



Professional Broadcast Equipment

PAG NMH60

Nickel-Metal Hydride Time Battery

Model No. 9374

Instruction Manual

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SECTION 1

POWER & TIME DISPLAY

The Paglok Digital NMH60 is a Nickel-Metal Hydride battery with a nominal rating of 14.4V 4Ah. The battery is intelligent, being the first professional broadcast battery to incorporate the highly accurate PAG Power & Time display. For the first time the user now has the truth about his battery performance available at the touch of a button. We know that you will regard the Power & Time display, **which is unique to PAG**, as one of the most beneficial features of this product.

The time and capacity computation embedded in this battery is **accurate and truthful**, since all display information is based upon the actual conditions under which the battery is being used.

The cells are rated at a nominal 4Ah, based upon a 5-hour discharge rate. In common with any battery, the NMH60 will demonstrate a reduced capacity at higher rates of discharge, and this effect is known as de-rating. Therefore, you must expect a variance between the displayed and rated capacity figures.

As an example, the NMH60 discharged at the 1-hour rate will produce a de-rated capacity of approximately 3.6Ah to 3.8Ah (a reduction of 5% to 10%) calculated against load.

For the purpose of the most accurate display the calculation of capacity and run-time has been based upon previous cycle history, and represents accurately the expected capacity given the prevailing mode of operation. The PAG NMH60 is the first battery to reveal this level of information to the user, so it is important that you understand its significance.

It must also be recognised that as a consequence of normal use, the maximum available capacity of **any battery** will gradually decline with cycle life. You will have noticed this unavoidable characteristic with Ni-Cd batteries; it is more pronounced with Ni-MH batteries, and particularly so with the new Lithium-Ion technologies.

There are, of course, occasions where capacity is lost as a direct result of the battery having been operated outside its rated specifications. In general these losses can be retrieved by a corrective charging regime. Most PAG chargers have a special program for the recovery of lost capacity and are new-technology upgradeable. The new AR Series 2 chargers which have been specifically developed for the new technologies as well as

conventional Ni-Cds, are outstanding in performance, and are able to measure, display and regain lost capacity where it is retrievable.

User beware! Batteries which feature indicators such as LCD bar graph displays or LED arrays, and which always show 'full' at the end of charge, **without providing a capacity reading**, may deceive the user into believing that these batteries are still operating at the original rated capacity. Many of us have experienced the scenario of these batteries indicating that they are fully charged and then rapidly failing in use.

SECTION 2

SPECIFICATION

- 2.1 **Description:** Model No. 9374 PAG NMH60 Time Battery.
- 2.2 **Construction:** PAGlok batteries have welded cell interconnections of low-resistance nickel strap. The case for these models consists of high-impact injection mouldings with an internal cradle feature designed to protect the cells from impact damage. The batteries are sealed and non user-serviceable.
- 2.3 **Cells:** Premium grade Nickel-Metal Hydride sealed rechargeable cylindrical cells.
- 2.4 **Voltage:** 14.4V nominal (12 cells connected in series, nominal voltage 1.2V per cell).
- 2.5 **Capacity:** 4.0 Ampere-hours, measured at the five hour rate.
- 2.6 **Capacity Data:** The battery incorporates state-of-the-art low-power microelectronic circuits, giving the user access to the battery state of charge and run-time information.
- 2.7 **Display:** The battery can display capacity in ampere-hours in 0.1Ah increments, and percentage of remaining available capacity in 1% increments. When on-load, a run-time prediction can be displayed.
- 2.8 **Output Protection:** The PAG NMH60 is protected against short circuit and excessive currents by means of a self-resetting protection device. Rated maximum continuous output current is 4.5 Amperes. The battery is also protected against over-temperature by means of a non-resetting thermal fuse rated 98°C.

- 2.9 **Operating Temperature Range:** Optimum discharge efficiency is achieved within the temperature range 10°C to +40°C.
- 2.10 **Weight:** 880gm (2lb approx.).
- 2.11 **Size:** 130mm (H) x 86mm (W) x 42mm (D) excluding locking claws.

