



rootwave™

Zaps weeds. Zero chemicals.

RootWave Pro Explorer

Model No: VLM-001-1

English, Original instructions



This document contains important supplemental information to be read in conjunction with:

- RootWave Pro User Guide U-UGD-PRO-001-3
- Lumag Electric Tracked Dumper Operator's Manual MD450E
 - Stephill Generator User Guides

Read and follow all instructions and safety precautions in these User Guides. Failure to do so will invalidate the warranty and may cause death or serious injury.

Keep this User Guide for reference - do not throw it away.



Copyright

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Intended use

This document provides important safety information and instructions for using RootWave Pro Explorer.

It contains supplemental information to the RootWave Pro User Guide U-UGD-PRO-001-3, Lumag Electric Tracked Dumper Operator's Manual MD450E, and the Stephill Generator User Guides, which must be read in conjunction with this document.

RootWave Pro Explorer consists of modified RootWave Pro System and generator mounted to a battery powered, electric tracked vehicle, for use in a variety of terrains.

Compliance



RootWave Pro complies with applicable EC directives:

Low Voltage Directive (2014/35/EU)

Machinery Directive (2006/42/EC)

Electromagnetic Compatibility Directive (2014/30/EU)

Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU

WEEE Directive 2012/19/EU

Product improvements

RootWave's philosophy is to continually improve its products. As a result, improvements are made from time to time. This user guide will be updated for significant improvements or any that affect safety. However, a user guide update may not always follow minor improvements that do not affect safety. If you are unsure of anything, please contact your RootWave supplier.

Contact details

United Kingdom

RootWave

8 Brook Business Park, Brookhampton Lane, Kineton, Warwickshire
CV35 0JA

www.rootwave.com

Telephone: +44 1926 800789

Email: support@rootwave.com

Other countries

For other countries contact your RootWave supplier. Contact details can be found on your sales documentation.

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Safety information

This section tells you how to safely use RootWave Pro Explorer. Ensure that you comply with all relevant local health and safety policy and legislation when you are using the machine.

In addition to symbols on the RootWave Pro system, the Lumag vehicle and the Stephill generator, which can be found in their respective user guides, the following symbols are marked on the machine:



Indicates a dangerous voltage. Take care to avoid coming into contact with electricity.



Complete user training

Training course and exam must be completed by all operators before using RootWave Pro.



Read User Guide.



The machine weighs 550kg.

Do not lift

Do not use lifting equipment unless machine is secured to a pallet.



TIE DOWN HERE

Correct place for attaching tie downs for transport to avoid damaging the system



DO NOT TIE DOWN HERE

Incorrect place for attaching tie downs for transport. Attaching tie downs here risks damaging the system.



Turn all systems to OFF before refueling to avoid risk of sparks and ignition

Turn all systems to OFF before refuelling to avoid risk of sparks and ignition

Stop and use rain cover



The machine must not be used in condensing conditions. Stop and replace Rainproof Cover immediately if it starts to rain.



Authorised service personnel only.
Do not modify.

The machine can only be serviced by trained and authorised service personnel. Do not modify.

RootWave takes a thorough and proactive approach to safety in the design of its products, labelling and training for safe use. If you have experienced any accidents, incidents or near misses while using the machine, please contact your RootWave supplier.

► *For contact information, see section 'Contact details' on page 3.*

- Notice**
- For safety information and operating instructions relating to the Lumag Battery Powered Vehicle, Stephill generator and any other equipment that you may use with the machine, refer to the equipment's user guide and warning labels.

► *If you contact RootWave about your product you may be asked to provide a model number and unique serial number. The model and serial number of the machine is affixed to the vehicle frame. It can be found on the inside face of the metal bracket positioned*

on the lower right-hand side of the vehicle, when viewed from the direction facing the vehicle controls.

Warning



Warning

- Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

General

To avoid death or serious injury from electric shock:

- The machine presents a number of hazards which if used incorrectly can cause death to humans or animals. Training course and exam must be completed by all operators before using the machine. For training courses including refresher training please contact your RootWave supplier.
- The machine should not be exposed to condensing conditions because water ingress can cause it to function incorrectly, leading to risk of electric shock or fire. Check weather forecast prior to using the machine. If it starts to rain, stop using the machine, turn off the generator and vehicle, and install the Rainproof Cover over the system. Transport the machine in an enclosed trailer that will protect from water ingress and store in a dry location indoors. Always store the Rainproof Cover in its bag and with the system, ready to install over the system when needed. Do not put the Rainproof Cover away if it is wet. Allow to dry before storing.

- Do not drop or expose parts of the machine to impact of any kind as this can damage the product and its safety systems. Drive vehicle carefully, reducing speed over rough or uneven terrain, taking care to reduce impact to the system. Check all parts of the machine for damage each time before use. If any parts appear to be damaged, do not use, contact your RootWave supplier. Before driving the vehicle, check all nuts and bolts on the frame are tight and that the frame does not wobble or rattle. Tighten or replace any loose, damaged, or missing fixtures. When transporting using a trailer, leave vehicle in gear, secure with harnesses, and drive carefully.
- To prevent untrained personnel from using the equipment, ensure the key for the vehicle is stored in a secure location and adequate key controls are in place.
- Modifications to the machine may compromise its structural integrity, or other safety features. Do not attempt to modify the machine or overcome safety features as this can lead to mechanical injury or electric shock.
- The machine must be serviced annually and can only be serviced by trained and authorised service personnel. Contact your RootWave supplier for servicing or replacements.
- The machine has moving parts and electrical components. Do not attempt to maintain or adjust what is on the machine while it is powered on or in operation.

To avoid death or serious injury from electromagnetic interference:

- Strong magnetic fields created by arcs can interfere with the function of adjacent sensitive electronic equipment including pacemakers and other carried electronic health equipment. Do not operate the machine if you have one of these devices. Ensure bystanders are kept a minimum of 5m from the machine.

