HVP
High Voltage Products. High Voltage Experts.

Advanced Energy

COOLX®600

FANLESS, NATURAL CONVECTION-COOLED MODULAR POWER SUPPLY

Advanced Energy's CoolX®600 series, part of our low voltage solutions, is the world's first fanless, natural convection-cooled modular power supply. The CoolX600 delivers an incredible 600 W without fan-assisted cooling from a very compact package. The CoolX600 offers system designers best-in-class efficiency and reliability in addition to the most comprehensive feature set and specifications available.

PRODUCT HIGHLIGHTS

No Fan Featured
- 600 W with 100% natural convection cooling
- No base plate needed
- No acoustic noise or vibrations

Reliability
- MTBF > 400,000 hours, 25% better than today's leading solutions
- High input surge protection — 4 kV line to PE for harsh environments
- Reverse energy protection — no blocking diodes required
- 24 W always ON auxiliary power output
- Safety approved to 5000 m altitude
- > 94% efficiency
- Five-year warranty

Flexibility
- Analog and digital management — PMBus™ monitoring and control capability
- Field-configurable — plug and play power
- Series and parallel outputs — higher voltages/currents
- Mounting options — base/side and DIN-Rail mounting

TYPICAL APPLICATIONS

Medical
- Clinical diagnostic equipment, medical lasers, dialysis equipment, radiological imaging, clinical chemistry

Industrial
- Test and measurement, industrial machines, automation equipment, printing, telecommunications, audio equipment

Hi Rel
- Harsh industrial electronics, radar (naval- and ground-based), communications, test and measurement

AT A GLANCE

	CX06S	CX06M
Power		
	600 W	600 W
Slots		
	4	4

Cooling

No fan featured, convection-cooled

Parameters

215.9 mm x 114.3 mm x 39.1 mm (8.5 in x 4.5 in x 1 U)

Certifications

Medical
- IEC60601-1 3rd edition, IEC60601-1-2 4th edition (EMC)
- 2 MOPP
- Dual fused
- Suitable for type B- and BF-rated applications
- ISO13485

Industrial
- IEC60950, IEC62368-1
- ISO9000
- SEMI F47

Defense/Aero
- MIL-STD-810G

MODULES

CoolX CoolMods Table				
Single Output Modules (1 Slot)	**Vnom(V)**	**Set Point Adjust Range (V)**	**Imax(A)**	**Power (W)**
CmA[1]	5	2.5-6.0	21.0	105
CmB[1]	12	6.0-15.0[2]	15.0	180
CmC[1]	24	15.0-28.0	8.3	200
CmD[1]	48	28.0-58.0[3]	4.2	200
High Power Modules (3 Slot)				
CmE[4]	24	24-25.2	25.0	550*
CmF[4]	48	48-50.4	12.5	550*
Dual Output Modules (1 Slot)				
CmG[5] V1	24	3.0-30.0	3.0	90
V2	24	3.0-30.0	3.0	90
CmH[6] V1	5	3.0-6.0	6.0	36
V2	24	3.0-30.0	3.0	90
Wide Trim Modules (1 Slot)				
CmA-W01	5	1.0-6.0	21	105
CmB-W01	12	1.0-15.0[2]	15	180
CmC-W01	24	2.0-28.0	8.33	200
CmD-W01	48	3.0-58.0[3]	4.17	200

1 Full dynamic specifications may not be met at full load when output voltage is trimmed above 13 V.

2 Max Trim 14 V when used with High Power Module

3 Max Trim 56 V when used with High Power Module

4 a) Only one High Power module (CmE or CmF) can be used per CoolPac.
b) During load transients starting from 0% load on the High Power modules, other modules in the CoolPac may experience an output voltage dynamic during the load change. Contact applications support for details or support.

