



## AC/DC Modular Designer Manual

*The Modular Power Solution of Choice  
for Mission Critical Applications*

- *High Efficiency*
- *High Reliability*
- *High Power Density*

# Section 3 Connectors, Derating, Mechanical Drawings and Configuration

## Section 3.1

### Connectors for Xgen Series

#### Output Connectors

The output *powerMods* connection details are shown below. Type A connectors are for single output *powerMods* XgA-XgT and Xg1-Xg7. The Type B connector is for the dual output XgF/Xg8 *powerMod*. The power and signal connectors are as follows:

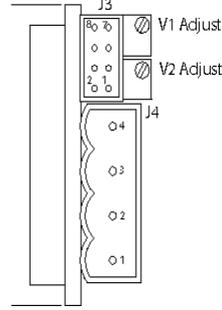
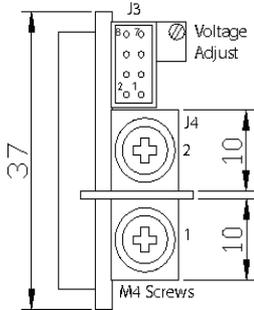
**Type A: *powerMods***  
XgA to XgE  
XgG to XgT  
Xg1 to Xg7

**Type B: *powerMod***  
XgF/Xg8

#### Output Signals and Power Connector Pinout

| Pin    | J3           | J3              | J3              | J3       | J3           | J4       | J4       |
|--------|--------------|-----------------|-----------------|----------|--------------|----------|----------|
| Module | (XgA to XgD) | (XgG-XgQ)       | (XgR-XgT)       | (XgE)    | (XgF)        | (Type A) | (Type B) |
|        |              | (Xg1-Xg5)       |                 |          | (Xg7)        | (Xg8)    |          |
| 1      | not used     | +Sense*         | not used        | not used | -pg (V2)     | -Vout    | -V2      |
| 2      | Common       | -Sense*         | -Vtrim          | not used | +pg (V2)     | +Vout    | +V2      |
| 3      | not used     | Vtrim           | +Vtrim          | not used | Inhibit (V2) |          | -V1      |
| 4      | not used     | Itrim           | Itrim           | Common   | Common (V2)  |          | +V1      |
| 5      | +Inhibit     | +Inhibit/Enable | +Inhibit/Enable | -pg      | -pg (V1)     |          |          |
| 6      | -Inhibit     | -Inhibit/Enable | -Inhibit/Enable | +pg      | +pg (V1)     |          |          |
| 7      | not used     | +pg             | +pg             | Inhibit  | Inhibit (V1) |          |          |
| 8      | not used     | -pg             | -pg             | Common   | Common (V1)  |          |          |

\*remote sense not present on XgR and XgT *powerMods*.



#### Output Mating Connectors

J3: Locking Molex 51110-0860; Non Locking Molex 51110-0850; Crimp Terminal: Molex p/n 50394: Or Molex 51110-0856, includes Locking Tab & Polarization Keying

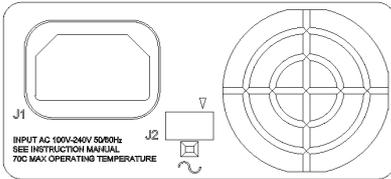
J4 (Type A): M4 Screw (8mm)

J4 (Type B) Connector(s): Camden CTB9200/4A or Würth Elektronik 691 352 710 004

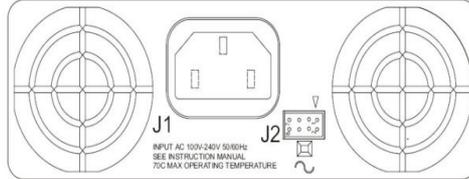
#### Input Connectors

Excelsys modular power supplies have a variety of input connector options to ease system integration. These include IEC, Input cables (3-wire) and IEC to Screw Terminal Adaptor.

#### J1 & J2 Connectors (4-slot)



#### J1 & J2 Connectors (6-slot)



| Pin | J1      | J2             |
|-----|---------|----------------|
| 1   | Line    | Common         |
| 2   | Neutral | +5V Bias       |
| 3   | Earth   | not used       |
| 4   |         | AC Fail        |
| 5   |         | Fan Fail       |
| 6   |         | Global Enable  |
| 7   |         | Temp Alarm     |
| 8   |         | Global Inhibit |

#### Input Mating Connectors

J1: IEC320 type female plug rated 13, Locking IEC cable and connector: Schaffner EMC part number IL13-US1-SVT-3100-183.

