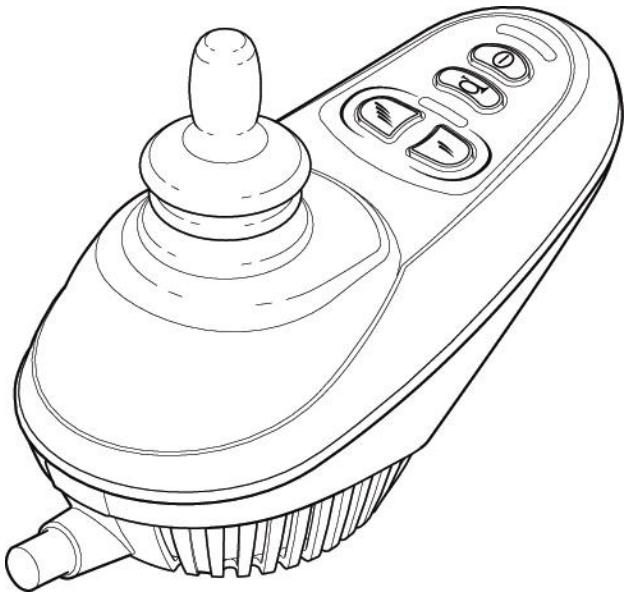
PG DRIVES TECHNOLOGY

THE NEW VSi

newVSI
TECHNICAL MANUAL

SK80151-1



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About this manual

This manual is divided into 6 chapters.

Chapter 1 – Operation

This chapter covers the newVSI operating instructions.

Chapter 2 – Installation

This chapter covers the newVSI mounting, connection and wiring.

Chapter 3 – Programming

This chapter provides detailed information on the newVSI programmable parameters.

Chapter 4 – Diagnostics

This chapter summarizes the diagnostic procedure.

Chapter 5 – Warning Summary

This chapter summarizes the warnings shown throughout the manual.

Chapter 6 – Specifications

This chapter documents the newVSI technical specifications.

Icons

Throughout this manual, icons are used to draw the reader's attention.

The icons used are:

Note – A general point for best practice.

Caution – A point of safety, which if ignored, could result in damage to the controller or the vehicle.

Warning – A point of safety, which if ignored, could cause injury to the individual.

PG Drives Technology accepts no liability for any losses of any kind if these points are not followed.

CHAPTER 1 – OPERATION

1 Introduction

The relevant contents of this chapter should be included in the wheelchair operating guide. Further copies are available from PGDT in either written or disk (Adobe PDF) format. Copies should not be made without the express permission of PG Drives Technology.

The operation of the newVSI varies dependent on programming. This chapter covers all types of operation. It is the responsibility of the wheelchair manufacturer to ensure that only the relevant sections of this chapter are included in the wheelchair's operating manual.

The operation of the newVSI wheelchair controller is simple and easy to understand. The controller incorporates state-of-the-art electronics, the result of many years of research, to provide you with ease of use and a very high level of safety. In common with other electronic equipment, correct handling and operation of the unit will ensure maximum reliability.

Please read this chapter carefully - it will help you to keep your wheelchair reliable and safe.

2 General

2.1 Handling

Avoid knocking your controller and especially the joystick. Be careful not to strike obstacles with the controller or joystick when you drive. Never drop the controller.

When transporting your wheelchair, make sure that the controller is well protected. Avoid damage to cables.

2.2 Operating Conditions

Your controller uses industrial-grade components throughout, ensuring reliable operation in a wide range of conditions. However, you will improve the reliability of the controller if you keep exposure to extreme conditions to a minimum.

Do not expose your controller or its components to damp for prolonged periods. If the controller becomes contaminated with food or drink clean it off as soon as possible.

2.3 Cleaning

Clean the controller and the joystick with a cloth dampened with diluted detergent. Be careful when cleaning the joystick.

Never use abrasive or spirit-based cleaners.

Do not operate the controller if the vehicle behaves erratically, or shows abnormal signs of heating, sparks or smoke. Turn the controller off at once and consult a local service agent. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

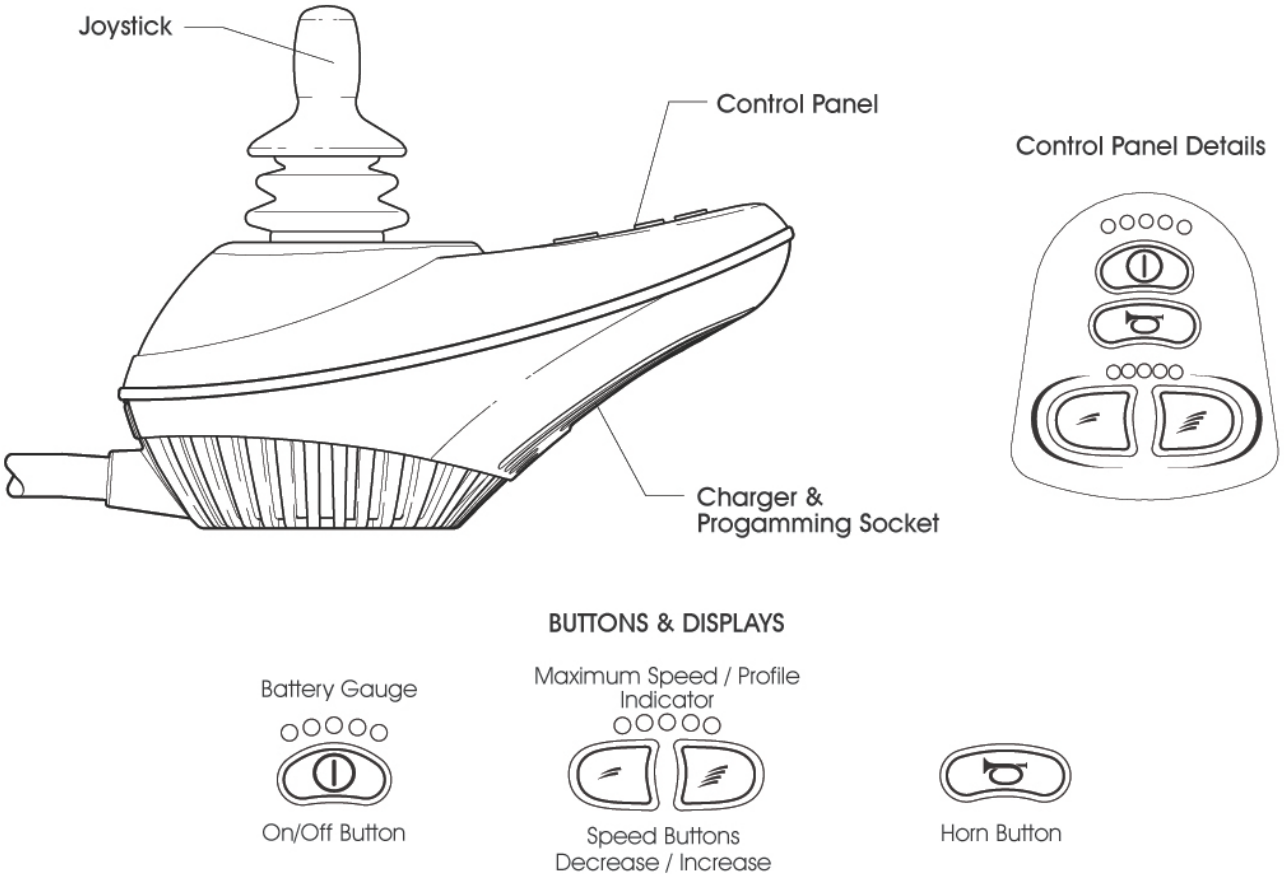
2.4 Heat Shield

The newVSi is built with an integrated heat shield. The purpose of the heat shield is to protect the wheehchair user from exposure to metal parts of the controller. Should the heatshield become damaged it should be replaced immediately. Contact the Wheelchair manufacturer for furter details.

On no account should the wheelchair be operated if the heat shield is damaged or removed. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

3 Controls

Each of the controls is explained within this section.



3.1 On/Off Button and Battery Gauge

The on/off button applies power to the controller electronics, which in turn supply power to the wheelchair's motors. Do not use the on/off button to stop the wheelchair unless there is an emergency. (If you do, you may shorten the life of the wheelchair drive components).

The battery gauge shows you that the wheelchair is switched on. It also indicates the operating status of the wheelchair. Details are given in section 8.0.

3.2 Locking / Unlocking the Wheelchair

The newVSI controller can be locked to prevent unauthorized use. The locking method is via a sequence of key presses and joystick movements, as detailed below.

To lock the wheelchair:

- While the controller is switched on, depress and hold the on/off button.
- After 1 second the controller will bleep. Now release the on/off button
- Deflect the joystick forwards until the controller bleeps.
- Deflect the joystick in reverse until the controller bleeps.

- Release the joystick, there will be a long bleep.
- The wheelchair is now locked.

To unlock the wheelchair:

- Use the on/off button to switch the controller on. The maximum speed / profile indicator will be rippling up and down.
- Deflect the joystick forwards until the controller bleeps.
- Deflect the joystick in reverse until the controller bleeps.
- Release the joystick, there will be a long bleep.
- The wheelchair is now unlocked.

3.3 Joystick

The primary function of the joystick is to control the speed and direction of the wheelchair. The further you push the joystick from the center position the faster the wheelchair will move. When you release the joystick the brakes are automatically applied.

3.4 Maximum Speed / Profile Indicator

This is a gauge which shows the maximum speed setting for the wheelchair or, if the controller is programmed for drive profile operation, the selected drive profile. For more information on drive profiles, refer to Chapter 3.

This gauge also indicates if the speed of the wheelchair is being limited or if the controller is locked, refer to sections 8.8 and 8.9.

3.4.1 Maximum Speed Indicator

This is a gauge that shows the maximum speed setting of the wheelchair. There are five speed settings – step 1 is the lowest speed and step 5 is the highest speed. For details of how to change the maximum speed setting, see sections 3.6 and 3.7.

3.4.2 Profile Indicator

This is an indicator that shows the selected drive profile. There may be up to 5 drive profiles available, this depends on the programming of the controller (refer to Chapter 3). For details of how to select drive profiles, see sections 3.6 and 3.7.

3.5 Horn Button

The horn will sound while this button is depressed.

3.6 Speed / Profile Decrease Button

This button decreases the maximum speed setting or, if the controller is programmed for drive profile operation, selects a lower drive profile.

It is possible to program the controller so this button has no effect while the wheelchair is being driven, refer to Chapter 3.

3.7 Speed / Profile Increase Button

This button increases the maximum speed setting or, if the controller is programmed for drive profile operation, selects a higher drive profile.

It is possible to program the controller so this button has no effect while the wheelchair is being driven, refer to Chapter 3.

3.8 Charger and Programmer Socket

This socket should only be used for programming and charging the wheelchair. Refer to section 10 for more details.

This socket should not be used as a power supply for any other electrical device. Connection of other electrical devices may damage the controller or affect the E.M.C. performance of the wheelchair.

The controller's warranty will be voided if any device other than a PG Drives Technology Programmer, or the battery charger supplied with the wheelchair, is connected into this socket.

4 Getting Ready to Drive

- Operate the on/off switch. The battery gauge will blink then remain on after a second.
- Check that the maximum speed control is set to a level which suits you.
- Push the joystick to control the speed and direction of the wheelchair.

If you push the joystick before or just after you switch the controller on, the battery gauge will ripple up and down and the wheelchair will not be allowed to move. You must release the joystick to resume normal operation. If you do not release the joystick within five seconds the wheelchair will not be able to move, even if you release the joystick and push it again. The battery gauge will then flash rapidly. You can reset this condition by switching the controller off and on again.

If the battery gauge flashes rapidly, then the newVSI has detected a problem somewhere in the wheelchair's electrical system. Refer to section 8.5 for details.

5 Tips for Using Your controller

5.1 Driving - General

Make sure that the controller is mounted securely and that the joystick position is correct. The hand or limb you use to operate the joystick should be supported, for example by the wheelchair arm pad. Do not use the joystick as the sole support for your hand or limb - wheelchair movements and bumps could upset your control.

5.2 Driving Technique

The controller interprets your joystick movements and produces appropriate movements of your wheelchair. You will need very little concentration to control the wheelchair, which is especially useful if you are inexperienced. One popular technique is to simply point the joystick in the direction you want to go. The wheelchair will "home-in" on the direction you push the joystick.

The further you push the joystick away from the rest position, the faster the wheelchair will go. Releasing the joystick will stop the wheelchair.

