C³V Series

2010 4005 6003

Programmable DC Power Supply

1. Important Safety Instructions

1.1 General

This chapter contains important safety instructions for fully utilizing the C3V Series DC Power Supply. It is important that this manual is read and understood by all persons prior to transporting, installing, operating, servicing, or maintaining the product.

1.2 Symbols & Messages

The following symbols mainly appear in this chapter and may be found in other chapters and on the product itself.

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, **will** result in death or serious injury
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, **may** result in death or serious injury
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, **may** result in moderate or minor injury
⚡	Electrical shock risk
🔥	Fire risk
❗	Attention
📡	EMI risk
🌡	High temperature
	Condensation
⏚	Earth terminal

1.3 Safety Instructions

1.3.1 Transportation
When transporting the product, please ensure that the original packaging is used to prevent damage to the product.

1.3.2 Ambient Conditions

	• The product is designed for indoor use. • Condensation may occur after the product was shipped, or subject to a sudden change in an atmosphere of temperature or humidity. Do not use the product for at least two hours to ensure it is dry before turning it on.
	• Do not place the product in high humidity area. • Do not expose the product to direct sunlight or any heat source. • Do not block the ventilation openings at the enclosure of the product. • Do not place any heavy objects on the product.

1.3.3 Installation The product

	The product is constructed to Protection Class I. Connect the product to an earthed wall receptacle with a power cord approved by relevant International Standards.
	The product is rated at AC input 85~264V, 47~63Hz mains.

1.3.4 Operation

	DANGER Be careful! A change from open circuit to short circuit could result in high current sparks and cause injury to eyes. An instantaneous power circuit change from short to open may induce high voltage and arcing, causing shock and injury to eyes.

1.3.5 Service & Maintenance

⚠	**⚠ DANGER** The product operates at hazardous high voltage (near DC 380V or AC 267V). Only qualified personnel can carry out servicing or maintenance.
⚠	**⚠ WARNING** Always use a properly rated voltage sensing device to confirm that all power is off.
⚠	**⚠ WARNING** Before attempting any service, disconnect the product from all power supply and ensure that no harmful residual voltage remains at the terminals of bulk capacitors.
⚠	Replace the fuse only with the same amperage and voltage ratings to avoid risk of fire.
⚠	• This is a Class A device which may cause RF interference within the home. • The product should only be operated when the case is securely closed, with all screwed tightened. • While operating the product, the wearing of metal or other conducting jewelry such as chains, bracelets, rings, etc. is not recommended.

1.3.6. Storage

• Location: Indoor
• Relative Humidity: <80%
• Temperature: -10℃ ~ 70 ℃

2. Get Acquainted with C³V Series

2.1 Front Panel Overview
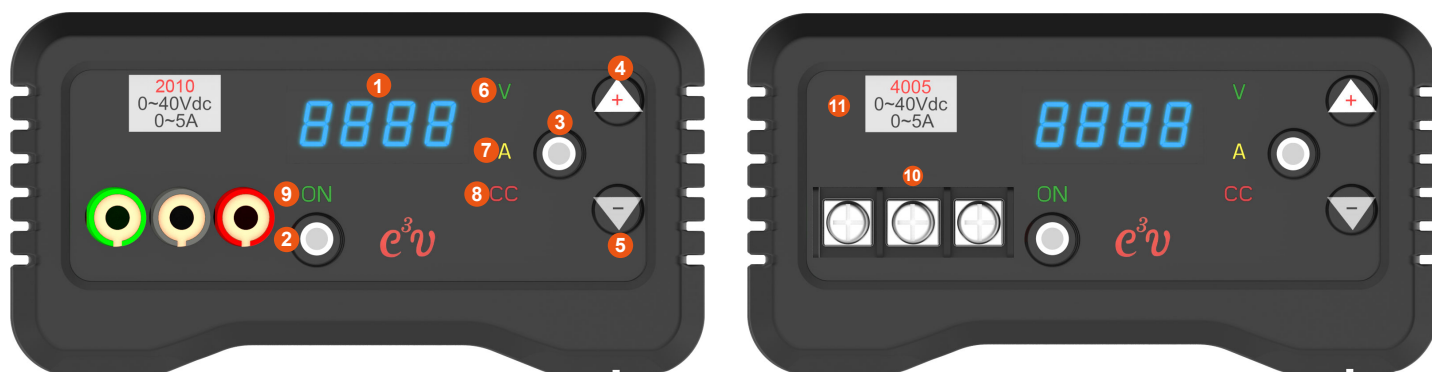
1	Display Meter	• 4-digit meter displays voltage, current and internal temperature of the product. • For auxiliary uses of system parameters setup.
2	Output key	Turns the output on/off.
3	Enter key	Circulatory mode selection. Up/Down inputs confirmation.
4	Up key	Input increments.
5	Down key	Input decrements.
6	V-LED	• Green "V" denotes unit = "VOLT" for meter display. • Lit state: Meter display in Output (Reading) mode. • Blinking: Meter display in Setting mode.
7	A-LED	• Orange "A" denotes unit = "AMPERE" for meter display. • Lit state: Meter display in Output (Reading) mode. • Blinking: Meter display in Setting mode.
8	cc-LED	• Red "cc" symbol. • Off state: Output in constant voltage (CV) mode. • Lit state: Output in constant current (CC) mode.

9	Output LED	Green "ON" symbol. Off: Output Off. Lit: Output On.
10	Output terminals	Ground terminal, negative terminal, and positive terminal, respectively.
11	Model & output ratings	See 2.2

2.2 Models & Output Ratings

C³V series consists of 3 models and ratings as listed below:

| Model	2010	4005	6003
Voltage	0 - 20V	0 - 40V	0 - 60V
Current	0 - 10A	0 - 5A	0 - 3.5A
Power	200W	200W	210W

3. Operation

3.1 General

C³VSeries integrates two power supplies – constant voltage (CV) and constant current (CC). These two power supplies exclusively operate, and outputs do not exceed user-preset limit. CV or CC states are dependent on and limited by the comparison between load conditions and C³V Series settings.

3.2 Description

C³VSeries utilizes the Up and Down keys to set desired voltage and current outputs. Real time voltage and current are displayed on the Display Meter. Pressing the Enter key momentarily switches between different operation modes.

