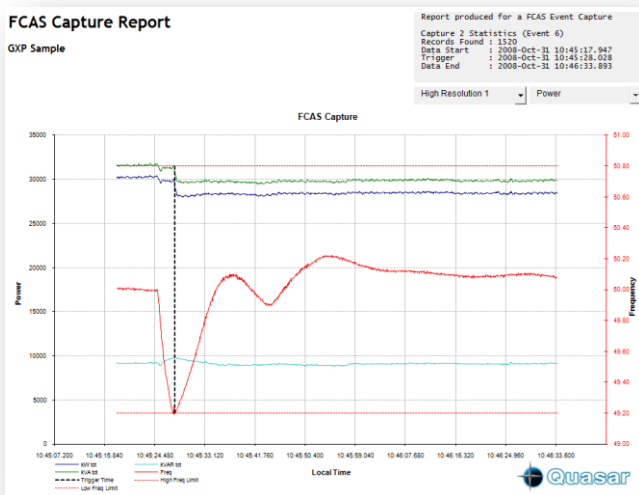


Quasar FCAS Application

Quasar's FCAS

Quasar's FCAS application provides high speed monitoring of electrical parameters for a period of a given number of seconds before, and after a grid or network frequency disturbance. It combines monitoring of system frequency, recording of frequency, load and disturbance time, and presenting this data in spreadsheet format.

The feature is designed to meet or exceed the requirements of the New Zealand and Australian markets.



Quasar FCAS Report

New Zealand (IR)

IR is the Instantaneous Reserve Ancillary Service Schedule, in New Zealand and is defined in Appendix A2 of Schedule C5 of the Electricity Governance Rules. The meters and software monitor the frequency then

produce the information required by the schedule. It requires the following captures:

| | |
|-----------------|--------------------|
| Fast (FIR) | 6sec/60sec @ 6sec |
| Sustained (SIR) | 6sec/15min @ 10sec |
| Under-frequency | < 48 Hertz |
| Over-frequency | > 52 Hertz |

New Zealand Requirement

Australia (AEMO)

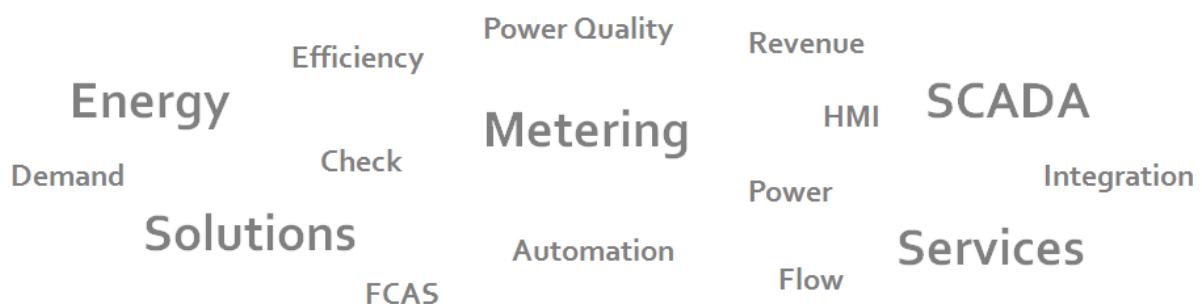
AEMO is the Australian Energy Market Operator (<http://www.aemo.com.au>) The Australian specification (MAS Spec) Version 2.0 dated 1 July 2009 requires monitoring of system frequency, recording of frequency, load & disturbance time and presenting this data in spreadsheet format. The meters and software monitor the frequency and then produce the information required by the schedule. This requires the following captures:

| | |
|--------------------------------|----------------------|
| Fast Raise/Lower Service | 5sec/60sec @ 0.05sec |
| Slow Raise/Lower Service | 20sec/5min @ 4sec |
| Delayed Raise/Lower Service | 20sec/15min @ 4sec |
| Regulating Raise/Lower Service | Continuous @ 4sec |

Australian Requirement

ION Meters and Software

The Quasar FCAS add-on application uses Schneider's ION 7650, ION 8600A and ION 8800A power meters and ION Enterprise software. The application is a package combining ION meter frameworks, software frameworks, screens and reporting.





ION7650



ION8600A



ION8800A

The ION intelligent metering and control devices offer revenue-certified power, energy, demand, time-of-use metering and true power quality analysis, with direct connect to a corporate LAN/WAN or Internet. They are ideal for energy management, outage avoidance, demand control and more; recording transients, harmonics, sag/swells, waveforms and load trends.



ION Enterprise™ web-enabled software is an energy information management solution for the operations end of your business. It offers control capabilities, comprehensive power quality and reliability analysis and can help you reduce energy related costs.

ION Enterprise allows you to manage intelligent ION metering and control devices, analyse data, and decide on new courses of action.

