. Due to continuous product improvement Dynamic reserves the right to update this Manual. This Manual supersedes all previous issues which must not continue to be used.

3. Any attempt to gain access to or in any way abuse the electronic components and associated assemblies that make up the wheelchair control system renders the Manufacturer's Warranty void and the Manufacturer free from liability.

Contents

Contents

1 Introduction

The DX Power Module (PM) is a DXBUS compatible module, which converts the signals generated by a DX Remote into high current outputs. These outputs drive the motors that control the wheelchair speed and direction. The combination of a PM and DX Remote gives an exceptionally smooth, powerful and safe drive system.

The PM is fully programmable to cater for a wide range of wheelchair types and user needs. Correct installation and programming are essential to ensure optimum performance and safety.

Note: This manual applies to DX-PMB, PMB1, PMB2 and PMB-S. The product number is situated on the base of the unit.

This manual and others listed in section 2 must be read and understood. For more information contact Dynamic Controls Ltd or an agent as listed in section 14.

PM Variants

In addition to the standard PM, there are three variants : PM-S, PM1 and PM2. The PM-S is used in DX Systems with only one drive motor, like many servo steered wheelchair systems. The PM1 and PM2 differ from the PM only by their higher current outputs. Unless otherwise stated, all features of the PM apply to the PM-S, PM1 and PM2.

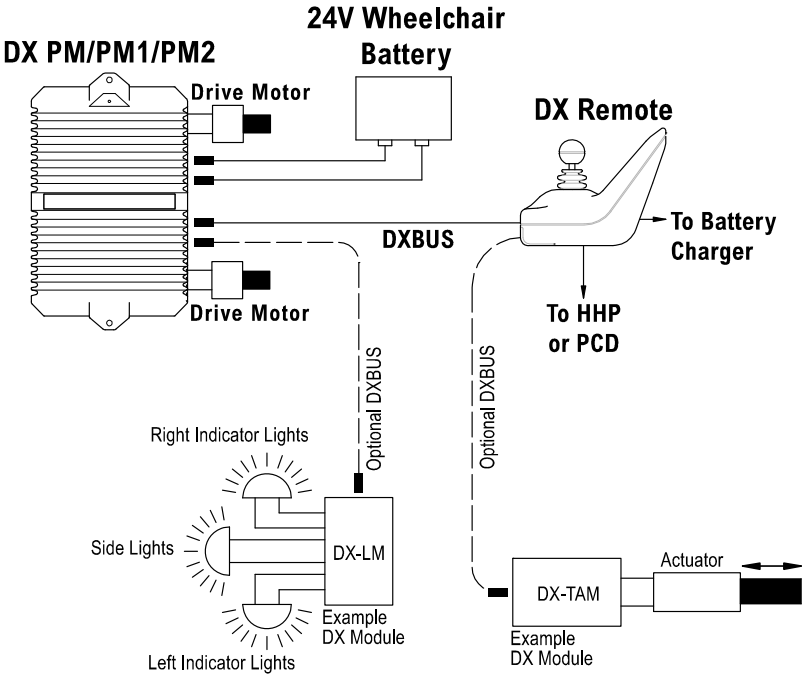
The PM-S has its two motor and Park Brake channels driven in parallel, for a single motor output with twice the current of each channel of a standard PM - see the motor and Park Brake wiring in the Installation section. Note that a standard PM is recommended for use on servo steered wheelchairs with separate left and right drive motors, rather than using a PM-S.

Where the PM has a 60A per channel output, the PM1 has 70A and the PM2 80A per channel output.

Example DX Systems

A PM/PM1/PM2 System

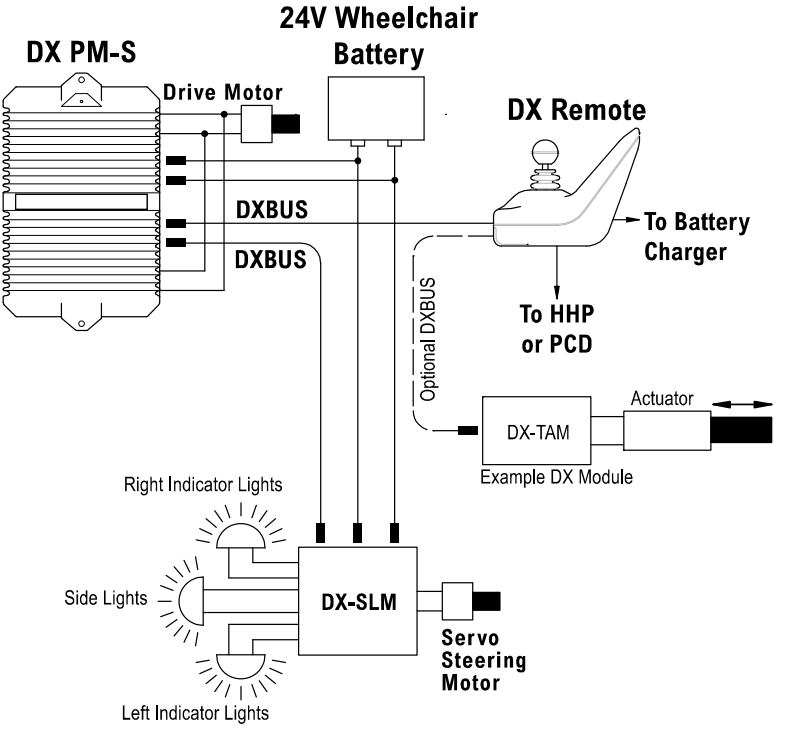
A DX System with a standard PM, a PM1 or a PM2 may look like the following:



A PM-S System

A DX System using a PM-S will normally only have one drive motor, and will contain a DX Servo Lighting Module (SLM) to drive the servo steering motor.

A PM-S system may look like the following :



2 Related Documentation

A DX System may comprise between two and sixteen DX compatible modules depending on the application. Each DX Module has its own Installation Manual which describes the installation requirements of that particular module.

This Manual describes installation of the PM only and must therefore be read in conjunction with :

- The DX Remote Installation Manual for the DX Remote to be used with the PM in your installation;
- The DX Hand Held Programmer (DX HHP) Manual;
- The Dynamic Wizard Installation Manual / Online Help;
- The Installation Manuals for all other DX Modules to be used in your application.

Installation Manual Re-order Information
(Please quote this information when re-ordering this manual)

DX Power Module - GBK63824

3 DX Power Module Features

General Features

The PM has the following general features:

- Digital communications bus interface (DXBUS compatible), with remote wake up and remote kill inputs via DXBUS;
- Two identical DXBUS sockets with protected 12A RMS maximum battery power supply;
- Digital motor control;
- Completely programmable for parameters such as load compensation, motor veer compensation, current limit level and dual or single Park Brakes;
- Protected against external events such as:
  - reverse battery
  - battery under and over voltage
  - overloaded motor or Park Brakes
  - external short circuits
  - stalled motor;
- Extensive range of wheelchair system safety and protection features such as:
  - open circuit motor detection
  - open and short circuit Park Brake detection
  - controlled speed reduction to a stop if a fault is detected;
- Electromagnetically compatible:
  - low RF emissions
  - low susceptibility to RF transmissions;
- Environmentally compatible (sealed to IP54);
- Built-in diagnostics with status LED and fault logging;
- Compact, rugged enclosure with robust mounting points;
- Approved by the German Safety Standards Authority TÜV.

Safety and Protection Features

The PM has the following safety and protection features:

- Detection of open circuit motors;
- Detection of open or short circuit Park Brakes;
- Battery under voltage protection with Battery Saver to prevent motor chugging and to protect battery;
- Thermal overload protection with progressive motor current roll back and automatic recovery;
- Over voltage shut down (protect outputs against damage if disconnected battery; eg. while wheelchair is driving downhill, ie. motors generating);
- Enhanced downhill control providing a smooth, controlled rollback of speed should the battery voltage rise too high;
- All outputs protected against over voltage transients and short circuits;
- Isolate relay protects against reverse battery connections and prevents runaway in event of H Bridge or Park Brake driver failure;
- Detection of welded isolate relay contacts;
- Detection of high resistance isolate relay contacts;
- Dynamic braking in neutral;
- Motor drive output monitoring;
- Microcomputer watchdog protection;
- Optional stalled motor time out;
- Self test of current sensor and H Bridge at power up;
- Hardware kill signal from DX Remote to prevent driving;
- Watchdog, CPU, ROM and RAM testing at power up.

Programmable Characteristics

The PM has the following programmable characteristics :

- Maximum motor current;
- Motor resistance (load compensation). Compensates for drive motor inefficiencies. Correct compensation provides an even drive characteristic over irregular driving conditions and terrain (eg on the flat, up hills, etc.);
- Wheelchair veer compensation (for motor mismatch compensation);
- Park Brake delay between the wheelchair stopping and the Park Brake engaging;
- Park Brake configuration (single or dual);
- Motor stall time out duration and enable (on or off);
- Rate of deceleration under fault conditions;
- Left/Right Motor swap option to facilitate motor looming;
- Left/Right Motor connector polarity swap to accommodate motor connector polarity options;
- Optional thermal motor protection;

4 Specifications

Electrical

Applicable to both channels. T_{amb} = -25 to 50° C, V_{BAT} = 24.0 V unless otherwise specified.

Symbol	Parameter	Conditions	Min	Nom	Max	Units
V_{BAT}	Battery Voltage		18.0	24.0	32.0	V
V_{BSH}	"Battery saver" high threshold	Averaged. Battery saver enabled		21.0		V
V_{BSL}	"Battery saver" low threshold	Averaged. Battery saver enabled		18.0		V
P_Q	Quiescent power	Relay de-energised		2.0	5.0	W
P_{SBV}	Standby power	PM "off"		15	30	mW
T_{lim0}	Thermal limit	I_{MO} =0 @ T_{lim0}		70		°C
I_{DXBUS}	DXBUS supply current	Case temp. 20°C	12			A

PM Left and Right Motor Outputs

Symbol	Parameter	Conditions	Min	Nom	Max	Units
f_{PWM}	PWM frequency			19.6		kHz
I_{MO}	Peak motor output current	Duration 15 seconds. Initial case temperature 20°C. Current limit programmed to 60A	54.0	60.0	66.0	A
I_{MO}	15 minute continuous motor current	T_{amb} = 20°C	23.5			A
V_{MO}	Max. motor output voltage	Full conduction, I_{MO} = 10A	23.5			V

PM1 Left and Right Motor Outputs

Symbol	Parameter	Conditions	Min	Nom	Max	Units
f_{PWM}	PWM frequency			19.6		kHz
I_{MO}	Peak motor output current	Duration 15 seconds. Initial case temperature 20°C. Current limit programmed to 70A	65	70	75	A
I_{MO}	15 minute continuous motor current	T_{amb} = 20°C	24.5			A
V_{MO}	Max. motor output voltage	Full conduction, I_{MO} = 10A	23.5			V

PM2 Left and Right Motor Outputs

Symbol	Parameter	Conditions	Min	Nom	Max	Units
f_{PWM}	PWM frequency			19.6		kHz
I_{MO}	Peak motor output current	Duration 15 seconds. Initial case temperature 20°C. Current limit programmed to 70A	75	80	85	A
I_{MO}	15 minute continuous motor current	T_{amb} = 20°C	27.4			A
V_{MO}	Max. motor output voltage	Full conduction, I_{MO} = 10A	23.5			V

PM-S Drive Motor Output

Symbol	Parameter	Conditions	Min	Nom	Max	Units
f_{PWM}	PWM frequency			19.6		kHz
I_{MO}	Peak motor output current *	Duration 15 seconds. Initial case temperature 20°C. Current limit programmed to 120A	54	60	66	A
I_{MO}	15 minute continuous motor current *	T_{amb} = 20°C	23.5			A
V_{MO}	Max. motor output voltage	Full conduction, I_{MO} = 20A	23.5			V

* = Output per motor connector

PM, PM1 and PM2 Left and Right Park Brake Outputs

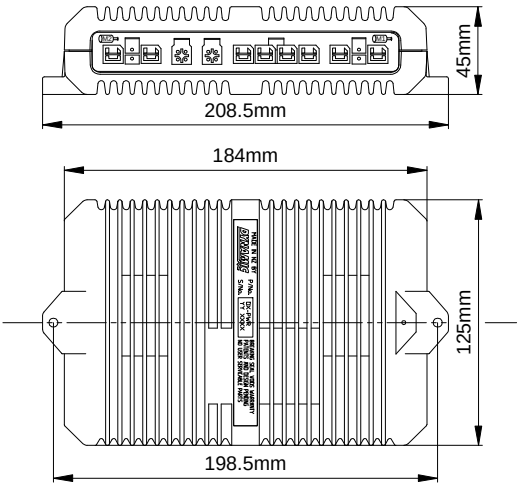
Symbol	Parameter	Conditions	Min	Nom	Max	Units
I_{PBO}	Park Brake output current	$V_{PBO} \leq 23.5V$			1.0	A
V_{PBO}	Park Brake output voltage	I_{PBO} = 0.5A	23.5			V

PM-S Left and Right Park Brake Outputs

Symbol	Parameter	Conditions	Min	Nom	Max	Units
I_{PBO}	Park Brake output current	$V_{PBO} \leq 23.5V$			2.0	A
V_{PBO}	Park Brake output voltage	I_{PBO} = 1A	23.5			V

Mechanical

Size:	208.5 * 125 * 45 mm (excluding mounting brackets)
Weight:	1.1 kg
Mounting:	Using 2 M5 socket cap screws through mounting lugs 198.5mm apart
Case material:	Pressure die cast aluminium
Case finish:	Epoxy powder coat
Case sealing:	IP54, tamper proof, if mounted as per instructions



Environmental

Temperature and Humidity Specification

Parameter	Min	Max	Units
Operating ambient temperature range	-25	50	°C
Storage temperature range	-25	70	°C
Operating and storage humidity	0	90	%RH

Electromagnetic Compatibility Specification

RF Emissions	CISPR 11, Class B
ESD	ISO7176, part 21

Standards

The PM controller has been designed to meet the requirements of prEN12184 : 1997 (pending).

