
003.1 ELECTRIC FACILITY DATA AND COMMUNICATIONS FOR THE ALBERTA CONTROL AREA

1. Purpose

The purpose of this Standard 003.1 is:

- to specify the **data** needed by the System Controller in fulfilling real-time operational responsibilities; and
- to define the System Controller's specific communications and other requirements for the transmittal of data from both new and existing **facilities** to the System Coordination Center.

2. Background

The System Controller is the real-time operating authority for the electric power system pertaining to the Alberta Control Area and acts to ensure the safe, reliable and economic operation of this power system. The power system pertaining to the Alberta Control Area includes the Alberta Interconnected Electric System (AIES) and the power system of the City of Medicine Hat (CMHS). To meet its responsibilities, the System Controller requires, among others things, the following:

- A computer model representing the electric power system pertaining to the Alberta Control Area.
- Real-time visibility of selected facilities in the Alberta Control Area and of selected data related to these facilities. The absence of such real time visibility may prevent the System Controller from properly guiding the operations in the Alberta Control Area.

3. Definitions

The following definitions apply within this Standard 003.1. Other definitions are provided in the Glossary (Section 004) or in the Pool Rules.

analog

The continuous reading of quantities such as Volts, Watts, Vars, Amperes and transformer tap positions.

availability

A measure of the percentage of time when the equipment can perform its critical functions.

commissioning

The project activity that brings the new or modified facilities in service, and integrates it in the power system operations. It includes, without limitation, the processes used to prepare the power system and the new or modified facility for their interconnection, the **energization** of that facility, validation of facility operation after interconnection, and the implementation of the appropriate, new or changed operating procedures.

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data

The **status** and **analog** information telemetered to the System Coordination Center.

designated party

The party identified and designated in accordance with section 5.1 of this Standard 003.1.

Facility or facilities

Facility or facilities, in the context of this Standard 003.1, include:

- Power generating stations that are operated synchronised to the system, including the following equipment:
 - Generating units
 - Power system stabilisers and automatic voltage controllers
 - Unit breakers
 - Unit transformers
 - Ancillary service equipment
 - Protection and telecommunication equipment
- Substation facilities that may include equipment like:
 - Breakers and other isolation devices
 - Protection equipment
 - Static and/or dynamic VAR devices
 - Telecommunications equipment
 - Transformers
- Points of delivery where load-related **ancillary services** are offered.
- Transmission lines.

interval

The time period needed to perform another poll of the data and/or to transfer real-time information from the facility to the System Coordination Center.

status

The information that indicates the state of operation or condition of a facility or of a specific piece of equipment from that facility.

visibility point

Equipment and software required for measuring and transmitting data from a facility to the System Coordination Center.

4. References

- Power Pool of Alberta:- Power Pool Code
- Power Pool of Alberta:- Pool Rules
- Power Pool of Alberta:- Participants Manual
- Province of Alberta *Electric Utilities Act*
- Pool Technical Standard 003.2 - Automated Dispatch and Messaging System for the AIES.

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- Pool Technical Standard 003.3 - Operational Voice Communications for the AIES.

5. Requirements

5.1 Designated party

- In the process of carrying out its real-time operational functions and duties, the System Controller needs the cooperation and assistance of all the parties that are interested in the development, **commissioning**, operation, maintenance and marketing of **facilities** located within the Alberta Control Area. To that end, these parties should determine and designate a specific entity that will carry out on their behalf those functions identified in this Standard 003.1 as being required to be carried out by the **designated party**. Such designated party should communicate in writing to the System Controller its acceptance to fulfill the obligations of the designated party as specified in this Standard 003.1.
- During the time when the facility operates interconnected to the electrical network of the Alberta Control Area, the designated party must ensure that the **visibility points** of the facility provide, without unreasonable interruptions, all the **data** required by the System Controller, as specified in this Standard 003.1.
- During the time periods when there is a temporary loss of ability to transmit real time data, the designated party must take all reasonable steps to inform the System Controller, by other means of communication, of any change in data.