The V-LED and A-LED indicate the selected operation mode. The CC-LED indicates that the power supply currently being in CC Output (Reading) mode.
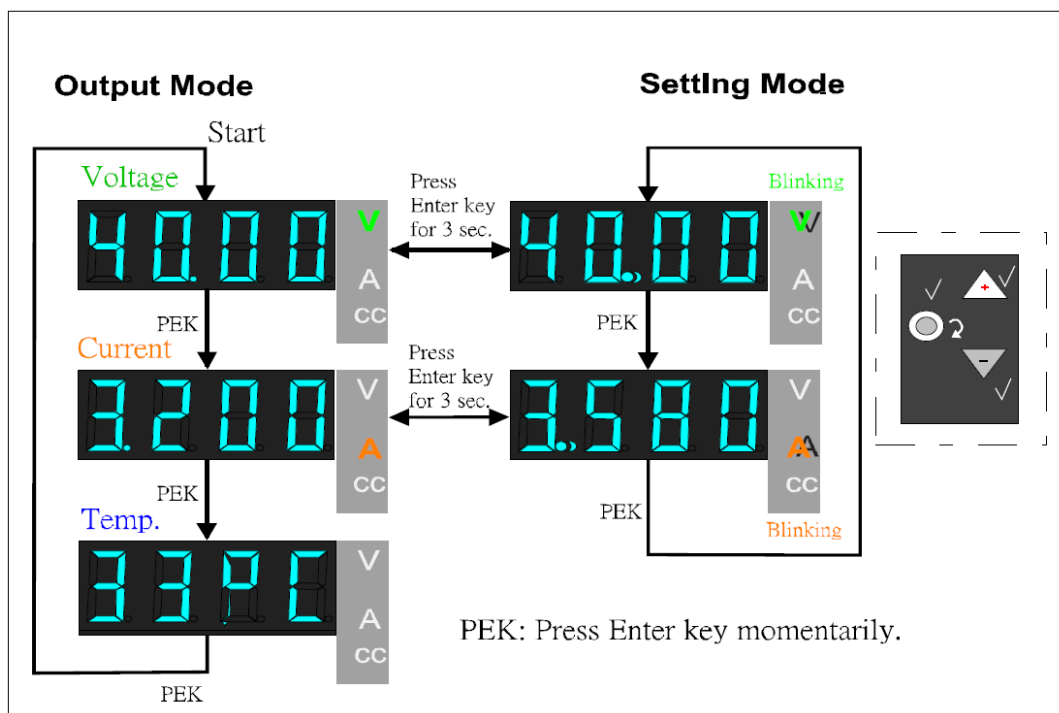
# 3.3 Output (Reading) Mode & Setting mode

Output (Reading) Mode
Upon AC powering on the C³V Series, the unit automatically enters "Output (Reading) Mode" and the green V-LED illuminates. The values shown on the Display Meter refer to the last used data. Pressing the Enter key momentarily, you can read the voltage, current (if a load was connected) and internal temperature. The outputs are controlled by preset CC and CV values, as shown in the graph below.
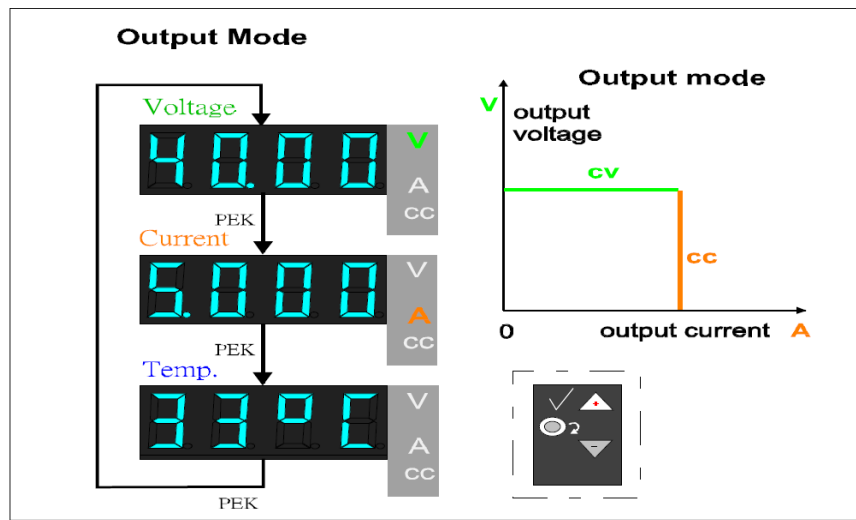
Setting Mode

By pressing the Enter key for 3 seconds, you will hear a short beeping sound. This indicates that the C³V Series has entered "Setting Mode". "The V-LED OR A-LED "AND" the respective decimal point" will be blinking on the 4-digit Display Meter.

Use the Up or Down keys to set the desired voltage or current. Press the Enter key for 3 seconds to confirm. The C³V Series now reverts to "Output (Reading) Mode". The adjusted value is displayed in the graph below.
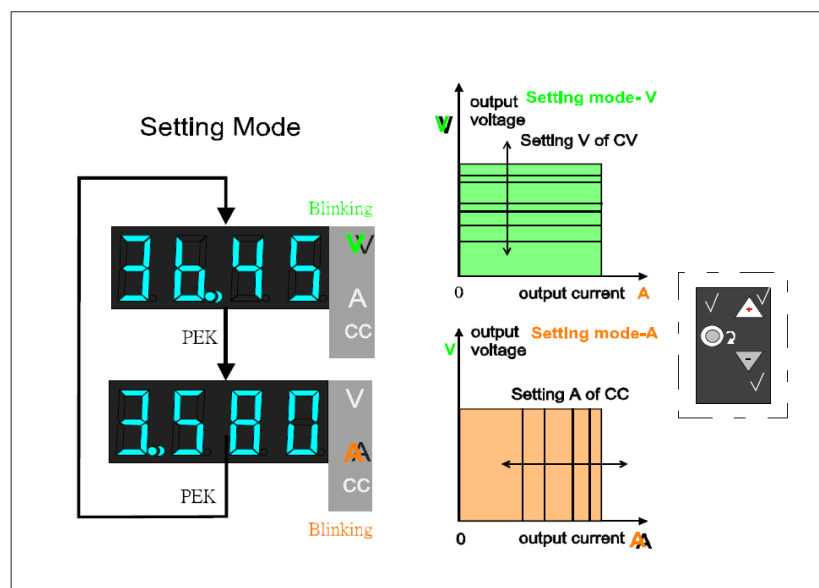
3.4 Switching between Two Modes

