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Revision History

Version	Date	Revisions
1.0	09/24/1999	Initial Release ➢ Information on the following topics was added to the Control Center Requirements Manual (Section 2.4, Number 6) Specifics on scheduled and unscheduled testing to verify continuity of communications in the event of NYISO Control Center evacuation.
2.0	06/15/2006	Global Changes ➢ Various grammar and syntax edits. ➢ Deleted "Information System Staff" and replaced with "Data Coordinator" ➢ Deleted "Centralized Dispatch" and replaced with "NYISO Directed" Section 2.2 ➢ Removed references to Bisync, IDEC, and IEC protocols. ➢ Information on TO communications can be found in Appendix B, which can be accessed by contacting your Customer Relations Rep. Section 2.3 ➢ Removed reference to PBX Tie Lines (item #3). ➢ Removed reference to weekly testing (item #7). Section 2.4.2 ➢ Renamed from "Generation Control" to "Interim Control Operation" ➢ Removed references to "Backup Dispatch" and renamed to "Backup Operations" Section 2.6 ➢ Added second paragraph – "Gen providers that want to receive their control base points directly…" Section 3 ➢ Removed third bullet "New York State Electric Meter Engineer Committee Guide for Uniform Practice in Inter Utility" Section 3.1.1 ➢ Removed from first paragraph "others can be found in the NYISO Filing Definitions Document and the NYISO Manual for Definitions." ➢ First bullet – Added "Meter or". Removed "and the cause of such poor quality has been traced to computer programming, communications limitations, computer equipment configuration or field metering equipment."

		➢ Removed bullet #6 – Metering Problem and bullet #7- Revenue Quality Real Time Metering. Section 3.1.2 ➢ Removed reference to implementation of the NYISO and the reference to NYPP. ➢ Removed second paragraph "For any existing customer who is obtaining…" ➢ Removed paragraphs #9 "Any Load which is not metered on an hourly…" and #10 "Ancillary Service suppliers shall provide…" ➢ Removed paragraph #12 "Metering for use in revenue…" Section 3.1.3 ➢ Section 3.1.3 Revenue Metering Data removed completely. ➢ Removing this section caused the numbering in the subsequent sections to change. Section 3.1.4 (old 3.1.5) ➢ Removed last paragraph "The metering and data accuracy analysis administrative process can be found in Section 3.5." Sections 3.1.6, 3.1.7, 3.1.8 (old) ➢ Removed these three sections – 3.1.6-Audits; 3.1.7- Scan Data List; 3.1.8-Loss of Metering or Telecommunications. ➢ Removing these sections caused the numbering in the subsequent sections to change. Section 3.1.5 (current) ➢ Removed from first paragraph "If after proper audit, an entity (TO, Generator, Load, etc.) is suspected of manipulating metering or metering data, all details will be turned over to the NYISO Board of Directors." Added, "Beyond any NYS PSC rules, each metering system may be…" Section 3.1.6 (current) ➢ Added paragraph "If data is lost due to a meter or telecommunications failure…" Section 3.2.2 (current) ➢ Removed third paragraph "Digital Data is used as the primary information…" Section 3.2.3 (old) ➢ Removed entire section "Calibration and Maintenance" Section 3.2.4 (current) ➢ Added "Phase 1" to Analog Telemetering ➢ Removed item (d) "For TO total area net…" from List item 1. ➢ Added "Phase 2" to Digital Telemetering ➢ Added last sentence to List item 4 "Generators treated as Load…" ➢ Removed list item 14 "Data Quality status is an indication of the currency…" ➢ Under "Data Quality Indication"

		• First sentence – replaced "currency" with "validity"; "MWh, Mvar" with "MVAR" • Second sentence – replaced "flag" with "code" • Third sentence – replaced "flag" with "code"; "set to true" with "abnormal". • Fourth sentence – removed "When set false (the expected" and added "is marked invalid within the system. When set to". Removed "state)," • Fifth sentence – replaced "indication" with "code" ➢ Removed "Revenue Metering Data" section ➢ Under "Metering Specifications" • Line item 1 – removed "The transducers" and added "All metering". Removed "The VT shall be a wound or…" • Line item 2 – removed "transmission"; "or as state of the art permits" and "both Analog and Digital" from first sentence. Removed "or state of the art accuracies" from second sentence. • Item b from List item 3 – Removed last sentence "Analog metering shall have the…" • Removed Item c completely from List item 3 "Metering connection drawings, schematics…" Section 3.3 (old) ➢ Removed Section 3.3 "New York State Electric Meter Engineer Committee Guide for Uniform Practices in Inter Utility Metering" entirely. Section 3.3.2 (current) ➢ Line item 2 – Removed "NYISO successor group to the" from first sentence. Removed "successor group" from last sentence. Section 3.4.1 (current) (old 3.5.1) ➢ Added to Line item 1 "The Transmission Owner"; "affected Transmission Owners", and "to 69kV and above equipment". ➢ Removed "NYISO Data Coordinator" and added "appropriate Data Coordinators". ➢ Removed "Modeling" and added "Electric System" ➢ Line item 1 – item c – Added "showing the location of all metering points." ➢ Line item 1 – new item d – Added "Any additional EMS parameter …" ➢ Line item 1 – removed old item e – "The notification shall be signed…" ➢ Line item 4 – Reworded "Transmission Owners requiring the data…" ➢ Line item 7 – Reworded "The NYISO Data Coordinator…" ➢ Line item 8 – Deleted "the DCTF and, if agreement cannot be reached again, to the" ➢ Line item 9 – Deleted line item 9 "The Chairman of the DCTF…" Section 3.5 (current) ➢ Removed second paragraph "Scan Data Lists are generated…" and list items a-f

