

OCTOBER 2024

Updates to IESO Monitoring Requirements: Synchrophasor Data

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Purpose

- Introduction and Background
- Updates to Market Manual
- PMU Registration Process
- Naming Convention
- Implementation Plan

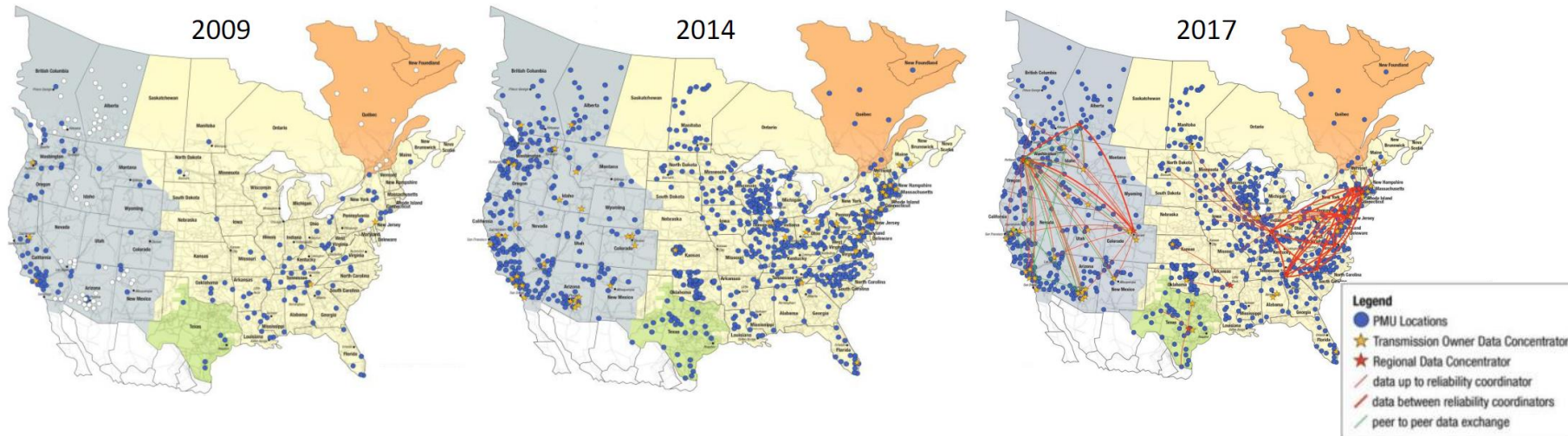
Introduction and Background

PMUs in the Broader Context

- Enhances the IESO's situational awareness – critical to maintaining reliability and resiliency with an increasingly dynamic power system
 - Increasing applications of phasor measurement unit (PMU) data in off-line, near-term and real-time systems
- Facilitates sharing and viewing wider portion of the interconnected grid for both Ontario & neighbouring jurisdictions - more accurately and consistently
- Improves IESO's ability to demonstrate reliability standards compliance
 - NERC reliability guideline for PMU placement published, future PMU related reliability standard anticipated

Introduction and Background

Growth of PMU Deployments in North America



Source: [North American Synchrophasor Initiative \(NASPI\)](#)

Introduction and Background

Market Rules Amendment and Requirements

- Market Rule amendment [MR-00471-R00](#) (effective December 31, 2024)
 - Appendix 4.15 – IESO Monitoring Requirements: Generators
 - Appendix 4.16 – IESO Monitoring Requirements: Transmitters
- Will require Transmitters and Generators provide synchrophasor data to the IESO for operational and planning purposes

Market Manual Changes

Summary

Previous Section	New Section	Changes
1.1 Purpose		Expended section to clarify the primary and secondary objectives of the manual
1.2 Scope		Minor changes
1.3 Real-Time Monitoring Devices	5.1 Real-Time Monitoring Devices	Relocated section within document
1.4 Overview of Synchrophasor Data Requirements		Moved requirements for GOs to Section 2 and requirements for TOs to Section 3
1.5 Typical Infrastructure Required for Providing Synchrophasor Data	5.2 Typical Infrastructure for Providing Synchrophasor Data	Some modifications to the figures and wording to illustrate a typical infrastructure. Also, the content on PDC was added in this section.

