Information Document
SCADA
ID #2012-013R

Information documents are not authoritative. Information documents are for information purposes only and are intended to provide guidance. If there is a discrepancy between an information document and any authoritative document[1] in effect, the authoritative document governs.

1 Purpose

This information document relates to the following authoritative document:

- Section 503.16 of the ISO rules, *SCADA* ("Section 503.16").

The purpose of this information document is to provide the legal owner with the AESO information referenced in Section 503.16 and additional clarity related to the AESO's supervisory control and data acquisition ("SCADA") system and data requirements.

2 Generic Communication Block Diagrams and Data Latency

Subsection 8(10) of Section 503.16 sets out the requirements related to communication block diagrams. The AESO's generic communication block diagrams are set out below in Figures 1 and 2.

The tables in Section 503.16 set out the total allowable data latency for each type of facility. The legal owner may calculate its data latency by adding the data latency associated with each of the communication path segments shown in the AESO's communication block diagrams below to ensure it is meeting the data latency requirements. The AESO expects the legal owner to take into account the AESO's data polling frequency configuration when setting up its SCADA system. The AESO data polling frequencies are:

(a) 2 seconds when the legal owner's data latency requirement is 2 to 4 seconds;

(b) 7 seconds when the legal owner's data latency requirement is 10 to 15 seconds; and

(c) 15 seconds when the legal owner's data latency requirement is 30 seconds.

The AESO assumes that there are minimal processing delays associated with any communication device, such as a router, firewall, or switch. Please indicate in the communication block diagram if this is not the case.

2.1 Network Communication Involving a Third-Party

The legal owner may use the communication block diagram described in this section when its SCADA data system involves a third-party. In this communication configuration, the legal owner's SCADA data is sent through a third-party energy management or control system. This communication configuration is shown below in Figure 1.

(a) **legal owner segment**

This communication path segment connects the legal owner's intelligent electronic measuring device and the legal owner's remote terminal unit. As shown in Figure 1, the data latency variable given to this communication path segment is t1. The key parameters associated with this communication path segment may include the following:

- the protocol; and
- the intelligent electronic measuring device scan rate.

[1] "Authoritative document" is the general name given by the AESO to categories of documents made by the AESO under the authority of the *Electric Utilities Act* and associated regulations, and that contain binding legal requirements for either market participants or the AESO, or both. Authoritative documents include: the ISO rules, the reliability standards, and the ISO tariff.

(b) **adjacent legal owner or third-party segments**

This communication path segment connects the legal owner's remote terminal unit and the adjacent legal owner or third-party's Inter-Control Center Communication Protocol server. Figure 1 illustrates a generic communication path that includes all intermediate data collection or processing devices that may be associated with this part of the communication path segment. As shown in Figure 1, the data latency variables given to the communication path segments are t2, t3, and t4 and represent the SCADA data transfer rates associated with this communication path segment.

The AESO expects the adjacent legal owner or third-party to provide the actual data flow and the adjacent legal owner or third-party and to update the information when a material change occurs to the legal owner's supervisory control and data control systems.

The key parameters associated with this communication path segment may include the following:

- the protocol;
- the scan rate from the legal owner's remote terminal unit to the adjacent legal owner or third-party's SCADA master or front-end-processor (t2);
- the data transfer rate from the adjacent legal owner or third-party's SCADA master to its primary Energy Management System server (t3); and
- the data transfer rate from the adjacent legal owner or third-party's SCADA primary Energy Management System server to its Inter-Control Center Communication Protocol server (t4).

(c) **AESO segment**

This communication path segment connects the adjacent legal owner's or third-party's Inter-Control Center Communication Protocol server and the AESO's Energy Management System. As shown in Figure 1, the data latency variables given to this segment are t5 and t6 and represent the SCADA data transfer and processing rates associated with this communication path segment.

The key parameters associated with this communication path segment, may include the following:

- the protocol;
- the data transfer rate from the adjacent legal owner or third-party's Inter-Control Center Communication Protocol server to an AESO Inter-Control Center Communication Protocol server (t5, 2 seconds, 7 seconds, or 15 seconds, depending on the AESO's data polling frequency); and
- the data transfer rate between an AESO Inter-Control Center Communication Protocol server and the AESO's Energy Management System (t6).

