AVION POWER

Voyager Power Source, Operator's Manual
Version 3.0

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Limited warranty

Avion Power warrants Voyager batteries to be free from defects in materials and workmanship for two years following the date of shipment. This limited warranty applies to the original purchaser of the battery and is not transferable except by Avion Power's authorized distributors.

The Voyager battery is produced with standard commercial parts, any of which may fail under some circumstances. Although the probability of such failure is low, it is not zero. During the limited warranty period, we will repair or replace, at our option, any defective product or parts at no additional charge. A return merchandise authorization (RMA) number must be obtained prior to returning a battery to Avion Power LLC. A battery returned to Avion Power LLC with shipping pre-paid, will be repaired or replaced, tested, and returned promptly. All replaced parts and products become the property of Avion Power LLC.

This limited warranty does NOT extend to any batteries which have been damaged as a result of accident, abuse, modification, misuse such as failure to follow operating instructions provided by Avion Power LLC, or other contingencies beyond our control. NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. AVION POWER LLC IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

Scope

This manual describes the operation of the following Voyager Power Sources:

- VPS 28V/20Ah
- VPS 28V/10Ah

Overview

The Voyager Power Source is a lightweight, high-power battery designed to start aircraft engines and provide auxiliary power. On a single charge, Voyager can conduct multiple starts, power on-board electronics, or provide a combination of auxiliary power and starting power. Voyager can be recharged in-flight or on the ground.

Features

- Power button - The power button is ergonomically located at the rear of the unit. It provides audible and tactile feedback when pressed and is recessed into Voyager's housing to prevent inadvertent activation.
- LEDs - Three simple LEDs (green, yellow, and red) communicate Voyager's state-of charge and mission readiness.
- Battery management unit (BMU) - The battery management unit is an electronic safeguard that continuously monitors critical functions and metrics. The BMU will activate redundant safeties that disconnect Voyager if a metric is outside acceptable limits.
- Internal charging circuit – Voyager can recharge using power from an aircraft or from 110-220V power grids through a power supply.
- Shell - Voyager's high-visibility shell is made of fire-retardant material and is water resistant.
- NATO connector – Voyager's NATO connector plugs directly into an aircraft's external power receptacle. Alternatively, a six foot extension cable is available for pilots who prefer to place Voyager on the ground during use.

Specifications

	28V / 20Ah	28V / 10Ah
Operating voltage	16V – 28V	16V – 28V
Nominal voltage	26V	26V
Capacity	20Ah	10Ah
Starts per charge*	10	5
Continuous current	400A	200A
Ipp / Ipr	1600A / 1200A	800A / 600A
Cranking power	16kW	12kW
Operating temperature	-20C to 60C	-20C to 60C
Storage temperature	-40C to 60C	-40C to 60C
Length, width, height	17.7" x 6.2" x 4.6"	17.7" x 6.2" x 2.7"
Weight	15 lbs	9lbs

* The number of starts per charge is an estimated specification based on multiple tests on a wide range of aircraft. Actual starts per charge is dependent on specific power requirements of a given helicopter as well as prevailing environmental conditions.

Safety

- Personnel using the Voyager must read and understand this manual and adhere to the warnings, cautions, and notes. Failure to do so may result in serious damage, injury, or death.

Warnings

- **Unplug and store Voyager before takeoff**
- Do not use Voyager if red LED is lighted
- Do not use Voyager if the case is cracked, crushed, or punctured
- Do not disassemble or modify Voyager
- Do not short circuit battery terminals
- Do not heat Voyager above 85C
- Do not incinerate or expose to fire
- Base chargers are not waterproof and may create a shock hazard if operated in wet conditions

Caution

- Visually inspect Voyager's terminals before use to ensure that debris or lubricant has not collected inside the NATO connector.
- Voyager's operating temperature range is between -20C and 60C. If Voyager has cooled below -20C, the operator should warm Voyager before use.
- When inserting Voyager into an aircraft's external power receptacle, ensure that it is adequately secured or supported.
- Operator must take the necessary steps to ensure that Voyager does not disconnect from the helicopter during the start procedure.
- Operators must ensure that Voyager's voltage is compatible with their aircraft. 28V Voyagers are not compatible with 12V aircraft. 12V Voyagers are not compatible with 28V aircraft.
- Avion Power provides operating specifications for each Voyager model. It is the operator's responsibility to ensure that these specifications are adequate to complete the task for which Voyager is being used.
- Operators must monitor the state of charge while using Voyager as a ground power unit.
- Permanent installation of the in-flight charging cable should only be attempted by a qualified aircraft electrician.
- Use of unapproved power sources or procedures can damage Voyager and will void Avion Power's limited warranty.
- Operators must ensure that the voltage of charging power source is compatible with the Voyager's voltage. Do not attempt to charge a 28V Voyager with a 12V power source or a 12V Voyager with a 28V power source.

