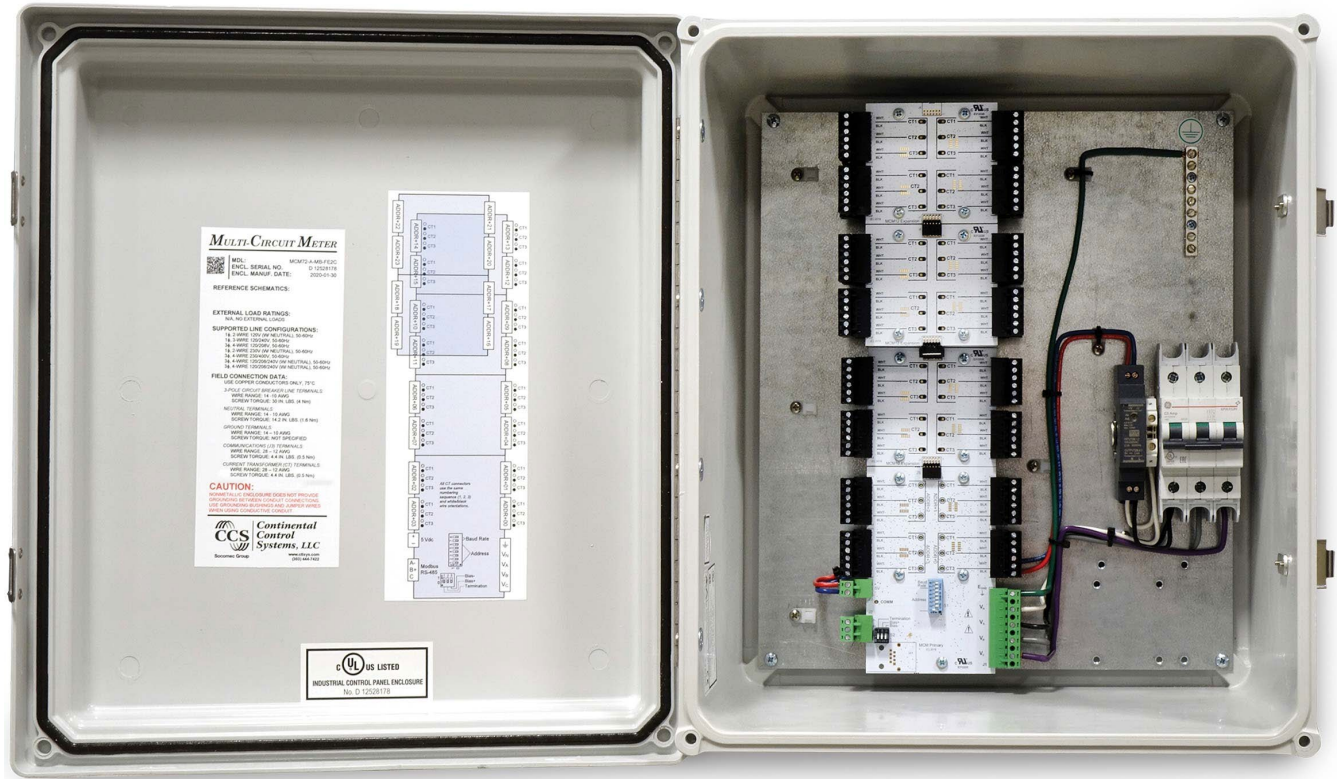




Socomec Group



The CCS Multi-Circuit Meter (MCM) for Modbus® measures bi-directional energy, power, voltage, current, etc. for up to 84 single-phase or 28 three-phase circuits. It communicates using either Modbus/RTU over RS-485 or Modbus/TCP over Ethernet. The MCM provides revenue-grade system accuracy when used with the CCS Accu-CT® family of revenue grade (C0.6 or better) current transformers.