The intelligent speed controller minimizes the effects of slopes and different types of terrain.

The wheelchair user must be capable of driving a wheelchair safely. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

6 Precautions for Use

In the event of the wheelchair moving in an unexpected way RELEASE THE JOYSTICK. This action will remove drive and power to the electro-magnetic brakes.

6.1 Hazards

Do not drive the wheelchair:

- Beyond restrictions indicated in your wheelchair user manual, for example maximum inclines, curb height etc.
- In places or on surfaces where a loss of wheel grip could be hazardous, for example on wet grassy slopes.

- If you know that the controller or other crucial components require repair.

Although the newVSI controller is designed to be extremely reliable and each unit is rigorously tested during manufacture, the possibility of a system malfunction always exists (however small the probability). Under some conditions of system malfunction the controller must (for safety reasons) stop the chair instantaneously. If there is any possibility of the user falling out of the chair as a result of a sudden braking action, it is imperative that a restraining device such as a seat belt is supplied with the wheelchair and that it is in use at all times when the wheelchair is in motion. PGDT accept no liability for losses of any kind arising from the unexpected stopping of the wheelchair, or from the improper use of the wheelchair or controller.

Do not operate the controller if the chair behaves erratically, or shows abnormal signs of heating, sparks or smoke. Turn the controller off at once and consult your service agent. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Electronic equipment can be affected by Electro Magnetic Interference (EMI). Such interference may be generated by radio stations, TV stations, other radio transmitters and cellular phones. If the chair exhibits erratic behavior due to EMI, turn the controller off immediately and consult your service agent. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

It is the responsibility of the chair manufacturer to ensure that the wheelchair complies with appropriate National and International E.M.C legislation. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The wheelchair user must comply with all wheelchair safety warnings. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

7 Safety Checks

The electronic circuits in your controller have been designed to be extremely safe and reliable. The on-board microcomputer carries out safety checks at up to 100 times per second. To supplement this safety monitoring you should carry out the following periodic checks.

If the controller fails any of these checks, do not use the wheelchair and contact your service agent.

7.1 Daily Checks

Joystick: With the controller switched off, check that the joystick is not bent or damaged and that it returns to the center when you push and release it. If there is a problem do not continue with the safety checks and contact your service agent.

7.2 Weekly Checks

Solenoid (parking) brake: This test should be carried out on a level floor with at least one meter clear space around the wheelchair.

- Switch on the controller.
- Check that the battery gauge remains on, or flashes slowly, after one second.
- Push the joystick slowly forwards until you hear the parking brakes operate. The chair may start to move.
- Immediately release the joystick. You must be able to hear each parking brake operate within a few seconds.
- Repeat the test a further three times, pushing the joystick slowly backwards, left and right.

Connectors: Make sure that all connectors are securely mated.

Cables: Check the condition of all cables and connectors for damage.

Joystick gaiter: Check the thin rubber gaiter or boot, around the base of the joystick shaft, for damage or splitting. Check visually only, do not handle the gaiter.

Mounting: Make sure that all the components of the controller are securely mounted. Do not overtighten any securing screws.

7.3 Servicing

To ensure continued satisfactory service, we suggest you have your wheelchair and controller inspected by your service agent after a period of 1 year from commencement of service. Contact your service agent for details when the inspection is due.

8 Control System Status Indication

The battery gauge and maximum speed /profile indicator show the status of the controller.

A number of supposedly defective controllers returned to us are subsequently found to operate correctly. This indicates that many reported faults are due to wheelchair problems rather than the controller.

8.1 Battery Gauge is Steady

This indicates that all is well.

8.2 First LED flashing slowly

The controller is functioning correctly, but you should charge the battery as soon as possible.

8.3 Battery Gauge Steps Up

The wheelchair batteries are being charged. You will not be able to drive the wheelchair until the charger is disconnected and you have switched the controller off and on again.

8.4 All 5 LEDs in the battery display are flashing

The controller safety circuits have operated and the controller has been prevented from moving the wheelchair.

This indicates a system trip, i.e. the newVSI has detected a problem somewhere in the wheelchair's electrical system. Please follow this procedure:

- Switch off the controller.
- Make sure that all connectors on the wheelchair and the controller are mated securely.
- Check the condition of the battery.
- If you can't find the problem, try using the self-help guide given in section 8.5.
- Switch on the controller again and try to drive the wheelchair. If the safety circuits operate again, switch off and do not try to use the wheelchair.

Contact your service agent.

8.5 Self-Help Guide

If a system trip occurs, you can find out what has happened by counting the number of flashes of the battery gauge.

Below is a list of self-help actions. Try to use this list before you contact your service agent. Go to the number in the list which matches the number of flashes of the battery gauge and follow the instructions.

If the problem persists after you made the checks described above contact your service agent.

If the programmable parameter, Motor Swap has been enabled, then left and right hand references in this table will need transposing.

1 Flash - The battery needs charging or there is a bad connection to the battery. Check the connections to the battery. If the connections are good, try charging the battery.

2 Flashes - The left hand motor has a bad connection. Check the connections to the left hand motor.

3 Flashes - The left hand motor has a short circuit to a battery connection. Contact your service agent.

4 Flashes - The right hand motor has a bad connection. Check the connections to the right hand motor.

5 Flashes - The right hand motor has a short circuit to a battery connection. Contact your service agent.

7 Flashes - A joystick fault is indicated. Make sure that the joystick is in the center position before switching on the controller.

8 Flashes - A controller fault is indicated. Make sure that all connections are secure.

9 Flashes - The parking brakes have a bad connection. Check the parking brake and motor connections. Make sure the controller connections are secure.

10 Flashes - An excessive voltage has been applied to the controller. This is usually caused by a poor battery connection. Check the battery connections.

8.6 Slow or sluggish movement

If the wheelchair does not travel at full speed or does not respond quickly enough, and the battery condition is good, check the maximum speed setting. If adjusting the speed setting does not remedy the problem then there may be a non-hazardous fault.

Contact your service agent

8.7 Maximum Speed / Profile Indicator is Steady

The display will vary slightly depending on whether the controller is programmed to operate with drive profiles. For more information on drive profiles, refer to Chapter 3.

8.7.1 Maximum Speed Indication

The number of LEDs illuminated shows the maximum speed setting. For example, if the setting is speed level 4, then the four left hand LEDs will be illuminated.

8.7.2 Profile Indication

The LED illuminated shows the selected drive profile. For example, if drive profile 4 is selected, the fourth LED from the left will be illuminated.

8.8 Maximum Speed / Profile Indicator Ripples Up and Down

This indicates the controller is locked, refer to section 3.2 for details of how to unlock the controller.

9 Battery Gauge

The battery gauge is included to let you know how much charge is left in your batteries. The best way for you to use the gauge is to learn how it behaves as you drive the wheelchair. Like the fuel gauge in a car, it is not completely accurate, but it will help you avoid running out of "fuel".

The battery gauge works in the following way:

When you switch on the controller, the battery gauge shows an estimate of the remaining battery charge.

The battery gauge gives you a more accurate reading about a minute after you start driving the wheelchair.

When you replace worn out batteries, fit the type recommended by the wheelchair manufacturer. If you use another type the battery gauge may be inaccurate.

The amount of charge in your batteries depends on a number of factors, including the way you use your wheelchair, the temperature of the batteries, their age and the way they are made. These factors will affect the distance you can travel in your wheelchair. All wheelchair batteries will gradually lose their capacity as they age.

The most important factor that reduces the life of your batteries is the amount of charge you take from the batteries before you recharge them. Battery life is also reduced by the number of times you charge and discharge the batteries.

To make your batteries last longer, do not allow them to become completely flat. Always recharge your batteries promptly after they are discharged.

If your battery gauge reading seems to fall more quickly than usual, your batteries may be worn out.

9.1 How to Read the Battery Gauge

If the battery gauge shows red, yellow and green, the batteries are charged.

If the battery gauges show just red and yellow, then you should charge the batteries as soon as you can.

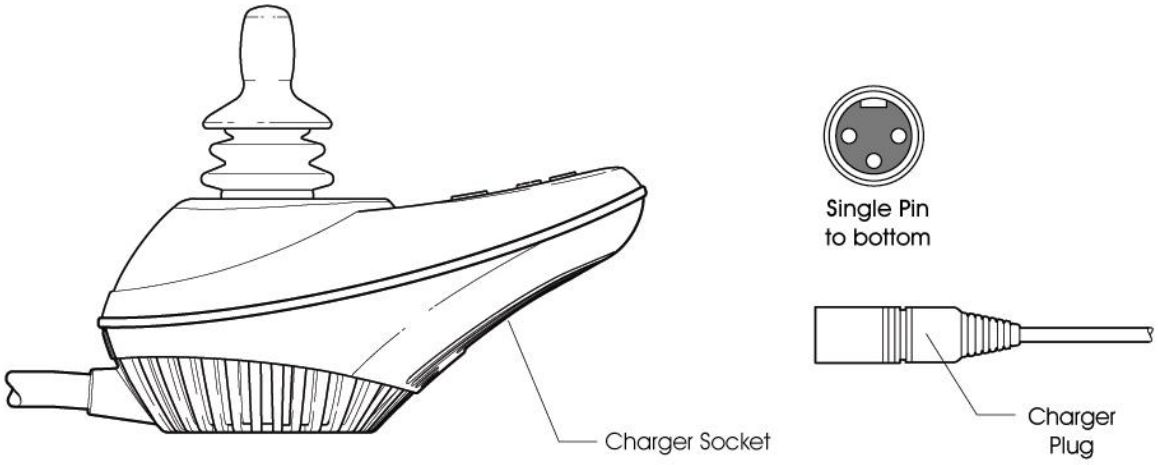
If the battery gauge shows just red, either steady or flashing slowly, then you should charge the batteries immediately.

Do not operate the controller if the battery is nearly discharged. Failure to comply with this condition may leave the user stranded in an unsafe position, such as in the middle of a road. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

10 Battery Charging

To charge the wheelchair batteries connect the charger plug into the battery charging socket on the newVSI. You will not be able to drive the wheelchair when the charger is connected.

To connect the charger plug, ensure the single pin is at the bottom, as shown in the following illustration, then offer the charger plug to the newVSI in a horizontal orientation. The molded guide on the newVSI will help you to locate the plug. Ensure the plug is pushed fully in position.



Do not exceed the maximum charging current of 12 Arms. Always use an off-board charger fitted with a Neutrik NC3MX plug. Failure to observe these conditions could result in poor contact resistance in the charger connector resulting in overheating of the charger plugs. This presents a potential burn hazard for the user. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the pin polarity shown on the controller's specific data sheet. Failure to observe this condition could result in a burn hazard or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Do not disconnect batteries or open-circuit the circuit breaker while charging is in progress. Failure to observe this condition could result in a burns hazard or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Only use the battery charger that has been supplied with your wheelchair. The use of incorrect chargers could damage the batteries, wheelchair, controller or charger itself, or may result in parts overheating creating the potential for burns or even fire. PGDT accepts no liability for losses of any kind if the charger is incompatible with the controller (see Chapter 2, section 7) or any other part of the wheelchair system.

II Programming

If you find that you cannot set a maximum speed control setting that suits you, the controller can be programmed to meet your needs. Programming can be performed using a Programmer such as the PP1, the DTT or specialist PC software and interface cable.

The PP1and DDT are hand-held units which can be plugged into your controller to alter the controller's programming. Your wheelchair distributor or service agent or wheelchair manufacturer will be able to program your controller for you.

If you have a PP1a or DTT, read the appropriate user guide before you use it.

If you re-program your controller, make sure that you observe any restrictions given in your wheelchair user manual. Note any changes you make for future reference.

Programming should only be conducted by healthcare professionals with in-depth knowledge of PGDT electronic controllers. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. PGDT accepts no liability for losses of any kind if the programming of the controller is altered from factory pre-set values.

12 Joystick Knobs

The knob fitted to your joystick is suitable for most applications. If you would prefer another type, there are a range of alternatives available. Please contact your wheelchair distributor or manufacturer for advice. Do not replace the joystick knob with any unauthorized item - it may cause hazardous operation.

Do not replace the joystick knob with any unauthorized item It may cause hazardous operation. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

13 Servicing

All repairs and servicing must be carried out by authorized service personnel. Opening or making any unauthorized adjustments or modifications to the controller or its components will invalidate any warranty and may result in hazards to yourself or other people, and is strictly forbidden.

