



Retooling Cost Models with Modular Power Panels



Specify, Order, Assemble, Ship and Install

That pretty much sums up the conventional order-to-install model for the commercial and industrial low-voltage power panel market.

Weeks, or months, before a panel's installation, a consulting-specifying design firm/engineer for a major construction project specifies what size, how many and what capacity and configurations are required for the dozens of power panels needed for the facility. The panels are ordered, built to specification electrical boxes are shipped for pre-installation and then, two to three weeks later, fully-configured power panels arrive on the job site.

Every electrical contractor managing a low voltage power panel installation knows the frustration of mis-specified panels that are the wrong size, under-powered because the load requirements have changed, pre-wired with the wrong breakers, or reconfigured with a top power feed when someone has already pulled cable for a bottom feed.

In recent years, some of these issues have been partially addressed with the advent of some modular components - breakers, surge protection devices (SPD) - that can be changed out on the site. However, the majority of power panels specified for commercial projects

are fully pre-configured and shipped as complete, somewhat bulky and heavy, full-sized units requiring labor-intensive handling and installation on the job site.

This paper will review some the newer, more modular approaches to power panels, including GE's new EntellEon* power panel platform, and it will examine how new cost, installation and site-adaptability models will impact the commercial construction industry.

Conventional Electric Panel Order-Deliver-Install Models

Ordering and Changes-to-Specification Challenges

The time between specifying a power panel, placing the order to accepting the final delivery, and installing it can create costly delays and job site work-arounds. For example, the load requirements for the panel may dramatically change in the two-three months between order and installation, requiring, for example, new wiring and circuit breaker re-configuration.

Power Panel Weight and Dimension Challenges

A typical power panel, fully assembled and configured by a panel manufacturer can weigh between 400 to upwards of 800 to 1,000 pounds, even before it is mounted in the power panel box or "can." Aside from shipping and logistics, managing units of that size and weight at the job site can create storage and handling issues. Given this size and weight, these panels can require two or three people with a pallet lift to roll the unit through the site – assuming interior doors can accommodate a full pallet.

Installation Challenges

Like any job-site project, if things go according to the specification, an average power panel can be mounted and connected to the power feed in anywhere from 15 to 30 minutes. As described earlier, the power boxes are typically already mounted beforehand, and cabling has been run to the box. In most cases, unless some breakers have been removed for inspection or to reduce the weight for easier installation, the breakers are already installed, ready for final connections.

But, change any of those “planned” specifications and time and costs rise dramatically.

With EntellEon, the average installation time averages about 15 to 30 minutes for one to two people, assuming all the pre-installed breakers remain in place. As mentioned earlier, sometimes to lessen the total weight of the panel to make installation easier, some breakers may be removed. Removing and reinstalling breakers can take up to 15 minutes per breaker.

Often the need for third-party inspection of breakers, or the need to upgrade a breaker to meet an increased load specification, are also common reasons to remove and reinstall breakers. For example, removing just 10 breakers

