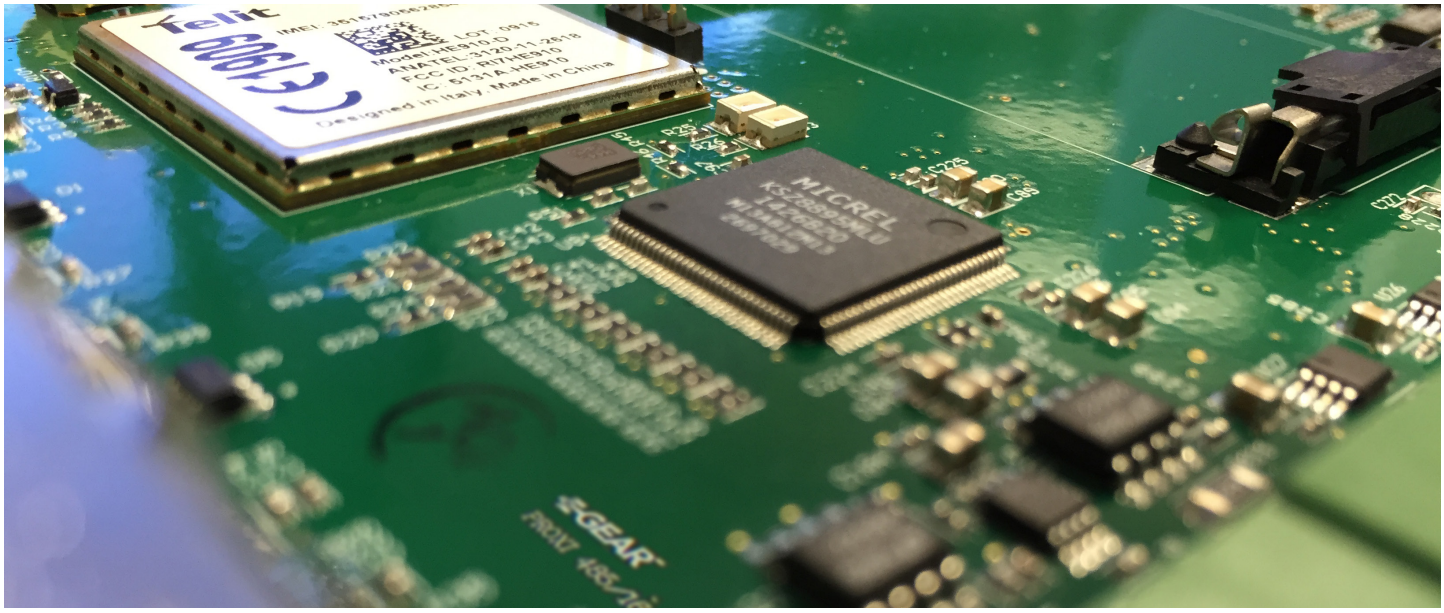
E-GEAR™

Energy Management Controller



The E-GEAR™ Energy Management Controller (EMC) does it all—optimizing PV energy production, usage and export. On-board capabilities include PV production and home usage monitoring, Time-of-Use load control, Time-of-Export optimization and grid support capabilities. Intuitive cloud-based user tools simplify the set of intelligent system controls and monitoring.

Our goal has always been simple—to provide affordable energy solutions that promote and accelerate the adoption of clean renewable energy.

We address three primary concerns: system visibility for both utility and homeowner, smooth delivery of stable power to the grid, and the ability to adapt to changes in solar energy policy. Then we added one more goal: develop a concept for the future, but find a solution within reach today.

We envisioned cutting-edge technology to address grid issues, allowing more households and small businesses to adopt solar and be grid-integrated as a welcomed clean energy source for the utility. The EMC is an all inclusive solution, with a way to upgrade existing PV systems and other renewable energy systems, too. Growing a community of distributed rooftop solar into a powerful alternative to imported oil, liquefied gas from fracking, or massive solar farms at the expense of green space.

