### Ordering information Unit type COSEL AD 4 240 -24 -AD 3 4 1 2 AD Series name Output wattage Output voltage Optional C :with Coating G :Low leakage current P :Parallel operation R :with Remote ON/OFF

MODEL	AD240-24	AD240-30
MAX OUTPUT WATTAGE[W]	240	240
DC OUTPUT	24V 10A	30V 8A

#### **SPECIFICATIONS**

0. 20.						
	MODEL		AD240-24	AD240-30		
	VOLTAGE[V]		AC85 - 132 / 170 - 264 1 (User-selectable)			
INPUT	FREQUENCY[Hz]		47 - 440			
	EFFICIENCY[%]		85typ 85typ			
	ACIN 100V		15max (lo=100%)			
		ACIN 200V	30max (Io=100%)			
	LEAKAGE CURRE	NT[mA]	1.0max (60Hz, According to DEN-AN)			
	VOLTAGE[V]		24	30		
	CURRENT[A]		10	8		
	LINE REGULATIO	N[mV]	300max	260max		
	LOAD REGULATION	ON[mV]	300max	420max		
	RIPPLE[mVp-p]	0 to +45°C *1	240max	240max		
OUTPUT	RIPPLE NOISE[mVp-p]	0 to +45°C *1	480max	480max		
	TEMPERATURE REGULATION[mV] 0 to +45°C		500max	600max		
	DRIFT[mV]	*2	500max	120max		
	OUTPUT VOLTAGE ADJUSTME	NT RANGE[V]	21.6 - 26.4	28.5 - 33.0		
	START-UP TIME[ms]		500max (ACIN 100/200V, Io=100%)			
	HOLD-UP TIME[m	s]	15typ (ACIN 100/200V, Io=100%)			
PROTECTION CIRCUIT	OVERCURRENT PRO	TECTION	Works over 105% of rating and recovers automatically			
	INPUT-OUTPUT		AC1,500V 1minute, Cutoff current = 10mA, DC500V 100M $\Omega$ min (At Room Temperature)			
ISOLATION	INPUT-FG		AC1,500V 1minute, Cutoff current = 10mA, DC500V 100M $\Omega$ min (At Room Temperature)			
	OUTPUT-FG		AC500V 1minute, Cutoff current = 50mA, DC500V 100M $\Omega$ min (At Room Temperature)			
	OPERATING TEMP.,HUMID.AN	id altitude	0 to +60°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max			
ENVIRONMENT	STORAGE TEMP.,HUMID.AND ALTITUDE		-25 to +80°C, 10 - 95%RH (Non condensing), 9,000m (30,000feet) max			
	VIBRATION		10 - 55Hz, 19.6m/s <sup>2</sup> (2G), 3minutes period, 30minutes each along X, Y and Z axis			
	IMPACT		98.0m/s <sup>2</sup> (10G), 20ms, once each X, Y and Z axis			
OTHERS	CASE SIZE/WEIGHT		75×99×220mm (W×H×D) /1.8kg max			
UTHERS	COOLING METHOD		Convection			

\*1 Measured by 15MHz oscilloscope.
 \*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.

AD

## Unit type **AD48**

Ordering information

1

2 3

Series name
 Output wattage
 Output voltage



Please refer to derating curve, because the rated load current depends on cooling method that is convention cooling or forced air.

MODEL	AD480-24	AD480-30	
MAX OUTPUT WATTAGE[W]	480	300(Peak 720)	
DC OUTPUT 24V 20A		30V 10(Peak 24)A Forced air	

