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2021/11/15

Multi-functional Power Meter DPM-C510 Operation Manual

Multi-functional Power Meter DPM-C510 Operation Manual

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Multi-functional Power Meter
DPM-C510 Operation Manual

Revision History

Version	Revision	Date
1st	The first version was published.	2021/11/15

Multi-functional Power Meter
DPM-C510 Operation Manual

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Chapter 1 Product Introduction

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1.1 Preface

Thank you for choosing our multifunction power meter, model DPM-C510. This manual provides specification, installation and operation instructions for the DPM-C510 model power meter, which is an obvious choice for any application in terms of power monitoring and control.

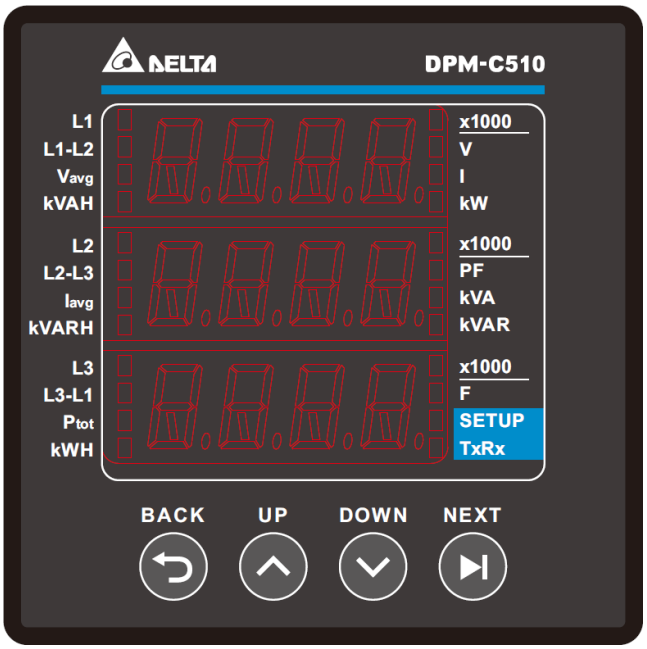
Before using the meter, read this manual carefully to ensure proper use of this meter. Please observe and follow the notes below prior to finish reading this manual.

- The installation environment must be free of water vapor, corrosive and flammable gas.
- Follow the instructions on the diagram in this manual for wiring the device.
- Grounding must be performed correctly and properly according to provisions for related electric work regulations currently effective in the country.
- Do not disassemble the meter or alter its wiring when the power is on.
- When the power is on, do not touch the terminal area to avoid electric shock.

If you still experience issues when using the device, please contact your distributor or our customer service center. As the product is updated and improved, changes to the specifications will be included in the newest version of the manual which you can get by contacting your distributor or downloading it from the Delta Electronics website (http://www.delta.com.tw/ia/).

1.2 Overview

The DPM-C510 model is equipped with a large LED display that displays up to three lines of information.



1.3 Safety Precautions

- **Installation Notes**

- Install the power meter according to instructions on the manual. Use appropriate personal protective equipment (PPE) and follow safe electrical work practices.
- Only qualified electrical workers should install this equipment. Such work should be performed only after reading the entire set of installation instructions.
- Operate the power meter according to instructions on the manual. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- This equipment should be installed in a suitable insulated and fireproof enclosure.

- **Operation Notes**

- DO NOT work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all electric power sources.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- Carefully inspect the work area for tools and objects that may have been left inside the equipment.

- **Operation Notes**

- Never short the secondary of a Power Transformer (PT).
- Never open circuit a Current Transformer (CT)
- Ensure that the CT secondary winding is fixed securely on the equipment. It may damage the equipment if the secondary winding becomes loose during operation.
- When used with CTs, make sure the CTs are UL2808 listed in America and Canada as well as meeting the accuracy specifications for IEC61869-2 class or accepted by authority having jurisdiction (AHJ) in other areas.

- **Wiring Notes**

- When the measured current is higher than the rated specification for the device, consider using an external current transformer (CT).
- When the measured voltage is higher than the rated specification for the device, consider using an external potential transformer (PT) (line voltage: 35 to 690V AC L-L or phase voltage: 20 to 400V AC L-N).
- Connect only one cord to one plug on the quick connector.
- For the device is accidently unplugged, check the connecting cord and restart.

- **Maintenance and Inspection Notes**

- While cleaning the equipment, be sure to unplug all external power sources first. Use a dry cloth to clean the equipment's exterior. DO NOT open the equipment or touch the wiring inside to prevent personal injury as well as damage to electrical equipment or other property. DO NOT use aerosol sprays, solvents, or abrasives.

MEMO

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Chapter 2 Product Specifications

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2.1 Electrical Characteristics

Measurement Accuracy					
Electrical Quantity	**Voltage/ Current**	± 0.5 %	**Electrical Energy**	**Real power**	± 0.5 %
	Real power	± 0.5 %		**Reactive power**	± 2 %
Power factor		± 1 %	**Reactive power**		± 2 %
Frequency Accuracy		± 1 %	**Apparent power**		± 2 %

Input		
Wiring Methods	1PH2W, 1 CT	3PH3W, Δ connection, 3 CT, 2 PT
	1PH3W, 2 CT	3PH4W, Y connection, 3 CT, No PT
	3PH3W, Δ connection, 3 CT, No PT	3PH4W, Y connection, 3 CT, 3 PT
	3PH3W, Δ connection, 2 CT, No PT	3PH4W, Y connection, 2 CT, 3 PT
Rated Voltage	Line voltage: 80–690 VAC (L-L) Phase voltage: 50–400 VAC (L-N)	
Rated Current	Nominal: 1 A / 5 A	
Measure Current	20mA to 6A	
Start Current	20mA*	
Frequency	50/60 Hz	
Harmonic Wave	31	
CAT Rating	Measuring Category: CAT III	
Power	Operating range	80-265 VAC
Frequency	Operating frequency	50/60 Hz
Communication	RS-485 port	Modbus-RTU, Modbus ASCII, BACnet MS/TP
		Baud rate 9600 / 19200 / 38400/ 76800 bps
Mechanical Characteristics	Dimension (W x H x D)	96 x 96 x 98.1 mm
	IP Degree of Protection	IP52 (front display), IP20 (meter body)
Environment	Ambient operating temperature	-20~+50°C (-4~+122°F)
	Storage temperature	-30~+60°C (-22~140°F)
	Relative Humidity	5–95% RH
	Altitude	Below 2000 meters

*Accuracy of measurements guaranteed according to IEC62053-22, accurate range starts from 50mA.