Vibration Specification

120 minutes @ 4g random vibration without damage.

5 Installation

General

Installation of a DX Power Module and basic DX system normally comprises:

1. Mounting the PM.
2. PM Connection with the DX System.
3. PM Connection with Motors and Park Brakes.
4. PM Connection with Batteries.
5. Pre-testing.
6. Programming and re-testing

Compatibility with Power Wheelchairs

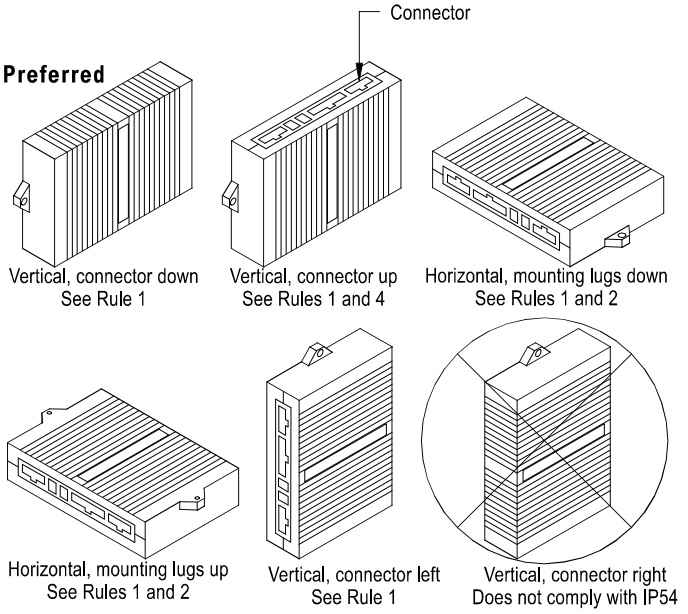
The model DX Series power wheelchair controller will function on those wheelchairs equipped with the following specifications:

- Motor resistance from 0 to 0.5 ohms;
- Motor voltage from 20V to 30V;
- Batteries greater than 20Ah lead acid;
- Peak motor current 60A - 80A maximum per motor output (model dependant);
- 12V or 24V Park Brake;

(Note: 12V motors can be used if the controller is programmed to half speed).

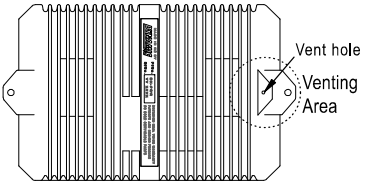
Mounting

The PM is designed to be mounted in a number of orientations. To maintain sealing to IP54, certain rules must be observed for the different mounting scenarios, as follows :



Mounting Rules

1. The vent hole area must be protected against direct splashing.



2. The mounting arrangement must prevent water accumulation under the vent hole area.

3. If mounting washers are used, they must be 30mm or greater in diameter for stability.

4. If the PM is mounted with its connectors upward, the connector should be shielded from water ingress and the cabling restrained such that water may not run down the cables into the connector systems.

General Mounting Considerations

- The selected position and orientation should give the module maximum mechanical and environmental protection. Avoid positions in which the module or its wiring can be knocked or physically damaged or which are exposed to splashing or other forms of abuse.

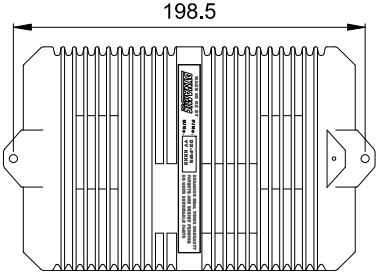
- The length of high current cabling should be minimised. A position close to the batteries and motors is favoured.

- An orientation and position in which the fins are vertical and airflow through the fins is unimpeded is preferred.

- An orientation in which the PM Status LED is visible may be helpful.

- Mounting the PM on a metal surface may assist heat conduction and give better performance.

- When all wiring is completed, it must be securely fastened to the wheelchair frame to ensure that in normal conditions there is no strain to the connectors.

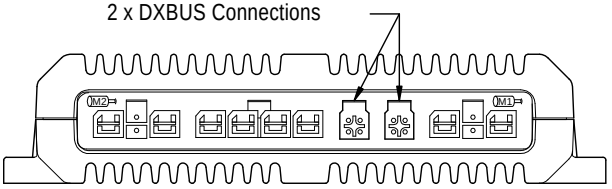


Once the position has been selected fix the unit securely using two M5 socket cap screws with suitable locking washers. Dimensions for hole centres are as shown.

- To fulfill ISO requirements, the left and right motor connections must be short enough so that they can not be swapped by the wheelchair user.

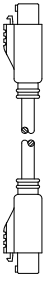
PM Connection with the DX System

DXBUS Connections



Note: If only one DXBUS connector is used on the PM and the remaining connector is accessible to the wheelchair user, a dummy plug should be fitted to the unused connector. DCL Part/Order Number GCN0792 DXBUS Connector Housing can be used. This will comply with ISO7176.

The two DXBUS connectors on the PM are identical. A DXBUS lead from the DX Remote is normally plugged into one of these. The other connector can be used to attach another DX Module.



DXBUS cables are available in the following lengths :

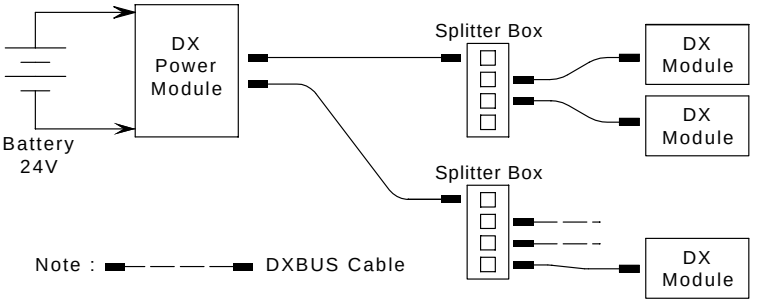
DXBUS CABLE, Straight, 0.3 M	Part/Order Number GSM63003
DXBUS CABLE, Straight, 0.5 M	Part/Order Number GSM63005
DXBUS CABLE, Straight, 1.0 M	Part/Order Number GSM63010
DXBUS CABLE, Straight, 1.5 M	Part/Order Number GSM63015
DXBUS CABLE, Straight, 2.0 M	Part/Order Number GSM63020

DXBUS cables are also available fitted with a ferrite bead to improve Electromagnetic Compatibility (EMC).

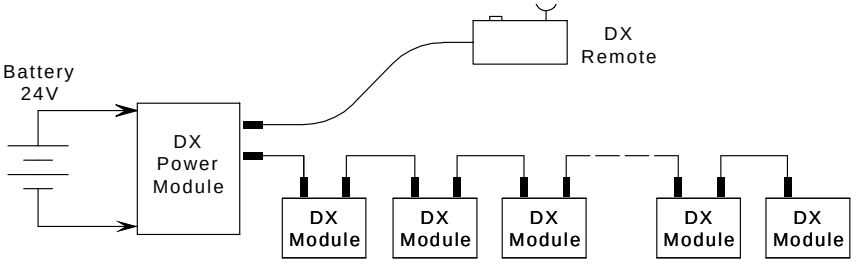
DXBUS CABLE, Ferrite, 2.0 M Part/Order Number GSM63020F

DX Module Interconnection Topology Options

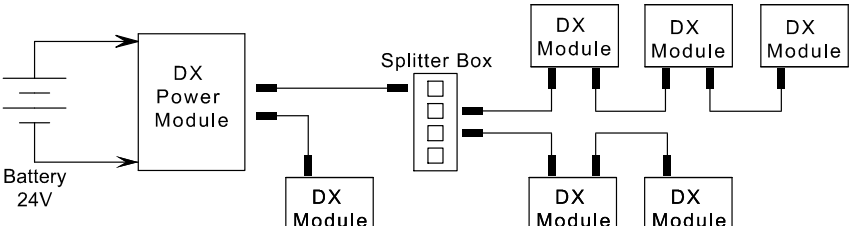
The battery and DX Power Module combination are always considered the heart of a DX system. Other DX Modules can be arranged in several ways:



Star DXBUS Topology



In-line DXBUS Topology



Mixed DXBUS Topology

DX modules normally have one or two DXBUS sockets for system interconnections. Smaller DX modules may have a permanently mounted cable terminated in a DXBUS plug, rather than DX sockets.

The star and mixed topologies both require the use of one or more DX Splitter Boxes. A Splitter Box is a separate panel of four DXBUS sockets that may be purchased from Dynamic or a Dealer.

The DX Splitter Box Part / Order Number is: DX-SKT-X4.

For lowest cost and simplicity the In-line topology is generally preferred, provided the DXBUS length and voltage drop requirements described below can be met.

Connections to other DX Modules

For connection to the DX Remote and other DX Modules, see the individual Installation Manuals.

DXBUS Length and Voltage Drop Restrictions

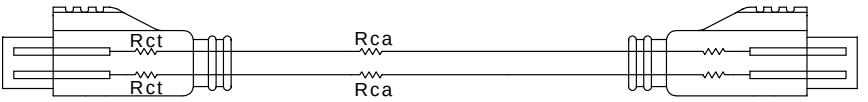
Due to signal distortion that increases with increasing DXBUS length, the total length of all DXBUS cable must not exceed 15 metres in any topology.

Two of the DXBUS's four cores (DXB+ and DXB-) are used to supply power to the modules and to the loads connected to them. A Positive Temperature Coefficient (PTC) device in the Power Module limits the total DXBUS current to 12 A, to protect the DXBUS wiring and connectors. The topology and cable lengths used may reduce the DXBUS's upper limit to below 12 A.

For correct DX System operation the voltage drop on the DXBUS's DXB- wire due to return currents, must not exceed 1.0 V between any two modules within the DX System. Use a topology and module placement that reduces this voltage drop as low as reasonably possible.

Voltage drops occur along the DXBUS due to the return of current back to the battery through the small but finite resistance of the DXBUS cable and connectors.

A DXBUS connector can be modelled as:

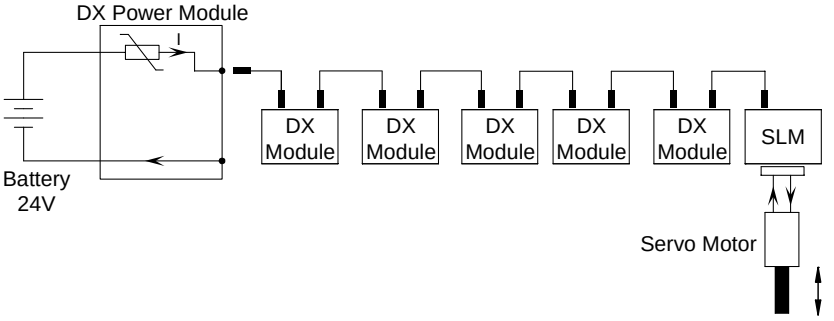


DXBUS Cable Model

R_{ct} = contact resistance = 5 mOhm
R_{ca} = cable resistance = 12 mOhm / metre

Example:

Consider a Power Module connected to an SLM via five other DX Modules using 1 metre cables.



