

Paralleling SkyBox

Installing multiple SkyBox units in a single system can provide power to systems requiring more than 5 kW. This note will cover how to properly set up a system of this magnitude.

Physical Installation

The first section of this note will cover the physical installation requirements and best practices of a multi-SkyBox system.

First, each SkyBox should have a minimum distance of 6" on both sides to ensure adequate airflow to the unit internals and ease of access to the BOS of each unit. The picture below represents this.

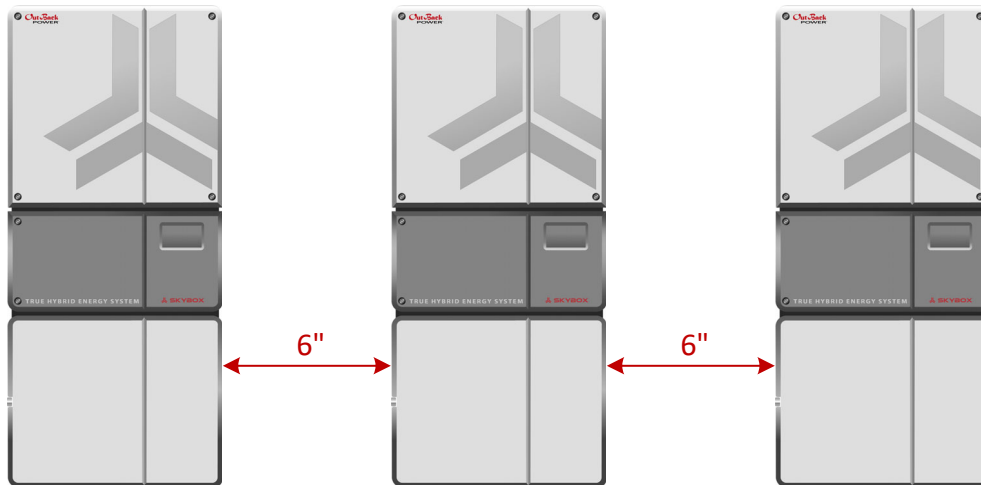


Figure 1 - Correct Spacing

Each unit will have its own battery bank. No two units may share the same battery bank as each unit controls its own battery monitoring program. Ensure enough room is left around the unit to accommodate each battery bank.



CAUTION: Hazard to Equipment

Each SkyBox MUST have its own, separate battery. Damage can occur if a battery is shared.

AC Input

All units must be tied to the same AC input, whether that is the grid or a generator. See the diagram on page 7 for further clarification. This may require the use of a bus bar. OutBack does not provide general specifications on the size of this bus bar as it is site-specific. Take the appropriate safety precautions when connecting the devices to the AC input.

AC Output

All units must be tied to the same AC output. While off grid, similar to a Radian or FXR system, the master unit sets the voltage and current parameters for each of the slave units. If the units are connected to separate outputs, damage can occur. Take the appropriate safety precautions when connecting the devices to the AC output.

Application Note

Communications Connections

The system controller on each unit is equipped with two Ethernet ports. One is labeled **WALL** and the other **SkyBox**. When paralleling units, the master unit has a connection from its **WALL** port to the internet router. To ensure the most stable connection, the master unit should have a direct connection to the router. Using a bridge device has caused many dropped connections.

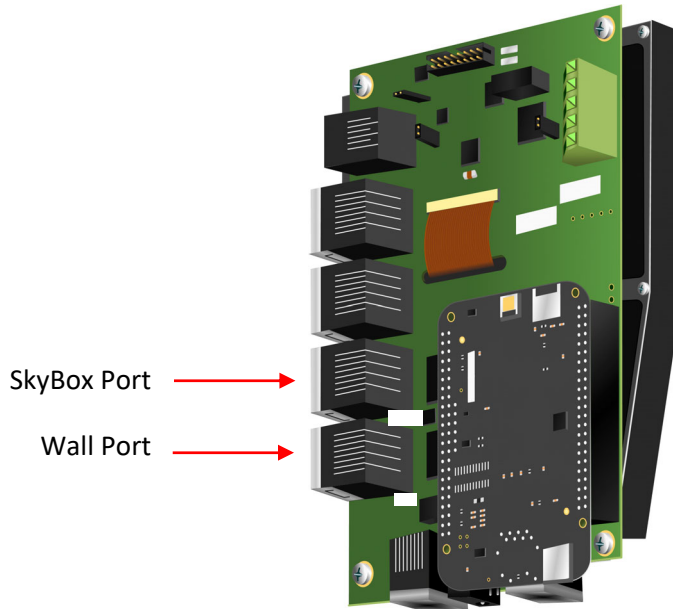


Figure 2 – Wall and SkyBox Ports

The connection from the master unit to the first slave unit is made from the master’s **SKYBOX** port to the slave’s **WALL** port. This pattern continues throughout the system. See Figure 3 below.