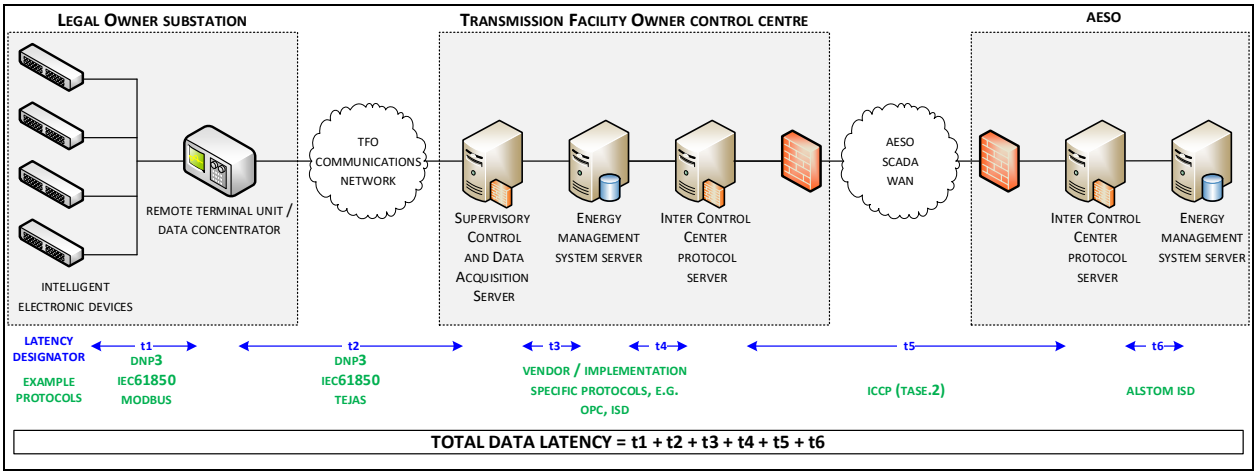

Figure 1 – Network Communication Involving a Third-Party

2.2 Network Communication Involving a Independant Network

The legal owner may use the communication block diagram described in this section when its SCADA system involves an independent network. In this communication configuration, the legal owner uses either an independent network provider or an adjacent legal owner of a transmission facility's multi-protocol label switching network to transmit SCADA data between its facility and the AESO control centre.

(a) **legal owner segment**

This communication path segment connects the intelligent electronic measuring device and the remote terminal unit. As shown in Figure 2, the data latency variable given to this communication path segment is t1. The key parameters associated with this communication path segment, may include the following:

- the protocol; and
- the intelligent electronic measuring device scan rate.

(b) **communication network provider segment**

This communication path segment connects the legal owner's remote terminal unit and the AESO's SCADA front-end processor. Figure 2 illustrates a generic communication path when the legal owner uses a communication provider network, such as a commercial telecommunication provider or an adjacent legal owner's communications network.

The key parameter associated with this communication path segment may include the following:

- the scan rate from the AESO's SCADA front-end processor to remote terminal unit using the Distributed Network Protocol 3 protocol (t2, 2 seconds, 7 seconds, or 15 seconds, depending on the AESO's data polling frequency configuration).

(c) **AESO segment**

This communication path segment connects the the AESO's SCADA front-end processor and the AESO's Energy Management System. As shown in Figure 2, the data latency variable given to this segment is t3 and represents the SCADA data transfer rate associated with this communication path segment.

The key parameter associated with this communication path segment, may include the following:

- the data transfer rate between the AESO's front-end processor server and the AESO's Energy Management System (t3).