Press the Enter key for 3 seconds to switch between Output (Reading) Mode and Setting Mode. This operation is especially useful for circuit experiments where frequent changes of V or A is necessary.
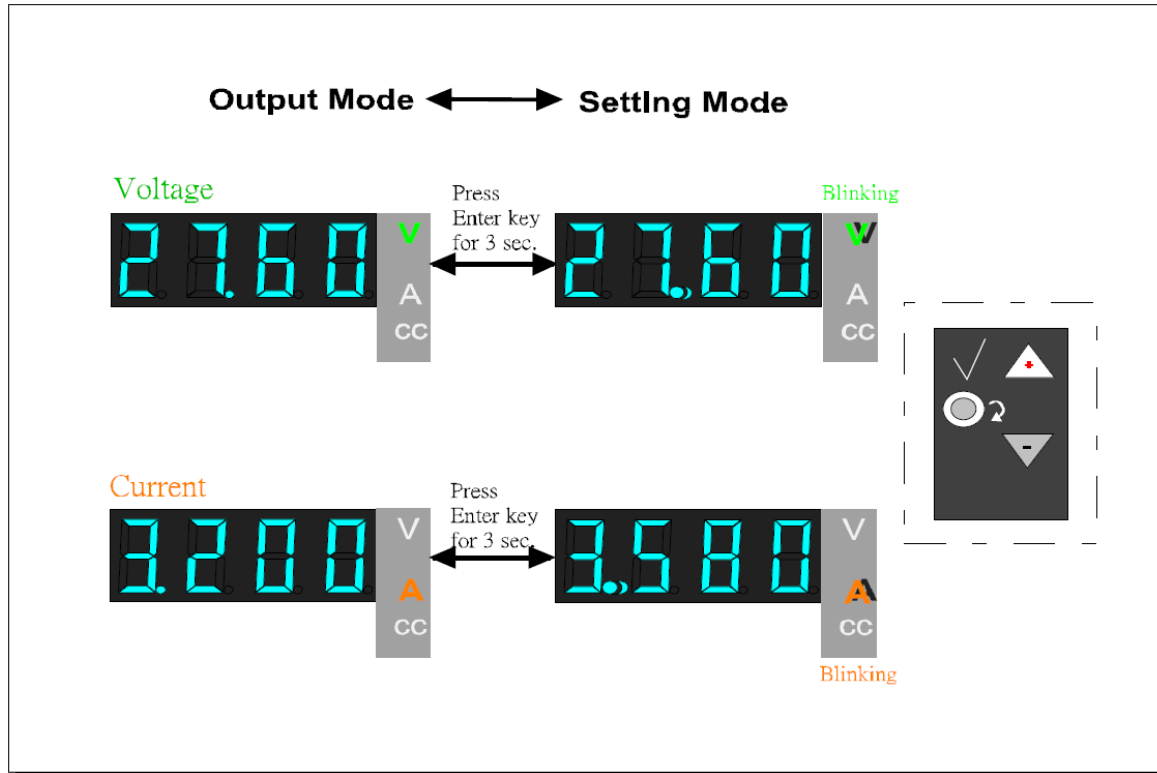
4. Keys: Special Functions

Some keys are programmed with special functions.

4.1 Normal Operations

Output key	• Press to toggle the output on / off (refer to 4.3 for default AC power setting).
Enter key	• Press for 3 seconds to select between Output (Reading) Mode and Setting Mode. • Momentary press to select V or A. • Please refer to V-LED and A–LED on the panel.
Up key	• Momentary press for least digit increment. • Press and hold for larger digit increment (larger and faster increment). • Please refer to the Display Meter on the panel.
Down key	• Momentary press gets least digit decrement. • Press and hold to get larger digit decrement (more and faster decrement). • Please refer to the Display Meter on the panel.

4.1 Special Functions

Query on firmware version / model number / RS-485 address	Hold down the Enter key and turn on AC power. You will find: • V-LED: firmware version • A-LED: model number • CC-LED: RS-485 address Release the Enter key to resume normal operations. Refer to the graphic below.
Set up RS-485 address	Press and hold the Output key for 10 seconds until it beeps. The LED will display the address. Press the Up and Down key to set the address and press the Enter key to confirm.
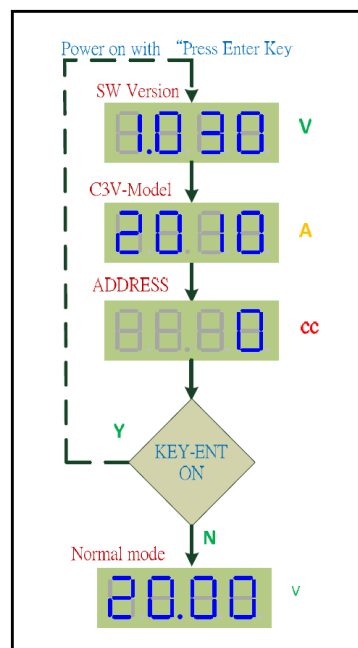
4.3 Default Output State (ON / OFF)
Output state when the unit is powered on:

JP12 on MCU card	Default state at AC power on
OPEN	Output ON
SHORT	Output OFF(Default)

Note: User modification not recommended.
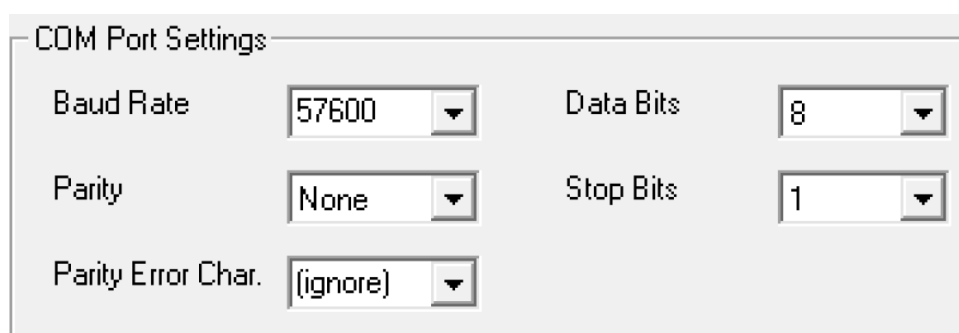
5. C³V Series Communication Interfaces

C³ VSeries provides three isolated communication interfaces: RS232, USB and RS485.The selected interface must be confirmed before shipping and cannot be modified after delivery.