PGDT accept no liability for losses of any kind arising from unauthorized opening, adjustment or modifications to the newVSI controller.

If the controller is damaged in any way, or if internal damage may have occurred through impact or dropping, have the product checked by qualified personnel before operating. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

14 Warranty

The newVSI controller is covered by a warranty period defined by the wheelchair manufacturer. For details of the warranty period, please contact your service agent.

The warranty will be void if the newVSI controller has:

- Not been used in accordance with the newVSI controller Technical Manual, SK80151.
- Been subject to misuse or abuse.
- Been modified or repaired by non-authorized persons.

The warranty will be void if the newVSI has not been used in accordance with newVSI Technical Manual SK80151, the newVSI has been subject to misuse or abuse, or if the newVSI has been modified or repaired by unauthorized persons.

CHAPTER 2 – INSTALLATION

1 Documentation

1.1 newVSI Operation

Study Chapters 1,3 and 4. It is important that the operation information in these chapters is supplied with the wheelchair, either as part of the wheelchair user handbook or as a separate document.

This chapter sets out the installation conditions that must be complied with in order to meet the safety requirements of TÜV (Germany), ISO7176-14 and EN12184.

1.2 Program Settings

You must supply the controller programmed with the manufacturer's preset settings. controllers are always supplied by PGDT with the preset settings shown on the data sheet.

It is the manufacturers responsibility to program the controller to suit the vehicle model and ensure safe operation in compliance with relevant legal requirements over the whole of the operating range. PGDT accepts no liability for losses of any kind due to incorrect programming of the newVSI controller. Refer to Chapter 3 for Programming details.

The wheelchair must stop within the maximum distance specified for the country in which the wheelchair will be used. TÜV Product Service (Germany) specify the distance to be as stated in EN12184.

If users with particular disabilities need very low braking rates and this results in a longer stopping distance, the maximum speed must be re-programmed so that the stopping distance requirement is satisfied.

State in the wheelchair user handbook that it is the responsibility of the person programming the controller to make sure that the stopping distance requirement is satisfied. If the braking rate is low, the forward and reverse maximum speed settings may need to be re-programmed. To assist the person in this task, include a graph in the wheelchair user handbook showing the relationship between the maximum forward/reverse speed settings and the forward/reverse braking rate which is required to ensure the correct stopping distance.

It may be possible to program settings which compromise the stability of the wheelchair. Perform suitable tests to establish which programming restrictions are needed to prevent instability. State any programming restrictions in the wheelchair user handbook.

State in the wheelchair user handbook that it is the responsibility of the person programming the controller to make sure that the settings are safe and to note any programming changes that they make.

Programming should only be conducted by healthcare professionals with in-depth knowledge of PGDT electronic controllers. Incorrect programming could result in an unsafe set-up of a wheelchair for the user. PG Drives Technology accepts no liability for losses of any kind if the programming of the controller is altered from factory pre-set values. PGDT accepts no liability for losses of any kind if the drive or stability characteristics of the chair are altered without prior notification and discussion with PGDT.

1.3 Soft-Stop

The newVSI has a programmable value called Soft Stop Rate which sets the emergency stopping distance. You must ensure that the emergency stopping distance is within the distance specified for the country in which the wheelchair will be used. TÜV Product Service (Germany) specify the distance to be as stated in EN12184.

1.4 Other Information

You must provide a diagram in the wheelchair user handbook showing the user controls and the main features of the controller.

In addition, you should include a brief specification of operating supply voltage range and operating temperature range.

2 Immobilizing the Wheelchair

2.1 Prevention of Unauthorized Use

TÜV requires that the wheelchair must have a means of preventing unauthorized use. This can be implemented electronically using the button and joystick sequence detailed in Chapter 1 section 3.2. This method of locking has been chosen to prevent problems arising from lost keys.

2.2 Charger Interlock

ISO 7176-14 requires you to provide a means of preventing the use of the wheelchair while the batteries are being charged. When a charger is connected to the charger port on the newVS, drive is inhibited until the charger is removed and power cycled.

The wheelchair manufacturer is responsible for providing a means of preventing the use of the wheelchair while the batteries are being charged. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

3 Connections

There are two generic connector configurations of the newVSI controller.

newVSI - Beau

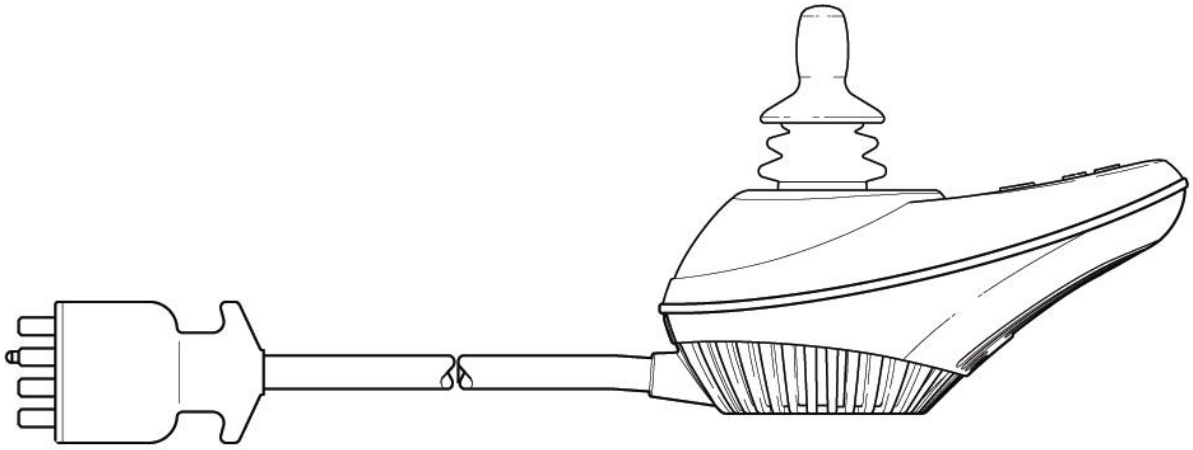
newVSI – Anderson

3.1 newVSI - Beau

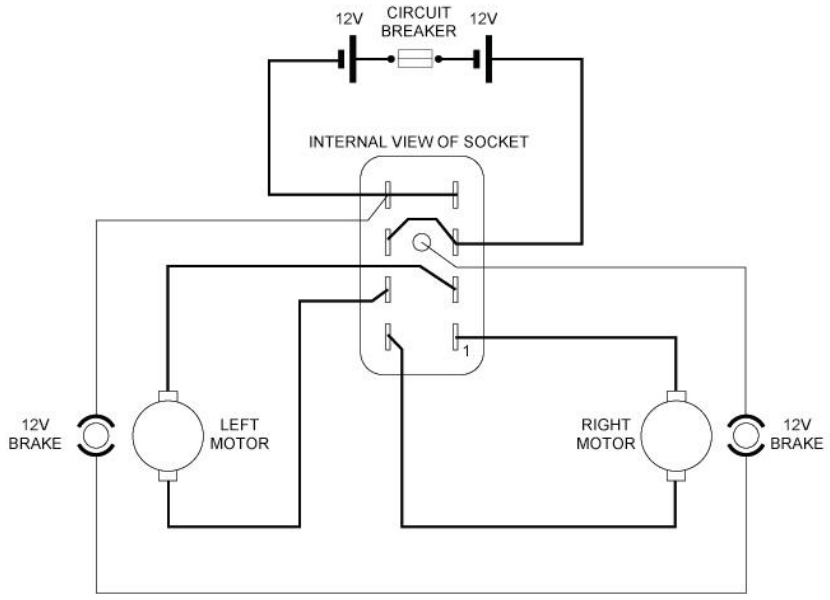
This configuration uses the industry standard 9 way Beau connector for battery, motor and brake connections.

Only use Beau part S9G-5409CCT (PG part 63.20.012) as the mating connector.

Refer to the following Illustration for connection details.
The Illustration shows 12V brakes connected in series. It is possible to use 24V brakes connected in parallel, refer to section 4.5.

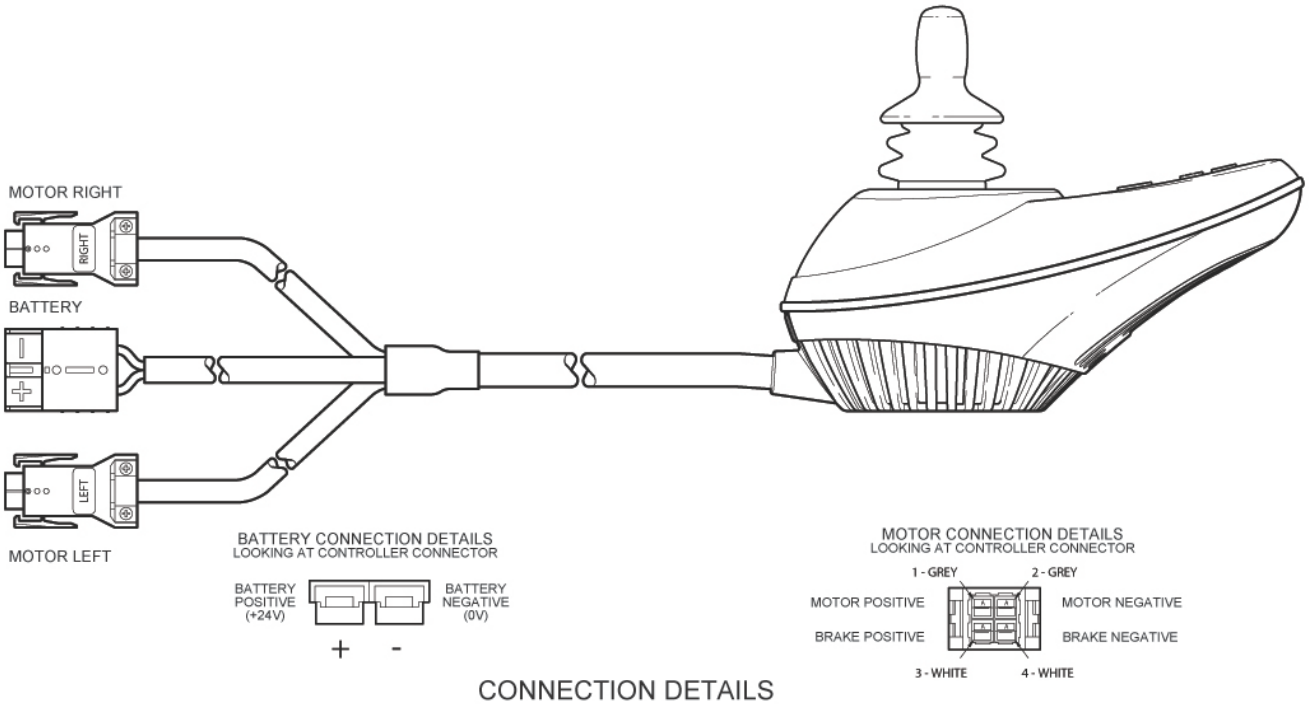


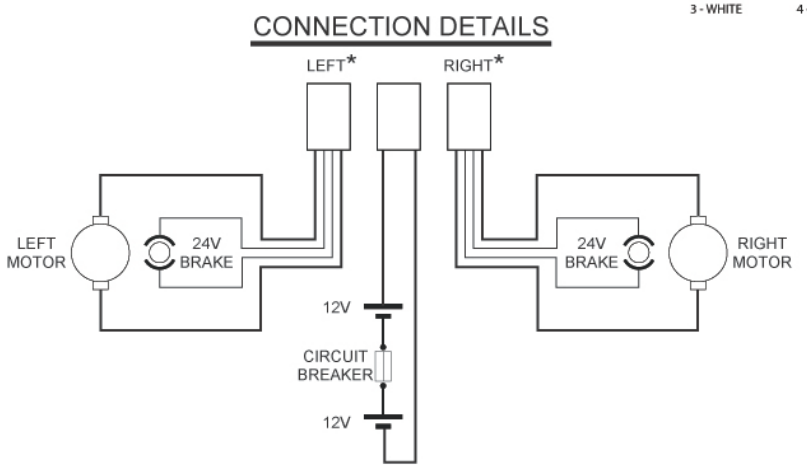
CONNECTION DETAILS



3.2 newVSI - Anderson

This configuration uses Anderson connectors for battery, motor and brake connections.