Market Manual Changes

Summary

Previous Section	New Section	Changes
1.6 Phasor Data Concentrator (PDC)		Content got incorporated in Section 5.2
1.7 Phasor Estimator	5.3 Phasor Estimator	
2. Monitoring Requirements: Generators	2. Requirements: Generators	Organized the content into sections: 2.1 Infrastructure Requirements for Generators, 2. Phasor Data Requirements for Generators, 2.3 Applicable Generator Connection Configurations, 2.4 Reliability, Maintenance and Repair, 2.5 Exemptions
3. Monitoring Requirements: Transmitters	3. Requirements: Transmitters	Organized the content into sections: 3.1 Infrastructure Requirements for Transmitters, 3.2 Phasor Data Requirements for Generators, 3.3 Reliability, Maintenance and Repair

Market Manual Changes

Summary

Previous Section	New Section	Changes
	4. PMU Registration Process	Describes the process of how PMU devices can be registered with the IESO
	5. Background Information for Synchrophasors and Associated Infrastructure	This new section is devoted for providing background information on synchrophasors and its infrastructure

Market Manual Changes

Section 2 – Requirements: Generators

Attribute	Status	Requirement
Coordinates	Required	Provide phasor data in polar coordinates where angles must be in degrees in the range of 0 to 360 radians in the range of $-\pi$ to $+\pi$ and magnitudes must be in SI units.
Network Protocol	Required	Provide phasor data via a network that comply with TCP/IP or UDP/IP protocol site-to-site VPN with the IESO. A public static IP address is required.
Latency	Required	Provide total latency for phasor data low enough to be appropriately utilized in IESO real time applications from PMU to the IESO control center or IESO owned PDC no more than 500 ms.

Market Manual Changes

Section 2 – Requirements: Generators

Attribute	Status	Requirement
Bandwidth	Required	<p>Provide communication channels with bandwidth adequate to reliably transmit the volume of PMU data at selected reporting rate.</p> <p>Note: The required bandwidth varies with the number of phasor data and reporting rate. Thus, the size of bandwidth required depends on the reporting rate, the facility MVA size and configuration and the communication segment for which bandwidth is applicable (i.e. from PMU to local PDC, local PDC to mid-level, mid-level to high level).</p> <p>For most generation facilities a bandwidth of 1 Mbps per transmitting PMU device will be sufficient. This could be lower for configurations wherein multiple PMU devices are aggregated at a local PDC before being transmitted to the IESO.</p>

Market Manual Changes

Section 2 – Requirements: Generators

Attribute	Status	Requirement
Bandwidth	Preferred	<p>Provide dedicated communication channels.</p> <p>Note: Provide Dedicated communication channels to avoid potential data transmission interruption and fluctuations in excessive latency.</p>
CIP	Preferred	<p>Applicable market participants are expected to include synchrophasor data under their North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) program.</p>

Market Manual Changes

Section 2 – Requirements: Generators

Attribute	Status	Requirement
Redundancy	Required	Provide primary communication path for synchrophasor data to the IESO.
Redundancy	Preferred	Provide primary and secondary communication paths for synchrophasor data to the IESO, if that data is to be used in a Linear State Estimator whose output is to be used in on-line Transient Stability program.
CVT/PT Selection	Preferred	Provide Metering Class Bus CVT or PT measurements where possible or Metering Class Transmission line or feeder CVT/PT measurements for better accuracy.
CT Selection	Preferred	Provide Protection Class CTs measurements where possible to capture the dynamic and fault conditions.