J2: Locking Molex 51110-0860; Non Locking 51110-0850; Crimp Terminal: Molex p/n 50394: Or Molex 51110-0856, includes Locking Tab & Polarization Keying

#### Input Cable (Option D)

Excelsys modular power supplies are also available with an input cable connection option allowing greater flexibility when mounting the power supply in the system. Individually insulated input cables are 300mm in length and come supplied with Faston connectors.

#### IEC to Screw Terminal Adaptor

Some applications may require a screw terminal input rather than the standard IEC320 connector provided with Excelsys modular power supplies. For such applications, Excelsys can offer the XE1, the IEC to Screw terminal adaptor accessory plug. This is a press fit connector that plugs securely into the *powerPac* and provides the system integrator with screw terminals for mains connection (not available on XCE, XVE, XMD, XLD, XF). Recommended IEC to Faston/Terminal Lugs Schurter P/N 4788.8000

#### Modular Power Supply Mounting Options

##### 1. Base Plate Mounting

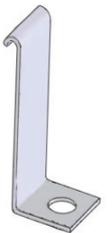
The unit can be mounted in the system via the mounting holes present on the UltiMod and Xgen base. See mechanical drawings for mounting hole positions. Use M4 mounting screws. Ensure that maximum screw penetration from base does not exceed 6mm.

##### 2. Fleximount System A

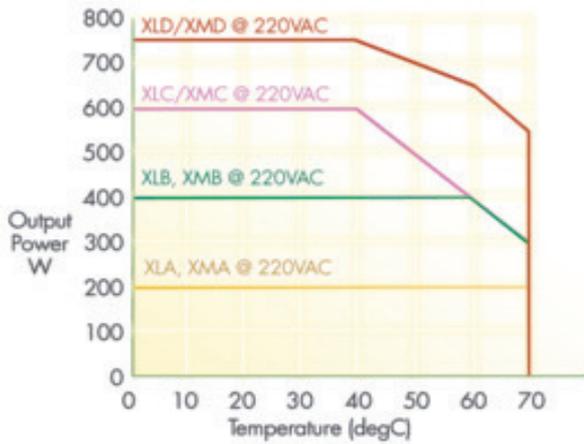
Using the side mounting clips accessory shown, the clip can be positioned at the user defined position along the slide rail on the side of the UltiMod/Xgen. The clip is then mounted to the system base plate. Use M4 mounting screws to fix mounting clip to system base. Excelsys part number Z165.

##### 3. Fleximount System B

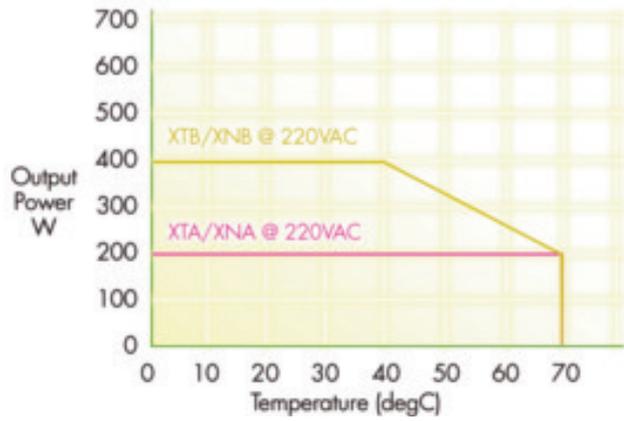
Using the slide rail on side of the UltiMod/Xgen, self clenching studs can be placed at a user defined position. Recommend: PEM FH-M4-X or FH-832-X or equivalent.