Display	
Screen Type	LED
Backlight	Red light

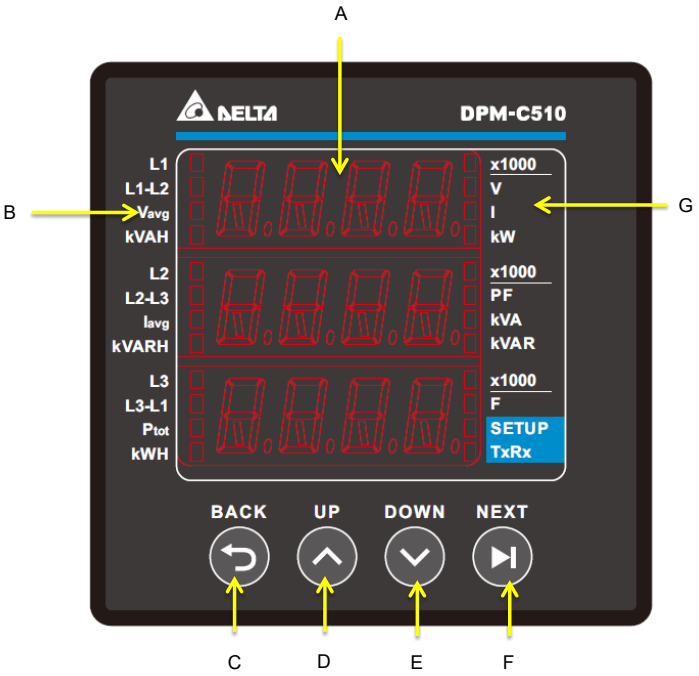
Electromagnetic Compatibility	
Electrostatic Discharge	IEC 61000-4-2
Immunity to Radiated Fields	IEC 61000-4-3
Immunity to Fast Transients	IEC 61000-4-4
Immunity to Impulse Waves	IEC 61000-4-5
Conducted Immunity	IEC 61000-4-6
Immunity to Magnetic Fields	IEC 61000-4-8
Immunity to Voltage Dips	IEC 61000-4-11
Radiated Emissions	FCC Part 15 Class A, EN55011 Class A
Conducted Emissions	FCC Part 15 Class A, EN55011 Class A
Harmonics	IEC 61000-3-2
Flicker	IEC 61000-3-3

Safety	
EU Safety	CE, as per IEC 61010-1 2nd Editiion
US Safety	cULus as per CAN/CSA-C22.2 NO. 61010-1, ISA-82.02.01 (IEC61010-1 MOD), UL 61010-1

2.2 Communications Specifications

Communications	
RS-485	Modbus-RTU
Baud rate	9600 / 19200 / 38400 bps

2.3 Operating the Display



A	Value display
B	Item display
C	BACK key
D	UP key
E	DOWN key
F	NEXT key
G	Unit/ Indicator

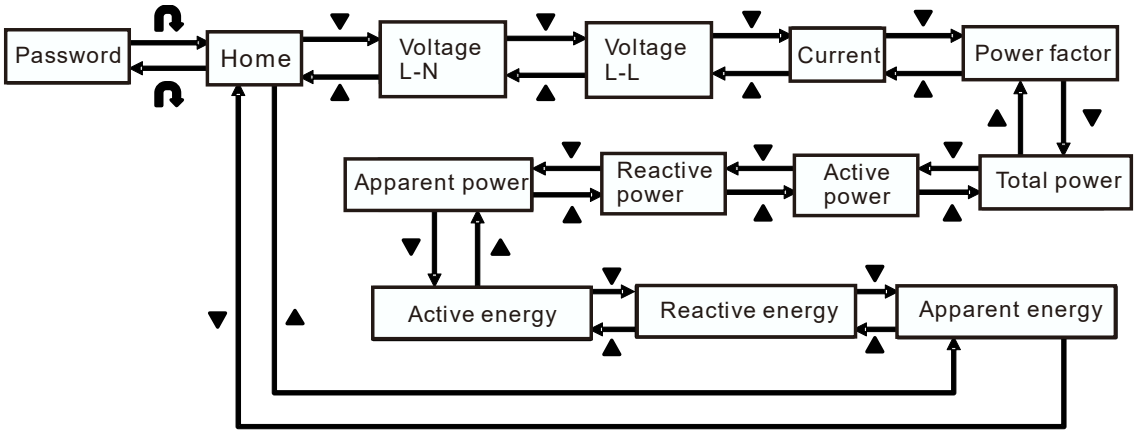
Button	Basic Mode	Setting Mode
BACK Key	Go to Menu or return to the previous screen	Return to the previous screen without saving the current setting
UP Key	To move between items and pages, use the UP key or the DOWN key.	Increment the number
DOWN Key		Decrement the number
NEXT Key	Enter the settings of selected item.	Enter the setting mode and move to the next setting.

*Home page display:

Parameter	Description
Vavg	Average voltage L-L: 3PH3W
	Average voltage L-N: 3PH4W
Iavg	Average current value
Ptot	Total real power

2.3.1 Menu Tree

- **UI Display**



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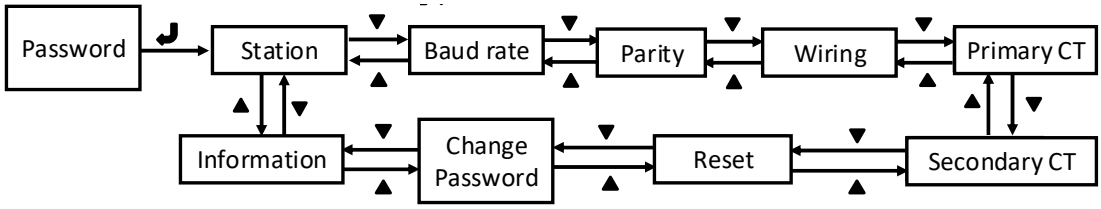
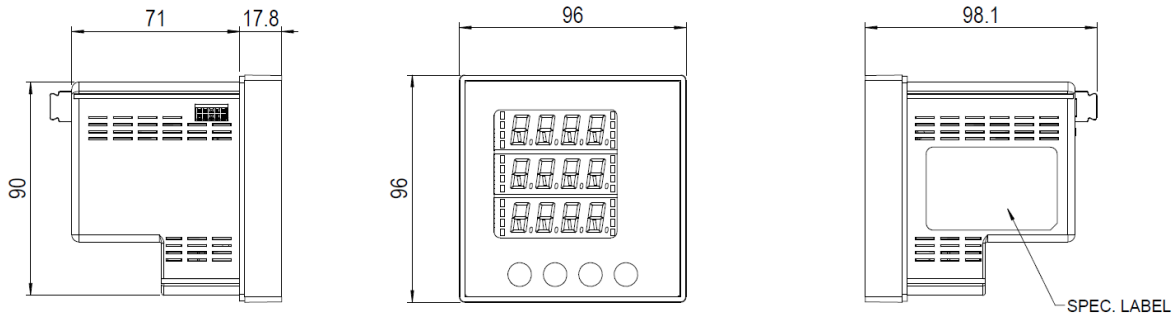
- **Configuration**



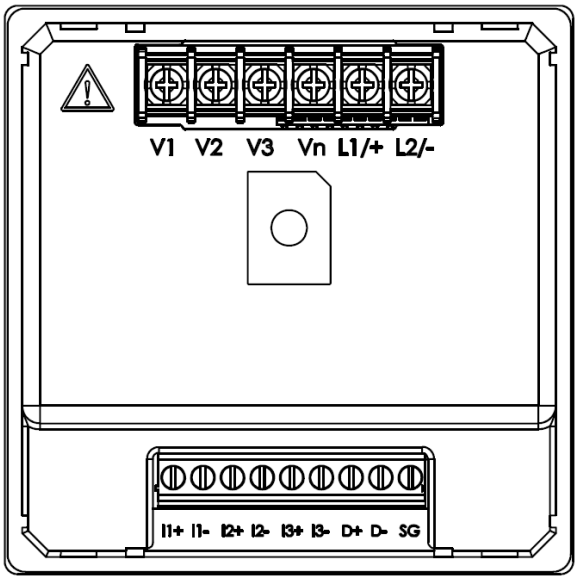
***Note:** Return to the homepage by clicking "↩" displayed on the page.