		Section 3.5.1 (current) ➢ Deleted line items 1 – 4 and replaced with new line items. Section 3.6 (current) ➢ Removed last sentence from paragraph 4 "Each Transmission Owner is responsible for…" ➢ Added paragraph 5 – "Scheduled outages to the NYISO or Transmission Owner…" Section 3.6.1 (current) ➢ Line item 1 – Removed reference to "noon of the working day preceding" and added "two days before" ➢ Line item 2 – Removed last sentence "Notification shall be via the…" Section 3.6.2 (current) ➢ Added to second sentence "Shift Supervisor, as well as the NYISO…" Section 3.6.3 (current) ➢ Line item 1 – Removed reference to "noon of the working day preceding" and added "two days before" Section 3.6.4 (current) ➢ Line item 1 – Added third sentence "If the NYISO Outage Coordinator is…" Section 3.8 (old) ➢ Section 3.8 - Request for Software and System Changes - Completely deleted.
3.0	03/28/2014	Global ➢ Reformatted per new template to standardize presentation. ➢ Implemented minor stylistic changes. ➢ Revised external-document links to explicitly cite URLs from which documents may be accessed. Revision History Table ➢ Changed column headings as follows: • "Revision" changed to "Version" • "Changes" changed to "Revisions" Section 1.1 ➢ Inserted defined terms from Section 2.3 and 3.1.1.1. Section 2.3 ➢ Definitions moved to Section 1.1. Section 3.1.1.1 ➢ Section removed. Section 3.1.5 (old) ➢ Added point of escalation for a data issue or metering problem. Section 3.2.4 ➢ From the 'Digital Telemetering' section, removed reference to Radial Loads in points 10 and 13.

		➢ From the 'Data Quality Indication' section, clarified a "valid" data quality code. Section 3.3.2 ➢ Updated responsibilities of "Data Coordination Task Force" and "NYISO Data Coordinator" Section 3.3.4 ➢ Removed. Section 3.4 ➢ Incorporated data pertaining to the EMS Modeling procedure and notification procedures of all power system equipment additions or modifications to equipment at 100KV and above Section 3.4.1 ➢ Title changed from "Data Requirements Coordination Procedure" to "EMS Modeling – Coordination Procedure Regarding System Changes" ➢ Updated to remove references to the NYISO Data Installation Schedule. ➢ Relocated required notification data to Section 3.4.2 ➢ Removed procedure steps 6 and 7 which pertained to NYISO Data Coordinator reporting. Section 3.4.2 ➢ New Section titled "Power System Changes – Notification Requirements" ➢ Added language pertaining to notification requirements related to power system modeling and communication of measurement data ➢ Section 3.6Reclassified Class 2 computer outage from >15 minutes, to any which the NYISO would remain in Directed Operations Mode ➢ Reclassified Class 3 outage from <15 minutes, to any unscheduled computer outage ➢ Class 4 eliminated ➢ Implemented various clarifying edits. Section 3.6.1 ➢ Clarified required means of notifying the NYISO of scheduling Class 1 computer outages as being via the NYISO e-mail–based list server. ➢ Clarified internal parties that the NYISO must notify of Class 1 scheduled computer outages. Section 3.6.2 ➢ Clarified preferred means of notifying the NYISO of cancellation or postponement of Class 1 scheduled computer outages as being via the NYISO e-mail–based list server. ➢ Clarified internal parties that the NYISO must notify of cancellation or postponement of Class 1 scheduled computer outages. Section 3.6.3

		➢ Clarified required means of notifying the NYISO of scheduling Class 2 computer outages as being via the NYISO e-mail–based list server. ➢ Clarified internal parties that the NYISO must notify of Class 2 scheduled computer outages. Section 3.6.4 ➢ Clarified preferred means of notifying the NYISO of cancellation or postponement of Class 2 scheduled computer outages as being via the NYISO e-mail–based list server. ➢ Changed required means of notifying the NYISO of the reason for the cancellation or postponement of Class 2 scheduled computer outages from passing the information to the NYISO Outage Coordinator to instead including the information in the notification e-mail sent to the NYISO. ➢ Clarified internal parties that the NYISO must notify of cancellation or postponement of Class 2 scheduled computer outages. Section 3.6.5 ➢ Updated Class 3 outage coordination in accordance with Class change noted in Section 3.6 ➢ Clarified required means of notifying the NYISO of scheduling Class 3 computer outages as being via the NYISO e-mail–based list server. ➢ Clarified internal parties that the NYISO must notify of Class 3 scheduled computer outages. Section 3.6.5 ➢ Removed due to deletion of Class 4 computer outages Appendix A, References Section ➢ Updated references in points 3 and 5.
4.0	06/21/2019	Section 3.4 ➢ Removed and incorporated into the RAD Manual with most other NYISO modeling data submittal instructions Section 3.5 ➢ Re-numbered as section 3.4 Section 3.6 ➢ Re-numbered as section 3f.5
4.1	12/29/2020	Global ➢ Changed Metering Authority to Meter Authority Section 1.1 ➢ Added Member System and Meter Services Entity definitions ➢ Updated Meter Authority definition to include Member System and Meter Services Entity Section 3.1.3 ➢ Added reference to Meter Services Entity program rules for meter installation and calibration Section 3.1.4

		➢ Added reference to Meter Services Entity program rules for dispute resolution
4.2	10/04/2021	Recertified Section 3.2.2 ➢ Added language to describe the SD-WAN solution for direct communications ➢ Moved language from Section 3.2.4 related to Phase 1 telemetry requirement Section 3.2.4 ➢ Added language to describe new Phase 1 telemetry requirement ➢ Added language to describe CSR MW requirements Added Appendix D to describe SD-WAN redundancy requirements
4.3	MM/DD/YYYY	Section 2.6, 3.2.2 ➢ Added Aggregators to indicate that they have similar requirements to Generation Providers. Section 3.2.2 ➢ Expanded description of the SD-WAN solution for direct communications

1. Overview

This Manual focuses on the computer, communications, and metering systems required for reliable and economic operations of the New York Independent System Operator (NYISO):

- ***Computer Systems*** — Each Transmission Owner must control its transmission system and the generation located within its transmission district using a Control Computer System. While it is beyond the scope of this document to provide the details of the design and operation of the systems and their interconnection with each other and the NYISO Control Computer System, some high-level interface and functional requirements are defined herein.
- ***Metering Policy and Certification*** — Operational Metering Requirements are detailed as well as testing and coordination.
- ***Voice Communications*** — The NYISO maintains several diverse communications paths.