Set-up

To avoid death or serious injury from electric shock or mechanical injury:

- Incorrect loading of items on machine can cause a crush injury or damage to the system leading to risk of electric shock. Never overload the vehicle and always load and secure items onto the vehicle in their correct locations. All box lids must be secured shut with bungee cords during transportation and Lance Lanyard must not be dangling down. Secure strap out of the way, under a bungee cord.
- The Electrode Module, Safety Earth and Treatment Return have features with pointed ends and sharp edges. Handle them carefully and ensure they are secured in a position that cannot damage other equipment during transportation.
- The machine weighs 550 kg. Do not attempt to manually pick up the machine or lift directly with lifting equipment as this may cause physical injury or damage to the equipment and its safety systems. When transporting the machine on an enclosed trailer, park trailer in a stable position on level ground and use a ramp with incline $\leq 11^\circ$ (20%) to load and unload the system. Make sure trailer and ramp are secure before loading and unloading the system. Proceed with care and ensure bystanders stand back. Alternatively, secure system onto a pallet and carefully lift pallet using suitable lifting equipment.

To avoid death or serious injury from fire or a burn:

- The generator exhaust may get hot during use. Never operate the machine with the Rainproof Cover installed as this can cause the cover to catch fire.

- The generator fuel is a flammable liquid and poses a fire risk. Refuel the generator before setting out and never store fuel canisters on the vehicle. When refuelling the generator, do so in a well-ventilated area and follow instructions on the fuel canister. Never refuel the generator when the generator or vehicle are running. Take care to avoid spilling any fuel. If fuel is spilt, wipe it up and clean the area.

Operation

To avoid death or serious injury from electric shock or mechanical injury:

- Treating in municipality environments can cause exposure to multiple hazards. Conduct a Site-Specific Risk Assessment found in U-DV1-ISA005, before commencing work and check for: pedestrians; animals; active trainlines; vehicles, pathways, areas where visibility is reduced, and conductive materials in adjacent structures above or below ground such as street furniture, cables, fences and signposts. Assess risk before operating in complex environments, see U-DV1-ISA005.

- Unsafe driving of the vehicle may cause death or serious injury. To avoid a collision or tipping over the vehicle, drive carefully and ensure you have adequate visibility when driving the vehicle. Do not operate in foggy conditions or without adequate lighting. Watch out for moving hazards such as animals, pedestrians, and vehicles; and slippery or unstable surfaces such as mud, ice and pools of water. Plan route ahead and monitor the vehicles angle. Do not exceed the following inclines when driving: Smooth slopes or ramps up to max 11° (20%) any direction; bumpy slopes up to max 6° (10%) any direction; bumpy slopes 6° to 11° (20%) driving up or down (forward and reverse) with vehicle facing up the slope; reverse up or down curbs up to 10cm high without a ramp or curbs 10 to 15cm high using a ramp up to 11° (20%). Do not steer on bumpy slopes 6-11° (20%). Do not overload the vehicle, changing its centre of gravity; and take care when driving the vehicle on loose, uneven, soft or muddy terrain and in high winds. Never stand or sit on the vehicle and ensure all bystanders stand back, out of the way of the vehicle. Ensure ramps, bridges and terrain can support the weight of the vehicle and driver before crossing. Park on level ground and in stable position. Leave vehicle in gear when parked to avoid it moving unexpectedly.
- The vehicle contains conductive materials. Although it is extremely unlikely, hazardous voltages may become present in the vehicle in certain fault conditions or if the electrode or weed being treated comes in contact with the vehicle. Avoid unnecessary contact with the machine when the generator is running. No one else should be within 5m of the treatment zone or vehicle during operation.
- Always wear the correct Personal Protective Equipment (PPE), when driving the vehicle including steel cap boots, close-fitting work clothes and ear defenders.

- Hazardous voltages may be present in the treated weed and plants in contact with the treated weed. Operators must wear dielectric insulating knee boots capable of withstanding 15 kV (peak) at 50 Hz whenever RootWave Pro system is turned on. The boots must be at least 30 cm tall, in good condition and with a rugged sole. Tuck the hem of your trousers or outerwear into your boots.

To avoid moderate injury from manual handling, slips trips or falls:

- Obstacles such as railway tracks, steps and uneven terrain including slopes, ballast and riverbanks can be trip hazards. Watch where you are walking when moving between treatment zones.

After use

To avoid death or serious injury from electric shock:

- To avoid accidental damage to the machine, turn off Power Module and generator, remove Treatment Return and Safety Earth from the ground, disconnect cables and place all items in their correct locations on the vehicle before moving the vehicle.
- Water and condensation can conduct electricity. Do not store the machine outside. Store inside in a dry location where risk of damage to the system is reduced.
- Storage box 1 may collect moisture picked up from the ground onto cables which if left unchecked could lead to water ingress and electric shock. Check and if necessary, wipe up moisture inside box.
- Disconnect all power sources before attempting any disassembly for recycling. Partial disassembly will render the machine unsafe for future use.

Overview of the machine

This section provides an overview of the machine and lists the components.

