APPLICATION NOTE

Fast Frequency Response and Ancillary Frequency Services

SATEC PRO measurement and recording solutions for BESS and flexible energy assets

Products: PM335 PRO, EM235 PRO, RTR software

Fast, dependable frequency and power measurements connect energy assets to grid-support applications. SATEC PRO Series meters provide the measurement, communications and event-recording functions used by battery energy storage systems, plant controllers and performance-monitoring platforms.



Supporting a changing power system

As renewable generation and inverter-based resources increase, lower synchronous inertia can allow grid frequency to change more rapidly after a disturbance. Fast Frequency Response helps limit this movement through a rapid change in active-power injection or consumption. Batteries, generators and controllable loads can contribute according to the service requirements.



SATEC value proposition

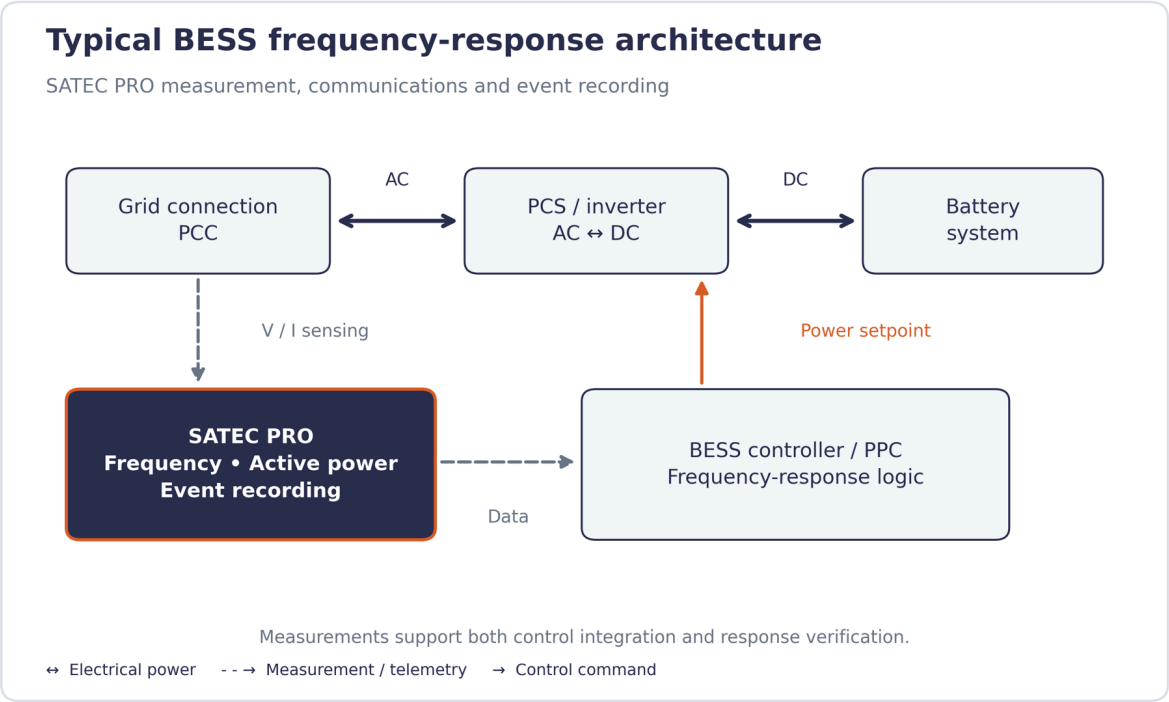
SATEC combines high-resolution frequency measurement, fast electrical data and utility communications in the PRO platform. This gives system integrators a measurement interface for plant control and a record of how the asset responded.

From grid measurement to response visibility

PRO meters measure frequency and active power at the grid connection or asset boundary and send data to the BESS controller, PPC or EMS. The controller applies the response curve and commands the power conversion system. Event records link the frequency disturbance to the resulting power response for analysis and reporting.

Overall service performance depends on the coordinated operation of measurement, communications, controller and power conversion equipment, together with the applicable market requirements.

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Typical measurement and control architecture

The SATEC PRO solution

PM335 PRO and EM235 PRO bring frequency and power measurement, communications and recording into a common platform. The panel-mounted PM335 PRO provides local visibility at the switchboard; the DIN-rail EM235 PRO suits control cabinets and integrated equipment.



PM335 PRO panel-mounted meter

PRO capability	Value for frequency-response applications
Frequency resolution up to 0.0001 Hz	Detailed visibility of frequency deviations for control integration and response analysis.
20 ms real-time Modbus RTU/TCP data	Frequent measurement updates for BESS controllers, PPCs and external data collection.
Frequency and active-power measurement	Correlates the grid disturbance with the change in asset power.
Utility protocol options	IEC 61850, DNP3 and IEC 60870-5-101/104 support integration with plant and substation systems.
Pre-event and post-event recording	Preserves the operating point before a disturbance and the subsequent response.