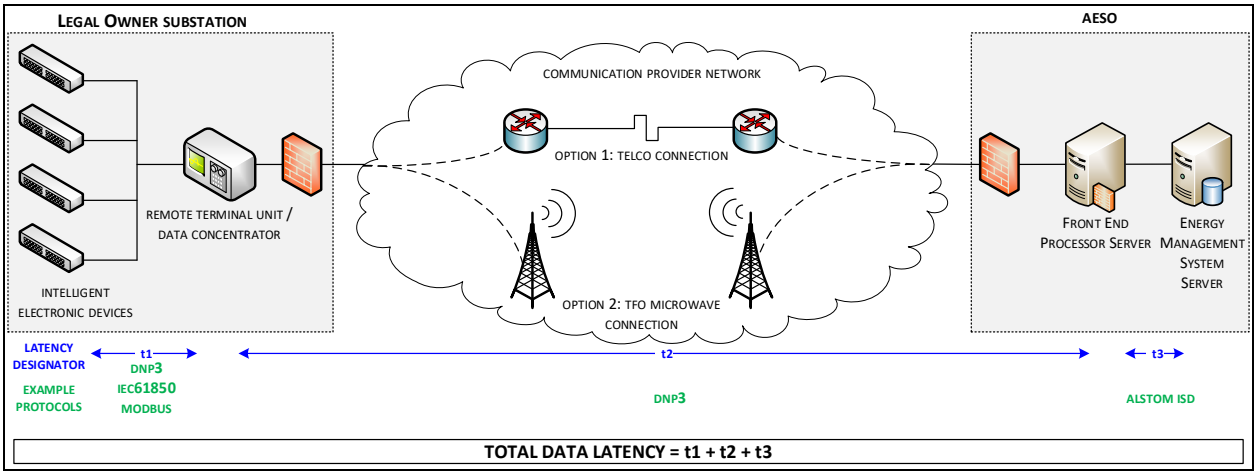

Figure 2 – Network Commuication Path Involving a Independent Network

3 AESO Contact for SCADA System Requirements

The legal owner may email the AESO at EMS_SCADA@aeso.ca when communicating information in writing to the AESO about its SCADA system in accordance with the requirements set out in subsections 2, 5, 6, and 7 of Section 503.16.

When notifying the AESO pursuant to subsection 6(1) of Section 503.16, the legal owner is expected to contact the AESO's System Operations team using the phone number the AESO provides.

The legal owner is also encouraged to provide the AESO with contact information using the email address provided above. The AESO monitors the SCADA application communication status alarms between the AESO's Energy Management System and a legal owner's SCADA system and uses the provided contact information to notify the legal owner when it identifies a communication connection issue.

4 AESO's Energy Management System Overview

This section provides a description of the AESO's Energy Management System to provide additional clarity to the legal owner with respect to how the AESO uses its SCADA data. The AESO collects the legal owner's SCADA data through its Energy Management System for use by the various AESO operational applications and systems that depend on this data. The AESO's Energy Management System consists of several components as illustrated and described in Figure 3.

