



BEST PRACTICE:

Battery Management for Portable Traffic Signals

A guide for the safe management of battery charging in your depot facility.

Battery Management

The Product

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10 million

Operating Hours*



57

Customers of the RC2



20+

Safety checks performed on each unit



18

Safety certifications

*Assumed 75% utilisation rate

Introduction

This document has been developed to provide guidance intended to ensure the safety of your business and employees, and to highlight the risks of working with batteries.

Traffic Group Signals are proactively contacting customers of the RadioConnect2 traffic signal to raise awareness of fire hazards and encourage best practice when working with battery powered equipment.

In summary, the risks of working with batteries can be minimised through training and a suitable charging environment. We also recommend that no alterations be made to electrical equipment without consulting the manufacturer.



Every year, at least 25 people are seriously injured when using batteries at work.

Health and Safety Executive, 2015



By following the advice in this document, you can improve workplace safety, while also reducing costs by improving the longevity of the battery.

The RadioConnect2

The UK's most advanced portable traffic signal

The RadioConnect2 traffic signal revolutionised the temporary traffic management industry with its striking ergonomic design, run time performance and advanced technology. It was the result of 2 years of product development, testing and field trials, built with the purpose of being the most reliable and efficient signal on the market.

The RadioConnect2 has been robustly tested to CE standards and all units undergo stringent Factory Acceptance Testing before despatch. Since launch in June 2018 over 3000 units have been sold nationwide.



AutoGreen Technology to deliver proven efficiency at street works



Reliable radio communications with Active Channel Management



Up to 18 days run time performance



Secure design to prevent battery theft and system tampering



The RadioConnect2 is built at the Hollco facility in Bourton-on-the-Water, Gloucestershire.

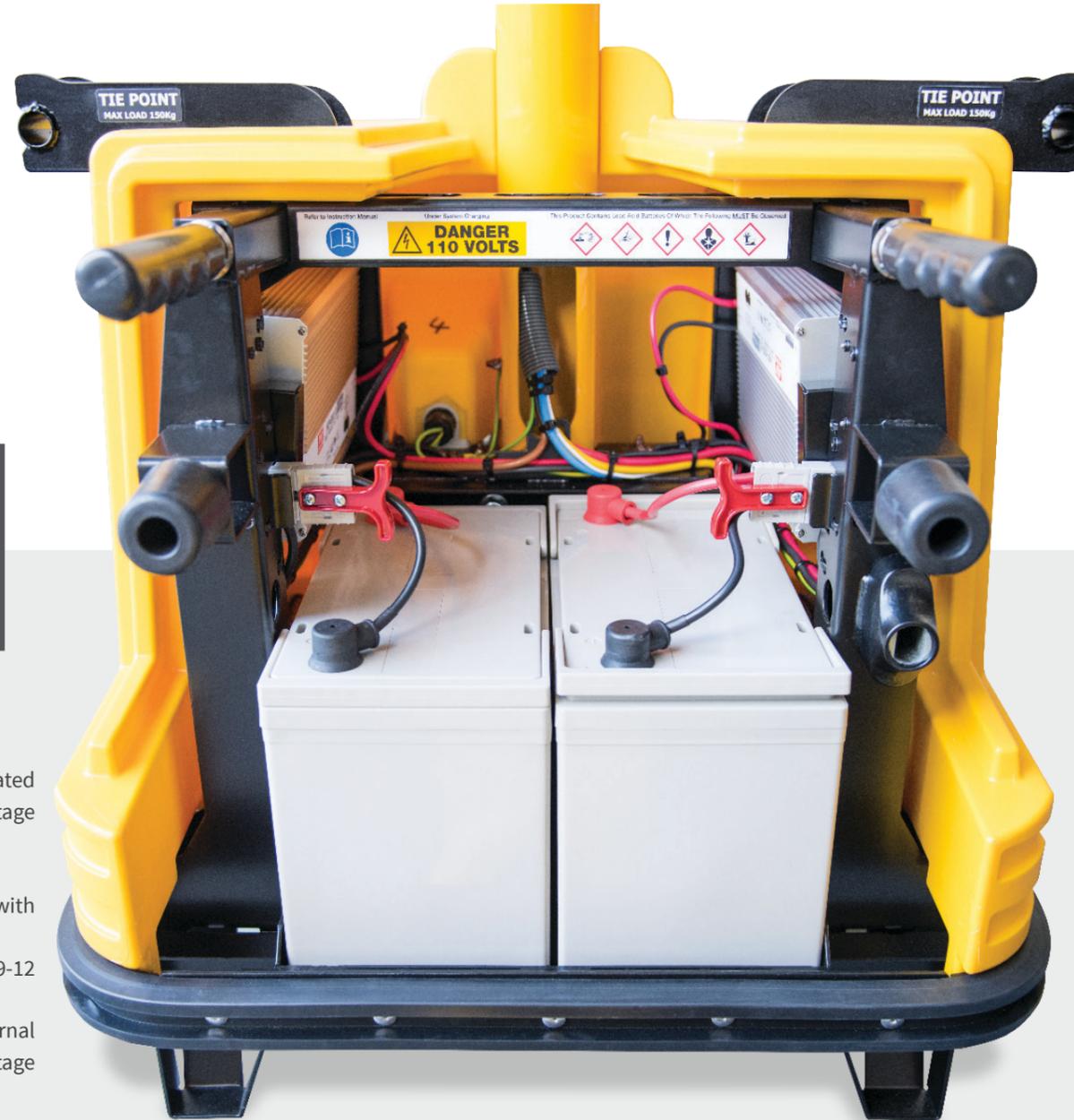
A team of engineers were involved in the design, development and configuration of the product, which has gone on to be nominated for a number of industry awards.