Dedicated FCAS configurations provide real-time data or internal recording options. Protocol features, data intervals and recording functions depend on the selected model and firmware; they are not all available at the same rate through every interface.

A platform for control and performance monitoring

- Use PRO data in local control systems, SCADA and external recording platforms.
- RTR software adds high-speed polling, collection and tailored output formats for monitoring architectures, with polling intervals down to 10 ms.
- The collection interval is distinct from the meter update interval and the asset response time.

Frequency-response markets

Frequency services share a common need for timely measurements and clear evidence of power delivery. Their activation curves, response times and delivery periods vary by market. SATEC PRO supports the measurement and recording functions within these service architectures.

Australia FCAS

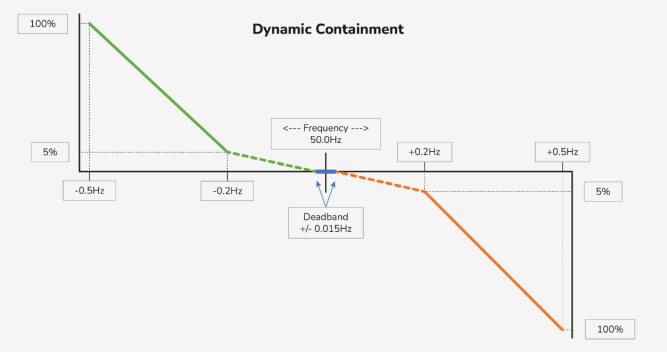
Frequency Control Ancillary Services include Very Fast, Fast, Slow and Delayed contingency services, commonly identified by 1 second, 6 seconds, 60 seconds and 5 minute response classes. Regulation services address ongoing frequency balancing. PRO FCAS configurations support fast real-time data and disturbance recording for these applications.

Recording configuration	Interval	Before FDT	After FDT
Very Fast and Fast	20 ms	5 s	60 s
Slow and Delayed	1 s	20 s	10 min

FDT means Frequency Disturbance Time. These are available PRO recording profiles; service qualification and assessment follow the applicable AEMO Market Ancillary Service Specification.

Great Britain Dynamic Containment

Dynamic Containment requires a rapid power response that follows a defined frequency-to-power curve. The 50 Hz profile shown has a ±0.015 Hz deadband, reaches 5% of contracted response at ±0.2 Hz and full contracted response at ±0.5 Hz. Under-frequency calls for increased net injection; over-frequency calls for reduced injection or increased consumption.



Dynamic Containment response as a percentage of contracted power

The service specifies initiation within 0.5 s and full delivery within 1 s, with 15 minutes of sustain for energy-limited providers. A 10 MW response sustained for 15 minutes represents 2.5 MWh of energy at the delivery boundary; usable battery energy and charging headroom depend on state of charge and system losses.

PRO meters supply frequency and power measurements, while configurable logs and external data collection support performance monitoring and reporting.

Application experience and solution value

Taiwan BESS integration

A documented Taiwan AFC project used PM335 PRO within an IEC 61850 BESS architecture for a Taipower distribution-substation application. The implementation measured frequency every 20 ms and communicated an average of four measurements every 100 ms. A customized IEC 61850 logical node made the calculated frequency available to the control system, including GOOSE messaging.

The project demonstrates how SATEC measurements can be integrated into a defined controller interface. Its 2021 deadband, averaging and response settings were specific to that installation. The transferable solution is the combination of fast measurement, engineered communications and BESS control integration.

Broader frequency-service applications

The same measurement and integration approach can support Nordic FFR and FCR-D, European frequency containment and restoration services, and emerging FFR applications. For standalone BESS, co-located solar or wind storage, generators and flexible loads, PRO provides visibility of frequency and power at the relevant electrical boundary.

Turning measurements into operational value

Customer need → SATEC solution value



Integrate an asset with a plant controller

Fast frequency and power data through established industrial and utility interfaces.

Understand response performance

Time-related frequency and power records show the initial operating point and subsequent delivery.

Investigate events and improve operation

Pre-event and post-event data help identify delays, limits and unexpected behavior.

Fit different equipment architectures

Panel-mounted PM335 PRO and DIN-rail EM235 PRO support switchboard and cabinet installations.

SATEC PRO provides the measurement and recording foundation for frequency-response solutions. Contact SATEC to discuss PRO integration with your BESS, PPC, EMS or monitoring platform.

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