

## BATTLE CARD

### EVERGREEN HIGH POWER PLATFORM

#### VENTO FAN-COOLED SERIES

FCM10K - 10 KW / 48 V PLUGGABLE MODULE

FCM30K - 30 KW / 3 SLOT / POWER SHELF

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# SOLUTION OVERVIEW

The Evergreen™ high power AC-DC power conversion platform offers an innovative new approach to the growing trend in our served markets of bulk AC-DC front end solutions with higher output voltages, improved efficiencies, higher power densities, and higher power building blocks.

This battlecard introduces the first products of the series to be released. The air-cooled Vento™ series consists of the FCM 10 kW which provides 10 kW of power in a 2 U x 3 U footprint, representing a leading-edge power density of 38 W/in<sup>3</sup>. The nominal 54.5 VDC output

is adjustable from 48 to 60 V. The output operates in constant voltage mode with a maximum output current of 184 A. Complementing the FCM 10 kW is the FCM 30 kW, which comprises three FCM 10 kW units assembled into a standard 19" shelf, producing 30 kW in a 2 U height. The power shelf includes a built-in power control manager (PCM) that allows the multiple units to operate as a plug and play single power source. Future developments will allow multiple shelves to be integrated into even higher power subsystems and cabinets.



FCM30K

## Target Applications and Products

The FCM 10 kW module and associated FCM 30 kW rack is designed to provide a bulk voltage regulated output that is adjustable in the range of 48 to 60 V. All applications that require a narrow output voltage with a true 3 phase 480 VAC input are perfect for the FCM family. A list of applications/markets are as follows:

- Semiconductor fabrication equipment (Bulk driver for RF power platforms, Heater Controls)
- Medical imaging equipment (CT, MRI, PET, etc.)
- Supercomputers
- Plasma (front ends)

- High power battery test (low voltage only)
- Electrolysis applications
- High power radar arrays (defense)
- Semiconductor burn-in and test

## Where to Avoid/Market Cautions

- Any application where a current source control is required
- Low line 3-phase (208 V, 240 V, 380 V) derating required
- Pulse current applications
- High dynamic load requirements

## Audience – Who to Engage and When

- Any application or customer using iHP today for single output 48 V
- Projects requiring high power 30 KW to the 1 MW range
- New prospects that are in early design stages and need high density bulk solutions
- Engage as early as possible to suggest system level turnkey solutions

## Business Benefits

- Industry leading high power density 38 W/in<sup>3</sup> for 52.5 V output
- High efficiency design up to 96.5% peak
- Range of output voltages : 48 V to 60 V

- Near Field Communications (NFC) feature allows set-up without power being applied
- Optional power management device for the shelf that can provide accurate input telemetry including real time PF, THD, efficiency, and phase balance, plus many others
- Highly expandable solution using Modbus Comms. Shelf level PSM provides single command control of all modules within the system. Other communication protocols being developed to include CAN, Ethernet, EtherCAT, etc.

# EVERGREEN HIGH POWER

INTERNAL CONTACTS


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## Qualifying Questions

- What is the input voltage/phase and output voltage required?
- What is the most demanding operating environment in terms of temperature, humidity, vibration, etc.?
- Do you need specific approvals/certifications/declarations of conformity?
- Do you require specific digital communication protocols?
- Is any dynamic loading required?
- What is your required total power output?
- Do you need a turnkey system?
- High power requirements (> 30 kW), how do you plan to distribute the output power?



## Customer Challenges

Each OEM has unique challenges based of their design choices and components

1. Reliability and mean time to repair (MTTR) is always a concern, especially with high power systems.
2. Configuration of new power modules (current limit settings, voltage adjustment, module address) can be challenging and time consuming.
3. In the rare instance a failure occurs, many times the root cause is unattainable due to destroyed circuitry or lack of

operating conditions of the system immediately prior to the failure.

