Document title:	Document number:
MW P&C PRODUCTION STANDARDS Interconnecting Facilities – Metering and Data Exchange Requirements	MWPS-PC-BPS-001
	Revision No.: 1
	Applies to: Duke Energy Midwest Transmission Engineering

1.0 Introduction

This document is intended as a guide for application of Duke Energy Midwest Transmission Interconnecting Facility Data Connection Requirements. It is a collection of requirements from various stakeholders, including Revenue Metering Engineering, EMS Engineering, System Operations (ECC), Cybersecurity, and NERC CIP compliance.

2.0 Scope

This guide lists requirements that apply to Interconnection Tie Partner Utilities, Duke Energy Non-Regulated Generation Facilities, and third party owned Generation Facilities that are connected at Transmission voltage levels 69kV and above.

This guide does not cover Revenue Metering at distribution voltage levels, such as Customer Delivery at a substation, Rural Electric Membership Cooperative (REMC), or Municipal/Co-op Revenue Metering requirements. Consult “Midwest Metering Guide” or similar document for distribution voltage level Revenue Metering requirements.

The requirements in this guide primarily pertain to greenfield substation installations and scenarios. For brownfield stations, every effort should be made to adhere to these guidelines as existing equipment allows.

3.0 Minimum Equipment Requirements

For any interconnection, there shall always be two revenue accurate meters installed at the Duke Energy Midwest (DEM) end of the transmission line. These meters are referred to as the Primary Meter and Backup Meter. The purpose of the Primary Meter is providing real-time power data to EMS as well as capturing revenue/billing information (sometimes known as “end of hour” or “accumulator” data) for Revenue Metering Engineering and Energy Billing departments. The Backup Meter is used by Transmission to provide a set of redundant data points as required by the Balancing Authorities that govern DEM, MISO and PJM. Additionally the Backup Meter is used by Revenue Metering in the event the Primary Meter fails.

In brownfield scenarios where no additional meter is present, the redundant set of data points may be selected from other nearby equipment, such as line relays or other devices capturing that data.

Real-time power data and relevant equipment status points need to be shared between the two Interconnecting Entities. For new interconnections, Duke Energy’s preferred method to share and exchange data is via DNP3.0 using RS-232 Serial Protocol. The preferred connection medium is a direct fiber optic link between corresponding station

Remote Terminal Units (RTU's), or equivalent device, that can meet the connection and client/server polling requirements.

When the preferred RTU-to-RTU serial link is utilized at Greenfield Interconnect installations, a second RTU separate from the main Station RTU shall be installed. This RTU shall be referred to as the "Interconnect RTU" and is owned and managed by Duke Energy. The purpose of this RTU is to provide a demarcation point/barrier for data exchange between the two interconnect partners that meets NERC CIP compliance standards. A RTU that is isolated from other station IP connected devices provides greater security from any unforeseen network entry points and makes gathering compliance evidence more straightforward in the event of an audit. For Brownfield sites, the serial connections may be made directly to Duke Energy's Station RTU if it is determined site configuration will not allow for the Interconnect RTU.

The Interconnecting Partner must also install a corresponding device for data exchange that has compatible connections and protocols with Duke Energy's Interconnect RTU, as outlined in section 7. For any Greenfield Interconnect installations, the Interconnecting Partner's data exchange device shall not be located in Duke Energy's control enclosure, regardless of NERC CIP classification. Brownfield and existing installations can be maintained as-is, provided the Interconnecting Partner's equipment is not connected to Duke Energy's telecom network via IP or other external, routable protocols.

When the connecting entities have existing "Inter Control Center Protocol", or ICCP, links available, additional points and data can be added to the existing link. Note that ICCP links are facilitated by the regional Balancing Authorities and some data points (e.g. accumulator/end-of-hour data) are not allowed. Interconnect Partners should check with Balancing Authority before assuming ICCP link can be utilized for additional data.

4.0 Primary and Backup Meter Functional Requirements

4.1 A four-quadrant, bi-directional, three element Revenue Class meter shall be used for both Primary and Backup meters. The meter shall be capable of producing the following outputs:

- Kilowatt-hours (kwh)
- KiloVAR-hours (kVARh)
- Instantaneous three phase watts
- Instantaneous three phase VARS
- Instantaneous single phase volts
- Instantaneous single phase amps

4.2 The meter shall be provided with a RJ45 Ethernet Port, as well as a RS 232/485 serial port. The meter shall support DNP-3.0 protocol.

