



 **Endurance**

Product Manual

Charger Series

12V 15A | Charging Panel

Accessories



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Safety Instructions



CAUTION: CAREFULLY READ AND FOLLOW ALL SAFETY INSTRUCTIONS

- Ensure the area around the battery and charger is properly ventilated.
- Do not cover or place any objects on top of the charger.
- Do not place the charger on top of the battery.
- Ensure that there are no sparks or ignition sources near the battery; batteries can emit explosive gasses while being charged.
- Battery acid is corrosive; if battery acid comes into contact with skin immediately rinse with water.
- Do not attempt to charge non-rechargeable or frozen batteries.
- The charger must not be used by people who cannot read and understand the instruction manual, or have not received suitable training.
- The charger must be connected in the following order:
 1. Connect the charger Anderson connector to the battery connector
 2. Switch on the AC power supply
- After charging, the charger must be disconnected in the following order (reverse of the connection order):
 1. Switch off the AC power supply
 2. Disconnect the Anderson connectors that connect the battery to the charger
- Connection to the mains supply must be in accordance with local electrical regulations. In case the AC power cable is damaged, do not use the charger/system.

Product Overview

IP65 Charger

The IP65 charger is built in a rugged and waterproof enclosure, able to withstand water and dust ingress.



Carry Case

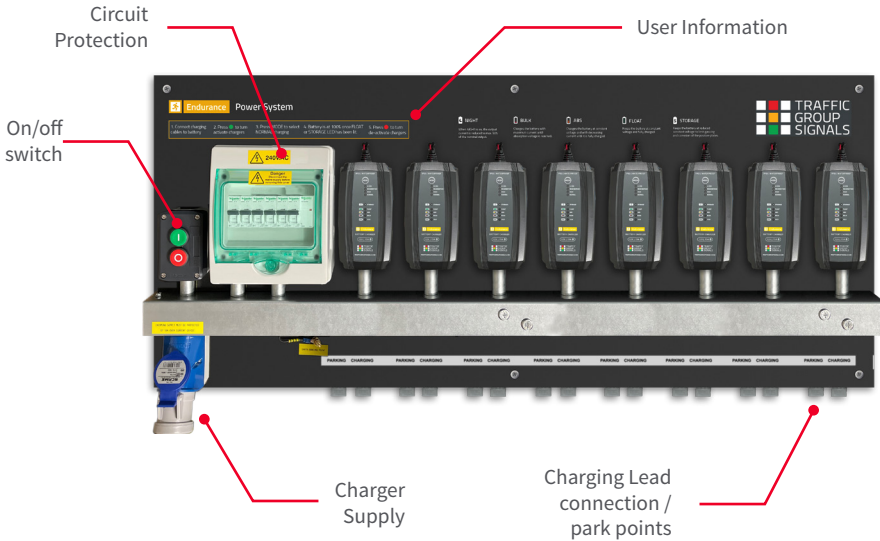
Provided with rugged IP65 rated flight case comprising of eight chargers when hired as part of a Metro system.



Product Overview

Panel Charging System

To support safe and efficient depot charging, the Endurance 15A charger is available as an 8-up wall panel charging system. The panel charging system features cut-off switch, circuit protection, containment and user instructions.



Key Features

The Endurance IP65 charger has a range of features designed to meet the needs of the traffic management industry.

- **Water, dust and chemical resistant** - Suitable for use in a depot/workshop area
- **7-stage smart charge algorithm** - Optimises charging and charge maintenance
- **Recover fully discharged batteries** - Increases battery longevity, reducing costs
- **Temperature compensated operation** - Will work in low temperatures (down to 0°C)
- **95% efficient** - Lower power usage and safer operation
- **Will automatically shut down when batteries are fully charged** - Preventing damage from overcharging
- **Fast charge** - Able to fully charge 12V batteries in approximately 16 hours, enabling quick asset turnaround.

