

# C<sup>3</sup>V Series

2010 4005 6003

Programmable DC Power Supply



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
# 1. Important Safety Instructions

## 1.1 General

This chapter contains important safety instructions for fully utilizing the C<sup>3</sup>V 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.



	Indicates an imminently hazardous situation which, if not avoided, <b>will</b> result in death or serious injury
	Indicates a potentially hazardous situation which, if not avoided, <b>may</b> result in death or serious injury
	Indicates a potentially hazardous situation which, if not avoided, <b>may</b> 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

	<ul style="list-style-type: none"> <li>•The product is designed for indoor use.</li> <li>•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.</li> </ul>
	<ul style="list-style-type: none"> <li>•Do not place the product in high humidity area.</li> <li>•Do not expose the product to direct sunlight or any heat source.</li> <li>•Do not block the ventilation openings at the enclosure of the product.</li> <li>•Do not place any heavy objects on the product.</li> </ul>






### 1.3.3 Installation

	<p>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.</p>
	<p>The product is rated at AC input 85~264V, 47~63Hz mains.</p>

### 1.3.4 Operation

	<p><b>⚠ DANGER</b></p> <p>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.</p>
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### 1.3.5 Service & Maintenance

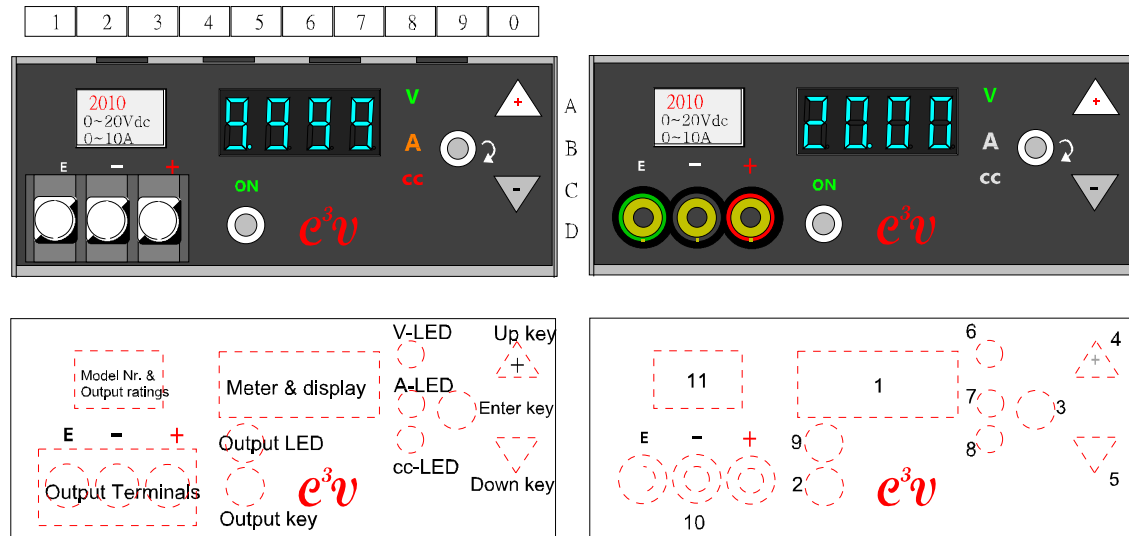
	<p><b>⚠ DANGER</b></p> <p>The product operates at hazardous high voltage (near DC 380V or AC 267V). Only qualified personnel can carry out servicing or maintenance.</p>
	<p><b>⚠ WARNING</b></p> <p>Always use a properly rated voltage sensing device to confirm that all power is off.</p>
	<p><b>⚠ WARNING</b></p> <p>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.</p>
	<p>Replace the fuse only with the same amperage and voltage ratings to avoid risk of fire.</p>
	<ul style="list-style-type: none"><li>• This is a Class A device which may cause RF interference within the home.</li><li>• The product should only be operated when the case is securely closed, with all screws tightened.</li><li>• While operating the product, the wearing of metal or other conducting jewelry such as chains, bracelets, rings, etc. is not recommended.</li></ul>

### 1.3.6. Storage

- Location: Indoor
- Relative Humidity: <80%
- Temperature: -10°C ~ 70 °C

## 2. Get Acquainted with C<sup>3</sup>V Series

### 2.1 Front Panel Overview



#### Panel display:

1	Display Meter	<ul style="list-style-type: none"> <li>4-digit meter displays voltage, current and internal temperature of the product.</li> <li>For auxiliary uses of system parameters setup.</li> </ul>
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	<ul style="list-style-type: none"> <li>Green "V" denotes unit = "VOLT" for meter display.</li> <li>Lit state: Meter display in Output (Reading) mode.</li> <li>Blinking: Meter display in Setting mode.</li> </ul>
7	A-LED	<ul style="list-style-type: none"> <li>Orange "A" denotes unit = "AMPERE" for meter display.</li> <li>Lit state: Meter display in Output (Reading) mode.</li> <li>Blinking: Meter display in Setting mode.</li> </ul>
8	cc-LED	<ul style="list-style-type: none"> <li>Red "cc" symbol.</li> <li>Off state: Output in constant voltage (CV) mode.</li> <li>Lit state: Output in constant current (CC) mode.</li> </ul>

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

C<sup>3</sup>V series consists of 3 models and ratings as listed below:

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



### 3. Operation

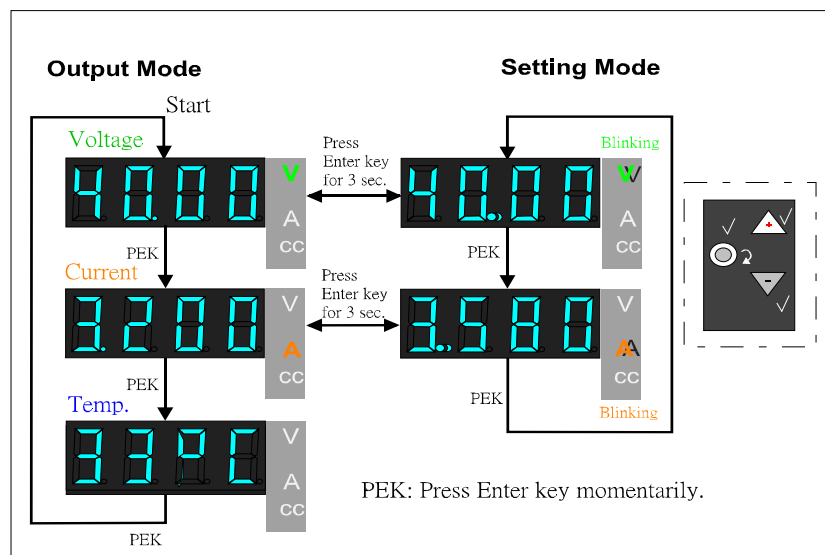
#### 3.1 General

C<sup>3</sup>V Series 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 C<sup>3</sup>V Series settings.

#### 3.2 Description

C<sup>3</sup>V Series 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.

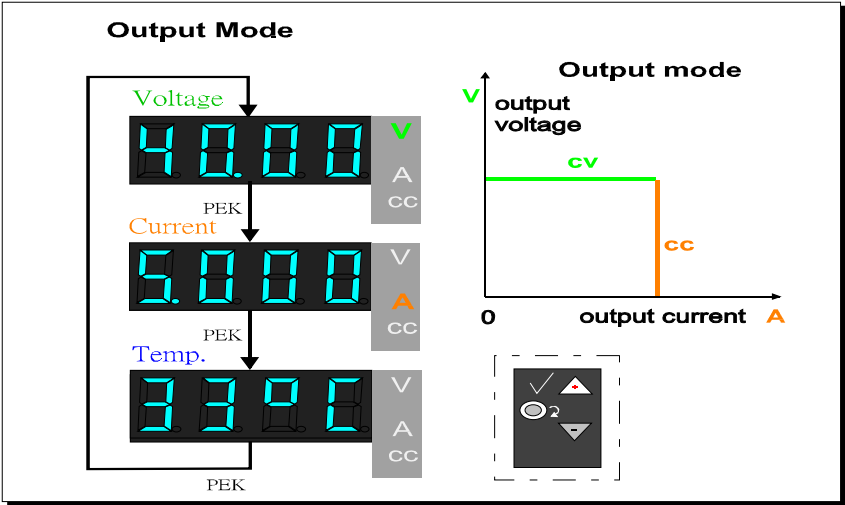
The V-LED and A-LED indicate the selected operation mode. The CC-LED indicates that the power supply currently being in CC Output (Reading) mode.



#### 3.3 Output (Reading) Mode & Setting mode

##### Output (Reading) Mode

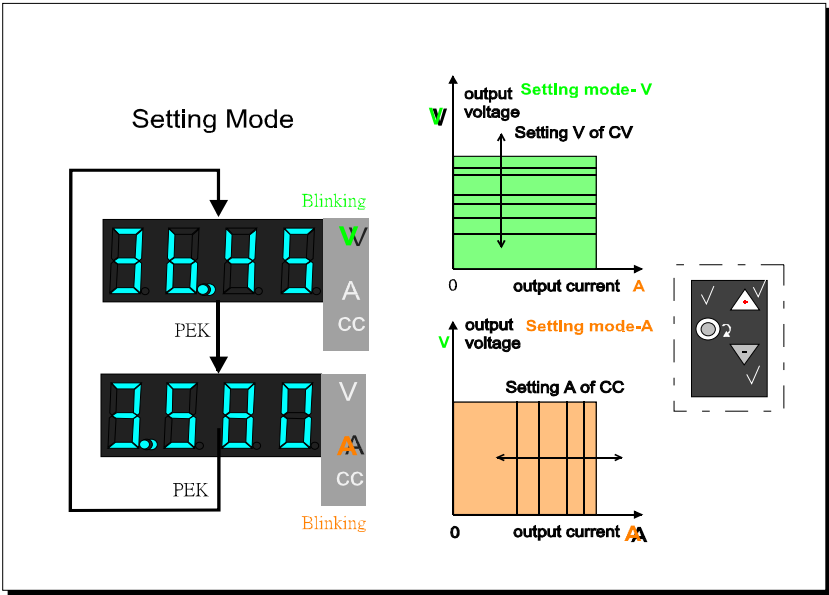
Upon AC powering on the C<sup>3</sup>V Series, the unit automatically enters “Output (Reading) Mode” and the green V-LED illuminates. The values shown on the Display Meter refer to the last used data. Pressing the Enter key momentarily, you can read the voltage, current (if a load was connected) and internal temperature. The outputs are controlled by preset CC and CV values, as shown in the graph below.



