

WEM RULES

TECHNICAL SPECIFICATIONS: OPERATIONAL DATA POINTS FOR GENERATING PLANT

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1. INTRODUCTION

1.1. Purpose

- 1.1.1. Step 2.1.2 of the Power System Operation Procedure (PSOP): Communications and Control Systems¹ requires that AEMO develop this document, which details the general real-time operational data points required for each type of Facility to be transmitted through SCADA between a Market Participant’s Facilities to the Network Operator and AEMO for monitoring, control, dispatch, and on-line studies associated with the management of the security of the SWIS.
- 1.1.2. Step 2.1.3 of the PSOP: Communications and Control Systems allows AEMO to specify SCADA points required for each Registered Facility and each Facility that is intended to be registered. The SCADA points specified:
 - (a) Could be in addition to those required by the Network Operator under the Technical Rules and other relevant statutory instruments.
 - (b) May vary over time or due to a modification of a Facility.
- 1.1.3. AEMO must specify the SCADA points in Step 2.1.3 of the PSOP: Communications and Control Systems in accordance with this document.
- 1.1.4. This document does not specify SCADA points for:
 - (a) Automatic Generation Control (AGC) or Automatic Balancing Control (ABC), which are defined in the AGC/ABC Interface Requirements.
 - (b) Network Operator purposes, unless that information is required by AEMO.

1.2. Definitions and interpretation

- 1.2.1. In this document:
 - (a) terms that are capitalised, but not defined, have the meaning given in the WEM Rules;
 - (b) to the extent that this document is inconsistent with the WEM Rules or Market Procedures, the WEM Rules or Market Procedures prevail to the extent of the inconsistency;
 - (c) a reference to the WEM Rules, or Market Procedures, includes any associated forms required or contemplated by the WEM Rules or Market Procedures;
 - (d) words expressed in the singular include the plural and vice versa; and
 - (e) unless the context requires otherwise, references to AEMO include AEMO in its System Management capacity.

Term	Definition
AGC	Equipment operated by AEMO, which sends signals to generating facilities participating in the AGC scheme to automatically adjust their output so as to maintain frequency or restore frequency within the SWIS Operating Standards.

¹ AEMO, *Power System Operation Procedure: Communications and Control*. Available at <https://www.aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Procedures>

Term	Definition
Supervisory Control and Data Acquisition (SCADA)	Network Operator systems to acquire data from remote devices. AEMO accesses this information via the Energy Management System, which enables AEMO to supervise and control the power system from a remote location.

1.3. Related documents

Reference	Title	Location
	AGC/ABC Interface Requirements	Market Web Site
PSOP	Communications and Control Systems	Market Web Site

2. TYPES OF GENERATION FACILITIES

- 2.1.1. The minimum specifications detailed in Appendix A apply to all types of Facilities that are likely to be connected to the SWIS, including:
- (a) Intermittent Generating Systems with a large number of small units.
 - (b) Conventional Steam Turbine Generators.
 - (c) Open Cycle Gas Turbine Generators.
 - (d) Combined Cycle Gas Turbine Generators with associated Steam turbine Generators.
 - (e) Generators that are part of a co-generation Facility .
 - (f) Biomass Generators.
 - (g) Landfill Gas Generators.
- 2.1.2. Appendix A specifies the SCADA points for each type of each type of Facility. Based on the Facility, AEMO may require additional types of SCADA points.

3. AGGREGATION

- 3.1.1. AEMO will identify whether the SCADA point is required at a Facility level or at a smaller level of aggregation.
- 3.1.2. The level of aggregation may vary for factors including:
- (a) Performance characteristics.
 - (b) Geographic dispersion of the components of the Facility.
 - (c) Forecasting requirements.

4. NETWORK PROTECTION SCHEMES

- 4.1.1. Where the Network Operator requires a Facility to have a special protection requirement, AEMO will require the Network Operator to provide SCADA information indicating the status of these protection requirements, as part of the data to be sent via the Inter-Control Centre Communications Protocol link detailed in Step 6.2.2 of the PSOP: Communications and Control Systems.

5. GENERAL SCADA POINT REQUIREMENTS

- 5.1.1. Alarm points may be provided as:
- (a) A single point where the points from individual devices are paralleled within the generation Facility.
 - (b) Individual points from the individual devices and paralleled within the Network Operator's equipment.
- 5.1.2. To ensure adequate redundancy for the security dispatch functions in the SCADA System, all analogue points must be provided from a direct measurement of the quantities. Summated analogue values are not acceptable.