5.2 Power system model requirements

The model of the power system pertaining to the Alberta Control Area is developed taking into account the physical characteristics of the facilities included in the model. This model needs to be continuously updated. The updates require the latest information on:

- the characteristics of both existing and new facilities that are within two weeks from the start of commissioning. (see Table 1); and
- the real-time data (power flows, voltages, etc. - see Tables 2 through 5) that change continuously.

5.3 New facilities or modifications to existing facilities - project stage requirements

- During the initial design stage of a project for a new facility or for modifying an existing facility, the designated party must provide to the System Controller the corresponding preliminary single line diagram(s). These diagrams should include all pertinent high voltage equipment, show isolation points, breakers, current and voltage transformers, locations of metering points, as well as the connections of the proposed generators, transmission lines, substations and major load devices of the facility to the existing electrical installations.
- As the project evolves, the designated party must keep the System Controller informed of any changes that affect the visibility point requirements. The designated party has to provide to the System Controller, no later than 30 days prior to the start of commissioning of the new or modified facility, the following:
 - the updated single line diagram(s) - same specifications as per 5.3.a above,
 - the lists with the characteristics of the main equipment of the facility, in accordance with the requirements specified in Table 1 of this Standard 003.1.

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- c. The **designated party** must ensure the full **commissioning** of each **visibility point** and announce to the System Controller that the **facility** has all of its visibility points ready to commence operations. This announcement should be made at least one week prior to the start of commissioning of the main electric power equipment installed in the facility.

5.4 Real-time data requirements - visibility levels

Real-time data requirements for monitoring aspects of the security of the power systems in the Alberta Control Area are categorized into two visibility levels. The visibility level associated with each facility depends on the individual facility parameters (see Table 2).

5.5 Real-time data requirements - status information

Status information is to be reported by exception (see Table 4 - Note 2).

5.6 Real-time data requirements - scaling, accuracy, and resolution

Analog scaling will not exceed the greater of 200% of the rating of the device used for measuring the parameter or the largest expected range of values. Real-time **data** must reflect the actual status, conditions and flows or levels within $\pm 2\%$ of the rated maximum values (full scale) and resolution within $\pm 0.5\%$ (see Table 3 and Table 8).

5.7 Interconnections to other power systems

Interconnections to power systems located outside the Alberta Control Area require distinctive real-time data and telecommunication specifications that depend on the configuration of the interconnection. The System Controller will establish the data and visibility point specification requirements for these interconnections by on a case by case basis.

5.8 Data update rates and integrity scans

The data update rates and integrity scans must satisfy the requirements presented in Table 4 of this Standard 003.1.

5.9 Supplemental requirements for ancillary service providers

Ancillary service providers must meet all applicable requirements specified elsewhere in this Standard 003.1 as well as the supplementary requirements listed in Table 5.

5.10 Communication protocol and physical medium combinations for real time data communications

The designated party must provide all the necessary hardware and software and make all of the necessary arrangements so that the visibility points could collect and transmit to the System Coordination Center data and status information, as specified in this Standard 003.1. The transmission of this information should be done using one of the methods (i.e. combination of protocol and medium) specified in Table 6.

5.11 Telemetry data availability specification

The System Controller will track and collect statistics on telemetry data availability/unavailability. The acceptable limits are specified in Table 7.

5.12 Notification of outages for real time data communication equipment

When an outage must be scheduled for one or several of the visibility points of a facility, the designated party has to submit the schedule for this proposed outage to the System Controller at

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least 10 days before its proposed start. Forced outages should be immediately communicated by phone to the System Coordination Center.

6. Revisions and Approval

Issued	Description
2002-04-18	Supercedes 2001-07-06
2001-07-06	New issue

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Table 1

Information required by the System Controller to maintain the network model of the Alberta Control Area

