NUVA® WAVE

INSTRUCTIONS FOR USE

NuvaWave® System
Models: NW-UVC-100 and NW-UVC-100-USP

Manufactured for:

UV Innovators™, LLC
part of the WellAir™ Group
401 Harrison Oaks Boulevard, Suite 230
Cary, NC 27513 USA

CE

EPA Est. No. 99860-NC-1

WELLAIR

037-0110 (Rev F)

Revision History				
Revision	**Date**	**Description of Changes**	**Author**	**Change Order**
A	09/11/20	Initial Release	J. Grenon	E2009041
B	10/26/20	Added metric units to all measurements and updated Figure numbering. Clarified eye protection caution. Added instruction on how to remove NuvaWave from holster. Added battery instruction manual and battery charger instruction manual to Appendix A and B, respectively. Added NuvaWave Belt, Battery Mount and Holster label.	J. Grenon	P2010152
C	11/10/20	Added user population specification. Updated Figure 1.2 photo.	J. Grenon	P2010301
D	03/03/21	Updated NuvaWave Label and NuvaWave Storage Case Label to reflect current EPA Establishment Number.	J. Grenon	P2103031
E	07/07/21	Updated Manufacturer Address. Added importer address. Updated table of contents. Added Core battery instruction manuals as Appendix B and D. Updated specification table. General edits for continuity between Quick Start Guide and IFU.	J. Grenon	P2103191
F	07/28/21	Updated Manufacturer Address. Updated title of Appendices A-D. Added Appendix E. In Table 1.3.a, corrected model # for chargers to NW-UVC-020.	J. Grenon	P2107291

Intended Use

NuvaWave Handheld Disinfection Device produces germicidal levels of ultraviolet-C (UVC) light for surface disinfection.

When used in the healthcare environment, NuvaWave augments the disinfection of surfaces after manual cleaning. NuvaWave can be used in the elimination of pathogens on high touch surfaces which aides in the prevention of Hospital Acquired Infections (HAI's).

User Requirements and Training

The Quick Start Guide or Instructions for Use manual must be read and understood prior to using NuvaWave to ensure the safety of the user and effectiveness of the device. Understanding the instructions for use, pre-cautions, and warnings contained within the Quick Start Guide or the manual is the first step of operating NuvaWave.

The Quick Start Guide and manual have been created for self-training of operators by providing all the information needed to become familiar with NuvaWave and the proper steps for use.

Operators should be at least 18 years old to use NuvaWave. Training of new operators should be conducted by someone who has read the Quick Start Guide or manual, has operated the device following the instructions effectively and is familiar with all aspects of its use and handling.

Contact Information

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Device covered under one or more patents. Refer to www.nuvawave.com/Patents

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Section 1: NUVAWAVE SYSTEM OVERVIEW

1.1 General Description

NuvaWave is a powerful, lightweight, intelligent, handheld UVC-emitting device intended for use in the disinfection of non-porous surfaces using non-ionizing UVC radiation. The UVC light is controlled with a simple trigger mechanism allowing for instant on/off by the operator. The system is powered by an external battery pack capable of more than 3 hours of continuous use when fully charged.

When used as directed, NuvaWave can disinfect and deactivate a surface area of 100mm x 100mm (4in x 4in), infected with SARS-CoV-2, the virus that causes Coronavirus Disease (COVID-19), in less than 2 seconds. For other disinfection rates, see Table 4.2.a to Table 4.2.d.

Caution: ***Operating NuvaWave requires the use of Personal Protective Equipment (PPE).*** *Refer to Section 1.4.1-Device Warning and Precautions, Section 2.3-How to Protect Yourself from Detrimental UVC Radiation Exposure and Section 2.4-PPE Included in the Kit.*

1.2 NuvaWave Kit Contents

NuvaWave Kit (the "kit") consists of the Storage/Transport case, one (1) NuvaWave Handheld Disinfection Device, two (2) rechargeable batteries, one (1) NuvaWave belt with holster for the device, one (1) battery charger, and two (2) UVC Face Shields.

Figure 1.2.a: Contents of Storage and Transport Case

Key	
1	Storage and Transport Case
2	(2) UVC Face Shields
3	(2) Batteries
4	(1) NuvaWave Handheld Disinfection Device
5	(1) Belt with Battery Mount and Holster
6	(1) Battery Charger

1.3 NuvaWave System Specifications

Table 1.3.a: NuvaWave System Specifications

Specification / Classification		Description
Charger	AC Input Requirements	100 - 240VAC, 50-60Hz, 90W
	DC Output Nominal	NW-UVC-020: 16.8VDC, 2-2.8Amps NW-UVC-020-US: 16.8V, 3Amps
NuvaWave Handheld Disinfection Device	DC Input Nominal	14.4VDC, 3.5 A, 50 Watts
	Irradiance @ 5cm (2”)	270nm, 1.2 Watts, 12mW/cm^2
	UVC Emitter Life Expectancy	5000 hrs
	Continuous Use (Fully Charged)	3 hrs
	Weight	0.64 kg (1.4 lbs)
	Disinfecting Area	100 mm x 100 mm (4 in x 4 in)
	Disinfection Distance	25 - 90 mm (1-3.5 in)
	Disinfection Times	Refer to Table 4.2.a to Table 4.2.d
Kit	Dimensions	51 cm x 41 cm x 20 cm (20 in x 16 in x 8 in)
	Weight	6.8 kg (15 lbs)
Battery	Technology / Voltage / Capacity (Nominal)	Lithium-ion / nominal 14.4-14.8VDC / 140-150Wh
	Weight	0.9 kg (2 lbs)
NuvaWave System	Operating Temperature	15°C to 25°C (59°F to 77°F)
	Storage Temperature	15°C to 35°C (59°F to 95°F)
	Transport Temperature	-25°C to 70°C (-13°F to 158°F)
	Relative Humidity	5% to 95%, non-condensing
	Operating Altitude	Up to 2000 Meters (2200 Yards)
	Operating Environment	Indoor use, only in dry locations

1.4 Labeling

1.4.1 Device Warning and Precautions

Table 1.4.a: NuvaWave System General Warnings

 ***GENERAL WARNINGS***	
Caution:	**Device Service**. Do not attempt to service the device. The device and its associated parts are not serviceable by the user. Modifying the device could reduce its effectiveness and/or cause bodily harm to the user, including electric shock, burn, or exposure to harmful levels of UVC radiation. Contact customer service at nuvawave@wellairsolutions.com or 1-855-NUV-AWAV (1-855-688-2928) for service.
Caution:	**Device Damage**. Do not drop the device or impact the device. Burns or shock could occur from exposure to internal components. Dangerous UV exposure could occur.
Caution:	**Battery**. Only use the manufacturer approved rechargeable batteries.

	GENERAL WARNINGS
Caution:	**Charger**. Only use the manufacturer approved charger. Using an unapproved charger can cause shock or fire.
Caution:	**Harmful Ingress of Liquid**. IP20. This equipment has no protection against ingress of liquids.
Caution:	The device is not to be operated outside of the specifications of this document. Refer to Table 1.3.a. Operate the device only with parts and components provided by the manufacturer. The performance of the device cannot be guaranteed if other parts or components are used.
Caution:	The device is not suitable for use in the presence of flammable mixtures.
Caution:	The device is not suitable for use in oxygen rich environments.
Caution:	Do not expose to flame.
Caution:	Do not dispose in a general public waste landfill.

Table 1.4.b: NuvaWave System Operational Warnings

	OPERATION WARNINGS
Caution:	**Operators should be at least 18 years old to use the device.**
Caution:	**Only use the device after the precautions and safety sections, have been read and understood.**
Caution:	**Always use Personal Protective Equipment (PPE)** when operating the device. The PPE must cover all visible skin including the arms, hands, legs, feet, and face.
Caution: 	**Always use UVC Eye Protection.** Eye exposure to UVC radiation can cause Photokeratitis (sensitivity to bright light) or Conjunctivitis (inflammation of membrane covering the eye) resulting in discomfort and a sensation of sand in the eyes. The eye is much more sensitive to UVC than the skin, which is why eye protection is so important. At 100-mm (4 inches), direct exposure to eyes for more than 1 second exceeds the safe threshold limit for an 8-hour shift. At 3 meters (10 feet), the maximum direct eye exposure time increases to 38 seconds.
Caution: 	**Do not look directly at the UVC light source.**
Caution:	Do not use NuvaWave if in the presence of unprotected personnel.
Caution:	Do not use the provided UVC face shields for purposes other than preventing exposure to UVC radiation.
Caution:	Do not depress the trigger until you are ready to disinfect a surface.
Caution:	Do not point NuvaWave at anyone.

	OPERATION WARNINGS
Caution:	Always route the battery cable around the back of the belt per the instructions to reduce potential snags which could damage the equipment.
Caution:	When wearing NuvaWave with the belt and battery, use caution when moving around so as to avoid snagging the power cable and potentially causing injury and/or damage to the device.
Caution:	Do not use the device if there is obvious damage including broken or cracked plastics.
Caution:	Maintain proper infection control procedures, including cleaning hands before and after contact with the device and wiping the device with a disinfecting cloth if it becomes contaminated.
Caution:	If a systems problem with NuvaWave occurs, identify the symptom then attempt to resolve the problem as indicated in the troubleshooting section. If the problem cannot be resolved, contact customer service at nuvawave@wellairsolutions.com or 1-855-NUV-AWAV (1-855-688-2928).
Caution:	To prevent scratches and maintain optimal performance of the reflector, only use 70% isopropyl alcohol on a microfiber cloth to clean the reflector.
Caution:	Risk of electrical shock. Do NOT attempt to connect items to the NuvaWave device that are not specified parts of the system or are not provided by the manufacturer.
Caution:	During charging, do not block access to the mains connection (connection and removal). Position device so that the power cable can be easily disconnected. Unplug the device to disconnect mains.
Caution:	NuvaWave may not eliminate 100% of all pathogens on the disinfected surface. Refer to Table 4.2.d.
Caution:	The device should not be used in environments outside of the specified operating temperature and humidity ranges.
Caution:	Use caution when operating NuvaWave near or around automatic faucets to prevent the device from getting wet.

