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Connectivity Troubleshooting Guide for Advanced Electricity Meters

September 2025

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U.S. DEPARTMENT of ENERGY

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Executive Summary

This guide is designed to walk users through a troubleshooting process for disconnected advanced electricity meters. The guide centers on two connectivity troubleshooting decision trees related to **power issues** and **network connectivity issues**, respectively.

Experienced users may prefer to navigate directly to the decision trees. However, this guide contains additional background information that can help a user prepare to troubleshoot meter connectivity issues. The guide is organized into the following sections:

- **Definitions** provides a list of terms and definitions for understanding the components of advanced metering infrastructure and interpreting the troubleshooting decision trees.
- **Introduction** orients the user to the decision trees and provides a safety disclaimer for performing work on advanced meters.
- **General Considerations** describes rules to keep in mind while troubleshooting and provides some additional information for specific steps in the decision trees.
- **Pre-Troubleshooting Checklists** are a set of planning tools to help the user prepare to troubleshoot a disconnected meter.
- **Decision Trees** describe step-by-step processes for troubleshooting power and network connectivity issues.
- **Simplified Diagrams** offer a set of simple reference diagrams that illustrate general connectivity concepts referred to in the decision trees.

This guide focuses on advanced electricity meters because currently they are the most frequently deployed type of meter at federal facilities. Further, advanced electricity meters are sometimes used as data interface for other meters on a fieldbus network. Future versions of this guide will include decision trees for other meter types (e.g., water, natural gas, steam), as well as additional background information for those technologies.

Remember that in most cases, restoring connectivity to an advanced meter is a team effort. The process can involve gaining access to the meter location, diagnosing connectivity issue(s), performing electrical work, performing network administration work, accessing an energy information management system to verify the data connection, and above all, performing all work safely. Before you begin the troubleshooting process, ensure that you know whom to call for help—you will need it! (See the Contact List template).

Note: This document provides general recommendations for troubleshooting disconnected meters. Always follow your facility's safety policies and consult the relevant standard operating procedures before proceeding with any troubleshooting steps in this guide. If in doubt about whether you have the authorization or knowledge to safely conduct an action, **do not proceed**. Instead, consult with your manager and the relevant safety personnel about appropriate next steps.

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Definitions

This section provides a list of terms and definitions for understanding the components of advanced metering infrastructure and interpreting the troubleshooting decision trees. **Note:** in this section, images of products are shown as illustrative examples of advanced metering concepts. Reference to a specific commercial product does not necessarily constitute an endorsement.

Advanced electricity meter: A device that records electricity consumption data hourly or more frequently and provides for daily or more frequent transmittal of measurements over a communication network to a central data collection point.[1] (See Figure 1). An advanced electricity meter includes a communications module for transmitting and receiving data over a network using digital signals (e.g., KYZ pulse), fieldbus protocols (e.g., Modbus RTU), or TCP/IP. Further discussion of advanced meters is provided in the *Federal Metering Guidance.*[2]

Figure 1. Illustration of an advanced electricity meter.[3]

Advanced metering infrastructure (AMI): An integrated network of advanced meters, communications networks, and data management systems.

Building automation/control system (BAS/BCS): A computerized system that allows automated access, monitoring, and control of all connected building systems from a single interface.[4] The typical control system network architecture consists of several levels: management-level, building- or system-level, and field-level controllers, as illustrated in Figure 2.[5] Advanced electricity meters may or may not be integrated with the building control system. Advanced electricity meters are often connected to a building-level controller that interfaces with the building control system via the local IP network.

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[1] 42 U.S. Code § 8253(e)—Metering of energy and water use.

[2] U.S. Department of Energy. 2022. *Federal Metering Guidance*. https://www.energy.gov/sites/default/files/2022-10/federal-metering-guidance-2022.pdf

[3] Electro Industries/Gauge Tech. 2025. "Power Meter and Energy Meter." https://www.electroind.com/products/shark-200-power-and-energy-meter/

[4] Schneider Electric. 2025. "Building Automation & Control Systems." https://www.se.com/us/en/work/products/building-automation-and-control/

[5] National Institute of Building Sciences. 2025. "Smart Controls". Whole Building Design Guide. https://www.wbdg.org/resources/smart-controls

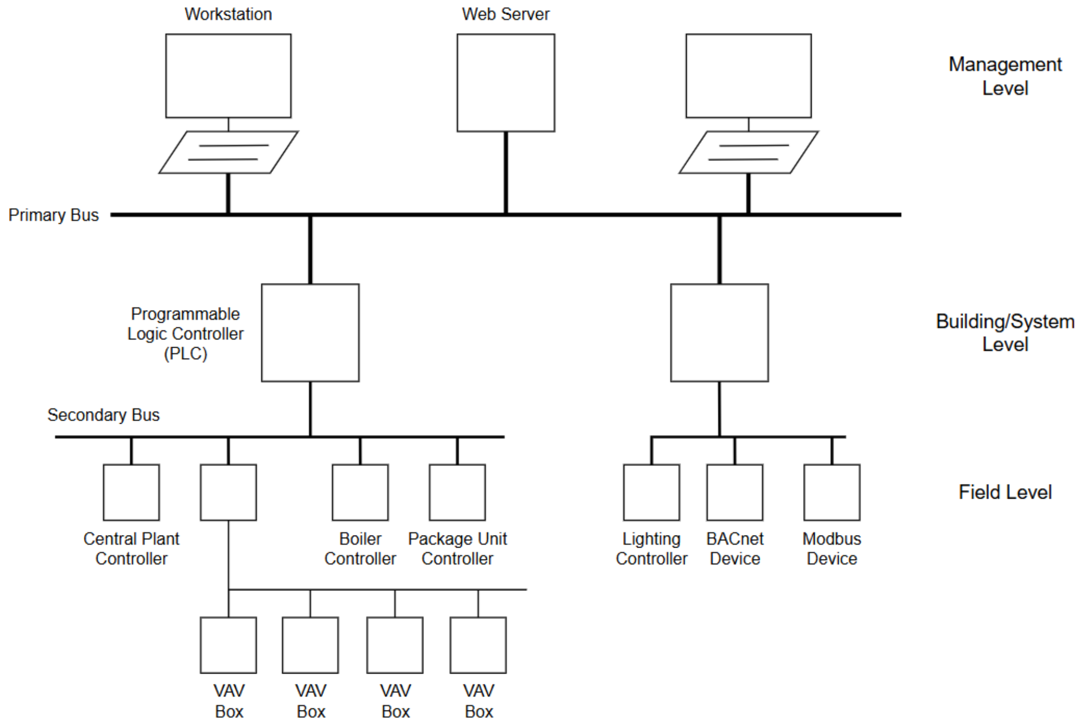

Figure 2. Conceptual architecture of a building automation network with controllers.[6]

Cable: An insulated wire or wires having a protective casing and used for transmitting electricity or telecommunication signals. An advanced electricity meter has various ports for connecting cables that transmit power and telecommunication signals. (See Figure 3). Depending on the port, the cable may be terminated with a standard connector (e.g., an RJ45 connector for Cat6 Ethernet cabling) or a terminal block (e.g., RS485 screw terminal block).

