Duke Energy Midwest Engineering Guide

Interconnection Metering

December, 2004

(Revised January 23, 2014 to reflect new Duke Energy logo only)

Developed by: Substation Standards

1. SCOPE

1.1 This guide document refers to Duke Energy Midwest Requirements for Interconnection Metering between Duke Energy Midwest and another Control Area for transmission voltage levels 69kV and above.

1.2 This guide is not intended to provide direction for Revenue Metering between a Duke Energy Midwest operating company and another entity or for metering at a Duke Energy Midwest generating station. For Revenue Metering please refer to the Revenue Metering guide.

1.3 Sections 2, 7, and 8 address the general interconnection requirements.

1.4 Sections 3-6, and 9 address the interconnections that are metered at the Duke Energy Midwest end using a Duke Energy Midwest standard line terminal.

2. LOCATION

2.1 There will always be two meters installed at the Duke Energy Midwest end of the line. These meters will be referred to as the Primary meter and the Backup meter.

3. CURRENT INPUT TO METERING

3.1 Separate CTs are required for primary and backup metering.

3.2 Primary Metering CTs

3.2.1 In a ring bus application, the summation of two dedicated breaker bushing metering accuracy CTs may be used. (See Figure 1)

3.2.2 In a radial bus application, a dedicated breaker bushing metering CT shall be used. (See Figure 2)

3.2.3 The minimum metering accuracy class for the metering CTs shall be 0.3B1.8.

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

3.3 Backup Metering CTs

3.3.1 In a ring bus application, the summation of two “breaker relay A” bushing CTs shall be used. (See Figure 1)

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

3.3.3 For backup metering CTs, the minimum relay accuracy class at the connected tap shall be C50.

3.4 CT ratio

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

3.4.2 CT ratio should also 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)

3.4.3 Engineering shall require the manufacturers to provide test data for metering CTs, and shall forward this data to Meter Operations.

4. VOLTAGE INPUT TO METERING

4.1 A PT or CCVT with three (3) secondary windings is required for the primary and backup interconnection metering. The accuracy class for the "X" & "Y" winding of the voltage source shall be 0.3% or better at WXY & Z burden. The accuracy class for the "Z" winding shall be 1.2% or better at WXY & Z burden.

4.2 The primary and backup meters shall be connected to the 115 volt windings.

4.3 Engineering shall require the manufacturers to provide test data for metering PTs or CCVTs, and shall forward this data to Meter Operations.

4.4 Primary Metering (See Figure 1 & 2)

4.4.1 The "X" secondary winding of the voltage source shall be dedicated for the primary metering.

4.4.2 No burden other than the meter shall be connected in this metering secondary PT circuit.

4.5 Backup Metering (See Figure 1 & 2)

4.5.1 The "Y" secondary winding of the voltage source shall be used for relays and backup metering.

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

5. METER

5.1 A four-quadrant, bi-directional, three element revenue class meter shall be used for the primary and backup meter. The meter shall be capable of producing the following outputs:

a. Kwh
b. KVARh
c. Instantaneous three phase watts
d. Instantaneous three phase vars
e. Instantaneous single phase volts
f. Instantaneous single phase amps

5.2 The meter shall be provided with an RS-232/485 communication port and shall support DNP-3.0 protocol.

6. METER OUTPUT

6.1 Primary Metering

6.1.1 Primary metering output shall be connected to the Substation RTU via the RS-232/485 communication port.

6.1.2 In the East, the Substation RTU shall send data to EMS in Cincinnati.

6.1.3 In the West, the Substation RTU shall send data to EMS in Plainfield.

6.2 Backup Metering

6.2.1 Backup metering output shall be connected to the Backup Telemetering RTU via the RS-232/485 communication port.

6.2.2 In the East, the Backup Telemetering RTU shall send data to the backup telemetering system in Cincinnati.

6.2.3 In the West, the Backup Telemetering RTU shall send data to the backup telemetering data concentrator in Plainfield.

6.3 Metering data shall not be transmitted to the MV90 system.

7. RTU REQUIREMENTS

7.1 Primary Metering Data

7.1.1 When no ICCP (Inter Control Center Protocol) communication exists between interconnected control areas, Primary Metering data shall be transmitted between the interconnected companies via RTU's. This requirement can be addressed by two separate RTUs (Substation RTU and Interconnected RTU) or the Substation RTU with two communications ports.

7.1.1.1. Two Separate RTUs (Substation RTU and Interconnected RTU)

7.1.1.1.1. The interconnected company will supply their own Interconnected RTU when two RTUs are to be used. The cost of installation, service and maintenance shall be provided by the interconnected company.