4.3 Primary Meter Communication Port(s) Connections (See Section 10.1)

4.3.1 The first connection is directly to the “Station RTU” via serial DB9 communication port for use by Transmission stakeholders. The connection and equipment are installed and maintained by Duke Energy SCADA technicians or other Duke Energy Construction and Maintenance (C&M) personnel.

4.3.2 The second connection is to a “Revenue Meter Modem”, utilizing the copper RJ45 ethernet, for use by Duke Energy’s Revenue Metering/Energy Billing group(s). The connection and modem are installed and maintained by Duke Energy Meter Technicians.

4.4 BACKUP Meter Communication Port(s) Connections (See Section 10.1)

4.4.1 The first connection is directly to the “Interconnect RTU” via serial DB9 communication port for use by Transmission stakeholder The connection and equipment are installed and maintained by Duke Energy SCADA technicians or other Duke Energy C&M personnel.

4.4.2 The second connection is to a “Revenue Meter Modem”, utilizing the copper RJ45 ethernet, for use by Duke Energy’s Revenue Metering/Energy Billing group(s). The connection and modem are installed and maintained by Duke Energy Meter Technicians.

5.0 Current Input Requirements to Meters

5.1 Separate CTs are required for the Primary Meter and Backup Meter

5.2 Primary Meter CTs (See Sections 10.2 & 10.3)

5.2.1 A standalone set of Extended Range Metering Class Accuracy CTs shall be installed at the interconnection point, with a minimum accuracy of 0.15B1.8. (See Section 9.2 & 9.3)

5.2.2 No burden other than the meter shall be connected in the metering CT circuits.

5.3 Backup Meter CT's (See Sections 10.2 & 10.3)

5.3.1 Backup Metering CTs may be Relaying Accuracy Class CT(s), with minimum accuracy of C800.

5.3.2 In a ring bus application, the summation of two "breaker relay A" bushing CT's shall be used. (See Figure 1)

5.3.3 In a radial bus application, the "breaker relay A" bushing CT shall be used. (See Figure 2)

5.3.4 The burden may be shared with other devices.

5.4 CT ratio

5.4.1 CT ratio shall be selected as small as possible to provide the required accuracy at low loads.

5.4.2 CT ratio should be large enough that the secondary current is less than 10 amps when the interconnection is loaded to its highest emergency rating. (Note: Some existing meters may not be rated for more than 5 amps)

5.5 CT Polarity

5.5.1 CT shall be oriented such that the revenue meter(s) read out positive power flow values.

6.0 Voltage Input Requirements to Meters

6.1 Three (3) CCVTs are required and each CCVT shall be connected to phase to ground. Each CCVT shall have three (3) secondary windings available. Each winding shall provide 115V at full connected ratio and 69V at tapped connected ratio, when connected phase to ground.

6.2 The “X” and “Y” windings shall be Metering Accuracy class, with accuracy of 0.3% or better at WXY & Z burden. The “Z” winding shall be Relaying Accuracy Class, with accuracy of 1.2% or better at WXY & Z burden.

6.3 Primary Meter Voltage Connections (See Sections 10.2 & 10.3)

6.3.1 The 115V “X” secondary winding of the voltage source shall be dedicated for Primary Metering.

6.3.2 The 69V “X” winding shall not be connected to any other devices.

6.3.3 No burden other than the meter shall be connected in the metering secondary circuit.

6.3.4 The meter circuit shall be fused separately from any other devices.

6.4 Backup Revenue Meter Voltage Connections (See Sections 10.2 & 10.3)

6.4.1 The 115V “Y” secondary winding of the voltage source shall be used for Backup Metering.

6.4.2 The 69V “Y” winding may be utilized for other devices.

6.4.3 The meter circuit shall be fused separately from any other devices.

7.0 RTU Requirements

7.1 Duke Energy shall install a local "Interconnect RTU" for exchanging data with the Interconnect Partner's corresponding RTU or equivalent data exchange device.