**Setting Mode**

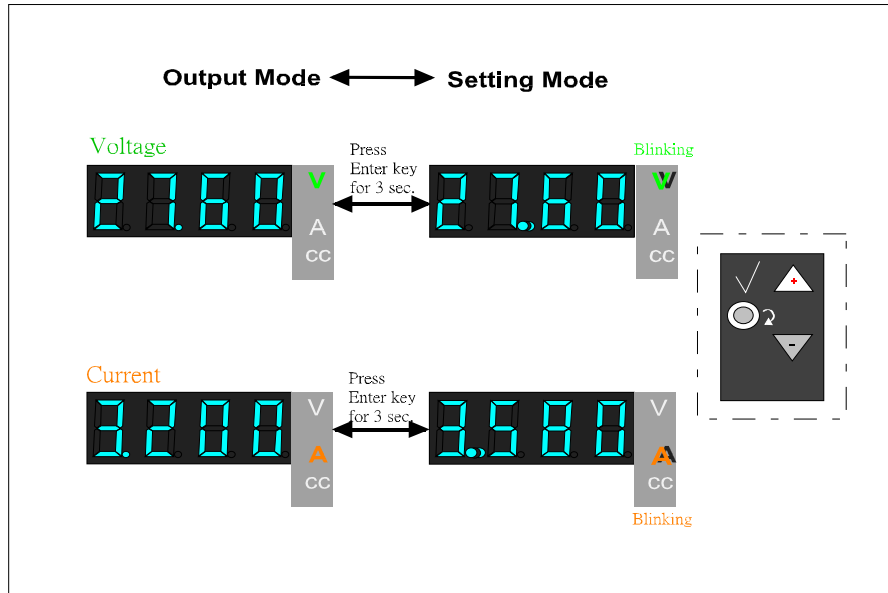
By pressing the Enter key for 3 seconds, you will hear a short beeping sound. This indicates that the C<sup>3</sup>V Series has entered "Setting Mode". "The V-LED **OR** A-LED " **AND** " the respective decimal point " will be blinking on the 4-digit Display Meter.

Use the Up or Down keys to set the desired voltage or current. Press the Enter key for 3 seconds to confirm. The C<sup>3</sup>V 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

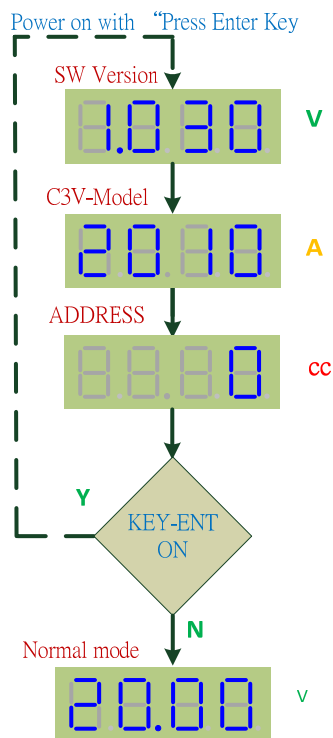
Some keys are programmed with special functions.

### 4.1 Normal Operations

Output key#	<ul style="list-style-type: none"> <li>• Press to toggle the output on / off (refer to 4.3 for default AC power setting).</li> </ul>
Enter key#	<ul style="list-style-type: none"> <li>• ###Press for 3 seconds to select between Output (Reading) Mode and Setting Mode.#</li> <li>• ###Momentary press to select V or A.</li> <li>• Please refer to V-LED and A-LED on the panel.</li> </ul>
Up key	<ul style="list-style-type: none"> <li>• Momentary press for least digit increment.</li> <li>• Press and hold for larger digit increment (larger and faster increment).</li> <li>• Please refer to the Display Meter on the panel.</li> </ul>
Down key	<ul style="list-style-type: none"> <li>• Momentary press gets least digit decrement.</li> <li>• Press and hold to get larger digit decrement (more and faster decrement).</li> <li>• Please refer to the Display Meter on the panel.</li> </ul>

### 4.2 Special Functions

Query on firmware version / model number / RS-485 address	<p>Hold down the Enter key and turn on AC power. You will find:</p> <ul style="list-style-type: none"> <li>• V-LED: firmware version</li> <li>• A-LED: model number</li> <li>• CC-LED: RS-485 address</li> </ul> <p>Release the Enter key to resume normal operations. Refer to the graphic below.</p>
Set up RS-485 address	<p>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.</p>



#### 4.3 Default Output State (ON / OFF)

Output state when the unit is powered on:

JP7 on MCU card	Default state at AC power on
OPEN	Output OFF
SHORT	Output ON

Note: User modification not recommended.

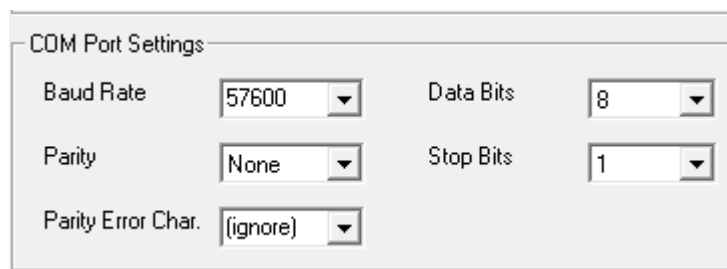
## 5. C<sup>3</sup>V Series Communication Interfaces

C<sup>3</sup>V Series 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



The image shows a 'COM Port Settings' dialog box with the following configuration:

Baud Rate	57600	Data Bits	8
Parity	None	Stop Bits	1
Parity Error Char.	(ignore)		