5 For the CmG module the max combined power of both outputs is 120 W.

6 For the CmH module the max combined power of both outputs is 100 W.

* Max Power of coolPac is 550W when High Power Module is used

ELECTRICAL SPECIFICATIONS

Input					
Parameter	**Conditions/Description**	**Min**	**Nom**	**Max**	**Units**
AC Operating Input Range		85	—	264	VAC
Nominal Input Voltage Range	Universal Input 47-440 Hz	100	—	240	VAC
Extended AC Operating Range	Maximum for 5 seconds	—	—	300	VAC
DC Input Voltage Range		120	—	300	VDC
Input Current	90 VAC @ 420 W	—	6	—	A
Inrush Current	230 VAC @ 600 W	—	—	25	A
Power Factor	120 VAC @ 500 W	0.98	—	—	—
Undervoltage Lockout	Shutdown	65		74	VAC
Input Fuses Rating	Dual Fused (Line and Neutral) 250 VAC	—	8	—	A
Efficiency	230 VAC, 600 W with 3 x CmC CoolMods	—	93	—	%
	230 VAC, 600 W with 1 x CmE CoolMod	—	94	—	%

ELECTRICAL SPECIFICATIONS (CONTINUED)

Output					
Parameter	**Conditions/Description**	**Min**	**Nom**	**Max**	**Units**
Power Rating	CX06: See derating curves	—	—	600	W
Minimum Load		0	—	—	A
Line Regulation	For ±10% change from nominal line	—	—	±0.1	—
	CmF, CmG, CmH	—	—	±0.5	%
Load and Cross Regulation	For 25% to 75% load change	—	—	±0.2	%
Transient Response	For 25% to 75% load change 0.5 A/uS: voltage deviation	—	—	4 (4)	%
	*CmE and CmF, CmG, CmH Figures in () Settling Time	—	—	500 (1000)	µS
Ripple and Noise	100 mV or 1.0% pk-pk. 20 MHz BW	—	—	1	%
	CmF	—	—	1.5	%
Overvoltage Protection	Tracking OVP Level (N/A in CmE and CmF, CmG, CmH)	105	—	125	%
	Latching OVP Level	110	—	160	%
Remote Sense	Max line drop compensation (N/A in CmG and CmH)	—	—	0.5	VDC
Rise Time	Monotonic CmG, CmH Figures in ()	—	—	10 (20)	ms
Turn-On Delay	From AC in *CmE and CmF, CmG, CmH Figures in ()	—	—	800	ms
	From Global Enable	—	—	10 (20)	ms
	From CoolMod Enable	—	—	10 (20)	ms
Hold-Up Time	For nominal output voltages at full load	20	—	—	ms
CoolMod Power	As per CoolMod table	—	—	—	—
Output Adjustment Range	Manual: Multi-turn potentiometer, as per CoolMod table Vtrim: As per CoolMod table	—	—	—	—
Overcurrent Protection	Straight line with hiccup activation @ 35% Vo nom CmE and CmF, CmG, CmH: Current limit hiccup autorecovery	110	130	150	%
Short Circuit Protection	Yes, Autorecovery	—	—	—	—
Over Temperature Protection	Yes, Autorecovery (CmG, CmH latch off)	—	—	—	—
Capacitive Load	Nominal output voltages at full load	—	—	10	mF
	CmG, CmH	—	—	270	uF

Auxiliary Output					
Parameter	**Conditions/Description**	**Min**	**Nom**	**Max**	**Units**
Nominal Output Voltage	Aux voltage option A	11.76	12	12.24	V
	Aux voltage option B	4.75	5	5.25	V
Load Regulation		—	—	±2	%
Line Regulation	For ±10% change from nominal line	—	—	±0.5	%
Maximum Output Current	Aux voltage option A	—	—	1.96	A
	Aux voltage option B	—	—	4.7	A
Maximum Output Capacitive Load		—	—	1000	uF
Output Overcurrent Protection	Hiccup	110		140	%
Short Circuit Protection	Yes, autorecovery	—	—	—	—

ELECTRICAL SPECIFICATIONS (CONTINUED)

Galvanic Isolation					
Parameter	**Conditions/Description**	**Min**	**Nom**	**Max**	**Units**
Input to Output	Reinforced (2 x MOPP); contact Advanced Energy for Hi-Pot instructions	4000	—	—	VAC
Input to Case	Basic (1 x MOPP)	1850	—	—	VAC
Output to Case	Basic (1 x MOPP)	1850	—	—	VAC
Output to Output	Basic (1 x MOPP)	1850	—	—	VAC
Output to Output (Dual)	CmG, CmH V1-V2	500	—	—	VDC

