INSTALLATION AND OPERATING MANUAL

EN

# Multi-circuit electric submeter

# *DIRIS MCM*


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# 1. INTRODUCTION

The DIRIS MCM meter is a revenue grade networked electric submeter capable of using 333 mV output Current Transformer (CT) or Rogowski style current sensors. The DIRIS MCM has been designed with mechanical, electrical and software features that will appeal to those seeking a simplified approach to facility energy management.

# 2. SAFETY

## 2.1. Safety Specifications

WARNING! DO NOT EXCEED 347 VAC Line to Neutral or 600 VAC Line to Line. Exceeding this voltage will cause damage to the meter and danger to the user. Always use a Potential Transformer (PT) for voltages in excess 600 VAC.

| | | |
|---|---|---|
| This general safety information is to be used by both the meter operator and servicing personnel. Socomec assumes no liability for user's failure to comply with these safety guidelines. | c UL us LISTED<br>MCM-XX-YZ | Conforms to:<br>UL 61010-1 Edition 3 (2016),<br>CSA C22.2 No 61010-1-12 Edition 3 Update 2 (2016), |

The DIRIS MCM meter may be used up to 600 VAC L-L in an overvoltage III category.

**CAUTION! THIS METER MAY CONTAIN LIFE THREATENING VOLTAGES. QUALIFIED PERSONNEL MUST DISCONNECT ALL HIGH VOLTAGE WIRING BEFORE SERVICING THE METER.**

### Symbols on Equipment

WARNING! Denotes caution. See manual for a description of the meanings.

WARNING! Denotes high voltage. Risk of electrical shock. Life Threatening voltages may be present. Qualified personnel only.

Equipment protected throughout by double insulation (IEC 536 Class II).

### Symbols in Documentation

Note: contains additional information or shortcut information.

## 2.2. Safety Information

Electrical equipment shall be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Socomec for any consequences arising out of the use of this material. A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

**General Requirements**

- Review the entire manual to familiarize yourself with the meter and any accessories.
- Comply with local and national safety codes.
- Use personal protective equipment if exposed to hazardous live conductors.
- Installation shall be performed by licensed electricians only.
- Equipment shall be accessible only to authorized personnel in a restricted area.
- If the fuse is open inside the meter or the meter has visible damage disconnect all power sources from the meter.

**Installation Requirements**

- Use only copper conductors of the appropriate size for each terminal.
- Upstream branch circuit protection breaker must be in the range of 1 – 15 amps.
- Mains wiring shall be temperature rated for 90 °C (194 °F) or higher.
- Mains wiring shall be no smaller than 14 AWG (1.6mm²) for model MCM / MCM-X
- Meter shall only be used with UL Listed Current Transformers (CT) or Rogowski Sensors.
- Meter shall be installed and serviced with the power disconnected.
- CT or Sensor wiring cannot exceed 75% of the cross-sectional area of conduits or troughs.
- CT or Sensors cannot be placed in such a way that they impede ventilation.
- CT or Sensors cannot be placed in an arc venting area of cabinetry.
- CT or Sensors are NOT suitable for Class 2 wiring methods (i.e. splicing restrictions apply).
- CT or Sensors shall be installed over insulated conductors only, no bare conductors or terminals.
- CT or Sensor wiring or terminals blocks shall be temperature rated 75 °C (167 °F) or higher.
- All un-used openings on the meter shall be plugged.
- If the equipment is used in a manner not specified by Socomec, the protection provided by the equipment may be impaired.

**California Proposition 65**

**Warning!** Under normal circumstances the DIRIS MCM Power meter does not pose an exposure health risk to users of the product. The internal printed circuit board and associated electronic components have been selected, designed and manufactured to international RoHS standards where verifiable. As a complex electrical circuit, it must be assumed that internal components could have plastics or chemicals that are known to the State of California to cause cancer, birth defects or other reproduce harm. It is recommended therefore to dispose of the product through an electronics reclamation service to prevent such materials from entering the environment.

### Safety Ratings

| Description | Rating |
|---|---|
| Equipment Function | Networked Multi-Circuit Sub Meter |
| Connection Type | Permanent |
| Over-Voltage Category | III |
| Pollution Degree | 2 |
| Enclosure Type | Metallic / Bonded |
| Operating temperature | -20 °C to + 60 °C |
| Humidity Range | 5% to 95% non-condensing |
| Altitude | < 2000 meters |
| Ingress Protection Rating | 40 |
| Location | DRY only |

# 3. DESIGN PHILOSOPHY

The DIRIS MCM design philosophy is simple; everything that represents “Best Practices” in sub metering is included in the design.

**Electrical Safety:** The closer a device gets to the electrical grid and the larger the transformer feeding the installation the higher the risk of an electrical accident. Typical transformers can deliver 20 times their rated current under fault conditions. If unknown the user should assume that their connection to the grid will support 50kA of current (UL61010 Table AA.1).

**Fuses.** Circuit breakers are designed to protect wiring in buildings from excessive heating caused by circuit overloads. Circuit breakers are NOT capable of interrupting the enormous currents that can flow into a low impedance electrical failure such as a shorted semiconductor. Best practice is to protect each HOT LEG coming from the utility with a fuse capable of disconnecting 200kA of current. This protection will greatly reduce the chances of an arc flash within the power meter.

**Surge / ESD.** It is expected that the electric grid will routinely expose connected devices to short duration over-voltage stresses orders of magnitude higher than the service voltage. All high voltage and high energy events should be directed to earth ground through a dedicated path that does not intersect with the measurement circuitry or connected equipment. Floating and isolating designs can pass the electrical stress down to connected devices.

**Universal Power Supply.** A power meter is a very low wattage device but one that needs to operate over a wide range of excitation conditions. The DIRIS MCM uses a wide-range three phase power supply and will power the meter if a voltage differential exists across any Line to Line or Line to Neutral combination.

**Disconnects.** Best practice for the installation of a power meters is achieved when a dedicated circuit breaker is installed that feeds only the power meter. It is recognized however that industrial locations, especially retrofits, may not be able to comply with this ideal and may instead daisy chain or splice from a nearby circuit. In such cases the DIRIS MCM is offered with a built in disconnect to allow the meter to be serviced independently of other circuits. We have introduced this feature to help facilitate safe installations of submetering.

**Enclosure.** The DIRIS MCM is designed with the installer in mind. All fasteners are “top access” and captured so that they are accessible in any meter configuration and cannot come loose or be dropped. The DIRIS MCM has no openings or buttons, which are the most common source of failure and tampering.

**Durability and Style.** You just invested in a piece of modern capital equipment, the DIRIS MCM uses scratch and corrosion resistant anodized aluminum and high-quality plastics.

**Multiple Data Models.** The DIRIS MCM supports several data organizational models for compatibility with a wide range of Modbus host types.

# 4. DIRIS MCM POWER METER OVERVIEW

## 4.1. Meter Models

The DIRIS MCM family of meters is a simplified design and is available with limited model variations: with or without a high voltage rotary disconnect. Product capabilities and variations may expand over time.

The ordering model is formatted below:

| M | C | M | - | X | X | - | Y | Z |
|---|---|---|---|---|---|---|---|---|

| MODEL | |
|---|---|
| MCM | Meter Family |

| XX = CIRCUITS | |
|---|---|
| 16 | 16 CT Inputs |
| 48 | 48 CT Inputs |

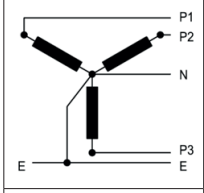
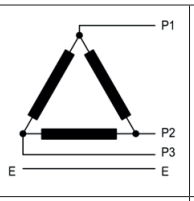
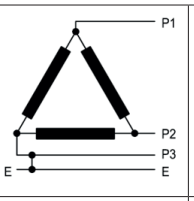
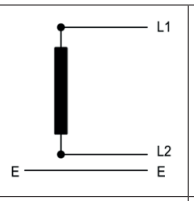
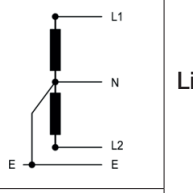
| Y = DISPLAY | |
|---|---|
| N | No Display |
| D | With Display |

| Z = DISCONNECT | |
|---|---|
| N | No Disconnect |
| D | With Disconnect |

| Meter model | Description | Reference |
|---|---|---|
| DIRIS MCM-16-N-N | 16-channel electric power meter | 4827 **16NN** |
| DIRIS MCM-16-D-N | 16-channel electric power meter with display | 4827 **16DN** |
| DIRIS MCM-16-D-D | 16-channel electric power meter with display and disconnect switch | 4827 **16DD** |
| DIRIS MCM-48-N-N | 48-channel electric power meter | 4827 **48NN** |
| DIRIS MCM-48-D-N | 48-channel electric power meter with display | 4827 **48DN** |
| DIRIS MCM-48-D-D | 48-channel electric power meter with display and disconnect switch | 4827 **48DD** |

## 4.2. Service types supported

The DIRIS MCM meter is intended for use in the following voltage supply services:

| MAINS System Nominal Voltages | | | | | Line to Neutral or Ground | CAT |
|---|---|---|---|---|---|---|
|  |  |  |  |  | | |
| 3P-4W Grounded | 3P-3W Floating | 3P-3W Grounded | 2P-2W Floating | 2P-3W Grounded | | |
| 120/208<br>127/220 | 110, 115<br>120, 127 | 100<br>120 | 100<br>110, 115<br>120, 127 | 110/220<br>115/230<br>120/240 | 150 | III |
| 220/380<br>230/400<br>240/415<br>260/440<br>277/480 | 200<br>220, 230, 240<br>260, 277, 347<br>380, 400, 415<br>440, 480 | 200<br>240 | 220<br>230<br>240 | 220/240<br>240/480 | 300 | III |
| 347/600 | 500 | 347<br>380, 400, 415<br>440, 480 | 480 | - | 600 | III |

## 4.3. DIRIS MCM technical characteristics

| | |
|---|---|
| **Electrical** | |
| Service Types | Single Phase, Split Phase, Three Phase-Four Wire (WYE), Three Phase-Three Wire (Delta), Open Delta, Corner Grounded Delta, Center Grounded Delta |
| Voltage Channels | 2 voltage inputs:<br>- Main voltage input: 90-600 VAC L-N / L-L - CAT III<br>- Secondary voltage input: 90-250 VAC L-N / L-L CAT III |
| Current Channels | 333 mV output CT's. Typical Values (5,50,100,200,400) amps<br>Rogowski Coil Sensors. Typical output Voltages (131 mV/kA @ 60 HZ) |
| Maximum Current Input | • 150% of current sensor rating.<br>• 4000 A for ROG Rogowski coil sensors |
| Measurement Type | True RMS using continuous sampling |
| Line Frequency | 50/60 Hz |
| Input Power | - Internal three phase power supply (90 - 600 VAC), L1, L2 or L3; 500 mA max.<br>- DC powered from 5V USB port (500 mA). |
| AC Protection | 500 mA Slow Blow CC Class Fuse 200kA on each hot leg (L1,L2, and L3) |
| Power Out | 24 VDC output, 50 mA steady state, 100 mA peak at Duty Cycle 10%, self-resetting fuse |
| Waveform Sampling | 1800 samples per second |
| 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 | - ANSI C12.1 Class 0.2 Meter alone<br>- ANSI C12.1 Class 0.5 (associated with Socomec ACTL current sensors) |
| Resolution | Values reported in IEEE-754 single precision floating point format (32 bit). |
| Indicators | Cylon LED bar |
| **Communication** | |
| Hardware | RS-485, Ethernet, & USB (for configuration only) |
| Supported Protocols | Modbus RTU, Modbus TCP & BACnet IP |
| Wiring Length | 1200 meters with Data Range of 100K bits/second or less |
| RS-485 Loading | 1/8 unit |
| Communication Rate | 9600, 19200 (Default), 38400, 57600, 76800, 115200 |
| Serial Protocol | 8N1 |
| Termination / Bias | None provided |
| **Mechanical** | |
| Wire Connections | Voltage Connection to PCB or Disconnect: 12-14 #AWG, 600 VAC 105°C<br>CT Connection: 12-22 AWG, 600 VAC 105°C |
| Mounting | Wall Mounting (2 or 3 fastener locations) |
| IP Rating | DIRIS MCM: IP40 (IP30 if SIRCO M disconnect switch installed)<br>High-voltage see-through cover: IP40 |
| Operating Temperature | -20 °C to + 60 °C (-4 °F to 140 °F) |
| Humidity | 5% to 95% non-condensing |
| Enclosure | Extruded anodized aluminum body<br>End caps 94-V0 flammability rating, connections sized for 1–inch EMT conduit |
| Dimensions | DIRIS MCM-16 without Disconnect: 12.4" (H) x 10.4" (W) x 3.11" (H) (31.4 x 27.7 x 7.9 cm)<br>DIRIS MCM-16 with Disconnect: 17.5" (H) x 10.4" (W) x 3.50" (H) (44.4 x 27.7 x 8.9 cm)<br>DIRIS MCM-48 without Disconnect: 15.4" (H) x 10.4" (W) x 3.11" (H) (39 x 27.7 x 7.9 cm)<br>DIRIS MCM-48 with Disconnect: 20.5" (H) x 10.4" (W) x 3.50" (H) (52.1 x 27.7 x 8.9 cm) |
| **Software** | |
| Operating System | Windows® 8, Windows® 10, Windows® 11 |
| Communications Port | One USB Port required on PC, Type A or Type C |

| Safety | |
|---|---|
| FCC Compliance | This device has been tested and found to comply with the limits for a Class B 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. |
| Serial/Ethernet Meters | Conforms to UL Std 61010-1, 3rd Edition, UL 61010-2-30:2010<br>Certified to CSA Std C22.2 No. 61010-1, 3rd Edition |

# 5. DIRIS MCM INSTALLATION

### Planning

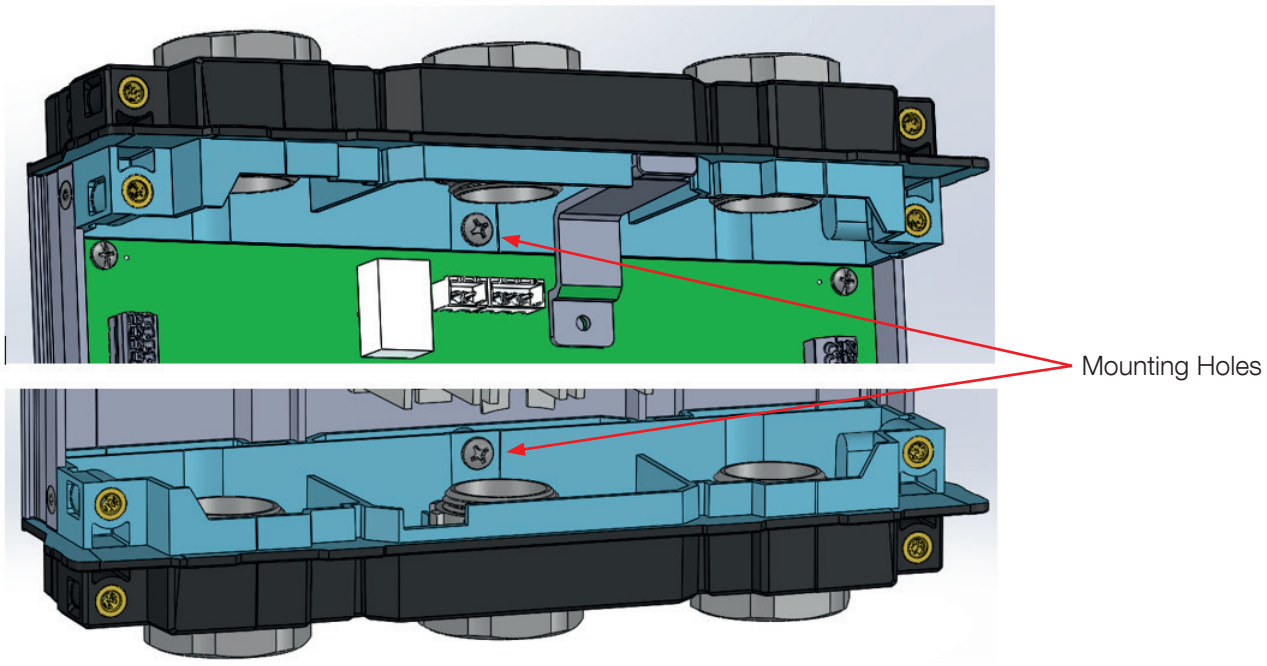
Things to consider include:

- Access to site documentation including predetermined element addresses and names.
- Laptop computers or tablets with pre-installed and tested software utilities.
- Extension cords and power strips.
- Communication cables.
- Appropriate fasteners and wall anchors.

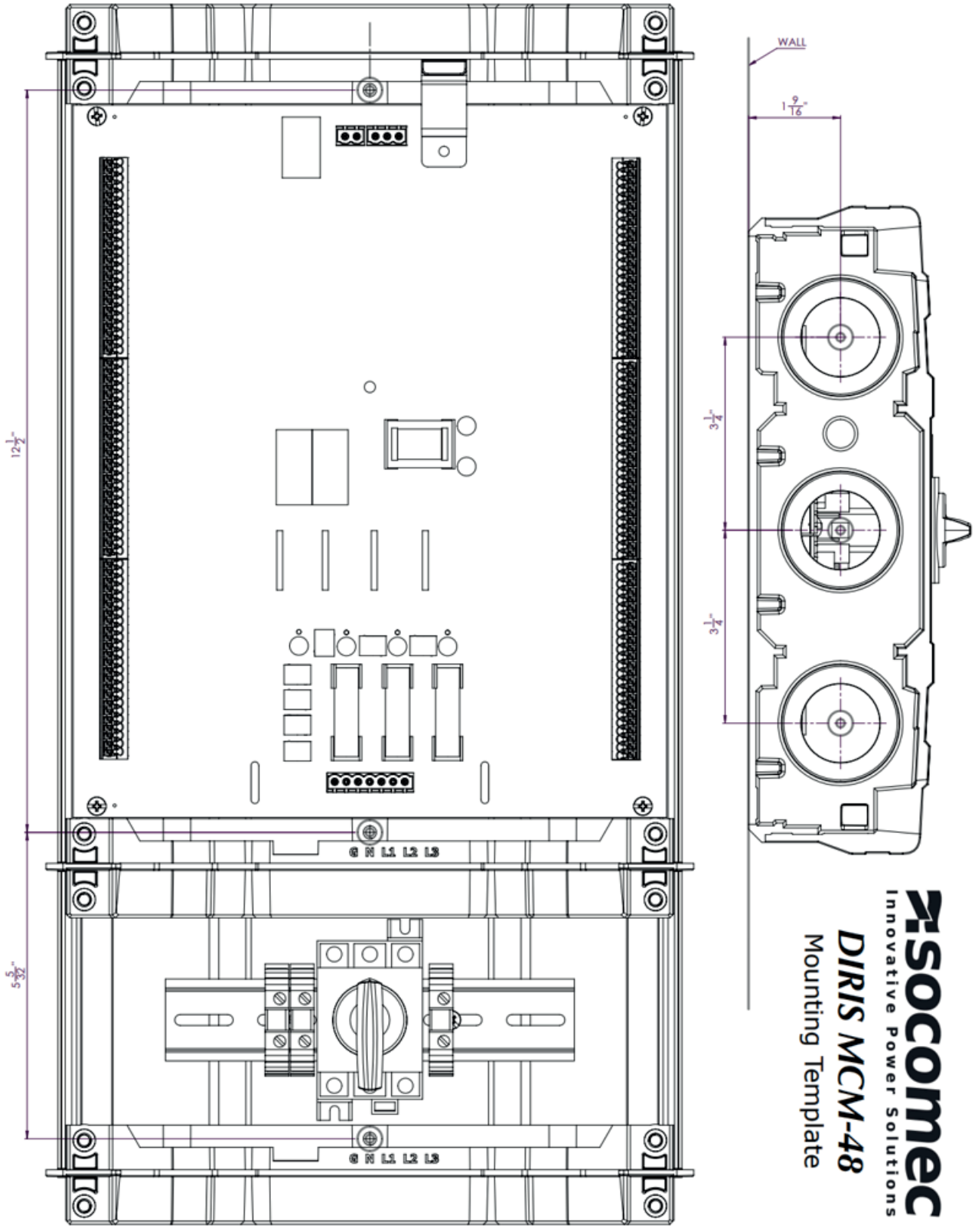
### Mounting

The DIRIS MCM is mounted to the wall using customer provided #8 - #10 fasteners. Ensure that the fasteners are appropriate for the type of surface: wood, concrete, drywall, metal etc. Screw holes are accessible with the top and / or disconnect covers removed and are easiest to access if mounted before conduit fittings are installed.