1.4.2 Symbol Definitions

Below you will find a brief explanation for the symbols used in NuvaWave System labeling. These symbols include important information about the device and its use. Familiarize yourself with these icons and their meanings before using NuvaWave.

Table 1.4.c: NuvaWave System Labeling Symbols

Label Symbol	Symbol Description
SN	Serial Number
LOT	Lot Number

Label Symbol	Symbol Description
	Refer to IFU (Instructions for Use) for safety measures
	Do not get wet
	Do not drop
	Warning or precaution relating to UV light safety. Read the text carefully and use the equipment as instructed to ensure safety.
	General warning or precaution. Read the text carefully and use the equipment as instructed to ensure safety
	Do not expose to flame
	Product meant to be recycled
	Do not dispose in landfill
	The device should be stored, transported or operated at a temperature that falls within the indicated range
	Date of manufacture
	Manufactured for
	The device should be stored or operated at a humidity level that falls within the indicated range
	The device was assembled in the USA
	Signifies European conformity mark
	Imported by

Label Symbol	Symbol Description
	Model Number
	Signifies device meets applicable Canadian and US electrical safety standard requirements.

Section 2: NUVAWAVE SYSTEM SAFETY INFORMATION

2.1 UVC Radiation and How it Works

The visible spectrum of light has been well characterized and can easily be seen in the colors of a rainbow from purple (400 nm) to red (700 nm). As the wavelength increases, the energy of the photon decreases, as seen in Figure 2.1.a.

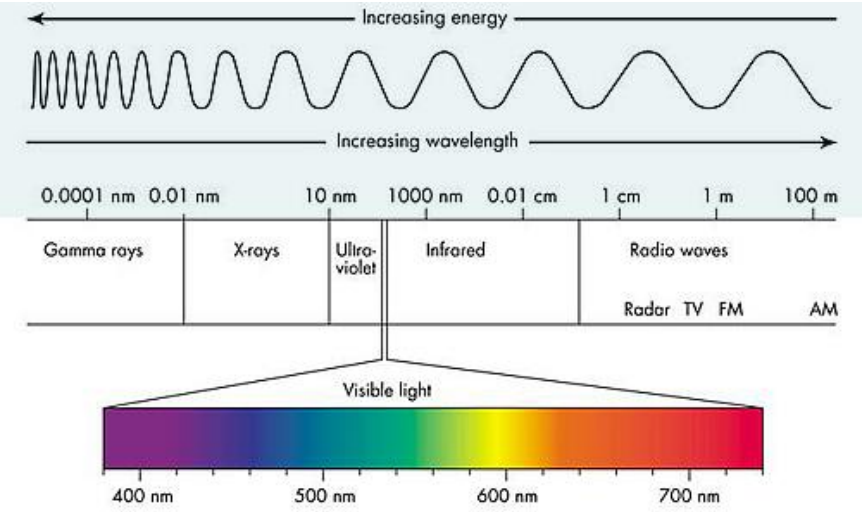


Figure 2.1.a: The Electromagnetic Spectrum

Ultraviolet (UV) radiation was discovered in 1801 by Johann Wilhelm Ritter, a German physicist, as he observed that invisible rays beyond the violet end of the visible spectrum darkened silver chloride-based paper. Over the next 100 years, scientists began to learn the power of the ultraviolet spectrum (Figure 2.1.b), and in 1878 they discovered the disinfecting effect of short wavelength UV light on bacteria.

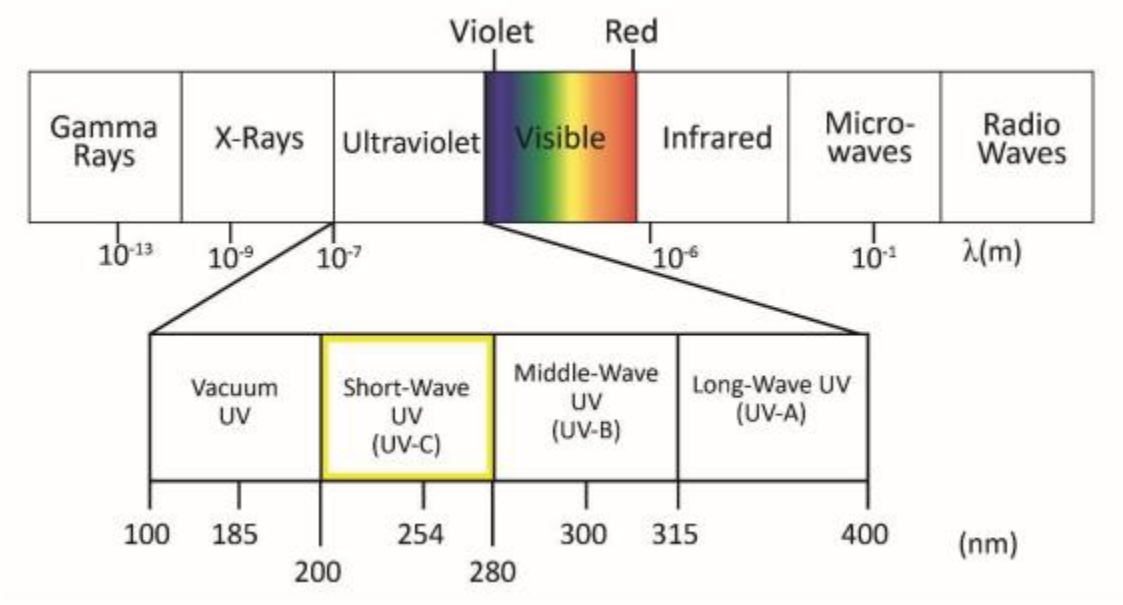


Figure 2.1.b: Ultraviolet Wavelength Subdivided Spectral Ranges

The UV spectrum is subdivided into 4 different ranges and they each have different features or uses:

- UVA: (315 – 400 nm, long wavelength) is used in tanning beds, curing applications, and black lights for forensics.
- UVB: (280 – 315 nm, medium wavelength) is used in phototherapy/psoriasis applications; this is the wavelength that causes sun burn and skin cancers.
- **UVC: (200 – 280 nm, short wavelength) is very effective for pathogen disinfection of surfaces, water, or air.**
- VUV: (100 – 200 nm, vacuum UV) is used to produce ozone plasmas.

2.2 Effects of UVC Radiation on Humans

The sun generates light that covers the entire electromagnetic spectrum. The Earth's atmosphere is blocking a significant portion of that spectrum from reaching the surface. UVC is blocked by our upper atmosphere and only UVB, UVA, and infrared light are able to penetrate and interact with humans. The protective layer of the atmosphere saves humans from detrimental exposure to UVC energy. Human cells interact with photonic energy in many different ways. For instance, near-UVA and visible light is absorbed by chromophores in cells and the transfer of energy stimulates independent cellular mechanisms. Most of those mechanisms are beneficial to the human body, since secondary effects of the photon absorption cause chain reactions in the cells that are protective and healthy.[1] As an example, the absorption of UVB into the skin is responsible for the formation of vitamin D in humans. In another mechanism of action, cellular activation by photonic interaction can cause these cells to produce reactive oxygen species that

[1] Glickman G, Byrne B, Pineda C, Hauck WW, Brainard GC. Light therapy for seasonal affective disorder with blue narrow-band light-emitting diodes (LEDs). *Biol Psychiatry*. 2006;59(6):502-507.

can attack bacteria and destroy their membranes.[2] UVC acts in a direct mechanism with the DNA of mammalian cells. The UVC energy is absorbed by the cells and causes a disruption of the thymine dimers of the DNA sequence and the RNA of viruses. This disruption renders the cells unable to replicate or reproduce.[3] This effectively restricts and causes the cells to die making the UVC wavelength very efficient at pathogen reduction. For this reason, UVC is known as the germicidal irradiation wavelength.

2.3 How to Protect Yourself from Detrimental UVC Radiation Exposure

Since the UVC wavelength of light can disrupt the DNA of cells, it is a requirement to protect humans from this powerful wavelength. The lens of the human eye absorbs most of UVA light, which can cause cataracts; the shorter wavelengths (UVB & UVC) are absorbed by the cornea, causing potential damage to these tissues.[4] This is why UV protective eyewear should always be used around UV light. In addition, the user should wear a UVC face shield to protect both the eyes and the other exposed skin of the face during the use of products with UVC irradiation. Most optically transparent polymer materials, like polycarbonate, will block shorter wavelengths (UVC) and allow visible light to move through. In addition, users of UVC irradiation devices should protect any exposed skin from direct or indirect exposure to these harmful wavelengths. Personal Protective Equipment (PPE) is required during disinfection of infected areas. Examples of PPE are:

Gloves	Gown	Sleeve Covers
Goggles/Glasses	Hood	Respirator
Face Shield	Boot Covers	Face Mask

Face shields certified to protect against UVC will protect both the eyes and exposed facial skin from UVC radiation. For this reason, if the UVC face shield provided in the NuvaWave System kit or a face shield with equivalent UVC protection is worn, additional eye protection, such as goggles, need not be worn.

The minimum required for PPE during the use of NuvaWave is a UVC face shield, gloves, tight weave long sleeve shirt, tight weave pants, and closed-toe shoes.

2.4 PPE Included in the Kit

For PPE, the Kit provides 2 UVC face shields. Users should always follow the procedures of the facility where they are working to ensure all PPE options are utilized properly. In addition to the provided UVC face shield, the user must cover any exposed skin with clothing such as tight weave long sleeve shirt and pants, gloves, and closed-toe shoes.