SECTION 3

CARE & MAINTENANCE

- 3.1 For long-term storage, the battery should be stored in a discharged state.
- 3.2 Maintenance charging is not required during long-term storage.
- 3.3 Store in a cool, dry place at a temperature between -20°C and +30°C and in a relative humidity of 65% ±20%. Long-term storage at temperatures above +30°C will reduce the battery's life because of deterioration of organic materials such as the gasket and separator. Excessively low storage temperatures (below -20°C) are also to be avoided since the electrolyte may freeze, resulting in permanent cell damage.
- 3.4 If the battery has not been in operation for a while, it may require several cycles of charge and discharge in order to restore its maximum available capacity. After prolonged storage, users with AR Series chargers may find the following procedure beneficial: Charge the battery until the charger indicates that it is charged. Disconnect the battery from the charger, and then re-apply it, using the 'Recovery' program. Allow this program to run until the charger again indicates that the battery is charged. This process will take a little over 1 hour to complete.
- 3.5 The battery should be in a fully charged state before use. Even after one week in storage, it is advisable to give the battery a top-up charge before use.
- 3.6 Use only a PAG charger which has been designed to charge PAG NMH (Nickel-Metal Hydride) batteries.
- 3.7 For maximum output always use within the temperature range: 0°C to +40°C. Never operate outside of the temperature range: -20°C to +45°C.

- 3.8 The battery is designed for a maximum continuous output of 4.5 Amperes. This is equivalent to a medium power camera together with a 35W light. Battery output is protected by means of a self-resetting over-current protection device and a thermal fuse.
- 3.9 The battery is sealed, and contains no user-serviceable components. If any attempt is made to open the case, it is probable that the damage will disrupt the digital circuitry, which will then cease to function. In order to maintain the quality standard for which you first chose this product, return it to a PAG Dealer or the PAG Service Department for servicing.

SECTION 4

INSTRUCTIONS FOR USE

4.1 CHARGING INSTRUCTIONS:

- 4.1.1 The battery should be in a fully charged state before use.
- 4.1.2 **IMPORTANT:** THIS BATTERY MUST BE CHARGED ONLY FROM A PAG ACS CHARGER THAT IS DESIGNED TO CHARGE PAG NMH BATTERIES. Other types of charger must never be used as the battery may be damaged irreparably; there is also the danger that the cells may disrupt forcibly, presenting the risk of personal injury.
- 4.1.3 When the battery has been discharged at a high rate it will become warm, and it is advisable to let it cool before charging it. For the best results the battery should be charged within the temperature range +10°C to +40°C. If the battery is either too cold or too hot to be charged safely, charging will be inhibited (accompanied by the appropriate charger display). In this event the charger will indicate '°C' if the display button is pressed. The battery should be left connected to the charger, which will automatically initiate charging as soon as the temperature is within the correct range. NOTE: In order to prevent abuse of batteries which are outside of the correct charging temperature range, a circuit is incorporated which prevents the battery from being charged while still allowing a PAG ACS charger to recognise that it is connected. If such a battery is removed from the charger and re-applied while it is still outside of the correct temperature range, the charger may fail to recognise it, in this event the charger will indicate 'Faulty'.

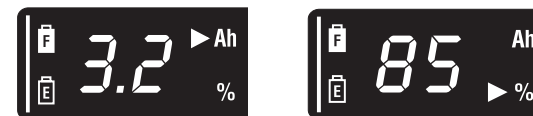
4.2 CAPACITY INDICATION:

- 4.2.1 The PAG NMH60 is a 'smart' battery, capable of providing the user with an accurate indication of the remaining capacity whenever required. The electronics within the battery gathers data and processes it on a continuous basis, so that the stored capacity figure is always updated. Powered by its own primary Lithium cell, the battery's microcontroller continually processes the mass of data which is required to make this system really accurate.
- 4.2.2 It is a fact that batteries perform in different ways under different conditions. The microcontroller is able to make accurate predictions relating to the battery performance. These predictions include the efficiency of energy conversion at varying discharge rates, storage capacity, variations relative to temperature, cell chemistry and plate wear out characteristics over cycle life, as well as self discharge rates relative to time and temperature. Then there are the many destructive, but sometimes reversible effects which batteries are subjected to. All these variations are taken into account by a microcontroller which matches the above data with stored information on detailed characteristics of each cell type.
- 4.2.3 The battery is able to display a predicted run-time against any given load. Connect the battery to the camera, and turn the camera on. The battery requires a minimum of 5 seconds before it is able to give an accurate run-time prediction. When the display button is pressed, the battery will indicate the predicted run-time under the prevailing conditions.