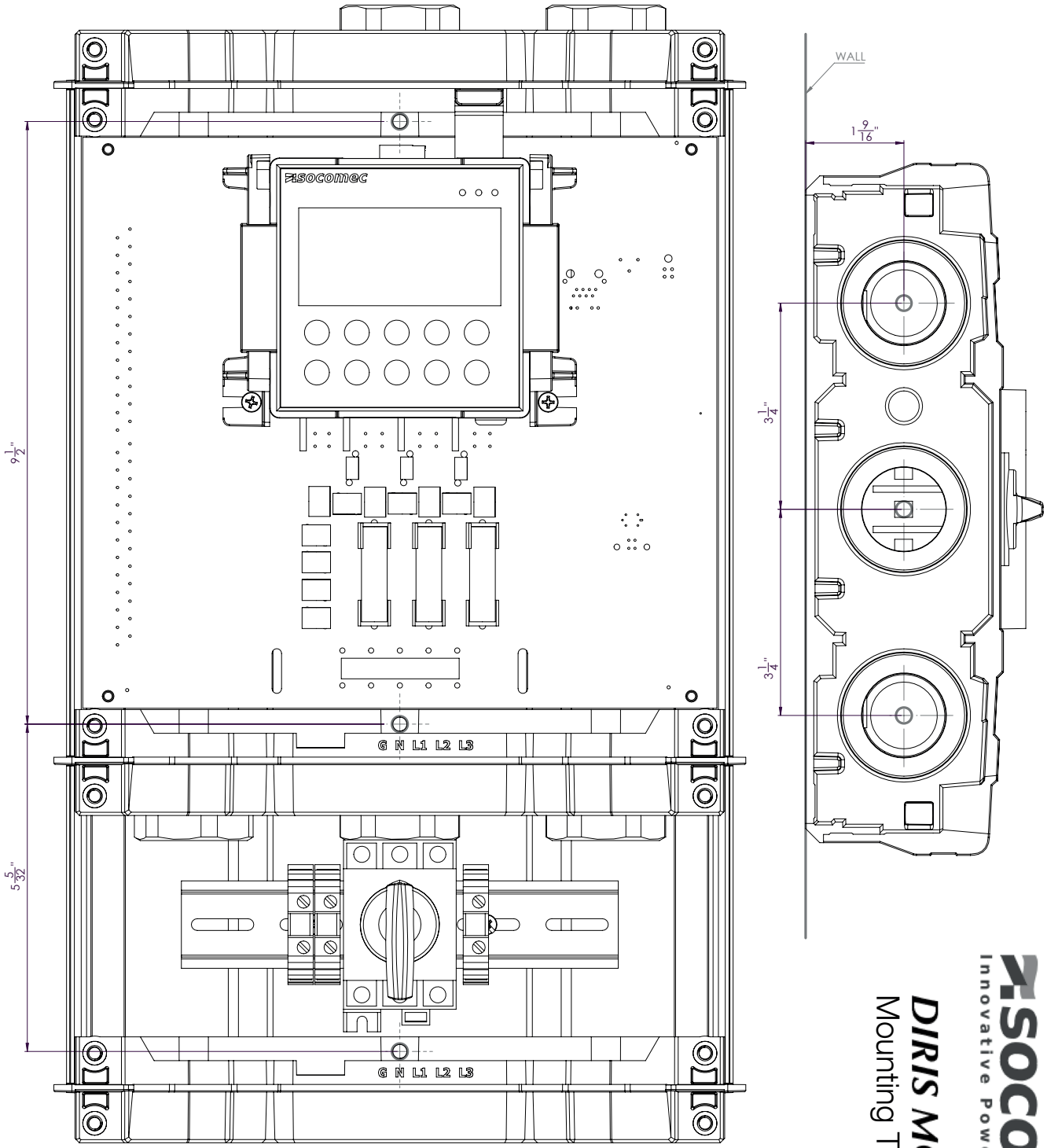
A full-size 1:1 scale paper drill template showing back plate and end cap conduit spacings will be provided with each DIRIS MCM meter. In the event that the template has been discarded the meter itself can be used as the drill template by marking the drill locations on the wall from within the meter. The meter shall then be removed while any drilling operations are performed to avoid depositing debris within the meter. Don't be that guy!




Wall Mounting Through Center Holes




Drill and Punch Template

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**DIRIS MCM-16**

Mounting Template

Drill and Punch Template

## High Voltage Wiring

**DANGER! - Failure to follow these instructions can result in serious injury or death.**
**HAZARD OF ELECTRICAL SHOCK, EXPLOSION, OR ARC FLASH.**

- The voltage leads of DIRIS MCM meters must be connected to the building through a dedicated disconnect.
- DO NOT EXCEED 600 VAC between L-G, L-N and 690 VAC between L-L terminals.
- Use a Potential Transformer (PT) to reduce voltage if ANY system voltage exceeds 690 VAC L-L.
- The DIRIS MCM meters must always be installed in compliance with local electrical codes and standards.
- The DIRIS MCM meters shall only be energized with the internal high voltage cover installed.

## Solid vs Stranded Wire

Either solid or stranded copper wiring is allowed at the meter or disconnect. The wiring space within these devices are tight. Best practice is to use the minimum stranded size and allow 4-6” additional length creating a small service loop. Wiring cut to the exact length is subject to mechanical stress that could compromise the connector. The use of crimped ferrules is recommended to eliminate the possibility of loose strands.

| Meter Model | Termination Location | Wire Size | Solid or Stranded | Max Torque Rating (N-M) / lbf*in |
|---|---|---|---|---|
| DIRIS MCM without Disconnect | PCB Connector | #12 - #14 AWG | THHN 600 VAC, 105 C | 0.5 / 4.4 |
| DIRIS MCM with disconnect | Disconnect and DIN Contacts | #12 - #14 AWG | THHN 600 VAC, 105 C | 1.8 / 15.8 |

When purchased with a disconnect option, the DIRIS MCM meter includes factory installed wiring that connects the downstream side of the disconnect switch to the primary voltage input on the PCB. This eliminates the need for the user to access the internal voltage cover to make this connection.
The secondary 250 VAC voltage input is not pre-wired to the disconnect switch. As a result, users must remove the voltage cover to connect the meter to a second voltage source manually.

### Protective Conductor Terminal

The first voltage network conductor connected to the DIRIS MCM shall be the safety ground. This terminal is referred to as the “Protective Conductor Terminal”, “Safety Ground”, or “Bonding Terminal”. This terminal is internally connected to the metallic enclosure and connected to the overvoltage protection devices on the printed circuit board. The wire attached to the Safety Ground must be 14 AWG or larger and either bare copper wire or an NEC approved color (Green or Green with a yellow stripe).

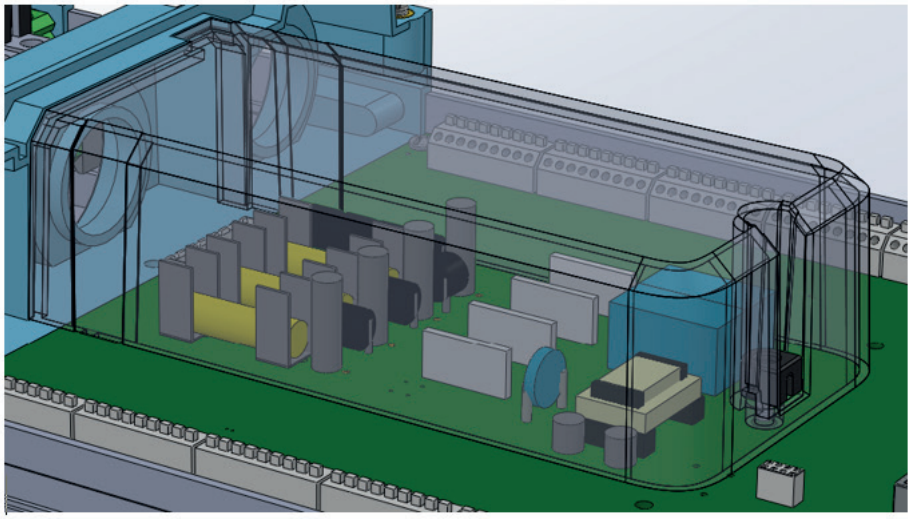
**Neutral vs Ground:** Installers are often confused about the difference between Neutral and Ground since these wires are connected back at the service panel. The ground wire is connected to all the overvoltage protection devices within the meter, included on each CT input and voltage terminal. Leaving the Ground wire disconnected defeats the ability of the DIRIS MCM to protect itself from voltage spikes.

The DIRIS MCM uses the neutral terminal as a reference to a precision amplifier. Electrical signals coming from CT’s are sampled and computed relative to the voltages measured between the Neutral and line terminals to compute power metrics. Leaving the Neutral terminal open allows the voltage at this terminal to “float” to the instantaneous center of voltage which may cause unexpected reporting. A voltage surge that is mitigated by directing current to flow in the ground bonding will not be able to travel “back up” to the meter via the neutral because of the inductance of the wire and the low impedance connection to earth.

**I only have 4 wires!:** If the wiring installer has not included a Neutral wire and it is not possible to add one then it is advised to connect the safety ground wire and add a jumper wire between the neutral terminal and safety ground. This provides a stable voltage for the reference amplifier and provides protection to the meter for voltage spikes below 2KV. Note that this is NOT a preferred solution.

### Wiring Access

Line Voltage connections are made accessible by removing either the disconnect cover (for DIRIS MCM models with disconnect switch) or the main meter cover and then the high voltage cover. The high voltage cover is held in place by a captured fastener mounted to the PCB. The cover is translucent so you can see if the meter is wired without removing it. The precision resistors within are somewhat fragile so avoid bending them.
The high voltage cover screw is accessed by removing or tilting the display (if equipped). Refer to paragraph "Removing the internal Display", page 16.



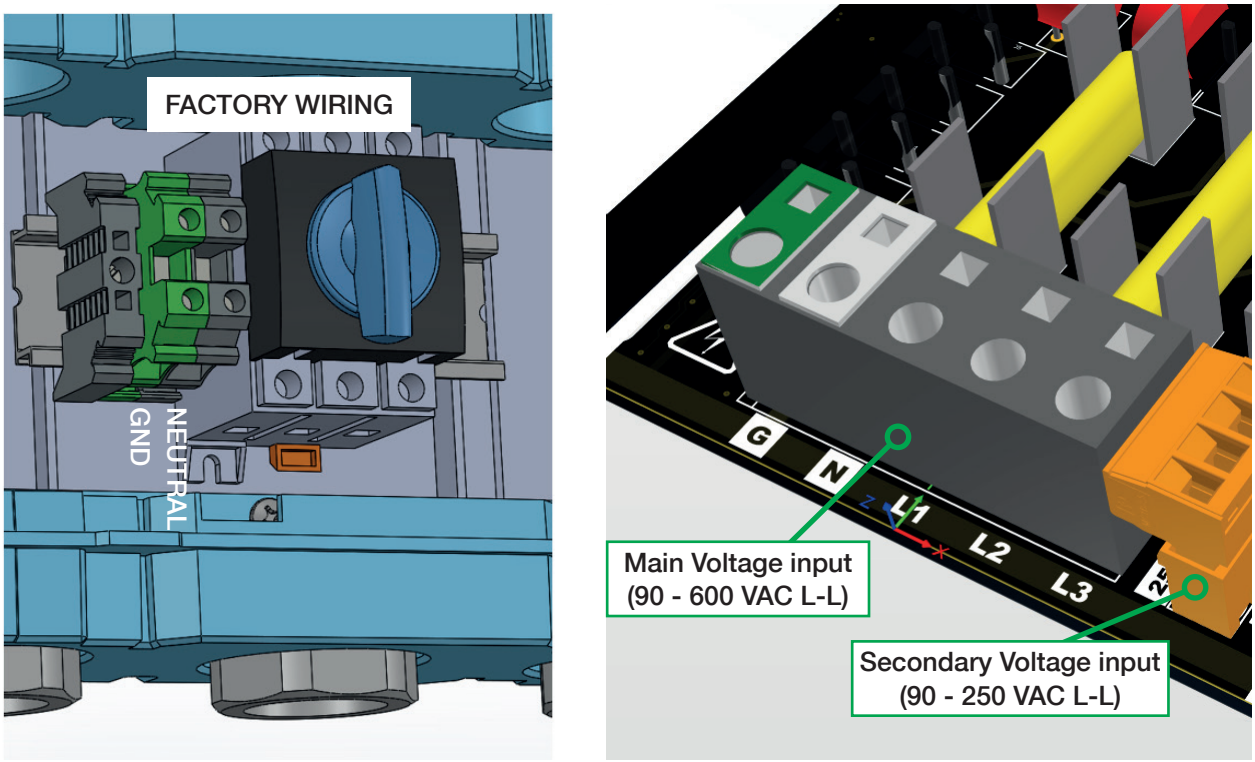
Internal High Voltage Cover

### Voltage Inputs

The DIRIS MCM meter has 2 voltage inputs:

- A primary voltage input, rated for 90 - 600 VAC L-L
- A secondary voltage input, rated for 90 - 250 VAC L-L

This typically allows to monitor loads on both sides of a HV (277/480V) / LV (120/208V) transformer using a single meter, therefore saving on hardware and wiring costs.




Customer Wiring Locations

**HAZARD OF ELECTRICAL SHOCK, EXPLOSION, OR ARC FLASH**

- Disconnect all voltage sources before opening the high voltage cover and servicing the DIRIS MCM meter.
- For DIRIS MCM models with disconnect switch, be aware that the secondary voltage input does not get disconnected when operating the main disconnect switch.

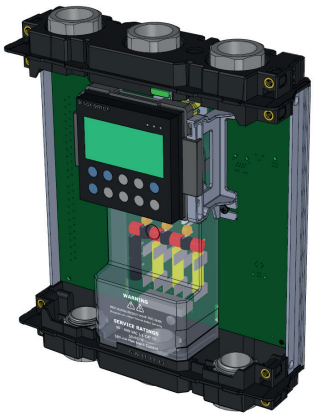
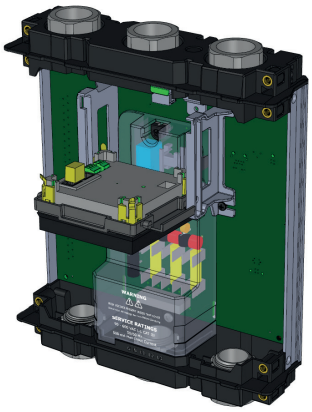
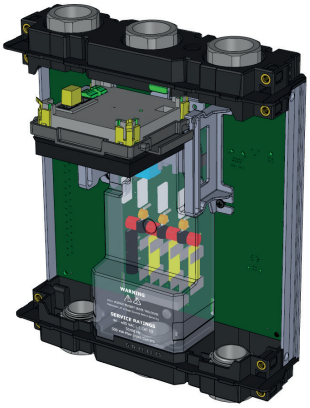
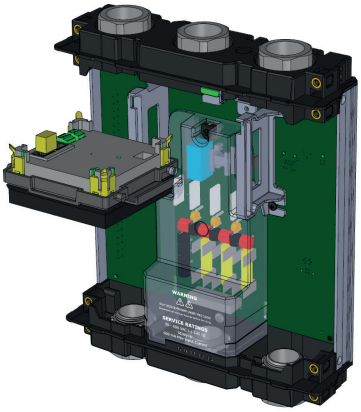
Although not strictly required by the NEC these wiring color codes are considered best practice and provided for reference

| Region | Ground (G) | Neutral (N) | Line 1 (L1) | Line 2 (L2) | Line 3 (L3) |
|---|---|---|---|---|---|
| USA (LV)* | Green | White | Black | Red | Blue |
| USA (HV)* | Green | Grey | Brown | Orange | Yellow |
| Canada | Green | White | Red | Black | Blue |

* USA (LV) This should be used for 120/208VAC 3 PHASE
* USA (HV) This should be used for 277/480VAC 3 PHASE.

### Removing the internal Display

With DIRIS MCM meters with a display, removing the display is required to access the voltage cover:

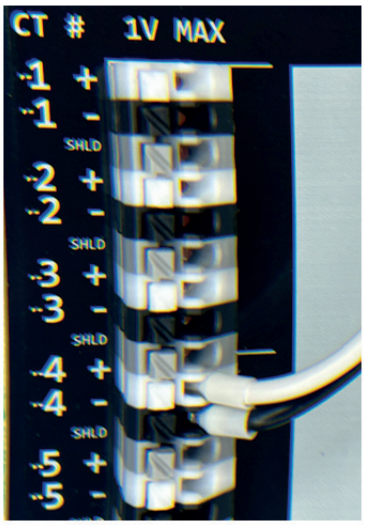
| | | | |
|---|---|---|---|
| **Step 1**: apply upward pressure to disengage the locking mechanism, then slide the display up on its guide rails. | **Step 2**: Tilt the display forward slightly to disengage the top mounting tabs from the slots in the rail. | **Step 3**: Slide the bottom of the display upward along the guide rails until the bottom tabs align with the guide rail slots. | **Step 4**: Pull the display out of the guide rails. |
|  |  |  |  |

### Low Voltage Wiring

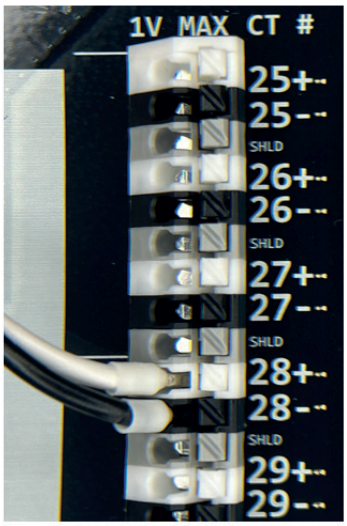
All DIRIS MCM current sensor and communication connections are made outside of the high voltage cover and can be considered safe to work on in the presence of power provided that the meter is properly grounded (visual inspection) and that the high voltage cover remain in place.

### Current Transformers Connector Inputs

Current transformers (333.3 mV type) and Rogowski Coil Sensors are connected along the edges of the Power Meter. The connectors are oriented such that the wires are inserted at a 45 degree angle facing the interior of the power meter. This orientation keeps the channel markers visible once the CT's wires are installed. The sensor terminals are color coded to match the polarity of the signal wires (+ White), (- Black) and (shield Grey). This color coding reduces installation errors associated with misalignment of loads into the terminal blocks. For ease of installation, current sensor lead length has been extended to 23 ft (7m) to eliminate the need for inline splicing for most applications. If the wire leads are shortened it is best practice to crimp a #22 ferrule onto the wire to prevent standing.



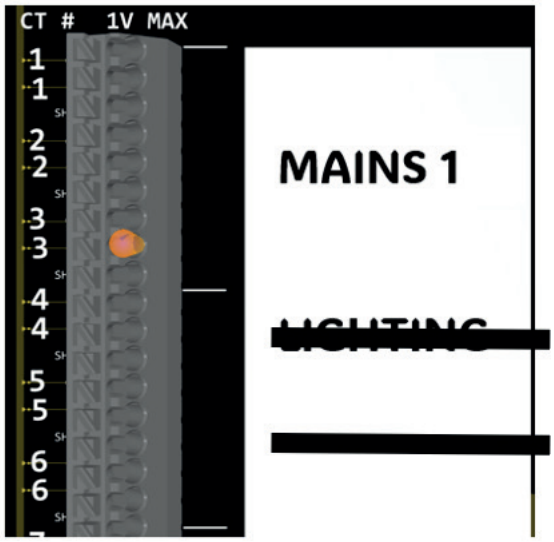

Left Hand Side




Right Hand Side

### Load Notes

The DIRIS MCM printed circuit board provides a location to write any user notes or load designations directly on the power meter. This space is intended to be used if needed to keep track of load locations during installation.



# 6. PRESENTATION OF ASSOCIATED CURRENT SENSORS

The DIRIS MCM meter is intended to be used with one of the three types of sensors manufactured by Socomec and selected based on the application.

- Compact Split-core: **TR-W**
- High accuracy Split-core: **ACCU-CT**
- High amperage Flexible Rogowski Coil: **ROG**

All three of these current sensors benefit from an open-ended design (split-core) which facilitates installation without disconnecting electrical wires inside electrical panels, ideal for retrofit applications.

The Low voltage output signal make them non-intrusive and ideal for retrofit applications with existing electrical panels, eliminating the need for shorting blocks.

The DIRIS MCM meter is also compatible with any third party 333 mV output current sensors.

**Pre-installation checklist**
Regardless of the model or brand of current sensors used with the DIRIS MCM meter, please observe the following recommendations:

- The CT's rated current should normally be greater than or equal to the maximum current of the measured circuit. Ensure that the fuse or circuit breaker's rating does not exceed the CT's maximum continuous current rating.
- It is preferable to install the CT and DIRIS MCM meter close to each other. However, you may extend the CT wires by 100 feet (30 m) or more by using shielded twisted-pair cable and by running the CT wires away from high current and line voltage conductors.
- When extending CT leads, we recommend using lead extensions with the same or larger gauge wire.
- For highest accuracy, try to separate the CTs on different phases by 1.0 inch (25 mm) to minimize magnetic interference.

## 6.1. TR-W Split-core 333 mV current sensors

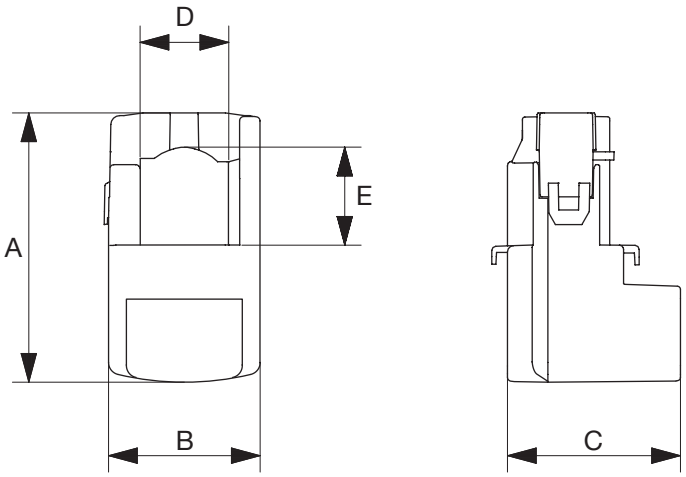
The TR-W are hinged split-core AC current sensors available in 63 A, 160 A, 250 A and 600 A primary rated currents.

