

# Cool 600

## NFF Series

Patent Pending Resonant Technology



### NFF Series; No Fan Featured

- 100% natural convection cooled
- No internal or external fans needed
- No base-plate needed

### No Acoustic Noise or Vibrations & Breakthrough Level Reliability

- No fans required – 600W with natural convection
- MTBF >400000 hours - 25% better, than today's leading solutions
- High Input Surge Protection
- 4KV Line to PE for harsh environments
- Reverse Energy Protection
- No blocking diodes required
- 24W Always ON Auxiliary Power Output
- Safety Approved to 5000m Altitude
- >94% Efficiency
- 5 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

### Certifications

- Medical
  - IEC60601-1 3rd Edition compliant
  - IEC60601-1-2 4th edition EMC compliant
  - 2 MOPP
  - Dual Fused
  - Suitable for Type B and BF rated applications
  - ISO13485
- Industrial
  - IEC60950, IEC62368-1
  - ISO9000
  - SEMI F47
- Defence/Aero
  - MIL810G certified
  - MIL461G, CE101, CE102

### 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, Ground Based), Communications Test & Measurement

The World's First Fanless modular power supply, the CoolX600 NFF Series is the revolutionary new Convection-Cooled modular power supply from Excelsys. It provides an incredible 600W in a compact 4.5 x 8.5 x 1U package with no fan.

The silent CoolX600 generates no acoustic noise and offers system designers best in class performance in efficiency (>94%) and unrivalled reliability in addition to the most comprehensive feature set and specifications.

The series comprises two base models. The CX06S is certified to IEC60950 2nd edition for industrial applications as well as the upcoming IEC62368-1 standard. The CX06M carries IEC60601-1 3rd edition & IEC60601-1-2 4th edition (EMC) for medical applications. The CoolX600 can be populated with up to 4 CoolMods, providing up to 8 isolated DC outputs ranging from 2.5V to 58.0V. Continuing the Excelsys tradition of flexibility, the CoolX600 is completely user and field configurable. Outputs can be adjusted to the required set point voltages and can be configured in parallel or series for higher current and/or higher voltages. CoolPacs can be paralleled for higher power and N+1 Redundancy applications. There are a range of CoolMods available including medium and high power single outputs and dual modules.

### CoolX CoolPac

CoolPac	Slots	Power	Medical Approval IEC60601-1 3rd edition & IEC60601-1-2 4th edition (EMC)	Industrial Approval IEC60950 2nd edition	IEC62368-1 Edition 2
CX06S	4	600W	-	Yes	Yes
CX06M	4	600W	Yes	-	-

### CoolX CoolMod

CoolModel	Vnom (V)	Set Point Adjust Range (V)	I <sub>max</sub> (A)	Power (W)	
<b>Single Output Modules (1 Slot)</b>					
CmA	5	2.5-6.0	21.0	105	
CmB	12	6.0-15.0	15.0	180	
CmC	24	15.0-28.0	8.33	200	
CmD	48	28.0-58.0	4.17	200	
<b>High Power Modules (3 Slot)</b>					
CmE	24	22.8-25.2	25.0	600	
CmF	48	45.6-50.4	12.5	600	
<b>Dual Output Modules (1 Slot)</b>					
CmG <sup>1)</sup>	v1	24	3.0-30.0	3.0	90
	v2	24	3.0-30.0	3.0	90
CmH <sup>2)</sup>	v1	5	3.0-6.0	6.0	36
	v2	24	3.0-30.0	3.0	90
<b>Wide Trim Modules (1 Slot)</b>					
CmM	5	1.0-6.0	21.0	105	
CmN	12	1.0-15.0	15.0	180	
CmP	24	1.0-28.0	8.33	200	
CmQ	48	3.0-58.0	4.17	200	

1) For the CmG module the max combined power of both outputs is 120W.  
2) For the CmH module the max combined power of both outputs is 100W.



