



rootwave™

Zaps weeds. Zero chemicals.

RootWave Pro

Model Nos. covered: PRO-001-3, PRO-002-3, TRA-001-3, TRA-002-3, APL-001-3, ETD-001-3, ETD-002-3, ETD-003-3, ETD-004-3, ETD-005-3, GRW-001-3, GRW-002-3, CAB-001-3 and CAB-002-3

User Guide

English

Original instructions



Read and follow all instructions and safety precautions in this User Guide. 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.

RootWave Pro can be used to treat invasive weeds such as Japanese Knotweed, Giant Hogweed, Himalayan Balsam and Ragwort.

RootWave Pro suppresses the growth of weeds by applying heat to the cells, causing lysis.

Compliance



RootWave Pro complies with applicable EU directives:

Low Voltage Directive (2014/35/EU)

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



RootWave Pro complies with applicable UK regulations:

The Electrical Equipment (Safety) Regulations 2016

The Electromagnetic Compatibility Regulations 2016

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The Waste Electrical and Electronic Equipment Regulations 2013

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 Pro supplier.

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Safety information

This section tells you how to use RootWave Pro safely.

Ensure that you comply with all relevant local health and safety policy and legislation when you are using RootWave Pro.

The following symbols are marked on the equipment:



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.



Strong magnetic field.
No electronic medical
devices.

Indicates risk of a strong magnetic field. Do not operate RootWave Pro if you wear an electronic medical device.



The Power Module weighs 105kg. Use suitable equipment and correct manual handling techniques when moving to avoid physical injury.



RootWave Pro must not be used in condensing conditions.



Never use a hammer or other object to force the Treatment Return or Safety Earth into the ground.



Indicates a risk of fire.



Metal electrodes reach lethal voltages. Turn off all power sources before handling.

Metal electrodes reach lethal voltages. Turn off all power sources before handling.



Indicates that equipment may be hot. Allow to cool before handling.



Authorised service personnel only. Do not modify.

RootWave Pro can only be serviced by trained and authorised service personnel. Do not modify.



Read the user guide.

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 RootWave Pro, please contact your RootWave Pro supplier.

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

-
- Notice**
- For safety information and operating instructions for the generator and any other equipment that you may use with RootWave Pro, for example the generator and dielectric insulating boots, refer to the equipment's user guide and warning labels.
 - For safety information relating to generator refuelling, refer to the user guide and warning labels of the fuel can and spout or refuelling station.
-

► *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 complete system is affixed to the Power Module. Each component is also labelled with its own model and unique serial number.*



Warning

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



Caution

- Indicates a hazardous situation which, if not avoided, could result in moderate injury or damage property.

Notice

- Indicates an important situation which, if not avoided, may seriously impair operations.



- Additional information relating to the current section.
-

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:

- RootWave Pro uses hazardous high voltages to kill weeds and if used incorrectly can cause death to humans or animals. Training course and exam must be completed by all operators before using RootWave Pro. For training courses including refresher training please contact your RootWave Pro supplier.
- Safety interlocks are in place to ensure correct set up and safe operation. Modifications to RootWave Pro may result in unexpected compromise to safety features. Do not attempt to modify the system, use non-genuine RootWave accessories or overcome safety features as this can lead to electric shock.
- RootWave Pro can only be serviced by trained and authorised service personnel. Contact your RootWave Pro supplier for servicing or replacements.
- Disconnect all power sources before attempting any disassembly for recycling. Partial disassembly will render RootWave Pro unsafe for future use.
- The Treatment Lance electrode is at a hazardous voltage when activated. The live electrode warning light located on the shaft of the Treatment Lance lights up in red when the high voltage output is activated, indicating the presence of hazardous voltages. This is true whether the Electrode Module is fitted or not. Before attempting to handle the electrode, turn the power isolator switch on the Power Module to 'Off' and turn off the generator and check the live electrode warning light is off.
- Water and condensation can conduct electricity. Never place the Treatment Lance or Electrode Module on damp or wet ground. Place Treatment Lance and Electrode Module in an elevated, dry location to avoid water ingress.

- To prevent risk of accidental activation when moving between weeds with the Treatment Lance, safe stop the system by squeezing one or both of the triggers fully inwards. To prevent risk of accidental activation during pauses in use, turn the power isolator switch on the Power Module to 'Off' and turn off the generator.
- Do not drop or expose parts of the system to impact of any kind as this can damage the product and its safety systems. Check all parts of the RootWave Pro system for damage each time before use. If any parts of RootWave Pro appear to be damaged, do not use, contact your RootWave Pro supplier.
- The Power Module has a lip on the front and rear of the lid but this lip is not designed to enable carrying of the Power Module and could result in it being dropped which would damage the product and its safety systems. The Power Module should only be lifted from its base using a forklift and or lifting straps.
- Working alone with potentially hazardous equipment can increase risk. If working alone ensure a suitable lone working protocol, written by a suitably qualified Health and Safety advisor, is in place and compliant with local regulations and procedures.
- Water can conduct electricity. Keep connector caps in place until you are connecting cables into the Treatment Return. Replace connector caps when not in use and while re-siting the Treatment Return. Do not place exposed cable connectors onto wet or damp ground during installation or re-siting of the Treatment Return.
- The Treatment Lance length from grip centre to tip is 1.6m. Be careful of overhead hazards such as power lines. There should be no need to raise the Treatment Lance electrode above 30cm from the ground.

To avoid death or serious injury caused by electromagnetic interference:

- Strong magnetic fields can be harmful to wearers of electronic medical devices. Magnetic fields can be caused by arcs formed between the treatment electrode and the target weed. Do not operate RootWave Pro if you wear an electronic medical device or if there is a possibility of people coming within 5 metres of the machine.

Set-up**To avoid death or serious injury from electric shock:**

- Electric shocks can be received from exposed connectors and electrodes. Do not switch on the generator output until the Electrode Module is fitted, all cable connectors are fitted, the Treatment Lance is placed on a dry surface with the Treatment Lance electrode clear of other objects, and the Treatment Return and Safety Earth are fully inserted into the ground.
- Access to the emergency stop button may be needed in an emergency. Ensure Power Module control panel is visible and easily accessible.
- The emergency stop is a critical safety feature that should be regularly checked. Before use check emergency stop function before commencing treatment. See section 'Check emergency stop' on page 54.
- The padlock on the power isolator switch helps ensure untrained personnel cannot activate RootWave Pro. Ensure the padlock is replaced locking the power isolator switch in the off position. Ensure key is stored in a secure location and adequate padlock and key controls are in place. If the padlock or key are misplaced then replace immediately.
- Good visibility is essential for safe operation. Do not use the RootWave Pro in conditions of low visibility, such as thick fog.

- Impact to the system may cause damage. When transporting RootWave Pro in a vehicle, secure it to prevent it from sliding while the vehicle is in motion.
- Hazardous voltages near water can cause death by electric shock or electric shock drowning. If there is activity in the water and within 50 metres of the target weed or Treatment Return such as swimmers, divers or boats. Do not operate from a position standing in water. Do not use on weeds that are standing in water or if the treatment return is on an opposing bank so that the direct return path crosses water.
- Uneven ground can cause you to lose control. Conduct a risk assessment before operating on loose, steep or uneven ground and use adequate safety equipment.
- Exposure of the Treatment Return and Safety Earth to mud and water can compromise safety interlocks. Do not insert Treatment Return or Safety Earth into ground where seepage of mud or muddy water into the device is possible, including saturated ground where water collects in indentations. If you suspect ingress has occurred, refer to section 'Treatment Return or Safety Earth has been exposed to mud or water' on page 72.
- Pedestrians and animals encroaching on the treatment area can lead to undue hazards. A barrier may be required to control the perimeter of the treatment area. If necessary, display signage requesting dogs to be kept on a lead, or close off public access to the treatment area. A second operator may be required to monitor the situation and be ready to press the emergency stop if required. No one within 5 metres (7 paces) of operator to avoid risk of coming into contact with live electrode.

- Treating too close to conductors can cause induced currents and touch voltages which can be exposed to bystanders (who may be out of sight) and can lead to death by electric shock.
 - Do not treat within 4 metres (5 paces) of exposed conductive cables pipes and conductive structures above, on or under ground.
 - Do not treat with 1 metre (1½ paces) of sheathed or insulated cables above, on or under the ground, or exposed conductors suspended on insulating structures such as wooden or plastic posts or a concrete or brick wall.

Use the Shrouded Electrode Module when treating near to conductive structures to reduce the risk of accidentally touching the electrode to the conductive object when treating weeds nearby.

 - Use a cable avoidance tool and signal generator to detect cables or other conductive materials underground such as gas, water, electricity mains or sewerage systems where the risk assessment identifies a potential hazard.
 - Check with land owner whether any maps exist that map underground installations and obtain them if available.
- When treating weeds with RootWave Pro, a voltage is applied to the ground between the treatment and return electrode. This causes a voltage gradient to occur in the ground. If you get too close to the treatment area without precautions, the voltage gradient between your feet can be high enough to cause current to flow through your body and can lead to death by electric shock. To avoid being exposed to hazardous voltages between your feet, operators, and bystanders within 2.5 metres (3 paces) of a line between the treatment and the Treatment Return, must wear dielectric insulating boots.
- RootWave Pro and its safety systems are designed to operate as a standalone circuit i.e. from a generator. Do not use a mains power source as in certain fault modes this may lead to hazardous voltages being propagated via the mains supply.