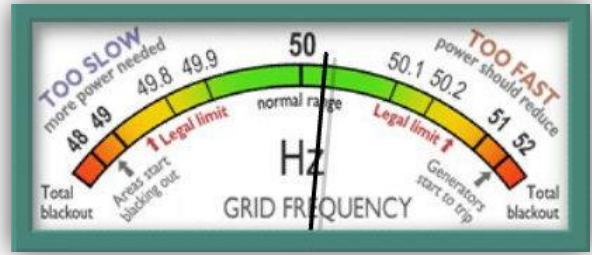
The Requirement for FCAS

The purpose of the Frequency Control Ancillary Service (FCAS) is to manage frequency recovery after a frequency excursion event, with the objective of arresting the frequency fall or rise, and recovering the frequency after the frequency event.

To assist in the understanding of frequency control, analogies can be drawn between a power system and the engine in a car. If a car travelling at a constant velocity is presented with a change in load with no corresponding change to the power output of the engine of the car, then the car will speed up (for decreases in load such as that presented by a down hill slope) or slow down (for increases in load such as an up hill slope).

In a similar manner, if the load on a power system is varied without a corresponding variation in the generation feeding that power system, the frequency (speed) will deviate.

In order to maintain the frequency to within the frequency standards, Ancillary services have been developed to alter the generation or demand, to maintain the generation / demand balance.



Frequency control can be divided into two distinct subsets, Regulation and Contingency.

Regulation frequency control can be described as the correction of the generation / demand balance in response to minor deviations in load or generation. Contingency frequency control refers to the correction of the generation / demand balance following a major contingent event such as the loss of a generating unit or a large transmission element.

Regulation services are continually used to correct for minor changes in the demand / supply balance. However, contingency services, while always enabled to cover contingent events, are only occasionally used.

FCAS providers submit bids in a similar way to generators bidding into the energy market. Payments for ancillary services include payments for availability and for the delivery of the services.

An ancillary service agent dispatched to provide instantaneous reserve in accordance with the rules must provide either additional generation automatically following an under-frequency event, or reduced demand whenever the frequency of the grid falls to or below the trip frequency.

The ancillary service agent must provide monitoring equipment that accurately measures in a time tagged manner the instantaneous reserve response (in MW) from the ancillary service agent's equipment, in a time tagged manner.

FCAS Event Recording

The trigger for an FCAS event is frequency which is sampled at high-speed every 1-cycle. A 20ms (1-cycle) delay is imposed to prevent triggers from voltage transients. The meter framework has an eight-event topology with four high speed/high resolution captures and four low speed/low resolution captures able to be stored.

High Resolution meets the requirements of the AEMO Fast Raise/Lower service. This high resolution recording can be disabled by the user if it is not required.

Low Resolution meets the requirements of both the AEMO Slow Raise/Lower & Delayed Raise/Lower

services as well as the New Zealand IR Fast & Sustained Instantaneous Response services.

| | |
|-----------------|----------------------|
| High Resolution | 6sec/65sec @ 0.05sec |
| Low Resolution | 6min/16min @ 4sec |

Typical FCAS Captures

Each event recording is designed to be stored within the meter until fully retrieved by the ION Enterprise software. Therefore the meter can hold three separate event recordings between successive communication sessions.

Rate of Change

If enabled, the recording of frequency excursions is governed by whether the frequency Rate of Change equals or exceeds a user-adjustable rate. This feature is normally disabled for the New Zealand IR market as it is not required.

| | |
|----------------|------------|
| Rate of Change | 0.05Hz/sec |
|----------------|------------|

FCAS Rate of Change

Continuous Recording

As an option, continuous recording of kW total and Frequency can be performed in the meter every 4 seconds. This continuous recording meets the requirements of the AEMO Regulating Raise/Lower service.

NOTE: This feature can create a large amount of data and should only be enabled after discussion with Quasar.

Extended Recording

The extended recording feature allows for a subsequent event to occur while an event is already recording. If this occurs, the meter will extend its event recording so that a complete post period is always recorded.

Multi-Parameter Recording

Each event capture contains the following parameters displayed within the Excel report on three user-selectable charts for Power, Voltage and Current.

| Chart Selection | Parameter |
|-----------------|-----------------|
| All | Freq (2nd axis) |
| Power | kW total |
| Power | kvar total |
| Power | kVA total |
| Voltage | Vll ab |
| Voltage | Vll bc |
| Voltage | Vll ca |
| Current | I a |
| Current | I b |
| Current | I c |

Recorded Parameters

Shed Output

A high-speed digital output of the ION meter can be enabled to provide a trip signal to downstream ripple control plant. When an event occurs a 2 second pulse will be sent to the chosen hardware port.