5.1 Communication Data Rate

Data rate: 57600/N/8/1

- Baud Rate: 57600
- Parity: None
- Data Bit: 8
- Stop Bit: 1
- Flow Control: None

5.2 C³V Series with RS232 Interface

Uses standard female DB9 connector.

RS232 pin assignment:

Pin No.	Signal Name	Description	DTE In/Out
1	DCD	Data Carrier Detect	Input
2	RX	Receive Data	Input
3	TX	Transmit Data	Output
4	DTR	Data Terminal Ready	Output
5	SGND	Signal Ground	-
6	DSR	Data Set Ready	Input

Pin No.	Signal Name	Description	DTE In/Out
7	RTS	Request To Send	Input
8	CTS	Clear To Send	Input
9	RI	Ring Indicator	Output

5.2.1 RS232 Connection with PC RS232 to PC

C³V Series   PC-DB9
Female

2 ———— 2
3 ———— 3
5 ———— 5
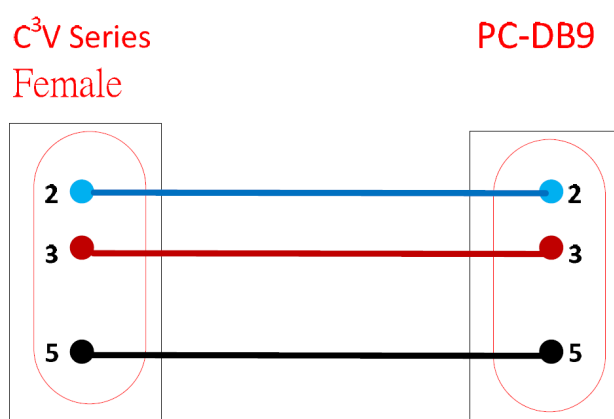
5.3 C³V Series with USB Interface

USB Type B Connector as shown below
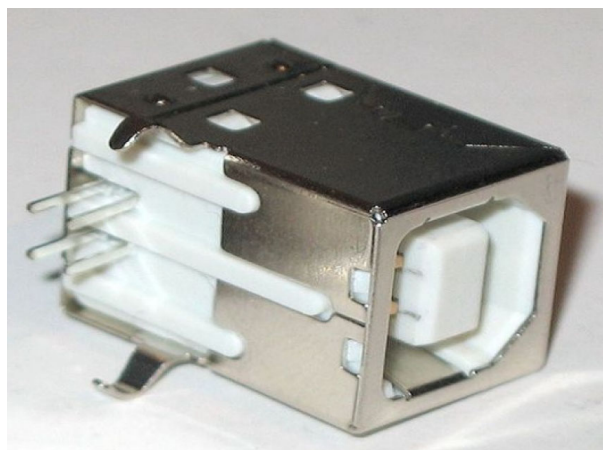
5.4 C³VSeries with RS485 Interface

The RS485 address needs to be set up before communication. Each C³V Series must

have a unique address ranging from 1 to 32. The address "0" is reserved for RS-232 and USB interface. Up to 32 units can be connected in parallel.

5.4.1 RS485 Termination Resistor (120R) Installation & Wiring

When installing, please connect a 120Ω termination resistor to the "+/-" terminals of the green terminal block of the final parallel unit of C³V Series.
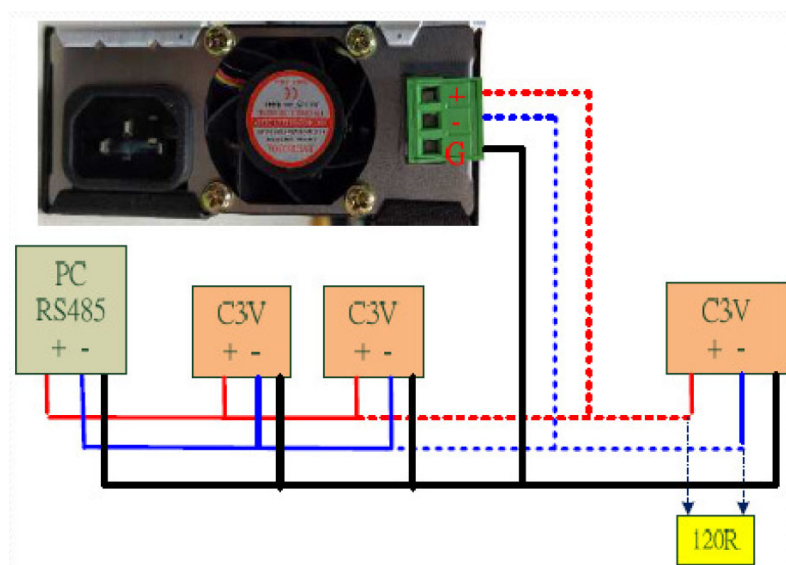
5.4.2 RS485 Address

The RS485 address must be set from 1 to 32 and cannot duplicated.
USB & RS232 interface do not require set up as default value "0"
is already factory preset.

Refer to Chapter 4 for instructions on the RS485 address setup and query.