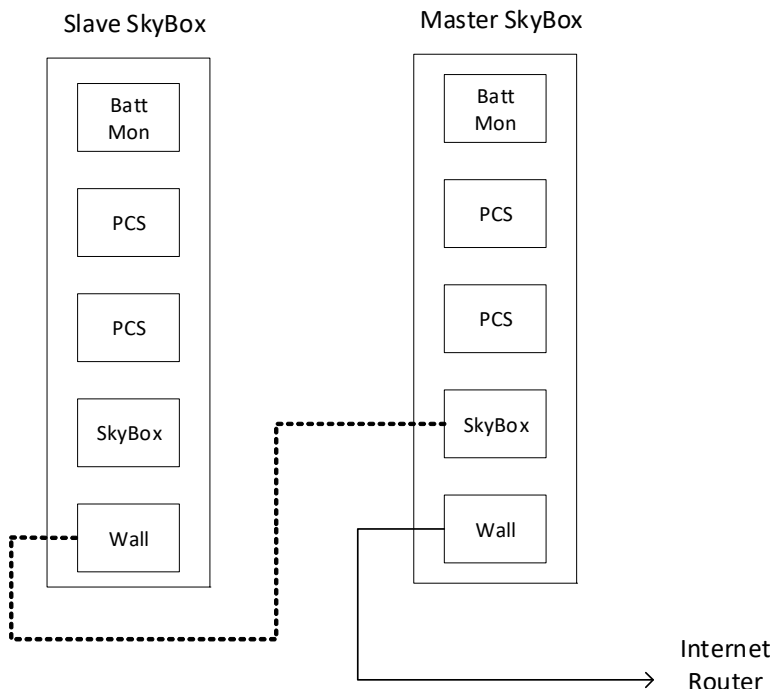


Figure 3 – Stacked system communications connections

Application Note

User Interface Setup

After all physical connections have been made and voltages have been checked for the appropriate phase relationship, apply power to the system.

Beginning with the master unit, log in as **Installer**. Under the **Network** tab edit menu, ensure the **Ethernet Connection** toggle is on **Wall**. Slave Ethernet connections will be on **SkyBox**.

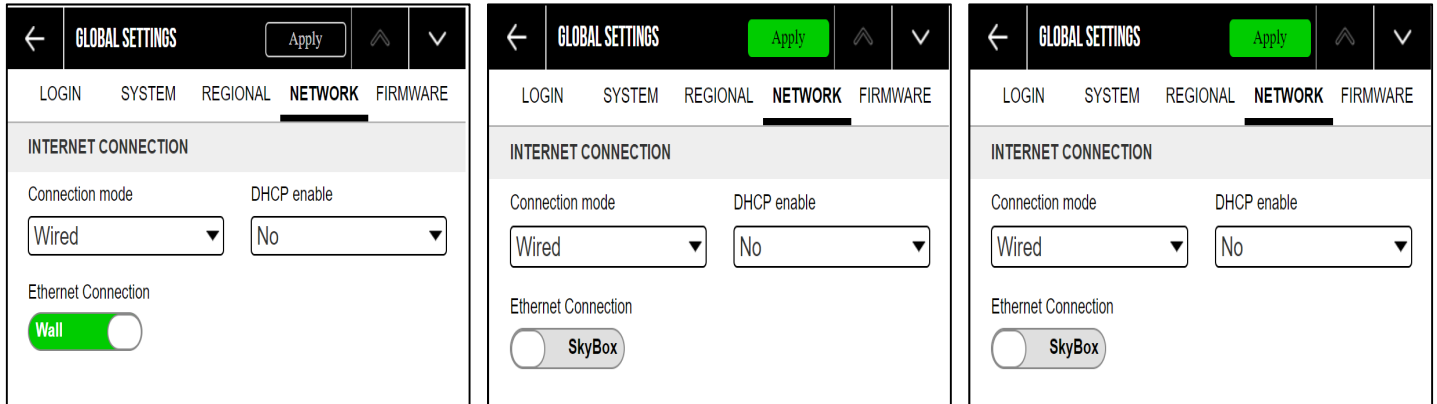


Figure 4 – Ethernet Connection Page, Master and 2 Slave Units

Next, navigate to the home screen and SkyBox icon. On the **Configure** menu screen labeled **PARALLEL SETTINGS**, change the **Units Installed** number to the appropriate value. Enable the **Endpoint Termination**. These settings tell the system how many units to look for and which units will start and end communications.

