



PART OF
BEMSIQ
GROUP

OPERATOR'S GUIDE

PowerScout™ **FLEX**

Installation & Wiring

PowerScout™ **FLEX** Meter Series:



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PowerScout™ FLEX Installation & Wiring Guide

TABLE OF CONTENTS

1	Introduction	1
1.1	General Description	1
1.2	Installation & Wiring Operator's Guide Scope	1
1.3	PowerScout FLEX Concepts and Data Structure	2
1.4	Supported Models	3
1.5	What's Included	4
1.6	PowerScout™ FLEX Anatomy	4
2	Safety	6
2.1	Safety Responsibility and Intended Use	6
2.2	Electrical Safety Precautions.....	7
2.3	Meter Safety Requirements.....	7
2.4	Symbols in Documentation	7
2.5	Symbols on Equipment	8
2.6	Compliance and Standards Summary	9
2.7	Maintenance	9
3	Planning.....	10
3.1	Project Coordination	10
3.2	Pre-Installation Checklist.....	11
3.3	Required Tools and Materials.....	11
3.4	Configuration and Viewing Interfaces	12
4	Meter Installation	13
4.1	Meter Mounting Configurations.....	13
4.2	all and Plate Mount Installation	14
4.3	Installation Sequence for PS3FX-R-D-N	15
5	Wiring – Voltage Connections and Service Types.....	16

5.1	Voltage Wiring Safety	16
5.2	Voltage Input Ratings	17
5.3	Voltage Input 1 and Voltage Input 2	18
5.4	Systems Without a Neutral Conductor	18
5.5	Power Meter Requirements	19
5.6	Single-Phase Powering Requirement	19
5.7	Voltage Wiring Sequence	19
5.8	Service Type Overview	22
5.9	Service Wiring Examples	23
5.10	Using Potential Transformers	28
6	Wiring – Current Sensor Installation	29
6.1	Current Sensor Requirements	29
6.2	Installing Current Sensors	31
6.3	Wiring Current Sensors to the Meter	34
6.4	Documenting CT Inputs for FLEXPoint™ Commissioning	38
7	Wiring – Communications Connections	39
7.1	Ethernet Connection	39
7.2	RS-485 Connection	39
7.3	USB Connection	40
8	Wiring – Auxiliary Inputs and Outputs	41
8.1	Available Auxiliary Connections	41
8.2	Pulse Inputs	41
8.3	Alarm Output Wiring	42
8.4	12-Volt Auxiliary Power Output	43
9	Basic Meter Configuration	44
9.1	Powering Up	44
9.2	Communication Interfaces	44
9.3	Meter Configuration Using FLEXPoint™	44

9.4	FLEXPoint™ Software Installation	45
9.5	Basic Workflow	49
9.6	Access Restriction Limitations	49
9.7	Security PIN Protection	50
10	Verification of Installation	52
10.1	Real-Time Value Check	52
10.2	PhaseChek™ Verification	53
10.3	CT Orientation Check.....	54
10.4	Phasor Plot Verification	56
10.5	Communication Verification	56
10.6	Host System Point Verification.....	57
10.7	Commissioning Closeout.....	57
11	Integration & Programming	59
11.1	Integration Overview	59
11.2	Information Covered in the Programming & Integration Guide.....	59
12	Communication Setup	60
12.1	RS-485 Network.....	61
12.2	Communication Verification	62
12.3	Ethernet Setup	63
12.4	Protocol Verification	64
12.5	Modbus Settings.....	64
12.6	BACnet Settings	65
12.7	BACnet/IP	65
Appendix A -	Glossary of Terms	1
Appendix B -	Enclosure Dimensions	1
Appendix C -	Mounting Templates	1
C.1	Enclosure Internal Mounting Hole Locations (Not to Scale)	1

C.2	Sheet Metal Plate Mounting Hole Locations (PS12FX/PS24FX/PS48FX only)	2
Appendix D -	PowerScout FLEX Technical Specifications	1

1 Introduction

1.1 General Description

The PowerScout™ FLEX Series is a family of multi-channel submeters designed for networked electrical monitoring in commercial, industrial, and institutional applications. The product line includes four base models:

- PowerScout™ FLEX 3 (PS3FX)
- PowerScout™ FLEX 12 (PS12FX)
- PowerScout™ FLEX 24 (PS24FX)
- PowerScout™ FLEX 48 (PS48FX)

PowerScout™ FLEX meters measure true RMS electrical parameters including voltage, current, power, energy, demand, power factor, frequency, and other electrical values on single-phase and three-phase systems. The meter connects directly to the system voltage and to supported external current sensors, including 333 mV current transformers (CTs) and DENT Rogowski coils. Electrical measurements are calculated from these inputs and reported to the host system in real time.

PowerScout™ FLEX meters are designed for integration with a Building Management System (BMS), Remote Terminal Unit (RTU), AcquiSuite® data acquisition device, DENTCloud™, or other supervisory host system. Depending on model and application requirements, communication options include:

- Ethernet (BACnet/IP or Modbus TCP)
- RS-485 (BACnet MS/TP or Modbus RTU)
- USB for local setup and service

PowerScout™ FLEX meters also support FLEXPoint™ software features for flexible point mapping, configuration, and system integration. These capabilities are described in later sections of this guide and in the Programming and Integration Guide.

Some models support direct connectivity to DENTCloud™ for remote access to real-time and historical meter data through a web browser. Refer to the product label and model information in this guide for supported features and options.

1.2 Installation & Wiring Operator's Guide Scope

This Installation & Wiring Guide covers physical installation, voltage wiring, current sensor installation, communication wiring, auxiliary wiring, and field documentation required before commissioning.

Detailed software configuration, programming, register access, protocol behavior, and host system integration are outside the scope of this manual.

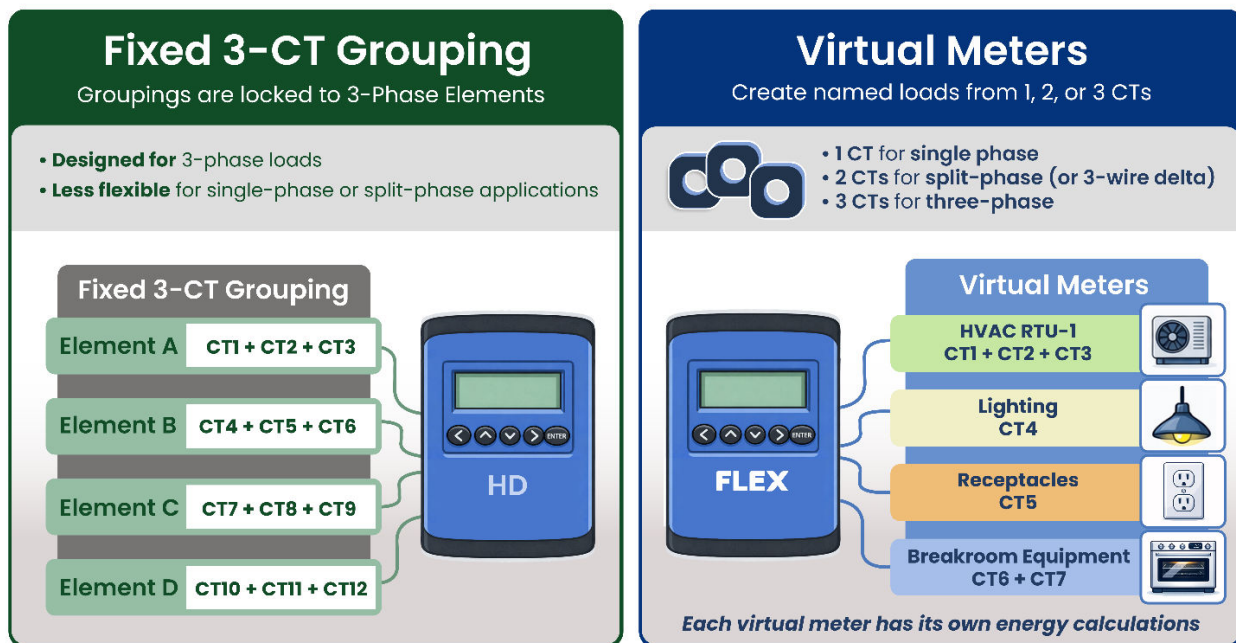
1.3 PowerScout FLEX Concepts and Data Structure

PowerScout™ FLEX meters use **Virtual Meters (VMs)** to represent electrical loads. A Virtual Meter replaces the fixed element concept used in earlier PowerScout™ models, such as PowerScout™ HD.

In earlier PowerScout meters, measurement channels were grouped into fixed three-channel elements. PowerScout™ FLEX uses a more flexible data structure that allows current inputs to be assigned to Virtual Meters based on the loads being measured.

Virtual Meters: Named Loads

From fixed CT groups to **flexible named loads**



Virtual Meter

A Virtual Meter represents a logical electrical load. It is the primary grouping used for configuration, measurement reporting, and integration data.

Each Virtual Meter may include one, two, or three current channels, depending on the service type and load being measured. Virtual Meters can be configured independently for service type, voltage reference, CT selection, scaling, phase correction, and labeling.

Channel

A Channel is a current channel within a Virtual Meter. Channels are identified as **CH1**, **CH2**, and **CH3** within each Virtual Meter.

Each Channel can be assigned to a physical CT input on the meter. This allows the meter's available CT inputs to be used more flexibly than fixed three-channel element groupings.

Physical CT Input

A Physical CT Input is an actual current transformer input terminal on the meter hardware. Depending on the model, a PowerScout™ FLEX meter may include 3, 12, 24, or 48 physical CT inputs.

Physical CT inputs are assigned to Virtual Channels during configuration.

System Scope

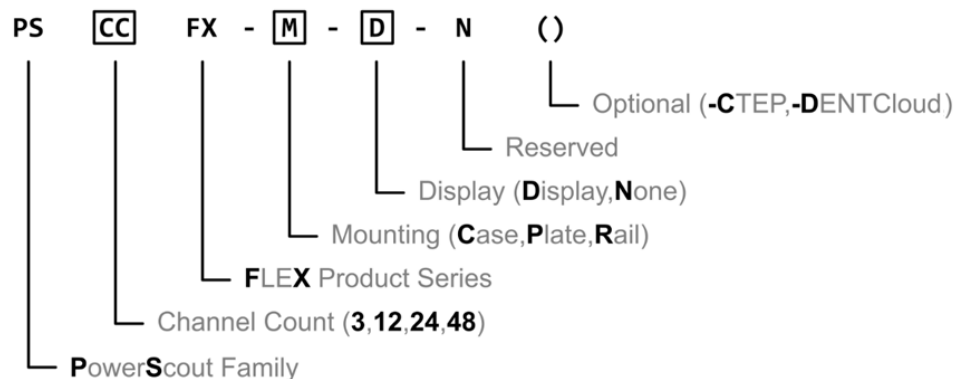
System scope refers to values or settings that apply to the meter as a whole rather than to a specific Virtual Meter. These may include meter identification, communication settings, security settings, voltage input scaling, or other global parameters.

Integration Data Structure

For Modbus and BACnet integrations, PowerScout™ FLEX data is organized around Virtual Meters, Virtual Channels, and System-level values.

1.4 Supported Models

PowerScout™ FLEX meters are available in multiple configurations. The full model number identifies the base meter, enclosure type, display option, communication features, and any special options or certifications.



PowerScout™ FLEX Part Numbering Scheme

1.5 What's Included

Each PowerScout™ FLEX shipment includes the following items:

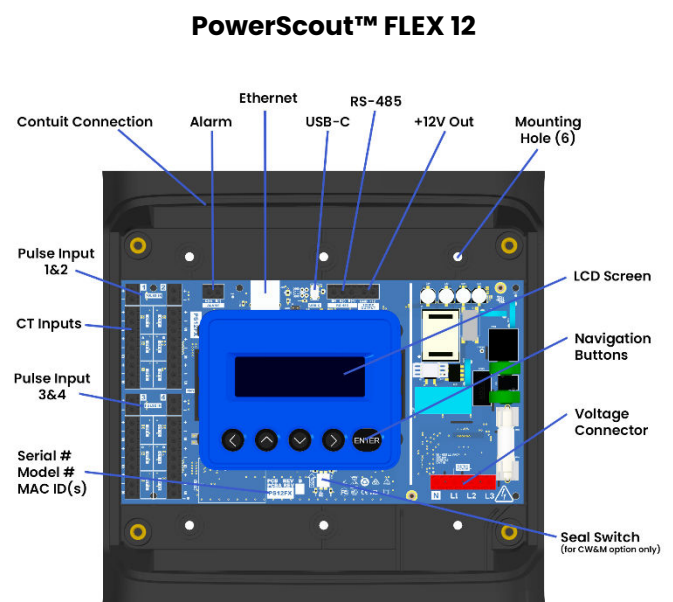
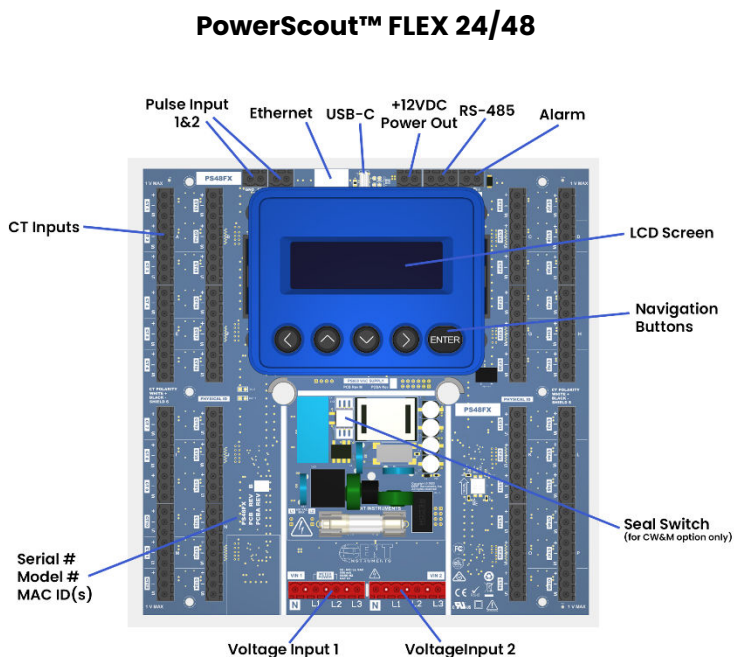
- PowerScout™ FLEX meter, as ordered
- Pluggable terminal connectors
- USB-C configuration cable
- Certificate of Calibration (COC)
- FLEXPoint™ software access information (Quick Start Guide download link)
- Product documentation

Depending on the model and options ordered, the shipment may also include:

- LCD user interface
- DIN-rail mounting hardware
- Tamper-evident seals for CTEP-certified models

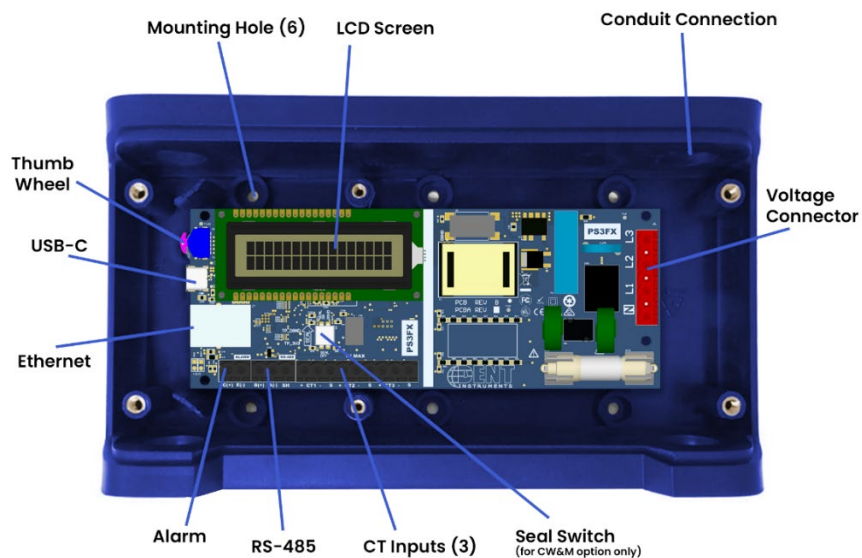
1.6 PowerScout™ FLEX Anatomy

All user connections are made on the circuit board. Connectors are identified by function and include polarity markers.



PS12FX-C (Enclosure with cover removed)

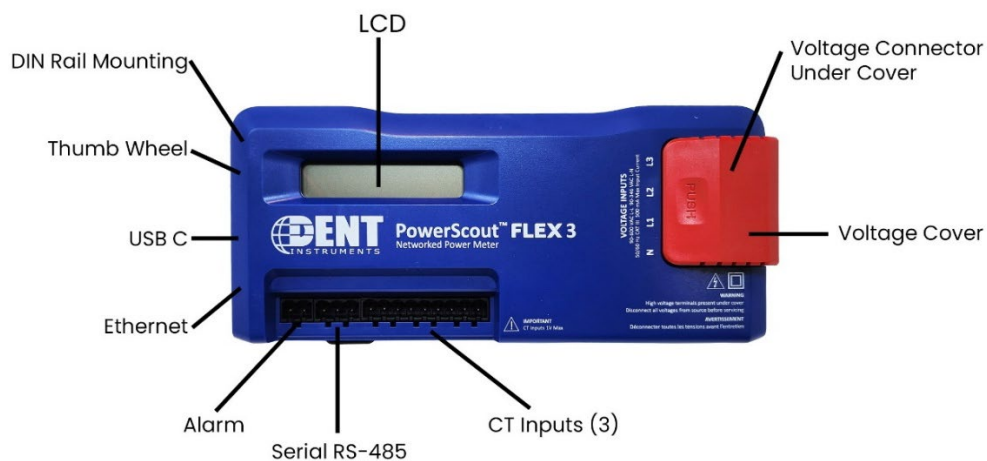
PowerScout™ FLEX 3 Available Configurations



PS3FX-C Wall Mount Option (Enclosure with Cover Removed)



Note: Must use the supplied USB C right angle cable. A standard USB C straight connector will not fit the PS3FX-C Wall Mount meter.



PS3FX-R DIN Rail Mount Option

2 Safety

This chapter summarizes important safety information for installing, wiring, operating, and servicing the PowerScout™ FLEX meter. Read and understand this section before installing the meter or making any electrical connections.

PowerScout™ FLEX meters are installed in electrical equipment where hazardous voltages may be present. Installation and service must be performed only by qualified personnel in accordance with this manual, applicable electrical codes, and site safety procedures.

Safety markings on the meter and safety symbols used in this manual identify important hazards, precautions, and compliance information. Failure to follow these instructions may result in equipment damage, inaccurate measurement, electrical shock, serious injury, or death.

2.1 Safety Responsibility and Intended Use

The PowerScout™ FLEX meter is intended for use as an electrical measurement and monitoring device in commercial, industrial, and similar electrical installations. The meter must be installed, configured, operated, and serviced only as described in this manual and in accordance with applicable electrical codes, regulations, and site safety procedures.

Installation and service must be performed only by qualified personnel who are trained and authorized to work on electrical equipment. The installer is responsible for verifying that the meter, current sensors, wiring methods, overcurrent protection, disconnecting means, enclosure, and installation environment are appropriate for the application.

This manual does not replace or supersede national, state, provincial, local, or site-specific electrical codes or safety requirements. Where requirements differ, the more restrictive requirement or the requirement specified by the authority having jurisdiction shall apply.

Do not use the meter in any manner not specified by DENT Instruments. Use of the meter outside the specified ratings, with incompatible current sensors, without required covers or enclosures, or in a manner not described in this manual may impair the protection provided by the equipment and may result in equipment damage, inaccurate measurements, electrical shock, serious injury, or death.

DENT Instruments is not responsible for damage, injury, measurement errors, or system failures caused by improper installation, incorrect configuration, unauthorized modification, use outside the meter's specified ratings, use with incompatible equipment, or failure to follow the instructions in this manual.

2.2 Electrical Safety Precautions

Before installing, wiring, servicing, or removing the PowerScout™ FLEX meter, de-energize all circuits connected to the meter and follow applicable lockout/tagout procedures. Verify absence of voltage before touching conductors or terminals.

Do not exceed the published voltage, current input, environmental, or enclosure ratings of the meter or connected current sensors. Exceeding rated limits may damage the equipment, impair the protection provided by the equipment, and create a hazardous condition.

Use only wiring methods, overcurrent protection, disconnecting means, enclosures, and accessories suitable for the installation environment and approved by applicable codes and the authority having jurisdiction.

2.3 Meter Safety Requirements

PowerScout™ FLEX meters must be installed and used only as described in this manual.

Board-level and panel-mount PowerScout™ FLEX models must be installed in a suitable user-supplied UL Listed or Recognized enclosure in accordance with NEC and local electrical codes.

The PowerScout™ FLEX is a **600 V Overvoltage Category III** device. Use approved protection when installing, operating, or servicing the meter.



Caution: This meter may contain life-threatening voltages. Qualified personnel must disconnect all high-voltage wiring before servicing the meter with the high-voltage TouchSaf™ cover removed.

Do not energize the meter with the high-voltage TouchSaf™ cover removed.

2.4 Symbols in Documentation



WARNING: This identifies crucial safety information.



IMPORTANT: Additional information that is very relevant to the instructions.



Caution: You should be careful when completing this step.



Note: This is a note please edit

2.5 Symbols on Equipment

Symbol	Definition
	Denotes caution. Refer to the manual for information about the nature of the hazard and required precautions.
	Denotes high voltage. Risk of electrical shock. Life-threatening voltages may be present. Qualified personnel only.
	Equipment protected throughout by double insulation or reinforced insulation.
	Indicates conformity with applicable European health, safety, and environmental protection requirements.
	Indicates that the marked product has been evaluated as a complete listed product for the U.S. and Canadian markets.
	Indicates that the marked product has been evaluated as a recognized component for use within another product or suitable enclosure.
	Restriction of Hazardous Substances. PowerScout™ FLEX Series is RoHS Compliant.
	Indicates conformity to mandatory compliance for most electrical, electronic, and telecommunications products sold in Australia and New Zealand.
	Indicates conformity to the legal obligations placed on businesses that manufacture, import, or sell electrical and electronic equipment (EEE) to ensure their products are safely collected, recycled, and disposed of at the end of their lifespan.

2.6 Compliance and Standards Summary

PowerScout™ FLEX meters are evaluated for safety and regulatory compliance as a product family. Certification status varies by model configuration: enclosure and wall-mount meters are UL Listed, while rail and plate versions are UL Recognized components. Refer to the product label for the certification markings applicable to the installed meter.

Category	Standard / Requirement	FLEX Wall Mount	FLEX Rail / Plate
Safety	UL 61010-1, 3rd Edition	UL Listed	UL Recognized
Safety	UL 61010-2-30:2010	UL Listed	UL Recognized
Safety	CSA C22.2 No. 61010-1, 3rd Edition	Certified / Listed configuration	Certified / Recognized component configuration
CE – Low Voltage Directive	EN 61010-1	Applies	Applies
CE – EMC	EN 61326-1	Applies	Applies
RoHS	EN 50581	Applies	Applies
FCC	FCC Part 15, Class A digital device	Applies	Applies

2.7 Maintenance

PowerScout™ FLEX requires no routine maintenance. Observe the following guidelines:

Cleaning

Do not use water, solvents, or other cleaning agents on the PowerScout™ FLEX meter.

Accessories

Use only accessories specified in current DENT Instruments product literature.

Damaged or Defective Equipment

If the meter appears damaged or defective, disconnect all power to the meter before further handling. Contact DENT technical support for assistance.

DENT Instruments, Inc.

Phone:

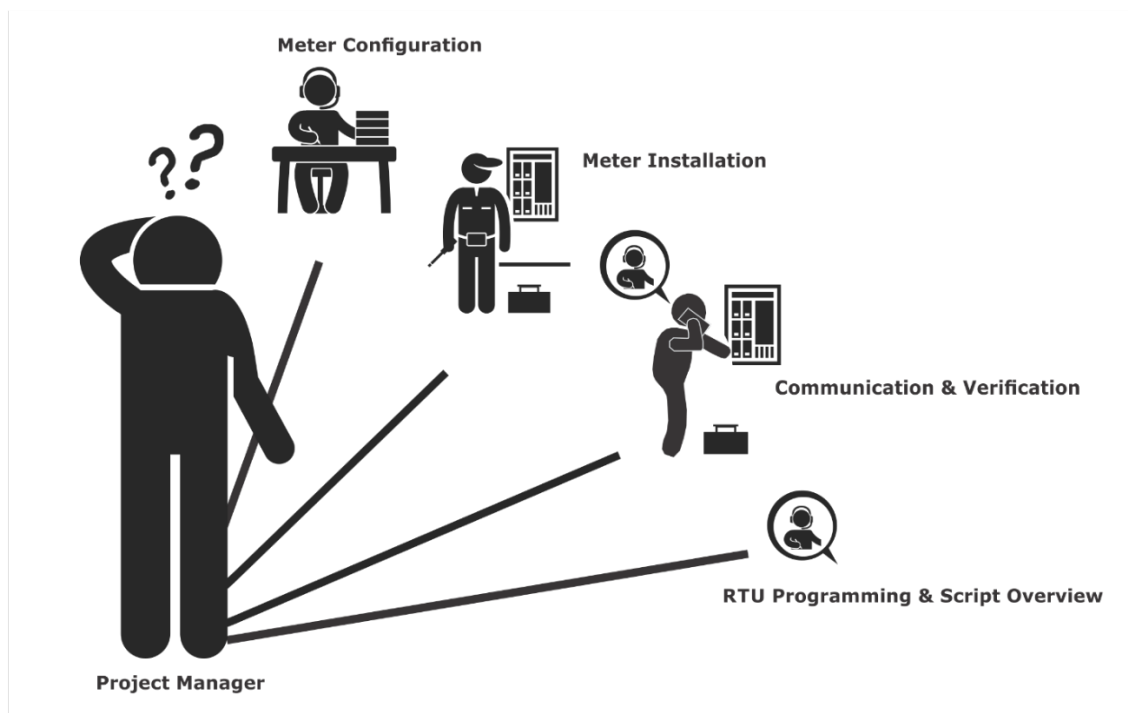
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3 Planning

3.1 Project Coordination

Installation of a PowerScout™ FLEX meter may involve coordination among installers, electricians, controls contractors, and commissioning personnel. Before field work begins, confirm which individual or team is responsible for each task and verify that all required tools, software, credentials, and network information are available.

Typical pre-installation activities may include selecting the communication method, assigning network or device addresses, obtaining required PINs or login credentials, and confirming integration requirements with the host system. Completing these items before arriving on site can reduce commissioning time and minimize field errors.



3.2 Pre-Installation Checklist

Before arriving on site or beginning installation, confirm the following:

- Correct meter model and current sensors have been selected.
- Panel schedules, one-line diagrams, and point lists are available.
- Service voltage and communication method have been confirmed.
- Device addressing, protocol settings, and register list are available.
- Installation location, disconnecting means, and working clearance are adequate.
- Mounting method and required accessories are confirmed.
- Required host-system integration details are available.
- Commissioning responsibilities are assigned. Configuration and Viewing Interfaces

3.3 Required Tools and Materials

Verify that the following are available before installation:

Tools

- Insulated hand tools
- Wire stripper/cutter
- Screwdrivers
- Drill and bits, if required
- Digital multimeter
- Laptop, tablet, or smartphone for setup
- Required PPE

Installer-Supplied Materials

- **Power and voltage wiring:**
 - 14 AWG minimum THHN wire rated for 600 VAC, or equivalent wiring appropriate for the installation
- **Dedicated breaker or disconnect**
 - Required for meter voltage/power connection
- **Communication wiring, as applicable**
 - RS-485, Ethernet, pulse input, alarm output, or other project-specific wiring
- **Conduit and fittings, as required**
 - 1 in. conduit connection for PS12FX / PS24FX / PS48FX wall-mount enclosures
 - 1/2 in. conduit connection for PS3FX wall-mount enclosure
- **Mounting hardware**
 - Installer supplied unless provided with the meter or enclosure
- **Current sensors specified for the installation**

Supplied with Meter

- PowerScout™ FLEX meter
- Pluggable terminal connectors
- USB-C configuration cable
- Certificate of Calibration
- FLEXPoint™ access information
- Product documentation

3.4 Configuration and Viewing Interfaces

PowerScout™ FLEX meters support multiple interfaces for configuration and data viewing, including FLEXPoint™, FLEXPoint™ Go, the optional LCD user interface, and host-system access through an RTU or other supervisory platform.

FLEXPoint™ is the primary and most capable configuration tool. FLEXPoint™ Go supports convenient field access for common setup and viewing tasks. The LCD user interface supports limited local observation and communication setup. When communication settings have already been established, some configuration and data access may also be available through the host system.

Detailed procedures for configuration, communication setup, and verification are provided in the sections that follow.

4 Meter Installation

This section provides guidance for physical installation of the PowerScout™ FLEX meter, including enclosure mounting, voltage wiring, and proper installation of the current sensors within the electrical panel and at the meter. Current sensors may include 333 mV CTs or DENT Rogowski coils, depending on the installation.

PowerScout™ FLEX meters are available in wall-mount, DIN-rail, and plate-mount configurations. Installation should be performed by qualified personnel in accordance with applicable codes and site safety procedures.



4.1 Meter Mounting Configurations

DENT PowerScout™ FLEX meters are available in several mounting configurations. Wall-mount enclosures are designed for attachment to electrical conduit and surface mounting. Plate-mount and DIN-rail versions are intended for installation inside a user-supplied UL- or NEMA-rated enclosure appropriate for the application.

Use care during installation to avoid flexing the circuit board or placing mechanical stress on the meter assembly.

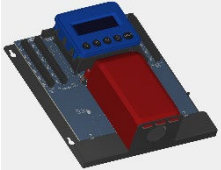
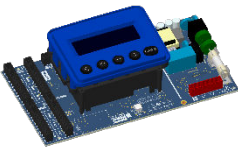
Mounting Options	PS48FX/PS24FX	PS12FX	PS3FX
Enclosure	 PS24FX-C-D-N PS48FX-C-D-N	 PS12FX-C-D-N	 PS3FX-R-D-N PS3FX-C-D-N
OEM Plate	 PS24FX-P-D-N PS48FX-P-D-N	 PS12FX-P-D-N	N/A

Figure X. Mounting configurations by model

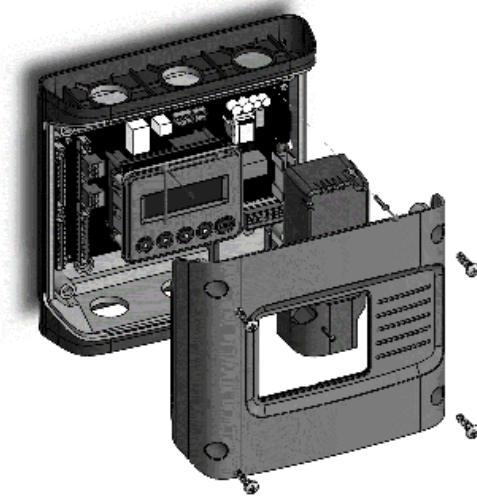
4.2 all and Plate Mount Installation

Refer to Section 6 for complete wiring instructions.