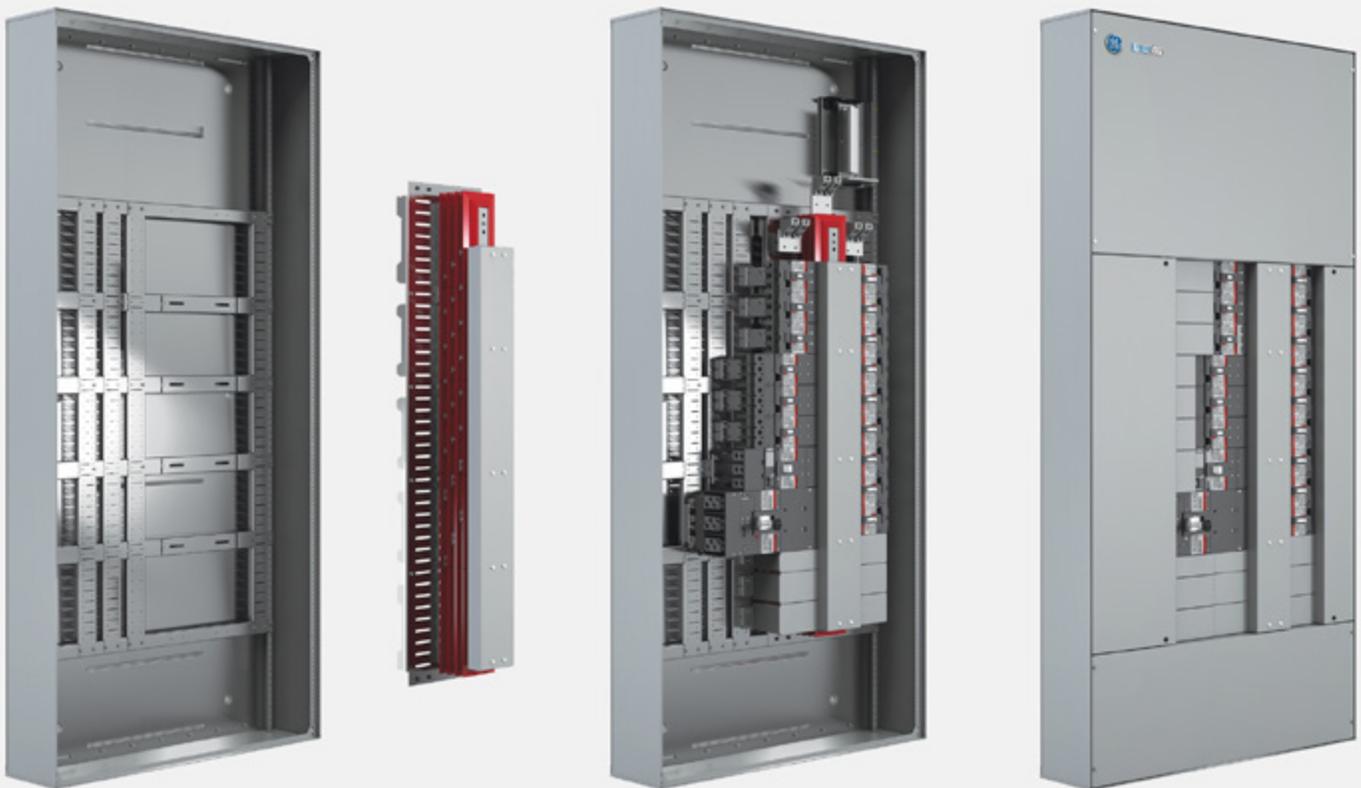
can add 150 minutes, or nearly two hours, to an installation. [This video](#) shows how the features of EntellEon enable installation time savings in comparison to other panels on the market.

A seemingly simple issue, the orientation of the power feed, can also stymie an installation. Power panels are typically specified with either a top or bottom power feed. But on the job site cables can be mis-oriented, either because of misspecification or a change in the power distribution cabling plan.

None of the typical fixes are completely acceptable. Ordering a new top-or-bottom-configured power panel takes a minimum of two weeks, not to mention the cost of an additional unit. There are some on-site solutions that require

significant manual modifications of the panel components. A power cable can be run up or down the side of the panel, but that approach limits the space for further expansion of power protection components. The last option, of course, is pulling new cable all together; both a time, materials and cost sink.

All these issues create pressures for the electrical distributor, who is often caught in middle between the speciation and the installation process. They’re the people that contractors turn to help make a “fix” to shorten the re-ordering and delivering times, or to stock the parts to make on-the-site changes or upgrades quickly.



GE's EntellEon – A New Model for Modular, Pluggable, Job-Site-Adaptable Power Panels

The move to more modular, more job-site-adaptable power panels has evolved over the past few years with newer installation-forgiving and affordable options. These modular components, such as circuit breakers, enable contractors to make some limited on-site changes during final installation.

GE, with more than 100 years in the electrical distribution industry, is extending this modular concept with a full end-to-end modular power panel approach. Employing the company's

FastWorks product development process, GE's power panel design team worked with electrical distributors and contractors to take a comprehensive view of power panel specification, assembly and installation processes.

The result is the modular GE EntellEon power panel platform that addresses the most prevalent issues from parts ordering and modular packaging and shipping, to highly adaptable solutions for easy job site installation and configurations.

The EntellEon concept is a shift from a "install-what-we ship" standard to a new "order, configure and install what we need on-site" model.

Modular, Configurable – From Exterior to Interior

GE's new EntellEon power panel system begins with a range of power box sizes to accommodate a series of modular, site-configurable interior panels, bus stacks and circuit breakers. The mounting boxes, or cans, are offered in four height configurations (60", 72", 84", or 96") with either 30", 40" or 45" widths (the 45" unit comes in either center or offset options), creating a series of size options for a wide range of specifications.

Each box can accept either a top or bottom power feed, which along with a reversible bus stack (see next section), eliminating costly rewiring and saving value installation time and costs.

Flexible, Pluggable Power Panel Components

A typical power panel, fully assembled At the core of EntellEon's modularity and flexibility is how key power components, from the bus stack to the pluggable circuit breakers and other power components, are oriented and installed into the power panel.

