



PAG L90 Slim Battery



INSTRUCTIONS



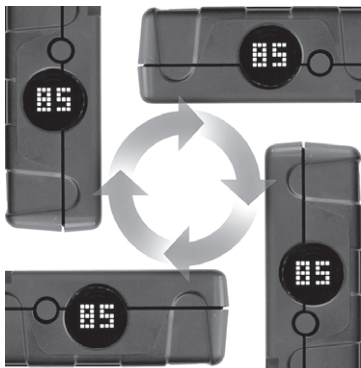
PAG L90 Slim Battery

Run-Time,
Capacity
& Data
Display

Display
Button



Reorienting Display



Thank you for choosing the PAG L90 Slim rechargeable Li-Ion battery.

Please read the important safety information and instructions before using the battery.

Keep the booklet for future reference and to take with you when you travel by air with your PAG batteries.

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1. Features

- The PAG L90 Slim battery has a low-profile and lightweight design, coupled with a high-current capability. These features make it ideal for use with small cameras that have a high power consumption, in situations where battery size and weight must be kept to a minimum.
- The PAG L90 Slim has been designed to withstand the vibration associated with multi-rotor aerial platforms.
- It incorporates the latest high-capacity, high-current cells which give it a greater energy density than most 90Wh V-Mount Li-Ion batteries.
- The L90 Slim delivers a maximum continuous current of 10A.
- It features the industry's first numeric Run Time & Capacity Display which senses the orientation of the battery and rotates to ensure legibility.
- Run-Time is displayed, on-load, to a resolution of 1 minute. Capacity/state-of-charge is displayed to a resolution of 1%. Data displayed includes the number charge/discharge cycles and software version.
- The accuracy of the display is maintained by tracking battery performance, and adjusting calibration values to compensate for the ageing of the cells.
- In keeping with the latest PAG battery technology, the L90 Slim detects and adapts automatically to multiple camera data systems, to provide capacity information in the viewfinder/LCD of various cameras.

- The L90 Slim is future-proof; its firmware can be updated easily by the user in the field.
- It is an intelligent battery which manages its own charge and discharge safely. It can be charged using the Li-Ion chargers of most reputable manufacturers.
- The PAG L90 Slim incorporates a superior design, a high-quality construction and long-life, premier-quality Li-Ion cells, which have no memory effect and are completely recyclable.
- The battery features a comprehensive and fail-safe electronic protection system, which guards against conditions that reduce battery life.
- The protection system circuit is conformally-coated to protect it and ensure operation of the safety systems in the event of damage to the battery.
- PAG's battery design philosophy ensures that the L90 Slim provides the longest possible working life.
- The battery is guaranteed for 2 years, without restrictions on the conditions of use.
- The PAG L90 Slim has been tested to UN 38.3 standard by an independent authority and certified safe for air transport in accordance with IATA regulations.
- The battery has a capacity that is below 100 Watt-hours and is therefore suitable for transport on passenger aircraft, in carry-on luggage, without quantity restriction. *See Page 23 Air Transport Certificate.*

2. Specification

2.1 **Battery models covered by these instructions:**

PAG L90 Slim Models 9307V & 9307GS.

2.2 **Battery Connector:**

V-Mount connector

2.3 **Cell Technology:** Premium grade, high-capacity, high-current, sealed, Lithium-Ion rechargeable cells.

2.4 **Capacity:** 6.1 Ampere-hours nominal, 90 Watt-hours.

2.5 **Voltage:** 14.8V nominal. 8 cells connected in series/parallel (4S2P). Each cell has a nominal voltage of 3.7V.

2.6 **Output Current:** The rated maximum continuous output current is 10 Amperes.

2.7 **Charge Voltage:** 16.8V.

2.8 **Run-Time & Capacity Display:**

Numeric Display that senses the orientation of the battery and adjusts accordingly, for legibility.

The display shows a run-time prediction on-load, expressed in hours and minutes, to a resolution of 1 minute. Capacity/state-of-charge is displayed as a percentage, in 1% increments.

2.9 **Construction:**

High-impact injection mouldings designed to protect the cells from impact damage. PAG has incorporated spacers between the cells to prevent the negative affects of vibration, when mounted to multi-rotor

aerial platforms. The cells have welded interconnections of low-resistance nickel strap. The battery case is sealed.

2.10 Protection:

The battery incorporates safety shutdown systems that guard against: over-current, over-voltage and under-voltage. It also has thermal protection, including a non-resetting thermal fuse. The protection system circuit is conformally-coated to protect it, and ensure operation of the safety systems in the event of damage to the battery.

