Future Home Design Ideas and Technologies

1. Power Distribution for Residential Housings

1.1 PROBLEM

The existing methods of electrical wiring of residential and commercial structures has fallen drastically behind the progress attained in other areas of construction.

KEY points:

- Time consuming installation, as each electrical device must be wired manually
- Costly, as manual labor costs are increasing
- Presents potential safe hazard, as practically every electrical device installed behind the walls has at least one hot wire lead clearly exposed. Safety hazard extends to the installers, service, maintenance and inspection personnel.
- Inconsistent quality, as each electrical connection is performed manually on-site under a number of potentially unfavorable conditions, including surrounding ambient environment (temperature, light, rain, snow…). Compliance to NEC and other regulations maybe compromised.
- Poor quality control, as it is practically impossible for city inspector (or anybody) to verify quality of each connection made
- Environmentally not friendly, as a lot of waste in a form of stripped insulations is generated as each connected wire must be stripped at both ends for installation. In addition, high power connections are not shielded, and as result will generate EMI when connected to high power switching loads, which may present health hazard
- Inadequate quality, as all devices have no water-proof rating of any grade
- The construction and quality of electrical distribution panel is not adequate, as in time it rusts, lowering efficiency, and creating potential hazard when must be approached by an ordinary user
- The design principals are focused entirely on distributing AC power, completely ignoring the fact that for some time now (and this trend is growing) there are a significant number of household devices which are powered by DC, 12VDC in particular
- There is no real-time on-site monitoring of power consumption and power quality, with basic guidance to the user to avoid increase in energy costs and promote energy conservation

DETAILS

Existing methods of wiring AC electrical power, such as the installation time, installation quality, reliability, repeatability and end-result safety of installations - depends heavily on hi-skill manual labor. Currently, every power wire has to be stripped on both ends and then attached to tie-grip connectors. This operation is time consuming, and to verify the quality of each connection is nearly impossible. As result, sections of the stripped wires with high AC voltages are being clearly exposed, and the quality of their connections is not guaranteed.

Although located “behind the walls”, the quality of connections is a great concern, since it may get loose during vibrations, such as minor earthquakes, etc., and as result presents a potential fire hazard.

The current process is not environmentally friendly as produced waste in a form of stripped cable insulation needs to be disposed of after installation.

Additionally, the existing electrical power panels are not “user-friendly”, and require costly maintenance. Potentially poor quality of AC connections within a “rusty” panel will lower power efficiency (increasing energy costs), and can increase EMI, depending on the load being connected.

The existing power entry and power distribution methods do not provide convenient on-site power monitoring and diagnostics to inform the end user of potential problems that may affect the energy usage and costs.

1.2 PROPOSED SOLUTION

KEY points:

- Highly efficient, as a completely tested kit in full compliance to agency regulations, including NEC, local ordinances, is designed and delivered to the project site for Plug-n-Power™ installation.

- Superior safety at all times, as there is no exposed hot power wire leads throughout the entire system. This includes hi-power devices such as electric stove, unless required by local regulations to be hard-wired.

- Consistent quality, as each electrical connection is performed using Plug-n-Power™ pre-fabricated, tested, agency approved standardized modules and custom length cables with agency approved standardized connections (IEC for example), with each connection having adequate strain-reliefs to withstand required vibrations.

- Efficient quality control, as the entire power distribution system or sections of can be tested, without load being attached, automatically for proper continuity and resistance level, including cold tests (no power applied) and hop pot test (specific high voltage power applied) to verify quality of all connections made.

- Environmentally friendly, as no waste produced. The entire Plug-n-Power™ kit is designed per specific housing floor plans and construction drawings, with number of devices, such as: outlets, switches, light, and length of interconnecting cables between them optimized with only service loop provided for convenience.

- Environmentally, as high power connections can be installed using shielded cables, and as result will minimize EMI with practically no impact on environment.

- Superior quality as devices and cables can be designed per required water-proof rating of any grade.

- The construction and quality of Plug-n-Power™ electrical distribution panel is durable and safe for light service, such as replacement of modules due to normal wear and tear, without safety hazard to ordinary user.

- Superior safety, as the design principals are focused to provide optimum distribution of AC and DC powers, improving overall efficiency, with adequate power backup of selected DC powered devices.