Throughout this Control Center Requirements Manual, the term "Resource" is used to refer to both Generators and Aggregations. Additional information on Aggregations can be found in the Market Administration and Control Area Services Tariff Section 4.1.10 and in the Aggregation Manual (https://www.nyiso.com/manuals-tech-bulletins-user-guides).

1.1. Definitions

The following terms are an integral part of this Manual[1]:

- ***Automatic Ringdown*** — The Automatic Ringdown circuits consist of a single dedicated voice line between the NYISO Control Center and each Transmission Owner's Control Center. To initiate a call, the operator at either Control Center selects the appropriate Ringdown circuit.
- ***Backup Lines*** — Conventional dial-up lines will provide back-up to the dedicated facilities.
- ***Control Center*** — The physical facilities housing the Transmission Owner operations or the Control Computer System of the NYISO or Transmission Owner.
- ***Control Computer System*** — The real-time computer used to monitor and control the power system. These systems are often referred to as SCADA (supervisory control and data acquisition) systems, SCADA/AGC (SCADA automatic generation control) systems, or Energy

[1] Capitalized terms used in this Control Center Requirement Manual shall have the same meaning as prescribed in the NYISO Tariffs (NYISO Market Administration and Control Area Services Tariff and NYISO Open Access Transmission Tariff) (available from the NYISO Web site at the following URL: https://www.nyiso.com/regulatory-viewer), unless otherwise defined, excepted, or noted in this Manual.

Management Systems (EMSs). Individual Transmission Owners may call their systems by other names, such as Power Control System. The term Control Computer System is used in this Manual to refer to any or all such systems employed by the NYISO or Transmission Owner.

- ***Data Quality*** — The measure of the reliability and accuracy of a data item transmitted to the NYISO Control Center.
- ***Direct Inward Dialing*** — The Transmission Owner PBX shall support Direct Inward Dialing to the Control Center operating positions for general voice traffic.
- ***Emergency Hot Line*** — The Emergency Hot Line is a network of diversely routed, private line telephone circuits connecting the primary and alternate Control Centers of the NYISO and the Transmission Owners. The Emergency Hot Line is a permanently connected, private, conference facility. The system includes two circuits (A and B) routed radially from the NYISO Control Center to each Transmission Owner Control Center, and hotline phones in each Control Center. To initiate a call, one circuit to each location is connected to the conference bridgecall. Indicators at the NYISO Control Center indicate the status of all parties (on or off hook) during a call and inform the NYISO of any malfunctions.
- ***Meter or Data Problem*** — One where the quality of a data item, either telemetered or obtained by other means at a Meter Authority, is poor enough to affect the operation of the power system.
- ***Metering and Data Accuracy Analysis*** — Methods to monitor the quality of NYISO Data and the procedure of communications between parties and NYISO Staff can be found in section 3.3.
- ***Member System*** – The eight Transmission Owners that comprised the membership of the New York Power Pool, which are: (1) Central Hudson Gas & Electric Corporation, (2) Consolidated Edison Company of New York, Inc., (3) New York State Electric & Gas Corporation, (4) Niagara Mohawk Power Corporation d/b/a National Grid, (5) Orange and Rockland Utilities, Inc., (6) Rochester Gas and Electric Corporation, (7) the Power Authority of the State of New York, and (8) Long Island Lighting Company d/b/a Long Island Power Authority.
- ***Meter Authority*** — An entity that is responsible for the calibration, maintenance, operation, and reporting of metered data from an electric revenue meter used in the wholesale electricity markets administered by the NYISO (i.e., a Member System or Meter Services Entity).
- ***Meter Services Entity ("MSE")*** – An entity registered with the ISO and authorized to provide metering and meter data services, as applicable, to an Aggregator, Responsible Interface Party, or Curtailment Service Provider.
- ***Satellite Telephone/Radio System*** — A voice circuit via satellite that is operated independent of the Public Telephone Switched Network. This system is to be utilized in the event landline telephone with one or more Transmission Owners is inoperable

2. Data and Voice Communications Interface

This section presents the data and Voice Communications requirements for Transmission Owners and Generation Owners. The term "interface" is considered to encompass all, in this Manual:

- The computer-to-computer communications interfaces between the NYISO and Transmission Owner Control Centers.
- The Voice Communications interfaces between the NYISO and Transmission Owner Control Centers.
- The functionality to be supported by the Transmission Owners Control Computer System.

2.1. NYISO/Transmission Owner Control Computer System Model

Each Transmission Owner is expected to monitor and control their transmission system using a Control Computer System. While many of the design details of this system are not of particular interest to the NYISO and the other Transmission Owners, the system is required to include functionality and interfaces compatible with the other Control Computer Systems operated by the NYISO and the other Transmission Owners.

2.2. Transmission Owner Communications

Refer to Appendix B.

2.3. NYISO/Transmission Owner Voice Communications

Each Transmission Owner must support the following Voice Communications facilities. These facilities will be developed and maintained in cooperation with the NYISO Network Services.

1. Emergency Hot Line
2. Automatic Ringdown
3. Direct Inward Dialing
4. Backup lines
5. Satellite Telephone/Radio System

2.4. Transmission Owner Control Computer System Functionality

The Transmission Owner Control Computer System shall support the following capabilities. These capabilities are defined largely as viewed from the NYISO Control Computer System.

2.4.1. Data Acquisition

The Transmission Owner Control Computer System shall transmit information on the state of the transmission system and generation under its control to the NYISO Control Computer System. The data to be exchanged shall be as defined in section 3.2.4 of this Manual.

The NYISO may request or transmit data periodically or "by exception" (periodically, as the need for information arises).

The Transmission Owners Control Computer System shall be capable of receiving and transmitting data at the full capacity of the connection to the NYISO Communications Network.

2.4.2. Interim Control Operation

When the NYISO Control Computer System is not in service or when the market has been suspended for any reason, the Transmission Owners may be called on to control the power system.