Reliabilty					
Parameter	**Conditions/Description**	**Min**	**Nom**	**Max**	**Units**
Reliability and MTBF	MTBF of > 400 kHours, Telecordia SR-332, Issue 1 CoolMod	—	0.52	—	Fpmh
	CoolPac	—	1.08	—	Fpmh
Warranty	5 years	—	—	—	—

Environmental					
Parameter	**Conditions/Description**	**Min**	**Nom**	**Max**	**Units**
Operating Temperature	Operates to specification below -20°C after 10 min warmup	-40	—	85	°C
Storage Temperature		-40	—	85	°C
Derating	See Derating Curves including note 5	—	—	—	—
Relative Humidity	Non-condensing	5	—	95	%RH
Shock and Vibration	MIL-STD-810G Method 514.6	—	—	—	—
Altitude		—	—	5000	m

Leakage Currents			
Parameter	**Conditions/Description**	**Nom**	**Units**
AC Leakage Current	**Input to Earth Ground**	—	—
Normal Condition (High Line)	Mains Voltage 264 VAC / 60 Hz	248	µA
Single Fault Condition (High Line)	Mains Voltage 264 VAC / 60 Hz	393	µA
Touch Current			
Normal Condition	Mains Voltage 264 VAC / 60 Hz	4.7	µA
Single Fault Condition	Mains Voltage 264 VAC / 60 Hz	247	µA

EMC		
Parameter	**Conditions/Description**	**Units**
Radiated Emissions[1]	EN 55011, EN 55022 and FCC, Class B	Compliant
Conducted Emissions[1]	EN 55011, EN 55022 and FCC, Class B	Compliant
Power Line Harmonics	EN 61000-3-2, Class A	Compliant
Voltage Flicker	EN 61000-3-3	Compliant
ESD	EN 61000-4-2, level 4, 8 kV contact, 15 kV air	A
Radiated Immunity	EN 61000-4-3, level 2, 3 V/m	A
Electrical Fast Transient	EN 61000-4-4, level 4, ±4 kV	B
Surge Immunity	EN 61000-4-5, level 4, 2 kV DM, 4 kV CM	B
Conducted RF Immunity	EN 61000-4-6, level 3, 10 Vemf 150 KHz-80 MHz	A
Power Frequency Magnetic Field	EN 61000-4-8, level 4, 30 A/m	A

[1] Consult AE applications for system level compliance

ELECTRICAL SPECIFICATIONS (CONTINUED)

