KEPCO®
THE POWER SUPPLIER™

APPLICATION NOTE

COTEK MODELS
AE-800
AE-1500
AE-3000
AEK-3000
AEK-3000 ORingFET
AEK-3000HV
AEK-3000HV Oring Diode

NOTE: The following appplication notes are for the Cotek models distibuted by Kepco, Inc. that are listed above.

1. RS 232 Communication is only possible using the CT Series adapters listed below. (Pins 23 and 24 of CN2 are not connected and do not function.) See CT Series User Guide (free download) for details.

www.kepcopower.com/support/opmanls.htm#ae

2. Computer control is also possible using the I^2C interface. Refer to the Cotek I^2C and RS 232/RS 485 Communication Protocol Manual (free download) for details.

www.kepcopower.com/support/opmanls.htm#ae

CT-201 - Used to control a single power supply from a PC via RS 232. Includes one (1) CT Series cable (Cotek P/N 47-0124-0001) to connect CT-201 to power supply and one 5-pin connector (ECH350R-05P) used for remote sense connections. Requires RS 232 cable to connect CT-201 DB-9F connector to computer RS 232 port (not supplied). See CT Series User Guide for details.

CT-204 - Used to control up to four (4) power supplies configured in series from a PC via RS 232; maximum output voltage: <500V d-c. Includes four (4) CT Series cables (Cotek P/N 47-0124-0001) to connect CT-201 to power supplies. Optional 5-pin connector(s) (Dinkle P/N ECH350R-05P) used for remote sense connections are not supplied. Requires RS 232 cable to connect CT-201 DB-9F connector to computer RS 232 port (not supplied).See CT Series User Guide for details.

NOTE: More than four (4) power supplies may be connected in series and controlled via RS 232 by the use of multiple CT-204 modules and the optional CT-204 to CT-204 series cable (Cotek P/N 47-0103-0028); <500V d-c max still applies.

CT-251 - Used to provide parallel control of multiple power supplies. Connecting a total of (N) power supplies in parallel requires (N-1) CT-251 modules plus one (1) CT-551 module which provides the RS 232/PC communication path. Each CT-251 and CT-551 module requires a CT series cable to connect to the associated power supply (supplied).See CT Series User Guide for details.

CT-551 - Used to provide parallel control of multiple power supplies. Connecting a total of (N) power supplies in parallel requires (N-1) CT-251 modules plus one (1) CT-551 module which provides the RS 232/PC communication path. Each CT-251 and CT-551 module requires a CT series cable to connect to the associated power supply (supplied). See CT Series User Guide for details.

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COTEK

3000W Programmable Single Output AEK-3000 HV Oring Diode

Features:

