PG DRIVES TECHNOLOGY

EGIS SERIES SCOOTER CONTROLLER

OPERATION & INSTALLATION

SK75326/7

The Egis Controller is covered by Patent No.:

US: 6,411,053 B1

TABLE OF CONTENTS

.

About this manual

This manual is split into 6 chapters which are in turn split into separate sections. Each chapter deals with a specific issue.

Chapter 1 - Operation

This chapter deals with the controls and functionality of the Egis Scooter Controller.

Chapter 2 - Installation

This chapter deals with the mounting, connection, wiring and setup procedures for the Egis Scooter Controller.

Chapter 3 - Tiller Module Installation

This chapter deals with the mounting, connection, wiring and setup procedures for the Tiller Module.

Chapter 4 - Warning Summary

Lists all the Warnings used within the manual.

Chapter 5 - Specifications

Lists all the Electrical Specifications of the Egis Scooter Controller.

ICONS

PG Drives Technology Ltd. will be abbreviated to PGDT throughout the manual.

Throughout the 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 control system or the vehicle.

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

CHAPTER I
OPERATION

1 Introduction

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

The operation of the Egis series of scooter controllers 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 user chapter carefully - it will help you to keep your scooter reliable and safe.

2 General

2.1 Handling

Avoid knocking your controller, especially the connectors. Never drop the controller.

When transporting your scooter, 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.

3 Controls

Depending on the specification of scooter to which the Egis is fitted, some or all of the following controls will be used.

3.1 On/Off Switch

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

Some scooters may have a keyswitch in addition to the normal on/off switch, the function of the keyswitch is the same as the on/off switch.

[Scooter manufacturers to include user controls layout diagram here.]

3.2 Status Indicator

Depending on the scooter model, the status indicator may be a single bulb (or LED) or a PGDT TruCharge battery and diagnostics indicator.

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

3.3 Throttle

The throttle controls the speed of the scooter. The further you push the throttle, the faster your scooter will move. When you release the throttle the brake is automatically applied.

Depending on the scooter model, the throttle configuration may be one of two types - wig-wag or single-ended.

3.3.1 Wig-wag Throttle

In this configuration, both the speed and the direction of the scooter are controlled by the throttle. To drive forwards, push the throttle in one direction: to drive in reverse, push the throttle in the other direction.

3.3.2 Single-ended Throttle

In this configuration, just the speed of the scooter is controlled by the throttle. When the throttle is pushed - depending on the position of the reverse switch (see section 3.4) - the scooter will drive in either the forward or reverse direction.

3.4 Reverse Switch

This switch will only be fitted to the scooter if the throttle configuration is single-ended (see section 3.3.2). The switch is used to change between forward and reverse drive.

3.5 Speed Limiting Control

This control sets the maximum speed of the scooter. Turn the knob clockwise to increase the maximum speed setting or anti-clockwise to decrease the maximum speed setting.

3.6 Slow/Fast Switch

This switch selects the driving mode - either slow or fast - of the scooter. You can use this switch to limit the scooter's driving behavior in environments where that may be desirable or necessary, e.g. if you are driving indoors or on the sidewalk.

3.7 Freewheel Switch

This switch allows you to push the scooter without having to mechanically disengage the parking brake. Whilst this switch is operated, the controller will not allow drive and the speed at which the scooter can be pushed will be limited to 75% of the maximum driving speed.

If you operate this switch whilst you are driving, the controller will stop the scooter and signal a fault.

3.8 Reverse Alarm

This provides an audible warning when the scooter is being driven in the reverse direction.

4 Getting Ready to Drive

Check that the speed limiting control is turned to a position which suits you.

Operate the on/off switch. A TruCharge type status indicator will blink and turn on after half a second. A single bulb (or LED) type status indicator will turn on immediately.

If the scooter has a single-ended throttle, use the reverse switch to select the direction you want to drive and then push the throttle to control the speed. If the scooter has a wig-wag throttle, push the throttle in the direction you want to drive.

During the first half-second after the scooter is switched on, the controller is performing important safety checks within itself and the rest of the scooter's electrical system. Therefore, if you push the throttle during this time, you will not be able to drive until you have returned the throttle to the rest position. This condition is indicated on a single bulb (or LED) type status indicator by a rapid flashing, or on a TruCharge type status indicator by a "rippling " up and down of the battery gauge.

If you do not push the throttle as you switch the scooter on and the status indicator flashes rapidly, then there may be a fault. Refer to section 8.4 for details.

5 Tips for Using Your Controller

5.1 Driving - General

Make sure that all the controls are within easy reach and are comfortable to operate.

5.2 Driving Technique

The controller interprets the throttle movements and reverse switch setting (if fitted) and drives the scooter in the correct direction at the appropriate speed. You will need very little concentration to control the scooter, which is especially useful if you are inexperienced.

The further you push the throttle away from the rest position, the faster the scooter will go.

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

The scooter user must be capable of driving a scooter 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 scooter moving in an unexpected way RELEASE THE THROTTLE. This action will stop the scooter in any circumstances.

6.1 Hazards

Do not drive the scooter:

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

Do not operate the scooter if it behaves erratically, or shows abnormal signs of heating, sparks or smoke. Turn the scooter 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 scooter exhibits erratic behavior due to EMI, turn it 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 scooter manufacturer to ensure that the scooter complies with appropriate National and International EMC legislation. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The scooter user must comply with all scooter 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 the Egis 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 control system fails any of these checks, do not use the scooter and contact your service agent.

7.1 Daily Checks

Throttle: With the scooter switched off, check that the throttle mechanism is not bent or damaged and that it returns to the rest position 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

Throttle: Put the throttle to the full speed forward position and switch the scooter on. The scooter should not move. To show you that you have switched the scooter on with the throttle already pushed, a TruCharge type status indicator will “ripple” up and down, whereas a single bulb (or LED) type status indicator will flash rapidly.

If the scooter does move, contact your service agent.

Parking brake: This test should be carried out on a level surface with at least one meter clear space around the scooter.

Switch the scooter on.

Check that the status indicator remains on, or flashes slowly, after half a second.

Go to drive the scooter slowly in the forwards direction until you hear the parking brake operate. The scooter may start to move.

Immediately release the throttle. You must be able to hear the parking brake operate within a few seconds.

Repeat the test in the reverse direction.

Cables and connectors:

Check that all connectors on the scooter are securely mated, and ensure that all cables are free from damage.

7.3 Servicing

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

8 Status Indication

Depending on the scooter model, the status indicator may be a single lamp (or LED) or a TruCharge battery gauge and diagnostics display. Both types indicate the status of the controller. See section 10 for more details of TruCharge battery gauge.

Please note that a number of supposedly faulty controllers returned to PGDT are subsequently found to operate correctly. This indicates that many faults are due to problems on the scooter rather than within the controller.

8.1 Status Indicator Steady

This indicates that all is well.

8.2 Status Indicator Flashes Slowly

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

8.3 Status Indicator Blinks Off Every 5 Seconds

The controller has detected that the batteries are being charged.

8.4 Status Indicator Flashes Rapidly (even with throttle released)

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

This indicates that there is a fault. Please follow this procedure:

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

8.5 Self-Help Guide

If a fault occurs and you have a scooter model fitted with a TruCharge display, you can find out what has happened by counting the number of bars that are flashing on the battery gauge.

The following diagrams give an overview of the fault types and 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 flashing bars and follow the instructions.

8.6 Diagnostic Flash Code Feature

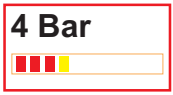
The Diagnostic Flash Code Feature is a factory programmed feature that allows a single status lamp or LED to display the TruCharge fault code. This is done by pulsing the lamp on for a number of times equivalent to the number of TruCharge bars that would be flashing for a given fault.

The information in the following diagrams still applies, so for example, if an Egis with this feature enabled had a throttle fault, the status lamp would flash 7 times, pause briefly, flash 7 times, pause briefly and so on.

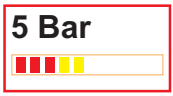
The battery needs charging or there is a bad connection to the battery. Check the connections to the battery. If the connections are good, try charging the battery.

There is a bad connection to the motor. Check all connections between the motor and the control system.

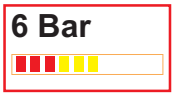
The motor has a short circuit to a battery connection. Contact your service agent.



The freewheel switch or manual brake disengagement mechanism are operated. This is instigated only on systems where there is a switch wired to the Egis' Freewheel input.Check the position of the switch



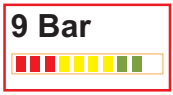
Not used.



The controller is being inhibited from driving, this may be because the battery charger is connected or the seat is not in the driving position.

A throttle fault is indicated. Make sure that the throttle is in the rest position before switching on the scooter.

A controller fault is indicated. Make sure that all connections are secure. Contact your service agent.



There is a bad connection to the parking brake. Some scooters will register this error type when the freewheel lever is disengaged. First of all, check the freewheel lever is in the drive position, then check all connections between the parking brake and the controller.

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 scooter does not travel at full speed and the battery condition is good, check the position of the speed limiting control. If adjusting the speed limiting control does not remedy the problem then there may be a non-hazardous fault. Contact your service agent.

9 Pushing your Scooter

Depending on the scooter model you have and the status of the controller, there are different methods of easily pushing your scooter.

9.1 Using Freewheel Switch

If the scooter is fitted with a freewheel switch then you can easily push the scooter by operating this switch with the scooter switched on. Whilst the switch is operated, the scooter is prevented from driving and the freewheel speed is limited to 75% of the maximum driving speed. See section 3.7 for more details.