Components

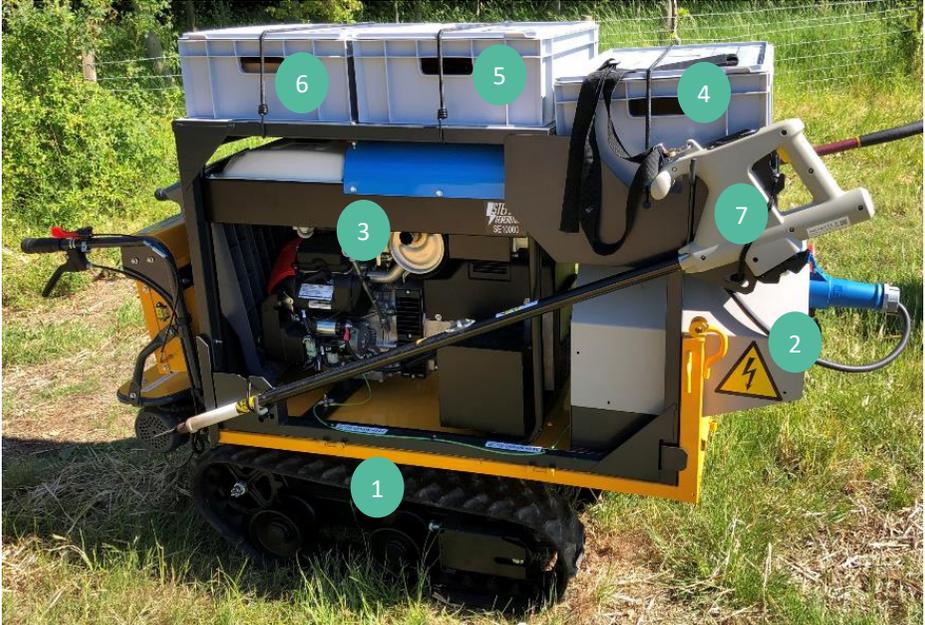


Figure 1 Components

Table 1 Components

1 Vehicle with frame	MD-450E Lumag battery powered, electric tracked vehicle, with frame attachment. Refer to Electric Tracked Dumper Operator's Manual MD450E, for important safety information.			
2 RootWave Pro Power Module with Padlock and Keys	<p>RootWave Pro Power Module TRA-002-3 which is fixed to the frame. Creates high-voltage electricity and contains safety and control systems. Refer to RootWave Pro User Guide U-UGD-PRO-001-3, for important safety information.</p> <p>Includes padlock for locking Power Module to Off. Only trained operators should have access to the key. Store the key in a secure location.</p>			
3 Generator	<p>SE10000 Stephill Generator with 10.0 kVA/8.0kW output. Provides power to the Power Module.</p> <p>Refer to the generator user guides for important safety information.</p>			
4 Box 1, containing:	<table border="0"> <tr> <td data-bbox="128 1037 308 1117">Treatment Return Body</td> <td data-bbox="341 1037 683 1436"> <p>Provides a return path for the electricity when assembled to the return blade, inserted into the ground.</p> <p>RootWave Pro cannot activate unless this is connected to return blade inserted into the ground.</p> </td> <td data-bbox="716 1037 948 1220" rowspan="2">  </td> </tr> </table>	Treatment Return Body	<p>Provides a return path for the electricity when assembled to the return blade, inserted into the ground.</p> <p>RootWave Pro cannot activate unless this is connected to return blade inserted into the ground.</p>	
Treatment Return Body	<p>Provides a return path for the electricity when assembled to the return blade, inserted into the ground.</p> <p>RootWave Pro cannot activate unless this is connected to return blade inserted into the ground.</p>			

Long
Treatment
Cable with
Carabiner

Connects the Treatment
Return to the Treatment
Lance.

20m long, belt loop and
carabiner provided to
attach to belt to reduce
strain.



Short
Treatment
Cable

Connects the Power
Module to the
Treatment Return.

7m long.



5 Box 2, Containing

Safety Earth

Part of the high voltage
safety system.

RootWave Pro cannot
activate unless the
Safety Earth is inserted
into the ground.



Treatment
Return Blade

Inserted into the ground
with the mallet before
the body is screwed on.
Provides a return path
for the electricity.



Extraction
Handle

To remove the
Treatment Return Blade
from ground.



Rubber Mallet

To insert the Treatment Return Blade into the ground.



File

For sharpening the Treatment Return Blade should it become blunt or burred.



Electrode Module with Shield, ETD-005-1

Lance attachment for use when treating around conductive objects such as railway lines and street furniture to reduce the risk of the live electrode contacting the structure.



6 Box 3, Containing:

User Guides in pouch

Important instructions for operating the system.



Powder Fire Extinguisher

To keep on hand in case of fire.



Fire Blanket	To keep on hand in case of fire.	
Abrasive sheet	To clean the tip of the electrode.	
Spirit Level	For measuring the slope of terrain to check if suitable for driving over with vehicle.	
Alcohol wipes	For cleaning the electrode module to prevent carbon build up.	
Bungee cord	Spare cord for attaching items to vehicle.	
Battery Charger	For charging vehicle battery.	
Tool Kit	For maintaining the vehicle	
Funnel	For topping up oil to the vehicle gearbox.	

Additional screws and hex key	For changing electrode modules.	
Additional fuses	To replace blown power module fuses.	
Clipboard, pen and Operator Checklist	For agreeing responsibilities and checking off steps.	
7 Treatment Lance with Lanyard and Electrode Module	Makes contact with the weed to deliver the electrical energy. Lanyard helps support the Treatment Lance during prolonged use.	
Bungee Cords	To secure storage baskets onto vehicle.	
Ball loop bungee cords	To secure Treatment Lance and additional tools to vehicle.	

- 8 Clinometer** Mounted to front of vehicle to monitor incline while driving. Use the on/off button to turn on when heading out and off once returned. Uses 2xAA batteries. To replace battery, remove from vehicle and replace with a sticky pad such as 'tesa® Powerbond® OUTDOOR Double-sided Mounting Tape' to reattach.



Rainproof cover with bag

Rainproof cover for protecting the machine from water ingress when it rains.



2 x ramps

For use when driving the vehicle on a step/curb 10-15cm high



Additional equipment

The equipment below is needed and is not provided with the machine.

Table 2 Additional equipment needed

Equipment	Purpose
Enclosed Trailer	For transporting the machine. Must be capable of holding 550 kg and fit a 1847x770x1250mm load
Ramp up to max 11° (20%) Or: Pallet and suitable lifting equipment	For loading the machine onto the enclosed trailer as it weighs 550 Kg. Only use lifting equipment if the machine is secured to a pallet and lift system up with the pallet. Lifting the system directly can damage it.
Harnesses	To secure the machine to trailer during transit. Additional harnesses or bungee cords may be needed for securing any additional equipment to the vehicle.
Personal Protective Equipment (PPE) for driving the vehicle	Steel cap boots, tight-fitting clothing and ear defenders must be worn when driving the vehicle. Refer to the Lumag Electric Tracked Dumper Operator's Manual MD450E for a list of additional PPE that may be worn.

Refer to the RootWave Pro User Guide U-UGD-PRO-001-3, Table 9, for additional equipment that may also be needed.

RootWave Pro PRO-002-3 features

- ▶ *For instructions on how to operate the RootWave Pro refer to the RootWave Pro User Guide U-UGD-PRO-001-3.*

The RootWave Pro System supplied with the machine, is essentially the same as the standard RootWave Pro system, PRO-001-3, with the only differences being to the Power Module shape and labelling:

- The Power Module, TRA-002-3 has a different enclosure shape to the standard Power Module, TRA-001-3, to enable it to fit onto the vehicle.
- The Power Module warning label has had the following additional languages add to it: French, Dutch, German and Swedish.