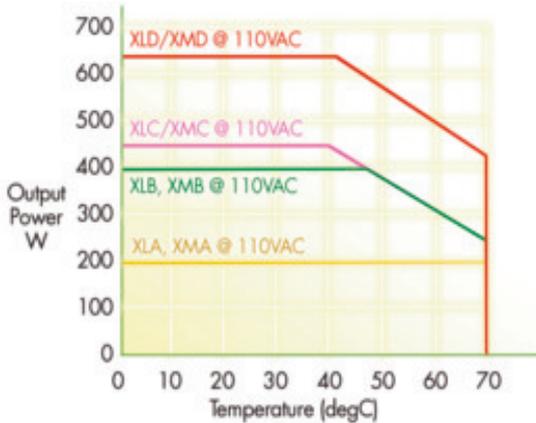
## Section 3.2 Deratings Curves for Xgen Series



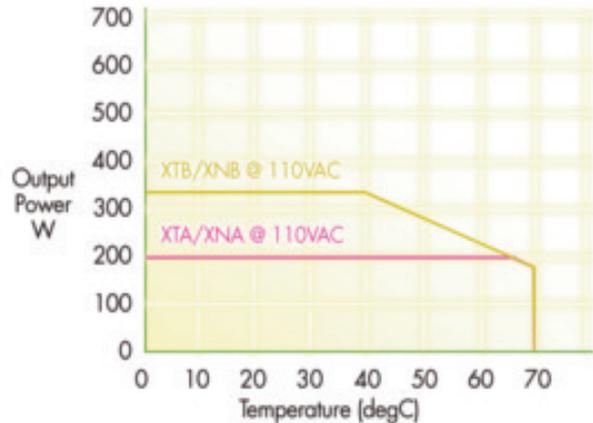
*XLA/XLB/XLC/XLD and XMA/XMB/XMC/XMD @ 220VAC Derating*



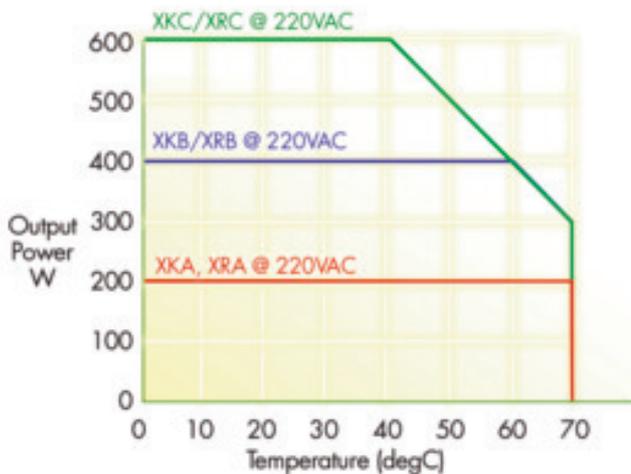
*XTA/XTB and XNA/XNB @ 220VAC Derating*



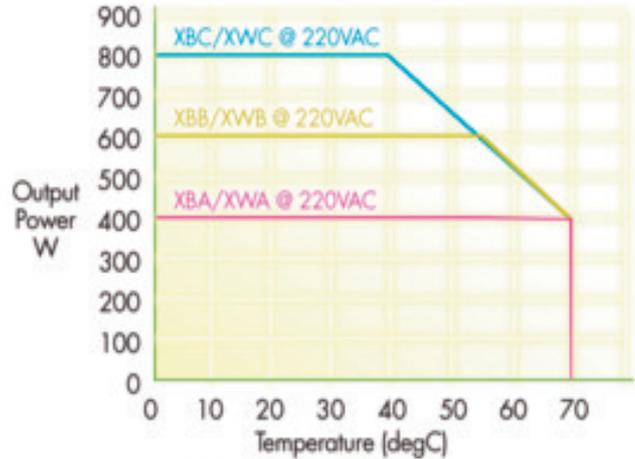
*XLA/XLB/XLC/XLD and XMA/XMB/XMC/XMD @ 110VAC Derating*