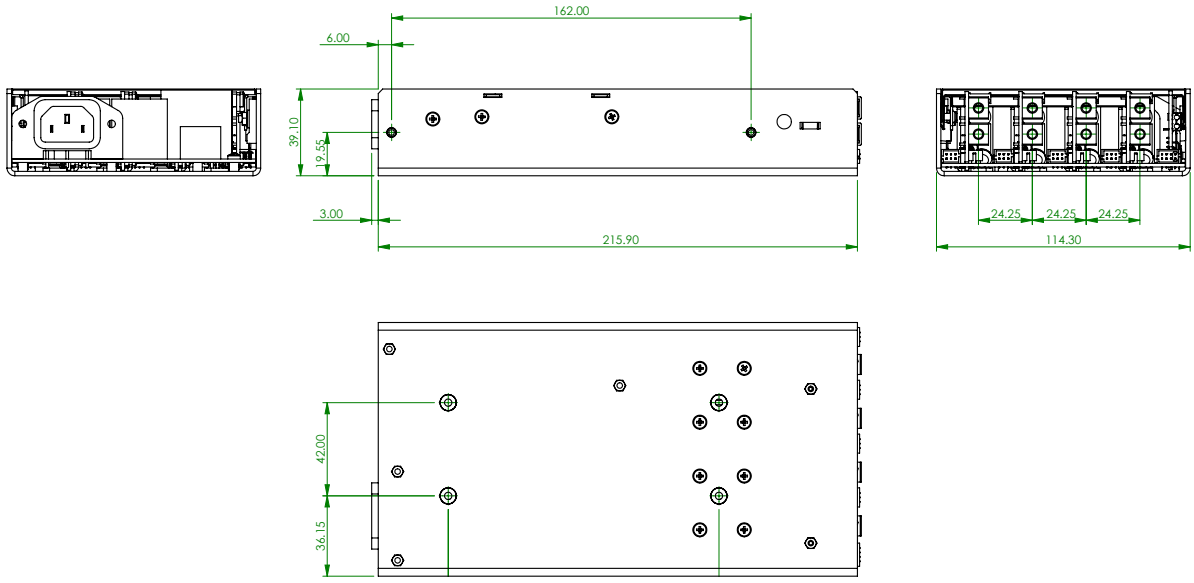
Standards and Directives[1]	
Parameter	**Conditions/Description**
Safety Agency Approvals	EN60601-1 3rd Edition, UL60601-1, CSA601
	EN60950 2nd Edition, CSA C22.2 No. 60950-1
IEC/EN 60950-1, Edition 2 and All National Deviations	UL 60950-1/CSA 22.2 No 60950-1, Edition 2
	5000 m (16,400 ft) altitude, 100 V to 240 ±10% VAC
IEC/EN 60601-1, Edition 3 and All National Deviations	IEC 60601-1(2005), EN60601-1 (2006)
	ANSI/AAMI ES 60601-1 (2005)
	CAN/CSA C22.2 No. 60601-1 (2008)
	5,000 m (16,400 ft) altitude, 100 V to 240 VAC ±10%
IEC 62368 Edition 2	IEC 62368-1 (2014) Edition 2
	5000 m (16,400 ft) altitude, 100 V to 240 ±10% VAC
IEC 60601-1-2 Edition 4	IEC 60601-1-2 (2014)
Protection Class	Class I
WEEE	Waste Electrical and Electronic Equipment Directive (WEEE) 2002/96/EC
ROHS	EU DIRECTIVE 2011/65/EC RoHS compliancy
REACH	Compliant

[1] Designed to support Type B and Type BF Applied Part End Product Requirements. BF rating achieved with CoolX600 configured without a cover.

MECHANICAL SPECIFICATIONS

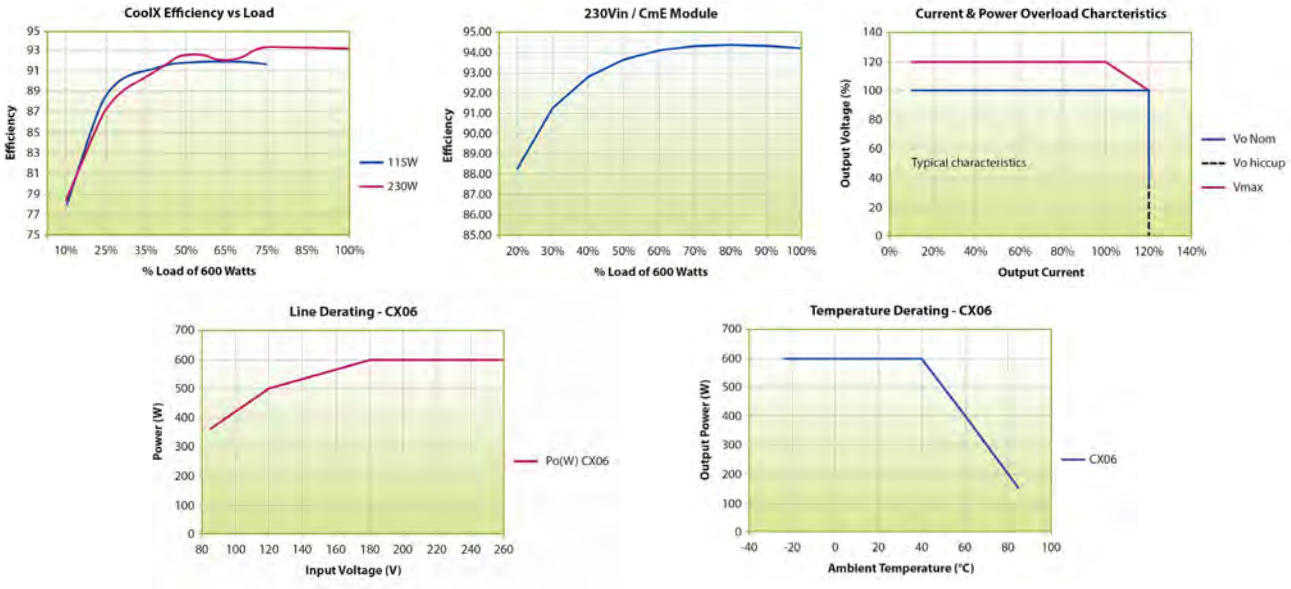
Mechanica Data		
Parameter	**Description**	**Min**
Dimensions (L x W x H)		215.9 mm x 114.3 mm x 39.1 mm (8.5 in x 4.5 in x 1 U)
Weight	Nominal Weight: CoolPac + 4 x CoolMods	1 Kg
Connectors	**Description**	**Mating Connectors (if applicable)**
AC/DC input terminal block	TE 2-1437667-S, DINKLE DT-35-B07W-03	—
AC/DC IEC input (Option)	IEC 320 Inlet	—
Main DC output terminal block (CmA-CmF, CmM-CmQ)	M4 Screws	—
Main DC output terminal block (CmG, CmH)	Camden - CTB9350/4A	—
Output Signal Connector (CmG, CmH)	Molex - 87833-0831	—
System Signal Connector J1005	Molex 87833-0831 8-way	Locking Molex 51110-0860; Non Locking Molex 51110-0850; Crimp Terminal: Molex p/n 50394 or Molex 51110-0856 which includes locking tab and polarization keying
Output Signal Connectors J1001-1004	Molex 87833-0631 6-way	Locking Molex 51110-0660; Non Locking Molex 51110-0650; Crimp Terminal: Molex p/n 50394 or Molex 51110-0656 which includes locking tab and polarization keying
Output Sense Connectors J3	JST-S2BPH-K(LF)(SN)	JST PHR2. Crimp Terminal JST BPH-002T-P0.5S or SPH-002T-P.05S
Auxiliary Output Connector J1	Molex 1041880210 2pin	—

