LEVITON®

VerifEye® Series 7200/7300
Cat. No 73D48, 72D48, 72N48

User Guide

Cat. 73D48

Cat. 72D48

PK-A3386-10-00-0A

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WEB VERSION

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WARNINGS:

- **RISK OF DEATH OR ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH. DO NOT ENERGIZE METER WITH THE VOLTAGE COVER REMOVED. CAREFULLY READ AND FOLLOW INSTRUCTIONS.**

- **TO AVOID FIRE, SHOCK, OR DEATH,** turn off all power sources supplying the equipment before working on or inside the equipment. Use a properly rated voltage sensing device to confirm that power is off.

- This equipment **MUST** be installed and serviced by an electrician or other qualified personnel, with the requisite knowledge, training, and experience related to the installation and operation of this equipment, and in accordance with applicable codes.

- Do not depend on this product for voltage indication.

- Only install this product on insulated conductors.

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 VerifEye® is a 600 Volt Over Voltage Category III device.

For use in a Pollution Degree 2 or better environment only. A Pollution Degree 2 environment must control conductive pollution and the possibility of condensation or high humidity. Consider the enclosure, the correct use of ventilation, thermal properties of the equipment, and the relationship with the environment. Installation category: CAT II or CAT III

Provide a disconnect device to disconnect the meter from the supply source. Place this device in close proximity to the equipment, and within easy reach of the operator, and mark it as the disconnecting device. The disconnecting device shall meet the relevant requirements of IEC 60947-1 and IEC 60947-3 and shall be suitable for the application. In the US and Canada, disconnecting fuse holders can be used. Provide overcurrent protection and disconnecting device for supply conductors with approved current limiting devices suitable for protecting the wiring. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

CAUTIONS:

- This product is not intended for life or safety applications.

- Do not install this product in hazardous or classified locations.

- Mount this product inside a suitable fire and electrical enclosure.

- If the collector is connected directly to a source of voltage, the pulse isolator will immediately burn out and become non-responsive.

- Do no use any cleaning agents, including water, on the VerifEye device.

- No accessories are approved for use with the VerifEye meter other than those specified in the Leviton Manufacturing product literature and price sheets.

- A circuit breaker used as a disconnect must meet the requirements of IEC 60947-1 and IEC 60947-3 (Clause 6.11.4.2)

- Current transformers may not be installed in equipment where they exceed 75 percent of the wiring space of any cross-sectional area within the equipment.

- Current transformers may not be installed in an area where they block ventilation openings.

- Current transformers may not be installed in an area of breaker arc venting.

- Not suitable for Class 2 wiring method nor intended for connection to Class 2 equipment.

- Secure current transformer and route conductors so that they do not directly contact live terminals or bus.

- External secondary inputs and outputs should be connected to devices meeting the requirements of IEC 60950

- The following additional requirements apply for Recognized board versions of the VerifEye meter

    - For use only with Listed Energy-monitoring Current Transformers
    - Associated leads of the current transformers shall be maintained within the same overall enclosure.
    - Unless the current transformers and their leads have been evaluated for REINFORCED INSULATION, the leads must be segregated or insulated from different circuits.
    - The current transformers are intended for installation within the same enclosure as the equipment. These may not be installed within switchgears and panel boards or similar.

- Use this device with **copper or copper-clad wire only**.

- For indoor use only.

1 INTRODUCTION

There are two meters in the VerifEye® series: the VerifEye 7200 and the VerifEye 7300. These meters monitor the voltage, current, power, energy, and many other electrical parameters on single and three-phase electrical systems. A VerifEye meter uses direct connections to each phase of the voltage and current transformers to monitor each phase of the current. Information on energy use, demand, power factor, line frequency, and more are derived from these voltage and current inputs.

The VerifEye meter is not meant to be a standalone energy recorder; rather it is connected as a slave device to a data logger, Remote Terminal Unit (RTU), or Building Management host network. The VerifEye 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.

1.1 Unpacking the Unit

The VerifEye meters can be ordered with optional product features which are identifiable on the part number label.

VerifEye Part Numbering Scheme

72D48-000 Series 7200 Embedded Branch Circuit Monitor, Mounting Plate 48 Input, with LCD Display

72N48-000 Series 7200 Embedded Branch Circuit Monitor, Mounting Plate 48 Input, with no display

73D48-000 Series 7300 Branch Circuit Monitor, Plastic Enclosure 48 Input, with LCD Display

Each VerifEye meter shipment also includes the following items:

- Meter with Options Installed – Serial Number, MAC ID, and FCC ID indicated on side label

- Pluggable Connectors (2 voltage, 50 three-position terminals, 3 two-position terminals)

- Thumb drive containing VerifEye Virtual Element Viewer Utilities Software, Register List, Manual, Tutorial Videos

- Certificate of Calibration (COC) for each unit

1.2   Meter Anatomy

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

WEB VERSION
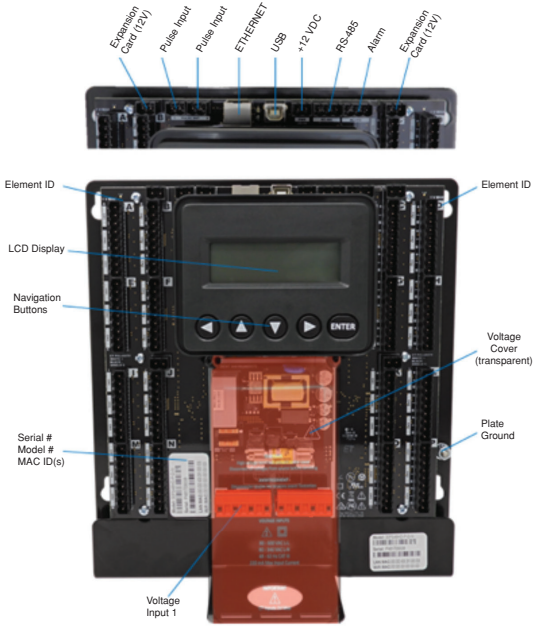
2   PLANNING FOR FIELD INSTALLATION

2.1   Project Manager Aspects

Meter installation often includes coordination between individuals or groups of people with different responsibilities. Spend a few minutes considering who will be executing each portion of the installation and what tools are needed at each stage. Things to consider include determining how to communicate with the meter, setting address configuration, installing Virtual Element Viewer Utilities, access to PIN numbers, etc. The more tasks completed before installation the fewer tasks will be needed in the field. The following section gives an overview of typical process activities followed by details in the next section.

2.1.1 Configuration & Data Viewing Options

The VerifEye meter has three methods for configuration and data viewing. The most powerful interface is a Microsoft Windows application (Virtual Element Viewer Utilities) that runs on PCs or tablets. Virtual Element Viewer Utilities is encouraged for complex installations and is required for configuring advanced functions like alarms. The third interface is an optional LCD display which is intended for intermittent end-user observation and is restricted in capability. The RTU can also be used for configuration if communication settings are already established. The feature set of each interface is summarized next.

2.1.2 Information Access by Interface Type

Interface Options	PC or Laptop Running Virtual Element Viewer Utilities	LCD on Meter (if equipped)	RTU (Host System) Modbus /BACnet
When	Meter Setup Field Visit	End User	Building System
Real Time Values	All Meter Parameters Waveform Capture Harmonic Analysis All Element View Phasor Plot Alarms	Voltage Current VA VAR kWh Single Element View	All Meter Parameters
Configuration	Entire Meter Visual Guides Copy / Paste	Communications Only	Entire Meter Register Based
Security PINs	Factory Support – Level 3	Read Only – Level 1* Read / Write Level 2* (limited to communication)	Factory Support – Level 3

* If PINs are configured

2 PLANNING FOR FIELD INSTALLATION

2.2   Meter Configuration Overview

Work performed ahead of the installation saves time in the field and results in fewer mistakes!

Tools	Typical Work
• Desktop or Laptop PC • USB Type AB Cable (preferred) or Ethernet & USB wall charger (> 500 mA) • Thumb Drive (Virtual Element Viewer Utilities Installer) or access www.Leviton.com and go tosoftware downloads for this product • Electrical Schematics of project	• Installation of Virtual Element Viewer Utilities Software • Connect USB/Ethernet cable from PC to meter • Establish communication with meter • Firmware update (if desired) • Configure software for anticipated meter setup • Field wiring documentation

2.3   Meter Installation Overview

Performed by licensed electrician.

Tools	Typical Work
• Mounting hardware (customer supplied) • Wiring & supplies, labels, wire ties • Tablet, Smart Device, or Laptop PC • Multi Meter, Current Clamp • Camera	• Mechanical mounting • Electrical installation • Install voltage cover • Apply power to meter • Confirm basic operation of meter

2.4   Verification & Communication Overview

Can be modified with power applied to the meter.

Tools	Typical Work
• Tablet, Smart Device (Web Page Based), or Laptop PC (Virtual Element Viewer Utilities Software) • On site troubleshooting • Multi Meter, Current Clamp • Camera	• Locate the power meter • Confirm RTU device • Add wire terminations (if required) • Confirm meter communication settings • Meter health metrics (check for setup errors) • Analytics (Virtual Element Viewer Utilities) • Correct instrumentation • Set security PINs • Checklist

2.5   RTU Programming and Scripting Overview

Tools	Typical Work
• Laptop PC (Remote Access to RTU) • Remote troubleshooting • Register List	• Confirm meter communication settings • Confirm communication protocols • Exercise remote connectivity • Run configuration scripting • Confirm data integrity

3   METER CONFIGURATION

This section is written to support setting up the VerifEye in an office environment and configuring the power meter for a pre-determined configuration. In many cases, the setup is standardized for an organization or project. In other cases, the setup can be documented and emailed to an installer. The setup can also be performed on-site and reflect "as-built" configurations.

3.1   Install the Virtual Element Viewer Utilities Software

Insert the Virtual Element Viewer Utilities thumb drive into the computer or download from the Leviton FTP site. (qualified Leviton personnel only). The installer should start automatically. If it does not, browse the thumb drive and locate the Setup.exe program, double-click on it, and follow the installer instructions.

Custom Installation

For users who want to specify the location of the Virtual Element Viewer Utilities software and support files, double-click the folder **[Install Files]** and run setup. exe. This will prompt the user for additional details.