[2] Hamblin M, Jori G. *Photodynamic Inactivation of Microbial Pathogens: medical and environmental applications*. Cambridge, UK: Royal Society of Chemistry; 2011:57-63.
[3] Yin R, Dai T, Avci P, et al. Light based anti-infectives: ultraviolet C irradiation, photodynamic therapy, blue light, and beyond. *Curr Opin Pharmacol.* 2013;13(5):731–62.
[4] Sliney DH., How light reaches the eye and its components. *Int J Toxicol*. 2002;21(6):501-9.

Section 3: NUVAWAVE SYSTEM OPERATION

3.1 NuvaWave Kit Description of Components

3.1.1 NuvaWave Handheld Disinfection Device

NuvaWave Handheld Disinfection Device ("NuvaWave") contains the UVC light source, reflector, microprocessor, and all of the safety circuitry. It interfaces to an external battery pack via the power cable.

Figure 3.1.a: NuvaWave Handheld Disinfection Device

Key	
1	Handle
2	Power Cable Connector
3	Fan Vent
4	LED Indicator Light
5	UVC Light Trigger
6	UVC Indicator – Glow Ring
7	UVC Reflector Plate
8	White LED Distance Spotlights
9	Power Switch
10	NuvaWave Device Label Position

3.1.2 Battery and Charger

The kit comes with two (2) 143W/hr batteries capable of powering the Device for up to 3 hours continuous use each. While one battery is being used, the alternate battery can be charged on the provided charger.

Figure 3.1.b: Battery

Figure 3.1.c: Battery Charger

Key	
1	Battery
2	Battery Charger
3	Charger LED Indicator Light
4	Charging Cable and Connector
5	AC Power Cord
6	Battery Label Position (on bottom of battery)
7	Battery Charger Label Position (on bottom of charger)

3.1.3 NuvaWave Belt and Holsters

The belt provides a convenient way of carrying the battery and holstering NuvaWave when not in use, freeing up both hands to perform other tasks.

Figure 3.1.d: NuvaWave Belt and Holsters

Key	
1	Adjustable Velcro Belt
2	Cable Loops
3	Battery Holster
4	Belt Buckle
5	NuvaWave Device Holster

3.1.4 UVC Face Shield

The kit comes with two (2) UVC face shields which protect both the eyes and exposed facial skin from UVC radiation.

Figure 3.1.e: UVC Face Shield

Key	
1	Forehead Rest
2	Back Headband
3	UVC Face Shield
4	UVC Face Shield Label Position

3.1.5 Storage and Transport Case

Provided with the kit is a convenient storage and transport case with a custom foam insert tailored for the NuvaWave and all its components.

Figure 3.1.f: Contents of Storage and Transport Case

Key	
1	Storage and Transport Case
2	(2) UVC Face Shields
3	(2) Batteries
4	NuvaWave Handheld Disinfection Device
5	Belt with battery mount and Holster
6	Battery Charger

3.2 NuvaWave Instructions for Use

3.2.1 Charging the Battery

The NuvaWave Kit comes with a specially designed battery charger capable of recharging a depleted battery in less than 6 hours. We recommend charging the second battery while the first battery is in use. To charge, the NuvaWave Device must be connected to AC power using the provided power cord. Connect one end of the power cord into the receptacle located on the D-TAP / P-TAP charging port of the NuvaWave battery pack. Connect the AC end of the cord into a standard 100-240 Volt 50-60 Hz electrical outlet. The charger cord connector mates directly with the battery cable for convenience.

Figure 3.2.a: Charging Battery

Figure 3.2.b: Battery Charge Indicator Lights

When the charger is powered and connected to the battery, the LED indicator light will on the charger turn red, indicating that the battery is charging. When the battery is fully charged, the LED indicator light will change to green.

3.2.2 Wearing the Battery Mount Belt

The belt and holster for NuvaWave are meant to be worn over the outermost layer of clothing including Personal Protective Equipment.

Remove the belt from the case and adjust the Velcro straps to fit your waist. To make the belt smaller, unlatch the Velcro and pull tighter, placing the strap towards the buckle on the belt. To make the belt bigger, unlatch the Velcro and loosen, placing the strap farther away from the buckle on the belt. The belt should fit securely and rest above your hips. For comfortable access, the holster for NuvaWave should fall on your dominant side, and the v-mount battery mount should fall on your non-dominant side. The device is shipped with the battery mount mounted on the left side of the device. To change the battery orientation, undo the belt Velcro, slide the battery plate out, and install on opposite side. Run the battery cable, attached to the battery plate, through the cable loops along the inside of the belt to reduce potential snags which could damage the equipment.

The belt buckle should be centered on your waist. To attach the battery to the belt, remove the battery from the storage case. Insert the battery into the battery mount on the belt until it “clicks” in place.

Figure 3.2.c: Belt with Battery Pack Installed

To insert NuvaWave into your device holster, first put on the belt and ensure it has been adjusted to fit comfortably over your PPE. The holster will be pre-attached but can be moved to the right or left side of the belt for comfortable access. Rotate NuvaWave so that the head of the device is pointing towards the ground, and the UVC Light Source is pointed towards your body. Line up the handle of the device with the opening in the holster. Push the handle back into the holster and slide the device down until NuvaWave is firmly in the holster. The power cable should be coming up from the bottom of the device and should be clearly visible from the belt.

3.2.3 Connecting the Battery to NuvaWave

Ensure the power switch located at the bottom of NuvaWave is in the OFF position.

Remove NuvaWave from the holster and insert the battery cable into the connector on the bottom of the device, pushing in and twisting clockwise simultaneously to secure the connection. To check the battery charge level, press the battery charge indicator button shown in Figure 3.2.d.

Figure 3.2.d: Charge Indicator Button on Battery

3.2.4 Proper Way to Hold NuvaWave

Proper handling technique is important in the effective use of NuvaWave. When using NuvaWave, the UVC light source should be facing away from you, and your hand should be resting lightly around the handle.

Figure 3.2.e: Holding NuvaWave

When not in use, NuvaWave should be placed in the holster on the belt.

To remove NuvaWave from holster, simply rock the handheld either left or right while placing light upwards pressure on the base of the handheld. NuvaWave will slide easily out of the holster.

Figure 3.2.f: Removing NuvaWave from Holster

If NuvaWave is not sliding out of the holster easily, check to make sure that it is perpendicular to the belt clip before removing it. When properly aligned, very little force is required to remove NuvaWave from the holster.

3.2.5 Powering up NuvaWave

To power on the device, make sure the battery cable is connected to NuvaWave and the battery is secured in the holster. Press the switch located at the bottom of NuvaWave to the ON position. NuvaWave has a power-up sequence that it will run every time the device is powered on.

The LED Indicator light will first flash Red, then Orange, then Green. If the device has passed all self-tests, the light will remain a solid Green, indicating that the system is ready for use. If the LED Indicator Light begins to flash at any point after the power-up cycle, this is an indication of either a user error or a system error. For a full break down of the LED error sequences and their meanings, refer to Section 3.4.2-Troubleshooting Guide.

3.2.6 Disinfecting with NuvaWave

To begin disinfecting with NuvaWave, make sure the UVC Light Source is pointed away from you and towards the surface you wish to disinfect. Engage the trigger located on the handle to begin disinfection. The Glow Ring will turn on and glow blue when the UVC light is being emitted. Four Spotlights will illuminate the corners of the area you are disinfecting with white light. UVC light is invisible, so the Glow Ring and the four Spotlights will alert you that UVC light is being emitted.

To properly disinfect an area, NuvaWave must be held 25mm to 90 mm (1 to 3.5 inches) above the surface you wish to disinfect. Hold the device above the contaminated area and move the device slowly in a sweeping motion, exposing each point on the surface for at least 2 seconds. Refer to Table 4.2.a to Table 4.2.d for a summary of 3-log disinfection times for common pathogens, including SARS-CoV-2.

The spotlights ensure that you are the proper distance from the surface. As the device is moved away from the surface the spotlight size increases, therefore the distance to the object can be approximated. The correct position of the NuvaWave device can be seen in Figure 3.2.g through Figure 3.2.i. The 100mm x 100 mm. (4 in. x 4 in.) area of disinfection is indicated by the blue highlighted area on Figure 3.2.g. As long as a distance of 25 to 90 mm. (1 to 3.5 inches) is maintained from the surface, the disinfection rates indicated in Table 4.2.d apply.

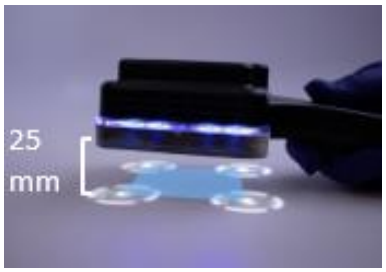


Figure 3.2.g:
Distance = 25 mm (1”)

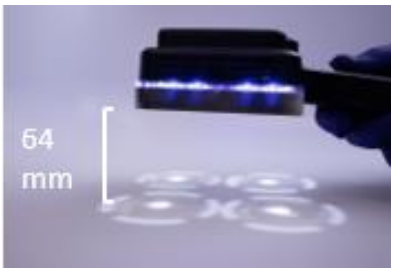


Figure 3.2.h:
Distance = 64 mm (2.5”)

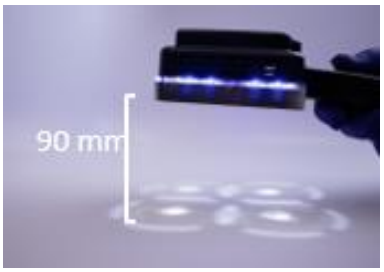


Figure 3.2.i:
Distance = 90 mm (3.5”)

3.3 NuvaWave Care

3.3.1 Cleaning NuvaWave

To clean NuvaWave, wipe down the plastic exterior with a 70% isopropyl alcohol wipe or disinfecting wipe. This will prevent cross-contamination as you move from area to area.