As a values-driven, family-owned company, Traffic Group Signals has always strived to provide the highest quality products and customer service that you have come to know and trust.



RadioConnect2 Power System

When we designed the RadioConnect2, we wanted to provide a safer product for traffic management firms that reduced the need for battery removal with longer running times and an integrated charging system



HIGH PERFORMANCE AGM Batteries

Two maintenance-free Lucas 12V 104Ah Deep Cycle AGM Rechargeable Batteries.

- Deliver 18 days run time
- Up to 5 year life expectancy
- AGM technology to prevent leakage of acid in the event of extreme impact



SEALED INTELLIGENT Chargers

Two IP66 600w integrated smart chargers with 3 stage charging capability.

- Chosen to work with supplied batteries
- Charges system in 9-12 hours
- Complete with internal overload and over-voltage protection



EXTERNAL 110V Charging Port

Ability to charge the batteries without opening the casing or removal.

- 110V ac only
- Protective cap to prevent dust and water ingress



SAFE AND SECURE Anderson Plugs

Batteries are fitted with terminal hoods and Anderson connectors to provide safe and secure power transmission.

- Ergonomic handles
- Prevents accidental short circuit

Working with batteries

This best practice guide is designed to aid portable signals users by recommending correct maintenance of signal batteries.

Overview



By maintaining portable signal batteries in the right way, you can improve the longevity and performance of the battery life and also ensure performance as per the manufacturers guidelines.

Battery Charging



The quality and care of a battery has a significant impact on the performance of your portable traffic signal. This guide explain the causes of battery damage and how to prevent it.

Pages 10-11

Environment



The temperature at which you charge the battery and also the temperature of the battery itself can have a dramatic affect on the safety and efficiency of the charging process.

Pages 12-13

Care & Maintenance



Every year, at least 25 people are seriously injured when using batteries at work. This gives a basic guide to working safely with batteries and minimising the risks involved.

Pages 14-15

Charging Station



Explosive gases are given off when batteries are charged. The risk of an explosion is great if the gases are allowed to collect. When charging batteries, ensure you have a suitable Charging Station by following our guide.