Mechanical Drawings



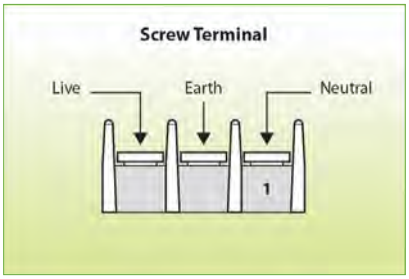
CoolX can be mounted on its base, vertically, or on its side. CoolX can also be mounted on the DIN Rail Accessory (Z744).

INTERFACE

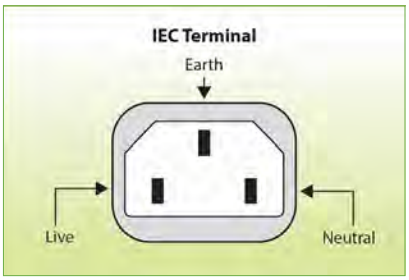


[1] Enhanced thermal performance with system fans and base plate cooling. Contact Advanced Energy for details.

Input Connectors

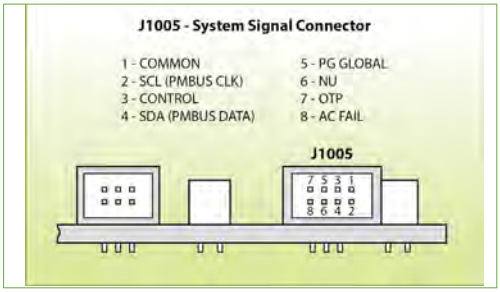


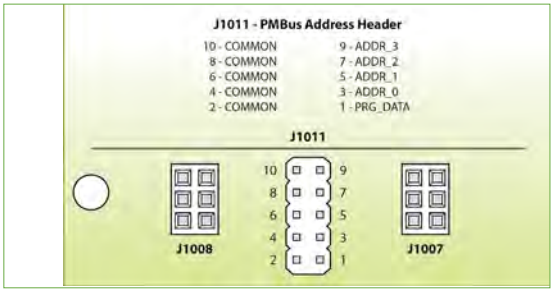
Standard (Screw Terminal)