Notes

- Refer to Pilot Operating Handbook (POH) and Aircraft Flight Manual (AFM) for guidelines related to external power sources.
- Ignore LEDs while the Voyager is under load during an aircraft start.
- Voyager's green, yellow, and red LEDs do not indicate the state-of-charge while charging with a base charger. Operators must use the LEDs on the base charger to confirm state-of-charge during the charging process.
- If the base charger has a voltage input selector, please select the appropriate input voltage based on your geographic location.

- Base chargers may require an adaptor plug in some locations

- Operators who choose a cigarette lighter style, in-flight charging cable must have a cigarette lighter receptacle that outputs Voyager's voltage. Some 28V helicopters have 12V cigarette receptacles.

- Operators may leave Voyager "on" and connected to the in-flight charging cable for extended periods during in-flight charging, even if the aircraft is "off." Voyager will not charge if the aircraft is "off," but the state-of-charge will not be materially diminished. Operators should power voyager off if it will not be used or charged within 24 hours.

LEDs

Voyager's LEDs communicate the health of the battery and the state of charge. When Voyager is powered "on," the green, yellow, and red LEDs conduct a lamp test by lighting all three LEDs simultaneously for five seconds. After the lamp test is complete, the LEDs communicate battery health and state of charge.

NOTE: Ignore LEDs while the Voyager is under load during an aircraft start.

Battery health

Voyager's electronics and software monitor and control the critical operations of the battery. If Voyager detects a fault or any of these parameters are outside acceptable limits, Voyager will electronically disconnect the battery from the aircraft and light the red LED.

A red LED indicates that there is a problem with the Voyager; the problem may be temporary or service may be required to repair the Voyager. Excessive heat may cause a temporary problem, resulting in a lighted red LED. If Voyager is heated above its operating temperature, the battery's electronics will prevent use and the red LED will light until Voyager has adequately cooled. If Voyager is damaged and needs service, the red LED will light and will not turn off. Users should follow the following procedure if the red LED is lighted.

The red LED communicates battery health.

Red

- Do not use
- Power "off"
- Place Voyager in a cool spot for 15-20 minutes
- Power "on"
- If red LED is still lighted, contact Avion Power for service

- If red LED has turned "off," follow normal procedures

State of charge

After Voyager is powered "on" and the lamp test is complete, Voyager uses the green and yellow LEDs to communicate state of charge. Evaluation of the state of charge can take up to 30 seconds, depending on the circumstances. Operators should allow 30 seconds for state of charge evaluation if Voyager has just been powered "on," or if a turbine start has just been conducted. The state of charge will be displayed in real-time if Voyager is providing auxiliary power to an aircraft or if Voyager is "on" and at rest.

Voyager exhibits minimal self-discharge, losing only 3% per month when "off." Voyager has no memory effect and can be fully discharged without harming the battery.

The state of charge is indicated by the following LED combinations.

Green	**Yellow**
▪ Full charge	▪ Low charge
▪ Ready to use	▪ Recharge required

Operation

Voyager is mechanically compatible with any aircraft that has a standard NATO power receptacle and it is designed to meet or exceed the starting requirements of many reciprocating, pneumatic, and electronic controlled (ECU) turbine aircraft engines. Voyager can also provide sufficient auxiliary power for many ground-based activities.

CAUTION: Avion Power provides operating specifications for each Voyager model. It is the operator's responsibility to ensure that these specifications are adequate to complete the task for which Voyager is being used.

CAUTION: Operators must ensure that Voyager's voltage is compatible with their aircraft. 28V Voyagers are not compatible with 12V aircraft. 12V Voyagers are not compatible with 28V aircraft.

Starting an aircraft

WARNING: Un-plug Voyager before takeoff.

NOTE: Refer to Pilot Operating Handbook (POH) and Aircraft Flight Manual (AFM) for guidelines related to external power sources.