The method to be used can be found in the *NYISO Emergency Operations Manual,*(available from https://www.nyiso.com/manuals-tech-bulletins-user-guides).

2.5. NYISO/Transmission Owner Control Computer System Availability

The Transmission Owner Control Computer System shall be designed to operate under single contingency failure conditions. The Transmission Owner Control Computer System shall meet the following availability requirements:

1. The failure of any single hardware element shall not render the system unavailable.
2. All connections to the NYISO communications network shall be via redundant communications interfaces.
3. The Control Computer System shall be powered from an emergency power supply capable of sustaining operation of the system.

2.6. Generation Provider Communications

Generation Providers, which include Aggregators, will communicate with the NYISO through the facilities of its applicable Transmission Owner. The Generation Provider shall satisfy the practices of the Transmission Owner.

Generation Providers that want to receive their control base points directly from the NYISO in addition to the utility or Transmission Owner SCADA system should refer to the *NYISO Direct Communications Manual and the NYISO Direct Communications Procedure*. The manual is available at the following link:

https://www.nyiso.com/manuals-tech-bulletins-user-guides (Please contact NYISO Stakeholder Services for details on obtaining the procedure at the following link: https://www.nyiso.com/support)

3. Operating Procedures

The operating practices presented herein include:

- Meter Certification for Participants of the NYISO
- NYISO Guidelines for the Installation, Operation and Maintenance of Data Acquisition Equipment
- Operational Metering and Data Accuracy Analysis
- Maintenance and Validation of Scan Data Lists
- Computer Outage Coordination
- Request for Software and System Changes

3.1. Meter Certification for the Participants of the NYISO

This policy provides operational metering standards for any participant of the NYISO, including loads, generators, etc. The NYISO requires accurate metering from all New York State (NYS) Power System Generators, Loads, and Transmission Owners to ensure the reliable and economic real-time operation of the NYS Power System. These standards provide guidelines for the installation and maintenance of all equipment utilized for data acquisition to ensure that the operational data requirements of the NYISO are met.

The standards stated in this document are minimum standards and do not supersede other agreements. In cases in which standards differ, the most restrictive criteria shall be used.

3.1.1. Guidance

The requirements of this document are applicable to new metering systems and equipment whose data are used for NYISO system operation. Metering currently in operation for the NYISO, Transmission Owner's, Eligible Customers and other applicable Participants, not conforming to these requirements, need not be upgraded or replaced until such time that the need for upgrade or replacement is demonstrated to be operationally and economically required, or if required by the NYISO or Transmission Owner Tariff.

Except as provided in the preceding paragraphs, all metering systems for customers must meet the requirements of the NYISO and of the Transmission Owner of the facilities in which they attach to the NYS Power System.

All metering systems whose data is used for NYISO systems operation must have a designated Meter Authority.

If an Eligible Customer is serving a Load Serving Entity (LSE) that is not an Eligible Customer itself, the NYISO metering requirements shall apply for the LSE.

All metering systems will adhere to the "NYISO Guidelines for the Installation, Operation, and Maintenance of Data Acquisition Equipment" (section 3.2).

All metering systems will adhere to the document entitled, Guide for Uniform Practices in Inter-Utility Metering (Appendix A).

The Meter Authority will provide instantaneous and stored metered data, which meets the NYISO (and Transmission Owner) requirements to the Transmission Owner Control Center.

The Transmission Owner may require that the Eligible Customer install an approved remote terminal unit (RTU) or analog telemetry equipment for the accurate and timely transmission of their data to the Transmission Owners Control Center.

3.1.2. Metering Equipment Standards and Specifications

Specifications for metering equipment and functionality can be found in the following documents:

1. Applicable standards published by the Transmission Owner of the facilities in which the Eligible Customer is attached to the NYS Power System, obtainable through the Transmission Owner.
2. NYISO Guidelines for the Installation, Operation, and Maintenance of Data Acquisition Equipment presented in section 3.2.
3. Guide for Uniform Practices in Inter-Utility Metering (Appendix A).
4. *NYISO Revenue Metering Requirements Manual* (available from https://www.nyiso.com/manuals-tech-bulletins-user-guides).

3.1.3. Maintenance and Calibration

Each Participant (not a retail customer) is responsible for the cost assumed with purchase, installation, and appropriate maintenance of meters, wiring, communications equipment and all components essential to their accurate and reliable operation, including spare equipment, if applicable, in accordance with the requirements of the NYISO and the appropriate Transmission Owner.

All metering shall be calibrated within the guidelines (Appendix A) of this document and in accordance with the Transmission Owner requirements. Maintenance and calibration shall be performed by the Meter Authority or its designated representative. Member Systems shall maintain control over the equipment in accordance with New York State (NYS) Public Service Commission (PSC) rules and regulations. Meter

Services Entities shall maintain control over the equipment in accordance with the Meter Services Entity Manual.

3.1.4. Procedures for Dispute Resolution of Data Issues

If a data issue or metering problem is a risk to system reliability and is not addressed in a reasonable time frame, it can be escalated to the Communication and Data Advisory Subcommittee (CDAS). The committee will act to resolve the problem as soon as possible and, if necessary, notify the Operating Committee (OC).

Beyond any NYS PSC rules, each metering system may be subject to testing and inspection by the NYISO, Transmission Owner, and/or Market Participant at the request of either party. If any inspection request is initiated, the nature and magnitude of the suspected accuracy problem must be stated. If after inspection it is determined that the suspected metering is within specifications, the requestor will be responsible for testing expenses incurred. If after proper audit, an entity (Transmission Owner, Generator, Load, etc.) is suspected of manipulating metering or metering data, all details will be turned over to the NYISO. For Member Systems, NYS PSC rules will be enforced. For Meter Services Entities, MSE program rules are enforced.

3.1.5. Loss of Metering or Telecommunications

If data is lost due to a meter or telecommunications failure, the Meter Authority will use the best available information to fill in values for data lost. All failed telemetry, metering, and communications equipment will be returned to operational status in the shortest practical time.

3.2. NYISO Guidelines for the Installation, Operation, and Maintenance of Data Acquisition Equipment

3.2.1. Introduction and Background

This document provides guidelines for analysis and procedures for the maintenance and calibration of data acquisition equipment.