6. C³VSeries Communication Protocol.

Commands can be written in either ASCII or hexadecimal codes. C³V Series never sends messages till it receives the CMD from the PC.
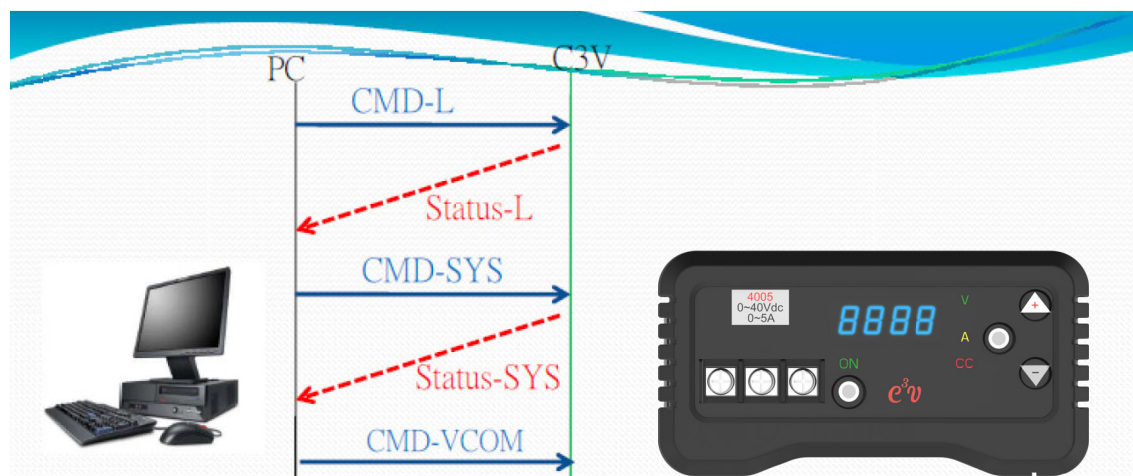
6.1 Communication between PC and C³V Series

As shown below:

- PC sends "CMD-L" – C³V Series replies "Status-L"
- PC sends "CMD-VCOM" – C³V Series replies "Status-OK"

6.2 Message Terminator of Protocol: CR LF

CR = 0x0D (HEX)

LF = 0x0A(HEX)

6.3 Data format (PC to C³V)
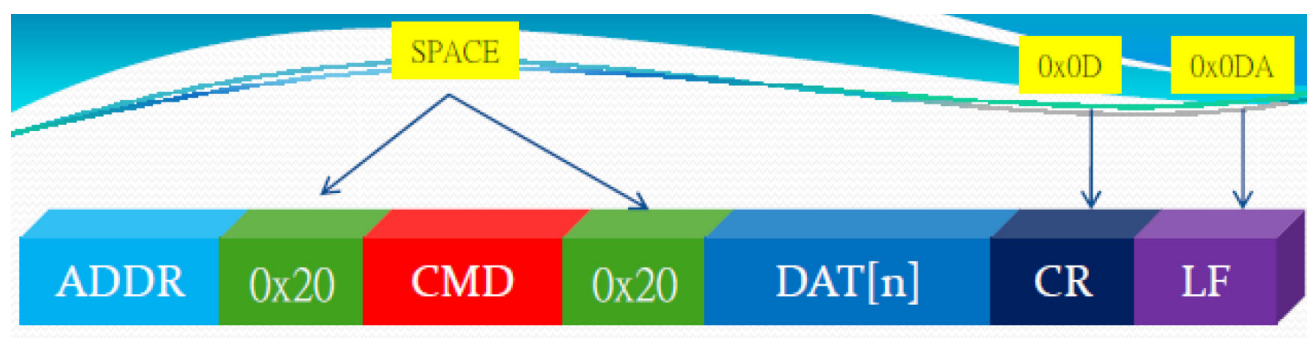
6.3.1 ADDR (PC to C³V Series)

This field is the address code of the protocol.
If this code is correct, C³V Series will receive commands. Every C³V Series unit can be set with an address from 1 to 32. When using the RS485 interface, you must set a unique address code for each power supply. 參考4.2

ADDR	Description	Interface
C³V00	This is a universal code. C³V Series will execute commands after receiving the code.	RS232, USB and RS485 (single unit)

C³V01	When the C³V Series receives and decodes the code (address), it will execute the received command.	RS485 (multiple units)
C³V02 . C³V32	. ...	

Command Set (PC to C³V Series)
This field is the command code of the protocol.

CMD	Function Description
L	The L query returns all C³V Series statuses: Reply: Status-L C³V00 L <CR><LF> Vcom=20.00,Vout=1.35 Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>
SYS	The SYS query returns the model and firmware version of the C³V Series: Reply: Status-SYS C³V00 SYS <CR><LF> C³V-405@1.01<CR><LF>
VCOM	VCOM sets output voltage level: Reply: Status-OK C³V00 VCOM 20<CR><LF> OK<CR><LF>
ICOM	ICOM sets the output current limit: C³V00 ICOM 3.5<CR><LF> OK<CR><LF>

ON	ON turns the output on: Reply: Status-OK C³V00 ON<CR><LF> OK<CR><LF>
OFF	OFF turns the output off: Replay: Status-OK C³V00 OFF<CR><LF> OK<CR><LF>

Data Format CMD-L (C³V Series to PC)
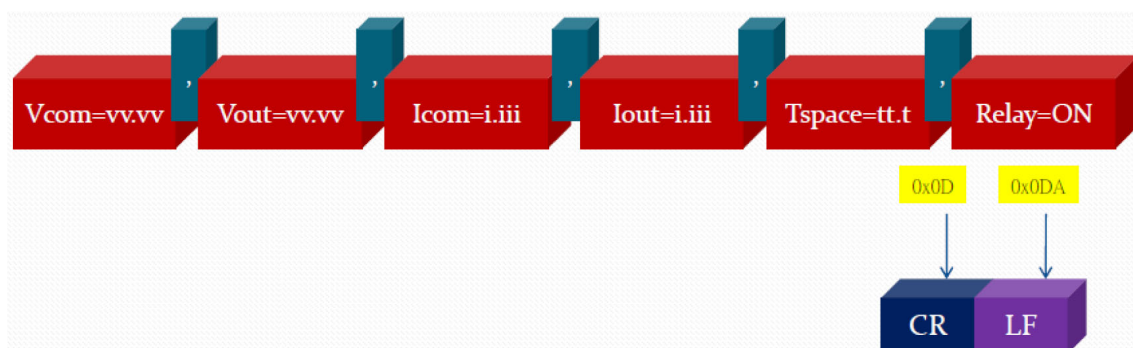
Status-L (C³V Series to PC)
This field is the command code of this protocol.