# CoolX600 NFF Series

## INPUT

Parameter	Conditions/Description	Min	Nom	Max	Units
AC Operating Input Range		85		264	VAC
Nominal Input Voltage Range	Universal Input 47-440Hz	100		240	VAC
Extended AC Operating Range	Maximum for 5 seconds			300	VAC
DC Input voltage range		120		300	VDC
Input Current	90VAC @ 420W		6.0		A
Inrush Current	230VAC @ 600W			25	A
Power Factor	120VAC@ 500W	0.98			
Undervoltage Lockout	Shutdown	65		74	VAC
Input Fuses Rating	Dual Fused (Line and Neutral) 250VAC		8		A
Efficiency	230VAC, 600W with 3 x CmC CoolMods 230VAC, 600W with 1 x CmE CoolMod		93 94		% %

## COOLMOD OUTPUT

Parameter	Conditions/Description	Min	Nom	Max	Unit
Power Rating	CX06: See derating curves			600	W
Minimum Load			0		A
Line Regulation	For $\pm 10\%$ change from nominal line CmE, CmG, CmH			$\pm 0.1$ $\pm 0.5$	%
Load & Cross Regulation	For 25% to 75% load change			$\pm 0.2$	%
Transient Response	For 25% to 75% load change 0.5A/uS: Voltage Deviation *CmE & CmF, CmG, CmH Figures in () Settling Time			4 (4) 500 (1000)	% $\mu$ S
Ripple and Noise	100mV or 1.0% pk-pk. 20MHz BW CmF			1 1.5	% %
Overvoltage Protection	Tracking OVP Level (N/A in CmE & CmF, CmG, CmH) Latching OVP Level	105 110		125 160	% %
Remote Sense	Max. line drop compensation		N/A in CmG & CmH	0.5	VDC
Overshoot				1	%
Rise Time	Monotonic CmG, CmH Figures in ()			10 (20)	ms
Turn-on Delay	From AC in *CmE & CmF, CmG, CmH Figures in () From Global Enable From CoolMod Enable			800 10 (20) 10 (20)	ms ms 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 & CmF, CmG, CmH: Current limit hiccup autorecovery CmM, CmN, CmP & CmQ: Straight line with hiccup activation at 70% of Vo min	110	130	150	%
Short Circuit Protection	Yes, Autorecovery				
OverTemperature Protection	Yes, Autorecovery (CmG, CmH latch off)				
Capacitive Load	Nominal output voltages at full load CmG, CmH			10 270	mF $\mu$ F

## AUXILIARY OUTPUT

Parameter	Conditions/Description	Min	Nom	Max	Units
Nominal Output Voltage	Aux Voltage Option A Aux Voltage Option B	11.76 4.75	12 5	12.24 5.25	V V
Load Regulation				$\pm 2$	%
Line Regulation	For $\pm 10\%$ change from nominal line			$\pm 0.5$	%
Maximum Output Current	Aux Voltage Option A Aux Voltage Option B			1.96 4.7	A A
Maximum Output Capacitive Load				1000	$\mu$ F
Output Overcurrent Protection	Hiccup	110		140	%
Short Circuit Protection	Yes, Autorecovery				

## GALVANIC ISOLATION

Parameter	Conditions/Description	Min	Nom	Max	Units
Input to Output	Reinforced (2 x MOPP)	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

# CoolX600 NFF Series

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

ENVIRONMENTAL					
Parameter	Conditions/Description	Min	Nom	Max	Units
Operating Temperature	Operates to specification below -20°C after 10 min warm-up	-40		+85	°C
Storage Temperature		-40		+85	°C
Derating	See Derating Curves including note 2				
Relative Humidity	Non-condensing	5		95	%RH
Shock & Vibration	MIL-STD810G Method 514.6				
Altitude				5000	m

LEAKAGE CURRENTS					
Parameter	Conditions/Description				Units
<b>AC Leakage Current</b>	<b>Input to earth ground</b>				
Normal condition (high line)	Mains Voltage 264VAC/60Hz	248			µA
Single fault condition (high line)	Mains Voltage 264VAC/60Hz	393			µA
<b>Touch Current</b>					
Normal Condition	Mains Voltage 264VAC/60Hz	4.7			µA
Single Fault Condition	Mains Voltage 264VAC/60Hz	247			µA