The bus stack, for example, can be installed (either bolted or plugged into the panel) in a top- or bottom-feed configuration. This eliminates the problem, as described earlier, of mis-oriented power feeds.

Pluggable circuit breakers are easily inserted into the bus stack in five seconds, compared with an average of 15 minutes to install all hardware and bus straps for traditional breakers.

Series Ratings

EntellEon panelboard – use only with EntellEon panelboard series circuit breakers

IC RATING	MAIN		BRANCH		
	TYPE	MAX. AMP	TYPE*	POLES	AMP. RANGE
100,000A @ 480VAC MAX.	SFP	250	SEP, SEL, SEH, SED	3	30-150
			SFP, SFL, SFH	3	150-250
	SGP	600	SEP, SEL, SEH, SED	3	30-150
			SFP, SFL, SFH	3	250
			SGP, SGL, SGH	3	400-600
	SH (PB II)	4000	SEP, SEL, SEH, SED	3	30-150
			SFP, SFL, SFH	3	150-250
			SGP, SGL, SGH	3	400-600
	SS (PB II)	4000	SEP, SEL, SEH, SED	3	30-150
			SFP, SFL, SFH	3	150-250
			SGP, SGL	3	400-600
	65,000A @ 480VAC MAX.	SFL	250	SEP, SEL, SEH, SED	3
SFP, SFL, SFK				3	250
SGL		600	SEP, SEL, SEH, SED	3	30-150
			SFP, SFL, SFH	3	250
			SGP, SGL, SGH	3	400-600
SKL		1200	SEP, SEL, SEH, SED	3	30-150
			SFP, SFL, SFH	3	250
			SGP, SGL, SGH	3	400-600
			SKL, SKH	3	800-1200
SS (PB II)		2000	SEP, SEL, SEH, SED	3	30-150
			SFP, SFL, SFH	3	150-250
			SGP, SGL, SGH	3	400-600
50,000A @ 480VAC MAX.	SKH	1200	SEP, SEL, SEH, SED	3	30-150
			SFP, SFL, SFH	3	250
			SGP, SGL, SGH	3	400-600

IC RATING	MAIN		BRANCH				
	TYPE	MAX. AMP	TYPE*	POLES	AMP. RANGE		
35,000A @ 480VAC MAX.	SGH	600	SEP, SEL, SEH, SED	3	30-150		
			SFP, SFL, SFH	3	250		
25,000A @ 480VAC MAX.	SFH	250	SEP, SEL, SEH, SED	3	30-150		
100,000A @ 240VAC MAX.	SFL	250	SEP, SEL, SEH, SED	3	30-150		
			SFP, SFL, SFH	3	250		
	SGL	600	SEP, SEL, SEH, SED	3	30-150		
			SFP, SFL, SFH	3	250		
			SGP, SGL, SGH, SGD	3	400-600		
	SKL	1200	SEP, SEL, SEH, SED	3	30-150		
			SFP, SFL, SFH	3	250		
			SGP, SGL, SGH, SGD	3	400-600		
			SKL, SKH	3	800-1200		
	SH (PB II)	800	SEP, SEL, SEH, SED	3	30-150		
			SFP, SFL, SFH	3	250		
	SH (PB II)	3000	SKL, SKH	3	800-1200		
SS (PB II)			4000	SEP, SEL, SEH, SED	3	30-150	
65,000A @ 240VAC MAX.	SFP	250	SEP, SEL, SEH, SED	3	30-150		
			SGD	600	SEP, SEL, SEH, SED	3	30-150
			SKH	1200	SEP, SEL, SEH, SED	3	30-150
SS (PB II)	800	SEP, SEL, SEH, SED	3	30-150			

* All breaker catalog numbers prefaced by "EZ" for EntellEon Panelboard Series branch breaker kits, or "EU" for EntellEon Panelboard Series vertical main breaker kits.

Fig A. The EntellEon platform also includes range of other compatible, pluggable power panel components including SPDs and reduced energy let-through (RELT) switches.



Further, the modular design of the panel enables mixed breaker side-by-side installation. This mix and match modularity of different height and width-sized breakers mounted in the same row simplifies both design and installation. Modular, pluggable breakers also mean any upgrade or changes in power load requirements can be made after the initial order or even initial installation.

Packaging, Handling and Installation - Install What's Needed, as Needed

The EntellEon modular approach also impacts how system elements – box, panels, power components, installation parts – are pre-packaged in two cartons and shipped in a single pallet to the job site. Traditional, fully assembled power panels are large, cumbersome to move, and can require up to four people to install.