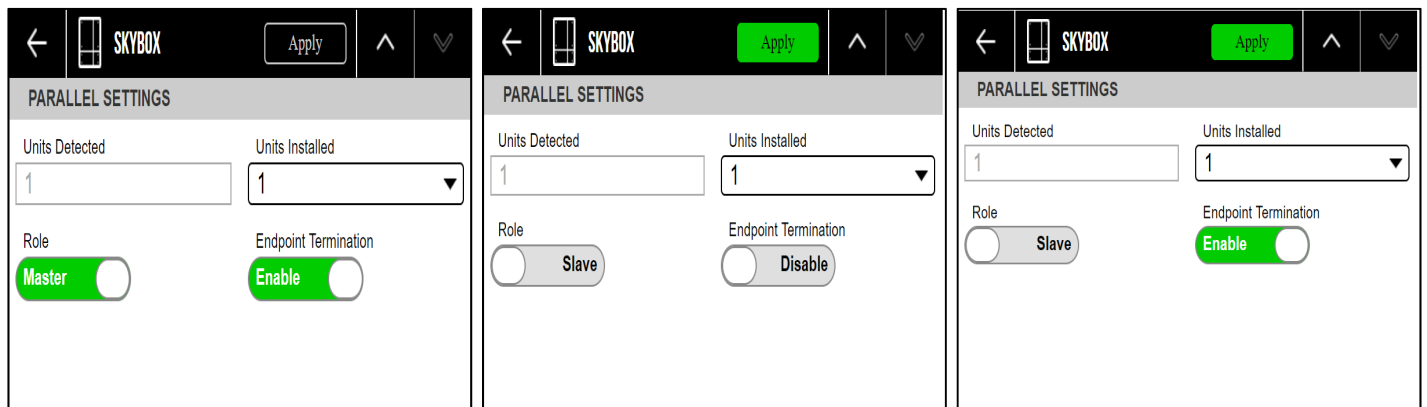


Figure 5 - Parallel settings for a master, middle slave, and end slave

Next, move to the first slave unit. Log in as **Installer**. Change the **Ethernet Connection** toggle to **SkyBox**. This is telling the unit it will be communicating to another unit in the system. Change the **Units Installed** to the appropriate value. If only two units are being installed, enable the **Endpoint Termination**. If three or more units are installed, disable the **Endpoint Termination** on this unit.

Repeat the above steps for each slave unit in the system. At the final unit in the system, enable **Endpoint Termination**.

Application Note

Startup Process

After completing the appropriate settings on the user interface, completely power down the system. At this point, all breakers should be open. Follow the steps below. If no batteries are present, start units from grid.

1. Close battery breakers on each unit in the system, starting with the master unit.
 - A. Startup from battery should take approximately 45 seconds to 1 minute.
2. Check for units installed vs. units detected on all units during the first power up. This value can be spot-checked on subsequent power cycles.
 - A. Log in as **Owner** or **Installer**
 - B. Return to home screen
 - C. Push SkyBox icon in upper right section of screen
 - D. Configure
 - E. Arrow down twice
 - F. If units detected equals units installed, proceed to Step 3
 - G. If units detected is different from installed, check communications cables for proper seating. Cycle power to affected unit.
3. Shut grid breakers on each unit.
4. Using the power button, turn on the system from the master UI.
5. Shut PV disconnects.

External CT

If using external current transducers (CT), they must be connected to the master unit. Enable this function on the master only on the screen shown below.

The screenshot shows the 'SETUP - CT TYPE' configuration screen. At the top, there is a navigation bar with a back arrow, a SKYBOX logo, an 'Apply' button, and up/down arrows. The main content area has a grey header 'SETUP - CT TYPE'. Below this, there are four input fields arranged in a 2x2 grid:

CT type	Rated current
OB CT-1000	200
Phase shift (degrees)	Turns ratio
0	2000

When this function is enabled, the master unit display will show the total grid demand seen at the external CT location. This number is then used to calculate a **Total Combined Load** value that is displayed on the master unit **LOAD** tile. Under the load tile, protected and unprotected load values are shown.