9.2 Disengaging the Parking Brake

If the scooter does not have a freewheel switch or the controller has detected a fault, then to push the scooter, you must mechanically disengage the parking brake. Your scooter will be fitted with a special lever to do this.

Depending on the gear ratio between the motor and the drive wheels, it may be difficult to push the scooter. If it is, switch off the scooter and less force will then be required.

If you have disengaged the brake and the controller has detected a fault or the scooter is switched off, then it may be possible for the scooter to freewheel at potentially dangerous speeds. Therefore, do not push the scooter up or down inclines on which you cannot stop or hold the scooter. Never sit on the scooter when the parking brake is disengaged. PGDT accept no liability for losses of any kind arising from the scooter being moved with the parking brake disengaged.

10 Battery Gauge

Depending on the type of scooter you have, the battery gauge may be a single bulb (or LED) or a TruCharge display. How to read each type is described in the following sections.

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 scooter. Like the fuel gauge in a car, it is not completely accurate, but it will help you avoid running out of "fuel".

Depending on the type of scooter you have, the battery gauge may also show you the charging status of the batteries.

The battery gauge works in the following way.

When you switch on the controller, after half a second, 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 scooter.

If you are charging the batteries and the scooter type you have is able to show you charging status, this information is accurate 5 seconds after the charger is connected.

When you replace worn out batteries, fit the type recommended by the scooter 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 scooter, the temperature of the batteries, their age and the way they are made. These factors will affect the distance you can travel in your scooter. All scooter 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.

10.1 How To Read a Single Bulb (or LED) Battery Gauge

If the battery gauge is steady then you have more than 20% battery charge remaining.

If the battery gauge is flashing slowly then you have less than 20% battery charge remaining and you should charge the batteries as soon as possible.

10.2 How To Read a TruCharge Battery Gauge

The way in which the battery gauge should be read depends on whether you are driving the scooter or charging the batteries. Each case is explained below.

10.2.1 Driving

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

If the battery gauge 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 scooter 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

10.2.2 Charging

In this display mode the battery gauge blinks off every 5 seconds.

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

If the battery gauge shows red and yellow or just red, then you should continue charging your batteries.

This facility is only available on certain scooter types.

II Battery Charging

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

Do not exceed the maximum charging current for the scooter. PGDT accepts no responsibility for losses of any kind from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the scooter's charging socket. Failure to observe this condition could result in a burn hazard or a fire hazard. PGDT accepts no responsibility for losses of any kind from failure to comply with this condition.

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

Only use the battery charger that has been supplied with your scooter. The use of incorrect chargers could damage the batteries, scooter, controller or charger itself, or may result in parts overheating creating the potential for burns or even fire. PGDT accepts no responsibility for losses of any kind from failure to comply with this condition.

12 Programming

If you cannot find a position of the speed limiting control that suits you, the controller can be programmed to meet your needs. The controller can be programmed in two ways – with an SP1 Programmer or with a Pocket Programmer.

The SP1 is a small hand-held unit which can be plugged into your controller to alter the program.

A Pocket Programmer is an interface module and a piece of software for Palmtop type computers. The module connects into the controller and then communicates with the Palmtop PC so that the controller can be programmed using a Windows type environment

The programming tools may be included with your scooter. If they are not, your scooter distributor or service agent or scooter manufacturer will be able to program your controller for you.

If you have a programmer, read the user guide before you use it.

If you re-program your controller, make sure that you observe any restrictions given in your scooter 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 scooter for a user. PGDT accept no liability for losses of any kind if the programming of the controller is altered from factory pre-set values.

13 Controller 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 Egis controller.

If the Egis 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 Egis Scooter Controller is covered by a warranty period defined by the scooter manufacturer. For details of the warranty period, please contact your service agent.

The warranty will be void if the Egis Scooter Controller has:

- Not been used in accordance with the Egis Scooter Controller Technical Manual, SK75326.
- Been subject to misuse or abuse.
- Been modified or repaired by non-authorized persons.

The warranty will be void if the Egis has not been used in accordance with Egis Technical Manual SK75326, the Egis has been subject to misuse or abuse, or if the Egis has been modified or repaired by unauthorized persons.

CHAPTER 2
INSTALLATION

1 Documentation

1.1 Egis Operation

Study Chapter 1: Operation. It is important that the information in Chapter 1 is supplied with the scooter, either as part of the scooter 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 ISO7176-14.

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.

The preset settings are chosen with the scooter manufacturer to ensure safe operation and compliance with relevant legal requirements over the whole of the operating range of the throttle, and speed limiting control.

The scooter must stop within the maximum distance specified for the country in which the scooter will be used. For countries requiring CE marking this is as specified in EN12184.

Users with particular disabilities may need very low braking rates. However, if the controller is programmed with a low braking rate, the stopping distance may be more than that specified. If this happens, the maximum speed must be re-programmed so that the stopping distance requirement is satisfied.

State in the scooter 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 scooter 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 scooter. Perform suitable tests to establish which programming restrictions are needed to prevent instability. State any programming restrictions in the scooter user handbook.

State in the scooter 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 scooter for the user. PGDT accept no liability for losses of any kind if the programming of the controller is altered from factory pre-set values. PGDT accept no liability for losses of any kind if the drive or stability characteristics of the scooter are altered without prior notification and discussion with PGDT.

1.3 Soft-Stop

If the version of Egis you have has the Soft-Stop function enabled (see controller data sheet), you must ensure that the emergency stopping distance is within the distance specified for the country in which the scooter will be used. For countries requiring CE marking this is as specified in EN12184.

1.4 Other Information

You must provide a diagram in the scooter user handbook showing the user controls.

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

2 Immobilizing the Scooter

2.1 Prevention of Unauthorized Use

Some markets require the scooter to have a means of preventing unauthorized use. This typically means fitting a keyswitch which can prevent the controller from being switched on.

2.2 Charger Interlock

ISO 7176-14 requires you to provide a means of preventing the use of the scooter while the batteries are being charged. The Egis includes an inhibit input which can be used to provide this function. Refer to section 7.1 for details.

Contact PGDT if you need advice..

The scooter manufacturer is responsible for providing a means of preventing the use of the scooter 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

3.1 General

Study the data sheet for the control system 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 3.5. These depend on the application. You are responsible for establishing the suitability of the particular wiring arrangement used on the scooter. PGDT can make general recommendations for wiring to Egis Controller, 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 scooter reliability.

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

The scooter manufacturer is responsible for ensuring that only the mating connectors specified by PGDT on the control system'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 scooter manufacturer is responsible for ensuring that suitable connectors are used and securely mated throughout the scooter wiring system and that the workmanship associated with the wiring system is of a good 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

The power connectors for the Egis controller are specially designed by PGDT for mobility applications. The crimps are standard AMP Timer parts but the plastic housings are custom. Kits of connectors can be purchased from PGDT or directly from the manufacturers, Intech.

Intech's details are as below.

Tel: +44 (0)1522 869460

Fax: +44 (0)1522 869461

The connector part numbers are:

Connector	PG Drives Technology Reference	Intech Reference
Battery	D49712 PG80-B	IPG-5202-PS
	D50287 PG80-B (High Current)	
Motor/Brake	D49925 PG80-SM	IPG-5403-S
	D50009 PG80-SM (High Current)	

Hand tools for crimping and extraction are available from Intech, 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 6.0-10.0mm² wire: ICT-532

Extraction tool for 0.5-1.0mm² wire: IET-503

Extraction tool for 4.0-6.0mm² wire: IET-552

Only use the exact tools specified

The High Current reference is available for customers who wish to use a 6.0 - 10.0mm² wire gauge.

For 6.0 - 10.0mm² crimp tools please refer directly to Amp.

Good quality crimping is essential in ensuring the long term reliability of the scooter'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.

For details of automatic crimp tools contact Intech.

Figures 1 and 2 give schematic details of the power connections.

3.2 Battery Connections

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 or the extremely unlikely event of a short circuit in the controller.

Place a suitable circuit breaker in series with the battery supply, for example in the link between two 12V batteries. If your batteries are held in separate enclosures, you must provide a circuit breaker with each of them.

The rating of the circuit breaker must match the capacity of the wiring specified in section 3.5. For Egis 70A models the circuit breaker rating should not exceed a 40A maximum rating. For Egis 110A models the circuit breaker rating should not exceed 70A.

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

It is recommended that the battery positive and negative wiring to the Egis is kept as short as possible

The scooter manufacturer must install a suitable circuit breaker to provide protection against short circuits in the battery wiring, power loom or the control system. 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.

3.3 Motor Connections

If a circuit breaker is fitted in series with the motor, it is essential that the scooter assumes a safe condition the moment the circuit breaker operates. You must therefore fit a circuit breaker with an auxiliary switch which inhibits the scooter from driving, see section 7.1.

3.4 Brake Connections

The solenoid brake should be a 24V type with a maximum current rating of 2A.

If the controller switches the solenoid brake and the current is less than 12mA or greater than 5A, the controller will detect a solenoid brake Trip.

3.5 Wire Gauge and Types

The table below gives the minimum recommended wire sizes for various Egis power specifications.

Egis Model	Battery Wires	Motor Wires	Brake Wires	Control Wires
70A	$4.0mm^2$	$4.0mm^2$	$0.5mm^2$	$0.22mm^2$
110A	$6.0mm^2$	$6.0mm^2$	$0.5mm^2$	$0.22mm^2$

These recommendations are derived from well proven field experience of various international scooter manufacturers. Nevertheless, it is advised that manufacturers confirm them by carrying out suitable tests. Keep wire lengths as short as possible.

If required up to 10.0mm2 wire gauge may be utilized with the High Current connecter kits. However it is advised that manufacturers carry out suitable tests. Keep wire lengths as short as possible.

