

EXCELSYS COOLX® 600 SERIES

FANLESS, NATURAL CONVECTION-COOLED MODULAR POWER SUPPLY



Advanced Energy's CoolX®600 series, part of our Excelsys product line, 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.

AT A GLANCE

CX06S CX06M

PRODUCT HIGHLIGHTS

No Fan Featured

- 600 W with 100% natural convection cooling
- No fan 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

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)

Certification and Compliance

Medical

- IEC60601-1 3rd edition, IEC60601-1-2 4th edition (EMC)
- Dual fused
- 2 MOPP

Industrial

- IEC60950, IEC62368-1
- SEMI F47**

Defense/Aero

- MIL-STD-810G

MODULES

| CoolX CoolMods Table | | | | |
|---------------------------------------|---------|----------------------------|----------------------|-----------|
| Parameter | Vnom(V) | Set Point Adjust Range (V) | I _{max} (A) | Power (W) |
| Single Output Modules (1 Slot) | | | | |
| CmA | 5 | 2.5-6.0 | 21.0 | 105 |
| CmB ¹ | 12 | 6.0-15.0 ² | 15.0 | 180 |
| CmC | 24 | 15.0-28.0 | 8.3 | 200 |
| CmD | 48 | 28.0-58.0 ³ | 4.16 | 200 |
| High Power Modules (3 Slots) | | | | |
| CmE ⁴ | 24 | 24.0-25.2 | 25.0 | 550* |
| CmF ⁴ | 48 | 48.0-50.4 | 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 | 21.0 | 105 |
| CmB-W01 | 12 | 1.0-15.0 ² | 15.0 | 180 |
| CmC-W01 | 24 | 2.0-28.0 | 8.3 | 200 |
| CmD-W01 | 48 | 3.0-58.0 ³ | 4.16 | 200 |
| High Voltage Modules (1 Slot) | | | | |
| CmK ⁷ | 200 | 175-205 | 0.66 | 132 |

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 550 W when High Power Module is used.

**SEMI F47 compliant at input voltages > 180 VAC. Consult Advanced Energy for details.

⁷ CmK module cannot be used in the same pack as a CmE or CmF module.

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 | — | 81 | VAC |

ELECTRICAL SPECIFICATIONS (CONTINUED)

| | | | | | |
|---------------------------------------|--|------------|------------|------------|--------------|
| 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, 550 W with 1 x CmE CoolMod | — | 94 | — | % |
| Output | | | | | |
| Parameter | Conditions/Description | Min | Nom | Max | Units |
| Single Output Modules (1 Slot) | | | | | |
| Line Regulation | From minimum to maximum rated voltage | — | — | ±0.2 | % |
| Load Regulation | For 0 to 100% load change | — | — | ±0.4 | % |
| Transient Response | For 25% to 75% load change, 0.5 A/μs: voltage deviation | — | — | ±6 | % |
| | For 25% to 75% load change, 0.5 A/μs: settling time | — | — | 500 | μs |
| Ripple and Noise | Peak-Peak, 20 MHz BW, 100 mV or % of nominal | — | — | 1.25 | % |
| Overvoltage Protection | Tracking OVP (autorecovery, % of setpoint) | 103 | — | 125 | % |
| | Latching OVP (% of maximum voltage) | 107 | — | 160 | % |
| Remote Sense | Maximum cable drop compensation | — | — | 0.5 | VDC |
| Rise Time | Monotonic | — | — | 5 | ms |
| Turn-On Delay | From AC in | — | — | 1000 | ms |
| | From Global Enable | — | — | 12 | ms |
| | From CoolMod Enable | — | — | 12 | ms |
| Hold-Up Time | For nominal output voltage at full load | 16 | — | — | ms |
| Overcurrent Protection | Straight line current limit with hiccup protection at 35% Vo nom | 105 | — | 130 | % |
| Short Circuit Protection | Hiccup, Autorecovery | — | — | — | — |
| Overtemperature Protection | Autorecovery | — | — | — | — |
| Capacitive Load | | — | — | 2.5 | mF |
| Dual Output Modules (1 Slot) | | | | | |
| Line Regulation | From minimum to maximum rated voltage | — | — | ±0.5 | % |
| Load Regulation | For 0 to 100% load change | — | — | ±2 | % |
| Transient Response | For 25% to 75% load change, 0.5 A/μs: voltage deviation | — | — | ±10 | % |
| | For 25% to 75% load change, 0.5 A/μs: settling time | — | — | 1000 | μs |
| Ripple and Noise | Peak-Peak, 20 MHz BW, 100 mV or % of nominal | — | — | 2 | % |
| Overvoltage Protection | Latching OVP (% of maximum voltage) | 110 | — | 130 | % |
| Rise Time | Monotonic | — | — | 20 | ms |
| Turn-On Delay | From AC in | — | — | 1000 | ms |
| | From Global Enable | — | — | 100 | ms |
| | From CoolMod Enable | — | — | 100 | ms |
| Hold-Up Time | For nominal output voltage at full load | 16 | — | — | ms |
| Overcurrent Protection | Hiccup, Autorecovery | 165 | — | 335 | % |
| Short Circuit Protection | Hiccup, Autorecovery | — | — | — | — |
| Overtemperature Protection | Latch off | — | — | — | — |
| Capacitive Load | | — | — | 270 | μF |
| High Power Modules (3 Slots) | | | | | |
| Line Regulation | From minimum to maximum rated voltage | — | — | ±0.5 | % |
| Load Regulation | For 0 to 100% load change | — | — | ±3.5 | % |
| Transient Response | For 25% to 75% load change, 0.5 A/μs: voltage deviation | — | — | ±4 | % |
| | For 25% to 75% load change, 0.5 A/μs: settling time | — | — | 1000 | μs |
| Ripple and Noise | Peak-Peak, 20 MHz BW, 100 mV or % of nominal | — | — | 3.5 | % |