Pages 16-19

Battery Charging

The quality and care of a battery has a significant impact on the performance of your portable traffic signal.

A weak or depleted battery can cause communications problems and cause your signals to cut-out when not expected, resulting disruption to road users and additional costs to your business.

Here are our 5 tips for improving battery performance:



Traffic Signal Batteries

Signals use leisure style Sealed Lead Acid batteries which are designed to deliver smaller currents over longer periods. As the batteries are sealed, this means they are reasonably service-free as they do not require topping up with electrolytes. Our signals are supplied with premium AGM batteries, which are typically more expensive than 'wet spillable' batteries but offer operational benefits and can last up to 10 years if well maintained.

TGS signals run Endurance System Technology, which typically provides one week's run-time for each battery.

<p>1</p> <h3>Charge as soon as possible</h3> <p>Discharged batteries have sulphate that must be removed immediately or else the sulphate will become permanently bonded to the plates. (see below)</p> <p>Signals or batteries returned to the depot must be charged as soon as possible, once batteries have reached ambient temperature (P.12).</p> <p>Leaving batteries overnight or over the weekend without charging will already start the problem.</p>	<p>2</p> <h3>Charge to full capacity</h3> <p>Charging the batteries to their full capacity removes all the sulphate.</p> <p>Part-charging batteries (i.e. taking them off charge before the battery has become fully charged) does not fully remove sulphate, allowing build-up. Repeatedly part-charging batteries this way will damage their capacity.</p> <p>Fully charging batteries that are already damaged doesn't recover them.</p>	<p>3</p> <h3>Do not leave to overcharge</h3> <p>When a battery is fully charged, it should be removed from the charger as soon as possible.</p> <p>Leaving batteries on charge for extended periods when they have reached full charge can damage the battery.</p> <p>Healthy fully-charged batteries do not readily lose charge in storage.</p> <p>Invest in an Endurance Chargers that can manage a fully charged battery automatically, preventing damage.</p>	<p>4</p> <h3>Use a suitable charger</h3> <p>You should not use a high current charger to charge your batteries quickly in order to get faster turn-arounds.</p> <p>You should use a charger that is rated for the battery, does not charge it too slowly and has a temperature sensor (see No. 5).</p> <p>The Endurance Charger optimises the speed of charging to avoid internal damage.</p>	<p>5</p> <h3>Charge at room temperature</h3> <p>The health of your battery is strongly connected to its temperature.</p> <p>They should be charged as close to 20°C as possible as this is the temperature chargers are designed for.</p> <p>Below 15°C the capacity of a battery to store and release charge starts to degrade.</p> <p>Charging below 5C can be dangerous, see Environment (P.12) for further information.</p>
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Stages of Charging

The RadioConnect2 used a intelligent 3 stage charger, which helps charge and condition the battery during use.

	<p>BULK</p> <p>The charger delivers a closely controlled current to the battery. During this phase, about 75% of capacity is restored</p>
	<p>EQUALISATION (ABS)</p> <p>The charger slowly reduces the current to maintain the battery at the "boost" voltage. This brings the battery to about 98% charge without excessive gassing.</p>
	<p>FLOAT</p> <p>The battery voltage is allowed to drop to the "float" voltage. The current from the charger is automatically adjusted to supply any loads connected to the battery and maintain the battery in a fully charged state..</p>

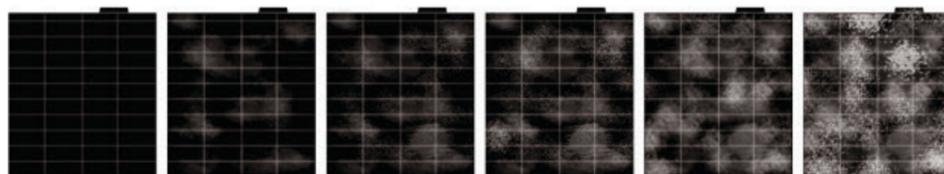
The second stage of the 3 phase charge (equalisation) is extremely important as this allows the batteries to reverse the sulfation process.