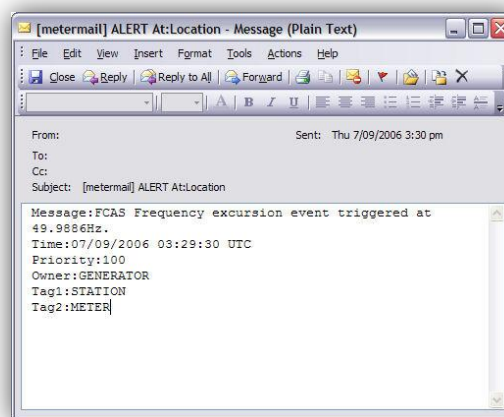
No-Volt Disable

The design incorporates detection for loss of voltage (Vln a). If enabled, the FCAS detection will be turned-off in the event of a loss of supply voltage to prevent false triggers.

Alert Emails

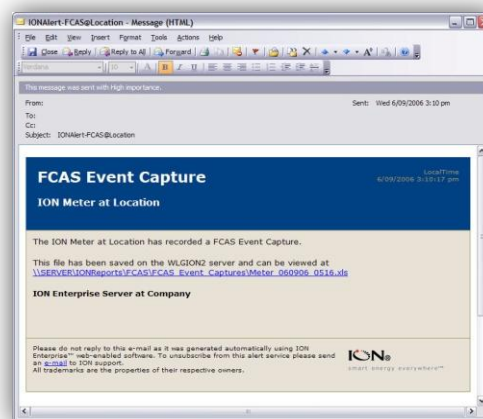
An alert email can be used to report FCAS events immediately from the Ethernet equipped meter via the corporate email server.

This plain text email would typically be sent to an email distribution group within the organization and includes the frequency trigger value recorded.



Meter-generated Event Trigger Alert Email

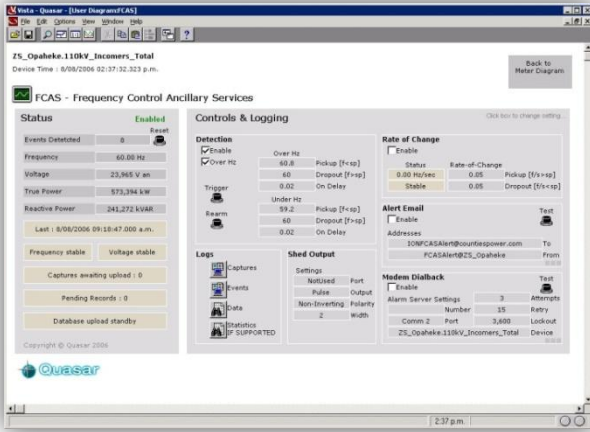
The ION server can also be configured to email the distribution group with the MS Excel event capture report attached or alternatively with a hyperlink to the saved report on the network. This also identified whether the capture originated from a frequency event or manual capture.



Server-generated Event Report Email

ION Enterprise Integration

The FCAS application is implemented with the ION Enterprise software which provides full graphical display and database logging. FCAS screens are configured by Quasar allowing setup and monitoring of the FCAS feature for each meter.



ION Enterprise FCAS Screen

Manual Capture

Event Reports can also be produced from a Manual Capture. The manual trigger could be sent from the user on ION Enterprise, via a digital input from a PLC or via serial communications from an RTU using DNP or Modbus protocols. The FCAS application detects this manual capture and will perform in the same way as if it was triggered from a frequency excursion. The subsequent email alerts and reports will identify that the cause was a Manual Capture.

Communications

An Ethernet connection is required from the ION Enterprise software to the remote ION meter for the FCAS application due to the large volume of data that is recorded during an event. The ION Enterprise software will continually poll the meter, and upload all data as it is available.

Generator Performance Monitoring

Using similar technology to Quasar's proven FCAS application, Generator Performance Monitoring takes advantage of the powerful standard and customisable features of the ION advanced metering devices and ION Enterprise software. Uses include studies of generator performance in terms of spinning reserve, response time to take load, governor performance, over/under generation and subsequent effect on frequency.

Generator Governor Performance Monitoring provides the capture of electrical data triggered during generator start-up or shut-down, or at any other significant time, in order to monitor the performance of generation plant. This application is appropriate for hydro, thermal and wind generation stations. Captures are triggered either manually by the user, direct from a PLC input, or automatically using a threshold setting on any electrical parameter. Facilities are provided to capture pre or post trigger recording.

ION Meter Template

In order to perform the FCAS function the ION meters must use the factory non-PQ template. Please contact Quasar technical support for further details.

Client Support



All FCAS systems are covered by a Quasar Managed System Support subscription. We view client support as a vitally important activity. Recognisable through the day-to-day technical relationships we share with

our clients, Quasar's commitment to support is best exemplified through the **MSS Managed System Support** program.

This offers a high level of system support to client's who rely on us maintaining their systems, allowing them to concentrate on with the business of running their business and infrastructure operations.

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