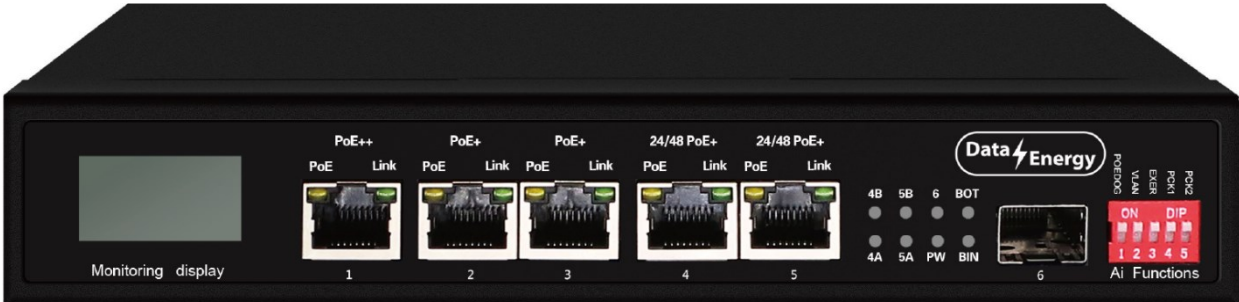


Network Switch Product Guide

NW 500

5 Port unmanaged GB PoE Solar switch + 1 SFP & 15A MPPT

Ver. 2A. - Jan 2023





Caution

Please carefully study this manual before using the equipment.

- **Risk of electrical shock**, all electrical work must be done by certified technicians with electrical knowledge. All work done must be done in accordance with local or international standards.
- Ensure that the product is installed in a clean & safe environment, free from any metallic surfaces or debris that **can cause short-circuits**.
- **Make use of insulated tools** when wiring the power terminals and remove any jewellery that might come into contact with the equipment.
- **Ensure all connections are secured & isolated** in the connector terminal, ensure no loose connections before switching on the product.
- **High Current Warning**, the battery charge and discharge current can reach dangerous levels, proceed with caution when connecting or disconnecting batteries, ensure that the switch is in the off state when connecting or disconnecting power sources.
- If the product is faulty, **do not attempt any repairs** as there are no serviceable parts.
- You will need a basic **understanding of Photovoltaics** to install this product.

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1. PRODUCT INTRODUCTION

The NW500 is a 5 port gigabit PoE solar switch integrating solar power generation, intelligent PoE functionality & automatic charge and discharge control. The switch is designed for remote or off-site network applications where traditional power supply is limited or inconsistent. The built-in MPPT charge controller uses the latest algorithms to achieve the most efficient charging method.

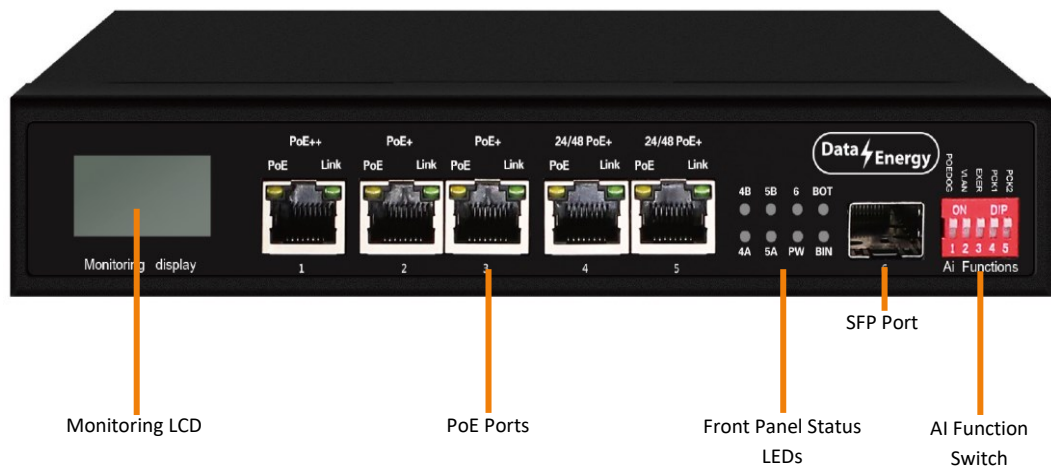
1.2 KEY FEATURES

- Integrated 15A advanced MPPT (Maximum power point tracking)
- SLA & Lithium battery support, LiFePO4 Type 1 & 2
- 12V / 24V System voltage
- Advanced PoE support, BT on 1 port, PoE+ & Auto PoE
- AI functions via dipswitch
- Full gigabit support with 12Gbps non-blocking backplane bandwidth
- Monitoring LCD for power information

