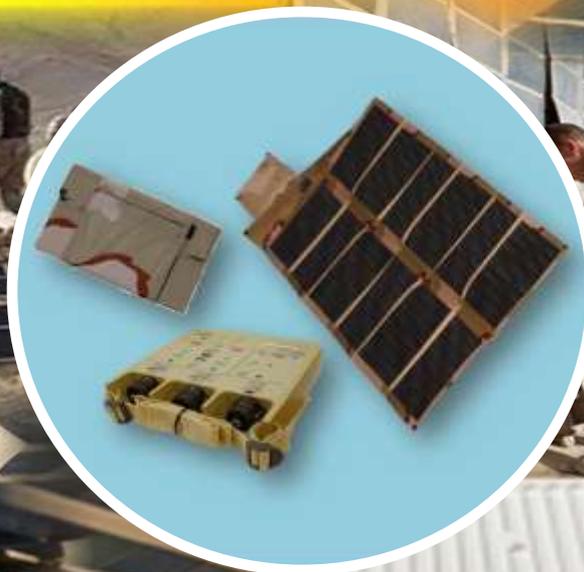


SOLAR PORTABLE ALTERNATIVE COMMUNICATIONS ENERGY SYSTEM



SPACES

DISTRIBUTION A – Approved for public release; distribution unlimited.



April 2011

Table 1: Input Status LED

Review of INPUT POWER LED color indications

LED Color	LED State (color)	Graphic	Indicates	Comments
	OFF Black Solid		No power	No input connection or voltage is below 9 VDC
	Green Solid		Input power good	Indicates input power is within operable and safe range
	Amber Solid		Input power weak	Indicated input power is less than the power needed by the load/battery charging
	Red Solid		Input voltage under operating range	<ul style="list-style-type: none"> Indicates the input voltage is too low Over voltage LED will light if voltage is above safe operating range

Table 2: Input Over Voltage LED

Review of OVER VOLTAGE LED color indications

LED Color	LED State (color)	Graphic	Indicates	Comments
	OFF Black Solid		Input voltage is within safe range	Only lights when input voltage is above safe operating range – the Input Status LED indicates usable input voltage
	Blue Solid		Input voltage is over safe operating range	<p><i>Disconnect the input immediately</i> The module's internal protection circuit will activate to protect the system</p>

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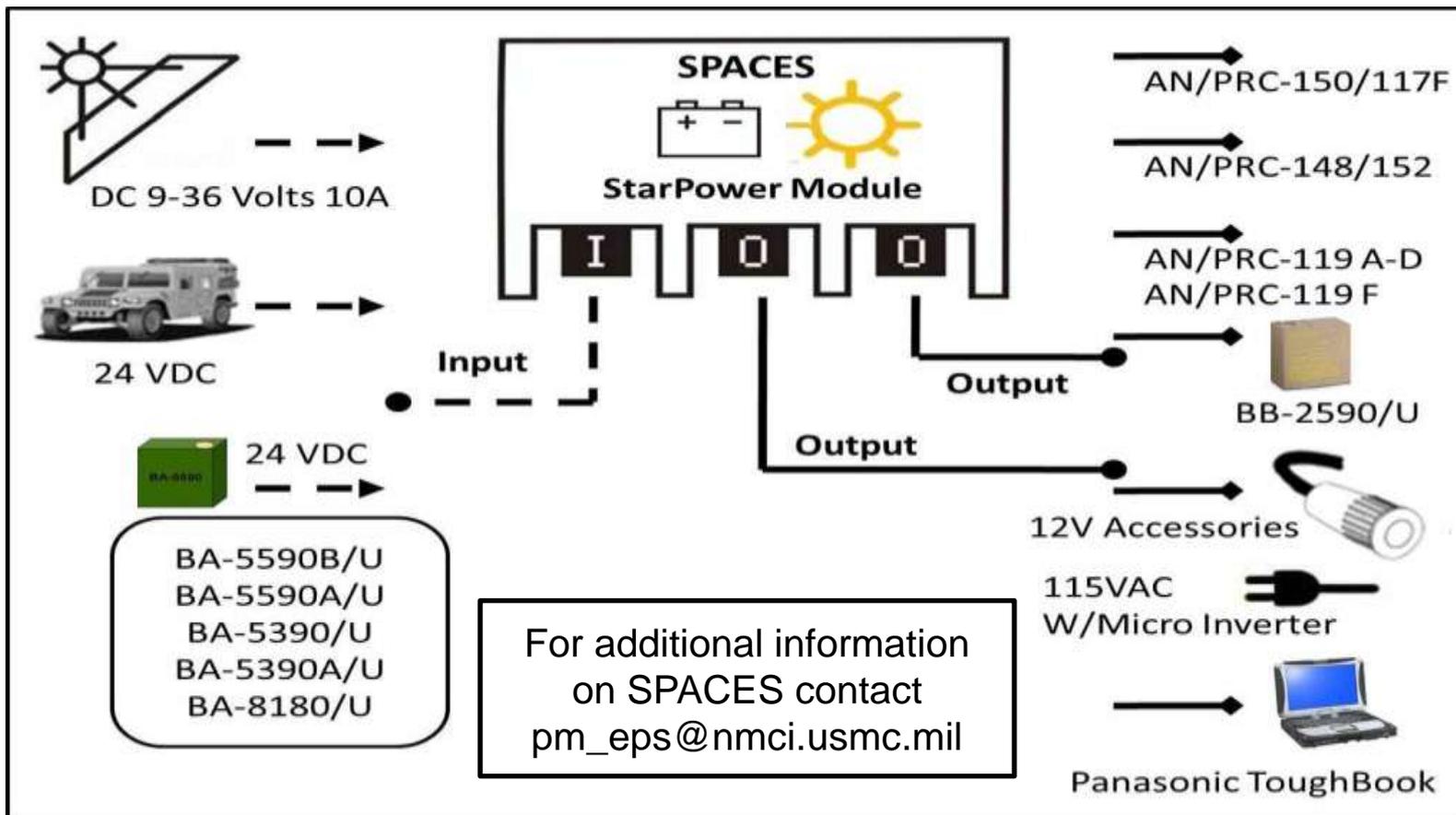
INTRODUCTION AND CAPABILITIES

SPACES is a portable, lightweight battery charger and DC power distribution system designed to operate using various sources of DC input power including renewable solar energy.

- Using INPUT cables selected by the user, SPACES accepts INPUT DC power in several ways including solar power input, vehicle DC power input, or batteries.
- Using optional OUTPUT cables selected by the user, SPACES can function as a battery charger or can directly power 12/24 volt battery operated weapon system.
- SPACES is capable of energizing many different types of systems including the AN/PRC-117, AN/PRC-150, AN/PRC-152 radios, Tough Book computers, low wattage AC powered devices and charge BB-2590/U and other batteries.

SPACES can also be used as a Power Distribution device enabling the user to transfer energy between different battery types (see page 49).

INTRODUCTION AND CAPABILITIES



IMPORTANT FACTS TO CONSIDER

A significant advantage in using solar panels is that they make energy accessible in locations where energy is scarce or unavailable. SPACES is designed to be a man packed system with solar panel selection based on weight, ruggedization and flexibility. The flex panels selected that make SPACES more expeditionary, however, also limit the amount of solar energy that can be collected when compared to larger panel arrays.

So how much solar energy can users expect SPACES to yield? On average, the most efficient time to collect solar energy is between 9 am and 3 pm daily. The standard SPACES configuration (see page 25) employs a minimum of two 12 Volt 62 Watt (thin-film photovoltaic) solar panels. Multiple panels can be employed (see page 41 to 44). During peak sunlight hours (solar noon), two SPACES solar panels can produce approximately 124 Watts of power.

Momentary interruptions (cloud cover, shadows) can result in sudden drops in energy with subsequent equipment loss of power. To counter this, the standard SPACES configuration includes a BB-2590/U rechargeable battery for reserve energy storage (see page 26).

IMPORTANT FACTS TO CONSIDER

The angle of solar panel deployment is important to optimize solar energy collection.

Using a BB-2590/U as a UPS for reserve energy limits the number of output devices that can be powered (only one output port remains available).

DO NOT overlook using Vehicle 24 VDC power or a primary battery (BA-5390 or BA-8180) as an input power source. When using Vehicle Power or Primary Batteries you do not require a BB-2590/U for reserve energy storage.

When using a BA-5390 or BA-8180 battery remember that they only produce approximately 50 Watts of power limiting the number of devices that can be powered.

AC power generated from many types of Micro Inverters ARE NOT PURE SINE WAVE but rather a Modified Sine Wave. Modified sine waves will power simple devices like lighting or battery chargers but may damage sensitive electronic components. Refer to page 68 to 70 for explanations on DC to AC power conversion and always check the manufacturer's specifications.

UNDERSTANDING POWER LIMITATIONS

The maximum amount of INPUT POWER that the StarPower Module can manage is 320 Watts (336 MAX) and the maximum OUTPUT WATTAGE per output port is 160 Watts.

The actual amount of INPUT POWER and resulting available OUTPUT WATTAGE depends not only on the number of solar panels deployed but also on the angle of panel deployment, time of the day, and environmental conditions. You will learn more about each of these as you progress through this job aid.

Actual RATED power levels could be limited to an average of 30 minutes per day and usually at high noon.

NUMBER OF PANELS	RATED INPUT WATTAGE	RATED OUTPUT FOR 1 PORT	RATED OUTPUT USING 2 PORTS
1	62	62	31
2	124	124	62
3	186	186	93
4	248	248	124
5	310	310	155
6	372	372	186

Figure 1 Panel to Wattage Comparison

UNDERSTANDING POWER LIMITATIONS

As shown in figure 1 (page 5) and discussed on page 25, the standard SPACES configuration uses a minimum of two solar panels providing 124 Watts of RATED power output power. The optimal configuration (depending on availability of other kits) would use three or more panels increasing both input and output power.

Under ideal (near perfect) conditions, using five panels would fully utilize the maximum amount of power that the StarPower Module can manage. In most cases you will not benefit from ideal conditions and never fully benefit from the 62 Watts each panel can produce. Using six panels, while technically exceeding the maximum input power the StarPower module can manage, would actually be your best opportunity to maximize the full potential of the StarPower Module.

GENERAL SAFETY PRECAUTIONS

NOTICE TO USER. This publication does not replace TM 11838A-OR/2. Review safety CAUTION, WARNING statements and warranty information IAW TM 11838A-OR/2 before operating SPACES.

This system is designed to use 12 VDC solar panels. Do not use solar panels rated with an open circuit voltage (OCV) greater than 35 volts.

SPACES does not accept AC power directly. An AC to DC converter must be used (refer to page 67 of this job aid).

Many SPACES cables have Smart Chips built into the connectors. Do not cut or disassemble cables to power other devices.

Do not disassemble the StarPower module.

GENERAL SAFETY PRECAUTIONS

The BA-5590A/U, BA-5590B/U, BA-5390/U, BA-5390A/U, BA-8180/U and BB-2590/U are the recommended battery input sources for SPACES. However, as provided in TM 11838-OR/2 many other battery types can be used. The rechargeable BB-2590/U, BB-390/U, AA, AAA, lead acid batteries, and the operational batteries for the AN/PRC-152 and AN/PRC-153 can be charged using the StarPower module.

Before using any batteries ensure that you have read the Material Safety Data Sheet for that battery.



When used incorrectly or mishandled, batteries can be hazardous. Page 8

INTRODUCTION TO USMC SL-3 COMPONENTS

SPACES is a collection of “Power Input” components and optional Output accessories. Components are identified as Supply System Responsible Items (SSRI) and Using Unit Responsible Items (UURI). SSRI are required items and are fielded with the SPACES system. UURI items are optional and ordered by the owning unit “AS REQUIRED”

Page 11, 12, 13, and 14 list all SSRI and UURI items adopted for USMC applications. SSRI items are identified with the following symbol ().

Prior to ordering UURI items units should contact the Program Manager for Expeditionary Power Systems (PM EPS) to see if any FREE issue UURI items are available. Send inquiries to pm_eps@nmci.usmc.mil.