The EntellEon packing includes a carton with the power box and front panels, and a second carton with a fully-configured bus stack, breakers and related parts. The result is an easy-to-store, easy-to-move, and easy-to-install power panel.

Measuring the End-To-End Impact and Productivity of GE's EntellEon Modular Power Panels

This paper has looked at the issues and challenges of traditional power panel spec-to-install scenarios. It has also examined the potential impact on new modular, site-configurable power panel systems, such as EntellEon. Finally, as we review each step of the specification-to-installation process, we chart the potential cycle time, costs and productivity savings the EntellEon power panel platform offers.

From Specification to Order

The conventional model for specifying and online ordering for power panels typically involves the builder's consulting specifying engineering drawing up the requirements; followed by contractors or distributors reviewing and matching these requirements with power panel options and components from electrical panel manufacturers. Under normal conditions, after entering specifications, online tools allow for one-step ordering.

The challenge comes when contractors and their distributors need to modify individual specifications to change or upgrade panel requirements. Then a simple order for an electrical

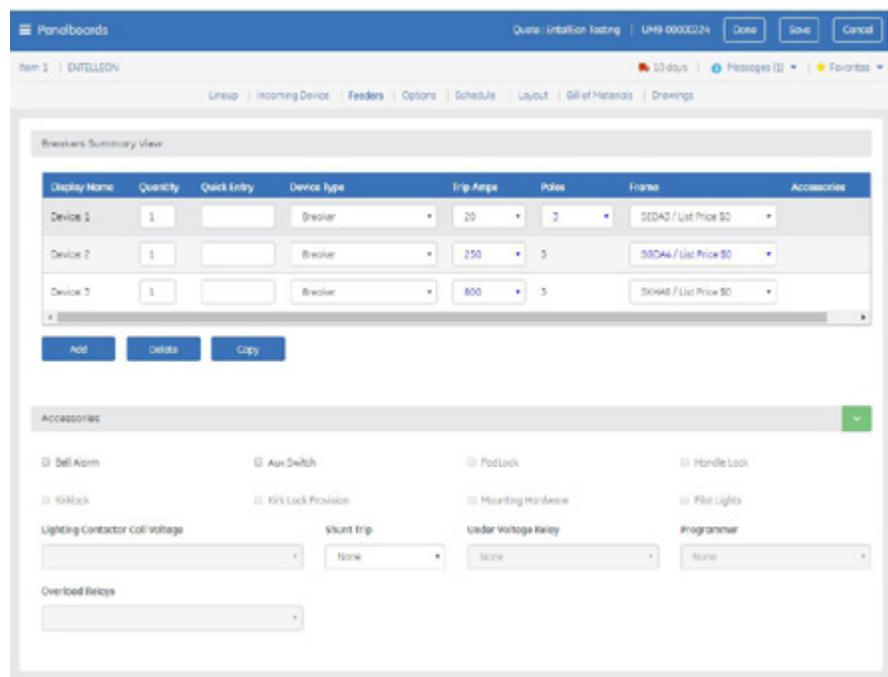


Fig B. Ordering Page

component, such as circuit breaker, can require finding and ordering multiple SKUs for even a single breaker. This is further complicated by matching a new component, such as breakers, to the pre-configured space on the panel. In this scenario, a new breaker may also require additional parts such as brackets, filler plates or additional wiring straps.

The EntellEon platform simplifies this process with single-SKU ordering for all components and related parts—from straps to screws. This single-catalog-part-ordering eliminates the frustration—and time and related costs—of holding up a job for a missing or mis-ordered 50 cents part.



Managing Shipping and Job-Site Storage

A modular approach to power panels also enables exterior (power box, entry panels, bus shield, and hinged filler doors), and interior power components to be packaged in separate cartons – all stacked on a single pallet. This pallet approach offers several advantages.

First, the shipping and handling – from the manufacture, to distributor, to job site – is easier and less labor intensive. Once on the job site, instead of three to four workers lugging a fully assembled power panel – some weighing up to 1,500 pounds -- a single worker with a hand truck can move the power panel to the correct location. This cuts time and labor costs as workers don't have the hassle of moving a pallet loader through a construction site, or upstairs when the elevator is not yet operational.

Palletized boxes containing some of the more expensive or precious-metal components – such as bus bars or breakers – can also be stored in secured locations to reduce loss and theft and costly delays.