Example of DX Module interconnection

The total resistance of the 0 V return path, between the Power Module and SLM is:

$$6 \text{ X } (2 * R_{ct} + R_{ca}) = 132 \text{ mOhms}$$

This means that the maximum load that the SLM can drive and not exceed the 1.0 V drop requirement is 1 / 0.132 = 8 A.

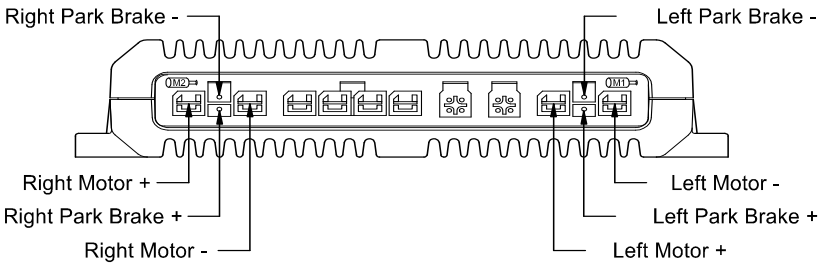
If, for example, the servo motor and lighting that the SLM is required to drive has a peak current of 10 A the interconnection order of the DX modules will have to be changed to place the SLM closer to the Power Module.

The above example illustrates a fundamental rule of DX Module interconnection **All DX Modules that connect to high current loads (e.g. actuators / motors and lights) must be connected as close to the Power Module as possible.**

The above example is simplified and does not include current to other DX Modules. The DXBUS maximum current rating of 12 A is for the entire DX System.

PM Connection with Motors and Park Brakes

Motor and Park Brake Connector Pin Definitions



The Left Motor and Park Brake connector and the Right Motor and Park Brake connector are identical.

Note : The motor connections shown above are correct for Power Modules which have their programable Left/Right Motor Swap parameter set to 'NORM'. If set to 'SWAP', the Left and Right motor connectors will be swapped from that shown. For this reason, the connectors are not labelled Left and Right, but M1 and M2, as shown.

The polarity of the motors connectors shown is correct for Power Modules which have their programmable Motor Invert parameter set to 'No'. If set to 'Yes', the polarity of the + and - terminals will be opposite. In either case, the + terminal will increase in voltage in response to a joystick being pushed forward.

See Page 23 for PM-S connector pin definitions.

Motor and Park Brake Connectors

Dynamic Connector and Lead Kits relating to Motor and Park Brake connections are as follows. Leads and connectors can be ordered separately. These can be ordered by contacting a Service Centre or Agent as given in Section 14.

Dynamic Part #	Description	Qty
DXLOOM-PM	Power Module Connector Kit	1
GSM60182	DX Motor Connector Kit	2
GSM61191	DX Left Motor Loom	1
GSM61192	DX Right Motor Loom	1
GCN0787	DX Motor Connector Cover	2

Notes :

1. The type of cable used must be appropriate for the environmental and mechanical abuse it is likely to encounter.
2. The four conductors should be sheathed, and the junction of the wires to the plug should have strain relief.
3. It is preferable for both left and right motor looms to be of equal length.

Warning : The motor looms must be fixed so that there is **no** possibility that the right and left motor plugs can be accidentally interchanged.

Minimum Wire Sizes

Function	Wire Size (PM Type)		Terminal Part
	PM / PM1	PM2	
Motor +	3mm²	4mm²	AMP Innergy 556880-2
Motor -	3mm²	4mm²	AMP Innergy 556880-2
Park Brake +	0.5mm²	0.5mm²	Positronic FC120N2
Park Brake -	0.5mm²	0.5mm²	Positronic FC120N2

Notes :

1. The motor wiring should be as short as practical in order to minimise voltage drops in the cable.

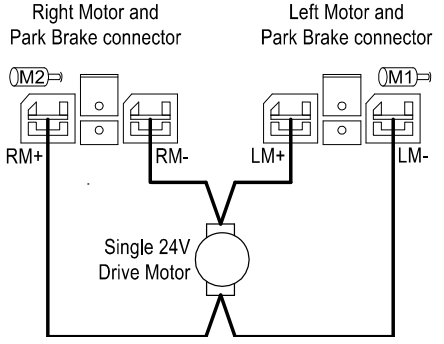
2. The motor wire sizes above are appropriate for motor loom lengths up to 400mm. For looms longer than this, increase the wires size by 0.5mm² for every additional 200mm in length. Generally, the larger the motor conductor size, the better the wheelchair performance will be.

3. The chosen size and length of the motor conductors can affect the optimum setting of the Load Compensation parameter.

4. The PM-S wire sizes are the same as for the PM, but two wires of each size are used to each motor terminal (one from each PM motor connector).

PM-S Drive Motor Wiring

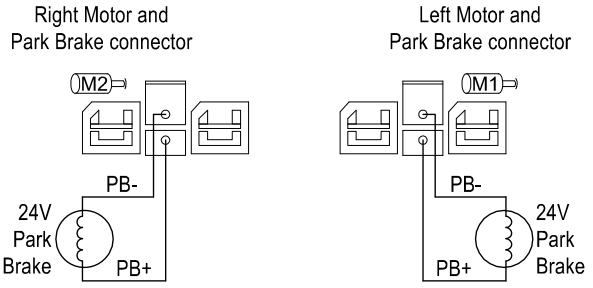
Wiring from the PM-S to a single drive motor must be as shown. Both left and right motor looms must be of equal length.



24V Park Brake Wiring (PM, PM1, PM2)

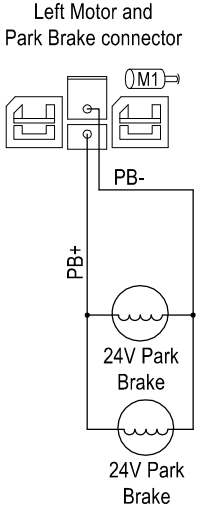
Dual Park Brakes

If the wheelchair has two 24V Park Brakes, the preferred wiring is as follows.



The above Park Brake configuration is referred to as the Dual Park Brake as each Park Brake is driven from a separate output.
For this configuration, the PM Park Brake parameter is set to ‘dual’. See the Programming section.

Single (Sngl) Park Brakes



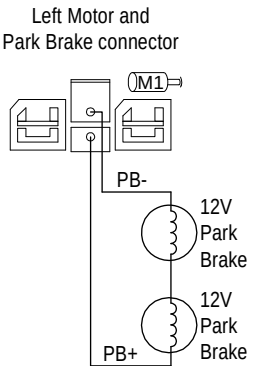
Both 24V Park Brakes can be driven in parallel from the M1 connector as shown, but this is discouraged. For this purpose the M1 connector must be used.

If the Park Brakes are connected to the M2 BP+ connector instead of M1, a Left Park Brake fault (Flash Code 5) will occur.

For this configuration, the PM Park Brake parameter is set to ‘sngl’. See the Programming section. If set to ‘dual’, a Right Park Brake fault (Flash Code 6) will occur.

12V Park Brake Wiring (PM, PM1, PM2)

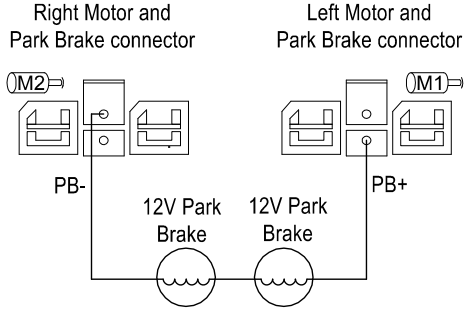
Single (Sngl) Park Brakes M1 only



If the wheelchair has two 12V Park Brakes, the wiring may be driven from just one Park Brake output. If this is the case, the M1 connector must be used.

When both Park Brakes are driven from the same output, the PM Park Brake parameter is set to ‘sngl’. See the Programming section. If set to ‘dual’, a Right Park Brake fault (Flash Code 6) will occur.

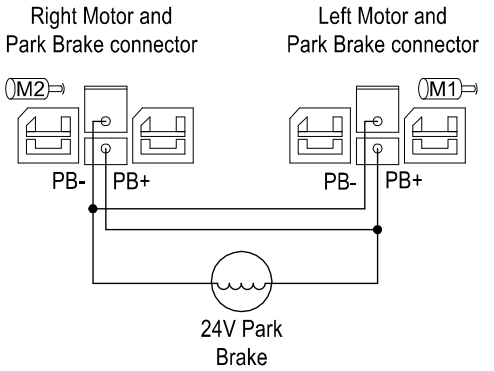
Single (Sngl) Park Brakes M1 and M2



Alternatively, the 12V Park Brakes can be wired to both Park Brake outputs but driven from the M1 PB+ output. If the M2 PB+ is used instead, a Left Park Brake fault (Flash Code 5) will occur.

For this Park Brake configuration the PM Park Brake parameter is set to ‘sngl’. See the Programming section. If set to ‘dual’, a Right Park Brake fault (Flash Code 6) will occur.

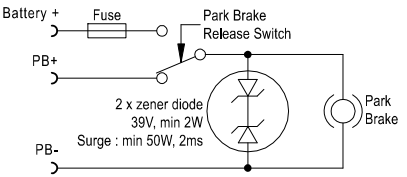
PM-S Park Brake Wiring

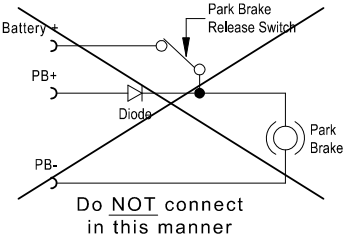


The PM-S has only one Drive motor and Park Brake. The single 24V Park Brake must be driven from both Park Brake connectors.

Park Brake Release Switches and Suppression Devices

Manually operated Park Brake release switches can be fitted as shown below, if appropriate to the application. A suitable suppression device **must** be fitted across each magnetic Park Brake to prevent generation of high voltage transients and possible damage to the PM or the Park Brake Release Switch.
Do not connect in the manner shown below right.

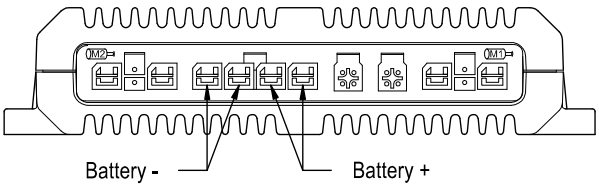




Some suitable suppression devices are :

Manufacturer	Motorola	Philips
	3EZ39D5	BZX70C36
	3EZ36D5	BZX70C39
	1N5365A	BZT03C36
	1N5366A	BZT03C39

PM Connection with Batteries



The Battery connector has two terminals each for battery + and battery -. Both Battery + terminals and both Battery - terminals must be used.

Note : The final connection to the Battery + terminals should not be made until the wheelchair is completely wired and ready for testing as described in the Testing section.

Battery Connector

Dynamic Part #	Description	Qty
DXLOOM-PM	Power Module Connector Kit	1
GSM60180	DX Battery Connector Kit	1
GSM61190	DX Battery Loom	1
GCN0788	DX Battery Connector Cover	1

The type of cable used must be appropriate for the environmental and mechanical abuse it is likely to encounter. The four conductors should be sheathed, and the junction of the wires to the plug should have strain relief.

Minimum Wire Sizes

Function	Wire Size (PM Type)		Terminal Part
	PM / PM1 / PM-S	PM2	
Battery +	3mm²	4mm²	AMP Innergy 556880-2
Battery -	3mm²	4mm²	AMP Innergy 556880-2

Notes :

1. The motor wiring should be as short as practical in order to minimise voltage drops in the cable.

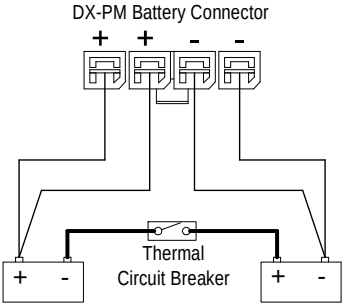
2. The battery wire sizes above are appropriate for battery loom lengths up to 400mm. For looms longer than this, increase the wires size by 0.5mm² for every additional 200mm in length. Generally, the larger the battery conductor size, the better the wheelchair performance will be.

Battery Wiring and Protection

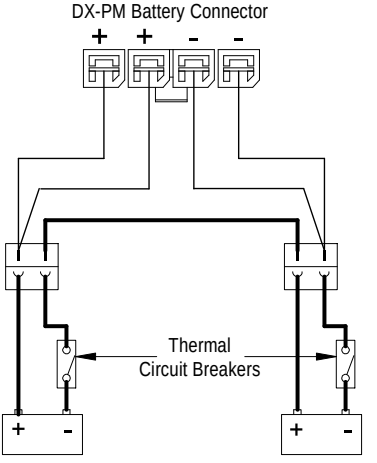
A thermal circuit breaker must be installed between the batteries and the PM, as close as possible to the batteries, to protect both the batteries and the system wiring. If the two batteries are permanently wired together (single battery box), the best position for the circuit breaker is between the two batteries. If the batteries are individually plugged together (separate battery boxes), each battery requires a circuit breaker.