Name	Date modified	Type	Size
bin	4/20/2018 8:54 AM	File folder	
license	4/20/2018 8:54 AM	File folder	
Local	4/20/2018 8:54 AM	File folder	
LVRTE	4/20/2018 8:54 AM	File folder	
supportfiles	4/20/2018 8:54 AM	File folder	
nidist.id	4/17/2018 10:51 AM	ID File	
setup.exe	4/17/2018 10:51 AM	Application	1,40
setup.ini	4/17/2018 10:51 AM	Configuration sett...	

8 items

3.1.1 Connection & Configuration Options Using Virtual Element Viewer Utilities

When the Virtual Element Viewer Utilities application is launched, it will prompt the user to select one of four connectivity options.

- Connect over USB cable
- Connect over Ethernet to a Predetermined IP address
- Scan Network
- Create Setup file only (no meter connected)
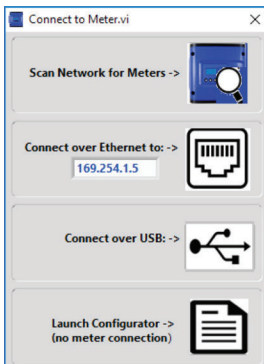
NOTE: The USB connection method is recommended for new users who have physical access to the meter using a USB A to B cable.

3.1.2 USB Connection (Power & Communications)

1. Connect the VerifEye meter to a USB port of your computer to provide both power and communications.

    a. If equipped, the LCD display 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 VerifEye meter has booted and is running.

CAUTION: The VerifEye meter draws 450mA from the USB port. Be sure the USB host is industry standard otherwise overloading may occur. If the meter fails to power, or flickers when powering over USB, an alternate configuration for power must be used.

2. Launch the Virtual Element Viewer Utilities application and select **[CONNECT OVER USB]** on the pop up window.

The meter should now be communicating. The Virtual Element Viewer Utilities application offers visual guides and context help to facilitate meter configuration. Please read the **Virtual Element Viewer Utilities overview section** for additional information on configuring the meter. By default, VerifEye meters are configured for DNS 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 Virtual Element Viewer Utilities by selecting **[Refresh Connectivity]** located in the upper right hand corner.

3.1.3 Ethernet Network Connections

Configuring the meter over Ethernet requires that the meter be powered used a second connection. The meter does not support Power Over Ethernet (POE). If the meter is already installed within the buildings electrical network, closing the AC breaker (or approved disconnect) will turn on the meter through the meter's internal power supply.

NOTE: In the rare case that a computer's USB port cannot provide 500mA of current, an AC / USB charger or a USB battery can be used as a power source while using Ethernet for communications.

NOTE: Both the **Network Scan** and **Connect Over Ethernet to IP** options require that a valid network connection exists between the VerifEye meter and configuration PC.

Dynamic Host Configuration Protocol (DHCP):

VerifEye 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, as long as the VerifEye 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 VerifEye meter will indicate the IP address on the LCD display (if equipped) or can be found using the Network Scan function.

Direct

When a PC is directly connected to a VerifEye 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 Display

For units equipped with an LCD display, 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 below.

Control Panel
 > Network and Sharing Center
  > Change Adapter Settings
   > Properties
    > Internet Protocol Version 4 (TCP/IPv4)
     > Properties

Use the following IP address:

IP address:	192 . 168 . 1 . 100
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	. . .

Change Computer **IP Address** and **Subnet Mask** to **192.168.1.100** and **255.255.255.000** respectively.

Once the PC and VerifEye meter are set to communicate on the same IP subnet:

1. Launch the Virtual Element Viewer Utilities application and enter the IP address of the meter (shown as the factory default).

2. Select **[Connect over Ethernet to:]** on the pop up window.

Connect over Ethernet to: ->
192.168.1.105
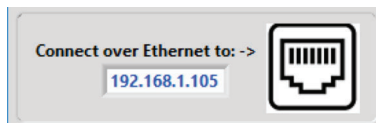
3. The meter should now be communicating. Virtual Element Viewer Utilities is an intuitive application; read the Virtual Element Viewer Utilities overview section for additional information on configuring the meter.

No LCD Display

A VerifEye meter without a display can only communicate directly with a PC over ethernet if the IP address of the meter is set to static. Setting the IP address must be done ahead of time using another interface (such as USB or serial).

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Network Scan

Network Scan is a feature for monitoring previously installed and configured VerifEye meters over an Ethernet network. Network Scan will broadcast a UDP discovery packet on the same network as the PC running the Virtual Element Viewer Utilities application. Normally this will be performed on a corporate network running DHCP. Any VerifEye 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	
SERIES 7100	182.168.233.150	P481807002	00:0D:63:31:10:3C	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 Virtual Element Viewer Utilities (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).

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3.2   Virtual Element Viewer Utilities Software Overview

Virtual Element Viewer Utilities is a Windows application and is the most versatile software tool for configuring and verifying a VerifEye meter. All functions and menus are accessed under the central drop-down list which has a content filter for viewing **Basic** metering data or **Extended** meter data that can be helpful in troubleshooting. The information displayed in the drop-down list for each filter setting is summarized below.
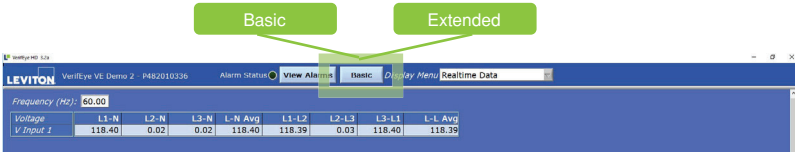
Display Data		Basic	Extended
Monitor	Power	a	a
	Energy	a	a
	Demand	a	a
	Power Factor		a
	Waveform Capture		a
	Harmonics		a
	Phasor Plots		a
Meter Setup	Communication Setup	a	a
	Alarms		a
	Advanced	a	a
	About the Meter	a	a

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3.2.1 Configuring Electrical Components

1. Navigate to **Configuration** under **Display Menu** List Box.

2. Enter a **System Description** for the physical location of the meter.

3. If the entire system uses 2 Pole, click on **Configure All Elements as 2 Pole.** This automatically assigns all 24 virtual elements as 2 Pole loads.

4. Select the **Incoming Voltage** (3 Phase or 2 Phase).

5. Enter the **Service Label** to identify each Virtual Element's circuit assignment.

6. Select the **Breaker Type** (1 Pole, 2 Pole, 3 Pole).

7. Select **CT Num** to assign the corresponding panel circuit.

8. Set **Volt Ref** to assign each circuit to the appropriate phase.

9. Set **Sign** to reverse the polarity of the CT *(optional)*.

10. Select **CT Type** to the appropriate CT installed for the selected circuit. Clicking the **Copy CT Type** will assign the same CT settings for each element below.

11. Set the **Slave Address** for Virtual Element #1 to the desired Modbus address for the meter. All other Save Addresses should be set to 256.

12. Repeat steps 5 though 11 for each active **Virtual Element**.

13. For any elements which are not activated, select **Not Used in the Voltage Ref.**

14. Click **SEND SETUP TO METER.**

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3.2.2 Configuring RS-485 Communications

If planning to setup communication via RS-485, follow the steps below:

1. Navigate to **Communication Setup** under **Display Menu** List Box.

2. Select **RS-485**.

3. Select either **Modbus** or **BACnet**.

4. If **Modbus** is selected, set the following:

     •   Serial Settings

     •   Set Modbus Address

If **BACnet** is selected, set the following:

     •   Serial Settings
     •   Device ID
     •   MS/TP Address
     •   Max Masters *(optional)*
     •   Max Info Frames *(optional)*

5. Click **SEND SETUP TO METER**

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3.2.3 Configuring Ethernet Communications

If planning to setup communication via Ethernet, follow the steps below:

1. Navigate to **Communication Setup** under **Display Menu** List Box.

2. Select **Ethernet**.

3. Select either **Modbus** or **BACnet**.

4. If **Modbus** is selected, set the following:

  • Modbus Port *(optional)*

If **BACnet** is selected, set the following:

  • Device ID
  • BACnet Port & BBMD

5. Select either **DHCP** or **Static IP**.

6. If **DHCP** is selected, proceed to the next step.

If **Static IP** is selected, set the following:

  • Static IP Address
  • Subnet Mask
  • Gateway Mask
  • Default Gateway

7. Click **SEND SETUP TO METER**

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3.2.4 Configuring Alarms

The VerifEye power meter has the ability to set alarms for under conditions for voltage and current on any meter channel.

Configuration Input Methods

Virtual Element Viewer Utilities uses dynamic entry for the specification of Alarm settings. Whichever text entry field is selected becomes the forcing condition and the other related fields are updated by calculation to reflect a consistent set of conditions. The text entry fields in grey are Configuration and are NOT retained by the meter. Only the fields with a black background are stored in the meters memory or in configuration files

Nominal Values

Entering alarm thresholds based on "percent of nominal" values is helpful when alarm conditions are desired to be centered around electrical components or industry standard conditions. For example, an over current alarm may be set to 80% of an installed circuit breaker to alert when that breaker exceeds NEC recommendations.

Absolute Values

Entering alarms based on absolute value is a matter of entering the triggering values directly in the register fields (black background).

			Lower Alarm
Copy	Channel	Enable	Voltage (RMS)

Voltage Alarms

Persistence (seconds) `15`

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	●	384
Copy…	V1 L2-L3	●	384
Copy…	V1 L3-L1	●	384

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3.2.5 Setting the Real Time Clock

The VerifEye meter includes a **Real Time Clock**. The clock is used only to time stamp Interval Data in the log, it is not used for calculation within the meter. For those customers using the 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 time can be set using Virtual Element Viewer Utilities, under the **Advanced Tab**, by clicking on the small time icon in the bottom right corner of the clock.

The clock icon launches the **Window Calendar** and allows the user to choose desired date and time. **Set Time to Now** populates the current time. Click **OK** to commit this time to the RTC chip onboard the meter.
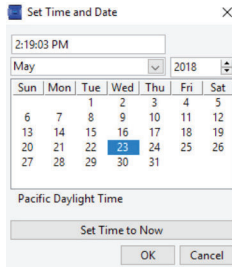
Real Time Clock Power Source

The RTC integrated circuit is a stand alone low power circuit within the VerifEye 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.

NOTE: It is recommended that users desiring to use the **Interval Data Recording** capability of the VerifEye meter ensure the **Real Time Clock** is set as part of the commissioning process.