2.4 Dimensions



Unit: mm (Inch)

- **DPM-C510 Back**



Unit: mm (Inch)

Feature	Terminals	Voltage	Current
Measurement voltage	V1	20V L-N ~ 400V L-N 35V L-L ~ 690V L-L	-
	V2		
	V3		
	VN		
Operation voltage	L	80 ~ 265 VAC	400 mA MAX
	N		
Measurement current	I1+	-	1A ~ 5A
	I1-		
	I2+		
	I2-		
	I3+		
	I3-		
RS-485	D+	-7 ~ +12 VDC	-
	D-		
	SG		

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Chapter 3 Installation

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3.1 Installation

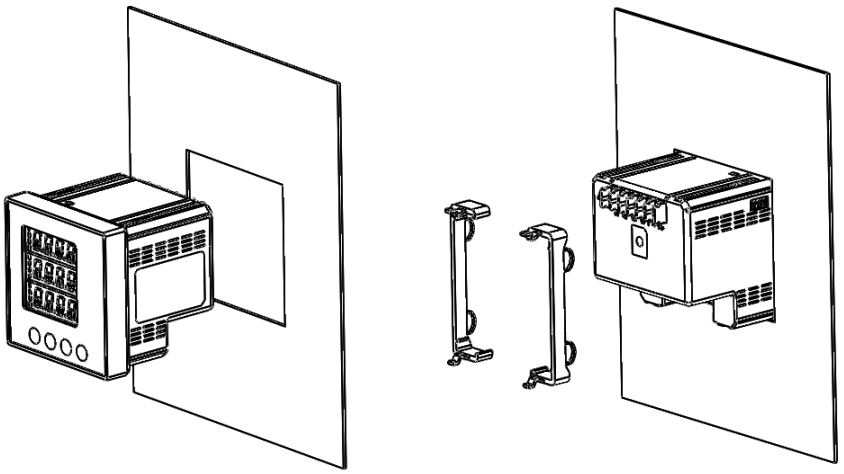
3.1.1 Installation Environment

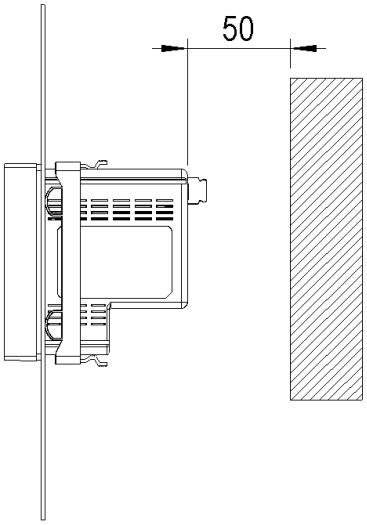
Keep the product in the shipping carton before installation. Store the product properly when it is not to be used for an extended period of time to retain the warranty coverage. Some storage suggestions are listed below.

- Store the power meter in a clean, dry, and controlled environment.
- Store in an ambient temperature range of -30–60°C (-22–140°F).
- Store in a relative humidity range of 5–95%, non-condensing.
- Do not store the product in a place subjected to corrosive gases or liquids.
- Place the product on a solid and durable surface.
- Do not mount the product near heat-radiating elements; or in a location subjected to corrosive gases, liquids, airborne dust or metallic particles; or where it can be subjected to high levels of electromagnetic radiation.

3.1.2 Installation Notes

- Follow the instruction when installing the product to prevent equipment breakdown.
- To increase the cooling efficiency, install the product with sufficient space between adjacent objects and baffles and walls to prevent poor heat dissipation.



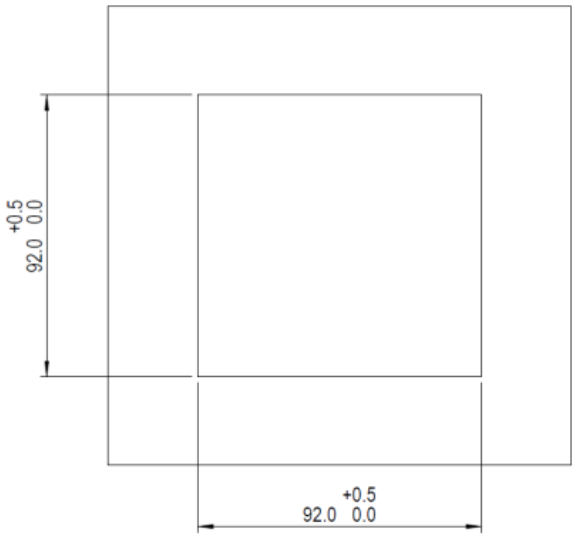


- Cabinet installation

1. For easier handling during mounting and dismounting, the mounting brackets and accessories are provided with the multi-function meter for the fixed installation
2. The dimension of the mounting hole is 92 mm * 92 mm in size. (Refer to the following description of mounting hole dimension).
3. Slide the mounting bracket into the slot. The maximum panel thickness should be 4.0 mm.

***Note:** Install on a flat mounting plane.

- **Mounting Hole Dimensions**



Panel Hole
Thickness : 0.8~4.0mm

Unit: mm

3.2 Basic Checks

Items	Contents
General Check	■ Regularly check for mounting looseness where the power meter and device are connected. ■ Prevent foreign objects, such as oil, water, or metal powder entering the device through the ventilation holes. Prevent drill shavings or other debris entering the power meter. ■ If the power meter is installed at a location with harmful gas or dust, prevent those materials from entering the power meter.
Pre-operation Check (not supplied with power)	■ Insulate the connections at the wiring terminals. ■ Communications wiring should be done properly to prevent abnormal operations. ■ Check for the presence of conducive and flammable objects, such as screws or metal pieces in the power meter. ■ If electronic devices near to the power meter experience electromagnetic interference, take steps to reduce the electromagnetic interference. ■ Check for the correct voltage level for the power supplied to the power meter.
Pre-running Check (supplied with power)	■ Check if the power indicator light is lit. ■ Check if communication between every device is normal. ■ If there is any abnormal response from the power meter, contact your distributor or our customer service center.