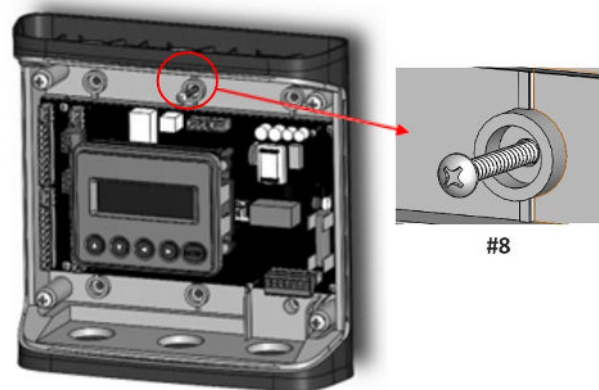
Installation Sequence for Wall-Mount and Plate-Mount Models

The following procedure illustrates a **PowerScout™ FLEX 12** wall-mount model (**PS12FX-C-D-N**). Other PowerScout™ FLEX wall-mount and plate-mount models may differ slightly in appearance, but the basic installation sequence is similar. For plate-mount models, install the meter onto a suitable mounting surface or inside an appropriate enclosure using the applicable mounting hole locations.

STEP 1) Remove the (4) enclosure top cover screws, **if applicable**, and remove the (2) high-voltage cover screws.



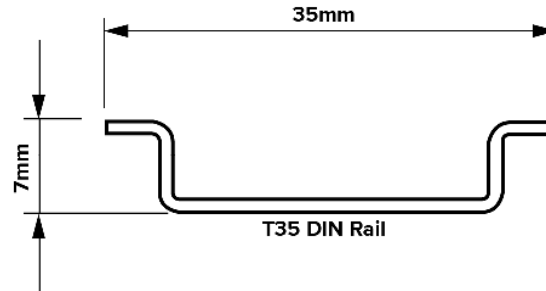
STEP 2) Using the enclosure or mounting plate as a template, locate and mark the mounting points. Drill the required mounting holes for the user-supplied hardware.



If the meter is not available to use as a drilling template, refer to the dimensional drawing in the [appendix for mounting hole spacing](#). The centerline mounting holes are intended for attachment to wall studs. For hollow-wall installations, use of the outer four mounting points is recommended.

4.3 Installation Sequence for PS3FX-R-D-N

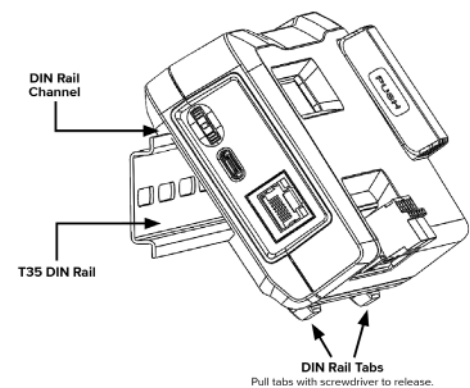
The following section illustrates the PS3FX-R-D-N model, which is equipped with a built-in DIN rail channel for easy installation. The PS3FX-R-D-N must be installed inside a UL approved electrical enclosure.



STEP 1) Within a suitable UL-approved enclosure, attach a section of T35 DIN rail on which the PS3FX will be mounted. Remember to leave enough clearance for voltage, CT, and communication wires to be routed within the enclosure. The UL-approved enclosure is customer supplied.

STEP 2) Mount the meter on the DIN rail by pressing the top edge of the DIN rail channel on the meter into the top of the DIN rail itself and then pushing the meter firmly towards the DIN rail so that it clicks into place. The meter can be released from the DIN rail by using a screwdriver to pull the DIN rail tabs at the bottom of the meter.

Link to: [Mounting Templates](#)



5 Wiring – Voltage Connections and Service Types

This section describes how to connect voltage wiring to the PowerScout™ FLEX meter and how those voltage connections relate to supported service types. Voltage connections provide the meter with the voltage reference required for measurement. On all PowerScout™ FLEX models, Voltage Input 1 also provides operating power to the meter.



WARNING: Do not exceed the published voltage, current input, environmental, or enclosure ratings of the meter or connected current sensors. Exceeding rated limits may damage the equipment and create a hazardous condition.

Current sensor installation is covered separately in **Section 6, Wiring – Current Sensor Installation**.

5.1 Voltage Wiring Safety

PowerScout™ FLEX meters are connected directly to building voltage. Installation must be performed by qualified personnel in accordance with applicable electrical codes and site safety procedures.



WARNING: High voltage may be present. Risk of electric shock. Life-threatening voltages may be present. Qualified personnel only.



IMPORTANT: Verify the circuit breaker is marked as the disconnect breaker for the meter.



WARNING: Do not energize the meter with the TouchSaf™ high-voltage cover removed.

Before connecting voltage wiring:

- Verify that the meter is securely mounted.
- Verify that the disconnecting means is open and locked out as required by site procedure.
- Verify that voltage conductors are properly identified.
- Confirm that the installation voltage is within the meter input rating.
- Confirm that the correct meter model and voltage input terminals are being used.

5.2 Voltage Input Ratings

Connect the voltage leads **L1, L2, L3, and N**, as required by the service type, to the meter through a dedicated disconnect or circuit breaker.

Use **14 AWG minimum THHN wire rated for 600 VAC**, or equivalent wiring appropriate for the installation.



WARNING: DO NOT EXCEED 346V Line to Neutral or 600 volts Line to Line. This meter is equipped to monitor loads up to 346V L-N. Exceeding this voltage will cause damage to the meter and danger to the user. Always use a Potential Transformer (PT) for voltages in excess of 346V L-N or 600 volts line to line. The PowerScout™ FLEX is a 600 Volt Over Voltage Category III device.



IMPORTANT: Verify the circuit breaker is marked as the disconnect breaker for the meter.

PowerScout™ FLEX voltage inputs are rated for:

Voltage Measurement	Rating
Line-to-Neutral	90–346 VAC
Line-to-Line	Up to 600 VAC
Installation Category	CAT III

For voltages above the meter's direct input rating, use properly rated potential transformers (PTs) and configure the appropriate voltage multiplier during meter setup.

5.3 Voltage Input 1 and Voltage Input 2

PowerScout™ FLEX 24 (**PS24FX**) and PowerScout™ FLEX 48 (**PS48FX**) meters include two sets of voltage reference inputs. These inputs allow Virtual Meters to reference different voltage sources when required by the installation.

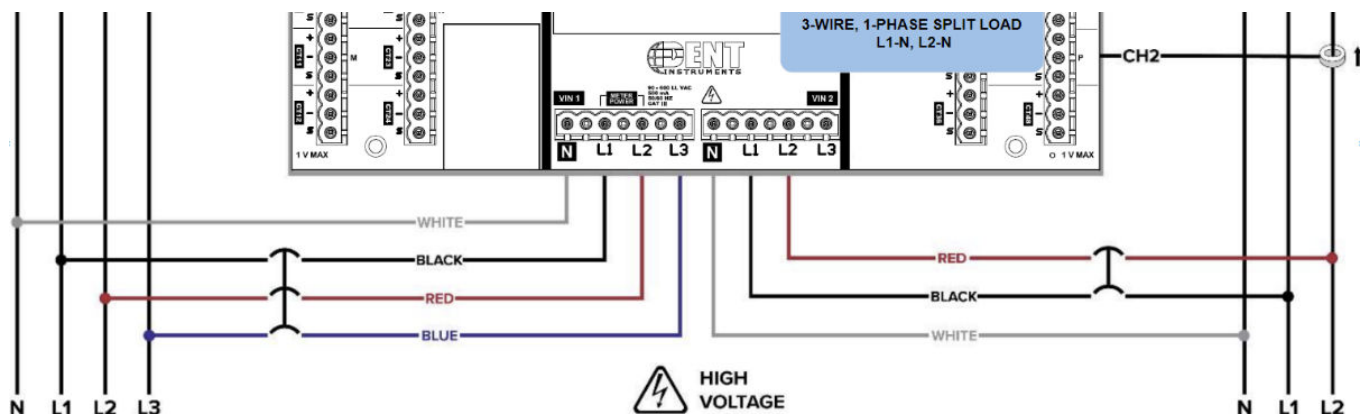
The meter is internally powered from **Voltage Input 1**, through the voltage between **L1 and L2**. **Voltage Input 2 is a measurement reference only and cannot be used to power the meter.**

When using Voltage Input 2:

- Voltage Input 1 must still be connected to provide meter power.
- Voltage Input 2 may be used as a voltage reference for Virtual Meters assigned to that voltage source.
- Voltage Input 2 conductors should be connected according to the service type and voltage reference required for the loads being measured.
- Voltage Input 2 does not replace the required power connection on Voltage Input 1.



IMPORTANT: DO not rely on Voltage Input 2 to power the meter. If Voltage Input 1 is not energized, the meter will not operate, even if voltage is present on Voltage Input 2.



5.4 Systems Without a Neutral Conductor

Some service types, including certain Delta services, may not include a neutral conductor. The PowerScout™ FLEX meter uses the **N terminal as the voltage reference point** for line-to-neutral measurements.

For systems without a neutral conductor, connect the **N terminal** according to the project wiring requirements and applicable electrical codes. In many grounded Delta installations, the grounding conductor may be used as the meter's reference connection at the **N terminal**.

If the N terminal is left open, line-to-line measurements may remain accurate, but line-to-neutral measurements may not be balanced or symmetrical. When a grounding conductor is connected to the N terminal as the voltage reference, less than **500 μ A** flows into the grounding conductor.



IMPORTANT: The N terminal reference connection is used for voltage measurement reference only. It does not replace required grounding or bonding practices for the electrical system.

5.5 Power Meter Requirements

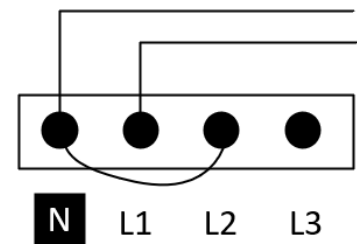
PowerScout™ FLEX meters are powered from the voltage connected between **L1 and L2 on Voltage Input 1**.

For three-phase and split-phase systems, this voltage is normally present as part of the standard voltage connection. For single-phase applications where no L2 conductor exists, an additional connection is required so the meter can power up correctly.

Voltage Input 1 must be connected and energized for the meter to operate from line power.

5.6 Single-Phase Powering Requirement

The PowerScout™ FLEX meter is internally powered through the voltage between L1 and L2. For Single Phase installations where no L2 exists it is advised to jumper N to L2. This connection provides power to the meter while maintaining Neutral as the metering voltage reference.



5.7 Voltage Wiring Sequence

For wall-mount models, conduit fittings and blanking plugs should be installed before voltage wiring. For DIN-rail models, all wiring must be completed inside a suitable customer-supplied enclosure.

For wall-mount and DIN-rail models, complete voltage wiring before installing current sensors or communication wiring.

Multi-Circuit Wall-Mount Models

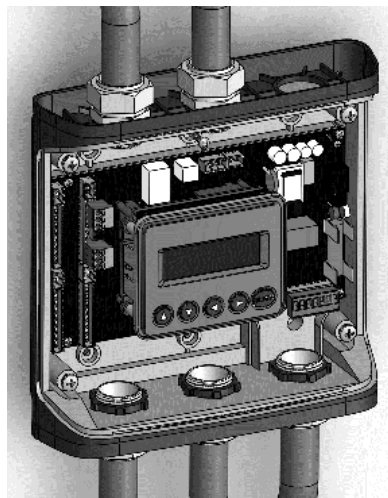
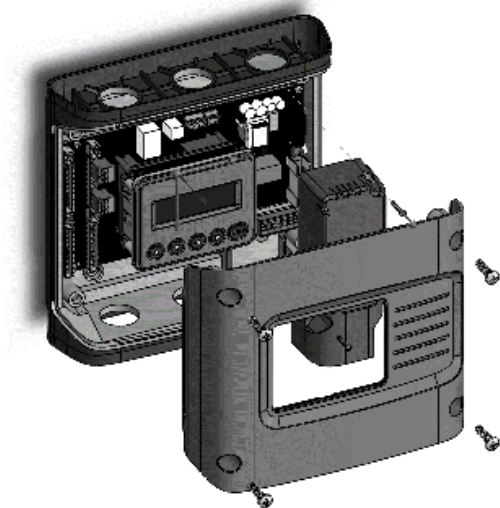
The following sequence applies generally to PowerScout™ FLEX 12 (**PS12FX**), PowerScout™ FLEX 24 (**PS24FX**), and PowerScout™ FLEX 48 (**PS48FX**) wall-mount models. Component layout may vary slightly by model.

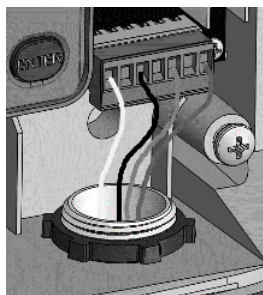
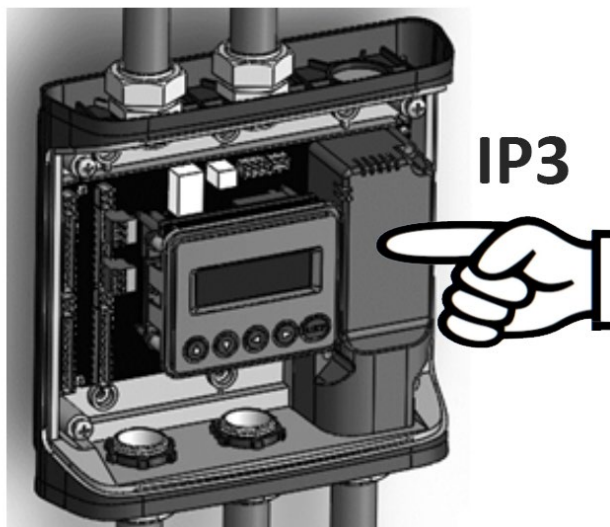


WARNING: Do not energize the meter with the TouchSaf high-voltage cover removed.

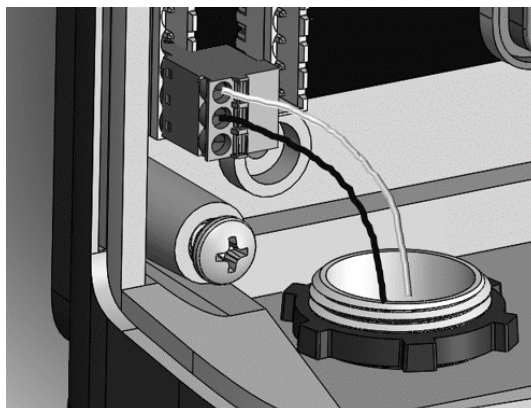
STEP 1) Remove top cover screws (4x) and high voltage cover screws (2x) – provided

STEP 2) Mount conduit fittings, conduits, and blanking plugs



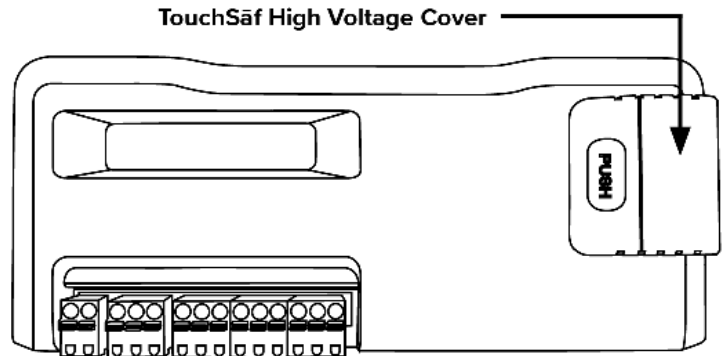
STEP 3) Connect voltage leads**WARNING:** DO NOT ENERGIZE METER WITH VOLTAGE COVER REMOVED!**STEP 4)** Attach the TouchSaf™ high voltage cover**STEP 5)** Connect CT and Communications Wiring

TOUCH SAFE
(with internal high voltage cover installed)



Voltage Wiring Sequence for PowerScout™ FLEX 3

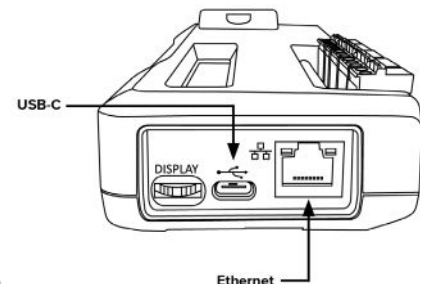
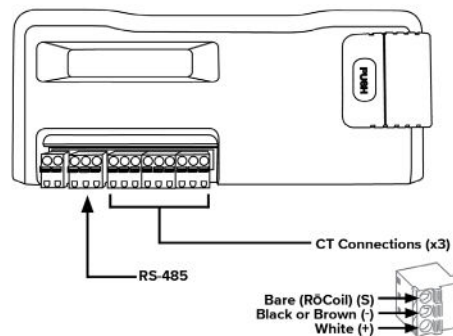
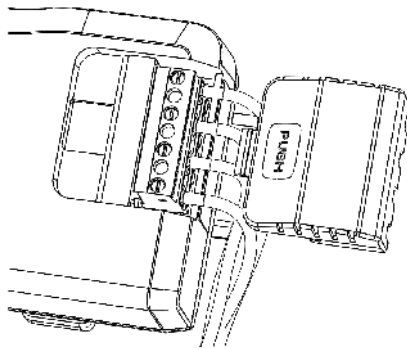
STEP 1) Remove the TouchSaf™ high voltage cover and connect the voltage leads to the meter.



WARNING: DO NOT ENERGIZE METER WITH VOLTAGE COVER REMOVED!

STEP 2) Reattach the TouchSaf™ high voltage cover

STEP 3) Connect CT and Communications Wiring.



5.8 Service Type Overview

The service type defines the electrical system or load configuration being measured. The selected service type determines how the meter interprets voltage and current measurements for each Virtual Meter.

Service type selection is completed during meter configuration, but it must match the physical voltage and current sensor wiring.

Service Type	Typical Use	Voltage Reference
2-Wire Single Phase, Line-to-Neutral	120 V or 277 V branch loads with one phase conductor and neutral	L1-N, L2-N, or L3-N
2-Wire Single Phase, Line-to-Line	208 V, 240 V, or 480 V two-wire loads without neutral	L1-L2, L2-L3, or L3-L1
3-Wire Split Phase / Single Phase	120/240 V services or loads with L1, L2, and Neutral	L1-N and L2-N
Three-Phase Wye	Four-wire three-phase systems	L1-N, L2-N, L3-N
Three-Phase Delta	Three-wire three-phase systems without neutral	Line-to-line references

5.9 Service Wiring Examples

The following examples illustrate common service types and voltage reference connections for PowerScout™ FLEX meters. These examples are intended to show typical voltage wiring arrangements only. Current sensor installation and CT input assignment are covered in **Section 6, Wiring – Current Sensor Installation**.

PowerScout™ FLEX voltage terminals are labeled **L1, L2, L3, and N**. In project drawings, host systems, or downstream documentation, these conductors may also be referred to as **Phase A, Phase B, Phase C, and Neutral**.

Meter Label	Common Phase Name
L1	Phase A
L2	Phase B
L3	Phase C
N	Neutral

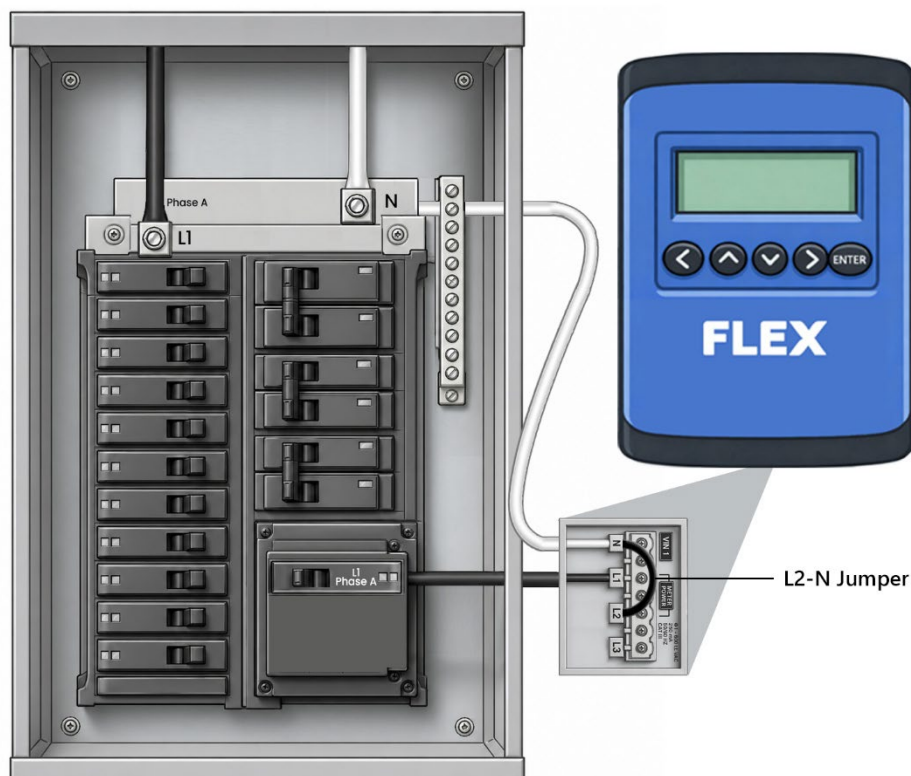
Connect voltage leads through a dedicated disconnect or circuit breaker as described earlier in this chapter. The disconnect should be clearly marked as the meter disconnect.



IMPORTANT: PowerScout™ FLEX meters are powered from L1 to L2 on the VIN1 connector. On PowerScout™ FLEX 24 and PowerScout™ FLEX 48 meters, the second voltage input connector may be used as an additional voltage reference, but it does not power the meter.

Two-Wire Single-Phase Service

Use this example for single-phase line-to-neutral applications where the measured service or load uses **L1-N**.



In this configuration, connect the line conductor to **L1** and the neutral conductor to **N**. The meter uses Neutral as the voltage reference for the measured load.

For single-phase installations where no L2 conductor is available, connect a jumper from **N to L2** on the VIN1 connector. This allows the meter to power from **L1 to L2** while maintaining Neutral as the metering voltage reference.

Typical uses include:

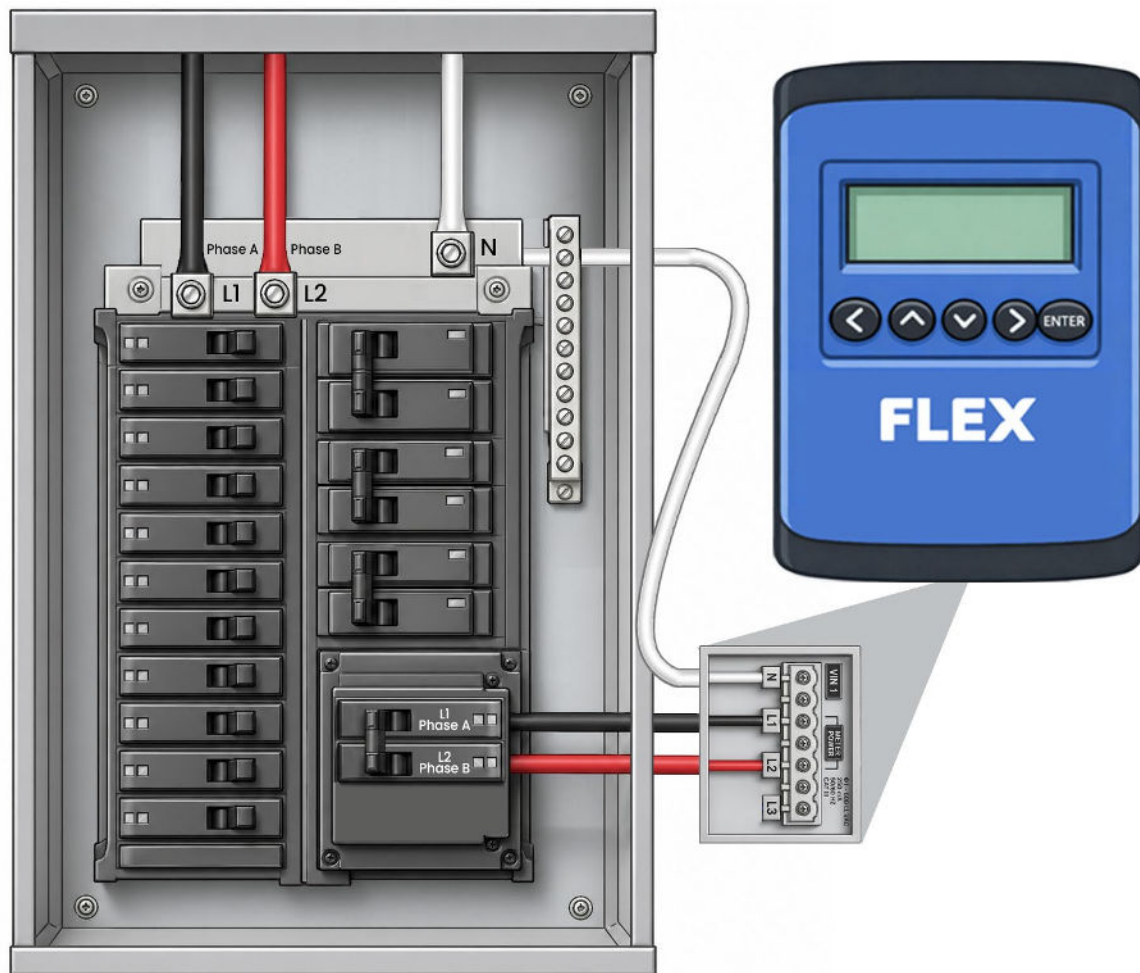
Example Load	Typical Voltage Reference
Single-phase branch circuit	L1-N
Lighting circuit	L1-N
Plug load circuit	L1-N
Other line-to-neutral load	L1-N



IMPORTANT: The N-to-L2 jumper is used only when required to power the meter in a single-phase installation where no L2 conductor exists. Always follow applicable electrical codes and project wiring requirements.

3-Wire, Split-Phase Service Panel

Use this example for common North American split-phase services with **L1, L2, and Neutral**. This service type is often used for 120/240 V panels.



In this configuration, connect **L1, L2, and N** to the VIN1 connector through the dedicated meter disconnect. The meter is powered from **L1 to L2** and uses Neutral as the reference for line-to-neutral measurements.

This service type can support multiple load types:

Example Load

Line-to-neutral branch load on Phase A
Line-to-neutral branch load on Phase B
Line-to-line load
Split-phase load using both legs

Typical Voltage Reference

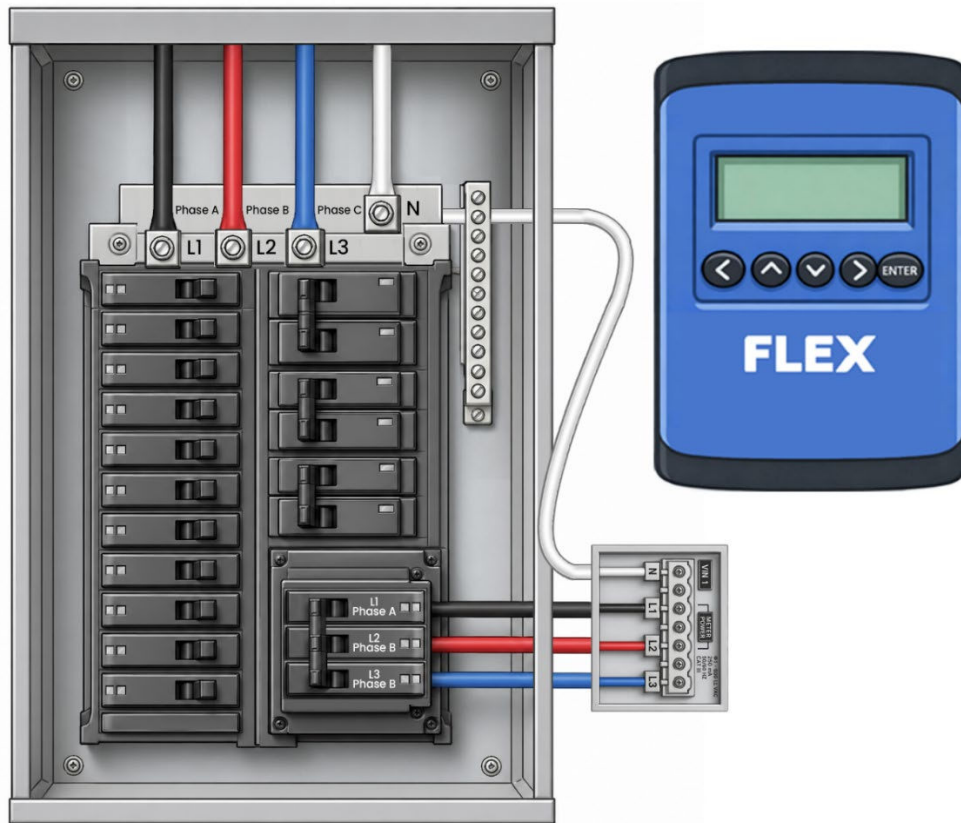
L1-N
L2-N
L1-L2
L1-N and L2-N

For line-to-neutral loads, match the current sensor placement to the corresponding conductor. For example, a load configured with an **L1-N** voltage reference should have the current sensor installed on the associated **L1 / Phase A** conductor.

For loads connected between two phase conductors, such as an **L1-L2** load in a split-phase panel, install the current sensor according to the selected service type in FLEXPoint™. For typical single-phase line-to-line measurements, install the current sensor on the first conductor listed in the voltage reference. For example, if the load is configured as **L1-L2**, install the current sensor on the **L1 / Phase A** conductor feeding that load.

4-Wire, Three-Phase Service Panel

Use this example for three-phase Wye services with **L1, L2, L3**, and Neutral. These conductors may also be identified as Phase A, Phase B, Phase C, and Neutral.



In this configuration, connect **L1, L2, L3**, and **N** to the meter voltage input through the dedicated meter disconnect. The meter is powered from **L1 to L2** on VIN1 and uses the connected voltage references for measurement.

Typical uses include:

Example Load

Three-phase Wye load
 Single-phase branch load on Phase A
 Single-phase branch load on Phase B
 Single-phase branch load on Phase C
 Line-to-line load

Typical Voltage Reference

L1-N, L2-N, L3-N
 L1-N
 L2-N
 L3-N
 L1-L2, L2-L3, or L3-L1

For three-phase Wye loads, match each current sensor to the corresponding voltage reference. For example, the current sensor for **L1-N** should be installed on **L1 / Phase A**, the current sensor for **L2-N** should be installed on **L2 / Phase B**, and the current sensor for **L3-N** should be installed on **L3 / Phase C**.

For Delta services or other systems without a neutral conductor, refer to **Section 5.4, Systems Without a Neutral Conductor**, before wiring the voltage reference.

5.10 Using Potential Transformers

Use potential transformers when the measured voltage exceeds the direct input rating of the meter.

Potential transformers reduce the measured primary voltage to a secondary voltage that is within the meter input rating. Do not use or rely on a potential transformer as a voltage isolation device.

When PTs are used:

- Confirm that the PT secondary voltage is within the meter input rating.
- Connect the PT secondary wiring to the appropriate voltage input terminals.
- Configure the voltage multiplier using FLEXPt™ so reported voltage values represent the primary voltage.
- Verify measured voltage values during commissioning.

Voltage multipliers apply to the voltage input, not to an individual current channel.