Battery , motor and on-board charger (if fitted) wires should use Tri-rated PVC equipment wire rated at 105°C.

4 Batteries

The controller is designed for operation with 24 V lead acid batteries. The batteries may be wet or gel electrolyte types. Contact PGDT if you need advice on battery selection.

5 Motors

The controller is designed to be connected to permanent magnet DC motor, fitted with a suitable gearbox and solenoid brake.

In order to optimize the performance of the scooter, the controller must be matched to the motor terminal impedance. The data sheet may define a motor compensation value (normally 70% of the total motor, cable and connector resistance).

Failure to match the controller with the motors may result in poor control characteristics, in particular speed stability on gradients may be affected, see Programming and Diagnostic Technical Manual.

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

6 Control Connections

The control connections are via a 14 way Molex Microfit 3.0 connector. The mating crimps and connector housing are Molex types 43030-0007 and 43025-1400 respectively. PGDT can supply these parts or Molex can be contacted directly. An optional rubber sealing boot is available for the connector, please contact PGDT for details.

Each control connection is described below. Refer also to the Sengle-Ended, Wig-Wag and TNO connection diagrams, and the controller data sheet.

6.1 24V, 2.5A Fused

Pin 1 is a battery positive supply for low current electrical circuits in the tiller. It is protected by a 2.5A self-resetting fuse within the Egis controller. Higher fuse ratings may be possible, please contact PGDT

6.2 On/Off Switch

Pin 8 is the battery positive supply to the controller from the on/off switch. The maximum power consumption of the controller via this connection will not exceed 1A.

The scooter wiring should be of sufficient gauge to ensure the voltage difference between Pin 1 and Pin 8 is less than 0.25V. If auxiliary circuits, such as lighting, are deriving their power from Pin 1, then it is absolutely essential that attention is given to the gauge of the wire used.

This connection should have no external capacitance connected to it, and care should be taken not exceed the fuse rating if lights or other auxiliary functions are connected.

Large capacitances connected between pin 5 and 0V may affect the ability of the Egis to switch on or off reliably. If it is desired to connect a large capacitance, for example to damp a battery gauge voltmeter or to suppress a horn sounder, then connection should be made between battery 24V (pin 1) and 0V.

6.3 Throttle Potentiometer

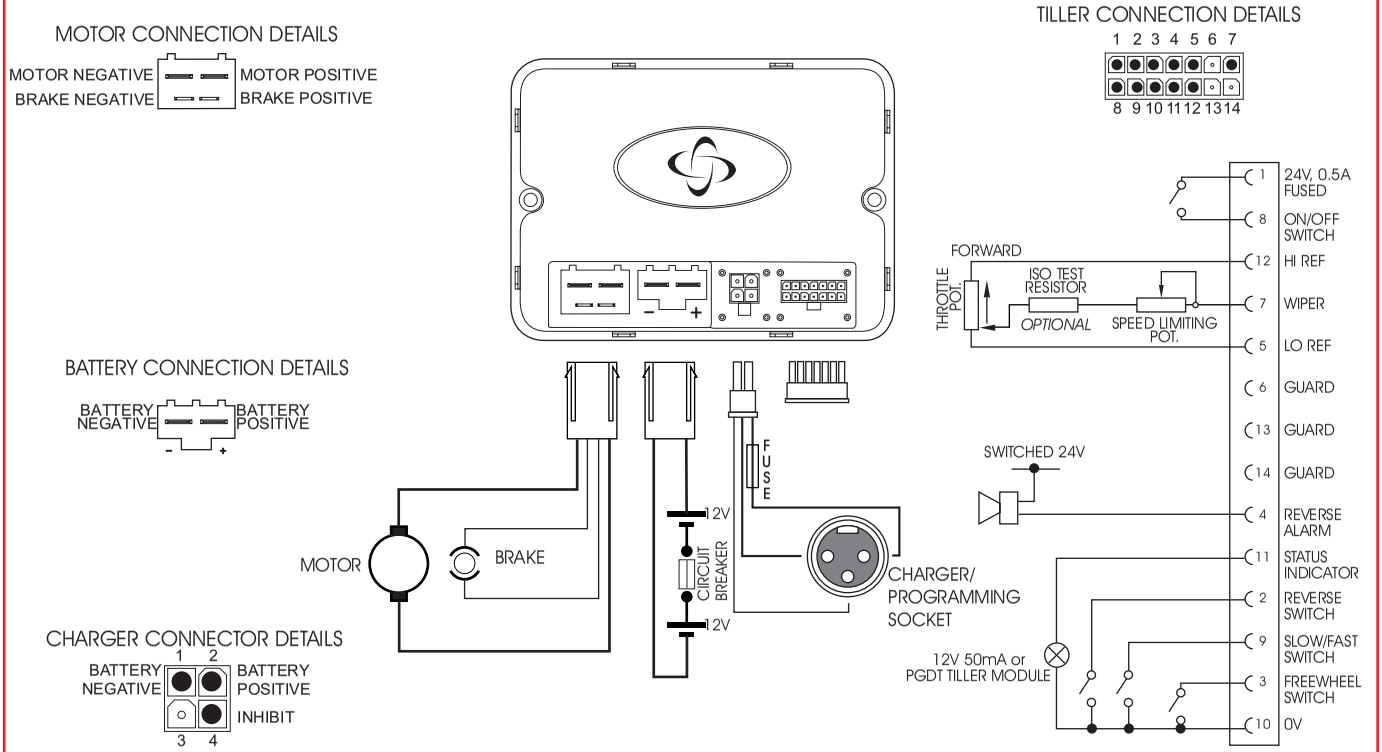
Pins 5, 7 and 12 are the connections to the throttle potentiometer. Both wig-wag (center off) and single-ended throttle configurations can be used but you should ensure the controller is programmed to the correct type, refer to the SP1 Programming and Diagnostic Technical Manual and the controller data sheet.

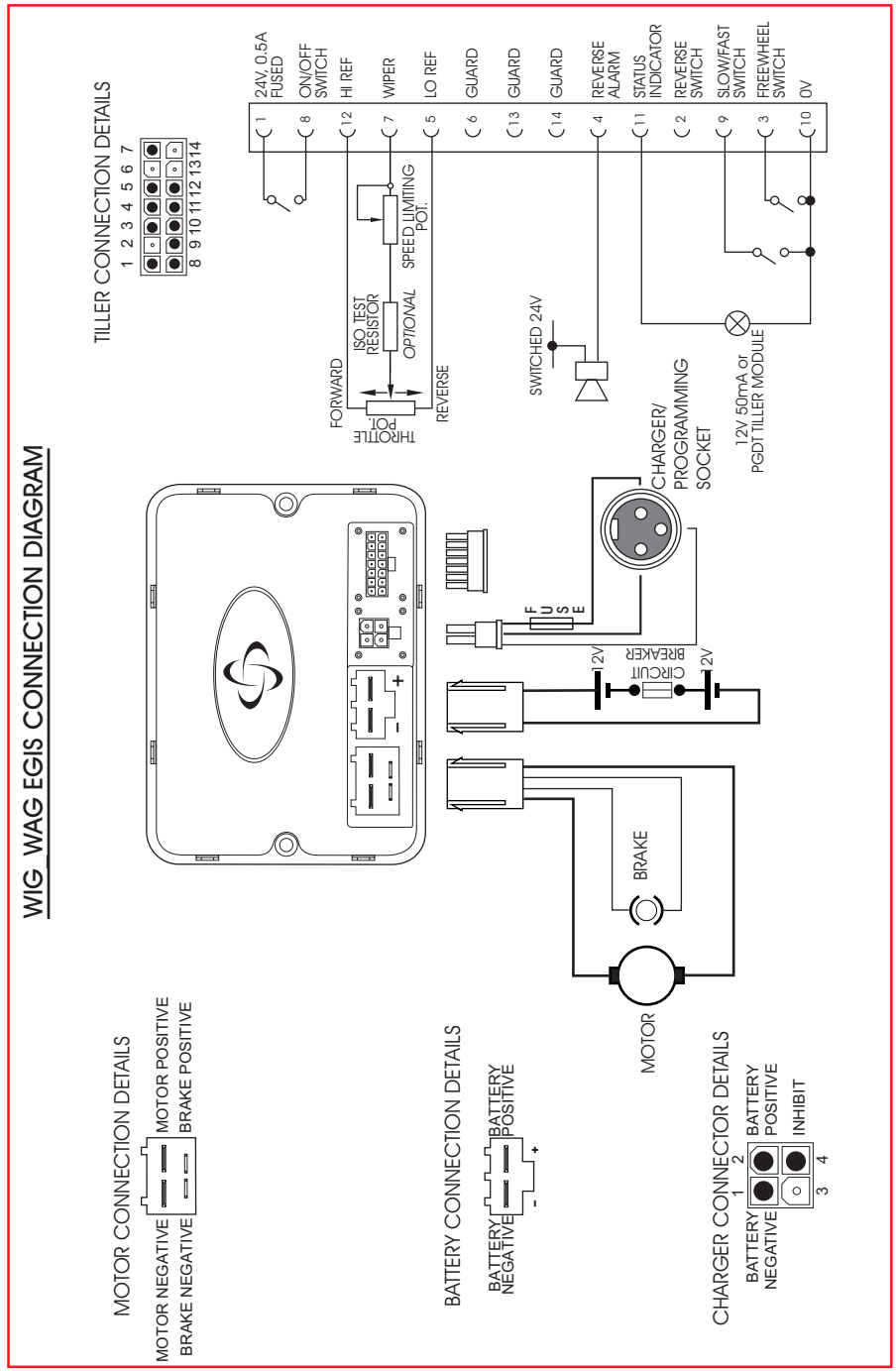
The value of the potentiometer should be between 2kΩ and 10kΩ ± 20%. If the full electrical span of the potentiometer is not used, a throttle gain can be programmed such that full speed can be achieved.