To clean the reflector plate, gently brush off any visible particulates with a soft cloth or brush and wipe away any smudges using lens cleaner. This prevents the plate from getting scratched. Then use 70% isopropyl alcohol on a microfiber cloth to gently clean the reflector plate. This will keep the reflector functioning at peak performance. Do not spray or pour directly on the reflector plate, as this may cause harmful ingress of fluids and damage the device.

3.3.2 Device Storage

Return NuvaWave and the components after use and cleaning to their proper location within the case after every use. Store the kit in a dry location.

3.3.3 Device Maintenance

Proper maintenance of NuvaWave will ensure that it continues to operate at peak performance. The daily maintenance steps for the device include:

- Cleaning the reflector plate by gently brushing off any visible particulates with a soft cloth or brush and wiping away any smudges using lens cleaner. Follow by disinfecting the reflector plate with 70% isopropyl alcohol using a microfiber cloth.
- Cleaning the device plastics with 70% isopropyl alcohol or disinfecting wipes to reduce the possibility of cross contamination
- Inspecting the device for cracked or broken plastic

3.3.4 Device Compatibility

Much like any disinfecting process, (i.e., chemical, mechanical scrubbing, heat) the surface being disinfected may be affected by the process. There have been very few formal studies on the effect of UVC radiation on surfaces. However, terminal cleaning devices used in the healthcare industry employing UVC towers will bathe an entire room for up to an hour. These devices have been in use for many years and the manufacturer is not aware of any negative effects to the sensitive medical equipment in the room. Some plastics like polypropylene have been shown to be very tolerant to UVC radiation while other plastics like ABS are not as tolerant[5]. Materials such as metals, glass and ceramic are virtually unaffected by UVC radiation[6].

[5] Teska P. Risks of Surface Damage to Polymeric (Plastic) Surfaces from UV-C Exposure. *UV Solutions Magazine*. June 2020:14-16.

[6] Rocket C., UV Degradation Effects in Materials- An Elementary Overview. *UV Solutions Magazine*. December 2019:14-16.

3.4 NuvaWave Troubleshooting and Warranty

3.4.1 Electronic Safety Features and Error Conditions

NuvaWave has multiple built-in safety features and the ability to test itself. If an error is detected, the device automatically shuts down and signals the user. The safety and error detection features include:

- Continuous self-testing while device is running. Self-testing includes checks for overheating, non-functioning UVC emitters, total usage time, UVC performance life, battery performance, distance spotlights checks, fan operation, computer and software checks, and proper functionality of circuitry.
- Low-battery indicator, which will engage if the battery is too low for use and needs to be re-charged.
- Drop detection, which automatically disables the device when it detects an impact.
- Haptic feedback, which vibrates the device any time there is an error.
- UVC Trigger, which enables the UVC emitter so long as the trigger is depressed.
- UVC Trigger stuck detection, which disables the light if the UVC trigger is depressed when the device is first powered.
- UVC Timeout, which will shut off the UVC emitter if the trigger is depressed for more than 5 minutes continuously.
- UVC Indicator - Glow Ring, which turns on whenever the UVC light source is active.
- Distant Spotlights, which turn on whenever the UVC light source is active, illuminating the corners of the target area and providing an estimate of surface distance.

3.4.2 Troubleshooting Guide

The LED Indicator Light located on the back of NuvaWave signals to the user the state of the device. The LED indicator light can be one of three colors: Green, Orange or Red. During power-up all three colors will cycle through as the device is initializing. A solid green light is the normal operating state of the device. Error conditions are signaled to the user by flashing the LED indicator light either orange or red and vibrating the NuvaWave using haptic feedback. Haptic feedback will vibrate the device whenever the user depresses the trigger while an error condition exists. There are two types of errors: user errors (orange) and device errors (red). When the trigger is depressed for more than five continuous minutes, the Indicator LED will flash orange, signaling a user error. A device error is signaled by a flashing red Indicator LED. The flashing sequence is unique for the error conditions to aid color blind users. Refer to the Quick Troubleshooting Guide in Table 3.4.a for indicator meanings and required actions. If error continues, contact customer service at 1-855-NUV-AWAV (1-855-688-2928).

Table 3.4.a: Quick Troubleshooting Guide

Indicator Light	Error	Reason	Action Required
Solid Green 	NONE	All System Self-Tests passed. No user errors.	Ready to use as directed.
Orange Flashing Off 	User Error	User has held trigger for more than 5 minutes or the trigger is depressed at power-on.	Point device away from body and release the trigger. Next re-engage the trigger to clear the error and continue.
OFF Flashing Red  *1 flash every 3 seconds*	Low Battery	Battery is too low to continue.	Recharge the battery or replace with a fully charged battery.
SOS Flashing Red  *3 quick then 3 slow flashes*	Device Error	Hardware malfunction	Power cycle device by turning the device OFF and back ON again. If the error does not clear, return to manufacturer for service.

3.4.3 Determining Software Revision

The software installed on the device has a revision number which is indicated by three numbers as follows: Revision: X.Y.Z where:

- X is the major revision#
- Y is the minor revision#
- Z is the build#

Since the device does not have a display, NuvaWave uses a series of flashes to indicate the software revision. To display the software revision, while wearing proper PPE, point the device away from body, depress the trigger and press the power switch OFF then ON. Watch the LED Indicator Light on the top of the device: the revision number will begin to flash. The light will first flash RED. Count the RED flashes to obtain the major revision number. The light will then flash ORANGE. Count the ORANGE flashes to obtain the minor revision number. The light will then flash GREEN. Count the GREEN flashes to obtain the build number.

Example: Depress the trigger and turn the device OFF then ON. For Revision 1.4.2 the LEDs will flash in the following sequence.

(1) Red

(4) Orange

(2) Green

Revision#: 1.4.2

3.4.4 Device Warranty

The warranty covers all parts and labor for 1 year from purchase and does not cover abuse like broken plastics and water damage. Contact customer service at 1-855-NUV-AWAV (1-855-688-2928) to file a claim and receive a Return Materials Authorization number (RMA#).

3.4.5 Device Disposal

The NuvaWave Kit, including the NuvaWave Handheld Disinfection Unit, two (2) batteries, one (1) battery charger, two UVC face shields, one (1) NuvaWave belt with battery mount and holster, and the storage/ transport case should not be disposed in a general public landfill. Please recycle the kit following the State and County regulations for your area, as well as the guidelines for waste station disposal.

Section 4: EFFECTIVENESS OF UVC RADIATION ON PATHOGENS

4.1 How to Read the Tables

There are many different levels for disinfection and ultimately sterilization. The EPA and other regulatory bodies classify levels of disinfection by the logarithmic (log) reduction of pathogens, per EPA Product Performance Test Guidelines, 2012. Log reduction correlates to a 10-fold reduction of the pathogen level. The standard performance metric is the log reduction in terms of colony forming units (CFU). Table 4.1.a represents the logarithmic reduction of pathogens.

Table 4.1.a: Logarithmic Reduction in Terms of CFU and Percentage

Log Reduction	Number of CFUs Remaining	Percentage Reduction
0log	1,000,000	0%
1log	100,000	90%
2log	10,000	99%
3log	1,000	99.9%
4log	100	99.99%
5log	10	99.999%
6log	1	99.9999%

Every institution has different requirements for disinfection, but most consider a routine disinfection that is a 3-log or 4-log reduction as effective.

In order to test the viability of UVC as a disinfectant, different bacteria, viruses, and spores are irradiated with a specific level of energy for a given time over a specific area. The key specifications for comparing different UVC light sources is understanding the following:

- Irradiance = Optical Power / Area; typically, this is represented as Watts / area (W/cm^2)
- Dose = Irradiance x time (in seconds); typically, this is represented as Joule / area (J/cm^2)

In order to compare experiments, devices, and overall effectiveness, the dose is evaluated as a function of log reduction per individual pathogen. The following tables indicate the dose required to receive a 3-log reduction (99.9%) in various pathogens and the relative amount of time required for NuvaWave for these results.

4.2 Viruses, Bacteria, and Other Pathogen Dosage Requirements

The following dosages are supported by the literature cited in the reference column. NuvaWave time represents the number of seconds a particular virus, bacteria, or pathogen needs to be exposed to obtain a 3-log reduction (99.9%) kill rate when the light is used as directed.