7.2 The Interconnect RTU shall connect to interconnecting facility's data exchange device using RS-232 serial data transport over fiber with SCADA protocol DNP version 3.0. DNP compliance Level 2 is required. See Duke Energy SPS: *STDP-STD-TRM-00094, section 4.2.2.1*.

7.2.1 In order to accommodate RTU "Client/Server" serial polling requirements, two pair (four total strands) fiber connections shall be utilized: one TX/RX pair for data exchange from Duke Energy to Interconnecting Facility and one TX/RX pair for data exchange from Interconnecting Facility to Duke Energy. These may be housed in the same cable.

*7.2.2 One DNP Client shall be configured for data transfer from Duke Energy, and one DNP Server will be configured for data transfer to Duke Energy. Duke Energy and Facility Owner DNP clients shall be configured for exception polling (Class 1 - Object 60, variation 2) for analogs and statuses. Default response provided by each DNP Servers shall be Object 32, variation 2 for analogs and Object 2, variation 2 for statuses. Duke Energy will deliver supervisory control analog setpoints to interconnecting facility via mapping value into Duke DNP server as and analog input read by interconnecting facility owner DNP Client. Client station addresses shall be 200, server addresses shall be 2. (*Duke Energy SPS: *STDP-STD-TRM-00094, section 4.2.2.1)*

7.2.3 Connections between facilities shall use fiber optic medium and fiber optic transceivers for optical to electrical conversion, as needed. (SEL-2812-MR, SEL-2829, or agreed equivalent).

7.3 P&C Engineering, SCADA, and EMS Engineering shall work with the Interconnection Partner to determine any additional data points that will be shared.

7.4 Minimum Required RTU Communication Ports (See Section 10.1)

7.4.1 Duke Energy Station RTU must have a minimum of (1) dedicated serial port for connection to Primary Meter in addition to any other communication ports required for regular station devices and Duke Energy Telecom network ethernet connection.

7.4.2 Duke Energy Interconnect RTU must have a minimum of (3) serial ports available: (2) for interconnect data exchange and (1) for connection to BACKUP Meter. Additionally, Interconnect RTU must have at least (1) ethernet communication port for connection to Duke Energy Telecom Network.

7.4.3 The Interconnecting Partner's RTU (or equivalent device) must have minimum (2) dedicated serial ports for interconnect data exchange.

7.5 When ICCP (Inter Control Center Protocol) communication exists between interconnected control areas, no additional RTUs or other data-exchange devices are required. Data can be passed between the interconnected control areas using ICCP, provided the data required is permissible by the Balancing Authority such as MISO or PJM. (e.g. MISO or PJM do not permit sharing "End of hour" or "Accumulator" data)

8.0 COMMUNICATION PATH

8.1 Type of communication circuit and destination for the Interconnection Partner shall be determined by the Interconnection Partner, in coordination with Duke Energy Telecom in order to not cause conflicts. The Interconnection Partner cannot use Duke Energy's network switch inside the Duke Energy Control Enclosure.