7.1.1.2. The Substation RTU with two communications ports

7.1.1.2.1. The use of a Duke Energy Midwest Substation RTU communication port shall be permitted only if Duke Energy Midwest supports the interconnected company protocol.

7.1.1.2.2. The RTU shall be capable of accepting separate pulse accumulator freeze inputs from each company.

7.1.1.3. The increase in cost of installation, service and maintenance of the RTU for the use of the interconnected company should be addressed in the interconnection agreement.

7.1.1.4. Engineering, SCADA, T&D Operations and EMS-East shall work with the interconnected company to determine the points that will be mapped to the interconnected company's communication port.

7.1.1.5. Engineering shall work with T&D Operations to determine a point list for the Substation RTU. EMS-East should be consulted and have approval authority over tie line metering points within the list.

7.1.2. When ICCP communication exists between interconnected control areas. The interconnected RTU or the second communication port requirement for the substation RTU is not required. Data can be passed between the interconnected control areas using ICCP.

7.2. Backup Metering Data

7.2.1. A separate Backup Telemetering RTU is required in addition to the Substation RTU in new or existing Duke Energy Midwest substations.

7.2.2. The Backup Telemetering RTU will not be used for other purposes.

7.2.3. Engineering shall work with EMS-East for development and approval of the point list for the Backup Telemetering RTU.

8. COMMUNICATION LINES

8.1 Communication Line for Interconnected Company

8.1.1 Type of communication circuit and destination for the interconnected company should be coordinated with the interconnected company.

8.2 Communication Line for Duke Energy Midwest

8.2.1 A full time communications channel is required for the Substation RTU to communicate with both EMS master and Backup Control centers.