Therefore, all instructions and safety information detailed in the RootWave Pro User Guide, U-UGD-PRO-001-3, are relevant to the RootWave Pro model, PRO-002-3, supplied with the machine and must be read and understood before attempting to operate the machine.



Figure 2: Power Module, TRA-002-3

Vehicle Features

The frame has the following features for safely attaching and storing the components required to operate the system:



Figure 3: Frame features

- For instructions on how to operate, maintain and clean the vehicle refer to the Lumag Electric Tracked Dumper Operator's Manual MD450E.

Table 3 Frame features

- | | |
|----------|--|
| 1 | Vehicle platform with Power Module and generator securely bolted in place. |
| 2 | Hooks for attaching the Treatment Lance to the vehicle. |
| 3 | Ball bungee cords for securing Treatment Lance in place. |
| 4 | Hook and support feature for attaching large garden tools such as a spades and rakes to the vehicle. |
| 5 | Ball bungee cord for securing large garden tools in the tool holder in place. |
| 6 | Framework for holding the three storage boxes. |
| 7 | Holes in the framework for attaching bungee hooks to secure the storage boxes to the vehicle. |

The following features of the standard Lumag vehicle have been removed as these are not required for the application. Any information regarding these features in the Lumag Electric Tracked Dumper Operator's Manual MD450E are not relevant and can be ignored:

- The headlight has been removed.
- The tilting bed for dumping of materials has been removed and feature disabled.

How to pack items on the vehicle

Pack boxes 1, 2, and 3 with items listed for each box in Table 1 Components, on page 16. Refer to label on inside of each box lid for a list of items which belong in that box.

Take care when handling and packing the Electrode Modules, Safety Earth, and Treatment Return blade as these have features with pointed ends and sharp edges. Pack with sharp or pointed features pointing away from other items to minimise risk of damage to other equipment during transportation.

Close lids and secure in place on vehicle using bungee cords.



Figure 4 Pack items with sharp or pointed edges facing away from other items

Hang the Treatment Lance handle and shaft over the Treatment Lance hooks and secure both ends in place against the frame using the ball bungee cords provided. Refer to items 2 and 3 in Table 3 Frame features on page 25.

Make sure the Treatment Lance Lanyard is secure and not dangling down. The bungee cord for box 1 can be used to tuck the Treatment Lance Lanyard out of the way.



Figure 5 Tuck the Treatment Lance Lanyard under bungee cord during transportation so it is not dangling down

Use the tool hook and support feature for attaching any large garden tools you require, such as a spade or rake, to the vehicle. Secure these in place using the ball bungee cord provided. Refer to items 4 and 5 in table 3 frame features on page 25.



Figure 6 Secure large garden tools to vehicle using tool hook and support feature, and secure with ball bungee cord

Store the ramps in the space between the vehicle control panel and frame as shown in Figure 7.



Figure 7 Store Ramps in space between the vehicle control panel and frame

Do not overload the vehicle and make sure all items are secure. Use additional bungee cords if needed.

Protection from water ingress

The machine is not protected from damage from rain and must not be exposed to condensing conditions as water ingress can cause the system to function incorrectly and lead to risk of electric shock or fire.

A Rainproof Cover is provided with the machine to protect from damage from water ingress in the event of unexpected rain. If it starts to rain, stop using the machine, turn off the generator and vehicle, and install the Rainproof Cover over the system.

Store the machine in a dry location indoors.

Only transport the machine in an enclosed trailer, which will protect from water ingress.

System weight and safe driving angles

The weight of the machine is 550kg.

Due to the weight of the system and its high centre of gravity, only the specific inclines and obstacles described in this section can be driven over, using the methods described.

Failure to do so can cause the vehicle to overbalance and tip over which could cause death or serious injury from physical injury or damage to the system.

The vehicle can be driven over the following inclines and obstacles:

- Smooth slopes or ramps up to max 11° (20%) any direction.



Figure 8: Smooth slopes or ramps up to max 11° (20%)

- Bumpy slopes up to max 6° (10%) any direction.

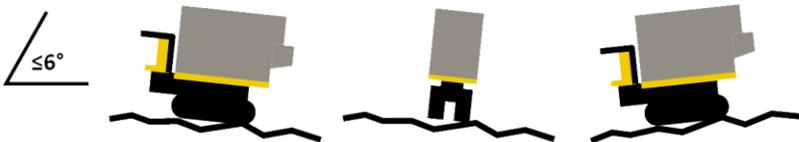


Figure 9: Bumpy slopes up to max 6° (10%)

- Bumpy slopes 6° to 11° (20%) can be driven up or down (forward and reverse) if vehicle is facing up slope.



Figure 10: Bumpy slopes 6° to 11° (20%)

- Vehicle can be reversed up or down obstacles up to 10cm high such as a curb or step, without a ramp.

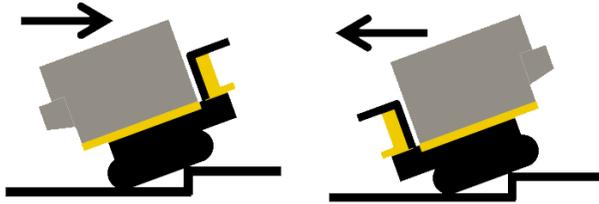


Figure 11: Curbs max 10cm

- Curbs 10cm to 15cm high require a ramp up to 11° (20%) to be used.



Figure 12: Curbs 10cm to 15cm use ramp max 11° (20%)

To measure the angle, a spirit level is provided with the system, located in storage box 3. The machine also has a vehicle mounted clinometer to assist with monitoring the angle during use.

The vehicle must be parked in a stable position on level ground. Do not exceed a 6° incline when parked and do not lean on the vehicle.