Status	Function Description
Vcom	Reply voltage value of setting: C³V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>
Vout	Reply output voltage value: C³V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>

Icom	Reply current limit setting: C³V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>
Iout	Reply output current value: C³V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>
Relay	Reply RELAY status: C³V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>
Tspac	Reply heat sink temperature value: C³V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>

Status-SYS (C³V Series to PC)

Status-SYS	Function Description
SYS	Reply model and software version of C³V Series: C³V00 SYS C³V-405@1.01

Status-OK (C³V Series to PC)

Status-OK	Function Description
OK	Reply OK C³V00 ON OK
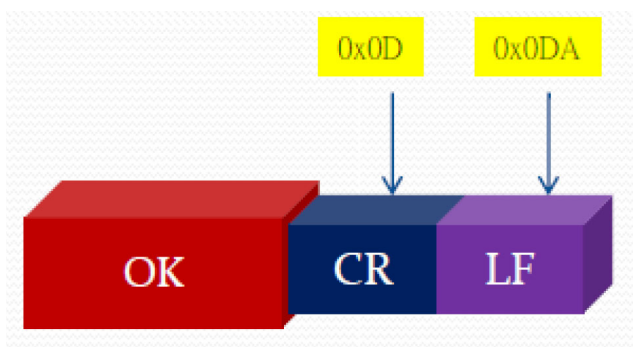
7. Automatic Fan Speed vs Temperature Control

7.1 PWM Fan Speed Control

C³V Series uses PWM to control the fan speed and temperature. The MCU senses the internal temperature of the unit and adjusts the fan speed automatically. Thisextends the fan lifespan and reduces mechanical noise when there is no output. If the output current exceeds one half of the maximum current, the fan will be set at full speed automatically.

7.2 Over Temperature Protection (OTP) Alarm

When the temperature of the secondary heat sink is high (> 85 ℃), it will turn off the output automatically and generate an acoustic alarm.

8. Wiring and Connections.

88.1 All Connections

The following table shows the types of connection to the unit:

1. AC input
2. DC output
3. Communication interfaces.

Please refer to the last graphic in this chapter.

	To be connected and fixed at C³V	Connection with external wires(cable)
AC input (Rear panel)	IEC male	IEC (female) cord
	Terminal board	Y or O type terminal with wires
DC output (Front panel)	Banana jack	Banana plug with wires
	Terminal board	Y or O type terminal with wires
Communication Interface (Rear panel)	USB type B connector	USB male connector
	RS-485 terminal block	Twisted wire pair
	RS-232 female D-sub	RS-232 male D-sub

8.2 Special Connectors to Prepare

"O" or "Y" type terminal

"O" type terminal

< 7mm

> 3.5mm

"Y" type terminal

< 7mm

> 3.5mm
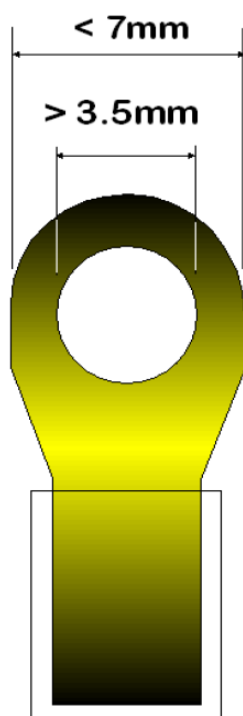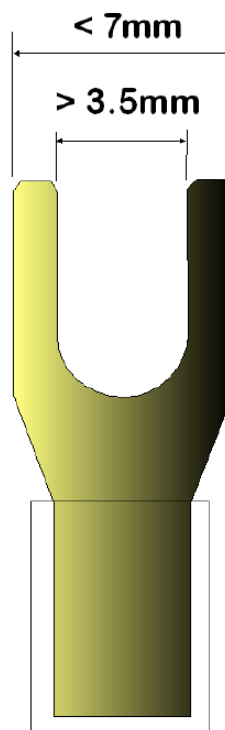
8.3 Wire Size Table

The following table suggests some applicable sizes for DC output lead wire where the maximum current and minimum DC resistance are considered.

Gauge	Diameter (mm)	Rated Current (A)	Ω/meter 阻值/米
AWG #12	2.06	26	.005211
AWG #14	1.63	16	.008286
AWG #16	1.30	10	.01317
AWG #18	1.02	6	.02095
AWG #20	0.81	4	.03331