* Assumes no Motor Swap programming has been undertaken

Joystick Movement	Motor Left		Motor Right		Actual Movement	
	Motor +ve	Motor -ve	Motor +ve	Motor -ve		
Forward	+ve	-ve	+ve	-ve	Forward	**
Backward	-ve	+ve	-ve	+ve	Backward	**

** Assumes no Joystick Orientation, Invert M1 Direction or Invert M2 Direction programming has been undertaken

The connector kits can be purchased from PG Drives Technology directly

PGDT Reference	Connectors	Kit Contents
D50999	newVSI motor connector kit (Anderson)	Connector TC 030 30A power pole *4 Connector TC 015 15A power pole *4 Connector TC 030 white power pole HSG *4 Connector TC 030 grey power pole HSG *4 Power pole pack TP 4F without latch *2
D51096	newVSI battery connector kit (Anderson)	SB50 Connector Black *1 6331 G4 Contacts *2

3.3 Crimping

Good quality crimping is essential in ensuring the long term reliability of the wheelchair's electrical system. Poor quality crimps may initially appear to be satisfactory but, over time, they may cause problems. It is recommended that crimp quality is maintained by implementing the procedures detailed in IEC-60352-2 1990.

Defective or poor quality crimps may affect the warranty of the controller. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Only use the exact parts specified in for the mating connectors.

The connectors can be purchased from PG Drives Technology or from Anderson directly.

Hand tools for crimping and extraction are available from Inconnect.

The references are as below.

Crimp tool for 0.5-1.0mm2 wire: ICT-249

Crimp tool for 2.5-4.0mm2 wire: ICT-531

Crimp tool for 4.0-6.0mm2 wire: ICT-532

Extraction tool for 0.5-1.0mm2: IET-503

Extraction tool for 2.5-6.0mm2: IET-552

4 Wiring

4.1 General

Study the data sheet for the controller to identify:

- The output current, ratings and restrictions
- The connector pin assignments

Recommendations for the cross-sectional area, ratings and materials for wiring are given in the table in section 4.2. These depend on the application. You are responsible for establishing the suitability of the particular wiring arrangement used on the wheelchair. PGDT can make general recommendations for wiring for newVSI controllers, but PGDT accepts no responsibility for the wiring arrangement used.

Make sure that the connectors you use are reliable under all operating conditions and correctly wired with no short circuits. Do not use unsuitable components - it may result in poor wheelchair reliability.

The chair manufacturer is responsible for establishing the suitability of the particular wiring arrangements used on the wheelchair for both normal use and stalled conditions. PGDT can make general recommendations for wiring for newVSI controllers, but PGDT accepts no responsibility for, and accepts no liability for losses of any kind arising from, the actual wiring arrangement used.

The chair manufacturer is responsible for ensuring that only the mating connectors specified by PGDT on the controller's specific data sheet are used to connect to the controller. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for ensuring that suitable connectors are used and securely mated throughout the chair wiring system and that the workmanship associated with the wiring system is of a high enough quality. Failure to meet this condition could result in intermittent operation, sudden stopping or veering, or even create a burn or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

4.2 Wire Gauge and Types

The table below gives the minimum recommended wire sizes defined in ISO7176: 2008.

Controller Current Limit (A)	Battery wire size (mm^2)		Motor Wiring size (mm^2)	
	For Length <1000mm	For length 1000mm - 1500mm	For Length <1000mm	For length 1000mm - 1500mm
30	2.5	3.0	2.5	2.5
40	3.0	4.0	2.5	3.0
50	4.0	5.0	3.0	4.0

Manufacturers must confirm these recommendations by carrying out suitable tests in particular the total length of cable used in wiring the wheelchairs' motors and batteries.

Battery and motor wires should use Tri-rated PVC equipment wire rated at 105°C.

4.3 Battery Wiring

The controller incorporates sophisticated current limiting circuitry as protection for the circuits in the controller.

ISO 7176-14 requires you to provide protection against short circuits in the battery wiring and the power loom in the extremely unlikely event of a short circuit in the controller.

Place a suitable circuit breaker in series with the battery supply (refer to sections 3.1 + 3.2), for example in the link between two batteries. If your batteries are held in separate enclosures, you must provide a circuit breaker with each of them.

The table below gives the minimum recommended circuit breaker sizes defined in ISO7176: 2008

Controller Current Limit (A)	Battery cut-out rating (A)
30	30
40	40
50	50

ISO 7176-14 states that the minimum operating time for the circuit breaker when the wheelchair is stalled is 15 seconds.

The chair manufacturer must install a suitable circuit breaker to provide protection against short circuits in the battery wiring, power loom or the controller. Failure to comply with this could result in a fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

4.4 Motor Wiring

In order to detect the disconnection of a motor while the wheelchair is in motion, the brake current must pass through the same connectors as the motor current, so that disconnection of either motor will interrupt the brake circuit and trip the controller. Refer also to section 4.5.

When the controller is starting up or standing by, it is able to detect a disconnected motor or a short circuit between a motor connection and either battery supply. With the TruCharge battery gauge, the number of flashes indicates the type of trip.

If circuit breakers are fitted in series with the motors, you must fit circuit breakers with auxiliary switches which will disconnect the brake circuit if either circuit breaker operates. In this way the controller can detect that the motor has been disconnected and stop the wheelchair. Should the motor be put into a stalled condition, the timed current foldback facility in the controller can also be used to offer some level of motor protection.

4.5 Solenoid Brake Wiring

The controller will be immobilized instantly if the brake current is less than approximately 100mA.

- The maximum continuous current is 1A.

4.5.1 newVSI Anderson

The newVSI (Anderson) can independently detect open circuit brake faults on either the left or right brake connections. This aids the diagnostic process. For details of the fault codes refer to chapter 4, section 3.

4.5.2 newVSI Beau

It is recommended that the wheelchair is fitted with two 12V brakes connected in series in order to detect the disconnection of one brake. It is possible to use two 24V brakes connected in parallel, however, disconnection of an individual brake may not be detected by the control system.

5 Drive Motors

The controller is designed to be connected to permanent magnet DC motors, fitted with suitable gearboxes and solenoid brakes.

In order to optimize the performance of the wheelchair, the controller must be matched to the motor terminal impedance. This matching is implemented by programming the controller. The parameter for adjustment is Motor Compensation. Refer to Chapter 3 for details.

The Motor Compensation value should be set in accordance with the armature resistance of the motor and all cables and connectors between the newVSI and the motor. The value is set in milli-Ohms. A recommended value is:

- 70% of the (armature resistance + cables and connectors)

Motor manufacturers should be able to supply figures for armature resistance and cable and connectors may typically be 40mOhms.

Example:

Motor has armature resistance of 200mOhms

Cables and connectors are 40mOhms

Set Motor Compensation to 0.7 x (200 + 40) = 170mOhms

Failure to match the controller with the motors may result in poor control characteristics.

If you have any doubts about the suitability of a particular motor type or you need advice on measuring motor impedance, contact PGDT.

The chair manufacturer is responsible for ensuring that the controller is matched to the motor resistance. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for always ensuring that any replacement motors or gearboxes are fully compatible with the originals that the controller was designed to match. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Users must not move a controller from one chair type to install it on a different chair type. controllers with different part numbers may have both hardware and software differences to ensure that they are compatible with the electrical and dynamic characteristics of their specific target vehicles. The characteristics of one type of controller may not be compatible with a different, unauthorized chair. Failure to observe this warning could result in an unsafe set-up for the wheelchair user and may create a fire hazard depending on the motors, wiring, connectors and circuit breakers installed on the unauthorized chair. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

6 Batteries

The controller is designed for operation with 24 V lead acid batteries. The batteries may be wet or gel electrolyte types.

Contact PGDT for advice on battery selection.

7 Battery Charging

All newVSI controllers have a battery charging socket mounted on their front face for connection to an off-board charger.

While the battery is being charged the newVSI's TruCharge display will continuously ripple or step upwards.

The maximum permissible charging current is 12A rms. Only chargers fitted with Neutrik NC3MX plugs should be connected into the newVSI controller. The pin connections of the socket are as below.

Pin	Connection
1	Battery Positive
2	Battery Negative
3	Inhibit

To prevent the wheelchair from driving while the charger is connected, pin 3 must be linked to pin 2 inside the charger's plug.

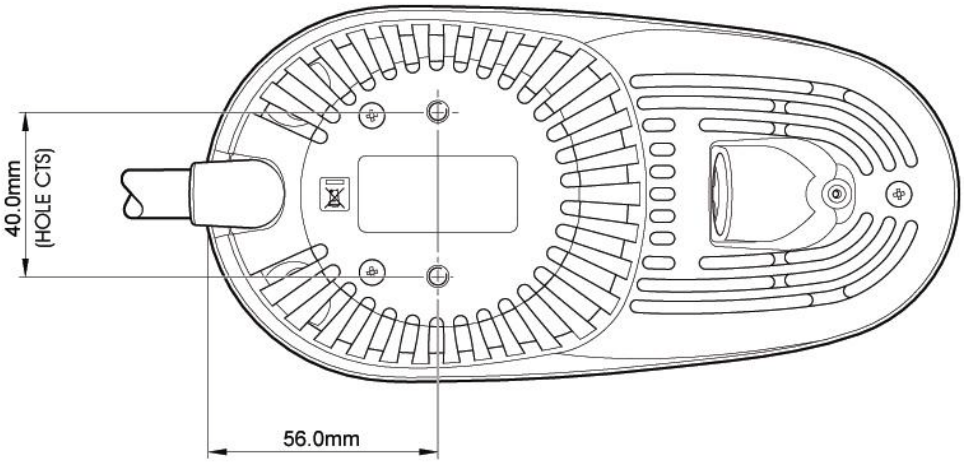
Do not exceed the maximum charging current of 12 A rms. Always use an off-board charger fitted with a Neutrik NC3MX plug. Failure to observe these conditions could result in poor contact resistance in the charger connector resulting in overheating of the charger plugs. This presents a potential burn hazard for the user. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the pin polarity shown on the controller's specific data sheet. Failure to observe this condition could result in a burn hazard or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Do not disconnect batteries or open-circuit the circuit breaker while charging is in progress. Failure to observe this condition could result in a burns hazard or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

8 Mounting

The Joystick Module should be secured using two M5 screws with a maximum penetration of 12mm. Be careful not to over-tighten the screws. See data sheet for further information.



8.1 Orientation

The controller is not sensitive to mounting orientation except where it is exposed to water or dust. In this situation the controller must be mounted with the joystick shaft pointing vertically upwards to maintain resistance to IPx4 as stated on the data sheet:

If you want to use any other mounting attitudes then contact PGDT for advice.

9 Production Tests

- Perform the following tests in order, for each wheelchair before dispatch.

These tests should be conducted in an open space and a restraining device such as a seat belt should always be used. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

9.1 Mounting

- Make sure that the controller is securely mounted. Do not over-tighten any securing screws.

9.2 Cables and Connectors

- Check all cables and connectors for damage. Make sure that all connectors are securely mated.

9.3 Joystick and Gaiter

- Check that the joystick is not bent or damaged.
- Check the thin rubber gaiter or boot, around the base of the joystick shaft, for damage or splitting. Check visually only, do not handle the gaiter.
- Check that the joystick returns to the center position when you push and release it.

9.4 Preset Settings

- Make sure that the controller is using the preset settings. Refer to the chapter 3 for detailed instructions.

Controllers are always supplied with the settings shown on the relevant data sheet.

9.5 Operational Test

This test should be carried out on a level floor with at least one meter clear space around the wheelchair.

- Switch on the controller.
- Check that the battery gauge remains on, or flashes slowly, after one second.
- Push the joystick slowly forwards until you hear the parking brakes operate. The chair may start to move.
- Immediately release the joystick. You must be able to hear each parking brake operate within a few seconds.
- Repeat the test a further three times, pushing the joystick slowly backwards, left and right.

9.6 Test Drive

- Drive the wheelchair and make sure that it operates correctly for all positions of the user controls.

9.7 Soft-Stop Test

- Drive the wheelchair at full forward speed and switch the controller off.
- The wheelchair must not stop suddenly, but should decelerate to standstill.

In addition, ensure that the requirements in section 1.3 of this chapter are satisfied.

10 Electromagnetic Compatibility (E.M.C.)

The newVSI controller has been tested for compliance with the EMC requirements of EN12184. The guidelines in this section will help you to make sure that your wheelchair installation will meet the requirements of the directive.

10.1 Emissions

A typical wheelchair and newVSI installation have been tested and have passed the requirements of EN55022 Class B.