The compactness of TR-W current sensors make them ideal for electrical panels having limited space for applications such as branch-circuit monitoring in panelboards.

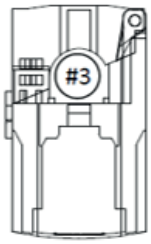
### 6.1.1. TR-W range and characteristics

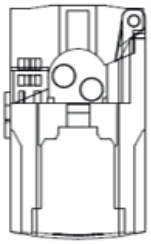
| Ideal for retrofit applications - compact space | TR-W Split-core 333mV current sensors | | | |
|---|---|---|---|---|
| |  |  |  |  |
| | **TR-10W** | **TR-14W** | **TR-21W** | **TR-32W** |
| **Primary rating (A)** | 63 | 160 | 250 | 600 |
| **Secondary** | 333 mV | 333 mV | 333 mV | 333 mV |
| **Phase orientation** | Arrow points towards Load | Arrow points towards Load | Arrow points towards Load | Arrow points towards Load |
| **Polarity** | White = Positive<br>Black = Negative | White = Positive<br>Black = Negative | White = Positive<br>Black = Negative | White = Positive<br>Black = Negative |
| **Window size (in/mm)** | Ø 0.39 / 10 | Ø 0.55 / 14 | Ø 0.83 / 21 | Ø 1.26 / 32 |
| **Lead length (ft/m)** | 22 / 7 | 22 / 7 | 22 / 7 | 22 / 7 |
| **Accuracy** | 0.5% | 0.5% | 0.5% | 0.5% |
| **Voltage rating** | 600 Vac | 600 Vac | 600 Vac | 600 Vac |
| **UL / CSA compliance** | UL61010 | UL61010 | UL61010 | UL61010 |
| **Reference** | **194S5010** | **194S5014** | **194S5021** | **194S5032** |

## 6.1.2. Dimensions (in/mm)

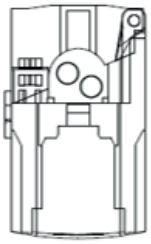



| Model | A (in/mm) | B (in/mm) | C (in/mm) | D x E (in/mm) |
|---|---|---|---|---|
| **TR-10W** | 1.73/44 | 1.02/26 | 1.10/28 | Ø 0.39 / 10 |
| **TR-14W** | 2.64/67 | 1.14/29 | 1.10/28 | 0.55/14 x 0.59/15 |
| **TR-21W** | 2.56/65 | 1.46/37 | 1.69/43 | 0.83/21 x 0.91/23 |
| **TR-32W** | 3.39/86 | 2.09/53 | 1.85/47 | 1.26/32 x 1.30/33 |

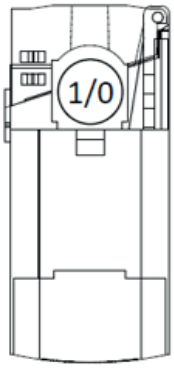


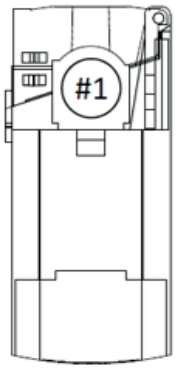



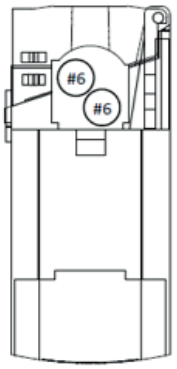
2–#10 AWG

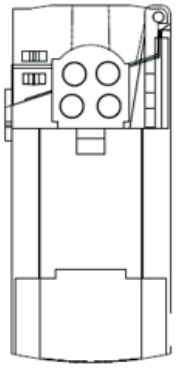


2–#12 AWG

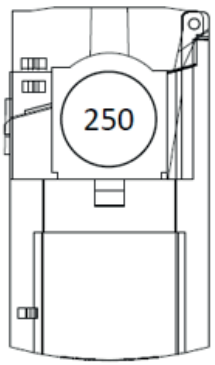


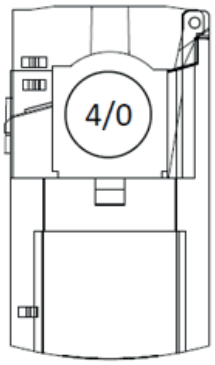



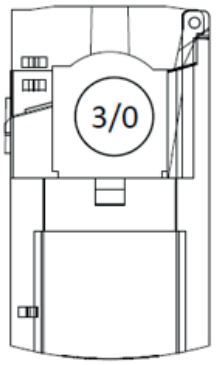



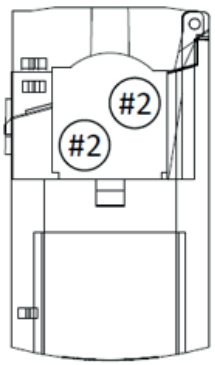



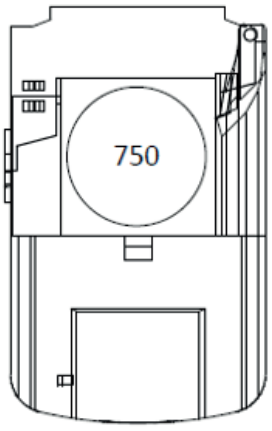
4–#10 AWG

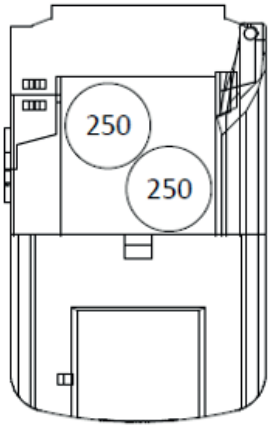


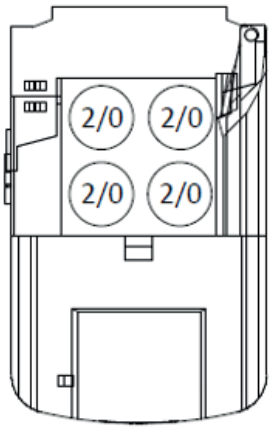



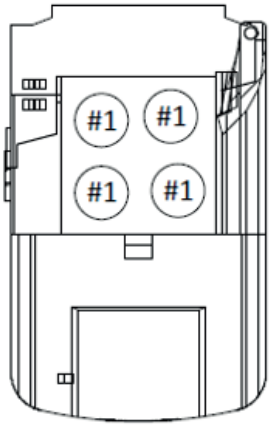



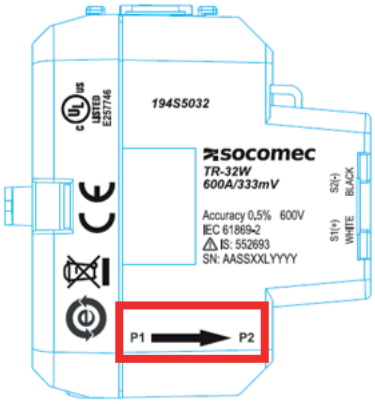




Note: the diameter of conductors based on Southwire THHN insulated stranded copper wire.

### 6.1.3. Installing TR-W current sensors

① Point the directional arrow toward the LOAD and away from the SOURCE.

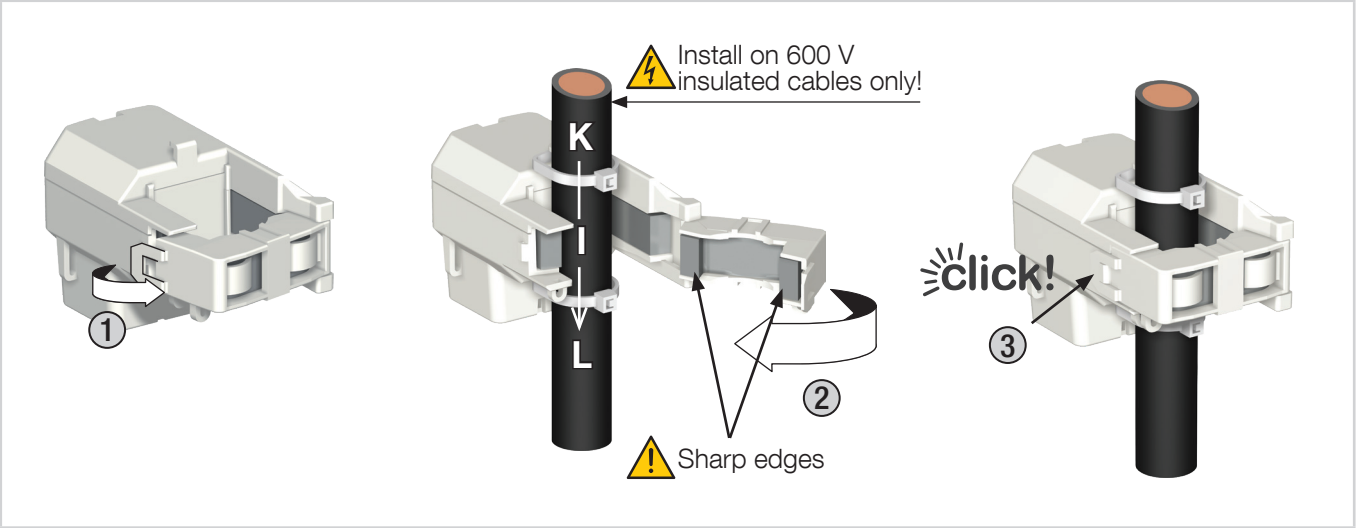



If the current sensor is mounted backwards, the measured active power (kW) will be negative.
Best practice is to correct the current sensor's orientation, but in case it is impractical to change the wiring, the MCM-View configuration software also allows you to perform a software correction

② Open the CT by undoing the latch and swinging the leg of the CT open.

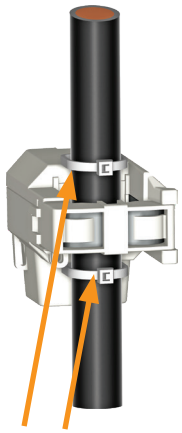
③ Place the CT around the conductor and close the CT.

④ Re-connect the latch--you will hear it click when it is properly closed. The conductor should be in the inside of the CT window.




Before closing the TR-W sensor, check and make sure the mating surfaces are clean (no contamination, corrosion or debris which could increase the magnetic gap and decrease accuracy).

⑤ Optional: Secure the TR-W sensor using cable ties to push the conductor against the base of the opening.

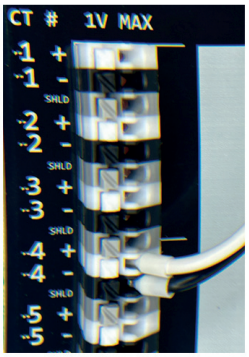


Cable ties

⑥ Route the twisted black and white wires from the CT to the DIRIS MCM meter.

⑦ Secure the CTs and route the lead wires so that they do not directly contact live terminals or busses.

⑧ Connect the white and black wires to the white and black terminals on the DIRIS MCM meter.




- If the white and black wires are reversed, the measured active power (kW) will be negative. Best practice is to fix the CT polarity by swapping wires on the DIRIS MCM terminals, but the MCM-View configuration software also allows you to perform a software correction.
- Be careful to match the CT to the voltage phases being measured. Make sure the ØA CT is measuring the current on the ØA conductor, and the same for phases B and C. Use colored labels or tape to identify the wires.

Do NOT clamp or pull out NON-INSULATED conductors carrying DANGEROUS VOLTAGE which could cause an electric shock, burn or arc flash. Ref. IEC 61010-2-032

## 6.2. ACTL Split-core 333 mV current sensors

The ACTL are high accuracy hinged split-core AC current sensors, offering outstanding linearity and very low phase angle error with a safe 0.333 Vac low voltage output.

The ACTL sensors are available in two window opening sizes:

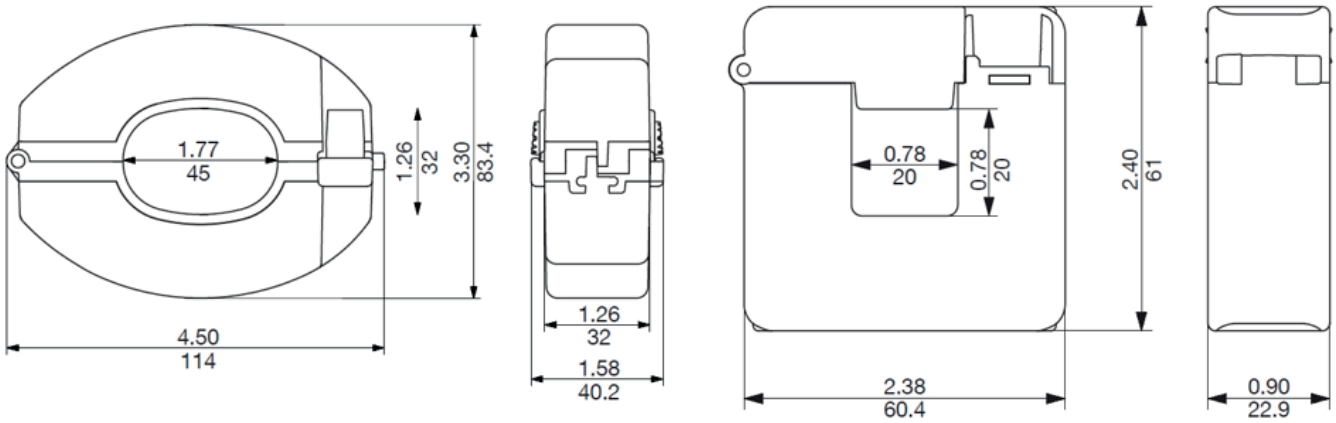
- The ACTL-0750 has a window opening of 0.75” x 0.75” for current measurements up to 250 amps
- The ACTL-1250, with its unique oval shaped window opening of 1.83” x 1.25” is designed for loads up to 600 amps.

### 6.2.1. ACTL range and characteristics

| Ideal for retrofit applications - high accuracy | ACTL-0750 Split-core 333 mV current sensors | | | | | |
|---|---|---|---|---|---|---|
| |  |  |  |  |  |  |
| **Primary rating (A)** | **20** | **50** | **100** | **150** | **200** | **250** |
| **Secondary** | 333 mV | 333 mV | 333 mV | 333 mV | 333 mV | 333 mV |
| **Phase orientation** | Arrow points towards source<br>Label faces source | | | | | |
| **Polarity** | White = Positive<br>Black = Negative | | | | | |
| **Lead length (ft/m)** | 8 / 2.4 | 8 / 2.4 | 8 / 2.4 | 8 / 2.4 | 8 / 2.4 | 8 / 2.4 |
| **Window size (in/mm)** | Ø 0.78 / 20 | Ø 0.78 / 20 | Ø 0.78 / 20 | Ø 0.78 / 20 | Ø 0.78 / 20 | Ø 0.78 / 20 |
| **Accuracy** | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| **Voltage rating** | 600 Vac | 600 Vac | 600 Vac | 600 Vac | 600 Vac | 600 Vac |
| **UL/CSA compliance** | UL2808 | UL2808 | UL2808 | UL2808 | UL2808 | UL2808 |
| **Reference**<br>**0.75% accuracy**<br>**0.5% accuracy** | **USACTL0750020**<br>**USACTL0750020C06** | **USACTL0750050**<br>**USACTL0750050C06** | **USACTL0750100**<br>**USACTL0750100C06** | **USACTL0750150**<br>**USACTL0750150C06** | **USACTL0750200**<br>**USACTL0750200C06** | **USACTL0750250**<br>**USACTL0750250C06** |

| Ideal for retrofit applications - high accuracy | ACTL-1250 Split-core 333 mV current sensors | | |
|---|---|---|---|
| |  |  |  |
| **Primary rating (A)** | **250** | **400** | **600** |
| **Secondary** | 333 mV | 333 mV | 333 mV |
| **Phase orientation** | Arrow points towards source<br>Label faces source | | |
| **Polarity** | White = Positive<br>Black = Negative | | |
| **Lead length (ft/m)** | 8 / 2.4 | 8 / 2.4 | 8 / 2.4 |
| **Window size (in / mm)** | Ø 1.77 / 45 | Ø 1.77 / 45 | Ø 1.77 / 45 |
| **Accuracy** | 0.2% | 0.2% | 0.2% |
| **Voltage rating** | 600 Vac | 600 Vac | 600 Vac |
| **UL compliance** | UL2808 | UL2808 | UL2808 |
| **Reference**<br>**0.75% accuracy**<br>**0.5% accuracy**<br>**0.2% accuracy** | **USACTL1250250**<br>**USACTL1250250C06**<br>**USACTL1250250C02** | **USACTL1250400**<br>**USACTL1250400C06**<br>**USACTL1250400C02** | **USACTL1250600**<br>**USACTL1250600C06**<br>**USACTL1250600C02** |

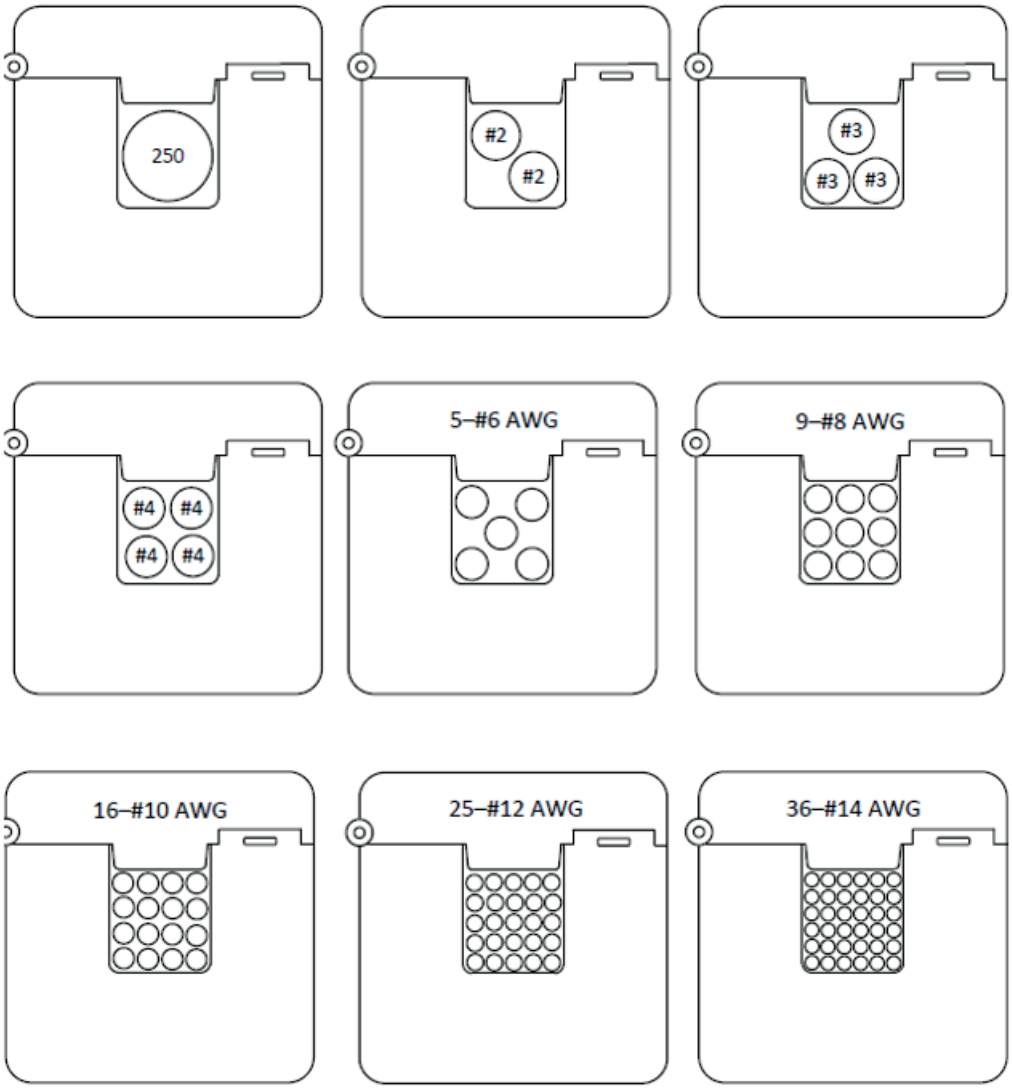
## 6.2.2. ACTL dimensions in/(mm)