Features

Features in Full

a. **Multi-stage charge algorithm**

The multi-stage charge algorithm is specifically engineered to optimise each recharge cycle and charge maintenance over extended periods.

b. **Adaptive absorption**

Adaptive absorption monitors the battery's response during initial charging and intelligently determines the appropriate absorption duration for each individual charge cycle. This ensures that the battery is fully recharged regardless of the discharge level or capacity and avoids excessive time at the elevated absorption voltage (that can accelerate battery aging).

c. **Temperature compensation**

Charge voltage is automatically compensated depending on the ambient temperature; this ensures that the battery is charged at the optimal charge voltage regardless of the climate and avoids the need for manual settings adjustments.

d. **High efficiency**

The Endurance charger range is up to ~95% efficient; resulting in lower power usage, less heat generated and cooler operation. Additionally, when not charging the unit only consumes 0.5W.

e. **Durable and safe**

- i. Engineered to provide years of trouble-free and dependable operation in all usage conditions
- ii. Protection against overheating: output current will be reduced if the charger temperature increases to 50°C
- iii. Protection against short circuit: If a short circuit condition is detected all status LEDs will start blinking
- iv. Protection against reverse polarity connection: If the charger is incorrectly connected to a battery with reverse polarity all status LEDs will start blinking
- v. Protection against ingress of dust and water/liquid

f. **Silent operation**

Charger operation is totally silent: there is no cooling fan or moving parts.

g. **Storage stage**

An additional stage to extend battery life whilst the battery is unused and on continuous charge.

h. **Recondition stage**

An optional stage that can partially recover/reverse lead acid battery degradation due to sulphation; typically caused by inadequate charging or if the battery is left in a deeply discharged state.

i. **Recovery function**

The Endurance charger range will attempt to recharge a severely discharged battery (even down to 0V) with low current and then resume normal charging once the battery voltage has risen sufficiently - many other chargers will not recognise a battery in this state.

Quick Start Guide

Getting Started

- 1 Connect the charger Anderson connector to the battery connector; ensure that there is a good electrical connection.

Note: Only 12V lead acid batteries can be charged which are in the range 50-150Ah

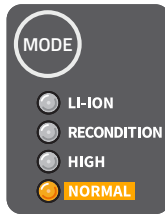
- 2 Connect the AC power cable to a mains power outlet; the TEST LED will be illuminated or blink when the Endurance charger is powered up.



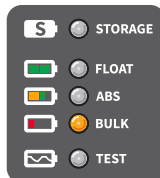
The **TEST** LED will continue to blink until a charge pulse is able to increase the battery voltage above 12.5V or 2 minutes have elapsed. If a fault is detected during the test phase (such as a short circuit, reverse polarity or incorrect charger voltage) all charge status LEDs will blink; in this case the charger should be immediately disconnected.

- 3 The charger has several modes but the **NORMAL** mode should be selected.

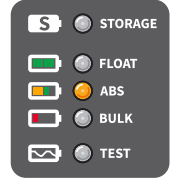
Note: The charger will automatically store the mode and recall it for future charge cycles (even after being disconnected from power), but this should be checked before the charge cycle commences.



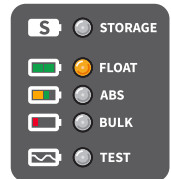
- 4 When the charging cycle has started, the **BULK** LED will illuminate (if the battery is <80% charged)



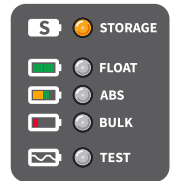
- 5 When the **ABS** LED is illuminated the charger has moved into absorption stage (bulk stage is complete); the battery will be approximately 80% charged (or less than 8hrs) and may be returned into service if required.



- 6 When the **FLOAT** LED is illuminated the charger has moved into float stage (absorption stage is complete); the battery will be fully (100%) charged and is ready to be returned into service.



- 7 When the **STORAGE** LED is illuminated the charger has moved into storage mode (float stage is concluded); to maintain the battery at full charge, the battery can be left in storage mode safely for an extended duration.



- 8 Switch off the AC power at any time to stop charging.

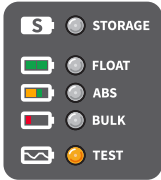


Operation

Charge Algorithm

The Endurance charger range are intelligent multi-stage battery chargers, specifically engineered to optimise each recharge cycle and charge maintenance over extended periods.

The multi-stage charge algorithm includes the individual charge stages described below:



1 TEST/CHARGE

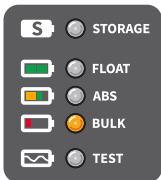
Before the charge cycle commences the battery is tested to determine if it will accept charge, even if the battery is fully discharged (close to 0V open circuit voltage) it may successfully accept charge.

The TEST LED will continue to blink until a charge pulse is able to increase the battery voltage above 12.5V (25.0V for 24V chargers) or 2 minutes have elapsed.

If there is a clear issue such as reverse polarity connection or short circuit the battery will be rejected, and all charge status LEDs will blink; in this case the charger should be immediately disconnected.