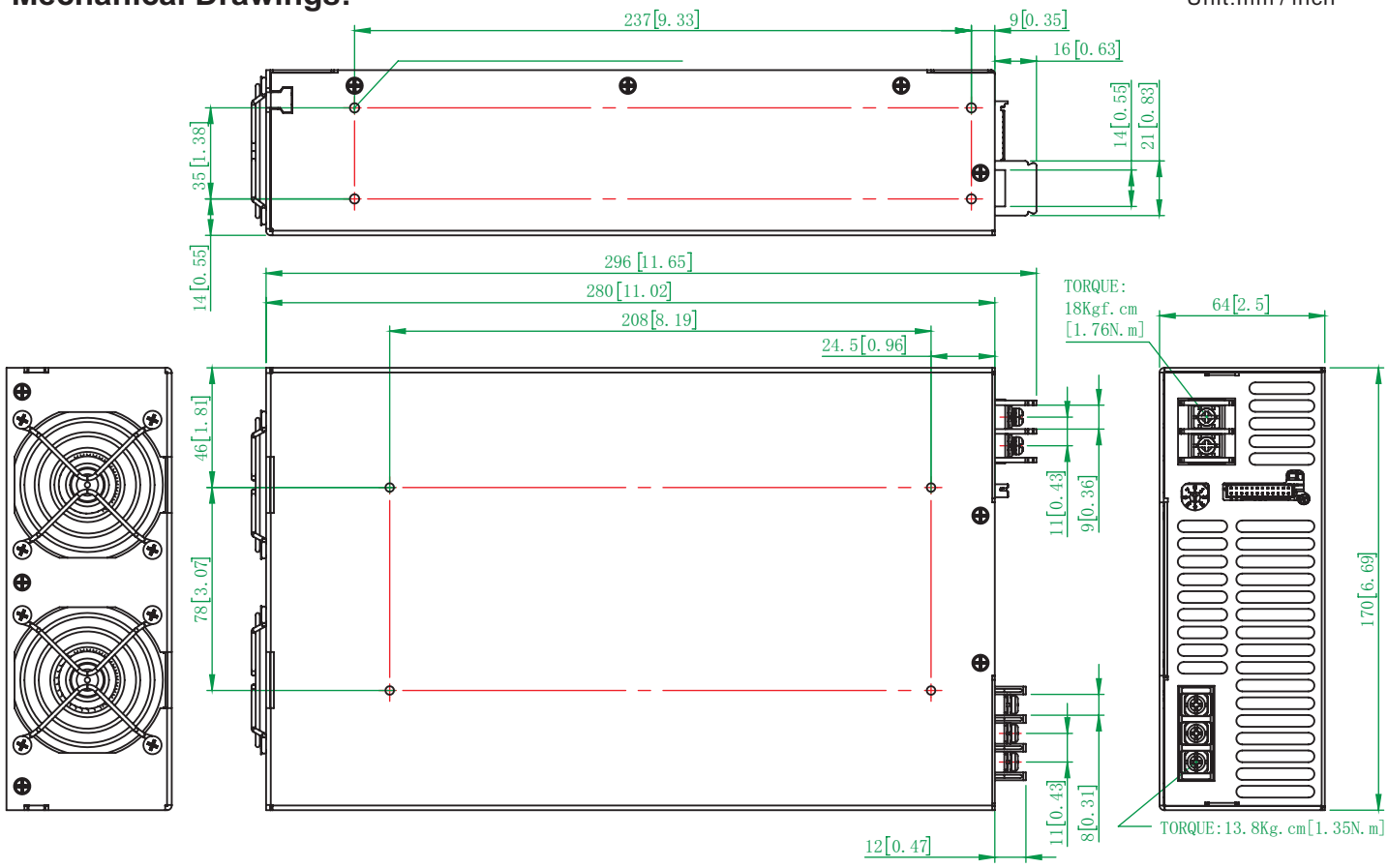
- Universal AC input / Full range
- Programmable output Voltage / Current (0% ~ 105%)
- Built-in active PFC Function & Oring Diode
  Built-in I²C and RS485 communication interface
- Constant current limit
- Forced current sharing at parallel operation (Refer to pg. 5 for connection diagram)
- Selectable +5V / 0.5A or +9V / 0.3A auxiliary output
- Global control via RS232 / RS485 protocol
- Remote setting multiple PSU via RS485 & I²C
- Power OK signal & Remote ON / OFF function
- Protection: OVP, OLP, OTP, SCP, Fan failure