3.3 Wiring

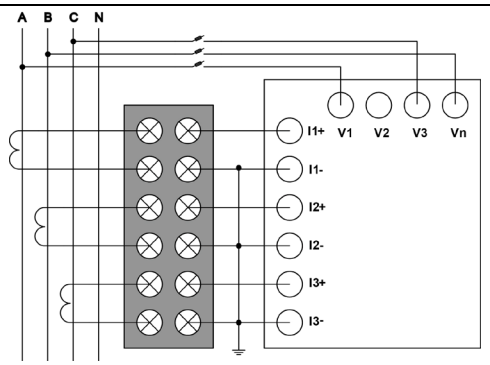
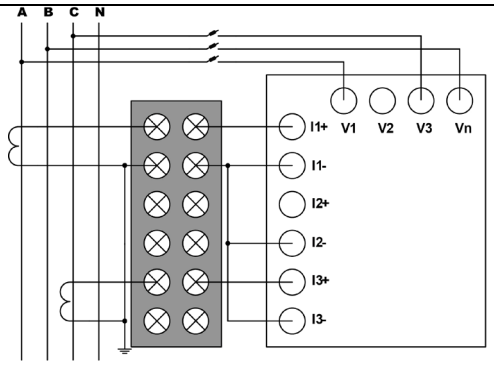
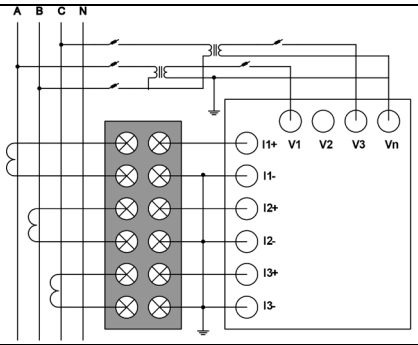
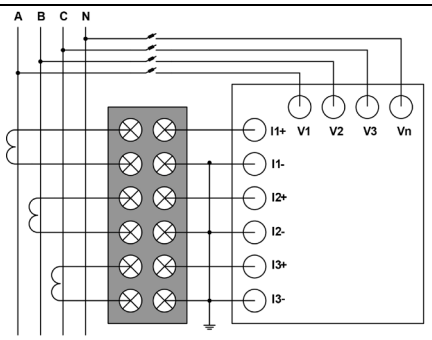
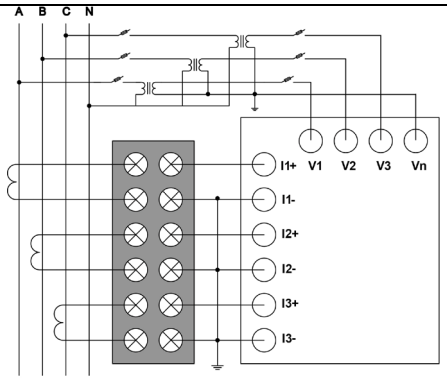
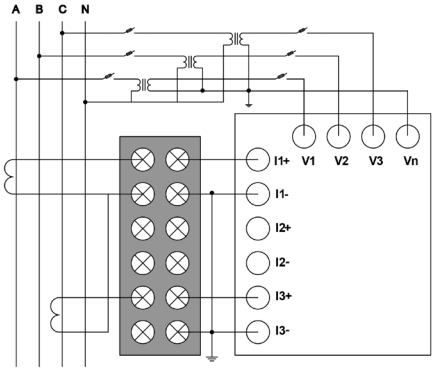
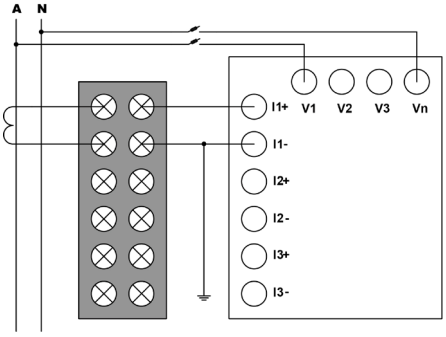
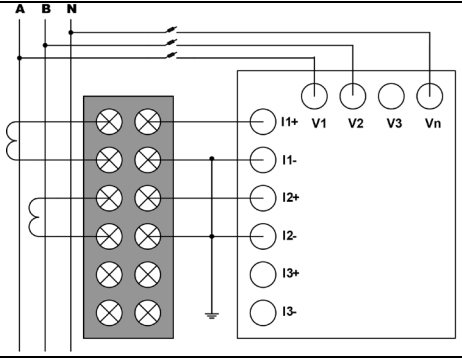
3.3.1 Wiring Diagrams

- To avoid electric shock, do not change the wiring when the power is on.
- It is necessary to install a breaker switch on the power cord of the meter due to no power switch on the power meter.
- When the measured voltage is higher than the rated specification for the device, it is necessary to use an external potential transformer (PT).
- When the measured current is higher than the rated specification for the device, it is necessary to use an external current transformer (CT).

The following table shows the recommended wiring materials.

Connecting Terminals	Wire Diameters	Screw Turning Torque	Temperature rating
Operating Power / Voltage Measurement	AWG 10–22	8.0 kgf-cm (0.8 N·m)	above 70°C
Current Measurement / RS-485	AWG 12–24	8.0 kgf-cm (0.8 N·m)	above 70°C

- **Connection Diagrams**

3PH3W, Δ connection, 3 CT, No PT	3PH3W, Δ connection, 2 CT, No PT
	
3PH3W, Δ connection, 3 CT, 2 PT	**3PH4W, Y connection, 3 CT, No PT**
	
3PH4W, Y connection, 3 CT, 3 PT	**3PH4W, Y connection, 2 CT, 3 PT**
	
1PH2W, 1 CT	**1PH3W, 2 CT**
	

The following table lists the symbols used in the diagram.

Symbol	⏚				
Description	Grounding	Current transformer	Terminal block	Voltage transformer	Fuse

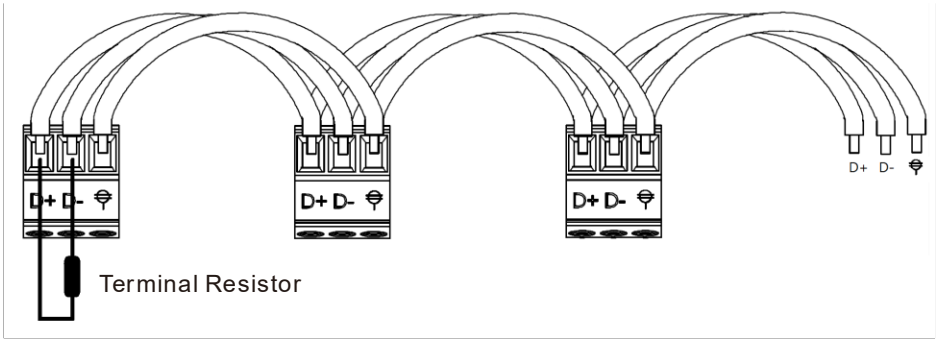
3.3.2 Communication Characteristics

- **Communications Specifications**

Max. Communication Distance	1200 m	**Baud Rate**	9600, 19200, 38400 bps
Max. Connection Number	32	**Data Length**	8-bits
Communication Protocols	Modbus RTU	**Parity**	None, Odd, Even
Function Code	03, 06, 10	**Stop Bits**	1

Note: The 7-bit data length is not available for the Modbus RTU protocol.

- Use shielded twisted-pair cables for RS485 communication. When connecting multiple devices in series, use the wiring method in the following diagram.



- Connect the D+ communication terminal for all devices on the same twisted pair cable. Connect the D- terminals on another twisted pair cable. Ground the cable shield. Install a terminal resistor on the terminal device as shown.

- Use cables with a diameter of 12–24 AWG.

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Chapter 4 Operation

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4.1 General Operation

4.1.1 Setting Menu

- HOME page (HOME): Voltage values measured by the power meter, including average voltage (Vavg), average current (Iavg), total power (Ptot).
- Phase voltage: phase voltage values measured by the power meter, including phase A voltage (L1), phase B voltage (L2), phase C voltage (L3).
- Line voltage: line voltage values measured by the power meter, including A-B line voltage (L1-L2), B-C line voltage (L3-L3), C-A line voltage (L3-L1).
- Electric current page: electric current measured by the power meter, including phase A current (A), phase B current (B), phase C current (C) and average current (T).
- Power factor page: power factors and frequencies measured by the power meter, including power factor (PF) and frequency (F).
- Power measurement: values measured by the power meter, including total active power (kW), total reactive power (kVAR), and total apparent power (kVA).
- Active power page (WATT): active power value measured by the power meter, including active power of phase A (L1), phase B (L2) and phase C (L3).
- Reactive power page (VAR): reactive power value measured by the power meter, including reactive power of phase A (L1), phase B (L2) and phase C (L3).
- Apparent power page (VA): apparent power value measured by the power meter, including apparent power of phase A (L1), phase B (L2) and phase C (L3).
- Positive active energy page (kWH): positive active energy measured by the power meter, including positive active energy.
- Positive reactive energy page (kVARH): positive reactive energy measured by the power meter, including positive reactive energy.
- Positive apparent energy page (kVAH): positive apparent energy measured by the power meter, including positive apparent energy.