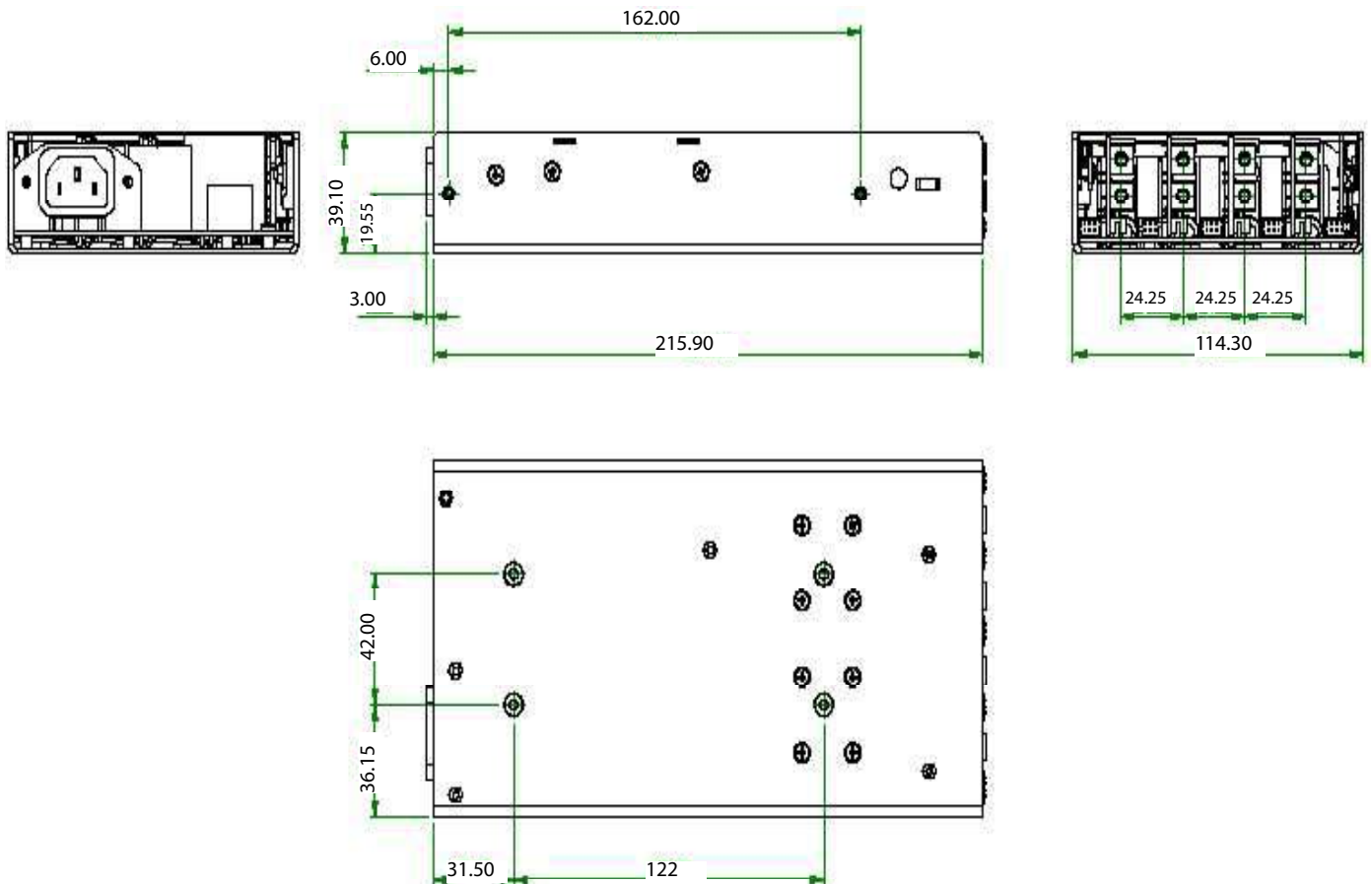
EMC		
Parameter	Conditions/Description	Criteria
Radiated Emissions	EN 55011, EN 55022 and FCC, Class B	Complied
Conducted emissions	EN 55011, EN 55022 and FCC, Class B	Complied
Power line harmonics	EN 61000-3-2, Class A	Complied
Voltage flicker	EN 61000-3-3	Complied
ESD	EN 61000-4-2, level 4, 8 kV contact, 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, 10Vemf 150KHz-80MHz	A
Power frequency magnetic field	EN 61000-4-8, level 4, 30A/m	A

STANDARDS & DIRECTIVES <sup>1)</sup>	
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