<p>Facility Overall Configuration: Single line diagram showing all pertinent high voltage equipment, isolation points, breakers, current and voltage transformers, revenue metering points, and connections of proposed generators or loads</p>
<p>Bus Data: Typical operating voltage range (bus emergency and sustainable maximum / normal / minimum)</p>
<p>Bus Shunt Reactor or Capacitor: (where applicable) Nominal rating (MVAR @ nominal voltage) Bus used as voltage monitoring point</p>
<p>Transformer Data: (where applicable) Transformer name plate data including the following: Transformer nominal voltage, resistance and reactance values (for all windings) Transformer tap positions(voltage ratios and corresponding tap positions) Configuration of transformer windings (star, delta, etc.) Rated capabilities (for each set of transformer windings)</p>
<p>Transmission Line Data: (where applicable) Line resistance and reactance values (R, X, B) Rated voltage Line MVA capacity rating (summer / winter / emergency) Line length (km)</p>
<p>Load Point Information: Identification of breakers for loads providing under frequency load shedding, ancillary services or demand bids.</p>
<p>Remedial Action Schemes or Thermal Protection Schemes: (where applicable) Description, triggers, actions and (where appropriate) amount of load effected</p>
<p>Protection and Communication Configurations: High level description of equipment protection (primary and secondary telecommunication aided protection) Communication method and paths used for protection and SCADA (primary and backup, if applicable)</p>
<p>Generating Unit Information: (where applicable) Unit primary energy source (nuclear, bio-mass, coal, gas, oil, wind, solar, hydro) Unit capability: Maximum continuous ratings (MCR), minimum loading levels and curves (in MVA/MW/MVAR) for normal conditions Emergency capability rating (ECR)</p>
<p>Additional requirements for generators greater than 50 MW (gross): Normal unit ramp rates – up, down (MW/minute) Maximum unit ramp rates – up, down (MW/minute) Specify if the unit has any rough zones (upper and lower MW/MVAR limit of each)</p>

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Table 2

Required visibility levels corresponding to individual facility parameters

Facility Parameters (see Note 1)	Required Visibility Level		Visibility Not Required
	Standard	Basic	
Facility generation capability levels			
The facility contains generation totaling less than 5 MW (sum of MCRs)			✓
The facility contains generation totaling 5 MW or greater, but less than 50 MW (sum of MCRs)		✓	
The facility contains generation totaling 50 MW or greater (sum of MCRs)	✓		
Generator (capacity totaling 5 MW or more) that provides ancillary services	✓ (see Note 2)	✓	
Facility voltage controls or voltage levels			
Contains switchable VAR device (capacitor or reactor bank,)		✓	
On line tap changer (OLTC) mounted on transformer connected to busses operating above 30 kV		✓	
Facility contains buses which are operated at two or more nominal voltage classes (25 kV and higher)	✓		
Facility contains an SVC or synchronous condenser	✓		
Facility operates at, or contains a bus with nominal voltage greater than 200 kV	✓		
Facility capability/configuration			
Facility connects 3 or more transmission lines		✓	
Facility supplies local (site) loads, with simultaneous total peak values of 5 MW or greater, that are offered for ancillary service or are included in RAS schemes		✓	
Facility supplies local (site) loads with simultaneous total peak values of 50 MW or greater	✓		

Notes:

1. Facility parameters determine the Required Visibility Level. The Basic and Standard visibility levels have different requirements as presented in Table 3, Table 4, Table 6 and Table 7.
2. These generators shall satisfy the supplementary requirements as listed in Table 5, in addition to the standard visibility level real time data requirements in Table 3.

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Table 3

Real time data requirements based on the required visibility level

Data Requirements	Required Visibility Level	
	Basic	Standard
Bus		
Bus voltage	✓	✓
Breaker and isolation devices status	✓	✓
Status Visibility for all load-shed (RAS) breakers	✓	✓
Bus- or line-connected capacitors/reactors (where applicable)		
Control device (status point)	✓	✓
Capacitor/Reactor MVAR analog	✓	✓
Transformers (where applicable)		
Regulator auto/manual status (see note 1)		✓
Tap position (see note 1)	✓	✓
Line		
Power flows (MW/MVAR)	✓	✓
Generator (for each unit, where applicable – see Note 2)		
Unit gross generation (MW/MVAR) analogs - see Figure 1 and Note 2	✓	✓
Unit service load (MW/MVAR) analogs (optional) – see Figure 1 and Note 2 and 3	✓	✓
Unit net generation (MW/MVAR) analogs – see Figure 1 and Notes 2		✓
Unit transformer OLTC auto/manual status - see Note 1		✓
Generator breaker status - see Note 2	✓	✓
Generator power system stabilizer status - enabled or disabled (where equipped)	✓	✓
Generator excitation control / voltage regulation – automatic or manual - status	✓	✓
Power Station (generating plant) and Site Information		
Station (plant) service load (MW/MVAR) analogs – see Figure 1 and Notes 3 and 4	✓	✓
Total Site Load (MW/MVAR) analogs – plant and generator service not included – see Figure 1 and Note 3	✓	✓
Net to Grid (MW / MVAR) analogs – see Figure 1	✓	✓
Bus (plant) frequency		✓
Remedial action scheme (where applicable)		
Arming status and actual amount of load armed (MW)	✓	
Remedial action scheme-operated alarm		✓
Communications and RTU:		
Communication failure alarm	✓	✓
RTU failure alarm	✓	✓