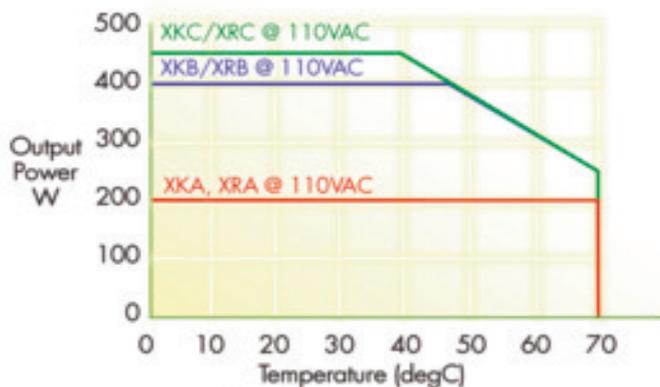
*XTA/XTB and XNA/XNB @ 110VAC Derating*



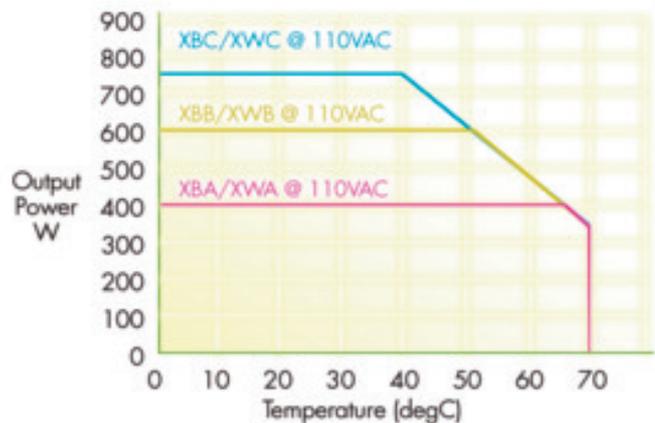
*XKA/XKB/XKC and XRA/XRB/XRC @ 220VAC Derating*