8.4 Types of Panel Layout

The following table and graphic illustrate the types of input / output connection and communication interfaces on both front and rear panels.
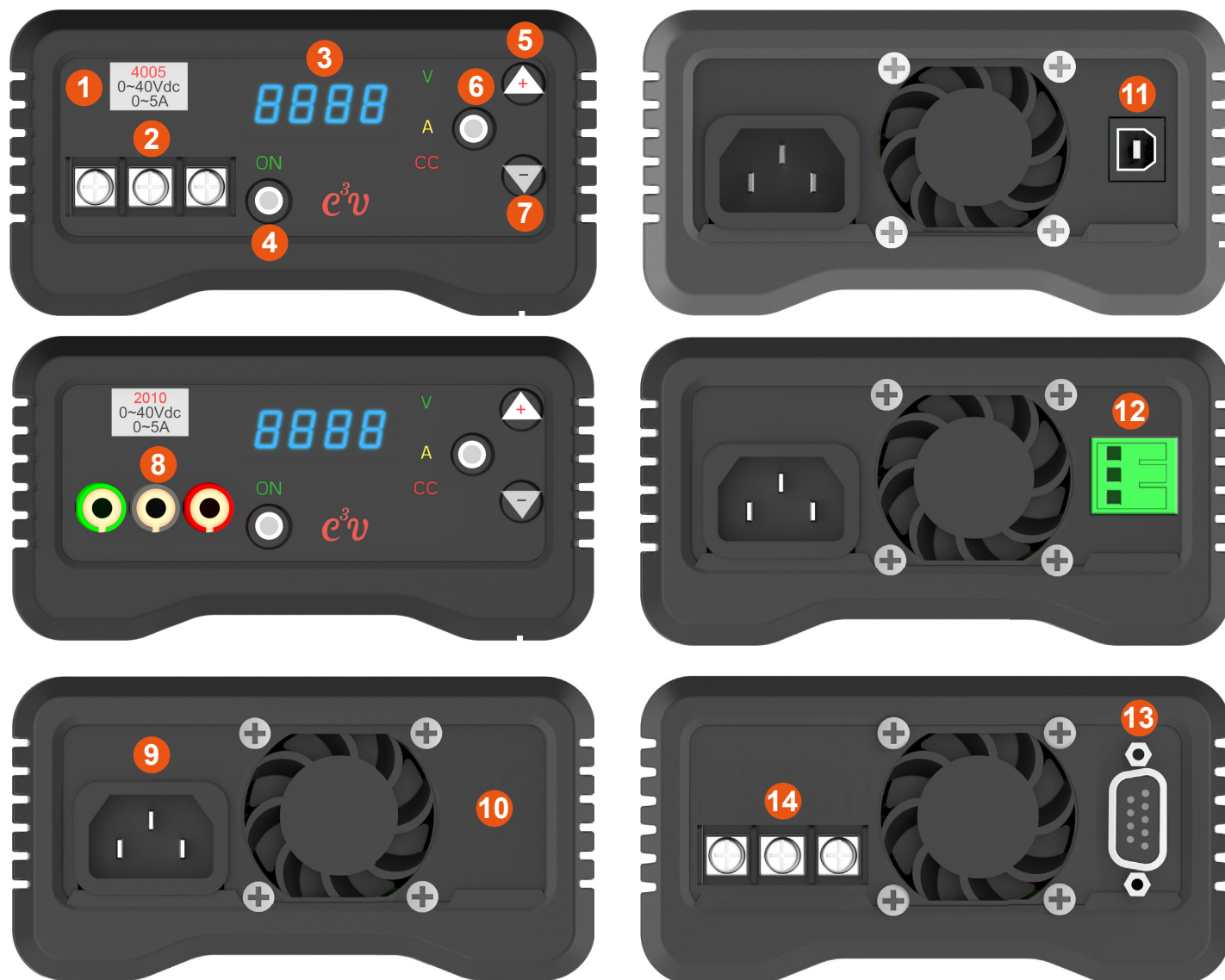
| 1	Model No.	8	Banana Post O/P
2	Terminal Board O/P	9	IEC Type AC Input
3	4-digit Display	10	w/o comm.
4	O/P ctrl	11	USB-B
5	UP key	12	RS-485
6	Enter key	13	RS-232
7	Down key	14	Terminal Board AC Input

9. Mountings and Ventilations

We suggest flat mount or erect mount when installation the C³V Series. Note that both mounting methods require clear ventilation paths. Please keep the ventilation paths free of blockings and obstacles.

9.1 Flat Mount and Ventilation

Flat Mount

Illustration for the flat mount and the associated ventilation flows

225.8

194

17

Bottom Side

100

89

Information for Flat Mounting

* Mounting holes on unit: M4 x 4 pcs.
* MUST USE LENGTH= 5 mm MAX. screws to fix.

FAN
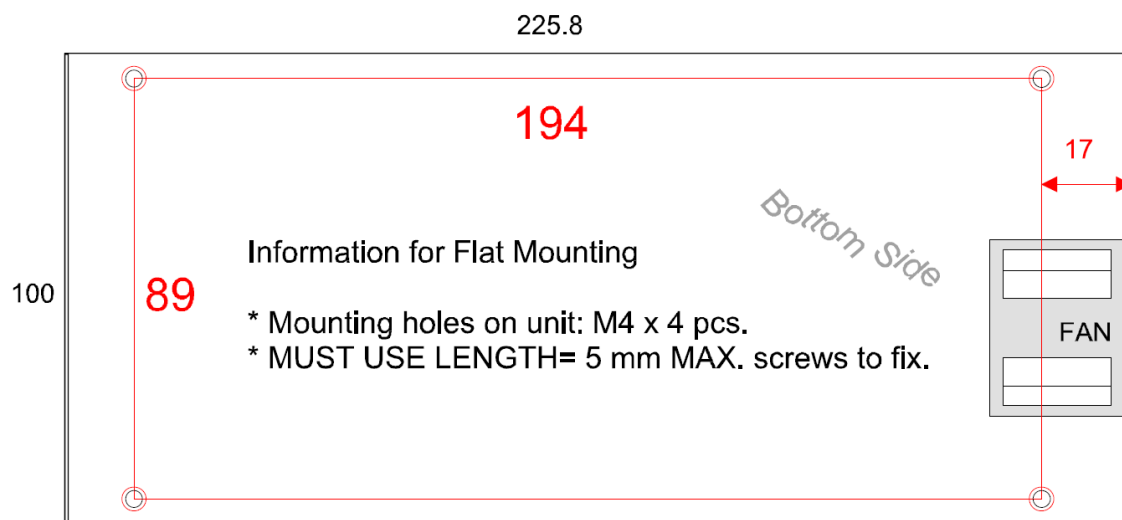
Position reference for flat mounting

⚠ **Caution: Using a screw longer than 5mm may penetrate the circuit board and cause product failure.**