Features

- One model can measure 100 to 600 Vac, single-phase or three-phase, wye or delta services
- Modbus registers can reverse CT polarity and change the assignment of CTs to voltage phases to correct wiring errors
- Modbus registers can assign different CT amps for each input

- Diagnostic LEDs for each CT input and for the RS-485 Modbus communication
- ANSI C12.20 class 0.5 and ANSI C12.1 accuracy
- Works with any 0.333 Vac current transformers and milliamp output CTs
- Line powered from 100 to 600 Vac

Links

- **Installation Guide:** <https://ctlsys.com/m/MCM-Install-Guide.pdf>
- **Install Record:** <https://ctlsys.com/s/mcm-install-rec/>
- **Product Web Page:** <https://ctlsys.com/product/mcm/>
- **Support Web Page:** <https://ctlsys.com/support/mcm/>
- **Modbus Register List:** <https://ctlsys.com/m/WND-Modbus-Registers-FW37.xls>

1 Models

1.1 Model Number Scheme

The model number has the format:

MCM<NumCTs>-<VoltageGroup>-<Comm>-<Enclosure><Protection>

With the following meaning and values for each field:

- **<NumCTs>** - The number of current transformer (sensor) input channels: 12, 24, 36, 48, 60, 72, or 84
- **<VoltageGroup>** - The electrical type group: A, B, C, D, or E. See **1.3 Voltage Groups** below for details.
- **<Comm>** - The communication type:
 - MB – Modbus RTU over RS-485
 - MBT – Modbus TCP over Ethernet
- **<Enclosure>** - The enclosure type. All models up to and including 48 CTs use smaller 12 x 12 inch enclosures, while 60 to 84 CT models use larger 16 x 14 inch enclosures.
 - ME3 – Steel enclosure; 12" x 12" x 6"; NEMA 3R, 4, 12, 13
 - FE1 – Fiberglass enclosure; 12.1" x 12.1" x 6.1"; NEMA 1, 2, 3, 3R, 4, 4X, 12, 13
 - ME4 – Steel enclosure; 16" x 14" x 6"; NEMA 3R, 4, 12, 13
 - FE2 – Fiberglass enclosure; 16.3" x 14.4" x 8.1"; NEMA 1, 2, 3, 3R, 4, 4X, 12, 13
- **<Protection>** – The circuit protection provided for the power supply and line voltage measurement inputs:
 - C – Circuit breaker; three-pole, 120 to 480 Vac
 - F – Fuse; three-pole, 120 to 600 Vac
 - N – No circuit protection provided; external protection must be provided by the installer.

1.2 Model Number Details

MCM models starting with MCM12 through MCM48 use smaller enclosures, while MCM60 through MCM84 use larger enclosures. In the table below:

- **v** is the voltage group, which indicates the electrical types that the MCM can monitor. See **1.3 Voltage Groups** below.
- **c** is the communication type: either MB for Modbus RTU over RS-485 or MBT for Modbus TCP over Ethernet.
- **p** is the circuit protection, which may be none (N), a three-pole circuit breaker (C), or a three-pole fuse (F).

Table 1: Models

Model	CT Channels	Enclosure
MCM12-v-c-ME3p	12	ME3: Steel, NEMA 4, 12" x 12" x 6"
MCM12-v-c-FE1p	12	FE1: Fiberglass, NEMA 4, 12" x 12" x 6"
MCM24-v-c-ME3p	24	ME3: Steel, NEMA 4, 12" x 12" x 6"
MCM24-v-c-FE1p	24	FE1: Fiberglass, NEMA 4, 12" x 12" x 6"
MCM36-v-c-ME3p	36	ME3: Steel, NEMA 4, 12" x 12" x 6"
MCM36-v-c-FE1p	36	FE1: Fiberglass, NEMA 4, 12" x 12" x 6"
MCM48-v-c-ME3p	48	ME3: Steel, NEMA 4, 12" x 12" x 6"
MCM48-v-c-FE1p	48	FE1: Fiberglass, NEMA 4, 12" x 12" x 6"
MCM60-v-c-ME4p	60	ME4: Steel, NEMA 4, 16" x 14" x 6"
MCM60-v-c-FE2p	60	FE2: Fiberglass, NEMA 4, 16" x 14" x 8"
MCM72-v-c-ME4p	72	ME4: Steel, NEMA 4, 16" x 14" x 6"
MCM72-v-c-FE2p	72	FE2: Fiberglass, NEMA 4, 16" x 14" x 8"
MCM84-v-c-ME4p	84	ME4: Steel, NEMA 4, 16" x 14" x 6"
MCM84-v-c-FE2p	84	FE2: Fiberglass, NEMA 4, 16" x 14" x 8"

Some example model numbers follow:

- **MCM24-A-MB-FE1C** – 24 CTs, 120-240 Vac line-to-neutral powered, Modbus/RTU, fiberglass, NEMA 4, 12" x 12" x 6", circuit breaker
- **MCM48-C-MB-ME3N** – 48 CTs, 480 Vac line-to-line powered, Modbus/RTU, steel, NEMA 4, 12" x 12" x 6", no circuit protection

1.3 Voltage Groups

Voltage groups A and C are the most common and are recommended when applicable. The bold electrical types within each voltage group are recommended, although the non-bold types will function correctly. Different voltage groups supply with AC/DC power supply or step-down transformer with line-to-line (L1, L2) or line-to-neutral (N, L1) voltages.

Table 2: Voltage Groups

Voltage Group	Wiring Description	Supported Electrical Types	Circuit Protection Options
A	Direct from overcurrent protection to AC/DC power supply (N, L1)	1-Phase, 2-Wire 120V with neutral 1-Phase, 3-Wire 120/240V 3-Phase, 4-Wire 208Y/120V 1-Phase, 2-Wire 230V with neutral 3-Phase, 4-Wire 400Y/230V 3-Phase, 4-Wire Delta 120/208/240V with neutral 3-Phase, 4-Wire Delta 240/415/480V with neutral	None (N), Circuit Breaker (C), Fuse (F)
B	Direct from overcurrent protection to AC/DC power supply (L1, L2)	1-Phase, 2-Wire 208V (no neutral) 1-Phase, 2-Wire 240V (no neutral) 3-Phase, 3-Wire 208-240V Delta (no neutral) 1-Phase, 3-Wire 120/240V 3-Phase, 4-Wire 208Y/120V 3-Phase, 4-Wire Delta 120/208/240V with neutral	None (N), Circuit Breaker (C), Fuse (F)
C	From overcurrent protection to step-down transformer (L1, L2) 480V tap to AC/DC power supply	3-Phase, 4-Wire 480Y/277V with neutral 3-Phase, 3-Wire 400V Delta (no neutral) 3-Phase, 3-Wire 480V Delta (no neutral) 3-Phase, 4-Wire 400Y/230V 3-Phase, 4-Wire Delta 240/415/480V with neutral	None (N), Circuit Breaker (C), Fuse (F)
D	From overcurrent protection to step-down transformer (N, L1) 277V tap to AC/DC power supply	1-Phase, 2-Wire 277V with neutral 3-Phase, 4-Wire 480Y/277V with neutral	None (N), Circuit Breaker (C), Fuse (F)
E	From fuse overcurrent protection to step-down transformer (L1, L2) 600V tap to AC/DC power supply	3-Phase, 4-Wire 600Y/347V with neutral 3-Phase, 3-Wire 600V Delta (no neutral)	None (N), Fuse (F)

1.4 DIP Switches

The MCM with RS-485 communication (MB) includes two DIP switches to configure the Modbus address, the baud rate, RS-485 termination, and RS-485 biasing. The DIP switches are inactive on the MCM with Ethernet (MBT) and may not be present. See the Installation Guide or Reference Manual for more details.

1.4.1 Eight-Position DIP Switch

For the eight position DIP switch, positions 1 through 6 specify the base Modbus/RTU address, with the values for the individual switches combined by adding, so if switch 2 and 4 are both up (1), then the Modbus address would be 10. The DIP switches allow addresses from 0 to 63, although 0 is an invalid, so be sure to use addresses from 1 to 63. Other addresses up to 220 may be ordered as a factory option or programmed using the **Address** register.

1. Modbus address bit 1: down (0) = 0, up (1) = 1
2. Modbus address bit 2: down (0) = 0, up (1) = 2
3. Modbus address bit 3: down (0) = 0, up (1) = 4
4. Modbus address bit 4: down (0) = 0, up (1) = 8
5. Modbus address bit 5: down (0) = 0, up (1) = 16
6. Modbus address bit 6: down (0) = 0, up (1) = 32

Each submeter block within the MCM has an offset from the base address. For example, an MCM24 has eight submeter blocks with offsets from 0 to 7 from the base address. So, if the base is set to 1, the submeter addresses will be 1, 2, 3, ... 8. DIP switch positions 7 and 8 specify the baud rate as follows. Other baud rates may be ordered as factory options or programmed using the **BaudRate** register.