9.0 MINIMUM REQUIRED DATA POINTS

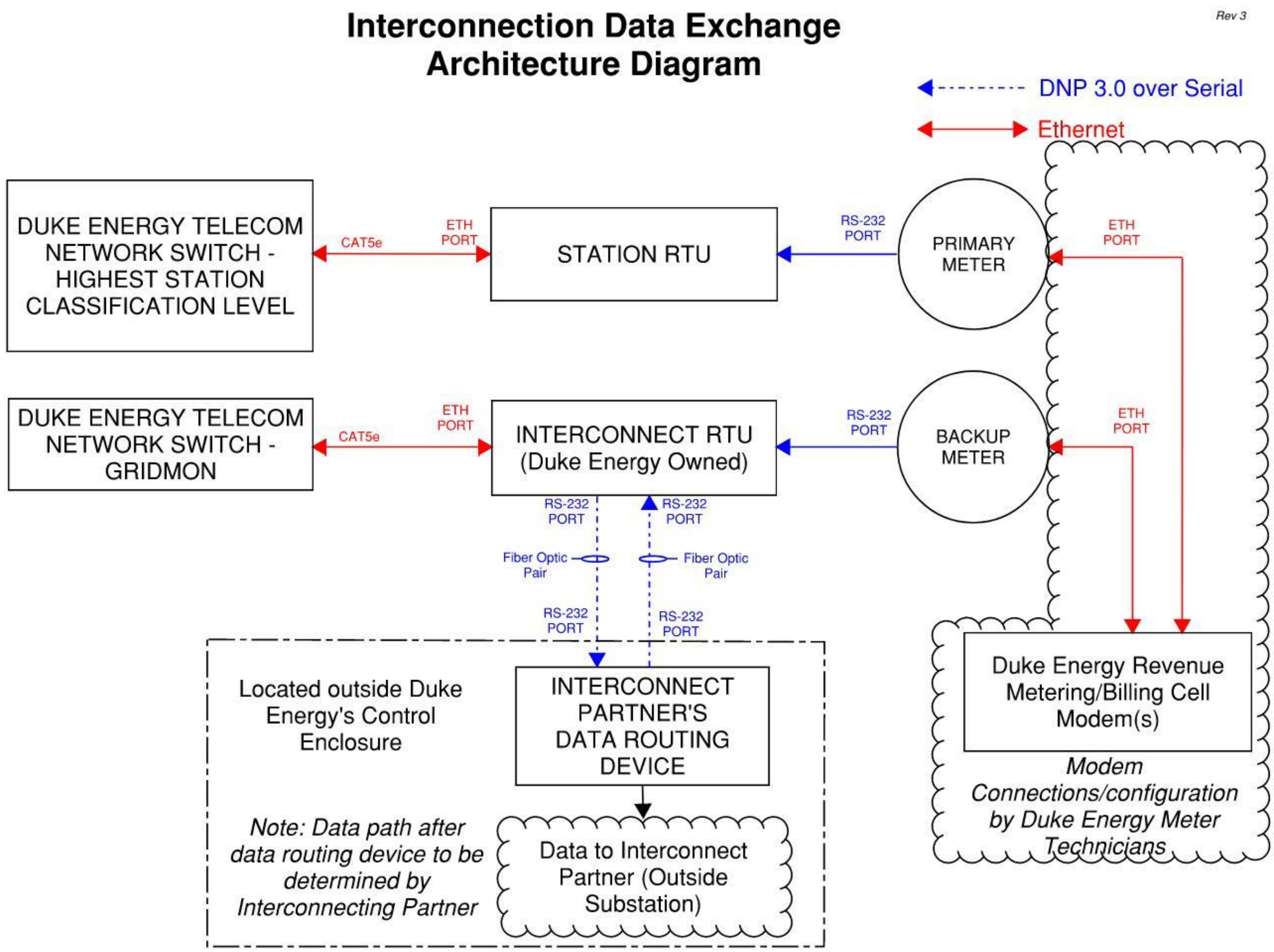
9.1 The below points shall be mapped from each corresponding meter. Additional points may be mapped depending on the interconnected substation configuration, such as breaker/switch status, etc. as determined by System Operations, EMS Engineering, and P&C Engineering.

The points shall be named in accordance with DEM's Standard Point Assignment Charts, as applicable.