Shortening this phase or terminating a charge before the recommended timings have been completed will cause premature failure of the batteries, resulting in reduced run time and early life failure of the battery.

Sulfation

Sulfation is the formation of sulfate crystals on the surface of the battery's lead plates. As more and more crystals form on these plates and either the active lead material or sulfate from the electrolyte is no longer available the battery is considered discharged. The battery must then be recharged to reverse this process and return the sulfate back to the electrolyte. The problem is, not all of the sulfation crystals are reversed back into the electrolyte. Repeatedly failing to completely reverse the formation of sulfation crystals will ultimately cause your capacity or "run time" to diminish.

Battery sulfation over time



Poorly Maintained Batteries lead to:

- Shorter run-times
- Comms failures
- Nuisance call-outs
- Increased frequency of battery swaps
- Shorter battery life
- Higher costs owing to frequent battery swaps
- Higher battery replacement costs

Charging Environment

The temperature at which you charge the battery and also the temperature of the battery itself can have a dramatic affect on the safety and efficiency of the charging process.

Always charge batteries in a well-ventilated area, and avoid charging on a concrete floor as this may reduce the temperature of the battery. It is recommended to have a dedicated area for charging and storing batteries, where you are able to control the temperature of the environment.

Below 5°C Dangerous



Charging below this temperature is dangerous and may result in a hydrogen leak and potential for a fire.

The risk is greater in colder seasons when batteries return from site and when being charged in non-insulated depot charging areas.

Allow the battery to reach ambient temperature before charging, consider insulating or heating the charging area in cold seasons whilst maintaining ventilation.

5-15°C Not Recommended



Batteries can be charged at this temperature where it cannot be avoided however doing this regularly will result in reduced battery life. It does not fully remove the sulphate.

Allow the battery to reach ambient temperature before charging, consider insulating or heating the charging area in cold seasons whilst maintaining ventilation.

15-25°C Optimal



Charging batteries in this range ensures that the long-term health of the battery is maximised.

Optimised charging maximises the reversal of sulphate as well as ensuring your battery is re-charged as quickly as possible without degradation.

25-35°C Caution



Charging in this range will reduce battery life.

Allow the batteries to cool first and disconnect chargers immediately after charging is complete to avoid any risk of overheating.



Above 35°C Dangerous

Never charge batteries above this temperature. This may result in a hydrogen leak and potential for a fire.

Allow the battery to cool before charging and take urgent measures to reduce the ambient temperature of the charging area.

Note: Using a specialist temperature compensated charger can help manage the charger optimisation with the variance in ambient temperature.

Care & Maintenance

Every year, at least 25 people are seriously injured when using batteries at work¹. This gives a basic guide to working safely with batteries and minimising the risks involved.



Personal Protective Clothing

Protect your workforce

Do

- Wear gloves and suitable eye protection, preferably goggles or a visor.
- Empty your pockets of any metal objects that could fall onto the battery or bridge across its terminals.
- Wash your hands thoroughly after working with batteries, especially before eating, smoking or going to the toilet.

Don't

- Wear a watch, ring, chain, bracelet or any other metal item.



Battery Handling

Safely work with batteries

Do

- Ensure batteries are moved safely and without causing any damage to them.
- Secure batteries in transit
- Train workforce on battery safety
- Consult the latest HSE guidance on working with batteries

Don't

- **Work with batteries unless you have been properly trained.**
- Slide batteries along the floor as this can cause damage to the outer casing.



Battery Condition

Ensure your batteries are safe to use

Do

- Carry out visual checks of all cables in the battery box.
- Replace any damaged cables
- Replace and recycle old or damaged batteries
- Regularly test
- Fit temporary plastic covers over the battery terminals.