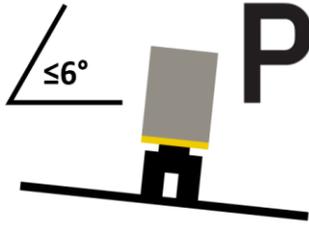


Figure 13: Park in a stable position on level ground

**Warning**

- The machine should not be exposed to condensing conditions because water ingress can cause it to function incorrectly, leading to risk of electric shock or fire. Check weather forecast prior to using the machine. If it starts to rain, stop using the machine, turn off the generator and vehicle, and install the Rainproof Cover over the system. Transport the machine in an enclosed trailer that will protect from water ingress and store in a dry location indoors. Always store the Rainproof Cover in its bag and with the system, ready to install over the system when needed. Do not put the Rainproof Cover away if it is wet. Allow to dry before storing.
- The machine weighs 550 kg. Do not attempt to manually pick up the machine or lift directly with lifting equipment as this may cause physical injury or damage to the equipment and its safety systems. When transporting the machine on an enclosed trailer, park trailer in a stable position on level ground and use a ramp with incline $\leq 11^\circ$ (20%) to load and unload the system. Make sure trailer and ramp are secure before loading and unloading the system. Proceed with care and ensure bystanders stand back. Alternatively, secure system onto a pallet and carefully lift pallet using suitable lifting equipment.
- Unsafe driving of the vehicle may cause death or serious injury. To avoid a collision or tipping over the vehicle, drive carefully and ensure you have adequate visibility when driving the vehicle. Do not operate in foggy conditions or without adequate lighting. Watch out for moving hazards such as animals, pedestrians, and vehicles; and slippery or unstable surfaces such as mud, ice and pools of water. Plan route ahead and monitor the vehicles angle. Do not exceed the following inclines when

driving: Smooth slopes or ramps up to max 11° (20%) any direction; bumpy slopes up to max 6° (10%) any direction; bumpy slopes 6° to 11° (20%) driving up or down (forward and reverse) with vehicle facing up the slope; reverse up or down curbs up to 10cm high without a ramp or curbs 10 to 15cm high using a ramp up to 11° (20%). Do not steer on bumpy slopes 6-11° (20%). Do not overload the vehicle, changing its centre of gravity; and take care when driving the vehicle on loose, uneven, soft or muddy terrain and in high winds. Never stand or sit on the vehicle and ensure all bystanders stand back, out of the way of the vehicle. Ensure ramps, bridges and terrain can support the weight of the vehicle and driver before crossing. Park on level ground and in stable position. Leave vehicle in gear when parked to avoid it moving unexpectedly.

- The Electrode Module, Safety Earth and Treatment Return have features with pointed ends and sharp edges. Handle them carefully and ensure they are secured in a position that cannot damage other equipment during transportation.
 - Incorrect loading of items on machine can cause a crush injury or damage to the system leading to risk of electric shock. Never overload the vehicle and always load and secure items onto the vehicle in their correct locations. All box lids must be secured shut with bungee cords during transportation and Lance Lanyard must not be dangling down. Secure strap out of the way, under a bungee cord.
-

Getting started

The machine is shipped partially assembled and on a pallet. The following steps must be completed before it can be used:

Unloading the machine

1. Remove transportation straps securing the machine onto the pallet.
2. Check all nuts and bolts on the frame are tight and that the frame does not wobble or rattle. Tighten or replace any loose, damaged, or missing fixtures.
3. Check all items are secured to the vehicle and that the Treatment Lance Lanyard is securely tucked under the bungee cord and not dangling down as per Figure 5 on page 27. Use additional bungee cords if needed.
4. Position the two ramps provided against the edge of the pallet, aligned with the vehicle's tracks so that it can be reversed down the ramp. See Figure 14.
5. Read the Lumag Electric Tracked Dumper Operator's Manual MD450E for instructions on how to operate the vehicle. If unsure contact your RootWave supplier for further information.
 - ▶ *For contact information, see section 'Contact details' on page 3.*
 - ▶ *You will find the vehicle key on a lanyard around the handle. Store key in a safe place when not in use.*
6. Carefully reverse the vehicle down the ramps and park in a stable position on level ground.



Figure 14 Position Ramps against pallet

Assemble Electrode Module to Treatment Lance

The Treatment Lance is shipped without the Electrode Module assembled.

See section ‘Setting up the Treatment Lance’ in the RootWave Pro User Guide U-UGD-PRO-001-3, for instructions on how to install the module.

Refuel the generator

The machine is shipped with an empty fuel tank and will need to be refuelled before use.

See the Stephill Generator User Guides for details on the fuel required and instructions on how to refuel the generator.



Warning

- The machine presents a number of hazards which if used incorrectly can cause death to humans or animals. Training course and exam must be completed by all operators before using the machine. For training courses including refresher training please contact your RootWave supplier.
- The generator exhaust may get hot during use. Never operate the machine with the Rainproof Cover installed as this can cause the cover to catch fire.

Charge the vehicle battery

Check the vehicle battery level and recharge if needed. See the Lumag Electric Tracked Dumper Operator's Manual MD450E for instructions on how to check and charge the vehicle battery.

Operation

Read and follow all safety messages in the following user guides, and complete the RootWave Pro Explorer training from a qualified trainer before attempting to operate the system:

- RootWave Pro Explorer User Guide: U-UGD-VLM-001-1
- RootWave Pro User Guide: U-UGD-PRO-001-3
- Lumag Electric Tracked Dumper Operator's Manual MD450E
- Stephill Generator User Guides
- User Guides of any additional equipment used.

Failure to do so will invalidate the warranty and may cause death or serious injury.

- ▶ *For more information see: 'Safety information' on page 7 and 'Training' on page 52*



Warning

- The machine presents a number of hazards which if used incorrectly can cause death to humans or animals. Training course and exam must be completed by all operators before using the machine. For training courses including refresher training please contact your RootWave supplier.
- The generator exhaust may get hot during use. Never operate the machine with the Rainproof Cover installed as this can cause the cover to catch fire.

Loading and transporting the machine

Use an enclosed trailer

To safely load and secure the machine onto an enclosed trailer:

1. Put on Personal Protective Equipment (PPE) for driving the vehicle including steel cap boots, close-fitting work clothes, and ear defenders.
 - ▶ *For information on more PPE you may wish to wear, see the Lumag Electric Tracked Dumper Operator's Manual MD450E.*
2. Check all nuts and bolts on the frame are tight and that the frame does not wobble or rattle. Tighten or replace any loose, damaged, or missing fixtures.
3. Check all items are secured to the vehicle and that the Treatment Lance Lanyard is securely tucked under the bungee cord and not dangling down as per Figure 5 on page 27. Use additional bungee cords if needed.
4. Use a ramp with incline $\leq 11^\circ$ (20%) to load the machine onto the trailer. Ensure the ramps and trailer can hold the 550 kg load of the machine plus the operator. Make sure trailer is parked on level ground and both vehicle and ramp are secure so will not roll or move when loading the system. Make sure bystanders stand back and carefully reverse the vehicle up the ramp and onto the trailer.