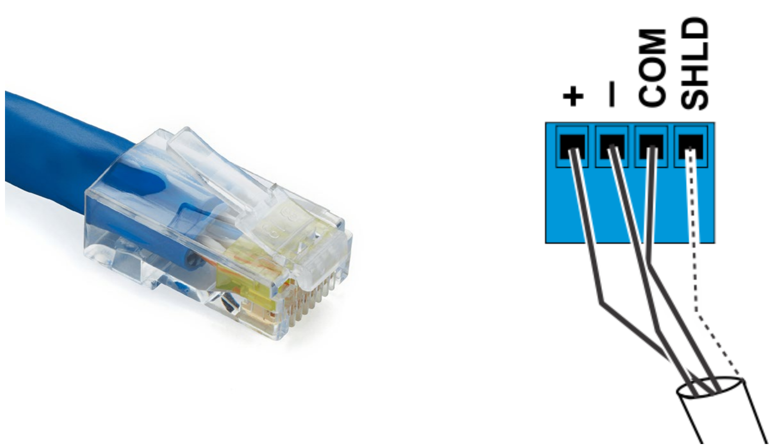

Figure 3. Illustrations of a Cat6 cable with RJ45 connector (left) and an RS485 cable terminal block (right).[7]

[6] Derived from: Kuruganti, Teja and Michael Brambley. 2014. "From the Information and Communications Technology Perspective." Buildings-to-Grid Technical Opportunities series. https://www.energy.gov/sites/prod/files/2014/03/f14/B2G_Tech_Opps--Info_Comm_Tech_Perspective.pdf
[7] Johnson Controls. 2012. "Modbus Gateway Installation Instructions." Document revision: C. https://docs.johnsoncontrols.com/bas/r/BCPro/en-US/Modbus-Gateway-Installation-Instructions/C

Communication port: A physical or logical endpoint for the exchange of information between a computer and another device.[8]

- **Physical port:** A physical interface on a piece of hardware. This includes physical connectors like a USB port, an Ethernet (LAN) port, or a RS-485 serial COM port. (See physical port examples in Figure 4). A physical port corresponds to the Physical layer of the OSI model.
- **Logical port:** A logical, numbered endpoint within an operating system. In the context of TCP/IP networking, when data arrives at a computer's IP address the port number tells the operating system which application to deliver the data to (e.g., HTTP to port 80, HTTPS to port 443).

Figure 4. Illustration of physical communication ports on an advanced electricity meter.[9]

Conduit: A protective tubing or channel used to route and safeguard electrical wiring within a building or structure.

Controller: A small, purpose-built computing device with input and output ports that is capable of automatically controlling other devices within a building. (See Figure 5). Also see Building control system.

[8] Matsusada. 2025. "Technical Terms: Communication port." https://www.matsusada.com/support/terms/remote/communication-port.html
[9] Electro Industries/Gauge Tech. 2025. "Nexus 1450." https://www.electroind.com/products/nexus-1450-cyber-secure-power-quality-meter-with-multiport-communication/

Figure 5. Example of a building-level controller.[10]

Device address: The unique identifier assigned to a device on a network. Depending on the network configuration, the term "address" could refer to a device's Media Access Control (MAC) address, Modbus address, IP address, etc. An IP-networked meter will have a unique IP address for sending and receiving data; non-IP meters may be networked using other communications protocols (e.g., Modbus RTU) and use a different addressing scheme. (See Figure 6 below).

- **Internet Protocol (IP) address:** A unique string of characters that identifies each computer using the Internet Protocol to communicate over a network. There are two versions of IP addresses: IPv4 and IPv6. IPv4 addresses are 32-bit numbers, e.g., 127.0.0.1 (localhost); IPv6 addresses are 128-bit numbers.

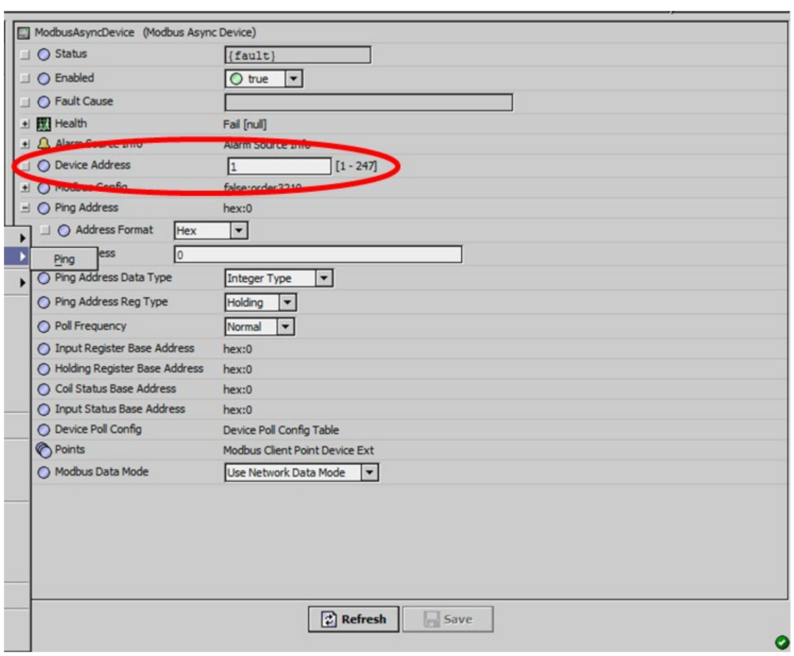

Figure 6. Example Modbus device configuration with address.

Electrical panel: In this guide, the term "electrical panel" refers to a component of an electrical distribution system that divides an electrical power feed into branch circuits and provides

[10] Tridium. 2025. "JACE 9000 Controller." https://www.tridium.com/us/en/Products/niagara/jace

overcurrent protection to those circuits. (See Figure 7). Advanced electricity meters are often installed at the electrical panel to measure whole-building or circuit-level power consumption. More specific terms for these components are differentiated by their maximum incoming current rating:

- **Panelboard:** A panelboard is limited to a maximum of 1,200 A incoming current. Panelboards are designed to meet UL 67 and NEMA Standard PB1.
- **Switchboard:** Switchboards can accommodate up to 6000 A bussing and overcurrent protective devices up to 5000 A. Switchboards are designed to meet UL 891. They are uncommon in residential buildings.

Figure 7. Example panelboard (left) and switchboard (right).[11]

Enclosure: A cabinet or box that protects electrical or electronic equipment and prevents electrical shock. Enclosures are usually made from rigid plastics or such metals as steel, stainless steel, or aluminum. Enclosures are rated to designate protection against hazardous, non-hazardous, and other specific environmental conditions.[12] An electrical panel is a type of enclosure; advanced electricity meters are typically housed within the panel or in a separate enclosure.

Energy management information system (EMIS): A broad family of tools and services used to manage commercial building energy use. These technologies include energy information systems, fault detection and diagnostic systems, benchmarking and utility bill tracking tools, automated system optimization tools, and building automation systems.[13] In this guide, the term "EMIS" refers to any system to which an advanced electricity meter reports data. (See Figure 8 for an example EMIS user interface).

[11] Eaton. 2025. "Panelboards: fundamentals of electrical panelboards." https://www.eaton.com/us/en-us/products/low-voltage-power-distribution-control-systems/panelboards/panelboard-vs--loadcenter---eaton.html

[12] National Electrical Manufacturers Association. 2025. "Enclosures." https://www.nema.org/membership/products/view/enclosures

[13] U.S. Department of Energy. 2025. "Energy Management Information Systems for Federal Facilities." https://www.energy.gov/femp/energy-management-information-systems-federal-facilities

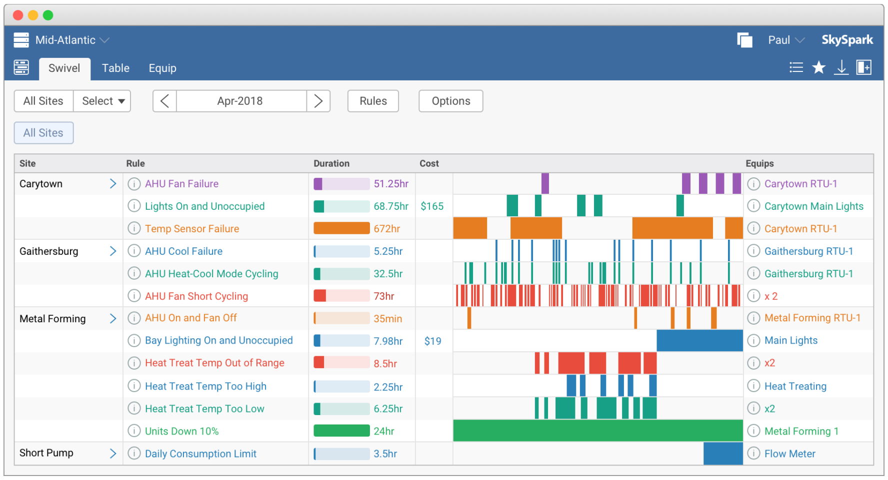

Figure 8. Example of an EMIS fault detection dashboard.[14]

Fieldbus: A digital communication network used for real-time distributed control. Fieldbus profiles are standardized by the International Electrotechnical Commission (IEC) as IEC 61784/61158.[15] Common fieldbus protocols in building automation include Modbus, LonWorks, and BACnet. The terms "fieldbus" and "operational technology (OT)" are closely related concepts dealing with the control of physical systems, where fieldbus refers to the type of network over which OT devices traditionally communicate.