IEC62368-1

MODEL		AEK-3000-150 Oring Diode	AEK-3000-200 Oring Diode	AEK-3000-250 Oring Diode	AEK-3000-300 Oring Diode	AEK-3000-400 Oring Diode
Output	DC Voltage Rated	150V	200V	250V	300V	400V
	Rated Current	20A	15A	12A	10A	7.5A
	Current Range	0 ~ 20A	0 ~ 15A	0 ~ 12A	0 ~ 10A	0 ~ 7.5A
	Rated Power	3000W				
	Ripple & Noise (Max.) Note.2	1500mVp-p	2000mVp-p	2500mVp-p	3000mVp-p	4000mVp-p
	Voltage Adj. Range	±5.0% Typical adjustment by potentiometer. (Via V-Adj from PSU front panel)				
	Voltage Tolerance Note.3	±2.0% (rated output voltage of single unit)				
	Current Tolerance	±3.0% (rated output current of single unit)				
	Line Regulation	±1.0%				
	Load Regulation	±1.0%				
	Setup, Rise Time	1100ms, 350ms at full load				
	Hold Up Time (Typ.)	14ms / 230VAC at full load				
Input	Voltage Range Note.4	90 ~ 264VAC, 127 ~ 370VDC (Refer to de-rating curve)				
	Frequency Range	47 ~ 63Hz				
	Power Factor (Typ.)	0.95 / 230VAC, 0.98 / 115VAC at full load				
	Efficiency (Max.)	91%			92%	
	AC Current (Max.)	19.7A / 115VAC (2000W), 14.5A / 230VAC (3000W)				
	Inrush Current (Typ.)	33A / 115VAC, 65A / 230VAC				
	Leakage Current	< 3.5mA / 240VAC				
Protection	Over Load	105% rated output power				
		Protection type: Constant current limit				
	Over Voltage	Variable OVP Refer to VCI VS OVP curve.(OVP Tolerance 7%)				
		Protection type: Latch-style (Recovery after reset AC power ON or inhibit)				
	Over Temperature	85 ±5°C detect on NTC, Protection type: Auto recovery after temperature goes down				
Function	Auxiliary Power	Selectable +5V / 0.5A or +9V / 0.3A auxiliary output				
	Remote ON / OFF Control	By external switch				
	Power OK Signal	Open drain signal low when PSU turns on, Max. sink current: 20mA, Max. drain voltage: 40V.				
	Output Voltage Trim	Adjustment of output voltage is between 0 ~ 105% of rated output				
	Output Current Trim	Adjustment of output current is between 0 ~ 105% of rated output				
	Parallel (Current Sharing) Note.5	Please refer to page 5				
	Communication Interface	Built-in RS485 and I²C.				
	Communication Protocol	RS232, RS485 and I²C				
Environment	Working Temp.	-20 ~ +60°C (Refer to de-rating curve)				
	Working Humidity	20 ~ 90% RH non-condensing				
	Storage Temp. & Humidity	-40 ~ +85°C, 10 ~ 95% RH				
	Temp. Coefficient	±0.02% / °C (0 ~ 50°C)				
	Vibration	10 ~ 500Hz, 2G 10min. / 1cycle, period for 60min. each along X, Y, Z axes Compliance to IEC 60068-2-6, IEC 60068-2-64				
Safety & EMC	Safety Standards	Certified EN 62368-1; UL62368-1				
	Withstand Voltage Note.7	I/P-O/P:3KVAC(4242VDC),I/P-FG:1.5KVAC(2121VDC),O/P-FG:0.5KVAC(707VDC)				
	Isolation Resistance	I/P-O/P, I/P-FG, O/P-FG: 100M Ohms / 500VDC (25°C/70%PH)				
	EMI Conduction Radiation	Certified EN 55032				
	Power Harmonic & Voltage Fluctuation and Flicker	Certified EN 61000-3-2; EN 61000-3-3				
	EMS Immunity	Certified EN 55035: 2017 / A11: 2020; IEC 61000-4-2,3,4,5,6,8,11				
Others	MTBF	90.2K HRS Certified MIL-HDBK-217F				
	Cooling	Load and temperature control fan				
	Dimension (WxHxD)	170x64x280 mm / 6.69x2.52x11.02 inch				
	Packing	3.3kg; 6pcs / 22.7kg / 2.48CUFT				
Note	1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25°C of ambient temperature. 2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uF & 47uF parallel capacitor. 3. Tolerance: includes setup time tolerance, line regulation and load regulation. 4. De-rating may apply in low input voltage. Please check the de-rating curve for more details. 5. In parallel connection only one unit will operate if the total output load is less than 5% of the rated power. 6. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives 7. This test is done without enclosure: I/P-O/P 4242VDC. If with enclosure: I/P-O/P 2121VDC,I/P-FG:2121VDC, O/P-FG: 707VDC					

Mechanical Drawings:

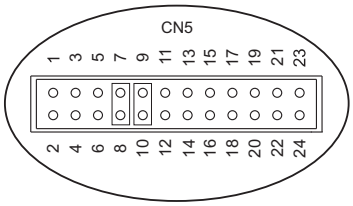
Unit:mm / inch



Note: Recommended screw length is measured from the power supply surface

AC Input Terminal Pin No. Assignment

Pin No.	Assignment
L	ACL
N	ACN
⏚	⏚



Control pin number assignment (CN5): JST S24B-PHDSS or equivalent

Pin No.	Assignment	Pin No.	Assignment	Pin No.	Assignment	Mating Housing / Contact	
1	AUX	9	EN+	17	NC.	JST PHDR-24VS or equivalent	JST SPHD-002T-P0.5 or equivalent
2	GND	10	AUX	18	NC.		
3	POK	11	ACI	19	+5VC		
4	GND	12	GND	20	GND1		
5	PAR	13	VCI	21	SCL		
6	VSET	14	GND	22	SDA		
7	EN-	15	AUX	23	DA-		
8	GND	16	GND	24	DA+		

CN5 Function Description:

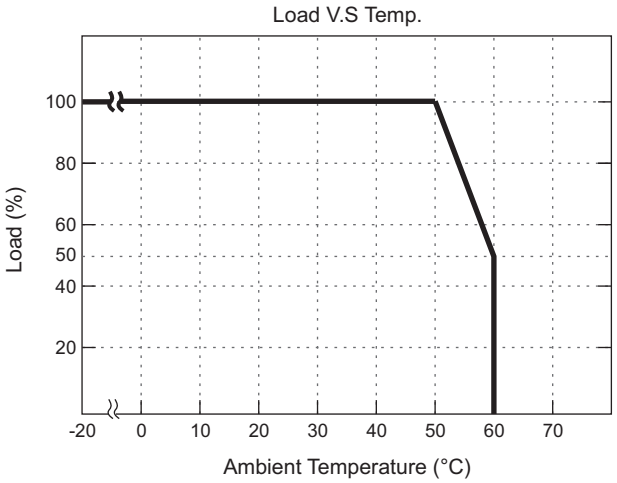
Pin No.	Function	Description	Pin No.	Function	Description
1	AUX	+5V / 0.5A or +9V / 0.3A Auxiliary power	13	VCI	V Program
2	GND	Ground	14	GND	Ground
3	POK	Power OK	15	AUX	+5V / 0.5A or +9V / 0.3A Auxiliary power
4	GND	Ground	16	GND	Ground
5	PAR	Parallel operation current share	17	NC.	
6	VSET	Aux output setting	18	NC.	
7	EN-	Inhibit ON/OFF (-)	19	+5VC	+5V power supply ,needs to be used with GND1
8	GND	Aux output setting	20	GND1	Ground ,needs to be used with +5VC
9	EN+	Inhibit ON/OFF (+)	21	SCL	Serial Clock for I^2C interface
10	AUX	+5V / 0.5A or +9V / 0.3A Auxiliary power	22	SDA	Serial Data for I^2C interface
11	ACI	I Program	23	DA-	For RS485 Data- Interface
12	GND	Ground	24	DA+	For RS485 Data+ Interface

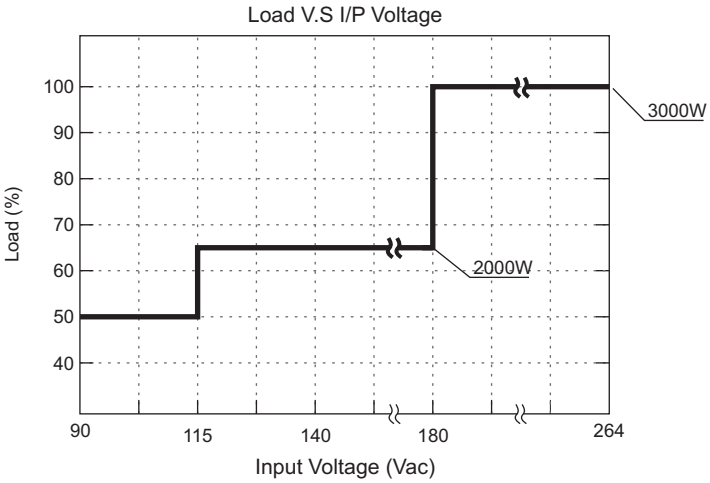
LED Status:

LED	LED Signal	Status
Solid(Green)		Power OK (Local mode)
Solid(Orange)		Power OK (Remote mode)
Slow Blink(Green)		Power Standby (Local mode)
Slow Blink(Orange)		Power Standby (Remote mode)
Fast Blink(Red)		Over Voltage Protection (OVP)
Solid(Red)		Over Load Protection (OLP)
Slow Blink(Red)		Over Temperature Protection (OTP)
Intermittent Blink(Red)		Fan Failure
Interlace Blink(Red)		Power Failure

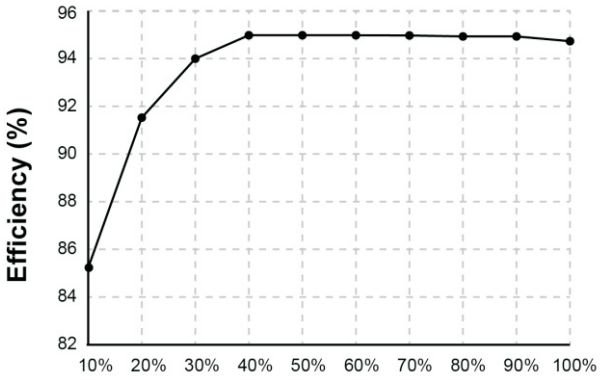
*Local mode : Use ACI/VCI to control output current and voltage.
Remote mode : Use RS-232/485 or I^2C command to control output current and voltage.

De-rating Curve:



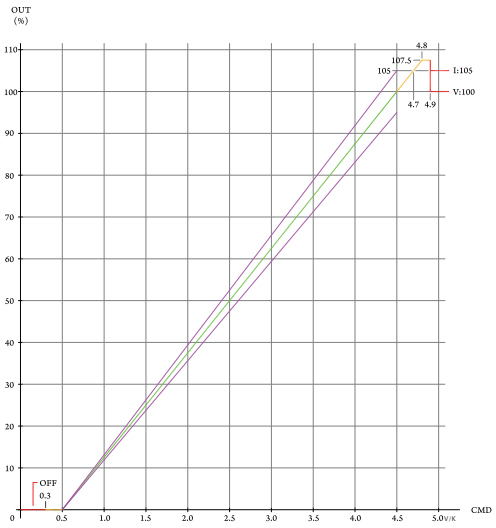


Efficiency Curve (400V Model):



