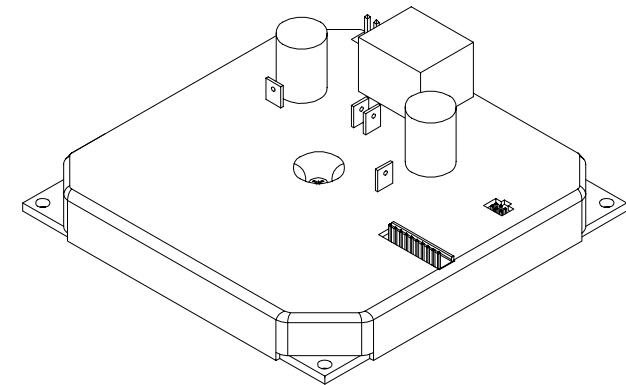




DS60 / DS70 Controller Installation Manual



Installation Manual Re-order Information

(Please quote this information when re-ordering this manual)

DS60/70 Installation Manual - GBK50574

or visit the Dynamic Mobility web site to download the latest version (in PDF format)

<http://www.DynamicMobility.co.nz>

Dynamic Controls Ltd. welcomes feedback from its customers on its products and documentation. If you would like to comment on this manual or the product it describes, please contact us at any of the addresses at the back of this manual, or by email at:

sales@dynamic-controls.co.nz

Order/Part Number for this Manual : GBK50574 issue 5

Important Notes

1. Read this Manual carefully before installing or operating your DS60 or DS70 Scooter Controller.
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 system renders the Manufacturer's warranty void and the Manufacturer free from liability.

Contents

1	Introduction	1
2	General Description	2
2.1	General Features	4
2.2	Safety and Protection Features	4
3	Specifications	5
3.1	Electrical Specifications	5
3.2	Mechanical Specifications	6
3.3	Environmental Specifications	7
4	Installation	8
4.1	General	8
4.2	Mounting	8
4.3	Connections and Wiring	9
4.3.1	Connections	9
4.3.2	Wires and Terminations	10
4.3.3	Battery Connection	11
4.3.4	Motor and Park Brake Connections	12
4.3.5	Battery Charger Connection	12
4.3.6	On / Off Switch	13
4.3.7	Speed Input	14
4.3.8	External LED (Optional)	16
5	Programming	17
5.1	Introduction	17
5.2	Programmable Characteristics	19
5.2.1	Setup Menu Characteristics	19
5.2.2	Options Menu Parameters	22
5.3	DZ-DS Programmer Operation	24
5.3.1	Main Menu	24
5.3.2	Setup Menu	26
5.3.3	Options Menu	27
5.3.4	Profiles Menu	28

6	Diagnostics	33
6.1	System Troubleshooting	33
6.1.1	If the Status LED is Off	33
6.1.2	If the Status LED is Flashing	33
6.1.3	If the Status LED is Permanently On :	34
6.2	DS System Fault Handling	36
7	Product Disclaimer	38
8	Electromagnetic Compatibility (EMC)	39
9	Maintenance	40
10	Safety and Misuse Warnings	41
11	Warranty	43
12	Sales and Service Information	44

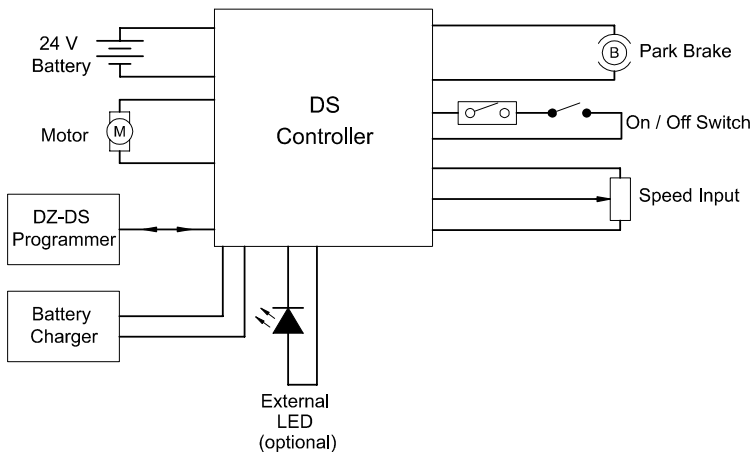
1 Introduction

The DS60 and DS70 are robust and versatile controllers for a wide range of DC motor control applications. The DS70P is the same as the DS60S but has a higher current rating. The DS60NS is the same as the DS60S but has a short travel (60°) speed pot rather than a long travel (270°) speed pot, and will be treated in this manual as the same product (DS60), except where necessary.

The DS60 and DS70 can be used with dual or single motor drives and dual or single direction speed inputs. Permanent magnet motors can be used with or without parking brakes. The power output to the motor is controlled by a full bridge, ultrasonic pulse width modulation circuit. This silently provides smooth transition between forward and reverse directions. Typical applications include scooters, electric vehicles, stair lifts and conveyor belts.

Superior safety features, smooth driving and programmable performance are all provided by the microcontroller. A hand-held DZ-DS Programmer is available to allow performance customisation to individual requirements.

This manual provides operation and installation information for the DS60 and DS70 Controllers and the DZ-DS Programmer, and must be read and understood. For more information contact Dynamic Controls Ltd or an agent as listed in [Section 11 - Sales and Service Information](#).



A Typical DS60 or DS70 System

2 General Description

The DS60 and DS70 Controllers are designed to operate with a nominal 24V battery input and to give a maximum output current of 60A and 70A respectively. If the battery voltage is low, the Status LED will flash slowly, as a warning to recharge the batteries. If a fault condition is detected, the Status LED (and the optional External LED) will flash rapidly, with the number of flashes indicating the type of fault. Faults can also be displayed by the DZ-DS Programmer.

The inbuilt microcontroller continually monitors the system, to ensure safe and reliable operation. Safety conditions that are monitored include:

- Speed control system integrity
- Internal voltages and circuits
- Motor voltages and circuits
- Safety isolate relay
- Battery voltages.