5. Park the vehicle in gear and secure to the trailer using ratchet straps across the vehicle bed in areas labelled 'TIE DOWN HERE'. See Figure 15. Tying down harnesses to any other part of the vehicle may cause damage to the system.
6. Check all additional items required are securely fastened to the vehicle and the lids on the storage boxes are closed. Use extra bungee cords or harnesses if required.



Figure 15 Secure harnesses in areas marked 'TIE DOWN HERE'

When transporting the vehicle, drive carefully to avoid impact damage to the system.

To unload the system:

1. Park trailer in a stable position on level ground and position ramp with incline $\leq 11^\circ$ (20%) for unloading the system. Make sure both vehicle and ramp are secure so will not roll or move when unloading the system.
2. Remove harnesses.
3. Check all items are still securely attached to the vehicle and Treatment Lance Shoulder Strap is not dangling down.
4. Make sure bystanders stand back and carefully drive the vehicle down the ramp and park in stable position on level ground.

Alternatively, the machine can be lifted using a pallet:

1. Position ramp with incline $\leq 11^\circ$ (20%) against pallet and reverse the machine up the ramp and onto the pallet.

2. Secure to the pallet using ratchet straps across the vehicle bed in areas labelled 'TIE DOWN HERE'. See Figure 15. Tying down harnesses to any other part of the vehicle may cause damage to the system.
3. Use suitable pallet lifting equipment to lift the pallet onto vehicle. Ensure load is stable before lifting.

**Warning**

- Do not drop or expose parts of the machine to impact of any kind as this can damage the product and its safety systems. Drive vehicle carefully, reducing speed over rough or uneven terrain, taking care to reduce impact to the system. Check all parts of the machine for damage each time before use. If any parts appear to be damaged, do not use, contact your RootWave supplier. Before driving the vehicle, check all nuts and bolts on the frame are tight and that the frame does not wobble or rattle. Tighten or replace any loose, damaged, or missing fixtures. When transporting using a trailer, leave vehicle in gear, secure with harnesses, and drive carefully.
- The machine weighs 550 kg. Do not attempt to manually pick up the machine or lift directly with lifting equipment as this may cause physical injury of damage to the equipment and its safety systems. When transporting the machine on an enclosed trailer, park trailer in a stable position on level ground and use a ramp with incline $\leq 11^\circ$ (20%) to load and unload the system. Make sure trailer and ramp are secure before loading and unloading the system. Proceed with care and ensure bystanders stand back. Alternatively, secure system onto a pallet and carefully lift pallet using suitable lifting equipment.
- The machine should not be exposed to condensing conditions because water ingress can cause it to function incorrectly, leading to risk of electric shock or fire. Check weather forecast prior to using the machine. If it starts to rain, stop using the machine, turn off the generator and vehicle, and install the Rainproof Cover over the system. Transport the machine in an enclosed trailer that will protect from water ingress and store in a dry location indoors.

Always store the Rainproof Cover in its bag and with the system, ready to install over the system when needed. Do not put the Rainproof Cover away if it is wet. Allow to dry before storing.

- The machine presents a number of hazards which if used incorrectly can cause death to humans or animals. Training course and exam must be completed by all operators before using the machine. For training courses including refresher training please contact your RootWave supplier.
 - Always wear the correct Personal Protective Equipment (PPE), when driving the vehicle including steel cap boots, close-fitting work clothes and ear defenders.
-

Before setting out

Before you set out to the treatment site, do the following:

1. Obtain the necessary permissions from the landowner and make any necessary arrangements for a safe work site such as minimising access of vehicles, pedestrians, and other workers to the treatment site, and ensuring railway lines are not live.
2. Conduct an initial risk assessment for the treatment site and obtain necessary PPE and any other equipment required such as barriers and signs.
3. Check the weather forecast. The machine cannot be used in wet or condensing conditions.
4. Check the last service was within 12 months. If an annual service is required, contact your RootWave supplier.
- ▶ *For contact information, see section 'Contact details' on page 3.*
5. Check and recharge the battery if needed. See section 'Recharge the battery' on page 36.

6. Check the generator has enough fuel. Refuel if needed before setting out. See section 'Refuel the Generator' on page 35.
 7. Check the Lumag vehicle gear box has enough oil and top up if needed. Refer to the Lumag Electric Tracked Dumper Operator's Manual MD450E.
 8. Check all items required are present, not damaged, and packed correctly as per section: How to pack items on the vehicle on page 26. If a component is damaged, do not use it. Replace the part or contact your RootWave supplier.
 9. Collect the padlock key for the Power Module power isolator switch and keys for the vehicle and generator.
 10. Start an Operator Checklist form: U-DV1-ISA005. You will need to complete this form when you have reached the treatment site. Keep this form on hand for reference in the event of an emergency.
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**Warning**

- Do not drop or expose parts of the machine to impact of any kind as this can damage the product and its safety systems. Drive vehicle carefully, reducing speed over rough or uneven terrain, taking care to reduce impact to the system. Check all parts of the machine for damage each time before use. If any parts appear to be damaged, do not use, contact your RootWave supplier. Before driving the vehicle, check all nuts and bolts on the frame are tight and that and that the frame does not wobble or rattle. Tighten or replace any loose, damaged, or missing fixtures. When transporting using a trailer, leave vehicle in gear, secure with harnesses, and drive carefully.
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- Treating in municipality environments can cause exposure to multiple hazards. Conduct a Site-Specific Risk Assessment found in U-DV1-ISA005, before commencing work and check for: pedestrians; animals; active trainlines; vehicles, pathways, areas where visibility is reduced, and conductive materials in adjacent structures above or below ground such as street furniture, cables, fences and signposts. Assess risk before operating in complex environments, see U-DV1-ISA005.
 - The Electrode Module, Safety Earth and Treatment Return have features with pointed ends and sharp edges. Handle them carefully and ensure they are secured in a position that cannot damage other equipment during transportation.
 - The generator fuel is a flammable liquid and poses a fire risk. Refuel the generator before setting out and never store fuel canisters on the vehicle. When refuelling the generator, do so in a well-ventilated area and follow instructions on the fuel canister. Never refuel the generator when the generator or vehicle are running. Take care to avoid spilling any fuel. If fuel is spilt, wipe it up and clean the area.
-

Driving the vehicle

- ▶ *For instructions on how to operate the vehicle and Personal Protective Equipment (PPE) required, refer to the Lumag Electric Tracked Dumper Operator's Manual MD450E.*
1. Vehicle driver to put on PPE for driving the vehicle including close fitting work clothes, steel cap boots and ear defenders. Gloves may also be worn to reduce discomfort from vibration.
 2. Ensure the Rainproof Cover is removed from the vehicle, packed in its storage bag, and placed in box 3 on the vehicle.