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3.2.6 Retrieving Interval Data

The VerifEye 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. The Interval Data Recording (IDR) is assessed through Virtual Element Viewer Utilities in the Advanced menu.

Click **Download**

Download Logged Data
Path to logged data file (.csv)
Download

By default, the name of the data file will include the Serial Number of the Meter and the System Description followed by – Datalog.

After clicking **OK** the entire data path will be displayed

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.

EXAMPLE:

Sequence Number	Time Stamp	A1 kWh	A2 kWh	A3 kWh	A System	B1 kWh …
123456	5/15/2018 12:00	1.11E+5	2.22E+5	3.33E+5	6.66E+5	0
123457	5/15/2018 12:15	1.12E+5	2.23E+5	3.34E+5	6.69E+5	0

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This section is intended to support the physical installation of the meter and provide guidance on connecting the current transformers (CTs) correctly within the electrical load center and to the VerifEye meter.

4.1   Meter Mounting Configurations

VerifEye meters are sold in several form factors. Enclosures are designed to be wall mounted and connected to electrical conduit. Plate mounted versions are ready to be mounted inside a customer supplied NEMA enclosure.

CAUTION: Care should be taken not to flex the circuit board during mounting.

Enclosure

Cat. 73D48 (pictured)

Plate Mounted

Cat. 72D48 (pictured)
Cat. 72N48

4   METER INSTALLATION

4.2   Installation Sequence
For Enclosure Model Only (Cat. 71D48)

1. Remove covers.

Screws provided.
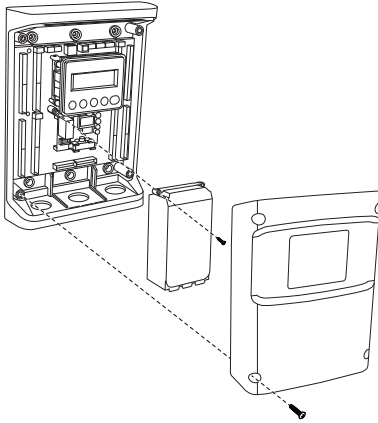
2. Mount.

Use the enclosure as a template.

NOTE: If meter is not available to use as a template, see the mechanical specifications drawing in the appendix.
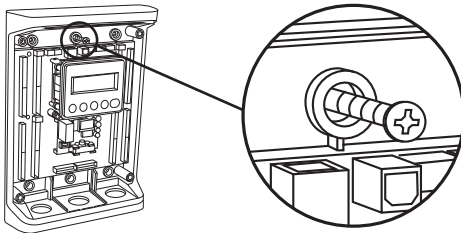
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3. Connect.

- • Conduit fittings
- • Conduits
- • Blanking plugs
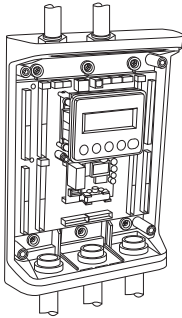
4. Connect voltage leads.

WARNING: RISK OF ELECTROCUTION, SHOCK, EXPLOSION, OR ARC FLASH. DO NOT ENERGIZE METER WITH VOLTAGE COVER REMOVED. CAREFULLY READ AND FOLLOW INSTRUCTIONS.

Connect the voltage leads (L1, L2, L3 and N as necessary) to the meter through a dedicated disconnect or circuit breaker.

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

Wiring the Meter in a Single Phase Application: The meter is powered through the voltage between L1 and L2. For single phase installations, where no L2 exists, install a jumper from N to L2. This connection provides power to the meter, maintaining L1-N as the metering voltage reference.
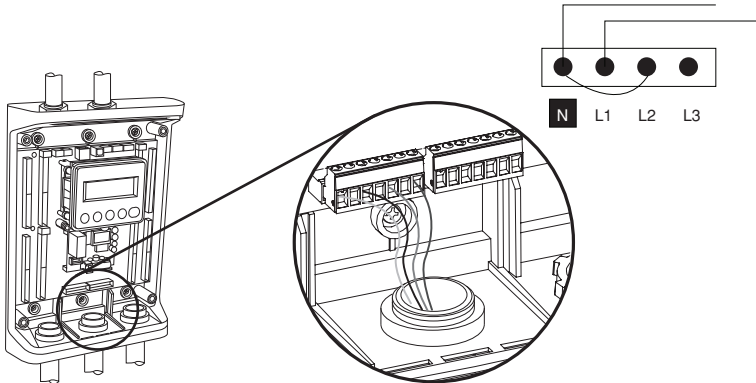
5. Attach high voltage cover.

   NOTE: IP30 TOUCH SAFE
        (with internal cover installed)
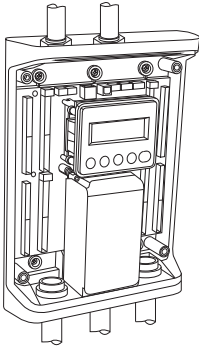
6. Connect CT and communications wiring.
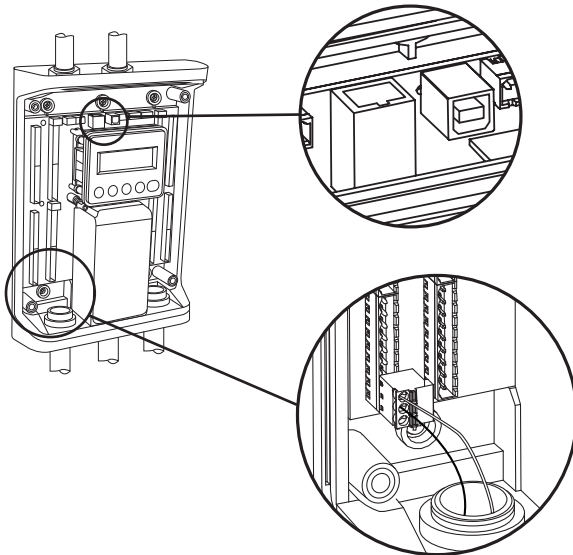
WEB VERSION

4.3   Wiring in a 3-wire, Split Phase Service Panel

WARNING: TO AVOID FIRE, SHOCK, OR DEATH, TURN OFF POWER at
circuit breaker or fuse and test that power is off before wiring!

WARNING: HIGH VOLTAGE MAY BE PRESENT. To be installed by qualified
personnel only.

Configurations shown are for service types available in the
METER SETUP drop down menu.

3-wire, 1 phase used
on MAINS L1-N, L2-N
(Rogowski coils shown)

Connect the Neutral
wire to V INPUT 1 (N)
on the meter

Meter is powered
from L1 to L2 on
the V input 1
terminal **(label as
disconnect)**

Single phase
220 VAC Plug Load
L1-L2

3-wire, 1 phase
split load
L1-N, L2-N

Single phase
110VAC plug loads
L1-N or L2-N
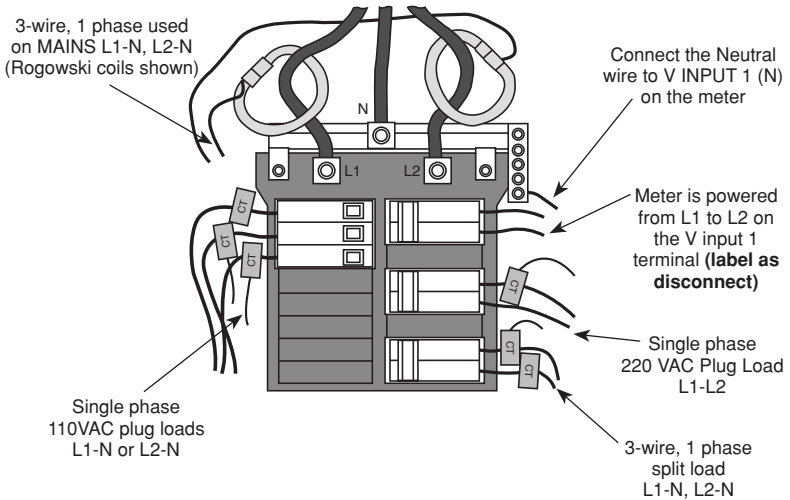
EXAMPLE LOADS:

Single phase L1-N or L2-N 110 VAC: lighting, appliance, living zone

Single phase L1-L2 220 VAC: water heater, clothes dryer,
equipment with no neutral wire

Split phase L1-L2 220 VAC: service entrance, equipment with neutral wire

4.4   Wiring in a 3 Phase, 4 Wire Service Panel

WARNING: TO AVOID FIRE, SHOCK, OR DEATH, TURN OFF POWER at circuit breaker or fuse and test that power is off before wiring!

WARNING: HIGH VOLTAGE MAY BE PRESENT. To be installed by qualified personnel only.

Configurations shown are for service types available in the **METER SETUP** drop down menu.

3-wire, 3 phase used on MAINS L1-N, L2-N, L3-N (Rogowski Coils shown)

Connect the Neutral wire or Ground wire to V INPUT 1(N) on the meter

Single phase branch loads L1-N

Meter power connect all phases to V INPUT 1 terminal **(Label as disconnect)**

4-wire, 3 phase WYE load (Neutral current) L1-N, L2-N, L3-N

3-wire, 3 phase delta load (no possibility of neutral current) L1-N, L2-N(est), L3-N

NOTE: The VerifEye meter series of products uses the NEUTRAL terminal as a voltage reference. For systems without a neutral conductor, Leviton suggests connecting a ground wire to this terminal. If the neutral terminal is left open, L-L measurements will be accurate, but L-N measurements may not be symmetric. If a ground wire is connected to the NEUTRAL terminal, <2mA will flow into the ground wire.

4.5   Current Transformers Basics

Ensure CTs meet the following criteria by referring to label on CT:

- 600 VAC UL Rated
- UL2808 Listed
- 1/3 (333 mV) output voltage
- Appropriate range for the circuits (5-120%) of CT Rating Recommended

Ensure CT orientation & placement:

- Arrow points toward load (or as instructed by CT label)
- Arrow points away from panel (or as instructed by CT label)
- Placed on first conductor of voltage reference (L1-L2) circuits are placed on L1
- Observe wiring color and polarity
- Use the Shield wire if provided (connect to PCB terminal marked S)

Current Transformers Basics

White: Positive

Black: Negative

(no shield)

Rogowski Coil CTs

White: Positive

Brown: Negative

Bare Wire: Shield

4.6   Wiring the CTs to the VerifEye Meter

The image below shows how to connect CTs to the input terminals on the S7200/7300 for each service type. For service types that are not specifically listed, choose SINGLE PHASE service from the drop down menu and configure each channel individually. The three phase loads that are illustrated on the left and split phase loads on the right are shown as *examples only*. Elements are fully interchangeable on the meter.