### 5.2 C<sup>3</sup>V Series with RS232 Interface

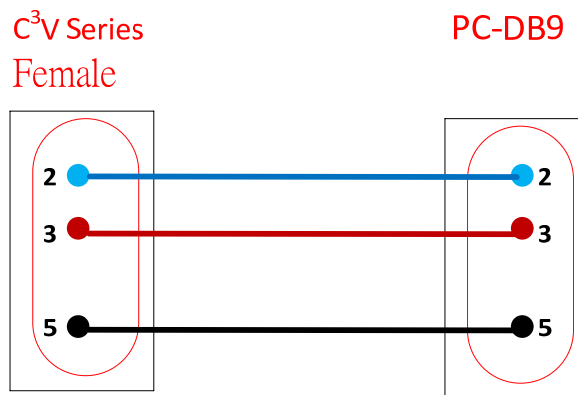
Uses standard female DB9 connector.

RS232 pin assignment:

Pin No.	Signal Name	Description	<a href="#">DTE</a> In/Out
1	DCD	Data Carrier Detect	Input
2	RX	Receive Data	Input
3	TX	Transmit Data	Output
4	DTR	Data Terminal Ready	Output

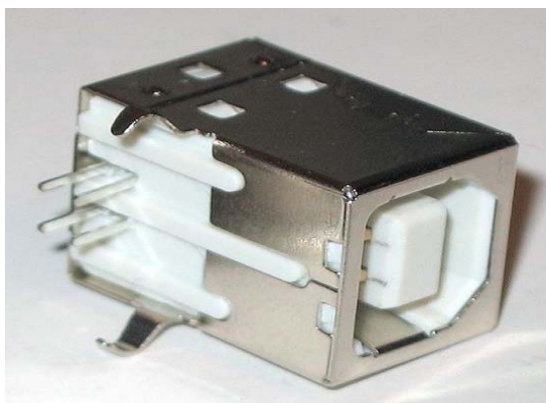
5	SGND	Signal Ground	-
6	DSR	Data Set Ready	Input
7	RTS	Request To Send	Output
8	CTS	Clear To Send	Input
9	RI	Ring Indicator	Input

### 5.2.1 RS232 Connection with PC



### 5.3 C<sup>3</sup>V Series with USB Interface

USB Type B Connector as shown below:

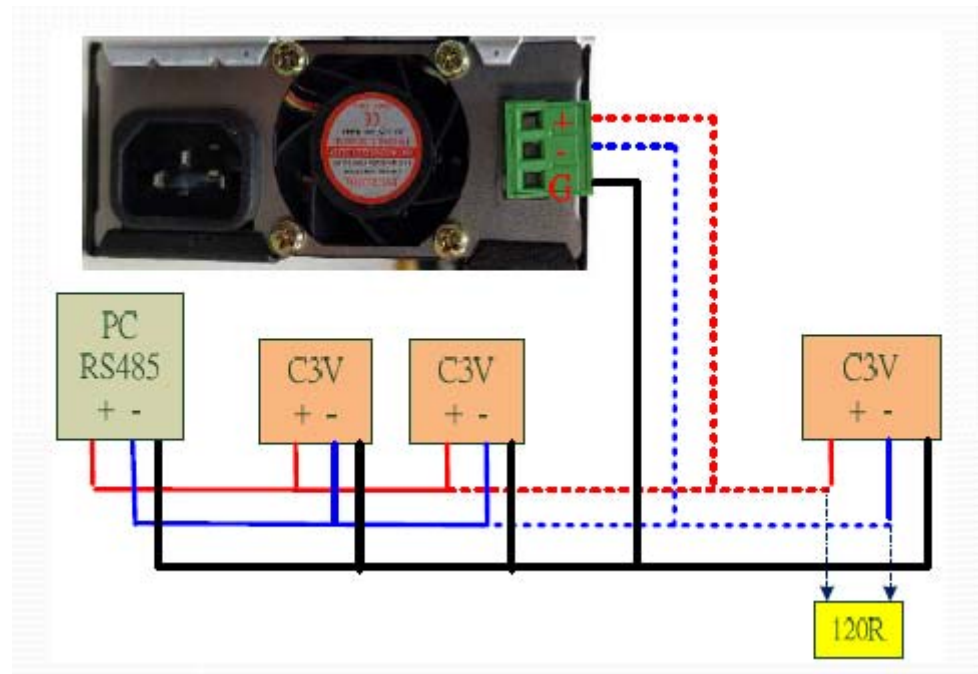


### 5.4 C<sup>3</sup>V Series with RS485 Interface

The RS485 address needs to be set up before communication. Each C<sup>3</sup>V 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 120 $\Omega$  termination resistor to the “+/-” terminals of the green terminal block of the final parallel unit of C<sup>3</sup>V Series.