Table 4.2.a: Virus Dosages

Virus: 3-log reduction	Dose (mJ/cm2)	NW Time (seconds)	Reference
Poliovirus – Type 1	21	2.1	Simonet and Gantzer 2006Picornaviridae
Picornaviridae aphthovirus (foot and mouth disease virus)	67	6.7	Nuanualsuwan et al. 2008
Echovirus – 12	18	1.8	Park et al. 2011
Hepatitis A	15	1.5	Wiedenmann et al. 1993
Adenovirus – Type 5	27	2.7	Guo et al. 2010
Escherichia coli bacteriophage MS2	10	1	Tseng et al., Journal of Occ. and Env. Hygiene, 4:400-405
Escherichia coli bacteriophage Phi X174	10	1	
Escherichia coli (Migula) Castellani and Chalmers	22	2.2	
Pseudomonas syringae van Hall pathovar phaseolicola	28	2.8	

Table 4.2.b: Bacteria Dosages

Bacteria: 3-log reduction	Dose (mJ/cm2)	NW Time (seconds)	Reference
Escherichia coli	5.7	0.57	Clauß et al. 2005
Helicobacter pylori	3.8	0.38	Hayes et al. 2006
Legionella pneumophila	4.5	0.45	Cervero-Aragó et al. 2014
Pseudomonas aeruginosa	2.3	0.23	Clauß 2006
Staphylococcus aureus	6.4	0.64	Clauß 2006
Yersinia enterocolitica	5	0.5	Clauß et al. 2005

Table 4.2.c: Other Pathogen Dosages

Spore: 3-log reduction	Dose (mJ/cm2)	NW Time (seconds)	Reference
Streptomyces griseus	15	1.5	Clauß 2006
Penicillium expansum	49	4.9	Clauß 2006
Clostridium pasteurianum	6.7	0.67	Clauß 2006
Bacillus subtilis	24	2.4	Mamane-Gravetz et al. 2005
Bacillus anthracis Sterne	52	5.2	Nicholson and Galeano 2003

Table 4.2.d: NuvaWave Pathogen Testing – 2" distance with pathogen swept across 4" x 4" aperture of device within the "NW Time"

Pathogen	NW Time (seconds)	% Reduction	Test Laboratory	Year
SARS-CoV-2	1	99.88%	Texas Biomedical Research Institute	2020
Methicillin-Resistant Staphylococcus aureus (MRSA)	1	99.75%	EMSL Analytical, Inc.	2020
Escherichia coli (E. coli)	1	99.99%	EMSL Analytical, Inc.	2020
Salmonella typhimurium	1	99.95%	EMSL Analytical, Inc.	2020
Enterococcus faecalis	1	99.96%	EMSL Analytical, Inc.	2020
Klebsiella pneumoniae	1	99.64%	EMSL Analytical, Inc.	2020
Pseudomonas aeruginosa	1	99.9%	EMSL Analytical, Inc.	2020
Acinetobacter baumannii	1	99.93%	EMSL Analytical, Inc.	2020

Appendix A: Battery Instruction Manual for Model No. NW-UVC-040 (IDX DUO C150)

DUO-C98 / DUO-C150 / DUO-C198

Li-ion V-Mount Battery

Instruction Manual

Lithium Ion

Endura SYSTEM

Thank you for purchasing the DUO-C98 / DUO-C150 / DUO-C198 Li-ion V-Mount Battery. Prior to using the DUO-C98 / DUO-C150 / DUO-C198, we strongly recommend reading this Instruction Manual on how to best use the DUO-C98 / DUO-C150 / DUO-C198 . Please keep this manual for your reference. If you have any additional questions, please contact your local IDX office listed at the end of this manual.

Caution for safety use

Improper handling of this Li-ion battery may result in smoke, heat, fire, explosion or leakage as well as cause performance degradation or failure. Please be sure to observe the following precautions.

⚠DANGER

May cause sudden serious injury and death.

- Charge with IDX battery charger only.
- Use with professional video cameras or other video equipment. Please contact IDX for more information.
- Do not short the contact pins with any metal object. Do not carry or store with metal equipment.
- Do not expose to heat and never throw the battery in a fire.
- Do not immerse in water. Keep the battery dry and away from excessively dry or humid environments.
- Do not leave the battery exposed to excessive heat such as in a car or directly under the sun light. Do not use outside of specified temperature ranges.
- Do not solder on the contact pins directly.
- Do not attempt to open the outer casing or break apart the battery.
- Do not subject the unit to extreme physical impact or pressure, or place any object across the terminals that could cause it to short.
- Do not pierce or drill into the outer casing of the unit.
- Do not attempt to use the battery if damaged.
- Do not use the battery in a corrosive environment. Damages occur from salt water, seawater, acid, alkali, corrosive gas, etc.
- Risk of explosion if battery cells are replaced by an incorrect type.

⚠WARNING

May cause serious injury and death.

- Please note that the outside casing becomes hot when the battery is discharged in high temperatures or with high loads.
- Stop charging immediately if the battery fails to charge within the designated time. Refer to charger manuals for charge times.
- Do not use if the battery displays unusual characteristics (odd odor, discoloration, etc.) when in use, during charge or in storage.
- Keep away from fire if the battery leaks fluid or has an unusual smell.
- In case of leakage immediately wash your hands and face thoroughly with clean water and contact your IDX representative for further instructions.
- Immediately seek medical attention if battery fluid gets into contact with your eyes.

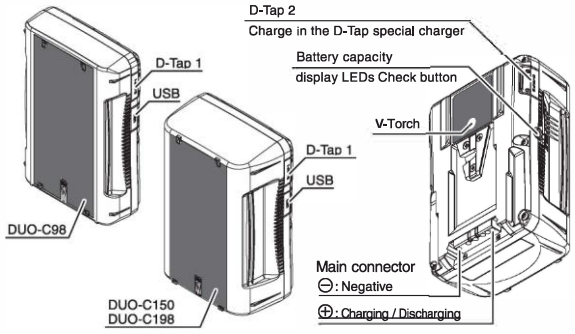
⚠CAUTION

May cause injury or damage other equipment.

- Follow instructions on charging and discharging.
- Store in cool and dry conditions.
- During long periods of inactivity, please remove the battery from the equipment.
- Do not use, store or place the battery in an electrostatic area.
- Always keep the connectors clean.

Features

- Light weight, compact, high performance Li-ion battery with a durable design.
- Five power status LED indicators accurately display remaining power capacity. [Refer to Capacity display LEDs]
- Two DC output connectors for peripheral equipments. [Refer to D-Tap] D-Tap 2 is compatible with charging.
- USB power output for charging portable devices. [Refer to USB]
- Equipped with V-Torch (LED Light) for universal purpose. (light for approx. ten seconds) [Refer to V-Torch]
- IB mode can be configured. [Refer to IB Setting]



Protection circuitry

- There are four types of protection circuits to ensure the battery is protected from Over-charge, Over-discharge, Over-current and Thermal protection. If the fuse is blown, the battery is no longer operable.
- When temperature of inside of the battery reaches 176°F (80℃), battery stops discharging automatically. Discharge will restart when the inside temperature becomes 140°F (60℃) or less.
- Please charge the battery quickly, if the over-discharge protection is activated. The battery may become unusable, if leave it without charging.

Discharging

- Please check that the total power consumption from the main, the two D-Taps and the USB connectors is less than the battery's maximum discharge power. If it exceeds the maximum discharge power, the safety protection function may be activated and it will stop discharging and may cause damage the battery. If the fuse is blown off due to an over load, the battery won't recover.
- The battery life may diminish if high loads are applied frequently.
- Battery run-time may reduce when used in extreme high and low temperatures. IDX highly recommends to use the battery in ambient temperatures of 50～104°F (10℃～40℃)
- The discharge characteristics of lithium ion batteries illustrate a steady curve until 13V. At 13V, the discharge curve sharply drops. For this reason, IDX recommends setting the camera's "Low Voltage" alarm settings to13～13.5V. Refer to battery settings on the camera's user manual.
- The battery will automatically stop discharging when the voltage reaches 11V. To extend battery life, IDX recommends to stop using before the battery reaches 12V.
- Microwave transmitters with 5W outputs or more should be kept as far away from the battery as possible. High power transmitters may disrupt or stop supplying power.
- Please be sure to remove the battery from the device after use. If a battery left mounted on the device that has large standby power, the battery's residual capacity will become lower and the over-discharge protection may be activated.
- Please do not use the batteries connected in series. This may cause the damage.

Charging

- Only charge with IDX lithium ion charger and refrain from charging with third party chargers. Please refer to the charger manual for charging method information.
- Estimated charging times may vary depending on the charger and condition of the battery. Refer to our website for more details.
- The ambient temperature range for charging is 32～104°F (0～40℃); however, 50～86°F(10～30℃) is recommended for optimizing the charging performance. When the battery is charged in temperatures 32°F(0℃) or below, it may not fully charge, even if the designated charge time has elapsed.
- Charging outside of the recommended temperature range can accelerate cell deterioration.
- Please use IDX D-Tap charger when charging the battery through the D-Tap2 connector.
- Lithium ion batteries have a slight self discharge; therefore, IDX recommends to charge prior to use.
- Can not be charged using with C-NP2E,C-VAL2E.

CAUTION The policy of IDX is to value safety above all other considerations and for this reason, the DUO batteries cannot be charged when the internal temperature of the batteries is below 32°F(0℃) or over 104°F(40℃). During use the internal temperature of all batteries rise. IDX monitor this temperature in the DUO batteries and if it is found to exceed 104°F(40℃) a protection circuit will trigger an error message on an IDX charger should charging be attempted whilst the battery is in this over temperature state. The error sign will cease once the battery is back within the correct temperature range and charging will resume.

* If the internal temperature of the battery below 32°F(0℃) or exceeds 104°F(40℃), when the battery capacity check button is pressed, the remaining capacity will be displayed with LEDs for 1 second. After that all LEDs will flash 2 times.

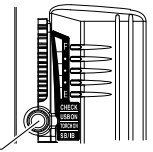
Reference time intervals for the internal temperature to drop below 104°F(40℃) following discharge. (Ambient Temperature : approx. 77°F(25℃))

DUO-C98		DUO-C150		DUO-C198	
Discharge load power	Approximate time	Discharge load power	Approximate time	Discharge load power	Approximate time
70W Discharge	20 Minutes	95W Discharge	20 Minutes	95W Discharge	25 Minutes
95W Discharge	35 Minutes	125W Discharge	35 Minutes	125W Discharge	50 Minutes
115W Discharge	45 Minutes	154W Discharge	45 Minutes	154W Discharge	60 Minutes

CAUTION The LED may not light up, if the battery is left without charging. In that case, the charger won't start charging the battery if the battery is attached, and the LED will blink. The charger will start charging and the LED will light up by putting on and taking off the battery twice over.

Capacity display LEDs

- When the check button is pressed, the LEDs will light for approximately 2.5 seconds.
- Remaining capacity is shown with five LEDs. This is displayed as 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% 90%, and 100%.