INTRODUCTION TO USMC SL-3 COMPONENTS

INPUT DEVICES



848.0501



848.A166

848.A168



848.0502



848.A162



848.A163



848.A164

BASIC KIT



848.A100



848.A192



848.A191

OUTPUT DEVICES



848.A151



848.A171



848.A176



848.0526



848.0512

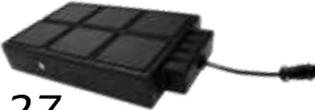
SPACES USMC SL-3 COMPONENTS

<p>1</p> 	<p>STARPOWER Module (SP) Module (848.A100)</p>	<p>6</p> 	<p>CABLE INPUT ZINC AIR (848.A166) connects SP to one BA-8180 Zinc-Air battery</p>
<p>2</p> 	<p>SOLAR PANEL 62W (848.0501) 12V 62W Solar Panel</p>	<p>7</p> 	<p>CABLE INPUT NATO (848.A162) connects SP to tactical vehicle NATO port</p>
<p>3</p> 	<p>CABLE INPUT SOLAR (848.A163) connects SP to one solar panel or splitter</p>	<p>8</p> 	<p>CABLE INPUT EXTENSION (848.A164) extends any input device by 10 feet</p>
<p>4</p> 	<p>CABLE INPUT Y SPLITTER (848.0502) connects to two solar panels</p>	<p>9</p> 	<p>CABLE INPUT BA-XX90 (848.A168) used to scavenge energy from a BA-XX90</p>
<p>5</p> 	<p>CASE HARD (848.A191) for transportation or storage of components</p>	<p>10</p> 	<p>SMARTCAP (848.A151) connects SP module to BB-2590/U battery</p>

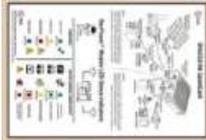
SPACES USMC SL-3 COMPONENTS

<p>11</p> 	<p>CABLE OUTPUT ZINC (848.A171) connects SP to any Zinc-Air radio adapter</p>	<p>16</p> 	<p>J-6687/U ADAPTER 24V RPA (848.0513) connects to output cable (848.A171)</p>
<p>12</p> 	<p>J-6633/U ADAPTER PRC-119F (848.0512) connects to output cable (848.A171)</p>	<p>17</p> 	<p>CABLE OUTPUT AUTO ACCESSORY (848.A176) connects SP to any 12V auto accessory output device</p>
<p>13</p> 	<p>J-6685/U ADAPTER M22 (848.0515) connects to output cable (848.A171)</p>	<p>18</p> 	<p>MODIFIED SINE WAVE DC TO AC INVERTER (848.0519) connects to SP to produce 115 VAC /160 Watts</p>
<p>14</p> 	<p>J-6634/U ADAPTER PRC-119D (848.0511) connects to output cable (848.A171)</p>	<p>19</p> 	<p>CABLE INPUT DUAL SAEP SOLAR (848.A184) connects SP to two solar panels or two splitters</p>
<p>15</p> 	<p>CABLE OUTPUT EXTENSION (848.A172) extends any output device by 10 feet</p>	<p>20</p> 	<p>J-6686/U ADAPTER PRC-148 (848.0514) connects to output cable (848.A171) to connect to SP</p>

SPACES USMC SL-3 COMPONENTS

 <p>21</p>	<p>CABLE OUTPUT PANASONIC TOUGH BOOK (848.A178) connects computer to SP module</p>	 <p>26</p>	<p>BB-2590/U RECHARGEABLE BATTERY used as UPS for energy storage</p>
 <p>22</p>	<p>OUTPUT CABLE MRC-93 (848.A182) connects MRC-93 RPA to SP module</p>	 <p>27</p>	<p>BA-8180/U ZINC-AIR PRIMARY BATTERY input power source for SP module</p>
 <p>23</p>	<p>BATTERY CHARGER DC charger for AN/PRC-153 battery</p>	 <p>28</p>	<p>BA-5590B/U or BA-5590A/U PRIMARY BATTERY input power source for SP module</p>
 <p>24</p>	<p>BATTERY CHARGER AC charger for AN/PRC-152 battery</p>	 <p>29</p>	<p>BA-5390/U or BA-5390A/U PRIMARY BATTERY input power source for SP module</p>
 <p>25</p>	<p>CASE SOFT (848.A192) for transportation of selected components</p>	 <p>30</p>	<p>AC TO DC CONVERTER (848.A165) used to power SP module from AC power source</p>

SPACES USMC SL-3 COMPONENTS

<p>31</p> <p style="text-align: center;">TBA</p>	<p>OUTPUT CABLE AA-SC (848.A183) connects the Scavenger</p>	<p>36</p> 	<p>QUICKCARD (848.F703) Operator's Quick reference card</p>
<p>32</p> 	<p>INPUT CABLE SAEP EXT (848.0525) extends Y-splitter 8 feet from solar input cable</p>	<p>37</p> 	<p>DC POWERED AA/AAA BATTERY CHARGER auto plug accessory charger</p>
<p>33</p> 	<p>ADAPTER PRC-148/152 (848.0514) connects to output cable (848.A171) to connect to SP module</p>	<p>38</p> <p style="text-align: center;">TBA</p>	<p>OUTPUT CABLE PRC-153 (848.0527) connects SP module to the AN/PRC-153</p>
<p>34</p> 	<p>AA SCAVENGER (848.0534) connect SP module to scavenger using 848.A183</p>	<p>39</p> <p style="text-align: center;">TBA</p>	<p>OUTPUT CBL DUPLEX PANA/12V (848.A199) allows (1) SP module port to power a Toughbook & 12V radio</p>
<p>35</p> 	<p>PURE SIGN WAVE DC TO AC INVERTER (848.0528) which connects to SP to produce 115 VAC /125 Watts</p>	<p>40</p> <p style="text-align: center;">TBA</p>	<p>OUTPUT CBL DUPLEX PANA/24V (848.A200) allows (1) SP module port to power a Toughbook & 24V radio</p>

SPACES USMC SL-3 COMPONENTS

41	TBA	OUTPUT CABLE IRIIDIUM (848.0533) connects SP module to Iridium phone	46		INPUT CABLE CLMP 12/24V (848.A167) connects SP module to lead acid Vehicle batteries for input power
42	TBA	AA/AAA BATTERY CHARGER (848.0529) charges 1-8 Nimh or NiCad batteries	47		OUTPUT CABLE CLMP 12/24V (848.A179) allows SP module to charge lead acid Vehicle batteries
43	TBA Does not charge the battery	OUTPUT CABLE DELL POWER (848.A177) power Dell Laptop from SP module	48		INPUT CABLE 12V AUTO PLUG (848.A161) connects SP module to Vehicle Auto Plug for input power
44	TBA	OUTPUT CBL DUPLEX PANA / AUTO (848.A196) allows (1) SP module port to power a Toughbook & Iridium	49	TBA	J-6688/U ADAPTER JAVELIN (848.0516) connects to cable (848.A171)
45		INPUT CABLE ULTRACELL (848.A169)	50	TBA	OUTPUT CABLE PRC-117G (102216) allows SP module to power the PRC-117G radio

SPACES USMC SL-3 COMPONENTS

51		<div style="border: 1px solid black; padding: 10px;"> <p>NSNs are being assigned for all components. Until final assignment all products can be ordered from Iris Technology at (866) 240-9540 and are available on GSA schedule GS-07F-0131N.</p> </div>
52		
53		<div style="border: 1px solid black; padding: 10px;"> <p>Cables can be customized for specific requirements.</p> </div>
54		<div style="border: 1px solid black; padding: 10px;"> <p>NOTE: While many NSN's have been assigned, historically it may take months before DLA can support NSN requisitions.</p> </div>
55		

PART # / GSA SCHEDULE CROSS REF

ITEM	NOMENCLATURE	PART NUMBER	CAGE	GSA PRICE	ITEM	NOMENCLATURE	PART NUMBER	CAGE	GSA PRICE
2	SOLAR PANEL 62 WATT (1)	848.0501	78535	\$975.00	19	INPUT CABLE DUAL SOLAR PANEL	848.A184	78535	TBA
3	INPUT CABLE FOR SOLAR PANEL	848.A163	78535	\$75.00	20	ADAPTER J-6686/U PRC-148/152	848.0514	78535	\$325.00
4	INPUT CABLE Y-SPLITTER SOLAR	848.0502	78535	\$25.00	21	OUTPUT CABLE TOUGHBOOK	848.A178	78535	\$230.00
5	CASE HARD	848.A191	78535	\$105.00	22	OUTPUT CABLE MRC-93	848.A182	78535	TBA
6	INPUT CABLE ZINC AIR BATTERY	848.A166	78535	\$135.00	23	DC CHARGER PRC-153 BATTERY	RLN4884	78205	NA
7	INPUT CABLE NATO	848.A162	78535	\$225.00	24	AC CHARGER PRC-152 BATTERY	RF-5853-CH001	14304	NA
8	INPUT 10 FT CABLE EXTENSION	848.A164	78535	\$145.00	26	BB-2590/U BATTERY	NA	NA	NA
9	INPUT CABLE BA-XX90 BATTERY	848.A168	78535	\$175.00	27	BA-8180/U ZINC AIR BATTERY	NA	NA	NA
10	OUTPUT CABLE SMARTCAP	848.A151	78535	\$325.00	28	BA-5590 PRIMARY BATTERY	NA	NA	NA
11	OUTPUT CABLE ZINC ADAPTERS	848.A171	78535	\$145.00	29	BA-5390 PRIMARY BATTERY	NA	NA	NA
12	ADAPTER J-6633/U PRC-119F	848.0512	78535	\$325.00	30	AC TO DC CONVERTER	848.A165	78535	\$360.00
13	ADAPTER J-6685/U M22 ACADIA	848.0515	78535	\$265.00	31	OUTPUT CABLE AA-SC	848.A183	78535	TBA
14	ADAPTER J-6634/U PRC-119D	848.0511	78535	\$85.00	32	INPUT CABLE SAEP EXT SOLAR	848.0525	78535	TBA
15	OUTPUT 10 FT CABLE EXTENSION	848.A172	78535	\$145.00	33	ADAPTER PRC-148/152	848.0526	78535	NA
16	ADAPTER J-6687/U 24V RADIO	848.0513	78535	\$950.00	34	AA SCAVENGER	848.A182	78535	NA
17	OUTPUT CABLE AUTO ACCESSORY	848.A176	78535	\$115.00	35	DC-AC INVERTER PURE SINE WAVE	848.0528		\$110.00
18	DC-AC INVERTER MODIFIED SW	848.0519	78535	\$90.00	37	DC CHARGER FOR AA BATTERIES	NA	NA	NA

Part numbers with CAGE code 78535 can be ordered directly from Iris Technology at (866) 240-9540

PART # / GSA SCHEDULE CROSS REF

ITEM	NOMENCLATURE	PART NUMBER	CAGE	GSA PRICE	ITEM	NOMENCLATURE	PART NUMBER	CAGE	GSA PRICE
38	OUTPUT CABLE PRC-153	848.0527	78535	\$225.00					
39	DUPLEX CBL PANA/12V	848.A199	78535	\$285.00					
40	DUPLEX CBL PANA/24V	848.A200	78535	\$285.00					
41	OUTPUT CABLE IRIDIUM PHONE	848.0533	78535	\$125.00					
42	AA/AAA BATTERY CHARGER	848.0529	78535	\$150.00					
43	OUTPUT CABLE DELL LAPTOP	848.A177	78535	\$235.00					
44	DUPLEX CBL PANA/AUTO 12V	848.A196	78535	\$285.00					
45	INPUT CABLE ULTRACELL	848.A169	78535	\$175.00					
46	INPUT CABLE 12/24V CLMP	848.A167	78535	\$135.00					
47	OUTPUT CABLE 12/24V CLMP	848.A179	78535	\$145.00					
48	INPUT CABLE 12V AUTO PLUG	848.A161	78535	\$115.00					
49	J-6688 JAVELIN ADAPTER	848.0516	78535	\$795.00					
50	OUTPUT CABLE PRC-117G	102216	78535	\$155.00					

**Part numbers with CAGE code 78535 can be ordered directly from Iris Technology
at (866) 240-9540**

NSN / DLA SCHEDULE CROSS REF

ITEM	NOMENCLATURE	NSN	DLA PRICE	ITEM	NOMENCLATURE	NSN	DLA PRICE
2	SOLAR PANEL 62 WATT (1)	6117015914474	TBA	19	INPUT CABLE DUAL SOLAR PANEL	TBA	TBA
3	INPUT CABLE FOR SOLAR PANEL	6150015914437	TBA	20	ADAPTER J-6686/U PRC-148/152	5940015173990	\$214.00
4	INPUT CABLE Y-SPLITTER SOLAR	6150015914490	TBA	21	OUTPUT CABLE TOUGHBOOK	6150015843909	TBA
5	CASE HARD	5895015919773	TBA	22	OUTPUT CABLE MRC-93	TBA	TBA
6	INPUT CABLE ZINC AIR BATTERY	6150015914459	TBA	23	DC CHARGER PRC-153 BATTERY	6130015487621	
7	INPUT CABLE NATO	6150015914432	TBA	24	AC CHARGER PRC-152 BATTERY	6130015487481	
8	INPUT 10 FT CABLE EXTENSION	6150015914439	TBA	26	BB-2590/U BATTERY	6140014904316	\$287.00
9	INPUT CABLE BA-XX90 BATTERY	6150015914498	TBA	27	BA-8180/U ZINC AIR BATTERY	6135015000572	\$358.14
10	OUTPUT CABLE SMARTCAP	6150015914721	TBA	28	BA-5590B/U PRIMARY BATTERY	6135014389450*	\$240.96
11	OUTPUT CABLE ZINC ADAPTERS	6150015914445	TBA	28	BA-5590A/U BATTERY W/SOCI	6135015233037*	\$342.67
12	ADAPTER J-6633/U PRC-119F	5940015043218	\$242.42	29	BA-5390/U PRIMARY BATTERY	6135015010833	\$508.82
13	ADAPTER J-6685/U M22 ACADIA	5940015169785	\$102.00	29	BA-5390A/U BATTERY W/SOCI	6135015176060*	\$519.64
14	ADAPTER J-6634/U PRC-119D	5940015045597	\$53.01	30	AC TO DC CONVERTER	6150015914513	TBA
15	OUTPUT 10 FT CABLE EXTENSION	6150015843911	TBA	31	OUTPUT CABLE AA-SC	TBA	TBA
16	ADAPTER J-6687/U 24V RADIO	5940015169787	\$457.00	32	INPUT CABLE SAEP EXT SOLAR	TBA	TBA
17	OUTPUT CABLE AUTO ACCESSORY	6150015914455	TBA	33	ADAPTER PRC-148/152	TBA	TBA
18	DC-AC INVERTER MODIFIED SW	TBA	TBA	34	AA SCAVENGER	6130015390646	

Prices are for FY11

(*) Package of 4

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NSN / DLA SCHEDULE CROSS REF

ITEM	NOMENCLATURE	NSN	DLA PRICE	ITEM	NOMENCLATURE	NSN	DLA PRICE
35	DC-AC INVERTER PURE SW	TBA	TBA				
37	DC CHARGER FOR AA BATTERIES	TBA	TBA				
38	OUTPUT CABLE PRC-153	TBA	TBA				
39	DUPLEX CBL PANA/12V	TBA	TBA				
40	DUPLEX CBL PANA/24V	TBA	TBA				
41	OUTPUT CABLE IRIDIUM PHONE	TBA	TBA				
42	AA/AAA BATTERY CHARGER	TBA	TBA				
43	OUTPUT CABLE DELL LAPTOP	TBA	TBA				
44	DUPLEX CBL PANA/AUTO 12V	TBA	TBA				
45	INPUT CABLE ULTRACELL	6150015914536	TBA				
46	INPUT CABLE 12/24V CLMP	6150015914506	TBA				
47	OUTPUT CABLE 12/24V CLMP	6150015914545	TBA				
48	INPUT CABLE 12V AUTO PLUG	6150015914503	TBA				
49	J-6688 JAVELIN ADAPTER	5940015171026	TBA				
50	OUTPUT CABLE PRC-117G	TBA	TBA				

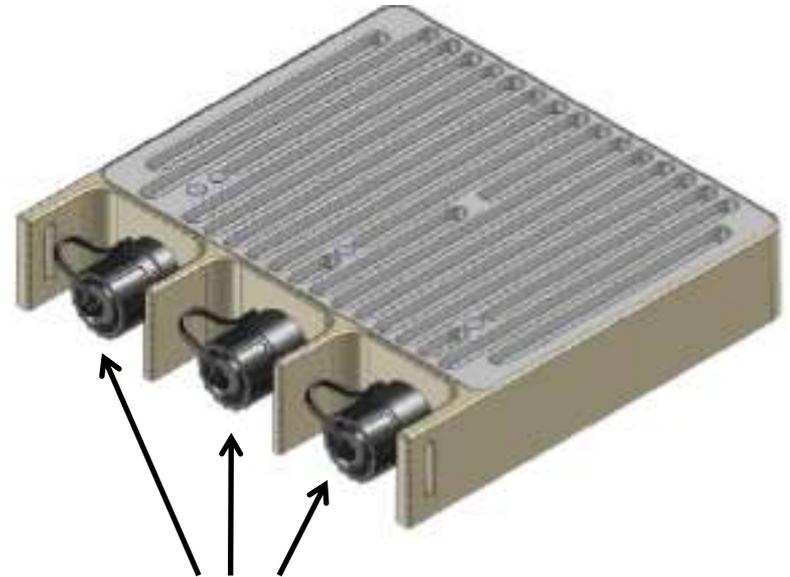
Prices are for FY11

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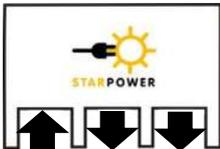
INTRODUCTION TO THE STARPOWER MODULE

The StarPower module is a self contained unit with one INPUT and two OUTPUT connectors. The INPUT connector is a keyed four pin connector and the OUTPUT connector is a keyed seven pin connector. This prevents misconnecting of INPUT or OUTPUT connectors.