#### 5.4.2 RS485 Address

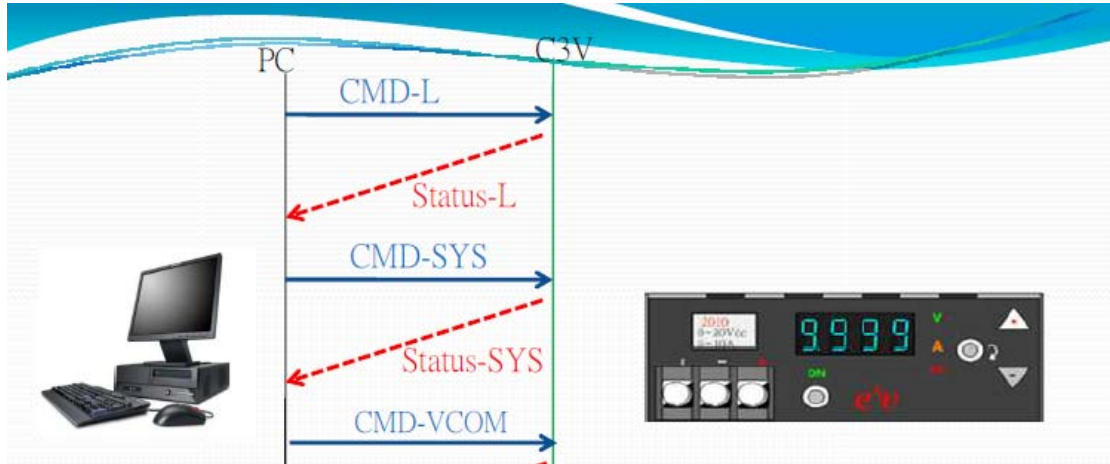
The RS485 address must be set from 1 to 32 and cannot be duplicated. USB & RS232 interface do not require setup as default value “0” is already factory preset.

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



## 6. C<sup>3</sup>V Series Communication Protocol

Commands can be written in either ASCII or hexadecimal codes. C<sup>3</sup>V Series never sends messages till it receives the CMD from the PC.



### 6.1 Communication between PC and C<sup>3</sup>V Series

As shown below:

- PC sends "CMD-L" – C<sup>3</sup>V Series replies "Status-L"
- PC sends "CMD-VCOM" – C<sup>3</sup>V Series replies "Status-OK"



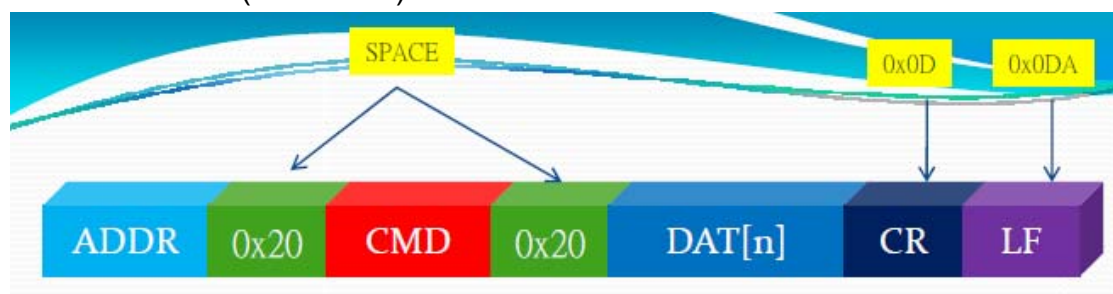
## 6.2 Message Terminator of Protocol: CR LF



CR = 0x0D (HEX)

LF = 0x0A(HEX)

## 6.3 Data format (PC to C<sup>3</sup>V)



### 6.3.1 ADDR (PC to C<sup>3</sup>V Series)

This field is the address code of the protocol.

If this code is correct, C<sup>3</sup>V Series will receive commands. Every C<sup>3</sup>V 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.

ADDR	Description	Interface
C <sup>3</sup> V00	This is a universal code. C <sup>3</sup> V Series will execute commands after receiving the code.	RS232, USB and RS485 (single unit)

C <sup>3</sup> V01	When the C <sup>3</sup> V Series receives and decodes the code (address), it will execute the received command.	RS485 (multiple units)
C <sup>3</sup> V02	.....	
C <sup>3</sup> V32	.....	

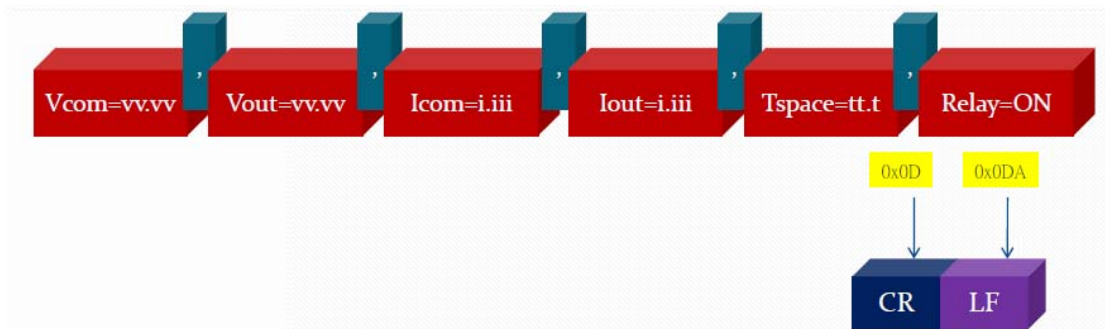
Command Set (PC to C<sup>3</sup>V Series)

This field is the command code of the protocol.