3.2.2. Present Design Overview

Analog metering (Phase I) transmits selected line megawatt flows, generator megawatts, and bus voltages directly from the source to the NYISO. Primary transducers are installed in the stations and connected to current and voltage transformers. The output of the transducer is input to the telemetering systems. The telemetering equipment is connected via a dedicated telecommunications line to the NYISO where telemetering receivers are installed. Analog metering may be obtained from the Transmission

Owner Control Centers with NYISO staff approval, but should be independent of the Transmission Owner's SCADA.

Digital data (Phase II) is transmitted to NYISO via computer-to-computer data links between the NYISO and the Transmission Owners computer. Digital data expands the NYISO data base to include all major transmission MW and MVAR flows, generator MWs and MVARs, tie line MWs and MVARs; substation breaker status, frequency and voltage. These data points are gathered by the Transmission Owner from local substation SCADA terminals to their Control Center Computers.

Generation Providers in the NYCA have the option to exchange direct SCADA communications with the NYISO. The NYISO offers Inter-Control Center Communications Protocol (ICCP) over either Multi-Protocol Label Switching (MPLS) on dedicated Tier 1 (T1) circuits or a Software-Defined Wide Area Network (SD-WAN) solution to send and receive telemetry data. The SD-WAN solution has been introduced by the NYISO to provide participants with a lower cost and easier to implement alternative to the MPLS T1 circuit solution. The SD-WAN solution is available to participants based on portfolio size as described in Appendix D SD-WAN Direct Communications Redundancy Requirements.

3.2.3. Metering Improvement Priorities

The various data types transmitted to NYISO shall be prioritized based on electric system costs, flow limits, operating limits, and security considerations. These priorities shall determine the basis on which metering replacements and improvements are to be completed. The priority classes are as follows:

1. Inter-Transmission Owner Transmission Lines Megawatts and Megavars
2. Inter-New York Control Area (NYCA) Transmission Lines Megawatts and Megavars
3. Resource Megawatts and Megavars
4. Bus Voltages
5. Intra-Transmission Owner Transmission Lines Megawatts and Megavars

3.2.4. NYISO Data Requirements

The following guidelines shall be used for the determination of NYISO minimum data requirements resulting from changes being made to the NYS Power System. They are intended to cover the normal requirement, but may be superseded by special situations.

Analog Telemetering (Phase I)

Analog Telemetering is provided to enable the NYISO to coordinate operation of the NYS Power System when the NYISO computer system is out of service, or when any of the computer-to-computer data links between the NYISO and Market Participant is not functioning.

1. MW telemetering will be required:
   a. On each interconnection to adjacent areas outside the NYCA. These should be from the end used by the Meter Authority to the NYISO independent of the Transmission Owner Control Center.
   b. On all circuits that are part of an internal NYISO interface for which transfer limits are observed, from one end to the NYISO independent of the Transmission Owner Control Center.
   c. For generation units of 500 MW or above, or intermittent generation of 200MW or above.
   d. For complexes where (a) the total generation is 500 MW or more, or there is 200 MW or more of intermittent generation connected to a single transmission station, and (b) where loss of the complex is determined by the NYISO Staff to have a significant impact on NYS Power System security.

2. Voltage:

   Voltage telemetering shall be required on busses 230 kV and above when the need is indicated by a review of transmission configuration changes or operating practices.

3. Frequency:

   Frequency telemetering shall be required when the need is indicated by a review of transmission configuration or operating practices.

Digital Telemetering (Phase II)

Digital data is presently obtained by the NYISO computer via the data links between the Transmission Owner's computer and the NYISO computer. Therefore, presently, only data available in the Transmission Owner's computer can be obtained by this method. Required data, which is not available in the Transmission Owner's computer, should be provided as soon as practical. The NYISO Operations Staff will designate the required data.

1. MW and MVAR will be required:
   a. On all transmission circuits, 115 kV and higher and on designated critical lower voltage circuits.
   b. On all transformer banks whose high voltage side is 115 kV or higher and on designated critical lower voltage equipment.
2. MW and MVAR will be required on all inter-NYCA ties.
3. MW and MVAR will be required on all ties between Transmission Owner Control areas.
4. MW will be required on all Resources. Non-Dispatchable generation may be provided in the form of plant total or group total dependent on how the owner intends to bid generation. Generators treated as Load Modifiers need not be metered.
5. For generators that participate in a CSR, the MW provided by each generator shall represent its equivalent output at the Point of Injection. The Market Participant will be responsible for taking into account the conversion losses between each generator and the Point of Injection/Point of Withdrawal when determining the output level for CSR generators.
6. MVAR will be required on designated Resources. If Resource MW is provided in the form of plant total or group total, as allowed in item 4, then MVAR output may also be provided in that form.
7. MVAR will be required on designated synchronous condensers, generators that can be operated as synchronous condensers, SVC's and STATCOM.
8. Voltage will be required from strategic locations throughout the NYCA sufficient to provide a voltage profile of the 115 kV and higher voltage systems and to provide critical lower transmission system voltages.
9. Tap position will be required on all load tap changing transformers and all voltage regulating transformers whose high side voltage is 115 kV and higher and on designated critical lower voltage equipment.
10. Frequency will be required from strategic locations that could reasonably end up as an island.
11. Status will be required on breakers that affect facilities 115 kV and higher, and on designated critical lower voltage facilities.
12. Status will be required on designated synchronous condensers, generators that can be operated as synchronous condensers, SVC's and STATCOM.
13. Status will be required on switchable capacitor banks and reactors whose voltage is 115 kV and higher and on designated critical lower voltages.

14. Status on disconnects or a combination of NYISO breaker and disconnects will be provided such that the NYISO can determine the status of facilities 115 kV and higher, and on designated critical lower voltage facilities.

Data Quality Indication

Data Quality is an indication of the validity of the MW, MVAR, voltage, and frequency values exchanged among the Market Participants and the NYISO. Each value must be accompanied by a Data Quality code. When the data has a validity attribute of "valid", the value is considered a good value and represents the real-time condition of the value to the best ability of the source. Only the source of the value may set the quality code.