The thermal circuit breaker will normally have a trip rating no higher than the current limit of the PM, or half the current limit of the PM-S. Check thoroughly to ensure that it provides the necessary degree of motor protection.

Wiring from the PM to the batteries must be as shown. The size of the wires as shown by thicker lines in the following diagram must be either twice the area (mm²) as specified above, or else two wires must be used. The size of the other wires is as specified above.



Single Battery Box



Separate Battery Boxes

6 Batteries and Charging

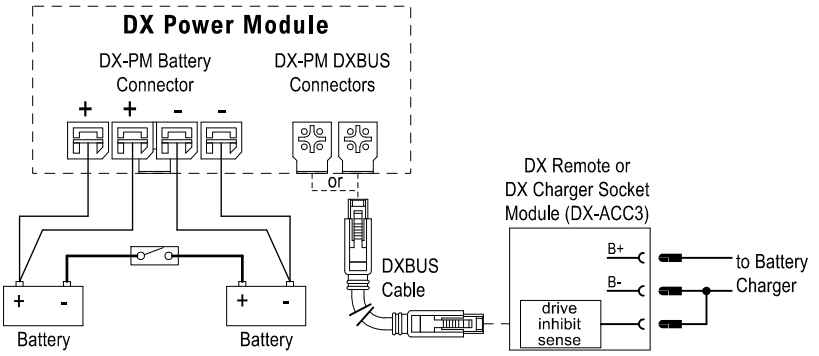
Battery Type

The DX System is designed to perform optimally with either Lead-Acid or Gel Cell 24 V deep cycle batteries, rated at 20 - 120 Amp hours. The maximum average discharge rate must not exceed half the rated capacity, in Amp hours.

High continuous discharge rates dramatically reduces the available battery capacity. For example, at a discharge rate equal to the rated capacity, the available capacity is 50 - 60 %. At a discharge rate of half the rated capacity, the available capacity is 70 - 80 %.

Battery Charging

The satisfactory performance of the PM is critically dependent on the type and condition of the batteries. The battery charger used must be correctly selected and adjusted according to the battery manufacturer's instructions. Failure to do so may damage or destroy the batteries, give poor range, or be potentially dangerous. Batteries should not be abused (for example by deep discharging or overcharging) and must be operated and maintained according to the manufacturer's instructions.



Ensure that the battery charger connector is fitted with the correct safety link between B- and the Inhibit pin, so that the wheelchair is prevented from driving when the batteries are being charged.

Warning : Do not disconnect batteries or open circuit the circuit breaker during charging. This is dangerous to both people and equipment.

7 Testing

The following procedure should be carried out in a spacious environment and with due regard to possible unexpected wheelchair movement in the event of faulty installation.

1. Raise the wheels off the ground using blocks under the wheelchair frame, so that the wheels can turn freely.

2. Recheck all wiring, paying particular attention to polarities of batteries, motors and Park Brakes.

3. Make the final connection to the Battery + terminal, then close the circuit breakers.

4. The DX Remote will have one or more buttons or switches for turning on the DX System. Refer to the appropriate DX Remote Installation Manual to identify the switch(es) and procedure to turn the system on and off.

   Turn on the DX System and check that the DX Remote powers up correctly - see the appropriate DX Remote Installation Manual for the normal response.

Note : The first time the DX Remote is turned on the System Status Led will flash a fault. This is because the DX Remote must download its information to the DX Power Module. Wait 10 seconds before turning the DX Remote off, wait 10 seconds, then turn it back on to clear this fault. Refer to the Auto Download section.

5. Check that the Power Module's Green Status LED is on steady. If this is still flashing the PM may be faulty. Refer to the Diagnostics section.

6. Try turning each driving wheel by hand to check that the Park Brakes are engaged. The wheels should not move.

7. Push the joystick slightly out of neutral and listen for the "click" as the park brakes disengage.

8. Move the joystick in all directions and ensure that the wheels respond smoothly and in the correct direction. Repeat for all Drive Programs.

9. Go through the DX Remote Check Sequence as described in the DX Remote Installation Manual.

10. Go through the Check Sequences as described in the Installation Manuals of all other DX Modules used in the system.

11. Turn off the DX System and take the wheelchair off its blocks. Ensure that the batteries are fully charged before proceeding.

12. Turn on the DX System and, if the DX Remote allows a choice of drive programs, select the least lively (normally Drive Program 1).

13. Sit in the chair and push the joystick slightly out of neutral and listen for the click of the Park Brakes dis-engaging. Release the joystick to neutral and listen for the click of the Park Brakes re-engaging.

14. Drive the wheelchair in all directions slowly and check for precise and smooth control.

15. Repeat at higher speeds and on all the other drive programs if available.

16. Drive the wheelchair on a 1 : 6 ramp and check for normal power, smoothness and parking.

Warning : Some of the more lively drive programs may not be suitable for testing indoors.

8 Programming

Warning !!

Incorrect or inappropriate programming of a DX System can put the wheelchair into a dangerous condition. Dynamic Controls accepts no responsibility or liability for accidents caused by incorrect programming. This Programming section, the DX HHP Manual, and the Dynamic Wizard Manual/On-line Help must be read and understood before attempting to program a DX System.

Ensure that the programmed wheelchair complies with all prevailing regulatory requirements for your country and application.

Introduction

The driving performance of the DX System is dependent on its programming. Different features can be selected and parameters fine tuned for a particular application, or to suit the requirements of an individual.

The DX Remote and the DX Power Module are the modules most responsible for defining the driving performance of the DX System. Software in the Remote processes the joystick movements according to its Drive Programs, and sends direction and speed commands to the DX Power Module. The PM adds load and veer compensation at the rate programmed for that unit and outputs the result in a high current form suitable for driving the motors.

Default Programs

The optimum settings for all programmable DX Modules are normally experimentally determined by the wheelchair manufacturer (OEM) on a sample system. These default settings are incorporated into a controlled document by Dynamic, and all production units are supplied programmed with these default settings.

If more than one type of wheelchair is to be used by the customer, each wheelchair type may have its own set of optimum settings. In this case, it is generally best for Dynamic to supply DX Modules with a standard set up, and for the wheelchair manufacturer to change the programming, using the Wizard, as required by their production.

Warning : If a wheelchair is programmed with settings other than default, under some very rare fault conditions default settings could be automatically restored, thereby changing driving characteristics. This in turn could lead to a chair moving in a direction or speed that is not intended. Programmers should consider this risk when programming settings other than default.

Auto Download

The DX System has a feature called Auto Download. It is designed to minimise the programming requirements associated with Module servicing by down loading the correct programming to a replacement DX Module.

When a DX Module is replaced, it is likely that the replacement module is programmed differently from the one that it replaces. This could leave the wheelchair in a dangerous condition. The DX System automatically detects that a DX Module swap has occurred, and the programmed data from the old module is transferred to the replacement module.

Auto Download is achieved by the DX Remote containing both its own programming and also a backup copy of the programmed data for all other DX Modules. When a module swap is detected, or a checksum error found in a module, the DX Remote automatically downloads its backup copy to the module.

Note : The Auto Download occurs immediately on power up after the Module has been replaced. This applies to all intelligent DX Modules **except** a DX Remote.

A DX Remote replacement will normally have the desired programming for the wheelchair. The fine tuning of the Drive Programs to suit the individual wheelchair user will however be necessary.

Warning : When a DX Remote is replaced, it will perform an Auto Download of the DX Power Module programming. This may result in incorrect and dangerous programming for a particular wheelchair system if the wheelchair program installed in the DX Remote is not suitable for that wheelchair system.

When replacing a DX Remote, use the HHP and / or Wizard to ensure that the DX Power Module parameters are programmed correctly for the wheelchair type.

After replacing a Module, turn the DX System off, wait 10 seconds, then turn on again to initiate the Auto Download of the DX Remote backup data.

When an Auto Download has occurred, but the system needs to be cycled on and off, a Module Fault (Flash Code 1) is displayed on the DX Remote's System Status LED. When the System is turned off then on again, the fault is cleared and the Auto Download is correctly terminated.

Programming Tools

Two programming tools are available, the Wizard and the DX HHP.

Dynamic Wizard

The Wizard is a PC based tool suited to programming production runs of identical wheelchairs or modules, or one-off highly customised wheelchairs. The Wizard is available in several versions :

OEM	Generally used by the wheelchair manufacturer. Able to program a wide range of parameters.
DEALER	Similar in function to the above, but with a reduced range of programmable options. This ensures that options that the manufacturer wishes to keep control of cannot be disturbed. Parameters that may cause hazards or require special expertise to set, are not available for adjustment.
ENHANCED DEALER	As Dealer above, but with the ability to edit parameters that relate to wheelchair accessories (e.g. actuators)
FACTORY	Can only replace Standard or Custom Wheelchair Programs. No editing or diagnostics available.

Warning : The Wizard is a very powerful tool and as such requires well trained operators and a disciplined approach to usage and distribution.

It is up to the wheelchair manufacturer to determine whether they will allow distribution of Wizards to dealers. Refer to the Wizard Manual for further details.

DX-HHP

The DX Hand Held Programmer (HHP) is the normal programming tool used by dealers, allowing easy adjustment of all commonly adjusted Drive Program parameters.

Warning : The DX-HHP is for use **only** by wheelchair manufacturers and their authorised dealers. It is **not** for use by the wheelchair user. Dealers may only program parameters as instructed by the wheelchair manufacturer.

The DX-HHP Manual should be read and understood before attempting to use the HHP.

PM Wizard Programming

Introduction

It is the combination of a DX Remote and a PM which define overall driving performance. Both modules have associated parameters which affect wheelchair performance and which must be considered together to get the best driving performance.

Most of the parameters that need to be set up on an individual wheelchair basis to suit the needs of particular users (e.g. the Drive Programs) are associated with the DX Remote and are described in the DX Remote Installation Manual.

Most of the parameters that are set up for a particular wheelchair type (e.g. Load Compensation, Current Limit) are associated with the PM and are described in this Manual.

Some parameters can be both read and written to (edited) by an OEM or a Dealer. Other parameters can only be read but not edited. Some parameters available to an OEM are not displayed for a Dealer.

The Load Compensation parameter can be set using the HHP. Veer Compensation should be set using the HHP to calibrate the DX System to the motors on the wheelchair. The adjustable range for these two parameters by the HHP can be limited by the Wizard.

With the Wizard's "Create a new Chair Program" option, you can set up the standard parameters for the PM and any other modules used for a particular wheelchair. This Chair Program is then saved to disc under a name such as "SuperChair, Deluxe" and can be down loaded to the DX System at the push of a button.

Example

Modify/Edit the "SuperChair, Deluxe" Chair Program as follows.

1. Enter the Wizard's Main Menu screen as described in the Wizard Installation Sheet.

2. Use the keyboard or the mouse, to select 'Edit Wheelchair Library' menu option.

3. Select either 'Edit Standard Wheelchair Program', or 'Edit Custom Wheelchair Program', as appropriate.

4. Select the "SuperChair, Deluxe" program.

5. Select the 'Edit Module Parameters' menu option.

6. Select 'Power Module'.

7. Scroll through the list of parameters and adjust as necessary.

8. Press «Enter» to accept the changes, or «Esc» to exit without saving. Select 'Write Program to Library' option and press «Enter». These values will then be part of the Standard Chair Program for the "SuperChair, Deluxe".