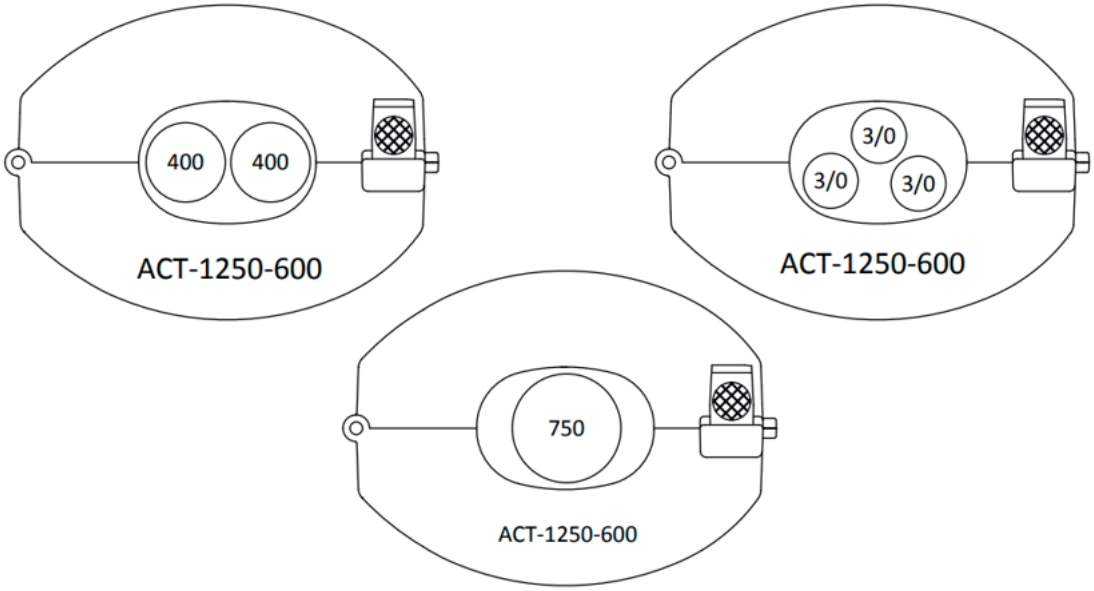

ACTL-1250

ACTL-0750

**Conductor sizes accepted by ACTL-0750 current sensors**



**Conductor sizes accepted by ACTL-1250 current sensors**



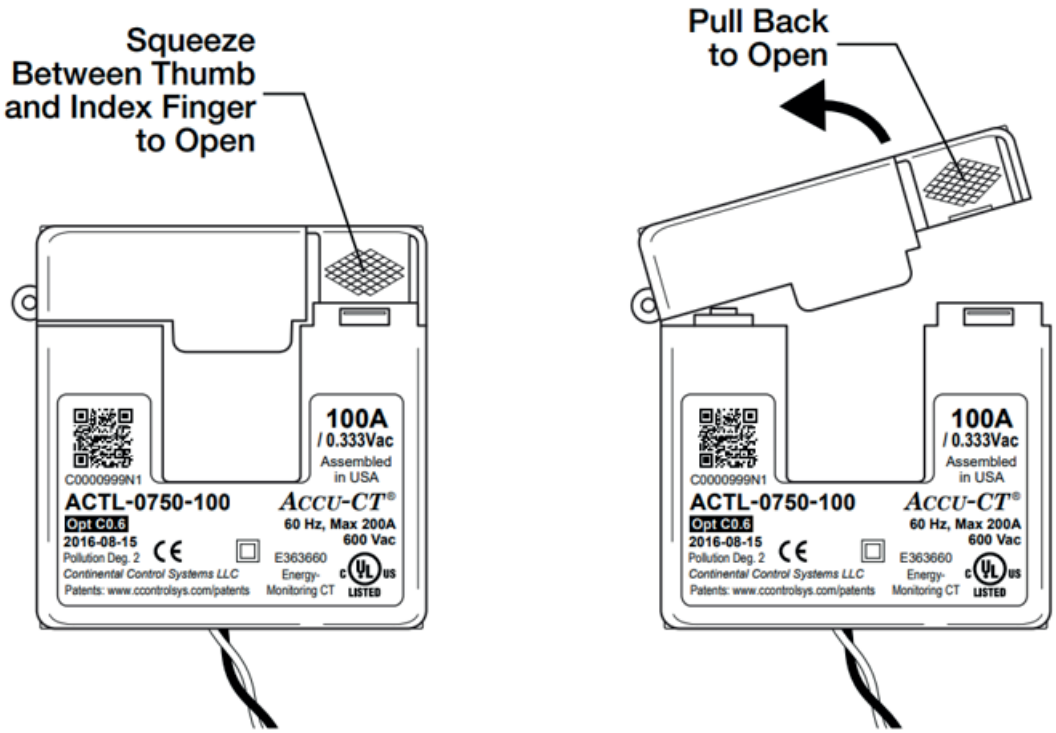

Note: the diameter of conductors based on Southwire THHN insulated stranded copper wire.

## 6.2.3. Installing ACTL current sensors

① Point the SOURCE directional arrow toward the current source and away from the load: the utility meter or the circuit breaker for branch circuits. In this situation, the label should be facing the source.

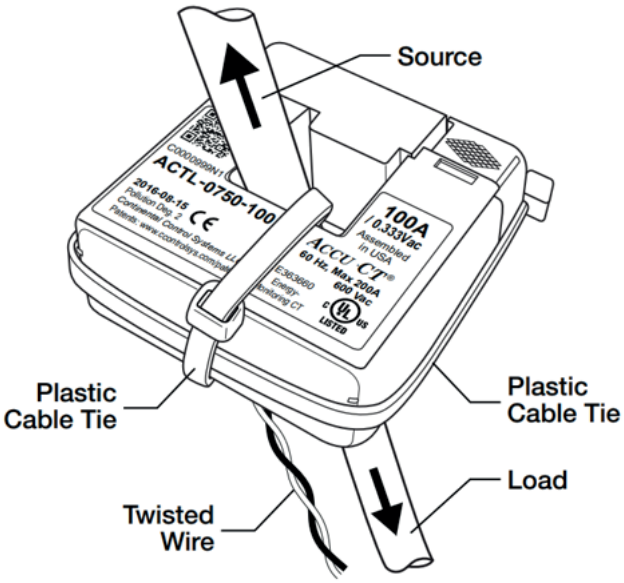
If the current sensors are mounted backwards, the measured active power (kW) will be negative.
Best practice is to fix the CT orientation, but in case it is impractical to change current sensor wiring, the MCM-View configuration software also allows you to perform a software correction.

② To open the CT, squeeze the knurled panels, then pull and rotate the top open.



Before closing the ACTL sensor, check and make sure the mating surfaces are clean (no contamination, corrosion or debris which could increase the magnetic gap and decrease accuracy).

③ Place the CT around the conductor and close the CT.



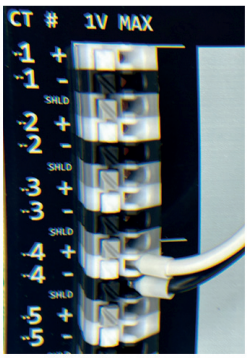

④ Optional: Secure the CT to the conductor with a cable tie.

⑤ Optional: For added security, wrap a cable tie around the outside of the CT.

⑥ Route the twisted black and white wires from the CT to the DIRIS MCM meter.

⑦ Secure the CTs and route the lead wires so that they do not directly contact live terminals or busses.

⑧ Connect the white and black wires to the white and black terminals on the DIRIS MCM meter.




- If the white and black wires are reversed, the measured active power (kW) will be negative. Best practice is to fix the CT polarity by swapping wires on the DIRIS MCM terminals, but the MCM-View configuration software also allows you to perform a software correction.
- Be careful to match the CT to the voltage phases being measured. Make sure the ØA CT is measuring the current on the ØA conductor, and the same for phases B and C. Use colored labels or tape to identify the wires.

Do NOT clamp or pull out NON-INSULATED conductors carrying DANGEROUS VOLTAGE which could cause an electric shock, burn or arc flash. Ref. IEC 61010-2-032.

## 6.3. ROG Rogowski coil 131 mV current sensor

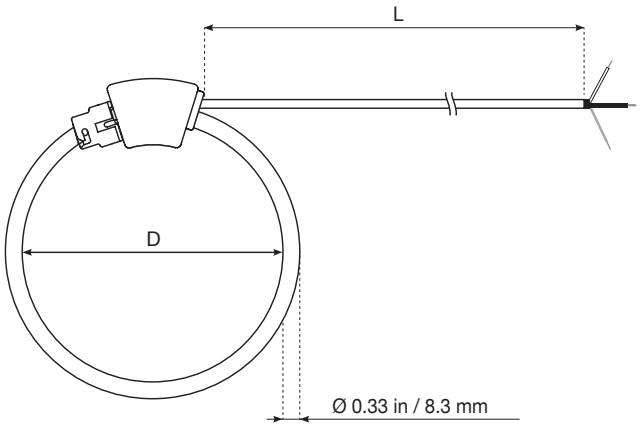
The ROG Rogowski current sensors are flexible rope style AC current sensors delivering an output signal of 131 mV / 1000 A @60Hz, and are compatible with the DIRIS MCM power meters, with no additional integrator or power supply required.

They are ideal for applications with high currents (up to 4000 A), busbars and multiple sets of parallel conductors where conventional rectangular or rigid split-core sensors will not fit.

### 6.3.1. ROG range and characteristics

| Ideal for busbars or higher currents | Rogowski 131mV current sensors | | | |
|---|---|---|---|---|
| |  |  |  |  |
| | **ROG-80** | **ROG-120** | **ROG-200** | **ROG-300** |
| **Output Signal** | 131 mV / kA @ 60Hz<br>Max. 4000 A | 131 mV / kA @ 60Hz | 131 mV / kA @ 60Hz | 131 mV / kA @ 60Hz |
| **Phase orientation** | Arrow points towards load | Arrow points towards load | Arrow points towards load | Arrow points towards load |
| **Polarity** | White = Positive<br>Black = Negative<br>Gray = Shield | White = Positive<br>Black = Negative<br>Gray = Shield | White = Positive<br>Black = Negative<br>Gray = Shield | White = Positive<br>Black = Negative<br>Gray = Shield |
| **Window size (in / mm)** | Ø 3.15 / 80 | Ø 4.72 / 120 | Ø 7.87 / 200 | Ø 11.81 / 300 |
| **Lead length (ft/m)** | 22 / 7 | 22 / 7 | 22 / 7 | 22 / 7 |
| **Accuracy** | 0.5% | 0.5% | 0.5% | 0.5% |
| **Voltage rating** | 600 Vac | 600 Vac | 600 Vac | 600 Vac |
| **UL / CSA compliance** | UL2808 | UL2808 | UL2808 | UL2808 |
| **Reference** | **194S1080** | **194S1120** | **194S1200** | **194S1300** |

### 6.3.2. ROG dimensions



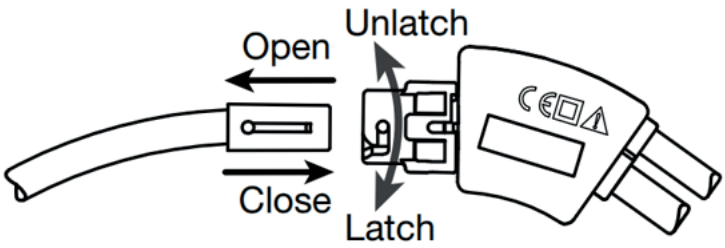

| Model | D (in/mm) | Loop length (in/mm) | L (ft/m) |
|---|---|---|---|
| ROG-80 | 3.15 / 80 | 9.88 / 251 | 22 / 7 |
| ROG-120 | 4.72 / 120 | 14.84 / 377 | 22 / 7 |
| ROG-200 | 7.87 / 200 | 24.72 / 628 | 22 / 7 |
| ROG-300 | 11.81 / 300 | 37.09 / 942 | 22 / 7 |

### 6.3.3. Installing ROG current sensors

① Point the SOURCE directional arrow toward the LOAD and away from the SOURCE

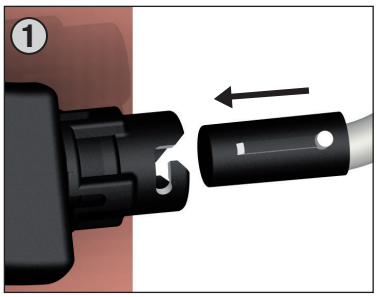
If the current sensors are mounted backwards, the measured active power (kW) will be negative.
Best practice is to fix the CT orientation, but in case it is impractical to change current sensor wiring, the MCM-View configuration software also allows you to perform a software correction.

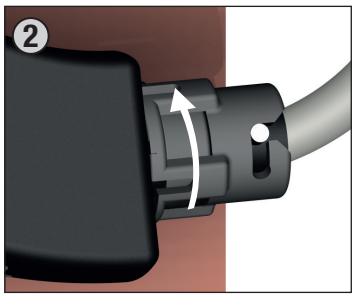
② To open the ROG current sensor, twist the locking ring counterclockwise until it unlatches the cap, then gently pull the removable coil end free (very little force should be required).

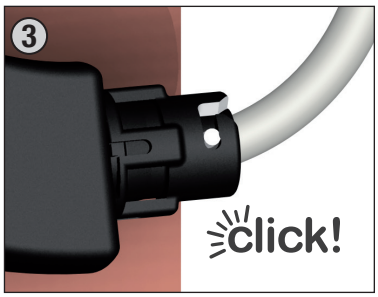



③ Place the coil around the primary conductor, group of conductors, or busbar.

④ Close the coil by inserting the coil cap into the junction (rotate if needed for proper alignment). Twist the locking ring clockwise until it latches (about a quarter turn).

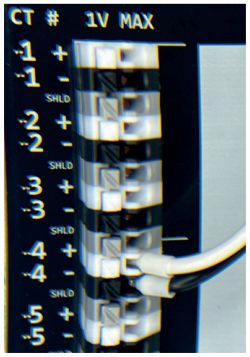



⑤ Route the twisted black and white wires from the ROG sensor to the DIRIS MCM meter. Be sure to route the lead wires so that they do not directly contact live terminals or busses.

⑥ Connect the white, black and gray wires to the white and black terminals on the DIRIS MCM meter



- If the white and black wires are reversed, the measured active power (kW) will be negative. Best practice is to fix the ROG sensor polarity by swapping wires on the DIRIS MCM terminals, but the MCM-View configuration software also allows you to perform a software correction.
- Be careful to match the ROG sensor to the voltage phases being measured. Make sure the ØA sensor is measuring the current on the ØA conductor, and the same for phases B and C. Use colored labels or tape to identify the wires.

Do NOT clamp or pull out NON-INSULATED conductors carrying DANGEROUS VOLTAGE which could cause an electric shock, burn or arc flash. Ref. IEC 61010-2-032

## 6.4. Splicing

When the standard lead wires of current sensors are not long enough, you can extend them by splicing on additional wire.

- You may want to shorten the original CT wires, especially if you are going to use shielded cable and ground the shield to earth ground.
- Avoid creating large loops or gaps between the white and black wires at the junction point, because this can increase electrical interference.
- Best practice is to use lever-nut splicing connectors (WAGO for example) which provide a secure and reliable connection of lead wires.
- Twist-on wire connectors (wire-nuts) can be used but only if they are rated for connecting the stranded CTs wires, typically #18 to #22 AWG to the gauge of the extension wire. Do not use wire nuts (typically red or yellow sizes) used for electrical work; they are too large to make reliable connections with smaller stranded wires! For reliable connections, be sure to follow the manufacturer's instructions.
- Butt splice and other styles of crimp connections can work well if a ratcheting crimping tool specifically designed for the crimp connector is use. Caution!: low-cost, general purpose crimping tools do not always make reliable connections. After crimping, tug on the wires to make sure that they do not pull out of the crimp.

# 7. DIRIS MCM METER DISPLAY

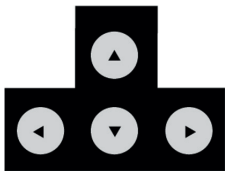
The DIRIS MCM meter can come with a native D-70 display to provide local measurement readings and the meter's IP Address.

⚠ The WEBVIEW-M web interface embedded in the D-70 display is currently NOT compatible with the DIRIS MCM power meter.

⚠ Connecting a USB cable from a laptop to the DIRIS MCM does not power the D-70 display.

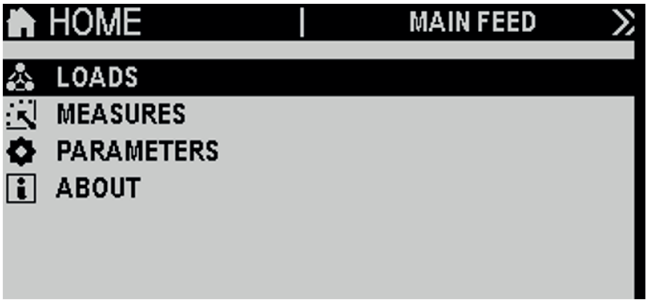
## 7.1. Display Buttons

The D-70 display consists of a screen and 10 capacitive key buttons:

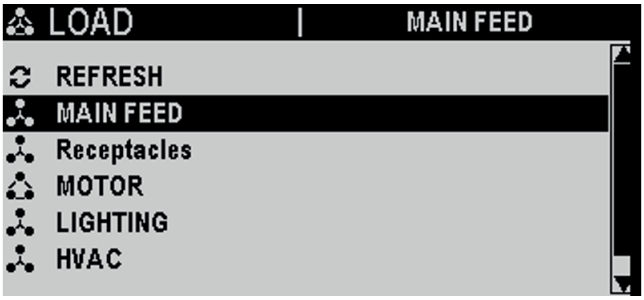
| | |
|---|---|
|   | Shortcut key for load measurement (current, kW, kvar, kVA, PF) |
|   | Shortcut key for electrical network measurements (line-to-neutral voltages, line-to-line voltages, frequency) |
|   | Shortcut for energy counters (kWh, kvarh, kVAh) |
|  | Navigation keys |
|  | Use this to go back to a previous navigation menu |
|  | Short Press: Use this to scroll through the different meters when you are in a measurement menu<br>Long Press: Displays the complete list of loads configured in the DIRIS MCM meter |
|   | Use this to confirm a navigation or entry selection |

## 7.2. Display Navigation

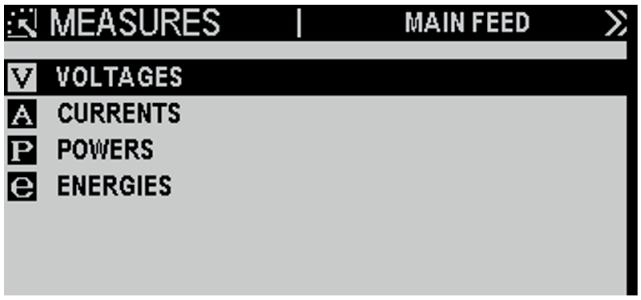
From the D-70 display home screen, pressing any key opens the main menu:



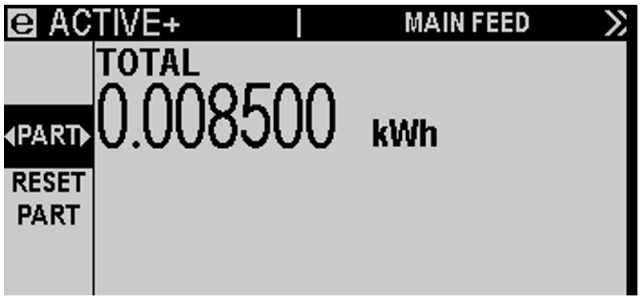

- LOADS: View the list of Loads configured in the DIRIS MCM from the MCM-View configuration software. Load names shown on the D-70 display match the ones configured in MCM-View.




- MEASURES: to access real-time measurement screens.



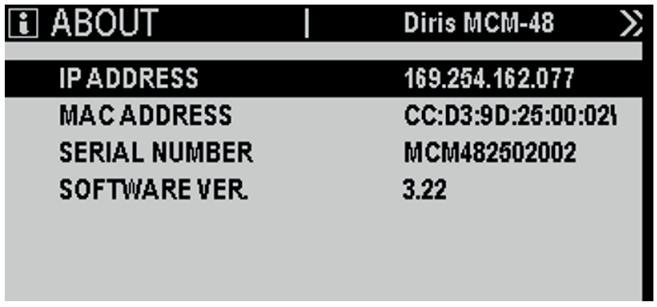

From a measurement screen, use the “DOUBLE ARROWS” to scroll from one Load to the next one:




You can also access measurement screens directly using the three display’s shortcut keys (IP, VF, E).

- PARAMETERS:
  - DISPLAY: allows to change the language of the display and update the password.
  - ETHERNET COMMUNICATION: to change the DIRIS MCM meter’s IP Address (DHCP is enabled by default)

- ABOUT: to view the DIRIS MCM system information including IP Address, MAC Address, Serial Number and Software version.

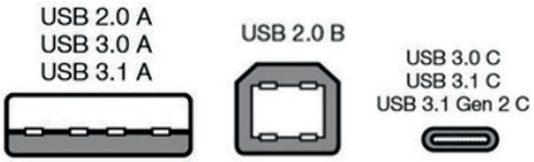


# 8. DIRIS MCM COMMUNICATION

The DIRIS MCM is a programmable device and must be configured to match the site conditions where it will be installed. The DIRIS MCM is configured through a PC Windows application called “MCM-View” running on a Windows computer (typically a laptop) connected over a Universal Serial Bus (USB).

## 8.1. Universal Serial Bus (USB)

The USB connection is intended for temporary use during configuration. The USB connection will provide power to the meter allowing it to be configured off-line. In response to the international standardization initiative around USB type C connectors, the MCM is transitioning away from the classical use of Type B connectors in this industry to Type C. In the interim, host computers may be connected using either Type B or Type C USB cables on the meter end. The host computer (laptop) end will either be Type A (also waning in popularity) or a Type C connection. The underlying protocol in both cases is USB 2.0. Under the 2.0 standard the DIRIS MCM is configured to negotiate for 500mA of operational current at 5.0 volts from the host.