2.11 Operating Temperature Range:

Discharging: -20°C to +50°C
(Optimum +10°C to +40°C)

Charging: 0°C to +40°C
(Optimum +10°C to +30°C)

Storage: -10°C to +40°C
(Optimum 0°C to +20°C)

2.12 Dimensions (L x W x D):

140mm (5.51") x 85mm (3.34") x 35mm (1.37")

2.13 Weight:

567g (1.25lbs)

3. Charging

- 3.1 **IMPORTANT:** The battery has been discharged for transit, and should be fully charged before use.

Read the charger handbook before attempting to charge the battery.

The battery is protected electronically, and will not accept a charge from unsuitable chargers.

- 3.2 PAG L90 Slim batteries can be charged using the following V-Mount chargers:

- PAGlink PL16 Charger (9707)
- PAGlink PL16+ Charger (9711)
- PAGlink Micro Charger (9713V)
- PAG RMC4X Rack-Mountable Charger (9702VR)
- PAGlink Cube Charger (9708) *discontinued*
- PAG Cube Charger (9702V) *discontinued*
- PAGlink Micro Charger (9710) *discontinued*
- PAG V4-iPC Charger (9700V) *discontinued*
- PAG V2 Charger (9613V) *discontinued*
- Constant-voltage, V-Mount Li-Ion chargers of other reputable manufacturers.

- 3.3 PAG L90 Slim batteries display their individual status on their display, when charged on PAG chargers.

- 3.4 The battery may be charged within the temperature range 0°C to +40°C, but for optimum performance, +10°C to +30°C is recommended. The battery incorporates a precision temperature sensor which will inhibit charging if its temperature is below 0°C.

3.5 Charge Times

For fully discharged batteries to fully charged using a PAGlink PL16 or PL16+ charger.

1 battery	2 hrs 30 mins
2 batteries	3 hrs
4 batteries	6 hrs

4. Discharging

- 4.1 The battery incorporates a precision fixed end-of-discharge cutoff, set to 12.5V, as measured by the battery. This cutoff will operate only if the battery capacity is less than 5%, eliminating unwanted cutoff operation due to high current and low battery temperature.
- 4.2 Maximum continuous discharge current is 10A. The battery incorporates an accurate precision current limit, and consumption above 10A (for more than 5 seconds) will trigger the over-current protection, turning the battery output off.
- 4.3 If the battery is discharged at too high a rate, even momentarily, the protection circuit may be triggered, disconnecting the battery output.
- 4.4 If the battery has been shut down by its protection circuit it can be recovered by simply removing it from the load and pressing the display button, provided the battery still retains some charge.
- 4.5 The battery may be discharged within the tempera-

ture range -20°C to $+50^{\circ}\text{C}$, but for optimum performance, $+10^{\circ}\text{C}$ to $+40^{\circ}\text{C}$ is recommended. When the battery has been discharged at a high rate it will become war, and it is advisable to let it cool before charging. The operating time will be shorter in conditions of low temperature, and discharging will be electronically inhibited if the battery temperature is below -20°C .

4.6 Computer Reset

The battery features a computer reset function, which may be required in exceptional circumstances. This is achieved by holding-in the display button for 20 seconds.

5. Storage

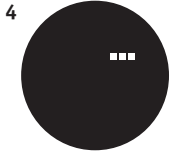
- 5.1 For long-term storage, the battery should be initially in the half-charged state.
- 5.2 The battery can be put into 'Sleep Mode' for long term storage. This will reduce the level of self-discharge. *See Section 6.4 Data Display* to discover how to put the battery into 'Sleep Mode' and how to wake the battery.
- 5.2 Maintenance charging is not required during storage.
- 5.3 Store in a cool, dry place at a temperature between -10°C to $+40^{\circ}\text{C}$. Long-term storage outside of this temperature range may reduce the battery's life.
- 5.4 The battery should be in a fully charged state before use. After extended storage it is advisable to give the battery a top-up charge.

6. Battery Display

6.1 Run-Time & Capacity



1. When connected to equipment that is turned on, two presses of the battery's display button will show a predicted run-time against the given load, expressed in hours and minutes.
2. A single button press of the display, whether the battery is off or on-load, shows a percentage figure of available capacity, to a resolution of 1%.

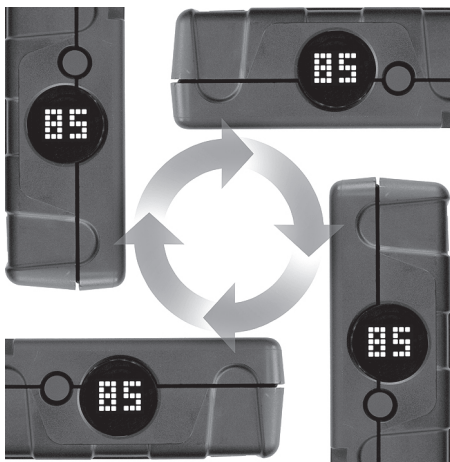


3. When the battery is fully charged the display will indicate 100%.
4. When battery is fully-discharged the display will indicate as above.