6 Wiring – Current Sensor Installation

This section describes how to select, install, wire, and configure current sensors for the PowerScout™ FLEX meter. Current sensors provide the current measurement used with the voltage reference connections described in Section 5.

PowerScout™ FLEX meters use physical current sensor inputs that are assigned to Virtual Meter channels during configuration. A current sensor must be physically connected to the meter and assigned to the correct Virtual Meter channel in FLEXPoint™ before the measured load can be reported correctly.



IMPORTANT: Measurement accuracy depends on proper current sensor selection, installation, orientation, wiring, and configuration. DENT Instruments cannot guarantee measurement accuracy when unsupported or incorrectly configured third-party current sensors are used.

Voltage connections and service type selection are covered in **Section 5, Wiring – Voltage Connections and Service Types**. Communication wiring is covered in **Section 7, Wiring – Communication Connections**.

6.1 Current Sensor Requirements

PowerScout™ FLEX meters support compatible low-voltage current sensors, including **333 mV voltage-output current transformers** and **DENT RōCoil™ Rogowski coils**.

Supported current sensor types may include:

- Split-core CTs
- Hinged CTs
- Solid-core CTs
- DENT RōCoil Rogowski coils

PowerScout™ FLEX current inputs are designed for low-voltage current sensor signals. **Do not connect CTs with 1 A or 5 A secondary current outputs to the meter.**

Selecting the Current Sensor Range

Select a current sensor with a rated current appropriate for the circuit being measured. For best measurement performance, choose a range that is high enough for the maximum expected current but not unnecessarily oversized for the normal operating current.

When selecting a current sensor range, consider:

- Normal operating current
- Expected peak current
- Circuit breaker rating
- Load type
- Future load changes

Oversized current sensors may reduce measurement resolution at low current levels. Undersized current sensors may exceed their rated range and reduce accuracy.

DENT Current Sensors and CT Picker

Current transformers can introduce a small phase shift between the measured current and the CT output signal. For power and energy measurements, phase shift can affect accuracy because the meter calculates power using the timing relationship between voltage and current.

DENT-supplied current sensors are recommended for use with PowerScout™ FLEX meters because their scaling and phase characteristics are known and supported. When a supported DENT current sensor is selected using the built-in **CT Picker** in FLEXPoint™, the appropriate scaling and phase correction values are loaded automatically.

Using supported DENT current sensors and the CT Picker helps reduce setup time, minimize configuration errors, and support the meter's published accuracy performance. FLEXPoint™ configuration includes CT type, range, phase shift, multiplier, and CT sign settings for each configured current channel.

RōCoil Rogowski Coils

DENT RōCoil Rogowski coils are flexible current sensors used for larger conductors or higher-current applications. RōCoils must be configured as RōCoil current sensors in FLEXPoint™.

The RōCoil output scaling is configured in FLEXPoint™ using the RōCoil output setting, expressed in **mV/kA at 60 Hz**. The default DENT RōCoil gain setting is **131 mV/kA at 60 Hz**.

Rogowski coils must include the required electronics or integrator so the meter receives a voltage output proportional to current. Do not connect a raw Rogowski coil directly to the meter unless it is specifically designed and configured for use with PowerScout™ FLEX.

Third-Party Current Sensors

When using third-party current sensors, the customer is responsible for confirming compatibility and configuring the correct settings.

When using third-party current sensors:

- The customer is responsible for configuring the correct CT ratio or scaling.
- Any required phase correction must be configured by the customer.
- Rogowski coils must include an integrator and provide a voltage output proportional to current.
- The current sensor output must remain within the meter's allowable input range.
- CTs with **1 A or 5 A secondary current outputs are not compatible.**

Because current sensor electrical characteristics vary between manufacturers, DENT cannot support or guarantee measurement accuracy when non-DENT current sensors are used. PowerScout™ FLEX meters are factory calibrated and accuracy-specified using DENT current sensors. For best performance, simplified configuration, and supported phase shift compensation, DENT recommends using supported DENT current sensor models selected through the CT Picker.

6.2 Installing Current Sensors



Current sensors must be installed by qualified personnel in accordance with applicable electrical codes, site safety procedures, and the instructions provided with the current sensor.



WARNING: High voltage may be present. Risk of electric shock. Life-threatening voltages may be present. Qualified personnel only.

Before installing current sensors:

- Verify the circuit or load to be measured.
- Confirm the service type and voltage reference.
- Confirm that the current sensor range is appropriate for the load.
- Verify current sensor orientation and polarity markings.
- Confirm that current sensor leads can be routed safely to the meter.
- Avoid routing current sensor leads across sharp edges, breaker arc vent areas, or exposed high-voltage terminals.

Current Sensor Placement

Install each current sensor on the conductor associated with the voltage reference used for that Virtual Meter channel.

PowerScout™ FLEX voltage inputs are labeled **L1**, **L2**, **L3**, and **N** at the meter. In electrical drawings, downstream documentation, and host systems, these same conductors may be referred to as **Phase A**, **Phase B**, and **Phase C**. For typical installations:

Meter Label	Common Phase Name
L1	Phase A
L2	Phase B
L3	Phase C
N	Neutral

For example, if a Virtual Meter channel is configured with an **L1-N** voltage reference, install the current sensor on the corresponding **L1 / Phase A** conductor for that load. If a channel is configured with an **L2-N** voltage reference, install the current sensor on the corresponding **L2 / Phase B** conductor.

For line-to-line loads, install the current sensor according to the selected service type and voltage reference. In typical single-phase line-to-line applications, the current sensor is installed on the first conductor of the selected voltage reference. For example, a channel configured as **L1-L2** would typically use a current sensor installed on **L1 / Phase A**.

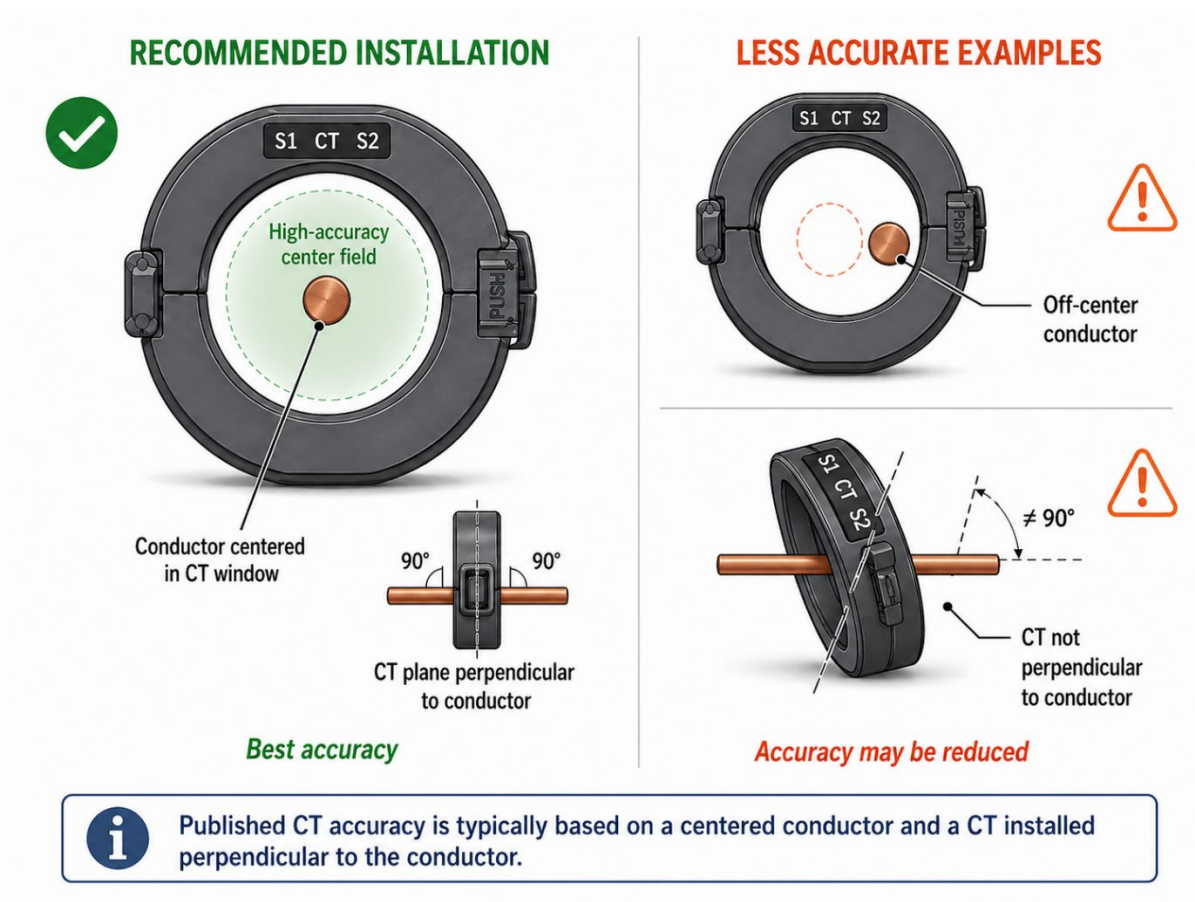
Confirm phase naming against the project drawings or site labeling before installation. Phase names and conductor colors may vary by facility, region, or documentation standard.

Current Sensor Fit, Position and Clearance

Current sensor accuracy is affected by how the sensor is positioned on the conductor. Published accuracy ratings are typically based on the conductor being centered within the CT window or RōCoil loop, with the sensor installed perpendicular to the conductor.

For best measurement accuracy:

- Center the conductor within the current sensor opening whenever possible.
- Install the current sensor so the sensor body is perpendicular to the conductor.
- Confirm that split-core and hinged CTs are fully closed and latched.
- Avoid installing the sensor at an angle, around a bend, or where the conductor is pressed against one side of the sensor opening.
- Avoid forcing the sensor into crowded wiring spaces.
- Select a larger sensor size or a different installation location if the conductor cannot be positioned cleanly.



Install each current sensor so that it surrounds only the conductor being measured. Do not install a current sensor around multiple conductors unless the measurement is specifically intended to capture the combined current of those conductors.

For RōCoil installations, avoid sharp bends, kinks, or twisting that may distort the coil shape. The coil should form a smooth loop around the conductor, with the conductor positioned as close to the center of the loop as practical.

Do not install current sensors where they interfere with breaker operation, panel covers, ventilation openings, or breaker arc venting areas. Route current sensor leads so they do not contact live terminals, bus bars, sharp edges, or moving parts. Existing safety guidance also notes that CTs should not exceed available wiring space, block ventilation openings, be installed in breaker arc venting areas, or have leads routed where they contact live terminals or bus.

If the current sensor cannot be installed with proper clearance and alignment, measurement accuracy may be reduced.

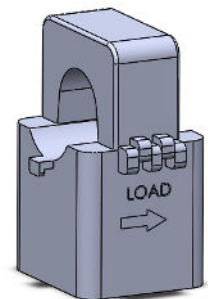
Current Sensor Orientation

For typical load monitoring, install the current sensor so the arrow or polarity marking points **toward the load**, unless otherwise indicated by the current sensor label or project documentation.

Some current sensors may be labeled **Toward Source**. When labeled this way, orient the current sensor so the labeled side faces back toward the panel, source, or supply side of the circuit.

Incorrect orientation will cause power and energy values to report with the wrong sign. Incorrect placement will cause low power factor, incorrect power values, or phase verification errors.

If a current sensor is installed backwards and cannot be physically reoriented, use the **CT Sign** setting in FLEXPoint™ to reverse the channel polarity in software. After changing CT Sign, verify the installation using real-time power values, PhaseChek™, phasor plot, or other commissioning procedures.



6.3 Wiring Current Sensors to the Meter

Connect current sensor leads to the appropriate current input terminals on the PowerScout™ FLEX meter. Observe the polarity markings on the current sensor and the terminal markings on the meter.

Current sensor wiring should be completed after the meter is mounted and voltage wiring is complete, but before commissioning in FLEXPoint™.

Wiring Guide for CT Types

Wiring Guide for CT Types	
Split, Hinged, & Solid Core CTs	Rogowski Coil CTs
	
White: Positive Black: Negative (no shield)	White: Positive Blue: Negative Bare Wire: Shield



IMPORTANT: Use the shield terminal where provided. Do not connect shield wires to current input positive or negative terminals.

Wiring Practices

Keep current sensor wiring neat and traceable. Label current sensor leads or document the physical CT input number during installation.

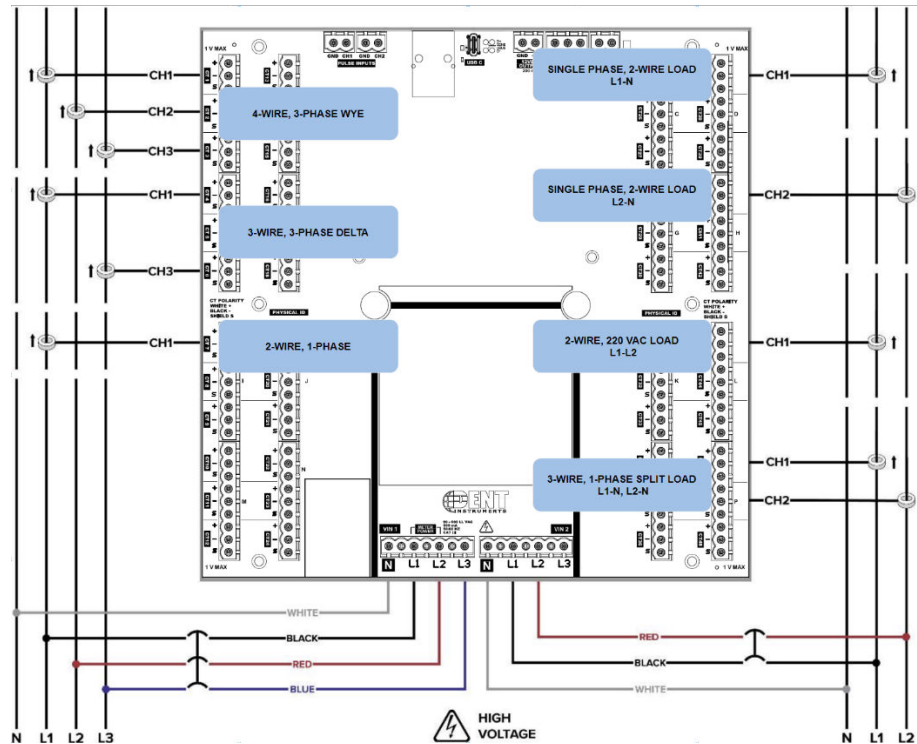
This is especially important on PowerScout™ FLEX meters because physical CT inputs are assigned to measured loads during FLEXPoint™ commissioning. Do not assume that the physical CT input number automatically determines the Virtual Meter or load assignment.

Route current sensor leads so they do not contact live terminals, bus bars, sharp edges, breaker arc vent areas, ventilation openings, or moving parts. Secure current sensor leads in accordance with applicable electrical codes and site practices.

Where practical, group and route current sensor leads so they can be traced from the current sensor back to the meter input. Avoid excess lead length inside the enclosure.

Wiring CTs to Multi-Circuit PowerScout™ FLEX Meters

The image below is the counterpart to the service panel illustration and shows how current sensors connect to multi-circuit PowerScout™ FLEX meters.



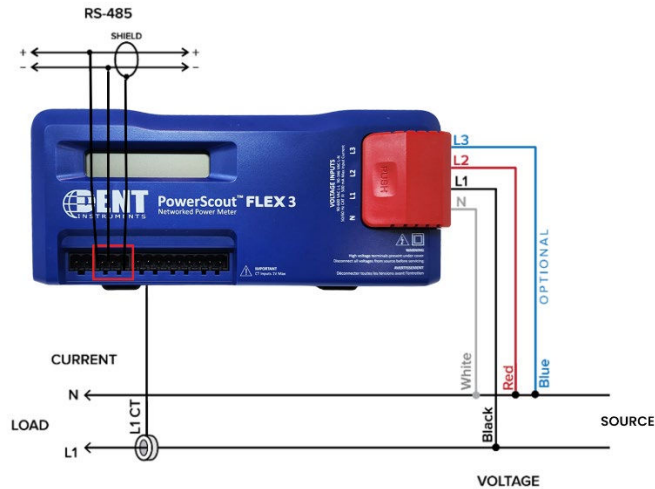
For service types that are not specifically shown, configure the load using the closest applicable service type in FLEXPoint™. Single-phase loads may be configured individually, and physical CT inputs may be assigned to the appropriate Virtual Meter during commissioning.

Three-phase and split-phase loads are shown as examples only. PowerScout™ FLEX meters use Virtual Meters, so physical current sensor inputs are not permanently tied to fixed three-channel elements. Document the physical CT input number and measured load for each installed current sensor before commissioning.

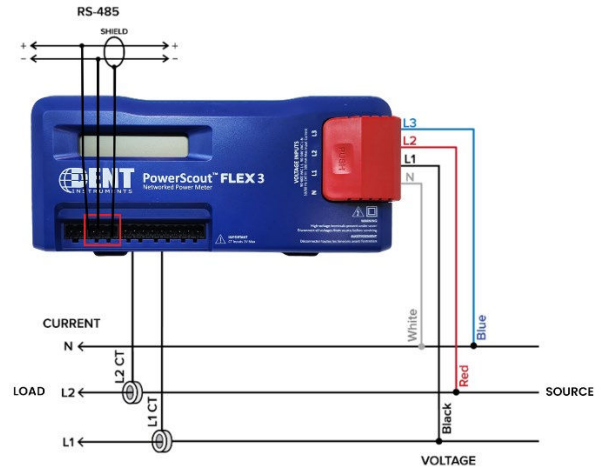
Wiring CTs to PowerScout™ FLEX 3 Meters

The images below show typical current sensor and voltage connections for the PowerScout™ FLEX 3.

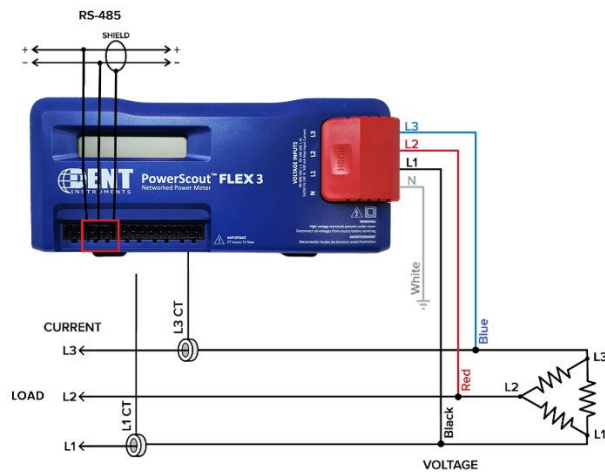
Two Wire Single Phase



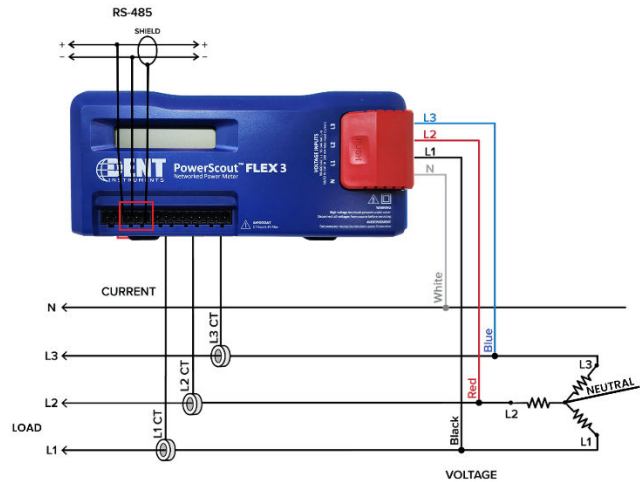
Three Wire Single Phase



Two CT Three Wire Delta



Four Wire Three Phase



For specific wiring questions outside the scope of this manual, contact DENT technical support.

6.4 Documenting CT Inputs for FLEXPoint™ Commissioning

After current sensors are installed and wired, document the physical CT input used for each measured load. This information is required during FLEXPoint™ commissioning to assign installed current sensors to the correct Virtual Meters.

At minimum, record the following information for each current sensor:

Field	Example
Physical CT input	CT 17
Load or circuit name	Panel A Lighting
Phase / conductor	L1 / Phase A
Voltage reference	L1-N
Current sensor type	Split-core CT
Current sensor range	200 A
Orientation note	Arrow toward load / label toward source
Special notes	CT Sign corrected in FLEXPoint™, if applicable

The physical CT input number should be recorded before the panel is closed or before wiring becomes difficult to trace. Do not assume that the CT input number identifies the load by itself. The load name, phase/conductor, and voltage reference are needed to complete configuration accurately.

Refer to the **FLEXPoint™ Commissioning Guide** for detailed instructions on creating Virtual Meters, assigning physical CT inputs, selecting CT types, setting voltage references, using the CT Picker, applying CT Sign correction, and verifying real-time measurements.

After commissioning, confirm that measured current, power, power factor, and energy direction are reasonable for each configured load.

7 Wiring – Communications Connections

PowerScout™ FLEX meters support communication by **USB, Ethernet, and RS-485**. USB is typically used for local setup and commissioning. Ethernet and RS-485 are typically used for permanent connection to a building automation system, data logger, RTU, gateway, or other host system.

This section covers only the physical communication wiring connection. Communication setup, protocol settings, network addressing, and verification are covered in **Chapter 11, Communication Setup**.



IMPORTANT: PowerScout™ FLEX meters do not support Power over Ethernet. When using Ethernet, the meter must be powered from line voltage or USB during setup.

7.1 Ethernet Connection

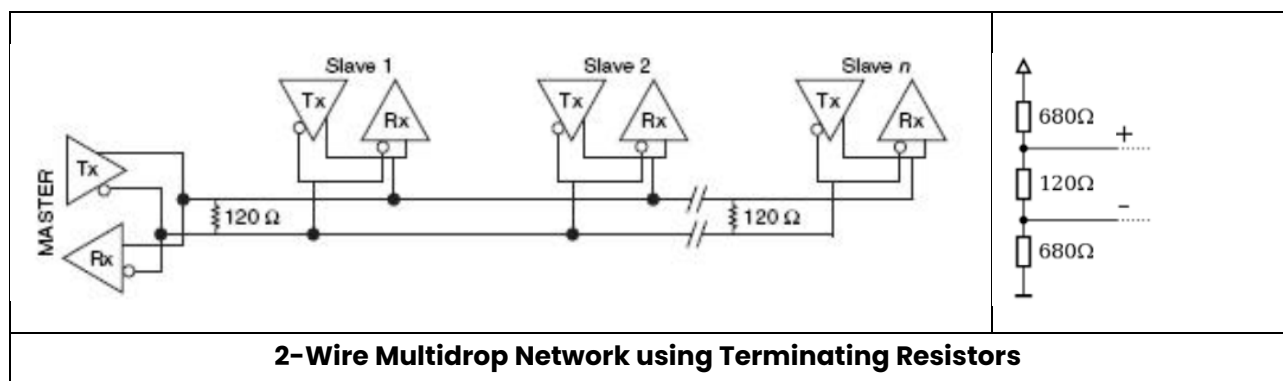
Connect the Ethernet cable to the meter's Ethernet port and to the appropriate network switch, router, gateway, or host device.

Ethernet may be used for FLEXPoint™, FLEXPoint™ Go, Modbus TCP, or BACnet/IP communication. Network configuration and verification are covered in **Chapter 11, Communication Setup**.

7.2 RS-485 Connection

Connect the RS-485 communication conductors to the meter's RS-485 terminals.

PowerScout™ FLEX uses a **2-wire half-duplex RS-485** connection. RS-485 networks should be wired in a daisy-chain topology. If the meter is installed at the end of the RS-485 daisy chain, install a user supplied termination resistor as required by the network design.



Terminal naming conventions vary by manufacturer. On PowerScout™ FLEX, **A corresponds to -** and **B corresponds to +**.

RS-485 topology, termination, biasing, addressing, and protocol verification are covered in **Chapter 11, Communication Setup**.

7.3 USB Connection

Connect the supplied USB cable between the meter and the computer running FLEXPoint™.

USB may be used for local setup, commissioning, and service access. USB is not typically used as the permanent communication connection to the host system.

8 Wiring – Auxiliary Inputs and Outputs

This section describes auxiliary wiring connections available on applicable PowerScout™ FLEX models. Auxiliary features may include pulse inputs, alarm output, and auxiliary power output depending on meter model and configuration.

Configuration, scaling, alarm setup, and verification are covered in **Chapter 11, Communication Setup** and the **FLEXPoint™ Commissioning Guide**.

8.1 Available Auxiliary Connections

PowerScout™ FLEX auxiliary connections vary by model. Confirm the meter model before wiring pulse inputs or auxiliary power.

Connection	PowerScout FLEX 3	PowerScout FLEX 12	PowerScout FLEX 24	PowerScout FLEX 48
Pulse Inputs	None	4 inputs	2 inputs	2 inputs
Alarm Output	Yes	Yes	Yes	Yes
12 V Auxiliary Power	Not available	200 mA max	200 mA max	200 mA max

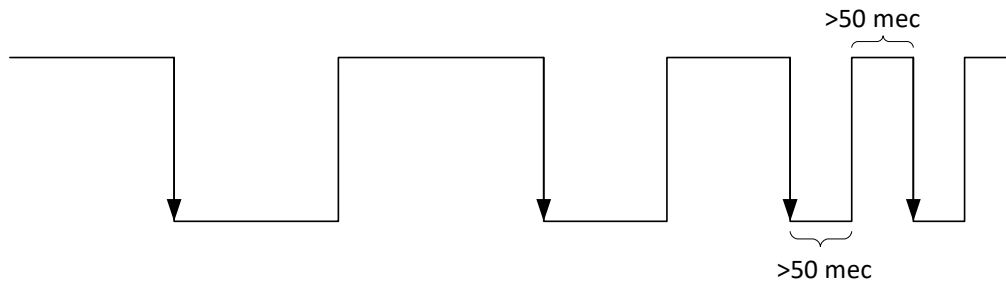
8.2 Pulse Inputs

Pulse inputs are used to count pulses from external devices such as water, gas, thermal, or other utility meters with compatible pulse outputs.

PowerScout™ FLEX pulse inputs are intended for **dry contact connections only**. Do **not** apply external voltage to the pulse input terminals. The meter provides an internal, current-limited sensing voltage for dry contact pulse detection.

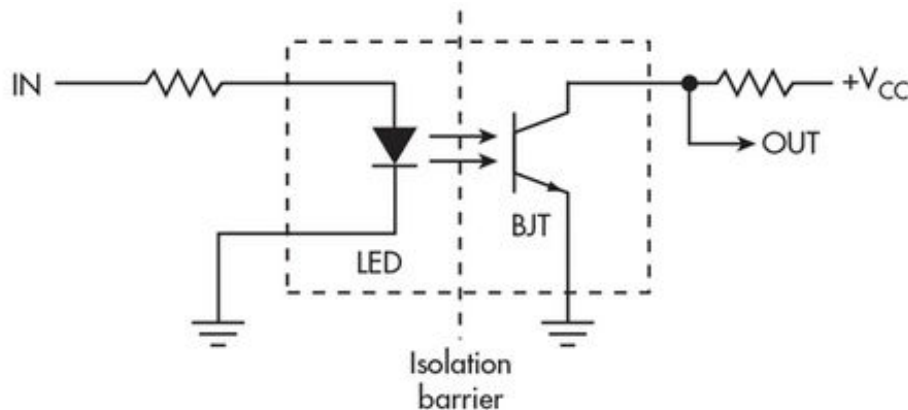
Connect the external pulse output device to the appropriate pulse input terminals on the PowerScout™ FLEX meter. Follow the wiring requirements for the external device and verify compatibility before connection.

Pulse inputs are intended for low-speed pulse counting. The pulse duration must exceed 50 ms in both the logic low and logic high state, allowing a maximum input frequency of 10 Hz.



Pulse scaling, reset functions, and accumulated pulse values are configured and viewed through FLEXPoint™ or the host system.

8.3 Alarm Output Wiring



The alarm output may be used to signal an alarm condition to external equipment or a host system input. The output is intended for low-voltage DC signaling and requires an external DC source between **5–24 VDC** with a customer-supplied pull-up resistor. A **10 kΩ, ¼ W** pull-up resistor is recommended.

Wire the alarm output according to the electrical requirements of the connected device. Do not exceed the rated voltage or current for the alarm output circuit.

Alarm conditions and alarm thresholds are configured in FLEXPoint™. Refer to the FLEXPoint™ Commissioning Guide for alarm setup and verification.



Note: The Master Alarm output is intended for low-voltage DC connections only.

8.4 12-Volt Auxiliary Power Output

PowerScout™ FLEX 12, PowerScout™ FLEX 24, and PowerScout™ FLEX 48 meters provide a 12 V auxiliary power output rated for **200 mA maximum**.

The auxiliary power output may be used to power compatible low-current external devices. Verify that the connected device is compatible with the available voltage and current before wiring.



IMPORTANT: Do not exceed the rated auxiliary power output. The 12 V auxiliary power output is not available on PowerScout™ FLEX 3 meters.

9 Basic Meter Configuration

This section is intended to give a brief overview of how meter configuration is performed using either the FLEXPoint™ software or the FLEXPoint™ Go on board webserver. For complete configuration details and instructions please refer to the PowerScout™ FLEX Programming and Integration Guide.

9.1 Powering Up

In order to configure the meter, it must be powered. This can either be accomplished by having the meter wired to a live voltage feed (See section 5.3), or by connecting to a computer through the USB port.



9.2 Communication Interfaces

The PowerScout™ FLEX meter communication interfaces include Ethernet (LAN) or RS-485 serial. BACnet MS/TP and Modbus RTU are the two communication protocols that operate over an RS-485 serial network and BACnet IP and Modbus TCP are supported over Ethernet. A USB port is also provided as the preferred connection for on-site configuration and can be run concurrently with an RTU.



Note: BACnet MS/TP is not supported when Ethernet connection is present.

9.3 Meter Configuration Using FLEXPoint™

This section describes how to configure the PowerScout™ FLEX meter using the FLEXPoint™ Windows application. In many installations, meter settings are prepared in advance using project documentation so the meter can be deployed with a predefined configuration. In other cases, configuration may be completed on site to match as-built conditions.



IMPORTANT: PowerScout™ FLEX cannot be configured with FLEXPoint™ over an RS-485 serial connection. If RS-485 is used for network communications, serial settings must be established in advance or configured through a Modbus or BACnet host system.



IMPORTANT: If the FLEXPoint™ Windows application cannot be used, refer to the FLEXPoint™ Go section for the simplified web-based interface. FLEXPoint™ Go can be accessed through the USB port and supports browser-based access, including on macOS systems.

9.4 FLEXPoint™ Software Installation

These instructions apply to a new FLEXPoint™ installation. If you are upgrading from an earlier version, complete the uninstallation procedure at the end of this section before installing the new version. Refer to the upgrade instructions included with the installer package, if applicable.



IMPORTANT: FLEXPoint™ Does NOT support ARM Processors!

Installation

Download the latest version of the FLEXPoint™ software from

You will need to have **administrative privileges** on your PC to properly install the software. This ensures that Windows permissions are in place to allow the software to access or create the required directories.