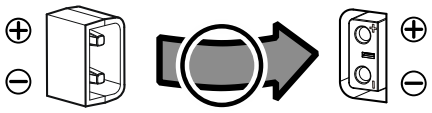
● : Solid / ☀ : Flashing

Capacity / Display	100% ～ 90%	89% ～ 80%	79% ～ 70%	69% ～ 60%	59% ～ 50%	49% ～ 40%	39% ～ 30%	29% ～ 20%	19% ～ 10%	9% ～ 0%
F	●	☀								
•	●	●	●	☀						
•	●	●	●	●	●	☀				
•	●	●	●	●	●	●	●	☀		
E	●	●	●	●	●	●	●	●	●	☀

D-Tap

- Two D-Taps power output terminals available.
- The maximum power output is 80W.
  *Upon usage, please make sure for the maximum discharge load value of the battery. Also please note that the maximum power output of the DUO-C98 is 70W at the temperature of 95～113°F (35～45℃).
- The output voltage is a battery through. (11～16.8V)
- Please do not use D-Tap connectors while charging the battery through the main connector. If you use D-Tap connectors while charging the battery through the main connector, it may cause a charging error or damage on the charger.
- D-Tap output can be used for IDX portable lights and monitors.
- You can charge the battery through the D-Tap2 connector only by using the IDX D-Tap charger. Please do not charge the battery through the D-Tap2 connector while charging the battery through the main connector. It may cause a charging error or damage on the charger.
- Please do not use the main, the D-Tap1 and the USB connectors while charging the battery through the D-Tap2 connector. It may cause a charging error or damage on the charger.

CAUTION Please make sure to check the ⊕ ⊖ polarity of D-Tap connector prior to plug-in.



Please confirm the shape of connector and ⊕ ⊖ polarity of plug side prior to connect with receptacle. Please do not force it when felt it is difficulty.

USB

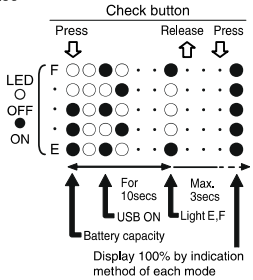
- USB connector for power supply. (DC5V / 2.3A)
- USB connector is A type. (USB Cable should be A type as well).
- To activate the USB power output, push and hold the CHECK / USB ON button for more than 3 seconds (see diagram to the right).
- USB power will turn off automatically 30 minute after the USB cable is removed.
- Do not draw power from USB while charging as it may interrupt charging, cause a charger error, or damage the charger.
- This terminal does not provide data, only power.

V-Torch (LED Light)

- Embeded LED (on rear side) will turn on the light by pressing the capacity check button two times in a row. Ten seconds later, the LED will automatically turn off the light.
- It can also turn off manually by pressing the button two times in a row while lighting.
- Please do not stare into the light directly while lighting.

IB Setting

- The SB communication function can be activated by pressing and holding the Battery capacity display LEDs check button. By activating the SB mode, the battery data can be read out from SMBus compliant equipment. Please refrain from using SB mode with equipment not compatible with SMBus protocol; Sudden power failure may occur due to communication failure.
- Configurable modes are the following two.
  ・SB mode : The battery can communicate with SMBus compliant equipment.
  ・IB mode : The battery can communicate with IDX's BMS compliant equipment through some data communication in it.
  ・The battery's default setting is in SB mode.
- Activating / Deactivating the SB mode (Activating / Deactivating the IB mode)
  ・ Press the Battery capacity display LEDs check button for more than10 seconds.
  ・ The top, middle, and bottom LEDs will briefly emit; the middle LED will turn off and the top and bottom (E and F) LEDs will remain lit for 3 seconds.
  ・ while the 2 LEDs (E and F) are emitting, release and press the button again.
  ・ When each mode is activated correctly, the LEDs will display 100%. If the LEDs do not display 100%, please restart the activation / deactivation process.
- SB mode and IB mode capacity display method
  The LED patterns will indicate the current mode.
  SB mode : the capacity display LEDs will light gradually from "E" to "F"
  IB mode : all of the capacity display LEDs will light simultaneously.
  (When the remaining capacity is 100%, 5 positions of LEDs will light simultaneously.)



Specifications

		DUO-C98	DUO-C150	DUO-C198
Cell chemistry		Li-ion		
Nominal voltage		DC 14.4V		
Capacity		6.6Ah / 96Wh *1	9.9Ah / 143Wh *1	13.2Ah / 191Wh *1
Charge voltage		DC 16.8V		
Charge current		Max 3.3A	Max 4.9A	Max 6.6A
Maximum discharge rate	≦77°F (25℃)	115W / 6.8A (16.8V) ≀ 10.5A (11V) *2	154W / 9.2A (16.8V) ≀ 14.0A (11V) *2	154W / 9.2A (16.8V) ≀ 14.0A (11V) *2
	≦95°F (35℃)	95W / 5.7A (16.8V) ≀ 8.6A (11V) *2	125W / 7.4A (16.8V) ≀ 11.4A (11V) *2	125W / 7.4A (16.8V) ≀ 11.4A (11V) *2
	≦113°F (45℃)	70W / 4.2A (16.8V) ≀ 6.4A (11V) *2	95W / 5.7A (16.8V) ≀ 8.6A (11V) *2	95W / 5.7A (16.8V) ≀ 8.6A (11V) *2
Maximum discharge current	≦77°F (25℃)	9.5A	12.4A	13.0A
	≦95°F (35℃)	7.5A	10.0A	10.0A
	≦113°F (45℃)	5.7A	7.8A	8.0A
D-Tap		Output voltage Battery through voltage (D-Tap1, D-Tap2)		
		Maximum load 80W / 4.8A (16.8V) ～ 7.3A (11V) (per D-Tap) *3		
USB		Output voltage DC 5.0V		
		Maximum current 2.3A		
		Connector type USB Type-A (Receptacles)		
		Auto power off 30 minutes after detection of less than 150mA		
End voltage		11V		
Battery protection circuit		Over-charge, Over-discharge, Over-current, Thermal protection		
Ambient temperature		Charge 32～104°F (0～40℃) (50～86°F (10～30℃) recommended)		
		Discharge -4～113°F (-20～45℃) (50～104°F (10～40℃) recommended)		
		Storage -4～122°F (-20～50℃) (less than 1 month)		
Dimensions	mm	97(W)×146(H)×39(D)	97(W)×146(H)×59(D)	97(W)×146(H)×59(D)
	Inches	3.82(W)×5.75(H)×1.54(D)	3.82(W)×5.75(H)×2.32(D)	3.82(W)×5.75(H)×2.32(D)
Weight	g	approx, 640	approx, 910	approx, 1,100
	lbs	approx, 1.41	approx, 2.00	approx, 2.42

*1. Measured capacity of battery is a minimum rating at 68°F(20℃).
*2. Maximum load is the sum of D-Tapx2, USB and Camera loads.
*3. The maximum power output of the DUO-C98 is 70W at the temperature of 95～113°F (35～45℃).

Storing

- Store in cool and dry conditions.
- Do not store or leave in temperatures of 122°F(50℃) or above.
- For long-term storage, please store with about 30～40% of capacity (with 2 LEDs) and recommend for re-charging every five months.
- Deterioration of battery performance will be accelerated when the battery stored in a high ambient temperature and/or stored for long period without used.

Life cycle

- Life may vary depending on frequency of use, storage and operational temperature environment.
- Life will be reduced if frequently used with high load applications.
- Life is also reduced if stored in fully charged and/or empty conditions for extended periods.

Compensation for recorded content

Recorded content cannot be compensated for if recording or playback is disabled due to a malfunction of the battery pack or other devices.

Battery recycle

This Li-ion battery can be recycled. Please follow the regulations in your country or contact your local IDX office for further details.

Li-ion Battery Air transport Compliance

The Air transport regulations for the lithium-ion batteries will be revised regularly, so please check our website before transporting the battery.
(http://idxtek.com/lithium-ion-transportation/)

EU only

Design and specifications are subject to change without notice.

Manufacturer : **IDX Company,Ltd.** 6-28-11 Shukugawara, Tama-ku, Kawasaki-shi, Kanagawa-ken, 214-0021 Japan
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Importer for EU : **IDX Technology Europe,Ltd.** Unit 9, Langley Park, Waterside Drive, Langley, Berkshire SL3 6AD, England
Tel : +44-1753-547692 Fax : +44-1753-546660 URL : http://www.idx-europe.co.uk/ E-mail : idx.europe@idx.tv
Importer for USA : **IDX System Technology, Inc.** 2377 Crenshaw Blvd, Suite 160, Torrance CA 90501 USA
Tel : +1-310-328-2850 Fax : +1-310-328-8202 URL : http://www.idxtek.com/ E-mail : idx.usa@idx.tv

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Appendix B: Battery Instruction Manual for Model No. NW-UVC-040 (CORE NEO-150) and Model No. NW-UVC-040-US (CORE NEO-150S)

Providing the power to create.

NEO150S/AG
Battery Pack
Instructional Manual

THIS BATTERY SHIPS IN STORAGE MODE.

Press the LED button to awaken the battery pack. You may also charge the battery pack full to awaken. Keep in mind some 3rd party chargers will not charge the pack when in storage mode. If the battery is in storage mode(LCD blank), the battery pack is functional, but no smart data transmission will occur.

Introduction:

Thank you for your choice in purchasing a Core SWX battery pack. The battery is designed to improve and assist you in your mobile powering requirements. This product is at the pinnacle of technological advancements, offering the features and performance of several different products, making it the most advanced battery product in the industry.

Please read this manual to help you understand and capitalize on the features of this battery.