Observe the following recommendations to minimize radio frequency emissions:

10.1.1 Motor Suppression

Solder a suitable suppression capacitor between the brush holders of each motor, inside the motor cases. Keep the lead length as short as possible. We recommend a value of 4n7F 250V AC ceramic. The maximum value you should use is 10nF. A typical type is Roderstein WY0472MCMCF0K.

For 4 pole motors, a capacitor should be fitted between each pair of brushes.

10.1.2 Cables

You do not need to use screened battery and motor looms, but:

- Keep the length of all wiring to a minimum.
- Make sure the loop area of the wiring is minimized. Route the positive and negative wires to each motor together.
- Route the battery positive and negative wires together. Where possible, route the battery and motor looms together.
- Secure the motor and battery looms to the wheelchair frame over as much of their length as is practical.

10.2 Immunity

The newVSI controller has been stringently tested for susceptibility to electromagnetic radiation over the frequency range 26 MHz to 1 GHz. The test was conducted on a typical wheelchair installation and passed the requirements of EN12184.

Follow the recommendations in section 12.1.2 to ensure maximum immunity to electromagnetic radiation.

11 Battery Gauge

For optimum accuracy of the battery gauge and low battery indicator, the controller should be programmed with the approximate nominal capacity of the wheelchair battery. However, accuracy is not greatly affected if the programmed type and capacity do not closely match the battery.

The most important factor affecting the accuracy of the battery gauge is the resistance of the cable and connections between the battery and the controller. The controller must be matched approximately to the cable resistance of your wheelchair to make the battery gauge accurate. The parameter for adjustment is Cable Resistance; refer to Chapter 3 for details on programming

As a guide, 2.5mm^2 cable has a resistance of about 8 milliohms per meter; 4mm^2 cable has about 5 milliohms per meter. Circuit breakers and connectors usually account for about 15 milliohms.

These values will be chosen at the time the controller is being specified by the wheelchair manufacturer. Like the preset acceleration rates, once the values for the battery are decided, they are programmed into controllers during manufacture and should never need changing.

- Controllers are set for a nominal 40amp hour battery and a 40milliohm cable resistance.

If you need advice, contact PGDT

CHAPTER 3 – PROGRAMMING

1 Introduction

This chapter gives an overview of the programmable parameters within the newVSI controller. The newVSI can be programmed with a PP1a handheld programmer, a DTT handheld programmer or a PG Drives Technology PC Programmer.

This chapter does not give details of how to make adjustments, for these details please refer to the relevant documentation for the programmer you are using.

Programming should only be conducted by healthcare professionals with in-depth knowledge of PGDT controllers. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. PGDT accept no responsibility for losses of any kind if the programming of the controller is altered from the factory pre-set values.

1.1 Handheld Programmers

The PP1a and DDT are hand-held units which can be plugged into your controller to alter the controller's programming. Your wheelchair distributor or service agent or wheelchair manufacturer will be able to program your controller for you.

The PP1a and the DTT handheld programmers are intended to give dealers and therapist access to the programmable parameters which can be used to adjust the wheelchair to an individual user. These parameters are:

- Acceleration
- Deceleration
- Turn Acceleration
- Turn Deceleration
- Forward Speed
- Reverse Speed
- Turning Speed
- Torque
- Tremor Damping
- Power
- Sleep Timer
- Joystick Throw
- Invert Joystick
- Steer Correct
- Bleep Volume
- Reverse Alarm
- Speed Adjust
- Profiles

The PP1a and DTT can also be used to read the System Log and Read Timers. For details of how to use the PP1a and DTT with the newVSI, read the appropriate user guide before you use it.

1.2 PC Programmer

There are three versions of the PC Programmer – one for dealers and therapist which gives the same access level as the PP1a handheld programmer, one for wheelchair OEMs which gives access to all standard newVSI controller parameters and one for use by OEM's on their production lines. These are known as Dealer, OEM and Manufacturing respectively.

For details of how to use these software packages with the newVSI, refer to the documentation supplied with the software.

1.3 Safety Fences

Limits (or fences) can be applied to some dealer accessible programmable parameters. These limits are known as safety fences and are programmed by PGDT when the controller is manufactured. The purpose of these fences is to prevent the wheelchair being programmed to be too fast, or too severe in its acceleration or deceleration. The parameters which can have fences applied to them are:

- Forward Speed
- Reverse Speed
- Turning Speed

Acceleration (forward and reverse combined)

Deceleration (forward and reverse combined)

Turn Acceleration (forward and reverse combined)

Turn Deceleration (forward and reverse combined)

Standard PGDT settings are 0 for the minimum fence value and 100 for the maximum fence value, meaning there is a full range of adjustment. If you wish to apply different fence values, please contact PGDT.

PGDT accepts no liability for losses of any kind if the chair manufacturer does not specify appropriate safety fence values for a particular scooter application.

1.4 Drive Profiles

The newVSI can operate with single or multiple drive profiles. A drive profile is a collection of programmable parameters comprising of Acceleration, Deceleration, Turn Acceleration, Turn Deceleration, Forward Speed, Reverse Speed, Turning Speed, Power, Torque and Tremor Damping. The number of drive profiles is determined by the programmable parameter, Number of Drive Profiles.

If the value of Number of Drive Profiles is 0, there is one setting for each of the parameters listed previously, and the controller's maximum speed setting can be changed with the maximum speed / profile increase and decrease buttons.

If the values of Number of Drive Profiles is 2 to 5, there is a corresponding number of drive profiles and each listed parameter can be individually set within a profile. The maximum speed /profile increase and decrease buttons are then used to switch between the available profiles.

Although a number of Drive Profiles can be set to one, the operation is the same as setting to 0 but without the ability to change maximum speed settings.

2 Programmable Parameters

The parameters have been separated into workable groups for easy referencing.

Speeds	**- Section 3**
Acceleration	Deceleration
Turn Acceleration	Turn Deceleration
Forward Speed	Reverse Speed
Turning Speed	Power
Number of Drive Profiles	Minimum Acceleration
Minimum Deceleration	Minimum Turn Acceleration
Minimum Turn Deceleration	

Operation	**- Section 4**
Sleep Timer	Joystick Throw
Invert Joystick	Steer Correct
Switch Bleep & Volume	Speed Adjustment while Driving
Service Timer	

Battery	**- Section 5**
Cable Resistance	Calibration Factor
Low Battery Alarm	Low Battery LED
Low Battery Cut Out	Low Battery Time
Output Voltage	

General	**- Section 6**
Fast Brake Rate	Soft Stop
Front Wheel Drive Rate	Soft Reverse Deceleration Rate
Reverse Driving Alarm	Brake Disconnected Alarm
Lock Function Enabled	Brake Fault Detect
Joystick Stationary Time	Joystick Stationary Range

Motor	**- Section 7**
Current Limit Max	Foldback Time & Level
Motor Compensation	Invert M1 Direction
Invert M2 Direction	Motor Swap
Torque	Tremor Damping

Memory Functions	**- Section 8**
Read System Log	Clear System Log
Read Timer	Clear Timer
Service Log	

3 Speed Parameters

3.1 Acceleration

Adjusts the value for forward and reverse acceleration of the wheelchair.

Adjustable in steps of 1 from 0 to 100.

A higher value gives faster acceleration. This programmed value of acceleration occurs when speed setting 5 is selected. Its value at other settings depends on the value of the Minimum Acceleration parameter.

3.2 Deceleration

Adjusts the value for forward and reverse deceleration (or braking) of the wheelchair.

Adjustable in steps of 1 from 0 to 100.

A higher value gives faster deceleration. This programmed value of deceleration occurs when speed setting 5 is selected. Its value at other settings depends on the value of the Min Deceleration parameter.

3.3 Turn Acceleration

Adjusts the value for turning acceleration of the wheelchair, from 0 to 100 in steps of 1. A higher value gives faster acceleration. This programmed value of acceleration occurs when speed setting 5 is selected. Its value at other settings depends on the value of the Minimum Turn Acceleration parameter.

3.4 Turn Deceleration

Adjusts the value for turning deceleration (or braking) of the wheelchair.

Adjustable in steps of 1 from 0 to 100.

A higher value gives faster deceleration. This programmed value of deceleration occurs when the controller has speed setting 5 selected. Its value at other settings depends on the value of the Minimum Turn Deceleration parameter.

3.5 Forward Speed

Adjusts the minimum and maximum values for forward speed of the wheelchair.

Adjustable in steps of 1% from 0 to 100%.

A higher value gives a faster speed. The minimum value occurs when speed setting 1 is selected, and the maximum value occurs at speed setting 5.

3.6 Reverse Speed

Adjusts the minimum and maximum values for reverse speed of the wheelchair.

Adjustable in steps of 1% from 0 to 100%.

A higher value gives a faster speed. The minimum value occurs when the speed setting 1 is selected, and the maximum value occurs at speed setting 5.

3.7 Turning Speed

Adjusts the minimum and maximum values for the turning speed of the wheelchair.

Adjustable in steps of 1% from 0 to 100%.

A higher value gives a faster speed. If 0 or 1 Drive Profile is selected, then the minimum value occurs when speed setting 1 is selected, and the maximum value occurs at speed setting 5.

3.8 Power

Sets the power of the wheelchair.

Adjustable in steps of 1% from 0 to 100%.

Power is the ability of a wheelchair to climb a hill or overcome an obstacle. If it is set to 100% then the wheelchair will provide full power. Values below 100% will result in reduced power.

A typical use is to minimise damage to doorways or furniture if the wheelchair is being used indoors. The values can be set independently between drive profiles, meaning separate indoor and outdoor profiles can be defined.

Example: newVSI is programmed to:

Current Limit Max. = 50 Amps

Power (Profile 1) = 50%

Power (Profile 2) = 25%

3.9 Number of Drive Profiles

Refer to section 1.4.

3.10 Minimum Acceleration

Adjusts the minimum value for forward and reverse acceleration of the wheelchair.

Adjustable in increments of 1% of the Acceleration value.

This percentage of the Acceleration value occurs when the newVSI speed setting is at it's minimum 1 bar illumination.

See following example.

Acceleration = 80 and Minimum Acceleration = 25%

Acceleration at step 1 = 25% of 80 = 20

Speed settings 2, 3 and 4 will interpolate linearly between 20 and 80

Acceleration at step 2 = 35

Acceleration at step 3 = 50

Acceleration at step 4 = 65

3.11 Minimum Deceleration

Adjusts the minimum value for forward and reverse deceleration of the wheelchair.

Adjustable in increments of 1% of the Deceleration value.

This percentage of the Deceleration value occurs when the newVSI speed setting is at it's minimum 1 bar illumination.

See following example.

Deceleration = 80 and Minimum Deceleration = 25%

Deceleration at step 1 = 25% of 80 = 20

Speed settings 2, 3 and 4 will interpolate linearly between 20 and 80

Deceleration at step 2 = 35

Deceleration at step 3 = 50

Deceleration at step 4 = 65

3.12 Minimum Turn Acceleration

Adjusts the minimum value for turning acceleration of the wheelchair.

Adjustable in increments of 1% of the Turn Acceleration value.

This percentage of the Turn Acceleration value occurs when the newVSI speed setting is at it's minimum 1 bar illumination.

See following example.

Turn Acceleration = 80 and Minimum Turn Acceleration = 25%

Turn Acceleration at step 1 = 25% of 80 = 20

Speed settings 2, 3 and 4 will interpolate linearly between 20 and 80

Turn Acceleration at step 2 = 35

Turn Acceleration at step 3 = 50

Turn Acceleration at step 4 = 65

3.13 Minimum Turn Deceleration

Adjusts the minimum value for turning deceleration of the wheelchair.

Adjustable in increments of 1% of the Turn Deceleration value.

This percentage of the Turn Deceleration value occurs when the newVSI speed setting is at it's minimum 1 bar illumination.

See following example.

Turn Deceleration = 80 and Minimum Turn Deceleration = 25%

Turn Deceleration at step 1 = 25% of 80 = 20

Speed settings 2, 3 and 4 will interpolate linearly between 20 and 80

Turn Deceleration at step 2 = 35

Turn Deceleration at step 3 = 50

Turn Deceleration at step 4 = 65

4 Operation Parameters

4.1 Sleep Timer

Sets the period of time after which the controller will go to sleep if the wheelchair is not driven.

The time can be set between 1 and 30 minutes in steps of 1 minute.

If the time is set to 0 the system will never go to sleep.

4.2 Joystick Throw

This allows you to program the controller so that full speed can be reached with a reduced joystick movement (throw). This is particularly useful for wheelchair users with limited hand or arm movement.