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Patent(s) Pending

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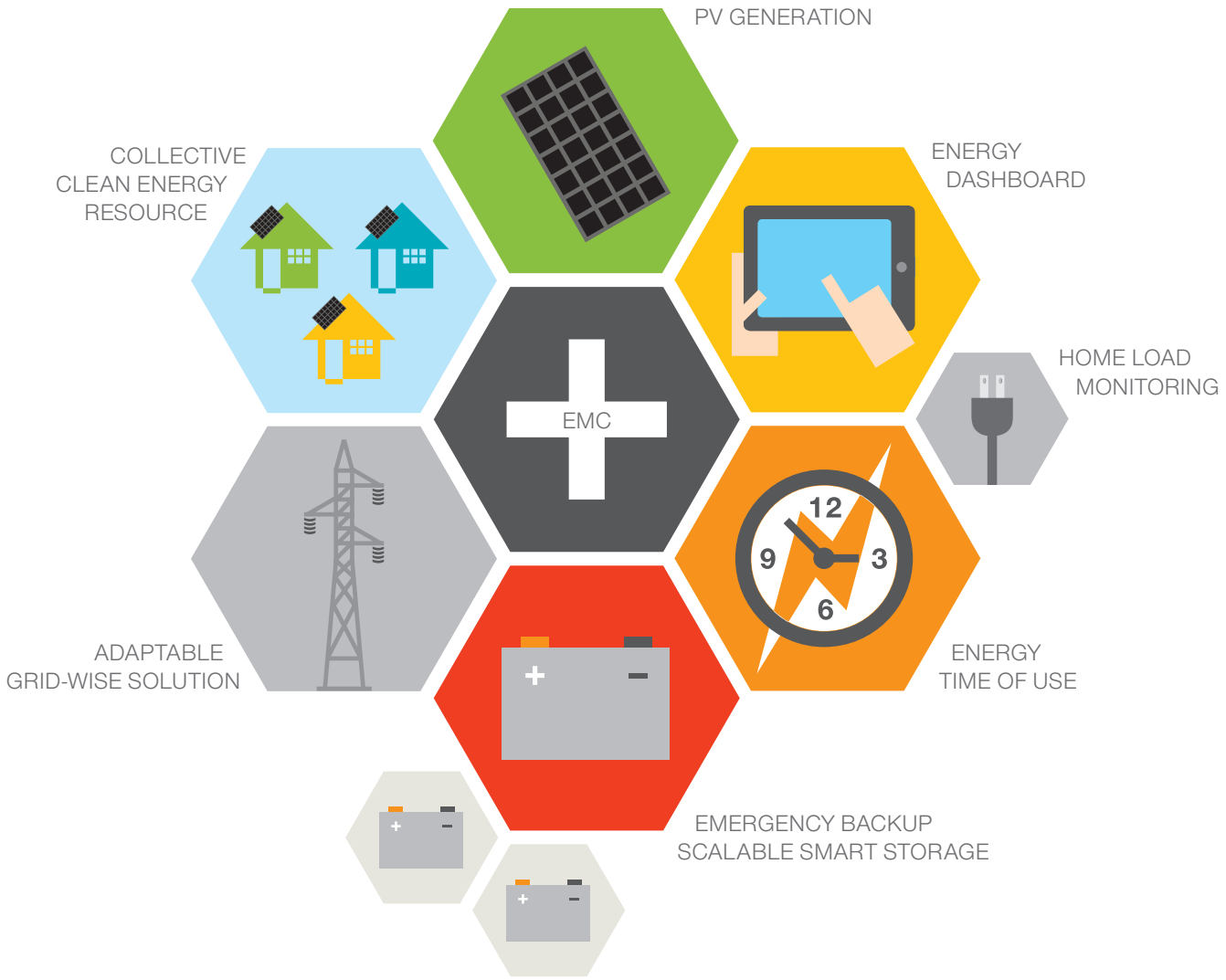


EMC + PV

KEY FEATURES:

- Inherent adaptability allows secure internet software/ firmware updates insuring optimum operation and compliance as needs change.
- Common secure networking protocols allow effective communication with numerous smart devices.
- Intuitive energy management tools offer energy visibility and control via any standard web browser.
- Participate in available demand-response incentives, which can save energy and money.
- Automate time-of-use, time-of-export and demand response incentive participation.
- Edge-of-grid intelligent real-time adaptive control.
- Optional Battery Energy Storage System compatibility.
- Load Monitoring and Control via integrated ZigBee™ protocols.

Welcome to the way forward—The E-GEAR™ Energy Management Controller (EMC). When you enhance a PV system with smart energy management, you get optimized energy production + optimized energy usage.