APPENDIX A. DATA POINT REQUIREMENTS

Table 1 AEMO Operational Data Points Requirements for Scheduled Generators

Point Description	Transmission Connected and 10 MW or more	Transmission Connected and less than 10 MW	Distribution Connected
Status			
All Facility switching devices opened/closed (e.g. isolators, earth switches, circuit breakers – two complementary contacts i.e. NO/NC pair)	✓	✓	✓
Remote generation load control on/off	R		
Generating unit operating mode (e.g. gen/synch comp if applicable)	R		
AVR or SVC control mode (e.g. constant q, constant V, manual, or off)	R		
Turbine control limiting operation (e.g. temp)	R		
Governor mode (e.g. droop/isochronous)	✓		
Generating Facility synchronising	✓	✓	✓
Generator run up and run down	R		
Fuel type (e.g. liquid/gas/coal)	✓		
Base/Peak mode	G		
Associated reactive plant switching devices opened/closed (e.g. isolators, circuit breakers – two complementary contacts ie NC/NO pair)	✓		
All Facility switching devices opened/closed (e.g. isolators, earth switches, circuit breakers – two complementary contacts i.e. NO/NC pair)	✓	✓	✓
Alarms			
Main circuit breaker(s) tripped by protection			✓
Protection defective alarms	R		
Over/Under excitation limiter operated	R		
Protective load shed operated	✓		
Communications link(s) fail	✓	✓	✓
High/Low severity alarms	R		
Generator protection operated	✓	✓	
Step up transformer protection operated	✓	✓	
Associated reactive plant protection operated	✓		
Measured Values			
Gross active and reactive power output of each generating unit	✓		
Net active and reactive power output of each generating unit	✓		
Net Facility active and reactive power import or export at each connection point	L	L	L
Local Load and/or unit auxiliary active power and reactive power	L	L	L
Generating unit stator voltage	✓	✓	✓ see note 1
Generator step-up transformer tap position	✓		

Point Description	Transmission Connected and 10 MW or more	Transmission Connected and less than 10 MW	Distribution Connected
Speed of rotor as percentage of synchronous speed	R		
Reactive power flow for each associated reactive power device	✓		
Control			
Pulse or set point control of exciter	R		
Generator step-up transformer tap position	R		
Generator Start /Stop (note: separate start commands are required if unit can be started to different output levels (i.e. min, 50%, max)	R		
Generator main circuit breaker	U		
Base/Peak mode selection	R		
Associated reactive plant operating mode (power factor/voltage)	R		
Power factor and voltage set points	R		
Each reactive power device circuit breakers	R		

Notes:

- ✓ = required
- Blank cell = not required
- N SCADA to the Generator
- G = required for Gas Turbines generators only
- L = required if local load or a unit auxiliary transformer is connected anywhere between the generator terminals and the point of connection
- R = required if AEMO contracted to provide remote control
- U = required if Facility unattended or if AEMO contracted to provide remote control
- Voltage on Western Power side of Main Switch

Table 2 AEMO Operational Data Points Requirements for Transmission Connected Non-Scheduled Generators

Point Description	Non-Intermittent 10 MW or more	Non-Intermittent less than 10 MW	Intermittent 10 MW or more	Intermittent less than 10 MW
Status				
All Facility switching devices opened/closed (e.g. isolators, earth switches, circuit breakers – two complementary contacts i.e. NO/NC pair)	✓	✓	✓ see notes	✓ see notes
Associated reactive plant Control Mode (e.g. power factor, voltage)	✓		✓	
Generating Facility synchronising	✓	✓	✓	✓
Associated reactive plant switching devices opened/closed (e.g. isolators, circuit breakers – two complementary contacts i.e. NC/NO pair)	✓		✓	
Alarms				
Main switch tripped by protection		✓		✓ see notes
Generator protection operated	✓		✓	
Step up transformer protection operated	✓		✓	
Associated reactive plant protection operated	✓		✓	
Communications link(s) Fail	✓	✓	✓	✓
Measured Values				
Gross active and reactive power output of each generating unit	✓		see notes	
Net active and reactive power output of each generating unit	✓		see notes	
Net Facility active and reactive power import or export at each connection point	✓	✓		✓ see notes
Local Load and/or unit auxiliary active and reactive power	L		L	
Generating unit terminal / local voltage	✓		✓ see notes	
Generator step-up transformer tap position	✓		✓	
Net Facility output of active energy (impulse)	M	M	M	M
Number of individual generator units available for service	✓		✓	
Number of individual reactive power devices in service	✓ see notes		✓ see notes	
Number and rating of reactive power devices available for services	✓ see notes		✓ see notes	
Reactive power flow in each reactive power device	✓ see notes		✓ see notes	
Wind data at nacelle height (see note 2)				
Wind speed (km/h) (10-minute average) (see note 5)			W	