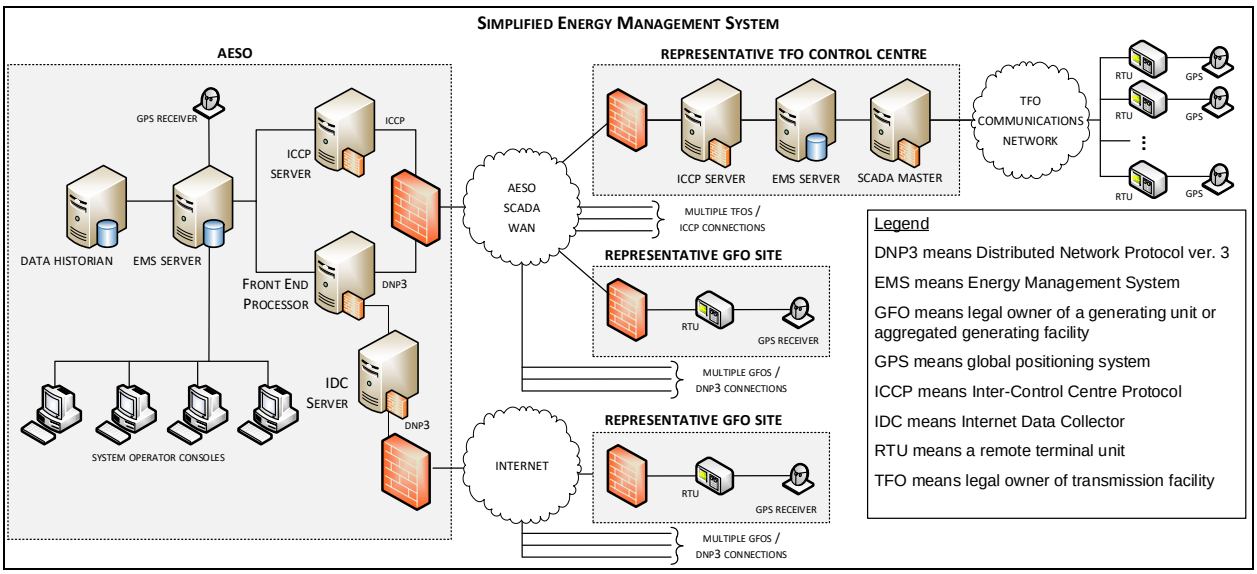

Figure 3 – Simplified Energy Management System

4.1 AESO Energy Management System

Operational applications within the AESO's Energy Management System include the following:

(a) **State Estimator**

The state estimator calculates and evaluates power flows on the transmission system based on SCADA data and the AESO's transmission system model. The results of the state estimator are used by the AESO's Energy Management System security applications, which provide real-time contingency analysis and load flows.

(b) **Automatic Generation Control**

The automatic generation control regulates generation on the transmission system to balance load, imports, exports, and generation. The automatic generation control also calculates the area control error and adjusts generation output to maintain the desired import or export levels.

4.2 Inter-Control Center Protocol Server

The AESO's third-party Inter-Control Center Protocol servers acts as one of the AESO's Energy Management System's data concentrators for SCADA data through wide-area network connections. These connections are depicted as the representative legal owner of a transmission facility control centre in Figure 3.

4.3 Front End Processor Server

The AESO's front-end processor serves as a data concentrator for the SCADA data the AESO collects from each legal owner's remote terminal units and other intelligent electronic measuring devices. A dedicated internet data collector obtains data for internet-based connections. Direct communications using dedicated wide-area network connectivity occur directly with the front-end processor. These connections are depicted as the representative legal owner of a generating unit site in Figure 3.

4.4 AESO's Virtual Private Network

The AESO has a virtual private network ("VPN") encryption capable connection option available to the legal owner that can host the legal owner's SCADA data.

4.5 Typical Generating Unit and Aggregated Facility Point Naming Convention

To assist the legal owner in understanding the AESO's supervisory point naming convention, typical generating unit and aggregated facility configurations have been provided in Figure 4, Figure 5, and Figure 6 as examples.