With a 25K speed limiting potentiometer the scooter's speed will be 30% of the programmed maximum speed. However, this will be affected in any of the following conditions apply:

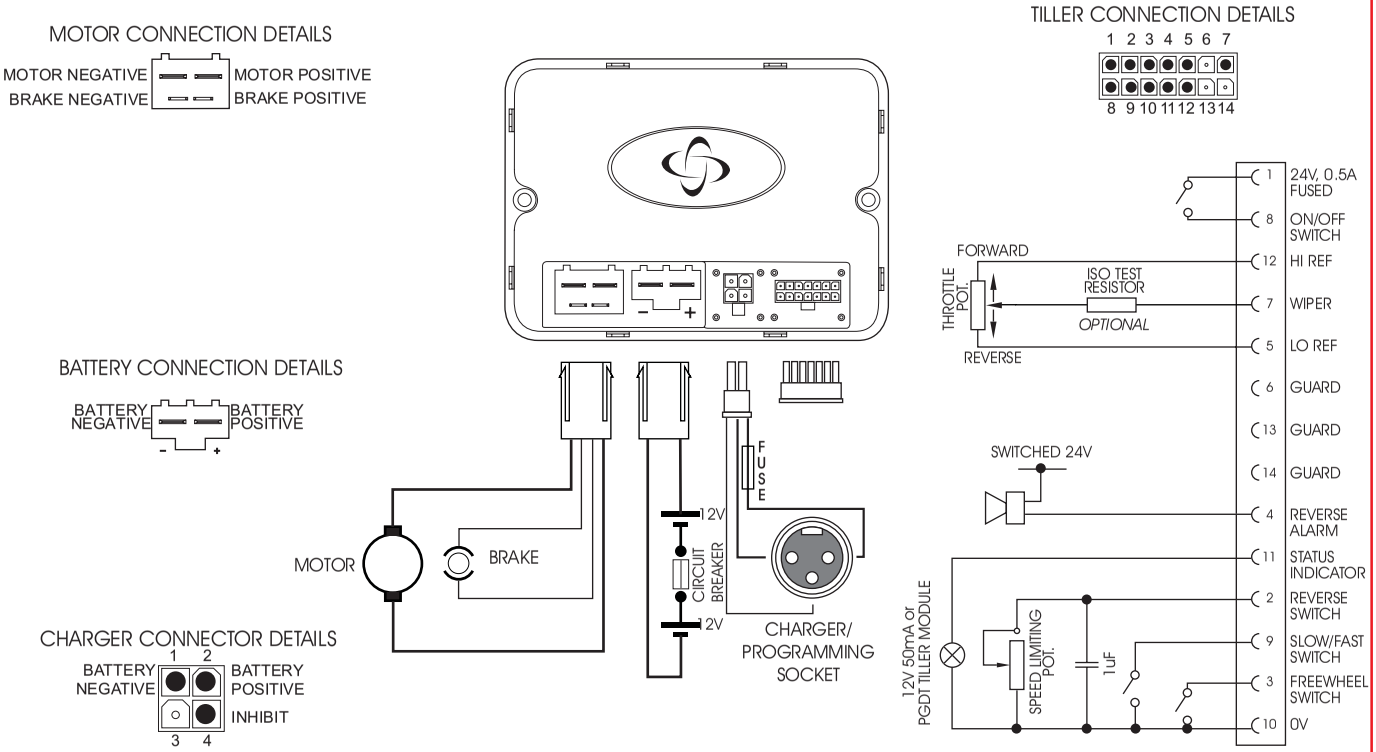
1. An ISO test resistor is fitted.
2. A throttle mechanism with reduced mechanical travel meaning the throttle potentiometer does not reach full electrical travel.

SINGLE-ENDED EGIS CONNECTION DIAGRAM




WIG WAG EGIS CONNECTION DIAGRAM
TILLER CONNECTION DETAILS
1 2 3 4 5 6 7
8 9 10 11 12 13 14
24V, 0.5A FUSED
ON/OFF SWITCH
HI REF
WIPER
LO REF
GUARD
GUARD
GUARD
REVERSE ALARM
STATUS INDICATOR
REVERSE SWITCH
SLOW/FAST SWITCH
FREEWHEEL SWITCH
0V
FORWARD
ISO TEST RESISTOR
OPTIONAL
SPEED LIMITING POT.
REVERSE
THROTTLE POT.
SWITCHED 24V
12V 50mA or PGDT TILLER MODULE
CHARGER/ PROGRAMMING SOCKET
FUSE
2V
CIRCUIT BREAKER
2V
BRAKE
MOTOR
MOTOR CONNECTION DETAILS
MOTOR NEGATIVE
BRAKE NEGATIVE
MOTOR POSITIVE
BRAKE POSITIVE
BATTERY CONNECTION DETAILS
BATTERY NEGATIVE
BATTERY POSITIVE
CHARGER CONNECTOR DETAILS
BATTERY NEGATIVE
BATTERY POSITIVE
INHIBIT

TNO EGIS CONNECTION DIAGRAM



In case 1, the scooter's slow speed would increase to 40% of the programmed maximum speed.

In case 2, the scooter's slow speed would decrease dependent on the actual electrical travel.

There is also an interaction between the 2 cases. Therefore, to achieve the desired slow speed, a value other than 25K may be required. In selecting a different value, the following maximum limits apply.

47K if no ISO test resistor is fitted.

39K if an ISO test resistor is fitted.

Please refer to the SP1 Programming and Diagnostic Technical Manual for details.

If the scooter has a wig-wag (center off) throttle configuration it is possible, by programming, to reverse the polarity of operation of the throttle. For single ended throttles the polarity of operation of the reverse switch can be selected, refer to the SP1 Programming and Diagnostic Technical Manual.

6.3.1 Speed Limiting Potentiometer

A speed limiting potentiometer may be connected between the throttle potentiometer wiper connection and pin 7 of the controller. A resistance of 25 kΩ will limit the speed to 30% of the maximum programmed speed. It is possible to use a different value potentiometer and to achieve different speed reductions, contact PGDT for details.

6.3.2 ISO Test Resistor

In order to detect the possible throttle wiring faults as defined by ISO 7176/14, it is recommended that a 10kΩ resistor is installed as shown in the connection diagrams overleaf. This ISO Test Resistor should be located as physically close as possible to the wiper of the throttle potentiometer and the controller must be programmed to detect the resistor. Please refer to the SP1 Programming and Diagnostic Technical Manual for details.

6.3.3 Alternative Throttle Inputs

Other factory programmed throttle inputs are available such as a voltage input that accepts signals in the range of 0-5V or a unipolar wig-wag input using the reverse switch to change direction. Please contact PGDT for details.

6.4 Guard Pins

Pins 6, 13 and 14 are linked to an electronic circuit which detects the presence of electrically conductive substances, such as water or salt. If potentially hazardous levels are detected, the controller will shut down to a safe condition. No connection should be made to these pins.

6.5 Reverse Alarm

Pin 4 is an output for a 24V sounder which will operate when the scooter is being driven in reverse. The positive terminal of the sounder should be connected, via the on/off switch, to battery positive. The negative terminal of the sounder should be connected to pin 4.

The maximum current rating of the output is 50mA, you must ensure that the sounder does not draw more than this value.

The controller can be programmed to give either a continuous alarm or a pulsed alarm. This can be selected by programming, (see Programming and Diagnostic Technical Manual).

6.6 Status Indicator

This output controls either a PGDT TruCharge type status indicator or a single bulb (or LED) type status indicator.

If you are using a bulb, this must be 12V with a maximum rating of 600mW: the bulb can be connected directly between pin 11 and 0V. If you are using an LED, it is connected between the same points but you must provide a series connected current limiting resistor. For details of connection to a TruCharge type status indicator, refer to the relevant data sheet.

6.7 Reverse Switch

Pin 2 is a connection to a reverse switch. This is required to select reverse drive if the controller is being used with a single-ended throttle configuration.

The polarity of the input is programmable and can be changed using the Invert Throttle Polarity command (see Programming and Diagnostic Technical Manual).

With Invert Throttle set to NO, the drive will be in reverse if pin 2 is connected to 0V.

With Invert Throttle set to YES, the drive will be forwards if pin 2 is connected to 0V.

6.7.1 TNO Applications

For TNO applications Pin 2 can be fitted with a 25kΩ Speed Limiting Potentiometer. In this instance a resistance of 25kΩ across pins 10 and 2 will enable maximum programmed speed. Speed is reduced as the resistance across pins 10 and 2 is reduced. Refer to the TNO configuration diagram for details.

This Connection type should only be used with a TNO configured Egis controller.

This connection should have a 1 micro Farad capacitor connected in parallel to the Speed Limiting Potentiometer to protect the circuit.

6.8 Slow/Fast Switch

Pin 9 is an input which can be used to limit the forward and reverse speeds, the forward and reverse acceleration and the forward and reverse deceleration of the scooter. Typical uses are: to select between indoor or outdoor use or, as is a requirement in certain countries, to limit the scooter's speed while driving on the sidewalk.

If pin 9 is connected to 0V the controller will drive using the programmed slow speeds and rates (see Programming and Diagnostic Technical Manual).

6.9 Freewheel

Pin 3 is an input which can be used to release the solenoid brake so that the scooter

can be freewheeled. To release the solenoid brake pin 3 should be connected to 0V.