3. Check all nuts and bolts on the vehicle frame are tight and that the frame does not wobble or rattle. Tighten or replace any loose, damaged, or missing fixtures.
4. Ensure all items are firmly secured in place on the vehicle and storage box lids are closed. Use additional bungee cords if necessary. Check Lance Lanyard is securely tucked under the bungee cord and not dangling down as per Figure 5 on page 27.
5. Ensure the vehicle is not overloaded as this may change its centre of gravity and increase the risk of the vehicle tipping over.
6. Plan route ahead to ensure you do not exceed the following inclines when driving:
 - Smooth slopes or ramps up to max 11° (20%) any direction
 - Bumpy slopes up to max 6° (10%) any direction
 - Bumpy slopes 6° to 11° (20%) driving up or down (forward and reverse) with vehicle facing up the slope
 - Reverse up or down curbs up to 10cm high without a ramp or curbs 10 to 15cm high using a ramp up to 11° (20%).
- ▶ *Use the spirit level provided to check angles. See section Vehicle Features on page 24 for further information*
7. Check conditions:
 - Ensure you have good visibility before driving vehicle. Do not operate in foggy conditions, at night or in other conditions without adequate lighting.
 - Do not operate in high winds as this may compromise stability
 - Do not operate in wet or condensing conditions. If it starts to rain, stop, turn off vehicle and replace the Rainproof Cover immediately.
8. Ensure all bystanders stand back out of the way of the vehicle, at least 5m from vehicle when it is moving.
9. Never sit or stand on the vehicle.

10. Drive the vehicle slowly and carefully to the treatment site, taking care to minimise impact to the system, and to avoid collisions or tipping over the vehicle. Pay attention to the following:
 - Moving hazards such as animals, pedestrians, vehicles, active roads, paths or railway lines.
 - Slippery or unstable surfaces such as mud, ice and pools of water.
 - Uneven terrain, steep slopes, cliffs, holes, drops, steps and curbs.
 - Ramps, bridges or terrain that cannot support the weight of the system and Operator.
 - The vehicles angle. Plan ahead and monitor this using the spirit level and vehicle mounted inclinometer to ensure it does not exceed the allowable inclines. See section
 - Vehicle Features on page 24 for further information.
 - Keep hands and feet clear of the moving machine and moving parts.
 - Be alert to trip hazards and pick up your feet as you walk with the machine. Take extra care in reverse and only use transmission speed 'LOW' when in reverse.
11. Park in a stable position on level ground. Leave at least a 2m gap between the vehicle and adjacent buildings or other structures for the generator exhaust.
12. Leave in gear and turn power off.
13. Remove key from ignition and store in a safe place.

**Warning**

- Unsafe driving of the vehicle may cause death or serious injury. To avoid a collision or tipping over the vehicle, drive carefully and ensure you have adequate visibility when driving the vehicle. Do not operate in foggy conditions or without adequate lighting. Watch out for moving hazards such as animals, pedestrians, and vehicles; and slippery or
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unstable surfaces such as mud, ice and pools of water. Plan route ahead and monitor the vehicles angle. Do not exceed the following inclines when driving: Smooth slopes or ramps up to max 11° (20%) any direction; bumpy slopes up to max 6° (10%) any direction; bumpy slopes 6° to 11° (20%) driving up or down (forward and reverse) with vehicle facing up the slope; reverse up or down curbs up to 10cm high without a ramp or curbs 10 to 15cm high using a ramp up to 11° (20%). Do not steer on bumpy slopes 6-11° (20%). Do not overload the vehicle, changing its centre of gravity; and take care when driving the vehicle on loose, uneven, soft or muddy terrain and in high winds. Never stand or sit on the vehicle and ensure all bystanders stand back, out of the way of the vehicle. Ensure ramps, bridges and terrain can support the weight of the vehicle and driver before crossing. Park on level ground and in stable position. Leave vehicle in gear when parked to avoid it moving unexpectedly.

- Do not drop or expose parts of the machine to impact of any kind as this can damage the product and its safety systems. Drive vehicle carefully, reducing speed over rough or uneven terrain, taking care to reduce impact to the system. Check all parts of the machine for damage each time before use. If any parts appear to be damaged, do not use, contact your RootWave supplier. Before driving the vehicle, check all nuts and bolts on the frame are tight and that the frame does not wobble or rattle. Tighten or replace any loose, damaged, or missing fixtures. When transporting using a trailer, leave vehicle in gear, secure with harnesses, and drive carefully.
 - The machine should not be exposed to condensing conditions because water ingress can cause it to
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function incorrectly, leading to risk of electric shock or fire. Check weather forecast prior to using the machine. If it starts to rain, stop using the machine, turn off the generator and vehicle, and install the Rainproof Cover over the system. Transport the machine in an enclosed trailer that will protect from water ingress and store in a dry location indoors. Always store the Rainproof Cover in its bag and with the system, ready to install over the system when needed. Do not put the Rainproof Cover away if it is wet. Allow to dry before storing.

- To prevent untrained personnel from using the equipment, ensure the key for the vehicle is stored in a secure location and adequate key controls are in place.
 - The Electrode Module, Safety Earth and Treatment Return have features with pointed ends and sharp edges. Handle them carefully and ensure they are secured in a position that cannot damage other equipment during transportation.
-

Operating the RootWave Pro

Before operating RootWave Pro, complete the Operators Checklist: U-DV1-ISA005., at the treatment site and assess risk, agree responsibilities and implement any additional controls required such as barriers, warning signs, or use of the Electrode Module with Shield.