9.2 Erect Mount and Ventilation
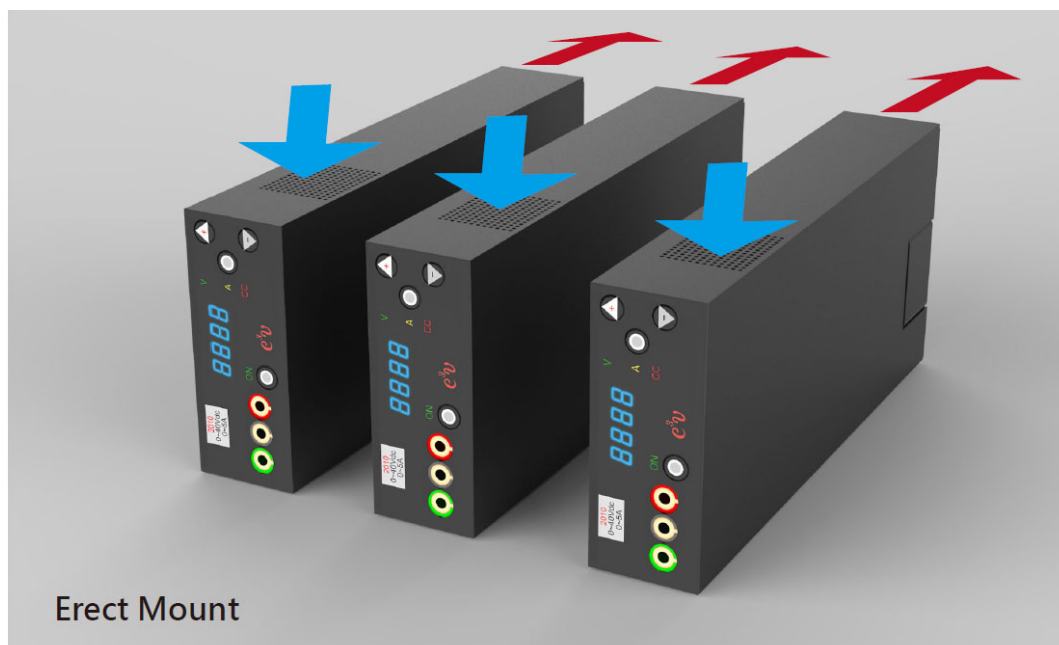
Erect Mount

Illustration for the erect mount and the associated ventilation flows.

* Erect Mounting Holes: M4 x 2 pcs
* MUST USE M4, length 5 mm MAX. screws to fix.

Top

Left Hand Side

45

20

40

154.6

225.8
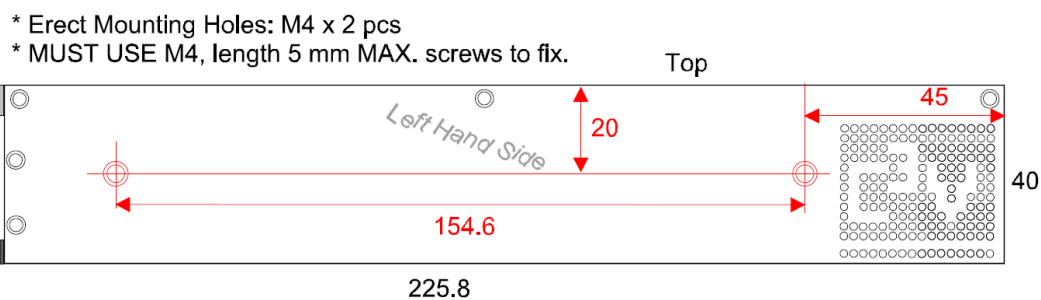
Positioning reference for erect mounting.

⚠ **Caution: Using a screw longer than 7mm may penetrate the circuit board and cause product failure.**

9.3 Lab Use w/o and with A Magnetic Stand

1. Use at least index finger to press on unit's top.
2. Use the thumb to push the button for input.

Recommended finger pressure

10. C³V Series Specifications

C³V Series	2010	4005	6003
ELECTRIC			
AC input rating			
Voltage	85~264VAC		
Current	2.4A max./115VAC , 1.2A max./230VAC		
Frequency	47~63Hz		
Inrush	22A max./115VAC , 46A max./230VAC		
power factor	PF>0.95/230VAC , PF>0.99/115VAC		
ELECTRONIC			
DC output rating			
Voltage, Volt	0-20.00V	0-40.00V	0-60.00V
Current, Amp	0-9.990A	0-5.000A	0-3.500A
Power, Watt	200W	200W	210W
Line regulation			
CV, mV	<= 10mV	<= 10mV	<= 10mV
CC, mA	<= 5mA	<= 5mA	<= 5mA
Load regulation			
CV, mV	<= 10mV	<= 10mV	<= 10mV
CC, mA	<= 5mA	<= 5mA	<= 5mA
Ripple / Noise (*1)			
CV p-p, mV	<=30mVpp	<=30mVpp	<=30mVpp
CV rms, mV	<= 10mV	<= 10mV	<= 10mV
CC rms, mA	<= 10mA	<= 10mA	<= 10mA

MEASUREMENT			
Panel setting resolution			
Voltage, mV	10mV	10mV	20mV
Current, mA	5mA	2mA	2mA
Programming resolution			
Voltage, mV	10mV	10mV	20mV
Current, mA	5mA	2mA	2mA
Measurement accuracy			
Voltage, %	0.05 % +5 cnt	0.05 % +6 cnt	0.05 % +7 cnt
Current, %	0.2% + 10 cnt	0.1% +8 cnt	0.1% +8 cnt
Temperature coefficient			
Voltage	0.001%/℃	0.001%/℃	0.001%/℃
Current	0.005%/℃	0.005%/℃	0.005%/℃
PROTECTIONS			
OVP	yes	yes	yes
OCP	yes	yes	yes
OTP	yes	yes	yes
COMMUNICATION			
Interface: only 1 option			
RS232	DB9		
RS485	terminal block		
USB	type-B		
Protocol			
Data rate	57600/N/8/1		

NORMS	
EMC EMISSION	EN61000-3-2,-3
EMC IMMUNITY	EN61000-4-2,3,4,5,6,8,1
SAFETY	EN60950-1
ENVIRONMENT	
Operating temp.	0℃~50 ℃
R.H., no condensed	20%~85%
Storage temp.	-20℃~70 ℃
R.H., no condensed	<90%
PHYSICAL	
Dimensions/Weight	W*D*H = 100mm*250mm*40mm(<1U) / 1.2Kg

*1: From output terminals, running a 25cm twisted wire pair terminated with a 0.1uf CC & 10uF
EC, observe voltage across the capacitors under 20 MHz BW at full resistive load.

11. Appendix:

Ordering and options details:
Neutral format of order code :

C3V-vvii-FT-RT-C

Options in details:

vvii: output ratings	**FT**: Front DC output terminals	**RT**: Rear AC input connections	C: Comm types
2010: 0~20V, 0~10A	tb: terminal board output	tb: terminal board input	N: not applied
4005: 0~40V, 0~5A	bn: banana jack output	ec: IEC input.	U: USB, type B
6003: 0~60V, 0~3.5A			2: RS-232
			5: RS-485

For example:

If a "C3V-4005-TB-EC-5" is ordered, the real product will be looking as followed