ELECTRICAL SPECIFICATIONS (CONTINUED)

| | | | | | |
|---|--|-----|---|-------|-----|
| Overvoltage Protection | Tracking OVP (autorecovery, % of setpoint) | 102 | — | 120 | % |
| | Latching OVP (% of maximum voltage) | 107 | — | 130 | % |
| Remote Sense | Maximum cable drop compensation | — | — | 0.5 | VDC |
| Rise Time | Monotonic | — | — | 8 | ms |
| Turn-On Delay | From AC in | — | — | 1000 | ms |
| | From Global Enable | — | — | 20 | ms |
| | From CoolMod Enable | — | — | 20 | ms |
| Hold-Up Time | For nominal output voltage at full load | 16 | — | — | ms |
| Overcurrent Protection | Straight line current limit with hiccup protection at 35% Vo nom | 105 | — | 130 | % |
| Short Circuit Protection | Hiccup, Autorecovery | — | — | — | — |
| Overtemperature Protection | Autorecovery | — | — | — | — |
| Capacitive Load | | — | — | 10 | mF |
| Wide Trim Power Modules (1 Slot) | | | | | |
| Line Regulation | From minimum to maximum rated voltage | — | — | ±0.25 | % |
| Load Regulation | For 0 to 100% load change | — | — | ±0.4 | % |
| Transient Response | For 25% to 75% load change, 0.5 A/μs: voltage deviation | — | — | ±6 | % |
| | For 25% to 75% load change, 0.5 A/μs: settling time | — | — | 500 | μs |
| Ripple and Noise | Peak-Peak, 20 MHz BW, 100 mV or % of nominal | — | — | 1.25 | % |
| Overvoltage Protection | Tracking OVP (autorecovery, % of setpoint) | 103 | — | 125 | % |
| | Latching OVP (% of maximum voltage) | 107 | — | 160 | % |
| Remote Sense | Maximum cable drop compensation | — | — | 0.5 | VDC |
| Rise Time | Monotonic | — | — | 5 | ms |
| Turn-On Delay | From AC in | — | — | 1000 | ms |
| | From Global Enable | — | — | 12 | ms |
| | From CoolMod Enable | — | — | 12 | ms |
| Hold-Up Time | For nominal output voltage at full load | 16 | — | — | ms |
| Overcurrent Protection | Straight line current limit with hiccup protection at 35% Vo nom | 105 | — | 130 | % |
| Short Circuit Protection | Hiccup, Autorecovery | — | — | — | — |
| Overtemperature Protection | Autorecovery | — | — | — | — |
| Capacitive Load | | — | — | 10 | mF |
| High Voltage Modules (1 Slot) | | | | | |
| Line Regulation | From minimum to maximum rated voltage | — | — | ±0.5 | % |
| Load Regulation | For 0 to 100% load change | — | — | ±1 | % |
| Transient Response | For 25% to 75% load change, 0.5 A/μs: voltage deviation | — | — | ±3.75 | % |
| | For 25% to 75% load change, 0.5 A/μs: settling time | — | — | 500 | μs |
| Ripple and Noise | Peak-Peak, 20 MHz BW, 100 mV or % of nominal | — | — | 1 | % |
| Overvoltage Protection | Tracking OVP (autorecovery, % of setpoint) | 103 | — | 125 | % |
| | Latching OVP (% of maximum voltage) | 112 | — | 122 | % |
| Rise Time | Monotonic | — | — | 20 | ms |
| Turn-On Delay | From AC in | — | — | 1000 | ms |
| | From Global Enable | — | — | 30 | ms |
| | From CoolMod Enable | — | — | 30 | ms |
| Hold-Up Time | For nominal output voltage at full load | 16 | — | — | ms |