Information technology (IT): Systems or equipment that manage and process information. This emphasis on information distinguishes IT from operational technology (OT), which is technology that interacts with the physical environment. IT networks and the Internet run on the Internet Protocol Suite, commonly known as TCP/IP.

Internet Protocol Suite (TCP/IP): The Internet protocol suite, commonly known as TCP/IP, is a framework for organizing the communication protocols used in the Internet and IT networks according to functional criteria. (Figure 11 presents the Internet Protocol Suite in relation to the OSI model.)

Light-emitting diode (LED): A semiconductor diode which glows when a voltage is applied. These status-indicating lights are commonly located on the outside of advanced electricity meters and indicate power and network connectivity status. They are important indicators of potential connectivity issues.

Local area network (LAN): A computer network that connects devices within a limited area, such as a home, office, or building. (See Figure 9). Ethernet and Wi-Fi are the two most common technologies used for connecting local area networks, the latter of which enables wireless local area networking (wLAN). In building automation, fieldbus networks are common for networking automation devices and controllers. Sometimes devices may be physically distributed but logically connected via a virtual local area network, or VLAN (see definition).

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[14] SkyFoundry. 2025. "SkySpark." https://skyfoundry.com/

[15] International Electrotechnical Commission. 2023. IEC 61158-1. "Industrial communication networks - Fieldbus specifications - Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series." https://webstore.iec.ch/en/publication/66931

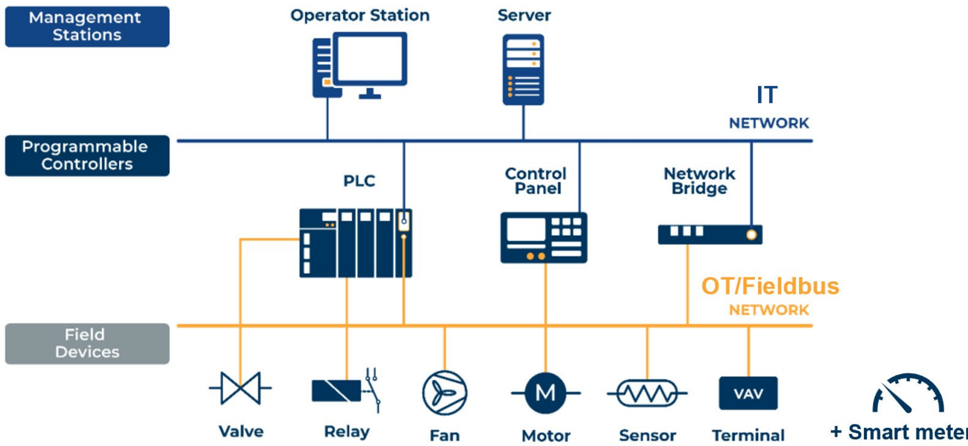

Figure 9. Example of LAN with bridge devices connecting OT/fieldbus and IT networks.[16]

Mechanical room: A mechanical room is a dedicated space within a building that houses various mechanical and electrical equipment crucial for the building's operation. This equipment typically includes systems for heating, ventilation, air conditioning (HVAC), electrical distribution, fire protection, and other essential building services. advanced electricity meters are often co-located with the electrical distribution equipment inside of a mechanical room.

Media Access Control (MAC) Address: A unique identifier assigned to a network interface controller (NIC) for communication on a network. A device's MAC address makes the device accessible using a specific Physical layer and Data-Link layer protocol such as Ethernet or Wi-Fi.

Multimeter: A measuring instrument that can measure multiple electrical properties. A typical multimeter can measure voltage, resistance, and current. They are used in diagnostic operations to test the proper function of an electrical circuit. (See Figure 10).

Figure 10. Example of a multimeter.[17]

[16] Derived from: New York State Energy Research and Development Authority. 2025. "A Primer for Building Automation." https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/RTEM/resources-Part-4.pdf
[17] Fluke. 2025. "What's a Voltmeter?" https://www.fluke.com/en-us/learn/blog/digital-multimeters/what-is-a-voltmeter

Network Interface Controller (NIC): A computer hardware component that connects a computer to a computer network using a specific Physical layer and Data-Link layer protocol such as Ethernet or Wi-Fi. An advanced electricity meter with an IP address will include a NIC as part of its communications module.

Open Systems Interconnection (OSI) Model: A conceptual framework that standardizes how different computer systems communicate over a network.[18] It divides the communication process into seven layers, each with specific functions, to ensure interoperability between various devices and technologies. The layers, from lowest to highest, are Physical, Data-Link, Network, Transport, Session, Presentation, and Application. Figure 11 presents TCP/IP and Modbus protocol layers in relation to the OSI model.

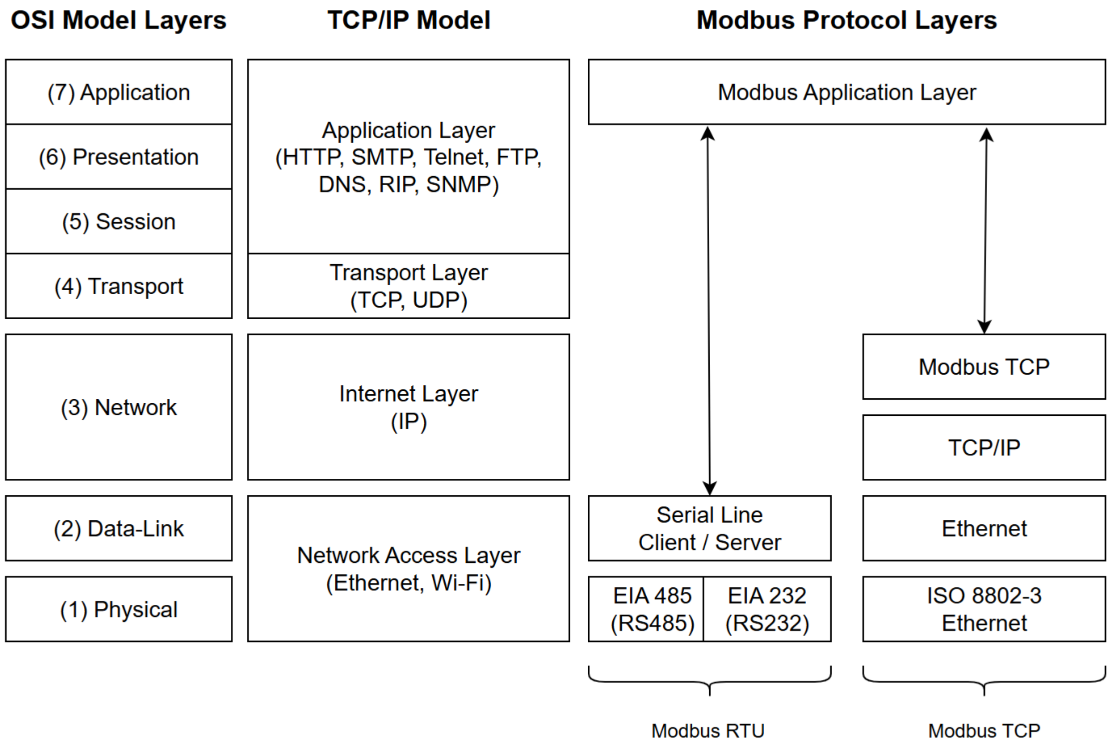

Figure 11. TCIP/IP, Modbus RTU and Modbus TCP protocol stacks relative to the OSI model.[19]