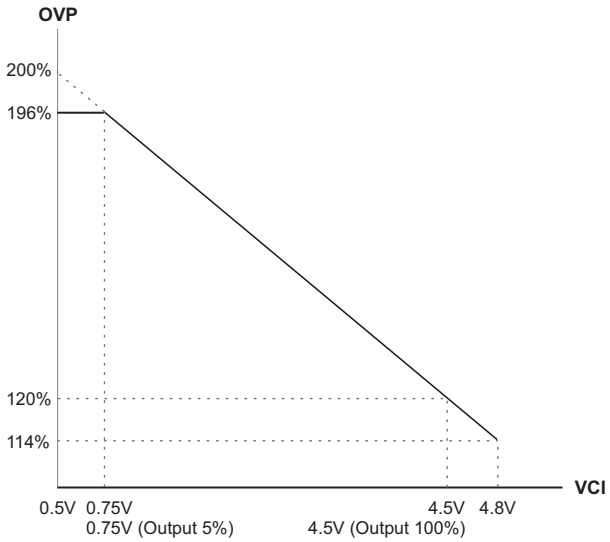
The curve above is measured at 230Vac
(Ambient temperature @ 25°C)

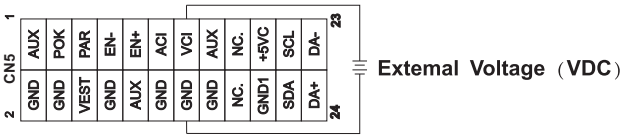
CMD VS Output Curve:

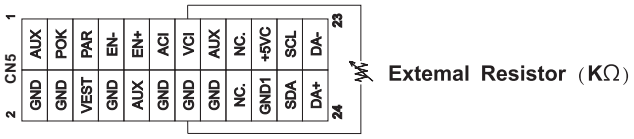


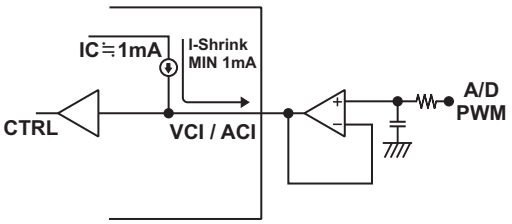
To ensure the power supply output voltage and current could be accurately adjusted, please make sure to adjust the output voltage and current > 10% vs. the rated voltage and current. (e.g. for a 300V unit, please adjust the DC output voltage above 30V to ensure accuracy; same applies to the output current)

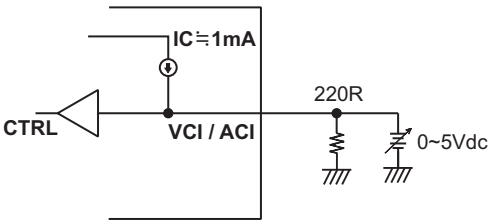
VCI VS OVP Curve:

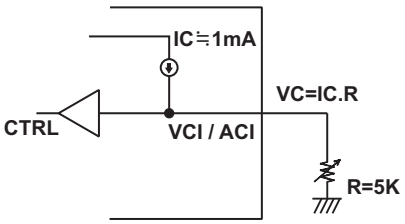






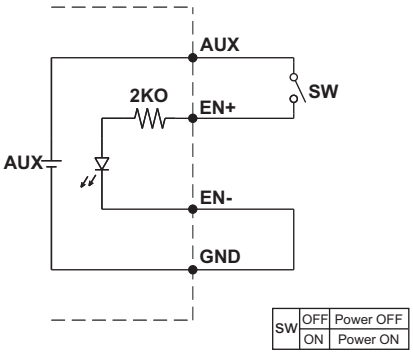






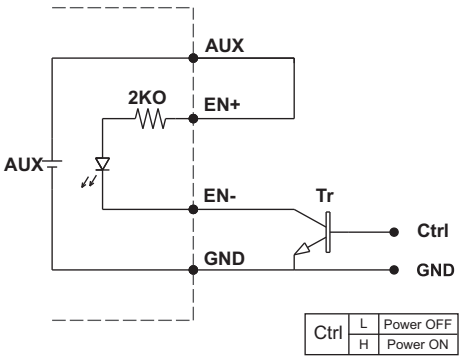
Remote ON/OFF:

(A) Default Setting



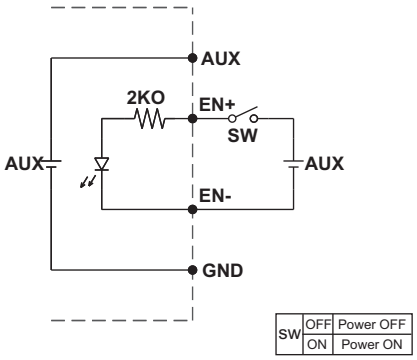
(A) Using internal 5V auxiliary source

(B)