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Notes:

1. OLTC tap position information and regulator control is required only for transformers which have two windings operating at a voltage higher than 60 kV, generating unit transformers larger than 5 MVA, and transformers that connect capacitor banks and reactors.
2. If the individual generator Maximum Continuous Rating (MCR) is less than 5 MW and the total plant generation capacity is equal to, or greater than 5 MW, the plant generation data can be telemetered instead of the unit generation data.
3. Unit generation should be provided in "gross" and "net" values. A net (MW/MVAR) value has to be metered at the high voltage side of the unit step-up transformer.

If net generation (measured at the generator terminals, or equivalent) metering is provided, telemetering of unit service (ancillary) loads is optional. Telemetering of net generation values is preferred instead of telemetering separately gross generation and unit service load values.

4. Station service should be telemetered separately, as well as the calculated net values for individual generators. Industrial sites and the City of Medicine Hat should also telemeter the total site load (excluding station and unit ancillary services).

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Table 4

Data update rates and integrity scans based on the required visibility level

Data Update Rates	Required Visibility Level	
	Basic	Standard
Analog		
2 second poll interval	✓ (see notes 1 and 2)	
10 second poll interval	✓	
60 second poll interval		✓ (see note 4)
10 second report by exception for ancillary services provision - see Note 3		✓
Status		
Report by exception – poll once every 2 seconds	✓ (see note 1)	
Report by exception – poll once every 10 seconds	✓	
Report by exception - poll once every 60 seconds		✓
Integrity Scan – initiated from master	✓ (once per hour)	✓ (once per day)

Notes:

1. For generators with a Maximum Continuous Rating (MCR) equal to or larger than 300 MW, the following data has to be reported at 2 sec intervals: MW, MVAR, frequency, and status of devices that disconnect the generator from the grid. Status is to be reported by exception – see Note 3.
2. For generators providing Regulating Reserve.
3. The term “report by exception” (also known as unsolicited report) is used for instances when data is sent only when its value changes. Data that is sent using reports by exception must be polled at time intervals defined in above Table 4.
4. Report by exception may be used instead of 60 second interval poll when appropriate analog dead band exists.

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Table 5

Supplementary requirements for facilities providing ancillary services

Ancillary Service Offered	Supplementary Requirements for Telemetered Information*
Spinning Reserve	No additional requirements
Supplemental Generation Reserves	No additional requirements
Supplemental Load Reserves	Site load (MW) contracted for ancillary service and totaling 5 MW or greater - analog
Regulating Reserves	High and low regulation limits - analogs Frequency source - analog Automatic generation control data - mode of automatic generation control for the unit (set point or pulse) Additional specific information may be required based on unit controller and unit tuning testing
Voltage Support	Telemetered MVAR data for facilities where dynamic voltage support is offered (i.e. SVC, synchronous condenser)
Power System Stabilizers	No additional requirements
Automatic Voltage Regulator	No additional requirements
Fast-acting Remedial Action Schemes (RAS) for loads	Total load available (MW) Total load contracted for RAS and armed (MW)
Black Start Service	Frequency at generation facility updated every 2 seconds
Transmission Must Run Service	No additional requirements
Remedial Action Schemes for Generators	Status of remedial action scheme (armed / disarmed) Status – trip-initiated alarm

* for update rates see Table 4.