<b>CMD</b>	Function Description
L	The L query returns all C <sup>3</sup> V Series statuses: Reply: Status-L C <sup>3</sup> V00 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 C <sup>3</sup> V Series: Reply: Status-SYS C <sup>3</sup> V00 SYS <CR><LF> C <sup>3</sup> V-405@1.01<CR><LF>
VCOM	VCOM sets output voltage level: Reply: Status-OK C <sup>3</sup> V00 VCOM 20<CR><LF> OK<CR><LF>
ICOM	ICOM sets the output current limit: C <sup>3</sup> V00 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>

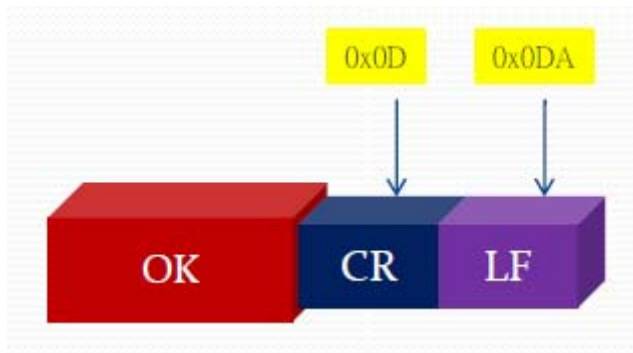
Icom	Reply current limit setting: C <sup>3</sup> V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>
Iout	Reply output current value: C <sup>3</sup> V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>
Relay	Reply RELAY status: C <sup>3</sup> V00 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: C <sup>3</sup> V00 L<CR><LF> Vcom=20.00,Vout=1.35,Icom=3.500,Iout=0.000,Tspace=30.8,Relay=ON <CR><LF>

Status-SYS (C<sup>3</sup>V Series to PC)

Status-SYS	Function Description
SYS	Reply model and software version of C <sup>3</sup> V Series: C <sup>3</sup> V00 SYS C <sup>3</sup> V-405@1.01

### Status-OK (C<sup>3</sup>V Series to PC)

Status-OK	Function Description
OK	Reply OK C <sup>3</sup> V00 ON OK



## **7. Automatic Fan Speed vs Temperature Control**

### **7.1 PWM Fan Speed Control**

C<sup>3</sup>V 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. This extends 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 ( $> 85\text{ }^{\circ}\text{C}$ ), it will turn off the output automatically and generate an acoustic alarm.

## 8. C<sup>3</sup>V Series Wiring and Connections

### 8.1 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.

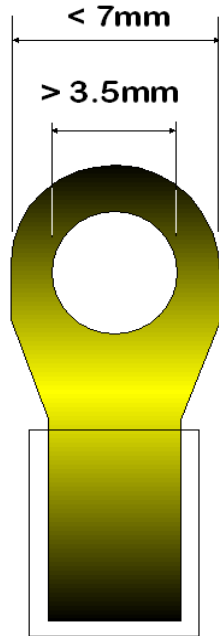
	To be connected and fixed at C <sup>3</sup> V	Connection with external wires(cable)
<b>AC input</b> (Rear panel)	IEC male	IEC (female) cord
	Terminal board	Y or O type terminal with wires
<b>DC output</b> (Front panel)	Banana jack	Banana plug with wires
	Terminal board	Y or O type terminal with wires
<b>Communication Interface</b> (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



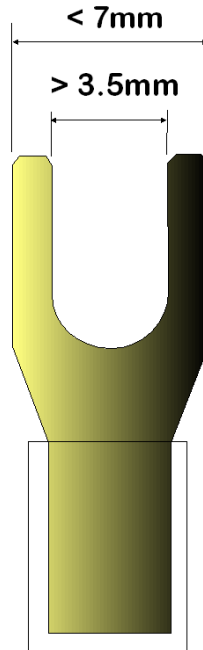
## 8.2 Special Connectors to Prepare

“O” or “Y” type terminal

**"O" type terminal**



**"Y" type terminal**



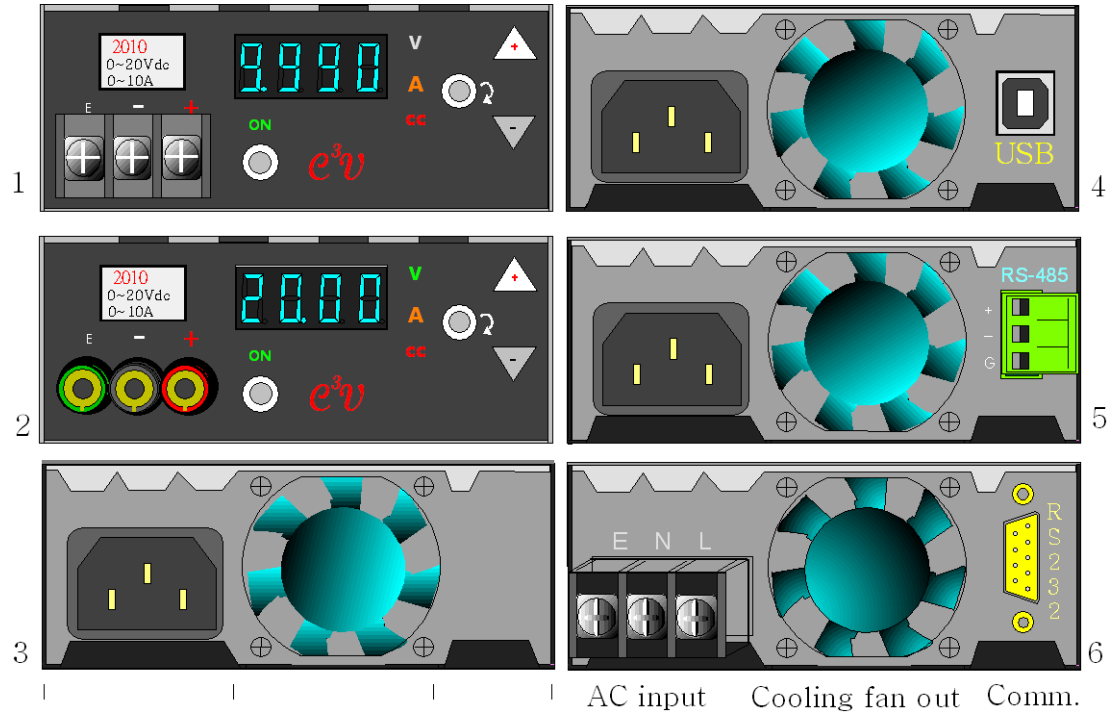
## 8.3 Wire Size Table

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)	$\Omega$ /meter
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.