Point Description	Non-Intermittent 10 MW or more	Non-Intermittent less than 10 MW	Intermittent 10 MW or more	Intermittent less than 10 MW
Wind direction (deg) (10-minute average)			W	
Air pressure (10-minute average)			W	
Air temperature (10-minute average)			WO	
Number of wind turbines available for generation data			W	
Number of wind turbines in operation data			W	
Relative humidity (%) or Dew Point (deg C)			WO	
Control				
Generator set point from special network protection schemes	S		S	
Set point control of reactive power devices (power factor and voltage)	R		R	
Generator step-up transformer tap position	R		R	
Generator emergency stop	✓	✓	✓	✓
Generator main circuit breaker	U	U	U	U
MW control scheme set points			W	
Solar Data				
Solar irradiance (W/m ²) - Horizontal			✓	
Solar irradiance (W/m ²) – Inclined Plane			✓	
Temperature – module surface temperature (°C) (10-minute average)			✓	
Air temperature (10-minute average)			SO	

Notes:

- ✓ = required
- Blank cell = not required
- L = required if local load or a unit auxiliary transformer is connected anywhere between the generator terminals and the point of connection
- For intermittent generators with a large number of small generating units, the SCADA interface does not need to monitor individual units but must provide data points for the aggregate of all the units.
- For windfarms, multiple sets of data points for wind quantities should be provided where necessary i.e. the specified wind quantity data should be provided for each group of wind turbines within the windfarm where the wind characteristics in each group differ from those in other groups.
- The 10 minute average data is the average of samples taken at specified intervals over a 10-minute period that are transmitted as real-time data.
- Required only if individual reactive devices are connected to each generating unit.
- Required only if reactive power devices are connected to the substation low or high voltage busbars.
- At hub height for wind farms or nominated height, in the absence of hub height.

Table 3 AEMO Operational Data Points Requirements for Distribution Connected Non-Scheduled Generators

Point Description	Intermittent 10 MW or more	Intermittent less than 10 MW
Status		
All Facility switching devices opened/closed (e.g. isolators, earth switches, circuit breakers – two complementary contacts i.e. NO/NC pair)	✓	✓
Generating Facility synchronising	✓ see notes	✓
Alarms		
Generating unit circuit breaker(s) tripped by protection;	✓	✓
Main switch tripped by protection;	✓	✓
Generator electrical or mechanical protection operated	✓	✓
Communications link(s) fail	✓	✓
Measured Values		
Gross active power output of each generating unit;	✓ see notes	✓
Gross reactive power output of each generating unit;	✓ see notes	✓
Net Facility active power import or export at each connection point;	✓ see notes	✓
Net Facility reactive power import or export at each connection point;	✓ see notes	✓
Voltage on Western Power side of main switch voltage;	✓	✓
Net Facility output of active energy (impulse); (not required if metered)	✓ see notes	✓
Wind speed data including relationship of wind to generator output	W	
Number of individual generator units available for service	✓	✓
Number and rating of reactive power devices available for services	✓	✓
Control		
Generator circuit breaker (s) or main switch intertrip	✓	✓
Generator circuit breakers(s) or main switch close enable interlock	✓	✓

Notes:

- ✓ = required
- Blank cell = not required
- W = required for wind farms
- The requirements listed may be applied to generators with a rating less than 1 MW if the Facility intends to participate in the Wholesale Electricity Market or where concerns for safety and reliability arise.
- For intermittent generators with a large number of small generating units, the SCADA interface does not need to monitor individual units but must provide data points for the aggregate of all the units.
- Points with grey background are sent from the Network Operator's SCADA to the Generator.