The installation and operational performance can be customised to the specific requirements of the user by using the DZ-DS Programmer.

The Controller incorporates motor load compensation which provides precise motor control over a wide range of driving conditions. When used on a scooter for example, whether the vehicle is driven on carpet or an uneven grade, load compensation automatically adjusts the power to the motor to maintain the selected speed. This feature ensures less roll-back when stopping on a slope. The correct level of load compensation depends on the type of motor and the length of wiring and is easily set using the DZ-DS Programmer.

The Controller can be used with either a dual direction Speed Lever or with a single direction Speed Lever and Forward / Reverse Switch. If required, a maximum speed potentiometer can be fitted in line with the speed control lever.

For safety, the Controller will not operate if the speed input lever is not in the neutral position when the Controller is turned on. The speed input should be set to the neutral position and the Controller will then be able to operate normally.

If the system is turned on but not operated for a set period of time, the Controller can be programmed to automatically turn itself off to conserve battery life. It can be turned on again by turning the On/Off Switch off and then on again.

In order to limit the Controller case temperature, the output current is reduced at high internal temperatures. In operation, the heating of the Controller is balanced by the cooling.

In most cases it is desirable for the motor to run at a constant speed irrespective of battery voltage. The Controller controls the motor voltage in this manner. Under these conditions the voltage at the motor terminals is limited to 24V even with freshly charged batteries.

The DS60 and DS70 control the power to the motor so as to limit drive at very high or very low battery voltages, thereby reducing battery damage and extending battery life. The Controller is protected against accidental reverse battery connection and a plastic vacuum moulded case protects the electronics.

2.1 General Features

The DS60 and DS70 have the following general features:

- Powered by a 24 V battery;
- Fully programmable with the DZ-DS Programmer for optimum driving performance;
- Load compensation to regulate speed to typical driving conditions;
- Two speed control options;
- Diagnostics displayed on the Status LED and DZ-DS Programmer;
- Electromagnetically compatible:
 - not susceptible to high levels of RFI;
 - emitting low levels of RFI;
 - protected against high levels of ESD;
- Compact enclosure protecting against dust to IP40.

2.2 Safety and Protection Features

The DS60 and DS70 have the following safety and protection features:

- Out-of neutral inhibit to prevent unexpected movement when mounting scooter;
- ESD protection to all inputs and outputs;
- Open circuit park brake protection;
- Motor and park brake output short circuit protection when driving;
- Over, under and reverse battery protected;
- Compliance with ISO 7176 requirements;

3 Specifications

3.1 Electrical Specifications

Parameter	Notes	Min	Nom	Max	Units
Operating Voltage	Equivalent to battery voltage	17.5	24.0	31.0	V
Voltage Drop	At 40 A		0.85		V
PWM Frequency		15.0	15.6		KHz
Peak Output Current	DS60. For 3 seconds	54	60	66	A
	DS70. For 10 seconds @ ambient	64	70	76	A
Continuous Current Rating	At full speed		22		A
	At half speed		15		A
Braking Current	DS60		60		A
	DS70		70		A
Quiescent Current	In sleep mode		1.25		mA
Parking Brake Output			2		A
Minimum Armature Resistance			5		mOhms
Recommended Motor Type	Permanent Magnet				
External Speed Control	3 Wire 5 KOhms Linear Travel Potentiometer. The DS60S and DS70P travel is 270°, the DS60NS 60°.				
Forward / Reverse Control	Bi-directional or Single direction lever with Reverse Switch				
Neutral Throttle Control	Motor plug braked into neutral - power On; Unbraked - power Off.				

3.2 Mechanical Specifications

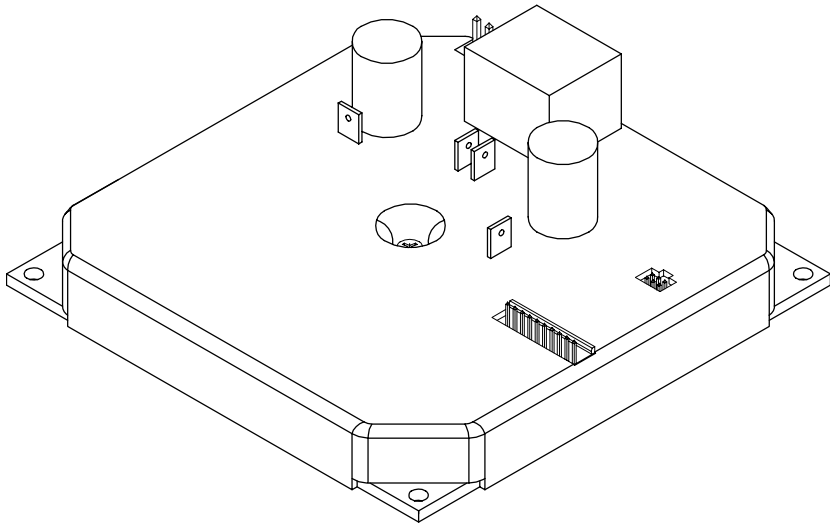
Size: 130 * 130 * 50 mm

Weight 0.5 Kg

Mounting: See [Section 4.2 - Mounting](#)

Case material: Clear Plastic Vacuum Moulded

Case sealing: IP40 if mounted as per mounting instructions



DS60 and DS70 Configuration

3.3 Environmental Specifications

Parameter	Minimum	Nominal	Maximum	Units
Operating ambient temperature range	-25		50	°C
Storage temperature range	-25		70	°C
Operating and storage humidity	0		90	%RH
RFI Susceptibility	20 V / m precal method. IEC 801-3			
RFI Emissions	CISPR 22, class B			
ESD	8 KV machine model. IEC 801-2			
Vibration Specification	BS2011 part 2Fd. BS7527 section 3.5, class 5M3			
Durability	ISO7176-14			