#### **SPECIFICATIONS**

	MODEL		AD480-24	AD480-30			
VOLTAGE[V]			AC85 - 132 / 170 - 264 1 (User-selectable)				
NOUT	FREQUENCY[Hz]		47 - 440				
	EFFICIENCY[%]		85typ	85typ			
INPUT	ACIN 100		30max (lo=100%)				
		ACIN 200V	30max (lo=100%)				
	LEAKAGE CURRENT[mA]		1.0max (60Hz, According to DEN-AN)				
	VOLTAGE[V]		24	30			
		Forced air	20 (Peak 25)	10 (Peak 24)			
	CORRENT[A]	Convection	12 (Peak 25) Ta=45℃	10 (Peak 24) Ta=45℃			
	LINE REGULATIO	N[mV]	300max	260max			
	LOAD REGULATION	ON[mV]	300max	420max			
	RIPPLE[mVp-p]	*1	240max (0 to +45°C)	240max (0 to +50°C)			
OUIPUI	RIPPLE NOISE[m	/p-p] *1	480max (0 to +45°C)	480max (0 to +50°C)			
	TEMPERATURE REGULATION[mV]		500max (0 to +45°C)	600max (0 to +50°C)			
	DRIFT[mV]	*2	100max	120max			
	OUTPUT VOLTAGE ADJUSTMEN	NT RANGE[V]	21.6 - 26.4	28.5 - 33.0			
	START-UP TIME[ms]		600max (ACIN 100/200V, Io=100%)				
	HOLD-UP TIME[m	s]	15typ (ACIN 100/200V, Io=100%)				
PROTECTION	OVERCURRENT PRO	TECTION	Works over 105% of rating and recovers automatically				
CIRCUIT	<b>REMOTE ON/OFF</b>		Use terminal RC and G				
	INPUT-OUTPUT		AC1,500V 1minute, Cutoff current = 10mA, DC500V 100M $\Omega$ min (At Room Temperature)				
ISOLATION	INPUT-FG		AC1,500V 1minute, Cutoff current = 10mA, DC500V 100M $\Omega$ min (At Room Temperature)				
	OUTPUT-FG		AC500V 1minute, Cutoff current = 50mA, DC500V 100M $\Omega$ min (At Room Temperature)				
	OPERATING TEMP.,HUMID.AN	d altitude	0 to +65°C, 20 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max				
ENVIRONMENT	STORAGE TEMP.,HUMID.AND	O ALTITUDE	-25 to +80°C, 10 - 95%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s <sup>2</sup> (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT		196.1m/s <sup>2</sup> (20G), 11ms, once each X, Y and Z axis				
OTHERS	CASE SIZE/WEIGHT		110×140×220mm (W×H×D) /3.0kg max				
UTERS	COOLING METHOD		Forced air/Convection				

\*1 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN: RM101).
 \*2 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25 °C, with the input voltage held constant at the rated input/output.
 \* When operated at pulse load, attach external capacitor at output line which is complying with the peak value of pulse current.

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AD

### Unit type 6 AD

Ordering information

2 3

1

Series name
 Output wattage
 Output voltage



Please refer to derating curve, because the rated load current depends on cooling method that is convention cooling or forced air.

MODEL		AD960-24	AD960-30
MAX OUTPUT WATTAGE[W]		960	960
Forc		24V 40A	30V 32A
DC OUIPUI	Convection	24V 20(Peak 40)A	30V 16(Peak 32)A

#### **SPECIFICATIONS**

	MODEL		AD960-24	AD960-30			
VOLTAGE[V]			AC170 - 264 1 ¢ or DC240 - 370				
INPUT	FREQUENCY[Hz]		47 - 440 or DC				
	EFFICIENCY[%]		85typ	85typ			
	INRUSH CURRENT[A] ACIN 200V		60typ (lo=100%)				
	LEAKAGE CURRE	NT[mA]	1.0max (60Hz, According to UL, CSA, VDE and DEN-AN)				
	VOLTAGE[V]		24	30			
		Forced air	40	32			
	CORRENT[A]	Convection *1	20 (Peak 40)	16 (Peak 32)			
	LINE REGULATIO	N[mV]	200max	260max			
	LOAD REGULATIO	ON[mV]	340max	420max			
	RIPPLE[mVp-p]	-10 to +45°C *2	240max	240max			
001101	RIPPLE NOISE[mVp-p]	-10 to +45°C *2	480max	480max			
	TEMPERATURE REGULATION[mV] -10 to +45°C		420max	520max			
	DRIFT[mV] *3		100max	120max			
	OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		22.8 - 26.4	28.5 - 33.0			
	START-UP TIME[ms]		600max (ACIN 200V, Io=100%)				
	HOLD-UP TIME[ms	s]	15typ (ACIN 200V, Io=100%)				
PROTECTION	OVERCURRENT PROT	FECTION	Works over 105% of rating and recovers automatically				
CIRCUIT	OVERVOLTAGE PROT	TECTION	Works at 115 - 140% of rating				
	INPUT-OUTPUT		AC3,000V 1minute, Cutoff current = 25mA, DC500V 50M $\Omega$ min (At Room Temperature)				
ISOLATION	INPUT-FG		AC2,000V 1minute, Cutoff current = 25mA, DC500V 50M $\Omega$ min (At Room Temperature)				
	OUTPUT-FG		AC500V 1minute, Cutoff current = 100mA, DC500V 50M $\Omega$ min (At Room Temperature)				
	OPERATING TEMP.,HUMID.AND ALTITUDE		-10 to +65°C, 10 - 90%RH (Non condensing) (Refer to DERATING CURVE), 3,000m (10,000feet) max				
	STORAGE TEMP.,HUMID.AND	ALTITUDE	-20 to +75°C, 10 - 90%RH (Non condensing), 9,000m (30,000feet) max				
	VIBRATION		10 - 55Hz, 19.6m/s <sup>2</sup> (2G), 3minutes period, 60minutes each along X, Y and Z axis				
	IMPACT		196.1m/s <sup>2</sup> (20G), 11ms, once each X, Y and Z axis				
SAFETY AND	TY AND AGENCY APPROVALS		UL1950, CSA C22.2 No.234, EN60950, VDE0160 C	omplies with IEC950			
REGULATIONS	CONDUCTED NOI	SE	Complies with FCC-A				
OTHERS	CASE SIZE/WEIGHT		89×141.6×230mm (without terminal block) (W×H×D) /3.0kg max				
	COOLING METHOD		Forced air/Convection				