The module has no controls or buttons. The module senses input power and adapts automatically. Each connector (or port) has an LED status indicator.

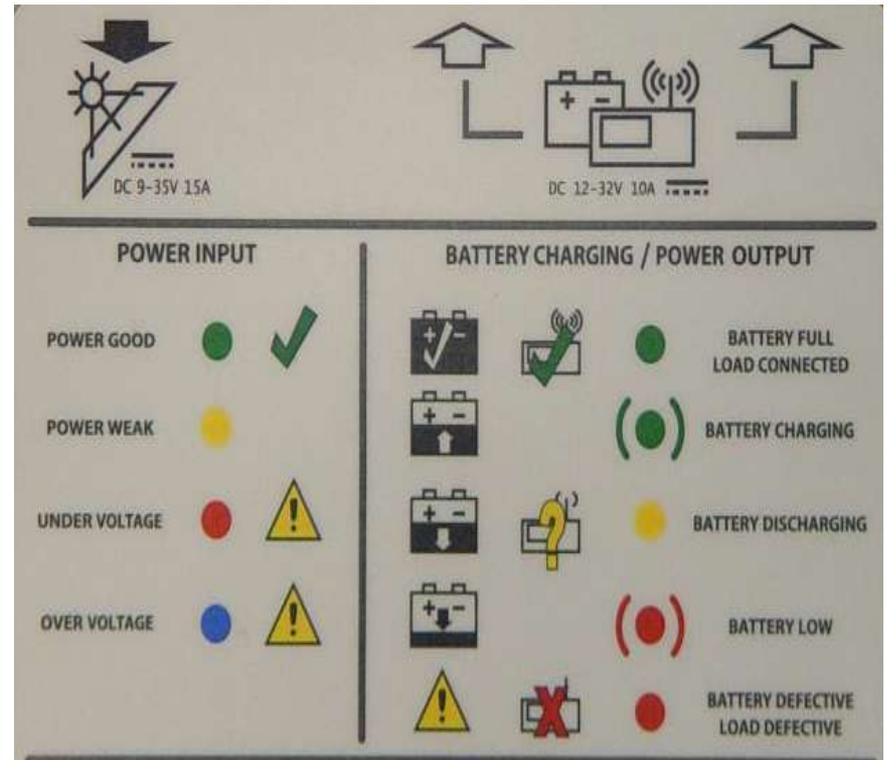


Keep the protective covers on during transportation and storage to prevent dirt from contaminating the electrical system.



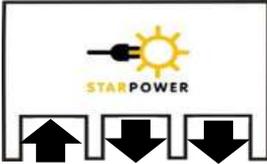
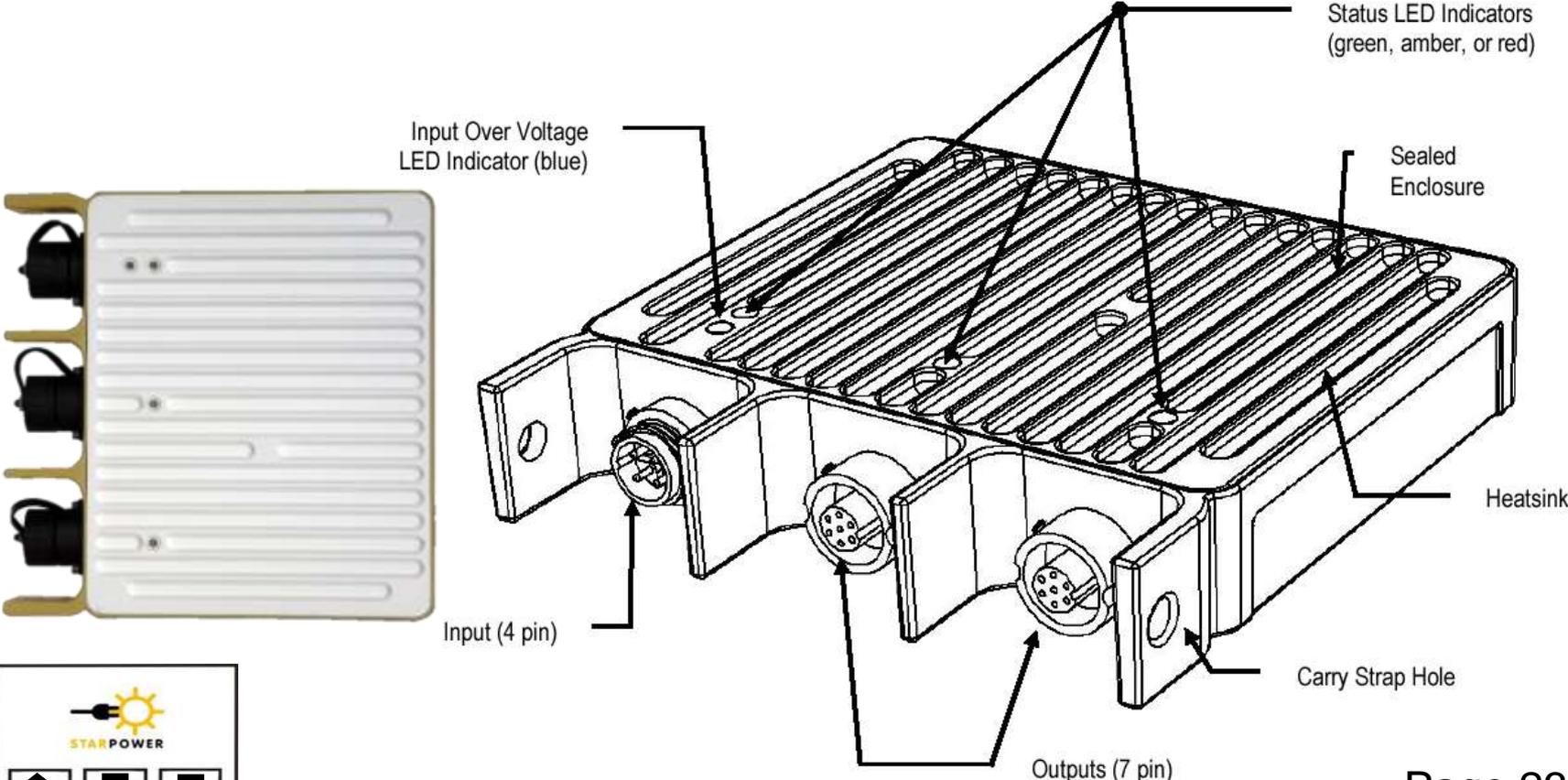
Refer to the Quick Card or chart inside of front cover

INTRODUCTION TO THE STARPOWER MODULE



QUICK REFERENCE

INTRODUCTION TO THE STARPOWER MODULE



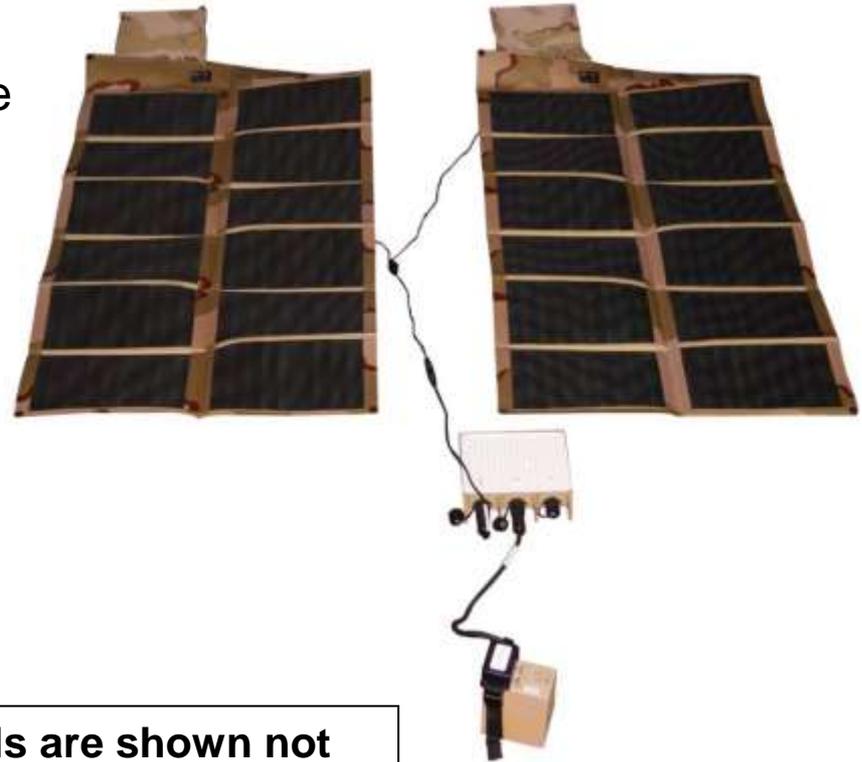
STARPOWER TECHNICAL SPECIFICATIONS

Parameter	Characteristics
Weight of USMC SPACES SSRI Kit	27 lb (12.2 kg) SSRI kit includes hard case which weighs 9.1 lb (4.1 kg)
Size of USMC SPACES SSRI Kit	22.8" (57.9 cm) X 15" (38.1 cm) X 7.75" (19.7 cm)
Weight of StarPower module	2.6 lb (1.2 kg)
Size of StarPower module	8" (20 cm) X 8" (20 cm) X 1.6" (4.1 cm)
Input connector, module	Iris PN 848.0183, C016-30G006-200-12
Output connector, module	Iris PN 848.0184, C016-30G006-200-12
Environmental	MIL-STD-810F
→ Operating Temperature Range	-4 degree F (-20 degree C) to +131 degree F (+55 degree C)
Storage Temperature Range	-59 degree F (-50 degree C) to +160 degree F (+71 degree C)
Input Voltage Range, module	9 - 35 VDC
→ Input Current, module	14 Amps (max)
→ Input Power, module	240 Watts typical, 336 watts (max)
→ Output Voltage, module	12 to 32 VDC with Iris smart cable
→ Output Power, module	160 Watts per output, 320 Watts (max)
Efficiency, module	96% typical

SPACES STANDARD CONFIGURATION

Solar input is known as a soft (power) source and it's output power can be reduced by several factors including the angle of the panels (to the sun's rays), overcast skies, dirt and contamination on the panels.

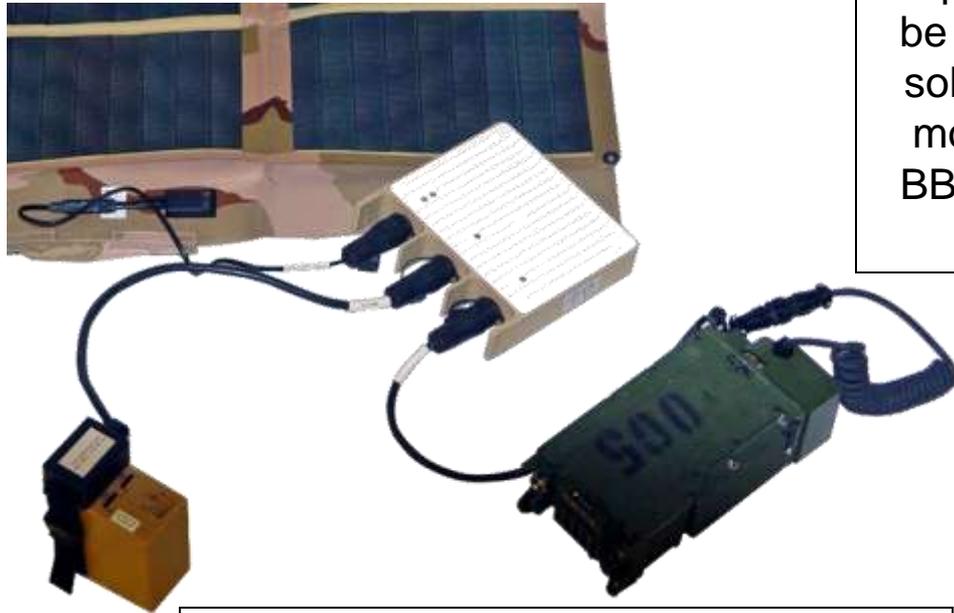
When using solar input the recommended "standard configuration" includes using a minimum of two solar panels and a BB-2590/U rechargeable battery attached to one of the output connectors to act as a UPS.