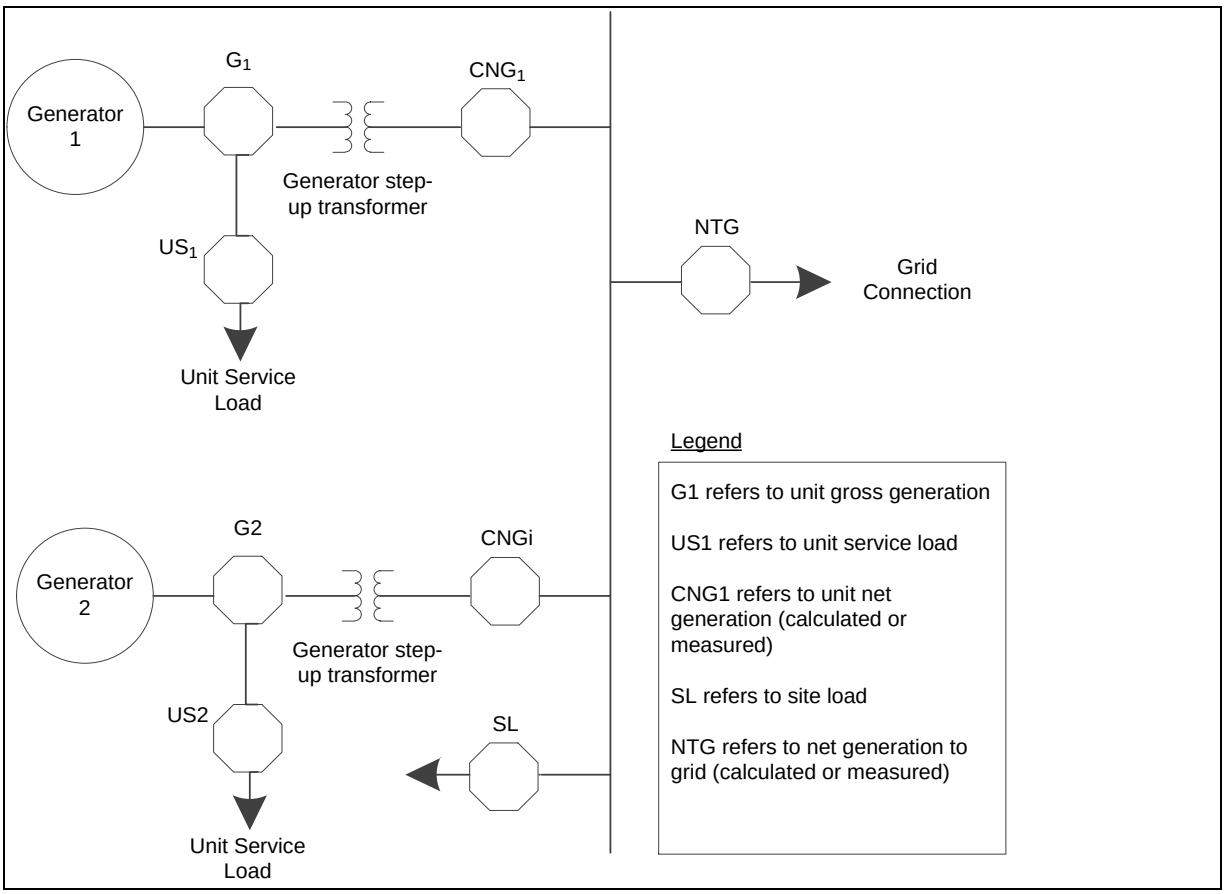

Figure 4 – Power Plant with Separate Station Service for Each Generating Unit

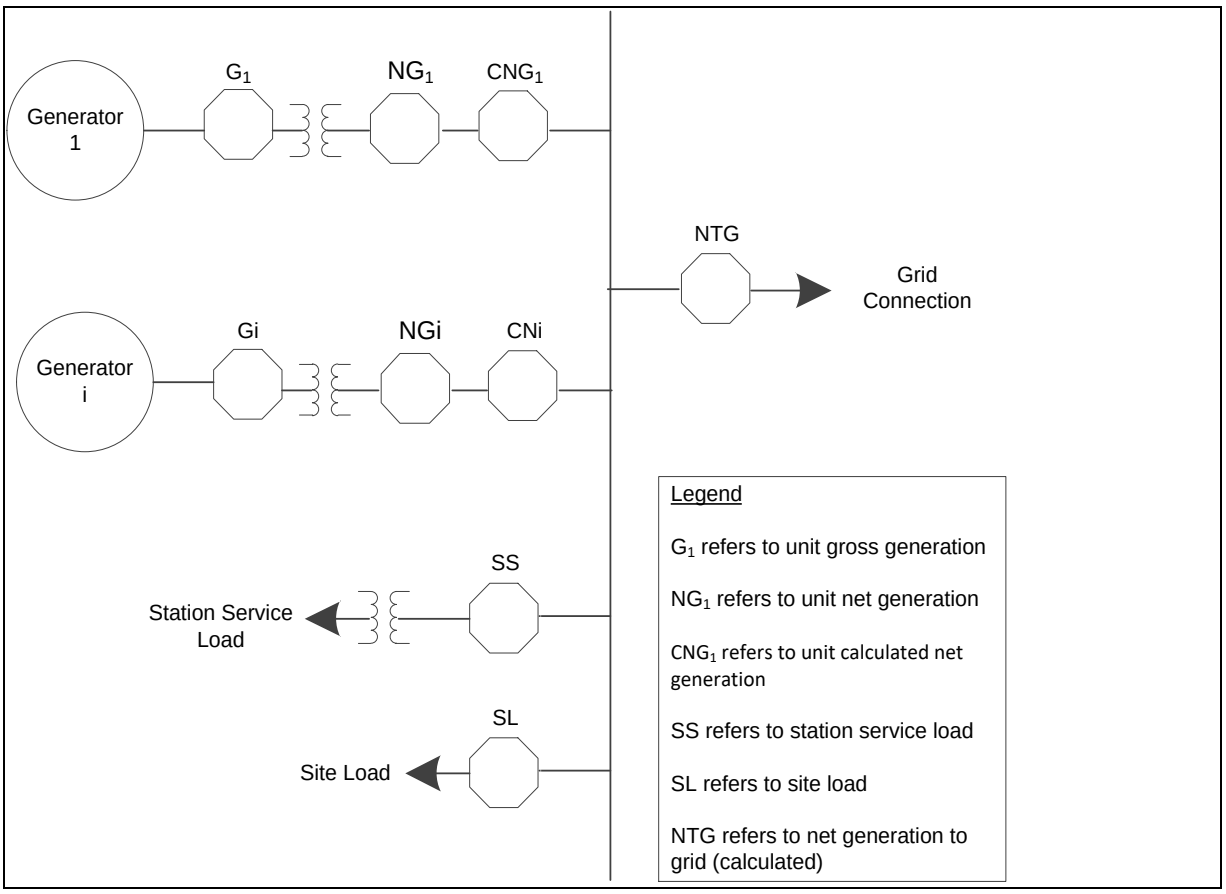

Figure 5 – Power Plant with a Single Station Service for All Generating Units

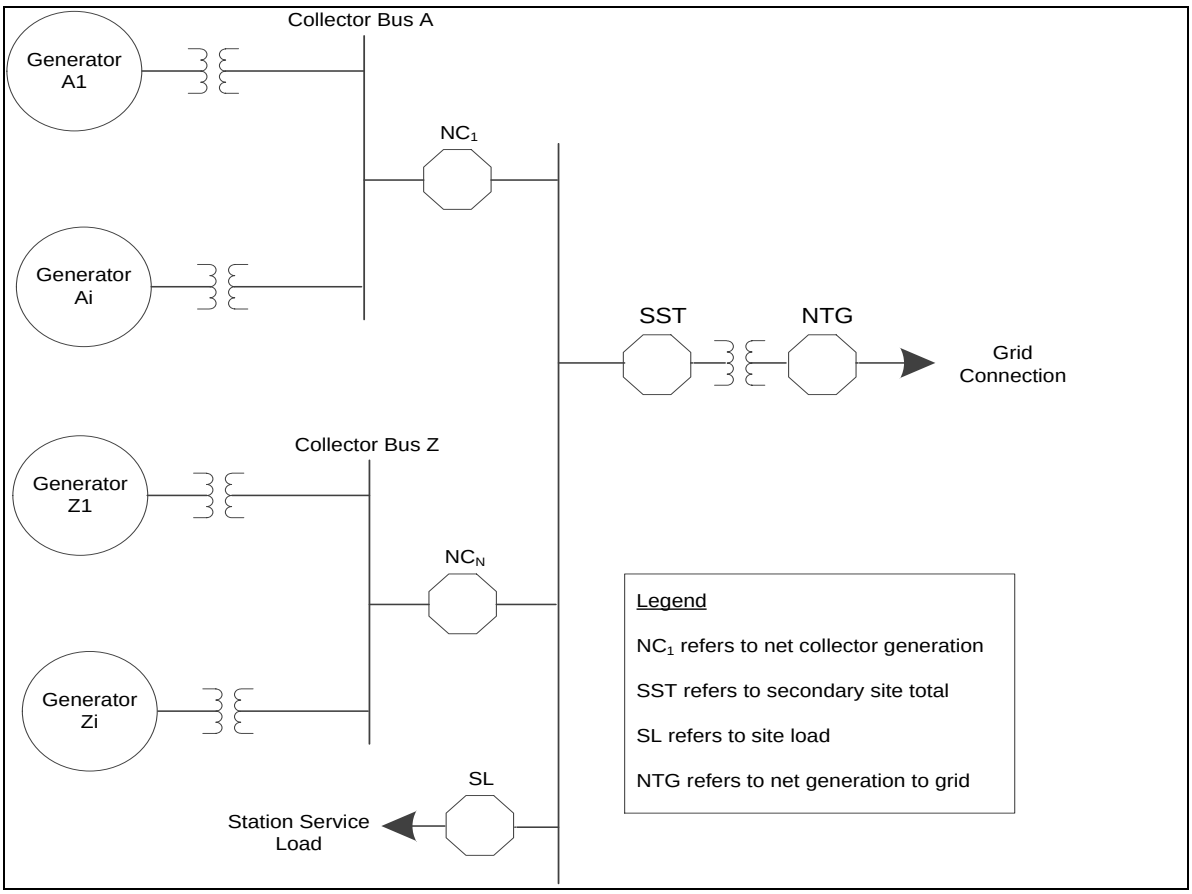

Figure 6 – Aggregated Facilitywith Multiple Generating Units

5 Polarity Convention

Subsections 4(8) and 4(9) of Section 503.16 set out legal owner requirements regarding the polarity convention that must be observed when reporting power flows. Figure 7 has been provided below as an example to assist the legal owner interpret these requirements.