- User-friendly information to further conserve energy by avoiding use of “bad” power devices within a household, or avoiding “power spikes” by using devices unnecessarily at the same time, as guided by real-time on-site monitoring of power consumption and power quality devices installed at the power distribution panel, and throughout the system as needed.

DETAILS

ADVS-technologies has recognized this issue, and addresses it heads on. The patented ADVS-*plug-n-power*™ waste-free distribution technology represents a significant step forward, delivering superior level of quality, safety and efficiency for every power distribution installation regardless of size, complexity, location or time schedule.

Each process step, including whether a hard-wired installation for a device is required, is reviewed in details with a respective local and national agency. For reference, the technology employed in practically all power devices, such as electric stoves, had made significant improvements in terms of energy efficiency. This fact should not be ignored, as a costly manual hard-wired installations for electric stoves can now be replaced with consistent quality and reliability Plug-n-Power™ connection.

The patented invention No. US 8,341,837 describe apparatus for designing and installing power distribution systems for: residential, commercial and industrial applications, as well as for power distribution within electro-mechanical devices.

The invention transforms existing labor-intense installations into practically plug-and-power type modular systems. For a specific project, pre-designed, fabricated and tested kit, including factory assembled and tested: power and control enclosures, power outlets and junction boxes, interface cables, as specified by the invention, will be delivered directly to the installation site. No labor intense operations: wire stripping, outlet/switch wiring, junction box wiring, load wiring.

No exposed hot wires or leads at any point outside enclosure. The invention will: significantly lower labor costs, reduce installation time, and improve safety, reliability and quality. Utilization of shielded cables and shielding of other components within a system, will significantly lower electrical power emissions, benefiting the environment for all – the end users and other technologies. The patented process is environmentally friendly as no waste produced during installation.

ADVS-technologies had also filed a patent pending application No. US 13,731,103 “Plug and Power Distribution and Control Apparatus”, which further describes the new technology of Plug-n-Power™ distribution, including power distribution of AC and DC powers, representing a significant step forward in conserving energy and lowering costs.

Invention describes apparatus providing plug-and-power distribution of power and communications for: residential, commercial, industrial applications, and for electro-mechanical devices and computer systems. Invention transforms existing labor-intense installations into plug-and-power modular systems.

For specific project, pre-designed, pre-fabricated kits, including factory assembled and tested: power and control modules, interface cables, will be delivered directly to the installation site. Labor intense operations, including: wire stripping, wire crimping are replaced with plug-and-power components.

Apparatus has no exposed hot leads accessible by bare hands, including service personnel. Invention will: significantly lower labor costs, reduce installation time, improve power distribution safety, reliability, utilization efficiency, and quality.

Application of shielded cables and shielding of other components within the apparatus, will significantly lower electrical power emissions, benefiting the environment for all – the end users and other technologies.

Invention describes plug-and-power DC power distribution replacing existing AC power distribution, further improving safety and efficiency.

ADVS-technologies had also filed a patent application No. US 61,859,723 “Apparatus DC Power Splitter to a Device from Several Power Sources with Controls”, which complements the Plug-n-Power™ DC distribution systems with an ability to connect within the system to alternate power sources, including power backup DC supplies, such as solar batteries. The switch-over to stand-by power backup DC supplies can be performed automatically in real-time during a loss of main power, or by controls for systems equipped with controller. This creates a “DC battery-backed network” of DC powered devices within a residential housing. The type of devices and the number of devices connected to the “DC battery-backed network” can be selected to provide required level of safety and security of a residence during partial or complete loss of AC power, such as power outage conditions.

Invention describes configurable apparatus providing DC plug-and-power distribution from DC power sources to DC power loads. Configuration of apparatus includes combination of input power interfaces configured to distinguish or interlock power supplies connected to the apparatus.

Configuration of apparatus includes combination of output power interfaces configured to distinguish or interlock power loads connected to the apparatus.

Apparatus configurations include controller to monitor and control each device connected to the apparatus. Monitored parameters include: voltage, current, temperature. Controller will execute pre-defined algorithm to prevent measured parameters from exceeding set operating criteria for the apparatus and devices connected to the apparatus.

Apparatus can be configured as a harness with components and interfaces embedded into the harness, or enclosure with components and interfaces inside enclosure.

Apparatus can be configured and controlled by a HOST over wired or wireless network, including INTERNET. Apparatus can be configured to execute real-time commands without operator assistance.