As a safety feature, whilst this input is active the scooter's freewheel speed is limited to 75% of the scooter's maximum driving speed.

Depending on the scooter specification, the freewheel switch can be fitted in one of two positions: firstly, on the tiller (or at another convenient point) so it can be operated directly by the person wishing to push the scooter, or, secondly, in a position such that it is operated by the solenoid brake manual disengagement mechanism. If the freewheel switch is fitted on the tiller, PGDT recommend the switch must be a momentary operation type.

If the freewheel switch is not operated by the solenoid brake manual disengagement mechanism, then an additional micro-switch which opens when the brake is disengaged should be fitted. This micro-switch should be connected in series with the solenoid brake. This interlock is to meet the requirements of ISO7176-14 which states that the scooter should not be able to drive if the solenoid brake is not engaged.

If the controller has detected a trip in either itself or elsewhere on the scooter's electrical system, then it is not possible to release the solenoid brake with the freewheel switch. In this instance, less force is required to push the scooter if it is switched off

If you have disengaged the brake and the scooter is switched off, then it may be possible for the scooter to freewheel at potentially dangerous speeds. Therefore, do not push the scooter up or down inclines on which you cannot stop or hold the scooter. Never sit on the scooter when the parking brake is disengaged. PGDT accept no liability for losses of any kind arising from the scooter being moved with the parking brake disengaged.

6.10 0 Volts

Pin 10 provides the battery negative connection to the scooter's tiller.

7 Charger Connections

The Egis controller has a dedicated connector for the battery charger. Because the charging current is routed via the controller, then the connection of a charger can be automatically detected and the actual level of charging current measured and displayed via a PGDT TruCharge type status indicator. This gives an indication of the charging status of the batteries. Refer to Chapter 1 section 10.2.2 for more details of this operation.

Ensure that a suitable fuse is connected to the Battery positive wire of the charger connection cable as shown in the Connection Diagrams in section 6.

The charger connector is a Molex Mini-Fit Junior. The mating crimps and connector housing are Molex types 44476-1112 and 39-01-2040 respectively. PGDT can supply these parts or Molex can be contacted directly. An optional rubber sealing boot is available for the connector, please contact PGDT for details.

The maximum charging current via this connector is 12A RMS.

For pin-out details of this connector, refer to the connection diagrams, Figures 1 and 2, and the controller data sheet.

This connector also provides communications to the programmer.

7.1 Inhibit

The Egis controller has a versatile input that can be configured to provide inhibit functions. This input is referred to as Inhibit and is located on the 4 way charger connector (Pin 4).

Inhibit 1 is programmed primarily to detect a charger inhibit condition, such as an off board charger being connected to the scooter or an onboard charger being connected to the line.

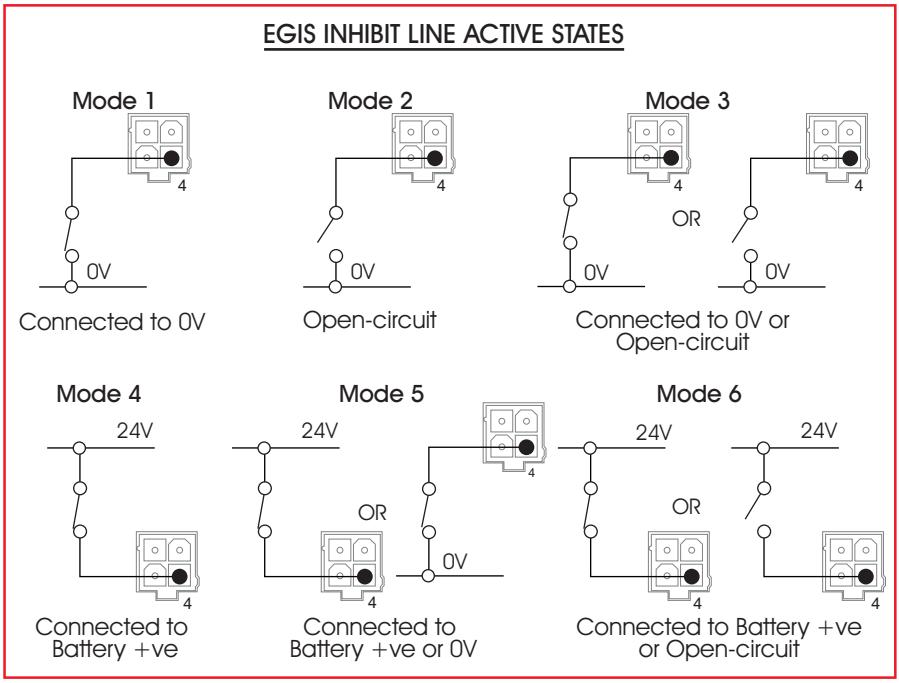
See the example in section 7.1.2

Inhibit 1 input has 2 programmable parameters.

- Inhibit Mode
- Inhibit Operation

7.1.1 Inhibit Mode

The Mode parameter refers to the state in which the inhibit is active.



7.1.2 Inhibit I Operation

The parameter can be set to one of two states:

Latched - Means the inhibitor, such as the charger plug, must be removed and the controller turned off and on before the scooter can be operated again.

Non-Latched - Means the controller can be reset to an operational state by removing the inhibitor.

If set to Latched, then when Inhibit is active the TruCharge display will step-up to indicate the scooter is charging.

Example - To provide a charge inhibit function that is active when Inhibit is connected to 0V and is latching, program as below.

Mode = 1

Operation = Latched

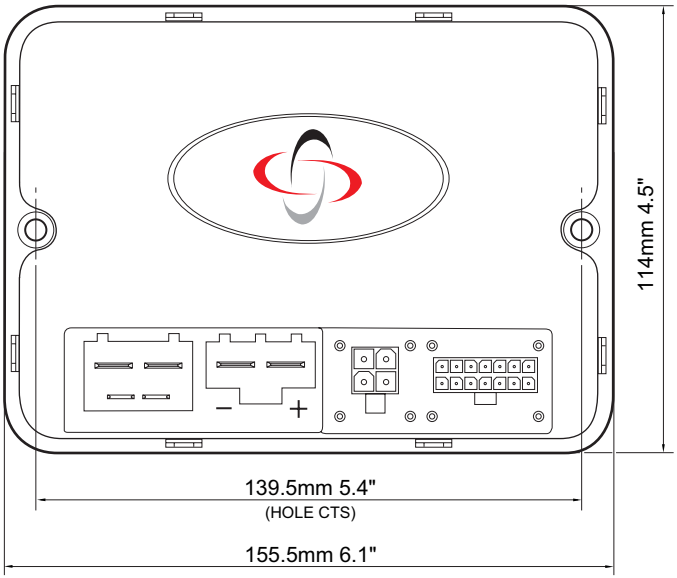
If this inhibit is activated then the controller will cause the scooter to decelerate to a complete stop (as if the throttle has been released).

8 Mounting

8.1 Orientation

The controller should be mounted so that water cannot enter and remain in the connector recesses. The recommended mounting orientation is such that the connectors must be lowermost. The function of the controller is not sensitive to mounting orientation. The electronics compartment of the controller has an IPX5 dust and water rating. Optional rubber sealing boots are available for tiller and charger/programming connector, please contact PGDT for details.

EGIS DIMENTION DIAGRAM



2 x Fixing Holes 5.5mm

8.2 Position

The controller must be mounted in a position where it is not exposed to levels of water, dust, shock or vibration above those expected on a mobility scooter application. The controller has been tested in accordance with IS07176/14 with respect to these conditions.

The controller has excellent thermal performance but, to improve this further, the base-plate may be secured against a metal part of the scooter chassis. To provide even better thermal performance, a non-silicone thermally conductive paste or pad may be applied between the base-plate and the scooter chassis.

Contact PGDT if you need further advice.

Under strenuous driving conditions it is possible for metal sections of the controller's case to exceed 41°C (106 °F) in temperature. Under such conditions, the scooter manufacturer should ensure that either the user cannot touch these surfaces, or that the user is warned not to touch these surfaces. While 41°C (106 °F) is very close to normal body temperature, prolonged contact with surfaces above 41°C (106 °F) can result in burns to the skin. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

8.3 Cables

The cables to the controller must be routed and secured in such a way as to prevent damage to them, for example by cutting or crushing.

9 Production Tests

Perform the following tests, in order, on each scooter 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 overtighten 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 Preset Settings

Make sure that the controller is using the preset settings. Refer to the Programming and Diagnostic Manual for detailed instructions.

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

9.4 Operational Test

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

- Switch on the scooter.
- Check that the status indicator remains on, or flashes slowly, after half a second.
- Go to drive the scooter slowly in the forwards direction until you hear the solenoid brake operate. The scooter may start to move.
- Immediately release the throttle. You must be able to hear the solenoid brake operate within a few seconds.
- Repeat the test in the reverse direction.

9.5 Test Drive

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

10 Electromagnetic Compatibility (EMC)

The Egis controller series has been tested for compliance with EC directive 89/336/EEC, and the EMC requirements of EN12184, the FDA and the FCC. The guidelines in this section will help you to make sure that your scooter installation will easily meet the requirements of the directive. You should consider EMC and perform relevant tests as early as possible in the design phase.

10.1 Emissions

A typical scooter and Egis installation have been type tested and have passed the requirements of CISPR 11 and FCC CFR47 part 15.

Observe the following recommendations to minimize radio frequency emissions:

10.1.1 Motor suppression

Solder a suitable suppression capacitor between the brush holders of the motor, inside the motor case. Keep the lead length as short as possible. We recommend a value of 4.7nF 250V AC ceramic. The maximum value you should use is 10nF. A typical type is Roderstein WY0472MCMCF0K.