ELECTRICAL SPECIFICATIONS (CONTINUED)

| | | | | | |
|----------------------------|--|-----|---|-----|----|
| Overcurrent Protection | Straight line current limit with hiccup protection at 35% Vo nom | 105 | — | 130 | % |
| Short Circuit Protection | Hiccup, Autorecovery | — | — | — | — |
| Overtemperature Protection | Autorecovery | — | — | — | — |
| Capacitive Load | | — | — | 10 | μF |

Auxiliary Output

| Parameter | Conditions/Description | Min | Nom | Max | Units |
|--------------------------------|------------------------------------|------|-----|------|-------|
| Nominal Output Voltage | Aux voltage option A | 11.6 | 12 | 12.4 | V |
| | Aux voltage option B | 4.8 | 5 | 5.2 | V |
| Load Regulation | | — | — | ±2 | % |
| Line Regulation | For ±10% change from nominal line | — | — | ±0.5 | % |
| Ripple and Noise | Peak-Peak, 20 MHz BW, % of nominal | — | — | 4 | % |
| Maximum Output Current | Aux voltage option A | — | — | 1.96 | A |
| | Aux voltage option B | — | — | 4.7 | A |
| Maximum Output Capacitive Load | | — | — | 1000 | μF |
| Output Overcurrent Protection | Hiccup | 105 | — | 145 | % |
| Short Circuit Protection | Yes, autorecovery | — | — | — | — |

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 |

Reliability

| Parameter | Conditions/Description | Min | Nom | Max | Units | |
|----------------------|--|---------|-----|------|-------|------|
| Reliability and MTBF | MTBF of > 400 kHours, Telecordia SR-332, Issue 4 | CoolMod | — | 0.11 | — | Fpmh |
| | | CoolPac | — | 0.19 | — | Fpmh |
| Warranty | 5 years | — | — | — | — | |

Environmental

| Parameter | Conditions/Description | Min | Nom | Max | Units |
|-----------------------|--|-----|-----|------|-------|
| Operating Temperature | Operates below -20°C after 10 min warmup | -30 | — | 85 | °C |
| Storage Temperature | | -40 | — | 85 | °C |
| Derating | See Derating Curves | — | — | — | — |
| Relative Humidity | Non-condensing | 5 | — | 95 | %RH |
| Shock and Vibration | MIL-STD-810G Method 514.6 | — | — | — | — |
| Altitude | | — | — | 5000 | m |

ELECTRICAL SPECIFICATIONS (CONTINUED)

| 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 | Criteria |
| Radiated Emissions ¹ | EN 55011, EN 55022 and FCC, Class B | Compliant |
| Conducted Emissions ² | 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