1. Checking for User Account Permissions

- a. Access the **Control Panel** on your computer
- b. Click on **User Accounts**
- c. **Confirm Permission**
 - i. User types are Administrator, Standard, and Guest

2. Install as Administrator

If your user profile is not listed as an Administrator, some installations allow a temporary permission as follows:

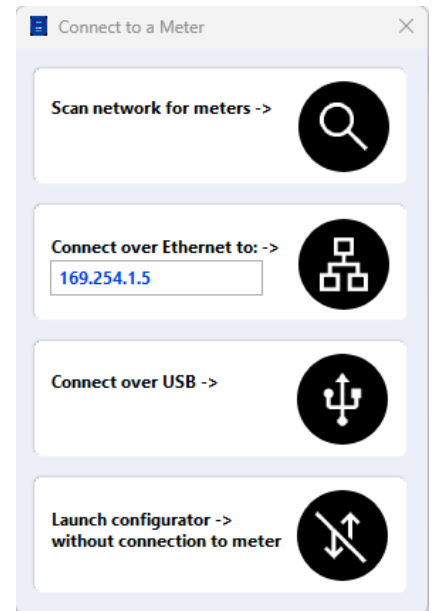
- a. Right-click on the “**FLEXPoint™ Installer.exe**” and select “Run as administrator”

Operation

The FLEXPoint™ software requires the LabView runtime engine to operate. If necessary, the installer will install the necessary runtime files to allow for full functionality.

When the FLEXPoint™ application is launched, it will prompt the user to select one of four connectivity options.

- Scan Network for Meters
- Connect over Ethernet to a Predetermined IP address
- Connect over USB cable (A to C)
- Launch without connection (no meter connected)

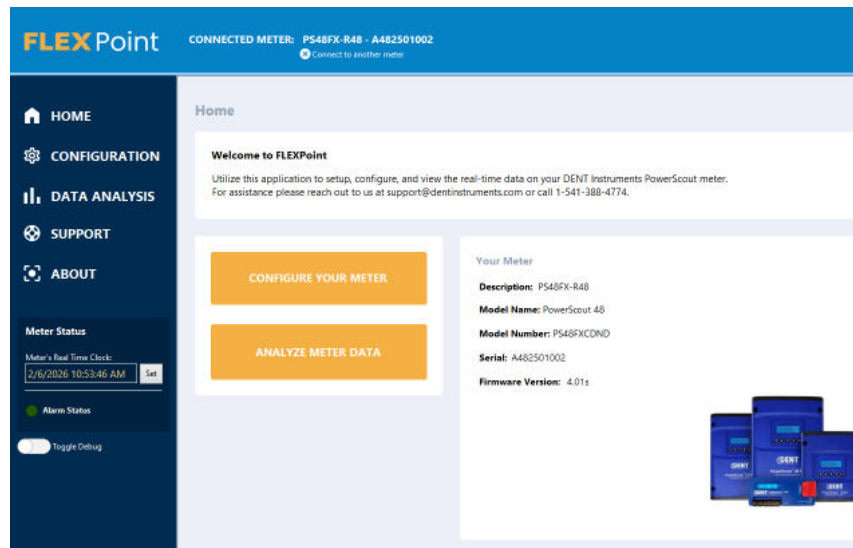


Note: The USB connection method is recommended for new users who have physical access to the meter and the appropriate USB cable (supplied)

Layout and Overview

FLEXPoint

FLEXPoint™ is a Windows application designed to easily configure, manage, and view your PowerScout™ FLEX meter setup and data. The application has been created with user experience in mind and modeled after modern application design best practices and standards.



The application interface is broken down into clear navigable sections to quickly and easily configure your meter, view the real-time data, and get support for your POWERSCOUT™ FLEX meter.

Virtual Meters Configuration Overview

Virtual meters are the primary advantage of the PowerScout™ FLEX product line. Your PowerScout™ FLEX meter is designed with maximum flexibility in mind. You can configure as many virtual meters as needed for your requirements up to the maximum number of virtual meters supported by your specific model.



Note: The USB connection method is recommended for new users who have physical access to the meter and the appropriate USB cable (supplied)

By default, your PowerScout™ FLEX meter has no factory virtual meters configured.

To create your first virtual meter, click the "Add Virtual Meter" button.



Add Virtual Meter

Add Virtual Meter

Virtual Meter Configuration Settings

ID: 2 Description: Mains V Input: 1

Breaker Type: 3 Pole Breaker Image:

SELECT BREAKER TYPE

Configure Virtual Channels

Channel 1

Physical CT #: 4 Volt Ref: L1-N Type: RoCoil Range: 4000 Ph. Shift: 0 Multiplier: 1 CT Sign: +

SELECT CT # SELECT TYPE

Channel 2

Physical CT #: 5 Volt Ref: L2-N Type: RoCoil Range: 4000 Ph. Shift: 0 Multiplier: 1 CT Sign: +

SELECT CT # SELECT TYPE

Channel 3

Physical CT #: 6 Volt Ref: L3-N Type: RoCoil Range: 4000 Ph. Shift: 0 Multiplier: 1 CT Sign: +

SELECT CT # SELECT TYPE

SAVE W/O SENDING TO METER SAVE AND SEND TO METER CANCEL

For each virtual meter, you will configure the following options:

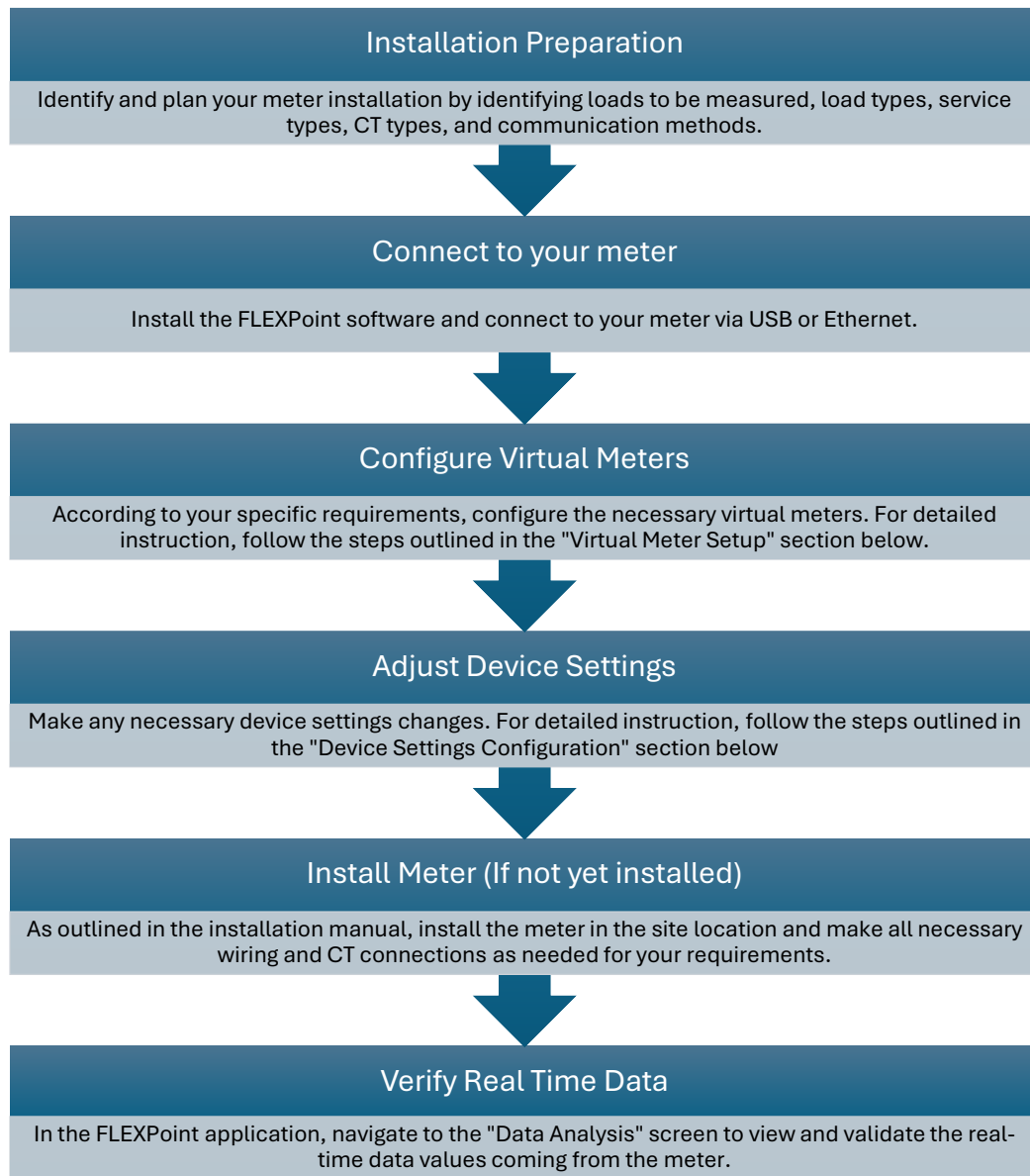
- **Description**
- **Voltage Input**
- **Breaker Type**
- **Virtual Channels (CT Selection)**

For each virtual channel, you will identify the following configuration options:

- **Physical CT#**
- **Volt Reference**
- **CT Type**
- **Range**
- **Phase Shift**
- **Multiplier**
- **CT Sign**

Configure your virtual meter options according to the physical setup on your electrical loads you intend to monitor.

9.5 Basic Workflow

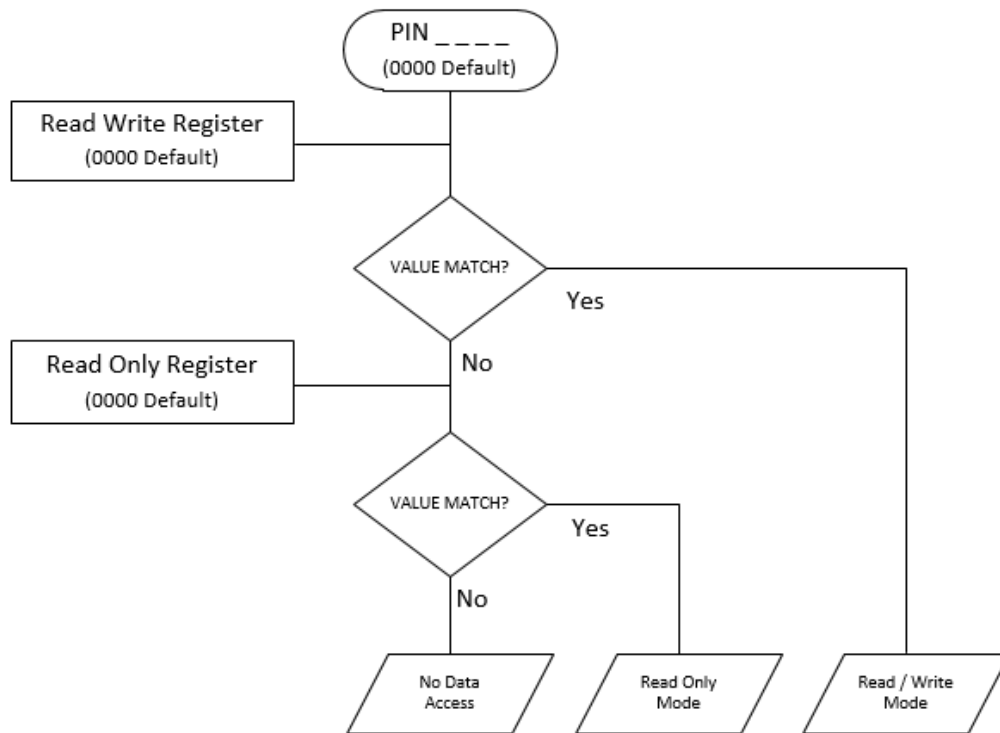


9.6 Access Restriction Limitations

If security levels have been set up in the meter, no data is accessible through the LCD user interface or FLEXPoint™ Go Web App without entering the PIN credentials. Note, however, that protocols such as Modbus do NOT SUPPORT ANY LEVEL of security such that any network traffic acting as a master can retrieve and write data from the registers. Generally, this will require knowledge of the IP address or slave ID and the register list which discourages casual intrusion.

9.7 Security PIN Protection

PowerScout™ FLEX meters have two levels of PIN protection that users can choose to assign for restricting access to meter information. The PIN logic is described in the figure below. The **default** user entry (on power up or time-out) is **0000** which satisfies **both** the Read Only and the Read / Write default register settings.



Using the Permission Registers

The POWERSCOUT™ FLEX meter uses both a “Read Only” register and a “Read / Write” register to compare against user entrees from the meter’s keypad or FLEXPoint™ Go Web App form entry. Both internal permission registers have a default value of [0000]. A consequence of this is that both PIN registers need to be configured (i.e. changed from defaults) to implement a read only PIN. Otherwise, a situation may occur where a user intends to restrict access to “Read Only” by setting only this PIN unaware of the fact that the default PIN still matches the criteria for “Read / Write” which will accidentally promote the user. FLEXPoint™ and the FLEXPoint™ Go Web App disallow this condition, but remote programmers using direct register access may create this condition.

Read Only Permission Register

Configuring the meter for a Read Only user allows data or configuration items to be viewed but not changed. This level of authorization might be appropriate for general end-users, such as building owners, who may not be aware of the details of the installation.

Use the FLEXPoint™ software to configure the Read Only PIN. FLEXPoint™ Go does not currently support setting or changing PINs.

Read/Write Permission Register

Read/Write permissions allow users to read and write configuration items and to reset PINs. This level of authorization is required by any technician or user who needs the ability to correct setup errors in the meter.

Use the FLEXPoint™ software to configure or reset the Read/Write PIN. The default PIN [0000] allows initial access until the PINs are changed. Permissions cannot be set through the LCD interface or FLEXPoint™ Go.

Reading PINs Over Modbus

FLEXPoint™ can be used to directly report the Read Only and Read/Write PINs under the Advanced tab. The value reported by FLEXPoint™ is the value entered when the PIN was configured.

PINs are also accessible as Modbus registers but are encoded so that reading the value of the register through an RTU does not reveal the PIN. This feature allows DENT Instruments to support retrieval of forgotten PINs if network access is available.

FLEXPoint™ – Unrestricted Access

The FLEXPoint™ software tool can be used to read and write configuration information to the meter without entering credentials.



NOTE: FLEXPoint™ is currently the only DENT software tool for setting, changing, or resetting access restriction PINs. FLEXPoint™ Go can require a configured PIN for access, but PIN setup must be performed in FLEXPoint™.

10 Verification of Installation

After the PowerScout™ FLEX meter has been installed, configured, and connected to the host system or commissioning tool, verify that voltage references, current sensors, CT orientation, and communication settings are correct.

Verification should be performed before the panel is closed out and before the system is handed over to the customer or integrator.

Typical verification includes:

- Confirming measured voltage values
- Confirming measured current values
- Confirming CT orientation and power sign
- Confirming CT-to-voltage phasing
- Confirming communication with the host system
- Confirming that Virtual Meter names and point mappings match the project documentation

Verification may be performed using FLEXPoint™, FLEXPoint™ Go, the LCD user interface if equipped, or the host system.

10.1 Real-Time Value Check

Use FLEXPoint™, FLEXPoint™ Go, or the LCD user interface to review real-time values for each configured Virtual Meter.

For each Virtual Meter, confirm that the following values are reasonable for the connected load:

- Voltage
- Current
- kW
- kVA
- kVAR
- Power factor
- Energy direction
- Frequency

Compare displayed values against expected circuit voltage, load type, breaker size, and operating condition. If a value appears incorrect, verify the physical wiring, CT placement, voltage reference, CT range, CT assignment, and Virtual Meter configuration.

A digital multimeter or clamp meter may be used to confirm voltage and current values during commissioning.

10.2 PhaseChek™ Verification

The PowerScout™ FLEX meter includes patent-protected PhaseChek™, a verification feature used to identify likely CT phasing or wiring issues. PhaseChek™ evaluates enabled Virtual Meters and flags channels where the measured power factor suggests that a CT may be associated with the wrong voltage reference or installed on the wrong conductor.

PhaseChek™ may indicate a potential issue when the absolute power factor is below 0.55.

PhaseChek™ can be viewed using:

- **FLEXPoint™**: Real-Time Values
- **FLEXPoint™ Go**: Real-Time Values
- **LCD user interface**: Verify Installation

In FLEXPoint™ and FLEXPoint™ Go, PhaseChek™ runs continuously on all enabled Virtual Meters. Channels with low power factor are shown in red or with a red indicator.

PhaseChek™ is applied only to enabled Virtual Meters.

Using the LCD user interface, navigate to **VERIFY INSTALLATION** and press **ENTER**. The LCD lists any enabled Virtual Meters with at least one channel below the PhaseChek™ threshold.

CHECK Virtual Meters

A EF

Use the navigation buttons to highlight a specific Virtual Meter, then press **ENTER**. Within each Virtual Meter, the LCD identifies each channel as **OK** or **Bad**.

Virtual Meter 4

CH1 OK

CH2 Bad

CH3 Bad

Two **Bad** channels on the same Virtual Meter may indicate that two CTs have been swapped or assigned to the wrong voltage references. When all enabled channels are above the PhaseChek™ threshold, the meter reports:

CHECK Virtual Meters

ALL Virtual Meters OK

If PhaseChek™ identifies a potential issue, verify that the CT is installed on the correct conductor, assigned to the correct Virtual Meter channel, and paired with the correct voltage reference. Also confirm that the service type is configured correctly and that the load is operating under normal conditions.

PhaseChek™ is advisory only. Some loads may legitimately operate below 0.55 power factor, such as lightly loaded motors or unusual reactive loads. Use measured voltage, current, power, and field conditions to confirm whether a wiring correction is required.

10.3 CT Orientation Check

For typical load monitoring, install each CT so the arrow or polarity marking points toward the load, unless the CT label or project documentation indicates otherwise.

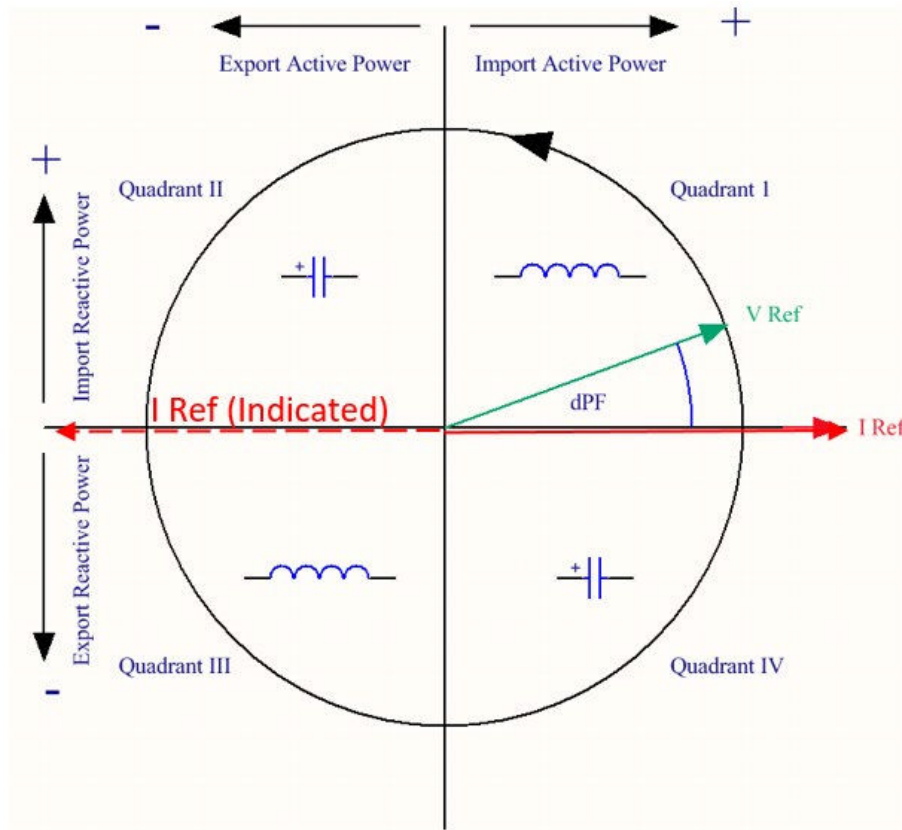
Incorrect CT orientation will cause power and energy values to report with the wrong sign. The PowerScout™ FLEX meter reports power and energy direction using import and export values. When a CT is installed backward, the indicated current vector is approximately 180 degrees from the expected position. Current magnitude will still appear correct, but real power, reactive power, and energy direction will report with the opposite sign.

In many load-monitoring applications, this means import power or energy may read near zero while export power or energy shows a value. A moderate power factor, such as greater than 0.7, together with negative real power is a common indication that the CT is on the correct phase but reversed. A reversed CT does not change the magnitude of the power factor.

Check CT orientation by confirming the sign of real power for each Virtual Meter or channel.

Use one of the following methods:

- **FLEXPoint™:** Real-Time Values
- **FLEXPoint™ Go:** Real-Time Values
- **LCD user interface:** Real-Time Values
- **Host system:** kW and energy registers



Electrical Power Quadrants with Reversed CT shown



IMPORTANT: If a CT is discovered to be backward after installation is complete and cannot be physically reoriented, use the CT Sign setting in FLEXPoint™ to reverse the channel polarity in software. CT Sign may also be configured through the applicable user configuration registers. Refer to the PowerScout™ FLEX Programming Guide for register details

10.4 Phasor Plot Verification

FLEXPoint™ includes a phasor plot that can be used to review voltage and current phase relationships for a Virtual Meter.

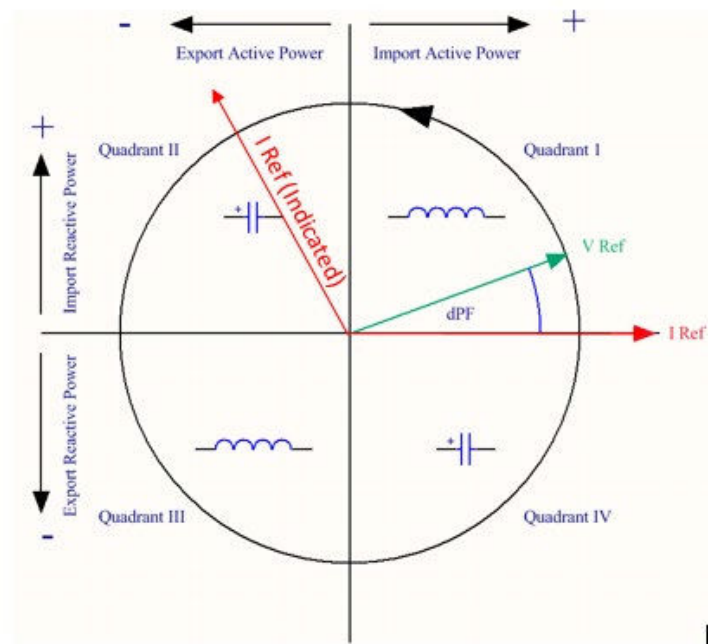
Use the phasor plot when PhaseChek™ flags a possible issue or when real-time values do not match expected load behavior.

The phasor plot can help identify:

- CTs installed on the wrong conductor or phase
- CTs assigned to the wrong voltage reference
- Reversed CT orientation
- Unexpected leading or lagging power factor
- Abnormal phase relationships

When a CT is associated with the incorrect voltage reference, the indicated current vector may appear approximately 180 degrees from the expected position in a split-phase system or approximately 120 degrees from the expected position in a three-phase system. This typically causes a significant decrease in reported power factor, even if the CT is also reversed.

Use the phasor plot together with PhaseChek™, real-time values, field wiring documentation, measured voltage, measured current, and load operating conditions.



Electrical Power Quadrants with Incorrect CT Phase shown

10.5 Communication Verification

After electrical verification is complete, confirm that the meter is communicating with the intended host system, RTU, BMS, gateway, or software platform.

For Ethernet installations, verify:

- IP address
- Subnet mask

- Gateway, if required
- Protocol selection
- Modbus TCP or BACnet/IP communication
- Host system discovery or point readout

For RS-485 installations, verify:

- RS-485 polarity
- Baud rate
- Parity
- Stop bits
- Modbus slave address or BACnet MS/TP address
- Network termination, if required
- Host system communication

Communication settings may be reviewed using FLEXPoint™, FLEXPoint™ Go, the LCD user interface if equipped, or the host system.

Detailed communication setup is covered in Section 12, Communication Setup.

10.6 Host System Point Verification

For integrated systems, confirm that the host system is reading the intended values from each Virtual Meter.

Verify that:

- Virtual Meter names match the project documentation.
- Point names match the intended loads.
- CT input assignments match the installed CTs.
- Voltage references match the configured service type.
- Units are correct.
- Energy, demand, and power values are mapped correctly.
- BACnet objects or Modbus registers match the integration documentation.

If Virtual Meter configuration changes are made after host system integration, the host system may need to rediscover the meter, refresh its object list, or update point mappings.

10.7 Commissioning Closeout

Before completing commissioning, record or export the final meter configuration.

Recommended closeout items include:

- Meter model and serial number
- Firmware version
- Network settings
- Protocol settings
- Virtual Meter names
- Service type for each Virtual Meter
- Voltage reference for each Virtual Meter or channel
- Physical CT input assignments
- CT type and range
- CT Sign settings
- PhaseChek™ results
- Host system point mapping
- Any field corrections made during commissioning

Save the final FLEXPoint™ configuration file with the project documentation.

11 Integration & Programming

This section provides guidance for integrating the PowerScout™ FLEX meter with a host system, including RTUs, BMS platforms, and software tools. It outlines the Virtual Meter data model, Modbus access models, and basic configuration concepts required for successful integration.

Unlike earlier PowerScout™ models, PowerScout™ FLEX uses **Virtual Meter** architecture, which allows flexible assignment of current sensors and more adaptable data organization.

11.1 Integration Overview

PowerScout™ FLEX meters may be integrated with host systems using Modbus RTU, Modbus TCP, BACnet MS/TP, or BACnet/IP. Integration setup depends on the selected communication interface, protocol, addressing method, and Virtual Meter configuration.

Unlike earlier PowerScout™ models, PowerScout™ FLEX uses Virtual Meters to represent configured loads. Virtual Meters affect how measurement data is organized, addressed, and presented to host systems.

For detailed setup, programming, register mapping, BACnet object information, and integration examples, refer to the **PowerScout™ FLEX Programming & Integration Guide** and the applicable register list.

11.2 Information Covered in the Programming & Integration Guide

Topic	Refer To
FLEXPoint software setup	Programming & Integration Guide
USB and Ethernet connection methods	Programming & Integration Guide
FLEXPoint GO web app	Programming & Integration Guide
Virtual Meter configuration	Programming & Integration Guide
Modbus RTU and Modbus TCP setup	Programming & Integration Guide
Flattened Modbus register model	Programming & Integration Guide
BACnet MS/TP and BACnet/IP setup	Programming & Integration Guide
Register organization and data acquisition	Programming & Integration Guide
Advanced settings, CT multipliers, and phase shift compensation	Programming & Integration Guide
Communication troubleshooting	Programming & Integration Guide

12 Communication Setup

This section describes basic communication setup and verification for the PowerScout™ FLEX meter. Communication settings may be confirmed using the LCD user interface, FLEXPoint™, FLEXPoint™ Go, or the host system, depending on the installation.

If electrical installation and commissioning are performed by different personnel, communication setup may require coordination between field technicians and remote controls or integration staff.



Once the meter is powered from line voltage, ONLY TOUCH THE METER IF THE TOUCHSÄF™ HIGH VOLTAGE COVER IS INSTALLED. For multi-circuit meters, it is safe to touch the meter (including the user buttons) with the top cover removed ONLY if the TouchSäf™ high voltage cover is installed.

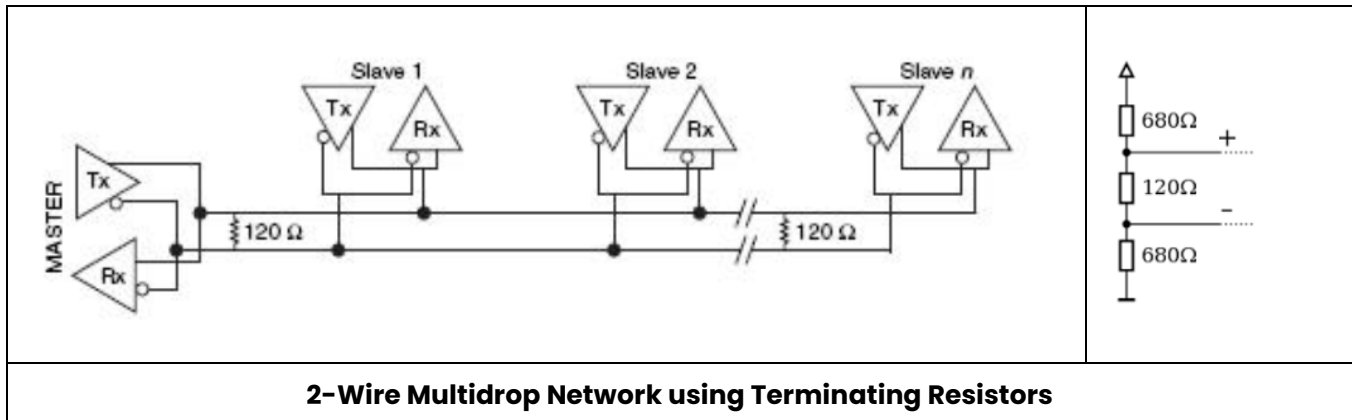


IMPORTANT: Communications settings and real-time data values can be confirmed quickly using the LCD interface if equipped. When significant setup modifications are anticipated, a computer interface is recommended.

12.1 RS-485 Network

Physical Connections on an RS-485 Multidrop Network

The PowerScout™ FLEX meter uses a 2-Wire Half Duplex RS-485 Implementation.



- **Termination Resistors**

Termination resistors are not provided with the meter. When a PowerScout™ FLEX meter is installed at the end of an RS-485 daisy chain, install a 120 ohm terminating resistor between the + and - terminals.

- **Bias Resistors**

Bias resistors are not provided with the meter. Biasing is required when needed to maintain a known idle bus state. These resistors are typically installed at the master node and are commonly 680 ohms for RS-485 networks.

- **Network Topology**

RS-485 is intended for daisy-chain wiring. Star and other branched topologies should be avoided.

- **Signal Names**

Terminal naming conventions vary among manufacturers. Some devices use **A/B**, while others use **+/-**. On PowerScout™ FLEX, **A corresponds to -** and **B corresponds to +**.

- **Bus Loading**

Each PowerScout™ FLEX meter represents a 1/8 unit load, allowing up to 256 similar devices on a single RS-485 segment.

12.2 Communication Verification



IMPORTANT: Verification includes confirmation of BOTH the physical interface settings (Serial or Ethernet) and the protocol (Modbus or BACnet) settings.

LCD User Interface

The optional LCD user interface can be used to confirm the communication settings required for the selected interface and protocol. Related settings are grouped together within the menu structure for easier review.

