

What is needed for a resource to provide regulation?

Automatic Generation Control (AGC) Operational Requirements for Generating Units Excerpt from Telemetry BPM section 10

10.1 Required DNP3 and Telemetry Data Points for AGC

To meet the minimum requirement of real-time visibility for Generating Units providing Automatic Generation Control (AGC) to the ISO, each Real-Time Device must be capable of communicating the following **types of values** to/from the ISO's Energy Management System (EMS):

- Analog input values to the ISO
- Digital input values to the ISO
- Analog output (Set Points) from the ISO

To meet the minimum requirement of real-time visibility for Generating Units providing Automatic Generation Control (AGC) to the ISO, each Real-Time Device must be capable of communicating the following **telemetry data points** to/from the ISO's EMS:

- Unit Control Switch (UCTL)
- Unit Authority Switch (UASW)
- Automatic generation control (UAGC)
- Automatic generation control Set Point
- Automatic generation control feedback
- Unit Operating High Limit (UOHL)
- Unit Operating Low Limit (UOLL)

For a detailed description of the minimum data point requirements for Generating Units providing AGC Regulation to the ISO please refer to Section 17.

The ISO Operations and Engineering groups have approved the list of data point requirements described herein. They are the minimum data point standards that will allow the ISO to manage effectively the reliability of the grid. At any time, the ISO may require additional telemetry values to meet real-time operational requirements.

10.2 AGC Control (Bumpless Transfer)

For resources providing AGC, the Real-Time Device may have the option to set up a bump less transfer method for AGC control, to track Set Point when resources are off AGC control. A calculated Set Point will be stored in the Real-Time Device, continually updating with the current Point of Delivery MW value of the resource or aggregate resource. When the resource transfers to AGC control, and starts accepting valid Set Points, the calculation will deactivate. The calculation should only reactivate when AGC control is disengaged.

Modified table from Telemetry BPM Section 6.1

Digitals and Analogs

Digitals	AGC	Purpose	Common Alias
Unit\Resource Connect	X	<p>May be dependent on data from breakers, meters or inverter status.</p> <p>May be critical for AGC functionality. If in open state or bad quality a set point will not be sent unless manually overridden.</p> <p>If an AGG UCON point exists the quality and status of the AGG UCON will take precedence</p>	*...* UCON
Power System Stabilizer	X Note 7	Compliance/Reliability	PSS
Automatic Voltage Regulator	X Note 7	Compliance/Reliability	AVR
Unit Low Side Breaker	X	Typical input for UCON. Bad quality or incorrect status may affect UCON status.	LSIDE CB
Related Unit Breakers	X	Typical input for UCON. Bad quality or incorrect status may affect UCON status.	*...* CB
Related Unit MOD's Disconnects	X	Compliance/Reliability	*...* MOD
Switchyard Line Breakers (if Generator Owned)	X	Compliance/Reliability	*...* CB
Switchyard Line MOD (if Generator Owned)	X	Compliance/Reliability	*...* MOD
Aggregated\Unit Connected	X Note 6	<p>May be dependent on data from child UCONs, breakers, meters or inverter status. Indicates to the ISO whether the unit is connected and available for dispatch.</p> <p>Critical for AGC functionality. If in open state or bad quality a set point will not be sent unless manually overridden. Used in RIG calculation of UAGC.</p>	AGG UCON
Aggregated\Unit Authority Switch	X Note 8	Critical for AGC functionality. If in open state or bad quality a set point will not be sent unless manually overridden. Used in RIG calculation of UAGC.	UASW

Digitals	AGC	Purpose	Common Alias
Aggregated\Unit Control Switch (“Remote\Local”)	X Note 8	Critical for AGC functionality. If in open state or bad quality a set point will not be sent unless manually overridden. Used in RIG calculation of UAGC.	UCTL
Aggregated\Unit Automatic Generation Control	X Note 8	Critical for AGC functionality. If in open state or bad quality a set point will not be sent by EMS unless manually overridden. UCON, UASW and UCTL must be true closed on for the RIG to calculate and send an “ON” status for the UAGC point.	UAGC
Governor Block Status	X	Compliance/Reliability	GOV BLK

Analogs	Point Required	Required for Technical Operation of Service?	Common Alias
Unit Gross MW	X	Compliance/Reliability	UGMW
Unit Net MW	X Note 1	Compliance/Reliability	UNMW
Unit Point of Delivery MW	X	Used as control point for regulation. The ISO only looks at single MW reading to determine regulation response. Resource should have controllers include Point of Delivery (POD) MW as bases for the amount of generation they are being requested to provide. If AGG POD exists it will take precedence and be used in place of individual unit POD for AGC.	POD MW, UPMW
Unit Auxiliary MW	X Note 2	Compliance/Reliability	UAMW
Unit Generator Terminal Voltage	X	Typical input for UCON, If Quality is bad we may not see resource as available	GEN KV
Unit Gross MVAR	X	Compliance/Reliability	UGMV
Unit Net MVAR	X Note 3	Compliance/Reliability	UNMV