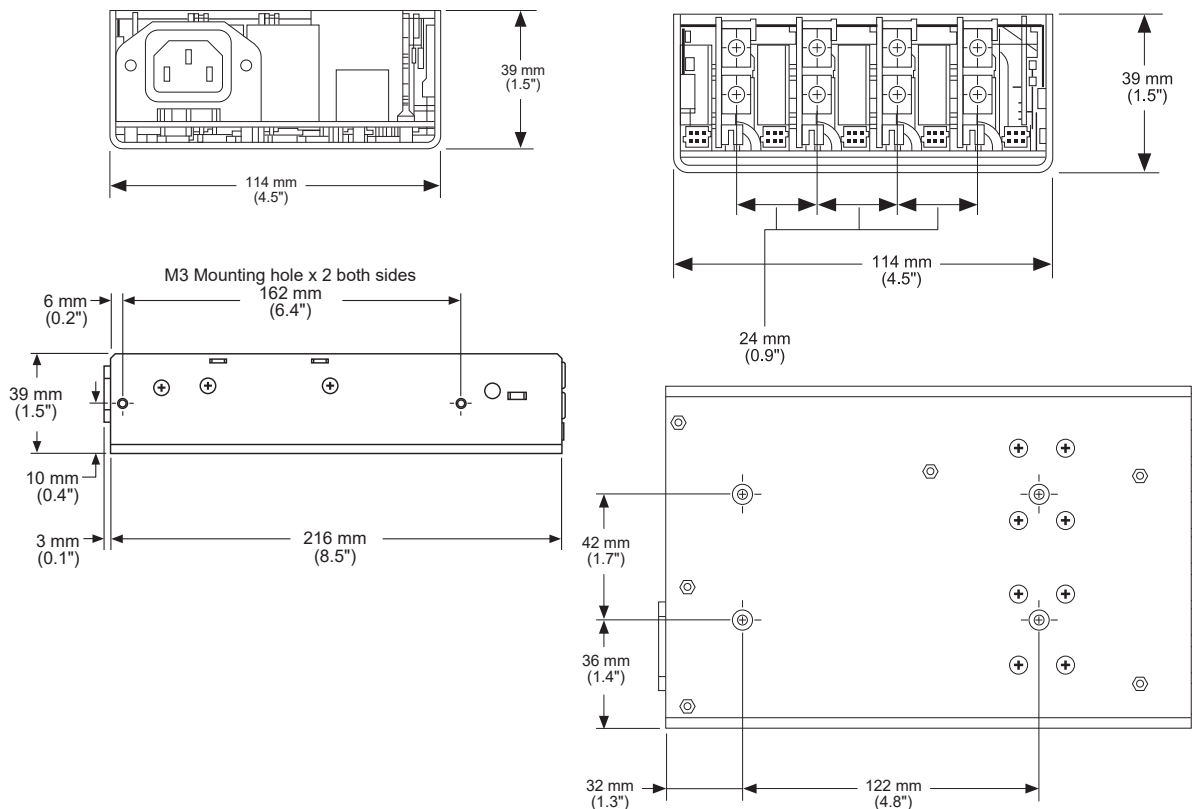
² Low leakage option – Class A

| Standards and Directives | |
|---------------------------|---|
| 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 | UL 60950-1/CSA 22.2 No 60950-1, Edition 2 |
| | 5000 m (16,400 ft) altitude, 100 to 240 VAC ±10% |
| IEC/EN 60601-1, Edition 3 | 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 to 240 VAC ±10% |
| IEC 62368 Edition 2 | IEC 62368-1 (2014) Edition 2 |
| | 5000 m (16,400 ft) altitude, 100 to 240 VAC ±10% |
| 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 compliance |
| REACH | Compliant |