Modular Design for One-Person Installation

Once EntellEon power panel modular shipping cartons are moved to the final site location – on pallet or individually moved by a person with a hand cart – the full panel is ready for installation. It's modular size and weight means installation can be done by one, or possibly two, people instead three or four.

Pluggable components, such as circuit breakers, also mean panel parts can be easily removed to reduce the weight during mounting, and reinstalled in a few seconds without rewiring.

Adapting to Job Site Changes

Any plan involves planning for the unplanned. That's true for most major construction projects, and certainly applies to the installation of power panels. Changes in the specification from the time of order to delivery are common. A panel box, for example, may be sized for 800 amperes (A) when updated specs may require 1200A cabling. We might see that occur in an energy-hungry application, such as an upgraded HVAC system, changing the specifications for circuit protection. Or, as mentioned earlier, a power panel ordered with a top feed must accommodate a reconfigured bottom

power feed. These and a range of other on-site installation challenges add time and drive up job costs. EntellEon's modular power panel platform - from boxes to breakers - create the "field-flexibility" to adapt to these on-site changes.

For example, the interior dimensions of a panel box might become too small if a larger wire gauge is later specified, of a panel preconfigured for "x" number of breakers may not have enough space when more or larger breakers are needed. In both situations, modular and pluggable components offer a solution.

A modular power bus stack, for example, can be re-oriented to make space for cabling to run from bottom to top, or the reverse. EntellEon's panel design, along with pluggable breakers, can also physically accommodate circuit breaker upgrades with mixed capacity breakers and sizes in the same row, improving power density and saving valuable panel real estate.

EntellEon's line of pluggable circuit breakers also means change-outs and upgrades or pre-installed pluggable breakers can happen in seconds instead of the usual 15 minutes each. Removing traditional pre-installed breakers - for inspection or to upgrade the service - is a time-consuming task, adding hours to each panel installation.

Specifications

- 600V, 1P3W, 3P3W/4W maximum voltage
- Copper 150A-1200A main bus
- SK, SG, SF, SE, FB 2 pole and FB 1 pole breakers available
- Fully Rated 200kAIC/240V, 100kAIC/480V Mains
250A-1200A MCB (SK, SG, horizontal mounted SF)

Standards

All GE panelboards meet the latest revisions of the following standards:

- National Electric Code Ref. Article 408 (NEC 2014)
- UL 67 for all panelboard types
- UL 50 for all cabinets and box structures
- UL 943 GFCI
- UL 489 molded case circuit breakers
- IBC-2013
- NEMA PB1

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Adapting to Job Site Changes (Cont.)

With fewer modular components to stock, a local distributor can readily keep a set number of EntellEon parts on hand to be ready to respond to on-site changes in hours instead of the days it takes to reorder individual parts.

Another major job-site “fix” is the orientation, or path, of the power feed to the box and panel. Perhaps one of the most common (and costly) problems, power panels are specified and delivered with either a top or bottom power feed. The power panel boxes are installed sometimes weeks before the actual power cables are pulled. In the meantime, a number of problems can occur from a damaged conduit, to a change in power distribution plans, requiring a change to either top or bottom.

With GE EntellEon’s modular design, regardless of the power feed order specification, the power panel can be reversed and remounted 180 degrees to accommodate either a top or bottom feed – without additional costs and without adding costly delays or rewiring. With its bolted/plug-in bus connection feature, the bus can be reconfigured in an estimated five minutes, with breakers removed and reinstalled in less than 15 seconds each (on average).

Given that installation costs, coupled with making in-the-field changes, are major cost factors in any power panel consideration, modular power systems offer new models that can greatly reduce delays, costs – and uncertainty – from the power system equation.

New Panel Manufacturer, Distributor and Contractor Competitive Value

GE’s EntellEon platform holds the potential to change the competitive advantage across the panel builder, distributor and contractor value chain. With the modular EntellEon power panel model, the players are the same, but their role – and competitive value-add – increases.

With EntellEon, a power panel builder is delivering a full system, not just a product, that is easier to install and update on-site as needed. The distributor, cost-effectively stocking a smaller number of modular components, can now offer faster, value-added services to their customers. They can better respond to the contractor’s needs for changes, updates or fixes. And the electrical contractor delivers services to the property developer on time, and on budget with typically better margins and less risk.

New Value Models for Power Panels

In the past decades we’ve seen how customizing products and services have changed the way we configure the products we buy - everything from PC’s to furniture. The concept of modular power panels – and the impact across every phase of the spec-build-deliver-install cycle – can be that game changer for the construction industry where flexible solutions, productivity and timely response to on-the-job changers will define success.

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