NOTE: Current and voltage inputs must be installed 'in phase' for accurate readings (e.g. CT1 on Line 1, CT2 on Line 2) **Orientation is critical.** Ensure that all CTs are properly oriented with the line and load, as marked.

CAUTION: Failure to install CTs in the correct orientation and on the correct phase will lead to inaccurate meter readings.
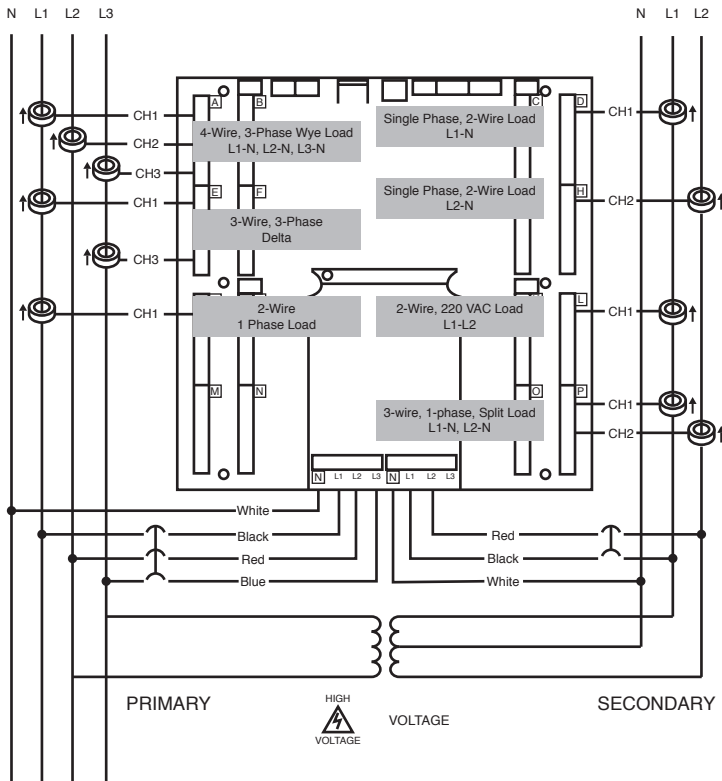
5 COMMUNICATION & VERIFICATION

This section is intended to support the commissioning of the meter by an instrumentation technician. In many cases, the electrical installation is conducted ahead of the availability of the RTU or was performed by a different installer. Often the technician is working in concert with a remote programmer who is confirming the connectivity with a remote host system. A Digital Multimeter (DMM) can be used to confirm measurements at the board terminals, if necessary.

WARNING: It is assumed that the meter is now powered up from the line voltage. **ONLY IF THE INTERNAL HIGH VOLTAGE COVER IS INSTALLED** is it safe to touch the meter (including the user buttons) with the top cover removed.

NOTE: 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.

5.1 Physical Connections on an RS-485 Multidrop Network

The VerifEye meter uses a 2-Wire Half Duplex RS-485 Implementation.
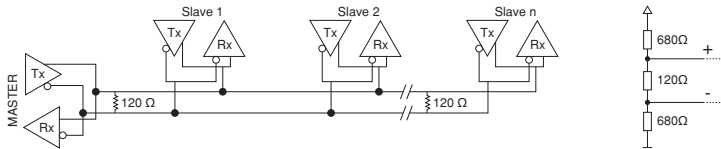
- **Termination Resistors** — These are NOT included on the VerifEye meter. If the VerfiEye meter is at the end of a daisy-chain, then connect a 120-ohm leaded resistor between the + and – terminal at the connector.

- **Bias Resistors** — These are NOT included on the VerifEye meter. Bias resistors are needed if the idle conditions of the bus are in an indeterminant logic voltage. Bias resistors are usually located at the master node and are usually 680 ohms for a 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 VerifEye meter is a 1/8th unit load allowing up to 256 like devices in parallel.

5.2 Communication Verification

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

The LCD User interface can be used to quickly confirm the settings required for each combination of interface and protocol. The interface is intuitive and groups together commonly associated registers. Arrows indicate how to move from one menu display to the next. The active menu item is indicated by a blinking character on the LCD. The ENTER button is used to select a property and up / down buttons are used to select among the values supported by the meter.

NOTE: Changes to the meter configuration are limited to the communication interface using the LCD. If additional changes (such as CT type) are required they must be made using a software interface.

Main Menu

View Communications

| View Communications |
| Real Time Values |
| View Meter Setup |
| Verify Installation |
| Log In/Out |
| About Meter |

| Protocol: BACnet |
| Baud Rate: 9600 |
| Bits: 8N1 |

| View Communications |
| Real Time Values |
| View Meter Setup |
| Verify Installation |
| Log In/Out |
| About Meter |

Real Time Values

Element A Channels		
V	100	101	99.9
A	23.2	22.9	22.0
kW	2.0	2.0	2.0

Element A Channels		
kVA	100	110	111
kVAR	100	-110	123
kWH	1234	***	100

NOTE: A full navigational map is available in Appendix A of this user guide.

Virtual Element Viewer Utilities

If your VerifEye model does not include the LCD User Interface, or if you prefer to verify the installation using software, then verification is facilitated through the Virtual Element Viewer Utilities PC application. Refer to the section on Configuration Details for an overview and list of instructional videos for Virtual Element Viewer Utilities.

WEB VERSION

5.3   Physical Interface Verification

Serial Setup Verification

In a multidrop serial network, the host data format settings are typically known or specified and the slave is adjusted to match. In some cases (long wiring runs, etc.), it may be necessary to experiment in determining the fastest allowable baud rate for a given wiring configuration by changing BOTH the host and slave devices. Configurations other than 8N1 are rare and it is advised to use this configuration for Data Bits, Parity, and Number of Stop bits, if possible.

LAN Ethernet Network Verification

The VerifEye meter communicates using IEEE 802.3 Ethernet connectivity running at a 10/100 Mbps. Verification of the meter settings over Ethernet includes ensuring that the IP address of the meter is within a range that allows communication with a host (if static) or is set for DHCP, allowing the meter to be assigned an address by a DHCP server as described below.

DHCP

If the VerifEye 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 LCD or can be found through connection with Virtual Element Viewer Utilities. The IP address assigned to the meter should be regarded as a temporary address as the address may change between power cycles making it difficult for the host system to know how to find the meter on the network. One common approach is to set the VerifEye for DHCP so that the address can be assigned by a DHCP server and then change that IP address to static once the connection is made. VerifEye meters are set to use DHCP as a default setting to facilitate
this approach.

Static IP

If the VerifEye meter is set to a static IP then its address should be assigned by an IT department to avoid multiple devices on the same network. This scheme is usually used when an RTU is expecting to find the meter at a specific
IP address.

5.4   Protocol Verification

The network protocol is typically specified as part of the installation. 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 the protocols over Ethernet. Each combination of interface and protocol require specific registers settings described below. The scope of this section is to use either the LCD interface or software tools to quickly confirm or change settings to match an existing specification. Further information and optimization tips are covered in the section on RTU programming.

5.5   Modbus Settings

Modbus RTU Settings

Device Address: In a Modbus network each device must be assigned a unique slave address. Valid Modbus addresses are 1-240 (the VerifEye 48 channel meter requires 15 addresses beyond Element A). The slave address of the power meter sets the register address for Element A. Adjacent elements B, C, D, etc. are accessed by incrementing the slave address by 1. The slave address of the VerifEye meter needs to be set to match the address expected by the RTU and is normally part of the network specification. The default address for element A is 1.

Modbus TCP Settings

Modbus Port: The VerifEye meter uses the industry standard Port 502 for Modbus. This port number can be changed, although this is considered an advanced setting and should be left at 502 unless this generates a conflict on the host system. The port number can only be changed through the Virtual Element Viewer Utilities software interface.

5.6   BACnet Settings

BACnet Device ID: In a BACnet network, each device must be assigned a <u>unique Device ID</u> and is common to **BACnet MS/TP and BACnet IP protocols**. Besides the standard ability to change this from a BACnet explorer tool it may be changed via Virtual Element Viewer Utilities or LCD.

BACnet MSTP

Device Address: VerifEye 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.

BACnet IP

BACnet Port: The BACnet default port is 47808 and does not usually need to be changed.

BBMD: The BACnet/IP Broadcast Management Device is set to 0.0.0.0 at default and can be changed through a software tool to allow discovery across networks.

WEB VERSION

5.7   Pulse Inputs

Series 7200/7300 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 pulse inputs are compatible with "low speed" meters. The pulse duration must exceed 50mS in both the logic low and high state allowing for a maximum input frequency of 10 Hz.

C(+) E(-)   C(+) E(-)

1 PULSE INPUT 2

>50 mec

>50 mec
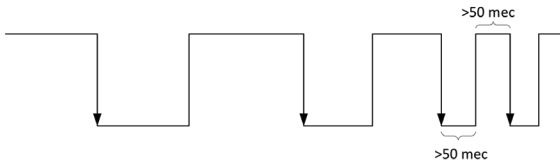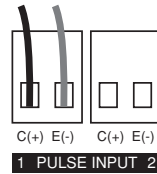
Pulse scaling, resetting and accumulated values are accessed through registers and are "system" in scope.

Refer to the register list or Virtual Element Viewer Utilities for more information.

5.8   Alarms (SPDT)

The VerifEye meter supports user-configurable alarms for under-voltage. Virtual Element Viewer Utilities helps users set these values by allowing for values to be entered using direct entry mode or specifying the limits as a percentage of nominal.

Alarm persistence settings are used to allow for temporary conditions, such as a motor starting, that are beyond trigger limits.

EXAMPLE: In the case of meter upset from ESD events, short persistence settings may lead to false alarm triggers. When any alarm condition has been satisfied throughout the persistence interval, the VerifEye trips the Master Alarm relay, which is an electromechanical relay on the PCB.

Once tripped, the relay can only be reset by clearing the alarm through Modbus register/ BACnet object 2451.

The Master Alarm relay can be hard wired to an interrupt or polling circuit in a host system allowing for a more rapid response than the data polling frequency, if desired. The status of each alarm is determined by reading status registers.

Refer to the register list or Virtual Element Viewer Utilities for more information.