1. Use UP and DOWN keys to switch among setting pages.
2. You can go back to HOME page by using BACK or INDEX (DPM-C520 / DPM-C520W) keys.

   Note 1: use BACK key in HOME page to enter the setting page.

4.2 Setting Operation

4.2.1 Password Key (PASS)

- Enter the password: The password key set for users to start operations. (Default: 0000)
- Steps:

    1. Press NEXT key until the first figure starts flickering.
    2. Press UP or DOWN keys to select the first figure of the password.
    3. Press NEXT key to select the next figure.
    4. Repeat step 2 and 3 until the setting of the fourth figure is complete.
    5. Then press NEXT key to enter the setting page of power meter parameters.

Note: In case that you enter a wrong figure, just press BACK key and the figure would stop flickering, then press NEXT key to enter the figure again.

4.2.2 Station Setup (id)

- **Communication station (id):** The setting range of station is from 1 to 254 with 1 being the factory default setting and 255 is set for the broadcasting station.
- Steps:

    1. Press NEXT key and the figures would start flickering.
    2. Press UP and DOWN keys to select the figures of the station number.
    3. Press NEXT key to complete the setting.

Note: You can go back to the previous setting item by pressing BACK key anytime, whether you have completed or canceled the setting.

4.2.3 Baud Rate (bAUd)

- Baud Rate (BR): Transmission speed; the setting options are 9600 kbps (default), 19200 and 38400 bps with 9600 bps being the default setting.
- Steps:

  1. Press NEXT key and the figures would start flickering.
  2. Press UP and DOWN keys to select the figures of the baud rate.
  3. Press NEXT key to complete the setting.

Note: You can go back to the previous setting item by pressing BACK key anytime, whether you have completed or canceled the setting.

4.2.4 Parity Setup (PRty)

- Parity (PRty): Odd and even checking bit for communication; the setting options are (8n1), Even (8E1) and Odd (8o1) with None being the default setting.
- Steps:

  1. Press NEXT key and the figures would start flickering.
  2. Press UP and DOWN keys to select the figures of the parity bit.
  3. Press NEXT key to complete the setting.

Note: You can go back to the previous setting item by pressing BACK key anytime, whether you have completed or canceled the setting.

4.2.5 System Setup (tyPE)

- Wiring methods (WR): options are tone-phase two-wire (1PH2W), one-phase three-wire (1PH3W), three-phase three-wire (3PH3W) and three-phase four-wire (3PH4W); default: three-phase four-wire.
- Steps:

  1. Press NEXT key and the figures would start flickering.
  2. Press UP and DOWN keys to select the wiring method.
  3. Press NEXT key to complete the setting.

Note: You can go back to the previous setting item by pressing BACK key anytime, whether you have completed or canceled the setting.

4.2.6 Primary Current Transformer Setup (Ct.PR)

- Ampere for the primary-side current transformer: ranging from 1 to 9999 A; default: 5 A.
- Steps:

    1. Press NEXT key until the first figure starts flickering.
    2. Press UP or DOWN keys to select the figures of the primary current transformer.
    3. Press NEXT key to select the next figure.
    4. Repeat step 2 and 3 until all the four figures are set completely.
    5. Then press NEXT key to complete.

Note: You can go back to the previous setting item by pressing BACK key anytime, whether you have completed or canceled the setting.

4.2.7 Secondary Current Transformer Setup (Ct.SE)

- Ampere for the secondary-side current transformer: options are 1 and 5 A; default 5 A.
- Steps:

    1. Press NEXT key and the figures would start flickering.
    2. Press UP and DOWN keys to select the figures of the secondary current transformer.
    3. Press NEXT key to complete the setting.

Note: You can go back to the previous setting item by pressing BACK key anytime, whether you have completed or canceled the setting.

4.2.8 Reset Setup (RST)

- **No action (noneE):** No reset action would be proceeded.
- **Restore factory defaults (dEF):** Reset all the meter setting values back to the default factory settings.
- **Reset the energy value (kwH):** Reset the accumulated energy value to zero.

- Steps:

    1. Press NEXT key and the figures would start flickering.
    2. Press UP and DOWN keys to select the desired reset setting.
    3. Press NEXT key to perform the reset action.

Note: You can go back to the previous setting item by pressing BACK key anytime, whether you have completed or canceled the setting.

4.2.9 Change Password (Pwd)

- Change the password key with 0000 being the default factory setting.

- Steps:

    1. Press NEXT key and the figures would start flickering.
    2. Press UP or DOWN keys to select the figures of the password
    3. Press NEXT key to select the next figure.
    4. Repeat step 2 and 3 until the last figure is set.
    5. Then press NEXT key to complete.

Note: You can go back to the previous setting item by pressing BACK key anytime, whether you have completed or canceled the setting.

4.2.10 Meter Information (inFo)

- **Firmware Version:** X.YY
- **Firmware release date:** XXYY (MM.DD)

MEMO

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Chapter 5 Parameters and Functions

Table of Contents

5.1 Overview of Parameters

Modbus Address		Item	Range	Data Type	Unit	Data Size (byte)	Read (R) / Write (W)
Hex	Modicom Format						
0. System Parameters: 0001 – 00FF							
5	40006	Meter Constant	3200	uint	P/kWh	2	R
6	40007	Meter Model	0: None 4: DMP–C510	word		2	R
7	40008	Total running time of the meter	0 ~ 4294967295	uint	Minute	4	R
8	40009						
9	40010	Firmware version	0.00 ~ 9.99	word		2	R
A	40011	Firmware release date	Year: 00–99 Month: 1–12	byte	Year, Month	2	R
B	40012		Date: 1–31	word	Date	2	R
C	40013	Reserved					
D	40014	Power system configuration	0: 3φ4W 1: 3φ3W 2: 1φ2W 3: 1φ3W	word		2	R/W
E	40015	Primary CT (A)	1 – 9999	uint	A	2	R/W
F	40016	Secondary CT (A)	0: 1A 1: 5A	word	A	2	R/W
10	40017	Primary PT	1 ~ 65534	uint	V	2	R / W
11	40018	Secondary PT	1 ~ 9999	uint	V	2	R / W
13	40020	Reserved					
14	40021	Backlight delay *For model C501L, this function is only supported by firmware V1.006 and above.	0 – 99 0: Backlight remains OFF. 99: Backlight remains ON.	word	Second	2	R/W
15	40022	Reserved					