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Table 6

Communication protocol and physical medium combinations based on the required visibility level

Required Visibility Level	ICCP	DNP 3.0	Medium
Standard	✓		ATM
	✓		ISDN
	✓		Frame relay
		✓	Dedicated copper
Basic		✓	Dedicated copper
		✓	Digital cellular packet data
		✓	Dedicated Internet Connection

Table 7

Availability requirements for the communication path based on the required visibility level

Required Visibility Level	Availability (%)	Upper Limit of Acceptable Values	
		Unavailability (hrs off/year)	Expected Mean Time to Repair
Standard	99.8	17.5	4 hours
Basic			
- without Ancillary Services	98.0	175.2	2 days
- with Ancillary Services	99.8	17.5	4 hours

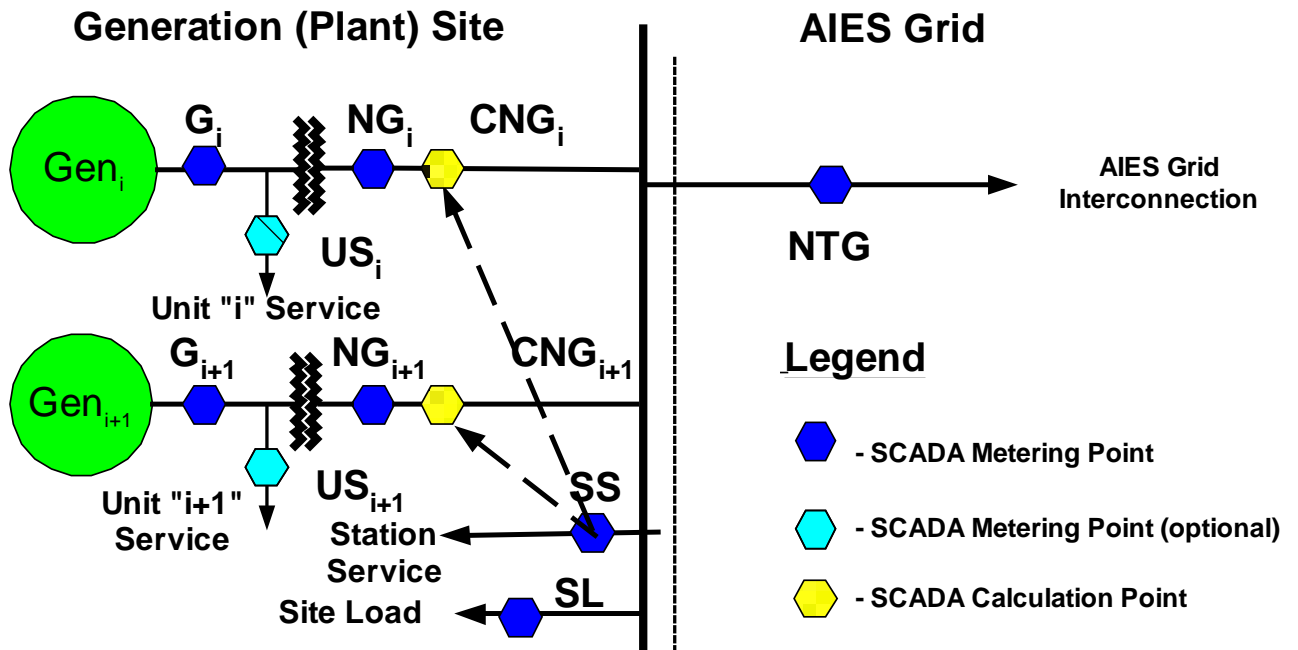
Table 8

Allowable dead-bands for analog report by exception using basic visibility

Value	Allowable Dead-band
MW: -without Ancillary Services - with Ancillary Services	±1 MW Deadband is no greater than the maximum allowable resolution of ±0.5%
MVAR	±1 MVAR
kV	±0.5% of nominal voltage
OLTC tap	0 (no deadband allowed)

Figure 1

Unit Net Generation



“i” Unit Gross Generation = G_i
 Site Load = SL

“i” Unit Service Load = US_i
 Station Service = SS

“i” Unit Net Generation “i” = $G_i - US_i - \text{Unit Transformer Losses}$

“i” Unit Calculated Net Generation = $CNG_i = NG_i - \frac{SS \times G_i}{\sum_{i=1}^n G_i}$

Plant Net to Grid = $NTG = \sum_{i=1}^n CNG_i - SL$