NOTE: The Master Alarm relay is intended for low voltage DC connections. The user must protect the switch from over-current conditions when closed.

5.9   12 Volt Auxillary Power

The VerifEye meter provides an auxiliary 12 volt output that is derived from an auxiliary winding on the VerifEye meter's line-connected power supply. The 12 volt supply voltage is unregulated but protected by a self-resetting fuse. The purpose of the supply is to power external radio equipment or provide supply voltage for analog sensors, such as 4-20 mA current loop devices. If full-rated current is drawn from this terminal, the minimum operating voltage of the L1-L2 power supply is 100 VAC.

5.10   Access Restriction Limitations

If security levels have been set up in the meter, no data is accessible through the LCD user interface, without entering the PIN credentials.

NOTE: 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.

5.11   Security PIN Protection

VerifEye 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.
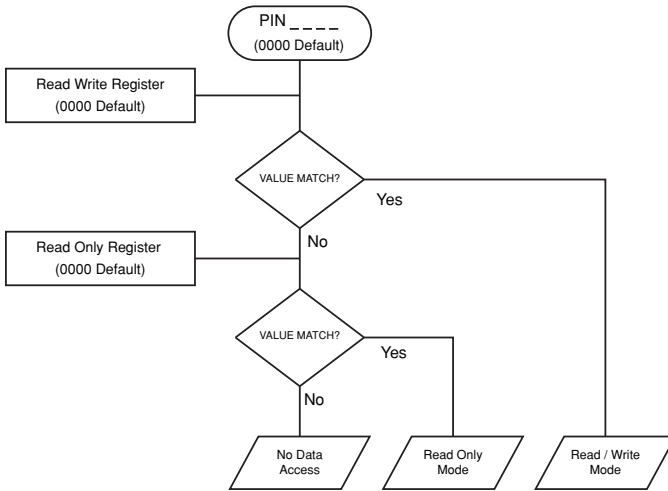
Using the Permission Registers

The VerifEye meter uses both a **Read Only** register and a **Read/Write** register to compare against user entries from the LCD keypad. 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 the 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 accidentaly promote the user. Virtual Element Viewer Utilities disallows 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. It is recommended to use Virtual Element Viewer Utilities to configure permissions.

Read/Write Permission Register

Read/Write permissions allow users to read and write configuration items and to reset the PINs. This level of authorization will be required by any technician or user who needs the ability to correct setup errors in the meter. The default PINs (0000) allow new users to reset the Read/Write PIN from the Virtual Element Viewer Utilities. Permissions cannot be set through the LCD interface.

Reading PINs Over Modus or BACnet

Virtual Element Viewer Utilities can be used to directly report the **Read Only** and **Read/Write** PINS under the Advanced Tab (passwords). The value reported by Virtual Element Viewer Utilities is the value as entered in the web page or LCD interface.

PINs are also accessible as 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 Leviton Manufacturing to support looking up forgotten PINs, if network access is available.

Virtual Element Viewer Utilities - Unrestricted Access

The Virtual Element Viewer Utilities software tool can be used to read & write configuration information to the meter without entering credentials.

NOTE: Virtual Element Viewer Utilities is the recommended tool for setting up access restrictions. It allows users to test the function of the PINs without locking themselves out from the ability to change the PIN.

5.12   Verification of Installation

Once the VerifEye meter is configured and communicating with the RTU, it is a good idea to perform some simple checks to ensure that all the CTs are on the correct voltage phases and that the CTs are facing the correct direction. The following are recommendations that work for typical installations. Special circuit conditions, like unloaded motors, may indicate an installation error when none exists. A Digital Multimeter (DMM) can be used to confirm these cases.

5.12.1 Installation Phase Verification

The VerifEye meter includes a PhaseChek™ algorithm that identifies any element that the meter suspects may be incorrectly phased (i.e., the CT is associated with the wrong voltage source or is physically on the wrong wire) based on power factors below 0.55. This feature is accessed using the LCD interface by navigating to **[VERIFY INSTALLATION]** and pressing **[ENTER]**. The LCD display will list the elements having at least one channel with a low power factor.

<div align="center">

CHECK ELEMENTS

A   EF

</div>

Use the navigation buttons to highlight a specific element and hit enter or just hit enter and move from element to element using the <- / -> keys. Within each element (identified on the top line of the display) the status of each channel is identified as good (PF > 0.55) or bad (PF < 0.55).

<div align="center">

ELEMENT F

CH1 Good

CH2 Bad

CH3 Bad

</div>

Two "Bad" channels are often an indication that two CTs are inadvertently swapped. When the power factor for all enabled channels is greater than 0.55, the meter reports:

<div align="center">

CHECK ELEMENTS

ALL CHANNELS GOOD

</div>

NOTE: PhaseChek is only applied for elements that are enabled. **[VIEW METER SETUP]** on the LCD screen can be used to ensure that all intended elements are active. PhaseChek is advisory only. It is possible that the power factor for a particular load is truly less than 0.55, as may be observed in a free running motor.

The Virtual Element Viewer Utilities run PhaseChek continuously on all enabled elements and report low power factor in the real time values table by turning the text RED or by a using a red indicator.

WEB VERSION

5.12.2 Phase Checking by Phasor Plot

When a CT is installed on the incorrect phase, the indicated current vector is pointing either 180 degrees away (a split phase system) or 120 degrees away (a three-phase system) from the true displacement angle. In the latter case, this usually causes a significant decrease in the reported power factor, even if the CT is also on backwards. When the absolute displacement power factor of a load is below 0.55 (an angle greater than 57 degrees between voltage and current), the VerifEye meter will flag it as a phasing error. Virtual Element Viewer Utilities has a Phasor Plot feature that can be used to study the voltage and current vectors of a given meter element.

Check for Low Power Factor

- **Virtual Element Viewer Utilities:** Real Time Values > (All power factors < 0.55 are shown in RED)

- **LCD:** Verify Installation > (LCD will list all elements having a PF < 0.55)

Electrical Power Quadrants with Incorrect CT Phase
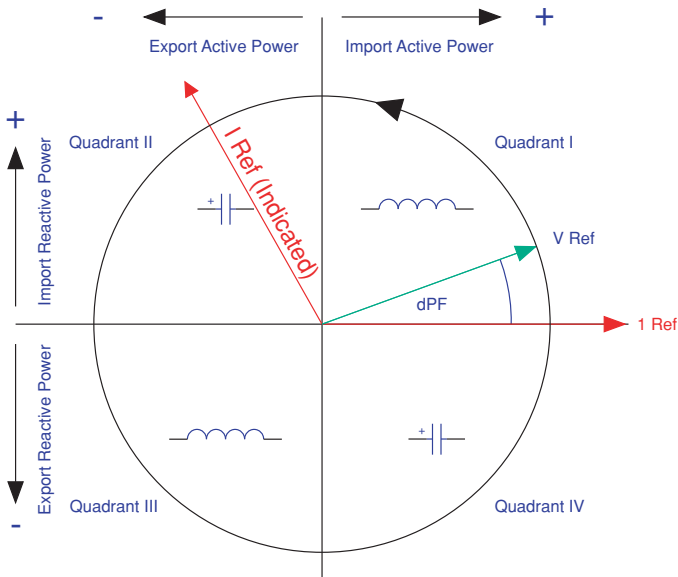
WEB VERSION

5.12.3 CT Orientation Check

The VerifEye meter reports power and energy in each electrical quadrant under a different register. When CTs are installed backwards, the indicated current vector is oriented 180 degrees away from the true displacement angle. In accordance with standard definitions, the Wattage and VARs of the effected channel report with a sign opposite from what is expected. Often this means that the import registers will be reading zero while the export registers are showing a value.

NOTE: Backward CTs have no impact on the amplitude of the power factor. A moderate power factor (>0.7) in concert with a negative power is a clue that the CT is on backwards, but is on the correct phase. If a CT is discovered to be on backwards after the installation is complete, the direction of the CT can be reversed through a user configuration register designed for this purpose, called the **Flipper**, located at 2226, 2234, and 2235 or use the meter setup within Virtual Element Viewer Utilities' meter setup.

Check that the wattage has the correct sign (Designated + for loads)

- **Virtual Element Viewer Utilities:** Real Time Values > (Confirm Sign of Power For All Elements)

- **LCD:** Real Time Values > (Confirm Sign of Power For All Elements)

Electrical Power Quadrants with Reversed CT Phase
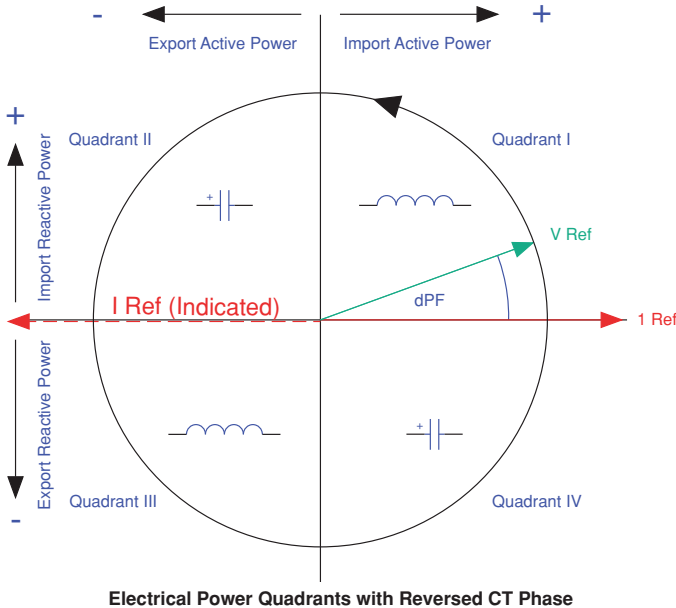
WEB VERSION

5.13 Power Factor Convention

Power Factor is the ratio of a signed number (true power) and an unsigned number (apparent power). This discrepancy has led to some customer confusion. The VerifEye 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). The sign relationships are shown below for these conventions in each electrical quadrant.

P.F.	Q1	Q2	Q3	Q4
ANSI	+	−.	+	−
IEEE	+	−	−	+

5.14 Total Harmonic Distortion

The Verifeye meter reports overall harmonic content in power (% T) 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.