For instructional purposes many panels are shown not fully deployed – in actual use always fully deploy panels.

RESERVE ENERGY STORAGE

Using the BB-2590/U for reserve energy storage means that any solar energy not required to operate the output device will be stored in the BB-2590/U. If you lose solar input (cloud cover) the StarPower module will automatically switch to the BB-2590/U for power and back to solar, when solar input is restored.

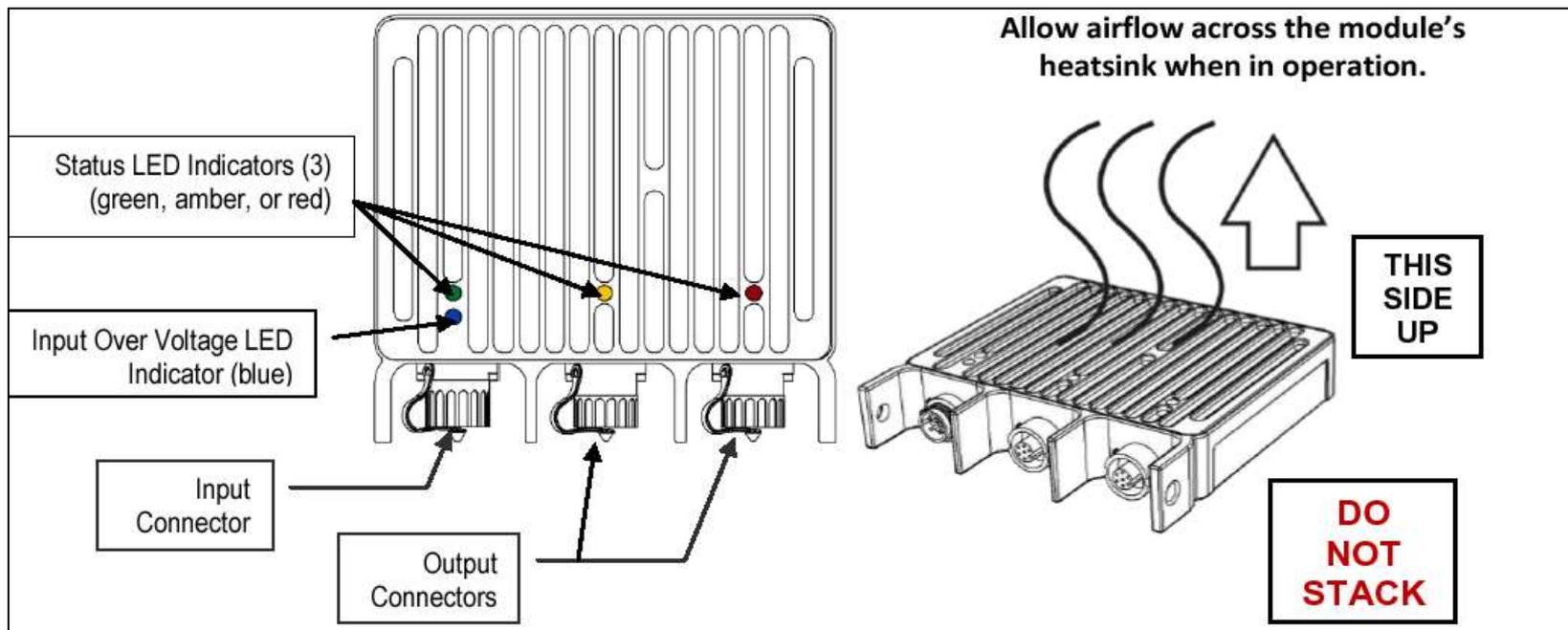


When the battery is depleted the StarPower module will no longer recognize the battery.

Energy storage for night OPS is limited to the number of batteries and amount of energy stored in each BB-2590's (one BB-2590 is equal to 178 Watt hours of energy).

STARPOWER MODULE ORIENTATION

The StarPower module has a (white) heatsink easily identified with the LED status indicator lights mounted on top of it. The heatsink allows the module to dissipate heat and must never be covered up. The module must be properly oriented to allow for air flow or overheating may result.

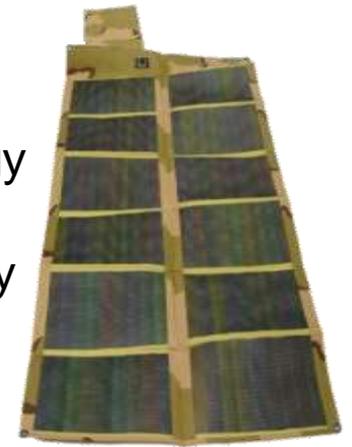


UNDERSTANDING SOLAR ENERGY

Solar photovoltaic (PV) power input is known as a soft power source, as the power available from the panels is limited by the amount of sunlight striking the panels. Many factors influence this, including geographic location (sun energy is different depending on geographic location and altitude), angle of the panels to the sun's rays, overcast skies, shade, dirt and contamination on the panels.



A solar cell converts energy of sunlight directly into electricity. An array of solar cells (panels) shown right, converts solar energy into usable amounts of direct current (DC) electricity. The total electricity generated in a day will depend on the number of sunny hours, environmental conditions and geographic location.



Clean solar panels on a regular basis for peak performance.

When possible, panels should be oriented solar (true) south/north.

IMPACT OF WEATHER CONDITIONS

Solar panels work best in completely sunny and clear conditions. Location, time of year, and angle all play critical roles in determining solar energy production. Unfortunately, direct sunlight is not always available at times during the daytime. The time it takes to charge batteries and/or operate battery operated weapon systems will vary depending on the daytime weather conditions.

Always use a BB-2590/U battery for energy storage as shown in the standard configuration on page 25. You can also enhance your collection of solar energy during low percentage hours by using additional panels as shown on page 41, 42, 43, and 44.

The chart on the next page demonstrates the percent of sun energy available to be absorbed by solar cells during different daytime weather conditions. The pictures are examples of some of the types of skies for selected weather conditions noted in the chart.

TYPICAL PERCENTAGE OF SUNLIGHT

Clear and Sunny	Misty	Partly Cloudy	Mostly Cloudy	Overcast	Severely Overcast
90 to 100%	85 to 90%	60 to 80%	30 to 100%	20 to 60%	10 to 40%
A		B	C		D



Flex panels work well in A – B conditions.
Rigid panels work well in A – C conditions.
C – D conditions will show significant drop off in performance.

Overcast conditions will show significant drop off in performance. Rigid panels can produce some power from extremely low sunlight.

DEPLOYING SOLAR PANELS

The default position for deploying flexible solar panels is flat on the ground. In this position solar panels will collect solar energy as designed.

Many factors affect the amount of energy that solar panels can collect. Most of these you cannot control. One key factor you may be able to correct is the angle of deployment. Panels laying flat on the ground can be approximately 20% less efficient than panels deployed at a 45 degree angle.

A 20% loss in efficiency means that you are generating less power.

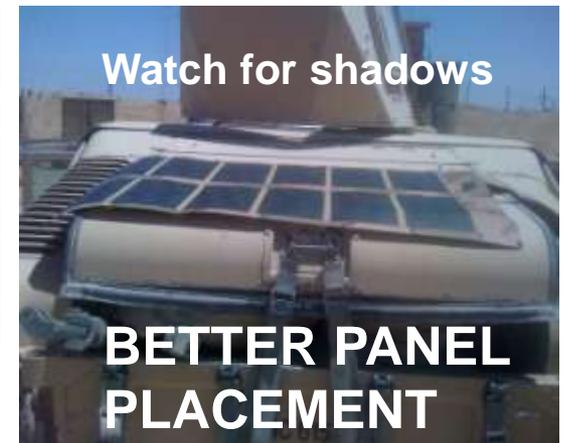


FACTORS AFFECTING SOLAR SYSTEMS

- * Weather (temperature, clouds, rain)
- * Time of year (hours of sunlight 9AM-3PM)
- * Environmental (dust, shade, etc.)
- * Latitude (angle of deployment)

DEPLOYING SOLAR PANELS

Another way of making panels more efficient is to try and keep panels as cool as possible. An actual increase in the panels temperature can reduce the amount of solar energy collected. If you are only able to deploy panels flat on the ground, placing them across a structure that allows for air flow will help to dissipate heat and improve panel performance.



The heat from a vehicles engine can be extremely hot. If possible, avoid laying panels over the engine compartment. Watch for objects that can cast a shadow. Page 32

SOLAR PANEL ANGLE OF DEPLOYMENT

Solar systems using “hard panels” are able to make angle adjustments to take advantage of sun location. Flex panels (like those fielded with SPACES) lay flat on the ground not providing the opportunity to make angle adjustments.



If targets of opportunity are available like inclines, hills, or large rocks, take advantage and use these to make angle adjustments.

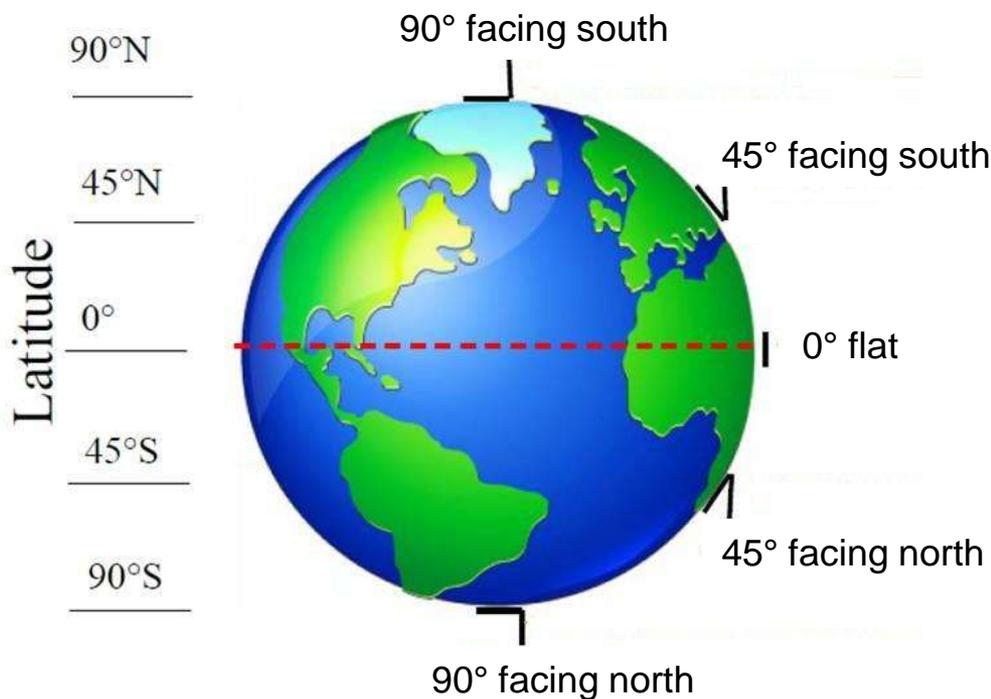


It is very important to periodically wipe any dust or excess water from the solar panels. Anything that restricts the light source from the solar panels (see picture on left) will reduce the amount of energy generated from the solar panels.

Always make sure panels will not be shaded by shadows from branches, vehicles, tents or other structures.

SOLAR PANEL ANGLE OF DEPLOYMENT

Deploying panels in the right direction



Two factors determine the “right direction”. Is the panel facing North or South? Is the panel deployed at the correct angle from the ground?

The ideal angle of deployment for solar panels is equal to Latitude.

The SPACES flex solar panels (unlike rigid panels) are not ideal for angle adjustments but users may be able to take advantage of terrain or fixed structures (vehicles).

Rigid panels →



When possible, panels should be oriented solar (true) south/north.

TRUE SOUTH AND MAGNETIC SOUTH

So what is the difference between “True South” and Magnetic South? Well, if you imagine the axis that the earth rotates around, the point at which it pokes out of the earth in the middle of Antarctica is true south. When you hold up a compass, you are not finding “true” north or south, you can only find “magnetic south”, which is the direction towards the south pole of our earth’s geomagnetic field. This point actually moves a few miles each year because the molten metal in the earth sloshes around.

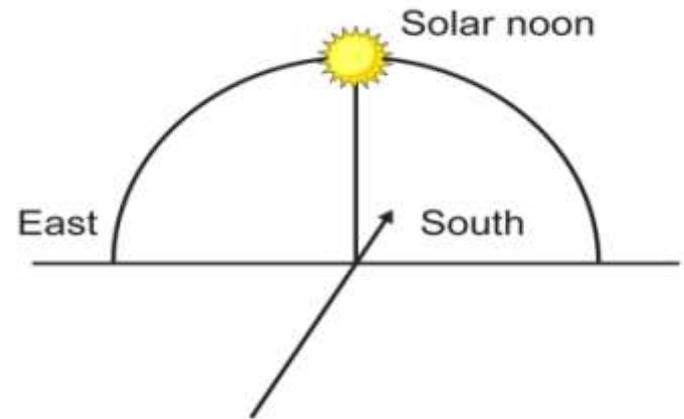
The most accurate way to determine true south is to find the magnetic declination in your area. Magnetic declination is the difference (in degrees) between the direction the compass needle points and true north. Magnetic Declination depends on your location. Look up the declination for your area at: <http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp>. If your compass does not allow you to set the declination, then on each compass reading, you must offset the compass needle from the true north mark on the compass by the declination angle. For example, if you live in Bozeman, MT your declination is about 14 deg east. To take a true compass bearing, rotate the compass until the needle points 14 degrees east of north.

Location	Declination	Location	Declination
Camp Pendleton	12° E	Kandahar AF	2° E
Camp Lejeune	9° W	Baghdad	4° E
Pearl Harbor HI	9° E	Djibouti Africa	1° E
Okinawa Japan	4° W	Bangkok Thailand	0° W
Iwakuni Japan	7° W	Incheon S. Korea	7° W

WHICH WAY IS SOUTH?

Don't have a compass, use the SOLAR NOON method. This method uses the fact that the sun is always due south at solar noon. A shadow cast by a vertical object at solar noon runs true north-south. So, at solar noon, use the shadow cast by a plumb-bob string or the vertical edge of a building to determine true south.