4 Installation

4.1 General

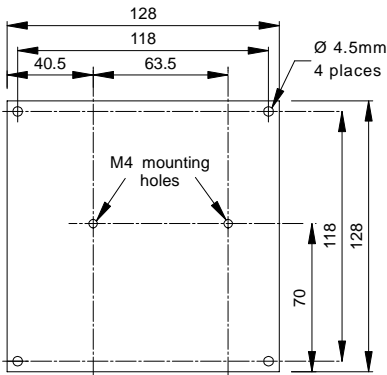
Installing a DS60 or DS70 Controller requires the following steps:

- a) Mounting See Section 4.2 - Mounting
- b) Connections and Wiring See Section 4.3 - Connections and Wiring
- c) Programming See Section 5 - Programming

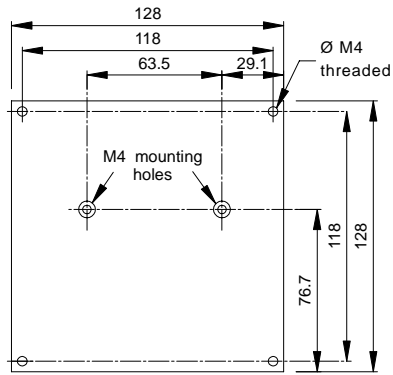
4.2 Mounting

The recommended mounting orientation is to align the base plate vertically. Visibility of the Status LED should be considered. Two mounting arrangements are available:

- Outer mounting holes symmetrically located in the corners of the square base plate.
- Inner holes situated as shown. The DS70 has M4 threaded holes while the DS60 has M4.5 holes that are not threaded.



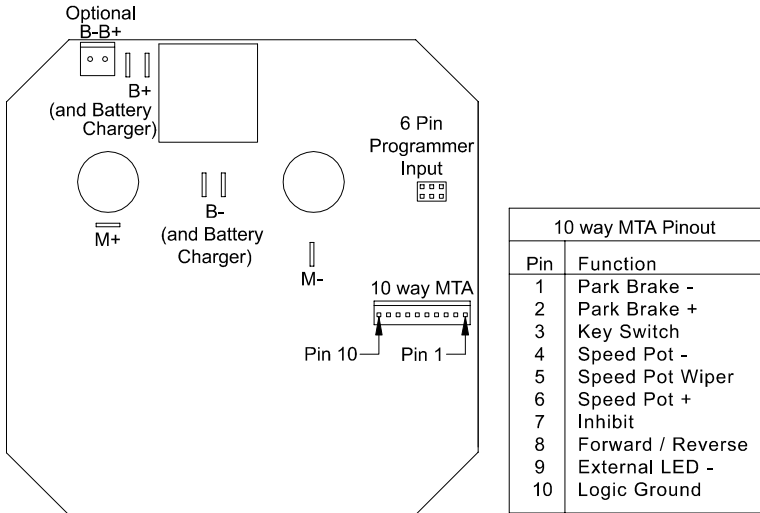
DS60 Base Plate Mounting Holes



DS70 Base Plate Mounting Holes

4.3 Connections and Wiring

4.3.1 Connections



DS60 and DS70 Connections

Note: Do not use the frame of a wheelchair or scooter as the earth return for any lights or actuators. Making any low resistance connection to the frame is regarded as a possible safety hazard and not allowed by international performance and safety standards for wheelchairs and scooters.

Note: Ensure that all wiring to the DS70 is suitably restrained and of such a length that incorrect assembly cannot occur.

4.3.2 Wires and Terminations

Function	Minimum Wire Size	Terminal Part	Max Rating of Circuit Protection
QC Terminals			
* Battery +	3.0 mm ² (14 GA)	AMP or Utilux 6.3 mm	35A
* Battery -		(0.25") Quick Connect	
Motor		Receptacle for 3.0 mm ²	N/A

* Two terminals: one available for Battery Charger connection.

Terminal	Minimum Wire Size	AMP Part	Circuit Protection Max Rating
MTA Terminals			
Optional B-	0.5mm ² (20 GA)	MTA - 156 Receptacle 0.156" Centres	10A**
Optional B+			
Park Brake -	0.2mm ² (24 GA)	MTA - 100 Receptacle 0.1" Centres	N/A
Park Brake +			
Key Switch			
Speed Pot -			
Speed Pot Wiper			
Speed Pot +			
Inhibit			
Forward / Reverse			
External LED -			
Logic Ground			

** All wiring must be protected against overload with suitably sized circuit protective devices.

Note: Wire sizes specified are a minimum.

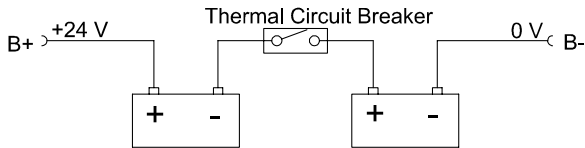
Warning: Elevate drive wheels or disconnect motor before making connections. When wiring is completed, it must be fastened to the frame to minimise wire strain and prevent snagging on connections.

4.3.3 Battery Connection

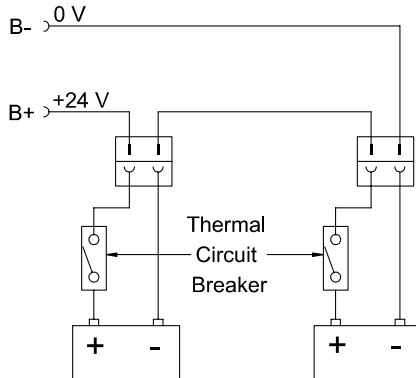
The DS60 and DS70 Controllers are designed to perform optimally with either free acid, AGM or Gel Cell deep cycle batteries. Consult Dynamic Controls for other battery types. It is recommended that two 12 V batteries with capacity greater than 20 A hours be used.

Either of the two B- or B+ terminals can be used to connect the batteries.