16	40023	Baud Rate	0: 9600 1: 19200 2: 38400	word	bps	2	R/W
17	40024	Communication mode	1: RTU	word		2	R/W
18	40025	Data bit	0: 8	word	bit	2	R/W
19	40026	Parity bit	0: None 1: Even 2: Odd	word		2	R/W
1A	40027	Stop bit	0: 1	word	bit	2	R/W
1B	40028	Modbus address	0 – 254	word		2	R/W
1C	40029	Reset	0: None 1: Reset to factory default 2: Reset energy value	word		2	W
1. Meter Parameters: 0100 – 01FF							
100	40257	Phase A voltage	0.000 – 99999.999	float	V	4	R
101	40258						
102	40259	Phase B voltage	0.000 – 99999.999	float	V	4	R
103	40260						
104	40261	Phase C voltage	0.000 – 99999.999	float	V	4	R
105	40262						
106	40263	Average phase voltage	0.000 – 99999.999	float	V	4	R
107	40264						
108	40265	A–B line voltage	0.000 – 99999.999	float	V	4	R
109	40266						
10A	40267	B–C line voltage	0.000 – 99999.999	float	V	4	R
10B	40268						
10C	40269	C–A line voltage	0.000 – 99999.999	float	V	4	R
10D	40270						
10E	40271	Average line voltage	0.000 – 99999.999	float	V	4	R
10F	40272						
120	40289	Phase A current	0.000 – 99999.999	float	A	4	R

121	40290						
122	40291	Phase B current	0.000 – 99999.999	float	A	4	R
123	40292						
124	40293	Phase C current	0.000 – 99999.999	float	A	4	R
125	40294						
126	40295	Three–phase average current	0.000 – 99999.999	float	A	4	R
127	40296						
128	40297	Neutral line current	0.000 – 99999.999	float	A	4	R
129	40298						
12A	40299	Phase A current unbalance	0.00 – 99.99	float	%	4	R
12B	40300						
12C	40301	Phase B current unbalance	0.00 – 99.99	float	%	4	R
12D	40302						
12E	40303	Phase C current unbalance	0.00 – 99.99	float	%	4	R
12F	40304						
130	40305	Current unbalance	0.00 – 99.99	float	%	4	R
131	40306						
132	40307	Total power factor	0.00000 – 1.00000	float		4	R
133	40308						
134	40309	Power factor of phase A	0.00000 – 1.00000	float		4	R
135	40310						
136	40311	Power factor of phase B	0.00000 – 1.00000	float		4	R
137	40312						
138	40313	Power factor of phase C	0.00000 – 1.00000	float		4	R
139	40314						
142	40323	Frequency	0.0000 – 99.9999	float	Hz	4	R
143	40324						
144	40325	Total instantaneous active power	0.000 – 99999.999	float	kW	4	R
145	40326						
146	40327	Instantaneous active power of phase A	0.000 – 99999.999	float	kW	4	R
147	40328						

148	40329	Instantaneous active power of phase B	0.000 – 99999.999	float	kW	4	R
149	40330						
14A	40331	Instantaneous active power of phase C	0.000 – 99999.999	float	kW	4	R
14B	40332						
14C	40333	Total instantaneous reactive power	0.000 – 99999.999	float	kVAR	4	R
14D	40334						
14E	40335	Instantaneous reactive power of phase A	0.000 – 99999.999	float	kVAR	4	R
14F	40336						
150	40337	Instantaneous reactive power of phase B	0.000 – 99999.999	float	kVAR	4	R
151	40338						
152	40339	Instantaneous reactive power of phase C	0.000 – 99999.999	float	kVAR	4	R
153	40340						
154	40341	Instantaneous apparent power	0.000 – 99999.999	float	kVA	4	R
155	40342						
156	40343	Instantaneous apparent power of phase A	0.000 – 99999.999	float	kVA	4	R
157	40344						
158	40345	Instantaneous apparent power of phase B	0.000 – 99999.999	float	kVA	4	R
159	40346						
15A	40347	Instantaneous apparent power of phase C	0.000 – 99999.999	float	kVA	4	R
15B	40348						
15C	40349	Active energy of three - phase delivered	0x00000000 – 0xFFFFFFFF	unit	kWh	4	R
15D	40350						
160	40353	Reactive energy of three - phase delivered	0x00000000 – 0xFFFFFFFF	unit	kVARh	4	R
161	40354						
164	40357	Apparent energy of three - phase delivered	0x00000000 – 0xFFFFFFFF	unit	kVAh	4	R
165	40358						

5.2 Modbus Communication

5.2.1 Supported Modbus Function Codes

Function Code	Modbus Name	Description
0x03	Read Holding Registers	Read the contents of read location
0x06	Preset Single Registers	Preset the contents of written location
0x10	Preset Multiple Registers	Preset the contents of written loacations

When the protocol is Modbus RTU, the maximum address to be gathered with a single Modbus block read is 50 for function code 0x3, and the maximum address is 49 for function code 0x10. The function code 0xFE can be used only when the protocol is Modbus RTU.

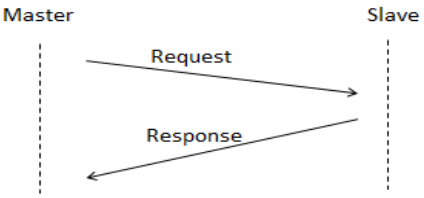
5.2.2 Modbus Communication Protocol

Modbus RTU mode is adopted with Modbus Master sending out the Request, in which the Function Code uses 0x03 to request response from Slave to correspond to values in Modbus address. In Response, Modbus Slave responds to the values of Modbus address in the Master request. The packet format of IEEE754 is used for the address of floating point numbers that corresponds to the register values found in table 5.2, using 2's complement packet format. The format are as follows:

Low Word		High Word	
High Byte	Low Byte	High Byte	Low Byte

The packet formats (2's complement) for the address of integers that corresponds to the register values found in table 5.2 are shown in the example below.

Read：



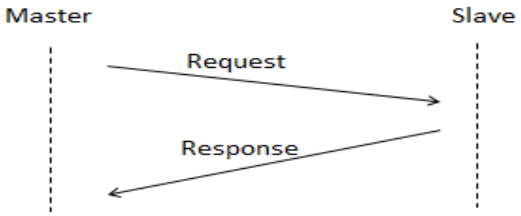
Request

Slave Address	1 ~ 255
Function Code	03h
Start Address (High)	00h ~ FFh
Start Address (Low)	00h ~ FFh
Number of Points (High)	00h
Number of Points (Low)	00h ~ FFh
Error Check (Low)	CRC
Error Check (High)	CRC

Response

Slave Address	1 ~ 255
Function Code	03h,
Byte Count	00h ~ FFh
Data (High)	00h
Data (Low)	00h ~ FFh
Error Check (Low)	CRC
Error Check (High)	CRC

Write:



Request

Slave Address	1 ~ 255
Function Code	06h
Start Address (High)	00h ~ FFh
Start Address (Low)	00h ~ FFh
Number of Points (High)	00h
Number of Points (Low)	00h ~ FFh
Error Check (Low)	CRC
Error Check (High)	CRC