4. Efficiency of the power supplies affects the operational costs (OPEX).
5. Simple single command control of large systems
6. Various communication protocols required



## Key Features and Specs (High-Level Differentiators)

- The FCM10KW module is hot pluggable within the FCM30K rack/shelf so access to rapid swap-out of damaged modules can be accomplished within minutes, not hours.
- Using NFC (Near Field Communication), the energy from the phone or tablet being used can set all operational parameters without the module even being plugged in.
- The FCM10KW/30KW series comes with a “Black-Box” feature allowing the user to query last telemetry data recorded before any failure occurred, thus providing critical information about system operation at the time of the event.
- High operating costs associated with utility power can be

mitigated due to the high efficiency of the FCM Platform (Titanium Efficiency).

- The power shelf controller provides a simple communication link to the users' system and in turn communicates to all the modules thus eliminating the need for multiple control commands.
- Wide range of communication accessory modules being developed. The unit comes standard with MODBus, and the first optional module will cover CANOPEN and PMBUS. IoT support to control the power from the cloud is also possible.

# EVERGREEN HIGH POWER

## COMPETITIVE ANALYSIS

Competitor	Their Positioning and Selling Points	Our Differentiation	Comparative Strategy
Meanwell	<ul style="list-style-type: none"><li>▪ High power</li><li>▪ High power factor (.98 at full load)</li><li>▪ Higher efficiency (≥ 95%)</li><li>▪ Power density (16.22 W/in3)</li></ul>	<ul style="list-style-type: none"><li>▪ FCM30K power and current range is 37% higher</li><li>▪ FCM30K uses Vienna PFC topology offering higher power factor (.99 at full load)</li><li>▪ FCM30K uses Vienna PFC topology offering higher peak efficiency (≥ 96.5%)</li><li>▪ Higher power density (21.42 W/in3)</li></ul>	<ul style="list-style-type: none"><li>▪ Higher power solution, no derating at 54.5 V</li><li>▪ Utility power savings</li><li>▪ We offer increased space utilization</li></ul>