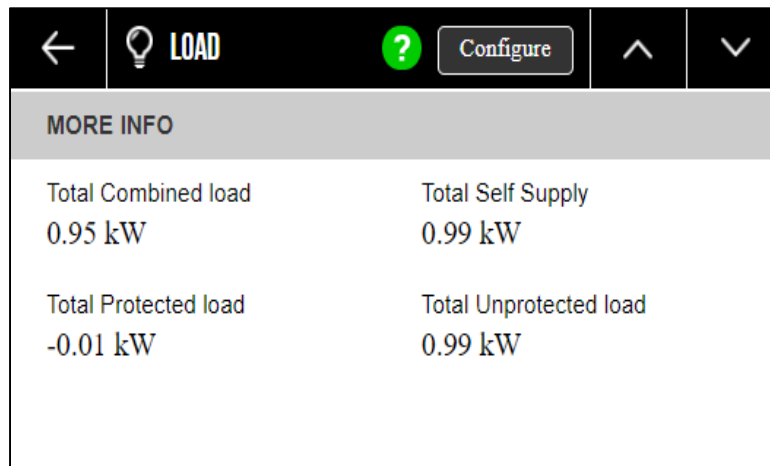


Figure 6 - Protected and Unprotected Loads

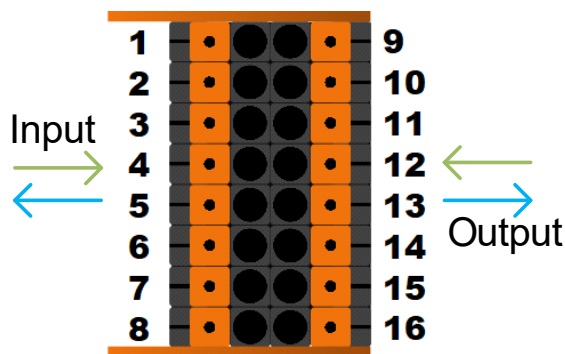
OPTICS RE Integration

Using the OPTICS RE interface provides a path for remotely monitoring and operating the SkyBox system. Multiple sites can be viewed as an aggregate under the **Site** dashboard. Individual units can then be seen under the respective **Device Map**.

A video tutorial for integrating multiple OPTICS RE sites can be found on the WattSchool YouTube channel.

Rapid Shutdown Wiring

Each SkyBox unit requires a short between its rapid shutdown terminals in order to operate. Multiple units may be connected in series using the input and output terminals in each unit. When a rapid shutdown event occurs in a stacked system, each unit will stop harvesting solar power, the power buttons will turn yellow, and an event message will be logged.



The rapid shutdown device, such as the RSD-1, should be connected to the master unit input terminals. A small wire should then be connected from the master output terminals (5 and 13) to the first slave unit's input terminals (4 and 12). This pattern should be continued throughout the system.

If rapid shutdown is not required, a small jumper should be connected between terminals 4 and 12 on the master unit. The pattern described above should then be followed.