8.2.2 A separate full time communications channel is required for Backup Telemetering RTU.

8.2.3 A method of testing the communications channel shall be provided.

8.3 Duke Energy Midwest does not require communications with the MV90 system.

9. SINGLE LINE DIAGRAMS

9.1 Figure 1 shows Interconnection Metering for ring bus application.

9.2 Figure 2 shows Interconnection Metering for radial bus application.

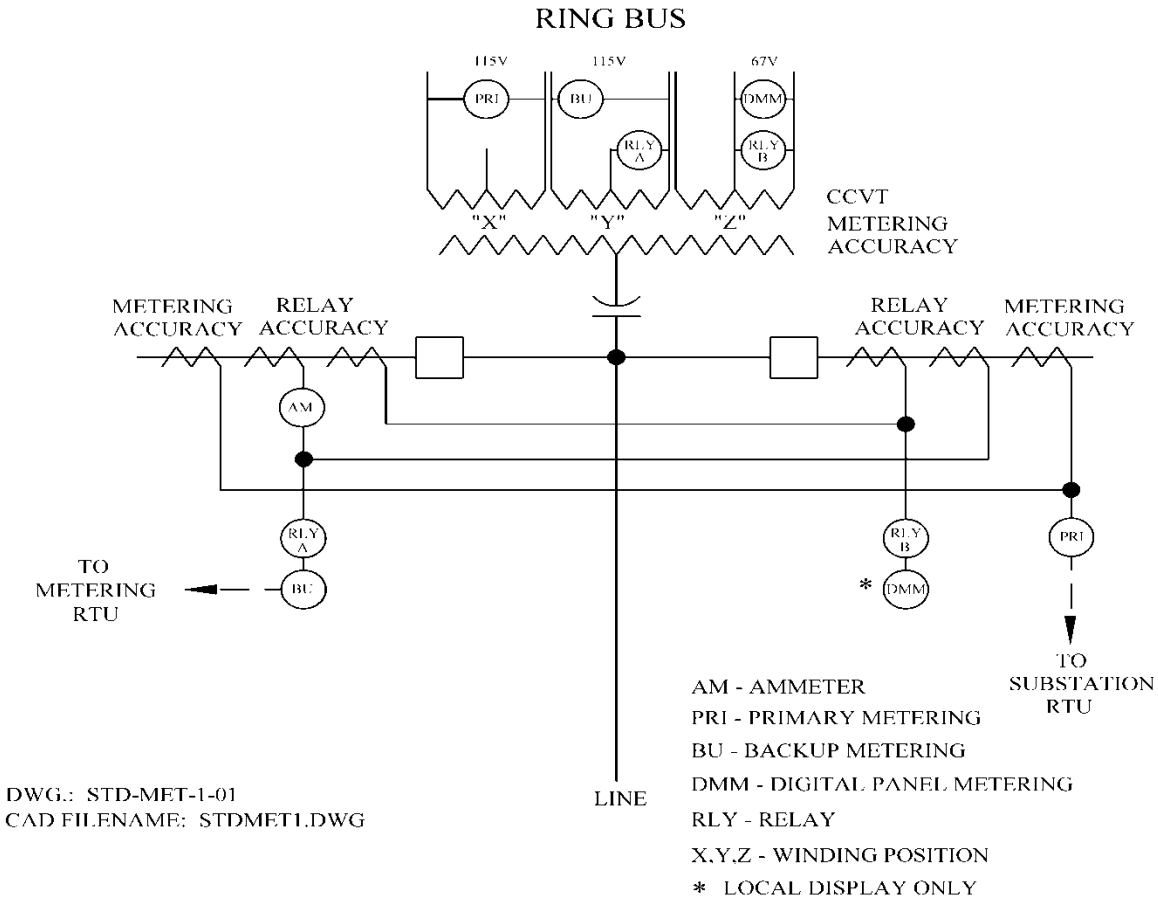

Figure 1. Primary & Backup Interconnection Metering Diagram for Ring Bus

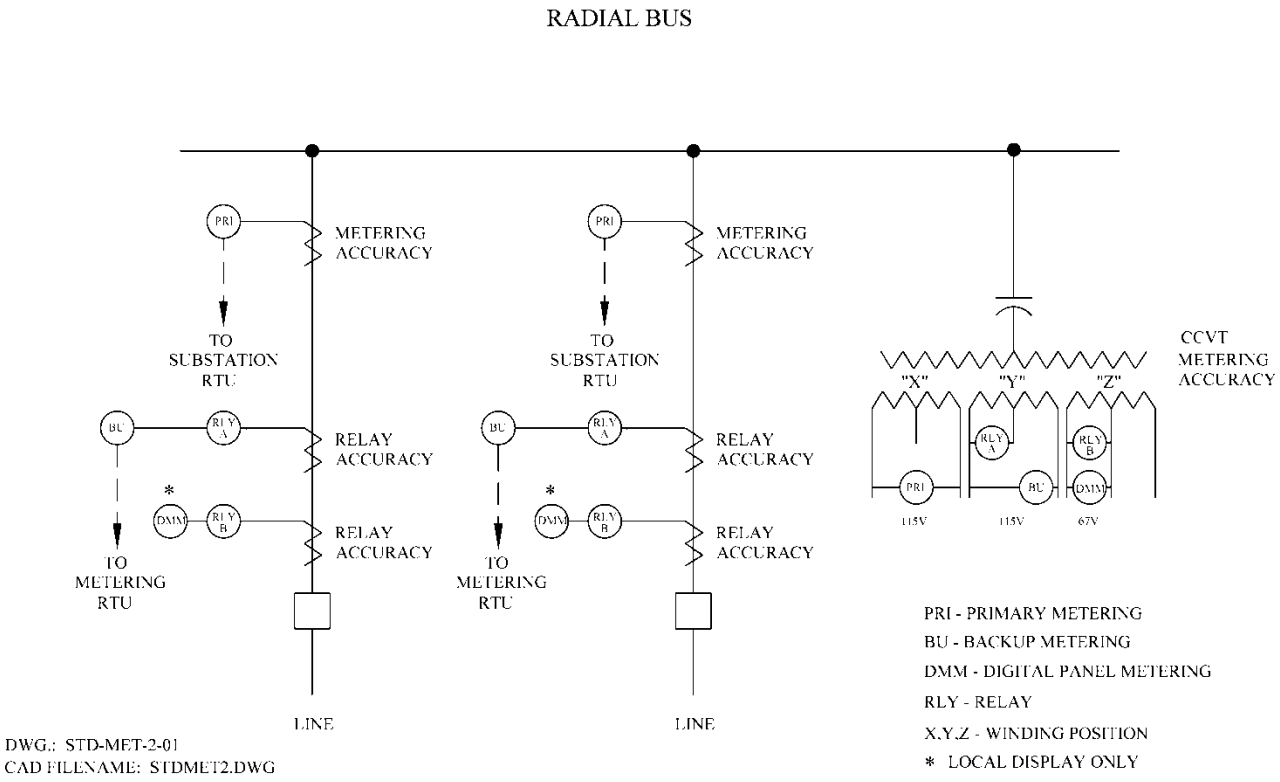

Figure 2. Primary & Backup Interconnection Metering Diagram for Radial Bus