[18] International Organization for Standardization. 2025. ISO 35.100. "Open Systems Interconnection (OSI)." https://www.iso.org/ics/35.100/x/

[19] Derived from: Chipkin. 2025. "Modbus Stack: A tested Modbus Protocol Library for embedded systems." https://store.chipkin.com/services/stacks/modbus-stack

Operational technology (OT): Programmable systems or devices that interact with the physical environment or manage devices that interact with the physical environment. These systems/devices detect or cause a direct change through the monitoring and/or control of devices, processes, and events. Examples include building control systems, fire control systems, and physical access control mechanisms.[20] Historically, OT protocols were often proprietary and developed separately from the TCP/IP Internet Protocol Suite, the framework for modern IT networks and the Internet. Recently, however, OT and IT networks are becoming more integrated, which has expanded the accessibility and interoperability of OT devices but has created new cybersecurity challenges as well. (See Figure 12).

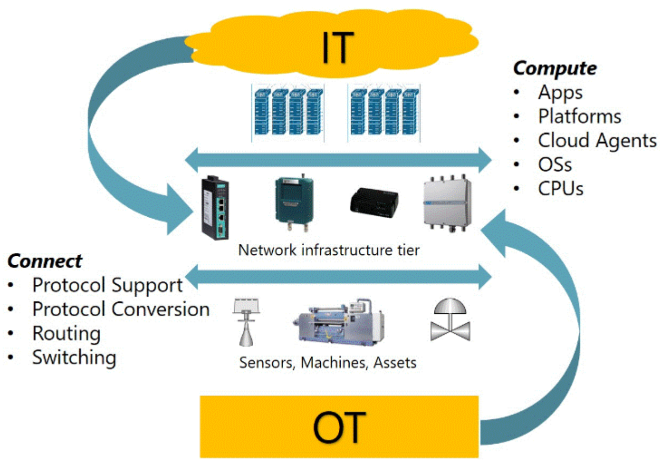

Figure 12. OT and IT convergence.[21]

Power-cycling: A troubleshooting method that involves turning a device off, disconnecting it from its power source, waiting, and then turning it back on.

Power over Ethernet (PoE): A technique for delivering DC power to devices over copper Ethernet cabling, eliminating the need for separate power supplies and outlets.[22]

Protocol: A standardized set of rules that determine how devices communicate on a network. Examples of protocols include the Internet Protocol (part of TCP/IP) and hypertext transfer protocol (HTTP).

Protocol gateway: A device that enables communication between systems using different network protocols. For example, a controller that acts as a protocol gateway could allow OT devices on a Modbus RTU network to communicate with computers on a TCP/IP network. A protocol gateway is also referred to as a protocol translator or protocol converter.

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[20] National Institute of Standards and Technology. 2025. Computer Security Resource Center Glossary. https://csrc.nist.gov/glossary
[21] ARC Advisory Group. 2018. "What is ITOT Convergence?" https://www.arcweb.com/blog/what-itot-convergence
[22] Cisco. 2025. "What is Power over Ethernet (PoE)?" https://www.cisco.com/site/us/en/learn/topics/networking/what-is-power-over-ethernet.html

Serial communication: A method of data transfer where bits are sent one at a time over a single wire or channel. Networked devices typically communicate using serial communication protocols. In discussions about building automation, it is common to hear certain terms for serial communication protocols such as “RS485”, “Modbus”, or “TCP/IP”; however, it is important to understand that these terms refer to layers within a “protocol stack” (see OSI Model definition), which collectively define how devices talk to each other.

- *Note:* sometimes the terms “serial network” or “serial comms” are used to distinguish fieldbus-based OT networks from TCP/IP-based IT networks, despite the fact the latter protocol stack also implements a form of serial communication.

Standard operating procedure (SOP): A set of step-by-step instructions compiled by an organization to help workers carry out routine operations.

Subnet: A logical subdivision of an IP network. Subnets are defined at OSI level 3 (Network Layer) to group devices using IP addresses. (See Figure 13). They are distinct but often mapped one-to-one with VLAN groupings, which are made at OSI level 2 (Data-Link Layer).

TCP/IP: see Internet Protocol Suite.

Virtual local area network (VLAN): A logical subdivision of a local area network. A VLAN allows network administrators to segment a larger, physically-connected network into multiple smaller networks on logically separated broadcast domains. VLANs are defined at OSI level 2 (Data-Link Layer) to group devices using MAC addresses. (See Figure 13). They are distinct but often mapped one-to-one with subnet groupings, which are made at OSI level 3 (Network Layer).

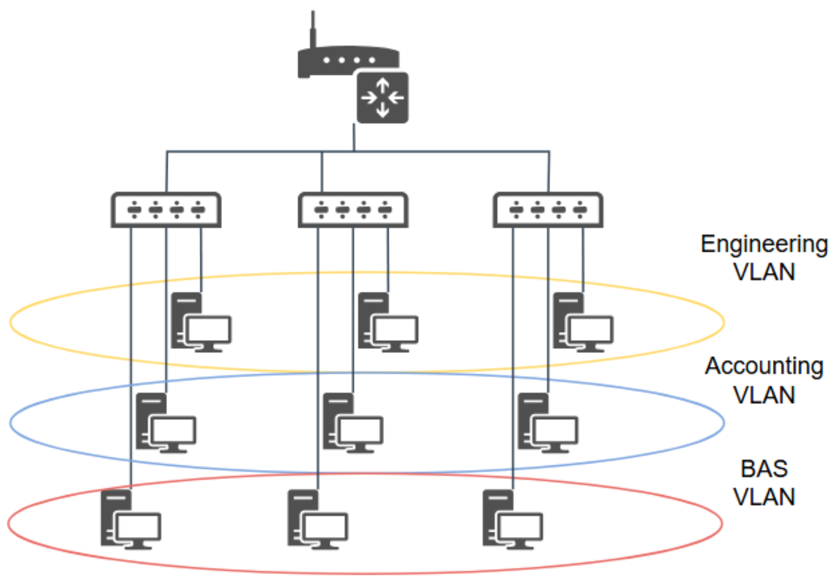


Figure 13. Simplified diagram of multiple VLANs on a larger physical network. Lines indicate physical connections and ovals indicate logical groupings.

Introduction

This document presents two decision trees that outline potential troubleshooting steps to take if an advanced electricity meter appears to be disconnected from the local area network (LAN). The first decision tree covers **power issues** and the second tree covers **network connectivity issues**. The decision trees assume that the meter location is known and that the user has the appropriate authorization to access and perform basic testing and servicing on the meter. The trees indicate steps where it may be necessary to call an authorized electrician or IT network administrator for further assistance.

Note: This document provides general recommendations for troubleshooting disconnected meters. Always follow your facility's safety policies and consult the relevant standard operating procedures (SOP) before proceeding with any troubleshooting steps in this guide. If in doubt about whether you have the authorization or knowledge to safely conduct an action, **do not proceed**. Instead, consult with your manager and the relevant safety personnel about appropriate next steps.

General Considerations

Locating the Electricity Meter

Generally, electricity meters are located near or inside of the main electrical panel in the mechanical room of a building. (See an example in Figure 14). Meters external to the panel are typically mounted adjacent to the panel with conduit connecting them. A meter located inside of the panel may require a scheduled power shutoff to access and perform diagnostics. Consult your facility's safety SOP on how to proceed before opening any electrical panel.