If the test phase persists for an extended period and the battery casing becomes unusually hot (after moving into bulk stage), its likely that the battery is damaged and has an developed an internal short circuit; in this case the charger should also be immediately disconnected.

If a load is simultaneously connected while attempting to test and charge a deeply discharged battery a false rejection may occur; in this case all loads should be disconnected, and the test stage repeated.

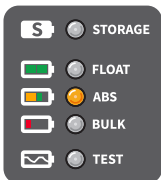


2 BULK

The battery is charged at the maximum 15A charge current until the voltage increases to the configured absorption voltage.

The bulk stage duration is dependent on the battery's level of discharge, the battery capacity and the charge current.

Once the bulk stage is complete, the battery will be approximately 80% charged (or >95% for Li-ion batteries) and may be returned into service if required.



3 ABSORPTION (ABS)

The battery is charged at the configured absorption voltage, with the charge current slowly decreasing as the battery approaches full charge.

The absorption stage duration is adaptive and intelligently varied depending on the battery's level of discharge – this is determined from the duration of the bulk charge stage.

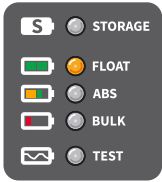
The absorption stage duration can vary between a minimum of 30 minutes, up to a maximum limit of 8 hours (or as configured) for a deeply discharged battery.

On every charge cycle is it desirable to complete part or all of the absorption stage to maximise battery life.

A battery should complete a full absorption stage at least every 5 cycles.

Operation

Charge Algorithm

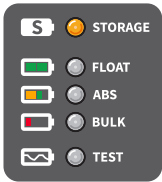


4 FLOAT

The battery voltage is maintained at the configured float voltage to prevent discharge.

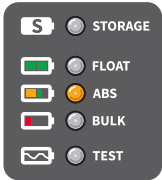
Once float stage is commenced the battery is fully charged and ready for use.

The float stage duration is also adaptive and varied between 4 to 8 hours depending on the duration of the absorption charge stage, at which point the charger determines the battery to be in storage stage.



5 STORAGE

The battery voltage is maintained at the configured storage voltage, which is slightly reduced compared to the float voltage to minimise gassing and extend battery life whilst the battery is unused and on continuous charge.



6 REFRESH

To refresh the battery and prevent slow self-discharge while in storage stage over an extended period, a 1 hour absorption charge will automatically occur every 7 days (or as configured).

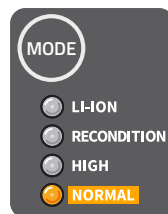
Operation

Using the Mode Button

There are 3 easily selectable integrated charge modes that are suitable for most common battery types, as well as an optional recondition stage that can be included (except for Li-ion mode).

Charge voltage

By simply selecting the appropriate charge mode for the battery type being charged, (refer to the battery manufacturer's recommendations) the voltage settings for each charge stage will be altered according to the table below:



Mode	Absorption	Float	Storage	Recondition
✓ Normal	14.4V	13.8V	13.2V	16.2V
✗ High	14.7V	13.8V	13.2V	16.5V
✗ Li-ion	14.2V	13.5V	13.5V	N/A

LI-ION	✗	Do not use
RECONDITION	i	See 'Recondition'
HIGH	✗	Do not use
NORMAL	✓	Normal operating mode

Charge Mode Selection

The desired charge mode can be selected by briefly pressing the MODE button to cycle through the charge modes – the LED beside the active charge mode (NORMAL / HIGH / LI-ION) will be illuminated.

The mode setting is stored and will not be lost when the charger is disconnected from mains power or the battery.

Battery Charge Time

This fast charge system is designed to charge the batteries for your signals safely, in a short period and minimises any damage (sulphation) to batteries which age through multiple discharge and recharge cycles.

Fast, safe and smart charging maximises the time the signal is operational for use and extends the life of batteries, so signal run-time is preserved for longer.

The following should also be noted;

- For Evo Multi, Evo ACM & Metro systems, 80% of run-time is available after approx. 8hrs of charge
- It is desirable to charge for a minimum of 14hrs (or until FLOAT is reached)
- Full charge is reached after approx. 16hrs
- Charge times can be affected by temperature
- Damaged or very aged batteries may not move on to the FLOAT stage of charging

Operation

Recondition Mode

If enabled the recondition stage is included in the charge cycle; use only if required as a corrective/maintenance action

To enable recondition mode, press MODE once NORMAL mode is active and both **NORMAL** and **RECONDITION** LEDs will be illuminated (this is the recommended recondition configuration). If recondition mode is enabled the **RECONDITION** LED will be illuminated and blink during recondition stage.