Don't

- **Overcharge the battery** – stop charging as soon as it is fully charged.
- Combine old and new batteries in a signal
- Leave batteries in a fully depleted state



Signal and Charging Equipment

Keep your equipment in good working order

Do

- Regularly check that charging equipment is undamaged and working correctly
- Perform regular PAT testing on charging equipment
- Have your charging station installed and regularly tested by a qualified electrician
- Contact the manufacturer if a repair or modification is required
- Check that the charging equipment is suitable for the Ampere Hour rating of the battery, e.g. correct voltage and current.

Don't

- Modify signals in any way
- Use high powered jet washers to clean signals
- Allow the internal electrical components to get wet

1. HSE (2015) Using Electric Storage Batteries Safely

The Battery Charging Station

A well-designed charging station can improve safety and efficiency.



Safe wiring

Have your charging station installed and regularly tested by a qualified electrician

It is important to check that your charging facilities are suitable for the equipment and batteries that you are charging. Not all chargers are suitable for all batteries, so consult the battery or signal manufacturers guidance to ensure your equipment is fit for purpose.



Guidance

In addition to prohibition signage, consider providing additional guidance around charging hazards.

This may include visual, smell and audible clues that could point to a hazard, or a checklist of steps to follow when putting batteries on charge.

A temperature display can ensure charging is performed at a safe temperature, and you may also wish to install a safety interlock to prevent charging in extreme conditions.

Battery Charging Station

TEMPERATURE

Charging or storing batteries at around 20°C can prevent internal damage.
Improve battery life by charging and storing around 20°C!

19.5°C

■ 13-27°C
Optimum

■ 5-12°C
Not recommended

■ 4°C and below
Never charge

CHARGING CHECKLIST

- Signal/battery is dry and free from damage
- Battery has reached ambient temperature
- Charging cables are free from damage
- Battery charger is fully functional
- Batteries will be charged to full capacity
- Batteries will be removed when fully charged
- If safety interlock switch has tripped, do not reset.

Any issues must be immediately reported to the Site Manager or persons in charge of QHSE.

VENTILATION

Battery charging using lead-acid batteries should only be carried out in well ventilated areas.

Charging must not be left unattended.

Look For any signs of visible damage or safety hazards

Smell For any unusual odours similar to rotten eggs

Listen For any unusual noise such as cracking or humming

Danger
Batteries contain acid

Explosive gases

Danger
Electric shock risk

No smoking or vaping

No mobile phones

Protective clothing must be worn

Keep designated area clear

Turn off when not in use

⚠ Batteries only to be charged by suitably trained persons. *If in doubt, ask!*



Gas detection

Charge batteries in a dedicated, well-ventilated area.

The battery charging process releases explosive hydrogen gas, the risk of an explosion is great if the gases are allowed to collect. Do not charge batteries below electric lights or other equipment that could be an ignition source.

We recommend to fit a gas detection system with a safety interlock, so that charging is immediately shut-off if dangerous gas levels are reached.



Safety signage

Make your workforce aware of the hazards of battery charging.

A visual reminder of the risks present in the handling of batteries is vital to ensure the safety of the workforce. Employees should be aware that any issues should be immediately reported to the QHSE or Site Manager.

Extinguishers and spill kits for fire or acid spills should be clearly marked and within proximity of the charging station.

The Battery Charging Station

GAS DETECTION WITH AUTOMATIC CUT-OUT

SAFETY LIGHTING & FIRE EXIT

PROTECTED SUPPLY PER EACH SIGNAL

STEP-DOWN TRANSFORMER

Battery Charging Station

TRAFFIC GROUP SIGNALS

TEMPERATURE
Charging or storing batteries at around 20°C can prevent internal damage.

23.3°C

13-27°C optimum
5-12°C cold temperatures
4°C and below avoid charge

CHARGING CHECKLIST

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SAFETY NOTICES

TEMPERATURE READING

CHARGING GUIDANCE

KILL SWITCH

SAFETY INTERLOCK

FIRE EXTINGUISHERS

PAT TESTED LEADS



CHEMICAL SPILL KIT

PAT TESTED LEADS



EXCLUSION ZONE



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