- The Safety Earth must be fully inserted into the ground for RootWave Pro to function correctly. Only treat in pots and troughs if the Safety Earth can be inserted into the ground (not into the soil in the pot or trough).
- The cables and connectors are not designed to support heavy loads. Excess loads can damage the connectors. Cables should be loose, tension free and rest on the ground. Do not allow cables to span ditches, banks or gaps in the ground as this leads to excess tension.
- Poor fitment of cable interconnections could result in water ingress into the connectors and electric shock. Ensure locking levers are clamped closed before placing cable on the ground. Check connectors for signs of ingress before and after use. Remove any debris with a cloth or synthetic brush. Check the terrain prior to operation and ensure cable connections are kept away from water and mud.
- Contact between cables and a live treatment electrode or arcs can cause damage and lead to electric shock. Keep cables tidy and clear of the treatment zone. Check cables for damage while cleaning after use. If damage is present then contact your RootWave Pro supplier.
- Excessive twisting or tension on the cables can damage connectors and cables or cause excessive cable heating. Always install Treatment Return without cables connected and disconnect cables before unscrewing Treatment Return Body from Treatment Return Blade. Ensure all cables are unravelled and not left coiled or twisted.
- The Power Module is designed to be installed on a flat horizontal surface. Do not fix in any other orientation as this may result in damage to components, electric shock and physical injury.

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

- Electrical arcs can form during treatment and could ignite flammable substances. Do not operate in explosive atmospheres, near flammable liquids, gases or dry materials including dry weeds or dry plant matter. Rake combustible material away from the treatment area.
- The Treatment Return blade and adjacent ground can get hot during use. Remove any surface vegetation from the Treatment Return site before insertion to avoid risk of fire.
- The Treatment Lance is not designed to be activated unless the Electrode Module is in place. Ensure the Electrode Module is correctly fitted including locking screw before activation. If the Electrode Module is not correctly in place this may result in internal damage that will require the Treatment Lance to be replaced. Ensure system is turned off and disconnected from power source before attempting to handle the electrode.
- The integrity of the Electrode Module and Treatment Lance is critical to safe use. Always handle them with care. Do not stand the Treatment Lance on the shaft end – with or without the Electrode Module fitted – as critical parts may become damaged.
- Certain types of soil or very dry soil may have higher electrical resistance properties. In some conditions this could lead to higher than normal temperatures occurring in the soil close to electrode spikes. The following instructions reduce the risk of this occurring:
 - Only fit the Short Treatment Cable between the Power Module and the Treatment Return. Do not fit the Long Treatment Cable between the Power Module and the Treatment Return.
 - It is recommended that where possible you set up the Treatment Return in a position that places it greater than 10 metres from the target weeds.
 - Approach the weed from a direction that puts the Treatment Return and Safety Earth in your line of sight so that you can look for indications of overheating.

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

- The Power Module weighs 105 kg. When loading or unloading RootWave Pro, use suitable equipment and correct manual handling techniques to avoid physical injury.

To avoid death or serious injury from poisonous plants:

- Poisonous plants can release harmful botanical agents when disturbed. Conduct a risk assessment before operating on poisonous plants. There have been no known instances of toxic reactions caused by botanical agents released from weeds during treatment with RootWave Pro, however, as a minimum it is recommended you wear a mask rated to FFP3 (and other personal protective equipment as appropriate) if treating poisonous species such as *Heracleum mantegazzianum* 'Giant Hogweed'.

Operation

To avoid death or serious injury from electric shock:

- In the event of an emergency, press the emergency stop button on the Power Module. The system can also be brought to a safe stop by fully pressing one or both of the triggers on the Treatment Lance.
- Remain alert to external factors that could lead to hazardous situations during treatment such as pedestrians or animals. Regularly carry out a visual check. Ensure you have good visibility of the treatment electrode during use. Do not wear headphones and listen to audio as this can cause loss of concentration. RootWave Pro does not require you to wear ear defenders, but it is OK to do so if required by other equipment that you are using with RootWave Pro.
- Water can conduct electricity. RootWave Pro should not be used in condensing conditions. If the weather conditions become unsuitable then stop, turn off the power source, and re-cover the equipment immediately.

- The Treatment Return blade and Safety Earth spike may reach hazardous voltages in some conditions. Before moving or handling the Treatment Return or Safety Earth turn the power isolator switch on the Power Module to 'Off' and turn off the generator.
- Hazardous voltages may be present in the treated weed and plants in contact with the treated weed. To protect from any hazardous voltages present in plants in the treatment area you must wear dielectric insulating boots capable of withstanding 15 kV (peak) at 50 Hz. The boots must be within any stated expiration date and should be retested annually. They 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. Do not use RootWave Pro in bare feet, sandals, flip flops, shoes, work boots or normal Wellington boots. Do not attempt to treat weeds close to your feet. Dielectric insulating boots can be supplied by RootWave.
- Weeds are at hazardous voltages while being treated and may collapse towards you. Before treatment cut down and rake clear any tall weeds so that the remaining stem is less than 30cm high and below the top of your dielectric insulating boots.
- Build-up of carbon on the Electrode Module can cause accelerated and excessive degradation of protective components that may lead to electric shock.
 - During treatment ensure only the treatment electrode is in contact with vegetation. Do not allow the Electrode Module body or Treatment Lance shaft to come into contact with target weeds.
 - The Electrode Module Body should be cleaned after use with an alcohol wipe to prevent any build-up of carbon on the tube.
- The Treatment Return Blade may be firmly retained in the ground. Do not attempt to remove the Treatment Return Blade from the ground by pulling on the Treatment Return Body, the Cables or connectors as this can damage components. Use the Extraction Handle provided.

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

- The return current may cause the Treatment Return Blade to get very hot. If left unchecked, in extreme circumstances this may lead to damage to equipment and fire.
 - Regularly check if the ground adjacent to the Treatment Return is warm to the touch, and if so re-site the Treatment Return before continuing to use RootWave Pro.
 - You should be especially vigilant in dry or warm conditions or periods of high duty.
 - As a minimum the Treatment Return should be moved and re-sited every hour – even if the ground doesn't yet feel warm to the touch
 - It may be necessary to leave the Treatment Return Blade to cool before it can be handled.
- Arcs can ignite dry matter and cause a fire. Do not treat dry weeds or dry plant matter such as dry grass or leaves. Excessive arcing may occur if the electrode is not in direct contact with the target weed, or if the voltage setting is too high for the target weed. Keep fire suppressant systems available during treatment.
- The Treatment Electrode may get very hot during use because electrical arcs generated during treatment can reach temperatures over 1,000°C. Do not handle the Treatment Electrode immediately after use. Leave to cool in air before handling or storing.

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

- The Treatment Return blade and Safety Earth may resist being pulled from the ground. After disconnecting, use correct manual handling techniques to remove the Treatment Return blade and Safety Earth from the ground.
- The Cables, Treatment Return and Safety Earth can form trip hazards if not properly managed. Keep cables tidy and clear of the treatment zone. Watch where you are walking when moving between treatment zones.

After use

To avoid death or serious injury from electric shock:

- To avoid risk of electric shock turn the power isolator switch on the Power Module to 'Off' and turn off the generator before disassembling the system.
- Water and condensation can conduct electricity. Store RootWave Pro in a dry location, for example inside a vehicle or building. Do not store RootWave Pro in wet, humid, condensing or foggy conditions.

Caution



Caution

- Indicates a hazardous situation which, if not avoided, could result in moderate injury, damage the product, or lead to loss of data.
-

Set-up

To avoid moderate injury or damage to property:

- The Treatment Return Blade and Safety Earth spikes must be fully inserted into the ground for safe and effective operation. It may be necessary to try more than one position before full insertion can be achieved in dry, hard or rocky ground. Press the Safety Earth into the ground with your foot. Do not stamp on the Safety Earth or Treatment Return body, or attempt to force them into the ground with a hammer or other object.
- The Treatment Return Blade is designed to be driven into the ground with the Rubber Mallet provided. Do not use a metal hammer as this may damage the interface at the top of the blade (including the thread) and prevent it from being assembled correctly.
- Exercise caution when driving the Treatment Return Blade into the ground with the Rubber Mallet - ensure your other hand is clear of the top to avoid accidental strikes with the mallet.