- 7 = Off, 8 = Off: 9,600 baud
- 7 = Off, 8 = On: 19,200 baud
- 7 = On, 8 = Off: 38,400 baud
- 7 = On, 8 = On: 115,200 baud

1.4.2 Three-Position DIP Switch

The three position DIP switch controls the RS-485 termination and biasing on the Modbus RTU (RS-485) models as follows:

1. RS-485 termination: down (0) = no termination, up (1) = 120 ohm termination
2. RS-485 B+ bias: down (0) = no bias, up (1) = 1.2 kilohm to 3.3 Vdc
3. RS-485 A- bias: down (0) = no bias, up (1) = 1.2 kilohm to 0.0 Vdc

1.5 Options

1.5.1 Current Transformer Options

The following CT= option is recommended for easier installation if all the inputs will use the same rated amps.

- **CT=xxx** - Pre-assign xxx as the global **CtAmps** value for the current transformers.

2 Specifications

2.1 Accuracy

The following accuracy specifications do not include errors caused by the current transformer accuracy or phase angle errors. "Rated current" is the current that generates a CT output voltage of 0.33333 Vac output.

Unless otherwise noted, all accuracy specifications assume the following conditions:

- **Line voltage:** 100 to 690 Vac
- **Power factor (PF):** 1.0
- **Frequency:** 48 - 62 Hz
- **Ambient Temperature:** 23°C ± 5°C
- **CT Current:** 1% - 100% of rated current

Table 3: Accuracies

Parameter	Test Conditions	Typ	Max	Unit
EnergySum, Energy1, 2, 3 ⁽¹⁾ (active energy)	elapsed time ⁽²⁾ >= 30 s	±0.2	±0.5	%
EnergySum, Energy1, 2, 3; PF 0.5 to 0.9	elapsed time ⁽²⁾ >= 30 s	±0.4	±0.8	%
PowerSum, Power1, 2, 3 (active power)	averaging >= 1 s	±0.3	±1.0	%
PowerSum, Power1, 2, 3; PF 0.5 to 0.9	averaging >= 1 s	±0.5	±1.0	%
VoltAN, BN, CN, VoltAB, BC, CA (RMS voltage)	averaging >= 1 s	±0.3	±1.0	%
Current1, 2, 3 (RMS current)	averaging >= 1 s	±0.25	±0.5	%
Freq (frequency)	averaging >= 1 s	±50 ±3	±150 ±9	ppm mHz
PowerFactor1, 2, 3	averaging >= 1 s, PF > 0.5	±0.5	±1.0	%
EnergyReacSum, EnergyReac1, 2, 3 (reactive energy)	elapsed time ⁽²⁾ >= 30 s, PF < 0.9	±0.6	±1.5	%
PowerReacSum, PowerReac1, 2, 3 (reactive power)	averaging >= 1 s, PF < 0.9	±0.6	±1.5	%
EnergyAppSum, EnergyApp1, 2, 3 (apparent energy)	elapsed time ⁽²⁾ >= 30 s	±0.3	±0.5	%
PowerAppSum, PowerApp1, 2, 3 (apparent power)	averaging >= 1 s	±0.3	±0.5	%

⁽¹⁾ Note: when parameters are written like Energy1, 2, 3, this means Energy1, Energy2, and Energy3.

⁽²⁾ Note: This indicates that energy accuracy should be evaluated over a period of 30 seconds or longer.

All models

- Meet the ANSI C12.1-2008 and ANSI C12.20-2010 class 0.5 accuracy requirements, excluding errors caused by attached current transformers.
- Meet the ANSI C12.1-2008 standard for revenue metering with CTs with class 0.6 or better current transformers.
- Meet the ANSI C12.20-2010 class 0.5 standard for revenue metering with class 0.2 and class 0.3 current transformers.

Internally, the MCM is made up of multiple independent metering blocks. Each block measures the line voltages and line frequency, but because each block is independent, they may report slightly different values for the same quantity. This is normal.

2.2 Measurement

- **Update Rate:** Approximately 0.1 second, adjusted to an integer number of AC line cycles. All measurements are performed at this rate. All measurement registers except the energy registers can update as fast as every 0.1 seconds depending on the configuration of the **Averaging** register. The energy registers are updated from the internal values every 1.0 second.
- **Start-Up Time:** ≤ 1 second after the supply voltage is applied.
- **Default CT Phase Angle Correction:** 0.0 degrees.
- **Creep Limit:** 0.04% (1/2500th) of full-scale.