To determine the local time that corresponds to solar noon, find the sunrise and sunset times from a current local paper (where "local" and "current" are both important!). Most GPS units will also give the times for sunset and sunrise -- just make sure the GPS is set to your time zone. Solar noon is exactly half way between the sunrise and sunset time. Note that the difference between local time noon and solar noon can be quite a bit, depending on your location in the time zone, and daylight saving time. You can also use the NOAA "solar me" calculator to find the local time for solar noon at your location: <http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html>



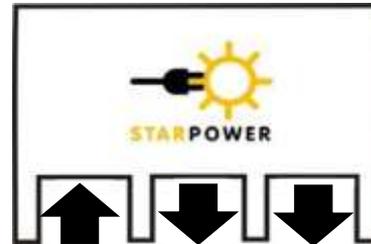
For renewable energy calculations we are not concerned with magnetic poles; just where the sun is.

OUTPUT PORTS PRIORITY OF POWER

CHARGING TWO BATTERIES – the StarPower module is designed to collect energy as quickly as possible. When charging two batteries the most depleted battery is charged first. Any available excess energy is directed to the second battery. Once the voltage of the more depleted battery is equal to the second battery, both are electrically joined and share equally in charging.

CHARGING ONE BATTERY AND RUNNING ONE LOAD – the load device always has priority over charging regardless of which output ports are used.

POWERING TWO LOAD DEVICES – StarPower does not assign priorities when running two load devices.



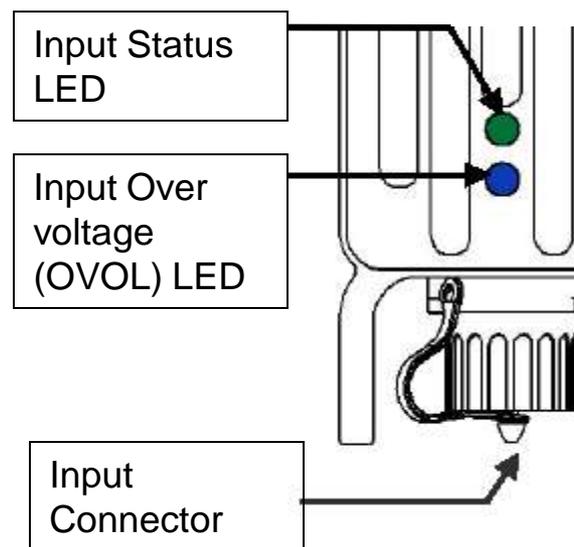
STARPOWER MODULE START-UP PROCEDURES

When the StarPower module is first powered up, the three “status LEDs” (page 23) are used to flash a software code version. Three patterns consisting of combinations of one, two, or three flashing LEDs. The patterns represent a numeric code. The module is operational if it displays the three patterns and then enters the normal status display. Actual content of the patterns is only important if the module requires troubleshooting.

Input power options include the Solar Panels (page 39 and 40), 24V vehicle power (page 45 and 46), or primary batteries (page 47 and 48). Once power is applied, and assuming that the software version flash code pattern was completed, the “Input Status LED” and “Input Over voltage LED” will indicate if input power is sufficient. LED state (color) and explanations are on the next page. A full color chart is located in the front cover.

Input LED - solid green – good input 9-35V
Input OVOL LED - solid blue – input > 35 VDC

Input Voltage MIN is 9 VDC / MAX is 35 VDC



INPUT POWER USING DUAL SOLAR PANELS

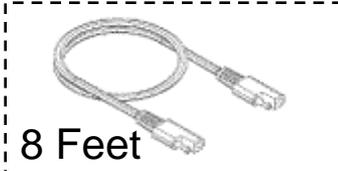


Item (2)



Item (4)

Item (32)



8 Feet



Item (3)



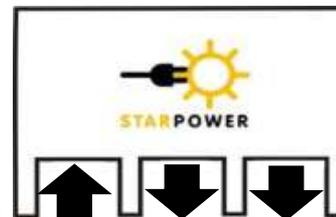
10
Feet

Item (8)

Item 8 is not shown
on page 40



Item (1)



INPUT POWER USING DUAL SOLAR PANELS



- a. Position solar panels
- b. Connect Y-Splitter cable (item 4) to panels
- c. Connect input cable (item 3) to Y Splitter (or to Y Splitter Ext)
- d. Connect 10 FT extension (item 8) optional
- e. Connect item 3 or 8 to the SP module
- f. Module automatically configures to solar panels
- g. Status LED indicates incoming power level
- h. Connect BB-2590/U (UPS)
- i. Ready to connect output device

Use of the 10 foot extension (848A.164 cable input) is recommended when using solar panels as a power source. Place the solar panels in full sun and if possible, place the StarPower module in a shaded or cooler area.

USING MULTIPLE SOLAR PANELS

The maximum number of panels that should be connected to the SP module at any time is six. While more than 6 can be connected, 6 panels generally provide the maximum amount of wattage (310) that the SP module can manage.

Anytime you have 2 SPACES kits and do not require more than one output port, you should combine panels on one of the two kits.

Additional panels (up to 6) allows the SP module to collect more solar energy during reduced visibility or poor environmental conditions. With optimal sunlight hours between 9 AM and 3 PM, using eight panels can increase collection periods to 8 AM and 4 PM.



USING MULTIPLE SOLAR PANELS

How many panels do I need?

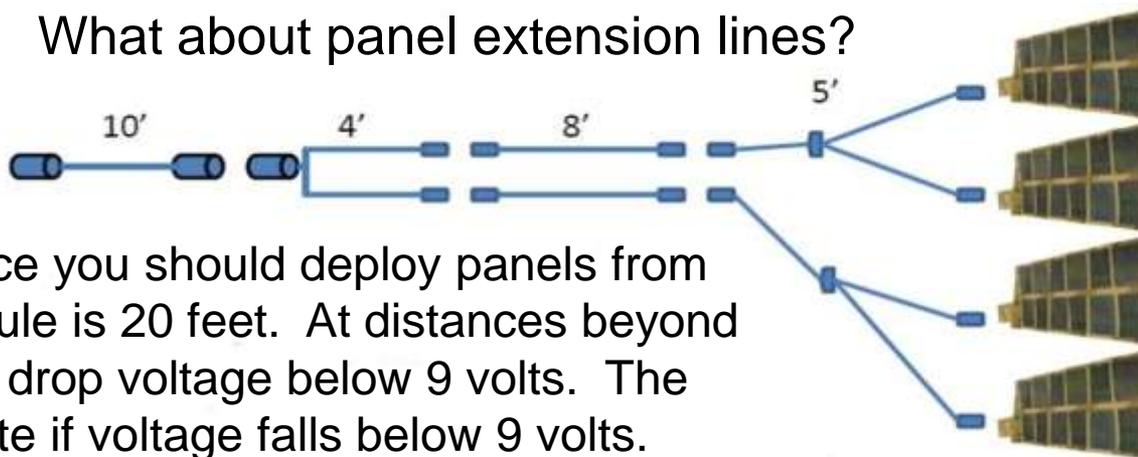
NUMBER OF PANELS	RATED INPUT WATTAGE	OUTPUT WATTAGE FOR TWO PORTS
1	62	31
2	124	62
3	186	93
4	248	124
5	310	155
6	372	186

What are you trying to power?

END ITEM	WATTS	END ITEM	WATTS
AN/PRC-153	5	AN/PRC-150	20
AN/PRC-148	5	AN/PRC-117F	20
AN/PRC-152	5	TOUGHBOOK	105
AN/PRC-119F	5	AN/PRC-119D	5



What about panel extension lines?

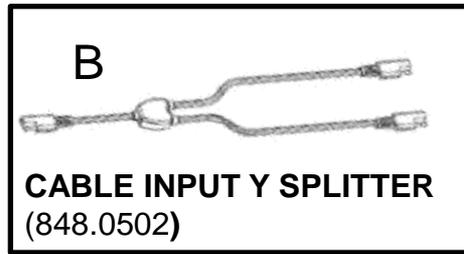
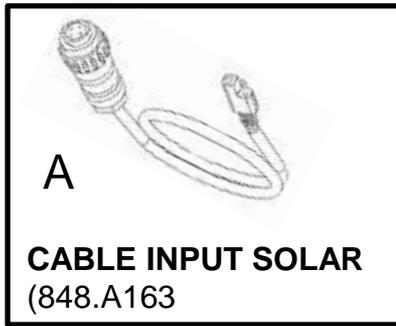
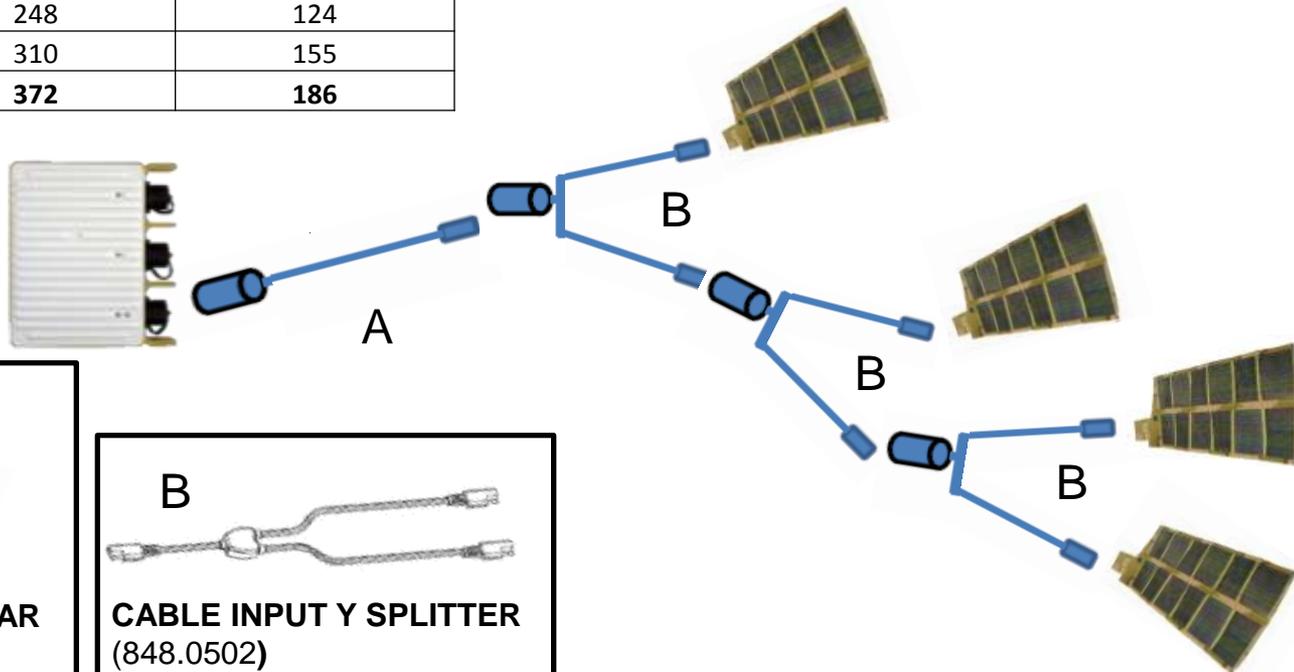


The maximum distance you should deploy panels from the a StarPower module is 20 feet. At distances beyond 20 feet, line loss may drop voltage below 9 volts. The module will not operate if voltage falls below 9 volts.

USING MULTIPLE SOLAR PANELS

NUMBER OF PANELS	RATED INPUT WATTAGE	OUTPUT WATTAGE FOR TWO PORTS
1	62	31
2	124	62
3	186	93
4	248	124
5	310	155
6	372	186

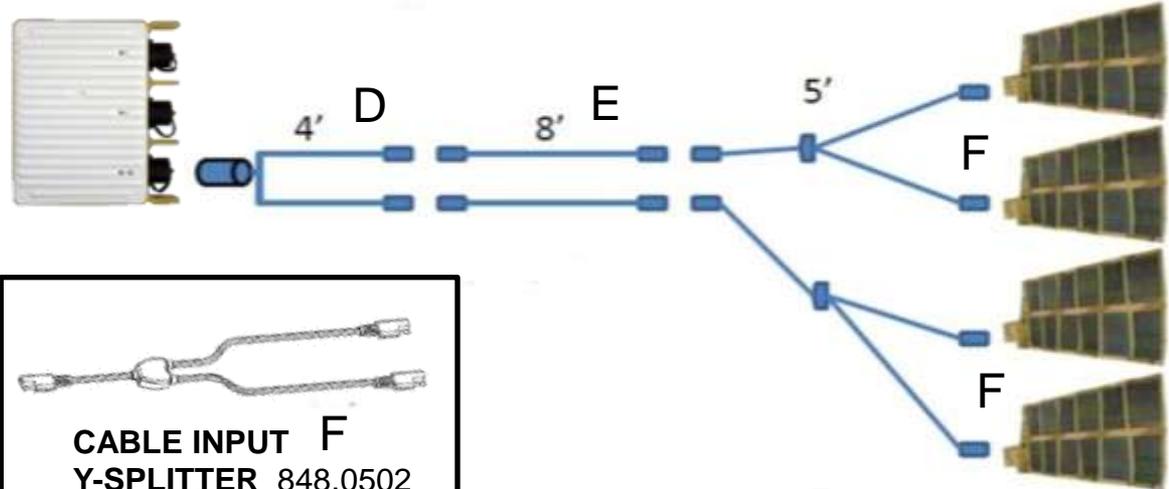
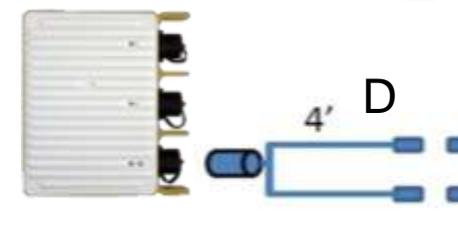
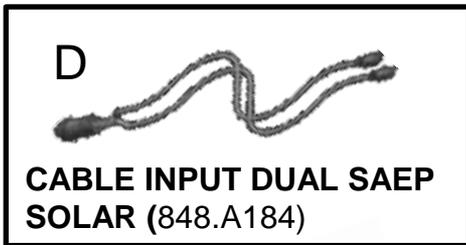
CURRENT SSRI OPTION Requires two SPACES kits



USING MULTIPLE SOLAR PANELS

NUMBER OF PANELS	RATED INPUT WATTAGE	OUTPUT WATTAGE FOR TWO PORTS
1	62	31
2	124	62
3	186	93
4	248	124
5	310	155
6	372	186

UURI OPTION



INPUT POWER FROM VEHICLE DC SYSTEMS



Item (7)



Item (8)

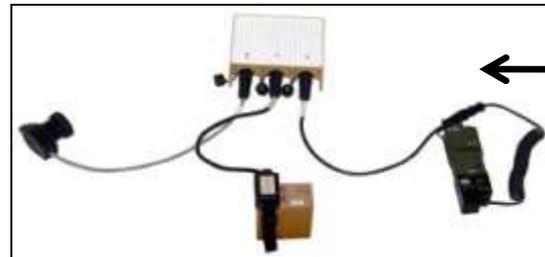
Item 8 is not shown on page 46



Item (1)

The StarPower module can connect to NATO adapted vehicles with 24 VDC systems using the NATO interface cable

- a. Connect NATO plug (item 7) to the extension cable (item 8) or directly to the StarPower module (item 1)
- b. The module will configure to the input voltage
- c. The status light will indicate green if the input voltage is within range
- d. Ready to connect output devices



Charging BB-2590/U while powering AN/PRC-152

INPUT POWER FROM VEHICLE DC SYSTEMS

Operating SPACES for extended periods with the engine off will deplete the vehicle battery and may render the vehicle inoperable (insufficient battery power to start the vehicle). If you are operating StarPower for extended periods (>1 hrs.) you should keep the vehicle engine running.