The hours will be displayed first, followed by the minutes.

- 4.2.4 The battery is also able to indicate the remaining capacity, expressed either in ampere-hours or percentage. These figures are available when the battery is not connected to a load.



The capacity in ampere-hours will be shown first, and if the button is pressed a second time, the battery will display the capacity as a percentage of maximum.



If the battery is either 100% charged or 0% charged, this is shown by an illuminated bar which indicates Full or Empty.

- 4.2.5 If the button is held in continuously, the display will operate for a short period and will then automatically turn off. This ensures that the battery cannot become discharged if the button is accidentally held in, perhaps during transit or storage.
- 4.2.6 The PAG NMH60 battery is self-diagnostic. Prior to any cumulative effect developing as permanent damage the battery will report that it requires a service by pulsing the capacity display (when the display button is pressed) with a 50% on/off duty cycle. A complete charge followed by a full discharge will clear the condition and the battery will confirm this by again showing the normal display when the button is pressed.

SECTION 5

SAFETY

- 5.1 When used correctly, Nickel-Metal Hydride batteries are a rugged, safe, clean and trouble-free method of storing power. Offering an extremely high energy density, the cells do not deteriorate when left in a discharged state, thereby making them ideally suited to applications where reliable portable power is required. However, the user should be aware that incorrect treatment can present a hazard. In the interest of safety, and the protection of our environment, please read and observe the following health and safety information.
- 5.2 **GENERAL:** Do not put cells in fire or mutilate - cells may burst or release toxic material. Do not short-circuit cells as this may cause burns. Batteries should be discharged for transit.
- 5.3 **CORROSIVE ELECTROLYTE:** The electrolyte is a strong alkaline solution, which can cause chemical burns to human tissue if leakage occurs. Wear protective gloves when handling all contaminated materials. In the event of contact with the skin, flood copiously with clean water. If significant amounts of electrolyte are involved, or if any has touched the eyes, seek immediate medical attention.
- 5.4 **ACCIDENTAL SHORT-CIRCUITING:** Nickel-Metal Hydride cells can deliver power at very high rates. PAG NMH60 batteries are protected at their output connections by self-resetting overload protection devices and thermal fuses, but severe mechanical abuse of a battery could result in damage to cells, and short-circuit internal to the battery. Arcing, excessive heat and the liberation of combustible gas could result, with the potential for personal injury or ignition of adjacent flammable materials.
- 5.5 **DISPOSAL:** Expired Nickel-Metal Hydride batteries are classified as controlled waste, and must be disposed of in accordance with the appropriate regulations or legislation. PAG Ltd. offers a recycling service for expired PAG batteries, which results in the materials being recovered for re-use. Do not dispose of batteries or cells in a charged condition. Return batteries by prior arrangement to:
 PAG Limited, 565 Kingston Road, Raynes Park, London SW20 8SA.
 Tel: +44 (0)20 8543 3131. Fax: +44 (0)20 8540 4116.
 Batteries must be in a discharged state, and be clearly marked "FOR RECYCLING".

SECTION 6**WARRANTY**

- 6.1 Notwithstanding any provision of any agreement the following Warranty is exclusive: PAG Limited warrants each **NMH60 Time Battery** it manufactures to be free of defects in material and workmanship under use and service for **1 year** from the date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses or any product or parts which have been subject to misuse, neglect, accident or abnormal conditions of operation.
- 6.2 In the event of failure of a product covered by this warranty, PAG Ltd. will repair and calibrate equipment returned to an authorised Service Facility within the period of the warranty, provided the warrantor's examination discloses to its satisfaction the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any equipment returned within this period, said repairs or replacements will be made without charge. If the failure has been caused by misuse, neglect, accident or abnormal conditions of operation, repairs will be billed at a nominal cost. In such a case, an estimate will be submitted before work is started, if requested.
- 6.3 The foregoing Warranty is in lieu of all other warranties, express or implied, including but not limited to any implied warranty or merchantability, fitness or adequacy for any particular purpose or use. PAG Limited shall not be liable for any special, incidental, or consequential damages, whether in contract, tort, or otherwise.