Power Triangle
(for active loads)
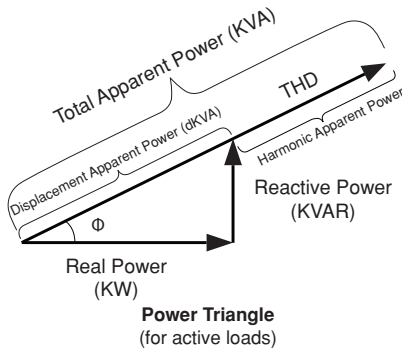
In many circumstances users are interested in the harmonic content of current. In cases where the voltage is very sinusoidial, the T measurement is a good estimate of both power and current. However, if the voltage waveform is distorted, the reported T in power can be misleading. Virtual Element Viewer Utilities can provide additional analysis of harmonic content in voltage and current by sampling the raw data from the VerifEye meter and performing digital signal processing on the signal. Using this method, the individual harmonics levels can be observed. The results are presented in a bar graph.
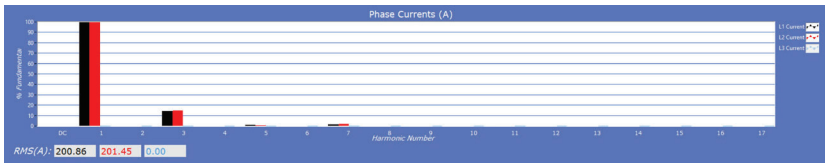
5.15 Pre-Processing Aids

The meter has several registers that can aid in pre-processing or post-processing data that otherwise may need seconday operations.

Snap Thresholds

The signal to noise ratio of the meter 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 tab in Virtual Element Viewer Utilities) tell the meter when to record 0 instead of the measurement result. The factory defaults for CT's 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.
Note: Changing the snap thresholds may affect compliance to accuracy standards, such as ANSI C12.1 or ANSI/NEMA SM3100-1.

Multipliers

The meter has registers that allow potential transformers and series current transformers to be used with the VerifEye 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. Default values are 1.0

CT Phase Shifts

Current transformers like all other transformers experience a small magnetizing current that is out of phase with the measurement current. Phase shift registers are available on a per channel basis and allow corrections of +/- 3 degrees. Virtual Element Viewer Utilities loads the default phase shift for the CT types available in the picker list. If no phase shift information is available then enter the accuracy class in degrees (i.e. 1% = 1.0 degree).

Demand

VerifEye meters keep track of electrical demand using a 15 minute sliding window. The Peak Demand and Present Demand registers contain the highest average power consumption in any 15 minute interval and the average power consumption in the last 15 minute interval respectively. The Clear Peak Demand register is used to reset the peak demand detector.

This section is intended for the programmer of the RTU or host system and includes details about meter and element addressing, register locations, data formats and protocol examples.

6.1 Register Organization

The VerifEye meter communicates through the reading and writing of registers. Registers are organized into functional groups and are compliant with the SunSpec Modbus interface model.

- SunSpec Common Registers
- SunSpec TCP Network Stack Registers
- SunSpec Serial Interface Registers
- SunSpec Energy Meter

The complete register set is included as an Excel file on the supplied thumb drive or at:

https://www.leviton.com and go to the S7200/7300 product page's Support/Downloads section.

6.2 Virtual Element vs. System Scope Virtual Elements

Element

The term "element" is used in two contexts. Physically the term Element is used to describe groups of channel sections identified by CT numbers on the circuit board. Logically the term Element describes the scope of a data item, register or point (Modbus register or BACnet object). Each Virtual Element based point is accessed by choosing the appropriate Modbus address, BACnet object range, or BACnet structured view. Virtual Elements in turn have points that refer to individual channels or to SUMS or AVERAGES of those channels. Registers that contain data inclusive of more than one channel are identified as being either SUMS or AVERAGES of the enabled channels within an element. In a BACnet structured view an Element represents a level of organization for related points.

Channel

CT Input Channels are identified on the circuit board as CT1, CT2, CT3... CT48, and represent physical CT inputs. These CT Input Channels are grouped together into Virtual Elements using the Configuration software. These virtual elements may be include 1, 2, or 3 CT inputs, as assigned in the configuration. Virtual Element Registers providing data for an individual channel are also described as elements in their scope as a unique value exists for each Slave Address or BACnet object instance.

System

The term "System" refers to registers defining the characteristics of the entire circuit board. System registers report the same value independent of the slave address. Under BACnet structured view the system points are grouped together.

6.3   Configuring Element and Channel Register for Service Types

The Virtual Element Viewer Utilities software enforces all element configurations to form a valid electrical system. Configurations performed by remote systems may produce unexpected results if configurations are internally inconsistent. If a configuration is required to be performed remotely, please contact Leviton for assistance.

6.4   Configuring System Registers

**Modbus Absolute Address/
BACnet Object Assignment**   **Configurations**

Register Template		System	
Description	2601	Description	31 Char
PF Sign Convention	2248	PF Sign Convention	ANSI [1] or IEEE[2]
V1 Multiplier	2203,2204	V1 Multiplier	Any > 0 [1]
V2 Multiplier	2205,2206	V2 Multiplier	Any > 0 [1]

6.5   Modbus Protocol Commands

If configured for Modbus, the Verifeye networked power meter family follows the Modbus RTU protocol and supports the following command set.

Supported Modbus Commands		
Command Name	**Command Number (Hex)**	**Description**
Read Holding Registers	03	Used to read the data values from the VerifEye meter
Write Single Register	06	Used to write a single holding register to a VerifEye meter
Report Slave ID	11	Used to read information from the identified VerifEye meter

Slave Address

For Modbus/TCP the base slave address (or unit address as the Modbus TCP spec. calls it) is fixed at 1.

Refer to the section **Serial Protocols** for additional information on setting the Slave Address and finding the address of a specific meter element.

Modbus String Entry

Registers that are identified as **strings** are handled uniquely by the VerifEye 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 NUL 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.

WEB VERSION

String example 1: Change a Static IP Address

Change the IP address of a meter from 192.168.2.8 to 192.168.2.9

Note: Update the entire IP Address, not just the "8" to "9". If you update only the "8" to "9" this will NOT perform as expected.

Internally, the meter uses a single string buffer for all string register operations and unspecified entrees will continue to contain the previous buffer contents unless specifically written to. Write every register from the beginning of the block to the end.

Reg (dec)	1079	1080	1081	1082	1083	1084	1085	1086
Reg (hex)	04 37	04 38	04 39	04 3A	04 3B	04 3C	04 3D	04 3E
Value (Chr)	'1' '9'	'2' '_'	'1' '6'	'8' '_'	'9' NUL	NUL NUL	NUL NUL	NUL NUL
Value (hex)	**31 39**	**32 28**	**31 36**	**38 2E**	**32 2E**	**39 00**	**00 00**	**00 00**
	START							STOP

Specific Implementation Examples – Element A set to ID 1

Note that in Modbus the CRC communicated is LSB then MSB.

VIA MODBUS RTU (SERIAL) USING FUNCTION
CODE 6 / WRITE SINGLE REGISTER

ID	FC	ADDR		DATA		CRC	
01	06	04	37	**31**	**39**	EC	B6
01	06	04	38	**32**	**2E**	9C	4B
01	06	04	39	**31**	**36**	CD	71
01	06	04	3A	**38**	**2E**	3B	2B
01	06	04	3B	**32**	**2E**	6C	4B
01	06	04	3C	**39**	**00**	5A	A6
01	06	04	3D	**00**	**00**	19	36
01	06	04	3E	**00**	**00**	E9	36

VIA MODBUS RTU (SERIAL) USING FUNCTION
CODE 16 / WRITE MULTIPLE REGISTER

ID	FC	ADDR		#REGS		LN	DATA0		DATA1		DATA2		DATA3		DATA4	
01	10	04	37	00	08	10	31	39	32	2E	31	36	38	2E	32	2E

DATA5		DATA6		DATA7		CRC	
39	**00**	**00**	**00**	**00**	**00**	9B	99

VIA MODBUS TCP (ETHERNET) USING FUNCTION
CODE 6 / WRITE SINGLE REGISTER

TXNID		PROID		LENGT		ID	FC	ADDR		DATA (TXNID will be arbitrary)	
01	87	00	00	00	06	01	06	04	37	**31**	**39**
01	88	00	00	00	06	01	06	04	38	**32**	**2E**
01	89	00	00	00	06	01	06	04	39	**31**	**36**
01	8A	00	00	00	06	01	06	04	3A	**38**	**2E**
01	8B	00	00	00	06	01	06	04	3B	**32**	**2E**
01	8C	00	00	00	06	01	06	04	3C	**39**	**00**
01	8D	00	00	00	06	01	06	04	3D	**00**	**00**
01	8E	00	00	00	06	01	06	04	3E	**00**	**00**

VIA MODBUS TCP (ETHERNET) USING FUNCTION
CODE 16 / WRITE MULTIPLE REGISTER

TXNID		PROID		LENGT		ID	FC	ADDR		#REGS		LN	DATA0		DATA1	
01	87	00	00	00	17	01	10	04	37	00	08	10	**31**	**39**	**32**	**2E**

DATA2		DATA3		DATA4		DATA5		DATA6		DATA7	
31	**36**	**38**	**2E**	**32**	**2E**	**39**	**00**	**00**	**00**	**00**	**00**

String example 2: Element Description

Change the Element Description from "Mains Bld 100" to "Mains Bld 101"

Note: Update the entire IP Address, not just the "0" to "1". If you update only the "0" to "1" this will NOT perform as expected.

Internally, the meter uses a single string buffer for all string register blocks and unspecified entrees will continue to contain the previous buffer contents unless specifically written to.