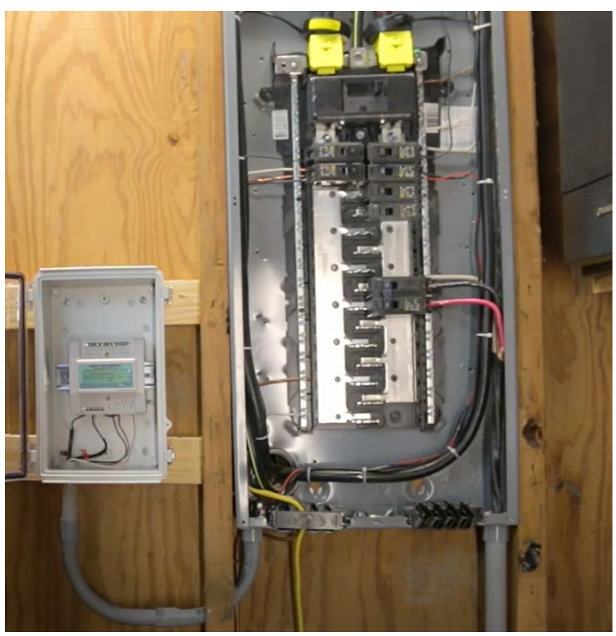


Figure 14. Advanced electricity meter co-located with a panelboard in a mechanical room.[23]

[23] Image captured from: Appalachian DIY. 2022. "EKM Omnimeter v.4 Install for Utility Sub-Metering." YouTube. https://youtu.be/ZRSLSxLwMqI?si=Gg7AwUuxnQG6g5VN

Testing

Power source testing: If a power source was previously unplugged or is suspected to be faulty, test the power source with a multimeter before reconnecting the meter to power. The power source should perform within acceptable limits (e.g., +/-5% 120V on standard outlet). Consult your facility's electrical safety SOP and do not perform any unauthorized electrical work.

Controller port testing: If a communications port on a controller is suspected to be faulty, connect a second, properly operating meter to test the port. If the properly operating meter can connect to the controller, then the issue is likely with the initial disconnected meter. A laptop running a terminal emulator such as PuTTY[24] can also be connected to the port to test its functionality. If the device is powered by the same port as the port from which it receives data, like with power over Ethernet (PoE), test the port with a multimeter before reconnecting any devices (see Power source testing above).

Checking for Power to the Meter

The first step after locating the problematic meter is to check for power to the meter. If it can be physically accessed, look for blinking or solid LEDs or a backlight to the display (if the meter has one). If your meter appears to be powered on, but is disconnected from the LAN, see page 1 of the Network Troubleshooting Decision Tree. If it can be done without unplugging the meter itself, attempt to power-cycle the device. You may need to consult the manufacturer documentation for your meter to find out how to do this properly. If the meter shows no signs of power, see the Power Troubleshooting Decision Tree. If the meter does appear to be powered on, but remains disconnected from the LAN, refer to page 1 of the Network Troubleshooting Decision Tree.

Checking for Power to a Controller

When checking for power to a controller, look for blinking or solid LEDs or a backlight to the display (if available). Power to the controller can also be checked by determining whether other devices connected to the controller are functioning correctly. If the controller is not powered on, first determine how it is connected to power, e.g., via a standard 120V outlet or a direct connection to the electrical panel. (See Figure 15). Look for frayed, loose, or incomplete connections. If the controller is powered directly by the panel, an authorized electrician may be required to proceed. Once the fault has been identified, follow your facility's electrical safety SOP to safely restore power to the controller.

Troubleshooting Connectivity on a Controller

If the controller is powered on but not connected, check to see if there are multiple devices connected to the controller. If so, verify whether they are accessible in the facility's energy management information system (EMIS). If they are not, then the issue is with the controller

[24] Tatham, Simon. 2025. "PuTTY: a free SSH and Telnet client." https://www.chiark.greenend.org.uk/~sgtatham/putty/

itself. If the controller is connected to the EMIS via an IP-based network, ensure that the controller's IP address matches the address assigned to it in the EMIS. If it is connected via a non-IP serial-based protocol, check that your controller's baud rate and address match with what is displayed for it in the EMIS. If the controller connects to the EMIS through an IP or ethernet-based protocol, it may be necessary to contact your IT department to ensure that no configuration changes have been made which might impact the controller's ability to access the network. It may also be necessary to test the cable by which your controller connects to the broader network.

If there are issues with only one or a few devices connected, test the ports into which the problematic devices are connected. If the ports are functioning correctly, this is likely an issue with the connected devices or the method by which they connect to the controller.

Connectivity Issues beyond the Controller

Connection issues can also be caused by factors outside the scope of the controller and meter. If the controller connects to your building EMIS through an IP-based network such as through a wireless local area network (wLAN), you may need to check with your IT department to make sure that network settings have not changed. Moreover, if your controller connects via Ethernet, a MAC address-based protocol, reconfigurations or issues with network switches can cause meters and controllers to go offline. If this is suspected, contact your IT department or submit a ticket regarding physical network issues. Due to the static nature of MAC addresses, address mapping issues are far less common in Ethernet-based networks. In some cases, if your controller connects to the EMIS through any form of cable such as RS485 twisted pair or Ethernet Cat6, the cable itself can be damaged or non-functional. Visually inspect the cable and look for any frays or loose connections. If none are found, it may be necessary to follow your facility's standard operating procedure for cable testing to test the functionality of the cable.

Pre-Troubleshooting Checklists

Consult these checklists before leaving to troubleshoot the meter.

Contact List

Role	Name	Official Title	Organization	E-mail Address	Phone Number
Your Manager					
Facility Owner/Manager					
Facility Energy/Water Manager					
Authorized Electrician					
IT Administrator					
EMIS Administrator					
Occupational Safety and Health Representative					
Site Point of Contact					

Questionnaire

Answer the following questions to determine whether you have the information and authorization necessary to troubleshoot the meter.

1. Meter location:
    a. What building/structure is the meter located in, on, or nearest to?
    b. If the meter is located inside of a building, what room is it located in? Meters located in a building are usually found inside of a mechanical room.
    c. Can you describe the specific location of the meter? Include details such as the orientation of the wall/post on which the meter is mounted, the electrical panel ID with which the meter is associated, whether the meter is in a separate enclosure or mounted within the panel itself, the approximate height of the meter, and helpful identifying visual details—include photos if available.
    d. Are any special tools needed to access the meter? For example, keys, proximity access cards, or alphanumeric codes are typically required to access mechanical rooms and enclosures. If the meter is located high up in an electrical panel, a ladder may be required for safe access.
2. Travel planning:
    a. How will you travel to the meter location?
    b. If the meter is located at a remote site, does your organization require you to obtain pre-travel authorization?
        i. Book any necessary flights, rental cars, and accommodations before you travel.
            1. If you are flying, consider whether any travel restrictions apply to items on your checklist. For example, a screwdriver longer than seven inches must be checked; bear spray is not allowed. (See

the Transportation Security Administration's What Can I Bring? web page for additional information.)[25]

   ii. If necessary, do you have a point of contact who will meet you at the travel destination?

  c. Where will you obtain the tools to troubleshoot the meter? When reviewing the Tool Checklist below, note whether you will obtain the tool from home, your office, or the meter location.