Invalid data may be handled at its source by substitution (by an operator) of a manually entered value or by switching to a back-up source. At the NYISO, such data failures may be handled with manual substitution or by the substitution of analog data. Where analog back-up exists, the quality code controls its automatic substitution. If a Transmission Owner dispatcher replaces a failed value or switches to an alternate source, then the corresponding quality code will denote the substituted state.

Metering Specifications

The following is the design for new equipment that will meet the requirements of minimal error necessary to affect efficient computer operation at both the Transmission Owners and the NYISO. For detailed specifications on meters, Transducers, VTs, and CTs see the Guide for Uniform Practices in Inter-Utility Metering.

1. Voltages for Transmission to NYISO — All metering shall be of the RMS type and have no external adjustments or external mechanical variable resistors. Any internal adjustments shall only be available through the removal of the case or a port capable of being sealed. Voltages of 230 kV and higher shall be metered by three phase-to-ground voltage transducers. The outputs may be transmitted individually or averaged back to the Transmission Owner Control Center. NYISO will require an average value for their calculation.
2. Data Transmission to NYISO — Digital data with a maximum error of + 0.1 percent of reading, is the preferred means from the remote terminal for data telemetry. However, where analog data transmission must be used, the system shall have a combined error of less than 1.0 percent of full scale reading end to end for the telemetering oscillator and converter. End to

end is defined as including all equipment from the input terminals of the telemetering oscillator to the output ends of the telemetry converter.

3. General Specifications

   c. Metering and data transmission equipment shall be powered by the station DC bus or other uninterruptible power source, with sufficient capability to support the metering for a minimum of eight (8) hours.

   d. Multiple Parameters measured at generating plants or critical transmission stations (KW, KWH, etc.) shall be from the same CTs, VTs, and transducers so that data used at the plant, the operating headquarters, and the NYISO are common.

3.3. Metering and Data Accuracy Analysis

3.3.1. Purpose

This procedure provides:

- A method to monitor the quality of NYISO data so that problems can be analyzed and resolved.
- A communications procedure between the Market Participants and the NYISO staff, whereby data and metering problems can be addressed and resolved.

3.3.2. Administration

1. The NYISO is responsible for analyzing all operational Metering and Data Accuracy anomalies as reported to them by NYISO Staff or Market Participants staff.
2. The NYISO Data Coordinator is responsible for maintaining a liaison between the NYISO and Market Participants staffs for problem analysis and resolution. Additionally, all operational Metering or Data Problems that cannot be satisfactorily resolved at a staff level will become the responsibility of CDAS.

3.3.3. Procedure

1. If the NYISO Data Coordinator determines that a potential Metering or Data Problem exists, an investigation into the cause of the problem will be initiated. In the case of a Market Participant initiated investigation, contact will be made through the NYISO Data Coordinator who will coordinate problem analysis.

2. The Market Participants representative receiving the request must respond by the next working day supplying the following information:

   a. Probable cause of the data or metering problem;

   b. Expected time frame in which the problem will be resolved.

3. Long Term Metering or Data Problems are those for which the time frame specified in 2b above is not acceptable to the NYISO or Market Participant and will be resolved in the following manner:

   a. Reasons and potential alternatives for problem solution shall be supplied, in writing, by the Market Participants receiving representative to the NYISO initiating representative.

   b. The NYISO initiating representative will respond in writing, analyzing the alternatives presented, indicating their effects on their respective operations.

   c. The NYISO representative will forward all long term operational Metering or Data Problems, with supporting documentation, to CDAS for their review and resolution.

3.4. Maintenance and Validation of Scan Data Lists

The purpose of this procedure is to ensure that any change made to data exchanged between the NYISO and Transmission Owners is adequately coordinated and validated, and that all impacted parties are informed of all changes pending or active. In addition, this procedure will ensure that there will be advance notification to impacted parties when any changes are to be made to a participants exchanged data.

3.4.1. Maintenance and Validation of Scan Data Lists Procedure

1. Each April and October, all Transmission Owner Data Coordinators will make available a complete Data List. The Data List (spreadsheet) shall contain the following information for each data item:

   a. Name of the station where the quantity is metered

   b. Common name of the metered quantity

   c. Metered quantity engineering units, i.e. MW, MVAR, KV, etc.

   d. Network ID of the metered quantity

2. Each Data Coordinator shall review the Data List and verify that all scan data pertinent to them is complete and accurate.

3. In addition to the semi-annual exchange of Data Lists, a Data Coordinator initiating a change to existing data shall inform those receiving affected data of any pending changes to the Data List at least 4 weeks in advance of any changes.
4. CDAS shall be notified of all outstanding “Data Change" requests prior to execution of any changes.

3.5. Computer Outage Coordination

The purpose of this procedure is to coordinate NYISO and Transmission Owner Control Computer System or infrastructure outages that could adversely affect the secure and economic operation of the NYISO and the interconnected power systems. For purposes of this Section 3.5, the term “computer outage” includes outages of Transmission Owner Control Computer Systems, data communications systems, voice communications systems and any other infrastructure outages that could adversely affect the secure and economic operation of the NYISO and the interconnected power systems.

Outages of the NYISO and Transmission Owners Control Computer Systems are assigned to Classes by the severity of the outages. Three classes of scheduled outages and one class of unscheduled outages are employed:

- Class 1 Outage — Any scheduled outage that would cause the NYISO to operate using Interim Control Operations as defined in the NYISO Emergency Operations Manual.
- Class 2 Outage — Any scheduled outage for which the NYISO would remain in NYISO Directed Operations Mode requires notification.
- Class 3 Outage — All unscheduled outages.

Outages of both NYISO and Transmission Owner control Computer Systems must be scheduled so that other parties in the control area can properly accommodate the outage. The party scheduling the computer system outage is referred to as the “outage initiator” for the purposes of this procedure only.