Page	Parameter	Range / State	Default	HHP	Dealer/Enh. Dealer Wizard	OEM Wizard
41	Load Compensation	0 - 500 milliohms	0m	Yes	Read	Read / Write
42	Temp. Dependant Load Comp.	On / Off	Off	-	Read	Read / Write
42	Current Limit	20 - 80 Amps	as req.	-	Read	Read / Write
42	Veer Compensation	-10 - +10% Left / Right	0%	Yes	Read / Write	Read / Write
43	Park Brake	Sngl / Dual	Dual	-	Read	Read / Write
43	Brk / Bridg Off Delay	100 - 1000 msec	500 msec	-	-	Read / Write
44	Emergency Decel.	25 - 100%	75%	-	-	Read / Write
45	Left / Right Motor Swap	Norm / Swap	Norm	-	Read	Read / Write
45	Left Motor Invert	Yes / No	No	-	Read	Read / Write
45	Right Motor Invert	Yes / No	No	-	Read	Read / Write
46	Stall Timeout	Yes / No	Yes	-	Read	Read / Write
46	Stall Time	5 - 50 sec	15 sec	-	Read	Read / Write
46	I^2T	On / Off	Off	-	-	Read
46	I^2T Threshold	10 - 90%	33%	-	-	Read
46	Motor Time Scale	10 - 200	32	-	-	Read
47	Max. Motor Temp.	70 - 200°C	130°C	-	-	Read
47	Temp. Rollback Min.	40 - 75°C	50°C	-	-	Read
47	Temp. Rollback Max.	50 - 85°C	70°C	-	-	Read
47	HW Current Scaler	0 - 100%	100%	-	-	Read / Write
48	Max. Motor Volts	24 - 30 Volts	26V	-	-	Read / Write
48	Joy. Demand Scaler	50 - 100%	95%	-	-	Read / Write
48	Halve Turning Gain	On / Off	Off	-	-	Read / Write
48	Voltmeter Battery Gauge	On / Off	Off	-	Read / Write	Read / Write
48	Battery Guess Max.	24.2 - 28.8	25.0	-	-	Read / Write
48	Battery Guess Min.	22.3 - 26.2	22.7	-	-	Read / Write
49	Batt. Guess Recover	0 - 30	15	-	-	Read / Write
49	Batt. Gauge Ramp Up Rate	3 - 480	36	-	-	Read / Write
49	Batt. Gauge Ramp Down Rate	3 - 480	27	-	-	Read / Write
49	Batt. Gauge High Threshold	0 - 33.4	28.4	-	-	Read / Write
49	Batt. Gauge Low Threshold	0 - 33.4	28.4	-	-	Read / Write
49	Slow Batt. Time Scale Driving	On / Off	Off	-	-	Read / Write
50	High Voltage Warning	On / Off	On	-	-	Read / Write
50	High Voltage Rollback	On / Off	Off	-	-	Read / Write
50	High Voltage Threshold	28V / 30V	28V	-	-	Read / Write
50	Test Park Brake Driving	On / Off	On	-	-	Read / Write

Description of Parameters

The following parameters are normally set up for a particular wheelchair type, rather than for a particular wheelchair user.

Load compensation

Load Compensation is the name given to the Power Module's ability to maintain a constant speed regardless of changing motor loads. This is particularly useful for slope/kerb climbing, turning on certain surfaces, cross-slope driving, and many other situations in which the motor load changes. It also affects the PM's ability to prevent the wheelchair rolling down a slope when starting or stopping.

The speed of a motor changes as a result of the combined resistance of its windings/brushes and the wiring from the controller to the motor. The poorer the quality of the motor and/or its associated wiring the more speed variation with load, and the greater the need for load compensation by the controller.

The PM has a programmable Load Compensation parameter, expressed in terms of milliohms of resistance that it has to compensate for. High quality motors may require a Load Compensation value of 50 milliohms while a poor quality motor may require as much as 300 milliohms. The default Load Compensation value is zero as it is safer to err on the low side.

Warning : When programming this parameter, a value lower than deemed necessary should be trialed before programming higher values.

It is extremely important to get the value of load compensation correct for the motors used. Entering a lower than optimum value will give sluggish and load dependent performance which will be tiring for the driver, while entering a higher than optimum value will give a jerky performance which will be hard to control and potentially dangerous. The Load Compensation should be determined based on the motor manufacturer's data and appropriate motor resistance testing.

For the PM-S, the actual Load Compensation at the drive motor is half of the value of the Wizard Load Compensation parameter. (The HHP displays the true value as seen at the motor).

Temp. Dependent Load Comp.

The motor resistance, wiring resistance and controller internal resistances all increase with increasing temperature. If this setting is set to ‘on’, the chair will automatically compensate for these factors and calculate a value that will alleviate any lurching motions from the chair caused by temperature extremes.

Current Limit

The Current Limit defines the controller's sustained motor current limit value. Each motor's current will be limited to this value until it is rolled back as the controller heats up (typically after 60 seconds at 60 Amps).

For the PM-S, the current for each channel is set to 50A. The actual current in the single drive motor is 100A, twice the programmed value displayed by the Wizard.

Do not set the current limit too high for the type of motor used.

Veer Compensation

Veer Compensation is the adjustment of the neutral steering position so that the wheelchair does not veer due to unbalanced motors when the joystick is pushed directly forwards or backwards. This parameter should be adjusted when a motor is replaced.

This parameter will have no effect on the PM-S. If, however, a Servo Steered DX System has two drive motors controlled by a PM, PM1 or PM2, Veer Compensation does have some effect.

The SLM also has a Veer Compensation parameter which controls the steering position with respect to the steering motor. The PM Veer Compensation parameter is used, in a Servo Steered system, to balance the load on the two drive motors. This is achieved by adjusting the Veer Compensation so that the current to both drive motors is equal.

See the later HHP Operation section for Veer Compensation adjustment.

Park Brake

Set to ‘dual’ when both Park Brake outputs are used i.e. the Park Brakes are connected to PB+ on both M1 and M2. If only one PB+ output is used, a Right Park Brake fault (Flash Code 6) will occur.

Set to ‘sngl’ when only one Park Brake output is used. This output will always be the M1 PB+ output (normally the Left Motor and Park Brake connector). If the M2 PB+ output is used instead, a Left Park Brake fault (Flash Code 5) will occur.

The PM-S must have this parameter set to ‘dual’.

Brk / Bridg Off Delay

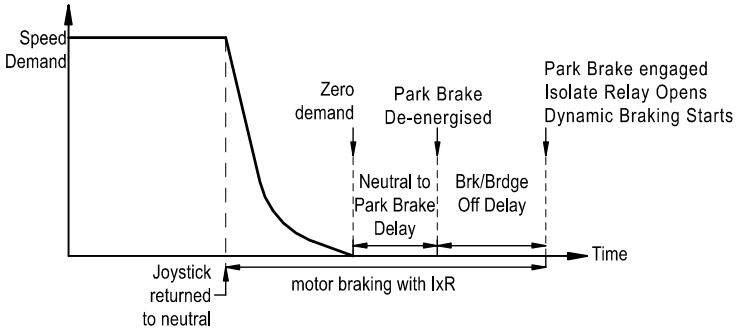
Brk / Brdg Off Delay is the delay between de-energising the Park Brake and turning off the H Bridge and opening the isolate relay.

When the joystick is returned to neutral the speed demand returns to zero at the programmed deceleration rate for the drive program in use at that time, reducing to a low deceleration as the wheelchair approaches a standstill.

The Neutral to PB Delay parameter is set as a UCM Wizard parameter, and is the delay between zero speed demand and de-energising the Park Brake. It is dependent on the particular Park Brake mechanics and is higher for chairs with fast acting Park Brakes. It is set so as to minimise the jerk when stopping at high deceleration and when parking on a slope. The jerk is also influenced by the Load Compensation setting. The Neutral to PB Delay also prevents the Park Brakes being applied when the joystick is passed through neutral and no stopping is intended.

Being inductive and mechanical, Park Brakes can take a significant time to engage from the time power is removed. To provide positive braking and to reduce roll back on a slope while the Park Brake is engaging, the PM maintains active motor braking for the programmed duration Brk/Bridg Off Delay. It should be set greater than the Park Brake's engage time.

The Brk/Bridge Off Delay setting will depend on how quickly the Park Brakes engage. The Park Brakes must engage before the motors turn off. It is safer to err on the high side.



Emergency Decel.

Emergency Decel sets the rate at which the wheelchair stops under most fault conditions or if the user turns the DX System off while driving. If the PM detects a fault which it considers unsafe and is unable to control, it will automatically bring the wheelchair to a halt at this rate. The optimum value will depend on the wheelchair type, the manufacturer's preferences, and any regulations that apply to the country of use.

A higher value will produce a faster emergency deceleration than a lower value.

Warning : Front Wheel Drive wheelchairs should have this parameter set lower e.g. 50%. Otherwise the wheelchair will stop too quickly, and the user may be thrown from the wheelchair.

Left / Right Motor Swap

Left / Right Motor Swap allows the Left and Right motor outputs to be swapped so as to appear at opposite connectors.

If set to 'norm' the Left motor should be connected to the connector labelled M1 and the Right motor connected to M2.

If set to 'swap' the Left motor should be connected to the connector labelled M2 and the Right motor connected to M1. This allows the looming between the PM and the motors to be optimised for particular PM mounting orientations. Most Fault and Diagnostic messages will not take a 'swap' into account when displaying messages.

This parameter will have no effect on the PM-S.

Left Motor Invert

Left Motor Invert is normally set to 'no', in which case the polarities of the Left Motor are as labelled in the Motor and Park Brake Connector Pin Definitions. The Left Motor may refer to M1 or M2, depending on the Left / Right Motor Swap setting.

If set to 'yes', the +ve and -ve polarity is reversed. This parameter will reverse the polarity of the drive motor in a PM-S system.

Right Motor Invert

Right Motor Invert is normally set to 'no', in which case the polarities of the Right Motor are as labelled in the Motor and Park Brake Connector Pin Definitions. If set to 'yes', the +ve and -ve polarity is reversed.

This parameter will have no effect on the PM-S.

If only one motor is inverted the performance of the DX System is reduced. This situation is not recommended for long term use.

Stall Timeout

Stall Timeout can prevent motor burning, particularly in situations when the joystick gets trapped at full deflection. Some Standards may require a particular Stall Time.

If set to 'yes', driving is disabled after Stall Time in current limit, and Flash Code 11 is displayed on the System Status LED of the DX Remote. The DX System has to be powered down and up again to return to the normal driving mode.

Stall Time

Stall Time defines the stall timeout time if this feature is enabled. Some Safety Standards may require a particular Stall Time.

I^2T

If I^2T is set to 'on' Motor I^2T is enabled. Motor I^2T parameters define the thermal characteristics of the motors used in the wheelchair. The OEM must provide sample motors or detailed motor specifications to Dynamic Controls. Dynamic will provide recommended settings to ensure correct motor protection against overheating.

I^2T Threshold

I^2T Threshold defines the continuous current rating as a percentage of maximum current rating, at a theoretical ambient temperature of 0°C. Given that the heating of a motor is proportional to I^2, values for other temperatures can be obtained from the maximum motor temperature. In practice, the PM uses its internal temperature measurement as ambient temperature. This means that the value for Motor I^2T Threshold needs to be greater than its theoretical value. This is especially so for higher current motors which will tend to heat the controller more.

Motor Time Scale

This is another I^2T parameter and relates to the thermal mass of the motor, i.e. how quickly it heats up and cools down. A sample motor is needed to evaluate the correct setting for this parameter.

Max Motor Temp

Max Motor Temp is the maximum allowed temperature of the motor wire's insulation. This value will be obtained from the motor manufacturer. Not as critical as the I^2T Threshold setting.

Temp Rollback Min

Temp Rollback Min is the temperature at which thermal roll-back begins.

Temp Rollback Max

Temp Rollback Max is the temperature at which thermal roll-back limits the output to zero.

HW Current Scaler

The sustained current limit that the PM can supply to a motor is limited to the programmed Current Limit setting as described above. Because of the response time of the nominal current limit mechanism transient currents higher than this value are possible. To reduce the possibility of these transient currents causing motor degradation due to de-magnetisation, a second fast-acting current limit mechanism is provided, which is programmable using the HW Current Scaler parameter.

A HW Current Scaler value of 100% is suitable for a Current Limit setting of 60 Amps and limits the transient current to between 60 - 90 Amps depending on temperature. Depending on the magnetic characteristics of the motor, it may be desirable to reduce the value of HW Current Scaler for Current Limit settings of less than 60 Amps. In this case recommended settings are :

Current Limit (A)	**PM-S Current** (A)	**HW Current Scaler (%)**
60	120	100
50	100	90
40	80	80
25	50	60

PM1 and PM2 would not normally be used with low current motors and would therefore have the HW Current Scaler set to 100%.

Max Motor Volts

This is the maximum voltage that will be applied across motor terminals. This can be reduced to lower maximum speed proportionally, e.g. if local regulations limit wheelchair speed. If the battery voltage is less than the programmed Max Motor Volts, then the battery voltage is the maximum voltage.

Joy Demand Scaler

The Joy Demand Scaler prevents the wheelchair slowing down while turning. All speed and direction demands are scaled by the Joy Demand Scaler, so as to leave a little in reserve when turning is required. This parameter is also useful for slowing a chair to a percentage of the DX Remotes speed settings when the lowest values are too fast.

If one of the Remote parameters (forward / reverse / turn speed) is too fast for a user, Joy Demand Scaler will slow the speed as a percentage of the parameter.