1.3 SPECIFICATIONS

Model	NW500
Full Description	5 Port Gigabit POE + 1 Port SFP Switch with Integrated 15Amp MPPT Solar Charge Controller
Ports	Port 1: 10/100/1000Base-TX 60W HiPoE Port 2 & 3: 10/100/1000Base-TX 30W PoE+ Port 4 & 5: 10/100/1000Base-TX Auto 24V/48V PoE SFP Port: 1000Mbps 10/100/1000BaseT(x) Automatic Detection, Full / Half duplex MDI/MDI-X Adaptive
PoE Budget	120W
Lightning Protection	3kV , 8/20us
AI Function (Front Dip Switch)	PDOG: PoE watchdog, VLAN: Port Disconnect, EXER: Long distance PoE switch; PCK: PoE Output Selection
Solar Function (Rear Dip Switch)	Voltage & Battery Selection 12V / 24V Support
Network Protocol	IEEE 802.3, IEEE 802.3i 10Base-T, IEEE 802.3u 100Base-TX, IEEE 802.3ab 1000Base-T IEEE 802.3x, IEEE 802.3z 1000Base-X, IEEE 802.3af/at/PoE++ & AI PSE
Bandwidth (Backplane) & Mode	12Gbps (Non Blocking) Store & Forward (Full Line Speed)
Packet Forwarding	8.64MPPS
MAC Table	2K
Operating & Storage Conditions	-20~+65°C, 10%~90% RH non-condensing -40~+70°C, 5%~90% RH non-condensing
Dimensions	158mm(L), 142mm(W), 35mm(H)
Weight	1.1KG - 1.2KG with Mounting Brackets
Ingress Protection	IP30
Warranty	12 Months

2.FRONT PANEL



2.1 MONITORING LCD



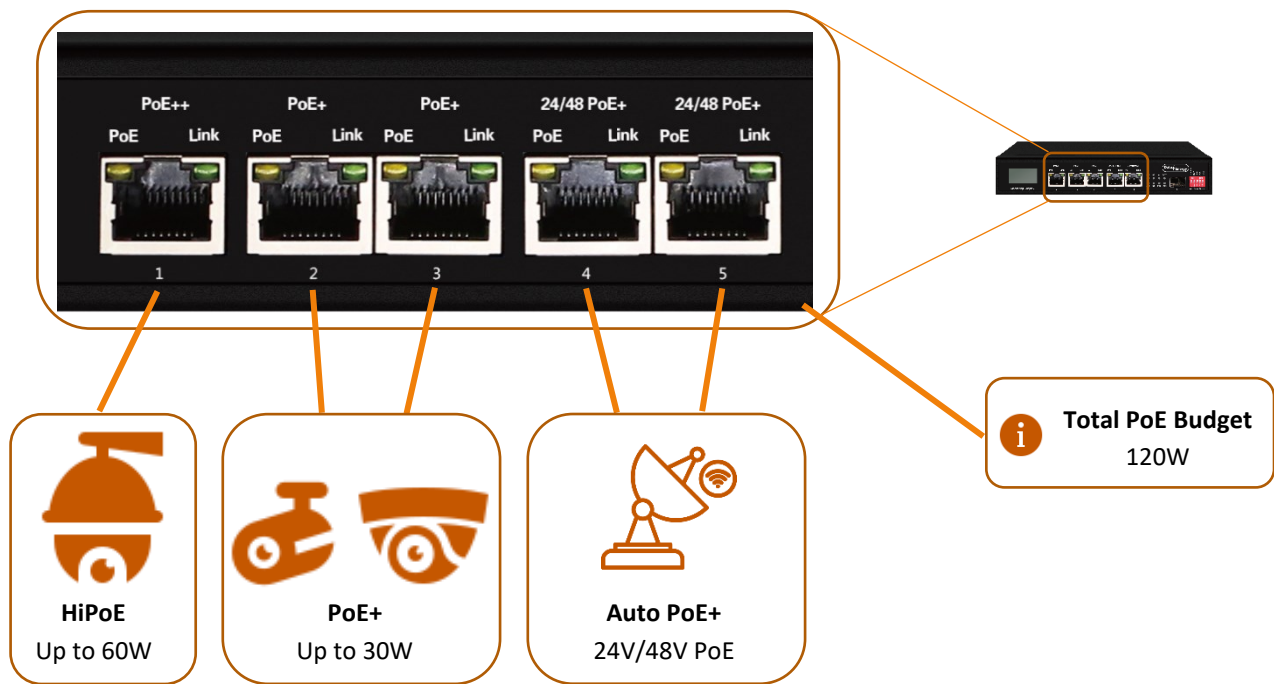
The LCD on the front panel of the switch displays the information relating to the solar charge controller. The following information will be displayed:

- Boot-up information / Solar controller starting procedure
- State of charge
- Battery information, voltage & estimated capacity in percentage
- Total active Load
- Solar input information, voltage, current & total generation



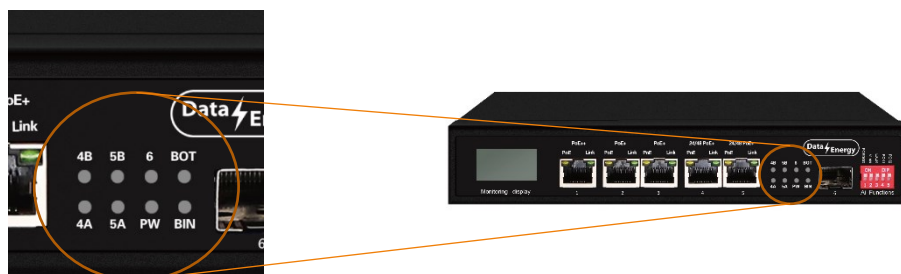
The information on the LCD cannot be customised.

2.2 POE PORTS



The NW500 supports 5 10/100/1000Mbps ethernet RJ45 ports, Port 1 supports HiPoE or PoE++ up to a maximum of 60W load. Port 2 & 3 supports standard PoE+ with a maximum load of 30W per port, and port 4 & 5 supports Auto PoE+, auto voltage sensing 24V or 48V passive PoE, 30W maximum load per port. The combined maximum PoE budget of the NW500 is 120W.

2.3 FRONT PANEL STATUS LEDs



The 8 LED indicators on the front panel indicates various operating information that is not displayed on the LCD, the LED status definitions are:

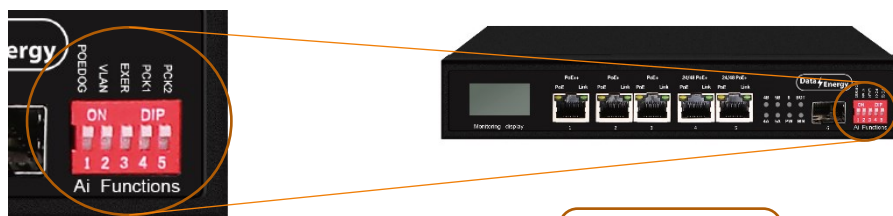
4B	Port 4 24V PoE Indicator	ON : 24V PoE Active	Off : 24V PoE not active
4A	Port 4 48V PoE Indicator	ON : 48V PoE Active	Off : 48V PoE not active
5B	Port 5 24V PoE Indicator	ON : 24V PoE Active	Off : 24V PoE not active
5A	Port 5 48V PoE Indicator	ON : 48V PoE Active	Off : 48V PoE not active
6	SFP Port Indicator	ON : SFP Port Active	Off : SFP Port not active
PW	Power Indicator	ON : Switch Powered On	Off : Switch powered Off
BOT	Discharge Indicator	ON : Battery Remaining Capacity is more than 85%	Off : Normal Discharge
		Flashing : Battery Remaining Capacity is less than 85%	
BIN	Charging Indicator	ON : Charging Active	Off : Charging Inactive or complete
		Flashing : Charging almost complete, capacity greater than 98%	