It may be necessary to complete a new Site Specific Risk Assessment in the Operators Checklist: U-DV1-ISA005, each time the machine is driven to a new location.

Before operating the RootWave Pro also complete the Functional Check Protocol: U-DV1-ISA008, to ensure the system is functioning correctly and safely after transportation to the treatment site.

To operate the RootWave Pro, follow steps in section 'Using RootWave Pro' in the RootWave Pro User Guide: U-UGD-PRO-001-3.



Figure 16 RootWave Pro system set up for operation



Warning

- Treating in municipality environments can cause exposure to multiple hazards. Conduct a Site-Specific Risk Assessment found in U-DV1-ISA005, before commencing work and check for: pedestrians; animals; active trainlines; vehicles, pathways, areas where visibility is reduced, and conductive materials in adjacent structures above or below ground such as street furniture, cables, fences and signposts. Assess risk before operating in complex environments, see U-DV1-ISA005. Strong magnetic fields created by arcs can interfere with the function of adjacent sensitive electronic equipment including pacemakers and other carried electronic health equipment. Do not operate the machine if you have one of these devices. Ensure bystanders are kept a minimum of 5m from the machine.
- Hazardous voltages may be present in the treated weed and plants in contact with the treated weed. Operators must wear dielectric insulating knee boots capable of withstanding 15 kV (peak) at 50 Hz whenever RootWave Pro system is turned on. The boots must be at least 30 cm tall, in good condition and with a rugged sole. Tuck the hem of your trousers or outerwear into your boots.
- Obstacles such as railway tracks, steps and uneven terrain including slopes, ballast and riverbanks can be trip hazards. Watch where you are walking when moving between treatment zones.
- The machine has moving parts and electrical components. Do not attempt to maintain or adjust what is on the machine while it is powered on or in operation.

Moving the machine between sites

If you need to move the machine to a new treatment area or to return to base, turn off and disconnect the RootWave Pro system and generator as per steps 14 and 15 in section 'Using RootWave Pro' in the RootWave Pro User Guide: U-UGD-PRO-001-3.

Pack items in correct locations on vehicle as per section How to pack items on the vehicle on page 26.

Storage box 1 may collect moisture picked up from the ground onto cables. Check and if necessary, wipe up moisture inside box.

Check all items are removed from the ground and stored correctly before moving.

Drive to the next treatment site or back to base, following instructions in 'Driving the vehicle' on page 43.



Warning

- To avoid accidental damage to the machine, turn off Power Module and generator, remove Treatment Return and Safety Earth from the ground, disconnect cables and place all items in their correct locations on the vehicle before moving the vehicle.
 - Disconnect all power sources before attempting any disassembly for recycling. Partial disassembly will render the machine unsafe for future use.
-

In case of emergency

Keep the completed Site-Specific Risk Assessment in U-DV1-ISA005, to hand as this contains important information you will require in an emergency such as details of your location, the nearest mobile phone signal, emergency services meeting point and A&E hospital.

Perform first aid and call for qualified medical help. Provide the following details:

- The site location
- What has happened
- How many injuries
- Kind of injuries

Cleaning

After use, use a brush or dry cloth to wipe clean the vehicle frame.

While cleaning, check for signs of damage or wear and tear. If a component is damaged or showing signs of wear contact your RootWave supplier.

- ▶ *For instructions on how to clean the RootWave Pro System, refer to the RootWave Pro User Guide: U-UGD-PRO-001-3.*
- ▶ *For instructions on how to clean the Lumag vehicle refer to the Electric Tracked Dumper Operator's Manual MD450E.*
- ▶ *For contact information, see section 'Contact details' on page 3.*

Storage

Store the machine indoors in a clean, dry, and secure location.



Warning

- Water and condensation can conduct electricity. Do not store the machine outside. Store inside in a dry location where risk of damage to the system is reduced.
- To prevent untrained personnel from using the equipment, ensure the key for the vehicle is stored in a secure location and adequate key controls are in place.

Training

For training courses including refresher training please contact your RootWave supplier.

- ▶ *For contact information, see section 'Contact details' on page 3.*

**Warning**

- The machine presents a number of hazards which if used incorrectly can cause death to humans or animals. Training course and exam must be completed by all operators before using the machine. For training courses including refresher training please contact your RootWave supplier.
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Accessories and replacement parts

Accessories and replacement parts are available from your RootWave supplier.

- ▶ *For contact information, see section 'Contact details' on page 3.*

Servicing

The machine must be serviced annually.

To arrange an on-site service or for information about repairs, contact your RootWave supplier.

- ▶ *For contact information, see section 'Contact details' on page 3.*
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**Warning**

- Modifications to the machine may compromise its structural integrity, or other safety features. Do not attempt to modify the machine or overcome safety features as this can lead to mechanical injury or electric shock.
 - The machine must be serviced annually and can only be serviced by trained and authorised service personnel. Contact your RootWave supplier for servicing or replacements.
 - The machine has moving parts and electrical components. Do not attempt to maintain or adjust what is on the machine while it is powered on or in operation.
-

Warranty

The machine is supplied with a 1 year warranty as standard. The warranty period will begin on the date that the machine is shipped. You can check on your sales documentation for details of what is covered by the warranty.

Contact your RootWave supplier if you require further information.

► *For contact information, see section 'Contact details' on page 3.*

Disposal

The machine must be recycled at a recycling station for electrical and electronic equipment. This helps minimise the impact of electrical and electronic goods on the environment. Speak to your local waste service or your RootWave supplier for more information.



Warning

- Disconnect all power sources before attempting any disassembly for recycling. Partial disassembly will render the machine unsafe for future use.



Specifications

Dimensions and weight

Table 4 Dimensions and weight

Model	RootWave Pro Explorer, VLM-001-1 (mm)	Weight (kg)
RootWave Pro Explorer, VLM-001-1	1930 x 800x 1320	550
SE10000 Stephill Generator	840 x 575 x 620	110
RootWave Pro Explorer Power Module TRA-002-3	506 x 545 x 428	116

Noise level

SE10000 Stephill generator: 75 dB(A) at 7m

MD-450E Lumag vehicle: 101 dB