Halve Turning Gain

Allows lower turning speeds and acceleration without a loss of resolution. Useful for higher speed chairs and also front wheel drive chairs. Must only be set to ‘on’ for “new” Power Modules.

Voltmeter Battery Gauge

This changes the Battery Gauge measurement calculation between ‘Voltmeter’ style and the standard DX Battery Gauge. These calculations differ in the way that battery gauge level is determined.

Battery Guess Max

This is the voltage corresponding to a guess of 100% battery capacity, as displayed on the fuel gauge.

Battery Guess Min

This is the voltage corresponding to a guess of 0% battery capacity, as displayed on the fuel gauge.

Batt Guess Recover

This is the voltage increase expected of the battery after driving when no charging has occurred. If the battery voltage rises by more than this value while the DX System is off, the battery gauge will be updated.

These last three battery parameters are used to optimise the accuracy of the fuel gauge. Normally these should be left at the factory pre-set values. Consult Dynamic for further details.

Battery Gauge Ramp Up Rate

This is the fastest rate at which the PM will register the battery charging i.e. time in minutes to fully charge the battery from minimum to maximum.

Battery Gauge Ramp Down Rate

This is the fastest rate at which the PM will register the battery discharging i.e. time in minutes to fully discharge the battery from maximum to minimum.

Battery Gauge High Threshold

This defines the location of battery gauge information at power up. At power down, battery level information is recorded. When, at power up this battery level differs by a large margin from the current level, the recorded value is used, unless the current battery level is lower than this setting.

Battery Gauge Low Threshold

This defines the location of battery gauge information at power up. At power down, battery level information is recorded. When, at power up this battery level differs by a large margin from the current level, the recorded value is used, unless the current battery level is higher than this setting.

Slow Battery Time Scale Driving

This determines the responsiveness of the voltmeter battery gauge. This damps down any voltage “wavering” that might affect battery readings while driving.

High Voltage Warning

Allows the high voltage warning to be disabled. This warning is normally shown by the battery gauge flashing.

High Voltage Rollback

If set, the maximum speed the chair can travel will be decreased as the battery voltage increases. This tries to prevent too much regeneration into a fully charged battery.

High Voltage Threshold

Toggles between a 28V and 30V threshold for the battery high voltage warning (if enabled).

Test Park Brake Driving

Allows one of the Park Brake tests to be disabled. Normally this is on, and the Park Brakes are checked for continuity while the chair is driving. Some Park Brakes omit a noise while this test is performed which can annoy the user. Disabling this test does not affect the testing performed when not driving, or the short circuit test while driving.

PM HHP Programming

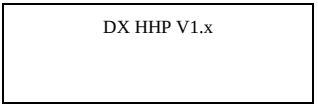
Warnings : Do not plug the HHP Programmer in while the vehicle is in motion.
Plug in the HHP Programmer while the DX System is turned on.
If the DX System is turned off during programming, new setting may not be saved and the DX System will retain all previous settings. Refer to the Saving Changes section.

Plugging the DX Hand Held Programmer (HHP) into a turned on DX System gives immediate access to a set of main menu options. The length of the main menu depends on how many DX Modules are connected to the DXBUS. Refer to the DX HHP Manual for full details.

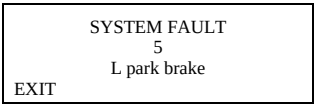
The two PM parameters that can be adjusted by the HHP are the Veer Compensation and the Load Compensation parameters.

Initial Operation

1. Plug the HHP into the Programmer Socket on the DX Remote and turn the DX System on. The initial screen appears for two seconds.



If a fault exists, the fault screen appears.

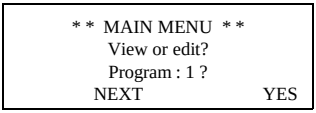


The number and message displayed represents the Flash Code being indicated by the DX Remote System Status LED. See the relevant DX Remote Installation Manual for a list of flash codes.

Note: Some DX Power Module flash codes differ from the DX Remote flash codes.

Press EXIT to return to the main menu.

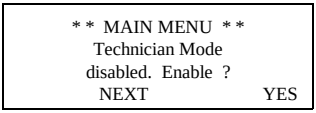
2. Then the main menu screen reads :



Pressing NEXT cycles through the Drive Programs. Refer to the DX Remote Installation Manual for details of how to view and adjust Drive Programs.

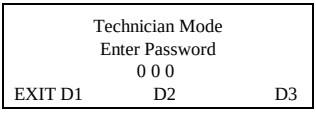
To Enable Technician Mode

1. Press 'NEXT' until the Technician Mode screen appears :



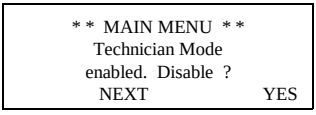
Pressing 'YES' toggles this screen between Technician Mode Enabled and Technician Mode Disabled. If disabled, press 'YES' to enable.

2. Press 'YES' and a password screen will appear. Enter the three digit password.



Press the D1, D2 and D3 buttons to cycle each digit through to the correct password. When the password reads correctly, press the 'EXIT' button.

The screen now reads :



Saving Changes

Changes are saved when the HHP is returned to the main menu screen. If the DX Remote is turned off before the HHP is returned to the main menu, all changes are lost.

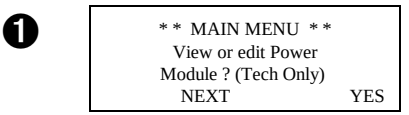
Changes can be test driven before being permanently saved as the DX System can be driven with the HHP plugged in. Even if the HHP is disconnected the changes will remain current unless the DX System is turned off. Once turned off, the settings will return to the original values.

Setting Veer Compensation

Ensure that the wheelchair tyres have balanced pressures before attempting to adjust Veer Compensation. This parameter should be adjusted when a motor is replaced. This parameter has no effect on the PM-S.

1. Enable the Technician Mode

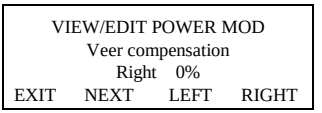
2. Press 'NEXT' in the main menu until the screen reads :



Press 'YES'.

Pressing 'EXIT' at any point during the following procedure will return you to screen 1 .

3. Calibrate the **Veer Compensation** (Veer (right +)) Parameter.



Press 'LEFT' and 'RIGHT' to adjust the value.

For non-servo steered DX Systems (PM,PM1, PM2)
Select a Veer Compensation value so that the wheelchair does not veer when the joystick is pushed directly forwards or backwards. If the wheelchair veers right, press 'LEFT'; if the wheelchair veers left, press 'RIGHT'.

For servo steered, two drive motor DX Systems (PM, PM1, PM2)
Use an ammeter to measure the current to each drive motor. Select a Veer Compensation value so that the current to the left drive motor is equal to the current to the right drive motor when the wheelchair is driven in a straight line. Use the SLM Veer Compensation to correct any veer.

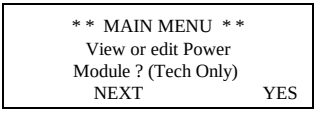
Selecting the correct value will require experimentation. Adjust the Veer Compensation value then test drive the wheelchair.
Refer to the Saving Changes section.

Setting Load Compensation

Warning: It is essential for safety and performance that the Load Compensation be set to the manufacturer's recommended value for the wheelchair type to be used in the DX System.

1. Enable the Technician Mode

2. Press 'NEXT' in the main menu until the screen reads :

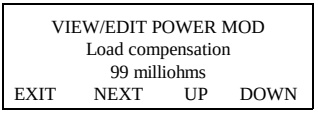


❶

Press 'YES'.

Pressing 'EXIT' at any point during the calibration procedure will return you to screen ❶ .

3. Press ‘NEXT’ until the Load Compensation screen appears.



4. Press ‘UP’ or ‘DOWN’ to set the required value.

   Refer to the Saving Changes section.

9 Diagnostics and Fault Finding

Power Module diagnostics can be examined from three platforms : from the Flash Codes signalled with the System Status LED on the DX Remote; from the DX Power Module Status LED; and from the Wizard which can provide more detailed information about the fault.

Flash Codes

Any fault condition on the DX system will cause the DX Remote's System Status LED to flash. Any fault condition relating to the DX Power Module will cause the DX Power Module's Status LED to flash. Flashing occurs in bursts of flashes separated by a two second pause. The number of flashes in each burst is referred to as the Flash Code and indicates the nature of the fault. The title of the Flash Code fault, as shown by the DX Remote System Status LED, is also displayed by the HHP if connected to the faulty wheelchair.

Faults that affect the safety of the chair will cause the chair to stop while less critical ones will be indicated but allow the chair to continue driving. Some faults will automatically clear when the fault condition is removed, in which case the System Status LED will become steady and the wheelchair may be driven normally. Other faults are latched and must be cleared by turning the DX System off, waiting for five seconds, then turning it back on again.

DX Power Module Status LED Flash Code	Possible Cause and Action
1	**DX Module Fault** (see Limp Mode below) Cause: An Auto Download has occurred. Action ▸ Turn the DX System off then on again. Cause: The DX Remote is not correctly programmed. Action ▸ Try reprogramming the DX Remote. Cause: Connection between DX Modules may be faulty, or there may be an internal fault in the Power Module. Action ▸ Check DXBUS connections and replace where necessary.

DX Power Module Status LED Flash Code	Possible Cause and Action
2	**Temperature Fault** Cause: Either there is a temperature sensor fault or the Power Module's internal temperature is above or below the programmed operating temperatures. Action ▸ Turn system off, wait a few minutes for the system to stabilise, and turn system back on. ▸ If fault re-occurs, consult your Dynamic Service Centre.
3	**Left (M1) Motor Fault** Cause: The connection from the PM left (M1) connector to its associated motor, or the motor itself, is defective. The connection is either open or short circuit. Action ▸ Disconnect the left motor plug and check continuity between the motor pins on M1. Action ▸ Ensure there is no continuity between motor and park brake terminals.
4	**Right (M2) Motor Fault** Cause: The connection from the PM right (M2) connector to its associated motor, or the motor itself, is defective. The connection is either open or short circuit. Action ▸ Disconnect the right motor plug and check continuity between the motor pins on M2. Action ▸ Ensure there is no continuity between motor and park brake terminals.
5	**Left (M1) Park Brake Fault** Cause: The M1 plug connection to its associated Park Brake is either open or short circuit. Action ▸ Disconnect the M1 plug and check continuity between the two Positronic Park Brake pins. Action ▸ Ensure there is no continuity between motor and park brake terminals. Cause: The Park Brakes are connected to M2 not M1. When programmed as 'sngl', the Park Brakes must be connected to PB+ on M1.

DX Power Module Status LED Flash Code	Possible Cause and Action
6	**Right (M2) Park Brake Fault** Cause: The M2 plug connection to its associated Park Brake is either open or short circuit. Action ▸ Disconnect the M2 plug and check continuity between the two Positronic Park Brake pins. Action ▸ Ensure there is no continuity between motor and park brake terminals. Cause: The Park Brake parameter has been set to 'dual' instead of 'sngl'. Refer to the Programming section for guidance.
7	**Low Battery Fault** Cause: The battery charge is not sufficient to allow safe driving. It has fallen below 17V. Action ▸ Check battery connection and terminals. The battery voltage should be similar when the battery is on charge, and when it isn't. ▸ Check that fuses have not blown, or circuit breakers tripped. ▸ Replace battery if worn out or if capacity is insufficient for the user's needs. **Note:** The wheelchair will behave sluggishly and the Battery Gauge will flash indicating low battery voltage prior to the display of this fault.
8	**Over voltage Fault** Cause: The battery voltage has exceeded 32V. Action ▸ If this fault occurs during battery charging, the battery charger is defective or incorrectly adjusted. ▸ Check the battery charger's open circuit voltage is in accordance with the battery manufacturer's limits, and is less than 32V. Cause: Battery connector is making intermittent contact when the wheelchair is stopped, or travelling down a slope. Action ▸ Check that the battery wiring and terminating is secure.

DX Power Module Status LED Flash Code	Possible Cause and Action
9	**CANL Fault** (see Limp Mode below) Cause: An invalid voltage has been detected on the DXBUS CANL line. Communication is not possible using the CANL wire. Action ▸ Check the continuity of the DXBUS cable. ▸ Check for shorts between DXBUS pins. An open or short circuit on another DX Module can cause this fault.
10	**CANH Fault** (see Limp Mode below) Cause: 1. An invalid voltage has been detected on the DXBUS CANH line. 2. Communication is not possible using the CANH wire, or the CANH and CANL wires are shorted together. 3. Hazard lights were turned on when the DX System was turned on. 4. The CANH is used to generate a Kill signal by any DX Module which detects an unsafe condition, or by an external device such as an emergency stop switch. The CANH wire is pulled to either Battery + or Battery - and causes the DX System to shut down. Action ▸ Check the continuity of the DXBUS cable. ▸ Check for shorts between DXBUS pins. An open or short circuit on another DX Module can cause this fault. ▸ If the Hazard Lights were already switched on when the DX System was turned on, Flash Code 10 and Limp Mode (slow driving) may result. To clear this fault, turn the Hazard Lights off, then turn the DX System off then on again. ▸ If generated by a Kill signal, the cause of the fault is severe.