- The Treatment Return Blade might be sharp or burred, grip with care.
- The Treatment Return Blade could, if dropped, both damage the integrity of dielectric insulating boots and injure your foot. Hold and carry it with care.
- 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.
- Electrical current can flow between plants that are in contact with each other. To avoid damage to adjacent plants from the target weeds you may need to cut plants back before commencing treatment.
- Generator exhaust may be hot. Ensure generator exhaust is pointing away from other equipment.
- Treating weeds close to water can be harmful to aquatic life. Ensure potential impact to aquatic life has been considered before treatment.
- Strong magnetic fields created by arcs can interfere with the function of adjacent sensitive electronic equipment. If adjacent equipment appears to function incorrectly then stop treatment and either turn off or relocate sensitive equipment or stop treatment in that area.

Operation

To prevent damage to equipment

- Treating too close to cables can cause interference in cables which can corrupt signals or prevent receiving equipment from working properly. Do not treat within 1 metre of sheathed or insulated cables above, on or under the ground.

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

- While the Treatment Lance is lightweight with an ergonomic design, operating RootWave Pro for long periods may cause fatigue. Use the belt hook and the lanyard to reduce strain. If experiencing discomfort stop immediately.
- The Treatment Return Blade may be firmly retained by the ground. Use the extraction handle provided and correct manual handling techniques to avoid physical injury.

Overview of RootWave Pro

This section provides an overview of RootWave Pro and lists the components.

About RootWave Pro

RootWave Pro treats weeds by forcing electric current through the weed using a high voltage. The current flow causes a rapid rise in temperature which damages the weed's cellular structure above and below the ground. The weed can then be left to naturally decompose.

The Treatment Lance targets the electrode tip at the weed's stem, delivering a voltage up to 5,000 volts at 50 hertz.

When activated, the electrical energy provided by the Power Module flows to the Treatment Lance, through the weed, through the soil, into the Treatment Return and back to the Power Module.

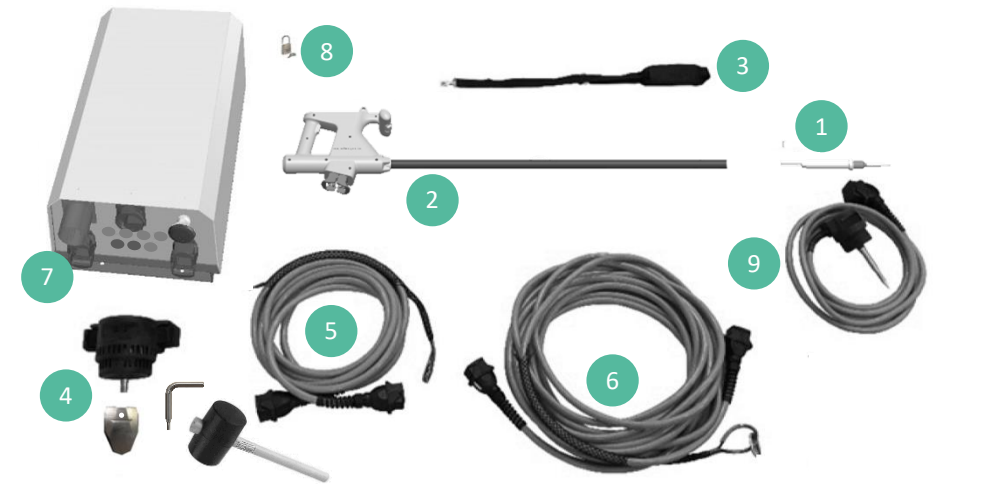


Figure 1 RootWave Pro components

Table 1 RootWave Pro components

| | | |
|----------|---|--|
| 1 | Electrode Module ETD-001-3 | Fitted to the Treatment Lance, makes contact with the weed to deliver the electrical energy. |
| 2 | Treatment Lance APL-001-3 | <p>The operator holds the treatment lance when treating weeds.</p> <p>It provides the controls that the operator needs at their fingertips to set voltage, reset, activate and safe stop the output.</p> <p>It allows the operator to apply the energy from a safe distance.</p> |
| 3 | Lanyard | Helps support the Treatment Lance during prolonged use. |
| 4 | Treatment Return GRW-001-3 | <p>Provides a return path for the electricity. Return blade is inserted into the ground with the mallet before the body is screwed on. Extraction handle also provided.</p> <p>RootWave Pro cannot activate unless this is inserted into the ground.</p> |
| 5 | Short Treatment Cable CAB-002-3 | <p>Connects the Power Module to the Treatment Return.</p> <p>7m long</p> <p>► See page 51 for more information</p> |
| 6 | Long Treatment Cable CAB-001-3 | <p>Connects the Treatment Return to the Treatment Lance.</p> <p>20m long, belt loop provided.</p> |
| 7 | Power Module TRA-001-3 or TRA-002-3 | Creates high-voltage electricity and contains safety and control systems. |

| | | |
|----------|------------------------|---|
| 8 | Padlock and key | Only trained operators should have access to the key. Store the key in a secure location. |
| 9 | Safety Earth GRW-002-3 | Part of the high voltage safety system. RootWave Pro cannot activate unless the Safety Earth is inserted into the ground. |

Components

This section describes the following main components of RootWave Pro:

- Power Module TRA-001-3 or TRA-002-3
- Treatment Lance APL-001-3
- Electrode Module ETD-001-3 (also applies to alternative Electrode Module formats ETD-002-3, ETD-003-3, ETD-004-3 and ETD-005-3)
- Treatment Return GRW-001-3
- Safety Earth GRW-002-3

Power Module TRA-001-3 or TRA-002-3

The Power Module creates high-voltage electricity, and provides some of the controls for RootWave Pro. Additional controls are provided on the Treatment Lance.

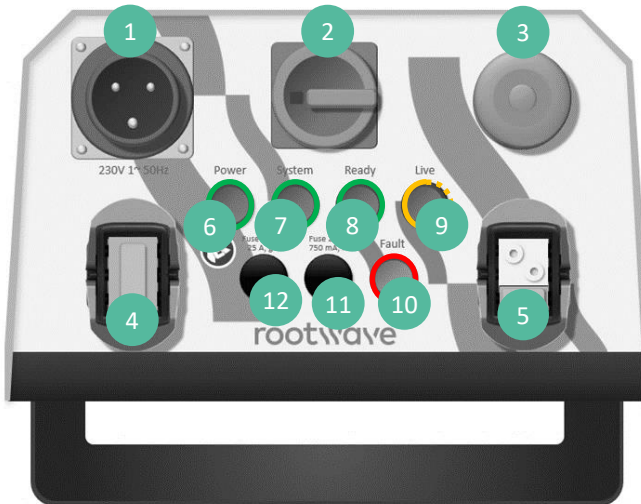


Figure 2 Power Module interfaces

Table 2 Power Module controls

| | | |
|-----------|----------------------------|---|
| 1 | Socket for generator cable | Connects generator to provide input power for system. ▶ See 'Specifications' on page 74. |
| 2 | Power isolator switch | Rotating dial for switching Power Module on and off. A padlock and key are provided to control access to the power isolator switch. |
| 3 | Emergency stop button | Push in to deactivate the Power Module in an emergency. Twist to release. |
| 4 | Socket for Safety Earth | Connects Power Module to Safety Earth. With dust cover. |
| 5 | Socket for Treatment Cable | Connects Power Module to Treatment Return (which in turn connects to Treatment Lance). Only use Short Treatment Cable. With dust cover. |
| 6 | Power light | Lights up when connected to the generator and the generator output is ON (green). |
| 7 | System light | Lights up when the power isolator switch is rotated to the ON position (green). |
| 8 | Ready light | Lights up when Treatment Return and Safety Earth are attached and inserted into ground, and Emergency Stop is not activated (green). |
| 9 | Live light | Lights up when the Treatment Lance has been reset and can be activated (amber). Flashes when Treatment Lance needs to be reset. |
| 10 | Fault light | If the Power Module overheats the Power Module is automatically deactivated and the fault lamp lights up (red). |
| 11 | 24V fuse | Caps for accessing internal fuses. |
| 12 | 230V fuse | ▶ See section 'Changing the fuse' on page 64 for more information including safety information |

Treatment Lance APL-001-3

Use the Treatment Lance to target treatment at the weed's stem. You can select a different power level depending on the types of weeds being treated.

You must install the Electrode Module before the Treatment Lance can be used.