System visibility is achieved through secure cloud-based tools with an intuitive Energy Dashboard interface that makes it easy to manage select home loads with real-time visibility and historical reporting capability. You can shift time-of-use costs to your best advantage, see where energy is being consumed, identify electricity hogs, set electricity reduction and savings goals, and monitor your progress.

Adaptability and responsiveness to the grid are accomplished with our Energy Management Controller. Compatible with most PV technology—old or new, micro or string inverters, including management of compliant smart PV systems. It can adapt to future utility requirements, address changing home and grid conditions, maximize production and optimize overall energy efficiency.

EMC + PV + Storage

A breakthrough in distributed energy resource management—our Battery Energy Storage System (BESS) option enhances a PV system's abilities and allows you to store your own PV energy. The modular design allows for easy upgrade and incremental expansion. The automatic emergency backup power feature provides for critical loads such as lighting, medical equipment, refrigerators, phone chargers, etc. during an outage. Smart Storage can also buffer, smooth out and stabilize the energy you want transferred back to the grid.

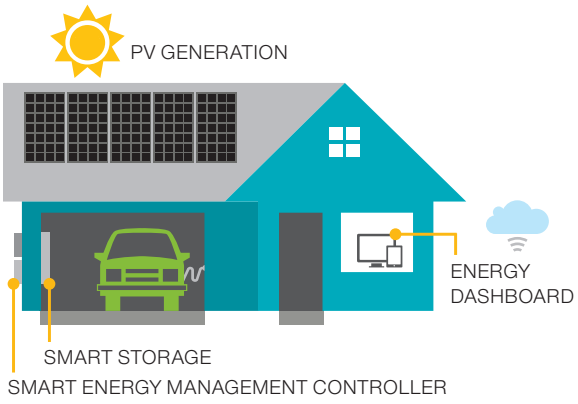
Utilities are rapidly moving away from simple electrical generation and distribution models to more intelligent and dynamic energy management systems. As technologies evolve so will the relationship between rooftop PV owners and their utility. Grid connected energy producers will become essential partners able to share the benefits of a smarter interactive grid.

Smart energy management has the ability to leverage a PV system's production to your advantage by automatically optimizing energy generation, usage and smart export. A secure cloud-based dashboard and toolset provide real-time PV energy generation and home usage visibility, putting easy home load monitoring and control at your finger-tips. Simple and automated control of your energy means you can take advantage of all utility and grid support benefits.

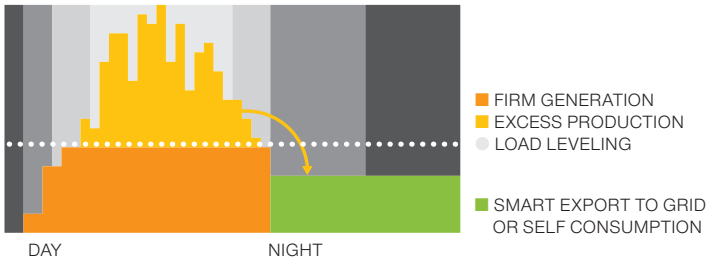
Modular in design, and scalable, optional Smart Storage increases your PV system's effectiveness by allowing both smart energy export or non-ex-port/self consumption between specific times each day. Additional benefits include emergency backup for important loads such as lighting, medical equipment and refrigeration when needed.

An intelligent system that will provide benefits now, adapting to changing needs, grid challenges, Utility benefits and evolving solar energy policy—essentially future-proofing your PV system.

Imagine a community of rooftop PV systems upgraded with Smart Energy Management technology. Each maximizing customer savings, improving our grid, providing greater renewable energy interconnection—reducing reliance on imported oil, liquefied gas from fracking and saving precious green space from massive solar farms.