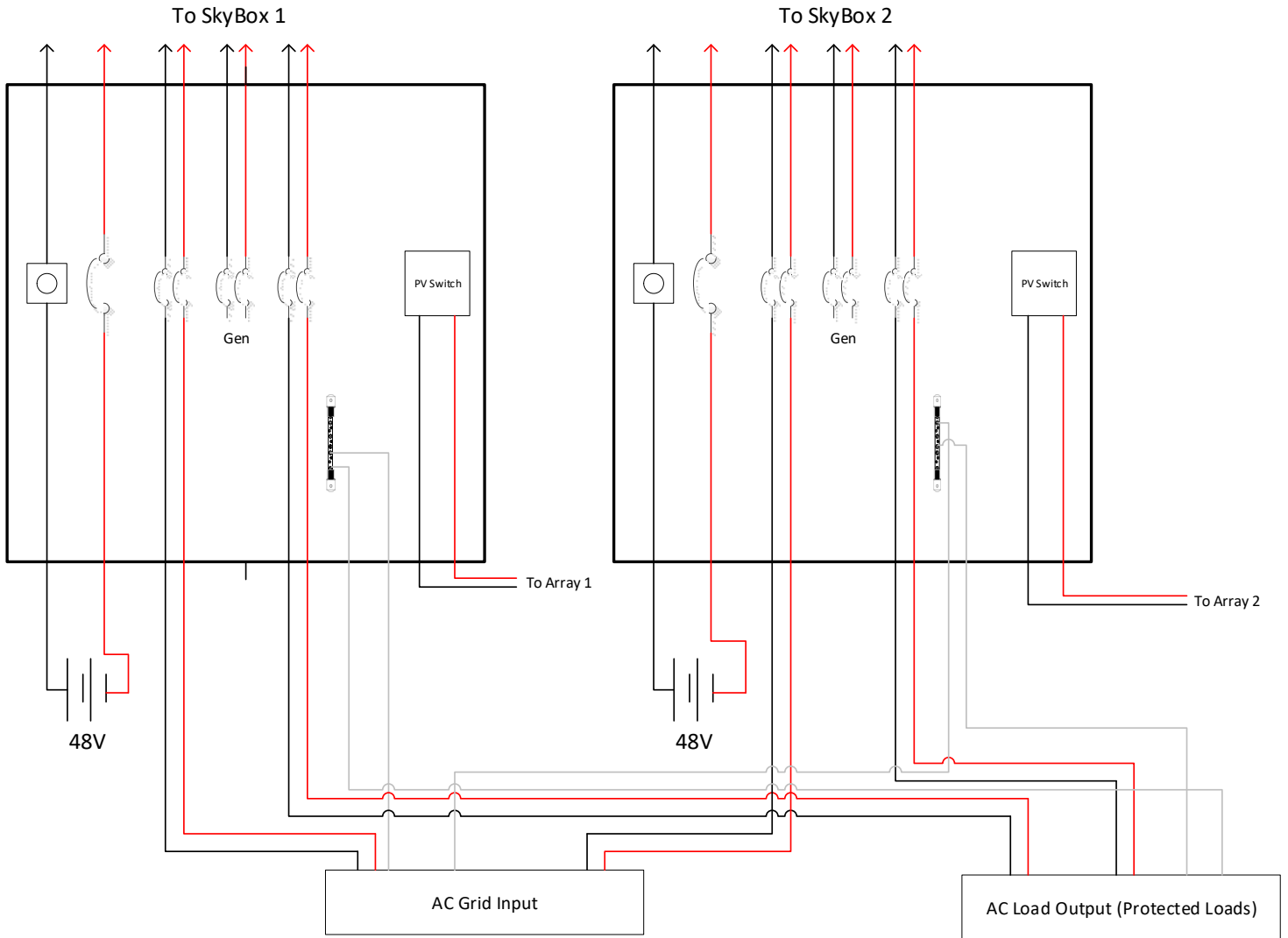
Refer to the appropriate technical documentation for details on rapid shutdown equipment.

Frequently Asked Questions and Basic Troubleshooting

1. Units will not turn on via master UI power button.
Check **Units Installed** vs. **Units Detected**. See page 4.
2. Some units turned on, but others did not.
Check the Ethernet connection setup for all units. All slave units should have the Ethernet connections set to **SkyBox**. See Figure 4.
3. Firmware update best practice
Turn off the system from the master UI. Apply update to the master, then the slaves. A **Firmware Version Verification Failed** error is expected during this time. This error will appear because once the update is applied, all the firmware versions will not match. Once firmware has been updated on all units, cycle power to the system. Bring the system up using only one source (grid or battery). Once the system is up, ensure **Units Installed** equals **Units Detected**. If these values match, turn the system on using the master UI. Bring in other sources of power. Finally, shut all load breakers.
4. Do all units need a separate battery bank?
Yes, each unit requires a separate battery bank.
5. Version Check Failure
This notification will appear when the firmware versions do not match between all units in the system. This notification will also appear when updating the units to a new firmware version.
6. Non-Stacked Systems on One Local Area Network Switch
A single LAN switch cannot be used for multiple SkyBox units that are NOT in the same system. Based on the way the SkyBox communicates, a unit on the same switch will detect another unit, even if it is not part of the same system. In this case, the **Units Installed** versus **Units Detected** will never match.

To prevent this problem, connect separate SkyBox systems directly to the router. Be aware that many switches and routers look alike. Please check the label on the device to ensure it is a router and not a switch.

Application Note



About OutBack Power

OutBack Power is a leader in advanced energy conversion technology. OutBack products include true sine wave inverterchargers, maximum power point tracking charge controllers, and system communication components, as well as circuit breakers, batteries, accessories, and assembled systems.

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