Market Manual Changes

Section 3 – Requirements: Transmitters

Attribute	Status	Requirement
Coordinates	Required	Provide phasor data in polar coordinates where angles must be in degrees in the range of 0 to 360 radians in the range of $-\pi$ to $+\pi$ and magnitudes must be in SI units.
Network Protocol	Required	Provide phasor data via a network that comply with TCP/IP or UDP/IP protocol site-to-site VPN with the IESO. A public static IP address is required.
Latency	Required	Provide total latency for phasor data low enough to be appropriately utilized in IESO real time applications from PMU to the IESO control center or IESO owned PDC no more than 500 ms.

Market Manual Changes

Section 3 – Requirements: Transmitters

Attribute	Status	Requirement
Bandwidth	Required	<p>Provide communication channels with bandwidth adequate to reliably transmit the volume of PMU data at selected reporting rate.</p> <p>The IESO recommends bandwidth of 1 MB per transmitting PMU device.</p> <p>Note: The required bandwidth varies with the number of phasor data and reporting rate. Thus, the size of bandwidth required depends on the reporting rate, the facility MVA size and configuration and the communication segment for which bandwidth is applicable (i.e. from PMU to local PDC, local PDC to mid-level, mid-level to high level).</p>

Market Manual Changes

Section 3 – Requirements: Transmitters

Attribute	Status	Requirement
Circuit Breaker Status	Preferred	<p>Provide Circuit Breaker Status (Digital Channels) of all transmission lines or feeders for Linear State Estimator Estimation, and for Single Line Diagram topological display purposes</p> <p>This may become a requirement in the future as the IESO deploys PMUs into real-time operations.</p> <p>Note that this data supports industry best practice to collect this data directly from PMUs in order to reduce dependencies and provide a solution for state estimation when SCADA is not available.</p>

Market Manual Changes

Section 3 – Requirements: Transmitters

Attribute	Status	Requirement
Isolator Status	Preferred	<p>Provide Isolator Status (Digital Channels) of all transmission lines or feeders for Linear State Estimator Estimation, and for Single Line Diagram topological display purposes.</p> <p>This may become required in the future as the IESO deploys PMUs into real-time operations.</p> <p>Note that this data supports industry best practice to collect this data directly from PMUs in order to reduce dependencies and provide a solution for state estimation when SCADA is not available.</p>

Market Manual Changes

Section 3 – Requirements: Transmitters

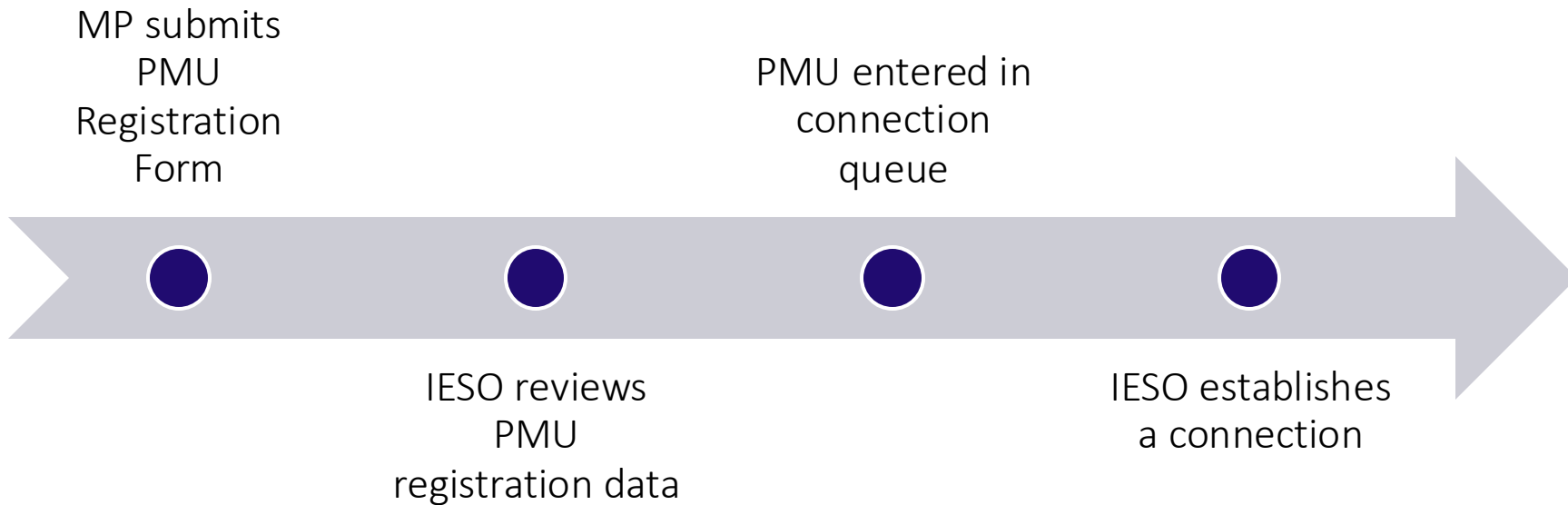
Attribute	Status	Requirement
CVT/PT Selection	Preferred	Provide Metering Class Bus CVT/PT measurements where possible or Metering Class Transmission line or feeder CVT/PT measurements for better accuracy.
CT Selection	Preferred	Provide Protection Class CTs measurements where possible to capture the dynamic and fault conditions.