(B) ON / OFF Control by NPN transistor

(C)



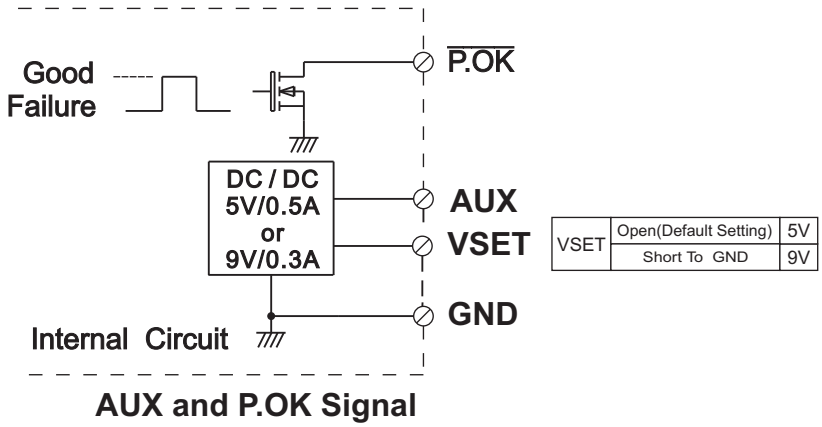
(C) Using external voltage source

GND shown in above diagram is referring to the GND of CN5, not the Grounding from main power(NEG-).

Power OK Signal & Auxiliary Power Setting:

*The grounding of "AUX" power and P.OK signal should be connected to "GND" port. If " VO-" is connected as Grounding, make sure to short the GND and VO- ports.

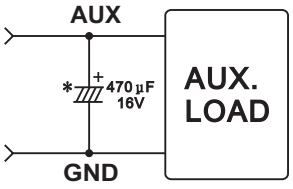
Open drain signal low when PSU turns on, Max. P.OK sink current: 20mA, Max. drain voltage: 40V.



VSET	Open(Default Setting)	5V
	Short To GND	9V

AUX and P.OK Signal

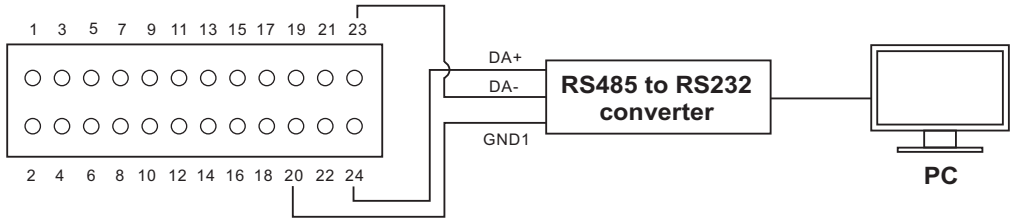
*Place an additional capacitor to have a better performance of auxiliary power operation.



Do NOT exceed 5V/0.5A or 9V/0.3A

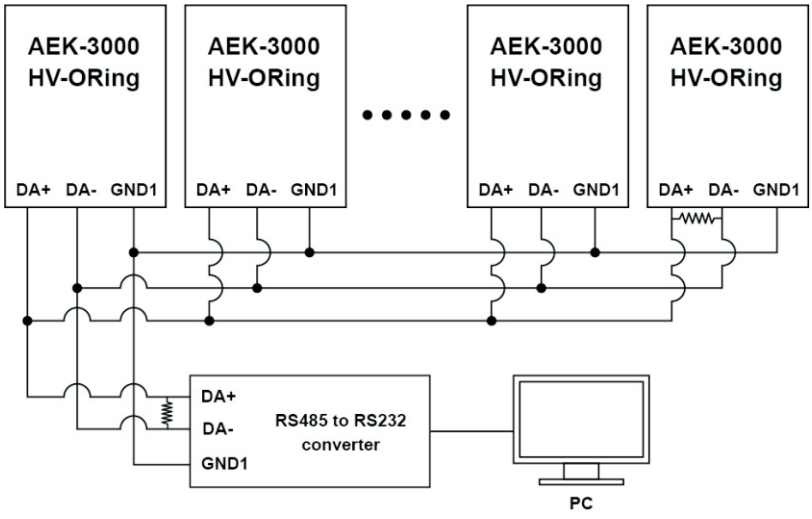
GND shown in above diagram is referring to the GND of CN5, not the Grounding from main power(NEG-).