A thermal circuit breaker must be installed in the battery wiring to protect the batteries, wiring loom and Controller from external short circuits. If the two batteries are permanently wired together (single battery box), the best position for this circuit breaker is between the two batteries. If the batteries are individually plugged together (separate battery boxes), each battery requires a circuit breaker.



(a) Single Battery Box



(b) Dual Battery Box

Battery Overload Protection and Wiring

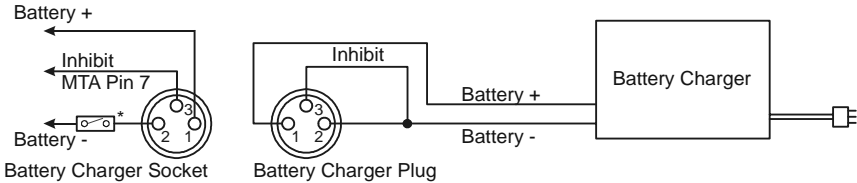
4.3.4 Motor and Park Brake Connections

The motor is connected to the QC terminals labelled M+ and M- in Section 4.3.1 - Connections.

The Park Brake is connected to Pins 1 and 2 of the 10 way MTA.

4.3.5 Battery Charger Connection

A battery charger socket is connected to the unused B+ and B- terminals and Inhibit Pin 7 of the 10 way MTA. For safety, the motor is prevented from driving when a correctly wired battery charger is plugged in to the Controller.



Battery Charger Wiring

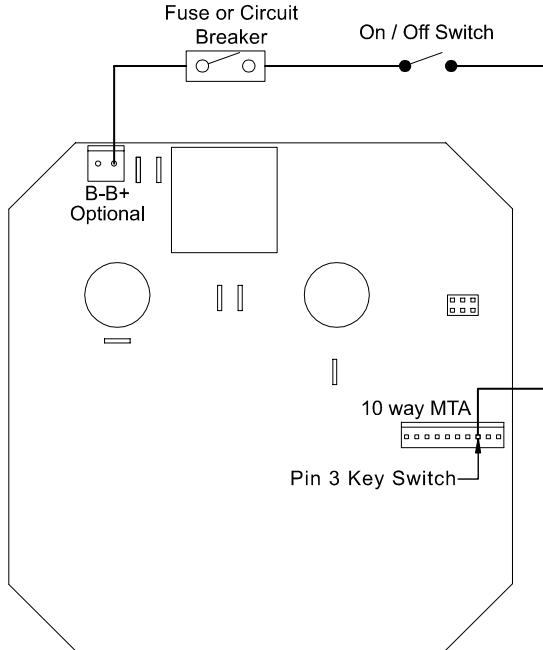
* A suitably rated fuse or circuit breaker to protect the associated wiring. For example, 10A for 0.5mm wiring.

Note: The inhibit must be shorted to B- on the battery charger plug.

Alternatively, where a permanently fixed battery charger is used, a Battery Charge/Run switch should be used to connect the inhibit to B- during charging.

4.3.6 On / Off Switch

The On / Off Switch is wired between the Key Switch Pin 3 of the 10 way MTA connector, and the B+ Optional terminal. A fuse or circuit breaker must be fitted as shown to protect the wiring as close as practical to the B+ terminal.



On / Off Switch Wiring

The switch life should be rated for at least 1 million cycles of operation and at least 350 mA continuous DC.

The fuse must have a minimum rating of 200 mA and a maximum of 60% of the switches DC rating.

Note: Excessive switch contact bounce can prevent the Controller from turning on properly.

4.3.7 Speed Input

The DS60S and the DS70P have standard long travel (270°) potentiometers. The DS60NS has a short travel (60°) potentiometer for speed control.

In either case, resistance should be 5 KOhm with linear resistance tapers. We recommend the use of a high quality long life (greater than 10 M cycles) potentiometer. Note that the use of carbon or wirewound potentiometers is not recommended.

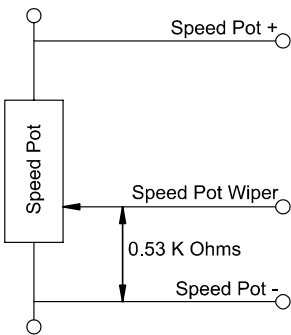
The long travel (270°) Speed Pot uses only the lower quarter of the pot travel. During operation, a Controller fault will occur if the pot shaft is rotated too far outside the voltage ranges given in the table below.

The speed input potentiometer may be used for speed control in both directions, or alternatively in one direction with a separate Forward / Reverse switch. This option is selected by the Single Ended Pot option using the DZ-DS Programmer.

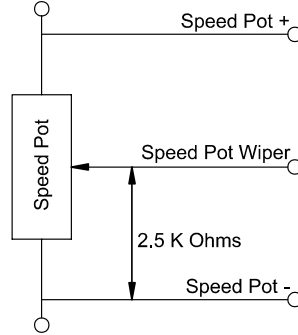
The input requirements corresponding to the programmable options are summarised below. All voltages given are nominal values.

	Voltage Required on Pin 5 of 10 way MTA Speed Pot Wiper			
	Single Ended Pot	Full Speed Reverse (V)	Zero Speed (V)	Full Speed Forward (V)
DS60S and DS70P (long 270°)	On	N/A	2.5	3.35
	Off	1.65	2.5	3.35
DS60NS (short 60°)	On	N/A	2.5	4.3
	Off	0.7	2.5	4.3

Note : The Controller is designed to Fault if the voltages are significantly outside these ranges.