Features:

- RunTime LCD
- On-Board Microprocessor stores: Name, Serial Number, Voltage, Temperature, Current, Chemistry Type, Charge Cycles, and Date of Manufacturing.
- The Viewfinder Capacity Display communicates with the camera to display your remaining battery capacity in your camera's viewfinder. This includes Sony, BMD and RED DSMC2 models.
- Four Stage, accurate, LED power gauge.
- No memory effect.
- Temperature, current, and voltage protection.
- Rubberized casing provides a shock absorbing, non-slip shell to protect the battery pack.
- Incorporated ptap/dtap provides unregulated power(11v-16.8v), as well as a 5v USB. The USB can also be used as a firmware update port.

*contact Core SWX for confirmation of battery charger compatibility if using other chargers.

Operation:

1. ***Charging the Battery:***
    - CoreSWX HC batteries were designed to be used with CoreSWX chargers. Any other charger may damage the battery and/or the charger. Please contact us before using other chargers.
    - CoreSWX batteries can be recharged in any charge condition.

- Charge the battery in ambient temperature range of 0 °C and 45 °C. For best results charge in an environment between 10°C and 35°C. Charging in conditions outside the aforementioned ranges may inhibit the pack from reaching maximum charge capacity.

2. ***Discharging the battery:***

• Maximum continuous discharge for the is 12A(144W) with a 10second peak discharge rate of 16A(192W)

• The LCD automatically switches between 3 different phases; Normal RT(based on default 30wh draw), Remaining RT(based on actual draw, when in use), and Remaining Charge Time(when connected to a charger).

• Press the side LED button for 1 second to activate the backlight feature.

• During operation, the battery samples the current entering or exiting the battery in 7 second intervals. During the charging process, the charge current fluctuates, causing the Charge Time readings to vary.

LED Indication Guide:

Remaining	***LED1***	***LED2***	***LED3***	***LED4***
0%	Off	Off	Off	Off
less than 10%	Blinking	Off	Off	Off
10-25%	On	Off	Off	Off
26-50%	On	On	Off	Off
51-75%	On	On	On	Off
76-100%	On	On	On	On

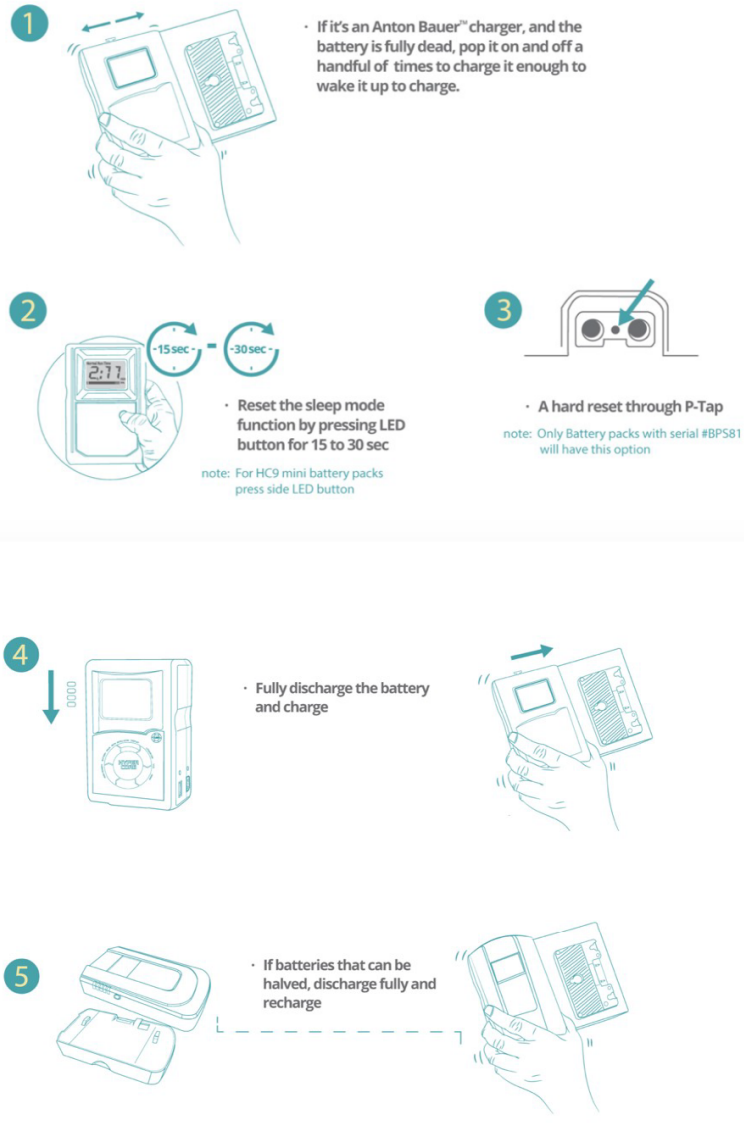
Overtime the RunTime LCD and power gauge's accuracy is dependent upon a full charge and discharge. At least once every 2 months the battery should be fully cycled(discharged and echarged) so the battery can relearn the capacity of the battery.

Battery Storage:

In the event the battery pack won't be used for an extended period of time, store the battery pack at 40% charged in an environment between 10°C and 35°C. Every two months the battery pack should be fully cycled to reduce the change of self discharge and capacity loss.

Reset/restore Function:

In the event the battery shuts down, it is possible the battery pack's protection internal circuitry was activated. To restore the pack, following the steps below:



Firmware Update Function:

The packs are equipped with a USB port which serves as an 5v output (for charging/powering devices) as well as a firmware update port. In the event of a firmware update, connect a USBA-USBA cable to the battery pack, and a PC or MAC. Once connected, you will see the LED on the bottom of the pack flash RED and GREEN. A folder will present on your Desktop and drag/drop the updated firmware packet into the folder. Firmware updates will take up to 30 seconds, but best to wait 1 minute prior to disconnecting the pack from the computing device. To disconnect, drag the firmware update folder into the Recycle bin, similar to disconnecting a Flash Drive. It is then safe to disconnect the pack from the computing device.

Notes on Use:

- An increase in temperature is normal during charging and discharging.
- Make sure to keep battery contacts clean.
- Do not attempt to disassemble the battery. Please contact Core SWX for any service issues.
- Keep batteries separated when transporting.
- Keep battery pack dry and avoid use in humid environments.

NEO150S and NEO150AG Air Transport Compliance

The battery pack models listed above are suitable for air transport as a non-hazardous article under the regulations of the IATA, the ICAO, and the UN. According to IATA regulations, Lithium-ion batteries may not be checked into the hold of a passenger aircraft, however, the Neo150 battery pack may be taken on-board in your carry-on baggage subject to the prior approval of your airline. Check with your airline's rules for specific limitations. Spare batteries should be individually protected to prevent the possibility of short circuits.

Specification Data:

NEO150S: V-mount Connection
NEO150AG: 3-Stud Mount Connection

Capacity: 147Wh(14.8v, 9.9Ah)
Size: 3.54” x 4.65” x 2.38”
Weight: 1.955lbs.
Normal Runtime: (25w) 5.9hrs.
Load: 16A peak/12A continuous

Warranty:

This product is warranted to the Original Purchaser against all defects in material and or workmanship for the period herein.

The warranty period shall be, 2 years for parts and labor, unless otherwise noted. Core SWX agrees to pay equal return freight costs to return the product the same method it was received. In the event of an issue, purchaser agrees to the below RMA procedure.

Procedure:

1. Go to http://www.coreswx.com/repairsreturns and fill out the online form
2. Print the RMA number confirmation, and ship the product needing service to Core SWX, LLC. along with RMA number confirmation, and copy of bill of sale.
3. All shipments must be done either through UPS or FEDEX, and insured if necessary
4. Core SWX, LLC. is not responsible for any lost shipments.

Core SWX reserves the right to repair or replace any defective product under warranty after Core SWX determines which is more practical.

If Core SWX receives defective product for warranty repair and they are found to be defective as a result of misuse or other damage, not caused by normal wear and tear, Core SWX will notify the customer of an estimate of repair. Customer will incur costs. There are no further warranties, either expressed or implied, including warranties of merchantability or fitness for a particular purpose that has any bearing upon this transaction.

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Appendix C: Battery Charger Instruction Manual for Model No. NW-UVC-020 (IDX VL-DT1)

VL-DT1
D-Tap Advanced Battery Charger

Instruction Manual

Thank you for purchasing the VL-DT1. The VL-DT1 is designed to charge Lithium Ion batteries equipped with D-Tap Advanced. Prior to using the charger, IDX recommends to read this Instruction Manual and keep this manual for future reference.

⚠WARNING

May cause sudden serious injury and death

- Do not connect to an AC power source that exceeds the voltage specification stated on the unit.
- Use only with the compatible batteries listed in this manual.
- Do not short the contact pins with any metal object.
- Do not carry or store with metal equipment.
- Do not immerse in water.
- Do not attempt to open the outer casing or break apart.
- Do not subject the unit to extreme physical impact or pressure, or place any object across the terminals that could cause it to short.
- Do not attempt to use if damaged.
- Protect the power cord from any damage.

⚠CAUTION

May cause injury or damage other equipment

- The unit should be used under the conditions listed in this manual.
- Do not expose the unit to extremely high temperatures.
- Use the approved power cord / appliance connector / plug conforming to the proper ratings (voltage, ampere) and safety regulations of each country if applicable.
- Keep the unit away form excessively dry or humid environments.
- Stop charging immediately if the charging does not complete within the designated time.
- In case of abnormal smell , leak , color change or case deformity during use, turn the power off and unplug the cable from the socket to avoid possible injury.
- Do not carry the charger while the battery is attached.
- Do not charge the battery while the battery is used with equipments.
- Do not charge the battery while the battery is charged from other charger.