RS485 communication connection diagram (Single Unit)



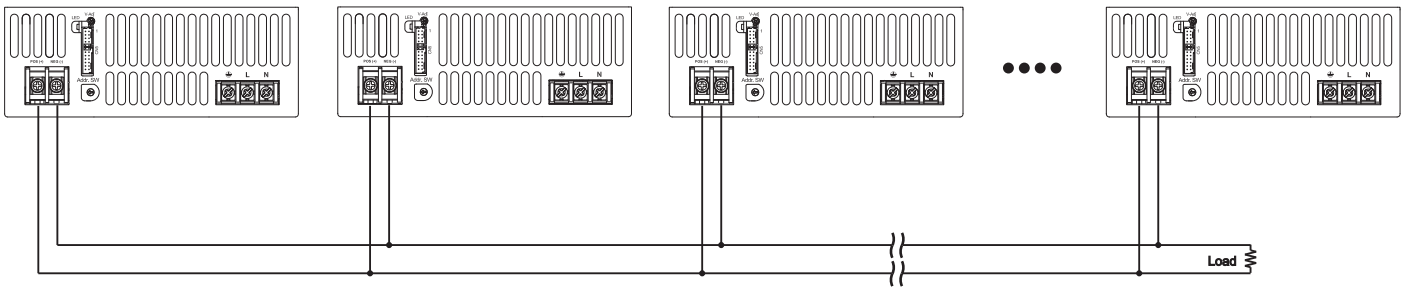
Note: Make sure GND1 (pin 20) is connected to the external communication kit when using RS485 / I^2C

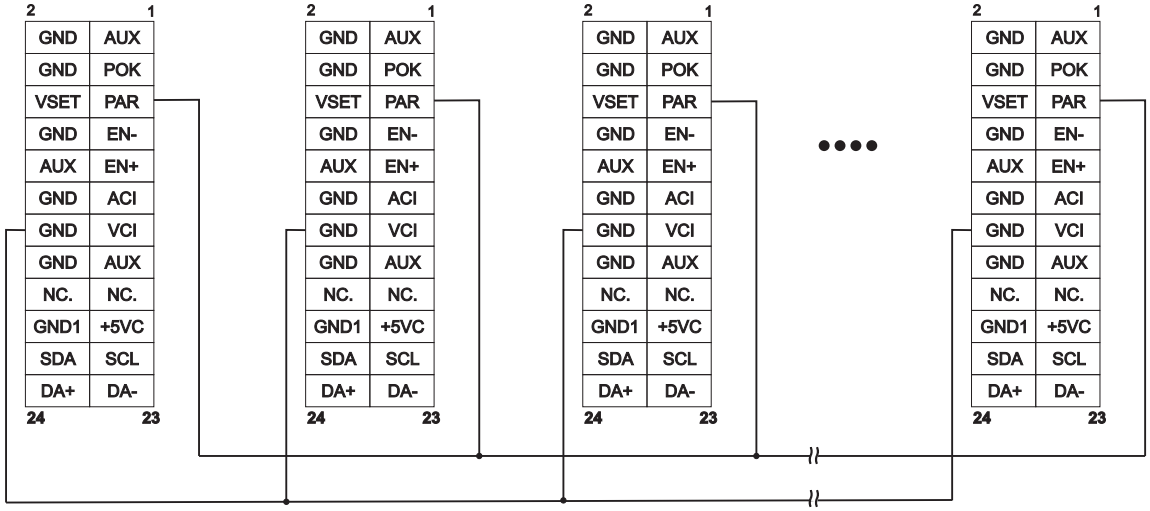
RS485 communication connection diagram (Multiple Units)



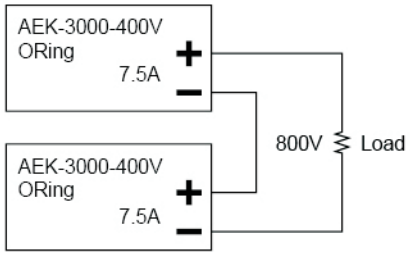
Note: Make sure GND1 (pin 20) is connected to the external communication kit when using RS485 / I^2C
Add 120Ω terminal resistance in between DA+ & DA- per diagram indication

1. Current Sharing





Block diagram to show 2pcs AEK-3000-HV ORing connect in series



1. P=(P1+P2)*0.9=6000W*0.9=5400W
2. V=V1+V2=800V
3. I=I1 or I2*0.9=7.5A*0.9=6.75A

Remarks:

1. AEK-3000-HV Oring diode has the built-in active current sharing function to support max. of 8pcs connected in parallel condition to support higher output power. When performing parallel connection, make sure to note the followings:
   a. Please connect PAR pins together for current sharing function
   b. Among the parallel connection units, output voltage difference of each PSU should be <0.2VDC (This can be set via V-adj from the PSU front panel VR)
   c. Total output current must not exceed 90% of the rated power in parallel condition
      Maximum output current at parallel condition = rated current per unit x number of unit x 0.9
   d. To ensure current share balance, output current of each unit must be >10% vs. the rated output current