MECHANICAL SPECIFICATIONS

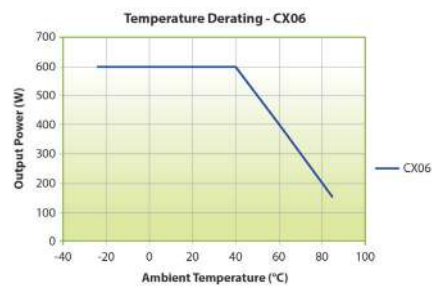
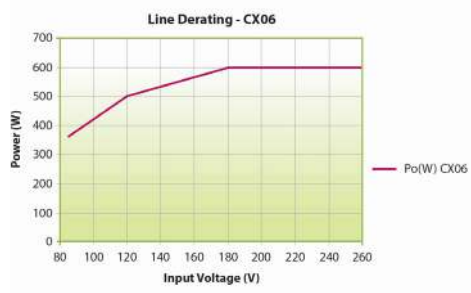
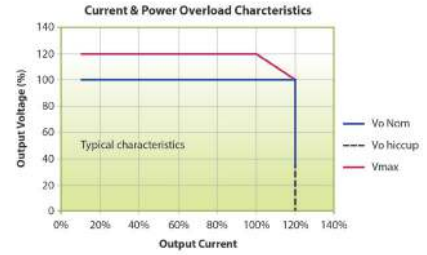
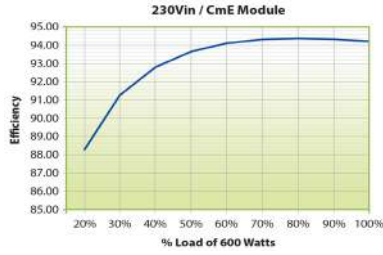
| Mechanica Data | | |
|--|--|--|
| Parameter | Description | Min |
| Dimensions (L x W x H) | | 215.9 mm x 114.3 mm x 39.1 mm (8.5 in x 4.5 in x 1 U) |
| Weight | Nominal Weight: CoolPac + 4 x CoolMods | 1 Kg |
| Connectors | Description | Mating Connectors (if applicable) |
| AC/DC input terminal block | 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 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 |
| 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-P05S |
| Auxiliary Output Connector J1 | Molex 1041880210 2pin | — |

Mechanical Drawings



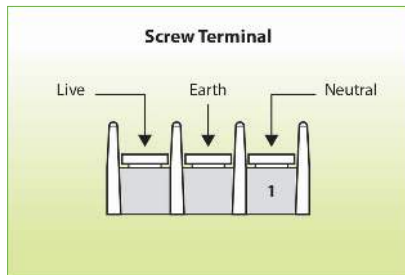
CoolX600 can be mounted on its base, vertically, or on its side. CoolX600 can also be mounted on the DIN Rail Accessory (Z744).

INTERFACE

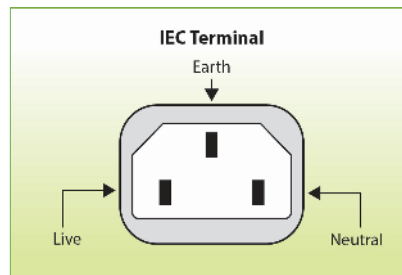


Enhanced thermal performance with system fans and base plate cooling. Contact Advanced Energy for details.

Input Connectors

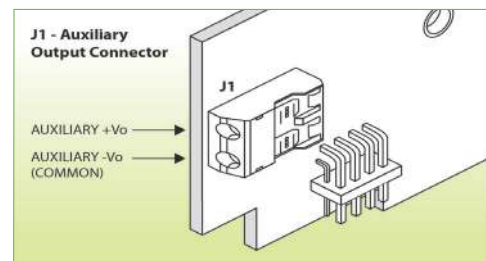
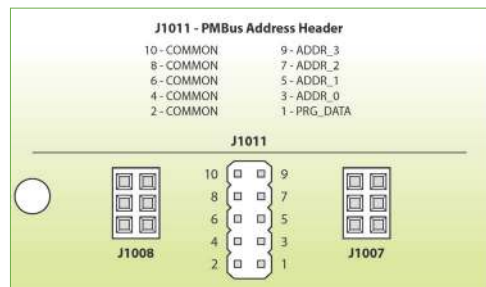
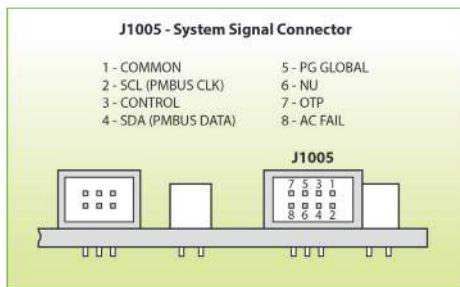


