

# Variable Module Management System



## Energy Advantage Architecture (EAA)

The rising demand for highly available, reliable and efficient power is a continuous challenge for data centre operators. Higher energy efficiency helps to address increasing environmental, regulatory and economic pressures.

Eaton has developed innovative and proprietary technologies that improve system efficiency without compromising on reliability under the Energy Advantage Architecture (EAA) umbrella.

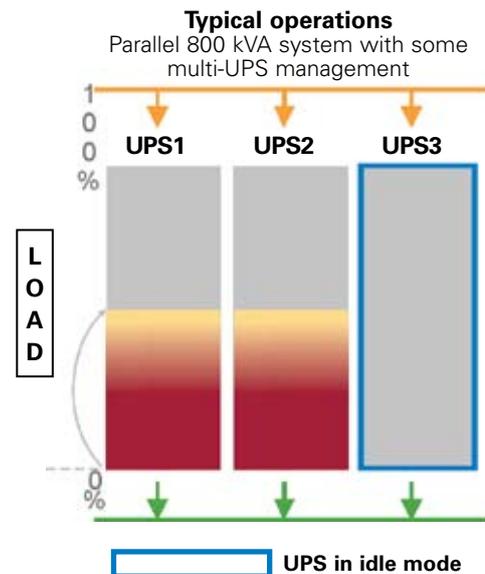
Typical field operations are usually within low load range, but UPSs do not operate at optimal efficiency when used for lighter loads.

In some multi-UPS parallel systems used with lighter loads, the system maximises the load percentage of the UPSs by putting the UPSs that are not needed to power the load into idle mode. This results in partial energy savings and is limited to multi-UPS systems, with no efficiency improvements for single-UPS systems.

## Applications

Typical applications where VMMS is particularly efficient include:

- UPSs in redundant N+1 and 2N systems
  - Lightly loaded: UPSs in these systems typically operate at low loads, < 45% load level
- Data centres, especially when the UPS system feeds dual-corded servers
- Any applications where load is not constant



**Variable Module Management System (VMMS)** technology maximises efficiencies at lighter loads without compromising reliability.



Powering Business Worldwide

# Variable Module Management System (VMMS)

## Maximised energy efficiency

VMMS optimally employs uninterruptible power modules (UPMs) in the UPS to achieve higher efficiencies in double conversion mode in order to maximise the percentage load level of the remaining active UPMs by switching UPMs that are not needed to ready state\*.

This is calculated according to the UPMs' VMMS load threshold – 80% by default – and the system configuration (redundancy requirements). This results in maximised energy savings.

VMMS is only possible thanks to Eaton 9395 UPS modularity. VMMS–can also be applied in multimodule single-UPS systems.

\*In "ready state," the UPM rectifies the DC-link, generates logic level PWM (Pulse Width Modulation) signals and filters EMI and lightning spikes.

## No compromise on reliability

When a disturbance or load increase occurs on a critical bus, all the UPMs in ready state are able to react quickly, immediately switching back to double conversion mode connecting the existing PWM signals to the IGBT gates.

In VMMS, all UPMs will switch to double conversion if:

- the output voltage fluctuates by more than 3% for any reason
- any UPM reaches its current limit or discharges its battery
- battery recharge is necessary.

Once the above conditions are resolved, the system switches back to VMMS, after a customer-preset time delay (1 to 60 hours): once the load stabilises, Eaton proprietary design and algorithms allow the system to determine which UPMs to switch back to ready state to maximise efficiency according to the new operating conditions.

## Extensive configurability

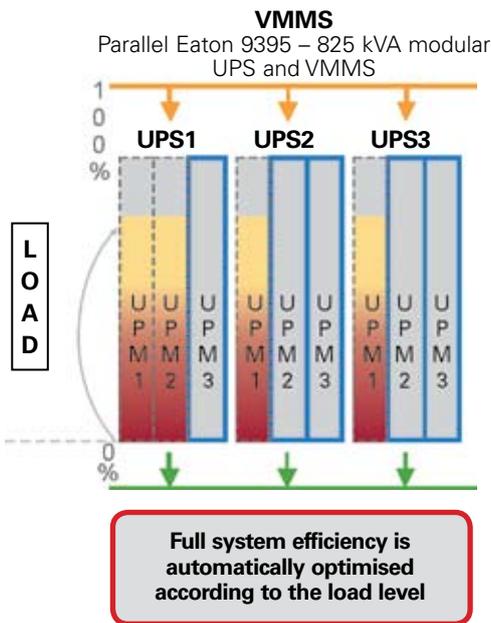
Customers can decide how to configure their system, establishing the number of redundant UPMs and the max percentage load level per UPM allowed in VMMS setting other UPM's in ready state.

VMMS can be used in all multi-module (multiple-UPM) 9395 systems:

- Single 9395 units from 550kVA to 1100kVA
- Distributed parallel systems (Xx550, Xx825, Xx1100)
- SBM system

Existing installations can also be upgraded with VMMS capability:

- VMMS maintains redundancy and achieves higher efficiency by intelligently controlling the load levels of UPMs
- Number of redundant UPMs can be selected (N+0, N+1, N+2, N+X)
- UPMs in ready state can be used as redundant units (N+0)



## Data centre with dual-corded servers, 825 (3x275) kVA UPS on A and B side – 440 kVA load

UPS configuration	Without VMMS	VMMS on N + 1 redundancy	VMMS on N + 0 redundancy
Efficiency @ 440 kVA load	91.2%	92.8%	94.3%
UPS energy savings	Used as reference for savings calculation	56 MWh / year	108 MWh / year
Additional benefits & comments	✓ Industry-leading UPS efficiency in double conversion	✓ Additional energy savings from reduced cooling in VMMS (typically 30-40% on top of UPS energy savings) ✓ UPMs in VMMS ready state available for redundancy	
	<p>A Feed 220 kVA B Feed 220 kVA</p>	<p>A Feed 220 kVA B Feed 220 kVA</p>	<p>A Feed 220 kVA B Feed 220 kVA</p>