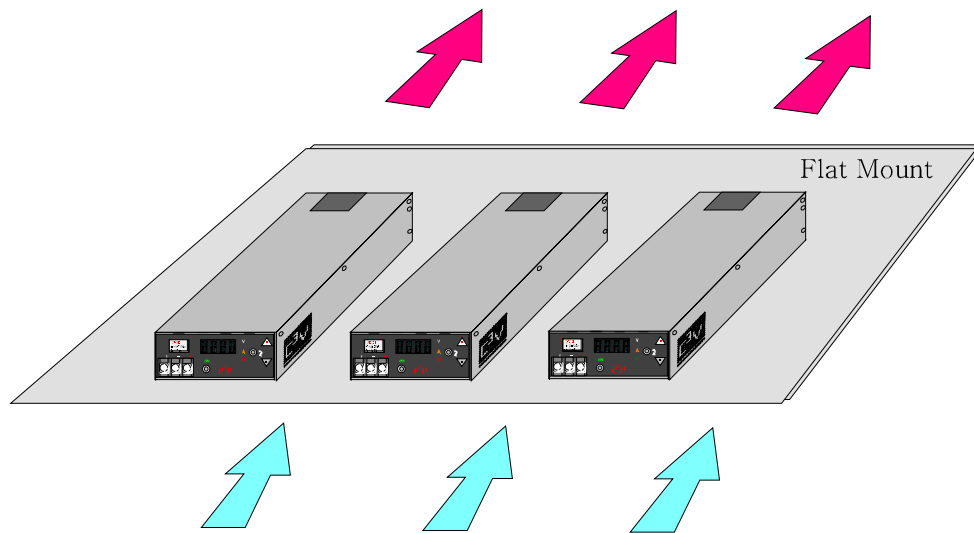


Model No. Terminal Board O/P	4-digit Display O/P ctrl	UP Enter Down	IEC Type AC Input	Cooling Fan	USB-B
Model No. Banana Post O/P	4-digit Display O/P ctrl	UP Enter Down	IEC Type AC Input	Cooling Fan	RS-485
IEC Type AC Input	Cooling Fan	w/o comm.	Terminal Board AC Input	Cooling Fan	RS-232

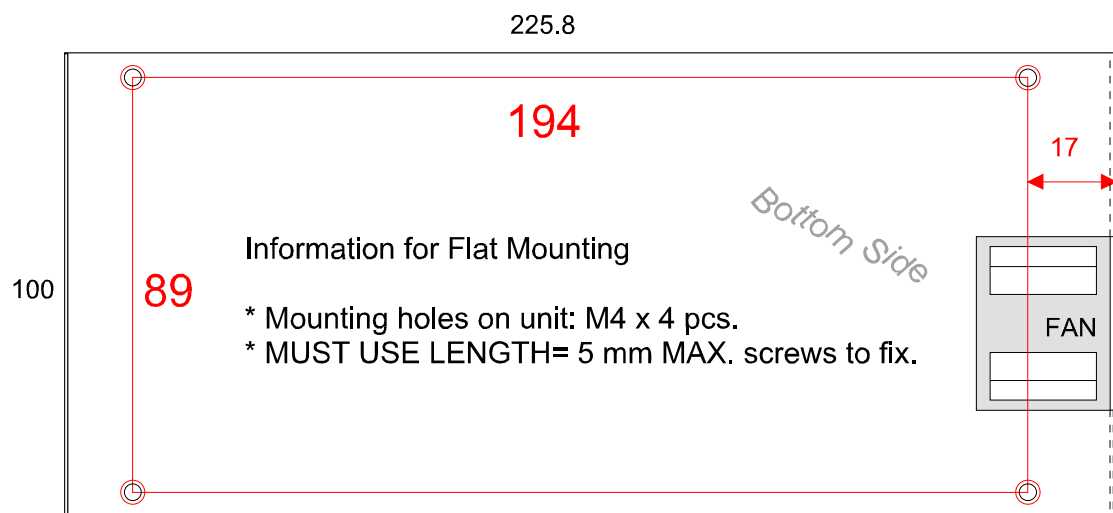
## 9. Mounting and Ventilation

We suggest flat mount or erect mount when installation the C<sup>3</sup>V 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