2.4 SFP PORT



Port 6 of the NW500 is a small form-factor pluggable (SFP) port, the SFP interface is a modular slot for a media-specific transceiver to connect a fiber-optic or copper cable. Most standard SFP modules are supported, with a maximum transmission rate of 1000Mbps. Port 6 operate independently from the rest of the ports on the switch.

2.5 AI FUNCTION SWITCH



i Up = On
Down = Off

The table below lists the dip-switch functions:

1	PDOG	PoE Watchdog	Switch Position ON to Activate
2	VLAN	Port Division	Switch Position ON to Activate
3	EXER	Long Distance PoE	Switch Position ON to Activate
4	PCK1	24V Passive PoE Forced Output on Port 4	Switch Position ON to Force 24V, OFF for Auto PoE
5	PCK2	24V Passive PoE Forced Output on Port 5	Switch Position ON to Force 24V, OFF for Auto PoE

PoE Watchdog – this function monitors communication on the PoE ports, if there is no communication, the corresponding PoE port will automatically restart, this will then restart the connected device to restore network communication. When using PoE splitters for external power sources, please turn off this function.

VLAN Port Division – the manual VLAN function isolate ports to suppress network broadcast storms, this also greatly improves port cache utilization and overall network performance. When VLAN is enabled, port 5 will be the designated uplink port.

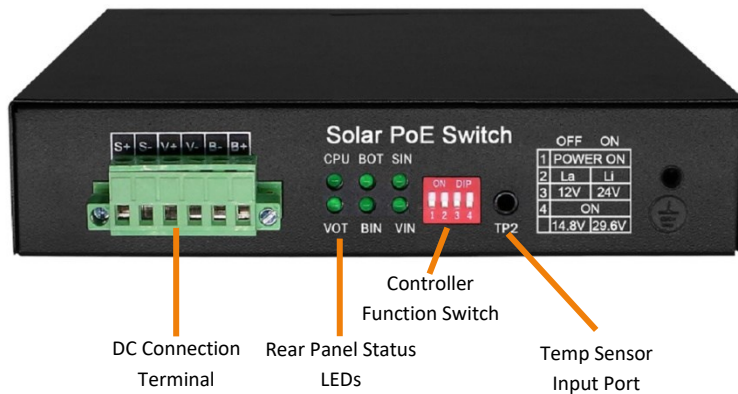
Long Distance PoE – increases the network communication & PoE power supply distance to a maximum of 250 meters distance.

24V PoE Switch – PCK1 & PCK2 controls the output voltage of the PoE supply on Port 4 & 5 respectively. Most 24V passive PoE devices will be auto detected by the switch and the switch will supply the correct PoE voltage based on the device requirements, however, should the detection fail, the PCK switch can force a 24V output.



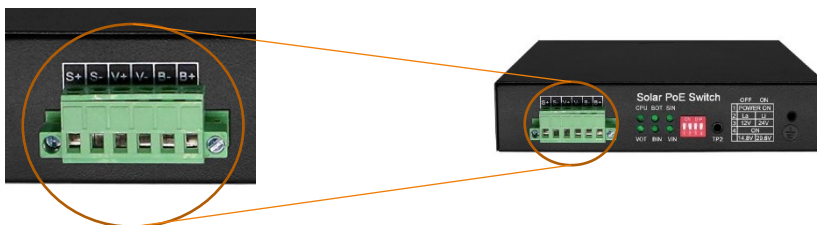
Using the EXER long distance PoE function will decrease the transmission rate.