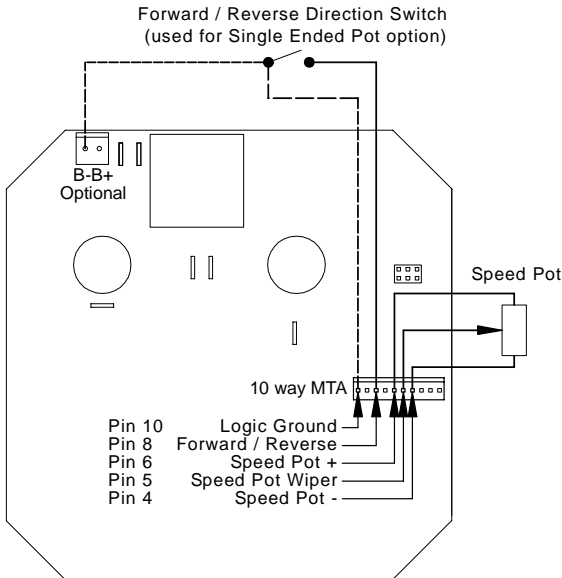


Long Travel (270°) Speed Pot



Short Travel (60°) Speed Pot

The long travel Speed Pot uses only the bottom quarter of its mechanical range, and the position of the wiper is determined by setting the impedance between Speed Pot- and the wiper to 0.53 K Ohms. A short travel Speed Pot has the Wiper set in the middle, with 2.5V either side.



Speed Pot Wiring

The Forward / Reverse Direction Switch, if used, is connected between the Forward / Reverse Pin 8 of the 10 way MTA, and either Logic Ground Pin 10 of the MTA or the Optional B- terminal.

The Speed Pot is connected between Speed Pot- Pin 4 and Speed Pot+ Pin 6 of the 10 way MTA, with the Speed Pot Wiper connected to Pin 5.

4.3.8 External LED (Optional)

The External LED operates in exactly the same way as the internal Status LED and displays operation, low battery and fault conditions.

The External LED does not require a resistor and is wired between Key Switch Pin 3 of the 10 way MTA or Optional B+ Pin 2 and External LED- Pin 9. The LED colour should be yellow.

Warning: LED's with voltage ratings, e.g. for 12 V or 24 V, have internally fitted resistors. These LED's must not be used.

5 Programming

Warning: Incorrect or inappropriate programming of a DS60 or DS70 may put the vehicle into a dangerous state.

Dynamic Controls accept no responsibility or liability for accidents caused by incorrect programming.

This chapter must be read and understood before attempting to program a DS60 or DS70.

Do not plug the DZ-DS Programmer into the Controller while the vehicle is in motion.

5.1 Introduction

The driving performance of a DS60 or DS70 is dependant on its programming. A Controller can be adjusted for a particular application and the driving performance defined to suit the requirements of an individual.

An Installation Programmer is available to the vehicle manufacturer. A simplified DZ-DS User Programmer is available for purchase by the user.

The DZ-DS Installation Programmer provides access to several menus:

- Setup Menu
- Options Menu
- Profile Menu
- Speed Lever in Neutral Menu
- Controller Version Menu

A Fault Menu appears when the Programmer is first plugged in if a fault is active. See [Section 5.3.1 - Main Menu](#).

The Speed Lever in Neutral Menu is not accessible with the DS60 or DS70. The Controller Version Menu is a screen to state the version of the Controller only.

The Setup Menu contains performance characteristics so that the vehicle can be programmed to suit a particular set of conditions.

The Options Menu contains configuration parameters, some of which are inter-related with settings in the Setup Menu.

The Profile Menu allows the settings in the above two menus to be saved as one of five Profiles. The DS Controller comes with a Default Profile installed during manufacture, but an additional five profiles can be programmed.

Note: 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.

5.2 Programmable Characteristics

5.2.1 Setup Menu Characteristics

See [Section 5.3.2 - Setup Menu](#) for step-by-step operation. The safety of the user must be considered when setting some of these characteristics. Only those characteristics marked (PD) are available in the DZ-DS User Programmer.

Characteristic	Functions / Settings	Min	Max	Default	Units
Acceleration (PD)	Sets the maximum acceleration of the motor when not in current limit. The lower the setting, the slower the acceleration. A lower acceleration can be used to give the motor softer performance, or to compensate for speed input jittering.	1	10	7	%/10 of max.
Deceleration (PD)	The time required to slow to a stop when the speed input requests zero speed. Normally set higher than acceleration except with very low Forward Speed values.	1	10	7	%/10 of max.
Forward Speed (PD)	Maximum forward speed of the motor. The higher the setting, the higher the maximum speed. Commonly set to 10.	1	10	10	%/10 of max.
Reverse Speed (PD)	Maximum reverse speed of the motor. The higher the setting, the higher the maximum speed. Usually set equal or less than Forward Speed..	1	10	6	%/10 of max
Reduce Speed	Not available in the DS60 or DS70				
Buzzer Volume	Not available in the DS60 or DS70				

Characteristic	Functions / Settings	Min	Max	Default	Units
Motor Resistance	<p>The DS60 and DS70 has inbuilt Load Compensation to maintain constant speed with varying motor load. When the Motor resistance is set too low, the motor speed decreases under load. When set too high the motor speed will increase excessively under load.</p> <p>Begin the selection of this setting at a low value of 50 and gradually increase until the motor does not slow when under load, when at half speed. When testing, set Acceleration and Deceleration to low values, e.g. 3 and 7 respectively. When the correct setting is found, reset Acceleration and Deceleration to suitable values.</p> <p>Load Compensation is turned Off and On in the Option Menu.</p>	5	255	50	mΩ
Sleep Time (PD)	<p>The maximum time that the Controller can be turned on in neutral before it goes into its low power Sleep Mode. In Sleep Mode the LED is off and the Controller does not respond. The On/Off Switch must be turned off and then on again to restart.</p>	5	60	10	min.

Characteristic	Functions / Settings	Min	Max	Default	Units
Park Brake Delay	<p>The time between the motor stopping and the Park Brakes engaging.</p> <p>A low value minimises creep when the motor stops under load. If, in the case of an electric scooter, the stopping load varies, the value should be between that when stopping on a smooth floor and stopping on a slope.</p>	1	30	6	*50 msec

5.2.2 Options Menu Parameters

See [Section 5.3.3 - Options Menu](#) for step-by-step operation. None of these parameters are available with the DZ-DS User Programmer.