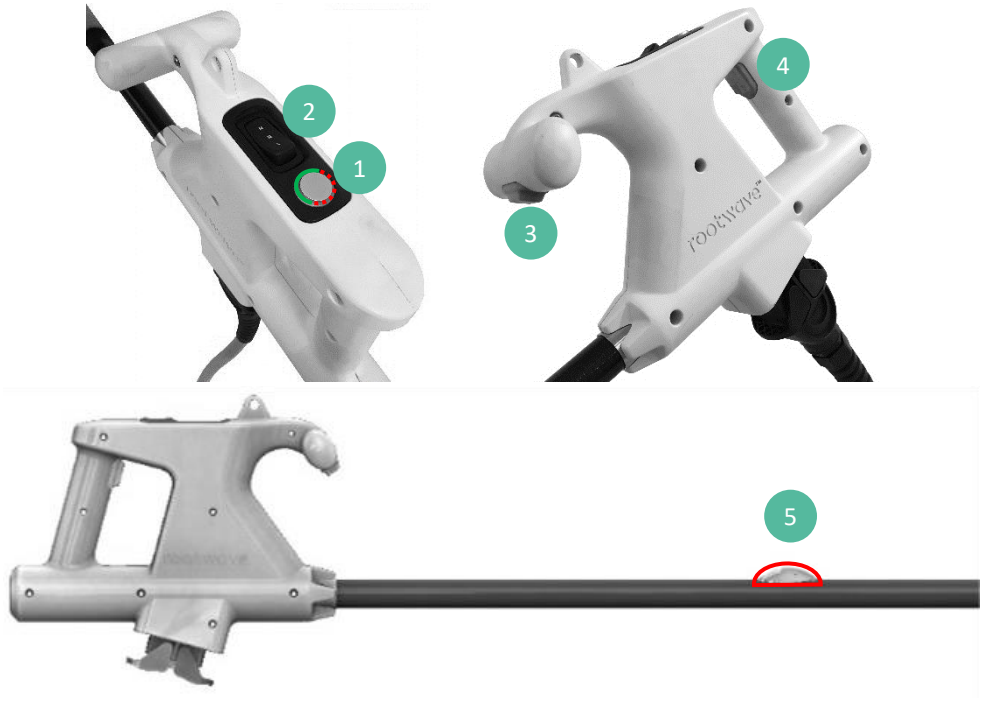


Figure 3 Treatment Lance features

Table 3 Treatment Lance features

| | | |
|-------------|------------------------------|---|
| 1 | Reset light and button | <p>The light indicates three different states of the system</p> <p>► See Table 4</p> <p>Press this button to reset the Treatment Lance.</p> |
| 2 | Voltage selector switch | <p>To select the required voltage level.</p> <p>► See Table 5</p> |
| 3, 4 | Two yellow triggers | <p>Used in combination to activate the Treatment Lance, and together or individually to deactivate the Treatment Lance and activate Safe Stop.</p> <p>► See Table 7</p> |
| 5 | Live electrode warning light | <p>Lights up in red when the electrode is activated to indicate the electrode is at a hazardous voltage.</p> <p>► See 'Live electrode warning light' on page 41</p> |

Reset button and light

The Reset light indicates one of the following states:

Table 4 Reset light

| | |
|------------------|--|
| Off | The Power Module is not 'Ready', cables are not connected, or there is a fault in the system. |
| Red flash | Flashes in red when a reset is required either before first use or after safe stop has been activated. |
| Green | Lights up when ready to activate and when activating. |



- If the reset light is off, this may also indicate that the generator has tripped.

To reset the Treatment Lance after it has been put into Safe Stop mode, fully release both triggers and press and hold the reset button until the flashing red light turns off.

Voltage selector switch

Use the power selector switch to select one the following three settings:

Table 5 Voltage switch settings

| Label | Description | Nominal off-load voltage |
|-------|-------------|--------------------------|
| L | Low | 3,000 V |
| M | Medium | 4,000 V |
| H | High | 5,000 V |

You can use different voltage levels and treatment times depending on the types of weed being treated and ground conditions. When treating a weed, its stem diameter and height determines the voltage setting and treatment duration that you should use.

Table 6 Example voltage settings and treatment duration

| | | | |
|-----------------------------|----------|-----------|------------|
| Weed height before trimming | 1-20 cm | 20-80 cm | 80-250 cm |
| Stem diameter | 0-1 cm | 1-2 cm | >2 cm |
| Typical voltage setting | Low | Medium | High |
| Typical treatment duration | 1 second | 5 seconds | 10 seconds |



- A higher voltage setting or longer duration may be required for woodier stems or very dry ground.
- A number of treatments may be required for weeds with extensive root systems.
- Excessive arcing may indicate that the voltage setting is too high. If you see excessive arcing while treating a weed, reduce the voltage setting.

Triggers

The Treatment Lance has two triggers. Use both triggers to activate the Treatment Lance, and either or both triggers to activate Safe Stop.



Figure 4 Treatment Lance trigger positions

Table 7 Treatment Lance trigger positions

| Position | Action | Purpose |
|----------|--|---|
| 0 | Either or both triggers are fully released | The Treatment Lance is inactive |
| 1 | Both triggers are pressed to the middle position | The Treatment Lance is active (if all other systems are on and reset button has been pressed) |
| 2 | Either or both triggers are fully pressed | Safe Stop is activated and the Treatment Lance cannot be activated until it is reset |

Electrode Module ETD-001-3 (also applies to ETD-002-3, ETD-003-3,ETD-004-3 and ETD-005-3)

The Electrode Module is a changeable component that securely attaches the electrode to the Treatment Lance, allows alternative electrode formats to be easily attached, and can be easily replaced if showing significant signs of wear.

The Electrode Module should be cleaned after use with an alcohol wipe to prevent the build-up of carbon on the body and around the electrode which can otherwise lead to accelerated wear.

- ▶ *See section 'Setting up the Treatment Lance' on page 36 for installation of Electrode Module.*
 - ▶ *See section 'Shrouded Electrode Module' on page 43 for information on use of this module.*
 - ▶ *Contact your RootWave Pro supplier for alternative electrode formats including 'hook' ETD-002-3, 'T bar' ETD-003-3, 'Arrow' ETD-004-3, ETD-005-3 'Shrouded Electrode Module' and replacement Electrode Modules if yours is showing signs of wear.*
-



Figure 5 Electrode Module (standard 'straight' electrode shown)

Treatment Return GRW-001-3

The Treatment Return provides a return path for the electric current passing through the Treatment Lance. It completes the electrical circuit through the weed back to the Power Module.

The Treatment Return, including its blade, must be fully installed into the ground before treating weeds.

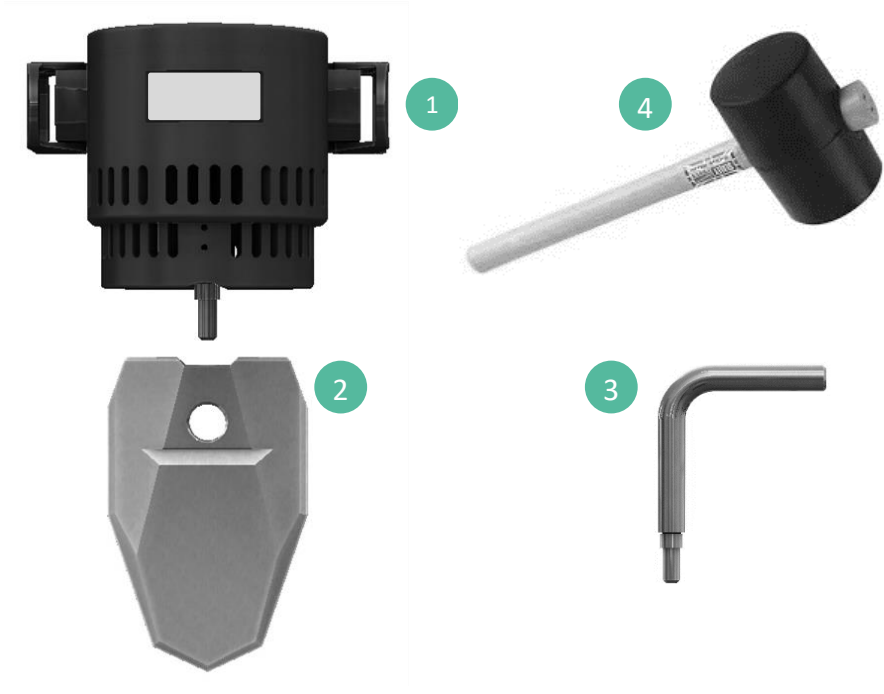


Figure 6 Treatment Return, Mallet and Extraction Handle

Table 8 Treatment Return components

| | | |
|---|------------------------|---|
| 1 | Treatment Return Body | Houses the connectors and interfaces with the Treatment Return Blade. |
| 2 | Treatment Return Blade | Acts as the return electrode to complete the circuit. |
| 3 | Extraction Handle | Can be used to free the Treatment Return Blade from the ground. Screw in fully in, wiggle from side to side and pull. |
| 4 | Rubber Mallet | Use to drive the Treatment Return Blade into the ground until it is submerged and the top is level with the soil surface. |

Safety Earth GRW-002-3

The Safety Earth provides a protective conductor to earth to ensure that you are protected from an electric shock should a fault occur. Like the Treatment Return, the Safety Earth must be fully inserted into the ground before treating weeds.



Figure 7 Safety Earth

Getting started

If RootWave Pro was shipped to you in a crate, then carefully unpack each of the items and check against the items listed in 'Table 1' on page 24.



- We recommend that you keep the box that RootWave Pro was delivered in, for storage and transportation.

In addition, you will need the components listed in 'Table 8' on page 37 and may need the equipment listed in 'Table 9' on page 38 depending on the weeds being treated and operating environment.

Setting up the Treatment Lance

Before you can use the Treatment Lance you must fit the Electrode Module.

To fit the Electrode Module, align it with the socket and at the end of the Treatment Lance shaft and push it fully home. Then, using a 3mm hex key, screw the locking screw fully home (the screw head will be flush with the shaft's surface).