NOTE: Ignore LEDs while the Voyager is under load during an aircraft start.

Operators should use the following procedure during aircraft starts

Pre-start	Start	Post-start
▪ Power Voyager "on"	▪ Plug-in voyager	▪ Un-plug Voyager
▪ Observe LED lamp test	▪ Start engine per POH and AFM	▪ Power Voyager "off"
▪ Confirm adequate charge after 30 seconds		

Ground power

Voyager has adequate capacity for many maintenance and avionics-focused activities that traditionally rely on large power carts located at fixed bases. Additionally, Voyager's portability can offer auxiliary power to battery dependent pilots, such as EMS pilots and electronic news pilots, who operate in remote areas.

When used as a ground power unit, Voyager's run-time is dependent on the activity's electrical load and the prevailing environmental conditions. The following hypothetical situation is an example of Voyager's potential run-time.

An operator wants to conduct a maintenance activity that draws 18A and he wants to know how long the Voyager will last. He divides Voyager's 20Ah capacity by 18A (20Ah / 18A = 1.11 hours). He multiplies 60 minutes by 1.11 and determines that Voyager will provide 18A for 66 minutes. In reality, this math yields an estimated runtime; the operator in this example should not assume he will have exactly 66 minutes of runtime. This example assumes moderate ambient temperature.

CAUTION: Operators must monitor the state of charge while using Voyager as a ground power unit.

NOTE: Refer to Pilot Operating Handbook (POH) and Aircraft Flight Manual (AFM) for guidelines related to external power sources.

Operators should use the following procedure while using Voyager as a ground power unit

Pre ground power

- Power Voyager "on"
- Observe LED lamp test
- Confirm adequate charge after 30 seconds

Ground power

- Plug-in voyager
- Conduct Voyager-powered activity
- Monitor state of charge

Post ground power

- Un-plug Voyager
- Power Voyager "off"

Charging

Voyager's internal charging circuit allows recharging from 110V-220V wall sockets with an approved base charger, or from an aircraft's power supply with an in-flight charging cable.

CAUTION: Operators must ensure that the voltage of charging power source is compatible with the Voyager's voltage. Do not attempt to charge a 28V Voyager with a 12V power source or a 12V Voyager with a 28V power source.

CAUTION: Use of unapproved power sources or procedures can damage Voyager and will void Avion Power's limited warranty.

Base charging

A base charger is included with every Voyager. Some Avion Power base chargers accept input voltages of both 110V and 220V, while others accept only 110V. Operators must confirm that their charger is compatible with the voltage in geographies in which Voyager will be used. The base charger will recharge an empty Voyager in about an hour.

WARNING: Base chargers are not waterproof and may create a shock hazard if operated in wet conditions.

NOTE: If the base charger has a voltage input selector, please select the appropriate input voltage based on your geographic location.

NOTE: Base chargers may require an adaptor plug in some locations

Operators should use the following procedure for base charging

Pre-charge

- Power Voyager "off"
- Power charger "off"

Charge

- Connect Voyager to charger
- Power Voyager "on"
- Power charger "on"
- Charger's LEDs show charging status

Post-charge

- Power Voyager "off"
- Disconnect Voyager from charger
- Power charger "off"

NOTE: Voyager's green, yellow, and red LEDs do not indicate the state-of-charge while charging with a base charger. Operators must use the LEDs on the charger to confirm state-of-charge during the charging process.

In-flight charging

The in-flight charging cable allows Voyager to recharge directly from the aircraft. Depending on the operator's preference, the in-flight charging cable can be hard-wired to the helicopter's BUS or it can plug-in to a 28V cigarette lighter adaptor.

NOTE: Operators who choose a cigarette lighter style, in-flight charging cable must have a cigarette lighter receptacle that outputs Voyager's voltage. Some 28V helicopters have 12V cigarette receptacles.

Operators should use the following procedure for in-flight charging

Pre-charge

- Power Voyager "off"

Charge

- Connect in-flight charging cable to helicopter
- Connect Voyager to in-flight charging cable
- Power Voyager "on"
- Voyager's LEDs indicate state of charge

Post-charge

- Power Voyager "off"
- Disconnect Voyager

NOTE: Operators may leave Voyager "on" and connected to the in-flight charging cable for extended periods during in-flight charging, even if the aircraft is "off." Voyager will not charge if the aircraft is "off," but state-of-charge will not be materially diminished. Operators should power voyager off if it will not be used or charged within 24 hours.