3. Authorization, training, and tools:
    a. If the meter is located in a mechanical room, do you have authorization and tools necessary to enter the room? If not, contact the responsible facility owner/manager.
    b. Do you have the authorization, training, and tools necessary to open the meter enclosure? If not, contact an authorized electrician at the facility to assist you.
    c. Do you have authorization, training, and tools necessary to open an electrical panel and perform electrical work? If not, contact an authorized electrician at the facility to assist you.
    d. Do you have authorization, training, and tools necessary to open a server rack/cabinet and reconfigure network connections? If not, contact the responsible IT administrator at the facility to assist you.
    e. Do you have access credentials to log into the meter and the EMIS front-end client software? If not, contact the EMIS administrator.
    f. Have you received the necessary safety training to perform other tasks related to meter troubleshooting? (E.g., ladder safety training). If not, contact your facility/organization's occupational safety and health representative.
4. Connectivity:
    a. Will you need to use a network-connected device while troubleshooting the meter? If so, will one or more of the following options be available?
        i. Ethernet
        ii. Wi-Fi
        iii. Cellular connection
        iv. Satellite connection
    b. Do you have authorization to take the network-connected device with you to the meter location? Personal devices may not be allowed in some spaces.
5. Personal safety:
    a. Is any personal protective equipment (PPE) required at the meter location? E.g., safety boots for a boiler plant or warehouse; hard hat, safety glasses, high-visibility vest for a construction site.
    b. What will the weather be like when you visit the meter location? Dress appropriately, particularly if the work must be conducted outdoors. Consider whether conditions may be icy, rainy, or hot.
    c. Are there any animal dangers at the meter location? Review relevant safety precautions for potential interactions with insects and wild animals (e.g., mosquitoes, ticks, wasps, bears).

[25] U.S. Transportation Security Administration. 2025. "What Can I Bring?" https://www.tsa.gov/travel/security-screening/whatcanibring/all

Tool Checklist

Refer to the following checklist to ensure that you have the necessary tools.

Tool	Category	Required / Optional	Notes
Bag/backpack	1. General	Required	
Clipboard/notepad	1. General	Required	
Pen	1. General	Required	
Screwdriver	1. General	Required	Ideally, bring a multi-bit screwdriver to accommodate various screw types and sizes.
ID badge	1. General	Required	Bring ID badge and any other necessary credentials.
Keys, proximity access cards	1. General	Required	
Flashlight/headlamp	1. General	Optional	Bring if working outdoors during dark hours or if the mechanical room is poorly lit.
Tool belt/apron	1. General	Optional	
PPE	2. Safety	Required	Personal protective equipment may include hard hats, safety glasses, ear protection, respirators, gloves, protective clothing, and safety boots. Check PPE requirements at the meter location.
Work gloves	2. Safety	Required	
Insect repellant	2. Safety	Optional	I.e., bug spray.
Rain gear	2. Safety	Optional	
Sun hat	2. Safety	Optional	
Sunscreen	2. Safety	Optional	
Ladder/step ladder	2. Safety	Optional	Required if meter is not accessible at ground height.
Camera	3. Electronics	Required	Valuable for documenting images of the meter and its surroundings. Can be a separate device or the built-in camera on a cell phone.
Multimeter	3. Electronics	Required	Ensure that multimeter battery has adequate charge.
Cables	3. Electronics	Optional	Required if using a laptop or other device to connect to and perform diagnostic checks on the meter. Depending on the physical comms ports used by the meter, the controller (if applicable), and the diagnostic laptop/device, various cables may be required
Cell phone	3. Electronics	Optional	
Laptop/diagnostic device	4. Documentation	Optional	Required if connecting directly to the meter to perform diagnostic checks.
Network configuration documentation	4. Documentation	Required	At a minimum, bring documentation of the meter address(es); e.g., Modbus device address, MAC address, IP address.
Passwords, alphanumeric access codes	4. Documentation	Required	
Contact list	4. Documentation	Required	Remember to bring your list of contacts with phone numbers in case you need assistance.
Troubleshooting guide(s)	4. Documentation	Required	Bring instructions to guide you through troubleshooting steps in the field.
Meter documentation	4. Documentation	Optional	Optional but recommended for reference to interpret signals from the meter.
Standard operating procedure(s)	4. Documentation	Optional	For reference if needed.

Meter Inventory Data Checklist

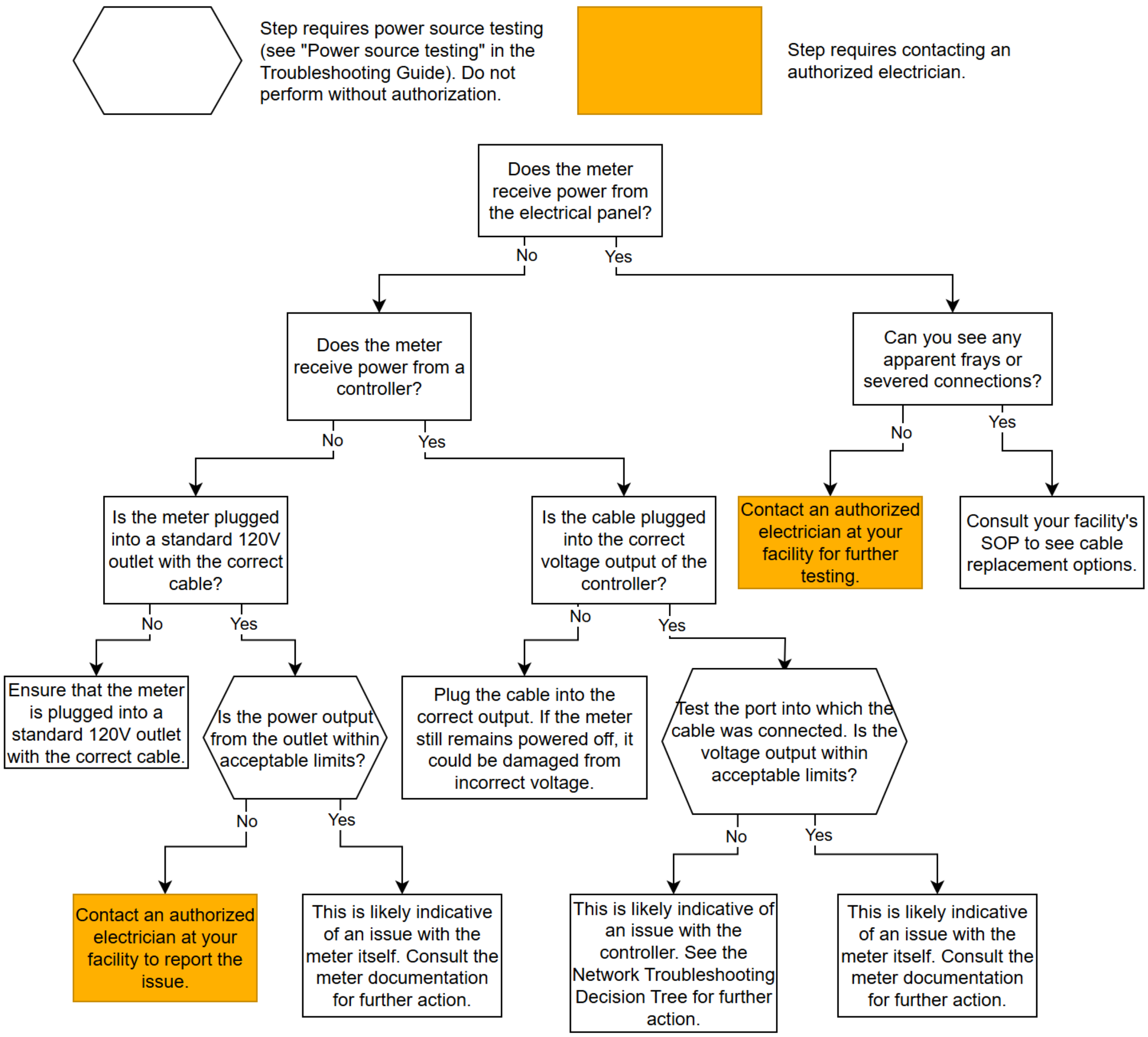
When inspecting a meter in the field, document as much of the following information as possible if it is available and not already recorded in an official meter inventory database. Take photos to supplement this data.

