



PAG L96 Battery Series



Instruction Booklet



UN tested and flight-friendly batteries:



A choice of run-time and capacity display:



A choice of mounting system:



Thank you for choosing the PAG L96 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

- PAG L96 batteries have a capacity of 96 Watt-hours (14.8V 6.5Ah).
- PAG L96 batteries can deliver a maximum continuous output of 8A.
- PAG L96 batteries are available in three formats: V-Mount, Gold-Mount and PAGlok.
- PAG L96 batteries feature a choice of built-in Run-Time & Capacity Display (numeric or 5-light).
- Accuracy of the display is maintained by tracking battery performance, and adjusting calibration values to compensate for the ageing of the cells.
- PAG L96 batteries will automatically detect and adapt to a multitude of camera data systems to provide capacity information in the viewfinders of various cameras.
- The capacities of two L96 batteries can be combined (192Wh) for a longer run-time and a higher current-draw capability (up to 10A) using a PAG PowerPlate dual battery mount.
- PAG L96 batteries are future-proof; their software can be easily updated by the user in the field.
- PAG L96 batteries can be charged using the Li-Ion chargers of other reputable manufacturers.

- PAG L96 batteries incorporate long-life, premier-quality Li-Ion cells, which have no memory effect, and are completely recyclable. In keeping with PAG's total battery design philosophy, they are designed and constructed to provide the longest possible working life.
- PAG L96 batteries feature an advanced electronic protection system that is fail-safe, and circuits that are designed to be electrolyte-resistant.
- PAG L96 batteries have been independently tested and certified to comply with UN standards for air transport safety. They have a capacity that is below 100 Watt-hours and are therefore suitable for air transport on passenger aircraft, in hand-luggage, without quantity restriction.
- PAG L96 batteries have an enhanced low-temperature performance.
- PAG L96 batteries feature a 2 year guarantee.

2. Specification

2.1 Battery models covered by these instructions:

Model 9310V	PAG L96e Battery	(V-Mount)
Model 9305V	PAG L96T Time Battery	(V-Mount)
Model 9310A	PAG L96e Battery	(Gold Mount)
Model 9305A	PAG L96T Time Battery	(Gold Mount)
Model 9310	PAG L96e Battery	(PAGlok)
Model 9305	PAG L96T Time Battery	(PAGlok)

2.2 Connector Variants:

9310V, 9305V V-Mount connector
9310A, 9305A Gold Mount connector
9310, 9305 PAGlok connector

2.3 Run-Time & Capacity Information:

Two variants are available:

PAG L96T uses a numeric display to show run-time, on-load, expressed in hours and minutes, and to show remaining capacity as a percentage (9305V, 9305, 9305A).

PAG L96e uses a 5-light indicator to show a run-time prediction, on-load, indicated by a combination of LEDs, and to show capacity as a percentage, in approximately 20% blocks (9310V, 9310, 9310A).

2.4 Construction: High-impact polycarbonate injection mouldings, featuring an internal cradle designed to protect the cells from impact damage. The cells have welded interconnections of low-resistance nickel strap. Batteries are sealed and non user-serviceable.

2.5 Cells: Premium grade Lithium-Ion sealed rechargeable cylindrical cells.

2.6 Voltage: 14.8V nominal. 12 cells connected in series/parallel. Each cell has a nominal voltage of 3.7V.

2.7 Capacity: Nominal 6.5 Ampere-hours (96 Watt-hours).

2.8 Output Current: Rated maximum continuous output current 8 Amperes.

2.9 Charge Voltage: 16.8V.

2.10 Protection:

The battery incorporates the following safety shutdown systems:

- 3 over-current shutdown systems.
- 2 over-voltage shutdown systems.
- 2 under-voltage shutdown systems.
- 2 thermal shutdown systems (including non-resetting thermal fuse).
- All protection circuits within the battery are designed to withstand the leakage of electrolyte. This is achieved by using a special layout and a coating of Parylene, the premier vapour-deposited conformal coating.

2.11 Operating Temperature Range:

Charging: 0°C to +45°C (Optimum +10°C to +40°C)

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

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

2.12 Size & Weight (both models):

	Height	Width	Depth
V-Mount	130mm (5.1")	86mm (3.4")	47mm (1.85")
Gold-Mount	130mm (5.1")	86mm (3.4")	52mm (2.00")†
PAGlok	130mm (5.1")	86mm (3.4")	42mm (1.65")*

*excluding locking claws. † excluding mushroom lugs.