2.3 Modbus/RTU EIA RS-485 Communication

- **Protocol:** Modbus RTU (binary)
- **Baud Rates:** 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, and 115200
- **Modbus Address Range:** 1 to 63 with the DIP switches, 1 to 220 with the **Address** register
- **Duplex:** Half (two-wire plus common)
- **Parity:**
 - **Standard:** N81 (no parity, eight data bits, one stop bit)
 - **Optional:** E81 (even parity, eight data bits, one stop bit)
 - **Optional:** N82 (no parity, eight data bits, two stop bits)
- **Modbus Buffer:** 256 bytes
- **Communication Response Time:** 5 - 60 milliseconds (may be longer immediately after a Modbus write command, while values are saved to non-volatile memory).

2.3.1 EIA RS-485 Physical Interface

- **Physical Link:** EIA RS-485
- **RS-485 Output Isolation:** 4500 Vac RMS
- **Driver Output:**
 - **Voltage (Open Circuit):** ± 6 Vdc maximum
 - **Voltage (54 Ω load):** ± 1.5 Vdc minimum
 - **Current (54 Ω load):** ± 60 mA typical
 - **Rise Time (54 Ω || 50 pF load):** 900 nS typical
- **Receiver:**
 - **Common-Mode Range:** -7 Vdc to +12 Vdc max
 - **Sensitivity:** ± 200 mV
 - **Bus Load:** 1/8 unit load (up to 256 WattNode meters per subnet)
 - **Failsafe Modes:** bus open, shorted, and idle

2.4 Modbus/TCP (Ethernet) Communication

- **Protocol:** Modbus TCP (binary)
- **Baud Rates:** not applicable
- **Modbus Addresses:** Fixed at 1..n, where n depends on the number of submeter blocks and may be 4, 8, 12, 16, 20, 24, or 28.
- **TCP/IP Address:** configurable with DHCP or telnet utility
- **Duplex:** effectively half duplex due to design constraints
- **Parity:** not applicable
- **Modbus Buffer:** 256 bytes
- **Communication Response Time:** 5 - 60 milliseconds (may be longer immediately after a Modbus write command, while values are saved to non-volatile memory).

2.4.1 Ethernet Physical Interface

- **Physical Link:** Ethernet
- **Connector:** RJ45
- **Cabling:** CAT-5 or better
- **Speed:** 10 or 100 Mbps,

2.5 Electrical

2.5.1 Power Supply

Table 4: Power Supply Specifications

Voltage Group	Nominal Voltage	Min / Max Voltage	Connection	MCM12 Typical Watts / VA	MCM84 Typical Watts / VA	Typical PF
A	110 to 240 Vac	85 / 264 Vac	Line-to-neutral	1.4 / 4.0	9 / 15	0.4
B	208 to 240 Vac	166 / 264 Vac	Line-to-line	1.5 / 5.5	9 / 22	0.35
C	480 Vac	384 / 552 Vac	Line-to-line	4.6 / 9.0	12 / 16	0.6
D	277 Vac	222 / 318 Vac	Line-to-neutral	4.5 / 9.0	12 / 17	0.6
E	600 Vac	480 / 690 Vac	Line-to-line	7 / 17	13 / 21	0.4

2.5.2 General Electrical

- **Line Frequency:** 45 to 65 Hz
- **Nominal Line-to-Neutral Vac:** 90 to 347 Vac
- **Nominal Line-to-Line Vac:** 120 to 600 Vac
- **Over-Current Limit:** 200% of rated current. Exceeding 200% of rated current will not harm the meter, but the current and power will not be measured accurately.
- **Measurement Category:** The line voltage measurement terminals on the meter are rated for CAT III, 600 Vac. Measurement Category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring, including cables, busbars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with a permanent connection to the fixed installation.