Characteristic	Functions / Settings	Settings	Default
Single-ended Potentiometer	<p>If On, speed control in only one direction available unless Forward/Reverse Switch connected.</p> <p>Set to Off if speed and direction are controlled by one lever and speed control of both directions is required.</p>	On / Off	Off
Standard Speed Pot	Always set to Off .	On / Off	Off
Motor Reverse	Set to On if the motor goes in the opposite direction to that required.	On / Off	Off
Pot Reverse	<p>If set to Off, input voltages higher than neutral provide forward speed, and input voltages lower than neutral produce reverse speed.</p> <p>Set to On if potentiometer polarity is reversed. The above input voltage requirements are reversed.</p>	On / Off	Off
Brake Checking	<p>Set to On if the motor has a Park Brake.</p> <p>Set to Off if there is no Park Brake</p>	On / Off	On
Enable Sleep	If set to On , the Sleep Time value in the Setup Menu is applied. The Controller can enter the low current mode to conserve power.	On / Off	On

Characteristic	Functions / Settings	Settings	Default
Check for Slope	<p>If set to On, the Park Brake Delay set in the Setup Menu is bypassed. This can cause a jerk when stopping on level ground if the Deceleration rate is low.</p> <p>Normally set to Off.</p>	On / Off	Off
Current Limit Timer	<p>If set to On, the Controller can only operate in Current Limit for 15 seconds. After this time the output current will reduce to zero and a Fault Code 4 will occur.</p> <p>If there is concern about the user being at risk when the Scooter stalls, set this to On.</p> <p>When set to On, the Scooter may turn off when heavily loaded, e.g. when going up a long, steep hill. This may be undesirable for some users. Some countries' standards require this parameter to be set to On.</p>	On / Off	On

5.3 DZ-DS Programmer Operation

Warning: Do not plug the DZ-DS Programmer into the Controller while the vehicle is in motion.

Plug in the DZ-DS Programmer while the Controller is turned on.

If the Controller is turned off during programming, new setting will not be saved and the Controller will retain all previous settings.

5.3.1 Main Menu

1. While the Controller is turned on, plug in the Programmer. The initial screen will appear for two seconds.

DYNAMIC CONTROLS	
Installation	
Programmer	
DS100PM	VER 1.35

If a fault has occurred, the fault screen appears.

Press ENTER to go to	
FAULT MENU	
MENU	ENTER

Press ENTER and the display will show the fault, e.g.

FAULT	
Speed Pot Not In	
Neutral	
MENU	

See [Section 6.2 - DS System Fault Handling](#) for the list of faults that can be displayed.

Press MENU to return to the Main Menu.

2. The main menu reads:



3. Press the MENU button to cycle through each of the five menus :
- Setup Menu
 - Options Menu
 - Profiles Menu
 - Speed Level in Neutral Menu
 - Controller Version Menu

Note: The Speed Lever in Neutral Menu is not accessible with the DS60 or DS70.

4. Press ENTER to select the menu you wish to modify.

5.3.2 Setup Menu

The Setup Menu provides access to nine performance characteristics, of which seven are available for adjustment on the DS60 and DS70.

1. Press NEXT to cycle through the characteristics described in Section 5.2.1 - Setup Menu Characteristics.

<p style="text-align: center;">SETUP Acceleration : 7 MENU NEXT VARY ENTER</p>
--

2. To modify individual performance characteristics:

Pressing VARY changes the value of the performance characteristic on the display.

3. Press ENTER to store the new value.

Some or all of the performance characteristics can be adjusted as many times as desired by pressing the NEXT button to step through the characteristics.

4. Unplug the Programmer to transfer the new information into the Controller.
5. Wait for two seconds before turning off the Controller. The Status LED will light when the data transfer is complete.

5.3.3 Options Menu

The Options Menu provides access to nine On / Off configuration parameters.

1. Press NEXT to cycle through the parameters described in Section 5.2.2 - Options Menu Parameters.

<p style="text-align: center;">OPTIONS Single-ended Pot : OFF MENU NEXT VARY ENTER</p>
--

2. To modify individual configuration parameters:

Pressing VARY toggles between On and Off, on the display.

3. Press ENTER to store the new setting.

Some or all of the configuration parameters can be adjusted as many times as desired by pressing the NEXT button to step through the parameters.

4. Unplug the Programmer to transfer the new information into the Controller.
5. Wait for two seconds before turning off the Controller. The Status LED will light when the data transfer is complete.

5.3.4 Profiles Menu

The DS60 and DS70 contains a Default Profile with factory settings specified by the customer. Five other profiles can be programmed into the DZ-DS Programmer by the customer.

The Profiles Menu allows :

- **Up-loading** of the current profile and saving as a profile number between one and five.
 - **Down-loading** of either the Default Profile or one of five previously programmed profiles. A Profile can be Locked when downloading the same profile onto multiple Controllers.
 - **Editing** of up to five previously saved individual profiles or the and saving to the DZ-DS Programmer. The Default Profile can be edited but can only be saved as Profile 1 to 5. The Default Profile is held in ROM and can not itself be changed.
1. Press NEXT to cycle through the above three options.
 2. Press ENTER to select one of the options.

To Up-Load a Profile from the DS60 or DS70 :

1. When Up-Loading a Profile from the Controller, the first screen reads:

PROFILES		
Press ENTER to Up-		
Load Profile		
MENU	NEXT	ENTER

Press ENTER.

- The screen now reads:

```
UPLOAD PROFILE  
Store As Profile # :  
1  
MENU VARY ENTER
```

Press VARY to select the profile number that you wish to save your profile into. Profiles 1 to 5 are available. The Default Profile can not be overwritten.

- Press ENTER to store the profile.
- Press MENU once to Upload another profile, and again to return to the Main Menu.

To Down-Load a Profile from the DZ-DS Programmer :

- When Down-Loading a Profile from the DZ-DS Programmer, the first screen reads:

```
PROFILES  
Press ENTER to Down-  
Load Profile  
MENU NEXT ENTER
```

Press ENTER.