OTHER SOURCES	INPUT WATTAGE	FOR 1 PORT	FOR 2 PORTS
VEH 24VDC	320	320	160
BA-8180	50	50	25
BA-5590	50	50	

WARNING: THE STARPOWER MODULE DOES NOT HAVE A LOW/HIGH VEHICLE VOLTAGE AUTOMATIC CUTOFF



INPUT POWER USING PRIMARY BATTERIES



Item (9)



Item (8)

Optional item



Item (6)

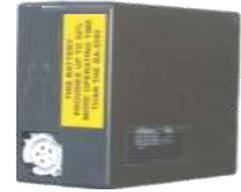


Item (1)

Battery Input



BA-5590/U



BA-5390/U

While the StarPower module is capable of drawing power from various Primary or Rechargeable batteries the preferred battery (as an input source) is the BA-8180/U Zinc-Air or BA-5390/U battery. For more information on batteries refer to page 73 to 75.

Note: the StarPower module will continue to draw power from a battery until the battery voltage drops below 9 Volts. When this happens the Input Status LED will turn off or turn solid red.

INPUT POWER USING PRIMARY BATTERIES



BA-8180/U



Item (8)

Optional item



Item (6)



Item (1)

If you can power your load by hooking directly to the battery, **DO NOT** use the StarPower Module.

OTHER SOURCES	INPUT WATTAGE	FOR 1 PORT	FOR 2 PORTS
VEH 24VDC	320	320	160
BA-8180	50	50	25
BA-5590	50	50	25



BA-8180/U

STARPOWER AS A POWER DISTRIBUTION DEVICE

The StarPower module can be used as a power Distribution Grid to transfer energy from one battery to another providing an option not previously available to operators.

For example, if you have charged BB-2590s but no way to recharge your PRC-153, PRC-152 or AA batteries, use the SP module to redistribute energy from the BB-2590/U or other battery source.

Note: the StarPower module will continue to draw power from a battery until the battery voltage drops below 9 Volts. When this happens the Input Status LED will turn off or be solid red.



BB-390 or
BB-2590

AN/PRC-153
charging station

Note: To transfer energy from a BA-5590, BA-5390, or BA-8180 connect the battery to the INPUT port.

OUTPUT POWER OPTIONS

The StarPower Module is capable of energizing many different types of battery operated weapon systems with the correct interface cable. Typical applications (with standard cables) are listed below.

Power AN/PRC-117F, AN/PRC-150, AN/PRC-152, AN/PRC-148, Panasonic Tough book. The StarPower module will also charge rechargeable batteries and convert DC power to 115 VAC at approximately 120 Watts.

What are you trying to power?

END ITEM	WATTS	END ITEM	WATTS
AN/PRC-153	5	AN/PRC-150	20
AN/PRC-148	5	AN/PRC-117F	20
AN/PRC-152	5	TOUGHBOOK	105
AN/PRC-119F	5	AN/PRC-119D	5

OUTPUT POWER CHARGING BATTERIES

The StarPower module can automatically detect and charge a single or multiple batteries of mixed types and chemistries. The StarPower module can regulate and charge batteries in various charge states at the same time.

Batteries can be charged from any of the standard INPUT power sources, Solar Energy, Vehicle electrical 24V system, or primary batteries (BA-8180/U preferred). When charging two batteries, the StarPower module charges the more depleted battery first. The module monitors and optimizes the charge state of connected batteries to best utilize available input power.



The preferred rechargeable battery is the BB-2590/U. The State of Charge Indicators (SOCI) on the BB-2590/U are monitored to determine amount of charge. Refer to page 75 for additional information.

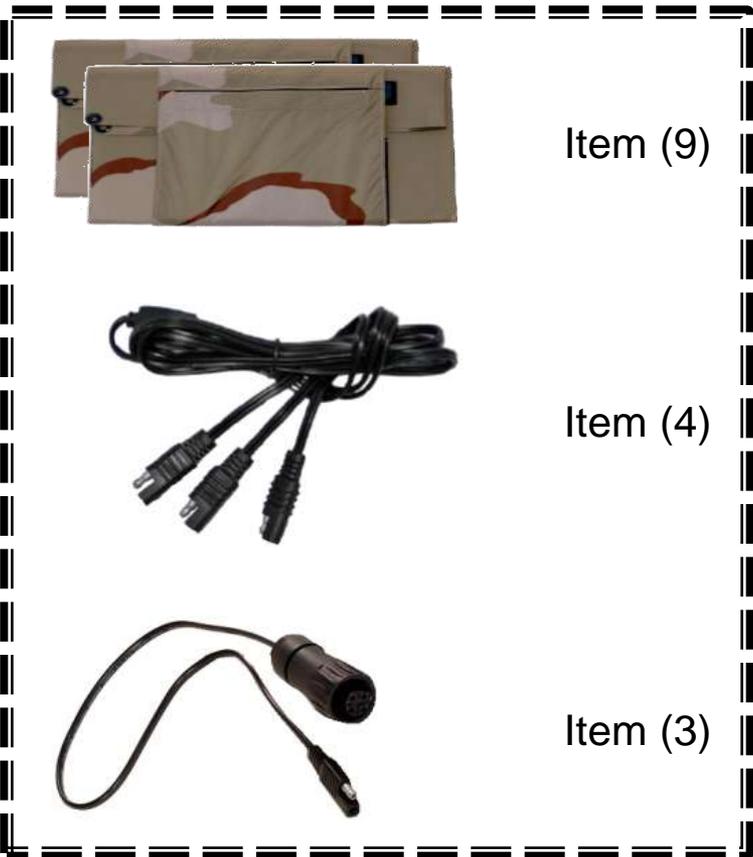
BATTERY CHARGING STATUS INDICATOR LIGHTS

Table 3: Output Status LED for battery charging.

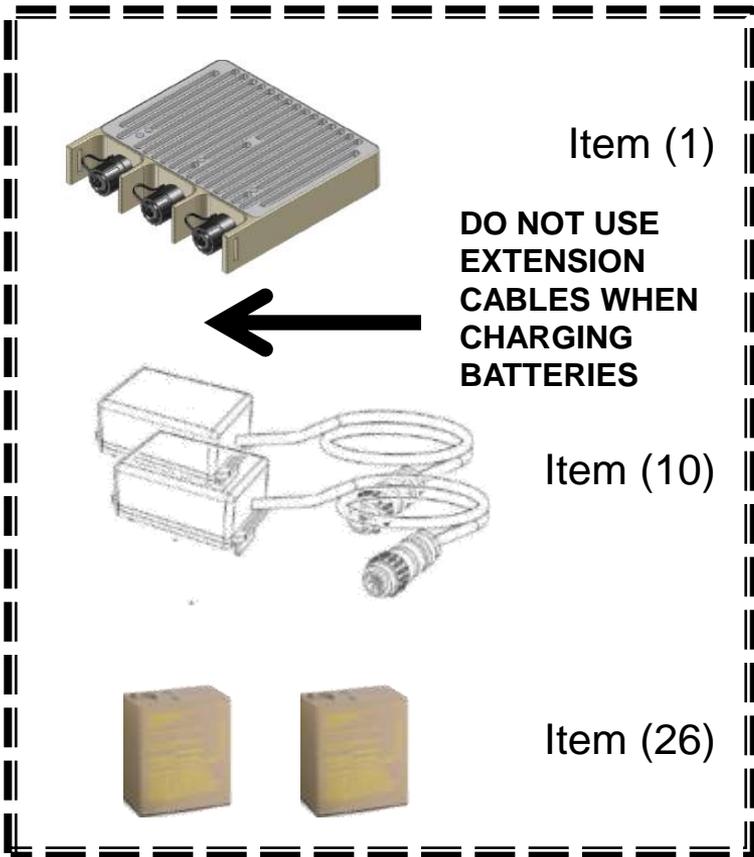
COLOR CHART INSIDE BACK COVER

LED Color	LED State (color)	Graphic	Indicates	Comments
	OFF Black Solid		<ul style="list-style-type: none"> No connection No output device connected No battery connected 	Normal when nothing is connected to the output(s)
	Green Solid		Battery charge complete	Battery charge complete
	Green Flashing		Battery charging in process	LEDs will go to solid green when charge is complete
	Amber Solid		Battery discharging	Battery is discharging and may not have enough power to run load
	Red Flashing		Battery low	<ul style="list-style-type: none"> Battery power is low and needs to be recharged Battery charging failed, battery did not charge within allotted or expected time Battery charge cycle did not complete successfully Battery is overheated, defective or reached end-of-life
	Red Solid		Battery is defective	Battery defective – needs to be replaced

BATTERY CHARGING CONFIGURATIONS



INPUT CONNECTOR



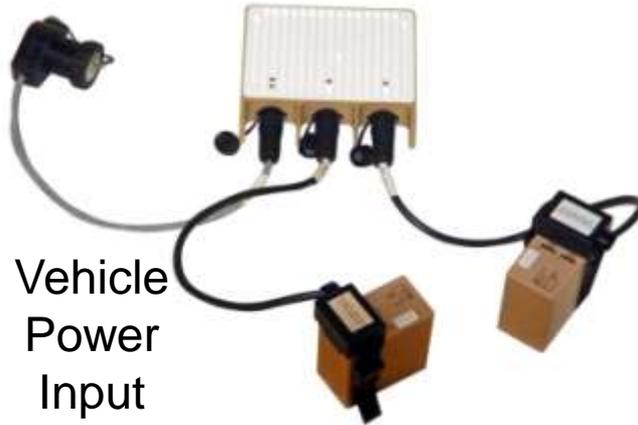
OUTPUT

BATTERY CHARGING CONFIGURATIONS

BA-8180/U
Power
Input

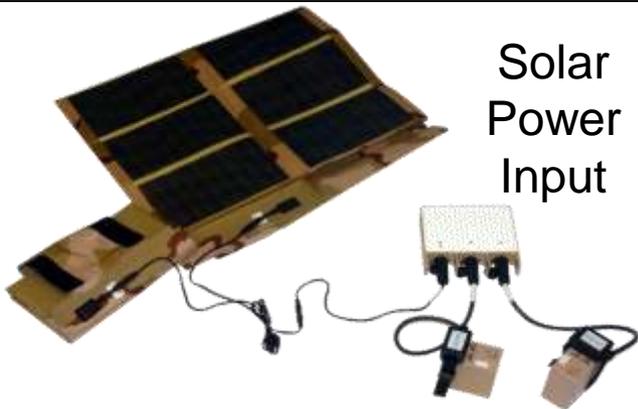


Vehicle
Power
Input

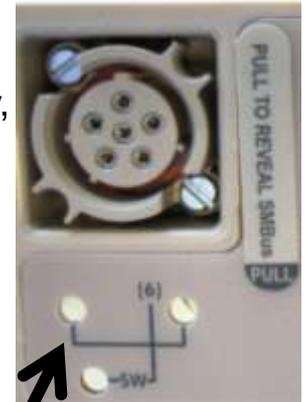


**DO NOT USE
EXTENSION
CABLES TO
EXTEND THE
DISTANCE
BETWEEN THE
BATTERY AND
STARPOWER**

Solar
Power
Input



Keep the battery contacts clean, especially the 3 brass buttons on the top of the battery, as well as the mating pogo pins on the smartcap. These contacts are used to determine the battery type and to enable optimal battery charging. Flashing green indicates the battery is recognized and charging. Solid green indicates charging is complete.



Brass buttons

Page 54

CHARGING BATTERIES IN COLD WEATHER

The operating temperatures for SPACES is -4°F to +131°F degrees. Rechargeable batteries are designed to operate from -4°F to +122°F (-20°C to +50°C). At low temperatures, rechargeable batteries will operate, but will not accept a recharge cycle.

Charging should occur above +40°F. In temperatures below +40°F, the batteries will take much longer to charge or may not charge fully. Batteries left in temperatures below -4°F must be thawed before charging or they may vent. Allow batteries to thaw for at least six hours.



IMPACT – while SPACES will operate below freezing, the BB-2590/U once depleted, may not accept enough energy to continue providing that UPS capability.

ENERGIZING LOADS STATUS INDICATOR LIGHTS

Table 4: Output Status LED for load (radio, accessories).