Maintenance

Voyager does not require maintenance, except charging.

Trouble shooting

Contact Avion Power if Voyager's red LED is lighted.

Storage

Voyager Power Sources are durable tools designed to withstand daily use as a ground power unit or start battery. In order to maximize Voyager's performance and service life, operators should follow these storage guidelines.

- Store Voyager within its storage temperature range of -40C to 60C
- Store Voyager in a dry location

Shipping

Li-Ion Batteries are classified and regulated as Class 9 dangerous goods. Voyager Power Sources qualify as "lithium-ion batteries" and are therefore subject to the regulations described by UN3480 during shipping. Packing instructions dictated by PI 965 Section 1A apply because Voyager's watt hour rating is greater than 100Wh. The requirements of PI 965 Section 1A are shown below.

Max quantity per package for passenger aircraft	5 kg net
Max quantity per package for cargo aircraft	35 kg net
Outer packaging	UN Specification Packaging, PG II performance standards
Inner packaging	Required. Protect against short circuit
Markings	UN3480, Lithium ion batteries
Labeling	Class 9, Cargo Aircraft Only (if applicable)
Allowed in small package (U.S. only)	Yes
Allowed in small package (Non-U.S. only)	Yes, all IDG countries except to/from/within Europe
Allowed in air cargo	Yes, passenger quantities only
Allowed in air freight	Yes
Dangerous goods document for small package (U.S. and Non-U.S.)	Shipper's declaration
Dangerous goods document for air cargo and air freight (U.S. and Non-U.S.	Shipper's declaration
Safety document required	No
Acceptance audit required	Yes
Information displays on the NOTOC	Yes

Disposal

Cell recycling is encouraged. Do NOT dump into any sewers, on the ground or into any body of water.

- USA: Dispose of in accordance with local, state and federal laws and regulations.
- Canada: Dispose of in accordance with local, provincial and federal laws and regulations.
- EC: Waste must be disposed of in accordance with relevant EC Directives and national, regional and local environmental control regulations. For disposal within the EC, the appropriate code according to the European Waste Catalogue (EWC) should be used.

Emergency procedures

Fire fighting measures

Rechargeable Li-ion battery contains graphite, lithium metal oxides, solvents and lithium salt. There is no metallic lithium in Li-ion battery. The following extinguishing agents effectively control fires involving lithium ion batteries.

- Water will effectively cool and extinguish a lithium-ion battery fire.
- Ordinary ABC fire extinguishers are effective on a fire involving lithium ion batteries because there is no metallic lithium in a lithium ion battery.

- CO2, dry chemical, and foam extinguishers are preferred for small fires, but may not extinguish burning lithium ion batteries. Burning batteries will burn themselves out.

- LITH-X (powdered graphite) or copper powder fire extinguishers, sand, dry ground dolomite or soda ash may also be used. These materials act as smothering agents.

First aid measures

In case of contact with electrolyte, gases, or combustion byproducts from a lithium battery or lithium ion battery release, the following first aid measures should be considered:

- Inhalation: If contents of an opened cell are inhaled, remove source of contamination or move victim to fresh air. Obtain medical advice.

- Eye contact: Contact with the contents of an opened cell can cause burns. If eye contact with contents of an open cell occurs, immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes while holding the eyelids open. Neutral saline solution may be used as soon as it is available. If necessary, continue flushing during transport to emergency care facility. Take care not to rinse contaminated water into the unaffected eye or onto face. Quickly transport victim to an emergency care facility.

- Skin contact: Contact with the contents of an opened cell can cause burns. If skin contact with contents of an open cell occurs, as quickly as possible remove contaminated clothing, shoes and leather goods. Immediately flush with lukewarm, gently flowing water for at least 30 minutes. If irritation or pain persists, seek medical attention. Completely decontaminate clothing, shoes and leather goods before reuse or discard.

- Ingestion: Contact with the contents of an opened cell can cause burns. If ingestion of contents of an open cell occurs, NEVER give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Have victim rinse mouth with water again. Quickly transport victim to an emergency care facility.

Accessories

- Base charger
- In-flight charging cable
- Six foot extension cable
- Suspender
- Vest

Certifications

- CE
- UN/DOT 38.3