DX Power Module Status LED Flash Code	Possible Cause and Action
11	**Stall Timeout Fault** Cause: The motor current has been at, or close to, current limit for longer than the Stall Timeout parameter value. Action ▸ Turn the DX System off then on again. The system may require time to cool down. Cause: Motor(s) are faulty. Wheel(s) may be rubbing on frame. Action ▸ Ensure wheels turn freely while under no load. Have motor(s) checked by a service technician.
12	**Module Mismatch** Cause: The data held by the DX Remote for the DX Power Module is corrupt, incompatible or non-existent. Action ▸ Reprogramming the wheelchair system may correct this problem. Cause: There is a compatibility problem between DX Modules in the System. The wheelchair will be disabled. Action ▸ Consult your Dynamic Service Centre.

Limp Mode

If the DX System detects some faults, it will revert to Limp Mode. This is a reduced speed mode which recognises problems, but allows the wheelchair user to limp home, where the problem can be assessed.

Warning : If the DX System is displaying a fault and the chair enters Limp Mode, do not operate except to reach a safe environment. Proceed with caution as the chair performance may be significantly altered. Have the chair serviced by a Service Agent.

Wizard Diagnostics

The Programming Configuration Diagnostic (Wizard) tool is used to provide diagnostics for the PM.

To View Diagnostics

1. Enter the Wizard's Main Menu screen as described in the Wizard Manual.

2. Select the 'Diagnostics' menu.

   Status Report
   Print Status Report
   Chair Log
   Print Chair Log
   Erase Chair Log

Print Chair Log prints the Status Report followed by the Chair Log. These reports should be sent along with a faulty controller to a Service Centre. Contact a Dynamic Sales and Service Centre (refer to section 14).

Status Report

Status report gives you the current status of the wheelchair, including faults and other warning conditions currently active. Pressing «?» or selecting `Info` will display further information about the condition. Some conditions in the Status Report are not caused by actual faults, but are only temporary conditions e.g. a motor lead was not connected when the DX System was turned on and driving was attempted, producing a Motor Fault.

To View Status Report

1. Perform steps 1. and 2. above.

2. Select 'Status Report'.

3. From the 'Modules Attached' menu, select 'Power Module'.

Chair Log

The Chair Log displays all faults and warning conditions recorded for the wheelchair since the Chair Log was last erased. Some conditions logged in the Chair Log are not caused by actual faults, but are only temporary conditions e.g. a motor lead was not connected when the DX System was turned on and driving was attempted, producing a Motor Fault. It is recommended to erase the Chair Log once the system is fully functional as only the previous 15 fault conditions are recorded.

To View Chair Log

1. Enter the Wizard's Main Menu screen as described in the Wizard Installation Sheet.
2. Select the Diagnostics' menu.
3. Select 'Chair Log'.
4. From the 'Modules Attached' menu, select 'Power Module'.

Below are listed the Chair Log codes and probable causes of these faults. If the suggested action does not remove the fault, contact a Dynamic Sales and Service Centre (refer to section 14).

Chair Log Messages

Message	Possible Cause and Action
CPU / General Fault	Cause : Internal Fault Action ▸ Replace PM. ▸ Consult an approved Dynamic Service Agent.
ADC Fault	Cause : Internal Fault Action ▸ Replace PM. ▸ Consult an approved Dynamic Service Agent.

Message	Possible Cause and Action
Zero current fault	Cause : Internal Fault Action ▸ Consult an approved Dynamic Service Agent
Kill circuit fault	Cause : The CANH DXBUS line has an invalid low voltage. The PM is powered up by the battery charger and there is a short between CANH and Battery -. Action ▸ Check for shorts.
Left H cur lim ref	Cause : Internal Fault Action ▸ Consult an approved Dynamic Service Agent
Right H cur lim ref	Cause : Internal Fault Action ▸ Consult an approved Dynamic Service Agent
No Wake-up Messages	Cause : Another DX Module or a Battery Charger has been plugged into the DX System. Action ▸ Turn the DX System off, wait 5 seconds, then turn on again.
Stall timeout fault	Cause : The stall current limit has been exceeded for the maximum stall time. Action ▸ Turn the DX System off. Allow to cool if necessary. Turn on again. ▸ Check that the drive wheels can turn freely.
Isolate relay fault	Cause : Short between a motor terminal and Battery + or an electrically noisy Battery Charger or accessory device is connected. Action ▸ Remove the short or remove the noise.
H bridge fault	Cause : Internal Fault Action ▸ Consult an approved Dynamic Service Agent
Left motor fault	Cause : Short or open circuit fault has been detected in a left or right motor. Action ▸ Check both motors.

Message	Possible Cause and Action
Right motor fault	Cause : Short or open circuit fault has been detected in a left or right motor. Action ▸ Check both motors.
Left park brake	Cause : Short or open circuit fault has been detected in the left Park Brakes. Action ▸ Check the left Park Brake.
Right park brake	Cause : Short or open circuit fault has been detected in the right Park Brakes. Action ▸ Check the right Park Brake and wiring. Check that the Park Brake is correctly programmed.
Battery low	Cause : The battery voltage has fallen below 14V briefly, or remains below 17V. The batteries are not being fully charged, or are reaching the end of their life. Action ▸ Check the battery connections and recharge batteries if required. Replace malfunctioning batteries. Cause : The battery wiring has more resistance than desirable for the motor current. Action ▸ Refer to the Installation section for minimum battery wire sizes. Cause : The user has run the batteries flat. Action ▸ Advise the user that the battery life will be reduced by fully discharging the batteries.
Battery high	Cause : The battery voltage has risen above 32V. Action ▸ May be caused by continuous braking down a hill at too high speed. The problem will occur when the batteries are fully charged, fully discharged, or worn out.

10 Electromagnetic Compatibility (EMC)

Dynamic Electronic Controllers have been tested on typical vehicles to confirm compliance with the following appropriate EMC standards:

Emissions:	CISPR22, class B
Susceptibility:	IEC1000-4-3
ESD:	IEC1000-4-2

Compliance levels and set-up as per ISO 7176, part 21.

National and international directives require confirmation of compliance on particular vehicles. Since EMC is dependant on a particular installation, each variation must be tested. The guidelines in this section are written to assist with meeting EMC requirements.

Minimising Emissions

Motors : Motor brushes generate electromagnetic emissions. It may be necessary to fit capacitors between the brush holders and motor case.
Ensure the leads are kept as short as possible.
A suitable capacitor is 4n7, 250V Ceramic.

Wiring : Keep wire lengths as short as practical for a tidy layout.
Minimise any wire loops, particularly loops of single wires as opposed to wire pairs.
Endeavour to run wires in pairs or bunches.
Where practical, tie cables to wheelchair frame.

Immunity to Radiated Fields

Follow the wiring recommendations for minimising emissions.

Immunity to ESD

Follow the wiring recommendations for minimising emissions.
Ensure all vehicle sub-frames are electrically connected.
Ensure speed setting potentiometers are electrically connected to the vehicle frame.
Do not leave connections unnecessarily exposed.

11 Maintenance

1. The DX System should be regularly checked for integrity. Loose, damaged or corroded connectors or terminals, or damaged cabling should be replaced.

2. All switchable functions on the DX System should be regularly tested to ensure they function correctly.

3. All DX system components should be kept free of dust, dirt and liquids. If necessary wipe with a cloth dampened with warm water or alcohol. **Do not** use solvents or abrasive cleaners.

4. Where any doubt exists, consult your nearest Service Centre or Agent.

5. There are no user-serviceable parts in any DX System component - do not attempt to open any case.

Warning : If any DX component is damaged in any way, or if internal damage may have occurred (for example by being dropped), have it checked by qualified personnel before operating.

12 Safety and Misuse Warnings

Do not install, maintain or operate this equipment without reading, understanding and following the proper instructions and manuals, otherwise injury or damage may result.

The completed installation must be thoroughly checked, and all programmable options must be correctly adjusted for safe operation prior to use.

A warning must be conveyed to the wheelchair operator that the controller could cause the chair to come to a sudden stop. In situations where this may affect the safety of the user, this will require the fitting and wearing of a seat belt.

Performance adjustments should only be made by professionals of the health care field or persons fully conversant with this process and the drivers capabilities. Incorrect settings could cause injury to the driver or bystanders, or damage to the wheelchair or surrounding property.

After the wheelchair has been set up, check to make sure that the wheelchair performs to the specifications entered in the programming procedure. If the wheelchair does not perform to specifications, turn the wheelchair off immediately and re-program. Repeat procedure until the wheelchair performs to specifications.

Do not operate the DX System if it behaves erratically, or shows abnormal response, heating, smoke or arcing. Turn the system off at once and consult your Service Agent.

Do not operate your DX System if the battery is nearly flat as a dangerous situation may result due to loss of power in an inopportune place.

Ensure the controller is turned off when not in use.

No connector pins should be touched, as contamination or damage due to electrostatic discharge may result.

Most electronic equipment is influenced by Radio Frequency Interference (RFI). Caution should be exercised with regard to the use of portable communications equipment in the area around such equipment. While the manufacturer has made every effort to ensure that RFI does not cause problems, very strong signals could still cause a problem. If RFI causes erratic behaviour, shut the wheelchair off immediately. Leave off while transmission is in progress.

In the event of a fault indicator flashing while driving (battery gauge and/or Status LED), the user must ensure that the system is behaving normally. If not, the system must be turned off and a service agent contacted.

Report any malfunctions immediately to your Service Agent.

Disclaimer

Dynamic Controls Ltd. products built today allow our customers' vehicles to conform to national and international requirements. In particular to:

ISO7176 - 9	Climatic Tests for Electric Wheelchairs
ISO7176 - 14	Power and Control Systems for Electric Wheelchairs
ISO7176 - 21	Requirements and Test Methods for Electromagnetic Compatibility of Electric Powered Wheelchairs and Scooters

However the performance of controllers fitted to wheelchairs and scooters is very dependant on the design of the wheelchair or scooter. Final compliance must be obtained by the vehicle manufacturer for their particular vehicle. No component certificate issued by Dynamic Controls Ltd. relieves a wheelchair or scooter manufacturer from compliance testing their particular vehicle.

If Dynamic Controls Ltd. controllers are fitted to vehicles or applications other than wheelchairs and scooters, testing to appropriate standards for the particular application must be completed as ISO7176 may be inappropriate.

13 Warranty

All equipment supplied by Dynamic Controls Ltd is warranted by the company to be free from faulty materials or workmanship. If any defect is found within the warranty period, the company will repair the equipment, or at its discretion, replace the equipment without charge for materials and labour.

The Warranty is subject to the provisions that the equipment:

- Has been correctly installed.
- Has been used solely in accordance with this manual.
- 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 person other than someone authorised by Dynamic Controls Ltd.
- Has been used solely for the driving of electrically powered wheelchairs in accordance with the wheelchair manufacturer's recommendations.

14 Sales and Service Information

For Sales and Service advice, or in case of any difficulty, please contact:

Head Office

Dynamic Controls Limited
Print Place
PO Box 1866
Christchurch
New Zealand

Telephone: Int. 64 3 338 0016
Fax: Int. 64 3 338 3283

Australia

Electronic Mobile Service (EMS)
46 Berripa Close
North Ryde, Sydney
NSW Australia 2113

Tel 24 hr: Int. 61 2 9887 2824
Pager: Int. 61 2 9963 1778
Fax: Int. 61 2 9887 2114

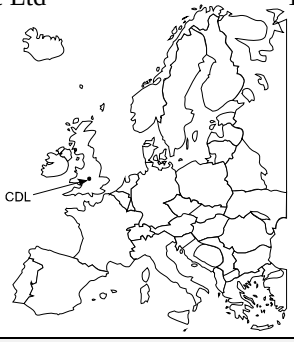
North America

Rosstron Inc
1521 W. 259th St
Harbor City, CA 90710
USA

Telephone: Int. 1 310 539 6293
Fax: Int. 1 310 539 4078

Europe

Controls Dynamic Ltd
Lisle Avenue
Kidderminster
DY11 7DL.
United Kingdom



Telephone Int. 44 1562 820 055
Fax: Int. 44 1562 742 720

Note: The controller should be clearly labelled with the manufacturer's service agent's telephone number.