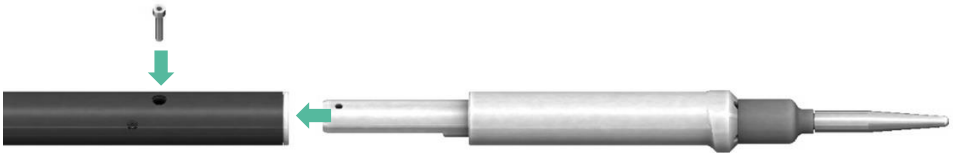


Figure 8 Fitting the Electrode Module to the Treatment Lance

- *If you are unsure of whether your Electrode Module is correctly fitted please contact your RootWave Pro supplier.*

Before you can use the Treatment Lance, you must also fit the lanyard by attaching it to the loop by the voltage selector switch.

Additional equipment

The equipment below is needed and not provided with RootWave Pro:

Table 8 Additional equipment needed

| Equipment | Purpose |
|------------------------------------|--|
| Generator | Provides power to the Power Module. RootWave Pro requires a generator capable of producing 230 V single-phase between 50-60 Hz and a power output of between 7.5 kVA and 10 kVA. |
| Dielectric insulating boots | To protect against electric shock from Treatment Lance. Must be capable of withstanding 15 kV (peak) at 50 Hz. Must be at least 35cm tall. Boots should be retested annually. |
| Rainproof cover | A rainproof cover such as a tarpaulin can be used as a temporary measure to protect the equipment from rain during transportation if adequately fitted. |
| Harnesses | To secure equipment to vehicle during transit. |
| Loading equipment | For loading Power Module onto vehicle as it weighs 105 Kg. |
| Fire suppressant equipment | As a precaution when using RootWave Pro in very dry conditions. |
| Alcohol wipes | To wipe down the distal end of the lance to prevent carbon build up. |
| Cloth | For wiping down components after use. |
| Emery cloth | To clean the electrode tip. |

| Equipment | Purpose |
|--------------------|---|
| Spade | May help to remove Treatment Return blade from ground in some conditions. |
| Metal file | To sharpen the Treatment Return Blade should it become blunt or burred. |
| 3mm hex key | For fitting Electrode Module to Treatment Lance |

The equipment below may be needed depending on local working practices and procedures, risk assessment, the operating environment and the weeds being treated.

Table 9 Additional equipment that may be needed

| Equipment | Purpose |
|---|---|
| Cutters and rake | For cutting down weeds and raking them to one side. |
| CAT (Cable Avoidance Tool) and signal generator | To identify subterranean hazards. |
| Barriers and signs | For cordoning off treatment area from bystanders, walkers, dogs or other animals. |
| Safety equipment as required | For operating on loose, steep or uneven ground. |
| Mobile phone with alarm / timer and GPS location | To support lone working. |
| Other PPE | As required by local working practices and procedures and risk assessment. |

Loading and transporting equipment

Safely load and secure the following items onto the vehicle before leaving for the treatment site:

- RootWave Pro system, including: Treatment Lance (with Electrode Module fitted), lanyard, Treatment Return, Short Treatment Cable, Long Treatment Cable, Power Module (with padlock fitted) and Safety Earth.

Check all components, including cables and connectors, for damage. If a component is damaged, do not use it. Replace the part or contact your RootWave Pro supplier.

The Power Module includes slots for a forklift and holes to secure tie-downs and lifting equipment.

► See 'Table 1' on page 24 for details

- Additional equipment needed, including: generator, generator cable, dielectric insulating boots, rainproof cover, harnesses, loading equipment, fire suppressant equipment, cleaning cloth and emery cloth.

► See 'Table 8' on page 37 for details

- Additional equipment that may be needed depending on local working practices and procedures, risk assessment, the operating environment or the weeds being treated: cutters and rake, CAT (Cable Avoidance Tool) and signal generator, barriers and signs, mobile phone and any other safety equipment and PPE.

► See 'Table 9' on page 38 for details

You might prefer to semi-permanently fix your Power Module to your vehicle. This can be done through the bottom face using M8 bolts.

► See section 'Dimensions and weight' on page 77 for more information.

Before setting out

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

1. Obtain the necessary permissions from the land owner.
2. If necessary follow suitable lone working protocol.
3. Check the weather forecast.
4. Check that the vehicle and generator have sufficient fuel.
5. Collect the padlock key for the Power Module power isolator switch.
6. If planning to treat near water ensure risk of harmful impact to aquatic life has been discussed with waterway owner.

Safety features

RootWave Pro provides safety features to ensure safe operation.

Live electrode warning light

The Treatment Lance has an indicator light located on the shaft which lights up in red when the Treatment Lance electrode is activated. The electrode is at a hazardous voltage when this light is on.

If this light does not turn on when the system is on, has been reset and both triggers are pressed to the middle position, then do not use and contact your RootWave Pro supplier.



Figure 9 Live electrode warning light

Safe Stop on Treatment Lance

The Safe Stop feature on the Treatment Lance deactivates it and prevents the accidental activation of the system when handling the Treatment Lance.

To activate Safe Stop, fully press one or both triggers on the Treatment Lance (position 2).



Figure 10 Treatment Lance trigger positions

- For more information, see
'Triggers' on page 31
'Move with the Treatment Lance' on page 59

Emergency stop on Power Module

The Emergency Stop on the Power Module cuts power to the system in an emergency.

To stop the Power Module in an emergency, push the Emergency Stop button in fully.

To reset the Power Module after an emergency stop, release the emergency stop by turning it clockwise. RootWave Pro can then be started up normally.

The emergency stop is a critical safety feature that should be regularly checked.

- For more information see 'Check emergency stop' on page 54.

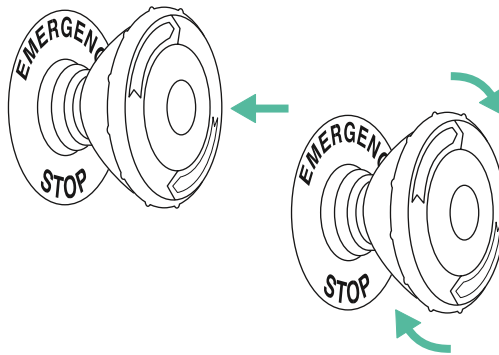


Figure 11 Emergency Stop button on Power Module

Shrouded Electrode Module

The Shrouded Electrode Module, ETD-005-3, is designed for use near conductive objects such as fence lines. The electrode is recessed within a non-conductive shroud to reduce the risk of accidentally touching the electrode to the conductive object when treating weeds nearby.

The Shrouded Electrode Module is designed for treating small to medium sized weeds only. The weed must be fully enclosed by the shroud. Any part of the weed that extends beyond the shroud and contacts the structure during treatment may cause the structure to become live at treatment voltage.

Ensure the base of the shrouded electrode rests on the ground.

If the weed is too big to be enclosed by the shroud, cut down the weed to a suitable size and rake to one side before treatment. If you are treating a patch of weeds then ensure none of the weeds are touching the conductive structure.

Even when using the Shrouded Electrode prevent bystanders or animals from touching the structure and have line of site to all of the structure. Use barriers if necessary. If you can't guarantee that no person or animal is touching the structure then do not treat.

Do not allow arcs to form when using the Shrouded Electrode as this may damage the material. To reduce arcing reduce the voltage setting H/M/L.

The Shrouded Electrode Module should be cleaned after use with an alcohol wipe to prevent the build-up of carbon on the body and around the electrode which can otherwise lead to accelerated wear.

The Shrouded Electrode Module is designed only for use with the short T bar electrode provided. Do not modify to use with any other electrode types.

- ▶ See section 'Setting up the Treatment Lance' on page 36 for installation of the Shrouded Electrode Module.
 - ▶ Contact your RootWave Pro supplier for a replacement Shrouded Electrode Module if yours is showing signs of wear.
-



Figure 12 Shrouded Electrode Module

Using RootWave Pro

Before using RootWave Pro, read and understand all safety messages and complete the training from a qualified trainer.

- ▶ *For more information see:
Safety information' on page 77
and 'Training' on page 64*
- ▶ A number of tools are available at rootwave.com/pro to support you:
 - **Site Specific Risk Assessment** – *to help you to assess the risks at the treatment site and identify potential risk controls*
 - **Functional Check Protocol** – *to take you through steps to check that the system is working normally*
 - **Lone Working Contact Log** – *a simple form to help the person checking in with you to stay in contact if you are working alone.*

1. Put on Personal Protective Equipment

Put on dielectric insulating boots and any other PPE as required by local working practices and procedures.

Bystanders also need to wear dielectric insulating boots if within 2.5 metres (3 paces) of a line between the treatment and the Treatment Return.