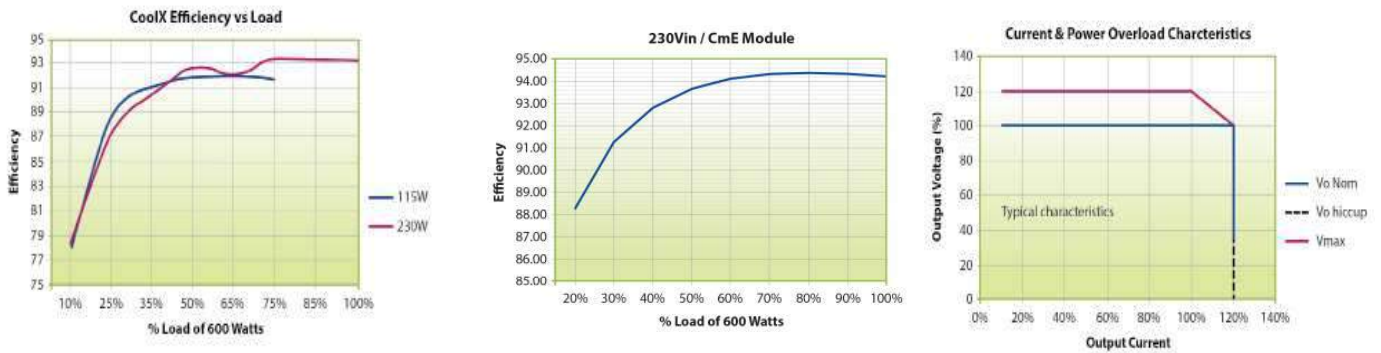
MECHANICAL DATA		
Parameter	Description	
Dimensions (L x W x H)	L x W x H	215.9mm x 114.3mm x 39.1mm 4.5" x 8.5" x 1U
Weight	Nominal Weight: CoolPac + 4 x CoolMods	1 Kg
Connectors	Description	Mating Connectors (if applicable)
AC/DC input terminal block	TE 2-1437667-S, DINKLE DT-35-B07W-03	
AC/DC IEC 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 & 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 & Polarization Keying
Output Sense Connectors J3	JST-S2BPH-K(LF)(SN)	JST PHR2. Crimp Terminal JST BPH-002T-P.0.5S or SPH-002T-P.05S
Auxiliary Output Connector J1	Molex 1041880210 2pin	

## CoolX Mechanical Drawings

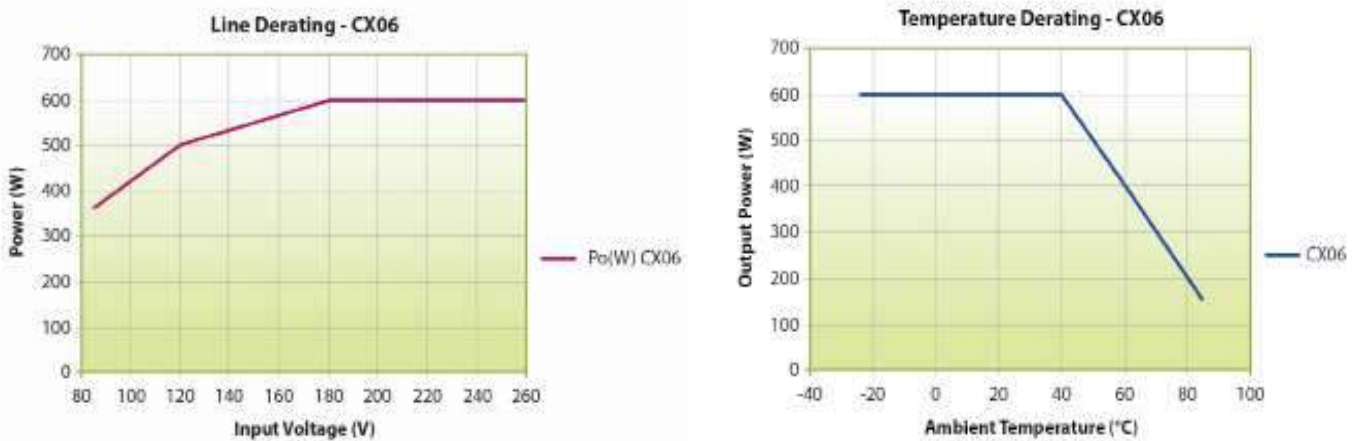


CoolX can be mounted on its base, vertically or on its side. CoolX can also be mounted on the Excelsys DIN Rail accessory (Z744).