**USB Pitfalls**

- Do not plug two cables into the DIRIS MCM meter at the same time.
- Some USB type C cables are intended for charging devices only and don’t contain data conductors.
- Do not plug USB C chargers into the DIRIS MCM meter.
- Modbus RTU is not currently supported over the USB interface.
- The use of USB hubs or port expanders may not provide the DIRIS MCM enough current to operate, especially if using a radio module. Best practices are to connect to the host PC directly.

**Trouble Shooting USB**

The PC Windows driver used with the DIRIS MCM is included in Windows 8 and beyond. There are some known resource conflict / arbitration issues that may prevent your computer from recognizing the meter. Please see the appendix materials for additional information.

## 8.2. Ethernet

The DIRIS MCM can connect to a Local Area Network (LAN) using Ethernet 10/100 Base T signaling.  This speed is typical of Cat 5 or Cat 6 wiring.

**Ethernet**

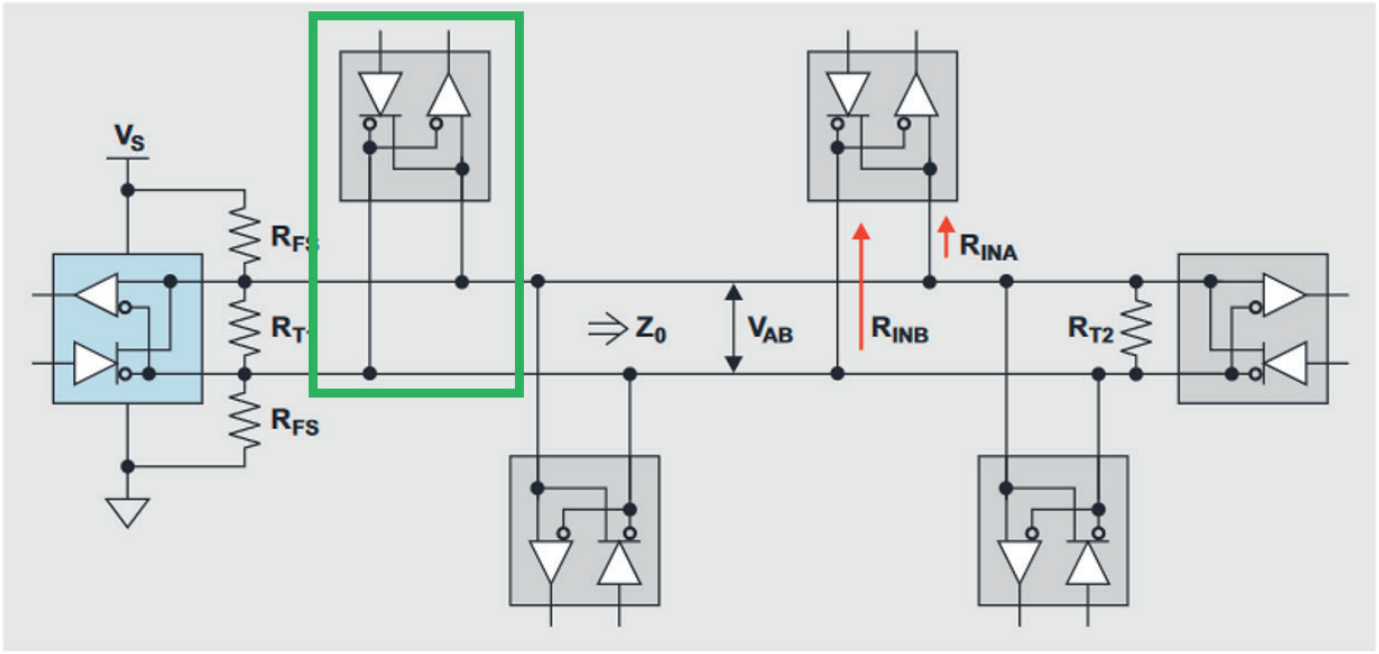
- MCM-View (configuration program) communicates over USB, not Ethernet.
- The system default is DHCP. Static addresses can be set using MCM-View
- Direct PC to Meter connections using third party Modbus tools will require Static addressing.

## 8.3. Serial Peripherals

The DIRIS MCM serial connection points include auxiliary power (PWR), RS-485, and Radio Connectors. The Auxiliary power and RS-485 connections are color coded to match the supplied 4 conductor radio cable with the RF-HUB node wireless system. Color coding reduces wiring errors in cases where the radio needs to be remotely mounted requiring the supplied cable to be spliced and extended. This connection can be extended up to 100 ft.

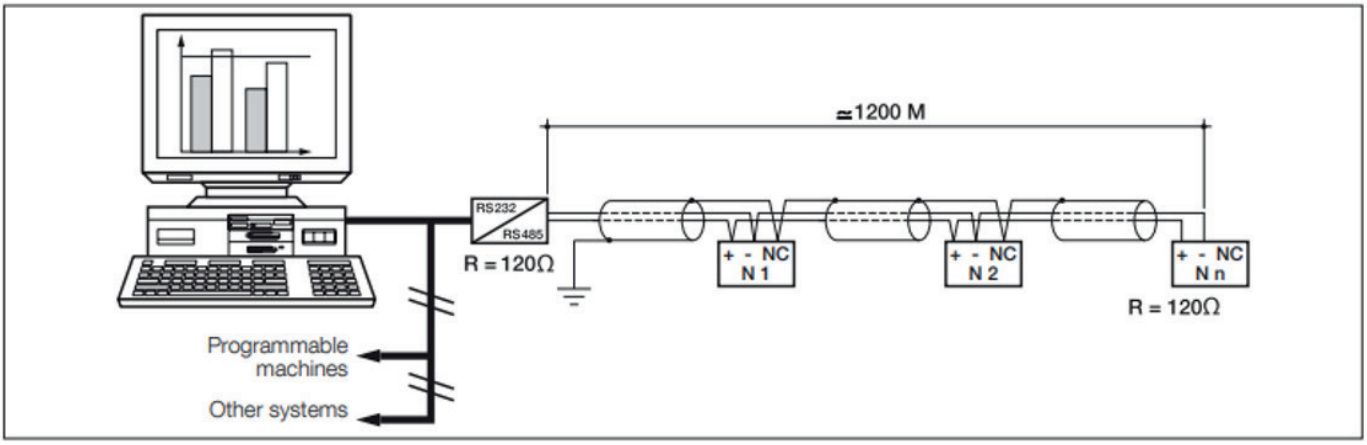

### Serial Connector

The DIRIS MCM serial connector is an RS-485 slave device with a 1/8 impedance load and is designed to connect as a stub connection in a multidrop twisted pair network (below in green).



**RS-485**

- The DIRIS MCM meter does NOT include 120 ohm termination resistors.
- Adding a 120 ohm resistor across the A/B terminals may help if the meter is at the end of the physical network.
- Best practice is to place “bias resistors” at the RS-485 Master. These are often neglected.
- The reference terminal is connected to earth ground through a 250 ohm resistor and may help if the common mode signal is out of the transceiver range of +5 to -9 volts DC.




Typical RS-485 Wired Network

### Aux Power

The Auxiliary power connector provides +24 VDC for powering an RF End node accessory radio. The steady state power available from this connector is ¼ watt, peaking to ½ watt. Attaching a load greater than this may work temporarily but will eventually overheat the power supply causing an interruption in power to the entire meter.

### Radio Connector

The Radio connector is simply a more convenient physical connector than the spring block and is internally tied to the Aux power and RS-485 terminals beside it. The RF End node will be supplied with a connector having a mating plug with this connector.

### RF Wireless Peripherals

See the section on MCM accessories.

# 9. CONFIGURING THE DIRIS MCM

The MCM-View application is a PC Windows application used to visualize and configure settings for the DIRIS MCM. It is an intuitive graphical application designed to configure settings on the DIRIS MCM meter, show real time measurements, and suggest configuration fixes in the case of an incorrect setup.

The configuration is also reflected and available for Read / Write access through Modbus registers. Minor edits to existing configuration elements can be done with low risk using registers but new content creation is highly discouraged. MCM-View uses validation rules to ensure that the only valid configurations are saved to the meter. Writing configuration registers over a third-party tool may lead to internally inconsistent definitions or an inoperable meter. Please contact Socomec if there is a need to remotely configure a fleet of power meters.

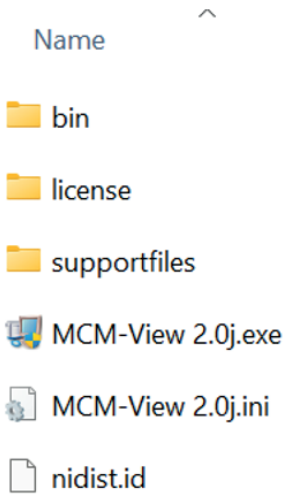
For a step-by-step guide on configuring your DIRIS MCM power meter, watch our tutorial video at: www.youtube.com/watch?v=KNZ0ODKNqzY

## 9.1. MCM-View installation

The MCM-View application can be downloaded as a zip folder from the Socomec website at the following link:

https://www.socomec.us/en-us/mcm-view-product-software

Best practices are to copy the zip folder to your local computer and then then unzip it. Double click on the «MCM-View xx.exe» file to start installation.




**PC Security / Virus Checkers**

- PC security measures can interfere with the installation procedure causing it to fail.
- The installation may take more than one attempt after clearing files identified by a virus checker.
- The PC permissions may need to be elevated to Administer to provide access to needed locations.

Upon successful completion of the installation process a shortcut will appear on the desktop as shown below. Use this icon or launch the software as MCM-View under the windows icon.

## 9.2. MCM-View Modes

There are two viewer modes: offline and online mode. When the program is in offline mode, it means there is not a meter connected to the computer. This mode restricts the content of the MCM-View to allow the creation of a meter configuration and save it for future use. This feature allows some work to be conducted ahead of a installation based on documentation. All functions are available in online mode.

### Connecting a Meter

First connect the DIRIS MCM to the configuration PC over a USB cable before launching the MCM-View application. This will avoid the application opening in Offline Mode!

A meter that is connected while MCM-View is in offline mode will not be recognized by the program. To fix this, restart MCM-View.

When MCM-View is opened after a meter is connected it will automatically connect to the meter and read the configuration currently saved to the meter. If MCM-View is opened when there is not a meter connected to the computer, MCM-View will notify the user and begin in offline mode.

**USB Sounds**

- A computer with a working sound output will produce a sound notification “bo-deep” if the computer can successfully enumerate a COM port.
- Disconnecting a DIRIS MCM meter will free up the com port with a disconnecting sound notification “de-boop”.

## 9.3. MCM-View Tabs

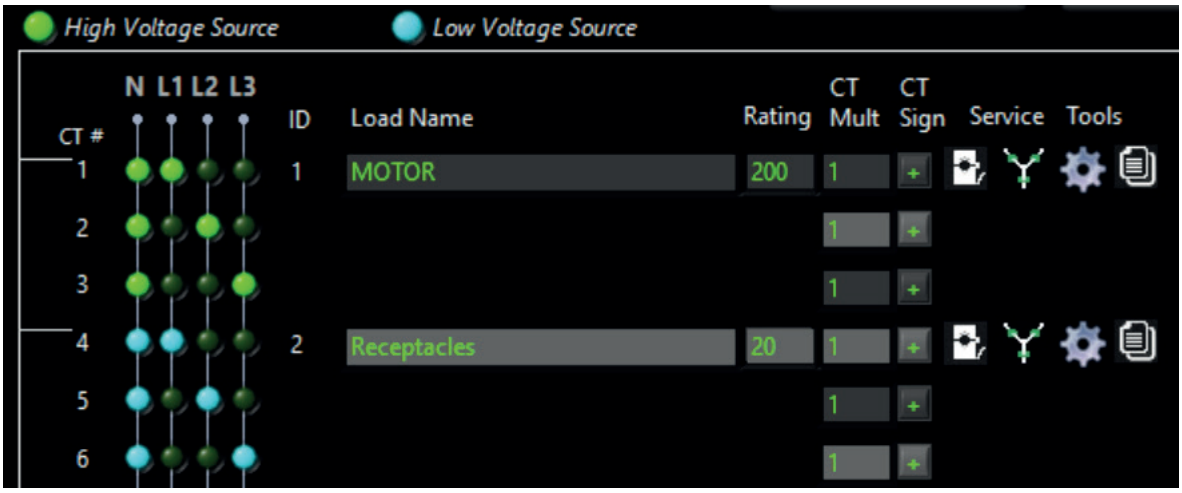
The MCM-View is navigated using four tabs: Configuration, Realtime, Utility, and Load Analysis.

- Configuration: Offers an all-in-one view of the current configuration of the meter. The configuration can be easily edited from this tab by pressing the “gear” settings icon next to each indicated load.
- Realtime: Displays the current readings from the meter. An in-depth view of real time values for each load can be accessed by clicking on the Zoom button next to the load.
- Utility tab: allows for viewing and editing of metrology settings, RS-485 settings, and Ethernet settings. It also provides a way to perform a firmware upgrade of the meter.
- Load Analysis: Analysis three phase wye loads and identifies potentially misconfigured elements and suggests possible corrections.

### 9.3.1. Configuration tab

**Parts of a Load (Element)**

A load (also referred to within this industry as an element) represents a single load and its configuration within a multi-element meter. Each load in MCM-View corresponds to a physical set of current transformer inputs on the DIRIS MCM meter. Loads are made up of one, two, or three CT’s and their configuration. Each CT is numbered in MCM-View in the same format as the CT connection points on the DIRIS MCM meter. A small ‘-‘ mark helps identify groups of three where configurations restrictions exist




The above image shows an example configuration for a single element. The above element is named “LOAD1”. The load type is Wye (3P+N – 3CT) with a voltage reference configuration of: L1->N, L2->N, L3->N respectively. The load has been configured to use a current transformer with a 100 amp rating and a multiplier of 1.0.

⚠ CT connection points designated in green are linked to the primary voltage reference, whereas those designated in blue correspond to the secondary Low Voltage input.

Below are icons found on the configuration tab and their meaning:

Clicking here will open the Load Configuration dialog window.

Clicking here will open the Copy Configuration dialog window.

Represents that the load is using a magnetic-core CT.

Represents that the load is using a Rogowski coil.

Represents that the load is configured as a 3CT Wye load (3P+N - 3CT).

Represents that the load is configured as a 2CT Delta (3P - 2CT).

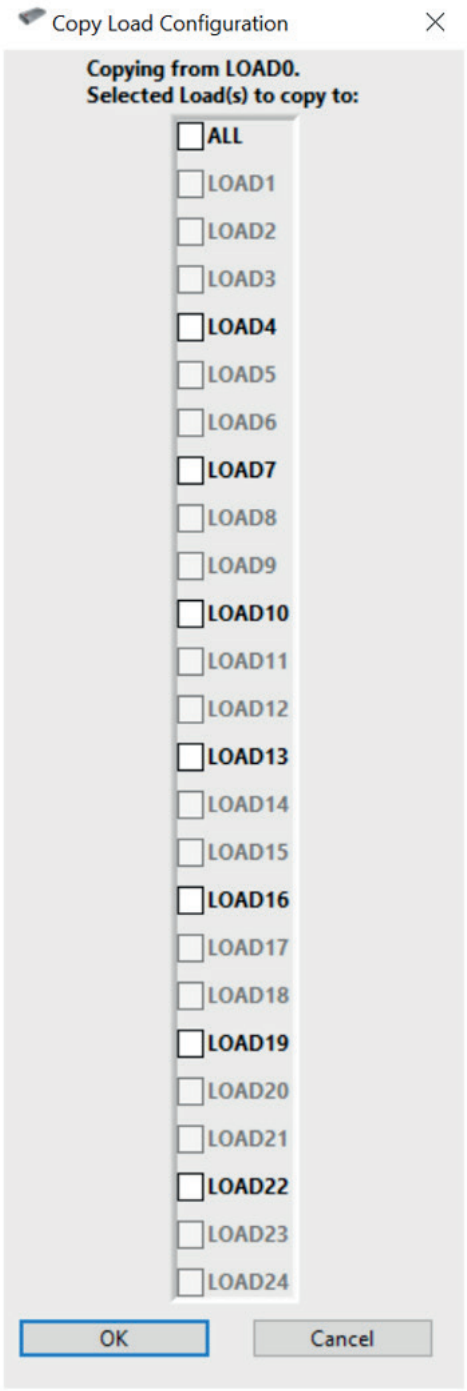
Represents that the load is configured as a 3CT Delta (3P - 3CT).

Represents that the load is configured as a Single-Phase plug load (1P+N - 1CT)

Represents that the load is configured as a Split Phase load (2P+N - 2CT).

### Copying Loads

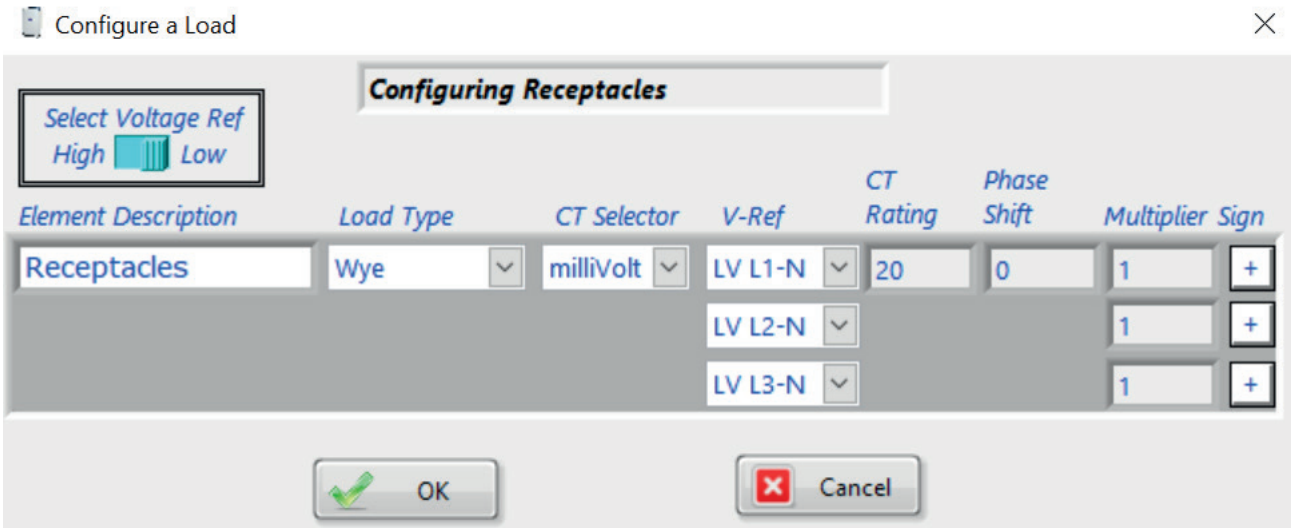
Clicking on the “Copy Configuration” icon will open the Copy Load Configuration Dialog window. In this window, select all the loads to copy the selected configuration to. Clicking “OK” copies this configuration from the source load to all selected destination loads. Checking the ALL option will automatically check all available loads of the source type. To exit this dialog without making changes, click the Cancel option.




When copying from loads 1-24 (left side of the DIRIS MCM), the user will only be able to select loads 1-24 as the destination. When copying from loads 25-48, the user will only be able to select lines 25-48 (right hand side of the DIRIS MCM) as the destination. Copy ignores the **name** of the load.  Be sure to give each load a unique and meaningful name to help reduce errors.

### Configuring a Load (Element)

To configure a load (element), click on the “Load Configuration” icon. This will open the Load Configuration dialog window containing the user selectable items described below.




#### 1 - Select Voltage Ref

This selection assigns each load to the proper voltage reference (High / Green for the primary MCM voltage input and Low / Blue for the secondary Low Voltage MCM voltage input). Selecting the voltage Reference will automatically update the corresponding values in the V-ref colum

#### 2 - Element Description

The name of the element that is currently being configured. This name will appear on the Configuration tab next to the configured element. This field is limited to 15 characters.

#### 3 - Load Type

Clicking this drop-down will open the Load Type Selector Dialog. The options for load type are: Delta, Wye, Split Phase, and Single Phase. From this selector a channel can also be turned off by selecting 1 CH OFF or 3 CH OFF to turn off one or three channels, respectively. This is covered in more detail below.

#### 4 - CT Selector

Clicking this drop-down will open the CT Selector Dialog. The options for magnetic-core CT’s and Rogowski Coil CT’s. There is also an option available for selecting and entering a custom CT with custom rating and phase shift values.

#### 5 - V-Ref

The V-ref drop-down selection is used to assign each load to the proper voltage reference (L1-L3 for the main voltage input and LV L1 - LV L3 for the secondary Low Voltage input), ensuring correct power and energy calculations.

#### 6 - CT Rating

This is automatically filled when choosing a Socomec CT. This field can be changed by selecting the custom CT option in the CT Selector and filling in the relevant CT rating in the CT Selector Dialog.

#### 7 - Phase Shift

This is automatically filled when choosing a Socomec CT. This field can be changed by selecting the custom CT option in the CT Selector and filling in the relevant CT phase shift in the CT Selector Dialog.