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 scooter chassis over as much of their length as is practical.
- Do not use the controller connectors as junction points for the battery connections. Separate junction points away from the Egis should be provided for the other scooter electrical functions.

10.2 Immunity

The Egis controller has been stringently tested for susceptibility to electromagnetic radiation over the frequency range 26MHz to 1GHz. The installations passed the FDA requirements and the proposed requirements of EN12184.

Follow the recommendations in section 10.1.2 to ensure maximum immunity to electromagnetic radiation.

10.3 Electro-Static Discharge (E.S.D.)

There are various international standards currently under development for this aspect of the system's performance. At present, most of the standards are specifying the system to be tested to requirements of IEC801-2 Severity Level 3. Tests are carried out at 8kV air discharge (to non-conductive surfaces) and 6kV contact discharge (to conductive surfaces).

E.S.D. produces very fast pulses of electrical energy which, if allowed to enter an

electronic system, may cause disruption of operation or even permanent damage. The Egis controller incorporates extensive protection against E.S.D., however, you should take the following precautions to prevent high levels of energy entering the controller.

The area where E.S.D. is most likely to enter the system is the tiller. Users who have become "charged", for example by walking on a nylon carpet, can impart a significant discharge to the scooter via the first point they touch. The best method of protection against such a discharge is to make all user controls and tiller enclosures non-conductive. Switch manufacturers should be able to provide appropriate advice and design rules.

Where controls and enclosures are conductive, a low impedance electrical connection to the main mass of the scooter's metalwork should be provided. If such a connection is used, it should be kept as short as possible to minimize its electrical inductance.

If such a low impedance connection cannot be made because of electrical isolation requirements then an alternative electrical connection should be provided via a varistor. For 24V systems a suitable device is manufactured by Harris, type GE-MOV V82ZA2. The varistor should be connected between the electrical terminal and battery negative.

Charger socket, battery and motor terminals do not normally require protection.

If you need advice please contact PGDT.

II Battery Gauge

Refer to Chapter 1 sections 8 and 10 for how to read the battery gauge.

The battery gauge typically starts to flash slowly when the battery voltage falls below 23.3V whilst the scooter is driving on a level surface. The controller can be programmed to inhibit the low battery flash, please refer to SP1 Programming and Diagnostic Technical Manual.

For optimum accuracy of the battery gauge and low battery indicator, the controller should be programmed with the approximate nominal capacity of the scooter 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 scooter to make the battery gauge accurate, (see Programming and Diagnostic Technical Manual).

As a guide, 2.5 mm^2 cable has a resistance of about 8 mΩ per meter; 4 mm^2 cable has about 5 mΩ per meter and 6 mm^2 has about 3.3 mΩ per meter. Circuit breakers and connectors usually account for about 15 mΩ.

These values will be chosen at the time the controller is being specified by the scooter 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.

If you need advice, contact PGDT.

CHAPTER 3
TILLER MODULE

1 Introduction

Study Chapters 1 & 2, they describe the intended functionality of the Tiller Module and the details for connection to the Egis Controller.

The Egis Status Indicator parameter will require adjustment before the TruCharge indicator will work correctly. Refer to the SpIb Pragramming and Diagnostic Technical Manual.

There are two variants of the Tiller Module. These are:

- Surface mount variant.
- Inset variant.

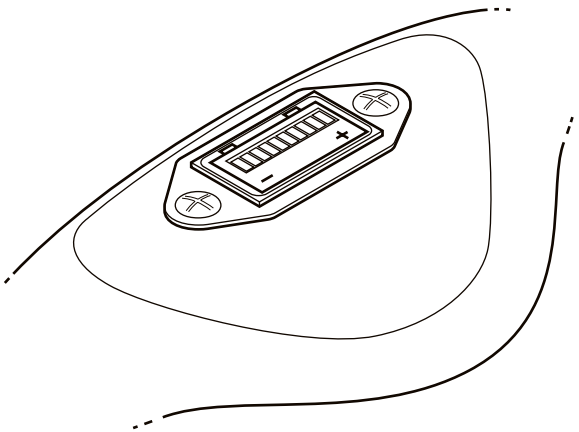
1.1 Surface Mount Variant

The Surface Mount variant attaches to the tiller module from the outside (See the following illustration). The electronics compartment of the Tiller Module has an IPX5 dust and water rating.

- Surface mount variants - D50133

D50133 consists of: 1 TruCharge Display Module, 1 TruCharge Display Cable, and 1 Gasket

EGIS TILLER MODULE - SURFACE



1.2 Inset Variant

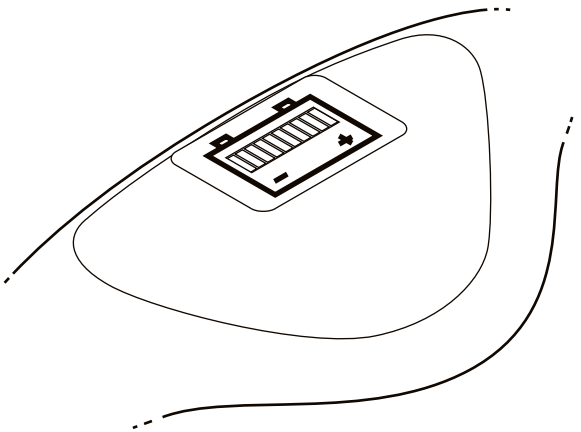
The Inset variant must be embedded within the Scooter Tiller's housing(See the following illustration). The electronics of the controller will then take on the dust and water rating of the Scooter Tiller.

- Inset variant - D50066 / D50032

D50066 Consists of: 1 TruCharge Display Module, 1 Label and 1 Double-sided Adhesive Gasket.

D50032 Consists of: 1 TruCharge Display Module and 1 Double-sided Adhesive Gasket.

EGIS TILLER MODULE - INSET

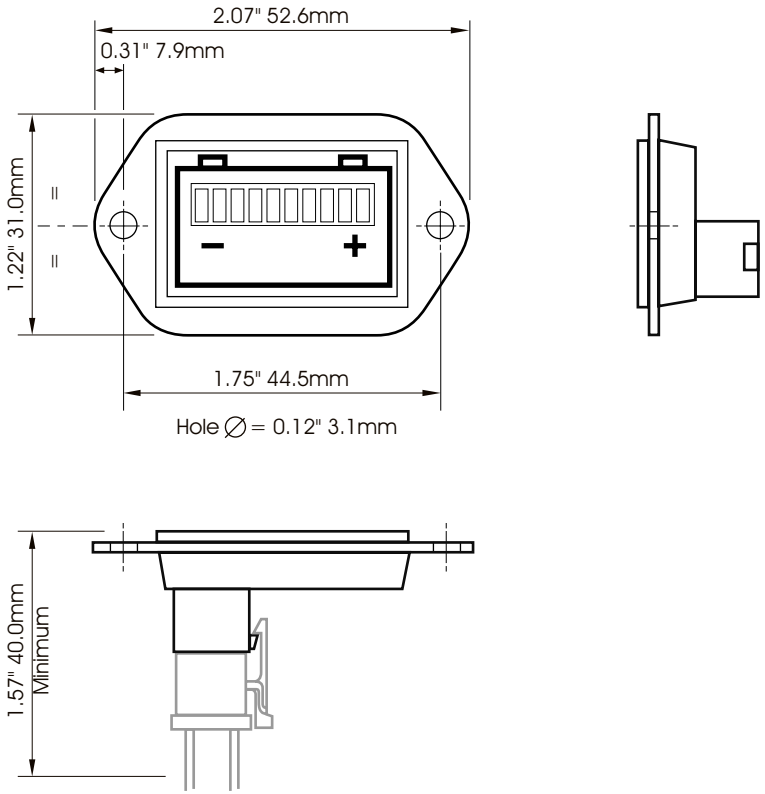


2 Dimensions

2.1 Surface Mount Variant

The Surface Mount Tiller Module has the dimensions shown in the following illustration.

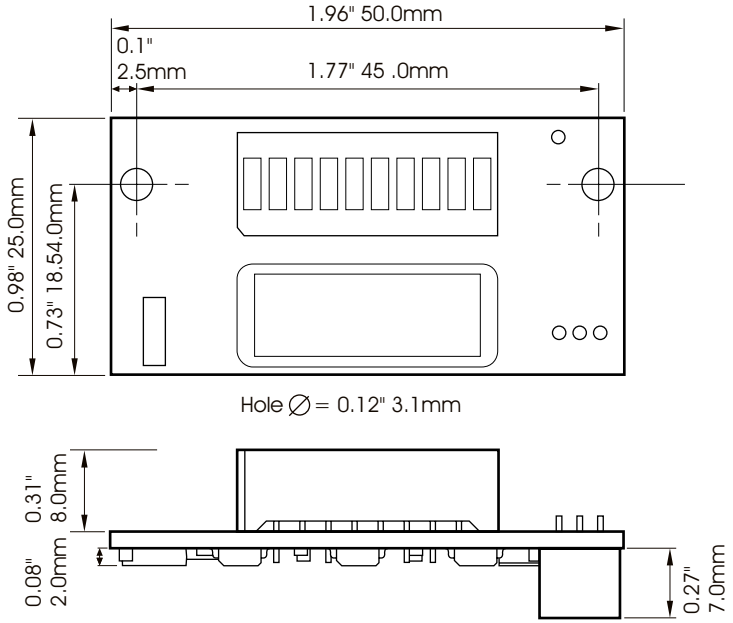
EGIS TILLER MODULE DIMENSIONS - SURFACE



2.2 Inset Variant

The Inset Tiller Module has the dimensions shown in the following illustration.