Components that affect the NYISO and the Transmission Owners are those that control or support the transmission of information between Transmission Owner and NYISO Control Centers. This would include all components affecting computer communications or the receipt of data at the Transmission Owners and the NYISO.

Scheduled outages to the NYISO or Transmission Owner data communication subsystems will be arranged via the NYISO e-mail–based list server.

3.5.1. Class 1 Computer Outage Coordination Procedure

Class 1 Outage — Any scheduled outage that would cause the NYISO to operate using Interim Control Operations as defined in the NYISO Emergency Operations Manual (available from https://www.nyiso.com/manuals-tech-bulletins-user-guides).

Class 1 computer outages shall be coordinated as follows:

Outage Initiator Action

1. Class 1 outages shall be scheduled two days before the requested outage date via the NYISO e-mail–based list server. An outage initiator may schedule a Class 1 computer system outage by providing the NYISO Outage Coordinator the following data:
    - Date and time of outage
    - Scheduled duration of outage.
    - Reason for outage.

NYISO Action

1. Notify all of the following of scheduled Class 1 outages at least two hours in advance of the outage.
    - All Transmission Owner Control Centers.
    - The NYISO Network Operation Center
    - The NYISO Manager, Infrastructure Services
2. Record all Class 1 outages on the NYISO Daily Outage Summary Form indicating if the outage was executed. The following information to be recorded is described in section 3.5.7.

3.5.2. Cancellation or Postponement of Class 1 Computer Outages Coordination Procedure

Outage Initiator Action

1. Class 1 outages previously scheduled may be canceled or postponed at any time by any affected Transmission Owner or the NYISO. The Transmission Owner shall notify the NYISO Shift Supervisor, as well as the NYISO Outage Coordinator of any cancellation or postponement as soon as practical. Use of the NYISO e-mail–based list server is encouraged to ensure appropriate personnel are notified. The reasons for the cancellation or postponement shall be passed to the NYISO Outage Coordinator at the same time.

NYISO Action

2. Notify all of the following of the canceled or postponed Class 1 outages as soon as practical.
   - All Transmission Provider Control Centers
   - The NYISO Network Operation Center
   - The NYISO Manager, Infrastructure Services
3. The record of the scheduled outage shall be amended by the NYISO Outage Coordinator to indicate that the outage was canceled or postponed and the reasons for the cancellation or postponement.

3.5.3. Class 2 Computer Outage Coordination Procedure

Class 2 Outage — Any scheduled outage for which the NYISO would remain in NYISO Directed Operations Mode requires notification.

Class 2 computer outages shall be coordinated as follows:

Outage Initiator Action

1. An outage initiator may schedule a Class 2 computer system outage by providing the NYISO the information described in section 3.5.1 via the NYISO e-mail–based list server. The outage initiator shall attempt to schedule Class 2 outages two days preceding the requested outage date.
2. If it is not practical to schedule a Class 2 outage as described in item 1, the outage may be scheduled directly with the NYISO Supervisor of Systems up to one hour before the requested time of the outage. The information provided to the NYISO Supervisor of Systems shall be that described in section 3.5.1.

NYISO Action

3. Notify all of the following of scheduled Class 2 outages at least one hour in advance of the outage. Notification shall be via telephone:
   - All Transmission Owner Control Centers
   - The NYISO Network Operation Center
   - The NYISO Manager, Infrastructure Services
4. Record all Class 2 outages on the NYISO daily Outage Summary Form indicating if the outage was executed. The information to be recorded is described in section 3.5.7.

3.5.4. Cancellation or Postponement of Class 2 Computer Outages Coordination Procedure

Outage Initiator Action

1. Class 2 outages previously scheduled may be canceled or postponed at any time by any affected Transmission Owner or the NYISO. The Transmission Owner shall notify the NYISO of any cancellation or postponement as soon as practical via the NYISO e-mail–based list server. The reasons for the cancellation or postponement shall be included within the e-mail notification.

NYISO Action

2. Notify all of the following of the canceled or postponed Class 2 outages as soon as practical. Notification shall be via telephone:
    - All Transmission Owner Control Centers
    - The NYISO Network Operation Center
    - The NYISO Manager, Infrastructure Services
3. The record of the scheduled outage shall be amended by the NYISO Outage Coordinator to indicate that the outage was canceled or postponed and the reasons for the cancellation or postponement.

3.5.5. Class 3 Computer Outage Coordination Procedure

Class 3 Outage — All unscheduled outages.

Class 3 computer outages shall be coordinated as follows:

Outage Initiator Action

1. The outage initiator shall provide the NYISO Shift Supervisor the information described in section 3.5.1 as soon as practical after the occurrence of a Class 3 computer outage via the NYISO e-mail–based list server.

NYISO Action

2. Notify all of the following of Class 3 as soon as practical. Notification shall be via telephone:
    - All Transmission Owner Control Centers

- The NYISO Network Operation Center
- The NYISO Manager, Infrastructure Services

3. Record all Class 3 outages on the NYISO daily Outage Summary Form indicating if the outage was executed. The information to be recorded is described in section 3.5.7.

3.5.6. Recording of Outages

The following information shall be recorded for all Class 1, 2, and 3 computer system outages.

a. Date and time of outage.

b. Scheduled duration of outage (Class 1 and 2 only).

c. Reason for outage.

Appendix A Guide for Uniform Practices in Inter-Utility Metering

1.0 Purpose

1.1. The purpose of this guide is to outline standards and practices associated with the performance and maintenance of operational metering.

1.2. The scope of this guide is limited to the equipment including meters, transducers and instrument transformers, and the practices associated with the operational metering that are necessary as agreed upon by the NYISO and affected Transmission Owner for the reliable operation of the New York State Power Systems.

1.3. The guide is intended to apply to new or completely revised operational metering installations.

1.4. Existing equipment for operational metering that no longer can be maintained by Transmission Owners within good utility practices should be replaced with new one that meets this guide.

2.0 General

2.1. Measurements covered under this guide include, but are not limited to, volts, volts-squared, amperes, amperes-squared, phase angle[2], volt-amperes, watts, and reactive volt-amperes.