The accuracy of the display is maintained by tracking battery performance and adjusting calibration values to compensate for the ageing of the cells.

6.2 Reorientation

The Run-Time & Capacity display senses the orientation of the battery and adjusts to ensure legibility.



6.3 In-Viewfinder/LCD Battery Status

The PAG L90 Slim allows battery capacity to be displayed as a percentage in the viewfinder or on the LCD of cameras designed to accept this data. The battery automatically adjusts the data output standard to support SMB (Sony & Red) and I²C (IDX).

6.4 Data Display

The battery display can reveal data stored in the battery's internal microprocessor using a series of button presses. Press the display button 3 times - in 1 second intervals - and hold down on the third press to put the display into data mode, indicated by alternating patterns of lights:



Press x3 in 1 sec intervals & hold to enter data mode



Release to see 1st menu item: 'Pd' (voltage)



Press & hold for 3 seconds to see voltage reading



Press without holding for 2nd menu item



Press & hold for temperature in degrees celsius



Press twice without holding for 3rd menu item



Press & hold for number of charge/discharge cycles



*Press x3 without
holding for
software version*



*Press & hold
for version
number*



*The number
appears in 2 parts
(indicating 1.7)*

*After selecting to view the software version number, the battery will enter **Sleep Mode** automatically. Sleep Mode reduces battery self-discharge and can be used when you are going to store or ship your batteries. To exit Sleep Mode or 'wake' the battery, press the display button twice.*



*Press x4 for
computer reset*



*Press & hold to
perform reset & do
not release until 3
lines disappear*

7. Battery Protection Features

7.1 Over-charge Protection

Charging will be inhibited if the battery voltage exceeds a pre-set level.

7.2 Over-discharge Protection

When the battery voltage reaches 12.5V, discharging is inhibited.

7.3 Over-current Protection

If a battery is subjected to a current greater than 10 Amps but less than 15 Amps, the output will be turned off after 5 seconds. If the current is greater than 15 Amps, the output will be turned off immediately. In either case, the battery display will be inoperative and there will be no voltage available at the terminals. The battery can be reset by removing it from the load and pressing the display button.

7.4 Thermal Protection

Software protection inhibits charging if the battery temperature is below 0°C. Return the battery to the charger when the battery temperature rises above 0°C.

Software protection inhibits discharging if the battery temperature falls to -20°C, or if it rises to +70°C. The output can be restored when the battery temperature becomes within the specified range by pressing the button.

A thermal fuse is incorporated within the battery construction as a 'backstop' protection device, and this cannot be reset. In the unlikely event of this fuse operating, please contact PAG or a PAG Distributor.

7.5 Construction

The cells are housed in high-impact injection mouldings designed to protect them from impact damage.

Although PAG batteries are designed to survive the rigours of everyday use in a professional environment, it is common sense to handle batteries with care and to avoid subjecting them to severe impact.

PAG has incorporated spacers between cells to prevent the negative affects of vibration, when mounted to multi-rotor aerial platforms.

The protection circuit is conformally-coated, ensuring the operation of the safety cut-outs in the event of damage to the battery.

The internal wiring is rated for high current and high temperature, and is double-insulated for added safety and protection.

8. Safety & Disposal

- 8.1** When used correctly, Lithium-Ion batteries are a rugged, safe, clean and trouble-free method of storing power. However, the user should be aware that incorrect treatment could present a hazard. In the interest of safety, and the protection of our environment, please read and observe the following health and safety information.
- 8.2 GENERAL:** Do not drop, puncture or crush the battery. Do not short circuit the battery. Do not attempt to use the battery if it has been submerged in water. Do not continue to use the battery if there is any change in the appearance of the casing. Do not open the battery case.
- 8.3 CORROSIVE ELECTROLYTE:** The electrolyte is an 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.
- 8.4 SEVERE DAMAGE:** PAG Li-Ion batteries incorporate several levels of internal electrical protection, but severe mechanical abuse could result in damage to the cells, and a short-circuit internal to the battery. Li-Ion cells can deliver power at very high rates. Arcing, excessive heat and the liberation of combustible gas could result, with the potential for personal injury or ignition of adjacent flammable materials.

8.5 SERVICING: The battery case is sealed to maintain the integrity of the UN tested build standard. Customers should not attempt to open the case for repair or any other purpose. For servicing, please contact your nearest authorised PAG Service Centre:

PAG UK:

Tel +44 (0)20 8543 3131, Email support@paguk.com

PAG America:

Tel +1 631 300 8215, Email sales@pagamerica.com

If you are located somewhere other than the US and the UK, please visit **www.paguk.com/agents** to discover your nearest point of contact.