- The screen now reads:

```
DOWNLOAD PROFILE  
Profile # :  
1  
MENU LOCK VARY ENTER
```

Press VARY to select the profile number that you wish to download. Profiles 1 to 5 and the Default Profile are available.

3. Press ENTER to store the profile.
4. The Programmer will now automatically enter the Check Profile Menu

CHECK PROFILE
Acceleration :
7
MENU NEXT

Press NEXT to cycle through the parameters to check that the correct profile has been downloaded.

5. Press MENU.

The Programmer will automatically enter the Speed Lever Neutral Menu..

6. Press MENU once to return to the Profile Men, and again to return to the Main Menu.

If the DZ-DS Programmer is unplugged while in the Download Profile screen, it can be plugged into another Controller and will immediately return to the same screen. In this way the same profile can be downloaded to multiple Controller's with minimum time wasted.

To prevent accidentally changing a profile, a Lock function is available for each profile. If the Lock is set, a combination is required to access that profile.

To Lock a Profile :

1. When in the Download Profile Menu:

```

DOWNLOAD PROFILE
Profile # :
1
MENU LOCK VARY ENTER
```

Hold down the LOCK button while pressing:

MENU button	2 times	
VARY button	3 times	
ENTER button	6 times	Release the LOCK button.

The MENU and VARY selections are now gone.

The DZ-DS Programmer can now only download the locked profile, even after disconnecting and reconnecting.

To Unlock the Profile :

Repeat the Lock sequence. The MENU and VARY selections come back and the Programmer will behave normally.

To Edit a Profile in the DS Programmer :

1. When Editing a Profile saved in the DZ-DS Programmer, the first screen reads:

```

PROFILES
Press ENTER to Edit
Programmer Profile
MENU NEXT ENTER
```

Press ENTER.

2. The screen now reads:

```
          EDIT PROFILE
          Profile # :
                1
MENU      VARY  ENTER
```

Press VARY to select the profile number that you wish to save your profile into. Profiles 1 to 5 and the Default Profile are available.

The Default Profile can be edited but can only be saved as Profile 1 to 5. The Default Profile is held in ROM and can not itself be changed.

3. Press ENTER
4. The screen now reads:

```
          EDIT PROFILE SETUP
          Acceleration:
                1
MENU NEXT VARY  ENTER
```

5. Press NEXT to cycle through the parameters to check that the settings are correct.
6. Press ENTER to store the profile.
7. Press MENU once to Upload another profile, and again to return to the Main Menu.

6 Diagnostics

6.1 System Troubleshooting

The following steps should be taken if a system with a DS60 or DS70 Controller does not operate. This will help identify if the problem is in the Controller or some other part of the system.

Note: See [Section 4.3.1 - Connections](#) for referenced connections.

The following voltages are nominal only.

Turn the On / Off Switch On before beginning any diagnostics.

6.1.1 If the Status LED is Off

1. **Confirm that the battery supply voltage is present on the Controller terminals.**

Connect a voltmeter between B+ and B- with the negative probe on B- and the positive probe on B+. The voltmeter should measure between 23 V and 27 V.

- If the voltage is negative, check for correct battery wiring polarity.
- If the voltage is 0 V, check the circuit breaker and for open circuit wiring.

2. Check that the Programmer is not plugged in.

6.1.2 If the Status LED is Flashing

1. Count the number of flashes and refer to [Section 6.2 - DS System Fault Handling](#),
OR
plug in the Programmer to determine the cause of the fault.

6.1.3 If the Status LED is Permanently On :

Warning: Elevate the drive wheels or disconnect the motor before carrying out the following tests.

1. Check the voltages on the Speed Pot terminals with the Speed Lever in neutral. The readings, in respect to B-, should be:

		Long Travel	Short Travel
Speed Pot -	Pin 4 of 10 way MTA	$1.3 \pm 0.1 \text{ V}$	$0.5 \pm 0.1 \text{ V}$
Speed Pot Wiper	Pin 5 of 10 way MTA	$2.5 \pm 0.5 \text{ V}$	$2.5 \pm 0.5 \text{ V}$
Speed Pot +	Pin 6 of 10 way MTA	$12.7 \pm 0.1 \text{ V}$	$4.5 \pm 0.1 \text{ V}$

When the Speed Lever is moved in the Forward and Reverse directions, the voltage on Pin 5 of the 10 way MTA should increase / decrease by $\pm 0.7 \text{ V}$ for a long travel Speed Pot, and $\pm 2 \text{ V}$ for a short travel Speed Pot.

- If this voltage swing is not present, check the potentiometer and wiring for open circuits.
2. Connect a voltmeter between M+ and M- . The voltmeter should measure 0 V when the Speed Lever is in neutral and between 10 V and 24 V when the Speed Lever is out of neutral and at full speed
 - If the voltage put of neutral is above 0 V but the motor is not driving, check the motor and wiring.
 3. Connect a voltmeter between Park Brake - Pin 1 of the 10 way MTA and Park Brake + Pin 2 of the 10 way MTA. The voltmeter should measure 0 V when the Speed Lever is in neutral and 24 V when the Speed Lever is out of neutral.

4. Measure the voltage at Inhibit Pin 7 of the 10 way MTA, in respect to B-. The voltmeter should measure 5 V.
 - If the measurement is 0 V, check that an inhibit switch is not engaged e.g. from a battery charger. When 0 V is applied to this terminal, driving will be inhibited.

If the Controller fails one of these tests and previous advice fails, try exchanging it with another working Controller, or contact your Service Agent.

If the Controller passes these tests, then the fault is likely to be in another part of the system.

6.2 DS System Fault Handling

Any fault condition on the DS60 or DS70 Controller, or associated system will cause the 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 DZ-DS Programmer automatically displays the fault when plugged into a Controller, when a fault is present. See [Section 5.3.1 - Main Menu](#) for details.