EGIS TILLER MODULE DIMENSIONS - INSET



3 Mounting

3.1 Handling

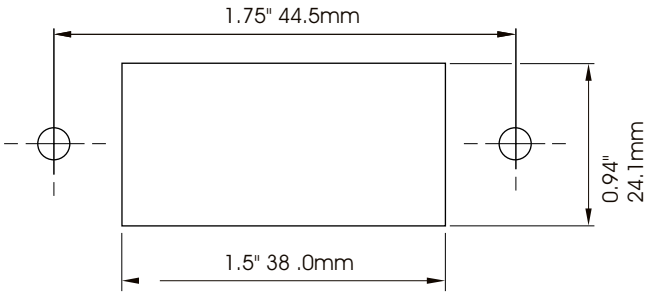
The Tiller Module contains electronic components which may be sensitive to static electricity. Always store the modules in the original packaging until they are ready to be used. When the modules are removed from the packaging, ensure correct anti-static precautions are taken.

3.2 Surface Mount Variant

3.2.1 Fixing

The scooter's Tiller should be fitted with holes as suggested in the diagram below.

EGIS TILLER MODULE FIXING HOLES - SURFACE

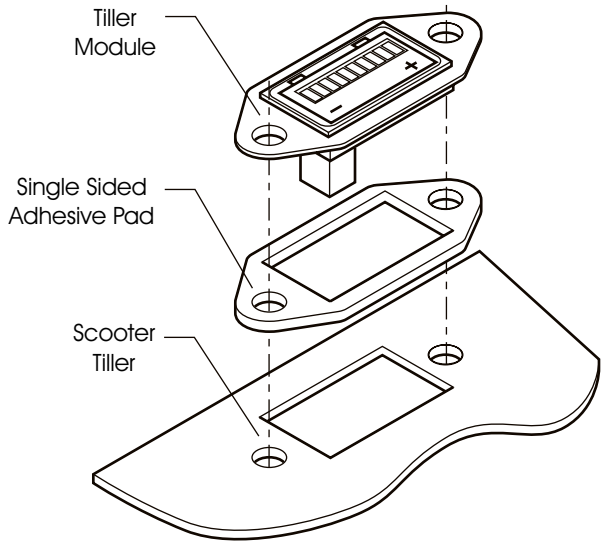


3.2.2 Sealing

The supplied single-sided adhesive gasket should be used to create a seal between the Tiller Module and the scooter's control panel. See the following illustration

When correctly fitted this arrangement will give the Tiller Module an IPX5 dust and water rating.

EGIS TILLER MODULE MOUNTING - SURFACE



3.3 Inset Variant

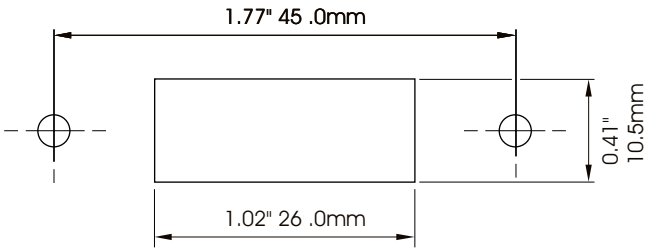
3.3.1 Fixing

The scooter's control panel should be fitted with holes as suggested in the diagram below.

The supplied double-sided adhesive pad should be used to secure the Tiller Module to the scooter's control panel. See the following illustration.

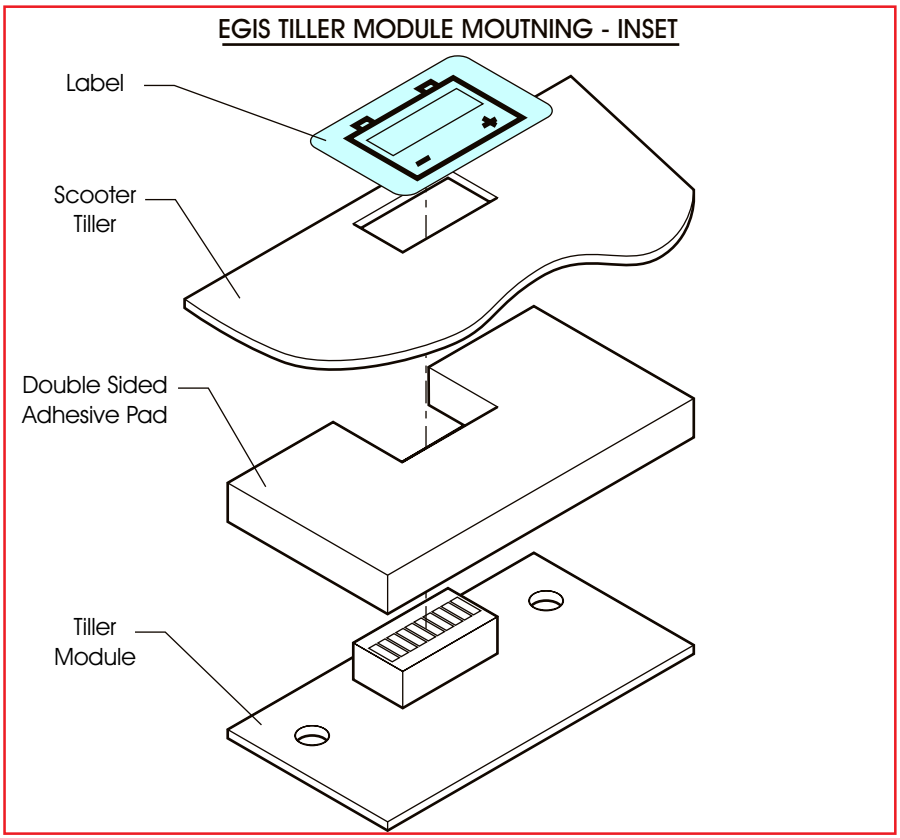
If the Adhesive pad is being used to attach the Tiller Module then the screw holes either side of the central rectangle will not be required.

EGIS TILLER MODULE FIXING HOLES - INSET



Alternatively M3 (4-40 UNC) hardware can be used. The height of the display from the printed circuit board is 8.0mm (0.31"). Suitable spacers should be used so that the display is fixed slightly below the scooter's control panel. Ensure that the metallic fixing hardware (nuts, washers etc.) do not touch the conductive tracks on the printed circuit board.

3.2.2 Sealing



The module should be sealed against the ingress of water and dust by a placing an adhesive waterproof overlay over the display cut-out. The overlay should contain a suitably sized transparent window and the overall dimensions should be at least 36.0mm x 20.5mm (1.41" x 0.81")

The sealing label is only supplied with the Tiller Module kit number D50066.

4 Wiring

You are responsible for establishing the suitability of the particular wiring arrangement used on the scooter. PG Drives Technology can make general recommendations for wiring to Tiller Modules, but PG Drives Technology accepts no responsibility for the wiring arrangement used.

4.1 Wire Gauge

The minimum recommended wire size is 0.22mm^2 for all connections.

4.2 Connectors

4.2.1 Surface Mount Variant

The Tiller Module is fitted with a Molex 'Mini-fit jr' 4 way connector.

See www.molex.com for your local distributor.

Part Numbers are as follows:

Molex 'Mini-Fit-Jr.' 4 socket receptacle:	39-01-2040

PG Drives Technology TruCharge Display Cable.

PGDT Part number:	SA76199

Only use the PG Drives Technology TruCharge Display Cable number SA76199 supplied with kit D50133.

Hand tools for crimping and extraction are available from Molex. The references are as below.

Molex 'Mini-Fit-Jr.' Crimp tool:	69008-0724
Molex 'Mini-Fit-Jr.' Extraction tool:	11-03-0044

Only use the exact tools specified.

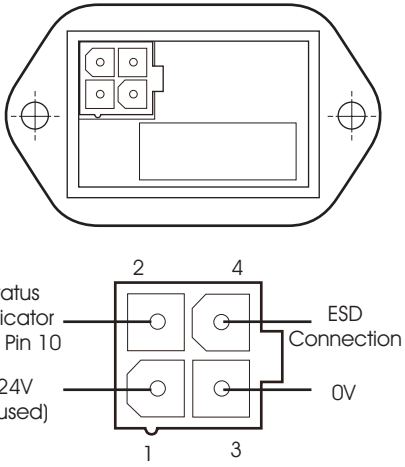
4.2.2 Inset Variant

The Tiller Module is fitted with a 3 way AMP CT series connector, part number 175487-3. The mating crimps and connector housing have Amp part numbers 179227-1 and 179228-3 respectively. Only these parts should be used.

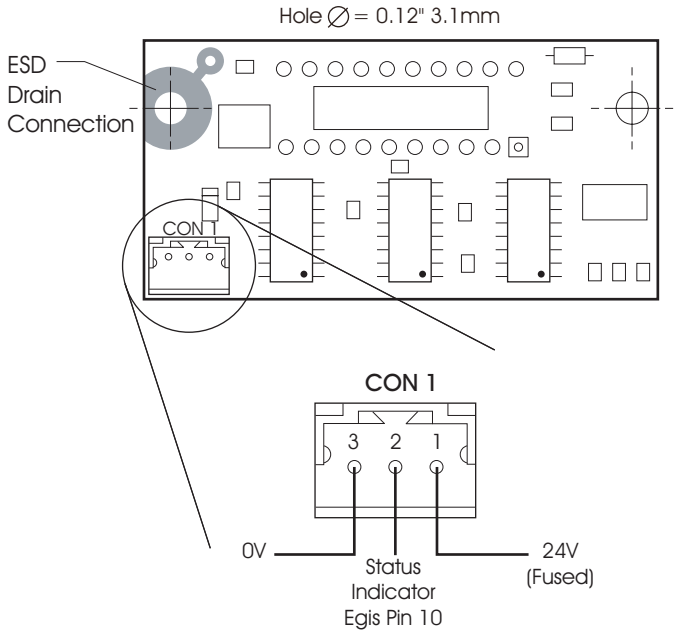
There is also a solder/ring tag point for an Electro-Static Discharge (ESD) drain path wire.