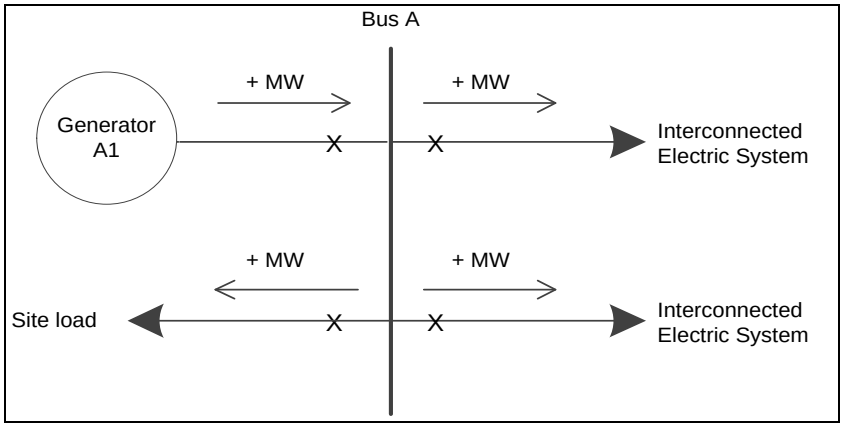

Figure 7 – Example of Analog Values

6 Analog Full-Scale and Accuracy Examples

Table 2 – Accuracy and Resolution Requirements by Measurement Type in subsection 4(5) of Section 503.16, sets out the accuracy ranges for analog measurements that the legal owner is required to provide.

Pursuant to subsections 4(6) and 4(7) of Section 503.16, the AESO expects that the legal owner considers the maximum, full-scale value of the system element being monitored when setting up the applicable SCADA data field device.

6.1 Line Voltage Example

(a) **Full-scale value**

The legal owner is expected to first calculate the maximum system element value. For example, if a transmission line has a nominal rating of 138 kV and a maximum, full-scale line voltage that is 120% of the nominal line voltage rating. Then the maximum, full-scale transmission line voltage may be calculated by using the following formula:

Maximum line voltage (kV) = 138 kV * 120% = 165.6 kV

(b) **Accuracy**

If a 138-kV measurement has a full-scale value of 165.6 kV, then a measurement value that is within +/- 2% of this value may be calculated as follows:

Measurement accuracy value (+/- kV) = 165.5 kV * +/- 2% = +/- 3.3 kV.

(c) **Transducer setting**

The legal owner is expected to use the full-scale data value when setting up a field device transducer. For this example, if a field device transducer has an input signal range of 4 mA to 20 mA, then the field device transducer input signal should be calibrated so that a full-scale transmission line voltage of 165.6 kV corresponds to the transducer maximum input signal of 20 mA.

6.2 Real Power Example

(a) **Full-scale value**

In this example, a generating unit has a nominal real power output rating of 50 MW and the generating unit has a full-scale generating unit rating that is 200% the nominal rating. The full-scale real power value can be calculated as follows:

Full-scale, maximum value (MW) = 50 MW * 200% = 100 MW

(b) **Accuracy**

If the 50 MW has a full-scale value of 100 MW, then a measurement value that is within +/-2% of this value may be calculated as follows:

Accuracy (+/- MW) = 100 MW * +/- 2% = +/-2 MW

7 Time Stamped Data

The AESO expects the legal owner to interpret the time stamp requirement set out in subsection 4(11) of Section 503.16 as being applicable to all SCADA data it provides to the AESO, pursuant to subsections 2 and 4 of Section 503.16.