- Meter manufacturer
- Meter model
- Meter serial number
- Date of meter manufacture
- Date of meter installation
- Meter device address(es) (e.g., MAC address, IP address, Modbus device address)
- Meter location
    - Building
    - Room (if applicable)
    - Description
    - Electrical panel ID
    - Circuit ID
- Phase and wiring configuration
- Analog inputs
- Connected communication ports
- Controller ID (if applicable)
- Controller device address(es) (if applicable)
- Brief description of loads metered
- Any information on physical labels affixed to the meter or enclosure
- Photos/videos (or link to directory path):
    - Front entrance of building
    - Hallway(s)
    - Room entrance
    - Meter enclosure on wall/post
        - Include related items included such as electrical panel
    - Meter in enclosure
    - Meter front, sides, back (if accessible)
- Tools needed
- Access permissions required to access facility and meter
- Relevant points of contact
    - Facility
    - Meter location
    - Meter owner (if applicable)
    - Utility account number (if applicable)

Power Troubleshooting Decision Tree

Page 1 of 1

Diagram Key

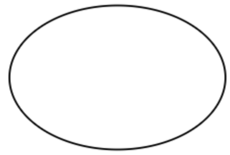


Network Troubleshooting Decision Tree

Page 1 of 3

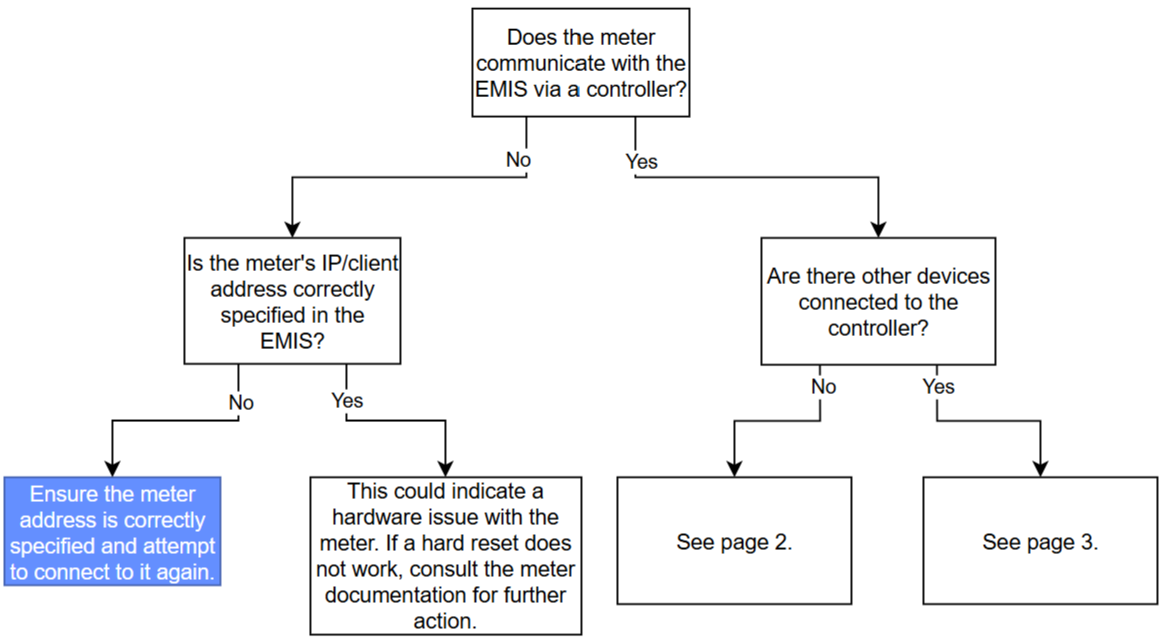
Diagram Key

Step requires testing a cable. Refer to your facility's SOP for cable testing.



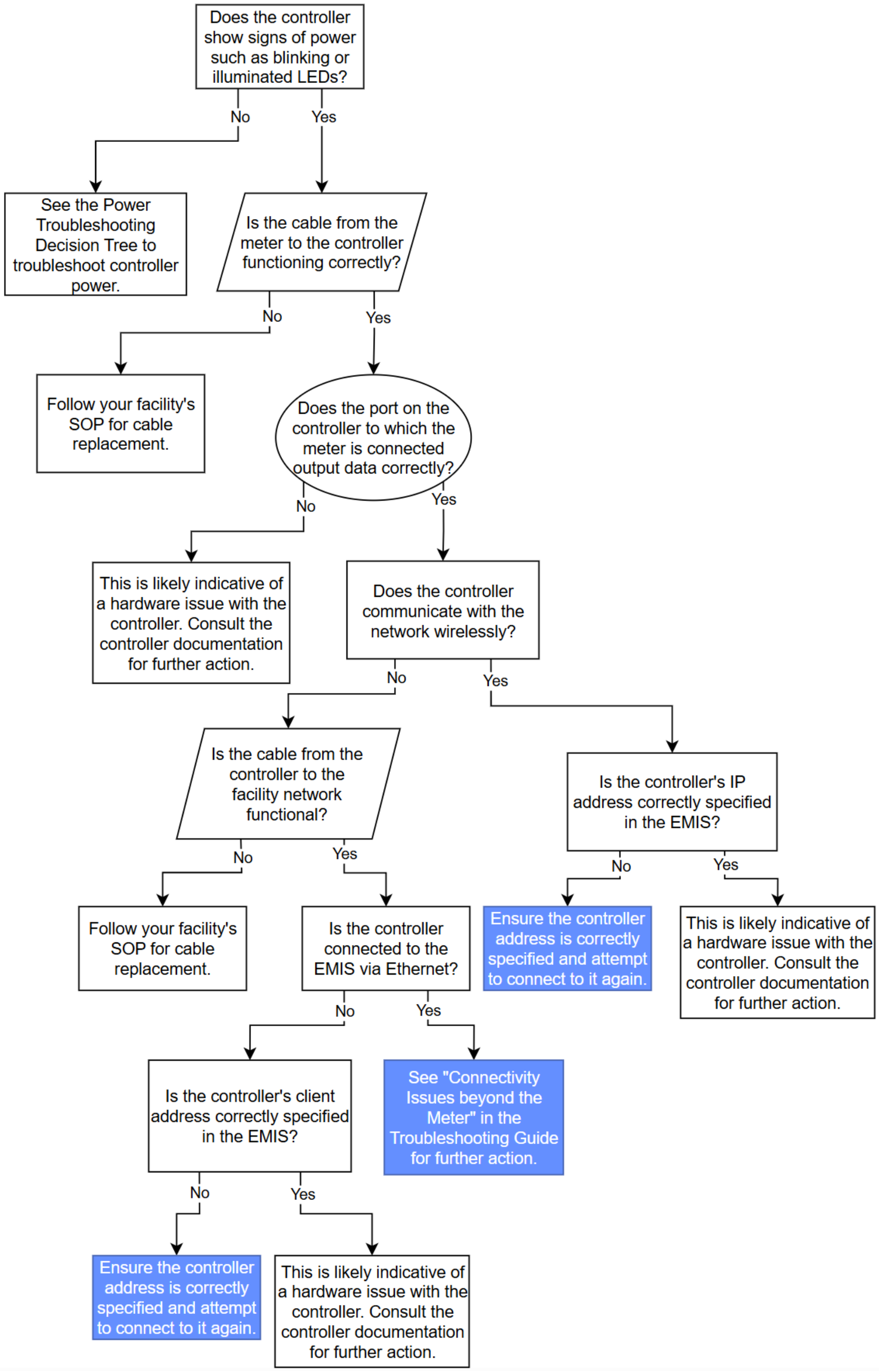
Step requires controller port testing (see "Controller port testing" in the Troubleshooting Guide).

Step may require contacting or submitting a ticket to your IT department.