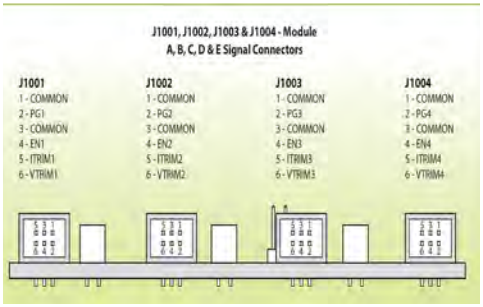


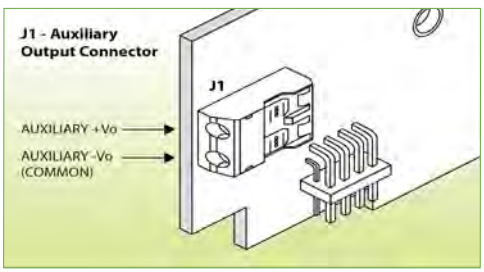
Option 1 (IEC Terminal)

CoolPac Connectors



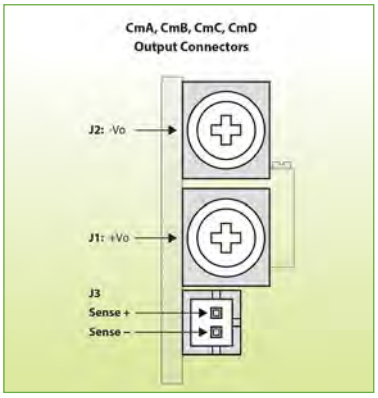


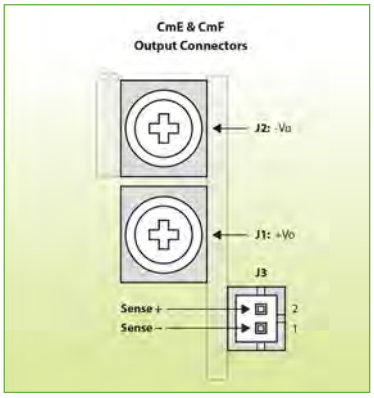


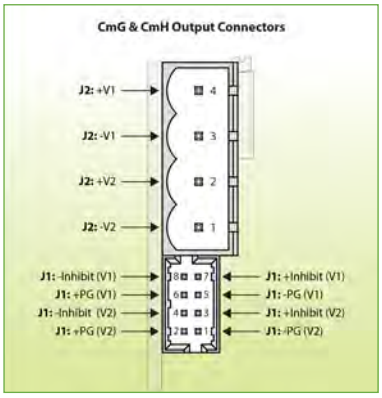


INTERFACE (CONTINUED)

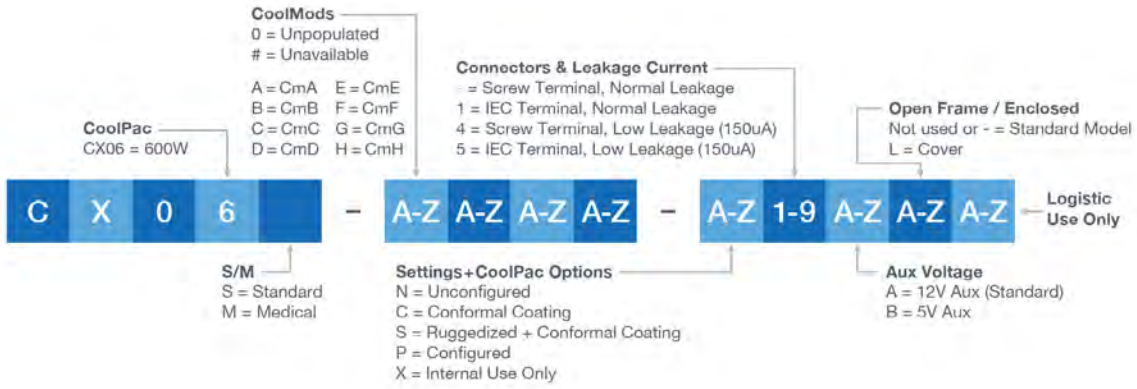
CoolMod Connectors







CONFIGURATION



-= Standard indicates that all voltages are set to the nominal setpoint of each module and there are no parallel/series links fitted to the power supply

*CmE or CmF High Power Module (3 slot module) can only occupy Slots B/C/D.