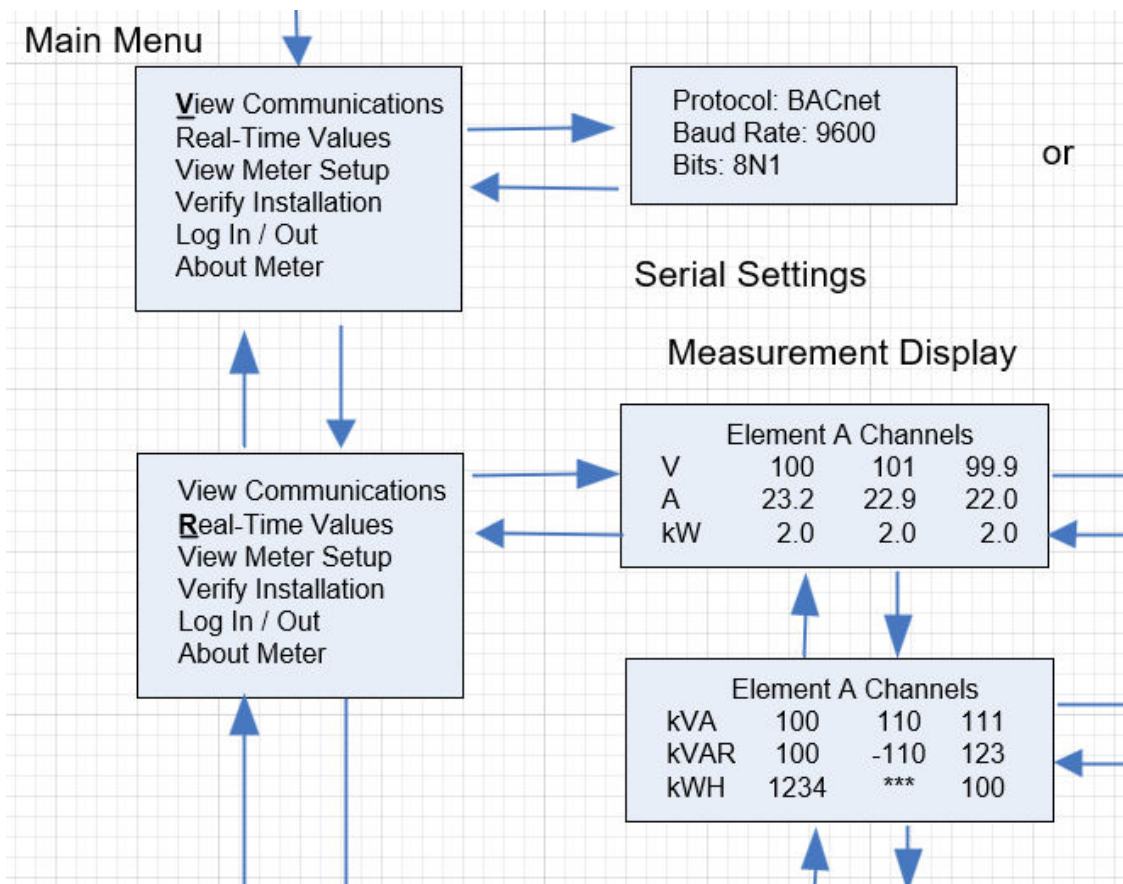
A complete menu map for the PowerScout™ FLEX 12, PowerScout™ FLEX 24, and PowerScout™ FLEX 48 is provided in Appendix A. Arrows in the appendix indicate how to move from one display to the next. In the menu documentation, the highlighted entry identifies the active menu item. On the physical LCD, the active item is indicated by a blinking character.

Use the **ENTER** button to select a menu item or property. Use the **Up** and **Down** buttons to scroll through menu options and available values.

Changes made through the LCD are limited to communication settings. Other configuration changes, including current sensor selection and other advanced setup options, must be completed using a software interface such as FLEXPoint™.

The PowerScout™ FLEX 3 uses a different LCD arrangement than the PowerScout™ FLEX 12, PowerScout™ FLEX 24, and PowerScout™ FLEX 48. Its two-line display and thumbwheel navigation differ from the four-line button-based interface used on the larger models. For wall-mount versions, the thumbwheel is accessible by removing the top enclosure.

The LCD interface can also be used to view real-time values, but it does not support advanced meter configuration. FLEXPoint™ is the recommended tool for full meter setup.



Example LCD Navigation

FLEXPoint™ / FLEXPoint™ Go Web App

If the PowerScout™ FLEX meter does not include an LCD user interface, or if verification will be performed in software, use FLEXPoint™™ or the FLEXPoint™ Go web app to confirm communication settings and review live meter data. FLEXPoint™ and FLEXPoint™ Go use a similar interface structure and support software-based verification of the installation.

Refer to the configuration section or the FLEXPoint™ Commissioning Manual for an overview of these tools and related instructional resources.

12.3 Ethernet Setup

Network Verification

PowerScout™ FLEX communicates over IEEE 802.3 Ethernet at 10/100 Mbps. Verification of Ethernet communication includes confirming that the meter has a valid IP configuration for the target network. For static IP installations, verify that the meter IP address, subnet mask, and gateway

settings are compatible with the host network. For DHCP installations, verify that the meter is configured for DHCP and has received a valid IP address from the DHCP server.

DHCP

If the PowerScout™ FLEX meter is configured for DHCP, it will request an IP address from the DHCP server when the meter is powered or connected to the network. The assigned address may be displayed on the LCD user interface or viewed through FLEXPoint™ or FLEXPoint™ Go.

Because DHCP-assigned addresses may change between power cycles or network events, DHCP is typically used for discovery or initial connection rather than long-term fixed integration, unless the network is managed accordingly.

STATIC IP

If the PowerScout™ FLEX meter is configured for a static IP address, the address should be assigned in accordance with the site network plan to avoid address conflicts. Static addressing is commonly used when an RTU, BMS, or other host system expects to find the meter at a known IP address.

12.4 Protocol Verification

The network protocol is typically specified as part of the installation. BACnet MS/TP and Modbus RTU operate over RS-485, while BACnet/IP and Modbus TCP operate over Ethernet. Each interface and protocol combination requires specific communication settings.

The purpose of this section is to confirm or adjust those settings to match the installation requirements. Additional integration and optimization guidance is provided in the Programming and Integration Guide.

12.5 Modbus Settings

Modbus RTU Settings

In a Modbus RTU network, each device must be assigned a unique slave address. Valid Modbus addresses are 1 to 240. The configured address must match the address expected by the RTU or host system.

The default Modbus address setting for Virtual Meter 1 or Element A is 1. For multi-element models, adjacent elements data can be accessed by incrementing the slave address by 1 up to the maximum number of 3 channel elements in the meter.

Note: The PS48 requires 15 addresses beyond VM1, the PS24 requires 7 addresses beyond VM1, and the PS12HD requires 3 addresses beyond VM1.

Modbus TCP Settings

Modbus Port: Modbus TCP uses the standard port **502**. This port number cannot be changed.

12.6 BACnet Settings

In a BACnet network, each device must be assigned a unique Device ID. This applies to both BACnet MS/TP and BACnet/IP. The Device ID may be changed using FLEXPpoint™, FLEXPpoint™ Go, or a BACnet explorer tool.

BACnet MSTP

Device Address

DENT meters are BACnet MS/TP master devices and must use addresses in the range from 0 to 127. Each address must be unique on the network.

Max Masters

The default setting is 127 and does not usually need to be changed.

Max Info Frames

The default setting is 1 and does not usually need to be changed.

12.7 BACnet/IP

BACnet Port

The default BACnet/IP port is **47808** and does not usually need to be changed.

BBMD

The BACnet/IP Broadcast Management Device setting defaults to **0.0.0.0** and may be changed through a software tool if discovery across networks is required.

Appendix A – Glossary of Terms

Term	Definition
Accuracy Class	A designation describing expected meter or CT accuracy under defined conditions. Actual measurement accuracy depends on the meter, CTs, installation, configuration, loading, and applicable standards.
Alarm	A meter-generated status condition that indicates a configured threshold or event has occurred. Alarms may be viewed in software, read through registers, or reported through a hardware output depending on model and configuration.
Alarm Persistence	The amount of time an alarm condition must remain continuously active before the alarm is triggered. This helps reduce nuisance alarms from short-duration events.
Analog Input (AI)	A BACnet object type typically used to represent floating-point meter readings.
Analog Value (AV)	A BACnet object type typically used to represent writable or configurable floating-point values.
ANSI Power Factor Convention	A power factor sign convention where positive power factor indicates lagging current, typically associated with inductive loads, and negative power factor indicates leading current, typically associated with capacitive loads.
Apparent Power	The total power supplied to a load, including both real and reactive components. Apparent power is measured in volt-amperes, or VA.
Auxiliary Power Output	A low-voltage output provided by some meter models for powering external devices such as radios or sensors. Use only within the specified voltage and current limits.
BACnet	Building Automation and Control Network. A communication protocol commonly used in building automation systems.
BACnet/IP	BACnet communication over Ethernet/IP networks.
BACnet MS/TP	BACnet communication over an RS-485 serial network. MS/TP stands for Master-Slave/Token-Passing.
BACnet Object	A data point exposed through BACnet communication. BACnet objects may represent meter readings, configuration values, status values, or text values depending on the object type.
BACnet Port	The network port used for BACnet/IP communication. The default BACnet/IP port is typically 47808.

BBMD	BACnet/IP Broadcast Management Device. A BACnet device or function used to support BACnet broadcast traffic across IP subnets.
Binary Value (BV)	A BACnet object type typically used to represent Boolean settings or two-state values.
BitString Value (BSV)	A BACnet object type typically used to represent bitfield status words or grouped binary flags.
Building Management System (BMS)	A host system used to monitor and control building equipment. A BMS may communicate with the meter using Modbus or BACnet.
Burden	The electrical load connected to a CT secondary circuit. Burden can affect CT accuracy, especially for current-output CTs.
Channel	An individual current measurement path within a Virtual Meter. Channels are identified as CH1, CH2, and CH3 within each Virtual Meter.
Character String Value (CSV)	A BACnet object type used to represent text string values.
Commissioning	The process of configuring, verifying, and documenting meter operation after installation. Commissioning commonly includes checking wiring, CT orientation, communication settings, and reported values.
Communication Interface	The physical communication connection used by the meter, such as Ethernet, USB, or RS-485.
Communication Protocol	The data communication method used between the meter and a host system, such as Modbus RTU, Modbus TCP, BACnet MS/TP, or BACnet/IP.
CT	Current Transformer. A sensor that produces an output signal proportional to current flowing through a conductor.
CT Picker	A FLEXPoint™ configuration tool used to select supported DENT CT models. When a supported CT is selected, FLEXPoint™ automatically loads related configuration values such as CT range and phase shift.
CT Range	The rated current of the connected CT. The meter uses this value to scale the CT output signal into measured current.
CT Secondary Output	The signal produced by the CT and connected to the meter input. PowerScout™ FLEX meters are designed for 333 mV voltage-output CTs. CTs with 1 A or 5 A secondary current outputs are not compatible.
CT Sign	A channel-level polarity setting used to correct current direction. If a CT is installed backward, the CT sign setting can be used to reverse the measured current direction in software.

CT Phase Shift	The small timing difference between the actual current waveform and the CT output signal. CT phase shift can affect power and energy accuracy. FLEXPoint™ can compensate for CT phase shift when the correct value is configured.
Current	The flow of electric charge through a conductor, measured in amperes.
Demand	The average rate of power usage over a defined time interval. Demand values are commonly used for billing, capacity planning, and load analysis.
Demand Interval	The time window used to calculate demand. PowerScout™ meters use a 15-minute demand interval for present and peak demand values.
DHCP	Dynamic Host Configuration Protocol. A network service that automatically assigns IP addresses and related network settings to devices.
Displacement Power Factor	The power factor component based on the phase angle between the fundamental voltage and current waveforms. It does not include harmonic distortion effects.
Distortion Power Factor	The power factor component that reflects the effect of harmonic current distortion on total RMS current.
Element	A fixed measurement grouping used in earlier PowerScout™ meters. In PowerScout™ FLEX, the fixed element concept is replaced by Virtual Meters.
Ethernet	A wired network interface used for IP-based communication, including Modbus TCP and BACnet/IP.
Factory Calibration	The process used to verify or adjust meter performance during manufacturing. Published accuracy specifications are based on supported meter and CT configurations.
Firmware	Internal software running on the meter hardware. Firmware may be updated through supported DENT software tools and release packages.
Flattened Register List	A Modbus register organization method where Virtual Meter data is available through a single slave address, with each Virtual Meter assigned its own register block. This differs from earlier PowerScout™ meters where elements were commonly accessed by incrementing the slave address.
FLEXPoint	DENT software used to configure, manage, and view PowerScout™ FLEX meter setup and data.
FLEXPoint GO	The on-device web app used to configure the meter and view selected real-time data through a web browser.
Four-Quadrant Measurement	Measurement of power or energy flow in all four electrical quadrants, accounting for import/export direction and inductive/capacitive reactive behavior.

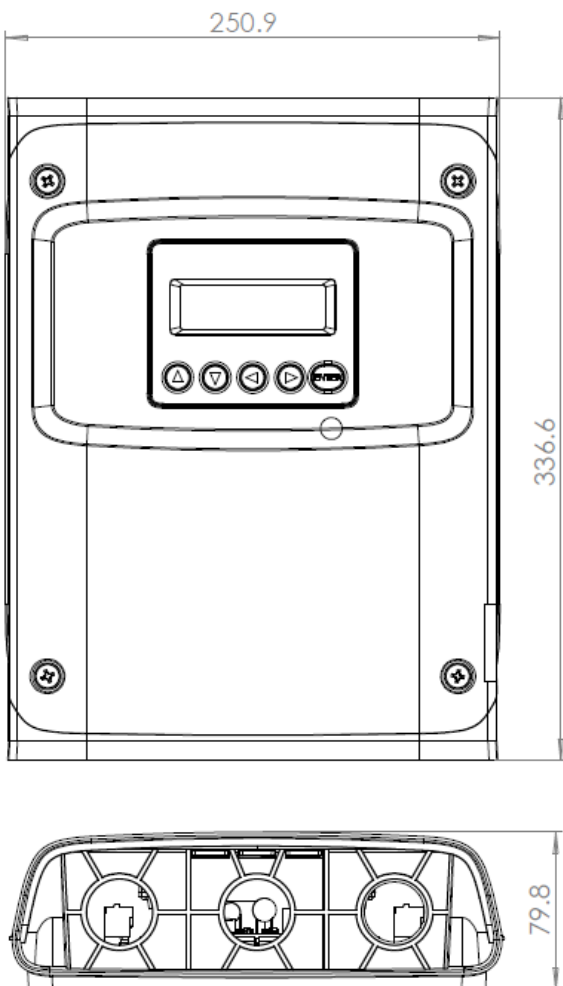
Full Scale	The rated maximum input value for a measurement channel or CT range.
Gateway Address	A network setting that identifies the router used to reach devices outside the local subnet.
Harmonics	Frequency components of a waveform that occur at integer multiples of the fundamental frequency. Harmonics are commonly caused by nonlinear loads.
Host System	An external system that communicates with the meter, such as a BMS, RTU, SCADA system, PLC, or data logger.
IEEE Power Factor Convention	A power factor sign convention where the sign of power factor follows the sign of real power.
Interval Data	Meter-recorded data stored at regular time intervals. PowerScout™ meters record 15-minute interval data that can be downloaded for historical review or gap filling.
IP Address	A network address used to identify the meter on an Ethernet/IP network.
Line Frequency	The frequency of the AC electrical system, typically 50 Hz or 60 Hz.
Line-to-Line Voltage	Voltage measured between two phase conductors, such as L1-L2, L2-L3, or L3-L1.
Line-to-Neutral Voltage	Voltage measured between a phase conductor and neutral, such as L1-N, L2-N, or L3-N.
MAC Address	A unique hardware address assigned to a network interface.
Media Release	A coordinated package of firmware, software, register lists, and documentation. Mixing files from different media releases is not recommended.
Modbus	A communication protocol commonly used by industrial and building automation systems to read and write register-based data.
Modbus Register	A numbered data location used for Modbus communication. Registers are used to read measurement data, write configuration settings, and issue certain meter commands.
Modbus RTU	Modbus communication over an RS-485 serial network.
Modbus TCP	Modbus communication over an Ethernet/IP network, typically using port 502.
MSW / LSW	Most Significant Word and Least Significant Word. These terms describe the two 16-bit register words used to represent certain 32-bit values, such as floating-point numbers.

Multi-State Value (MSV)	A BACnet object type typically used to represent enumerated settings.
Network Scan	A software function used to discover compatible meters on the local Ethernet network.
Over-Voltage Category III	A safety category for equipment connected to building electrical distribution systems.
Phase Angle	The angular difference between voltage and current waveforms, typically measured in degrees.
PhaseChek™	A DENT verification feature used to identify likely CT phasing or wiring issues based on measured power factor conditions.
Phasor Plot	A graphical representation of voltage and current magnitude and phase angle. It is useful for checking CT orientation, phase relationships, and wiring correctness.
Physical CT Input	An actual current input terminal on the meter hardware. Depending on the model, the meter may include 3, 12, 24, or 48 physical CT inputs.
PLC	Programmable Logic Controller. A host or control device that may communicate with the meter using supported protocols.
Positive Integer Value (PIV)	A BACnet object type typically used to represent restricted-range integer settings.
Potential Transformer (PT)	A transformer used to step down voltage in applications where the measured voltage exceeds the meter's direct input rating.
Power Factor	The ratio of real power to apparent power. Power factor describes how effectively electrical power is being converted into useful work.
Pulse Input	A meter input used to count pulses from an external device, such as another meter with a dry-contact or open-collector output.
Read Only PIN	A security PIN level that allows data and configuration values to be viewed but not changed through supported user interfaces.
Read/Write PIN	A security PIN level that allows configuration values to be viewed and changed through supported user interfaces.
Real Time Clock (RTC)	A clock circuit used to timestamp interval data. The RTC is used for data logging timestamps and is not used for meter calculations.
Real-Time Data	Measurement values reported by the meter during operation, such as voltage, current, power, power factor, and frequency.

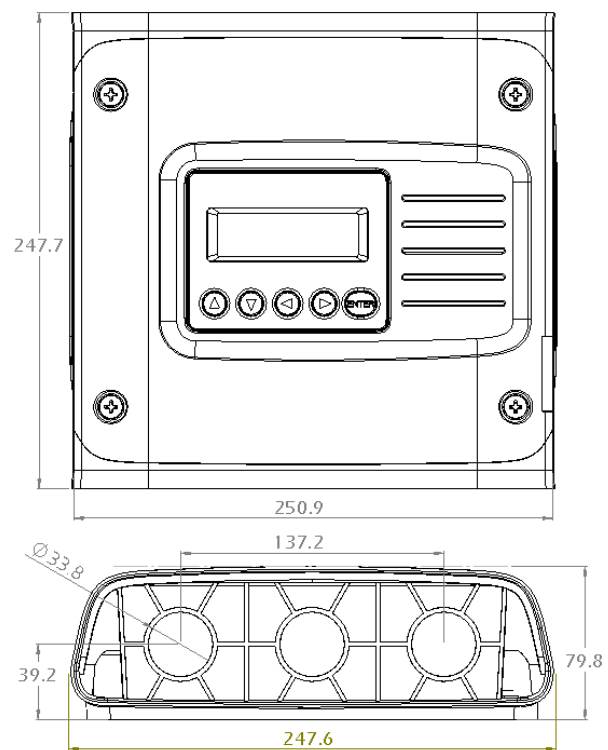
Register List	A document or table that defines the Modbus registers and BACnet objects supported by the meter.
Revenue Grade	A general term for metering equipment or CTs designed for high-accuracy energy measurement applications. Revenue-grade performance depends on the meter, CTs, configuration, installation, and any applicable certification requirements.
Rogowski Coil	A flexible current sensor used to measure AC current. For use with PowerScout™ FLEX.
RS-485	A two-wire serial communication physical layer commonly used for Modbus RTU and BACnet MS/TP networks.
RTU	Remote Terminal Unit. A host device that collects data from field equipment and may pass it to a larger automation, monitoring, or control system.
Scaling	The process of converting meter input signals into reported engineering values. Scaling may include CT range, CT multiplier, voltage multiplier, and related configuration settings.
SCADA	Supervisory Control and Data Acquisition. A system used for monitoring and control of industrial or facility equipment.
Secondary Current Output CT	A CT that outputs a current signal, commonly 1 A or 5 A, at rated current. These CTs are not compatible with PowerScout™ FLEX meter inputs.
Segmentation	A BACnet feature used when data is too large for a single packet. PowerScout™ meters may have limitations related to BACnet segmentation, depending on model and object type.
Service Type	The electrical system or load configuration assigned to a Virtual Meter, such as single-phase, split-phase, three-phase Wye, or three-phase Delta.
Slave Address	The Modbus address assigned to a device on a Modbus RTU network. Each device must have a unique slave address.
Snap Threshold	A threshold that tells the meter to report zero when a measured signal is small enough that it may be indistinguishable from noise.
Soft Reset	A restart of the meter processor without removing power. Some configuration changes may require a soft reset before they take effect.
Split-Core CT	A current transformer that opens and closes around a conductor, allowing installation without disconnecting the conductor.
Static IP Address	A manually assigned IP address that does not change unless reconfigured.
Structured View	A BACnet organization method that groups related objects logically, such as by Virtual Meter and system-level data.

Subnet Mask	A network setting that determines which IP addresses are considered part of the local network.
System Scope	Values or settings that apply to the meter as a whole rather than to a specific Virtual Meter or channel.
System Description	A user-configurable text field used to identify the meter, often by location or application.
THD	Total Harmonic Distortion. A measure of waveform distortion relative to the fundamental frequency.
TouchSaf™ Cover	A protective high-voltage cover used on certain PowerScout™ models to reduce risk of contact with hazardous voltage terminals.
True RMS	A measurement method that accurately represents the effective value of AC voltage or current, including non-sinusoidal waveforms.
USB	A local communication and power interface commonly used for meter configuration.
Virtual Channel	A current channel within a Virtual Meter. Each Virtual Channel can be mapped to a physical CT input and configured independently.
Virtual Meter (VM)	A logical meter grouping used by PowerScout™ FLEX to represent an electrical load. A Virtual Meter replaces the fixed element concept used in earlier PowerScout™ meters.
Voltage Input	A physical voltage measurement connection used by the meter. Some models include multiple voltage inputs.
Voltage Multiplier	A scaling factor applied to a voltage input, commonly used with potential transformers or other voltage scaling arrangements.
Voltage Reference	The voltage phase relationship used with a channel's current measurement, such as L1-N, L2-N, L3-N, or line-to-line references.
Waveform Capture	A feature that records high-resolution voltage and current waveform data for analysis of signal shape, harmonics, and other power quality conditions.
Wye	A three-phase service configuration with phase-to-neutral voltage references. Also called a star configuration.
Delta	A three-phase service configuration that commonly uses line-to-line voltage references and may not include a neutral conductor.

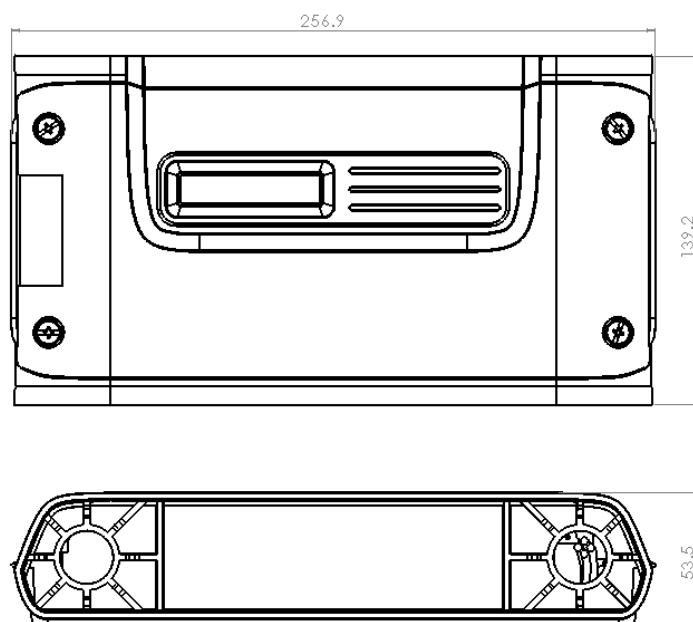
Appendix B – Enclosure Dimensions



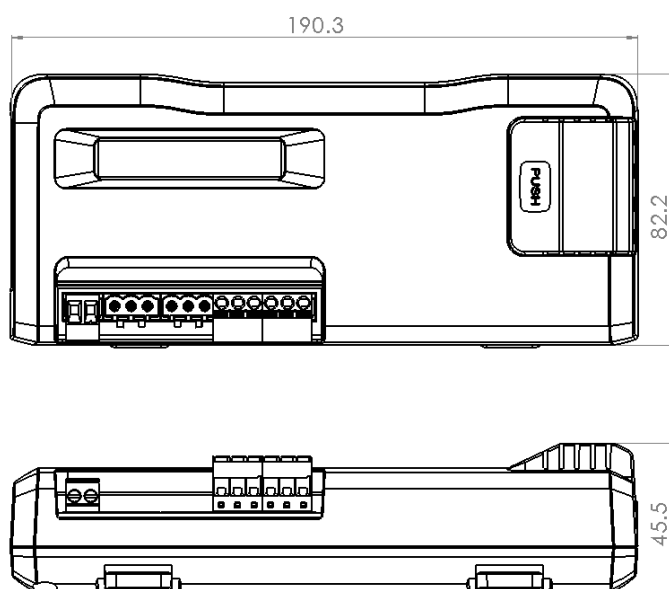
PS24FX/PS48FX Enclosure Dimensions



PS12FX Enclosure Dimensions



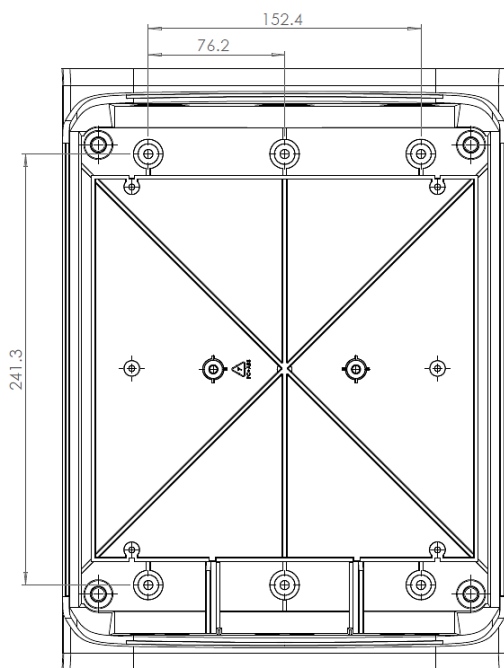
PS3FX Wall Mount Enclosure Dimensions



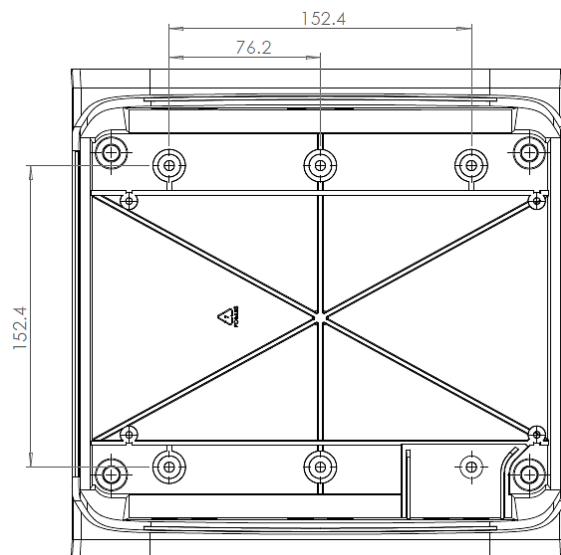
PS3FX DIN Rail Enclosure Dimensions

Appendix C – Mounting Templates

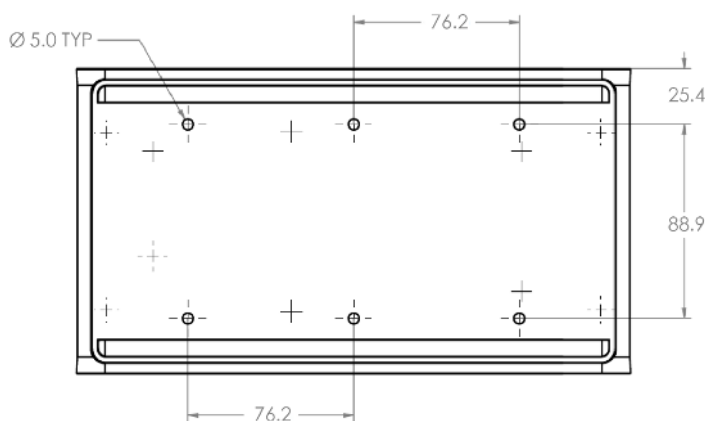
C.1 Enclosure Internal Mounting Hole Locations (Not to Scale)



PS24FX/PS48FX Drill Template



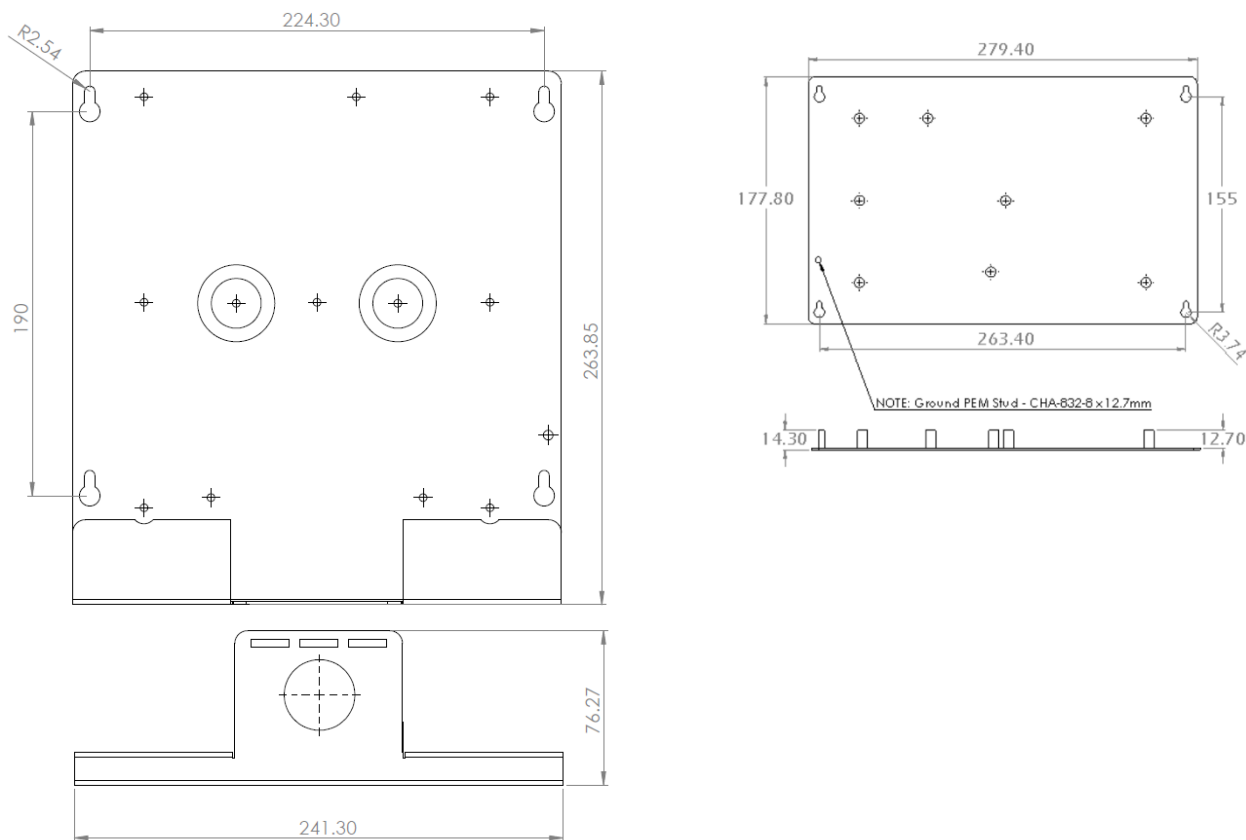
PS12FX Drill Template



PS3FX Drill Template

C.2 Sheet Metal Plate Mounting Hole Locations (PS12FX/PS24FX/PS48FX only)