Reg (dec)	2617	2618	2619	2620	2621	2622	2623	2624
Reg (hex)	0A 39	0A 3A	0A 3B	0A 3C	0A 3D	0A 3E	0A 3F	0A 40
Value (Chr)	'M' 'a'	'i' 'n'	's' ' '	'B' 'l'	'd' ' '	'1' '0'	'1' Nul	NulNul
Value (hex)	**4D 61**	**69 6E**	**73 20**	**62 6C**	**64 20**	**31 30**	**31 20**	**00 00**
	START							STOP

Reg (dec)	2625	2626	2627	2628	2629	2630	2631	2632
Reg (hex)	0A 41	0A 42	0A 43	0A 44	0A 45	0A 46	0A 47	0A 48
Value (Chr)	NulNul	NulNul	NulNul	NulNul	NulNul	NulNul	NulNul	NulNul
Value (hex)	**00 00**	**00 00**	**00 00**	**00 00**	**00 00**	**00 00**	**00 00**	**00 00**
	START							STOP

6 RTU PROGRAMMING & SCRIPTING

Specific Implementation Examples – Element A set to ID 1

VIA MODBUS RTU (SERIAL) USING FUNCTION
CODE 6 / WRITE SINGLE REGISTER

ID	FC	ADDR		DATA		CRC	
01	06	0A	39	**4D**	**61**	AE	A7
01	06	0A	3A	**69**	**6E**	05	A3
01	06	0A	3B	**73**	**20**	DF	37
01	06	0A	3C	**62**	**6C**	63	53
01	06	0A	3D	**64**	**20**	30	C6
01	06	0A	3E	**31**	**30**	FE	5A
01	06	0A	3F	**31**	**20**	AE	56
01	06	0A	40	**00**	**00**	8B	C6
01	06	0A	41	**00**	**00**	DA	06
01	06	0A	42	**00**	**00**	2A	06
01	06	0A	43	**00**	**00**	7B	06
01	06	0A	44	**00**	**00**	CA	07
01	06	0A	45	**00**	**00**	9B	C7
01	06	0A	46	**00**	**00**	6B	C7
01	06	0A	47	**00**	**00**	3A	07
01	06	0A	48	**00**	**00**	0A	04

VIA MODBUS RTU (SERIAL) USING FUNCTION
CODE 16 / WRITE MULTIPLE REGISTER

ID	FC	ADDR		#REGS		LN	DAT00		DAT01		DATA02		DAT03		DATA04	
01	10	0A	39	00	10	20	**4D**	**61**	**69**	**6E**	**73**	**20**	**62**	**6C**	**64**	**20**

DAT05		DAT06		DAT07		DAT08		DAT09		DAT10		DAT11		DAT12		DAT13	
31	**30**	**31**	**20**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**

DAT14		DAT15		CRC	
00	**00**	**00**	**00**	3A	18

VVIA MODBUS TCP (ETHERNET) USING FUNCTION
CODE 6 / WRITE SINGLE REGISTER

TXNID		PROID		LENGT		ID	FC	ADDR		DATA (TXNID will be arbitrary	
01	87	00	00	00	06	01	06	0A	39	**4D**	**61**
01	88	00	00	00	06	01	06	0A	3A	**69**	**6E**
01	89	00	00	00	06	01	06	0A	3B	**73**	**20**
01	8A	00	00	00	06	01	06	0A	3C	**62**	**6C**
01	8B	00	00	00	06	01	06	0A	3D	**64**	**20**
01	8C	00	00	00	06	01	06	0A	3E	**31**	**30**
01	8D	00	00	00	06	01	06	0A	3F	**31**	**20**
01	8E	00	00	00	06	01	06	0A	40	**00**	**00**
01	8F	00	00	00	06	01	06	0A	41	**00**	**00**
01	90	00	00	00	06	01	06	0A	42	**00**	**00**
01	91	00	00	00	06	01	06	0A	43	**00**	**00**
01	92	00	00	00	06	01	06	0A	44	**00**	**00**
01	93	00	00	00	06	01	06	0A	45	**00**	**00**
01	94	00	00	00	06	01	06	0A	46	**00**	**00**
01	95	00	00	00	06	01	06	0A	47	**00**	**00**
01	96	00	00	00	06	01	06	0A	48	**00**	**00**

VIA MODBUS TCP (ETHERNET) USING FUNCTION
CODE 16 / WRITE MULTIPLE REGISTER

TXNID		PROID		LENGT		ID	FC	ADDR		#REGS		LN	DAT00		DAT01	
01	87	00	00	00	27	01	10	04	37	00	10	20	**4D**	**61**	**69**	**6E**

DAT02		DAT03		DAT04		DAT05		DAT06		DAT07		DAT08		DAT09	
73	**20**	**62**	**6C**	**64**	**20**	**31**	**30**	**31**	**20**	**00**	**00**	**00**	**00**	**00**	**00**

DAT10		DAT11		DAT12		DAT13		DAT14		DAT15	
00	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**	**00**

WEB VERSION

6   RTU PROGRAMMING & SCRIPTING

6.6   Floating Point Registry Entry

The VerifEye 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 <u>sequentially without interruption</u>.

Note: 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

Note: It is likely that the RTU program has built-in support for multiple data types including floating point. The VerifEye 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 the 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 Virtual Element Viewer) 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.

Entering Floating Point Data Using a Script

Consider the process of setting the CH1 CT Full Scale Rating to a value of 100.00 amps for a meter having an element at slave address #1.

1. Convert 100.00 into an IEEE 754 floating point format by entering the number in a conversion utility.

   a. Internet Utility.

   b. Virtual Element Viewer

a) Internet Utility
   The 16-bit floating point representation of 100.00 is shown below as 0x42C8 0x0000. These are the required MSW and LSW register contents respectively.

b) Leviton Virtual Element Viewer

c) If an internet utility is not available, Leviton Virtual Element Viewer has a built-in conversion utility under the Advanced Tab. Enter 100.00 and press the "Convert to Modbus Integers" button.

This utility identifies that the MSW and LSW registers need to be set to 17096 & 0 (decimal) respectively. If hexadecimal notation is required these decimal values can be converted using a utility such as the MS Windows Calculator (under Programmer mode) as shown below.
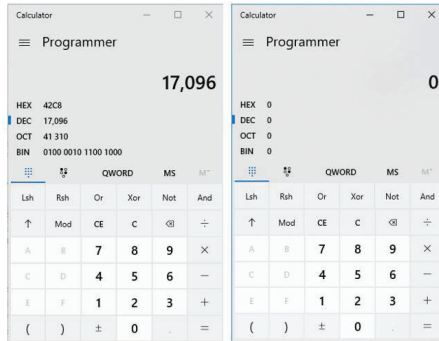
After padding, we also arrive at 0x42C8 0x0000 as the MSW and LSW register values respectively.

2. Identify which configuration registers control the CH1 CT Full Scale Rating

a. Refer to the MS Excel Register List (USB drive)

b. Use Virtual Element Viewer to discover the address of displayed data.

a) Open the MS Excel Register List and locate the CH1 CT Full Scale Rating Registers under USER CONFIG POINTS group.

Modbus Register Name	Modbus Register	Absolute Address
CH1 CT Full Scale Rating (MSW)	2213	42219
CH1 CT Full Scale Rating (LSW)	2219	42220

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3. Calculate the CRC-16 (Modbus RTU) for the expression. There are several variations of the CRC-16; ensure the one you are using is for Modbus. The CRC is entered LSB first.

Enter the Entire Expression into a CRC Calculator (a web utility can be helpful)

Input Data	CRC-16 (Modbus)
01 06 08 AA 42C8	**0xBC9A**

4. Putting it all together

VIA MODBUS RTU (SERIAL) USING FUNCTION
CODE 6 / WRITE SINGLE REGISTER

ID	FC	ADDR		DATA		CRC (note to CRC order is swapped)	
01	06	08	AA	**42**	**C8**	98	BC
01	06	08	AB	**00**	**00**	FA	4A

VIA MODBUS RTU (SERIAL) USING FUNCTION
CODE 16 / WRITE MULTIPLE REGISTER

ID	FC	ADDR		REGS		LN	DATA0		DATA		CRC	
01	06	08	AA	00	02	04	**42**	**C8**	**00**	**00**	8B	EE

VIA MODBUS TCP (ETHERNET) USING FUNCTION
CODE 6 / WRITE SINGLE REGISTER

TXNID		PROID		LENGT		ID	FC	ADDR		DATA (TXNID will be arbitrary)	
01	87	00	00	00	06	01	06	08	AA	**42**	**C8**
01	88	00	00	00	06	01	06	08	AB	**00**	**00**

VIA MODBUS TCP (ETHERNET) USING FUNCTION
CODE 16 / WRITE MULTIPLE REGISTER

TXNID		PROID		LENGT		ID	FC	ADDR		#REGS		LN	DATA0		DATA1	
01	87	00	00	00	0B	01	10	08	AA	00	02	04	**42**	**C8**	**00**	**00**

Commands Requiring a Processor Reset

Register manipulation of communication protocols or addressing require that the VerifEye meter performs a soft reset in order 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 effect a soft reset. The meter reboot time is approximately 10 seconds.

See the Modbus examples document on the Leviton Manufacturing web site or included with your electronic documentation for additional support on programming Modbus.

WEB VERSION

6.7   BACnet

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.

BACnet Device ID: 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.

Serial: The VerifEye Serial version supports writable max_master, MS/TP address, max_info_frames properties in the device object for MS/TP networks. For best network performance, the max_master should be set to the highest MS/TP MAC address on the network. The MS/TP address (object 1069) must be unique on the MS/TP network. The max_info_frames does not need to be changed in most installations.

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

BACnet Structured View

The VerifEye meter supports the Structured View (SV) object container. If this option is supported in the BACnet exploring tool, objects will be grouped logically into elements which can be named to reflect electrical or physical locations, followed by system objects, as shown below for a VerifEye 12 having elements A-D.
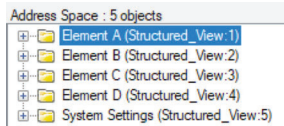
Within each element, Structured View lists the BACnet objects by Object Type and then by numeric number as shown below. In addition objects for elements are grouped in a "hotel room" scheme. That is Element A (and system objects) have a range from 0-9999, Element B 10000-19999, Element C 20000-29999, to Element P on the VerifEye 48 circuit meter 150000-15999. Some BACnet explorer tools have additional sorting capabilities.

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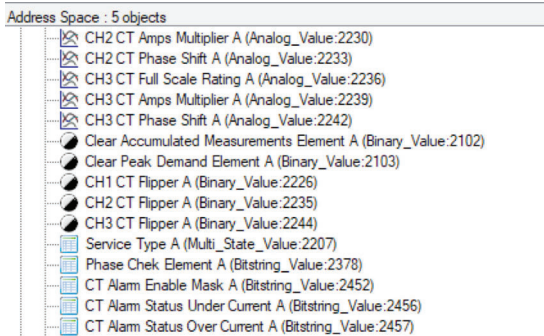
VerifEye Supported BACnet Object Types		
Object Type	Abbreviation	Typical Usage
Analog Input:	AI	Meter Readings (floating point numeric inputs)
Analog Value:	AV	Analog User Settings (floating point numeric outputs)
Binary Value:	BV	User Boolean Settings
Multi State Value:	MSV	Enumerated Settings
BitString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

WEB VERSION

About Meter

The complete LCD navigation map is shown in diagram form in the next few pages. The "About Meter" menu is the most commonly accessed item which requires 5 down presses or 1 up (rolling menu) to access.