## CoolX 600 Efficiency, Derating and Power Limit Curves

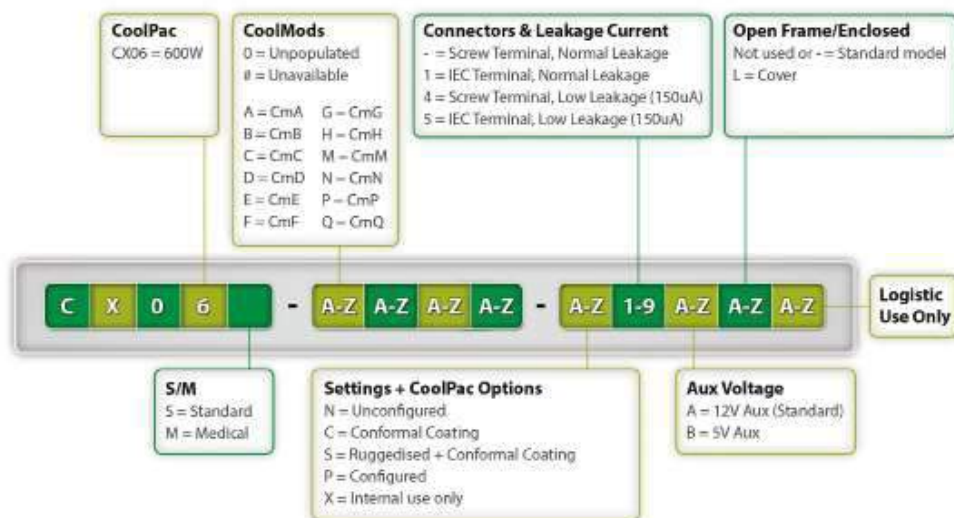


## CoolX Derating



2) Enhanced thermal performance with system fans & base plate cooling. Consult Excelsys for details.

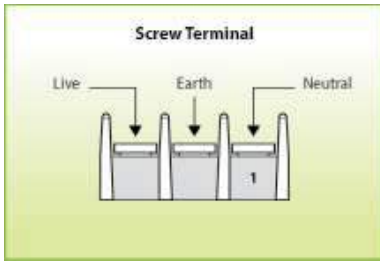
## Configuring Your CoolX



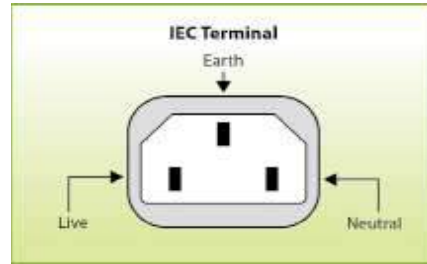


## CoolX Connectors

### Input Connectors

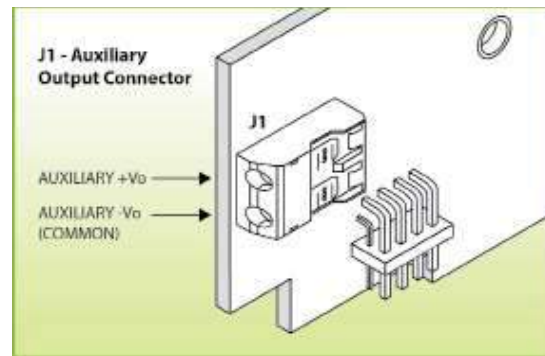
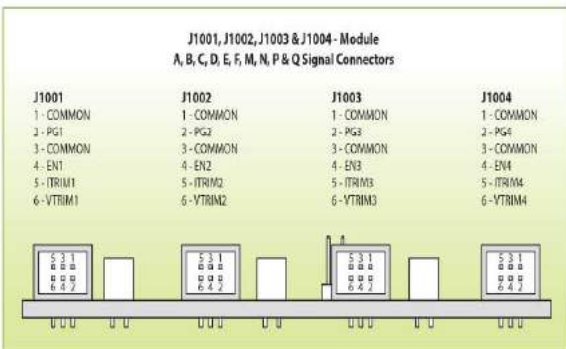
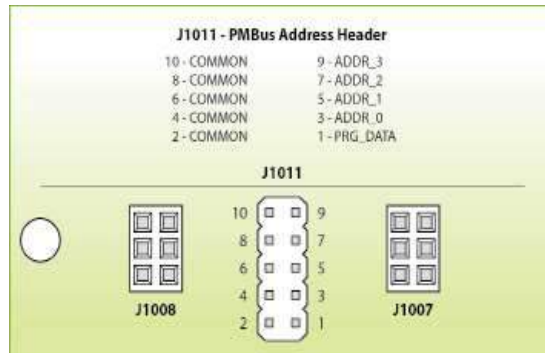
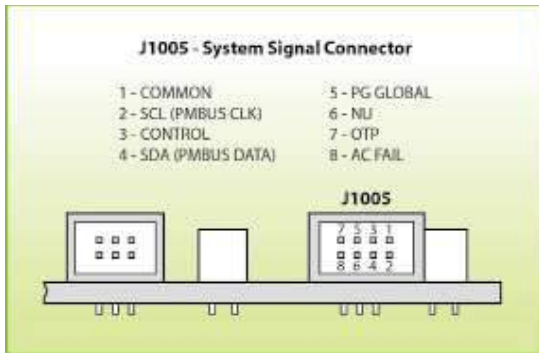


Standard (Screw Terminal)



Option 1 (IEC Terminal)

### CoolPac Connectors



### CoolMod Connectors

