

Nickel Metal Hydride Battery Pack

User Handbook



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Safety Instructions

Please read the following warnings carefully before using a PPM Nickel Metal Hydride (NiMH) battery pack.

PPM NiMH battery packs contain sealed rechargeable cells that are entirely safe under normal charging, discharging and storage conditions, but may become hazardous if abused.

WARNING



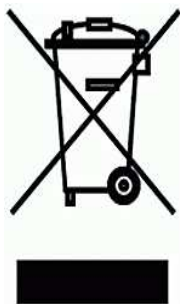
Battery cells are sealed but contain caustic, flammable, toxic hazardous chemicals.

Avoid all abuse that might lead to damage exposing cell chemicals.

Abuse includes, but is not limited to, physical damage and overheating.

NiMH battery packs are more environmentally friendly than other battery types – such as NiCd.

DISPOSAL



PPM recommend battery packs are recycled using a local collection and recycling scheme.

WARNING



Under no circumstances should battery cells be crushed, short-circuited or incinerated.

Description

PPM Nickel Metal Hydride (NiMH) battery packs have been designed for use with PPM fibre-optic modules and systems.

The battery pack has built in protection suitable for its operating environment. This will protect the battery and allow it to deliver 3 Amps of continuous current. The protection consists of a bimetal thermal protection, PTC resetable fuse and a non-resetable thermal fuse. The non resetable fuse will only be blown under extreme abuse, under all normal operating conditions the resetable fuses will open first.

PPM NiMH battery packs have been designed for use only with PPM equipment. Use in any other application may be hazardous - see [safety warnings](#).

Rechargeable battery packs have more complex charging requirements than individual cells. It is therefore extremely important that only the PPM recommended charger is used to recharge batteries.

Operation

Battery Charger

PPM have collaborated with PAG, a specialist battery charger manufacturer, to develop a customised charger specifically to recharge PPM NiMH battery packs.

The customised charger is available as a kit complete with charging leads suitable for connection directly to PPM battery packs. PPM part no 56291/56292.

CAUTION



PPM battery packs must not be recharged with any other charger. Please see [safety warnings](#).

The battery charger has a single automatic operating mode

Battery Charging

Battery packs should only be charged using the [recommended charger](#).

Ideally batteries should be charged when they have returned to ambient temperatures between 15°C to 25°C. This will require battery packs to be left at such ambient temperatures for at least an hour if they are too hot or cold.

It is acceptable to charge batteries at temperatures between 0°C and 40°C, but operating at these extreme temperatures will degrade battery life.

To charge a battery pack, simply connect it to the recommended charger using the supplied cable. Charging will start and stop automatically.

The front panel of the charger will show the status of each connected battery.

- ABST = No battery connected or detected
- DONE = Charging complete
- CHRG = Charging in progress
- FAIL = Charging failed (see battery end of life)
- BLNC = Charging (balancing) in progress

CAUTION



Batteries should not be left discharged for extended periods of time. Self-discharge (with no load connected) can over-discharge batteries causing reduced life or permanent damage.

See [storage times](#).

Battery Discharging

PPM battery packs are designed for use with PPM equipment only.

Every PPM module designed to operate from a battery pack includes a voltage-detector and switch to automatically disconnect the load from the battery at a safe voltage.

Battery powered PPM modules also include an early visual warning to indicate a low battery-voltage prior to switch-off.

WARNING



PPM battery packs should not be used to power non-PPM equipment. Doing so could result in over-discharge or other hazardous abuse. See [safety warnings](#).

Ideally batteries should be discharged at temperatures between 15°C and 25°C. Batteries may be discharged at temperatures from -10°C to +45°C, but repeated discharging at extreme temperatures will shorten working life.

If batteries are stored at temperatures below -10°C or above +40°C, it is very important they are left for at least an hour within this temperature range before starting a discharge.

Battery Reconditioning

Battery packs contain a string of series cells that gradually become unbalanced in stored capacity.

PPM recommend battery packs are rebalanced at regular intervals to help rebalance cells. Rebalancing is done automatically at the end of the charging cycle.