Standard (Screw Terminal)



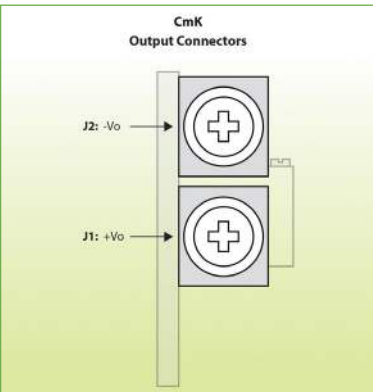
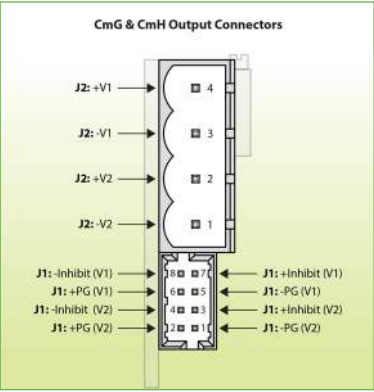
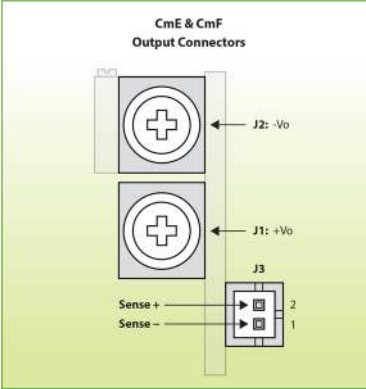
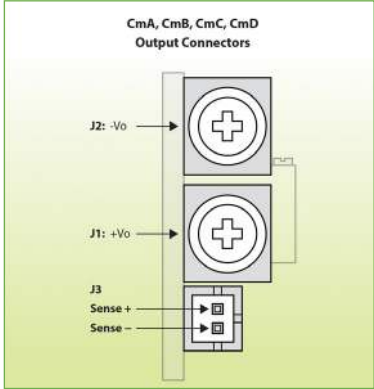
Option 1 (IEC Terminal)

CoolPac Connectors

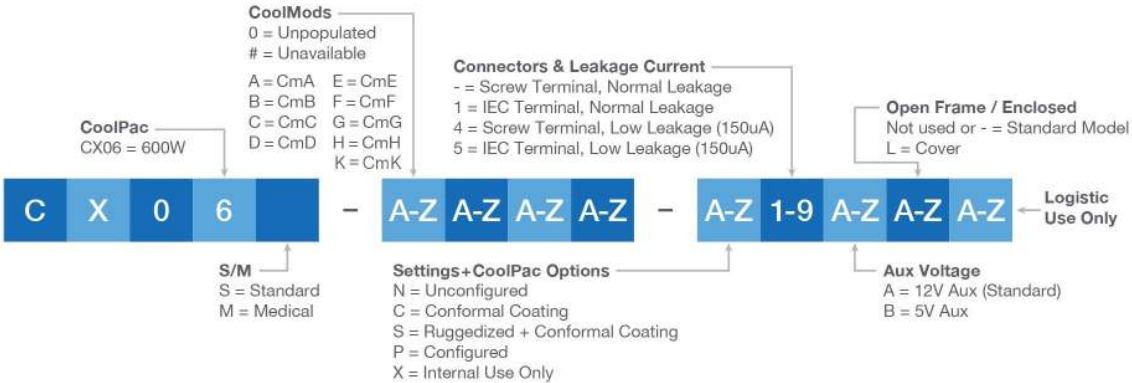


INTERFACE (CONTINUED)

CoolMod Connectors



CONFIGURATION



N = Unconfigured 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.



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ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

AE's power solutions enable customer innovation in complex semiconductor and industrial thin film plasma manufacturing processes, demanding high and low voltage applications, and temperature-critical thermal processes.

With deep applications know-how and responsive service and support across the globe, AE builds collaborative partnerships to meet rapid technological developments, propel growth for its customers and power the future of technology.

PRECISION | POWER | PERFORMANCE | TRUST

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