4.2 Invert Joystick

This parameter inverts the direction of travel when moving the joystick.

This parameter can be set to On or Off.

On Deflecting the joystick North will result in Reverse drive.

Off Deflecting the joystick North will result in Forward drive.

4.4 Steer Correct

This parameter compensates for any mismatching of motors to ensure that the wheelchair drives directly forward when the controller's joystick is being pushed directly forward.

It is normally set to zero but may be varied from -9 to +9 in increments of 1. If the chair is veering to the left, you should increase the setting. If the chair veers to the right, decrease the setting.

4.5 Switch Bleep Volume

Switch Bleep Volume sets the volume of the audible feedback given whenever a button on the newVSI is operated.

Adjustable between 0 and 10 in steps of 1.

The higher the value, the louder the audible feedback. When set to 0 there will be no audible feedback.

4.6 Speed Adjustment while Driving

This parameter sets whether the newVSI's speed/profile buttons are active while the wheelchair is being driven. The parameter can be set to on or off.

On Means the buttons are active while the wheelchair is being driven, so the user can make maximum speed setting adjustments (or select a different drive profile) while actually moving.

Off Means the buttons are not active while the wheelchair is being driven, so the joystick must be released and the wheelchair at rest before maximum speed setting adjustments (or different drive profile selections) can be made.

4.7 Service Timer

The service timer function is used to set the number of hours that need to elapse before the controller notifies the user that a new service is required.

The service timer can be programmed between 0hrs (off) and 10000 hours.

When the service timer is active the 5 LEDs in the battery gauge will flash 100ms on, 1 second off, for the first 20 seconds after the controller is switched On. The service reminder is reset by incrementing the Service Timer in the PC Programmer.

5 Battery Parameters

5.1 Cable Resistance

This parameter should be set to the total value of the electrical resistance of wires between the batteries and the newVSI body. This parameter ensures the TruCharge battery gauge gives an accurate reading under all driving conditions.

Adjustable between 0 and 255 mOhms in steps of 1 mOhms.

The value should take into account the electrical resistance in both the positive and negative connections.

The battery wires in the newVSI cable have a typical electrical resistance of 4.6mOhms/metre. Therefore, if the newVSI has a 1.2m cable, the Cable Resistance setting must be at least:

(1.2 x 4.6mOhms) x 2 = 11 mOhms.

To this value you must also add the resistance of the wheelchair wiring between the batteries and the newVSI connectors.

5.2 Calibration Factor

This allows further fine calibration of the TruCharge battery gauge.

This is normally set at the factory and should not need further adjustment.

5.3 Low Battery Alarm

This parameter sets whether the level newVSI will signal a low battery condition.

O = Off,

1= Red LED flashing,

2= Red LED steady.

3= 1 Red and 1 Yellow LED

4= 1 Red and 2 Yellow LED

5=1 Red, 2 Yellow and 1 Green LED

The audible alarm will sound if the newVSI is programmed between 1-5.

5.4 Low Battery LED

This parameter allows users to change the color of the first LED in the TruCharge display.

The programmable options are Red or Yellow.

This programmable option enables the controller to comply with GB9706.01 1995 section 6.7. Compliance with this standard is required in some instances to sell product into China.

5.5 Low Voltage Cut Out

This parameters sets the battery voltage threshold that must be read for the period set by Low Voltage Time before the controller ceases to operate.

This parameter is programmable between 16V and 22V in steps of 0.5V.

5.6 Low Voltage Time

This parameters sets the time the controller must read the low voltage cut before the controller ceases to operate.

This parameter is programmable between 1 and 255 seconds

5.7 Output Voltage

This sets the value of voltage applied to the motors when the joystick is fully deflected and the relevant speed, forward or reverse, is set to 100%. This feature allows you to choose a motor voltage value such that the wheelchair's top speed will remain constant all the time the battery voltage is above that value.

This value can be set between 20 and 25V in steps of 0.5V.

6 General Parameters

6.1 Fast Brake Rate

Adjusts the deceleration rate used while fast braking. Fast braking is when the joystick is pulled to the reverse position to make a faster stop.

Adjustable between 1 and 200 in steps of 1.

If this value is set lower than the Deceleration value, then the latter value will be used for fast braking.

6.2 Soft Stop Rate

Adjusts the deceleration rate that is used while the wheelchair is soft-stopping. Soft-stopping happens if the newVSI is switched off while the wheelchair is being driven.

Adjustable between 0 and 200 in steps of 1.

6.3 Front Wheel Drive Rate

Front Wheel Drive Rate adjusts the driving characteristics of the newVSI to suit a wide range of front wheel drive wheelchairs.

Adjustable between 1 and 100 in steps of 1.

Increasing this value means that the newVSI's software is more suitable for higher speed front wheel drive wheelchairs.

6.4 Soft Reverse Deceleration

Adjusts the deceleration rate used while the wheelchair is stopping in reverse. This rate is separately adjustable from the Deceleration parameter, to prevent the wheelchair tipping when reversing down a gradient.

Adjustable between 25 to 100% in steps of 1%.

The value is a percentage of the Deceleration parameter.

A typical value is 70%.

6.5 Reverse Driving Alarm

Sets whether the newVSI gives an audible warning while driving in reverse. The parameter can be set to on or off.

On Means there is an audible alarm given.

Off Means there will be no audible alarm.

6.6 Brake Disconnected Alarm

Sets whether the newVSI gives an audible warning while the wheelchairs electrical brakes are disconnected. The parameter can be set to on or off.

On Means there is an audible alarm given.

Off Means there will be no audible alarm.

6.7 Lock Function Enabled

Sets whether the newVSI's locking sequence can be used to prevent the wheelchair being driven by unauthorized persons. The parameter can be set to on or off.

On Means the Lock function is available.

Off Means the Lock function is not available.

6.8 Brake Fault Detect

Sets whether the newVSI detects a fault in the wheelchair's electrical brakes or the connections to them. The parameter can be set to on or off.

On Means the newVSI will detect brake faults.

Off Means the newVSI will not detect brake faults.

This parameter should only ever be set to off if there are no electrical brakes fitted to the wheelchair.

6.9 Joystick Stationary Time

If the joystick is held in a deflected position i.e. away from center for a period of time exceeding this value, it is assumed the deflection is accidental and drive to the motors will be cut. The programmable range is 0-60 minutes in steps of 1 minute. A value of 0 disables this function.

It is not normally necessary to adjust this parameter.

The value of Joystick Stationary Time has been selected by the wheelchair manufacturer in order to minimize the risk of motor damage. Do not adjust these values without consulting the wheelchair manufacturer. PGDT accept no liability for losses of any kind resulting from the adjustment of these parameters.

6.10 Joystick Stationary Range

This sets the window within the joystick is considered to be stationary. It the joystick moves by more than this value, the timer is reset.

It is not normally necessary to adjust this parameter.

The value of Joystick Stationary Range has been selected by the wheelchair manufacturer in order to minimize the risk of motor damage. Do not adjust these values without consulting the wheelchair manufacturer. PGDT accept no liability for losses of any kind resulting from the adjustment of these parameters.

7 Motor Parameters

7.1 Current Limit Max.

This parameter sets the long term current output of the newVSI it is programmable between 20-50A in steps of 1Amp.

7.2 Current Foldback Threshold, Current Foldback Time and Current Foldback Level

These parameters can be used to protect the wheelchair motors from overheating. These parameters are closely related so are dealt with in one section.

Current Foldback Time sets the period of time, which if exceeded will initiate a reduction in the maximum current output. This parameter is programmable between 1-250 seconds in steps of 1 second.

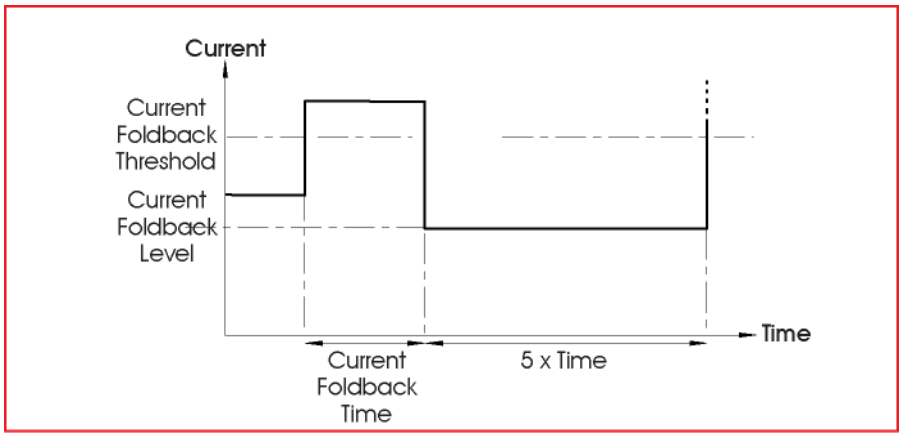
Current Foldback Level sets the level of current reduction as a percentage of the Maximum Current Limit. This parameter is programmable between 25%-100% in steps of 1%.

Current Foldback Threshold sets the current threshold at which the timer starts to run. This parameter is programmable between 20A and Current Limit Max. in steps of 1A

Example:

The parameters Time and Level can be used to protect the motors from overheating. If the motor current exceeds the value set by Threshold for a period set by Time, then the newVSI's current output will be reduced to a value set by Level.

After a fixed reset period of 5 x Current Foldback Time, the current output will be allowed to return to the full current, if demanded. This reset period is to allow the motor(s) sufficient time to cool.



Settings: newVSI is programmed to:

Current Limit Max. = 50 Amps

Current Foldback Threshold = 40 Amps

Current Foldback Time = 15 Seconds

Current Foldback Level = 25%

This is useful for protecting motors against potential damage when the wheelchair is being used on a long gradient. After 15 seconds the current output of the newVSI will reduce to 25% of 50A = 12.5A. After 5 x 15s = 75s, the current output will return to 50A.

If no timed foldback is required, simply set Current Foldback Level to 100%.

7.2 Motor Compensation

This matches the newVSI to suit different motor types in order to achieve optimal performance and drive control. This value should be set in accordance with the armature resistance of the motor and all cables and connectors between the newVSI and the motor. The value is set in milli-Ohms (mOhms). A recommended value is:

- **70% of the (armature resistance + cables and connectors)**

Motor manufacturers should be able to supply figures for armature resistance and cable and connectors may typically be 40mOhms.

Example: Motor has armature resistance of 200mOhms

Cables and connectors are 40mOhms

Set Motor Compensation to 0.7 x (200 + 40) = 170mOhms

Never exceed the 70% relationship described above.

The chair manufacturer is responsible for ensuring that the controller is matched to the motor resistance. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for always ensuring that any replacement motors or gearboxes are fully compatible with the originals that the controller was designed to match. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Users must not move a controller from one chair type to install it on a different chair type. controllers with different part numbers may have both hardware and software differences to ensure that they are compatible with the electrical and dynamic characteristics of their specific

target vehicles. The characteristics of one type of controller may not be compatible with a different, unauthorized chair. Failure to observe this warning could result in an unsafe set-up for the wheelchair user and may create a fire hazard depending on the motors, wiring, connectors and circuit breakers installed on the unauthorized chair. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

7.3 Invert MI Direction

This inverts the direction of rotation of motor channel M1. M1 relates to the left motor channel. The parameter can be set to on or off.

On Means the motor output, M1, will be inverted.

Off Means the motor will rotate in the normal direction.

7.4 Invert M2 Direction

This inverts the direction of rotation of motor channel M2. M2 relates to the right motor channel. The parameter can be set to on or off.

On Means the motor output, M2, will be inverted.

Off Means the motor will rotate in the normal direction.

7.5 Motor Swap

This swaps the motor output channels of the newVSI. I.e. left becomes right and right becomes left. The parameter can be set to on or off.

On Means the motor outputs will be swapped.

Off Means the motor outputs will not be swapped.

7.6 Torque

The Torque parameter boosts the current to the motors at low speed settings. If the motor is stalled, for example, the wheelchair is stuck against an obstacle, such as a door threshold; then this will be automatically detected and the current to the motors will be increased, allowing the obstacle to be overcome.

Torque can be set between 0% and 100%

A value of 0% means the Torque parameter has no effect. Higher values mean that more current will be permitted in the described stall conditions.

Ensure that the motor compensation is set correctly for the chair, torque does not counter the effects of incorrect compensation settings.

The higher the Torque setting the more responsive the chair becomes to joystick commands. If set too high, the chair can have a jerky or jumpy feel.