#### 8 - Multiplier

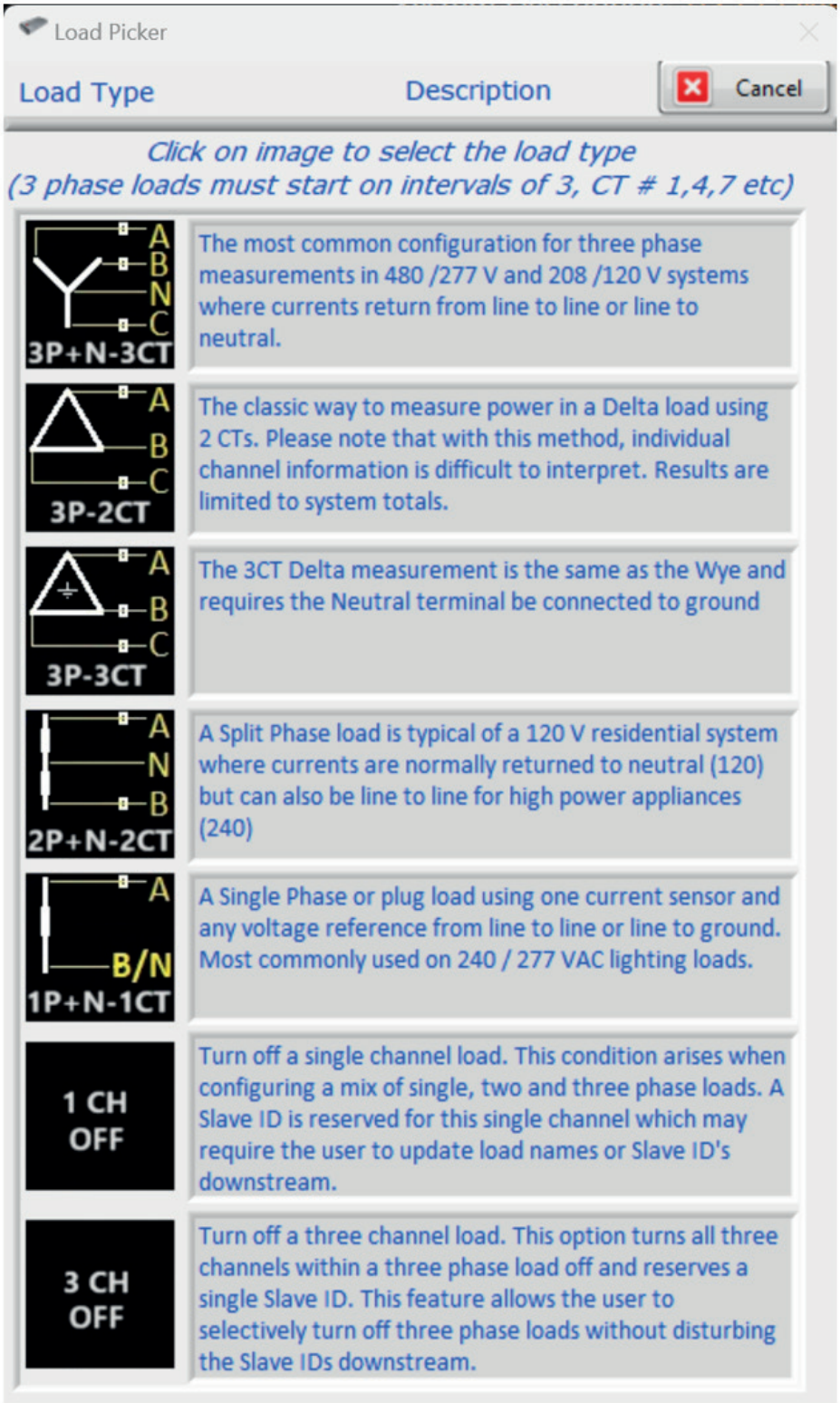
A CT multiplier can be used to multiply the selected range by a multiplication factor. Common uses of this multiplier include cascaded CT’s where an existing 5 amp CT is buried inside a panel and a second “mV” type CT is installed to the secondary. Here a multiplier can be used to account for both CT ranges.

#### 9 - Sign

Changing the sign from + to – reverses the direction of the relevant CT. This is used to help correct a backwards CT when the wiring is no longer accessible. It is always best practice to correct wiring errors rather than rely on electronic compensation.

### Load Type

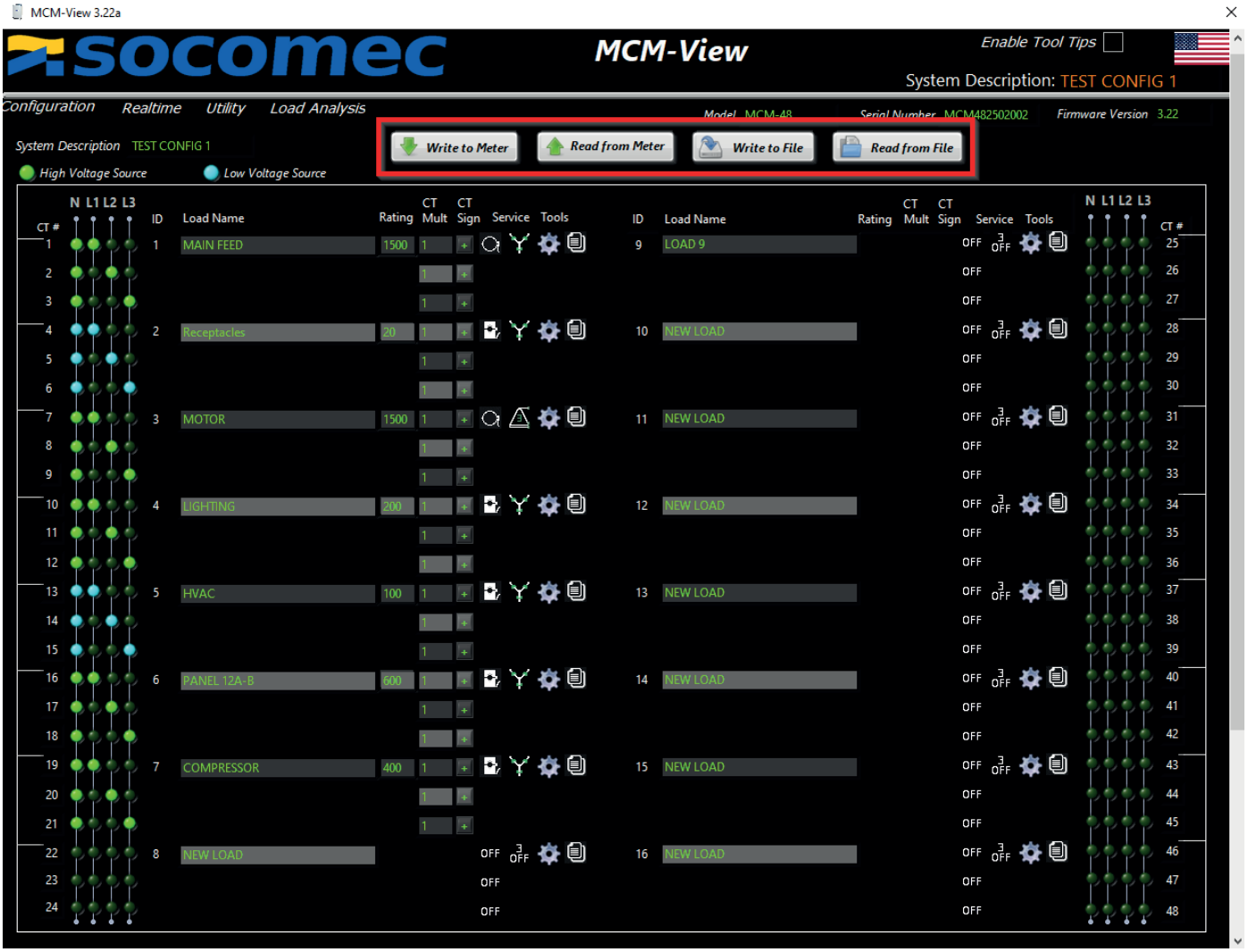
The load types supported by the DIRIS MCM are shown below along with some common use cases.




Supported Load Types.

### Writing and Saving Meter Configurations.

The content displayed on MCM-View shows the desired configuration. This configuration only takes effect when written to the meter's memory.




#### 1 - Write to Meter

Saves the configurations displayed to the meter. This function is unavailable in offline mode.

#### 2 - Read from Meter

Reads the configurations currently saved to the meter and loads them into the display so they can easily be viewed and changed. This function is unavailable in offline mode.

#### 3 - Write to File

Saves configured settings to a file stored on the computer at the path: "Documents\Socomec\DIRIS MCM".

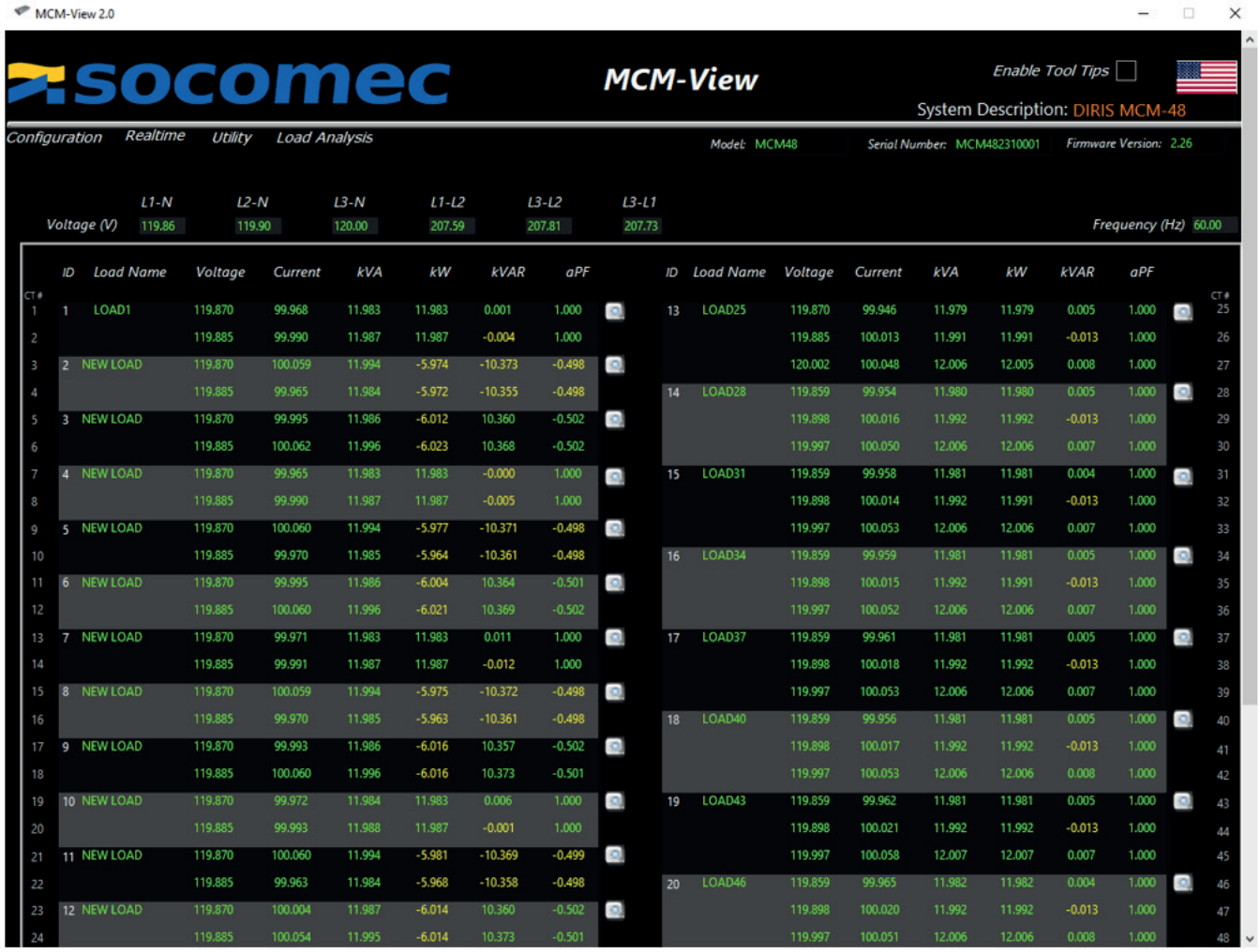
#### 4 - Read from File

Opens a dialog to select a file to read input from. The selected file will be read and its settings are shown in the display. Note that reading settings from file does not automatically save those settings to the meter.

Note that reading settings from file does not automatically save those settings to the meter. To save settings shown in the display to the meter, click the "Write to Meter" button.

## 9.3.2. Realtime Tab

The Realtime tab shows readings for each of the configured loads in “Real Time”. If an element has been configured to be off, an empty placeholder will show in the display for the relevant CTs. Loads are visually separated by black and grey background boundaries.




On this page you will find the measured line to neutral and line to line voltages which are common to all loads.

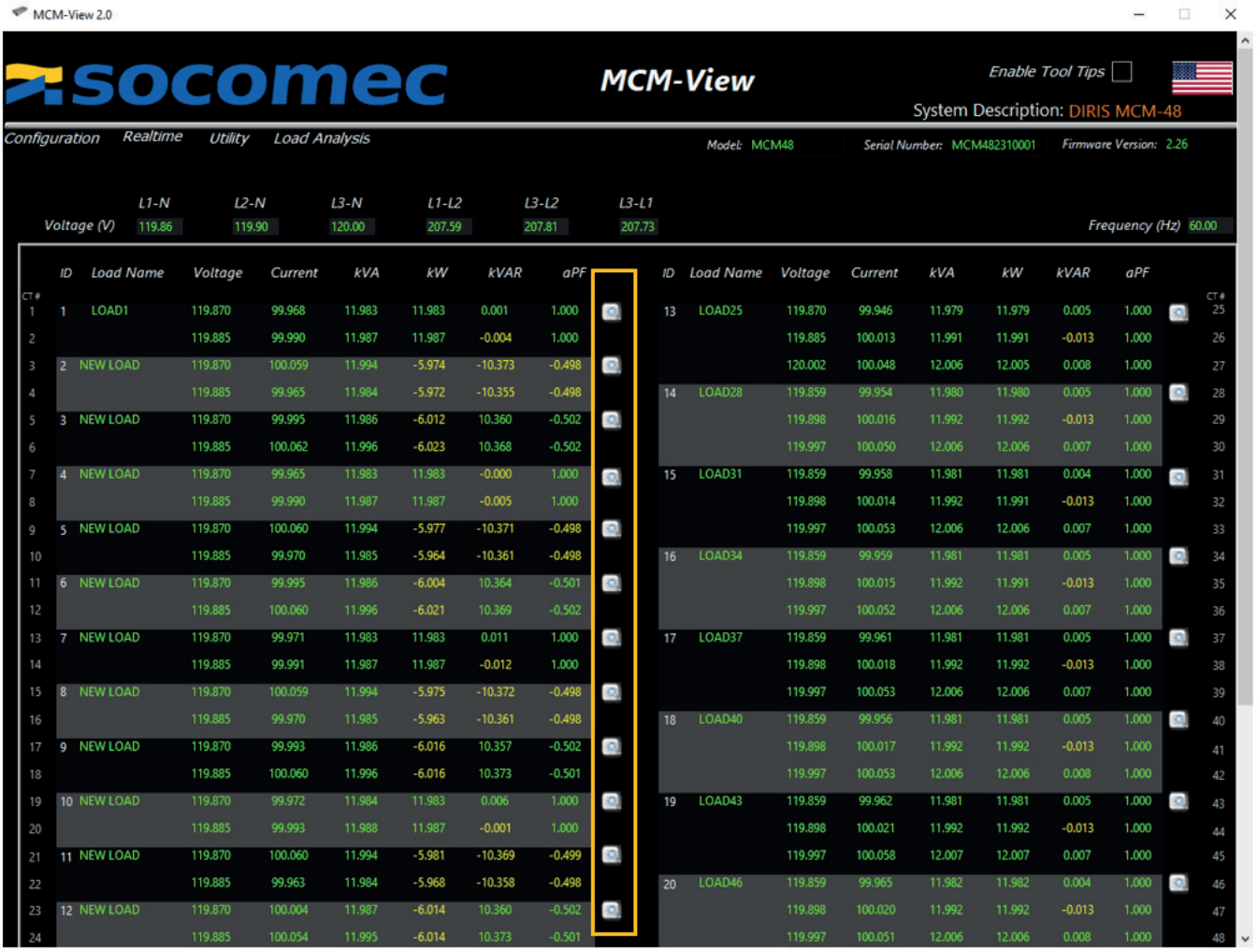
The real time readings update approximately every 2 seconds depending on the speed of the host computer. The following measurements are displayed for each load:

- Voltage
- Current
- kVA – Apparent Power
- kW – Active Power
- kVAR – Reactive Power
- aPF – Apparent Power Factor

The measurements are validated against typical conditions and change color to draw attention to loads that may indicate a configuration mistake.

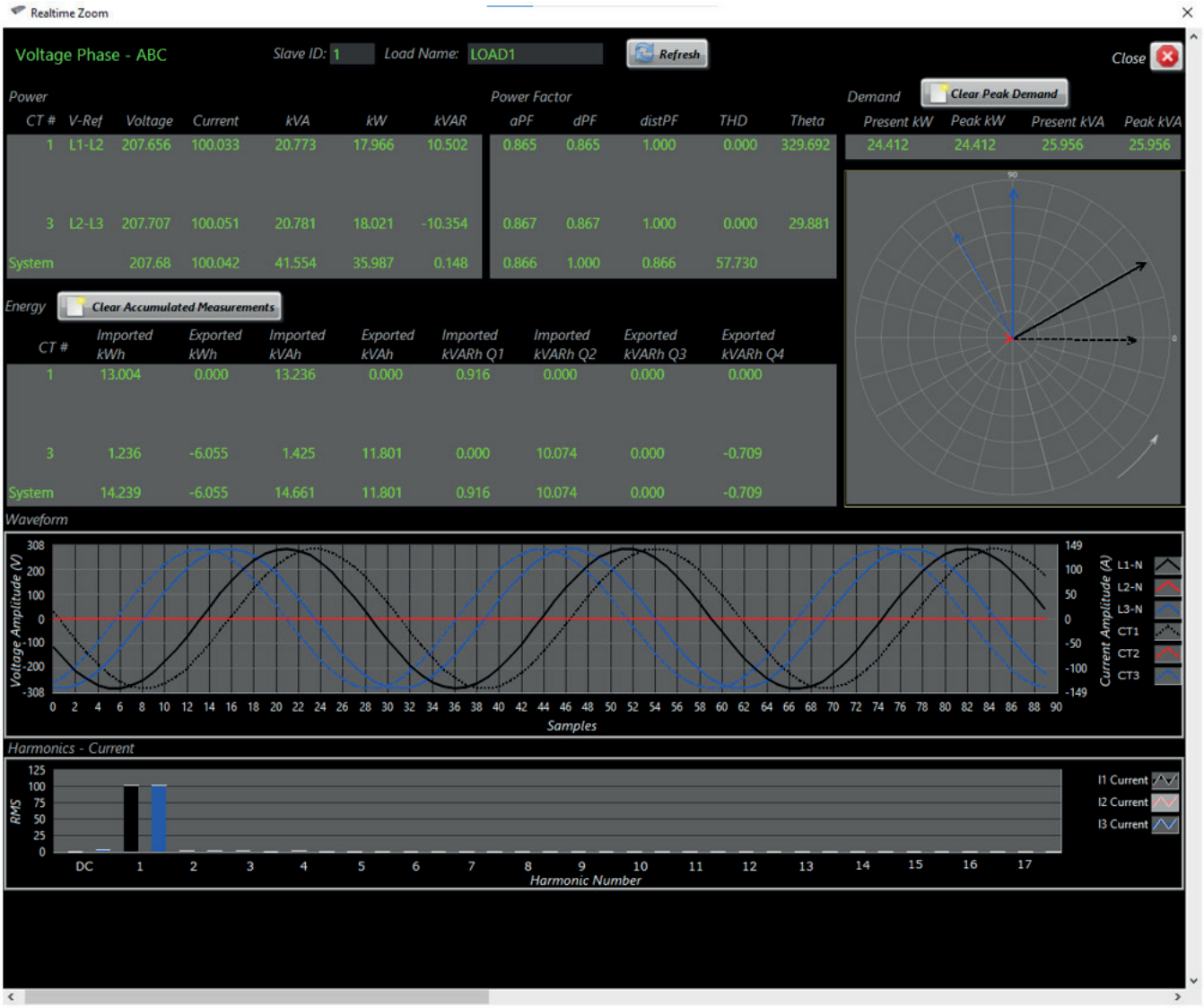
Green text in this application indicates that the field is “read only”. A yellow value indicates one of the following:

- The current is less than 0.5% of its CT rating,
- The kW and/or kVAR are negative (which may indicate a configuration error), or
- The absolute power factor is less than 0.5




A more detailed version of each load can be viewed by pressing the magnifying glass button (Zoom tool) next to the load you want more detail on. This opens up the Realtime Zoom screen.