\*1 For convection cooling, peak current for 10 seconds or less is acceptable, and output current must be less than 20A on average.
 \*2 Measured by 20MHz oscilloscope or Ripple-Noise meter (equivalent to KEISOKU-GIKEN: RM101).
 \*3 Drift is the change in DC output for an eight hour period after a half-hour warm-up at 25°C, with the input voltage held constant at the rated input/output.
 \* When operated at pulse load, attach external capacitor at output line which is complying with the peak value of pulse current.

When operated at pulse load, attach external capacitor at output line which is complying with the peak value of pulse current.



AD

### **Basic Characteristics Data**

Madal	Circuit mathed	Switching	Input	Rated	Rated Inrush	Inrush	PCB/Pattern			Series/Parallel operation availability	
Iviodei	Circuit method	[kHz]	[A]	input fuse	protection	Material	Single sided	Double sided	Series operation	Parallel operation	
AD240	Forward converter	54	5.0	250 10A	Triac	FR-4		Yes	Yes	*1	
AD480	Forward converter	200	10.0	250 15A	Triac	FR-4		Yes	Yes	<b>*</b> 1	
AD960	Forward converter	170	10.0	250 20A	Triac	FR-4		Yes	Yes	Yes	

\* 1 Refer to Instruction Manual.
 \* The value of input current is at ACIN 100V and rated load (As for AD960, ACIN200V and rated load).

# Instruction Manual COSEL

AD

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COSEL

AD

## 1 Terminal Block

•AD240



Output
 Output
 Frame ground

④ Input voltage selecting terminal
⑤ Short: AC 85 - 132V Open: AC170 - 264V
⑥AC(L)
⑦AC(N)
⑧Output voltage adjustable potentiometer

•AD480



(1) ② +Output

3 -Output

4

⑤Remote ON/OFF(RC)
 ⑥Remote ON/OFF(RCG)
 ⑦Frame ground

 Short: AC 85 - 132V Open: AC170 - 264V

 MAC(N)

 MAC(L)

 WOutput voltage adjustable potentiometer

Input voltage selecting terminal

### •AD960



+Output
 +Output
 -Output

SVoltage balance(VB)
Current balance(CB)
Frame ground
AC(L)
AC(N)
Output voltage adjustable potentiometer

## 2 Function

### 2.1 Input voltage range

#### •AD240 · AD480

- The range is from AC85V to AC132V or AC170V to AC264V (user selectable).
- By changing the input voltage selector between VS1 VS2 (short or open), either AC100V or AC200V is possible.
  - Short AC85V to AC132V
  - Open AC170V to AC264V
- The unit is shipped from the factory for AC200V (open condition). In the case of AC100V, install the short-piece between VS1 and VS2.
- If the wrong connection is made for short/open, the power supply may be damaged. The input voltage should be within the above range.



Short-piece should be attached as per above drawing.

### •AD960

- The range is from AC170V to AC264V or DC240V to DC370V.
- ■AC input voltage must have a range from AC170V to AC264V or DC240V to DC370V for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damaged.

### 2.2 Inrush current limiting

- ■Inrush current limiting is built-in.
- If a switch on the input side is installed, it has to be the one handling the input inrush current.
- The thyristor technique is used for protection from inrush current.
- When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time between power ON and OFF to operate resistance circuit for inrush current.

### 2.3 Overcurrent protection

The overcurrent protection circuit is built-in to prevent the unit from a short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.



#### •AD480

When short/overcurrent condition continues more than 10 seconds, average overcurrent circuit (operated at 110% of rated current) operates, and it reduces the current by hang of voltage.
 When cause of activation of overcurrent protection is removed, the output will be automatically recovered.

#### 2.4 Overvoltage protection

#### •AD960

- The overvoltage protection circuit is built-in and comes into effect at 115 - 140% of the rated voltage. The AC input should be shut down if overvoltage protection is in operation. The minimum interval of AC recycling for recovery is 5 minutes.
  - **★** The recovery time varies depending on input voltage.

#### Remarks:

Please avoid applying the over-rated voltage to the output terminal. Power supply may operate incorrectly or fail.In case of operating a motor etc. , please install an external diode on the output terminal to protect the unit.

#### 2.5 Output voltage adjustment range

Adjustment of output voltage is possible by using potentiometer.Output voltage is increased by turning potentiometer clockwise and is decreased by turning potentiometer counterclockwise.