3. REAR PANEL



DC Connection Terminal Rear Panel Status LEDs Controller Function Switch Temp Sensor Input Port

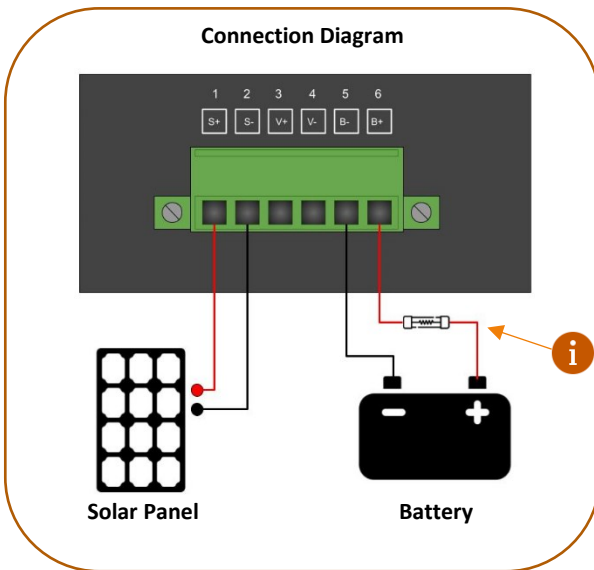
3.1 DC CONNECTION TERMINAL



S+	Solar Positive Input
S-	Solar Negative Input
V+	Secondary Solar Positive Input
V-	Secondary Solar Negative Input
B+	Battery Positive Connection
B-	Battery Negative Connection

Caution

Please verify solar input voltage
Solar Input Voltage range 15-57V
DO NOT EXCEED 57V



The connection sequence should always be battery first, then solar. Ensure the device is powered off when connecting battery or solar terminals. Terminal 3 & 4 is typically not used. For high load configuration, these terminals can serve as a secondary solar input. The recommended cable size 14AWG or 2.5mm².

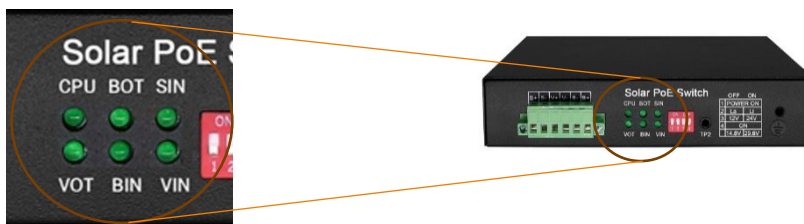


Always install a protection fuse on the positive lead of the battery, 15A recommended.



S+ and V+ are connected in parallel, and S- and V- are connected in parallel.

3.2 REAR PANEL STATUS LEDs



The 6 LED indicators on the rear panel indicates the solar controller operating information, the LED status definitions are:

CPU	System Operation Indicator	ON : Controller Normal Off : Incorrect Start-up
VOT	Output Voltage Indicator	ON : Output Normal Off : Output Abnormal
BOT	Discharge Indicator	ON : Battery Discharging Off : Discharging Stopped / Charging Active Flashing : Battery Capacity Less Than 15%
BIN	Charging Indicator	ON : Charging Active Off : Charging Inactive or complete Flashing : Charging almost complete, capacity greater than 98%
SIN	Solar Input Indicator	ON : Solar Input Normal Off : Solar Not Connected Flashing : 1 flash every 2 sec indicates Delayed Input (10 Minutes) 1 flash every 4 sec indicates Input Voltage Abnormal
VIN	Not in Use	---

3.3 CONTROLLER FUNCTION SWITCH



The solar controller function switch located on the rear panel is used to operate the controller as well as setting up the battery type and voltage. When setting the system voltage or battery type, please ensure that the device is switched off.



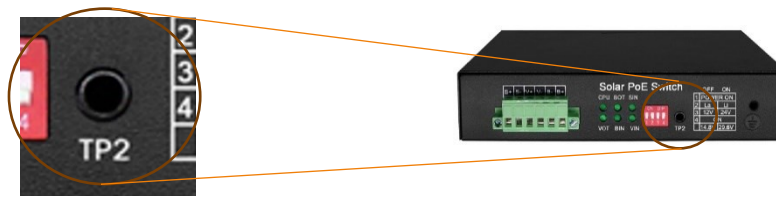
Pay attention when working with the function switch, incorrect settings will damage equipment.

