

Making Data Centers Grid Friendly

UPS Behavior Under Grid Disturbances

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UPS and FRT

In a data center the majority of the load sits behind a UPS, so regulatory requirements for data centers are transferred to requirements for UPS behavior.

UPS are historical designed to protect the critical load against any disturbance from grid.

The emerging requirements for data centers are challenging this paradigm, with a new objective

- Protect the critical load from grid disturbances, like before
- At the same time protect the grid from load disturbances. Be more resilient.

The challenge for UPS for the number of emerging requirements is

- The pace of new regulatory and adjustments coming out,
- Maturity of requirements - requirements are in draft or just proposals, but our customers are meet with compliance demands.
- The diversity – no harmonization of standards which makes compliance difficult. It takes time to adapt.

Common requirements

HVRT: High Voltage Ride Through

Resilient to voltage swells

LVRT: Low Voltage Ride Through

Resilient to voltage sags

PFAPR: Post Failure Active Power Recovery

Recovery to 90% power when $V > 0.9$ p.u., time varies from 0.3 to 5 seconds

Frequency

- Window (60Hz) 57Hz - 61.8Hz
- Window: (50Hz) 47.5Hz – 51.5Hz
- ROCOF: 2Hz/s - 5Hz/s

Special requirements

Frequency

- LFSM-U (Limited Frequency Sensitivity Mode – Underfrequency), the capability to reduce grid load when frequency is decreasing

Number of FRT events

- No automatic trip for a certain number of events within a certain timeframe

Ramp rates:

Limitations on load ramp up and ramp down behavior

Phase jumps

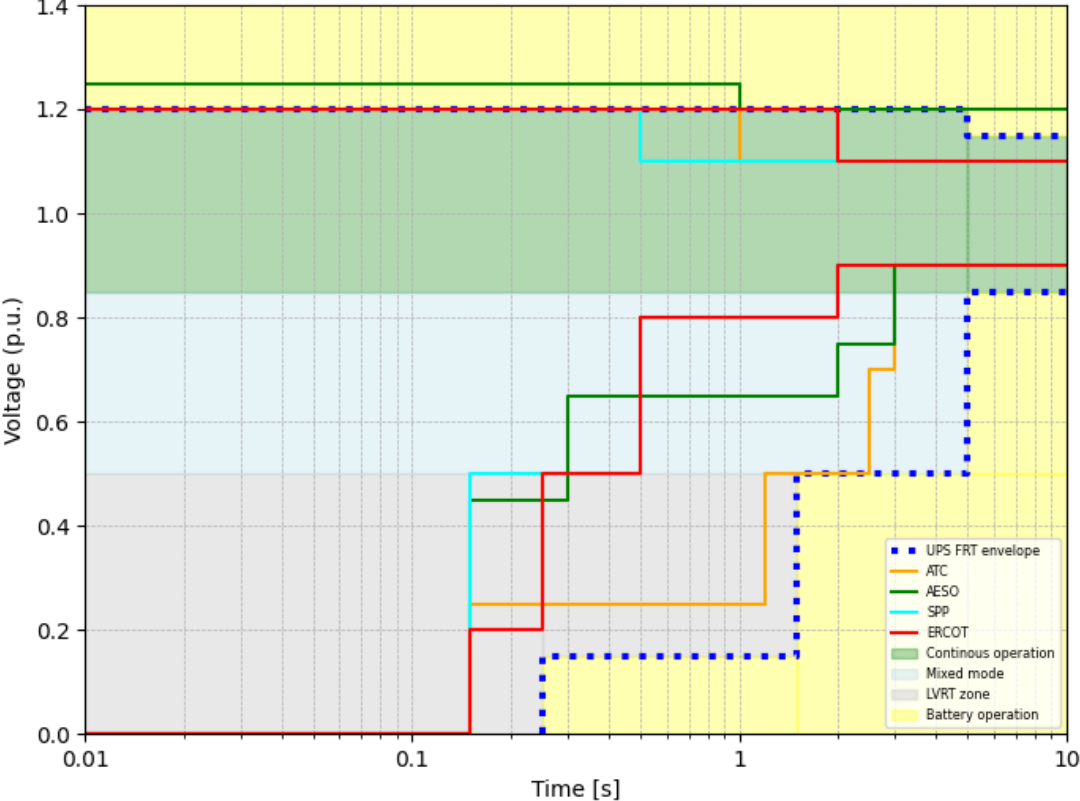
Capability to withstand phase jumps of 20 Deg – 30 Deg

PSCAD models

- It is a requirement to deliver PSCAD models of the data center to show compliance to FRT

NAM requirements

FRT curve response for Galaxy V series UPS



ERCOT (red)

- Issued : 14 November 2025
- State: Applicable

Southwest Power Pool (light blue)

- Issued: 15 Aug 2025
- State: Draft

ATC (orange)

- Issued: 28 August 2025
- State: Applicable

AESO (dark green)