# EVERGREEN HIGH POWER

## CROSS-SELLING OPPORTUNITIES

- RF plasma generators
- DC-DC products 48 V input



AVQ/ADQ 1/4 Bricks



eVerest™ RF Generator

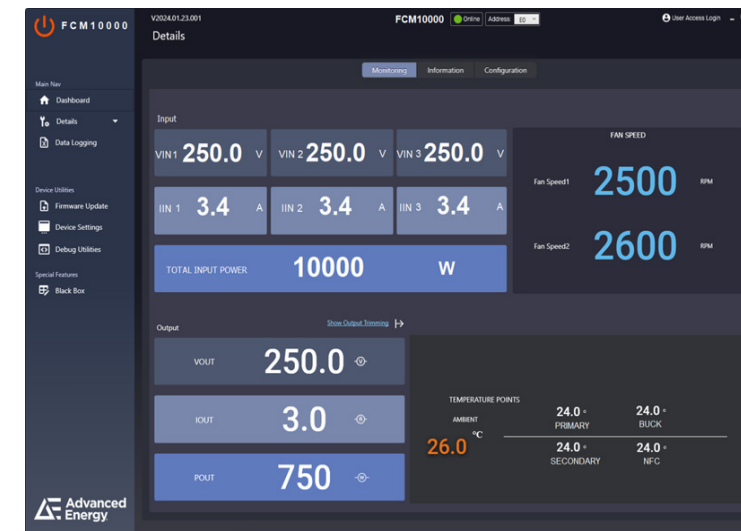


Paramount™ RF Generator

# EVERGEEN HIGH POWER

## FCM 10 KW AND FCM 30 KW GUI

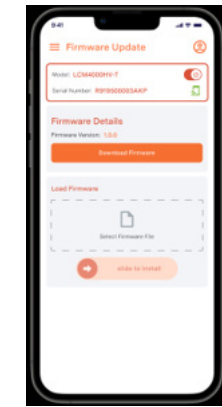
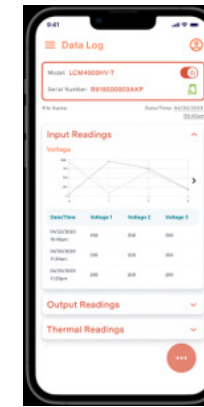
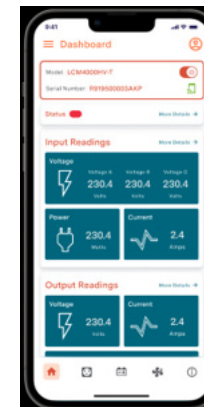
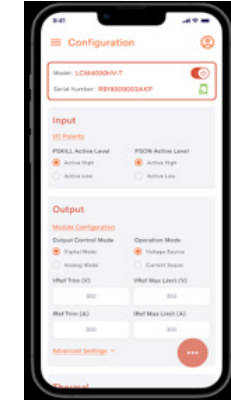
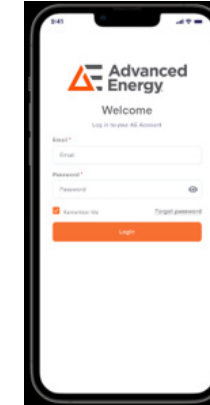
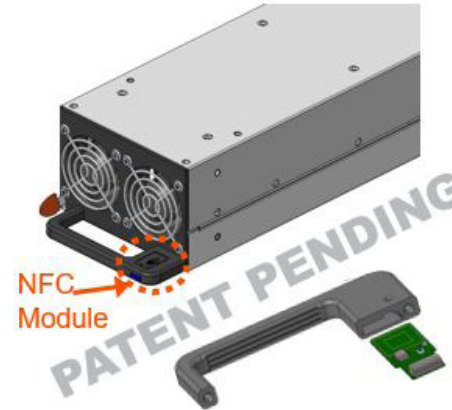
GUI available through download provides communication to monitor and control both FCM 10 kW and shelf-level FCM 30 kW



# EVERGEEN HIGH POWER

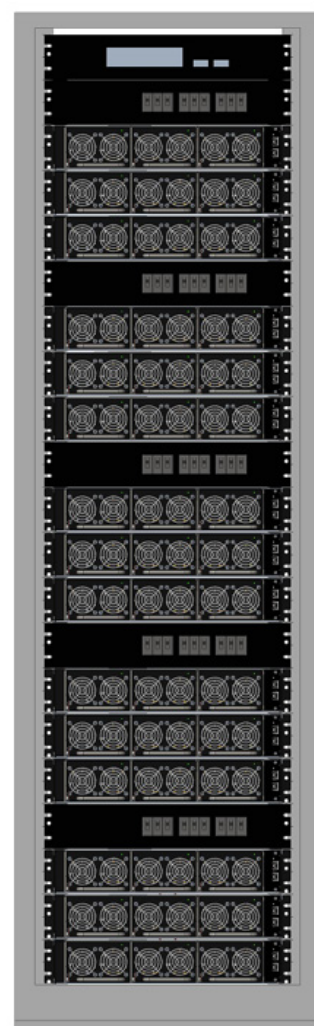
## FCM 10 KW – NFC ENABLED PSU

- Dashboard to monitor basic real-time parameters
- Graphical view of collected data points
- Control product to turn on/off, and override fan speed
- Product configuration can be performed even when unpowered
- Blackbox (fault history logs) accessible even if the product had a hard failure and cannot power up anymore
- Product firmware update – firmware image downloadable from server
- User management and device management – validation through web server



# EVERGEEN HIGH POWER

TURNKEY SYSTEM SOLUTIONS: MODULES + POWER SHELVES = SUBSYSTEMS



Rack Controller

48 V/90 kW Power Subsystem #1

Subsystem #2

Subsystem #3



AC Input Distribution and Controller Subsystem

3 x 30 kW 2 U Shelf

- 48 V/400 kW power rack
- Provides 5 x 90 kW separate outputs
- DC output distribution is considered outside rack
- Each subsystem works independently, uses 9 x 10 kW AC-DC rectifier modules.

42 U Rack Dimensions

- Standard 19" Rack Rails
- External Width: 23.6" (600 mm)
- Height: 78.74" (2,000 mm)
- Depths: 31.5" (800 mm)