V-Mount	749g	(1.65lbs)
Gold-Mount	760g	(1.67lbs)
PAGlok	731g	(1.61lbs)

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

- 3.2 PAG L96 batteries can be charged using the following chargers:

V-Mount Models:

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

Gold-Mount Models:

- PAGlink PL16+ Charger (9711A)
- PAGlink PL16 Charger (9707A)
- Constant-voltage, Li-Ion chargers manufactured by Anton Bauer.

PAGlok Models:

- PAG Cube Charger (9702)
- PAG RMC4X Rack-Mountable Charger (9702R)
- PAG Freelancer Charger (9613) *discontinued*

PAG AR Series 2 Chargers Models 9792, 9793, 9795, and PAG Quasar Chargers Models 9752, 9753, 9726, 9727 (all discontinued) can be used to charge L96 batteries directly, or via the front 2.1mm sockets using PAG charge adaptors. Chargers manufactured prior to November 2008 will require a software update for charging Li-Ion batteries.

- 3.3 PAG L96 batteries display their individual status, during charging, on their built-in display. When using the PL16 charger, the numeric display of the V-Mount L96T battery (9305V) can be inverted, for legibility, with a single button press. It reverts automatically after removal from the charger.
- 3.4 The battery may be charged within the temperature range 0°C to +45°C, but for optimum performance, +10°C to +40°C is recommended. The battery incorporates a precision temperature sensor which will inhibit charging if its temperature is below 0°C.

4. Discharging

- 4.1 Batteries incorporate a precision fixed end-of-discharge cutoff set to 12.5V, as measured by the battery. This cutoff will only operate 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 for a single battery is 8A. The battery incorporates an accurate precision current limit, and consumption above 8A (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. High current surges can occur when a tungsten light is turned on, which may be sufficient to momentarily exceed the rating and trip the protection circuit. The Paglight Softstart lamp unit (Model 9938) will alleviate this.
- 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. The battery features a computer reset function, which may be required in exceptional circumstances. This is achieved by holding the display button in for 20 seconds.
- 4.5 Where total continuous consumption is above 90W, the capacities of two or more batteries should be combined using a PAG Power Plate dual battery

mount. This will increase the maximum continuous discharge current to 10A, or approximately 110W.

- 4.6 The battery may be discharged within the temperature 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 warm, and it is advisable to let it cool before charging it. 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 .

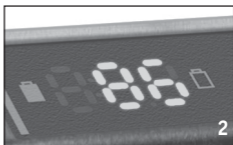
5. Storage

- 5.1 For long-term storage, the battery should be initially in the half-charged state.
- 5.2 Maintenance charging is not required during long-term storage.
- 5.3 Store in a cool, dry place at a temperature between -10°C and $+40^{\circ}\text{C}$. 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 before use.

6. Run-Time & Capacity Display

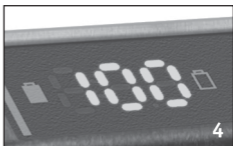
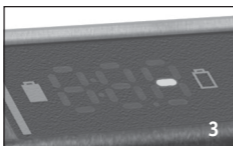
6.1 PAG L96T Time Battery:

The battery is able to display a run-time prediction, against load, expressed in hours and minutes.



1. When connected to a camera 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. The battery requires a minimum of 5 seconds before it is able to give an accurate run-time prediction.

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 battery capacity drops below 5% the display will indicate that the battery should be charged by pointing to the empty battery symbol.

4. When the battery is fully charged the display will indicate 100%.

6.2 PAG L96e Battery:

The L96e is capable of indicating an estimate of remaining run-time, on-load.



Two button-presses activates the time display. The 'HRS' LED will flash twice.



The number of hours will be indicated by the number of lit LEDs: each LED = 1 hour.



The 'MINS' LED will then flash twice.



The number of minutes will be indicated by the number of lit LEDs: each LED = 10 mins.



A single press of the display button, on or off-load, shows charge status in terms of percentage.