2.2. All devices used in an operational metering system should conform to applicable IEEE standards. These devices include relays, transducers, current transformers, potential transformers, Remote Terminal Units (RTU.)

2.3. New meter installations should meet or exceed a full-scale accuracy of 5% as measured at the NYISO or Transmission Owner control room.

2.4. Each operational metering device shall be provided with nameplate information that lists the manufacturer's name, serial number, and type of device.

2.5. All other pertinent input and output ratings including impulse levels, where applicable, and necessary connection diagram and polarity designations, should be maintained by the Transmission Owner as long as the device is in service.

3.0 Current Transformers

[2] Phase Angle: Referring to the measure of power factor for a flow.

3.1. All current transformers will conform to relay class, or better metering accuracy class, in accordance with IEEE standard C37.110 and ANSI/IEEE standard C57.13.

3.2. One current transformer shall be installed in each of the three-phase connections. Provisions for testing and calibration of each current transformer should be provided.

3.3. The burden imposed on each current transformer should be kept as small as practicable. Relays, transducers, and meters may be connected to a current transformer for operational metering provided the total burden imposed on the current transformer is within the rated burden.

3.4. All secondary wiring connected to the current transformers should be limited to the minimum length necessary to complete the circuit to the metering devices and transducers. It should be adequately sized to remain within the burden rating of the CT and be capable of withstanding any possible short circuit currents.

4.0 Voltage Transformers

4.1. All voltage transformers should conform to relay class, or better metering accuracy class, in accordance with ANSI/IEEE standard C57.13.

4.2. One voltage transformer should be installed on each phase conductor to the substation ground. Provisions for testing or calibration of each voltage transformer should be provided.

4.3. The burden imposed on a voltage transformer should be limited to the metering devices and transducers requiring a highly accurate voltage source. However, where it is necessary to supply other burdens from the voltage transformer, the total burden must be within the burden rating of the voltage transformer.

4.4. Where coupling capacitor voltage transformers are used, test connection points for periodically verifying their ratio and phase angle errors should be provided. These errors should be determined by test methods that simulate in-service conditions as closely as practical.

4.5. All secondary wiring supplying voltage to the measuring devices requiring a highly accurate voltage source should be a minimum size and should be limited to the minimum length necessary to complete the circuit to the metering devices and transducers.

5.0 Meters and Transducers

5.1. It is recommended that meters and transducers for the measurement of 3 phase quantities should be designed with three elements.

5.2. Transducers for the measurement of voltage and current should be of the RMS sensing type.

5.3. Transducers used for the measurement of phase angle should be of the single phase design.

5.3.1. Electromechanical phase angle meters or transducers should not exhibit errors greater than one degree.

5.3.2. The phase angle meter should obtain its voltage from a phase-to-ground connected voltage transformer and its current from a current transformer whose primary is in series with the phase conductor.

5.3.3. Digital phase angle meters based on zero crossing detection should be designed to filter out harmonic components, so that the measured phase angle corresponds to the phase relation between the 60 Hz fundamentals of the applied voltage and current.

5.4. Meter installation should be designed to provide a means to both measures the input quantities from the current and/or voltage transformers and to allow the application of test quantities to the meter or transducer. Where the output of the meter or transducer is an electrical rather than visual quantity, provisions should be made to conveniently measure the output.

6.0 Testing and Calibration

6.1. Operational metering should be tested and, if appropriate, calibrated, when indications are suspect or maintenance has been performed that may have interrupted or otherwise adversely impacted the accuracy of operational data.

7.0 Determining the need for Upgrading Equipment

7.1. Meters not meeting the accuracy specified by the manufacturer's standards should be repaired or replaced. In certain cases when upgrade of an existing metering system to complete conformance to this guide is not practical or economically justifiable, the responsible Transmission Owner will work with the NYISO for an alternate solution.

8.0 Definitions

8.1. Where there is a question on the meaning of terms used in this guide, reference the following standards:

a. *IEEE Standard Dictionary of Electrical and Electronic Terms*

b. ANSI Standards

c. FERC Tariff

d. *McGraw Hill Dictionary of Scientific and Technical Terms*

e. *Webster's Unabridged Dictionary*

References

1. ANSI C39.1 – 1981 (R1992) Requirements for Electrical Analog Indicating Instruments
2. ANSI/ISA S82.03 – 1988 Safety Standard for Electrical Test, Measuring, Controlling, and Related Equipment (Electrical and Electronic Process Measurement and Control Equipment) (Partial Revision and Redesignation of ANSI C39.5-1974)
3. ANSI/IEEE C37.90-2005 – IEEE Standard for Relays and Relay Systems Associated With Electric Power Apparatus
4. ANSI C39.6 – 1983 American National Standard for Electrical Instrumentation, Digital Measuring Instruments
5. IEEE C37.110-2007/Cor 1-2010 – IEEE Guide for the Application of Current Transformers Used for Protective Relaying Purposes Corrigendum 1: Corrections to Equation 18 and Equation 19
6. ANSI/IEEE C57.13 – 2008 IEEE Standard Requirements for Instrument Transformers

Appendix B Communication Services and Protocol

Note: This appendix is available only to Transmission Owners, who may obtain a copy by contacting NYISO Member Relations at customer_registration@nyiso.com.

Appendix C Wide-Area Network Services

Note: This appendix is available only to Transmission Owners, who may obtain a copy by contacting NYISO Member Relations at customer_registration@nyiso.com.

Appendix D SD-WAN Direct Communication Redundancy Requirements

NYISO required redundancy for Market Participants employing SD-WAN for direct communications to the NYISO. Note that in all cases, communication through the Transmission Owners is required.

Market Participant Portfolio	SD-WAN
X <25MW	Single Internet Service Provider supporting one gateway for one SD-WAN vendor
25MW≤ X <100MW	Two Internet Service Providers supporting two gateways for one SD-WAN vendor i. Market Participant may elect to also establish connection with secondary SD-WAN vendor
X ≥100MW	SD-WAN not available option for communication with NYISO

Note: * Contact NYISO Stakeholder Services at customer_registration@nyiso.com to advise on identity of Vendor 1 and 2.