8 Notification of Actual or Suspected Data Unavailability or Data Error

Pursuant to subsection 5 of Section 503.16, the legal owner's SCADA data availability is assumed to be calculated on an annual basis as follows:

Data availability Required (days available/year) = 98% availability * 365 days = 357.7 days available/year.

The legal owner is not expected to include the time its SCADA data is unavailable during data repair or restoration in its data availability calculation above if: the legal owner provides notification to the AESO, pursuant to subsection 5 of Section 503.16; and the AESO has accepted the legal owner's plan and expected date when the SCADA data are anticipated to be restored or repaired, in accordance with subsection 7 of Section 503.16.

Pursuant to subsections 5, 6(1), and 6(3) of Section 503.16, the AESO expects the legal owner to use best efforts to identify, diagnose, and resolve issues with data unavailability or error. Practicable considerations may include service territory, resource availability, and work priority.

9 Wind and Solar Power Ramp Up Management SCADA Clarifications

Appendix 2 of Section 503.16 lists SCADA signals exchanged with legal owners of applicable wind or solar aggregated generating facilities. The AESO sends analog values for the Facility Limit and Reason for the Facility Limit.

Reason for Facility Limit and Identifier	Facility Limit Description	Comment
1 – Transmission	The Facility Limit manually entered into the EMS PRM application by the AESO System Controller (SC).	This is a true curtailment. An AESO SC may set the Facility Limit below the current asset generation level.
2 – Ramp	The Facility Limit calculated based on system conditions, specifically the AIES's capability to absorb wind and solar ramp up events. These formulae are documented in ID 2018-013, Wind and Solar Power Ramp Up Management.	Limits will always be greater than or equal to the current asset generation level.
3 – No Limit	The Facility Limit is the asset energy market dispatch sent from the AESO.	The asset energy dispatch is sent to the market participant from the AESO through the Automated Dispatch and Messaging Service (ADaMS) interface, and then represented in the Facility Limit. This Facility Limit can be a true curtailment under specific conditions (e.g., Supply Surplus or Transmission Constraint Management / Constrained Down Generation)

Regardless of the reason for facility limit code, the market participant is expected to utilize the real power limit sent by the AESO to limit the facility output as required through subsection 3 of Section 304.3, Wind and Solar *Power Ramp Up Management.* The reason for facility limit is simply a reference code indicating why the Facility Limit is in place.In Appendix 2 of Section 503.16, the analog signal representing the real power limit used by the power limiting control system at the aggregated generating facilities. This is a

feedback signal of the Facility Limit value received by the remote terminal unit (RTU) and indicates to the AESO that the market participant has received the value and is operating based on it.

10 Potential Real Power Capability SCADA Clarification

Pursuant to Appendix 2 of Section 503.16, wind and solar generating facilities are required to provide the potential real power capability to the AESO where potential real power capability is the real power that would have been produced at the point of connection without aggregated generating facilities curtailment and based on real time meteorological conditions.

For further clarity, the potential real power capability calculation should contemplate additional relevant limits and operating conditions, such as the following:

a) Limitations of real power output at the point of connection, such that the potential real power doesn't exceed the wind or solar facility's Maximum Authorized Real Power or the Maximum Capability;, as applicable;

b) Limitations of real power output based on any outages or derates impacting the facility; and

c) Temporary physical or operational limitations of real power output including those based on manual or automatic actions, in response to adverse weather conditions.

Revision History

Posting Date	Description of Changes
2024-04-25	Administrative amendment to section 8.
2024-04-12	Administrative amendments to align with Energy Storage ISO Rule amendments and new definitions.
2023-12-19	Revisions to Section 8 to include reference to subsections 8, 9(1), and 9(3) of Section 502.8. Addition of Section 9 by including SCADA clarifications on wind and solar power ramp up management. Addition of Section 10 to include SCADA clariifcations on potential real power capability. Updated to define SCADA, remove redundant content, fix typographical errors, and to align with current AESO drafting principles.
2021-03-08	Updated to align with amended Section 502.8, remove redundant Section 502.8 content, fix typographical errors, and align with current AESO drafting principles.
2019-06-27	Addition of sections 11 and 12
2017-04-06	Addition to section 6 Amendment to section 9, section reference changed
2017-02-09	Addition of Section 10 - Time Stamped Data. Administrative Amendments
2013-02-28	Initial release