No. of Flashes	Fault	Controller Condition	Comment
1	Battery needs recharging	Will drive	The battery voltage has dropped below 23.3 V in neutral. Recharge the batteries soon.
2	Battery voltage too low	Drive inhibited	The battery voltage at the Controller has dropped to 16.5 V. Check the battery condition and the connections.
3	Battery voltage too high	Drive inhibited	The battery voltage at the Controller is greater than 32 V. Check the battery condition and the connections. Suspect a charger malfunction.
4	Current limit time out	Drive inhibited	The Controller has detected a shorted motor. Check the loom for shorts and check the motor. Contact your Service Agent.
5	Brake feedback error	Drive inhibited	Check that the Park Brake release switch is off. Check the Park Brake and wiring for open or short circuits. Contact your Service Agent.
6	Out of Neutral at Power up	Drive Inhibited	Check that the speed pot is not deflected, and the wiring is connected.

No. of Flashes	Fault	Controller Condition	Comment
7	Speed pot error	Drive inhibited	Check speed pot wiring for open or short circuits. Speed pot may not be correctly set up. Contact your Service Agent.
8	Motor volts error	Drive inhibited	Contact your Service Agent.
9	Other Internal errors	Drive inhibited	Contact your Service Agent.

7 Product 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.

8 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.

9 Maintenance

1. All vehicle components should be regularly checked for loose, damaged or corroded connectors, terminals, or cabling. All cables should be restrained to protect them from damage. Damaged components should be replaced.
2. All switchable functions on the DS System should be regularly tested to ensure they function correctly.
3. All DS 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 DS System component - do not attempt to open any case or undertake any repairs as warranty claims will be affected.

Warning: If any DS 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.

10 Safety and Misuse Warnings

Warnings to be included in the User Manual

The following warnings are applicable to both the installer and the user and must be passed on to the end user before use of the product.

- Do not install, maintain or operate this equipment without reading, understanding and following the proper instructions and manuals, otherwise injury or damage may result.
- A warning must be conveyed to the vehicle operator that the Controller could cause the vehicle to come to a sudden stop. In situations where this may effect 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, bystanders, damage to the vehicle and surrounding property.
- Users and suppliers of Assistive Mobility products should give thought to the possibility of a failure to operate, or an incorrect operation, by the product. Should an operator be left with limited or no mobility due to equipment failure, they should be able to summon assistance from where ever they are.
- A warning must be conveyed to the operator that they have the responsibility to ensure that the vehicle is kept in a good, safe operating condition and ensure that components, such as cables, are protected from damage by securing them in optimum positions.
- Do not operate the vehicle if it behaves erratically, or shows abnormal response, heating, smoke or arcing. Turn the vehicle off at once and consult your Service Agent.
- Do not operate your vehicle if the battery is nearly flat as a dangerous situation may result due to loss of power in an inopportune place.
- If the vehicle drives without demand, turn the key switch to the off position to halt the scooter.
- The vehicle should not be operated when the temperature is below -25°C or above 50°C .
- No connector pins should be touched, as contamination or damage due to electrostatic discharge may result.

- If the vehicle speed surges when driving down hill, the common reason is the operation of an over voltage protective device. When running down hill, the braking energy from the over voltage motor is sent to the battery, which charges it. However, if the battery is fully charged, it won't accept the generated energy without dramatically increasing its voltage. If this over voltage condition were allowed to last, there would be a risk of damage to the battery or an explosion. To prevent these risks, the controller forces the vehicle to slow down until the battery voltage drops to a safe level, after which allowing the vehicle to speed up again. To prevent speed surging with charged batteries, we advise drivers to descend hills slowly.
- The user should turn the system off while getting in and out of the vehicle.
- Ensure the vehicle is turned off when not in use.
- The vehicle must not be driven with the manual park brake release operated.
- The manual park brake release must not be operated on a slope.
- 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, turn the vehicle off immediately. Leave off while transmission is in progress. Turn the vehicle off before using a cell phone or portable communications device.
- 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 called immediately.
- Report any malfunctions immediately to your Service Agent.

Service and Configuration Warnings

The following warnings are applicable to the installation technician only.

- After the vehicle has been set up, check to ensure the vehicle performs to the specifications entered in the programming procedure. If the vehicle does not perform to specifications, turn the vehicle off immediately and re-program. Repeat this procedure until the vehicle performs to specifications.
- The completed installation must be thoroughly checked, and all programmable options must be correctly adjusted for safe operation prior to use.

11 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 vehicles in accordance with the vehicle manufacturer's recommendations.
- Setup of a DS60 or DS70 Controller is to be performed only by individuals certified by Dynamic Controls Ltd. The fine tuning adjustments of the Controller may affect other activities of the vehicle. Damage to the equipment could occur under these circumstances. If uncertified individuals perform any work on these units, the warranty is voided.

12 Sales and Service Information

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

New Zealand



Head Office

Dynamic Controls Ltd.

Print Place
Christchurch
New Zealand

Web site:
Email:

<http://www.dynamicmobility.co.nz>
sales@dynamic-controls.co.nz

Telephone: Int. +64 3 338 0016
Fax: Int. +64 3 339 1234

Europe



Sales and Service

Controls Dynamic Ltd.

Lisle Avenue
Kidderminster
DY11 7DL
United Kingdom
Email:

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

sales@controls-dynamic.co.uk

North America



Sales and Service

Dynamic Controls, North America Office Dynamic North America

31335 Industrial Parkway, Suite 2
North Olmsted, Ohio 44070
USA

Tel: Int. +1 440 979 0657
Fax: Int. +1 440 979 1028

Email:

dbaker@dynamic-controls.com

Service Agent

Rosstron Inc.

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

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

Email:

rosstron@earthlink.net

Australia



Service Agent

Electronic Mobile Service

46 Berripa Close
North Ryde, Sydney
NSW Australia 2113
Email:

Tel - 24 hour: Int. +61 2 9887 2824
Pager: Int. +61 2 9963 1778
Fax: Int. +61 2 9887 2114
fredems@ozemail.com.au

NOTE:

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