Main Menu

View Communications
Real Time Values
View Meter Setup
Verify Installation
Log In/Out
About Meter

The **About Meter** menu contains the following items which are displayed 4 lines at a time and accessed by using the up and down keys on the front display.

S7000 v3.00	Model and version
Serial: P121501001	Serial number
LAN: Connected	State of LAN connection
IP: 10.1.1.1	Current IP address
MC 00:0D:63:00:00:00	MAC Address
Line Frequency: 60.0	Current line frequency
Obvius	Manufacturer name
Copyright (c) 2018	Copyright notice
Protocol: Modbus	Communication protocol
Modbus Address: 1	Modbus address
Modbus Port: 502	Modbus port
MSTP Address: 1	MSTP address
Baud Rate: 9600	RS485 baud rate
DHCP: ON	Current DHCP Setting
BACnet Port: 47808	BACnet Port
BACnet DevID: 527000	BACnet Device ID
Pulse In 1: 0.0	Channel 1 pulse accumulator
Pulse In 2: 0.0	Channel 2 pulse accumulator
System Descriptor:	System description
70x48	set by user
UTC Date / Time:	Current time in UTC (GMT)
2018-04-24 10:04:08	

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Menu Navigation

Leviton — Idle Screen

If **Enter** button

Enter PIN Code
0 0 0 0   OK — Login if enabled

Main Menu
View Communications
View Meter Setup
Verify Installation
Log In / Out
About Meter

Communication settings can only be changed if logged in.

Baud Rate: 9600
Data Bits: 8N1   or
MSTP Address: 1
Serial Settings

DHCP: ON
IP: 192.168.1.1
BACnet Port: 47808
Ethernet Settings

Protocol
√ Modbus
  BACnet

Baud Rate
√ 9600
  19200

Enter IP Address
192.168. 1. 1 OK

▲ and ▼ changes a digit.
► selects digit to change.
◄ returns to main menu.

View Communications
Real-Time Values
View Meter Setup
Verify Installation
Log In / Out
About Meter

Measurement Display

Element A Channels
V   100 101 99.9
A   23.2 22.9 22.0
KW   2.0 2.0 2.0

Element B Channels
V   100 110 99.9
A   23.2 22.9 22.0
KW   2.0 2.   2.0

Next Element

▲ and ▼ move between fields. ◄ and ► move between elements. Hold button to go faster. **Enter** returns to main menu.

Element A Channels
kVA 100 110 111
kVAR 100 -110 123
kWH 1234 *** 100

Element B Channels
kVA 100 110 111
kVAR 100 -110 123
kWH 1234 *** 100

Element A Channels
PF   1.0 2.0 1.1

Element B Channels
PF   1.0 2.0 1.1

Element A Sum
V   100
A   23.2
kW   2.0

Element B Sum
V   100
A   23.2
kW   2.0

View Communications
Real-Time Values
View Meter Setup
Verify Installation
Log In / Out
About Meter

Element A
Type: CT   CT   CT
Range: 10   10   10
Phase: 0.0 0.0 0.0
Mlplr: 1.0 1.0 1.0
V In: 1   1   1
Ref: L1   L2   L3

PIN Entry:
► To first Field
▲▼ To enter 1
► To next Field
▲▼ To enter 9
► To next Field. Enter 6 and 4 for 3rd and 4th fieldS
► To OK
► To Finish (or ENTER)

View Communications
Real-Time Values
View Meter Setup
Verify Installation
Log In / Out
About Meter

Element A
Ch1: Good
Ch2: Good
Ch3: Good
Sys: Good

Installation Check

Logged in?

No → Enter PIN Code
1 2 4 5   OK

View Communications
Real-Time Values
View Meter Setup
Verify Installation
Log In / Out
About Meter

S7000 v1.011b

IP: 192.168.1.141
MC:00:00:12:34:56:78
Network Connected
Line Frequency: 60.1
Copyright (c) 2017

About Box

Yes → Logged Out

Communication Navigation

Main Menu

```
Communications
Real-Time Values
View Meter Setup
Verify Installation
Log In / Out
About Meter
```

Modbus Settings

```
Protocol: Modbus
Serial Settings
Ethernet Settings
LAN Connected
```

```
      Protocol

√ Modbus
  BACnet
```

BACnet Settings

```
Protocol: BACnet
Serial Settings
Ethernet Settings
LAN Connected
BACnet Dev ID: 52700
```

```
      Protocol

  Modbus
√ BACnet
```

Modbus Ethernet Settings

```
DHCP: On
IP: 192.168.1.1
Modbus Port: 502
```

```
   Set DHCP:

√ On
  Off
```

BACnet Ethernet Settings

```
DHCP: On
IP: 192.168.1.1
BACnet Port: 47808
```

```
   Set DHCP:

√ On
  Off
```

```
  Enter IP Address

192.168. 1. 1  OK
```

```
  Enter IP Address

192.168. 1. 1  OK
```

```
 Enter Modbus Port:

   502  OK
```

```
 Enter BACnet Port:

   47808  OK
```

Modbus Serial Settings

```
Baud Rate: 9600
Bits: 8N1
Modbus Address: 1
```

```
Select a Baud Rate:

√ 0600
  19200
  38400
  57600
  76800
  115200
```

```
 Enter BACnet ID:

   47808  OK
```

BACnet Serial Settings

```
Baud Rate: 9600
Bits: 8N1
MSTP Address: 1
```

```
√ 8N1
  8N2
  8E1
  8E2
  8O1
  8O2
```

▲ and ▼ changes a digit.
► selects digit to change.
◄ returns to main menu.

```
  Enter Address:

   001  OK
```

APPENDIX B: TECHNICAL SPECIFICATIONS

Main Specifications

Specification	Description
Service Types	Single phase, split phase, three phase-four wire (WYE), three phase-three wire (Delta)
Voltage Input Channels	90-346 VAC line-to-neutral, 600V line-to-line, CAT III, two independent voltage reference inputs.
Current Channels	48 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 measureable 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	Unregulated 12VDC output, 200 mA, self-resetting fuse
Waveform Sampling	1.8 kHz
Parameter Update Rate	1 second
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 C12.20-2010 Class 0.2
Resolution	Values reported in IEEE-754 single precision floating point format (32 bit).
Indicators	4-line display, tri-color backlight (PhaseChek™)
Pulse Inputs	VerifEye 72D48, 72N48, 73D48 - 2 inputs 3.3V sourcing voltage (current limited) to customer dry contact pulse output Maximum Pulse Rate 10 HZ (50 msec minimum transition time)
Alarm Output	Over/Under Voltage & Current (SPDT Relay - 30 VDC)

Communication Specifications

Specification	Description
Hardware	RS-485, Ethernet, & USB (for configuration only)
Supported Protocols	Modbus RTU or BACnet Master Slave Token Passing protocol (MS/TP) Modbus (using SunSpec IEEE-754 single precision floating point model) Modbus TCP BACnet IP
Max Communication Length (RS485)	1200 meters total length, 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 (Default), 19200, 38400, 76800
Data Bits	8
Parity	None, Even, Odd
Stop Bit	2, 1
Termination	None provided

Mechanical Specifications

Specification	Description
Wire Connections & Voltage	12-22 AWG 600 VAC, Voltage connection must be #14 AWG or larger & 600 VAC rated
Mounting	Enclosure or Panel Mount
High Voltage Cover	IP30 (embedded version)
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, connections sized for 1–inch EMT conduit
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)
PCBA Dimensions	(L) 21.6cm x (W) 21.6cm x (H) 6.4 cm (8.5" x 8.5" x 2.5")

Virtual Element Viewer Utilities Minimum System Requirements

Specification	Description
Operating System	Windows® 7, Windows® 8, Windows® 10
Communications Port	USB or Ethernet connectivity

WEB VERSION

LIMITED 5 YEAR WARRANTY AND EXCLUSIONS

Leviton warrants to the original consumer purchaser and not for the benefit of anyone else that this product at the time of its sale by Leviton is free of defects in materials and workmanship under normal and proper use for five years from the purchase date. Leviton's only obligation is to correct such defects by repair or replacement, at its option. For details visit www.leviton.com or call 1-800-824-3005. This warranty excludes and there is disclaimed liability for labor for removal of this product or reinstallation. This warranty is void if this product is installed impro perly or in an improper environment, overloaded, misused, opened, abused, or altered in any manner, or is not used under normal operating conditions or not in accordance with any labels or instructions. There are no other or implied warranties of any kind, including merchantability and fitness for a particular purpose, but if any implied warranty is required by the applicable jurisdiction, the duration of any such implied warranty, including merchantability and fitness for a particular purpose, is limited to five years. Leviton is not liable for incidental, indirect, special, or consequential damages, including without limitation, damage to, or loss of use of, any equipment, lost sales or profits or delay or failure to perform this warranty obligation. The remedies provided herein are the exclusive remedies under this warranty, whether based on contract, tort or otherwise.

FOR CANADA ONLY

For warranty information and/or product returns, residents of Canada should contact Leviton in writing at **Leviton Manufacturing of Canada ULC** to the attention of the **Quality Assurance Department, 165 Hymus Blvd, Pointe-Claire (Quebec), Canada H9R 1E9 or by telephone at 1 800 405-5320.**

FCC COMPLIANCE STATEMENT:

This equipment 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 his own expense.

Any changes or modifications not expressly approved by Leviton Manufacturing Co., could void the user's authority to operate the equipment.

FCC SUPPLIER'S DECLARATION OF CONFORMITY:

Models 72D48, 72N48, and 73D48 are sold by Leviton Manufacturing Inc. 201 N Service Rd, Melville, NY 11747. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

INDUSTRY CANADA COMPLIANCE STATEMENT:
This device contains license-exempt transmitter/receiver that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:
(1) This device may not cause interference.
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

TRADEMARK DISCLAIMER:

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FOR TECHNICAL ASSISTANCE CALL:

1-800-824-3005 (U.S.A. Only)

1 800 405-5320 (Canada Only)

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