7.7 Tremor Damping

This parameter allows the effects of hand tremor to be reduced. If the user has a condition that results in hand tremor, then increasing the value of Tremor Damping will reduce the effect of the tremor, making the wheelchair more controllable.

Tremor Damping can be set between 0% and 100%

A value of 0% means Tremor Damping has no effect. Note, even at this value, there is inherent damping in the controller. Higher values apply a higher level of damping.

The higher Tremor Damping is set the slower joystick response will become.

When setting Tremor Damping, pay particular attention to stopping distances. As the parameter dampens the response to the joystick commands, stopping distance can be affected. To stop the wheelchair with Tremor Damping activated you must release the joystick and allow it to center. It is the responsibility of the wheelchair manufacturer to ensure requirements on stopping distances are adhered to.

8 Memory Functions

The newVSI has a timer and a diagnostic log. These can be read and cleared using the PP1a Programmer, the DTT Programmer or the PC Programmer.

8.1 Read Timer

The newVSI has a timer which records how long the wheelchair is in use. The timer runs whenever the joystick is moved away from the center position, and stops when the joystick is released. The timer records the number of hours the wheelchair has been in use.

8.2 Clear Timer

This function resets the newVSI's timer. This function is only present in the OEM and Manufacturing versions of the PC Programmer.

8.3 Read System Log

The newVSI has a diagnostic log facility which stores the number of occurrences of the last eight detected system problems. This allows you to view the contents.

8.4 Erase System Log

This function clears the newVSI's diagnostic log. This function is only present in the OEM and Manufacturing level PC Programmers.

8.5 Service Log

This records the actual number of hours that the wheelchair was in use before a service was undertaken. The record is made each time the Service Timer is programmed to the next service interval. An example is given below.

The first service interval is set for 1000-hours, i.e. Service Timer = 1000h. However, the service is actually conducted at 1050-hours. After this service, the Service Timer is set for the next service interval and it is at this point that 1050h will be written to the Service Log.

This facility allows a wheelchair OEM or service agent to determine if the required service routine has been carried out.

CHAPTER 4 – DIAGNOSTICS

1 Introduction

The primary objective of this section is to assist service personnel in finding the likely area of a detected fault within the whole wheelchair electrical system. It is important to realize that even though the controller is signaling a fault, it may not be the controller itself that is defective. This is because the controller is able to detect problems in other electrical components (motors, batteries, solenoid brakes etc.) or, more importantly, the wiring to them. When a controller has detected a fault a system trip is indicated.

Using this guide, it is possible to define a trip as belonging to one of 10 types. Once this type has been established, there are suggestions as to what the possible cause may be.

The guide should only be used to decide the starting point of your own diagnosis, as it is possible for the controller to indicate a fault in another component even though the controller itself may be defective. Nevertheless, experience has shown that connectors and wiring are the major cause of wheelchair electrical problems, so it is necessary to examine these more vulnerable areas first.

Diagnostics should only be conducted by healthcare professionals with in-depth knowledge of PGDT electronic controllers. An incorrect or badly effected repair could result in an unsafe set-up of a wheelchair. PGDT accept no liability for losses of any kind arising from an incorrect or badly effected repair.

2 Diagnostics

2.1 Diagnostics Process

For efficient and effective diagnosis the following basic steps should be taken.

- Establish the type of controller fitted to the wheelchair.
- Confirm there is a trip, or has been an intermittent trip.
- Establish the trip type.
- Refer to the trip table.
- Refer to the possible cause as indicated by the trip table, and carry out recommended investigative and corrective action.

2.2 Detecting a Trip has occurred

Firstly observe the controller's battery gauge. This will behave as described in one of the following sections.

2.2.1 All 5 LEDs in the battery display are flashing.

The controller is tripped.

- Connecting a programmer to the controller while this is happening will give you a trip code.
- To determine the trip type, refer to section 3.

2.2.2 First LED flashing slowly

No trip is currently detected by the controller. The slow flash is an indication that the batteries require charging.

- A trip may have occurred previously, read the controller's diagnostic log, then refer to section 3 to establish the trip type.

2.2.3 Display is steady

No trip is currently detected by the controller.

- A trip may have occurred previously, read the controller's diagnostic log, then refer to section 3 to establish the trip type.

2.2.4 Display does not illuminate

No power is reaching the controller.

- Ensure the batteries are fully charged and that all connections between batteries and the controller are made.
- If these connections are good, then the controller may be defective, refer to Section 5.

2.3 Other conditions

This covers conditions that are not displayed as trip codes or on the battery gauge. This may be because: either the controller cannot switch on; the condition is not considered critical enough to force a trip or the controller cannot detect the condition.

2.3.1 Controller will not switch on

- Check the battery connections to the controller. If these appear to be good, then the controller may be defective, refer to section 5.
- Check the cable from the controller. If this appears to be good, then the controller may be defective, refer to section 5.

2.3.2 Wheelchair drives slowly

This could be caused by one of the following.

- The controller has been incorrectly programmed.
- Defective motor or defective brake.

2.3.3 Wheelchair will not drive in a straight line

This could be caused by a defective motor or defective brake.

2.3.4 One motor or brake becomes very warm

This could be caused by a defective motor or defective brake.

2.3.5 Batteries discharge very quickly

The batteries can discharge very quickly for several reasons, these are described below.

- Worn or damaged batteries – check battery condition.
- Charger defective or incorrect charger being used – check charger operation (refer to wheelchair's operating manual).
- Incorrect batteries being used – refer to wheelchair manufacturer's instructions for correct battery types.
- One motor or brake jamming.

The ambient temperature has a significant effect on battery capacity. Therefore, if the temperature is lower than normal the wheelchair's range will be reduced. In this situation, the battery gauge still gives an accurate state-of-charge reading.

2.4 Trip Diagnosis

There are two methods of trip diagnosis.

2.4.1 Trip diagnosis with the battery gauge

The battery gauge Flash Codes are illustrated in Chapter 1 Section 8.

2.4.2 Using a programmer to read the trip code

If you connect a programmer while the battery gauge is flashing, then a four digit trip code will be displayed. Refer to the trip code table in section 3.

You must connect the programmer to the controller after the battery gauge has started flashing. If the programmer is already connected when the flashing commences the trip code will not be displayed.

3 Trip Types and Their Possible Causes

Once the trip type has been established, refer to the relevant section below for further information.

Trip Code	Trip Type	Description & Reference
0A00	-	Controller in Sleep Mode - 3.13
1320	-	Timed Foldback Active - 3.12
1D05	7	JS Time Exceeded - 3.7
1500	9	Solenoid Brake Trip - 3.9
1505	9	Left Solenoid Brake Trip - 3.9
1506	9	Right Solenoid Brake Trip - 3.9
1600	10	High Battery Voltage - 3.10
2C00	1	Low Battery Voltage - 3.1
2C02	-	Low Battery Lockout - 3.1
2F00	User	Refer to sections 3.7 & 3.11
3B00	2	Left Motor Disconnected – 3.2

Trip Code	Trip Type	Description & Reference
3C00	4	Right Motor Disconnected – 3.4
3D00	3	Left Motor Wiring Trip – 3.3
3D01	3	Left Motor Wiring Trip – 3.3
3E00	5	Right Motor Wiring Trip – 3.5
3E01	5	Right Motor Wiring Trip – 3.5
4401	8	Control System Trip – 3.8
7100	7	Joystick Trip – 3.7
7821	-	Thermal Foldback Active – 3.14
7825	-	Thermal Foldback Active – 3.14
All Other Codes	7 or 8	Possible controller Trip (3.7, 3.8 & 3.14)

3.1 Trip Type 1 - Low Battery Voltage

This occurs when the controller detects that the battery voltage has fallen below 16V. Check the condition of the batteries and the connections to the controller.

If the trip is still present after the batteries and connections have been checked, then the Power Module may be defective. Refer to section 5.

In the case of 2C02 the controller is making a log of the number of times the Low Battery Lockout has been initiated.

3.2 Trip Type 2 – Left Motor Disconnected

This occurs when the controller detects that the left motor has become disconnected. Check the left motor, motor connectors and wiring.

If the trip is still present after the above checks have been made, then the controller may be defective. Refer to Section 5.

3.3 Trip Type 3 – Left Motor Wiring Trip

This occurs when the controller detects a fault in the wiring to the left motor, in particular if a motor connection has short-circuited to a battery connection. Check the left motor connectors and wiring.

If the trip is still present after the above checks have been made, then the controller may be defective. Refer to Section 5.

3.4 Trip Type 4 – Right Motor Disconnected

This occurs when the controller detects that the right motor has become disconnected. Check the right motor, motor connectors and wiring.

If the trip is still present after the above checks have been made, then the controller may be defective. Refer to Section 5.

3.5 Trip Type 5 - Right Motor Wiring Trip

This occurs when the controller detects a fault in the wiring to the right motor, in particular if a motor connection has short-circuited to a battery connection. Check the right motor connectors and wiring.

If the trip is still present after the above checks have been made, then the controller may be defective. Refer to Section 5.

3.6 Trip Type 6 – Not Used

3.7 Trip Type 7 – Possible Joystick Trip

This occurs if the controller detects a problem within its own joystick. The joystick can only be replaced by a person authorized by the wheelchair manufacturer.

1D05 - Joystick Stationary Time Exceeded

This occurs when the joystick has been held stationary for an excessive period of time. The controller will stop drive to prevent possible damage to the wheelchair's motors.

Turning the controller Off and On again will clear this error message.

7100 - Possible Joystick Trip

If you have authorization check the joystick ribbon cable, connections and mating sockets.

If the trip is still present after the appropriate checks have been made then the controller may be defective. Refer to Section 5.

3.8 Trip Type 8 - Possible controller Trip

This occurs if the controller detects a problem within itself. The controller can only be repaired by an authorized person. Refer to Section 5.

3.9 Trip Type 9 - Solenoid Brake Trip

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

1500 - Brake Short

1505 - Left Brake Trip

1506 - Right Brake Trip

Check these connections and the solenoid brakes.

If the trip is still present after the above checks have been made, then the controller may be defective. Refer to Section 5.

3.10 Trip Type 10 - High Battery Voltage

This occurs when the controller detects that the battery voltage has risen above 35V. The most common reasons for this are overcharging of the battery or bad connections between the controller and the batteries. Check the batteries and the connections to them.

If the trip is still present after the batteries and connections have been checked, then the controller may be defective. Refer to Section 5.

3.11 Joystick Displaced at Power-up

The most common cause of this trip is if the joystick is deflected away from center when the controller is being switched on. When the controller is switched on, the battery gauge will blink for a short time. Check that the user is not deflecting the joystick before the blink finishes.

If the problem persists, refer to section 3.7.

3.12 Timed Foldback Active

This occurs when the controller is in 'Timed Foldback, i.e. the current has been reduced in order to protect the motors.

Check the motors are in good condition and are allowed to rotate freely. In particular, check the brakes are releasing fully.

3.13 Controller in Sleep Mode

This condition is indicated by the Status Indicator "blinking on" once every 2.5 seconds. It is not a trip condition, but an indication that the controller has gone to sleep.

To awake the system, switch off and on again.

3.14 High Temperature

This occurs when the controller is in 'Thermal Foldback, i.e. the current has been reduced in order to protect the controller. There are two trip codes associated with this condition.

7821 – The current has been reduced.

7825 – The current has been cut completely

Check the motors are in good condition and are allowed to rotate freely. In particular, check the brakes are releasing fully.

4 Basic Tests

After a repair has been completed, the following tests should be carried out. These are minimum recommendations, depending on the nature of the original trip, additional tests may be required.

These tests are a minimum recommendation only. It is the responsibility of the service person(s) to perform other tests relevant to the original trip and wheelchair type. Refer to the wheelchair's Technical Manual for exact information of other tests. PGDT accept no liability for losses of any kind arising from failure to carry out of the described tests, or from not carrying out additional relevant tests.

These tests should be conducted in an open space and a restraining device such as a seat belt should always be used. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

4.1 General Inspection

Make sure all connectors are securely mated.

- Check the condition of all cables and connectors for damage.
- Check the thin rubber gaiter or boot around the base of the joystick shaft for damage. Check visually only, do not handle the gaiter.
- Make sure that all components of the controller are securely mounted.
- Do not over-tighten any securing screws.

4.2 Brake Test

These tests should be carried out on a level floor with at least one meter clear space around the wheelchair.