Market Manual Changes

Reliability, Maintenance and Repair

- Synchrophasor equipment must be maintained as per MR Ch.4 s.7.7: Reliability, Maintenance and Repair of Monitoring and Control Equipment

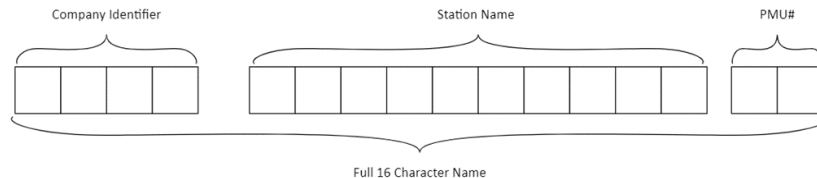
PMU Registration



Naming Convention

Station Name

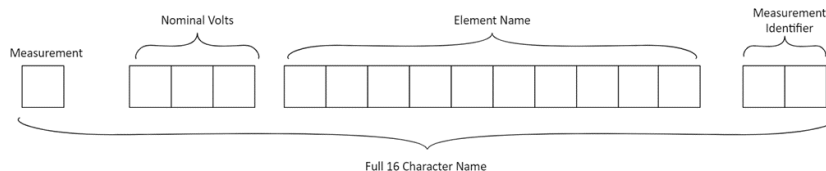
- Company Identifier – IESO assigns the identifier
- Station Name – up to 10 characters for the name of station where PMU is installed
- PMU# - number of PMU in the station (e.g., 01 to 99)



Naming Convention

Channel Name

- Measurement – 1 character identify the type of measurement
- Nominal Volts – 3 characters to identify the nominal voltage of the measurement location
- Element Name – 10 characters to identify the equipment where measurement is taken
- Measurement Identifier – 2 characters that signifies the type of measurement



Implementation Plan

- Facilities connected to the IESO-controlled grid prior to December 31, 2024
 - Market Participants having one facility, provide data on or before **Dec 31, 2024**
 - PMU registration data to be received by December 1, 2024
 - Market Participants having multiple facilities, provide data via mutually agreed staged implementation plan
 - High-level implementation plan that includes milestones for PMU device commissioning at each owned facility by December 31, 2024
- Facilities connecting to the IESO-controlled grid after December 31, 2024⁽¹⁾:
 - Provide data on latter of the time of connection or **Dec 31, 2024**

⁽¹⁾ Any exceptions will be managed on a case-by-case basis

Additional Support

- Market Participants are encouraged to reach out to the IESO if they require support.



Thank You