During recondition, the battery voltage is attempted to be increased to the configured recondition voltage, while the charger output current is regulated to 8% of the nominal charge current (for example - 1.2A maximum for a 15A charger).

Recondition is an optional charge stage for lead acid batteries and not recommended for regular/cyclic use - use only if required, as unnecessary or overuse will reduce battery life due to excessive gassing.

The higher charge voltage during recondition stage can partially recover/reverse battery degradation due to sulphation, typically caused by inadequate charging or if the battery is left in a deeply discharged state for an extended period (if performed in time).

The recondition stage may also be applied to flooded batteries occasionally to equalise individual cell voltages and prevent acid stratification.

Recondition stage is terminated as soon as the battery voltage increases to the configured recondition voltage or after a maximum duration of 1 hour (or as configured).

Note that in certain conditions it is possible for the recondition state to end before the configured recondition voltage is achieved, such as when the charger is simultaneously powering loads, if the battery was not fully charged before recondition stage commenced, if the recondition duration is too short (set to less than one hour) or if the charger output current is insufficient in proportion to the capacity of the battery/battery bank.



Operation

Temperature Compensation

The Traffic Group Signals Endurance charger range will automatically compensate the configured charge voltage based on ambient temperature.

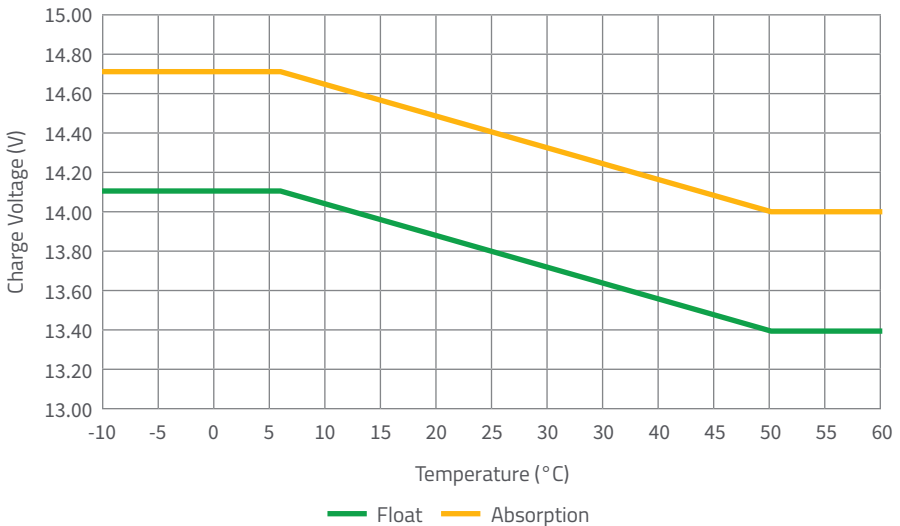
The optimal charge voltage of a lead acid battery varies inversely with battery temperature; automatic temperature-based charge voltage compensation avoids the need for special charge voltage settings in hot or cold environments.

During power up the charger will measure its internal temperature and use that temperature as the reference for temperature compensation, however the initial temperature measurement is limited to 25°C as it's unknown if the charger is still warm from earlier operation. It is important for accurate temperature compensated operation that the charger/bank is switched off when not in use.

Since the charger generates some heat during operation, the internal temperature measurement is only used dynamically if the internal temperature measurement is considered reliable; when the charge current has decreased to a low/negligible level and adequate time has elapsed for the charger's temperature to stabilise.

The configured charge voltage is related to a nominal temperature of 25°C and linear temperature compensation occurs between the limits of 6°C and 50°C based on the default temperature compensation coefficient of 16.