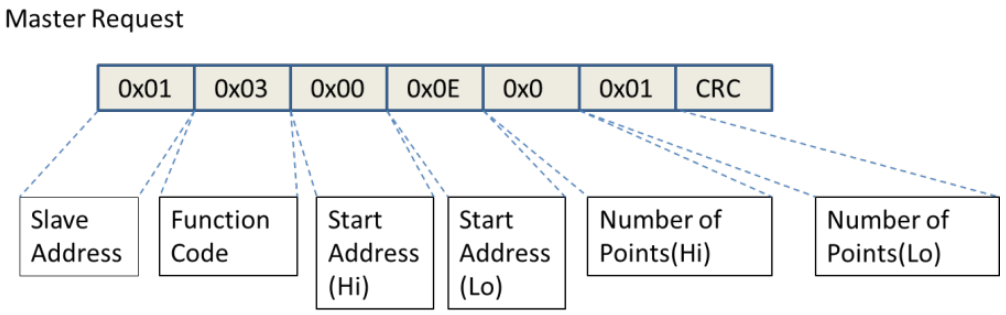
Response

Slave Address	1 ~ 255
Function Code	06h
Start Address (High)	00h ~ FFh
Start Address (Low)	00h ~ FFh
Number of Points (High)	00h
Number of Points (Low)	00h ~ FFh
Error Check (Low)	CRC
Error Check (High)	CRC

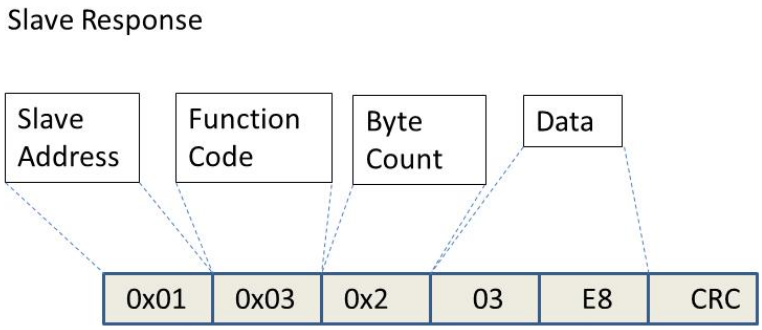
Example:

For Modbus Master, such as PLC or data collector, it uses Modbus protocol to get the value of CT setting (Register address 0x000E) on the power meter (Modbus Slave) (Slave address 0x1). The register value is 1000.

The packet format for Request sent out by Modbus Master (PLC or data collector) is as follows:

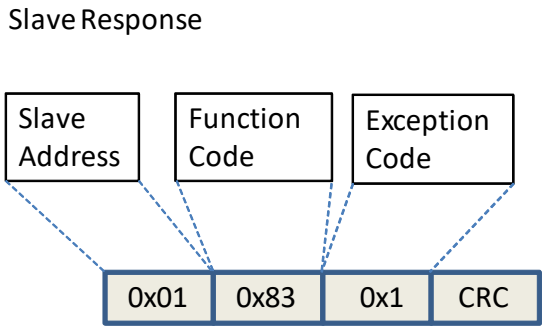


The packet format for Response responded by Modbus Slave (power meter) is as follows:



After receiving response from the power meter, Modbus Master acquires the value of currents from the primary-side current transformer (register address 0x000E), which is 1000.

Should Modbus Slave (power meter) receive an abnormal Request, the format of the abnormal packet responded is as follows.



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Chapter 6 Error Codes

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6.1 Error Codes

When an error occurs during operation, the power monitor sends an error code through Modbus. The following table lists the error codes and causes.

Error Code	Name	Description
0x01	Illegal function	Incorrect function code
0x02	Illegal data address	Incorrect data address to read or write
0x03	Illegal data value	Incorrect data format (for example, data length)
0x04	Slave device failure	Slave cannot execute the command.

Appendix A Accessories

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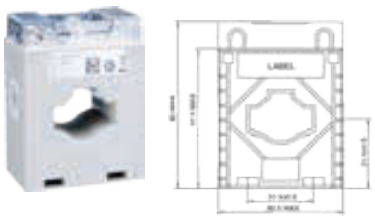
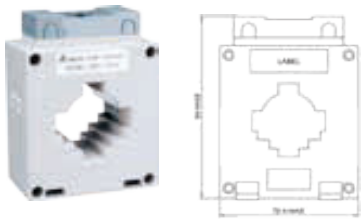
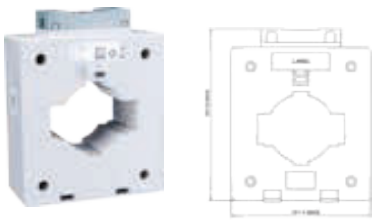
When measured current is higher than the rated specification for the device, use of an external current transformer (CT) is necessary. Choose the proper CT from the table below to install.

A.1 DCTMC Series

Model Number	Measurement Accuracy	Primary Current	Secondary Current	Rated Burden (VA)	External Dimension*1 (mm)	Size of Opening*1 (mm)
DCT-MC010-5	1.0%	100A	5A	1.5	80*60*38	20*30.5
DCT-MC020-5	0.5%	200A	5A	3.75		
DCT-MC030-5	0.5%	300A	5A	5	98*74.5*43	42*42
DCT-MC040-5	0.5%	400A	5A	7.5		
DCT-MC050-5	0.5%	500A	5A	5	127*103*45	51*61
DCT-MC060-5	0.5%	600A	5A	10		

*1: See the following table for detailed information on the external dimensions and sizes of opening.

Toroidal Current Transformer

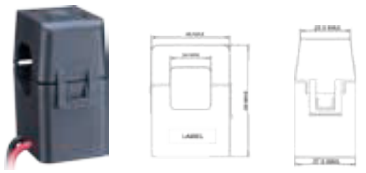
Model Number	Dimension (mm)	
DCT-MC010-5	External Dimension：80 x 60 x 38 Size of Opening：20 x 30.5	
DCT-MC020-5		
DCT-MC030-5	External Dimension：98 x 74.5 x 43 Size of Opening：42 x 42	
DCT-MC040-5		
DCT-MC050-5	External Dimension：127 x 103 x 45 Size of Opening：51 x 61	
DCT-MC060-5		

A.2 DCTCS Series

Model Type	Measurement Accuracy	Primary Current	Secondary Current	Rated Burden (VA)	External Dimension*1 (mm)	Size of Opening*1 (mm)
DCT-CS010-5	1%	100A	5A	1000	66.8*49.8*34.2	23.8*25.2
DCT-CS020-5	1%	200A	5A	1000		
DCT-CS030-5	1%	300A	5A	1000		
DCT-CS040-5	1%	400A	5A	1000	85*69*42.5	36.5*36.5
DCT-CS050-5	1%	500A	5A	1000		
DCT-CS060-5	1%	600A	5A	1000		

*1: See the following table for detailed information on the external dimensions and sizes of opening.