The below table explains the dip-switch functions:

1	Controller Power Switch	On: Power On	Off: Power Off
2	Battery Type Selector	On: Lithium	Off: Lead-Acid
3	System Voltage Selector	On: 24V Mode	Off: 12V Mode
4	Lithium Type Selector	On: Lithium Type 1 (*4 Cell)	Off: Lithium Type 2 (*3 Cell)

**Lithium Type Selector: Type 1 = 14.8V / 29.6V & Type 2 = 12.6V / 25.2V*

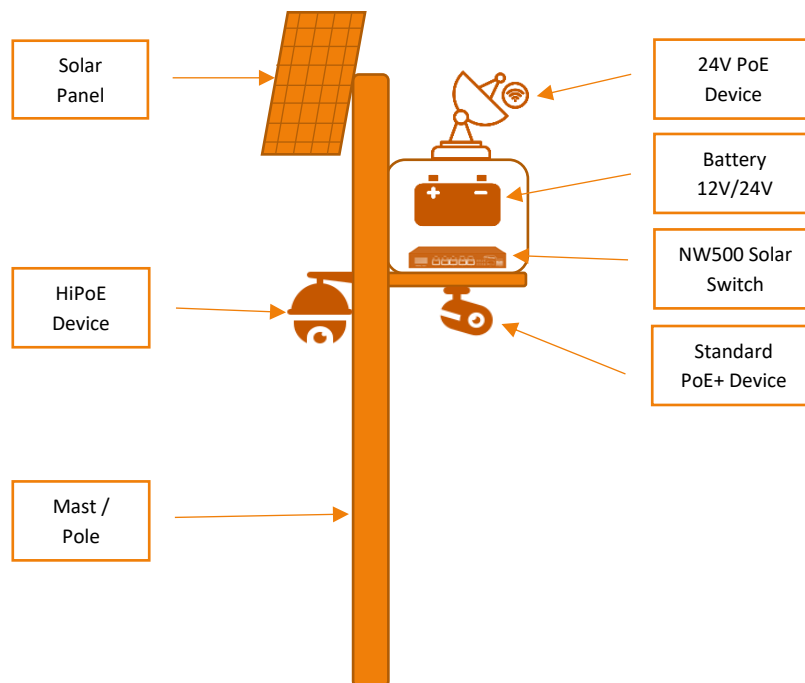
3.4 TEMPERATURE SENSOR INPUT



The TP2 Temperature input jack is used to connect a 3.5mm TRRS plugged temperature probe, this is used to monitor battery temperature which will then apply the appropriate charging algorithm. Using LiFePO4 batteries will not require this input as the batteries are not that susceptible to fluctuating temperatures. By the way, thank you for taking the time to read this manual, you have covered quite a bit, keep it up, almost done.

4. BASIC APPLICATION DIAGRAM

The NW500 Switch is designed for “Off-Grid” PoE requirements, the below diagram illustrates the basic application scenario.



Always install the NW500 in an environment that will not exceed the maximum operating conditions. Vented cabinets / enclosures will prolong the equipment lifespan. Maintain a minimum Ingress protection of IP55 when using cabinets / enclosures in an outdoor environment.

5. PV & BATTERY SIZING

When designing off-grid solutions, the size of the solar panel & battery is vital to the success of the solution. There are many factors to keep in mind as every application will have different variables to consider. The combined power load current & no sun runtime are the 2 most basic requirements to determine the required battery capacity & solar panel size.

5.1 TOTAL LOAD CONSUMPTION CALCULATION

The combined power load current is calculated by adding the power consumption of all the connected PoE devices together, most vendors will stipulate the maximum power consumption of the device in the equipment datasheet. The values are typically based on the maximum consumption, actual and average consumption might be very different. For accurate load calculation, use a PoE tester under the various operating conditions, keep in mind that night-time consumption might be different to the day-time consumption, and the same applies for different weather conditions.