*Illustration for the flat mount and the associated ventilation flows*

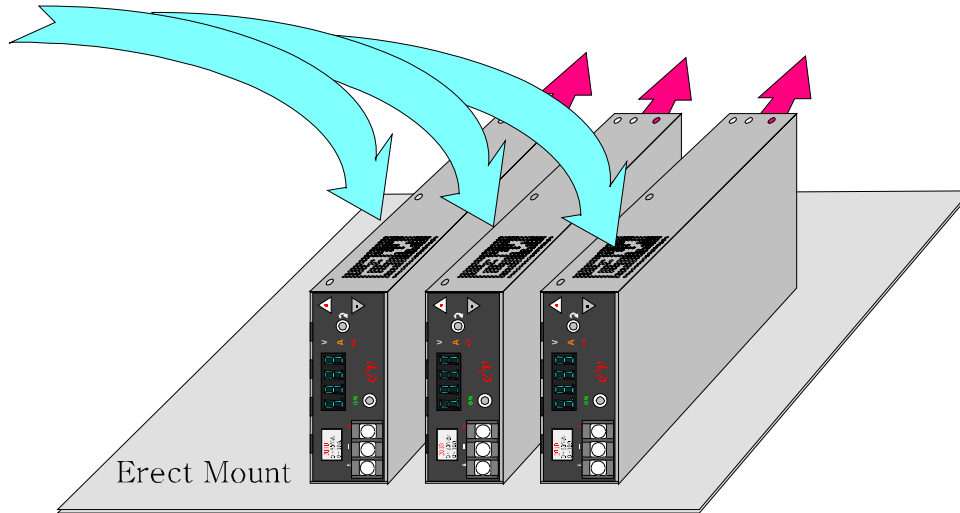


*Position reference for flat mounting*



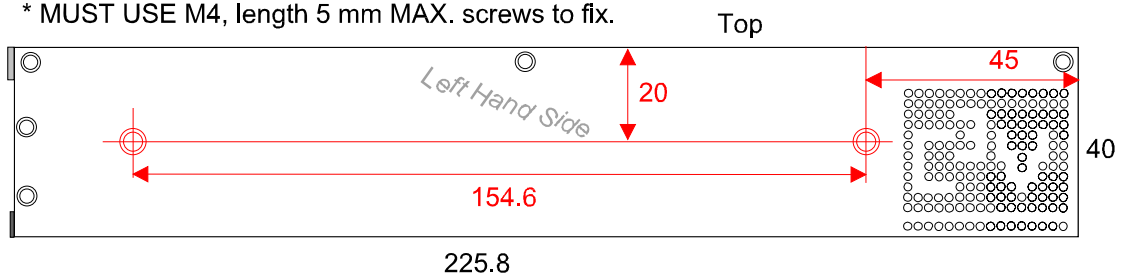
**Caution:** Using a screw longer than 5mm may penetrate the circuit board and cause product failure.

## 9.2 Erect Mount and Ventilation



*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.



*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



fig-1, flat positioning

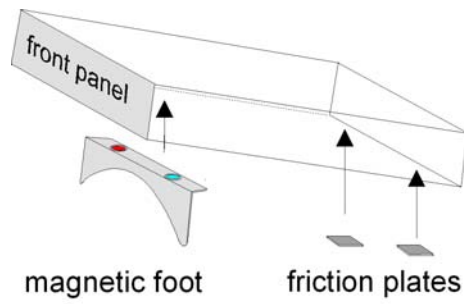


fig-2, tilt positioning

\* If using a magnetic foot to tilt the unit, try to stick the adhesive friction plates on the 2 rear- bottom- end -corner edges.

## 10. C<sup>3</sup>V Series Specifications

C <sup>3</sup> V Series	2010	4005	6003
<b>ELECTRIC</b>			
AC input rating			
Power	210W max.		
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		
<b>ELECTRONIC</b>			
DC output rating			
Voltage, Volt	0-20V	0-40V	0-60V
Current, Amp	0-9.99A	0-5A	0-3.5A
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
<b>MEASUREMENT</b>			
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
Programming 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

<b>C<sup>3</sup>V Series</b>	<b>2010</b>	<b>4005</b>	<b>6003</b>
<b>Measurement resolution</b>			
Voltage, mV	10mV	10mV	20mV
Current, mA	5mA	2mA	2mA
<b>Measurement accuracy</b>			
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
<b>Temperature coefficient</b>			
Voltage	0.001%/°C	0.001%/°C	0.001%/°C
Current	0.005%/°C	0.003%/°C	0.003%/°C
<b>PROTECTIONS</b>			
OVP	yes	yes	yes
OCP	yes	yes	yes
OTP	yes	yes	yes
<b>COMMUNICATION</b>			
<b>Interface: only 1 option</b>			
RS232	DB9		
RS485	terminal block		
USB	type-B		
<b>Protocol</b>			
Data rate	57600/N/8/1		
<b>NORMS</b>			
EMC EMISSION	EN61000-3-2,-3		
EMC IMMUNITY	EN61000-4-2,3,4,5,6,8,1		
SAFETY	EN60950-1		
<b>ENVIRONMENT</b>			
Operating temp.	0°C~50 °C		
R. humidity, no condensed	20%~85%		
Storage temp.	-20°C~70 °C		
R. humidity, no condensed	<90%		
<b>PHYSICAL</b>			
Dimensions	W*D*H = 100mm*250mm*40mm(<1U)		
Weight	1.2 Kg		
*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

2010: 0~20V, 0~10A

4005: 0~40V, 0~5A

6003: 0~60V, 0~3.5A

**FT:** Front DC output terminals

tb: terminal board output

bn: banana jack output

**RT:** Rear AC input connections

tb: terminal board input

ec: IEC input.

**C:** Comm types

N: not applied

U: USB, type B

2: RS-232

5: RS-485

For example:

If a "C3V-2010-TB-EC-5" is ordered,  
the real product will be looking as followed:



Mod. records:

Change p27, March 18, 2021

Add p29, March 18, 2021

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