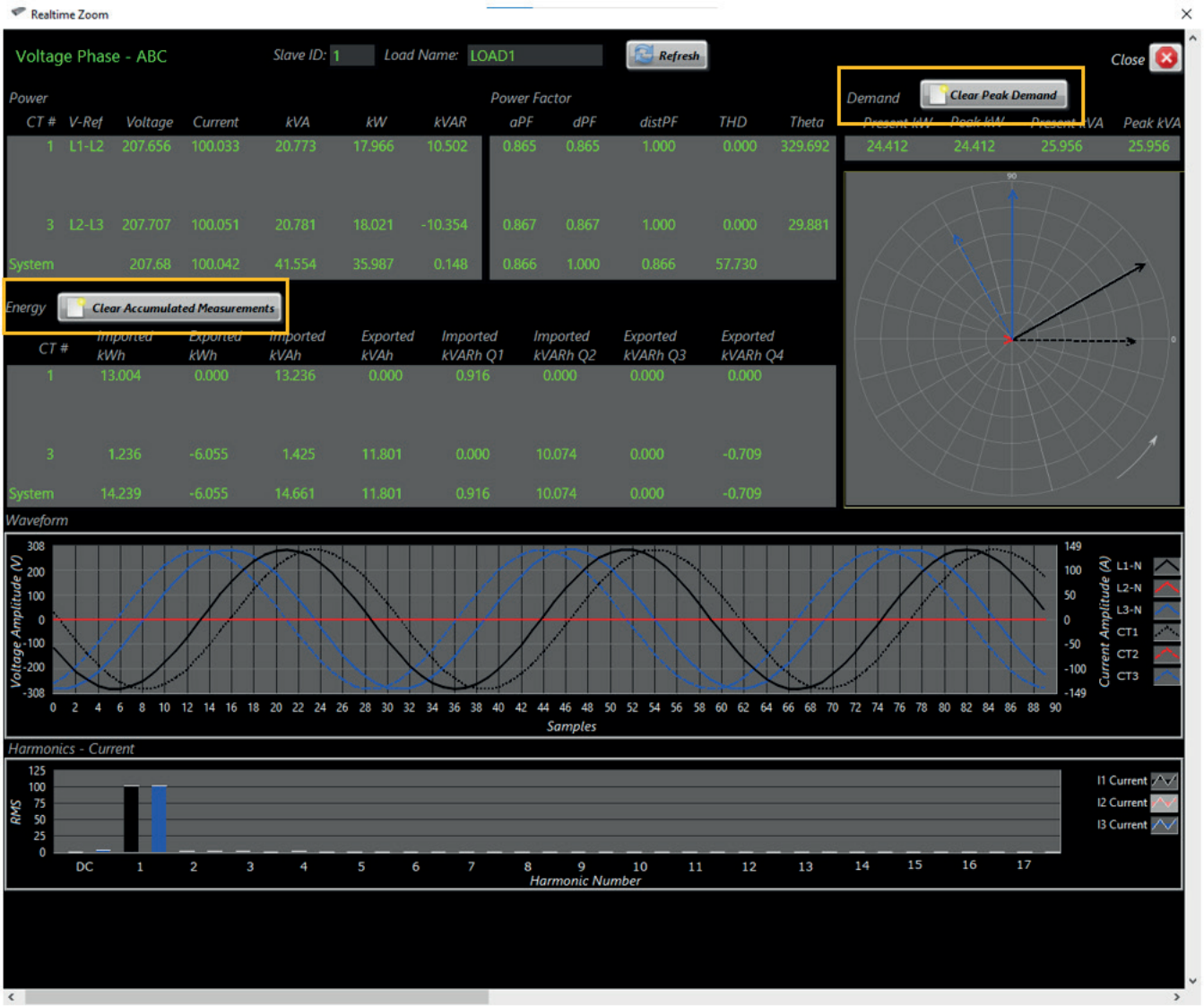
## Realtime Zoom




The Realtime Zoom feature displays more detailed information about the selected load. Each Realtime Zoom page displays the following measurements for each channel:

- Voltage
- Current
- kVA – Apparent Power
- kW – Active Power
- kVAR – Reactive Power
- aPF – Apparent Power Factor
- dPF – Displacement Power Factor
- THD – Total Harmonic Distortion
- Theta – Angle between the voltage and the current
- Imported/Exported kWh – Active Energy
- Imported/Exported kVAh – Apparent Energy
- Imported/Exported kVARh – Reactive Energy

There is a polar plot of the voltage and current vectors in the upper left of the Realtime Zoom page. The image uses the voltage vector associated with the first CT as the 0 degree reference. To collect a new data set for visualization, click the refresh button.




From this page, you can clear all accumulated values for the selected load by clicking the “Clear Accumulated Measurements” button. You can also clear the peak demand for the selected load by clicking on the “Clear Peak Demand” button.

The waveform graph visualizes the voltage and current based on a 20 millisecond sample. This data will move when refreshed.

The harmonics chart displays the computed current harmonics based on a 20 millisecond sample. Note that higher harmonics are slightly under-reported due to measurement bandwidth.

Note that this view does not show values updating in real-time. To update the values, click the “Refresh” button at the top of the screen.

Note that the measurements show in the Realtime Zoom page do not update in real time. To update the values, click the “Refresh” button found at the top of the page next to the Load Name.

## 9.3.3. Utility Tab

### Clear Commands


#### 1 - Clear Peak Demand of all Elements

Clears the peak kW and kVA of all loads. This can be verified by looking at the Realtime Zoom page of each element under the Realtime tab.

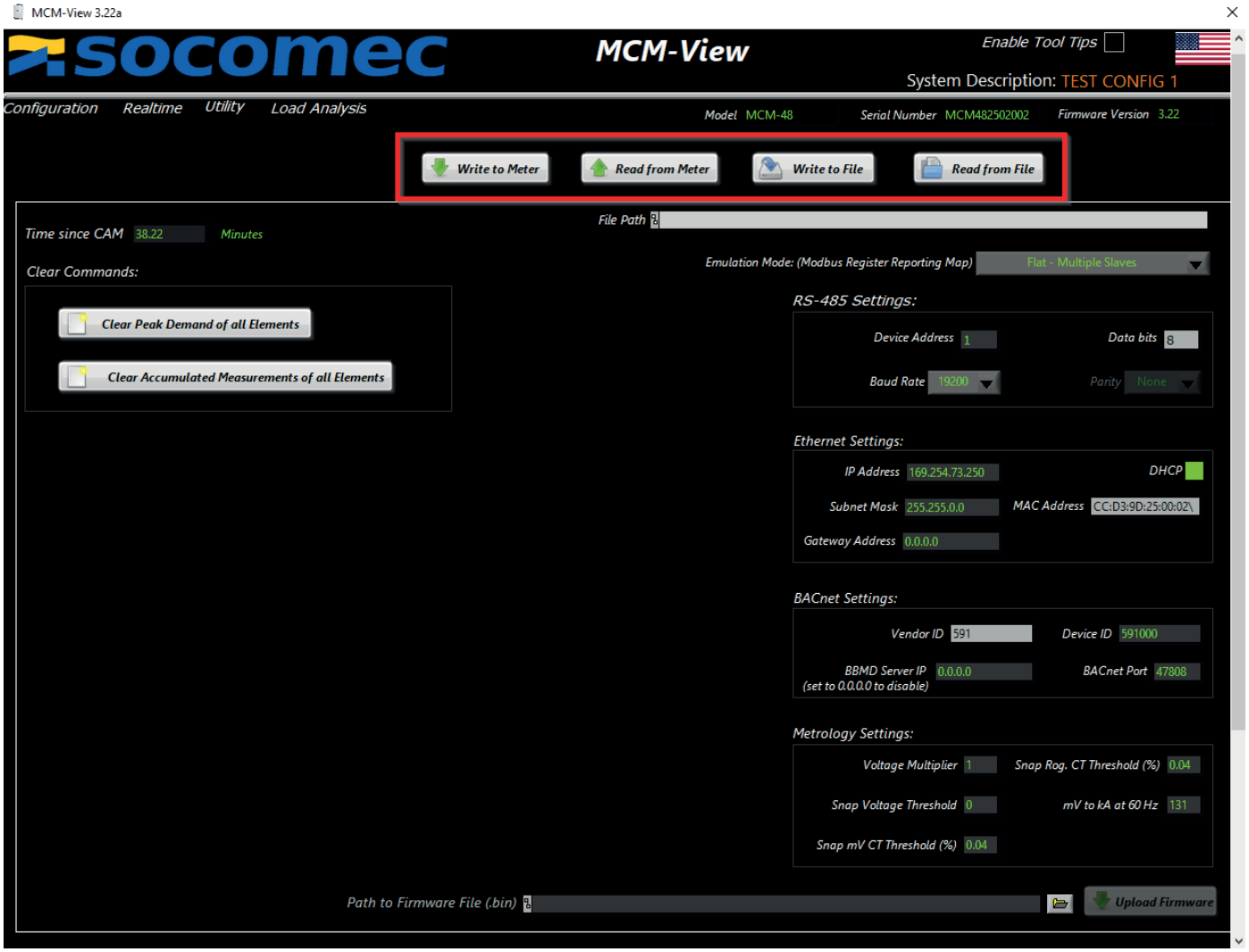
#### 2 - Clear Accumulated Measurements of all Elements

Clears the accumulated measurement readings for all loads. This can be verified by looking at the Realtime Zoom page of each element under the Realtime tab.

#### 3 - Time Since CAM

Shows how much time has elapsed since the last time all accumulated measurements were cleared. When the “Clear Accumulated Measurements of all Elements” button is pressed, this value will start counting up from 0 seconds. To update this value, read settings from the meter or switch to a different tab and then return to the Utility tab.

## Save Settings




### 1 - Write to Meter

Saves the configured settings for RS-485, Ethernet, and Metrology and stores them in non-volatile memory on the meter. This function is not available in offline mode.

### 2 - Read from Meter

Reads the saved settings from non-volatile memory on the DIRIS MCM that is connected. These settings will be displayed so they can easily be viewed and changed. This function is not available in offline mode.

### 3 - Write to File

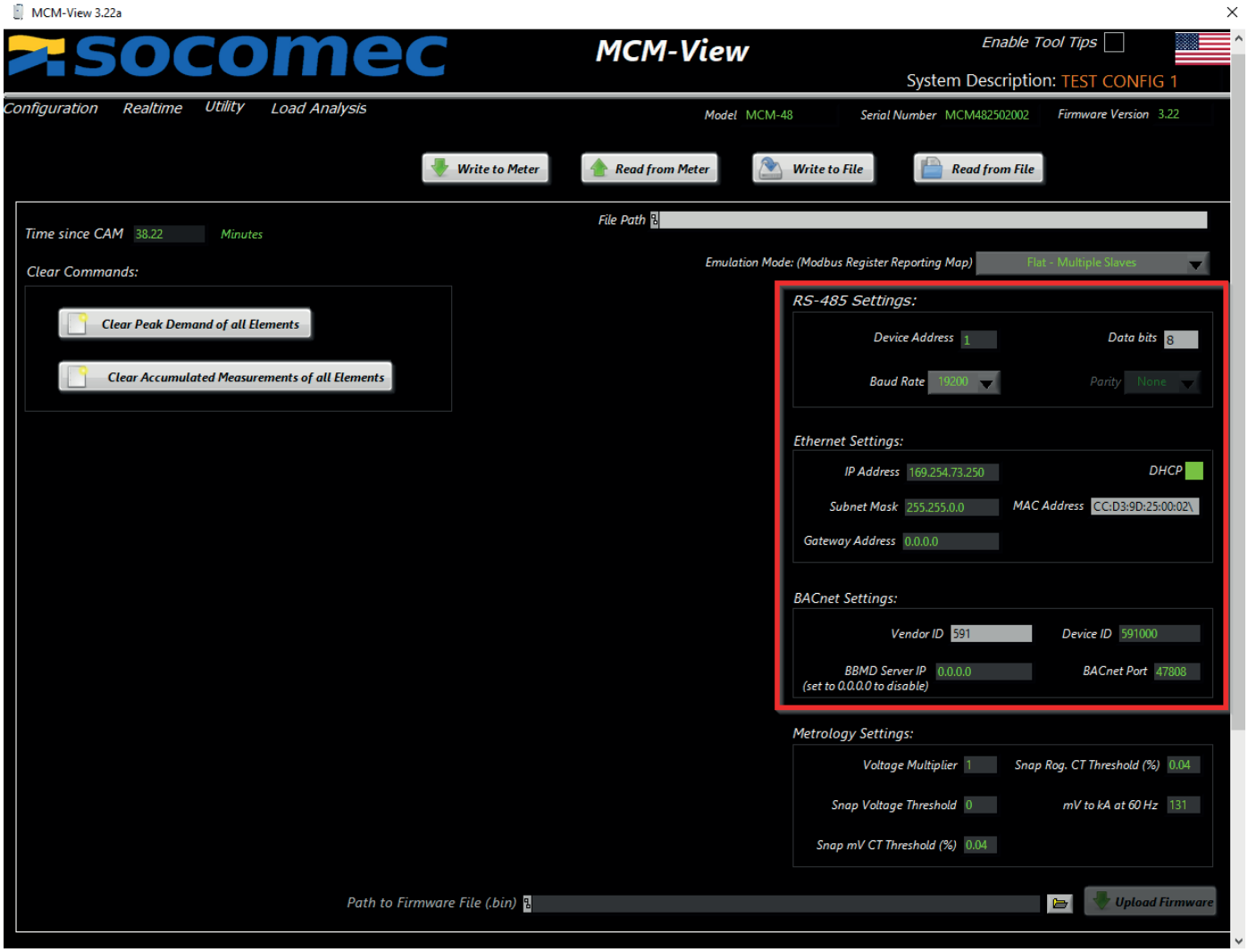
Saves the currently configured settings to a file store on your computer at the following path: “Documents\Socomec\DIRIS MCM”.

### 4 - Read from File

Opens a dialog to select a file to read input from. The settings saved in the selected file are shown in the display

Note that reading settings from file does not automatically save those settings to the meter. To save settings shown in the display to the meter, click the “Write to Meter” button.

## RS-485, Ethernet and BACnet Settings




The RS-485, Ethernet and BACnet Settings allow for different ways for a user to communicate with the meter. Refer to these settings to define the parameters for a serial communication or an Ethernet connection. These settings can be modified to match the user's needs.

If a DHCP server is available, check the DHCP box, and save the settings to the meter. Give the DHCP server time to assign an IP address (up to 20 seconds or more), and then click the "Read from Meter" button. If an available IP address was assigned by the server, it will populate in the "IP Address" box when settings are read from the meter. If an available static IP address is known and a DHCP server is unavailable, put the available IP address in the "IP Address" box.

## Metrology Settings


### 1 - Voltage Multiplier

A potentiometer ratio, if there is one installed in the measurement system. The multiplier can also be used for field calibration, if necessary.

### 2 - Snap Voltage Threshold

Defines when the meter will report 0 instead of displaying a small value. Expressed in volts. Unused voltage inputs will fluctuate unless they are tied to neutral or ground.

### 3 - Snap mV Threshold

Defines when the current for mV magnetic core sensor types will report 0 instead of displaying a small value. Expressed as a percentage. Settings this value prevents that are turned off from accumulating energy.

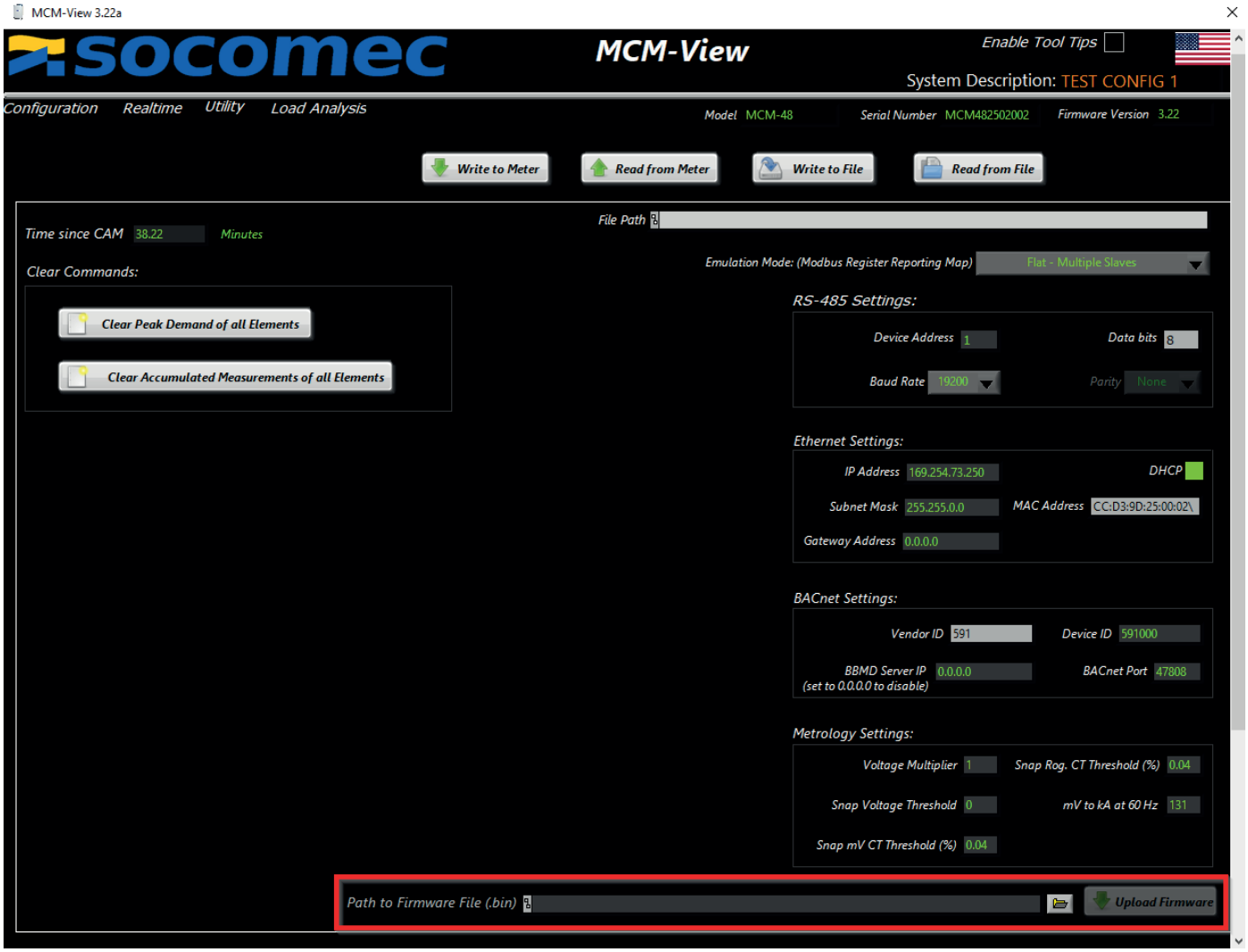
### 4 - Snap RoCoil Threshold

Defines when the current for Rogowski types will report 0 instead of displaying a small value. Expressed as a percentage. Settings this value prevents that are turned off from accumulating energy.

### 5 - mV to kA at 60 Hz

Controls the amplitude characteristics of Rogowski coil current sensors. The default value is 131 (mV per kA at 60Hz).

## Firmware Upgrade




The firmware upgrade tool in the MCM-View provides the simplest way to upgrade the firmware of the DIRIS MCM. To select a file, click on the open folder button. Only files with a .bin extension will be accepted.

Once a file has been selected, click the “Upload Firmware” button. This starts the process of loading the firmware onto the DIRIS MCM. Once the upload has begun, it takes 30 - 60 seconds to update the meter.

Do not disconnect the meter from the computer while the firmware is being updated. This could result in a loss of data and may make the meter inoperative.

## 9.3.4. Load Analysis

MCM-View includes a tab dedicated to Load Analysis. This tab can be helpful in trouble-shooting common wiring errors in three phase Wye circuits. The polar plotting on this page is an idealized diagram based on the selected load type and the reported values in the associated tables. These plots are not based on FFT analysis as is done in the Realtime Zoom page.

**Load Analysis:** The methodology used by the load analyzer is effective for normal loads found in commercial buildings with power factors above 0.60. This utility will not work on Power Factor Correction Capacitors, chemical plating loads etc. It is up to the user to decide whether the load is correctly instrumented or not. This information is provided to prompt the user to double check if the loads are unusual which may result from an incorrect configuration such as the CT type or phase assignments.


### 1 - Voltage Phase Rotation

Although the DIRIS MCM meter does not need to know the voltage rotation to correctly compute power or energy, it is helpful in visualizing the electrical system. This field indicates the measured voltage rotation (ABC or ACB). The polar diagrams are always drawn to reflect counterclockwise rotation but will swap the L2 and L3 vectors in reflection of the detected voltage rotation.

### 2 - Load Table Names

The Load Names for all Wye configured loads will be presented in this table. Two-Phase and Single-phase loads do not include ambiguity and cannot be ranked by correlation. Graphical corrections for Delta + 2CT loads using Blondell metering theory will not generate recognizable diagrams and have been omitted.

### 3 - Status

An indicator provides a glimpse at the status of each Wye configured load. **Green** indicates a load where Power Factor, Power, and VAR sign reflect normal loads. **Yellow** indicates a load where the VAR is negative. This is becoming more common with electronic loads or high efficiency lighting but should be reviewed. **Red** indicates that the power is negative. Unless it is known that the load is a source (PV, Wind, etc), this typically implies the CT was installed backwards.

### 4 - Plot

This radio button selects which load is being analyzed.

### 5 - Legend

Describes the meaning of the Status legend.

### 6 - System As Configured

The data table and polar plot in this section reflect the data coming from the load under the existing configuration. The polar plot is an idealized plot based on detected rotation and numeric values.

### 7 - Solution Maximizing System Power with Positive Total VAR

Using the data coming from the “As Configured” system, the Load Analyzer computes all the possible combinations that would result from changes in the instrumentation and visualizes that solution with the constraint that the total VARs are positive.