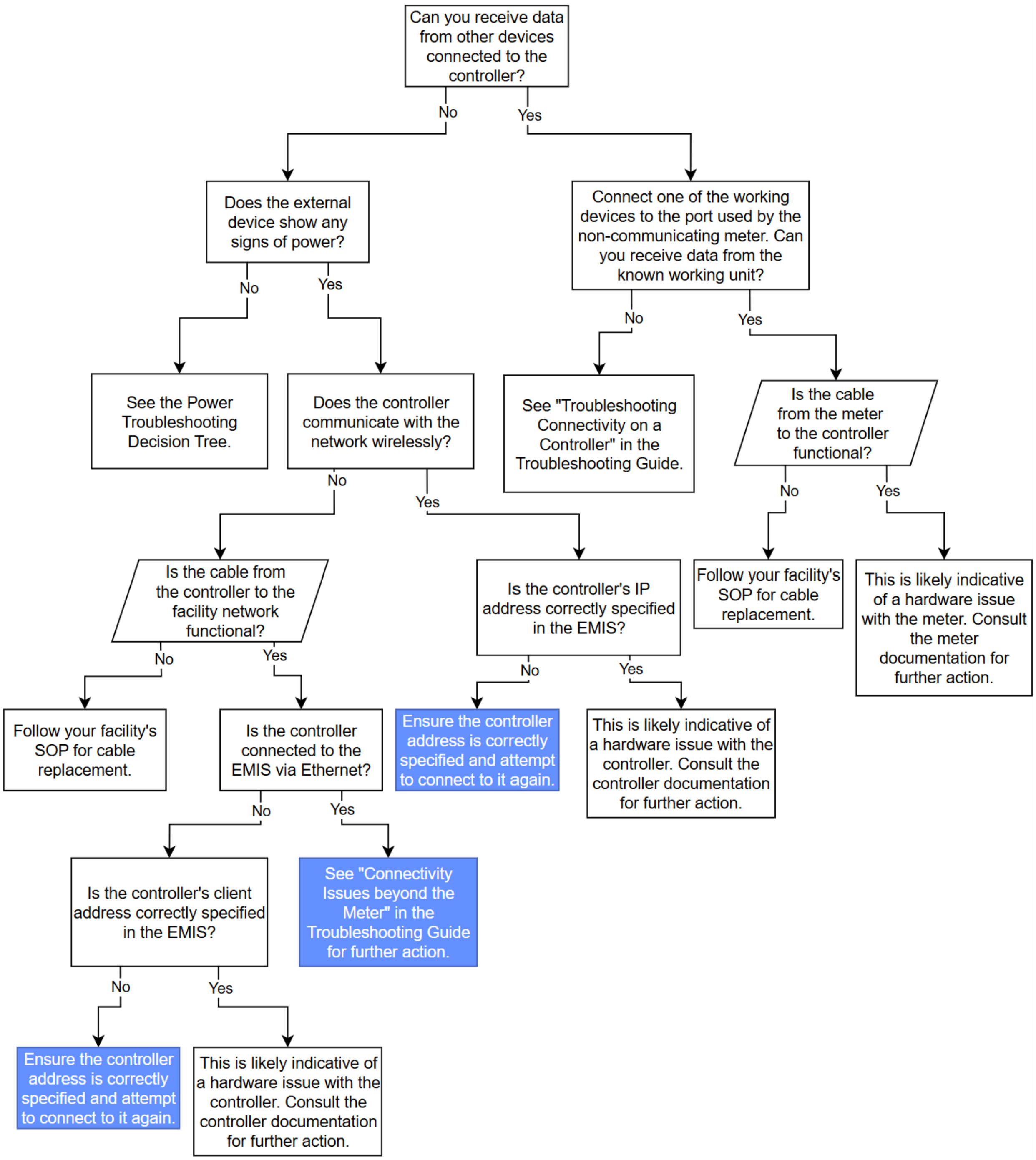
Network Troubleshooting Decision Tree

Page 2 of 3



Network Troubleshooting Decision Tree

Page 3 of 3



Simplified Diagrams

Refer to these simplified power and networking reference diagrams to help interpret the troubleshooting decision trees.

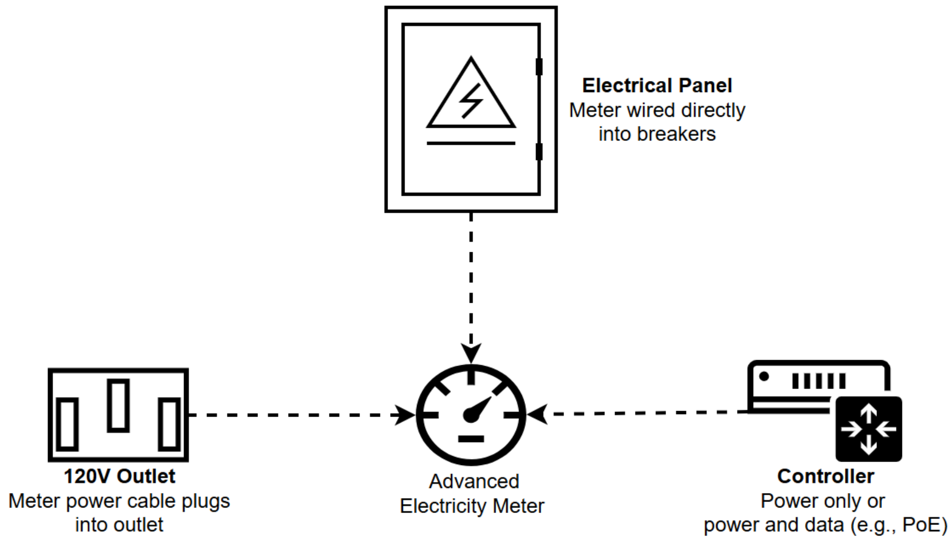


Figure 15. Power supply options for an advanced electricity meter.

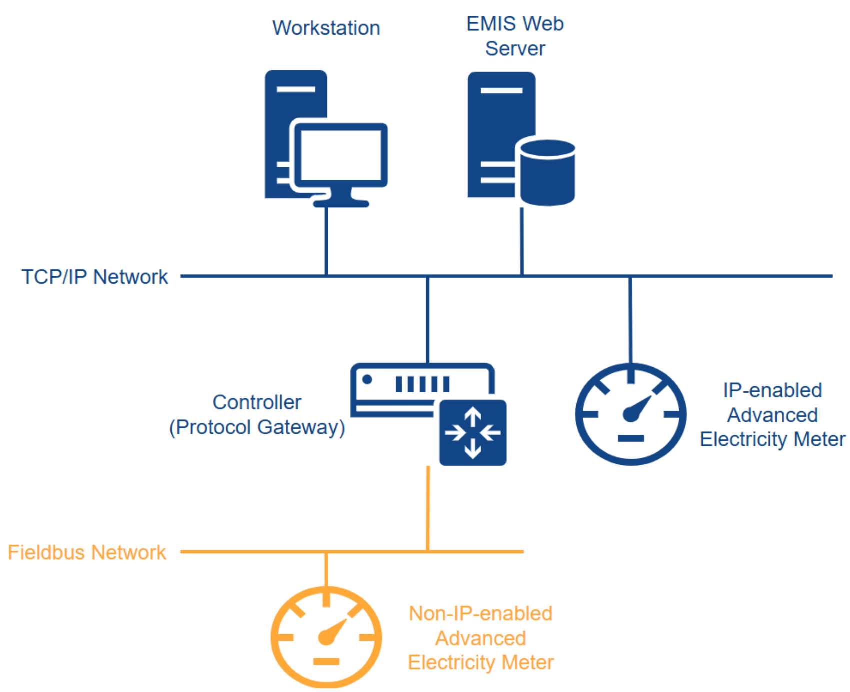


Figure 16. Network connection options for an advanced electricity meter.

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