- Switch on the controller.
- Check the TruCharge display remains on, or flashes slowly, after one second.
- Push the joystick slowly forwards until you hear the parking brakes operate. The wheelchair may start to move.
- Immediately release the joystick. You must be able to hear each parking brake operate within 2 seconds.
- Repeat the test a further three times, pushing the joystick slowly backwards, left and right.

4.3 Drive Test

With the maximum speed control in the minimum position, drive the wheelchair in all directions, ensuring the drive is comfortable and easy to control for the user.

Repeat the above but with the speed control set to maximum.

4.4 Gradient Test

Before carrying out this test ensure another person is present to prevent the wheelchair from tipping backwards.

Drive the wheelchair forwards up its maximum rated gradient. While on the gradient release the joystick and ensure the wheelchair comes to rest and the brakes are applied without the front wheels lifting of the ground.

Deflect the joystick forwards and continue driving up the slope. Ensure the pick up is smooth and positive.

Stop the wheelchair and reverse down the gradient. While on the gradient release the joystick and ensure the wheelchair comes to rest and the brakes are applied without the front wheels lifting of the ground.

5 Servicing of Defective Units

There are no serviceable parts, in any of the PGDT controllers. Consequently, any defective units must be returned to PGDT or a PGDT approved service organization for repair.

Any replacement work carried out without the wheelchair manufacturer's permission will invalidate the controller's warranty.

Opening or making any unauthorized adjustments or modifications to a controller or its components will invalidate any warranty and may result in hazards to the vehicle user, and is strictly forbidden.

PGDT accept no liability for losses of any kind arising from unauthorized opening, adjustments or modifications to a any component of a controller.

CHAPTER 5 – WARNING SUMMARY

1 Introduction

This section summarizes all of the very important warnings that appear throughout the text of this manual. Do not install, maintain or operate the newVSI controller without reading, understanding and observing the following warnings. Failure to observe these warnings could result in UNSAFE CONDITIONS for the user of a wheelchair or affect the reliability of the controller. PG Drives Technology accepts no liability for losses of any kind arising from failure to comply with any of the conditions in the warnings listed below. Failure to observe these warnings will invalidate the newVSI warranty.

The wheelchair manufacturer may wish to use this section as a checklist, to ensure the risk areas identified below have been addressed within their own wheelchair designs and associated documentation.

2 Warnings

2.1 Cleaning

Do not operate the controller if the vehicle behaves erratically, or shows abnormal signs of heating, sparks or smoke. Turn the controller off at once and consult a local service agent. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 2.3.

2.2 Heat Shield

On no account should the wheelchair be operated if the heat shield is damaged or removed. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 2.4.

2.3 Precautions for Use

In the event of the wheelchair moving in an unexpected way RELEASE THE JOYSTICK. This action will remove drive and power to the electro-magnetic brakes. Chapter 1 Section 6.

2.4 Hazards

Although the newVSI controller is designed to be extremely reliable and each unit is rigorously tested during manufacture, the possibility of a system malfunction always exists (however small the probability). Under some conditions of system malfunction the controller must (for safety reasons) stop the chair instantaneously. If there is any possibility of the user falling out of the chair as a result of a sudden braking action, it is imperative that a restraining device such as a seat belt is supplied with the wheelchair and that it is in use at all times when the wheelchair is in motion. PGDT accept no liability for losses of any kind arising from the unexpected stopping of the wheelchair, or from the improper use of the wheelchair or controller.

Do not operate the controller if the chair behaves erratically, or shows abnormal signs of heating, sparks or smoke. Turn the controller off at once and consult your service agent. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Electronic equipment can be affected by Electro Magnetic Interference (EMI). Such interference may be generated by radio stations, TV stations, other radio transmitters and cellular phones. If the chair exhibits erratic behavior due to EMI, turn the controller off immediately and consult your service agent. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

It is the responsibility of the chair manufacturer to ensure that the wheelchair complies with appropriate National and International E.M.C legislation. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 6.1.

2.5 Battery Charging

Do not exceed the maximum charging current of 12 Arms. Always use an off-board charger fitted with a Neutrik NC3MX plug. Failure to observe these conditions could result in poor contact resistance in the charger connector resulting in overheating of the charger plugs. This presents a potential burn hazard for the user. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the pin polarity shown on the controller's specific data sheet. Failure to observe this condition could result in a burn hazard or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Do not disconnect batteries or open-circuit the circuit breaker while charging is in progress. Failure to observe this condition could result in a burns hazard or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Only use the battery charger that has been supplied with your wheelchair. The use of incorrect chargers could damage the batteries, wheelchair, controller or charger itself, or may result in parts overheating creating the potential for burns or even fire. PGDT accepts no liability for losses of any kind if the charger is incompatible with the controller (see Chapter 2, sections 7.1 and 7.2) or any other part of the wheelchair system.. Chapter 1 Section 10.

2.6 Programming

Programming should only be conducted by healthcare professionals with in-depth knowledge of PGDT electronic controllers. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. PGDT accepts no liability for losses of any kind if the programming of the controller is altered from factory pre-set values. Chapter 1 Section 11.

2.7 Joystick Knobs

Do not replace the joystick knob with any unauthorized item It may cause hazardous operation. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 12.

2.8 Servicing

PGDT accept no liability for losses of any kind arising from unauthorized opening, adjustment or modifications to the newVSI controller.

If the controller is damaged in any way, or if internal damage may have occurred through impact or dropping, have the product checked by qualified personnel before operating. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 1 Section 13.

2.9 Warranty

The warranty will be void if the newVSI has not been used in accordance with newVSI Technical Manual SK80151, the newVSI has been subject to misuse or abuse, or if the newVSI has been modified or repaired by unauthorized persons. Chapter 1 Section 14.

2.10 Program Settings

It is the manufacturers responsibility to program the controller to suit the vehicle model and ensure safe operation in compliance with relevant legal requirements over the whole of the operating range. PGDT accepts no liability for losses of any kind due to incorrect programming of the newVSI controller. Refer to Chapter 3 for Programming details.

Programming should only be conducted by healthcare professionals with in-depth knowledge of PGDT electronic controllers. Incorrect programming could result in an unsafe set-up of a wheelchair for the user. PG Drives Technology accepts no liability for losses of any kind if the programming of the controller is altered from factory pre-set values. PGDT accepts no liability for losses of any kind if the drive or stability characteristics of the chair are altered without prior notification and discussion with PGDT. Chapter 2 Section 1.2.

2.11 Charger Interlock

The chair manufacturer is responsible for providing a means of preventing the use of the wheelchair while the batteries are being charged. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 2.2.

2.12 Wiring

The chair manufacturer is responsible for establishing the suitability of the particular wiring arrangements used on the wheelchair for both normal use and stalled conditions. PGDT can make general recommendations for wiring for newVSI controllers, but PGDT accepts no responsibility for, and accepts no liability for losses of any kind arising from, the actual wiring arrangement used.

The chair manufacturer is responsible for ensuring that only the mating connectors specified by PGDT on the controller's specific data sheet are used to connect to the controller. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for ensuring that suitable connectors are used and securely mated throughout the chair wiring system and that the workmanship associated with the wiring system is of a high enough quality. Failure to meet this condition could result in intermittent operation, sudden stopping or veering, or even create a burn or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 4.1.

2.13 Battery Wiring

The chair manufacturer must install a suitable circuit breaker to provide protection against short circuits in the battery wiring, power loom or the controller. Failure to comply with this could result in a fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 4.3.

2.14 Drive Motors

The chair manufacturer is responsible for ensuring that the controller is matched to the motor resistance. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for always ensuring that any replacement motors or gearboxes are fully compatible with the originals that the controller was designed to match. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Users must not move a controller from one chair type to install it on a different chair type. controllers with different part numbers may have both hardware and software differences to ensure that they are compatible with the electrical and dynamic characteristics of their specific target vehicles. The characteristics of one type of controller may not be compatible with a different, unauthorized chair. Failure to observe this warning could result in an unsafe set-up for the wheelchair user and may create a fire hazard depending on the motors, wiring, connectors and circuit breakers installed on the unauthorized chair. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 5.

2.15 Battery Charging

Do not exceed the maximum charging current of 12 A rms. Always use an off-board charger fitted with a Neutrik NC3MX plug. Failure to observe these conditions could result in poor contact resistance in the charger connector resulting in overheating of the charger plugs. This presents a potential burn hazard for the user. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the pin polarity shown on the controller's specific data sheet. Failure to observe this condition could result in a burn hazard or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Do not disconnect batteries or open-circuit the circuit breaker while charging is in progress. Failure to observe this condition could result in a burns hazard or fire hazard. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 7.

2.16 Production Tests

These tests should be conducted in an open space and a restraining device such as a seat belt should always be used. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 9.

2.17 Programming Introduction

Programming should only be conducted by healthcare professionals with in-depth knowledge of PGDT controllers. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. PGDT accept no responsibility for losses of any kind if the programming of the controller is altered from the factory pre-set values. Chapter 3 Section 1.

2.18 Safety Fences

PGDT accepts no liability for losses of any kind if the chair manufacturer does not specify appropriate safety fence values for a particular vehicle application. Chapter 3 Section 2.1.

2.19 Joystick Stationary Time & Joystick Stationary Range

The values of both these parameters have been selected by the wheelchair manufacturer in order to minimise the risk of motor damage. Do not adjust these values without consulting the wheelchair manufacturer. PGDT accept no liability for losses of any kind resulting from the adjustment of these parameters. Chapter 3 Section 6.9 & 6.10

2.20 Motor Compensation

Never exceed the 70% relationship described above.

The chair manufacturer is responsible for ensuring that the controller is matched to the motor resistance. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The chair manufacturer is responsible for always ensuring that any replacement motors or gearboxes are fully compatible with the originals that the controller was designed to match. Failure to do this may result in poor control characteristics, which in extreme instances can make a chair uncontrollable and potentially unsafe. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

Users must not move a controller from one chair type to install it on a different chair type. controllers with different part numbers may have both hardware and software differences to ensure that they are compatible with the electrical and dynamic characteristics of their specific target vehicles. The characteristics of one type of controller may not be compatible with a different, unauthorized chair. Failure to observe this warning could result in an unsafe set-up for the wheelchair user and may create a fire hazard depending on the motors, wiring, connectors and circuit breakers installed on the unauthorized chair. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 3 Section 7.2.

2.21 Torque

Ensure that the motor compensation is set correctly for the chair, torque does not counter the effects of incorrect compensation settings. Chapter 3 Section 7.6.

2.22 Tremor Damping

The higher Tremor Damping is set the slower joystick response will become.

When setting Tremor Damping, pay particular attention to stopping distances. As the parameter dampens the response to the joystick commands, stopping distance can be affected. To stop the wheelchair with Tremor Damping activated you must release the joystick and allow it to center. It is the responsibility of the wheelchair manufacturer to ensure requirements on stopping distances are adhered to. Chapter 3 Section 7.7.

2.23 Diagnostics - Introduction

Diagnostics should only be conducted by healthcare professionals with in-depth knowledge of PGDT electronic controllers. An incorrect or badly effected repair could result in an unsafe set-up of a wheelchair. PGDT accept no liability for losses of any kind arising from an incorrect or badly effected repair. Chapter 4 Section 1.

2.24 Basic Tests

These tests are a minimum recommendation only. It is the responsibility of the service person(s) to perform other tests relevant to the original trip and wheelchair type. Refer to the wheelchair's Technical Manual for exact information of other tests. PGDT accept no liability for losses of any kind arising from failure to carry out of the described tests, or from not carrying out additional relevant tests.

These tests should be conducted in an open space and a restraining device such as a seat belt should always be used. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 4 Section 4.

2.25 Servicing of Defective Units

PGDT accept no liability for losses of any kind arising from unauthorized opening, adjustments or modifications to a any component of a controller.

CHAPTER 6 – SPECIFICATIONS

I Electrical Specifications

Supply Voltage:	24Vdc
Operating Voltage:	16Vdc to 35Vdc
Reverse Battery Protection:	-40Vdc
PWM Frequency:	19.5kHz ± 1%
Brake Voltage:	24Vdc
Brake Current:	1.25A max.
Battery Charging Current:	12Arms max.
Charger Connector:	Use only Neutrik NC3MX
Maximum Drive Current:	50A
Moisture Resistance:	IPx4
Operating Temperature:	-25°C to +50°C
Storage Temperature:	-40°C to +65°C

EMC tested on sample wheelchair:

Susceptibility:	Tested at 30V/m to EN12184 and ANSI/ RESNA requirements
Emissions:	To EN55022 Class B
ESD:	IEC801 part 2