5 Connections

TILLER MODULE CONNECTION - SURFACE



TILLER MODULE CONNECTION - INSET



5.1 Controller Connections

Tiller Module Type	Tiller Module Connector	Function	Tiller Interface
Inset	1	24V	Pin 1
Inset	2	Status Indicator	Pin 11
Inset	3	0V	Pin 10
Surface	1	24V	Pin 1
Surface	2	Status Indicator	Pin 11
Surface	3	0V	Pin 10
Surface	4	ESD	--

5.2 ESD Connection

5.2.1 Surface Mount Variant

This is an optional connection and may not be required, refer to section 6.2 for details.

If the connection is required then connection point 4 in the Molex 'Mini-fit jr' 4 way connector must be utilized

5.2.2Inset Mount Variant

This is an optional connection and may not be required, refer to section 6.2 for details.

If the connection is required there are two methods available. Firstly, a solder hole for wires or electrical suppression components. Secondly, if screws are used to secure the Tiller Module, then a ring terminal can be used.

6 Electromagnetic Compatibility (EMC)

The controller has been tested for compliance with EC directive 89/336/EEC, and the EMC requirements of prEN12184, the FDA and the FCC. The guidelines in this section will help you to make sure that your scooter installation will easily meet the requirements of the directive. You should consider EMC and perform relevant tests as early as possible in the design phase.

6.1 Immunity and Emissions

Refer to the Electromagnetic Compatibility section in the controller's technical manual.

6.2 Electro-Static Discharge (E.S.D.)

The tiller is the most vulnerable area on the scooter to electro-static discharges. These discharges may cause disruption of operation or even permanent damage. The tiller module incorporates extensive protection against E.S.D., however, you should take the following precautions to prevent high levels of energy entering the scooter's electronic system.

- The highest degree of protection can be achieved by making the tiller enclosure, switches and other controls non-conductive. Membrane keypads in particular provide good E.S.D. protection, keypad manufacturers will be able to give appropriate design rule guidance. It should also be considered that high voltages can jump through gaps in enclosures, thereby gaining access to the electronics. Enclosures should therefore be as closed as possible.
- If controls or enclosures are conductive, a low impedance electrical connection to the scooter's metalwork should be provided. If such a connection is used, it should be kept as short as possible to minimize its electrical inductance.
- The tiller module has a connection point, ESD: this can be used to provide an ESD drain path. The path should be via a varistor connected between the ESD pin and the scooter's metalwork. A suitable device is manufactured by Harris, type GE-MOV V82ZA2.

7 Production Tests

7.1 Mounting

Make sure that the tiller module is securely mounted. Do not overtighten any securing screws.

Ensure that the adhesive sealing overlay is fully pressed down.

7.2 Cables and Connections

Check all cables and connections to the tiller module for damage. Ensure there are no dry solder joints.

7.3 Operational Test

The following tests should be carried out on a level floor with at least one meter of clear space around the scooter.

With the scooter switched off, displace the throttle and then switch the scooter on. The TruCharge display should "ripple" up and down. When you have observed that all the bars illuminate, release the throttle and the display should now become steady and indicate the battery condition.

There are two conditions when this test cannot be performed. Firstly, if the controller is programmed (Tiller Displacement on Start-up) to instantly trip if it is powered-up with the throttle displaced. Secondly, if the controller is programmed (High Pedal Disable) to drive immediately after power-up regardless of throttle position.

If this test cannot be performed due to the above conditions, then the only other test method is to power-up the scooter with fully charged batteries and check that all the TruCharge bars illuminate.

CHAPTER 4
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 Egis Scooter Controller without reading, understanding and observing the following warnings. Failure to observe these warnings could result in UNSAFE CONDITIONS for the user of a scooter 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 Egis warranty.

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

2 Warnings

2.1 Driving Technique

The scooter user must be capable of driving a scooter safely. PGDT accepts no liability for losses of any kand arising from failure to comply with this condition. Chapter 1 Section 5.2

2.2 Precautions for Use

lthough the Egis is designed to be extremely reliable and each unit is rigorously tested during manufacture, the possibility of system malfunction always exists (however small the probability). Under some conditions of system malfunction the controller must (for safety reasons) stop the scooter instantaneously. If there is any possibility of the user falling out of the scooter as a result of a sudden braking action, it is imperative that a restraining device such as a seat belt is supplied with the scooter and that it is in use at all times when the scooter is in motion. PGDT

accept no liability for losses of any kind arising from the unexpected stopping of the scooter, or arising from the improper use of the scooter or controller.

Do not operate the scooter if it behaves erratically, or shows abnormal signs of heating, sparks or smoke. Turn the scooter 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 scooter exhibits erratic behavior due to EMI, turn it 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 scooter manufacturer to ensure that the scooter complies with appropriate National and International EMC legislation. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition.

The scooter user must comply with all scooter safety warnings. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter I Section 6.1

2.3 Disengaging the Parking Brake

If you have disengaged the brake and the controller has detected a fault or the scooter is switched off, then it may be possible for the scooter to freewheel at potentially dangerous speeds. Therefore, do not push the scooter up or down inclines on which you cannot stop or hold the scooter. Never sit on the scooter when the parking brake is disengaged. PGDT accept no liability for losses of any kind arising from the scooter being moved with the parking brake disengaged. Chapter I Section 9.2

2.4 Driving

Do not operate the scooter 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. Chapter 1 Section 10.2.1

2.5 Battery Charging

Do not exceed the maximum charging current for the scooter. PGDT accepts no responsibility for losses of any kind from failure to comply with this condition.

Ensure that the charger plug pins are of the correct polarity to be compatible with the scooter's charging socket. Failure to observe this condition could result in a burn hazard or a fire hazard. PGDT accepts no responsibility for losses of any kind from failure to comply with this condition.

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

Only use the battery charger that has been supplied with your scooter. The use of incorrect chargers could damage the batteries, scooter, controller or charger itself, or may result in parts overheating creating the potential for burns or even fire. PGDT accepts no responsibility for losses of any kind from failure to comply with this condition. Chapter 1 Section 11

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 scooter for a user. PGDT accept no liability for losses of any kind if the programming of the controller is altered from factory pre-set values. Chapter 1 Section 12

2.7 Controller Servicing

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

If the Egis 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

2.8 Warranty

The warranty will be void if the Egis has not been used in accordance with Egis Technical Manual SK75326, the Egis has been subject to misuse or abuse, or if the Egis has been modified or repaired by unauthorized persons. Chapter 1 Section 14

2.9 Program Settings

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 scooter for the user. PGDT accept no liability for losses of any kind if the programming of the controller is altered from factory pre-set values. PGDT accept no liability for losses of any kind if the drive or stability characteristics of the scooter are altered without prior notification and discussion with PGDT. Chapter 2 Section 1.2

2.10 Charger Interlock

The scooter manufacturer is responsible for providing a means of preventing the use of the scooter 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

2.11 Connections - General

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

The scooter manufacturer is responsible for ensuring that only the mating connectors specified by PGDT on the control system'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 scooter manufacturer is responsible for ensuring that suitable connectors are used and securely mated throughout the scooter wiring system and that the workmanship associated with the wiring system is of a good 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.

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. Chapter 2 Section 3.1

2.12 Battery Connections

The scooter manufacturer must install a suitable circuit breaker to provide protection against short circuits in the battery wiring, power loom or the control system. 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 3.2

2.13 Freewheel

If you have disengaged the brake and the scooter is switched off, then it may be possible for the scooter to freewheel at

potentially dangerous speeds. Therefore, do not push the scooter up or down inclines on which you cannot stop or hold the scooter. Never sit on the scooter when the parking brake is disengaged. PGDT accept no liability for losses of any kind arising from the scooter being moved with the parking brake disengaged. Chapter 2 Section 6.9

2.14 Position

Under strenuous driving conditions it is possible for metal sections of the controller's case to exceed 41°C (106 °F) in temperature. Under such conditions, the scooter manufacturer should ensure that either the user cannot touch these surfaces, or that the user is warned not to touch these surfaces. While 41°C (106 °F) is very close to normal body temperature, prolonged contact with surfaces above 41°C (106 °F) can result in burns to the skin. PGDT accepts no liability for losses of any kind arising from failure to comply with this condition. Chapter 2 Section 8.2

2.15 Production Tests

This test 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.

CHAPTER 5
SPECIFICATIONS

I Electrical Specifications

Supply Voltage:	24Vdc
Operating Voltage:	16Vdc to 30Vdc
Peak Voltage:	38Vdc
Reverse Battery Current:	40Vdc
Output Current:	70A / 110A
Throttle Input:	Wig-Wag, Single-ended, Voltage
PWM Frequency:	19.5kHz ± 1%
Solenoid Brake Current:	2A max.
Status Output:	12V, 50mA source
Reverse Alarm Output:	24V, 50mA sink
Bat. Charging Current:	12A rms max.
Moisture Resistance:	IPX4
Operating Temperature:	-25°C to +50°C
Storage Temperature:	-40°C to +65°C
Safety:	Multiple hardware and software stratergy designed to ISO7176/14
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
Enviromental Resistance:	Electronics to IPX5