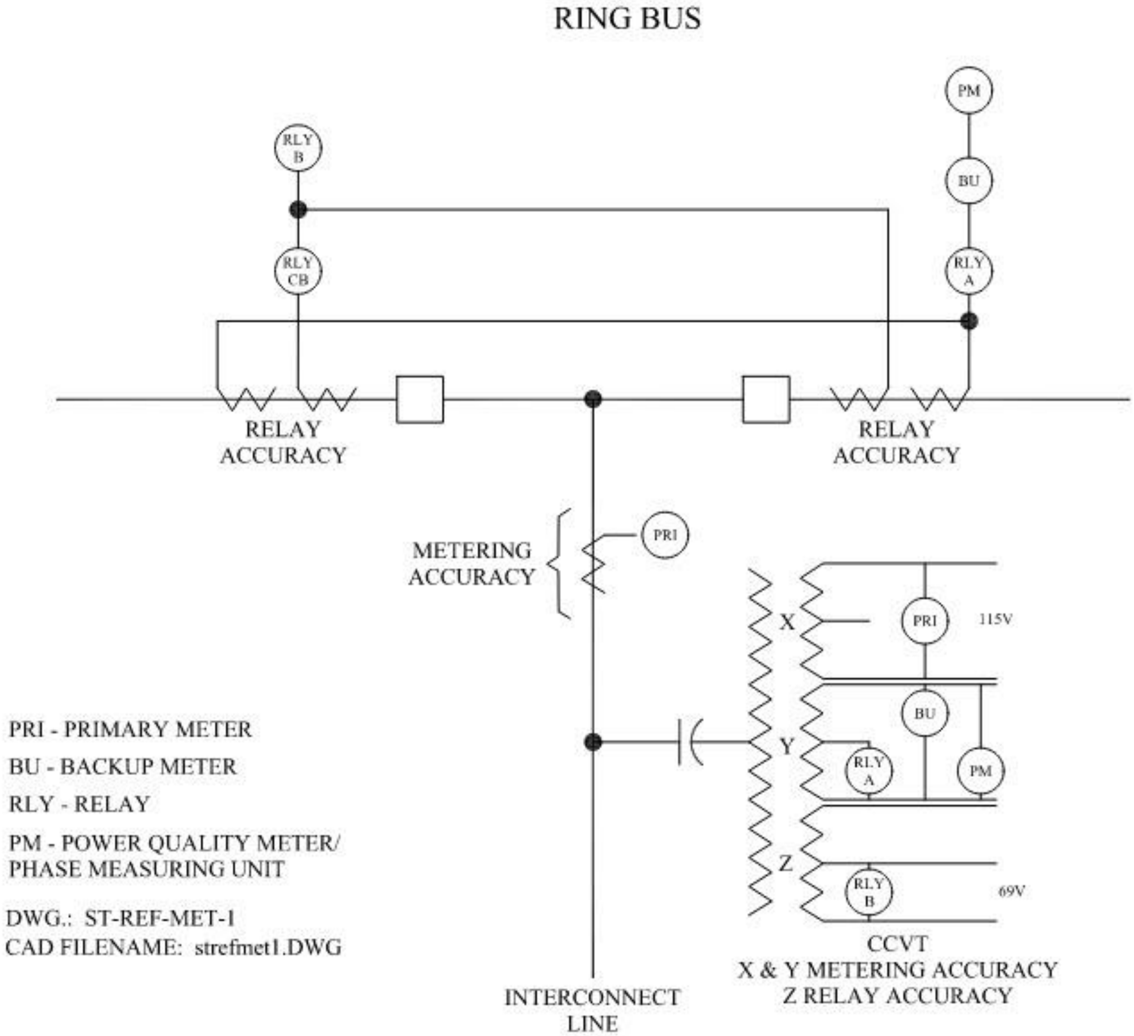
PRIMARY REV METER MW	BACKUP REV METER MW
PRIMARY REV METER MVAR	BACKUP REV METER MVAR
PRIMARY REV METER PHASE A VOLTS	BACKUP REV METER PHASE A VOLTS
PRIMARY REV METER PHASE B VOLTS	BACKUP REV METER PHASE B VOLTS
PRIMARY REV METER PHASE C VOLTS	BACKUP REV METER PHASE C VOLTS
PRIMARY REV METER PHASE A AMPS	BACKUP REV METER PHASE A AMPS
PRIMARY REV METER PHASE B AMPS	BACKUP REV METER PHASE B AMPS
PRIMARY REV METER PHASE C AMPS	BACKUP REV METER PHASE C AMPS
PRIMARY REV METER KWH DELIVERED	
PRIMARY REV METER KVARH DELIVERED	
PRIMARY REV METER KWH RECEIVED	
PRIMARY REV METER KVARH RECEIVED	