Issue 2: PCO 2754, 2766, 2786.

Appendix A : Abbreviations

Abbreviation	Expansion / Explanation
CANH	Controller Area Network High line. One of the four wires which make up the DXBUS.
CANL	Controller Area Network Low line. One of the four wires that make up the DXBUS.
CISPR	Comite International Special des Perturbations Radioelectriques
DX	Dynamic Control Modular Mobility System
DXBUS	The DX System communication CAN communication lines plus power supply to DX Modules.
ESD	Electrostatic Discharge
HHP	Hand Held Programmer. The HHP can be used by both DX System and all DlxxUxxx Controllers.
IEC	International Electrotechnical Committee
IP54	Ingress Protection rating
ISO	International Standards Organisation
LED	Light Emitting Diode
LM	Left Motor.
M1	The Left Motor and Park Brake connector, if the Left/Right Motor Swap parameter set to ‘norm’
M2	The Right Motor and Park Brake connector, if the Left/Right Motor Swap parameter set to ‘norm’

Abbreviation	Expansion / Explanation
OEM	Original Equipment Manufacturer. Generally refers to the wheelchair manufacturer.
PB	Park Brake.
PM	DX Power Module. The DX Module that produces the DX System output to the motors and Park Brakes.
RFI	Radio Frequency Interference.
RJM	Remote Joystick Module.
RM	Right Motor.
TÜV	German Safety Standards Authority.
UCM	User Control Module. The core component of all DX Remotes. The name is sometime used interchangeably with DX Remote.
Wizard	A Programming, Configuration and Diagnostics tool used by the DX System.

Appendix B : Parts List

Part / Order Number	Part Name	Page Reference
GSM63003	DXBUS Cable, straight 0.3 M	16
GSM63005	DXBUS Cable, straight 0.5 M	16
GSM63010	DXBUS Cable, straight 1.0 M	16
GSM63015	DXBUS Cable, straight 1.5 M	16
GSM63020	DXBUS Cable, straight 2.0 M	16
GSM63020F	DXBUS Cable, Ferrite 2.0 M	16
GCN0792	DXBUS (dummy) Connector Housing	16
DX-SKT-X4	4-way DXBUS Socket Extension	18
DXLOOM-PM	Power Module Connector Kit	22, 27
GSM60182	DX-PM Motor Lead Kit	22
GSM61191	DX Left Motor Loom	22
GSM61192	DX Right Motor Loom	22
GCN0787	DX Motor Connector Cover	22
GSM60180	DX Battery Connector Kit	27
GSM61190	DX Battery Loom	27
GCN0788	DX Battery Connector Cover	27

See Dynamic Controls or a Sales and Service Agent for information regarding other parts and their availability.

Anhang C: Deutschsprachige Warnhinweise

Installations-Hinweise für die DX-Handbedienung, Type 1

Bemerkung: Der folgende Text muß in jedem Bedienungshandbuch abgedruckt werden, welches die DX Steuerung verwendet.

Das DX Installations-Handbuch ist ausschließlich für Rollstuhlherstelller geschrieben worden. Sofern der Rollstuhlhersteller ein Bedienungshandbuch zur Verfügung stellt, dann wird empfohlen zumindest die folgenden Auszüge an passender Stelle mit in das Handbuch einzufügen. Die folgenden Auszüge sind nicht geordnet und können je nach Zusammenhang in ein Handbuch eingefügt werden.

1. Einleitung

   Die DX Steuereinheit ist voll programmierbar, damit sie für viele Rollstuhl- und Bedienungsvarianten einsetzbar ist. Die vorschriftsmäßige Installation und Programmierung sind Voraussetzung für optimale Sicherheit und Leistung.

2. Batterie Ladung

   Die zufriedenstellende Arbeitsweise der DX Steuereinheit hängt im entscheidenden Maß von der Art und dem Zustand der Batterien ab. Das passende Batterieladegerät muß nach den Angaben des Batterieherstellers eingestellt werden. Fehleinstellungen können zu Schäden oder vollständiger Zerstörung der Batterien führen, können den Aktionsradius einschränken oder möglicherweise Gefahren herbeiführen. Batterien sollten auf keinen Fall mißhandelt werden (zum Beispiel durch Tiefentladung oder Überladung) und müssen nach den Angaben des Herstellers bedient und gewartet werden.

3. Batterieanzeige Varianten

Bemerkung: Bitte fügen Sie einen der folgenden Paragraphen in das Handbuch ein, je nachdem welche Batterieanzeige am Rollstuhl angeschlossen ist.

a) Zehn-Segment Batterieanzeige
Wenn die vorletzte Stufe erreicht wird fängt der Anzeiger an zu blinken und zeigt dem Fahrer damit an, daß die Batterien umgehend geladen werden sollten. Die Steuereinheit arbeitet von dann an in einem 'Sparzustand' um die verbleibende Batteriekapazität optimal auszunutzen - der Rollstuhl reagiert dann langsamer und die Geschwindigkeit wird beschränkt.

b) Batterie-Entladeanzeige
Die Entladeanzeige blinkt, wenn die Batteriespannung im Leerlauf unter 23.3 Volt fällt. Bitte laden Sie die Batterien bald möglichst auf.

4. Ladestrom Zuführung

Bemerkung: Falls diese Lademethode verwendet wird, dann muß dies im Bedienungshandbuch vermerkt werden, um irreführende Störungsanzeigen zu vermeiden (siehe auch Paragraph 7.2.2 im DX-Installations-Handbuch).

5. Störungsanzeigen

a) Jede Störung des DX Systems wird durch das Blinken der 'POWER' Anzeige im Handbedienungsteil angezeigt. Die Blinkzeichen erfolgen in Schüben und sind durch Pausen von 2 Sekunden Dauer getrennt. Die Anzahl von Blinkzeichen per Schub wird als 'Blink-Code' bezeichnet und deutet auf die Störungsursache hin.

b) Störungen, die die Sicherheit des Rollstuhles beeinträchtigen, bringen diesen zum Stillstand. Einfachere Störungen werden auch angezeigt, aber ermöglichen den weiteren Betrieb des Rollstuhls. Einige Störanzeigen verschwinden von selbst, sobald die Fehlerursache behoben wird. In diesen Fällen leuchtet die 'POWER' Anzeige dann wieder stetig und der Rollstuhl kann wieder normal betrieben werden. Andere Störanzeigen werden gespeichert und können nur durch das Aus- und Einschalten der Steuereinheit (Ausschalten nicht unter 2 Sekunden) zurückgesetzt werden. Anhaltende oder unregelmäßig wiederautretende Störanzeigen müssen dem Vertragshändler umgehend mitgeteilt werden.

6 Störanzeige 7 deutet darauf hin, daß die Batterie nicht ausreichend aufgeladen ist, um eine sichere Fahrt zu gewährleisten. Bitte laden Sie die Batterie umgehend mit dem passenden Ladegerät auf.

Sie können als Rollstuhlfahrer/in bereits an langsamer Reaktion und reduzierter Geschwindigkeit des Rollstuhles, sowie durch die Batterieanzeige (sofern montiert) erkennen, daß die Batterie fast leer ist, bevor die Batteriestörungs-Anzeige aktiviert wird.

7. Wartungshinweise für die DX-Steuereinheit

a) Alle Anschlüsse zum DX-Steuersystem sollten regelmäßig auf ihre Vollständigkeit hin überprüft werden. Lose, beschädigte oder korrodierte Buchsen und Stecker sowie beschädigte Kabel sollten ausgetauscht werden.

b) Alle Schaltstellungen und Funktionen des DX-Steuersystems sollten regelmäßig überprüft werden, um deren vollständiger Arbeitsweise zu versichern.

c) Alle Teile der DX-Steuereinheit sollten von Staub, Schmutz und Flüssigkeiten freigehaten werden. Benutzen Sie bitte ein feuchtes Tuch mit warmem Wasser oder Alkohol sofern erforderlich. Benutzen Sie auf keinen Fall Lösungsmittel, scharfe oder scheuernde Reinigungsmittel.

d) Sollten Sie irgendwelche Zweifel an der einwandfreien Arbeitsweise der Steuereinheit haben, dann lassen Sie diese bitte von einem Vertragshändler überprüfen bevor Sie sie wieder benutzen.

e) Das DX System beinhaltet keinerlei wartungsbedürftige Teile für den Anwender, versuchen Sie daher nicht das Gehäuse zu öffnen.

f) **VORSICHT**
Wenn irgendwelche Komonenten der DX Steuereiheit beschädigt sind oder wenn Verdacht auf innere Beschädigung besteht (zum Beispiel nach Stürzen des Gerätes), dann lassen Sie die Steuereinheit bitte von einem Vertragshändler überprüfen bevor Sie sie wieder benutzen.

g) **ACHTUNG**
Jedweder Versuch, sich Zugang zu den elektronischen Teilen oder Komponenten des Rollstuhl-Steuersystems zu verschaffen, oder der Versuch diese zu mißbrauchen, macht die Garantie des Herstellers ungültig und befreit den Hersteller von jeglicher Haftung.

h) Die Steuereinheit muß einen deutlichen Hinweis mit der Adresse und Rufnummer des Vertragshändlers versehen sein.

8. Sicherheitsvorschriften

a) Alle programmierbaren Werte müssen sorgfältig für eine sichere Bedienung eingestellt werden bevor das Gerät benutzt wird.

b) Die Steuereinheit kann den Rollstuhl zum unvorhergesehenen Stillstand bringen. Sollte dies die Sicherheit des Fahrers/Fahrerin beeinträchtigen, dann wird das Anbringen und Tragen von Sicherheitsgurten empfohlen.

c) Die DX Steuereinheit ist voll programmierbar, um optimale Leistung und Sicherheit zu gewährleisten. Bitte bedienen Sie den Rollstuhl nur dann, wenn Sie das Fahrzeug in voller Gewalt haben. Bitte sorgen Sie dafür, daß der Rollstuhl entsprechend Ihrer Wünsche und Ihrer Umgebung programmiert ist. Bitte wenden Sie sich an Ihren Vertragshändler sollten Veränderungen notwendig werden. Bitte wählen Sie ein sicheres Fahrprogramm aus, welches Ihrer Umgebung gut angepaßt ist.

d) Bedienen Sie die DX Steuereinheit auf keinen Fall, wenn diese sich unregelmäßig verhält oder wenn sich ungewöhnliche Hitze, Qualm oder Funken bilden. Bitte schalten Sie dann das System sofort ab, und treten Sie mit Ihrem Vertragshändler in Verbindung.

e) Bedienen Sie die DX Steuereinheit nicht, wenn die Batterie fast leer ist weil sich dies, aufgrund von Leistungsverlust an ungewünschtem Ort, in eine gefährliche Situation entwickeln könnte.

f) Bitte sorgen Sie dafür, daß die Steuereinheit abgeschaltet ist, wenn sie nicht benutzt wird.

g) Bitte berühren Sie keine Kontakte der Steuereinheit weil dies zu elektrostatischer Beschädigung der Elektronik führen könnte.

h) Bitte benachrichtigen Sie Ihren Vertragshändler umgehend von jedwedigen Störungen.

9. Vertragshändler:

Bemerkung: Eine der folgenden Kontaktadressen muß in einem Bedienungshandbuch abgedruckt werden.

Mit Schwierigkeiten oder Fragen bezüglich Ihres DX wenden Sie sich bitte an:

Hauptgeschäftsstelle

Dynamic Controls Limited
Print Place
PO Box 1866
Christchurch
Neuseeland

Telephone: Int. 64 3 338 0016
Fax: Int. 64 3 338 3283

Australia

Electronic Mobile Service (EMS)
46 Berripa Close
North Ryde, Sydney
NSW Australia 2113

Tel 24 hr: Int. 61 2 9887 2824
Pager: Int. 61 2 9963 1778
Fax: Int. 61 2 9887 2114

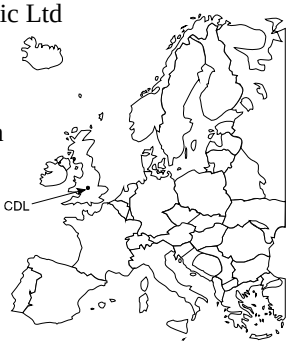
Nord Amerika

Rosstron Inc
1521 W. 259th St
Harbor City, CA 90710
USA

Telephone: Int. 1 310 539 6293
Fax: Int. 1 310 539 4078

Europa

Controls Dynamic Ltd
Lisle Avenue
Kidderminster
DY11 7DL.
United Kingdom



Telephone Int. 44 1562 820 055
Fax: Int. 44 1562 742 720

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