The LEDs light clockwise, starting from the top right:

5 LEDs	=	80 - 100%	remaining
4 LEDs	=	60 - 79%	remaining
3 LEDs	=	40 - 59%	remaining
2 LEDs	=	20 - 39%	remaining
1 LED	=	10 - 19%	remaining
1 LED flashing	=	0 - 9%	remaining

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

6.3 In-Viewfinder Battery Status

The PAG L96 allows battery capacity to be displayed as a percentage in the viewfinders of cameras designed to accept this data. Different data standards are used by camera and battery manufacturers; PAG L96 batteries automatically adjust the data output standard to support the following: SMB (Sony), I²C (IDX) and analogue 0V to 5V (Anton-Bauer).

PAG L96 batteries can be programmed easily by the user to also provide capacity data in the viewfinders of RED cameras. Press the display button twice, and hold down on the second press until 'rEd' appears on

the display (L96T battery) or the top 2 LEDs light (L96e battery). This indicates that the battery is now compatible with the RED data protocol (reversed SMB). When the battery is connected to a camera with a different data protocol it will automatically adjust to communicate with that system. To return to RED compatibility repeat the two-press process.

6.4 PAGlink Battery Reader

PAGlink Battery Reader, Model 9647, will read data stored in the microprocessor of V-Mount L96 batteries. Slide the Reader onto the battery contacts and it will automatically display '%' followed by a figure for the battery state of charge. You can then use the up and down buttons to reveal more information, the categories are as follows:

1. State of charge as a percentage
2. Available capacity in ampere-hours
3. Cell temperature in degrees Celsius
4. Number of charge/discharge cycles
5. Voltage
6. Full capacity in ampere-hours
7. Date of birth (manufacture)
8. Software version

This information is extremely useful for tracking battery usage and performance. 'Software version' will help tell you if the battery is running the latest program. An update can then be supplied by PAG, or your PAG dealer, and the latest software version can be applied without opening the battery.

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 8 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 your PAG Distributor.

7.5 Construction

Cells are housed in high-impact polycarbonate injection mouldings designed to protect the cells 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.

Circuits are coated with Parylene, the premier vacuum-deposited conformal coating, effectively ensuring protection against electrolyte leakage within the battery case.

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 put in fire or mutilate - cells may burst or release toxic material. Do not short-circuit. Do not continue to use the battery if there is any change in the appearance of the casing.
- 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 ACCIDENTAL SHORT-CIRCUITING: Lithium-Ion cells can deliver power at very high rates. 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. 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 DISPOSAL: Expired Lithium-Ion batteries should 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.

WARNING: DO NOT MUTILATE OR INCINERATE BATTERIES. DO NOT DISPOSE OF BATTERIES OR CELLS IN A CHARGED CONDITION.

Return batteries by prior arrangement to:

**PAG Ltd. 565 Kingston Road, Raynes Park,
London SW20 8SA, United Kingdom.**

Contact:

E-mail: support@paguk.com

Tel: +44 (0)20 8543 3131

Fax: +44 (0)20 8540 4116

Batteries must be in a discharged state, and clearly marked "FOR RECYCLING".

- 8.6 SERVICING:** The battery is sealed, and contains no user-serviceable components. 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 (London) for servicing.
- 8.7 RECELLING:** Cell-replacement will invalidate the UN certification of the battery. It is a mandatory requirement for Li-Ion batteries to be sealed in order to preserve the original certified build standard; for this reason PAG Li-Ion batteries should never be opened or recycled.
- 8.8 PAG TECHNICAL INFORMATION & SUPPORT:**
For further information, please contact PAG Ltd. (London) by telephoning: +44 (0)20 8543 3131, Email support@paguk.com or contact your nearest PAG Authorised Service Centre (see www.paguk.com).

9. Guarantee

Notwithstanding any provision of any agreement the following guarantee is exclusive: PAG Limited guarantees each PAG L96e & L96T 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 Lithium-Ion Batteries

Models: L96e & L96T

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: 12.09.12.

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, as required by law?

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 and approved by Intertek Group PLC:

PAG L96 Batteries: Test Report Number 11054580

Each PAG Li-Ion battery is labelled 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 PAG L96 Lithium-Ion batteries have 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 (2016), Section 2.3.5.9.

PAG L96 Batteries: Test Report Number 11054580

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 (2016) 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: 1. 1. 16.



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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