COLOR CHART ON BACK COVER

LED Color	LED State (color)	Graphic	Indicates	Comments
	OFF Black Solid		No load connected	
	Green Solid		Load connected	Load cable/accessory is connected
	Amber Solid		Not enough power to run load	Battery/input power too low to sustain operation of load
	Red Solid		Load defective	Short circuit in cable, load or accessory

OUTPUT POWER ENERGIZING PRC-148/152



Item (9)



Item (4)



Item (3)



Item (8)

Item 8 is shown
on page 46

INPUT CONNECTOR



Item (10)



Item (26)



OUTPUT 1



Item (1)



Item (11)



Item (20)

OUTPUT 2 Page 57

OUTPUT POWER ENERGIZING PRC-148/152



Item 33 is issued with the kit and will power both the PRC-148 and the PRC-152.



Item 20 is a ZINC-AIR adapter J-6686 that will power both the PRC-148 and PRC-152.



Use Item 33 and item 9 to power the PRC-148 or 152 directly from a BA-5590, BA-5390, BB-390 or BB-2590.



OUTPUT POWER ENERGIZING SINGARS RADIOS



Item (9)



Item (4)



Item (3)



Item (8)

Item 8 is not shown on page 48

INPUT CONNECTOR



Item (10)



Item (26)



OUTPUT 1



Item (1)



Item (11)



Item (12)

OR



Item (14)

OUTPUT 2 Page 59

OUTPUT POWER ENERGIZING SINGARS RADIOS



Item 12 is used with the PRC-119F.



Item 14 is used with legacy SINGARS.



OUTPUT POWER ENERGIZING 24 VOLT RADIOS



Item (9)



Item (4)



Item (3)



Item (8)

Item 8 is not shown on page 62

INPUT CONNECTOR



Item (10)



Item (26)



OUTPUT 1



Item (1)



Item (11)

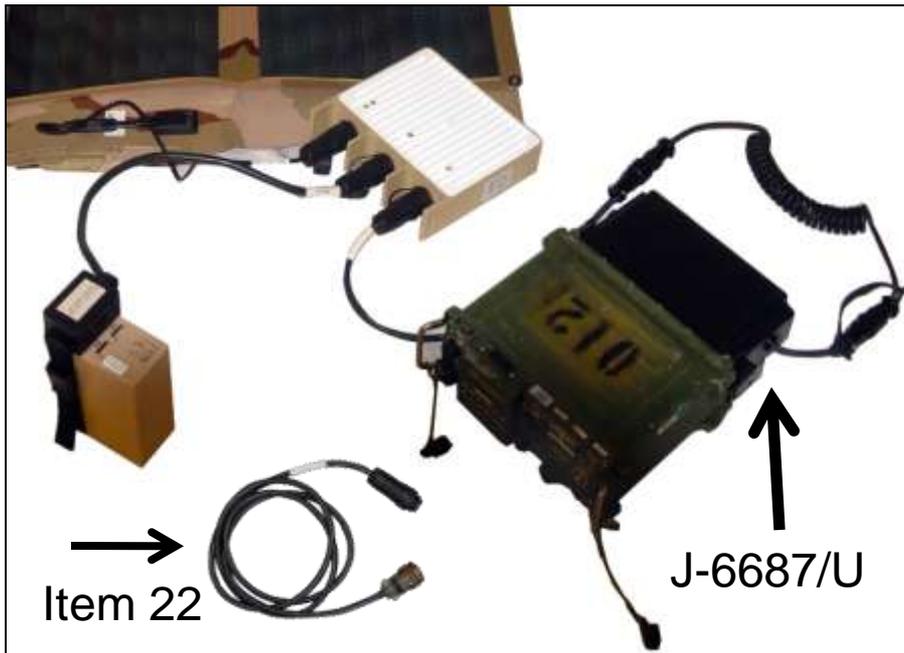


Item (16)

OUTPUT 2 Page 61

OUTPUT POWER ENERGIZING 24 VOLT RADIOS

There are several options for connecting a 24V radio to the StarPower module.



Option 1 - use the J-6687/U item 16.

Option 2 - modify the DC cable of the MRC-93 Radio Power Adapter IAW TI 11838A-OI.

Option 3 - use item 22 (Output Cable MRC-93) to connect the SP module directly to a MRC-93 RPA.

MRC-93 Radio
Power Adapter
H7706



OUTPUT POWER AUTO ACCESSORY ADAPTER



Item (9)



Item (4)



Item (3)



Item (8)

INPUT CONNECTOR



Item (10)



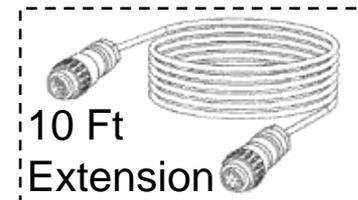
Item (26)



OUTPUT 1



Item (1)



10 Ft
Extension

Item (15)

Item 15 is an
optional item
not shown



Item (17)
AUTO
accessory plug

OUTPUT 2 Page 63

OUTPUT POWER AUTO ACCESSORY ADAPTER

The Auto Accessory Adapter (item 17) can supply 12 VDC power up to 10 Amps to power auto plug configured accessories including DC to AC inverters.



AA Battery Charger



AN/PRC-153 vehicle battery charger



DC to AC Inverters (page 68-70)



Cell phone chargers



USB Charger



iPod Charger Page 64

OUTPUT POWER ENERGIZING LAPTOP COMPUTERS



Item (9)



Item (4)



Item (3)



Item (8)

INPUT CONNECTOR



Item (10)



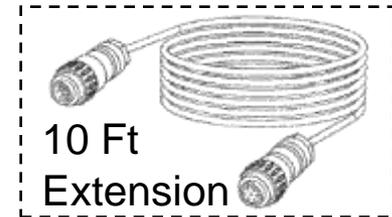
Item (26)



OUTPUT 1



Item (1)



10 Ft
Extension

Item (15)

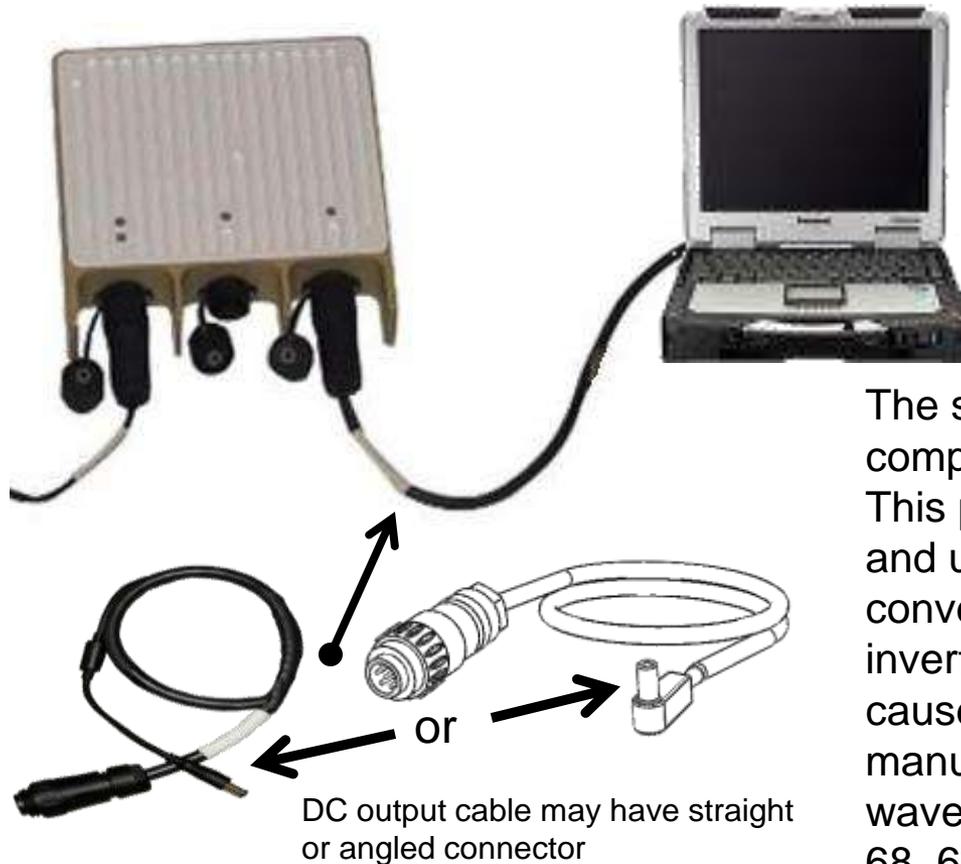
Item 15 is
optional and
not shown



Item (21) for
Panasonic &
item (43) for
Dell

OUTPUT 2 Page 65

OUTPUT POWER ENERGIZING LAPTOP COMPUTERS



The primary method of powering laptop computers is directly from the SP Module using cable item 21 (Panasonic) or item 43 (Dell). The Dell cable does not charge the laptop battery

The secondary method of powering laptop computers is using the DC to AC inverter. This process is a less efficient use of energy and users must be aware of the type of converter being used. Many inexpensive inverters are a modified sine wave that could cause possible damage. Consult with the manufacturer before using modified sine wave inverters (refer also to page 68, 69, and 70).

USING THE AC TO DC CONVERTER

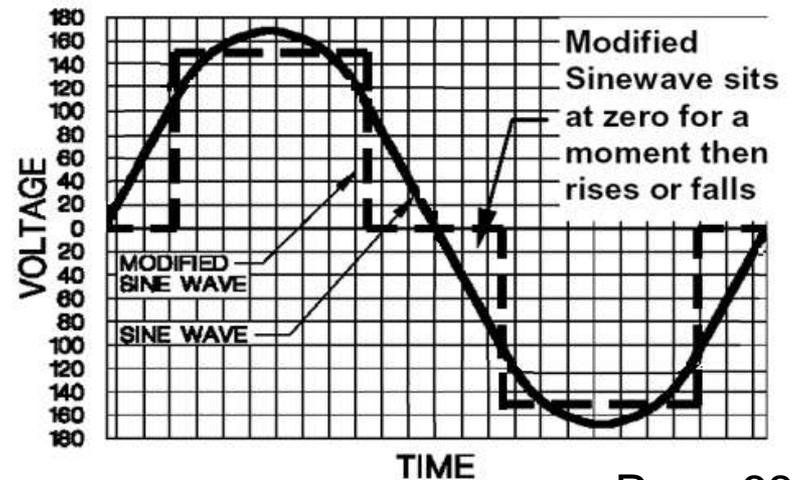
The AC to DC converter is used to power the StarPower module from standard 115 VAC power. This is typically done in garrison when troubleshooting the module or components.



OUTPUT POWER DC TO AC CONVERSION

There are two basic types of micro inverters that work with SPACES – those that produce a modified sine wave and those that produce a pure sine wave. Although modified sine wave micro inverters are less expensive (average \$30.00) than true sine wave models (average \$110.00), they do not produce the quality waveform required by some equipment. Utility companies produce electricity that is a true sine wave. A modified sine wave inverter produces a slightly squared off electrical waveform that can damage some types of equipment. Pure sine wave inverters produce a sine wave that is the same as utility generated waveforms. Pure sine waves are needed by high-end audio equipment and other specialized equipment that are electrically sensitive such as life support equipment.

The DC output of the StarPower module is regulated at 12 Volts / 10 Amps.
Using micro inverters rated above 120 Watts **WILL NOT** produce over 120 Watts.



OUTPUT POWER DC TO AC CONVERSION

Pure Sine Wave inverters produce a better and cleaner current. The PST-12S-12A pictured below is a 120 watt Pure Sine Wave inverter. It retails for approximately \$110.00.



Modified Sine Wave inverters can damage equipment with sensitive electronic components.

The Duracell 175 pictured below is a 175 watt Modified Sine Wave inverter. It retails for approximately \$30.00.



While Panasonic Tough book laptop's should run fine on a modified sine wave inverter, check with the manufacturer before using other commercial brands.

OUTPUT POWER DC TO AC CONVERSION

SAMLEX 120 PST-12S-12A MICRO INVERTER

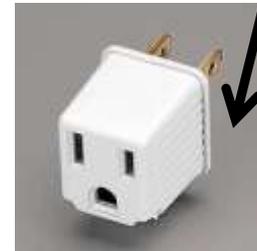
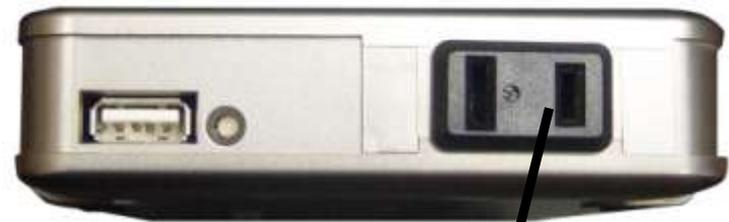


Requires two prong adapter (not included)
Over TEMP protection
Low DC cut off
High DC cut off

Fan cooled



Fuse



SCAVENGING POWER FROM PRIMARY BATTERIES



Item (28)



Item (9)

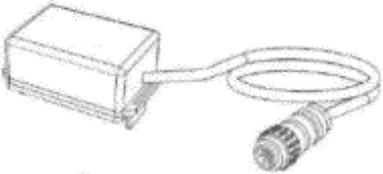


Item (6)

INPUT CONNECTOR



Item (1)



Item (10)



Item (26)

OUTPUT

SCAVENGING POWER FROM PRIMARY BATTERIES

This feature is typically used to scavenge remaining energy from used primary batteries (BA-5590B/U, BA-5390/U, BA-8180/U) and transfer that energy to a rechargeable battery (BB-390B/U, BB-2590/U) for later use.

**DO NOT USE BB-390A/U
OR BB-590 BATTERIES**

Note: the StarPower module will continue to draw power from a battery until the battery is depleted. When this happens the Input Status LED will turn off or turn solid red.



PRIMARY BATTERY INFORMATION



BA-5590B/U



BA-5390/U



BA-8180/U

The BA-5590 lasts on average 24 hours in most 24V radio systems. The BA-5390/U and BA-8180 have approximately 40% more capacity than the BA-5590B/U and lasts much longer. Both the BA-5590B/U and BA-5390/U can be ordered with State of Charge indicators (SOCl).

