SUSTAINABLE
POWER SYSTEMS

Universal Microgrid Controller®
Frequently Asked Questions

What does the Universal Microgrid Controller (UMC) do?

Simply put, the UMC is a power and energy management system. It provides real-time supervisory control of a set of power system assets to minimize the customer's cost of energy, maximize the utilization of available renewable energy, and minimize consumption of fossil fuels. These assets may include wind turbines, solar arrays, a grid intertie, energy storage systems, and controllable loads. In the case of grid-connected microgrids, the UMC can also provide services to the utility grid operator, such as demand response and frequency/voltage regulation.

Why do you call it the Universal Microgrid Controller? What is universal about it?

To date, most microgrid projects have required a large amount of project-specific engineering and custom integration. In contrast, the UMC is a single hardware and software platform pre-engineered to meet the needs of a wide spectrum of microgrid applications. It is a standardized drop-in industrial control cabinet that can be installed quickly and easily.

How is your approach different than other microgrid control vendors?

Our goal with the UMC is to provide project developers a product that provides not only advance microgrid control functionality but that is also easy to buy, install, operate, and support. Some of the UMC features that make this possible:

- The UMC has an advanced Simulation Mode, in which the actual UMC software operates as if it were controlling the microgrid but is actually communicating with and controlling virtualized components built into the UMC. This allows customers to “test drive” the controller on their proposed microgrid before it is built.
- Once the customer has defined the microgrid architecture and component sizing (with our assistance, if desired), we do the rest. We provide a fully integrated control cabinet, complete with pre-installed software, networking infrastructure (switches, gateway/firewall, etc.), backup power, and rich operator interface. This eliminates the burden on the project developer to select and procure a bunch of different control hardware components, or to figure how to deploy various complex software products on a robust platform that will operate reliably in a customer's facility for 25 years.
- Our UMC communicates directly with the power system components in their native communication protocol. Our system does not require RTUs or communication nodes to be placed on each device. This reduces hardware cost and simplifies installation and commissioning.

Which is better for microgrids, centralized or distributed control?

All practical microgrid control systems are a hybrid of distributed and centralized control. All power system components (grid intertie breakers, diesel generator or gas turbines, wind turbines, PV inverters, energy storage inverters, etc.) have an embedded machine level controller responsible for the high speed control of the local device. On any microgrid of significant size (>100 kW), there is always a central supervisory controller to perform such functions as status visualization, parameter setting, fault annunciation, data historian, and remote access. The question not whether the microgrid control system is purely distributed or purely centralized. Rather, it is which of the intermediate control functions (spinning reserve management, optimal component dispatch, load management, battery management, grid interactions, etc.) are performed at the distributed level or centralized level.

SPS believes that the optimum approach is one that makes maximum use of the inherent control capabilities of the various power components' built-in embedded controllers to perform functions requiring high speed control (frequency and voltage control, synchronization, etc.), but then performs all higher level control functions in a central controller. This approach has the following advantages over “distributed” microgrid control systems:

- No costly control devices need to be added to each power system component. The supervisory controller communicates directly with the embedded controller through its native communications port.
- There is reduced communications traffic on the microgrid control network, because each device only needs to communicate with the central controller, rather than broadcasting to all the other distributed controllers on the network.
- The central controller has direct access to all of the status information available in the machine level embedded controller. This information is typically not available when communicating through a distributed controller, making it more difficult for a system operator to diagnose component problems from a central location.
- Software upgrades and modifications of the microgrid control algorithms can be accomplished more quickly, since all of the dispatch level control software is centrally located on one control computer.

What are your target markets? What kind of projects is the UMC good for?

We have designed our microgrid controller to serve a wide variety of markets and applications. We generally talk about three categories of microgrid:

- Off-grid: islands, remote communities, and off-grid industrial operations
- Weak grid: Commercial/Industrial facilities and communities that are grid-connected but suffer from unreliable and intermittent service and/or poor power quality. These are found mostly in developing countries.
- Grid-tied: Facilities that are served by the grid but want to increase their on-site utilization of renewable energy, reduce their utility demand charges, and increase their energy security and resiliency.

We are not aimed at very small “nanogrid” systems. Rather, we strive to be the highest performing and most cost effective option in the 100 kW to 20 MW size range.

Who are your customers?

Generally speaking, our customers are renewable energy microgrid project developers and EPC firms (Engineer/Procure/Construct). We seek to create ongoing partnerships with such companies, particularly those that have a strong presence in our target market segments.

How many systems have you deployed so far?

Our CEO provided control systems to five different wind-diesel microgrids in Alaska prior to founding SPS. Since its founding in 2012, SPS has been primarily a development stage company, working with early adopters to do several pilot projects. To date, SPS has three systems in the field that represent a diversity of applications:

- 100% renewable 100 kW wind-solar-battery commercial irrigation microgrid on the big island of Hawaii
- 160 kW wind-diesel-battery grid-tied microgrid for a condominium complex in Kansas
- 1 MW wind-diesel-battery island microgrid on San Nicolas Island, a US Navy facility in California
- 100 kW PV-battery-diesel behind-the-meter grid-tied factory microgrid in Jixi, China.
- 1 MW microgrid test and demonstration facility (GridNXT) at SolarTAC in Denver, Colorado.

Does SPS provide engineering services?

While not primarily a consulting firm, SPS does provide design engineering services to help customers identify the optimum system architecture and component sizing for their application. We also perform detailed system stability studies to verify that a proposed system will provide acceptable power quality under various transient conditions.

How much does the UMC cost?

To be able to offer cost-effective solutions to the widest possible range of customers, our microgrid controller is priced according to the specifics of the project, taking into account the size and complexity of the microgrid. With the UMC, the full cost of microgrid controls integration will generally be 3-5% of the overall cost of the microgrid, which is considerably less than many of our larger competitors. Another way to estimate the price of the microgrid controller is as $25-50 per kw of the total rated capacity of all power system components. Many competing microgrid control systems end up being $100-200 per installed kW when all costs are considered.

For example, consider a commercial grid-tied microgrid consisting of two 500 kW PV inverters, a 500 kW diesel backup generator, and 500 kW / 2MWh battery energy storage system, and two independently controllable load circuits for critical and non-critical loads. For this project, the UMC would cost about $80,000.

Once you can describe your planned microgrid application, configuration, and sizing, please call or go to our website to request a quote. Major quantity discounts based on annual purchase commitments are available.

What if we want to expand our microgrid after several years of operation? Can the UMC accommodate that?

Yes, the UMC can be easily reconfigured with no hardware modifications and minimal software changes. Typically, the System Status screen, which shows the system diagram and overall operating status, will have to modified. Once the customer identifies the desired system upgrades, SPS will generate any required revisions of the system configuration files. As the UMC software is licensed for a particular microgrid configuration, a new activation key may be required.