Charge Voltage - Temperature Compensation



Technical Specifications

Endurance IP65 Charger	12V 15A
Input voltage and frequency range	180 - 265VAC 45 - 65Hz
Efficiency	94%
Standby power consumption	0.5W
Charge voltage - Absorption	Normal: 14.4V High: 14.7V Li-ion: 14.2V
Charge voltage - Float	Normal: 13.8V High: 13.8V Li-ion: 13.5V
Charge voltage - Storage	Normal: 13.2V High: 13.2V Li-ion: 13.5V
Max output current - Normal mode	15A
Max battery capacity (recommended)	150Ah
Min battery capacity - Normal mode	Lead-acid: 50 Ah
Temperature compensation (lead-acid only)	16mV/°C
Charge algorithm	7-stage adaptive
Power supply mode	Yes
Back current drain	0.7Ah/month (1mA)
Protection	Reverse polarity, output short circuit, over temperature
Operating temperature	-40 to +50°C (full rated output up to 30°C)
Humidity (non condensing)	Max 95%
Enclosure	
Battery connection	Red and black cable
AC connection	Cable with BS 1363 3-pin plug (where fitted)
Protection category	IP65 (splash and dust proof)
Charger Dimensions (h x w x d)	60 x 105 x 190mm
Standards	
Safety	EN 60335-1, EN 60335-2-29
Emission	EN 55014-1, EN 61000-6-3, EN 61000-3-2
Immunity	EN 55014-2, EN 61000-6-1, EN 61000-6-2, EN 61000-3-3

Safety Precautions

It is important that the products concerned should be installed and maintained by competent persons in accordance with good engineering practice, statutory requirements and codes of practice. Comprehensive guidance on this can be found in the HSE guidance - "Using Electric Storage Batteries Safely".

It is necessary to utilise batteries within the systems covered by this Manual that involves a need for managed handling, usage and disposal techniques to ensure the safety of operatives and care of the environment. PPE must be worn when charging and handling batteries.

All work must be performed in accordance with company working practices, in-line with adequate risk assessments. Only skilled and instructed persons should carry out work with the product.

Attention is drawn to the following;

1. This system is compliant to the Restriction of Hazardous Substances (RoHS - European Union directive 2011/65/EU).
2. No user-maintainable parts are contained within the product. Removing or opening the outer casing is deemed dangerous and will void all warranties.
3. Charging system is subject to an annual PAT test, to be undertaken by a certified professional.
4. Charging leads, connectors and batteries must be regularly inspected for damage.
5. Under no circumstances should a product suspected of damage be used. Damage may be suggested by electrical trips or sparks, any unusual odours or damage to any of the outer enclosures. Please contact Traffic Group Signals Limited for further advice.
6. 'Control of lead at Work Regulations 2002' The Approved Code of Practice for the Control of Lead at Work' from the Health and Safety Commission.
7. Automotive batteries are classed as hazardous waste and therefore must be stored, transported and disposed of in accordance with the following pieces of legislation.

Environmental Protection Act 1990, Part II 2.

Environmental Protection (Duty of Care) Regulations 2014

The Waste Management Licensing Regulations 1994

The Controlled Waste (Registration of carriers and seizure of vehicles) Regulations 2012

Hazardous Waste Regulations 2011 and List of waste regulations 2011

The Carriage of Dangerous Goods by Road Regulations 2009

HSE - Using Electric Storage Batteries Safely; <https://www.hse.gov.uk/pubns/indg139.pdf>



BE	BG	CZ	DK	DE	EE	IE	EL	ES	
FR	HR	IT	CY	LV	LT	LU	HU	MT	
NL	AT	PL	PT	RO	SI	SK	FI	SE	UK



Warranty & Disclaimer

Three Year Limited Warranty

This limited warranty covers defects in materials and workmanship in this product, and lasts for three years from the date of original purchase of this product.

The customer must return the product together with the proof of purchase to Traffic Group Signals.

This limited warranty does not cover damage, deterioration or malfunction resulting from alteration, modification, improper or unreasonable use or misuse, neglect, exposure to excess moisture, fire, improper packing, lightning, power surges, or other acts of nature.

This limited warranty does not cover damage, deterioration or malfunction resulting from repairs attempted by anyone unauthorized by Traffic Group Signals to make such repairs.

Traffic Group Signals is not liable for any consequential damages arising from the use of this product.

The maximum liability of Traffic Group Signals under this limited warranty shall not exceed the actual purchase price of the product.

Disclaimer

While we (**Traffic Group Signals Limited**) endeavour to keep the information in this manual correct at the time of print, we make no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the information, products, services, or related graphics contained herein for any purpose.

Any reliance you place on such information is therefore strictly at your own risk. In no event will we be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this manual.

In the unlikely event that the charging unit suffers a failure or in any other way performs in a manner that is deemed to be unexpected or potentially incorrect by the operator, the unit should be powered off and all equipment disconnected from the system. No attempt to operate the system should be made until such time as the system has been inspected by a suitably qualified electrician.

The stated approximate charging times are subject to environmental factors and the condition and age of the battery being charged.



Endurance

For more information

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