### 8 - Solution Maximizing System Power with Negative Total VAR

Using the data coming from the “As Configured” system, the Load Analyzer computes all the possible combinations that would result from changes in the instrumentation and visualizes that solution with the constraint that the total VARs are negative.

### 9 - CT Configurations

The CT configuration table underneath each respective solution explains how to re-arrange the existing CT’s to produce the estimated results. For example, CT1 -> CT2R suggests that the CT wires be removed from Channel 1 and inserted into Channel 2, but in a backwards orientation. Again, these are suggestions that correct typical installation errors. When the term “OK,OK,OK” exists, it means that the “As Configured” solution matches one of the two possible maximum power solutions and is probably correct, nice job!

### 10 - Accept Alternate Solution

If it is determined that an error has been made in the instrumentation and it is not possible to physically change the CT connections, then it is also possible to correct the installation by re-defining the voltage references used for this load. This is accomplished by pressing the button beneath one of the suggested alternative solutions. This is only recommended when the installer no longer has access to the DIRIS MCM or wants to quickly experiment where uncertainty exists.

### 11 - Refresh

The data on this tab is static unless a new load is selected using the Plot radio button or the refresh button is pressed. Either action will cause MCM-View to acquire a new 20 millisecond sample from the meter.

# 10. MODBUS COMMUNICATION

The DIRIS MCM power meter supports Modbus communication:

- Modbus RTU over RS485
- Modbus TCP/IP communication

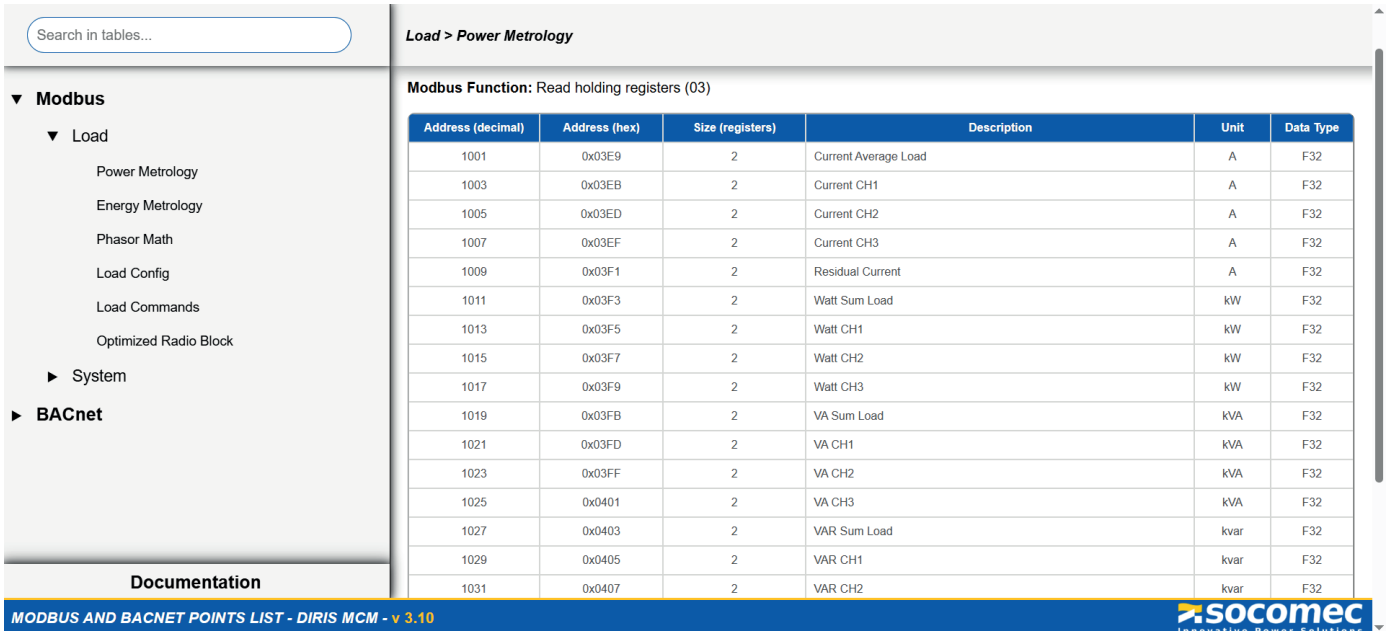
## 10.1. Modbus register documentation

Modbus and BAcnet register documentation is available on the socomec.us website at the following link, scrolling down to Resources section.
https://www.socomec.us/en-us/p/diris-mcm

The BACnet point list can be found in the BACnet section of the same document. Refer to the next chapter for more information on the BACnet communication protocol.

One important concept is the classification of data objects to be belonging to a “System” or “Load” scope.

System Scope: Settings, objects, or data values that are common to the entire Power Meter (this includes Voltage).
Load Scope: Settings, objects, or data values that are unique to a particular load/element.

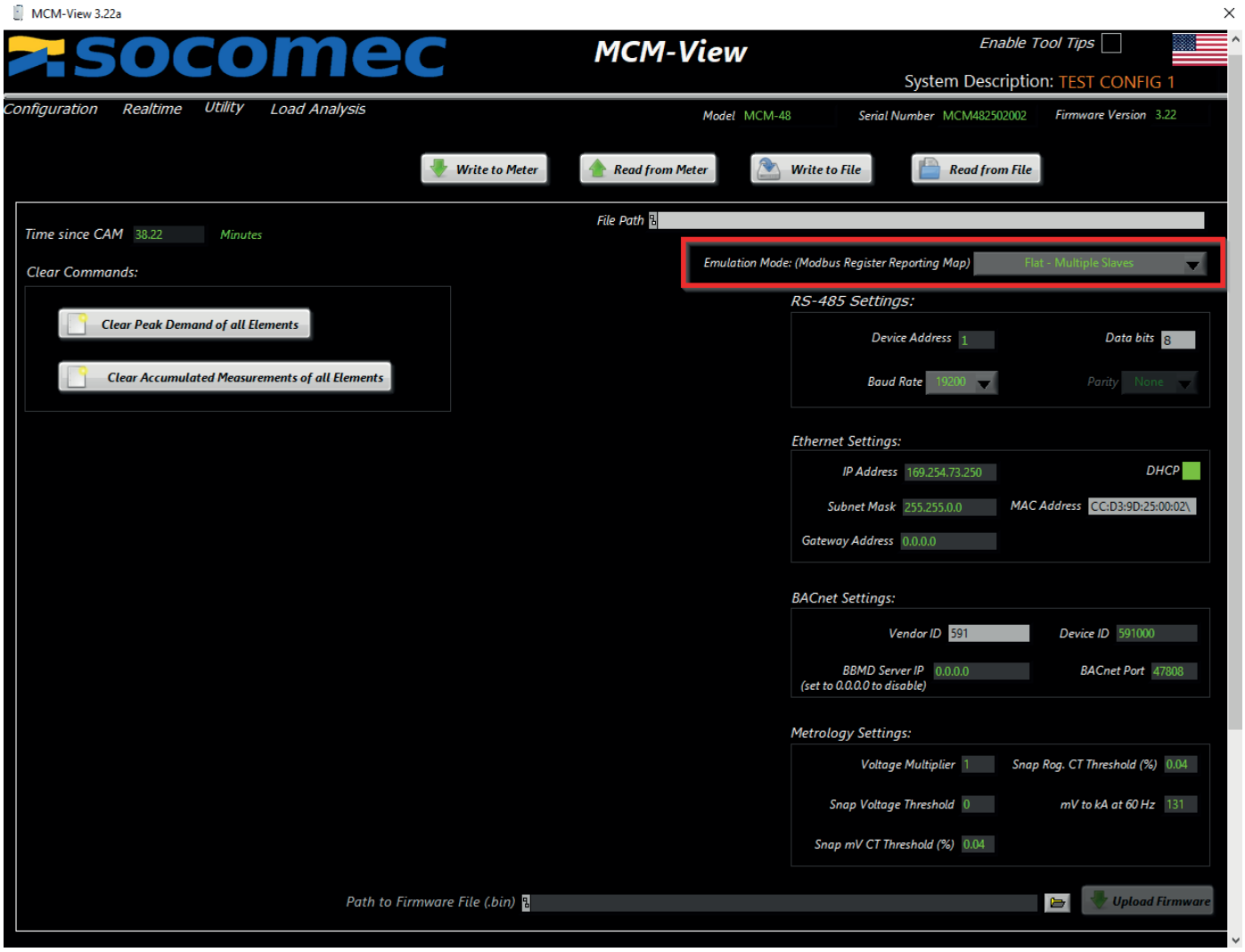



HTML Documentation: DIRIS MCM Register List

Click on «Documentation» in the bottom left corner for more information on Modbus and BACnet protocols in the DIRIS MCM meter.

## 10.2. Modbus Emulation Mode

The DIRIS MCM can report measurement data via Modbus using 2 different “Emulation modes”. You can choose between Flat (Multiple Modbus slave addresses, one per element) or Hotel (one unique Modbus slave address). The emulation mode can be selected from the “Utility” page:




### Flat Mode

In the DIRIS MCM “Flat” mapping scheme, a unique Modbus Address (also called Slave ID) is associated with each load. The host script queries data in a loop using the same register numbers but changing the Slave ID to point to a different load. Note that the DIRIS MCM meter is available with a wireless network option (RF END-Node) that uses this scheme.

### Hotel Model

In the “Hotel” Modbus mapping scheme, each Load is designated as a floor in a data addressing model where floors are separated by 1000. This scheme is popular for host systems that would attempt to open a new TCP/IP socket for each Load. Here a single Slave ID is used but the host script loops through a sequence adding 1000 to reach the next load. This scheme is not well suited to the RF radio system.

# 11. BACNET COMMUNICATION

The DIRIS MCM power meter implements the BACnet IP protocol certified by BACnet Testing Laboratory.

Each DIRIS MCM contains a BACnet Device object with properties including custom field configurable instance number to allow for unique device instance within an IP network. The default device instance number is 591000.

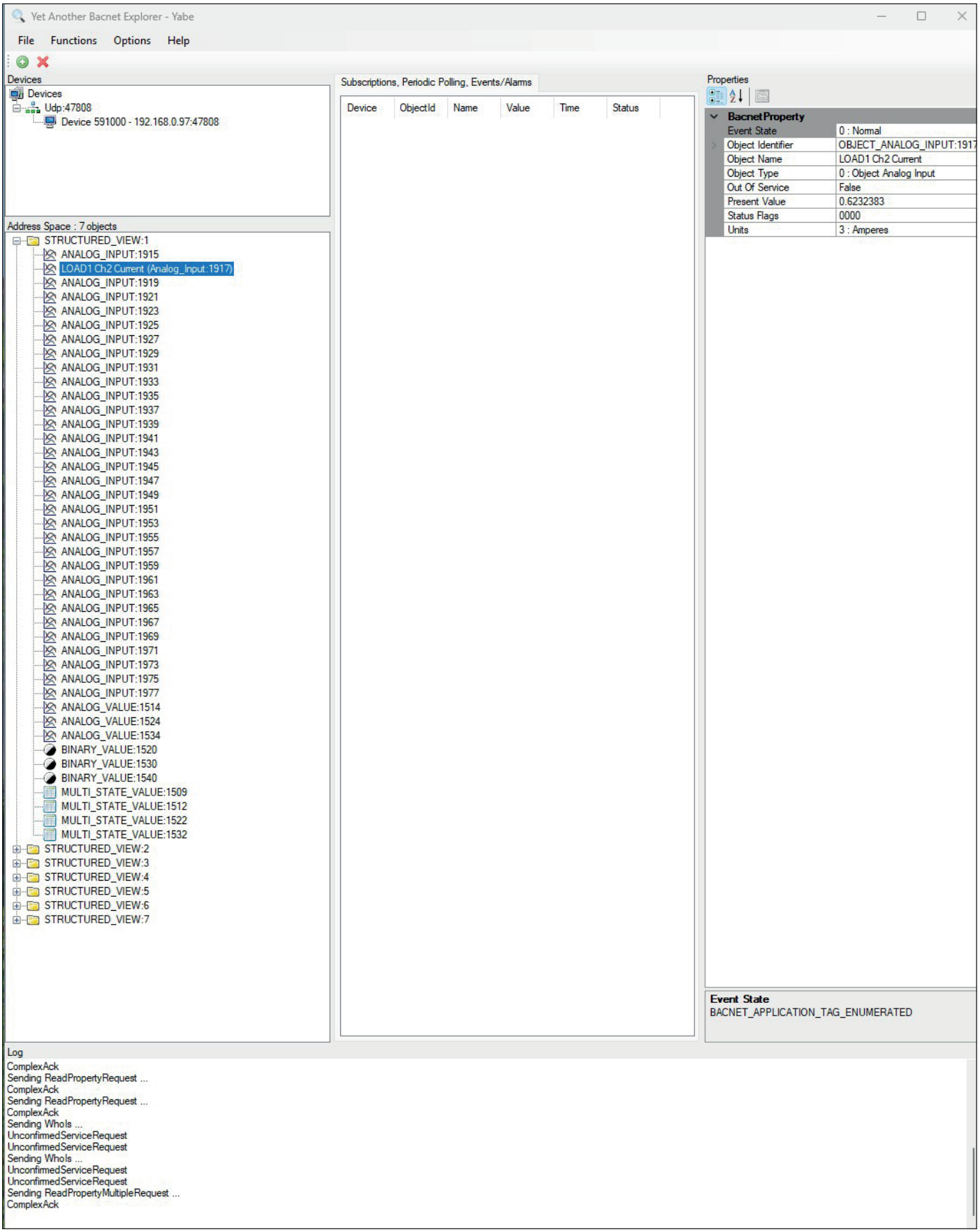
The BACnet configuration is done using the MCM-View software package. The details of the BACnet related configuration parameters are explained below.

In addition to the Device object, the Device contains a collection of hierarchy of objects specific to common system and loads within the MCM system. At the top level, the Device object has Structure View objects. There is a Structure View object for the common system and a Structure View object for each load configured in the DIRIS MCM. The instance number of the Structure View object is the same as the load number. The common system Structure View is the last load number + 1. Within each Structure View is a collection of objects related to the load and common system. A load Structure View contains objects pertaining to the load and the common system Structure View contains objects for communication configuration.

## 11.1. Smart Adaptable Object Discovery

The number of objects for a given load varies by the type of load it is configured for. A 3-phase load has objects pertaining to currents, powers and energies for all 3 phases of the load. A 2-phase (Split Phase) load has objects pertaining to currents, powers and energies for all 2 phases of the load. A single-phase load such as a lighting load has fewer number of objects on account of a single current being measured. A Disabled load will have just a single object to identify the load type itself. This **Smart Adaptable Object** discovery is implemented to optimize the throughput of the ethernet traffic payload an thus improve the discovery times for a given DIRIS MCM meter during the Objects Discovery.

The instance numbers for objects for a given load is the load number multiplied by 1000. An example of the Device hierarchy of objects is presented below:




Detailed documentation and listing of BACnet objects is available at the following link, scrolling down to Resources section:

https://www.socomec.us/en-us/p/diris-mcm

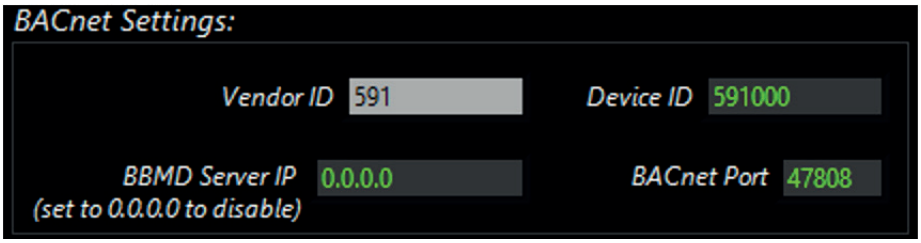
## 11.2. BBMD (BACnet/IP Broadcast Management Device)

The DIRIS MCM implements Annex J for messaging with the networking protocols using the BVLC (BACnet Virtual Link Control) functions to support BACnet/IP directed and broadcast messages.

The DIRIS MCM implements Foreign Device Registration (FDR) to register as a foreign device with a BBMD server in a network infrastructure. The IP address of the BBMD server is part of the BACnet configuration. Time-to-Live parameter is set to 60000 seconds and refreshes the registration recurringly within that time period.

## 11.3. BACnet Configuration

A screen capture of the BACnet configuration from the MCM-View software is shown below:




Vendor ID: is a read-only property of the Device object, assigned by ASHRAE for Socomec.

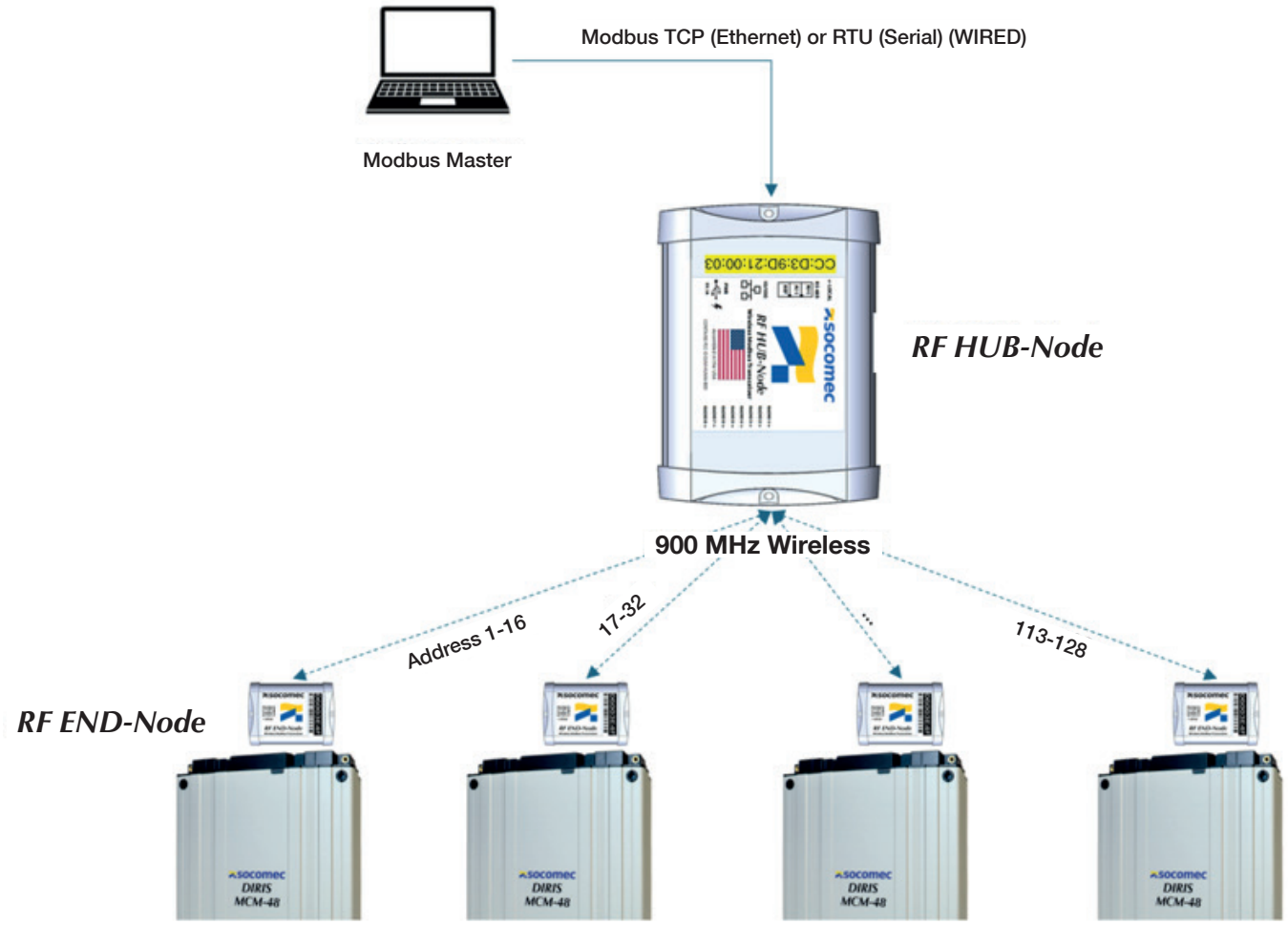
Device ID: is the instance number of the device that can be configured by users to maintain the requirement for a unique instance number in a BACnet IP network.

BBMD Server IP Address: is the IP address of the BBMD server within the BACnet IP network infrastructure. To disable the BBMD FDR, enter 0.0.0.0 for this parameter. There is no separate enable/disable setting.

UDP Port: is the UDP Port for the BACnet IP communication. Default is 47808 (0xBAC0).

# 12. DIRIS MCM RF WIRELESS SYSTEM

The RF wireless system is designed to replace Ethernet LAN network infrastructure and Modbus RS-485 multidrop wiring runs with a secure local wireless network. The system is designed as a “star” or “Wheel” network with a Modbus Master physically connected to the RF-Hub Node which remotely communicates with wireless End Nodes. Each end node services a wired RS-485 sub-network or device with up to 48 slave devices or addresses. The End Nodes are powered from the DIRIS MCM directly and do not need a separate power source. The system uses encryption and is not discoverable, a great solution for reaching power meters where no IT infrastructure exists.




If you need any assistance, please email our support team at tech.us@socomec.com

For all other inquiries, contact info.us@socomec.com

For more information on our other products and solutions, visit our website at www.socomec.us

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