2. Check the environment

On arrival at the site, assess the treatment area for the following hazards and prepare the site as necessary:

- Check the weather and visibility.
- Identify any exposed conductive cables pipes and conductive structures above, on or under ground - and ensure you will not treat within 4 metres (5 paces).
- Identify any sheathed or insulated cables above, on or under the ground – and ensure you will not treat within 1 metre (1½ paces).
- Identify any exposed conductors suspended on insulating structures such as wooden or plastic posts or a concrete or brick wall – and ensure you will not treat within 1 metre (1½ paces).
- You can use cable avoidance tool and signal generator to ensure there are no cables, conductive structures or pipes under ground.
- Identify footpaths and rights of way, and whether the treatment area needs to be cordoned off.
- Identify any animals that may be near the treatment site.
- Identify uneven ground.
- Identify any combustible materials, dry weeds or plant matter.
- Identify presence of water:
 - Ensure there is a dry place to operate from.
 - Ensure that the Treatment Return can be placed away from the water's edge and in a position that doesn't lead to the direct return path crossing water.
 - Check that there is no activity in the water within 50 metres.
 - Check risk of harmful impact to aquatic life has been considered.



► Use the **Site Specific Risk Assessment** – to help you to assess the risks at the treatment site and identify potential risk controls

3. Prepare weeds for treatment

Identify any weeds that you need to prepare before treating.

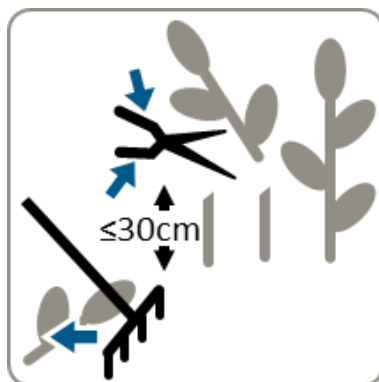
If it's necessary to stand in the treatment patch to reach the target weeds, then before treatment, cut down and rake to one side any weeds that are over 30cm high.

If you're standing on clear ground and the target weed is short enough that when it collapses it will fall clear of you, then cutting down weeds before treatment is not necessary.

If you're using the Shrouded Electrode Module to treat near conductive structures, then cut down any weeds that are too big to be enclosed by the shroud.

Chop down any target weeds that are touching conductive structures.

Rake away dry dead weeds, litter and potentially combustible materials from the treatment site.

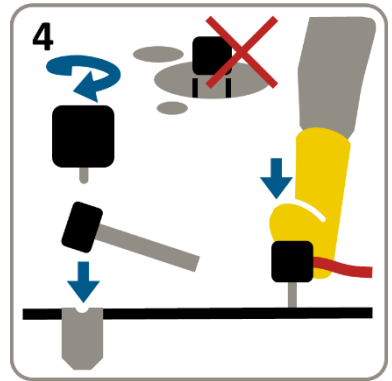


- Even if you're on open ground, it may be easier to treat the weed if it has been cut down first as this may provide better visibility and access to its stem.

4. Insert the Treatment Return and Safety Earth into the ground

To install the Treatment Return:

- Do not yet connect the Long Treatment Cable, the Short Treatment Cable and the Treatment Return. Instead, lay them out on dry ground.
- Remove any vegetation from Treatment Return site as the Treatment Return should sit directly onto soil surface.
- Gripping the Treatment Return Blade firmly in one hand place the sharp end on the soil surface and use the rubber mallet to drive it into the ground until it is submerged with the top level with the soil surface.
- ▶ *Do not prepare the ground for the Treatment Return Blade by making a hole or incision into which you insert the blade. The Blade needs pressure from the soil over its entire surface to ensure good electrical contact is made to minimise underground arcing which can lead to accelerated heating. Forcing the blade into unprepared ground with the mallet ensures this.*
- Take the Treatment Return, position it over the Treatment Return Blade lining up the threaded spigot with the threaded hole, then lower the Treatment Return onto the Treatment Return Blade. Screw the Treatment Return firmly in a clockwise direction onto the Treatment Return Blade until it comes to a stop.
- Once the Treatment Return has been full assembled onto the Treatment Return Blade the cables can then be connected to the Treatment Return.
- ▶ *If the rubber mallet becomes damaged replacements are available from your RootWave Pro supplier.*



To install the Safety Earth into the ground:

- Position the Safety Earth close to the Power Module (within 2 metres). Keep it away from the Treatment Return and the area of weeds to be treated with the Treatment Lance.
 - Push the Safety Earth spike firmly and fully into the ground with your foot.
-

Notice

- If the Treatment Return Blade has not been fully inserted into the ground, or if the Treatment Return hasn't been fully screwed onto the Treatment Return Blade, then RootWave Pro will not activate.



- The blade can become blunt or burred over time. The blade can be sharpened with a metal file.
 - Rocks and roots can impede insertion. It might be easier to relocate the blade slightly for an easier insertion.
-

5. Connect up

Ensure the generator and its output are off.

Remove the dust caps on all connectors.

Connect the Safety Earth to the Power Module.

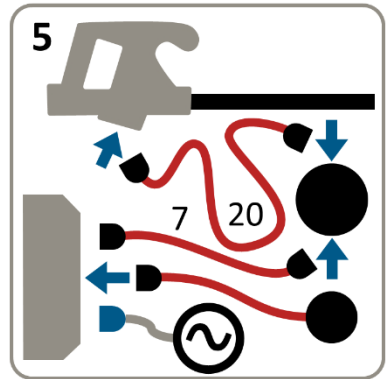


Figure 13 Connect the Safety Earth to the Power Module



Figure 14 Cable Configuration

Only connect the cables to the Treatment Return once it is installed in the ground.

Connect the Treatment Return to the Power Module using the Short Treatment Cable.



Figure 15 Connecting the short 7m Treatment Cable to the Treatment Return and Power Module

Connect the Treatment Lance to the Treatment Return with the Long Treatment Cable.



Figure 16 Connecting the long 20m Treatment Cable to the Treatment Lance and Treatment Return

Place the Treatment Lance on a dry surface.

Using the generator cable, connect the Power Module to the generator.

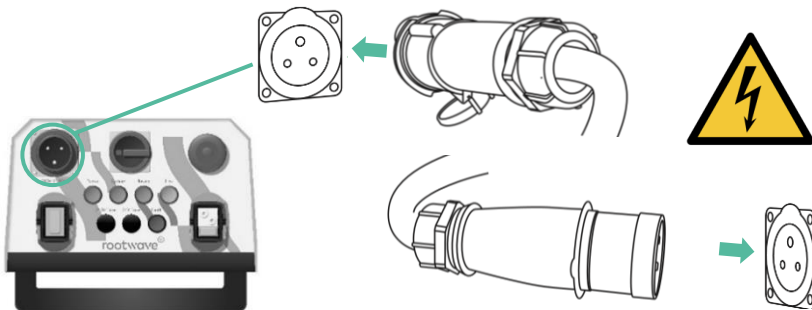


Figure 17 Connecting the generator cable to the Power Module and generator

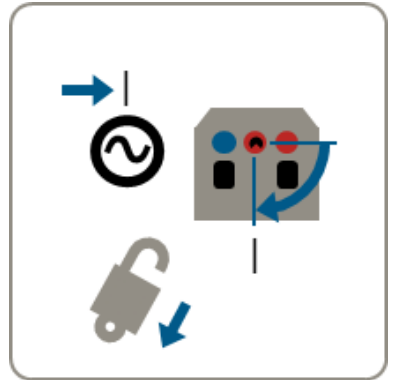
6. Turn on the system

Start the generator and turn on the generator's output. Confirm the 'Power' light is now lit.

Remove the padlock from the power isolator switch on the Power Module.

Turn the power isolator switch on the Power Module to the 'ON' position.

Confirm that the 'Power', 'System' and 'Ready' lights are now lit. RootWave Pro can now be used.



- If the 'Ready' light is not lit, check that the Treatment Return and Safety Earth are fully inserted in the ground.

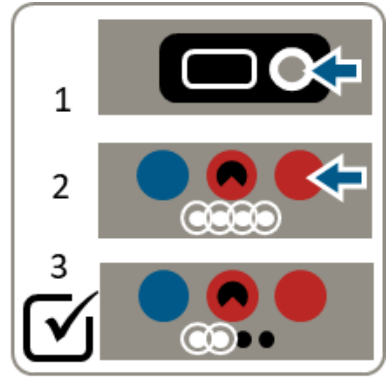
7. Check emergency stop

The emergency stop is a critical safety feature that should be regularly checked. Before each use, follow these steps:

1. Reset the Treatment Lance so it is ready to activate
2. Press the Emergency Stop on the Power Module
3. Check that the 'Ready' light (green) has turned off

If the 'Ready' light does not turn off, do not use RootWave Pro. Shut down the system, isolate the padlock key and contact your RootWave Pro supplier.

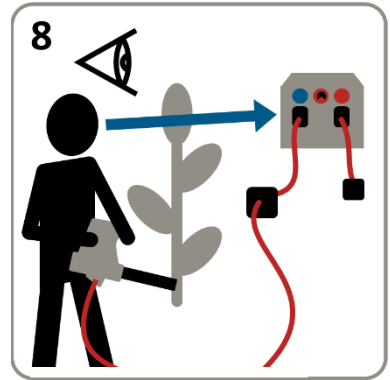
► *For contact information, see section 'Contact details' on page 3.*



8. Approach the weed

Attach the cable to your belt using the carabiner and loop the Treatment Lance lanyard around your neck.