Not to Scale



PS24FX/PS48FX Mounting Plate Drill Template

Appendix D – PowerScout FLEX Technical Specifications

Specification	Description
Service Types	Single Phase, Split Phase, Three Phase-Four Wire (WYE), Three Phase-Three Wire (Delta)
Voltage Channels	90-346 Volts AC Line-to-Neutral, 600V Line-to-Line, CAT III. Two voltage reference inputs (PS48FX and PS24FX only)
Current Channels	3 (PS3FX) or 12 (PS12FX) or 24 (PS24FX) or 48 (PS48FX) channels, 0.525 VAC max, 333 mV CTs, 0-4,000 Amps depending on current transducer
Maximum Current Input	150% of current transducer rating (mV CTs) to maintain accuracy. Measure up to 4000A with RōCoil CTs.
Measurement Type	True RMS using high-speed digital signal processing (DSP) with continuous sampling
Line Frequency	50/60 Hz (45 - 70 Hz measurable range) – measurement taken L1-N
Power	From L1 Phase to L2 Phase. 90-600VAC RMS CAT III 50/60Hz, 500mA AC Max Use of 12-volt auxiliary output requires 100 VAC minimum input voltage.
AC Protection	0.5A Fuse 200kA interrupt capacity
Power Out	PS12FX/PS24FX/PS48FX only: Unregulated 12VDC output, 200 mA, self-resetting fuse
Waveform Sampling	PS3FX/PS12FX/PS24FX 7.2 kHz; PS48FX 3.6 kHz
Parameter Update Rate	1 second
Interval Data Recording	Energy (kWh) values are recorded every 15 minutes for 63 days (downloadable log) Each record is time stamped.
Measurements	Volts, Amps, kW, kVAR, kVA, aPF, dPF, kW demand, kVA demand, Import (Received) kWh, Export (Delivered) kWh, Net kWh, Import (Received) kVAh, Export (Delivered) kVAh, Net kVAh, Import (Received) kVARh, Export (Delivered) kVARh,

Specification	Description
	Net kVARh, THD, Theta, Frequency. All parameters for each phase and system total.
Accuracy	0.2% ANSI C12.20–2015 Class 0.2
Resolution	Values reported in IEEE-754 single precision floating point format (32 bit)
Indicators	PS3FX: Standard 2-line display, tri-color backlight (PhaseChek™) PS12FX/PS24FX/PS48FX: Optional 4-line display, tri-color backlight (PhaseChek™)
Alarm Output	User-configurable alarm with open collector output
Pulse Inputs	PS3FX – None PS12FX – 4 inputs PS24FX – 2 inputs PS48FX – 2 inputs 3.3V sourcing voltage (current limited) to user dry contact pulse output Maximum Pulse Rate 10 HZ (50 msec minimum transition time)
Communication	
Hardware	RS-485, Ethernet (IPv4 only), and USB
Supported Protocols	Modbus RTU or BACnet Master Slave Token Passing protocol (MS/TP) Modbus (using SunSpec IEEE-754 single precision floating point model)
Max Communication Length	1200 meters with Data Range of 100K bits/second or less
RS-485 Loading	1/8 unit
Communication Rate (baud)	Modbus: 9600 (Default), 19200, 38400, 57600, 76800, 115200 BACnet: 9600, 19200, 38400, 76800
Data Bits	8
Parity	None, Even, Odd
Stop Bit	2, 1
Termination	None provided

Specification	Description
Data Formats	Modbus RTU, BACnet MS/TP, Modbus TCP or BACnet IP
Mechanical	
Wire Connections	12-28 AWG 600 VAC, Voltage connection must be #14 AWG or larger & 600 VAC rated
Mounting	Enclosure or Panel Mount
High Voltage Cover	IP30. Included with all models except PS12FX-P-D-N
Operating Temperature	-20 to + 60° C (-4 to 140° F) (the colder the temperature the more voltage needed to power the board)
Humidity	5% to 95% non-condensing
Enclosure	ABS Plastic, 94-V0 flammability rating Conduit Connections: 1" (PS12FX/PS48FX Wall Mount enclosures) or ½" (PS3FX Wall Mount enclosure)
PS24FX/PS48FX Dimensions	(L) 33.7cm x (W) 25.1cm x (H) 8.0 cm (13.3" x 9.8" x 3.1") (enclosure version) (L) 26.2cm x (W) 24.1cm x (H) 8.0 cm (10.3" x 9.5" x 3.1") (mounting plate version)
PS12FX Dimensions	(L) 24.8cm x (W) 25.1cm x (H) 8.0 cm (9.8" x 9.8" x 3.1") (enclosure version) (L) 17.8cm x (W) 26.3cm x (H) 8.0 cm (7.0" x 10.4" x 3.1") (mounting plate version)
PS3FX Dimensions	(L) 19.1cm x (W) 8.2cm x (H) 3.8cm (7.5" x 3.2" x 1.5") (DIN Rail Version) (L) 25.7cm x (W) 14.0cm x (H) 5.4cm (10.1" x 5.5" x 2.1") (Wall Mount Version)
FLEXPoint™ HD Minimum System Requirements	
Operating System	Windows® 10, Windows® 11 (Does NOT support ARM Processors)
Communications Port	USB or Ethernet connection
Certifications	
FCC Compliance	This device has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful

Specification	Description
	interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at user's own expense.
Safety	The following are UL Recognized: ▪ PS12FX-B-y-z ▪ PS12FX-P-y-z ▪ PS24FX-P-y-z ▪ PS48FX-B-y-z ▪ PS48FX-P-y-z ▪ PS3FX-R-D-N The following are UL Listed: ▪ PS12FX-C-y-z ▪ PS48FX-C-y-z ▪ PS24FX-C-D-N ▪ PS3FX-C-D-N Conforms to UL Std 61010-1, 3rd Edition, UL 61010-2-30:2010 Certified to CSA Std C22.2 No. 61010-1, 3rd Edition
CE	LVD (EN61010-1) EMC (EN61326-1) RoHS 2 (EN50581)



PART OF
BEMSIQ
GROUP

OPERATOR'S GUIDE

FLEX Point™ Software Commissioning & Integration



Software for:

PowerScout™ FLEX Series: 3 | 12 | 24 | 48

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Table of Contents

Table of Contents	ii
1. Introduction	1
1.1. Purpose of this guide	1
1.2. Supported Models	1
1.3. Communication Interfaces Overview	1
1.4. Additional Resources	1
2. FLEXPoint™	2
2.1. Overview	2
2.2. Basic Workflow	3
2.3. Software Setup	3
2.3.1. Installing FLEXPoint™	3
2.3.2. Installation Troubleshooting	4
2.3.3. Uninstallation Procedure	5
2.4. Connecting to the Meter	5
2.4.1. FLEXPoint™ Connection Modes	5
2.4.2. USB	6
2.4.3. Ethernet	6
2.4.4. Network Scan Tool	9
2.4.5. Connection Limitations	9
2.5. Configuration	10
2.5.1. Virtual Meter Setup	10
2.5.2. Device Settings	13
2.5.3. General Settings	13
2.6. Communication Setup	14
2.6.1. Communication Interface Options	14
2.7. Advanced Settings	16
2.7.1. Alarm Configuration	16
2.8. Real Time Data Analysis	18
2.8.1. Power	18

2.8.2.	Energy.....	20
2.8.3.	Energy (Advanced)	20
2.8.4.	Power Factor	23
2.8.5.	Demand	25
2.8.6.	Waveform Capture.....	26
2.8.7.	Harmonics.....	27
2.8.8.	Phasor Plot.....	28
2.9.	Real Time Clock.....	29
2.10.	Interval Data	30
2.11.	Firmware Updates	30
2.12.	macOS Support.....	31
3.	FLEXPoint™ GO - PowerScout™ FLEX Web App.....	32
3.1.	Overview	32
3.2.	Ethernet Access.....	32
3.3.	Authentication.....	33
3.4.	Capabilities & Limitations.....	33
4.	Modbus Integration	34
4.1.	Modbus RTU.....	34
4.2.	Modbus TCP	34
4.3.	Register Organization	34
4.4.	Flattened Register List.....	34
4.5.	Modbus Commands	35
4.6.	String Handling	35
4.7.	Floating Point Settings.....	36
4.8.	Soft Reset.....	36
5.	BACnet Integration.....	37
5.1.	BACnet Overview	37
5.2.	Device IDs.....	37
5.3.	BBMD Setup.....	37
5.4.	Segmentation.....	37

5.5.	Structured View	38
5.6.	Object Types	38
6.	Advanced Features	39
6.1.	Pulse Inputs (PS12/PS24/PS48 Only)	39
6.2.	CT Multipliers	39
6.3.	Phase Shift Compensation	39
6.3.1.	Snap Thresholds	39
6.4.	RS-485 Physical Layer Requirements	40
7.	Security	41
7.1.	Overview	41
7.2.	PIN Types	41
7.3.	Read-Only	41
7.4.	Read/Write	41
7.5.	Network Security Best Practices	41
8.	Troubleshooting	44
8.1.	USB Power	44
8.2.	Ethernet Communication Issues	44
8.2.1.	Meter Not Discoverable via Network Scan	44
8.2.2.	Cannot Connect via Modbus TCP	45
8.3.	RS-485 Communication Issues	45
9.	Appendices	47
9.1.	Technical Specifications	47
9.2.	Measurement Parameters	50



1. Introduction

1.1. Purpose of this guide

The purpose of this guide is to provide the necessary information to successfully set up and configure your PowerScout™ FLEX meter. This guide primarily provides instructions on utilizing the FLEXPoint™ and FLEXPoint™ GO software applications.

FLEXPoint FLEXPointGO

Supported Models

This guide covers all available models of the PowerScout™ FLEX meter line. FLEXPoint™ software is only compatible with the PowerScout™ FLEX meter line.

1.2. Communication Interfaces Overview

The PowerScout™ FLEX meter communication interfaces include Ethernet (LAN) or RS-485 serial. BACnet MS/TP and Modbus RTU are the two communication protocols that operate over an RS-485 serial network and BACnet IP and Modbus TCP are supported over Ethernet. A USB port is also provided as the preferred connection for on-site configuration and can be run concurrently with an RTU.

1.3. Additional Resources

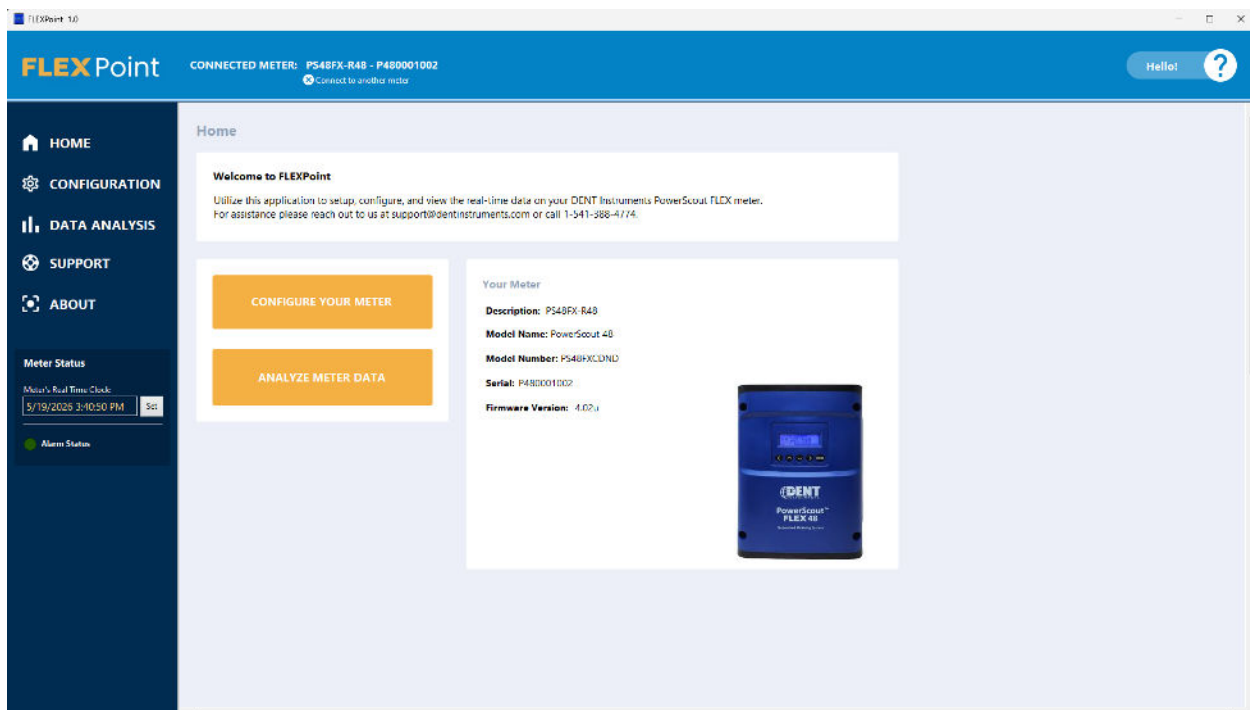
Additional information about the capabilities of FLEXPoint™ software are presented in short videos and can be found at

2. FLEXPoint™

2.1. Overview

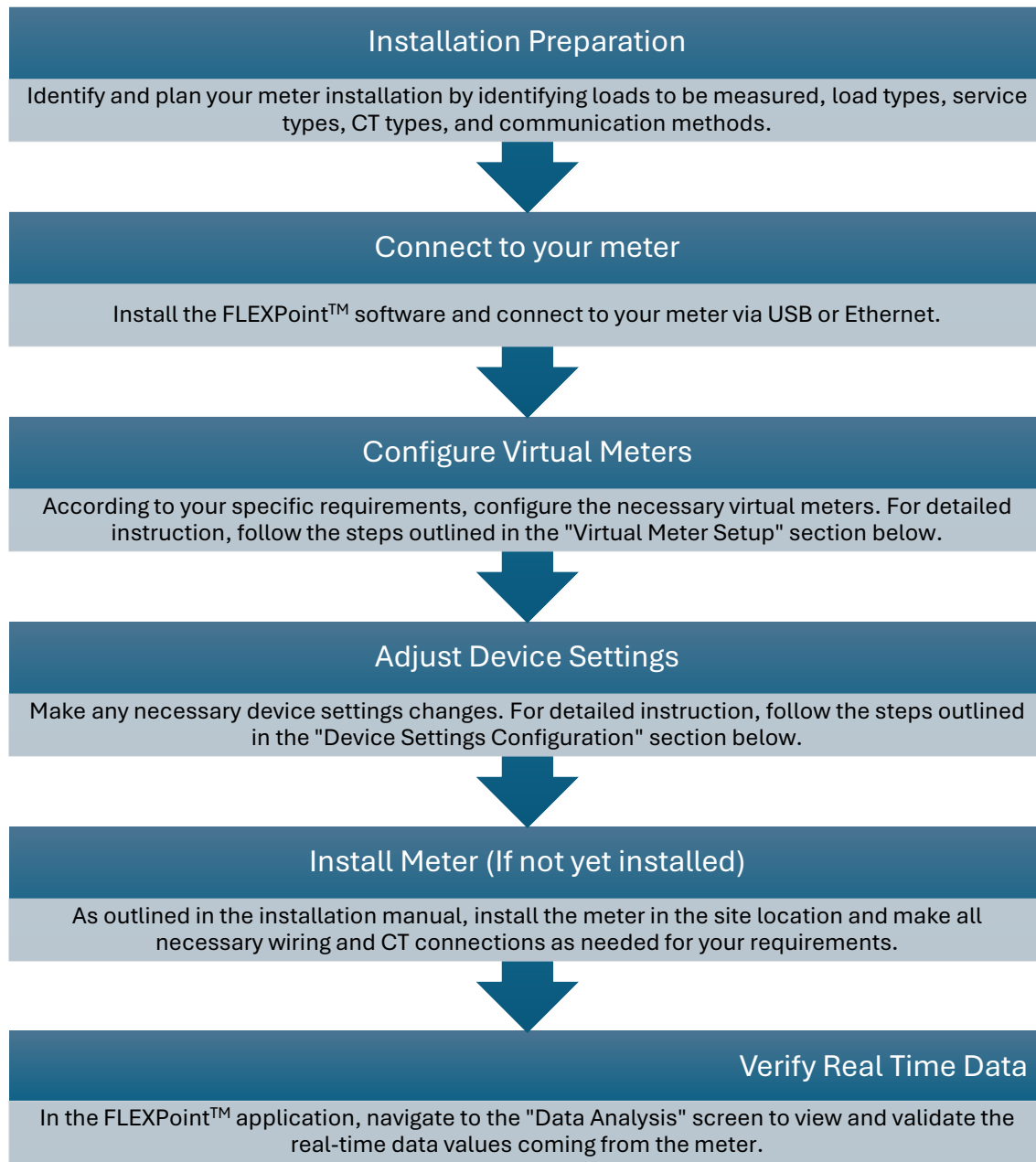
FLEXPoint

FLEXPoint™ is a Windows application designed to easily configure, manage, and view your PowerScout™ FLEX meter setup and data. The application has been created with user experience in mind and modeled after modern application design best practices and standards.



The application interface is broken down into clear navigable sections to configure your meter, view the real-time data, and get support for your PowerScout™ FLEX meter quickly and easily.

2.2. Basic Workflow



2.3. Software Setup

2.3.1. Installing FLEXPoint™

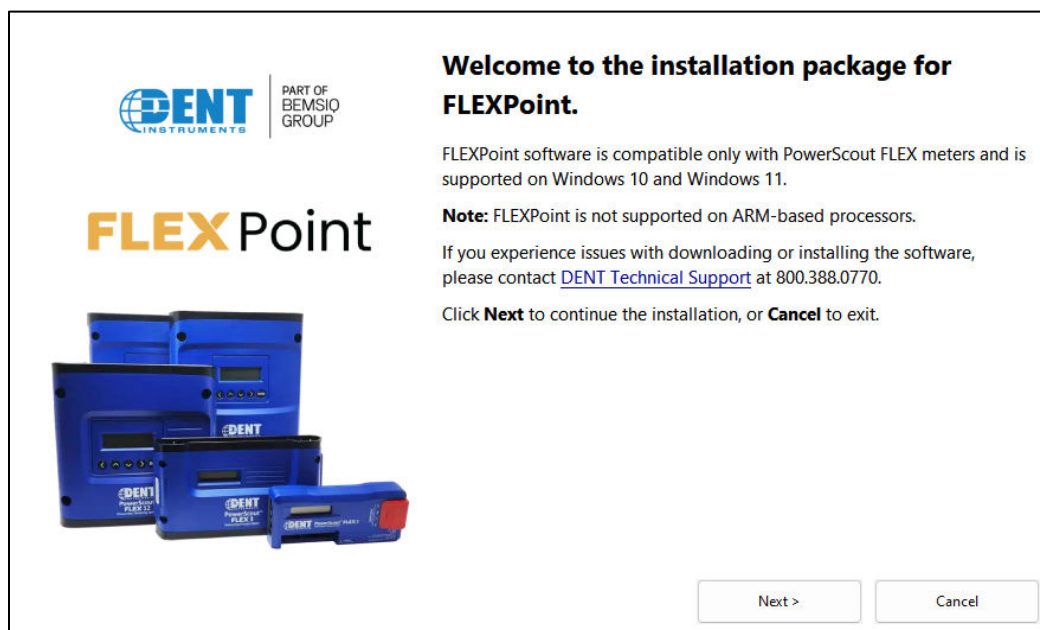
Download the latest version of the FLEXPoint™ software from

Begin the installation by double-clicking the executable. Follow the on-screen instructions to complete the installation. If desired, you may change the file install location during the installation steps.

The FLEXPoint™ software requires the *National Instruments 2021 LabVIEW* runtime engine to operate. If necessary, the installer will install the necessary runtime files to allow for full functionality.

Software Requirements: FLEXPoint™ software is compatible only with PowerScout™ FLEX meters and is supported on Windows 10 and Windows 11.

Note: FLEXPoint™ is not supported on ARM-based processors.



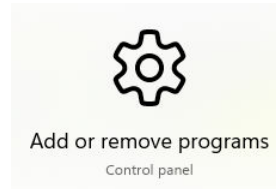
2.3.2. Installation Troubleshooting

Successful installation of FLEXPoint™ application may be prevented by settings specific to your PC for the following reasons:

- 1) Anti-virus protection software may interfere with the installation of FLEXPoint™. If the installation is not completed for this reason, try temporarily disabling the virus protection software on your PC and re-attempt the installation.
- 2) Administrative Access. In some cases, user privilege settings may disallow the installation of new applications. This may require logging in as an administrator.

2.3.3. Uninstallation Procedure

To uninstall FLEXPoint™, navigate to the Add/Remove Programs section in the Windows settings, select the FLEXPoint™ application, and then click uninstall.

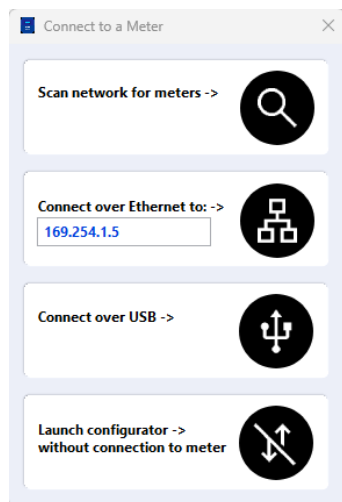


2.4. Connecting to the Meter

2.4.1. FLEXPoint™ Connection Modes

When the FLEXPoint™ application is launched, it will prompt the user to select one of four connectivity options.

- Scan Network for Meters
- Connect over Ethernet to a Predetermined IP address
- Connect over USB cable (A to C)
- Launch without connection (no meter connected)



Note: The USB connection method is recommended for new users who have physical access to the meter and the appropriate USB cable (supplied).

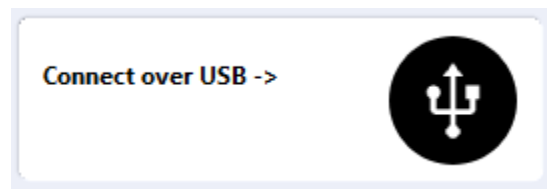


2.4.2. USB

Connect the PowerScout™ FLEX meter to a USB port of your computer to provide both power and communications.

- a. If equipped, the LCD user interface is the most visible indication of a running meter.
- b. For meters without a display, a green flashing LED on the circuit board indicates that the PowerScout™ FLEX meter has booted and is running.

Launch the application and press the “CONNECT OVER USB” button on the pop-up window.



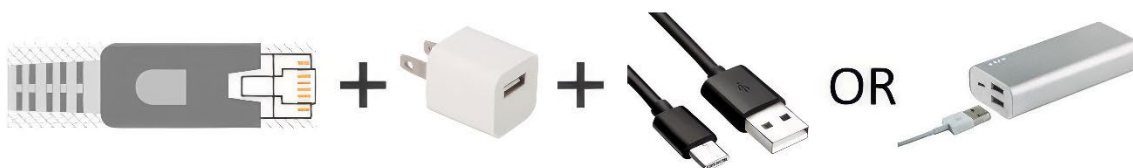
The meter should be communicating. The FLEXPoint™ application offers visual guides and context help to facilitate meter configuration. By default, PowerScout™ FLEX meters are configured for DHCP Ethernet addressing. A very common configuration sequence is using USB to configure a meter for Ethernet communications at a static IP address and then switching from USB over to Ethernet to locate it. This is facilitated in FLEXPoint™ by pressing the “Connect to Another Meter” icon located in the top bar within the application.

CONNECTED METER: PS48FX-R48 - A482501002

 Connect to another meter

2.4.3. Ethernet

Configuring the PowerScout™ FLEX over Ethernet requires that the meter be powered via a second connection, either USB or line power (L1-L2). The PowerScout™ FLEX does not support Power Over Ethernet (POE). If the meter is already installed within the building's electrical network, closing the AC breaker (or approved disconnect) will turn on the meter through the meter's internal power supply. In the rare case that a computer's USB port cannot provide enough current, an AC / USB charger or a USB battery can be used as a power source while using Ethernet for communications.



Dynamic Host Configuration Protocol (DHCP):

PowerScout™ FLEX meters are shipped in DHCP mode to prevent IP conflicts with other equipment. The meter is expecting to receive an IP address from a DHCP service provided by a router, Layer 3 switch, or a server providing DHCP service. Under this configuration, if the PowerScout™ FLEX meter and the host PC are requesting an IP address from the same DHCP service provider, they will be able to communicate. Upon powering up, the PowerScout™ FLEX meter will indicate the IP address on the LCD user interface (if equipped) or can be found using the Network Scan function.

Direct:

When a PC is directly connected to a PowerScout™ FLEX meter via an ethernet cable, no DHCP service exists. This configuration can be made to work but requires changes to either the meter communication settings or the PC network configuration.

LCD User Interface

For units equipped with an LCD user interface, navigate to:

Communications > Ethernet Settings > DHCP > OFF

Change the IP address in the meter to match the subnet of your PC's IP address, making the meter IP unique, or note the current address on the meter and prepare to configure your PC's IP settings as shown on the next page.

How to Change Your IP Address in Windows 11

Set IP to: **192.168.1.100** | Subnet Mask: **255.255.255.0**

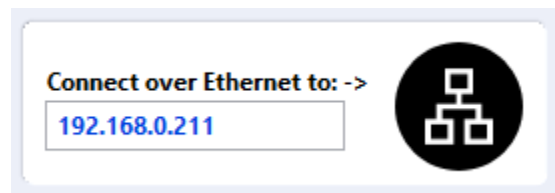
1. Right-Click on the Windows Icon and select "Settings"
2. Go to "Network & Internet"
3. Click "Properties" for "Ethernet"
4. Click on "Edit" under IP Assignment
5. Select "Manual" and enter the IP details:
6. Save Changes

Your IP is now set to **192.168.1.100**!



Once the PC and PowerScout™ FLEX are set to communicate on the same IP subnet:

- 1) Launch the FLEXPoint™ application and enter the IP address of the meter (shown as the factory default).
- 2) Press the "Connect over Ethernet to:" button on the pop-up window.

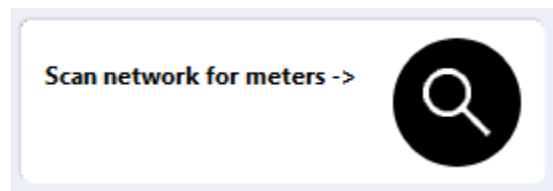


The meter should be communicating.

Meters without an LCD User Interface

A PowerScout™ FLEX meter without an LCD user interface has no way to communicate to the user its IP address and is only recommended if the meter has been previously set to a known static address. Setting the IP address must be done ahead of time using another interface such as FLEXPoint™ over USB or via user-supplied applications over RS-485.

2.4.4. Network Scan Tool



Network Scan is a feature for monitoring previously installed and configured PowerScout™ FLEX meters over an Ethernet network. Network Scan will broadcast a User Datagram Protocol (UDP) discovery packet on the same network as the PC running the FLEXPoint™ application. Normally this will be performed on a corporate network running DHCP. Any PowerScout™ FLEX meter that responds will be displayed in a table that includes the system description register, IP address, serial number, and communication configuration.

Meter	IP Address	Serial Number	MAC Address	Modbus Port	BACnet Port	Mode	Device ID	
PS48FX-R48	192.168.0.211	A482501002	00:0D:63:41:00:02	502	47808	Modbus	527000	OK
								CANCEL
								RESCAN
								TEST
								SETUP

Highlight the desired meter and select OK, Test, or Setup. Note that the effectiveness of this technique is highly dependent on the configuration of the PC running FLEXPoint™ (which may have more than one network card) and the network configuration. Rescans can be used to make multiple attempts to locate a particular meter on busy networks (UDP has no built-in retry provisions).

2.4.5. Connection Limitations

Each PowerScout™ FLEX meter can support no more than 4 concurrent connections.

2.5. Configuration

2.5.1. Virtual Meter Setup

Virtual meters are the primary advantage of the PowerScout™ FLEX product line. Your PowerScout™ FLEX meter is designed with maximum flexibility in mind. You can configure as many virtual meters as needed for your requirements up to the maximum number of virtual meters supported by your specific model.

By default, your PowerScout™ FLEX meter has no factory virtual meters configured. To create your first virtual meter, click the "Add Virtual Meter" button.



Add Virtual Meter

For each virtual meter, you will configure the following options:

- **Description**
- **Voltage Input**
- **Breaker Type**
- **Virtual Channels**

For each virtual channel, you will identify the following configuration options:

- **Physical CT#**
- **Volt Reference**
- **CT Type**
- **Range**
- **Phase Shift**
- **Multiplier**
- **CT Sign**

Configure your virtual meter options according to the physical setup on your electrical loads you intend to monitor.

Follow the steps below for each virtual meter you intend to configure.

1. First, give your virtual meter a description. We recommend a description that will help you clearly identify what loads you are measuring. In the example above, "Mains" is set as the description.
2. If applicable for your meter type, make sure to identify the correct voltage input reference.
3. Select the load circuit breaker type you will be monitoring according to your wired setup.
4. The next step is to configure your virtual current channels associated with this meter.

This is where the flexible capabilities of the PowerScout™ FLEX meter comes in. For each virtual meter you can assign up to 3 virtual current channels as necessary. Each channel can be associated with any physical CT attached to your meter. This capability allows you to maximize your meter's available CT inputs and allows for simple straightforward one-time CT setup.

- Next, choose your voltage reference according to your CT wiring.
- And finally, identify your CT details by clicking the "Select Type" button. You can choose your specific CT from the CT picker list. If you need to make any adjustments to the phase shift, multiplier, or CT sign polarity fields, you can do so.

Most configurations will have the same CT attributes for each virtual current channel, however, if necessary, you can choose to configure a different CT type for each available channel.

Once all your virtual current channels have been configured, save your new virtual meter by clicking the "Save and send to meter" button. This will automatically send your new virtual meter to your PowerScout™ FLEX meter.

NOTE: Delta Load Configuration

When configuring a virtual meter for a delta load breaker type, it is required to consume a CT input for all 3 channels, even though no physical CT will be connected to channel 2. See the screenshot below as an example:

Add Virtual Meter

Virtual Meter Configuration Settings

ID: 1 Description: VM_1 V Input: 1

Breaker Type: 3 Pole Delta Breaker Image:

Configure Virtual Channels

Channel	Physical CT #	Volt Ref	Type	Range	Ph. Shift	Multiplier	CT Sign
Channel 1	1	L1-N	RoCoil	4000	0	1	+
Channel 2	2						
Channel 3	3	L3-N	RoCoil	4000	0	1	+

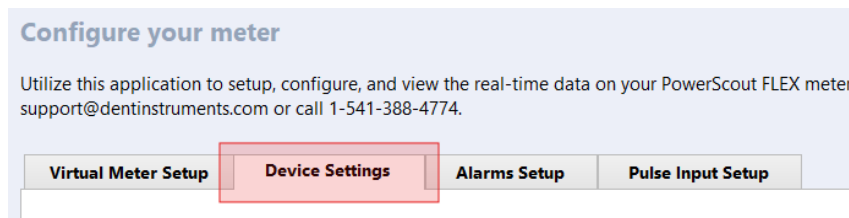
NOTE: For Delta wiring configurations, channel 2 measurements are calculated. A CT will not be installed, but a CT# must still be reserved.