NOMENCLATURE	NSN	REMARKS
BA-5590B/U	6135-01-438-9450	Package of 4
BA-5590A/U W/SOCI	6135-01-523-3037	Package of 4
BA-5390/U	6135-01-501-0833	Package of 4
BA-5390A/U W/SOCI	6135-01-517-6060	Package of 4
BA-8180/U	6135-01-500-0572	Package of 1

RECHARGEABLE BATTERY INFORMATION



BB-390B/U

- Nickel Metal Hydride
- Condition Quarterly
- Recharge every 3 months
- 6140-01-490-4317
- Package of one



BB-2590/U

- Lithium Ion
- Requires NO Conditioning
- Recharge every six months
- 6140-01-490-4316
- Package of one

The BB-590 and BB-390A/U batteries are obsolete and should not be used in any application.



**DISCHARGE CAP
PP-8497/U**

NSN 6130-01-490-4310

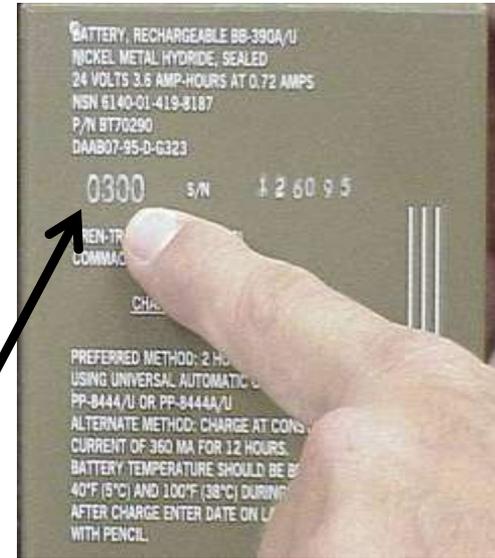
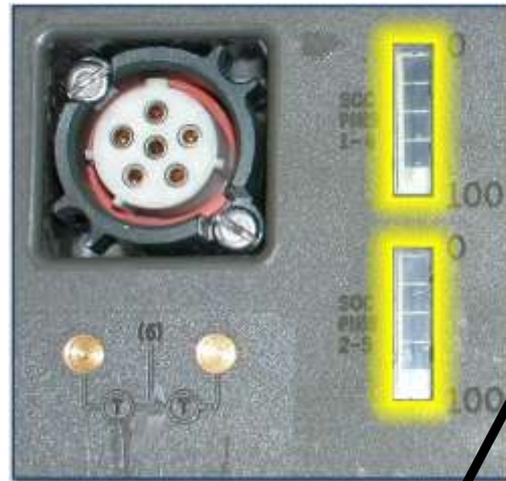
RECHARGEABLE BATTERY INFORMATION

SOCI and Warranty Expiration

The SOCI only shows the battery is fully charged, not the battery capacity.

Just because a battery shows a full SOC, it may only have enough energy to run your equipment for a few short hours.

Watch the age of your batteries. Just another good reason to dispose of those aged BB-390A/U batteries.



Check the date code –

0300 (left of S/N)
03 – Month (March)
00 – Year (2000)

- BB-390B/U – (4) Years
- BB-2590/U – (4) Years

PREVENTIVE MAINTENANCE

**CAUTION – DO NOT USE HARSH OR ABRASIVE CLEANERS
OR PETROLEUM-BASED PRODUCTS OF ANY KIND.**

STARPOWER MODULE. Clean to remove obstructions from the input connectors and the status LED indicator windows. Use a damp cotton cloth with mild soap to remove excess dirt/mud accumulations.

SOLAR PANELS. Inspect for damage to the panels and connectors. Clean connectors with compressed air or a dry plastic brush. Solar panels can be cleaned with a damp cotton cloth using mild soap to remove excess dirt. **DO NOT USE SOLVENTS.** Panels exhibiting excessive wear or clearly damaged should be replaced.

CABLES. Inspect for obstructions in the electrical connectors, the connector locking mechanism, or threads. Clean with compressed air or a dry plastic brush.

Cables should be checked for compression damage (crushed), wear, burns, cuts, or heat damage. Clean with a damp cotton cloth. Mild soap can be used to remove excess dirt/mud accumulation.

TROUBLE SHOOTING CHARTS

MODULE DOES NOT TURN ON

INPUT LED STATUS	POSSIBLE FAULTS	QUICK CHECK	TEST AND TROUBLE SHOOTING
OFF	No input voltage	Verify input connector is fully seated.	Remove input connector. Use a digital multimeter (DMM) to measure the voltage between positive pins 1 and 2 and negative pins 3 and 4.
	Wrong polarity of input voltage	Verify that the input polarity is correct.	Pins 1 and 2 are positive and pins 3 and 4 are negative on the input cable that connects to the StarPower™ module input port.
	No power source	Verify input power is connected.	Use DMM to measure voltage at the source. Input voltage must be in the range of 9 to 35 Volts DC.
	Broken wire in input cable	Try another input cable.	Refer to TM 11838A-OR/2 Table 17; Cable Pinouts for Continuity Testing of cables.
BLUE	Input voltage is over 35 V		Disconnect voltage source and measure input voltage. Input voltage must be in the range of 9 to 35 Volts DC.

TROUBLE SHOOTING CHARTS

OUTPUT LOAD IS NOT WORKING

OUTPUT LED STATUS	POSSIBLE FAULTS	QUICK CHECK	TEST AND TROUBLE SHOOTING
OFF	Output cable not connected.	Verify that output cable is fully seated on either of the two StarPower™ module output port connectors.	Only Iris output cables will be recognized because of a one wire detection circuit in the cable connector. Non iris cables will not work with the StarPower™ module.
		Try the output cable in the other StarPower™ module output port.	If the cable works on one port and not the other there may be a malfunction with the StarPower™ module port that does not recognize the cable.
		Connect a different output cable to the questionable output port.	If second output cable works correctly check continuity of defective cable.
Green Output LED but still incorrect output to load	Broken wire or connector in output cable.	Try another cable if available.	Refer to TM 11838A-OR/2 Table 17; Cable Pin outs for Continuity Testing of cables.
		NOTICE: The Zinc output cable does not deliver voltage until it is connected to the RPA and the Radio. The StarPower module dynamically identifies the type of radio and voltage needed before it will supply power.	Check cable for continuity. Refer to TM 11838A-OR/2 Table 17; Cable Pinouts for Continuity Testing of cable.

TROUBLE SHOOTING CHARTS

MODULE NOT WORKING

OUTPUT LED STATUS	POSSIBLE FAULTS	QUICK CHECK	TEST AND TROUBLE SHOOTING
OFF	No battery voltage to StarPower™ module	Verify that the SmartCap™ connector is fully seated on either of the two output connectors of the StarPower™ module.	Without input voltage to the StarPower™ module the battery output port LED will be green. With sufficient input power the battery output port LED will flash green or remain solid green depending on the charge state of the battery.
		Verify that the SmartCap™ is fully engaged with the battery.	Secure clamping strap to ensure all battery contacts are fully engaged.
	Dirty or corroded contacts on battery or SmartCap™		Completely clean electrical contacts.
	Broken wire or pin in SmartCap™ cable	Try another SmartCap™ cable.	Check for bent, broken, or missing pins on the SmartCap or its connector. Refer to TM 11838A-OR/2 Table 17; Cable Pin outs for Continuity Testing of cables.
	Battery is completely discharged	Verify bars on windowed batteries.	Battery needs to be charged for 3 to 6 hours to fully charge. (5 bars)

TROUBLE SHOOTING CHARTS

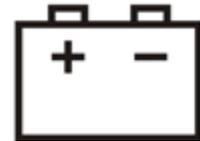
MODULE NOT WORKING

GREEN SOLID	Input power not connected	Verify that input LED is OFF if input power is not connected.	This is a normal state of operation when no input source is available and there is no load on the output.
AMBER SOLID	Input power not connected or is insufficient to supply the load	Output load is drawing more current than the input source can provide - thus draining power from the battery.	This is a normal state of operation when no input source is available and the load is running off of the battery. If possible increase the input source power to run the load and charge the battery.
RED FLASHING	Battery charge is depleted	Try charging battery for an hour. LED should change to flashing green indicating that the battery is charging.	If battery does not begin taking a charge within an hour, the battery is defective and needs to be replaced. Battery temperatures greater than 40° C or less than 5° C may reduce battery's ability to take a charge. Refer to battery specifications.
RED SOLID	Battery is faulty - Does not accept a charge.	Replace battery	

FREQUENTLY ASKED QUESTIONS

Q - Can SPACES charge vehicle batteries?

A – Yes, but it is not recommended. Doing so requires Cable, Output, Clamp (battery clamp cable not included in USMC kit).



Q - What are the solar panels already on tactical vehicles and generators used for?

A – These are called Pulse Solar Chargers (PSC) and ARE VERY different than the SPACES solar panels. The PSC panels generate a very low milliamp charge to off set parasitic battery drains when the equipment is sitting idle.



FREQUENTLY ASKED QUESTIONS

Q - How rugged are the flex panels and will they continue to work if damaged?

A – Panels are designed to last under harsh climate conditions and have a 2 year warranty. Depends on the level of damage, but yes, with degraded output power.

Q - How many extension cables can I connect and not suffer line loss?

A – Limit to 1 (one) 10 foot output extension cable per output port.

Q - Will the StarPower module condition a BB-390B/U or BB-2590/U before attempting to charge?

A – No. Use discharge CAP PP-8497/U (page 74) for the BB-390B/U. The BB-2590/U does not require conditioning.

FREQUENTLY ASKED QUESTIONS

Q - If the overvoltage light comes on will the unit automatically reset when voltages fall back within range or do I have to disconnect the input connector?

A – The StarPower module will automatically turn on once the input voltage drops below 35 volts. The input does not need to be disconnected to reset.

Q - How much heat is generated from the StarPower module heatsink?

A – The StarPower module dissipates very little heat even under heavy loads. The heatsink is used to ensure operation at elevated ambient temperatures up to 131 degrees F.

FREQUENTLY ASKED QUESTIONS

Q – Can I use a BA-5590B/U in place of a BB-2590/U on the output port?

A – No. The StarPower software will not recognize a primary (BA) on the output ports.

Q – How can I find warranty information?

A – Refer to Fielding Plan FP 11838 or Supply Instruction SI11838A-OI.

Q – Does it matter which output port I connect the SmartCAP to?

A – No. It is easier to connect and disconnect other devices if you connect the SmartCap to the center port.

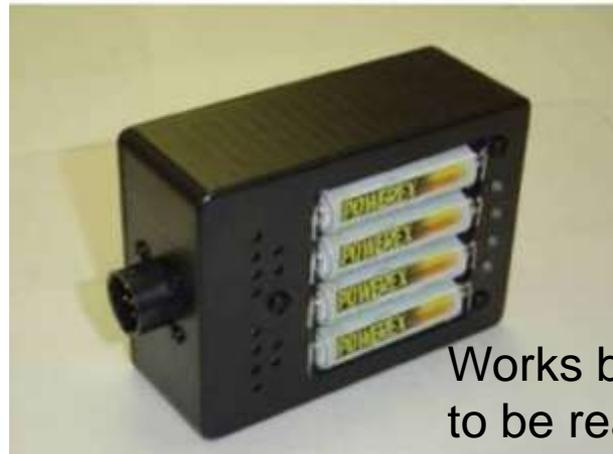
FREQUENTLY ASKED QUESTIONS

Q – How can I use SPACES to charge AA/AAA rechargeable batteries?

A – Yes, we recommend that you use a commercial auto plug configured charging station. The SCAVENGER (pictured bottom left) can be used to transfer energy from a BB-2590, BB-390, BA-5590 or BA-5390 directly to AA batteries. See page 19 for the Scavenger NSN.



Commercial AA/AAA
12V auto plug charger



Works but not found
to be real efficient.



FREQUENTLY ASKED QUESTIONS

Q – Can I power a PRC-153 radio using the StarPower module?

A – Yes but you will need cable 848.0527. You can use the HH-RPA-153 to power the PRC-153 from a BB-2590 battery once the StarPower can charged the BB-2590.



The HH-RPA-153 is available for FREE.
Send a request to
pm_eps@nmci.usmc.mil

PM EPS FIELD SERVICE REPRESENTATIVES

Location	<p align="center">PM EPS WEB SITE</p> <p align="center">http://www.marcorsyscom.usmc.mil/sites/pmeps</p>
	<p><u>Talmadge Jackson</u>, Camp Pendleton (951) 491-3556, talmadge.d.jackson.ctr@usmc.mil</p>
	<p><u>Ken Copeland</u>, Camp Lejeune - Maintenance Operations Center (MOS) (910) 545-2547 / ken.copeland@usmc.mil</p>
	<p><u>John O'brien</u>, Camp Kinser, Material Operations Center 011-81-611-745-7284, DSN 645-7284 / john.o'brien.ctr@usmc.mil</p>

Mike Bissonnette - michael.bissonnette@L-3com.com
 Daryl Wilson - daryl.wilson@L-3com.com
 Scott Allen - scott.b.allen@L-3com.com

Table 3: Output Status LED for battery charging.

LED Color	LED State (color)	Graphic	Indicates	Comments
	OFF Black Solid		<ul style="list-style-type: none"> No connection No output device connected No battery connected 	Normal when nothing is connected to the output(s)
	Green Solid		Battery charge complete	Battery charge complete
	Green Flashing		Battery charging in process	LEDs will go to solid green when charge is complete
	Amber Solid		Battery discharging	Battery is discharging and may not have enough power to run load
	Red Flashing		Battery low	<ul style="list-style-type: none"> Battery power is low and needs to be recharged Battery charging failed, battery did not charge within allotted or expected time Battery charge cycle did not complete successfully Battery is overheated, defective or reached end-of-life
	Red Solid		Battery is defective	Battery defective – needs to be replaced

Table 4: Output Status LED for load (radio, accessories).

LED Color	LED State (color)	Graphic	Indicates	Comments
	OFF Black Solid		No load connected	
	Green Solid		Load connected	Load cable/accessory is connected
	Amber Solid		Not enough power to run load	Battery/input power too low to sustain operation of load
	Red Solid		Load defective	Short circuit in cable, load or accessory