Move to within treatment range of the weed. Approach the weed from a direction that puts the Treatment Return, Power Module, and vehicle in your line of sight so that you can remain alert to hazards. Ensure the cable is safely out of the way.

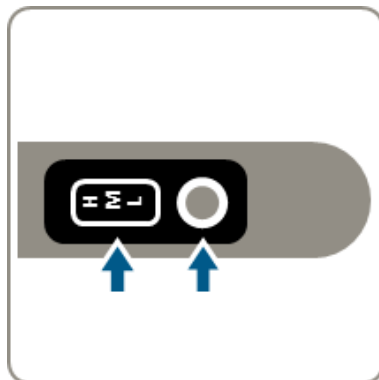


9. Reset system and select voltage

On the Treatment Lance, press and hold the Reset button until it turns green. It is now ready to activate.

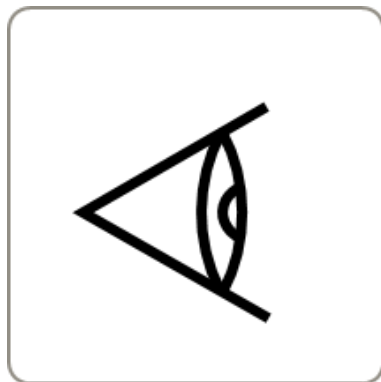
Select a voltage setting, depending on the size of the weed.

For more information see section 'Voltage selector switch' on page 30.



10. Re check your environment

Check you have good visibility of the treatment area and equipment, and re check your surroundings for any hazards including people or animals.



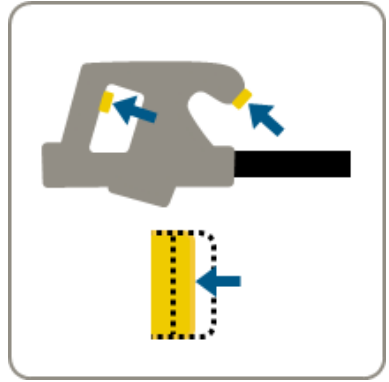
11. Activate the electrode

Touch the stem of the weed with the tip of the Treatment Lance and press both triggers on the Treatment Lance to the middle position. The live electrode warning light located on the Lance shaft will light up red, indicating the Electrode is activated.

Arcs should be avoided. An arc or flash may be visible. If the arc or flash is larger than expected, reduce the voltage setting. Look out for signs of fire at the Treatment Return and treatment patch.

Maintain contact for duration depending on the size of the weed.

► For more information, see 'Treatment Lance' on page 28.



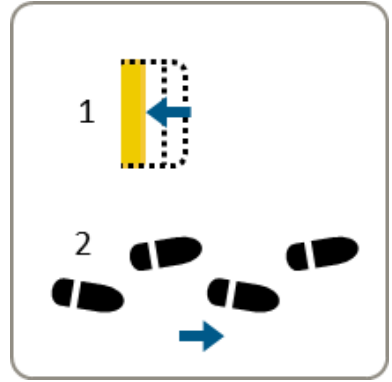
- Moving the electrode in a gradual upwards motion during treatment helps to keep the energy flowing into the weed without breaking the weed's structure before the treatment can be completed.
- Signs that the treatment is complete include:
 - Releasing steam
 - Popping noises
 - Collapsing stem
- If the generator starts to labour pause the treatment for moment to allow the generator to recover and try treating large weeds with repeated small zaps.

Release both triggers on the Treatment Lance. RootWave Pro is deactivated. Weeds can be left to decompose.

12. Move with the Treatment Lance

Before moving with the treatment lance, safe stop the system by squeezing one or both of the triggers fully inwards.

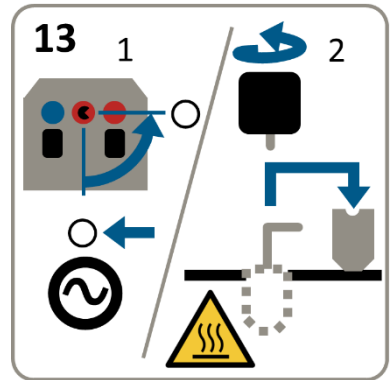
The reset button will flash red when safe stop has been activated. Carry the Treatment Lance with one hand and the lanyard; keep one hand free.



13. Move the Treatment Return

The Treatment Return Blade should be re-sited regularly and at least every hour to avoid it getting too hot.

It may also be necessary to move the Treatment Return to reach target treatment areas.



To withdraw the Treatment Return:

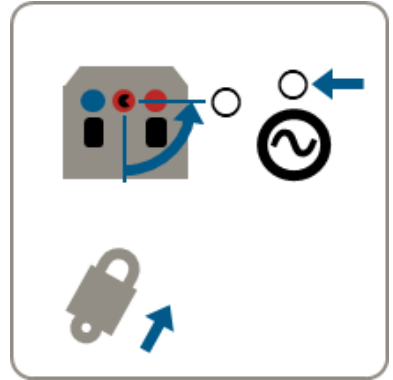
1. Before moving the Treatment Return, safe stop the Treatment Lance, turn the power isolator switch on the Power Module to 'Off' and turn off the generator.
 2. Disconnect both treatment cables and lay them on dry ground.
 3. Unscrew the Treatment Return and place it on one side. Clean out any debris from the thread.
 4. Withdraw the Treatment Return Blade from the ground. If the soil is loose then the Treatment Return Blade may be withdrawn from the ground easily. Alternatively, you can use the extraction handle or a spade to help free it from firm ground:
 - To use the extraction handle, screw the handle fully into the Treatment Return Blade, wiggle from side to side and pull.
 - To use a spade, insert the spade into the ground about 5cm from the face of the Treatment Return Blade at an angle of about 45 degrees, then push the spade in towards the Treatment Return Blade, and the spade handle down towards the ground, to catch the lip on the Treatment Return Blade and lever it out of the ground.
- To re install the Treatment Return see steps 4 and 5.

14. Turn off the system

Press either or both triggers on the Treatment Lance fully in (position 2) to activate Safe Stop. The reset button will flash red.

Turn the power isolator switch on the Power Module to the 'OFF' position and replace padlock.

Deactivate the generator's output and stop the generator.

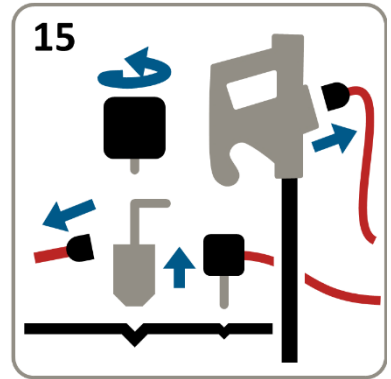


15. Disconnect the system

Disconnect the Treatment Lance cable, Treatment Earth cable, and the generator cable.

Remove the Safety Earth from the ground.

Disconnect the Treatment Return and remove from ground as per step 13.



-
- Notice**
- Lubricants can reduce electrical conductivity. Keep threads on Treatment Return Body and Blades clean and dry and don't use grease or other lubricants. Store parts disassembled - don't reassemble them until installation.
-

16. Clean and check

After use wipe clean with a dry cloth all components of the RootWave Pro system before storing.

Wipe down the Electrode Module with an alcohol wipe to prevent the build-up of carbon on the body and around the electrode.

Ensure the thread in the Treatment Return blade is clear of debris.

Replace the dust caps on all connectors and coil the cables.

While cleaning, check all components for signs of damage or wear and tear, including cables and connectors and Electrode Module. If a component is damaged or showing signs of wear contact your RootWave Pro supplier.

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



- Build-up of debris on the electrode tip can reduce the treatment effect. The tip of the electrode can be cleaned with a mild abrasive material such as emery cloth or wire wool.



Transportation and storage

If you are transporting RootWave Pro, secure all components in the vehicle, ensuring they are kept dry during transport.

Store all components of RootWave Pro in a clean, dry, and secure location.

► *For more information, see ‘Specifications’ on page 74.*

Training

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

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

Changing the fuse

The fuses are mounted on the control panel of the Power Module.

Before attempting to access the fuse, turn the power isolator switch on the Power Module to ‘Off’ and turn off the generator.

Once all power is off, to change the fuse, unscrew the fuse cap and withdraw the sleeve from the control panel, replace the fuse and screw the sleeve back into the control panel.

If you experience repeated blown fuses then contact your RootWave Pro supplier.

► *For more information, see:
‘Power Module’ on page 26*

| | |
|-------------------|---|
| 24 V fuse | 750 mA, 10 mm x 38 mm, speed F (fast acting) |
| 230 V fuse | 25 A, 10 mm x 38 mm, gG (fast acting, full-range breaking capacity) |

Accessories and replacement parts

Accessories and replacement parts are available from your RootWave Pro supplier.