#### 2.6 Remote ON/OFF

#### •AD480

The ground terminal of remote ON/OFF circuit is connected with -V output terminal.

Between RC and RCG: Output voltage is ON at "High" level or open circuit.

Between RC and RCG: Output voltage is OFF at "Low" level or short circuit.

When RC terminal is "Low" level, fan out current is 5mA.

#### 2.7 Isolation

■For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for the start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

#### •AD480

If the unit is tested on the isolation between input & output and output & FG, remote ON/OFF must be shorted to output.

#### 2.8 Thermal protection

#### •AD960

- Thermal protection is built-in. If this function comes into effect, shut down the output, eliminate all possible causes of overheating, and drop the temperature to normal level. Output voltage recovers after applying input voltage. To prevent the unit from overheating, avoid using the unit in a dusty, poorly ventilated environment.
- (1) Over 45°C (Ambient temperature)
- (2) Poor ventilation
- (3) Excessive output current for over 10 seconds

## 3 Series Operation and Parallel Operation

#### 3.1 Series operation

Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest rated current in each unit.



#### 3.2 Parallel operation/master-slave operation

#### •AD240 · AD480

Parallel redundancy operation is available by connecting the units as shown below.



#### AD

Values of I1 and I2 become unbalanced by a slight difference of the output voltage. Make sure that the output voltage of units is of equal value and the output current from each power supply does not exceed the rated current.

I1, I2  $\leq$  the rated current value

#### •AD960

■Parallel operation is available by connecting below.

■As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

(Output current in parallel operation)

= (the rated current per unit)  $\times$  (number of unit)  $\times$  0.9

When the number of units in parallel operation increases, input current increases at the same time. Adequate wiring design for input circuitry is required, such as circuit pattern, wiring and current capacity for equipment.

In parallel operation, the maximum operative number of units is 5.



- Output voltage in parallel operation is adjustable by using the potentiometer of the "master" unit. Select one power supply to be the master, and turn the potentiometer of the other, "slave" power supplies, clockwise to the end. Then use the potentiometer of the mater to adjust output voltage.
- When remote sensing is used in parallel operation, the sensing wire must be connected ONLY to the master.
- In parallel operation, output voltage increases like stairs due to a delay of the rise time of output voltage at turn on.



■In parallel operation, please connect diode to the +side of the output circuit. If diode is connected to the -side, it will damage the unit or/and the balancing function will not work.





## 4 Assembling and Installation Method

#### 4.1 Installation method

When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

### 4.2 Derating

- The operative ambient temperature is different by with/without case cover or mounting position. Please refer drawings as below.
- When unit mounted except below drawings, it is required to consider ventilated environment by forced air cooling or temperature/load derating. For details, please consult our sales or engineering departments.



#### •AD240



<sup>①</sup>A part should be kept below 80°C.

(When operating ambient temperature is at  $45^{\circ}$ C)

②Do not block the ventilation hole.

#### (2)Derating curve



★ 100% load factor means 240W of output power.

#### •AD480





①Keep the temperature of part A and B as below chart.

#### •AD480-24

		[°C]
Operating condition	A part	B part
Forced air	Below 65	Below 61
Convection	Below 73	Below 72

(When operating ambient temperature is at 45°C)

 $\ensuremath{\textcircled{}^{2}\text{Do}}$  not block the ventilation hole.

#### (2)Derating curve

#### •AD480-24



★ 100% load factor means 480W of output power.

#### •AD960

(1)Installation method

Cooling by Forced air

OVentilate to get temperature as per drawing (Operating ambient temperature is at 45°C).

<sup>2</sup>Do not block the ventilation hole so that the air ventilates equally.



#### Cooling by convection

①Install the unit as per drawing so that enough convection is applied.②Do not block the ventilation hole.

★ Consult factory if the unit needs to be mounted in a non-listed position.



#### (2)Derating curve

Operative ambient temperature varies depending on the cooling method. Please refer to the following derating curve.



Ambient temperature [°C]

★ 100% load factor means 960W of output power.

#### 4.3 Mounting screw

- Keep isolation distance between screw and internal components, as below chart.
- Do not mount the unit only on the front side (terminal side) or the reverse side.



### Unit type

COSEL

## 5 Peak Loading

- When unit operates by pulse load, attach the external capacitor at output line which corresponds to peak value of pulse current (If the pulse current is drawn directly, it will shorten the life time of capacitor installed in the power supply).
- Due to the nature of a pulse load, a power supply may make a sound (noise). If the unit is used in an quiet place, consult factory for the load condition in advance.

•AD240







•AD960



- Note 1. Select an external capacitor with capacity above the line in the graph.
- Note 2. Make sure ripple current of an external capacitor is allowable.
- Note 3. Select the electrolytic capacitor with a capacity over 35V of its rated voltage.
- Note 4. When the load current draws continuously, external capacitor is not necessary.