- Issued: 22 August 2025
- State: Draft

Voltage FRT requirements

Mapped against GVX and GVXL compliance with new FW release in 2026



GVX will support HVRT +25%, while GVXL will support up to +20%

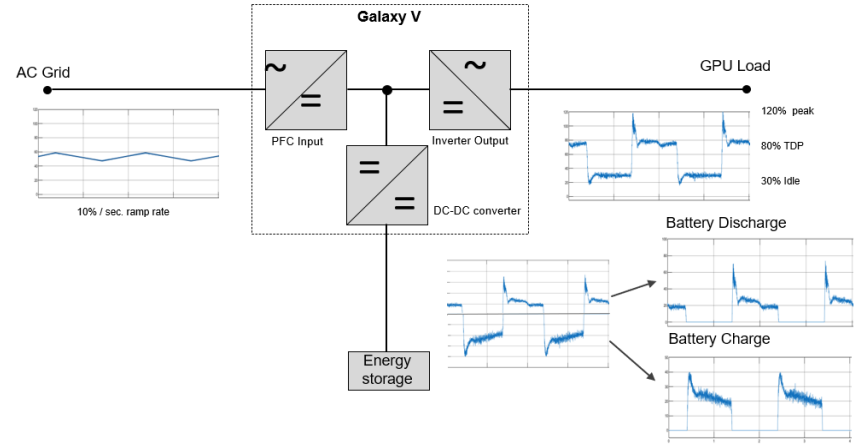
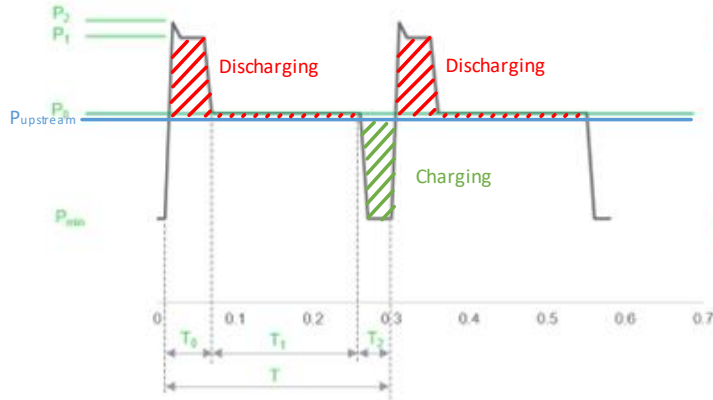
GVX will support HVRT, while GVXL will support up to +20%

GVXL will support HVRT up to +15% for 415V

Life Is On



AI load power smoothing



The purpose of an AI load power smoothing feature is to smoothen out the load profile seen from the upstream installation so that it becomes relatively constant even though the load on the UPS output has a dynamic profile as illustrated in the above figure. The AI smoothing principle is illustrated in the figure where the blue line is the load seen upstream, which is kept constant by either discharging the battery when the output load is high (marked in red) or charging the battery when the output load is low (marked in green).

In summary

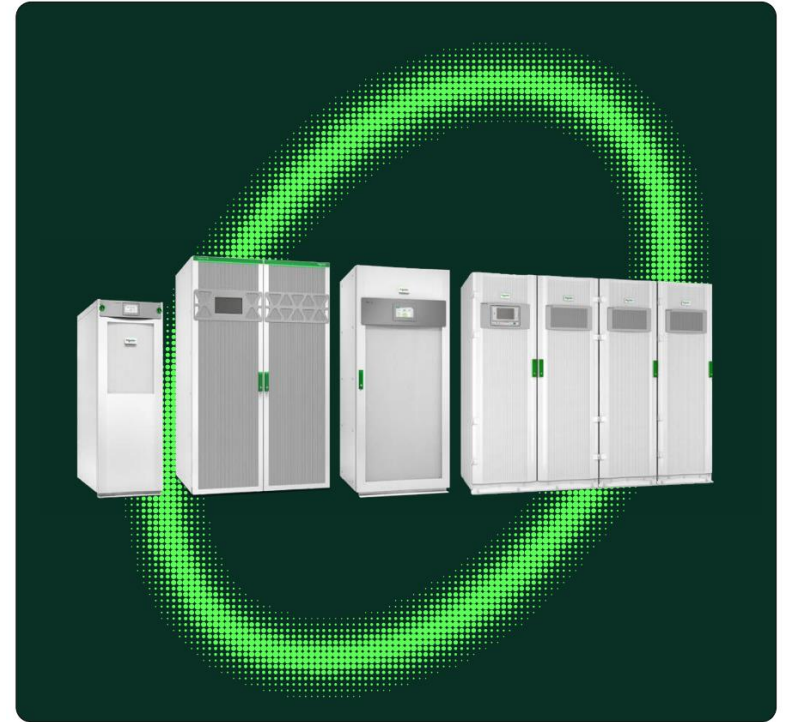
The industry is in a learning state and the requirements are evolving during the way.

As a product provider we have to adapt at the same pace, which is challenging, as we do world wide products.

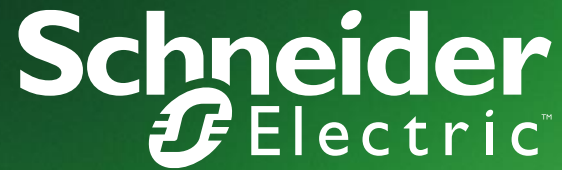
To be compliant to regulatory is challenging as it is a moving target

Keep monitoring the regulatory, and adapt and release product updates in iterations

Harmonized standards will help this common journey



Galaxy V series products, from 10KW to 1500KW



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