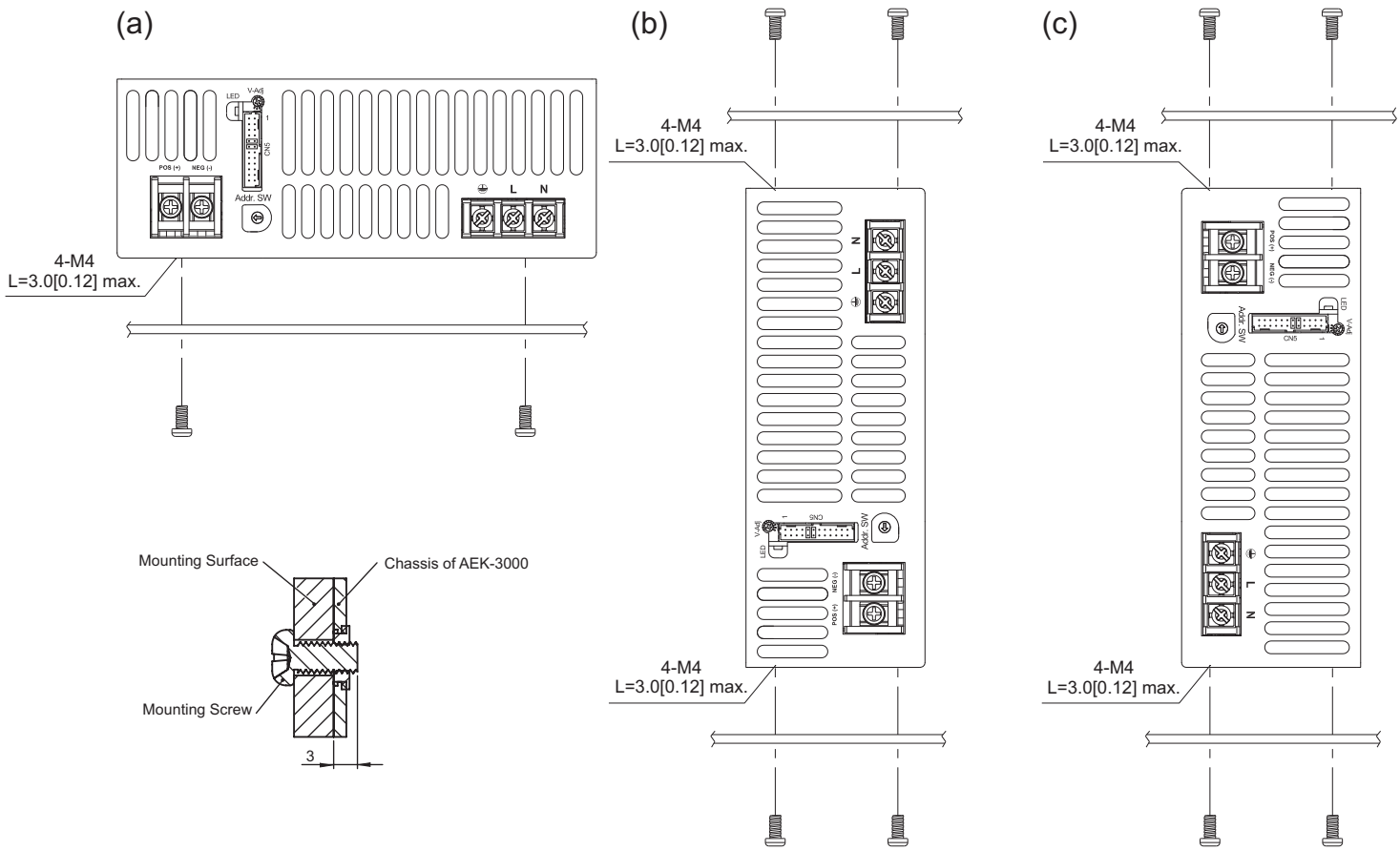
2. For Series connection, please find some of the remarks as follow:
   a. Max. units for series connection is 2pcs
   b. Total output current must not exceed 90% of the rated power in series condition
      maximum output current at series condition = rated current per unit x 0.9
   c. Make sure to isolate all the signals from CN5, except I^2C/RS485, Pin 19, 20 and +5VC

Installation Instruction:

1. Mounting Directions

Unit: mm [inch]

1-1 Recommended standard mounting methods:



Recommended screw length is measured from the power supply surface

2. Mounting Method

2-1 There are ventilating holes on the front and back side panels, do not obstruct; allow 50mm at least for air flow.

2-2 The Maximum allowable penetration of screw is 3mm. Incomplete threading should not be penetrated.

2-3 Recommended the torque of mounting screw:
M4 screw: 1.27N • m (13.0kgf • cm)