10.0 CONNECTION DIAGRAMS

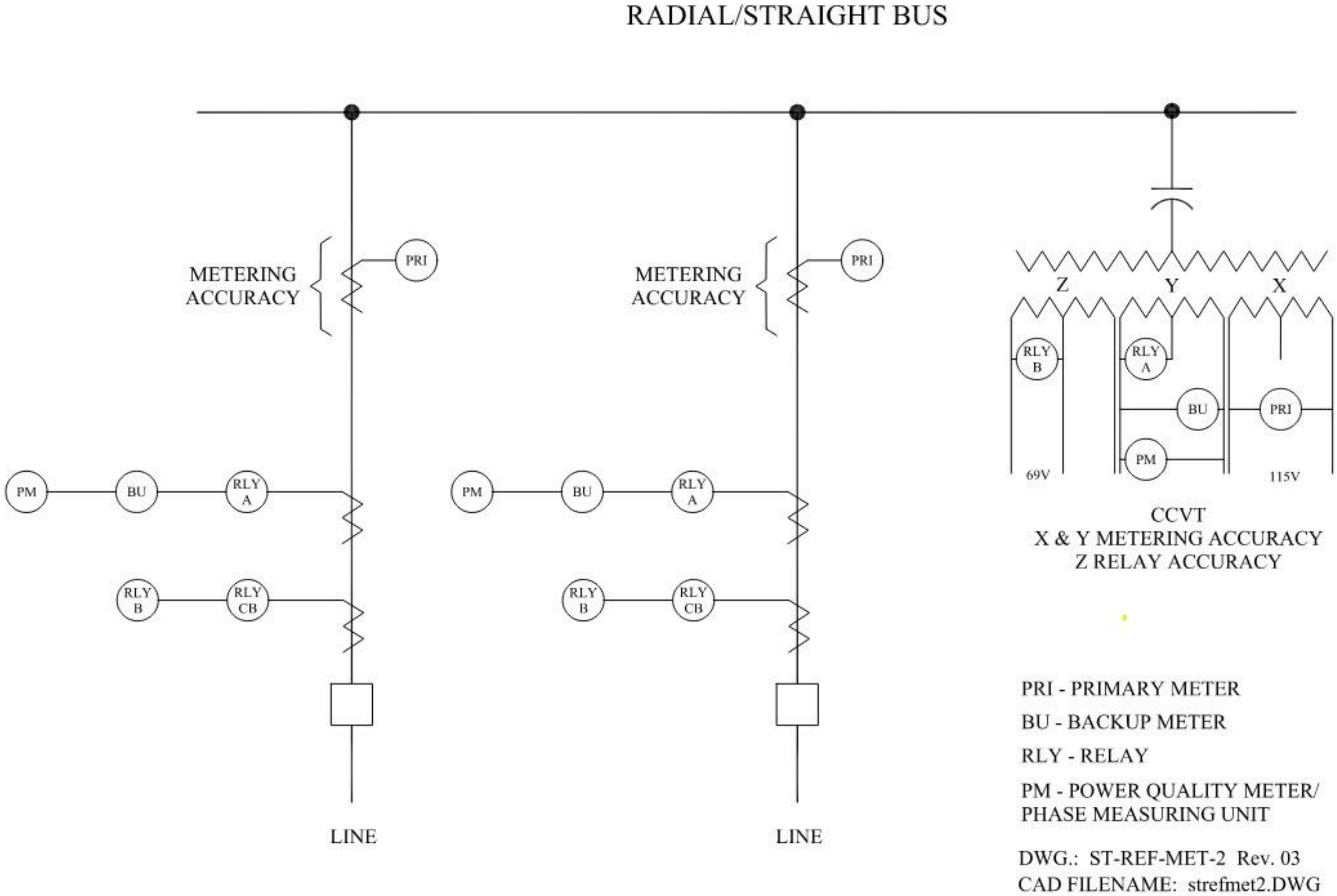
10.1 Figure 1 - Interconnection Data Exchange Architecture Diagram



10.2 Figure 2 - Interconnection Metering AC connections for Ring Bus Application



10.3 Figure 3 - Interconnection Metering AC Connections for Radial/Straight Bus Applications



11.0 Revision History

Version	Effective Date	Change Description	Author	Approved By
0	*12/16/2022*	New Document. Supersedes 12/15/2004 “Duke Energy Midwest Engineering Guide - Interconnection Metering”	Jon Wiltshire & Doug Wash	James Farley
1	*1/12/2024*	• Updated connection diagrams. Removed ICCP preference language, added RTU-to-RTU preference language. • Added DNP points list section. • Added approval/signing section for document stakeholders.	Jon Wiltshire	