SAVE W/O SENDING TO METER SAVE AND SEND TO METER

2.5.2. Device Settings

All device-wide settings can be found within the “Device Settings” tab in the configuration section.

To access the settings, connect to your meter using FLEXPoint™, navigate to the configuration section, then click the “Device Settings” tab.



2.5.3. General Settings

In the device settings tab, scroll to the “General Settings” section.

The screenshot shows the "General Settings" section of the configuration interface. It contains three input fields: "System Description" with the value "PS48FX-R48", "V Input 1 Multiplier" with the value "1", and "V Input 2 Multiplier" with the value "1". Below these is a "Power Factor Sign Convention" dropdown menu with "ANSI" selected.

Within the general settings, you may adjust the following options:

- **System Description**

The system description can be used to uniquely identify the PowerScout™ FLEX meter.

- **V Input 1 Multiplier**

Voltage multiplier settings allow potential transformers to be used with the PowerScout™ FLEX meter. This allows for transformer winding ratios or other scaling adjustments to be included in the meter processing to eliminate post process scaling. Adjustments for voltage are global to the meter while CT's can be adjusted on a channel-by-channel basis. The multiplier is a floating-point number and can also be used for post installation calibration if desired.

Valid range: 0.9 – 10000

- **V Input 2 Multiplier (if applicable)**

- **Power Factor Sign Convention**

Power Factor is the ratio of a signed number (true power) and an unsigned number (apparent power).

This discrepancy has led to some user confusion. The PowerScout™ FLEX meter allows users to select between two conventions (ANSI & IEEE).

In the IEEE convention, the sign of PF follows the sign of power itself. In the ANSI convention, a “+” PF indicates a lagging current (inductive load) while a “–” PF indicates a leading current (capacitive load).

2.6. Communication Setup

In the device settings tab, scroll to the “Communication Settings” section.

Within the communication settings section, you can choose which communication interface you would like to configure the meter with (Ethernet or RS-485) and additionally, which communication protocol you will be using to communicate with the meter.

2.6.1. Communication Interface Options

Ethernet

For ethernet, you can choose to configure the device for DHCP or enter your network settings manually.

If the PowerScout™ FLEX meter is configured for DHCP when the meter is powered on, or the Ethernet cable is inserted, the meter is assigned an IP address by the DHCP server. This address appears on the meter's LCD user interface or by viewing the communication settings through FLEXPoint™. PowerScout™ FLEX meters are set to use DHCP as a default setting.

When DHCP is turned off, enter the relevant network related settings according to your network configuration. You will need the following:

- IP Address assigned to the meter
- Subnet Mask
- Default Gateway Address

RS-485

For RS-485 serial communication, make sure to select the RS-485 option in the communication interface dropdown.

When selected, the following configuration options are available:

- **Data Bits**
- **Parity**
- **Baud Rate**
- **Slave Address**

Configure each option as necessary for your serial device.

Communication Protocol Options

- **Modbus**

No additional protocol settings required when communicating via Modbus.

- **BACnet**

For BACnet the following configuration options are available:

- Device ID
- Vendor ID (optional)
- Max Masters (optional)
- Max Info Frames(optional)
- BACnet Port (optional)
- BBMD (optional)

Configure each option as necessary for your requirements.

2.7. Advanced Settings

Advanced Settings

Communication Inactivity Timeout (minutes)
0

mV CT Threshold (% Range)
0.04

RoCoil CT Threshold (% Range)
0.04

Volt Threshold (V)
0

mV /kA @ 60 Hz
131

Password Settings

Read/Write Password
0000

Read Only Password
0000

Factory Only Access Password

Within the advanced settings you can adjust the following options:

- **Communication Inactivity Timeout**
Resets the processor if no comms are detected for N minutes (0 is disabled)
- **mV CT Threshold**
Report 0 rather than values below this % of CT full scale, use with caution
- **RoCoil CT Threshold**
Report 0 rather than values below this % of 4000A, use with caution
- **Volt Threshold**
Report 0 rather than values below this absolute voltage, use with caution
- **mV /kA @ 60hz (RoCoil Output)**
Gain at 60 HZ, use with caution (preset to 131)
- **Password Settings**
The read only password and read/write password options can be set to restrict access to the meter's LCD screen and web application.

Each password option can be a 4-digit numerical value.

PINs are also accessible as Modbus registers but are encoded so that reading the value of the register through an RTU does not inform a user what the password is. This feature allows DENT Instruments to support retrieval of forgotten PINs if network access is available.

2.7.1. Alarm Configuration

All PowerScout™ FLEX meters can set conditional alarms.

To access the alarm setup screen, connect to your meter using FLEXPoint™, navigate to the configuration section, then click the “Alarms Setup” tab.

Configure your meter

Utilize this application to setup, configure, and view the real-time data on your PowerScout FLEX meter. | support@dentinstruments.com or call 1-541-388-4774.

Virtual Meter Setup

Device Settings

Alarms Setup

Pulse Input Setup

Integer Values can be entered for Voltage Input 1 (PS3FX and PS12FX meters) and Voltage Input 2 (PS24FX and PS48FX meters) for L-N and L-L voltage measurements.

Alarms are activated by toggling the “Enable” button for each voltage reference independently and pressing the “Send Alarm Setup to Meter” button.

An example of a 10% drop in a 480 VAC Delta System is shown below. Only Line to Line measurements for Voltage Input 1 are enabled.

Persistence (seconds)
15

V1 Alarms

Copy	Channel	Enable	Lower Alarm Voltage (RMS)
COPY	V1 L1-N	☐	222
COPY	V1 L2-N	☐	222
COPY	V1 L3-N	☐	222
COPY	V1 L1-L2	☒	432
COPY	V1 L2-L3	☒	432
COPY	V1 L3-L1	☒	432

V2 Alarms

Copy	Channel	Enable	Lower Alarm Voltage (RMS)
COPY	V2 L1-N	☐	222
COPY	V2 L2-N	☐	222
COPY	V2 L3-N	☐	222
COPY	V2 L1-L2	☐	384
COPY	V2 L2-L3	☐	384
COPY	V2 L3-L1	☐	384

Lower Alarm Voltage values can be copied to other voltage references using the “Copy” button, which brings up a dialog and allows the user to choose which references to copy.

The Alarm Persistence field is user-configurable, and the time can be adjusted from 15–60 seconds. The alarm condition must be continually expressed for the persistence time to trigger the alarm. This behavior helps reduce false positives on momentary voltage changes or events that cause the meter to reboot such as changing communication settings.

A triggered alarm will cause the Alarm Status indicator in the left-hand navigation bar to turn red. If an alarm is enabled but not triggered, the indicator will be bright green. If no alarms are enabled, the indicator remains dark.

Host systems are notified of an alarm via a hardware circuit (normally low) that can be wired to an interrupt input. Details about which alarm triggered are determined by reading the status registers under the alarm block 2450 – 2500.

The alarm will be expressed whenever the condition exists and will clear itself if measured values exceed the trigger points. Alarm conditions are evaluated by the meter once per second.

2.8. Real Time Data Analysis

The PowerScout™ FLEX meter provides a plethora of measured and calculated energy related data according to the configured loads. Under the data analysis screen, you can navigate to the following tabbed data sections:

- Power
- Energy
- Energy (Advanced)
- Power Factor
- Demand
- Waveform Capture
- Harmonics
- Phasor Plot

Each tab will dynamically poll the meter and gather the relevant data as configured in the virtual meter setup configuration.

2.8.1. Power

Within the power tab, you can view the RMS measurement of Line to Neutral and Line to Line.

Frequency (Hz):	60.00							
Voltage	L1-N	L2-N	L3-N	L-N Average	L1-L2	L2-L3	L3-L1	L-L Average
V Input 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Additionally, for each configured virtual meter, you can view the measured voltage, current, kW, kVA, kVAR, and dPF for each channel and the whole virtual system.

Mains (ID: 1)				
V Input 1				
	CT 1	CT 2	CT 3	System
V Reference	L1-N	L2-N	L3-N	L-N Avg
Voltage (V)	0.00	0.00	0.00	0.00
Current (A)	0.01	0.00	0.00	0.00
kW	0.00	0.00	0.00	0.00
kVA	0.00	0.00	0.00	0.00
kVAR	0.00	0.00	0.00	0.00
dPF	1.00	1.00	1.00	1.00

- **Voltage (V)**
 - **Voltage** is the electrical potential difference between two points.
 - Unit: **Volts (V)**
 - In power systems: Determines how strongly current is driven through loads.
- **Current (A)**
 - **Current** is the flow of electric charge through a conductor.
 - Unit: **Amps (A)**
 - In power systems: Current increases as more electrical load is connected.
- **kW (Kilowatts) – Real Power**
 - **kW** is the amount of *real (true)* power being consumed and converted into useful work.
 - Unit: **Kilowatts (kW)**
- **kVA (Kilovolt-Amps) – Apparent Power**
 - **kVA** is the total power supplied to a load, combining both real and reactive components.
 - Unit: **Kilovolt-Amps (kVA)**
 - It represents the total electrical demand placed on the system.
- **kVAR (Kilovolt-Amp Reactive) – Reactive Power**
 - **kVAR** represents the portion of power that oscillates back and forth between the source and reactive elements of a load (inductors and capacitors), sustaining electric and magnetic fields but not performing net useful work.
 - Unit: **Kilovolt-Amp Reactive (kVAR)**
- **dPF (Displacement Power Factor)**
 - **dPF** stands for **Displacement Power Factor**.
 - Describes how well the timing of electrical current lines up with the timing of voltage in an AC system.

2.8.2. Energy

Within the Energy tab, you can view accumulated energy data within each configured virtual meter. Each virtual meter will display kWh, kVAh, and kVARh.

Time since reset: (Days)

	Mains (ID: 1)  CLEAR			
	CT 1	CT 2	CT 3	System
kWh	0.00	0.00	0.00	0.00
kVAh	0.00	0.00	0.00	0.00
kVARh	0.00	0.00	0.00	0.00

- **kWh (Kilowatt-hour) – Real Energy**

kWh is the total amount of real (useful) energy consumed over time.

$$kWh = kW \times \text{hours}$$

- **kVAh (Kilovolt-amp hour) – Apparent Energy**

kVAh is total apparent energy delivered over time.

$$kVAh = kVA \times \text{hours}$$

- **kVARh (Kilovolt-amp reactive hour) – Reactive Energy**

kVARh is reactive energy over time.

$$kVARh = kVAR \times \text{hours}$$

Each virtual meter's accumulated energy data can be cleared on demand. Additionally, the accumulated entire meter's energy data can be cleared.

2.8.3. Energy (Advanced)

The energy (adv) tab will display cumulative energy flow in all four quadrants of operation, capturing real energy (kWh), apparent energy (kVAh), and reactive energy (kVARh) for both import (energy delivered to the load) and export (energy returned to the source). These measurements support bi-directional power systems such as facilities with on-site generation, energy storage, or regenerative loads. The meter distinguishes between real, apparent, and reactive energy components and tracks reactive energy separately in each quadrant (Q1–Q4), enabling full four-quadrant energy analysis and accurate assessment of load behavior, power factor, and system power flow direction.

Mains (ID: 1) CLEAR				
	CT 1	CT 2	CT 3	System
kWh (Import)	0.00	0.00	0.00	0.00
kWh (Export)	0.00	0.00	0.00	0.00
kWh (Net)	0.00	0.00	0.00	0.00
kVAh (Import)	0.00	0.00	0.00	0.00
kVAh (Export)	0.00	0.00	0.00	0.00
kVAh (Net)	0.00	0.00	0.00	0.00
kVARh (Import Q1)	0.00	0.00	0.00	0.00
kVARh (Import Q2)	0.00	0.00	0.00	0.00
kVARh (Export Q3)	0.00	0.00	0.00	0.00
kVARh (Export Q4)	0.00	0.00	0.00	0.00
kVARh (Net)	0.00	0.00	0.00	0.00

kWh (Import)

Total real energy delivered from the source (e.g., utility grid) to the load over time. This represents energy consumed by the facility and typically forms the basis for energy billing.

kWh (Export)

Total real energy delivered from the load back to the source. This occurs when on-site generation (such as solar) exceeds facility demand.

kWh (Net)

The algebraic difference between imported and exported real energy:

- **kWh (Net) = kWh (Import) - kWh (Export)**

Positive values indicate net consumption; negative values indicate net generation.

kVAh (Import)

Total apparent energy supplied to the load. This includes both real and reactive components and reflects total system loading on conductors, transformers, and switchgear.

kVAh (Export)

Total apparent energy delivered back to the source. This reflects the total exported system load including both real and reactive components.

kVAh (Net)

The algebraic difference between imported and exported apparent energy. This represents the net apparent energy exchange over time.

kVARh (Import Q1)

Reactive energy imported in Quadrant 1:

- Real power (kW) positive
- Reactive power (kVAR) positive

This typically represents inductive reactive energy absorbed by the load while consuming real power.

kVARh (Import Q2)

Reactive energy imported in Quadrant 2:

- Real power negative
- Reactive power positive

This represents inductive reactive energy imported while real power is being exported.

kVARh (Export Q3)

Reactive energy exported in Quadrant 3:

- Real power negative
- Reactive power negative

This represents capacitive reactive energy exported while real power is also exported.

kVARh (Export Q4)

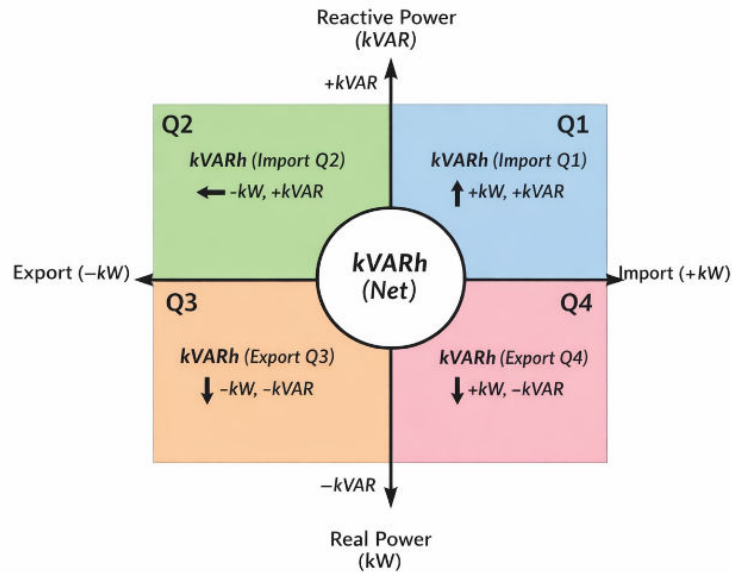
Reactive energy exported in Quadrant 4:

- Real power positive
- Reactive power negative

This typically represents capacitive reactive energy supplied back to the source while consuming real power.

kVARh (Net)

The algebraic sum of reactive energy across all four quadrants. This indicates the net reactive energy exchange over time and can be used to evaluate overall reactive power behavior and long-term power factor performance.



2.8.4. Power Factor

The meter provides multiple power quality and power factor measurements to fully characterize how efficiently electrical power is being used and how waveform distortion affects system performance. Apparent Power Factor represents overall power utilization efficiency, incorporating both phase shift and harmonic distortion effects. Displacement Power Factor isolates the phase relationship between the fundamental voltage and current waveforms. Distortion Power Factor quantifies the impact of harmonic currents on total RMS current. Phase Angle indicates the angular separation between voltage and current fundamentals, and THD% (Total Harmonic Distortion) measures the degree of waveform distortion caused by harmonics. Together, these values provide a complete assessment of load behavior, power quality, and system efficiency.

Mains (ID: 1)				
	CT 1	CT 2	CT 3	System
Apparent PF	1.00	1.00	1.00	1.00
Displacement PF	1.00	1.00	1.00	1.00
Distortion PF	1.00	1.00	1.00	1.00
Phase Angle	180.00	180.00	180.00	
THD (%)	0.00	0.00	0.00	0.00

Apparent Power Factor (True Power Factor)

Apparent Power Factor is the ratio of real power to apparent power:

$$\text{Apparent PF} = \frac{kW}{kVA}$$

It reflects the **overall efficiency** of power usage, including both phase displacement and harmonic distortion effects. Values range from 0 to 1 (or -1 to 1 depending on sign convention). This is the most comprehensive measure of power factor and is often used for system performance evaluation and utility compliance.

Displacement Power Factor (dPF)

Displacement Power Factor is defined as:

$$\text{dPF} = \cos(\theta)$$

where θ is the phase angle between the **fundamental voltage and current waveforms**.

It reflects only the effect of phase shift caused by inductive or capacitive loads and assumes sinusoidal waveforms. It does not account for harmonic distortion. A value close to 1 indicates minimal phase shift. dPF is used to determine if power factor correction is required for a load.

Distortion Power Factor

Distortion Power Factor quantifies the reduction in power factor caused by harmonic current distortion:

$$\text{Distortion PF} = \frac{I_1}{I_{RMS}}$$

where:

- I_1 = RMS value of the fundamental current
- I_{RMS} = Total RMS current including harmonics

As harmonic current increases, total RMS current increases and distortion power factor decreases. This value isolates the harmonic contribution to reduced power factor.

Phase Angle (θ)

Phase Angle is the angular difference between the fundamental voltage and current waveforms, measured in degrees.

- Positive angle → current lags voltage (inductive load)
- Negative angle → current leads voltage (capacitive load)
- 0° → purely resistive load

Phase Angle directly determines Displacement Power Factor:

$$\cos(\theta) = \text{dPF}$$

THD (%) – Total Harmonic Distortion

THD% measures the amount of harmonic distortion present in a waveform relative to its fundamental component.

For current:

$$THD_I = \frac{\sqrt{I_2^2 + I_3^2 + I_4^2 + \dots}}{I_1} \times 100\%$$

For voltage:

$$THD_V = \frac{\sqrt{V_2^2 + V_3^2 + V_4^2 + \dots}}{V_1} \times 100\%$$

THD indicates waveform distortion caused by nonlinear loads such as VFDs, rectifiers, LED drivers, and switching power supplies. Higher THD increases RMS current, contributes to heating losses, and lowers overall (apparent) power factor.

2.8.5. Demand

The meter calculates demand values using a sliding **15-minute demand window**, representing the average power over each rolling block (sliding window) 15-minute interval. Demand measurements indicate the rate at which power is being used, rather than total energy consumed. kW demand reflects real power usage, while kVA demand reflects total apparent power loading on the electrical system. “Present” demand represents the current active 15-minute interval, and “Peak” demand records the highest measured 15-minute demand value since the last reset. These values are commonly used for utility billing, capacity planning, and system loading analysis.

Virtual Meter	kW Demand Present	kW Peak Demand	kVA Demand Present	kVA Peak Demand
Mains (ID: 1)	0.000	0.000	0.000	0.000
VM 2 (ID: 2)	0.000	0.000	0.000	0.000

kW Demand Present

The average real power (kW) measured over the current 15-minute demand interval.

- Represents the current rate of real energy consumption.
- Updates every minute during the active demand window.
- Used to monitor real-time loading relative to demand thresholds.

This value reflects actual usable power (kW) being consumed by the facility.

kW Demand Peak

The highest 15-minute average real power (kW) measured since the last demand reset.

- Captures the maximum real power demand event.
- Often used by utilities to determine demand charges.

- Critical for managing peak load costs.

This value indicates the facility's maximum real power requirement during the measurement period.

kVA Demand Present

The average apparent power (kVA) measured over the current 15-minute demand interval.

- Includes both real (kW) and reactive (kVAR) components.
- Represents total system loading on transformers, conductors, and switchgear.
- Reflects infrastructure stress, not just usable power.

This value is important in facilities where power factor impacts system capacity or billing.

kVA Peak Demand

The highest 15-minute average apparent power (kVA) measured since the last reset.

- Indicates the maximum total electrical loading on the system.
- May be used for utility billing where demand charges are based on kVA.
- Important for sizing generators, transformers, and service capacity.

Practical Difference Between kW and kVA Demand

- **kW Demand** → Reflects real power doing useful work.
- **kVA Demand** → Reflects total system loading, including reactive power.

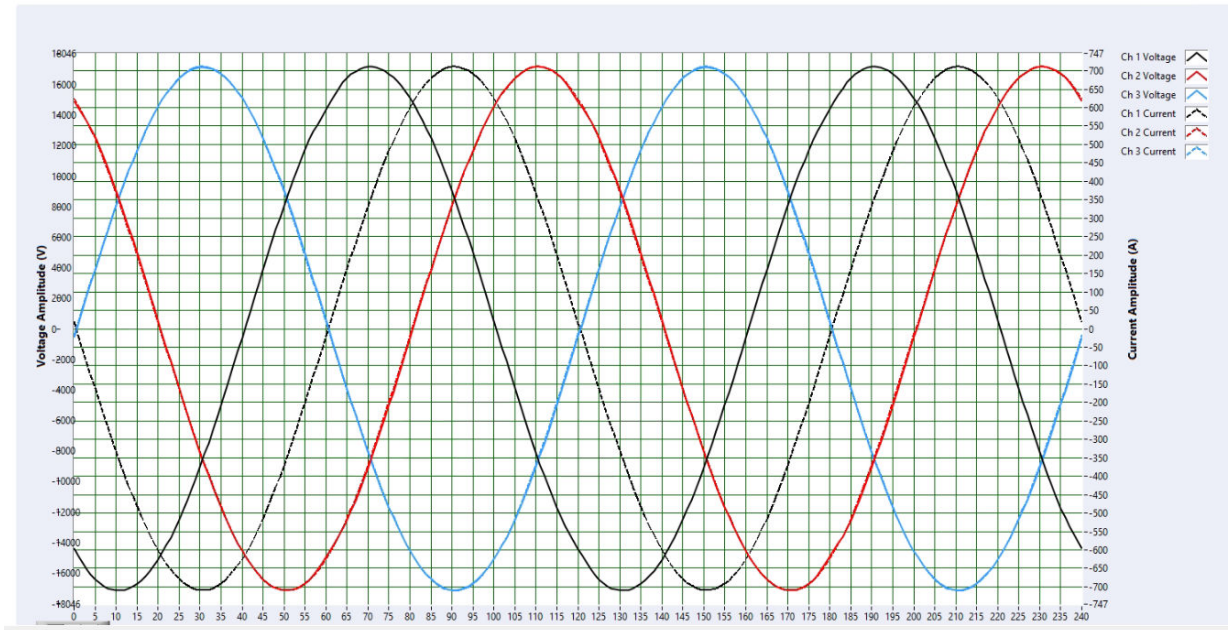
If power factor is less than 1.0:

$$kVA > kW$$

Meaning apparent demand charges or equipment loading may be higher than real demand alone would suggest.

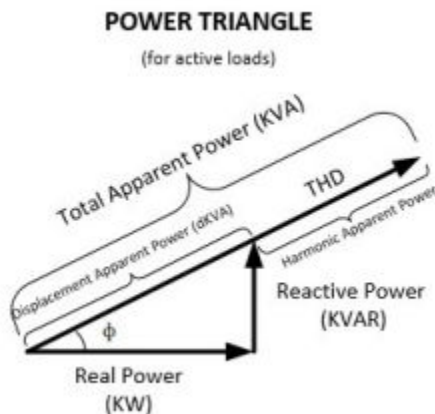
2.8.6. Waveform Capture

Waveform capture data provides high-resolution, time-domain recordings of voltage and current signals. Unlike standard RMS, energy, or demand measurements (which are averaged values), waveform capture preserves the actual instantaneous shape of the electrical waveforms. This data is used to analyze transient events, power quality disturbances, harmonic distortion, and other abnormal system conditions. Waveform capture enables detailed forensic analysis of electrical events that cannot be fully understood through averaged measurements alone.



2.8.7. Harmonics

The PowerScout™ FLEX meter reports overall harmonic content in power (% THD) based on its measurement of Power, Var, and Apparent Power as illustrated in the figure below. This method cannot indicate the harmonic number or distribution but provides the overall harmonic content.



In many circumstances, users are interested in the harmonic content of current. In cases where the voltage is very sinusoidal, the THD measurement is a good estimate of both power and current. However, if the voltage waveform is distorted, the reported THD in power can be misleading. FLEXPoint™ can provide additional analysis of harmonic content in voltage and current by sampling the PowerScout™ FLEX raw data and performing digital signal processing

on the signal. Using this method, the individual harmonics levels can be observed. The results are presented in graphical form.

2.8.8. Phasor Plot

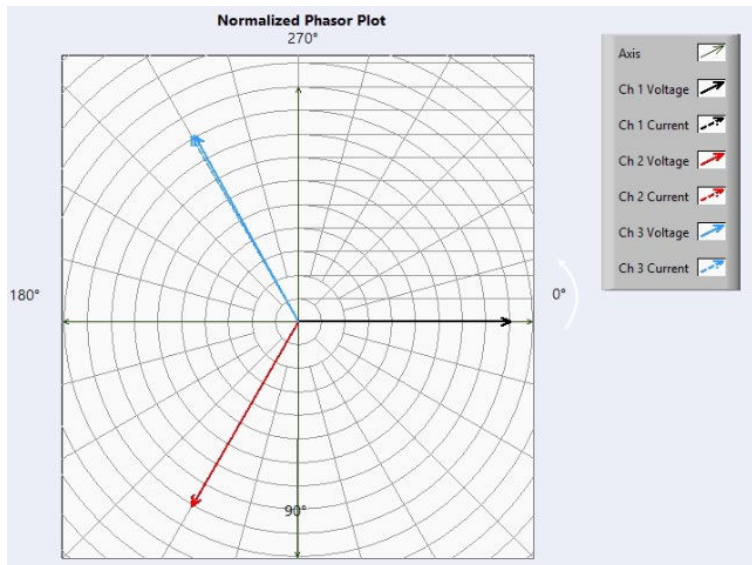
The meter's phasor plot is a graphical representation of the magnitude and phase angle of sinusoidal voltage and current waveforms at the fundamental frequency. While waveform capture shows the instantaneous time-domain shape of voltage and current signals, a phasor plot converts those same waveforms into a frequency-domain vector representation. This makes it easier to visualize phase relationships, magnitude balance, and system conditions in a steady-state AC system.

From captured waveform data, the meter extracts the **fundamental frequency component** (e.g., 50 Hz or 60 Hz) using Fourier analysis. Each fundamental component is then represented as a rotating vector (phasor) with:

- **Length** proportional to RMS magnitude
- **Angle** representing phase position relative to a reference (typically Phase A voltage)

Each phasor (vector) contains two key pieces of information:

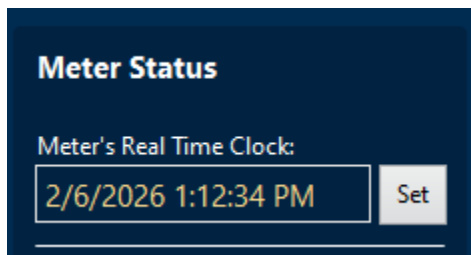
1. **Magnitude**
 - Voltage magnitude (V RMS)
 - Current magnitude (I RMS)
 - Represented by vector length
2. **Phase Angle**
 - Angular displacement relative to a reference waveform
 - Measured in electrical degrees



2.9. Real Time Clock

The PowerScout™ FLEX meter includes a Real Time Clock (RTC). The clock is used only to time stamp Interval Data in the log; it is not used for calculation within the meter. For users of the Interval Data Recording (IDR) function of the meter, it is helpful (but not strictly necessary) to set the real time clock so that data records can be uniquely identified.

The Real Time Clock is visible in the left-hand navigation bar and can be set by clicking the "Set" button.



The clock icon launches the Calendar window and allows the user to set any desired date and time. "Set Time to Now" populates the sets the time and date to match the PC. Press the "OK" button to commit this time to the RTC chip onboard the meter.

Real Time Clock Power Source

The RTC integrated circuit is a standalone low power circuit within the PowerScout™ FLEX meter. Time is kept in the absence of a connected external power source (AC or USB power) by a super capacitor. The capacitor can keep the RTC running over normal power outages (days to weeks) but is not expected to keep time while the meter is being stored or shipped.

2.10. Interval Data

The PowerScout™ FLEX meter maintains an internal log of the energy data (Net kWh) for each channel in the meter. This log is updated every 15 minutes and is always active. The meter stores 63 days' worth of 15-minute data in its memory. This data can be retrieved by users looking to restore gaps in data collection where RTUs may have been offline or communication has been interrupted.

To access the meter IDR data, navigate to the Device Settings Tab under the configuration screen. Toward the bottom of the tab, click the "Download Interval Data Recording Data" button. You will be prompted to save the file to your local PC.

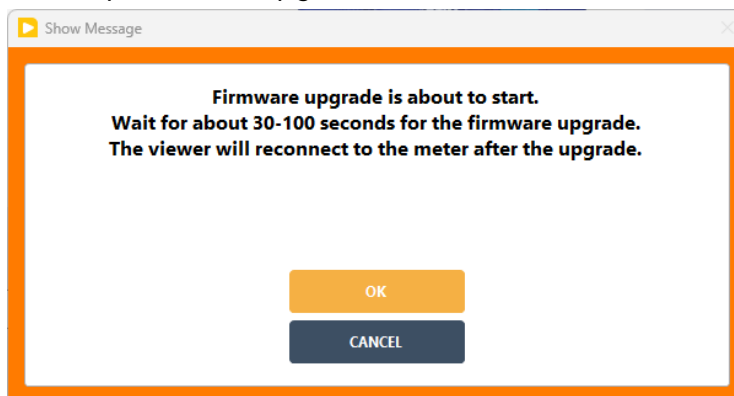
DOWNLOAD INTERVAL DATA RECORDING DATA

The data log is a Comma Separated Values (CSV) file that can be opened in Excel or another program. The data will be listed in chronological order according to an internal 32-bit sequence counter. The sequence counter can be used to merge separate files together, if necessary.

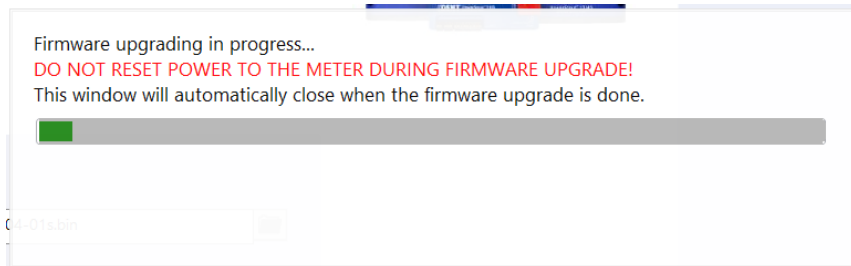
2.11. Firmware Updates

The meter firmware is updated, when necessary, in response to minor bug correction or customer requested features. The firmware update is expected to be downloaded. The basic updating procedure is as follows:

- 1) Download the latest firmware and FLEXPoint™ software update (from the DENT website).
- 2) Install the latest version of the FLEXPoint™ software.
- 3) Locate the appropriate binary file within the Firmware folder
- 4) In the FLEXPoint™ software, navigate to the "ABOUT" screen, and click the folder icon with the "Firmware Upgrade" section.
- 5) Locate the appropriate binary file on your computer and click ok.
- 6) When ready, click the "upgrade" button to initiate the firmware upgrade process.