2.5.3 Current Transformer Inputs:

- **Nominal Input Voltage (At CT Rated Current):** 0.33333 Vac RMS
- **Absolute Maximum Input Voltage:** 5.0 Vac RMS
- **Input Impedance at 50-60 Hz:** 23 kΩ

2.5.4 Circuit Protection:

- **C - Three-phase circuit breaker:** three-pole; 480 Vac; 5A; 10kA UL 489 interrupting capacity; operating temperature -25°C to +55°C (-13°F to 131°F)
- **F - Three-phase fuse block and fuses:** three-pole; 600 Vac; 2A; 100kA or greater interrupting capacity; time-delay; class CC; not rated as a disconnect; operating temperature range of -50°C to +125°C. Note: the MCM is not rated for this range, so do not exceed the MCM's limits.
- **N - No circuit protection:** the MCM is provided with terminal blocks in place of the circuit protection to allow field wiring

2.6 Regulatory

- **Safety:**
 - PCBAs are UL Recognized (U.S. and Canada), file number E312220 to UL / IEC 61010-1, 3rd Edition and CAN/CSA-C22.2 No. 61010-1-12, 3rd Edition
 - Complete MCM meters are UL Listed (U.S. and Canada), file number E495898 to UL 508A
- **FCC:** Class B, FCC Part 15, radiated and conducted emissions
- **RoHS:** Not specified

2.7 Environmental

- **Operating Temperature:**
 - **MCM12, MCM24, MCM36, MCM48, MCM60:** -30°C to +70°C (-22°F to 158°F)
 - **MCM72, MCM84:** -30°C to +65°C (-22°F to 149°F)
 - **All models with circuit breaker:** -25°C to +55°C (-13°F to 131°F)
- **Operating Humidity:** non-condensing, 5 to 90% relative humidity (RH) up to 40°C, decreasing linearly to 50% RH at 55°C.

- **Operating Altitude:** Up to 3000 m (9842 ft)
- **Pollution:** POLLUTION DEGREE 2 - Normally only non-conductive pollution; occasionally, a temporary conductivity caused by condensation must be expected
- **Indoor Use:** Suitable for indoor use
- **Outdoor Use:** Suitable for outdoor use if electrical enclosure NEMA 4 rating is preserved

2.8 Mechanical

2.8.1 Enclosure ME3 – Small steel

- **Enclosure Material:** steel, 16 gauge
- **Model:** Hammond Manufacturing EJ12126
- **Overall Size:** 12" x 12" x 6"
- **NEMA Ratings:** 3R, 4, 12, 13

2.8.2 Enclosure FE1 – Small fiberglass

- **Enclosure Material:** fiberglass
- **Model:** Allied Moulded Products, Inc. AM1226RL
- **Overall Size:** 12.1" x 12.1" x 6.1"
- **NEMA Ratings:** 1, 2, 3, 3R, 4, 4X, 12, 13

2.8.3 Enclosure ME4 – Large steel

- **Enclosure Material:** steel, 16 gauge
- **Model:** Hammond Manufacturing EJ16146
- **Overall Size:** 16" x 14" x 6"
- **NEMA Ratings:** 3R, 4, 12, 13

2.8.4 Enclosure FE2 – Large fiberglass

- **Enclosure Material:** fiberglass
- **Model:** Allied Moulded Products, Inc. AM1648RL
- **Overall Size:** 16.3" x 14.4" x 8.1"
- **NEMA Ratings:** 1, 2, 3, 3R, 4, 4X, 12, 13

2.8.5 Connectors

- **Connectors:** Euroblock pluggable terminal blocks
 - **Line Vac:** Green, five-position, 10.16 mm (0.4 in) pitch, 18 AWG (0.82 mm²) to 12 AWG (3.3 mm²), 600 V, screw torque: 3.5 lbf·in (0.4 N·m)
 - **RS-485:** (when applicable) Green, three-position, 5.08 mm (0.2 in) pitch, 28 AWG (0.081 mm²) to 12 AWG (3.3 mm²), 300 V, screw torque: 3.5 lbf·in (0.4 N·m)
 - **Ethernet:** (when applicable) RJ45 jack, eight-position
 - **DC Power:** Green, two-position, 5.08 mm (0.2 in) pitch, 20 AWG (0.52 mm²) to 12 AWG (3.3 mm²), 300 V, screw torque: 3.5 lbf·in (0.4 N·m)
 - **CT Inputs:** Black, six-position, 5.08 mm (0.2 in) pitch, 28 AWG (0.081 mm²) to 12 AWG (3.3 mm²), 300 V, screw torque: 3.5 lbf·in (0.4 N·m)