Small Size Toroidal Current Transformer

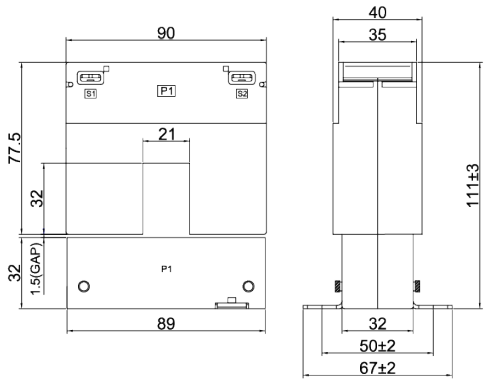
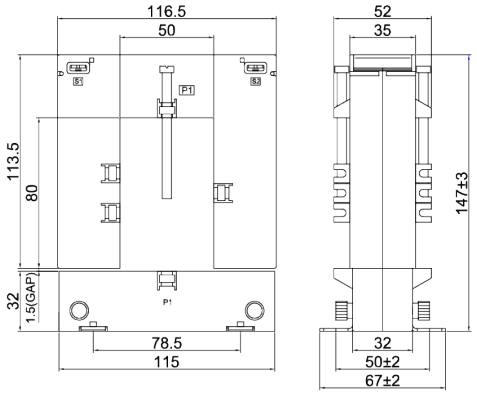
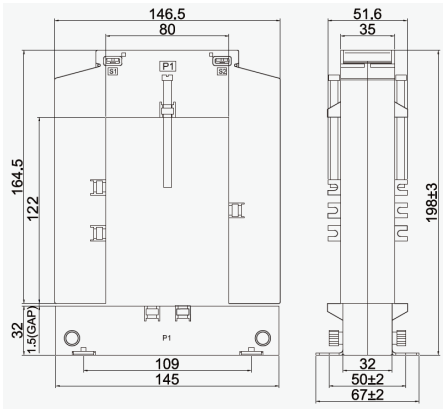
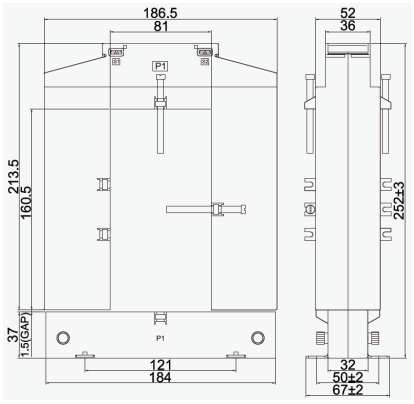
Model	**Dimension (Unit: mm)**	
DCT-CS010-5	External Dimension：66.8 x 49.8 x 34.2 Size of Opening：23.8 x 25.2	
DCT-CS020-5		
DCT-CS030-5		
DCT-CS040-5	External Dimension：85 x 69 x 42.5 Size of Opening：36.5 x 36.5	
DCT-CS050-5		
DCT-CS060-5		

A.3 DCT1000 Series

Electromagnetic Compatibility: CE-marking, IEC61869-2.

Model Number	Measurement Accuracy	Primary Current	Secondary Current	Rated Burden (VA)	External Dimension*1 (mm)	Size of Opening*1 (mm)
DCT-S301C	1.0%	100 A	5 A	1.5	90 x 40 x 111	21 x 32
DCT-S211C	0.5%	200 A	5 A	1		
DCT-S221C	0.5%	300 A	5 A	1.5		
DCT-S231C	0.5%	400 A	5 A	2.5		
DCT-S241C	0.5%	500 A	5 A	2.5	116.5 x 52 x 147	50 x 80
DCT-S251C	0.5%	600 A	5 A	2.5		
DCT-S261C	0.5%	750 A	5 A	2.5		
DCT-S271C	0.5%	1000 A	5 A	5		
DCT-S281C	0.5%	1500 A	5 A	7.5	146.5 x 51.6 x 198	80 x 122
DCT-S291C	0.5%	2000 A	5 A	10	186.5 x 52 x 252	81 x 160.5
DCT-S2A1C	0.5%	2500 A	5 A	15		
DCT-S2B1C	0.5%	3000 A	5 A	20		

*1: See the following table for detailed information on the external dimensions and sizes of opening.

Model Number	Dimension (mm)	
DCT-S301C DCT-S211C DCT-S221C DCT-S231C	External Dimension: 90 x 40 x 111 Size of Opening: 21 x 32 	
DCT-S241C DCT-S251C DCT-S261C DCT-S271C	External Dimension: 116.5 x 52 x 147 Size of Opening: 50 x 80 	
DCT-S281C	External Dimension: 146.5 x 51.6 x 198 Size of Opening: 80 x 122 	
DCT-S291C DCT-S2A1C DCT-S2B1C	External Dimension: 186.5 x 52 x 252 Size of Opening: 81 x 160.5 	

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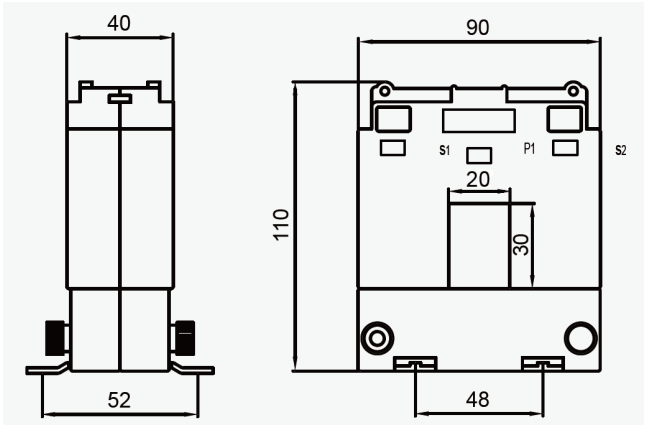
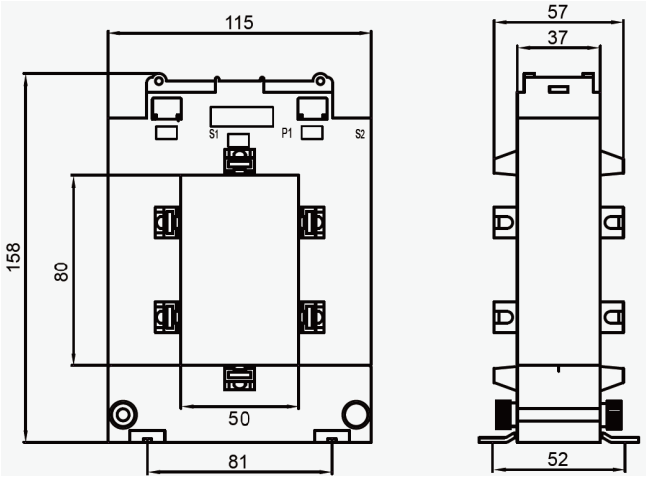
A.4 DCT2000 Series

Electromagnetic Compatibility: UL, UL2808.

Model Number	Measurement Accuracy	Primary Current	Secondary Current	Rated Burden (VA)	External Dimension*1 (mm)	Size of Opening*1 (mm)
DCT-S201B	1.0%	100 A	5 A	1	90 x 40 x 110	20 x 30
DCT-S211B	0.5%	200 A	5 A	1		
DCT-S221B	0.5%	300 A	5 A	1.5		
DCT-S231B	0.5%	400 A	5 A	1.5	115 x 57 x 158	50 x 80
DCT-S241B	0.5%	500 A	5 A	2.5		
DCT-S251B	0.5%	600 A	5 A	2.5		
DCT-S261B	0.5%	750 A	5 A	2.5		
DCT-S2C1B	0.5%	800 A	5 A	3.75		
DCT-S271B	0.5%	1000 A	5 A	5		

*1: See the following table for detailed information on the external dimensions and sizes of opening.

Model Number	Dimension (mm)	
DCT-S201B	External Dimension: 90 x 40 x 110 Size of Opening: 20 x 30	
DCT-S211B		
DCT-S221B		

DCT-S231B DCT-S241B DCT-S251B DCT-S261B DCT-S2C1B DCT-S271B	External Dimension: 115 x 57 x 158 Size of Opening: 50 x 80 	

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