The NW500 self-consumption is less than 3W.

Calculation Example:

Device 1: Speed Dome Camera

Tested consumption: 16.5W (the peak consumption might only be achieved when the internal speaker is activated, or when the device is in patrolling mode).

Device 2: Static Bullet Camera

Tested consumption: 7.2W (night-time consumption is higher due to the activation of IR illumination lights).

Device 3: CPE Radio Link

Tested consumption: 5W

Total Load Consumption:

$$\underline{16.5W \text{ (device 1)} + 7.2W \text{ (device 2)} + 5W \text{ (device 3)} + 3W \text{ (NW500)} = 28.7W}$$

5.2 NO-SUN RUNTIME CALCULATION

The no-sun runtime is used to determine the required battery capacity, this will greatly vary depending on the location and site conditions. As a general recommendation, the required runtime should be based on a minimum of 24 hours.

The example below is based on the Total Load Consumption as per the example used in 5.1.

Calculation Example:

Total Load Consumption times by 24 Hours:

$$\underline{28.7W \times 24h = 688.8Wh}$$



Battery Capacity is measured in Wh (Watt-hours) or Ah (Amp-hours)

5.3 BATTERY SIZING CALCULATION

Batteries perform very different based on type of battery, but also based on the environment & operating conditions. The 2 main supported battery types are Lead Acid & Lithium batteries. In terms of general performance, lifespan and overall environmental impact, Lithium based batteries like LiFePO4 are by far more superior compared to lead-acid equivalents.

The depth of discharge (DOD) will determine the useable energy in the battery. Most Lithium based batteries will support a DOD rate of 80% or more, meaning that the battery can be discharged to a level of 20% remaining capacity.

Another important factor to consider when sizing batteries, are the charging and discharging specifications. With LiFePO4 batteries this value is usually represented by the C-Rate, the rate at which level the battery is providing energy. A 0.5C rate means that the battery is fully charged or discharged within 2 hours.

The below example is based on the example value used in 5.2, and based on a LiFePO4 battery:

Calculation Example:

Required Capacity divide by 80% DOD:

$$688.8Wh \div 80\% = 861Wh$$

To convert the value to Amp Hour the total energy is divided by the voltage:

$$861Wh \div 12V = 71.75Ah$$

5.4 SOLAR PANEL SIZING CALCULATOR

The size of the solar panel required is based on the battery used and total load consumption. The NW500 will use all the available PV energy to first power the connected combined load and secondly to charge the battery if needed. When sizing the PV panel, it is recommended not to use the exact amount of available sun hours but rather the average. Area specific solar radiation information are available on <https://globalsolaratlas.info>. The tilt and direction of the installed PV panel will also determine the actual generated power.

The total required PV power will therefore be the combined value of 1. The total connected load & 2. Energy required to charge the battery with the average available sun hours.

The below example is based on the values used in 5.1 & 5.3 and assume 6 hours of useable sun radiation.

Calculation Example:

Total connected load + Charging requirement:

$$28.7W + (861W \div 6) = 172.2Wp$$

This total Wp value does not account for conversion & efficiency losses, it is recommended to allow for a minimum of 15% for PV energy losses.

5.5 PV & BATTERY SIZING TABLE

The table below is a basic suggestion and for guidance only, it is important to confirm the specifications of equipment used and consider all site specific variations & limitations when designing a solution.

Connected Load	System Voltage	Recommended Battery Size (LiFePO4)	Recommended Solar Panel Size	Backup Time In Hours	Charging Time In Hours	Controller Current (15A is Maximum)
10W	12V	25Ah / 300Wh	80Wp	24	6	5.5A
35W	12V	95Ah / 1140Wh	225Wp	24	6	15A
75W	24V	190/ 2280Wh 2 X 95Ah (12V)	450Wp	24	6.2	15A

NOTES:

SYSTEM CHECKLIST

12V / 24V SETUP: 12V 24V

BATTERY INSTALLED: _____

PV INSTALLED: _____

BATTERY FUSE:

PV SWITCH:

TOTAL LOAD: _____W

DATE: _____

INSTALLED BY: _____