Please do not attempt to return Li-Ion batteries without first contacting a PAG Service Centre.

8.6 DISPOSAL: Do not mutilate or incinerate batteries as the cells may burst and release toxic material.

Do not dispose of batteries or cells in a charged condition. Expired batteries should be disposed of in accordance with the appropriate regulations or legislation.

PAG Ltd. offers a **Recycling Service** for its expired batteries. They can be returned to PAG by prior arrangement only.

They must be in a discharged state and clearly marked **"FOR RECYCLING"**.

8.7 PAG TECHNICAL INFORMATION:

For technical enquiries please contact PAG Ltd.

Email: support@paguk.com

Tel: +44 (0)20 8543 3131

9. Guarantee

Notwithstanding any provision of any agreement the following guarantee is exclusive: PAG Limited guarantees each PAG L90 Slim Battery it manufactures to be free of defects in material and workmanship under normal use and service for **2 YEARS** from the date of purchase. This guarantee extends only to the original purchaser. This guarantee shall not apply to fuses or any product or parts which have been subject to misuse, neglect, accident or abnormal conditions of operation.

In the event of failure of a product covered by this guarantee, PAG Limited will repair and calibrate equipment returned to an authorised Service Facility within the period of the guarantee, provided the guarantor's examination discloses to its satisfaction the product was defective. The guarantor 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.

The foregoing guarantee is in lieu of all other guarantees, express or implied, including but not limited to any implied guarantee 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.

EU Declaration of Conformity



We, PAG Ltd. London, England

hereby declare that the products described below conform to the relevant requirements of the appropriate EU Directives. This declaration shall cease to be valid if modifications are made to the products without our approval.

Product: PAG L90 Slim Li-Ion Battery

Models: 9307V & 9307GS

Applicable EU Directives:

EMC Directive 89/336/EU

CE Marking Directive 93/68/EU

Harmonised Standards Applied:

Generic: EN 50081 - 1 (Emissions)

EN 50082 - 1 (Immunity)

Product Specific:

IEC 801 - 2/3/4

Signed for and on behalf of PAG Ltd.



Alan Lavender, Chief Executive

Date: 01.10.18.

Independent Testing of Li-Ion Batteries to UN Standards



Is your company buying Li-Ion Batteries that have NOT been independently tested to United Nations standards as required by Air Transport regulations?

IATA (International Air Transport Association) regulations state that Li-Ion batteries must comply with the **UN Manual of Tests and Criteria, Part III, subsection 38.3**

These regulations exist because poorly constructed Li-Ion batteries have been known to break down internally and self-ignite.

Manufacturers state that their batteries comply with the regulations for air transport, as required by the IATA and the ICAO (International Civil Aviation Organization), but how many actually submit their products for independent testing?

The only way to know for sure if the battery has been tested to UN standards is by asking the manufacturer to produce a test report issued by an independent test facility.

PAG Li-Ion batteries have been tested by Intertek Group PLC and certified to comply with UN specification ST/SG/AC.10/11/Rev 4.

PAG L90 Slim Battery Test Report Number 102471069

Each PAG Li-Ion battery is labeled with the test report number applicable to that battery design. Copies of the test reports can be obtained from PAG.

When you arrive at the airport check-in you may be told that without a test report number your Li-Ion batteries are unsuitable for air transport. Choosing PAG Li-Ion batteries is one way of ensuring that this scenario will never occur.

Air Transport Certificate for PAG Li-Ion Batteries

PAG Ltd. London, England

hereby declares that the PAG L90 Slim Lithium-Ion battery has been tested and certified by Intertek Group PLC to comply with the UN Manual of Tests & Criteria, Part III, subsection 38.3 as required by the IATA Dangerous Goods Regulations (2018), Section 2.3.5.9.

PAG L90 Slim Battery Test Report Number: 102471069

In addition to UN testing, this Li-Ion battery has an individual Watt-hour rating below 100Wh. This rating is in compliance with the IATA DGR (2018) which states:

- (a) each installed or spare battery must not exceed:*
- 2. for lithium ion batteries, a watt-hour rating of not more than 100Wh.*

Signed for and on behalf of PAG Ltd.



Alan Lavender
Chief Executive
Date: 01.04.18.





POWER | INNOVATION | **QUALITY**

PAG is one of the broadcast industry's longest established global providers of innovative portable power solutions. Founded in 1968, and based in London, England, PAG is the original designer and manufacturer of the world's most technologically advanced batteries, chargers, power accessories and camera lights. The company's international customer base includes broadcasting organizations, hire companies, video production companies, freelancers, cinematographers, videographers, the military and civil authorities.

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