Analogs	Point Required	Required for Technical Operation of Service?	Common Alias
Point of Delivery MVAR	X	Compliance/Reliability	UPMV, POD MVAR
Auxiliary MVAR	X Note 4	Compliance/Reliability	UAMV
High\Line Side Bank MW	X Note 5	Compliance/Reliability	H SIDE_BANK MW, L SIDE_BA NK MW
High\Line Side Bank MVAR	X Note 5	Compliance/Reliability	H SIDE_BANK MVR, L SIDE_BA NK MVR
High\Line Side Bank Voltage	X Note 5	Compliance/Reliability	H SIDE_BANK KV, L SIDE_BANK KV
Aggregated Gross MW	X Note 6	Compliance/Reliability	AGG UGMW
Aggregated Net MW	X Note 6	Compliance/Reliability	AGG UNMW
Aggregated Point of Delivery MW	X Note 6	Used as control point for regulation. The ISO only looks at single MW reading to determine regulation response. Resource should have controllers include POD MW as bases for the amount of generation they are being requested to provide. If AGG POD exists it will take precedence and be read in place of individual unit POD for AGC.	AGG POD, AGG UPMW
Aggregated Gross MVAR	X Note 6	Compliance/Reliability	UGMV
Resource ID Set Point Feedback	X	Control feedback is used to confirm resource is receiving instructions from the ISO EMS. Primarily used for troubleshooting. Expected feedback delay is 8-12 seconds. RIGs polled every second should have shorter delay time.	CTLFDBK
RIG Heart Beat	X	Compliance/Reliability	HRT

Analogs	Point Required	Required for Technical Operation of Service?	Common Alias
Aggregate\Unit Operating High Limit	X	Identifies high operating limit of resource with respect to POD MW. If POD is read above this limit set points will not be sent.	UOHL
Aggregate\Unit Operating Low Limit	X	Identifies low operating limit of resource with respect to POD MW. If POD is read below this limit set points will not be sent.	UOLL
Instantaneous State of Charge		The SOC will be maintained within energy limit constraints (minimum and maximum) defined in the ISO Master File. Data should be updated every four seconds and should vary from zero to maximum energy limit. SOC MUST NOT EXCEED MXENERGY. Resource will not receive set point instructions if limit is exceeded. In terms of MWh.	SOC
Maximum Continuous Energy Limit		The Maximum Continuous Energy Limit is the maximum energy in MWh that can be stored in the battery for ISO participation. When the Participating Generator provides this value through telemetry, Market dispatch will respect the energy limit. This value cannot be above the maximum energy limit defined in the ISO Master File. The derate should be reflected, when applicable, in real-time. In terms of MWh.	MXENERGY
Droop Setting	X	Compliance/Reliability	GOV DRP
Governor Dead Band	X	Compliance/Reliability	GOV DB
Operational Unit Ramp Rate	X	Compliance/Reliability	OPER RR

1. If Aux MW are over 1 MW then Net MW are required.
2. Required If Aux MW are over 1 MW.
3. If Aux MW are over 1 MW then Net MVR are required.
4. Required if Aux MW are over 1 MW.
5. Transformer High Side or Line values required depending on meter location.
6. Provide Unit Connected and Gross MW for each unit and aggregated values if Resource ID is an aggregate. Individual POD not required if the Resource ID is an aggregate.

Testing

A telemetry-only AGC test is conducted as part of the point-to-point testing in resource commissioning with the ISO. The resource is not expected to respond with generation/load, however all communication systems should be configured so that set point data is passed from the RIG to relevant controllers. Any deficiencies in implementation should be reported to the ISO test administrator to insure a complete test is conducted at a later date.

As a best practice Resource Operators should have documentation on hand to allow for the proper overrides to place the resource in the correct operating mode. During certification testing the resource will not receive flags/award data that may be used to automatically place the unit into the AGC control mode (UAGC=ON)

Operating Procedure 5330 provides guidelines for scheduling and conducting Regulation certification tests. Battery Energy Storage System (BESS) resources should ensure adequate SOC is available at start of test to complete testing.

Any time the resource is expected to follow set point instructions, the following conditions must be set:

- Operating limit points must define an operating band suitable for the test/operation.
- UCON must have a CLOSED/HIGH/ON value.
- UASW must have a CLOSED/HIGH/ON value.
- UCTL must have a CLOSED/HIGH/ON value.
- POD MW readings must be within the defined operating limit band.
- SOC must be below MXENERGY.
- Data quality of all points must be good.

These conditions identify the resource as available for AGC. Tests are conducted per test administrator's instruction. The set point will increment linearly from starting point to target at an agreed on ramp rate. Set points will increment every 4 seconds from start to finish. In turn, Resource is expected to respond linearly as instructions are received. Resource response must never "Step" above its expected ramp rate during testing or normal operations.

Additional Considerations for Performance Verification

- Resource should have correct outages in place for testing.
- Default ramp rate should be a controlled value.
- Ensure resource can make corrective “jumps” to match set point if output starts to deviate.

References

Telemetry Business Practice Manual

https://bpmcm.caiso.com/BPM%20Document%20Library/Direct%20Telemetry/BPM_for_Direct_Telemetry_V19%20Clean.docx

Certification – Operating Procedure 5330

<http://www.caiso.com/Documents/5330.pdf>

Performance Verification – Operating Procedure 5370

<http://www.caiso.com/Documents/5370.pdf>