SMOOTHING PV ENERGY

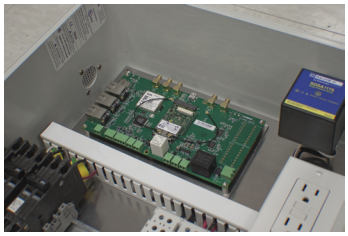


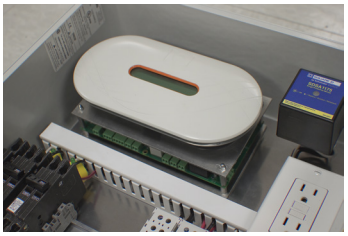
The average household consumes only 20-30% of PV energy generated within solar production hours. During peak solar production the excess energy sent to the grid by thousands of net-metered systems introduces instability and additional challenges to the grid. The E-GEAR™ EMC leverages a Battery Energy Storage System to capture the excess PV production that is typically exported during the day. The stored energy can later be smoothly exported to the grid when most advantageous, or used directly in your home instead of drawing energy from the grid during peak demand hours. It can also be used as your emergency reserve for critical loads during a power outage.

ACXIS®

EN-240 for the Enphase® Envoy®

Our EMC can also be configured to neatly retrofit behind the Enphase Envoy® unit in the ACXIS® EN-240 AC Circuit Combiner.





Energy Management Controller (EMC)

	OPERATING VOLTAGES
EMC Primary Power	24VDC DIN Rail Supply
EMC Secondary Power	12VDC (6.0-13.0VDC) battery backup
Utility/AC Line Voltage Reference	240VAC (+25%) Max., Utility/AC Reference
	POWER MONITORING + CONTROL
Management Interface	Proprietary, secure “cloud-based” management + user interface
Processor	On-board Processor
Operating System	Embedded Firmware (w/ secure remote updates)
Energy Measurement	Accuracy: < 0.5% Wh Accuracy Over Wide 2000:1 Current Range and Over Temperature. Exceeds IEC 62053/ANSI C12.20 Standards
	Voltage Reference: < 40ppm/°C
	Frequency Rage: 46-64Hz Line Frequency Range with Same Calibration
	Calculations: True RMS Calculations for Current, Voltage, Line Frequency, Real Power, Reactive Power, Apparent Power, and Power Factor
	Accumulations: Watt-Hours, Kilowatt-Hours
	Additional Features: Intelligent Switch Control at Zero Crossings, Digital Temperature Compensation, and Phase Compensation +/- 15 deg.
Relay Contact	10A contact for external systems control (PV)
RS485 (unpowered)	RS485 connection. (Can be daisy-chained.)
Powered RS485 Expansion Port	500mA max (+5VDC), for on-site ancillary equipment communications
	COMMUNICATIONS
Ethernet	3-port Integrated Ethernet Switch, 10/100Base-T, RJ45
WiFi	Standard, Frequencies: 802.11a/b/g/n; 2.412 - 2.484 GHz, 4.900 - 5.850 GHz;
	Data rates: 802.11b: 1, 2, 5.5, 11 Mbps 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n: 15, 30, 45, 60, 90,120, 135, 150 Mbps (HT40, MCS 0-7)
	Security: WEP, WPA-PSK/WPA2-Personal, WPA/WPA2 Enterprise, 802.11i
ZigBee	Data Rate: RF 250 Kbps, Serial up to 1 Mbps
	Indoor/Urban Range: 200 ft (60 m)
	Outdoor/RF Line-of-Sight Range: 4000 ft (1200 m)
	Transmit Power: 3.1mW (+5 dBm) / 6.3mW (+8 dBm) boost mode
	Receiver Sensitivity (1% PER): -100 dBm / -102 dBm boost mode
	Frequency Band: ISM 2.4 GHz
	Protocol: ZigBee PRO 2007, HA-Ready with support for binding/multicasting
	Encryption: 128-bit AES
	Channels: 16 channels
	Approvals: FCC, IC (North America)
USB OTG	Mini USB / USB “On-The-Go” devices compatibility
Cellular	Supported Bands: 4 Bands GSM / GPRS / EDGE: 850 / 900 / 1800 / 1900 MHz 5 Bands UMTS / HSPA: 850/900/1700/1900/2100 MHz
	Speed: HSPA+ data up to 21.0 Mbps downlink / 5.76 Mbps uplink; UMTS uplink/downlink up to 384kbps; EDGE uplink up to 236.8kbps / downlink up to 296kbps
	Approvals: RoHS Compliant, FCC, PTCRB, IC (North America)
	MECHANICAL
Physical Dimensions	7.75”L x 4”W x 1”H
Status Indicators	External Green LED indicator (various)
	External Red LED indicator (various)
Operating Temperature Range	EMC board only -40degC to +85C; EMC with secondary power option (various)
Optional Cooling Fan	+5VDC External Fan