If your batteries are not regularly fully discharge and exhibiting reduced capacity. You may wish to fully discharge them using your P2P module as a load. This can be done overnight as the P2P module will switch off when the battery is fully discharged. Then run the unit through its normal charge cycle.

Appropriate reconditioning intervals will depend on battery usage. A typical interval would be 3 months.

Battery packs at the end of their working life cannot be reconditioned and should be returned to PPM for replacement of all battery cells. Batteries at the end of their life will often fail to charge.

Storage

Ideally batteries should be stored in a dry environment at temperatures between 15°C and 25°C. Batteries may however be stored at:

- 20°C to +50°C for up to 30 days at 25 to 65%RH
- 20°C to +40°C for up to 90 days at 25 to 65%RH
- 20°C to +30°C for up to 1 year at 25 to 65%RH

Storage at high relative humidity (RH) is not recommended because expansion and contraction of battery materials may cause leaks and rust to form on metal parts.

Battery self-discharge rate increases with storage temperature.

At 20°C battery capacity falls to 70% after 30 days.

At 40°C battery capacity falls to 40% after 30 days.

Batteries left for extended periods resulting in over-discharge may be permanently damaged.

Performance

The time a battery can provide power to its' load will depend on many factors including:

- Battery state of charge
- Battery age and condition
- Ambient temperature
- Load current
- Elapsed time since battery was charged

Nominal times new, fully-charged batteries will power a load at 20°C are:

Load	2Ah Battery Pack
100mA	18 hours
150mA	12 hours
200mA	9.0 hours
250mA	7.2 hours
300mA	6.0 hours
350mA	5.1 hours
400mA	4.5 hours
450mA	4.0 hours
500mA	3.5 hours

As a guide, temperature and battery condition will cause these times will vary as follows:

- 95% time if discharged at 0°C (-5%).
- 90% time if discharged at -10°C.
- 90% if stored at 25°C for one week after charging
- 75% if stored at 40°C for one week after charging
- 90% after 500 charge/discharge cycles
- 80% after 3 years usage

These variations can be multiplied together as applicable.

e.g. A 3 year old battery fully charged then stored for a week at 25°C before being discharged at 0°C will only last:

$$80\% \times 90\% \times 95\% = 68\% \text{ of nominal time.}$$

Battery Life Stages

Service Life

PPM NiMH battery packs have been designed to provide the maximum possible useful working life.

Reliability of all NiMH rechargeable battery cells does however depend on the way battery packs are treated.

Storage and operating temperatures are the most important factors determining useful life, with high temperatures being the most detrimental.

Battery capacity will build up to a maximum over the first few charge/discharge cycles then gradually decline with age and usage.

Battery End of Life

PPM recommend batteries are replaced after 500 charge/discharge cycles, 3 years usage or when capacity falls below 80% of nominal – whichever occurs first.

Batteries at the end of their life will often fail to charge. When connected to the charger they will initially charge typically for approximately 1 minute but then display "FAIL". First check that only the battery is connected to the charger, other loads may cause a false fail. You may try to rectify this by disconnecting and reconnecting the battery or fully discharging and reconditioning the battery (see Battery Reconditioning).

Disposal

PPM recommend battery packs are recycled using a local collection and recycling scheme.

Please see [battery disposal](#).

Glossary

Abbreviations used in this handbook:

Ah	<p>Ampere-hours</p> <p><i>The capacity of a battery defined as the current, in amperes, multiplied by the number of hours.</i></p>
mAh	<p>milli-Ampere-hours</p> <p><i>The capacity of a battery defined as the current, in milli-amperes, multiplied by the number of hours.</i></p>
NiCd	<p>Nickel cadmium</p> <p><i>A mature type of rechargeable battery designed with Nickel and Cadmium electrodes. Unfortunately cadmium and cadmium compounds are highly toxic, so their use is being phased-out or prohibited.</i></p>
NiMH	<p>Nickel metal hydride</p> <p><i>A type of rechargeable battery designed with Nickel and Metal-Hydride electrodes. NiMH batteries are increasingly being used to replace NiCd batteries because they are more environmentally friendly.</i></p>
RoHS	<p>Restriction of use of Hazardous substances</p> <p><i>European legislation that prohibits the use of six highly toxic substances. One of these is cadmium.</i></p>