If you've misplaced the locking screw that retains the Electrode Module in the Treatment Lance then either contact your RootWave Pro supplier or replace with M4x20mm stainless steel cap head hex screw with head diameter 7.0mm.

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

Troubleshooting

If this section cannot solve your problem, or if you’re unsure, please contact your RootWave Pro supplier.

► For contact information, see section ‘Contact details’ on page 3.

RootWave Pro does not activate

| Cause | Power | System | Ready | Live | Fault | Solution |
|--|-------|--------|-------|------|-------|--|
| Generator has tripped or output is off | ● | ● | ● | ● | ● | Restart generator Check output is on ► For more information see page 70 |
| 230 V, 25 A, gG inlet fuse has blown. | | | | | | Turn the power isolator switch on the Power Module to ‘Off’ and turn off the generator. Change fuse on the Power Module. ► For more information see page 64. |

| Cause | Power ● | System ● | Ready ● | Live ● | Fault ● | Solution |
|--|------------|-------------|------------|-----------|------------|---|
| 24 V, 750 mA, F inlet fuse has blown. | On | | | | | <p>Turn the power isolator switch on the Power Module to 'Off' and turn off the generator. Change fuse on the Power Module.</p> <p>► <i>For more information see page 64.</i></p> |
| Emergency stop hasn't been released. | On | On | | | | <p>Twist to release emergency stop.</p> <p>► <i>For more information see page 42.</i></p> |
| Cables aren't properly plugged in. | On | On | | | | <p>Turn the power isolator switch on the Power Module to 'Off' and turn off the generator. Check all cables are properly connected.</p> |

| Cause | <div>●</div> Power | <div>●</div> System | <div>●</div> Ready | <div>●</div> Live | <div>●</div> Fault | Solution |
|---|--------------------|---------------------|--------------------|-------------------|--------------------|---|
| Treatment Return or Safety Earth aren't fully inserted into ground. | On | On | | | | Turn the power isolator switch on the Power Module to 'Off' and turn off the generator. Ensure Treatment Return spike and Safety Earth spike are inserted fully into ground. |
| Treatment Lance needs to be reset (reset light flashes red but can be difficult to see in bright sunlight). | On | On | On | Flash | | Press and hold reset button. The reset button lights in green, Treatment Lance ready to activate. |
| Triggers haven't been squeezed to middle position. | On | On | On | On | | Squeeze both triggers on Treatment Lance to middle position. |

| Cause | <div>●</div> Power | <div>●</div> System | <div>●</div> Ready | <div>●</div> Live | <div>●</div> Fault | Solution |
|--|--------------------|---------------------|--------------------|-------------------|--------------------|--|
| Temperature fault on transformer core. | On | On | | | On | <p>Turn the power isolator switch on the Power Module to 'Off' and turn off the generator.</p> <p>Allow to cool down (this may take more than an hour).</p> <p>Try treating with multiple shorter zaps and treating one weed at a time.</p> <p>If fault persists contact your RootWave Pro supplier.</p> |

Treatment effect seems inadequate

| Cause | Solution |
|---|---|
| Weeds are too dense. | Cut down weeds and treat them at the base of their stem. |
| Voltage setting selected on Treatment Lance is too low. | Increase voltage setting on Treatment Lance. |
| Return circuit is too weak. | Move Treatment Return closer to treatment area. Treat when conditions aren't so dry. |
| Ground is too dry. | Relocate Treatment Return to more moist ground or closer to treatment area. Treat weeds in the spring when the ground has a higher moisture content. |



- Treat in the Spring for optimum results:
 - Ground less likely to be dry
 - Weed growth is younger and will take less energy to treat

The generator stops working or won't start

| Cause | Solution |
|--|---|
| Generator does not have enough output power. | Use a generator with a higher power output between 7.5 kVA and 10 kVA. |
| Too many weeds being treated simultaneously. | Treat large weeds with multiple small and controlled treatments. Pause treatment when generator labours to allow generator recovery. |
| Treating big mature weeds that cause the generator to labour, and then suddenly stopping, may cause the generator to cut out. | Treat large weeds with multiple small and controlled treatments. |

Treatment Return or Safety Earth has been exposed to mud or water

| Cause | Solution |
|---|--|
| Treatment Return or Safety Earth has been exposed to mud or water. | <div><div>1. Turn off and disconnect system.</div><div>2. Remove excess mud with a cloth or synthetic brush.</div><div>3. Check base can move freely when pushed approximately 10mm into the body against moderate internal spring force.</div><div>4. Connect up the system, turn on generator output and power module power isolator switch, check 'Ready' light comes on.</div><div>If 'Ready' light does not come on, then contact your RootWave Pro supplier.</div></div> |

Servicing

RootWave Pro must be serviced annually.

RootWave Pro does not have any user serviceable parts.

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

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

Warranty

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

Contact your RootWave Pro supplier if you require further information.

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

Disposal

RootWave Pro 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 Pro supplier for more information.



Specifications

Power inlet

| | |
|----------------|---|
| Description | 3 pin commando plug (2P+E) on the Power Module. See "Note 1" |
| Voltage rating | 230 VAC |
| Current rating | 32 A |
| Frequency | 55 Hz +/- 5% |
| Power | 5,000 W |
| Standards | IEC60309 |

Note 1

The inlet (Live) is to be individually fused and both (Live and Neutral) are filtered. Earth is to be directly Chassis bonded.

Treatment Lance

| | |
|--|---|
| Voltage levels (nominal) | Low: 3,000 VAC +/- (5+supply stability)% Medium: 4,000 VAC +/- (5+supply stability)% High: 5,000 VAC +/- (5+supply stability)% |
| Current rating | 0- 1.7 A RMS +5% (input stability and load reactance dependent) |
| Frequency | 50 Hz +/- 2% (input stability dependent) |
| Short circuit | Secondary side short circuit stable. Current limiting a function of Primary side supply capabilities and internal primary side 32 A fuse. See "Note 2". |
| Charge storage (Primary side) | None |
| Charge storage (Secondary side) | None |
| Switch on | <50 ms |
| Switch off | <50 ms |
| Switch off (Emergency stop) | <10 ms |

Note 2

The main conversion transformer is designed to dissipate the internal heating energy of providing 5 kVA into a direct secondary side short circuit.

Temperature

| | |
|------------------------------------|--|
| Ambient / operational range | +0 Degrees Centigrade to +40 Degrees Centigrade. |
| Ambient / storage | -20 Degrees Centigrade to +60 Degrees Centigrade. |
| Temperature cutout | +150 Degrees Centigrade (+/- 5%). See "Note 3". |

Note 3

Measured inside the transformer core.

IP ratings

| | |
|---------------------------------|----------------------|
| System operational | IP40 |
| Single system components | IP20 See "Note 4" |

Note 4

IP rating limited by connector ports.

IP rating of connectors increased through connection of mating part (cap or cable).

Dimensions and weight

Table 10 dimensions and weight

| Model no | Width x depth x height (cm) | Weight (kg) |
|--|--|-------------|
| TRA-001-3 | 40 x 73 x 36 | 105.0 |
| APL-001-3 with ETD-001-3 fitted | 12 x 30 x 168 (other Electrode Modules may result in different lengths and widths) | 2.5 |
| GRW-001-3 | 22 x 17 x 19 | 2.5 |
| GRW-002-3 | 12 x 12 x23 (plus 4m cable) | 3.0 |
| CAB-001-3 | 20m cable | 7.6 |
| CAB-002-3 | 7m cable | 3.3 |

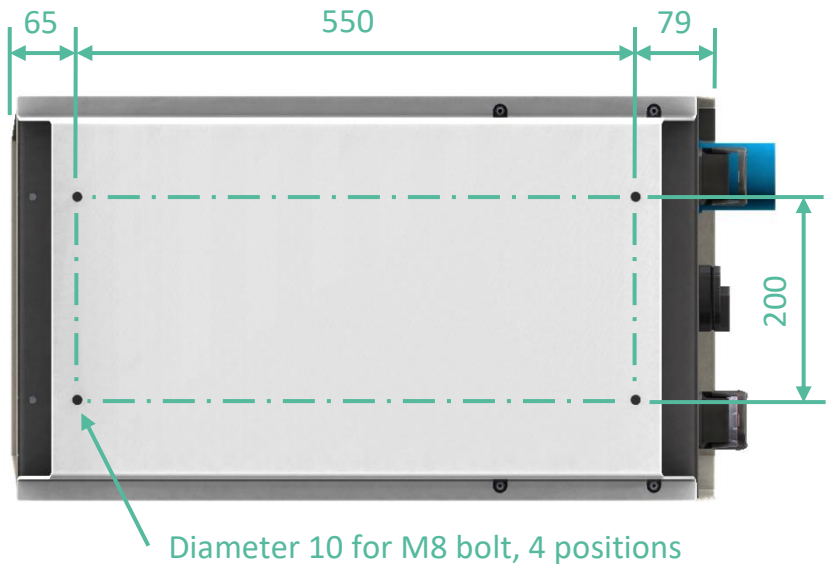


Figure 18 Power Module fixing holes (all dimensions in mm)

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