- 7) FLEXPoint™ will display an in-progress message during the firmware installation process.



If successful, you will be notified on screen and your meter will reconnect.

2.12. macOS Support

The FLEXPoint™ application is not supported on the macOS platform. To access the meter configuration from a macOS device, utilize the FLEXPoint™ GO web server option as described below.

3. FLEXPoint™ GO – PowerScout™ FLEX Web App

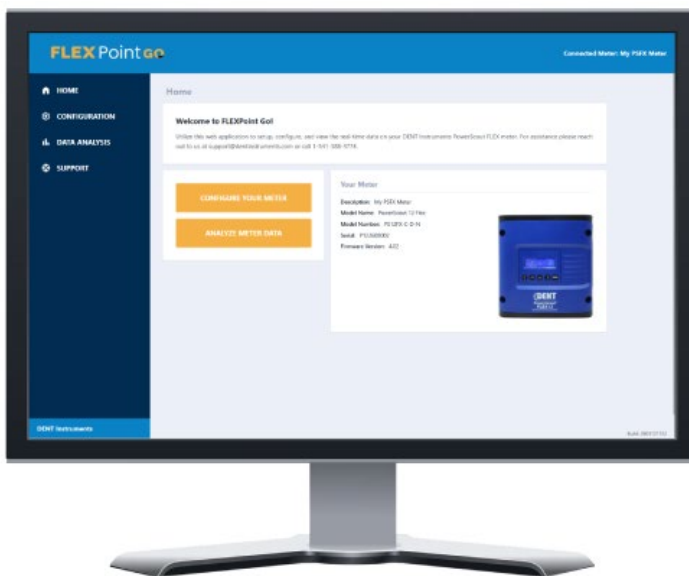
3.1. Overview

FLEXPoint GO

In addition to the FLEXPoint™ application, you may configure your meter and view a subset of real-time data from the on-device web server, also known as FLEXPoint™ GO.

With FLEXPoint™ GO you can experience the same modern and user-friendly interface as FLEXPoint™ without needing to install any additional software on your PC.

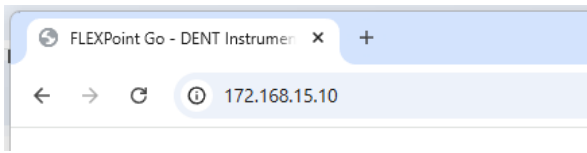
The web server can be accessed directly within a web browser such as Google Chrome, Mozilla Firefox, or Microsoft Edge. (Note: Internet Explorer is not supported)



3.2. Ethernet Access

- 1) Discover the IP address of the meter by one of the following methods (a-c)
 - a. Navigate to About Meter on the LCD user interface.
 - b. Use a network discovery tool to find the address by connecting and disconnecting the Ethernet cable.
 - c. Set the meter to a static address using the serial interface
- 2) Connect your device to the same subnet as the PowerScout™ FLEX meter

- 3) Open a web browser
- 4) Enter the Ethernet address into the web browser



3.3. Authentication

Because the FLEXPoint™ Go Web App can be viewed and controlled by any device with a web browser and communicates in parallel to the host system, the meter can be configured to require a PIN# to restrict access the meter.

Enter the PIN#, if assigned, or leave blank, if unassigned, and press the Login button.

3.4. Capabilities & Limitations

With FLEXPoint™ GO you can experience the same modern and user-friendly interface as FLEXPoint™ without needing to install any additional software on your PC.

The FLEXPoint™ Go Web App works much the same as FLEXPoint™. However, it has no advanced analytics data such as waveform capture, harmonics, or phasor plot data.

Additionally, some advanced device settings require the full FLEXPoint™ application to be installed.

4. Modbus Integration

4.1. Modbus RTU

In a Modbus network, each device must be assigned a unique slave address. Valid Modbus addresses are 1-240.

The slave address of the PowerScout™ FLEX meter needs to be set to match the address expected by the RTU and is normally part of the network specification. The default slave address for Virtual Meter 1 (VM1) is 1.

For multi-element models, adjacent elements data can be accessed by incrementing the slave address by 1 up to the maximum number of 3 channel elements in the meter.

Note: The PS48 requires 15 addresses beyond VM1, the PS24 requires 7 addresses beyond VM1, and the PS12HD requires 3 addresses beyond VM1.

4.2. Modbus TCP

Modbus Port: The PowerScout™ FLEX meter uses the industry standard Port 502 for Modbus. This port number cannot be changed.

4.3. Register Organization

The PowerScout™ FLEX meter communicates through the reading and writing of registers. Registers are organized into functional groups and are based on the SunSpec Modbus interface model.

- SunSpec Common Registers
- SunSpec TCP Network Stack Registers
- SunSpec Serial Interface Registers
- SunSpec Energy Meter
- DENT Factory Registers
- DENT User Command Registers
- DENT User Configuration Registers
- DENT Metrology Registers
- DENT Waveform Capture Registers

The complete register list is available at: [landing-page/powerscout-flex/register-list](#)

4.4. Flattened Register List

PowerScout™ FLEX meters now support a fully flattened register list accessible via a single slave id.

Each virtual meter has a defined block of registers allocated for all of the specific registers associated to that meter.

For full register mappings, visit <https://www.valuetesters.com/page/powerscout-flex/register-list>

4.5. Modbus Commands

The PowerScout™ FLEX networked power meter family follows the Modbus RTU protocol and supports the following command set.

Supported Modbus Commands		
Command Name	Command Number	Description
Read Holding Registers	03	Used to read the data values from the PowerScout™ FLEX meter
Write Single Register	06	Used to write a single holding register to a PowerScout™ FLEX meter
Write Multiple Registers	16 (0x10)	Used to write multiple registers (useful but not required for 32-bit values and strings)
Report Slave ID	17 (0x11)	Used to read information from the identified PowerScout™ FLEX meter

4.6. String Handling

Registers that are identified as “strings” are handled uniquely by the PowerScout™ FLEX power meter. Each register in the string block must be written to sequentially, without interruption, either by using a “write multiple” command or by sending single register commands back-to-back. The final character in the string MUST be a NULL character (ASCII 0). The meter will process the entire string only if these two conditions are met, otherwise the data is ignored. This special processing has been implemented to protect partial updates for network settings.

4.7. Floating Point Settings

The PowerScout™ FLEX meter uses 32-bit IEEE 754 formatted floating-point numbers for reporting results and storing scalable user register values such as CT range, CT and PT scaling factors, etc. Because these registers require two 16-bit Modbus addresses to convey, these registers must be accessed as multiple registers or accessed sequentially without interruption. The reason for preventing floating point registers from being updated as single 16-bit registers is that interim values (when the number is half entered) represent valid but unknown numeric values! Requiring both the MSW and LSW registers to be written sequentially prevents meter data from having unknown and potentially very large scaling factors applied to measurement data between register writes.

Selecting the Data Type

It is likely that the RTU program has built-in support for multiple data types including floating point. The PowerScout™ FLEX meter data is stored as MSW, LSW which may take some trial and error to identify in the RTU setup. Float ABCD is an example of how this RTU identifies the matching byte order.

It is anticipated that command-line programmers or script writers may prefer to enter data in hexadecimal format. Non-programmers using Modbus or BACnet utilities (or those using FLEXPoint™) may prefer to use decimal notation. This example works through the details of converting information found in our user documentation (decimal) into a hexadecimal format which should cover the highest level of complexity.

4.8. Soft Reset

Register manipulation of communication protocols or addressing require that the PowerScout™ FLEX performs a “soft reset” to take effect. Register 2100 can receive a user command to facilitate this process. BACnet users write a “1” and Modbus users write “1234” to affect a soft reset. The PowerScout™ FLEX reboot time is approximately 10 seconds.

5. BACnet Integration

5.1. BACnet Overview

Building **A**utomation and **C**ontrol **N**etwork (BACnet) protocol was developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and is recognized as an American National, European, and ISO global standard. The BACnet default port is 47808 and does not usually need to be changed.

Device Address: DENT meters are Master devices and, as such, must use MS/TP addresses in the range from 0-127. This address must be unique on the network.

Max Masters: The default setting is 127 and does not usually need to be changed.

Max Info Frame: The default setting is 1 and does not usually need to be changed.

The following online BACnet resource is also helpful.

5.2. Device IDs

All device IDs on a BACnet network must be unique. Refer to the section “Serial Protocols” and refer to the Register List for additional information.

5.3. BBMD Setup

Ethernet versions can register as Foreign Devices to a BBMD. BBMD stands for BACnet/IP Broadcast Management Device. The BBMD IP address can be set from FLEXPoint™ or through character string object 2264. A value of 0.0.0.0 disables foreign device registration. This process requires a processor soft reset.

5.4. Segmentation

The PowerScout™ FLEX meter does not support BACnet Segmentation. Segmentation is required when the requested data is longer than the underlying data packet size limitations of the protocol, i.e., the Maximum Transmission Unit (MTU). The MTU for BACnet MS/TP is 480 bytes and for BACnet/IP it is 1476 bytes. This means that some objects with large data arrays will not fit within a packet.

This limitation effectively means that some BACnet client software cannot read the Structured View Object List. In this case the BACnet client structured view mode may need to be disabled, and the standard flat object view will need to be used instead, particularly with BACnet MS/TP.

5.5. Structured View

The PowerScout™ FLEX meter supports the Structured View (SV) object container. If this option is supported in the BACnet exploring tool, objects will be grouped logically into virtual meters which can be named to reflect electrical or physical locations, followed by system objects.

For each virtual meter, Structured View lists the BACnet objects by Object Type and then by numeric number as shown below. In addition, objects for elements are grouped in a “hotel room” scheme.

Some BACnet explorer tools have additional sorting capabilities.

5.6. Object Types

Supported BACnet Object Types		
Object Type	Abbr	Typical Usage
Analog Input	AI	Meter Readings (floating point numeric inputs)
Analog Value	AV	Analog User Settings (floating point numeric outputs)
Binary Value	BV	User Boolean Settings
Multi State Value	MSV	Enumerated Settings
BitString Value	BSV	Bitfield Status Words and Settings
Positive Integer Value	PIV	Restricted Range User Settings
Character String Value	CSV	User Text string settings

6. Advanced Features

6.1. Pulse Inputs (PS12/PS24/PS48 Only)

PS12 meters are equipped with 4 pulse inputs and PS24/PS48 meters are equipped with 2 pulse inputs. Pulse counting supports accumulation of consumption data from any external meter using a dry contact (Form A Relay) or open collector outputs. The PowerScout™ FLEX pulse inputs are compatible with “low speed” meters. The pulse duration must exceed 50 ms in both the logic low and high state allowing for a maximum input frequency of 10 Hz. Pulse scaling, resetting and accumulated values are accessed through registers and are “system” in scope. Refer to available documentation for more information.

6.2. CT Multipliers

The PowerScout™ FLEX has registers that allow potential transformers and series current transformers to be used with the PowerScout™ FLEX meter. These registers allow for transformer winding ratios or other scaling adjustments to be included in the meter processing to eliminate post process scaling. Adjustments for voltage are global to the meter while CT's can be adjusted on a channel-by-channel basis. The multiplier is a floating-point number and can also be used for post installation calibration if desired. The default value is 1.0. Values below 0.9 are disallowed.

6.3. Phase Shift Compensation

Most current transformers sold by DENT Instruments have phase shifts from a few tenths of a degree up to a few degrees. For energy meters, this phase shift can produce accuracy errors. However, DENT's FLEXPoint™ software can compensate for CT phase shifts to help maximize reading accuracy. If you are using the desktop version of FLEXPoint™, these values will automatically be populated for you when using the CT Picker. If you are configuring your meter through the FLEXPoint™ GO Web App, use the table located here

to find the correct phase shift value.

6.3.1. Snap Thresholds

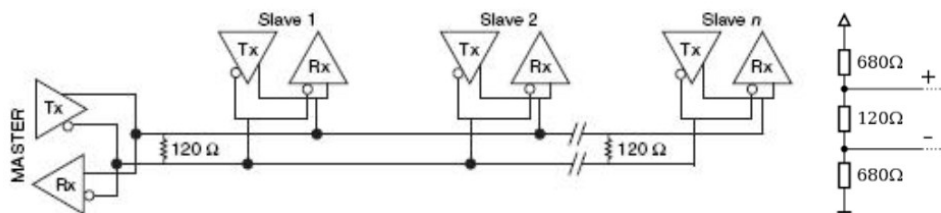
The signal-to-noise ratio of the PowerScout™ FLEX is above 80 dB at full scale (1 part in 10,000). When the signal amplitude becomes so small that it is indistinguishable from noise, it is often better to record 0 than a small, random value. Snap Threshold registers (Advanced Settings section in FLEXPoint™) tell the meter when to record 0 instead of the measurement

result. The factory defaults for CTs are expressed in percent and have a default value of 0.04% Full Scale. The voltage thresholds are in absolute value, the recommended minimum voltage is 1.0 volt.

Changing the current Snap Threshold may affect the ANSI C12.20 compliance.

6.4. RS-485 Physical Layer Requirements

The PowerScout™ FLEX meter uses a 2-Wire Half Duplex RS-485 Implementation



- **Termination Resistors**—are NOT included on the PowerScout™ FLEX meter. If the PowerScout™ FLEX meter is at the end of a daisy-chain, then connect a 120-ohm leaded resistor between the + and – terminal at the connector.
- **Bias Resistors**—are NOT included on the PowerScout™ FLEX meter. Bias resistors are needed if the idle conditions of the bus are in an indeterminate logic voltage. Bias resistors are usually located at the master node and are usually 680 ohms for an RS-485 network.
- **Network Topology**—RS-485 is designed to be implemented as a daisy chain (series connections) rather than star or cascade topologies.
- **Signal Names**—Some RS-485 devices use the terminology A/B while others use +/-. Note that A is (-) and B is (+). Many manufacturers incorrectly label the terminals.
- **Bus Loading**—The PowerScout™ FLEX meter is a 1/8th unit load allowing up to 256 like devices in parallel.

7. Security

7.1. Overview

If security levels have been set up in the meter, no data is accessible through the LCD user interface or FLEXPoint™ GO without entering the PIN credentials. Note, however, that protocols such as Modbus do NOT SUPPORT ANY LEVEL of security such that any network traffic acting as a master can retrieve and write data from the registers. Generally, this will require knowledge of the IP address or slave ID and the register list which discourages casual intrusion.

7.2. PIN Types

PowerScout™ FLEX meters have two levels of PIN protection that users can choose to assign for restricting access to meter information. The PIN logic is described in the figure below. The default user entry (on power up or time-out) is 0000 which satisfies both the Read Only and the Read / Write default register settings.

7.3. Read-Only

Configuring the meter for a Read Only user allows data or configuration items to be viewed but not changed. This level of authorization might be appropriate for general end-users, such as building owners, who may not be aware of the details of the installation. It is required to use FLEXPoint™ to configure permissions.

7.4. Read/Write

Read/Write permissions allow users to read and write configuration items. This level of authorization will be required by any technician or user who needs the ability to correct errors in the meter. Permissions cannot be set through the LCD interface or FLEXPoint™ GO.

7.5. Network Security Best Practices

While the PowerScout™ FLEX meter supports industry-standard protocols such as Modbus and BACnet, it is important to understand that **Modbus RTU, Modbus TCP, and BACnet MS/TP/IP do not natively include encryption or authentication mechanisms**. As such, security must be implemented at the network level.

DENT Instruments recommends the following best practices when deploying PowerScout™ FLEX meters in commercial or industrial environments:

Network Segmentation

Place PowerScout™ FLEX meters on a dedicated industrial control network or VLAN separate from:

- Corporate IT networks
- Guest Wi-Fi networks
- Public-facing systems

Segmentation reduces exposure and limits lateral movement in the event of network compromise.

Firewall Configuration

Where Modbus TCP or BACnet/IP is used:

- Restrict inbound traffic to **only trusted master devices (PLC, BMS, SCADA, RTU)**
- Block external WAN access to Port 502 (Modbus TCP) and Port 47808 (BACnet/IP)
- Disable unused protocols when possible

Strong PIN Configuration

PowerScout™ FLEX meters support two PIN levels:

- Read Only
- Read/Write

Best practices include:

- Change default PIN (0000) during commissioning
- Use non-obvious 4-digit combinations
- Limit distribution of Read/Write credentials
- Periodically review access controls

Note: PIN protection does not secure Modbus traffic. It applies only to the LCD interface and FLEXPoint™ GO Web App.

Secure Remote Access

If remote monitoring is required:

- Use VPN tunnels instead of port forwarding
- Use encrypted industrial gateways
- Implement access logging at firewall or router level

Direct port forwarding of Modbus TCP (Port 502) to the public internet is strongly discouraged.

Physical Security

- Install meters inside locked electrical panels or enclosures
- Restrict physical access to RS-485 terminals
- Prevent unauthorized USB access

Physical access may allow configuration changes regardless of network protections.

Firmware Management

To maintain secure operation:

- Keep firmware and FLEXPoint™ software updated
- Use official DENT Firmware Releases only
- Avoid mixing firmware and register lists from different releases

Industrial Cybersecurity Standards

For high-security environments, consider aligning deployment with:

- IEC 62443 (Industrial Automation Security)
- NIST SP 800-82 (Industrial Control System Security)
- Corporate OT cybersecurity policies

Security Responsibility Disclaimer

Because Modbus and BACnet are open industrial protocols without encryption, overall system security depends on proper network design and infrastructure controls implemented by the system integrator or facility IT team.

DENT Instruments provides device-level configuration tools but does not provide network firewall or cybersecurity infrastructure.

8. Troubleshooting

8.1. USB Power

PS12FX, PS24FX, and PS48FX meters draw 500mA from the USB port which may overload “out of spec” USB hosts. If the meter fails to power, or flickers when powering over USB, an alternate configuration for power must be used.

8.2. Ethernet Communication Issues

8.2.1. Meter Not Discoverable via Network Scan

Symptoms:

- Network Scan does not display the meter
- Meter LCD shows IP address but FLEXPoint™ cannot connect
- Intermittent visibility

Possible Causes & Resolutions:

- **Different Subnets**

Ensure PC and PowerScout™ FLEX are on the same subnet.

- Example:

- Meter: 192.168.1.50 / 255.255.255.0
- PC must be 192.168.1.xxx

If unsure, temporarily configure both to static addresses.

- **Corporate Firewall Restrictions**

Some enterprise networks block UDP broadcast packets required for discovery.

Resolution:

- Attempt manual IP connection.
- Use USB to confirm meter IP.
- Consult IT to allow local subnet broadcast.

- **DHCP Not Present**

If directly connected PC ↔ Meter:

- DHCP will not assign IP automatically.
- Set static IP on both devices.

- **Duplicate IP Address**

If two devices share the same static IP:

- Communication may be intermittent or fail.
- Use Network Scan to confirm serial number.
- Change one device to a unique IP.

8.2.2. Cannot Connect via Modbus TCP

Check:

- Port 502 is open
- No firewall blocking
- Protocol selected correctly in FLEXPoint™
- Meter configured for Ethernet interface (not RS-485 only)

Use a Modbus client tool to confirm register response.

8.3. RS-485 Communication Issues

If you are receiving no response from the meter (Modbus RTU or BACnet MS/TP), check the following troubleshooting recommendations.

- **Wiring Polarity Reversed**
 - A/B polarity may be mislabeled.
 - Note: A = (-), B = (+) on PowerScout™ FLEX. Swap wires and test.
- **Missing Termination**
 - If meter is end of line:
 - Install 120Ω resistor between A and B.
 - Only two terminations per network.
- **No Bias Resistors**
 - If bus idle state floats:
 - Install bias resistors at master device.
- **Incorrect Baud / Parity**
 - Verify:
 - Baud rate matches master
 - Data bits = 8
 - Stop bits = 1 or 2
 - Parity matches configuration
 - Mismatch results in no communication but no physical fault.

- **Duplicate Slave Address**
 - Each Modbus RTU or MS/TP device must have unique address.
Duplicate addresses cause unpredictable behavior.
- **Excessive Network Length**
 - Max 1200m at ≤100 kbps
 - Reduce baud rate for long runs.
- **Star Topology**
 - RS-485 must be daisy-chain.
 - Star topology causes reflections and intermittent failures.

9. Appendices

9.1. Technical Specifications

Specification	Description
Service Types	Single Phase, Split Phase, Three Phase-Four Wire (WYE), Three Phase-Three Wire (Delta)
Voltage Channels	90-346 Volts AC Line-to-Neutral, 600V Line-to-Line, CAT III. Two voltage reference inputs (PS48FX and PS24FX only)
Current Channels	3 (PS3 FX) or 12 (PS12 FX) or 24 (PS24 FX) or 48 (PS48 FX) channels, 0.525 VAC max, 333.3 mV CTs, 0-4,000 Amps depending on current transducer
Maximum Current Input	150% of current transducer rating (mV CTs) to maintain accuracy. Measure up to 4000A with RōCoil CTs.
Measurement Type	True RMS using high-speed digital signal processing (DSP) with continuous sampling
Line Frequency	50/60 Hz (45 - 70 Hz measurable range) – measurement taken L1-N
Power	From L1 Phase to L2 Phase. 90-600VAC RMS CAT III 50/60Hz, 500mA AC Max Use of 12-volt auxiliary output requires 100 VAC minimum input voltage.
AC Protection	0.5A Fuse 200kA interrupt capacity
Power Out	PS12FX/PS24FX/PS48FX only: Unregulated 12VDC output, 200 mA, self-resetting fuse
Waveform Sampling	PS3FX/PS12FX/PS24FX 7.2 kHz; PS48FX 3.6 kHz
Parameter Update Rate	1 second
Interval Data Recording	Energy (kWh) values are recorded every 15 minutes for 63 days (downloadable log). Each record is time stamped.
Measurements	Volts, Amps, kW, kVAR, kVA, aPF, dPF, kW demand, kVA demand, Import (Received) kWh, Export (Delivered) kWh, Net kWh, Import (Received) kVAh, Export (Delivered) kVAh, Net kVAh, Import (Received) kVARh, Export (Delivered) kVARh, Net kVARh, THD, Theta, Frequency.

	All parameters for each phase and system total.
Accuracy	0.2% ANSI C12.20-2015 Class 0.2
Resolution	Values reported in IEEE-754 single precision floating point format (32 bit)
Indicators	PS3FX: Standard 2-line display, tri-color backlight (PhaseChek™) PS12FX/PS24FX/PS48FX: Optional 4-line display, tri-color backlight (PhaseChek™)
Alarm Output	User-configurable alarm with open collector output
Pulse Inputs	PS3FX - None PS12FX - 4 inputs PS24FX - 2 inputs PS48FX - 2 inputs 3.3V sourcing voltage (current limited) to user dry contact pulse output Maximum Pulse Rate 10 Hz (50 msec minimum transition time)
Communication	
Hardware	RS-485, Ethernet (IPv4 only), and USB
Supported Protocols	Modbus RTU or BACnet Master Slave Token Passing protocol (MS/TP) Modbus (using SunSpec IEEE-754 single precision floating point model)
Max Communication Length	1200 meters with Data Range of 100K bits/second or less
RS-485 Loading	1/8 unit
Communication Rate (baud)	Modbus: 9600 (Default), 19200, 38400, 57600, 76800, 115200 BACnet: 9600, 19200, 38400, 76800
Data Bits	8
Parity	None, Even, Odd
Stop Bit	2, 1
Termination	None provided
Data Formats	Modbus RTU, BACnet MS/TP, Modbus TCP or BACnet IP

Mechanical	
Wire Connections	12-28 AWG 600 VAC, Voltage connection must be #14 AWG or larger & 600 VAC rated
Mounting	Enclosure or Panel Mount
High Voltage Cover	IP30. Included with all models except PS12FX-P-D-N
Operating Temperature	-20 to + 60° C (-4 to 140° F) (the colder the temperature the more voltage needed to power the board)
Humidity	5% to 95% non-condensing
Enclosure	ABS Plastic, 94-V0 flammability rating Conduit Connections: 1" (PS12FX/PS48FX Wall Mount enclosures) or ½" (PS3FX Wall Mount enclosure)
PS24FX/PS48FX Dimensions	(L) 33.7cm x (W) 25.1cm x (H) 8.0 cm (13.3" x 9.8" x 3.1") (enclosure version) (L) 26.2cm x (W) 24.1cm x (H) 8.0 cm (10.3" x 9.5" x 3.1") (mounting plate version)
PS12FX Dimensions	(L) 24.8cm x (W) 25.1cm x (H) 8.0 cm (9.8" x 9.8" x 3.1") (enclosure version) (L) 17.8cm x (W) 26.3cm x (H) 8.0 cm (7.0" x 10.4" x 3.1") (mounting plate version)
PS3FX Dimensions	(L) 19.1cm x (W) 8.2cm x (H) 3.8cm (7.5" x 3.2" x 1.5") (DIN Rail Version) (L) 25.7cm x (W) 14.0cm x (H) 5.4cm (10.1" x 5.5" x 2.1") (Wall Mount Version)
FLEXPoint™ Software Minimum System Requirements	
Operating System	Windows® 10, Windows® 11 (Does NOT support ARM Processors)
Communications Port	USB or Ethernet connection
FCC Compliance	This device has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful

	interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at user's own expense.
Safety	The following are UL Recognized: • PS3FX-R-D-N • PS12FX-B-y-z • PS12FX-P-y-z • PS24FX-P-y-z • PS48FX-B-y-z • PS48FX-P-y-z The following are UL Listed: • PS12FX-C-y-z • PS48FX-C-y-z • PS24FX-C-D-N • PS3FX-C-D-N Conforms to UL Std 61010-1, 3rd Edition, UL 61010-2-30:2010 Certified to CSA Std C22.2 No. 61010-1, 3rd Edition
CE	LVD (EN61010-1) EMC (EN61326-1) RoHS 2 (EN50581)

9.2. Measurement Parameters

PowerScout™ FLEX meters report measurement parameters at different data scopes depending on how the value is produced and how it is used. Some values apply to the meter as a whole, some apply to a Virtual Meter, and others apply to an individual channel within a Virtual Meter.

Data Scope

System-level parameters apply to the meter as a whole and are not tied to a specific Virtual Meter. Examples may include line frequency, communication settings, meter status, or other global values.

Virtual Meter-level parameters apply to the logical electrical load represented by a Virtual Meter. These values may be calculated from one, two, or three enabled channels within that Virtual Meter. For example, a Virtual Meter-level kW value may represent the sum of the enabled channel kW values for that load.

Channel-level parameters apply to an individual current input assigned to a Virtual Meter. Channel-level values are useful for viewing phase-level or conductor-level measurements, such as current, power, power factor, or energy on a specific channel.

Parameter Types

PowerScout™ FLEX reports both instantaneous values and accumulated values.

Instantaneous parameters represent the measured or calculated condition at the time the value is read. These values update continuously during operation and are commonly used for real-time monitoring, commissioning, and troubleshooting. Examples include voltage, current, kW, kVA, kVAR, power factor, phase angle, frequency, and THD.

Accumulator parameters represent values accumulated over time. These values continue increasing or decreasing as energy flows through the measured load and are commonly used for energy tracking, reporting, billing support, and historical analysis. Examples include kWh, kVAh, kVARh, import energy, export energy, and net energy.

Demand parameters represent average power over a defined time interval rather than a single instantaneous reading or a continuously accumulated total. PowerScout™ FLEX demand values are based on a 15-minute demand interval and may include present demand and peak demand values.

Parameter Table

Term	Unit	Scope	Parameter Type	Definition	Common Use
Voltage	V	System / Channel reference	Instantaneous	Electrical potential difference measured between voltage conductors, such as line-to-neutral or line-to-line.	Verifying service voltage, monitoring voltage stability, identifying under-voltage or phase-loss conditions.
Line-to-Neutral Voltage	V	System	Instantaneous	Voltage measured between a phase conductor and neutral, such as L1-N, L2-N, or L3-N.	Used for Wye and single-phase voltage monitoring.
Line-to-Line Voltage	V	System	Instantaneous	Voltage measured between two phase conductors, such as L1-L2, L2-L3, or L3-L1.	Used for three-phase and Delta system monitoring.
Current	A	Channel	Instantaneous	The flow of electric charge through a conductor, measured for an	Real-time load monitoring and circuit-level

				individual CT input or Virtual Meter channel.	current verification.
Real Power	kW	Virtual Meter / Channel	Instantaneous	The portion of electrical power converted into useful work by the load.	Monitoring active load, demand trends, and consumption behavior.
Apparent Power	kVA	Virtual Meter / Channel	Instantaneous	The total power supplied to a load, combining real and reactive components.	Sizing transformers, generators, conductors, and electrical infrastructure.
Reactive Power	kVAR	Virtual Meter / Channel	Instantaneous	The portion of power that oscillates between the source and reactive load components such as motors, inductors, and capacitors.	Evaluating power factor correction needs and reactive load behavior.
Power Factor	PF	Virtual Meter / Channel	Instantaneous	The ratio of real power to apparent power. Power factor indicates how effectively supplied power is being converted into useful work.	Identifying inefficient loads and possible utility penalty conditions.
Apparent Power Factor	aPF	Virtual Meter / Channel	Instantaneous	Overall power factor including both phase displacement and harmonic distortion effects.	Evaluating total power-use efficiency and power quality.
Displacement Power Factor	dPF	Virtual Meter / Channel	Instantaneous	Power factor based on the phase angle between the fundamental voltage and current waveforms. It does not include	Identifying inductive or capacitive phase shift behavior.

				harmonic distortion effects.	
Distortion Power Factor	—	Virtual Meter / Channel	Instantaneous	The power factor component associated with harmonic current distortion.	Understanding how waveform distortion reduces overall power factor.
Phase Angle / Theta	degrees	Virtual Meter / Channel	Instantaneous	The angular difference between voltage and current waveforms.	Checking load type, CT phasing, and power factor behavior.
Line Frequency	Hz	System	Instantaneous	The measured frequency of the AC electrical system, typically 50 Hz or 60 Hz.	Grid synchronization and frequency stability monitoring.
Total Harmonic Distortion	% THD	Virtual Meter / Channel	Instantaneous	A measure of waveform distortion relative to the fundamental frequency.	Identifying nonlinear loads, harmonic distortion, and power quality issues.
Real Energy	kWh	Virtual Meter / Channel	Accumulator	Accumulated real energy over time. kWh represents useful energy consumed or produced.	Energy consumption tracking, tenant allocation, billing support, and usage analysis.
Apparent Energy	kVAh	Virtual Meter / Channel	Accumulator	Accumulated apparent energy over time, including both real and reactive components.	Evaluating total electrical loading over time.
Reactive Energy	kVARh	Virtual Meter / Channel	Accumulator	Accumulated reactive energy over time.	Long-term power factor analysis and reactive energy tracking.
Import Energy	kWh / kVAh / kVARh	Virtual Meter / Channel	Accumulator	Energy delivered from the source to the load.	Tracking facility consumption from the utility or source.