Specifications

- Recommended batteries : IDX Lithium Ion batteries equipped with D-Tap Advanced
- Input voltage : AC100V-240V 50 / 60Hz Automatic
- Rated output : DC16.8V/2A
- Power consumption : MAX 90VA
- Charging method : Constant current / Constant voltage
- Operating temperature : 0 ~ 40˚C / 32 ~104˚F
- Operating humidity : 20% ~ 90% RH
- Safety Features : Temperature protection / Over-current protection / Short-circuit protection / Reverse polarity protection / Charge protection timer
- Indication : Status LED Indicator (RED / GREEN)
- Dimensions : Charger approx. 110(W)×33.5 (H)×62 (D)mm
  4.3(W)×1.3 (H)×2.44 (D)inches
  Charging cable length 0.8m / 31.5 inches
- Weight : Charger body approx. 230g / 0.5 lbs
- Charge time standard :
  For the latest charging time information, please visit our website (http://idxtek.com/charge-chart)

Features

- IDX Lithium Ion batteries equipped with D-Tap Advanced can be charged.
- Auto safety & protection features

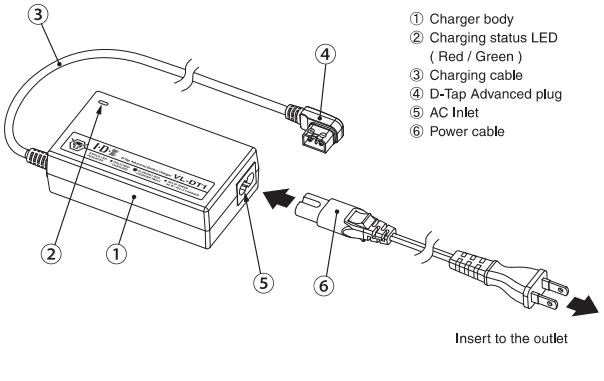
＊ D-Tap Advanced is a 3 pin connector that enables charging.

Status LED Indicator

LED indicator states

LED	Indication	Status
Solid Red	●	Charge in progress
Flashing Red	✹	Battery abnormal temperature/ Charger fault
Solid Green	●	AC is plugged in / Fully Charged
Light Off	○	No power

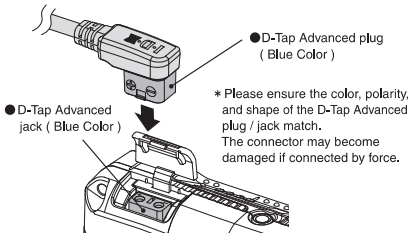
Operating Instructions / Location and Function of Parts



① Charger body
② Charging status LED (Red / Green)
③ Charging cable
④ D-Tap Advanced plug
⑤ AC Inlet
⑥ Power cable

1 : Insert a plug into the battery equipped with D-Tap Advanced connector, and start charging.
※Please be sure to check the LED shows RED.
It might be a battery fault/full charge if the LED continuously flashing Green.

2 : Charging will complete when the charger detects the battery is fully charged.
※The charger won't start charging if the charger detects abnormal.
※The charger won't start charging if the battery's temperature is extremely high/low.
Please be sure to bring a battery back to normal temperature before charging it.



Manufacturer : **IDX Company,Ltd.** 6-28-11 Shukugawara, Tama-ku, Kawasaki-shi, Kanagawa-ken, 214-0021 Japan
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Importer for EU : **IDX Technology Europe,Ltd.** Unit 9, Langley Park, Waterside Drive, Langley, Berkshire SL3 6AD, England
Tel : +44-1753-547692 Fax : +44-1753-546660 E-mail : idx.europe@idx.tv
Importer for USA : **IDX System Technology, Inc.** 19001 Harborgate Way, Suite 105, Torrance, CA 90501 USA
Tel : +1-310-328-2850 Fax : +1-310-328-8202 E-mail : idx.usa@idx.tv

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＊ Design and specifications are subject to change without notice.

Appendix D: Battery Charger Instruction Manual for Model No. NW-UVC-020 (CORE DSS48-16PB)

Providing the power to create.

DSS48-16PB
Ptap Charger
Instructional Manual

Introduction:

Thank you for your choice in purchasing a Core SWX DSS48-16PB Ptap Battery Charger. The charger is designed to improve and assist you in your battery charging requirements. Please read this manual to help you understand and capitalize on the features of this charger.

Please read this manual to help you understand and capitalize on the features of this battery.

Features:

- Safely charges one Core SWX battery pack through the pack's ptap port.
- Rugged, sleekly styled, high impact molded charger chassis.
- Automatic Universal AC input(100-240VAC) for world-wide use.
- Automatic detection of damaged or misused batteries for
- added safety.
  *contact Core SWX for confirmation of battery charger compatibility if you intend to charge other battery packs.

Charging Operation:

- Insert the AC power cord into the AC receptacle in the back of the charger.
- Plug the charger into AC power mains.
- Connect the charger ptap cable to the battery pack.
- At this time the LED light on the charger will turn red when charging.
- The charging will turn solid green when the the battery is fully charged.

Notes On Use:

- While operating the charger do not place anything on the charger or impede heat dissipation.
- An increase in temperature is normal during charging.
- Make sure to firmly insert AC cable into the charger and that the contacts are clean.
- The product must be grounded.
- Do not attempt to disassemble the charger, please contact Core SWX for any service issues.
- Do not operate this device near equipment susceptible to noise(i.e. TV).

Specification Data:

Part# DSS48-16PB

Quick Charge Current: 2.8A
Input Voltage: auto AC 100~240V 50/60Hz
Charge time: 2.4hrs. (98w battery)
Dimensions: 4.46"(W) x 2.1" (H) x 1.22" (D) *excludes charger cabling.
Weight: 0.4 lbs.

Warranty:

This product is warranted to the Original Purchaser against all defects in material and or workmanship for the period herein.

The warranty period shall be, 3 years for parts and labor, unless otherwise noted. Core SWX agrees to pay equal return freight costs to return the product the same method it was received. In the event of an issue, purchaser agrees to the below RMA procedure.

Procedure:

1. Go to http://www.coreswx.com and to the the support section to fill out the online RMA form.
2. Print the RMA number confirmation, and ship the product needing service to Core SWX, LLC. along with RMA number confirmation, and copy of bill of sale.
3. All shipments must be done either through UPS or FEDEX, and insured if necessary
4. Core SWX, LLC. is not responsible for any lost shipments.

Core SWX reserves the right to repair or replace any defective product under warranty after Core SWX determines which is more practical.

If Core SWX receives defective product for warranty repair and they are found to be defective as a result of misuse or other damage, not caused by normal wear and tear, Core SWX will notify the customer of an estimate of repair. Customer will incur costs. There are no further warranties, either expressed or implied, including warranties of merchantability or fitness for a particular purpose that has any bearing upon this transaction.

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Appendix E: Battery Charger Instruction Manual for Model No. NW-UVC-020-US (CORE GPM-X2S)

Specifications:

GPM-X2 Series, 2-Channel Simultaneous Charger

Quick Charge Current: 1.5A Simultaneous
Size: 4.5" x 5.5" x 3"
Weight: 1.0 lbs.
Input Voltage: 90-240VAC 50/60Hz

CORE SWX
Providing the power to create.

GPM-X2 Series
Brick Battery Charger
INSTRUCTION MANUAL

Warranty:

This product is warranted to the Original Purchaser against all defects in material and or workmanship for the period herein.

The warranty period shall be, 3 years for parts and labor, unless otherwise noted. Core SWX agrees to pay equal return freight costs to return the product the same method it was received. In the event of an issue, purchaser agrees to the below RMA procedure.

Procedure:
1. Go to http://www.coreswx.com/repairsreturns and fill out the online form
2. Print the RMA number confirmation, and ship the product needing service to Core SWX, LLC. along with RMA number confirmation, and copy of bill of sale.
3. All shipments must be done either through UPS or FEDEX, and insured if necessary
4. Core SWX, LLC. is not responsible for any lost shipments.

Core SWX reserves the right to repair or replace any defective product under warranty after Core SWX determines which is more practical.

If Core SWX receives defective product for warranty repair and they are found to be defective as a result of misuse or other damage, not caused by normal wear and tear, Core SWX will notify the customer of an estimate of repair. Customer will incur costs. There are no further warranties, either expressed or implied, including warranties of merchantability or fitness for a particular purpose that has any bearing upon this transaction.

Core SWX
91B Commercial st
Plainview, NY 11803

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Thank you for your choice in purchasing a Core SWX style battery charger. The charger is designed to improve and assist you in your battery charging requirements.

Please read this manual to help you understand and capitalize on the features of this charger.

Features:

- This charge is designed for Li-Ion packs solely. When charging two packs, the charger will charge simultaneously at 1.5A per hour charge rate. 98wh packs will charge in approximately 4hours.
- Rugged, sleekly styled, compact charger chassis.
- Automatic Universal AC input for world-wide use.
- Automatic detection of damaged or misused batteries for added safety.

Charging Operation:

- Insert the AC power cord into the AC receptacle in the back of the charger.
- Connect all batteries needing charge into the charger.
- Turn the rear panel power switch to the ON position. At this time the switch will light and the LED lights on the front panel of the charger will blink green when charging.
- If the battery does not meet quick charging conditions(i.e. temperature or deeply discharged) the charger will precharge the battery and go into a trickle charge mode until it is safe to enter quick charge mode.
- The LED corresponding with the charging bay will turn solid green when the battery is fully charged.

Notes On Use:

- While operating the charger do not place anything on the charger or block the ventilation slots.
- An increase in temperature is normal during charging.
- Make sure to firmly connect batteries to the charger mounts and that the contacts are clean.
- The product must be earthed.
- Do not attempt to disassemble the charger, please contact CoreSWX for any service issues.
- The fuse within the AC receptacle can be replaced only with one of the same type and rating. (A spare fuse is included for your convenience)
- Do not operate this device near equipment susceptible to noise(i.e. TV).

Compatibility outside of Core SWX battery packs

- For V-mount, this charger will charge most V-mount, Lithium Ion packs on the market.
- For 3-Stud, this charger will only charge Core SWX packs.