*XBA/XBB/XBC and XWA/XWB/XWC @ 220VAC Derating*

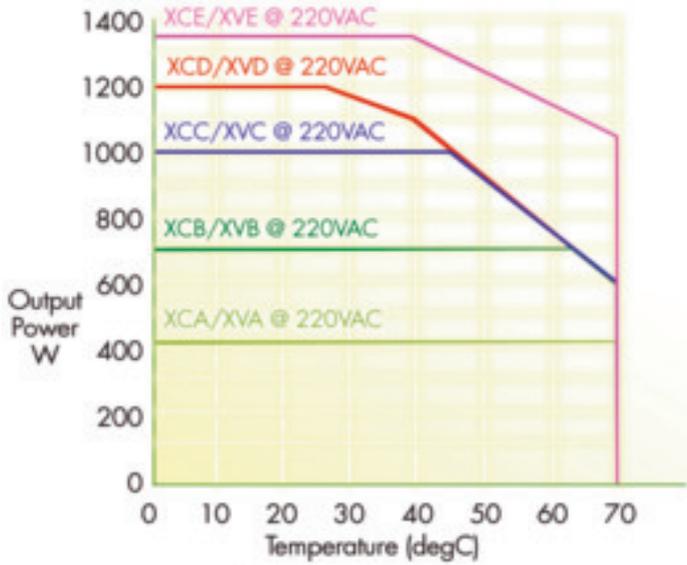


*XKA/XKB/XKC and XRA/XRB/XRC @ 110VAC Derating*

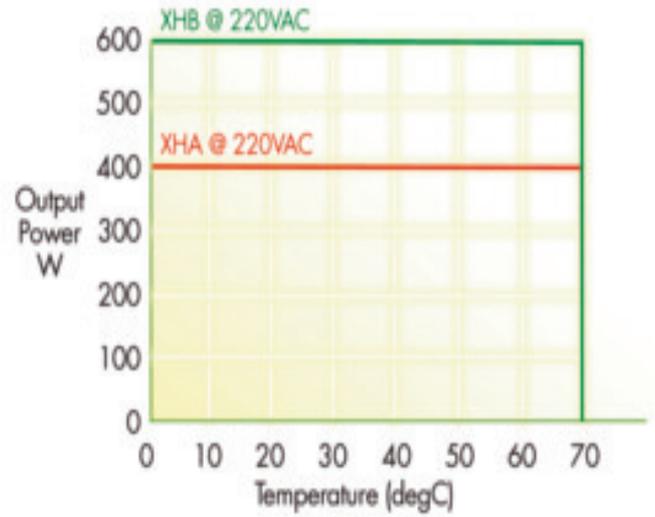


*XBA/XBB/XBC and XWA/XWB/XWC @ 110VAC Derating*

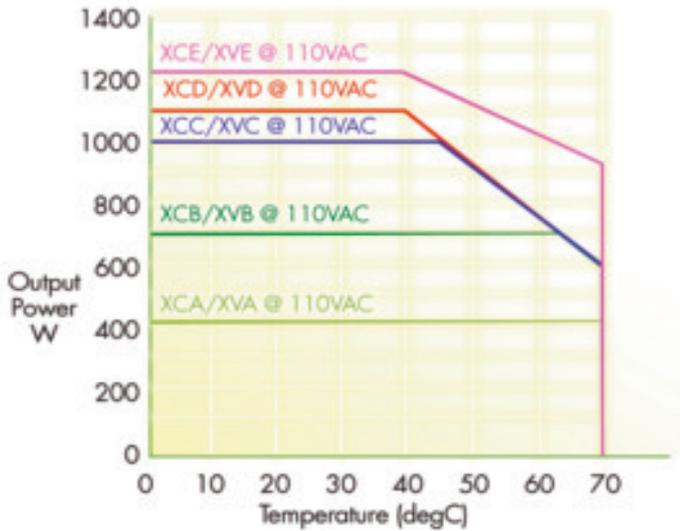
## Deratings Curves for Xgen Series



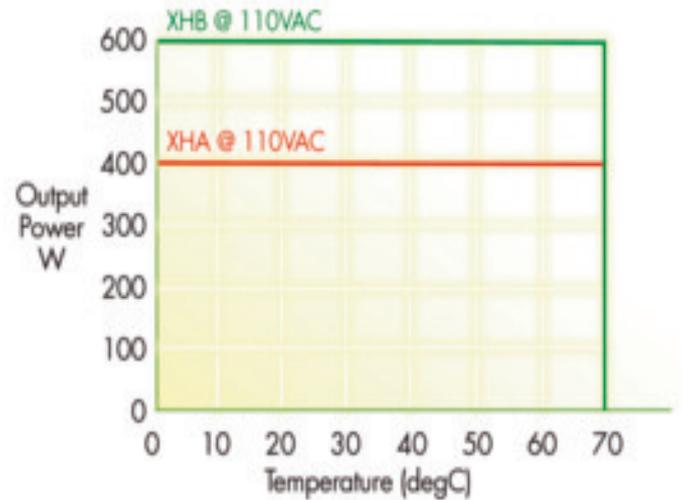
XCA/XCB/XCC/XCD/XCE and XVA/XVB/XVC/XVD/XVE Derating @ 220VAC Derating



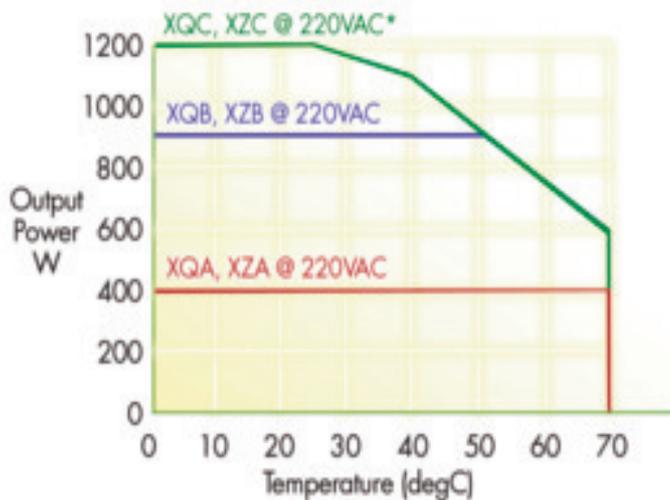
XHA/XHB @ 220VAC Derating



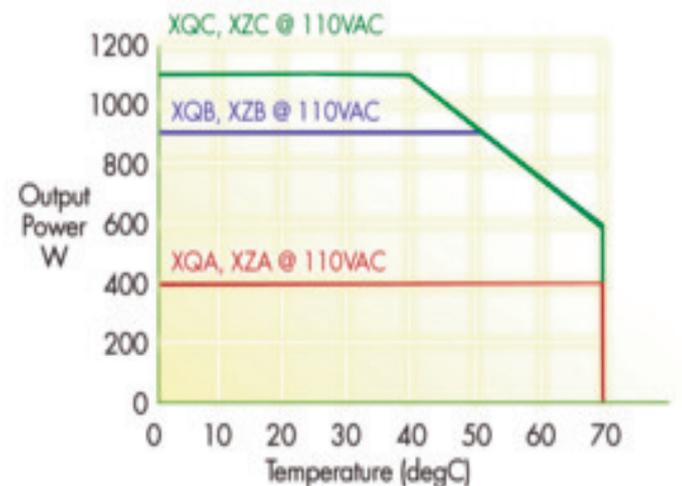
XCA/XCB/XCC/XCD/XCE and XVA/XVB/XVC/XVD/XVE Derating @ 110VAC Derating



XHA/XHB @ 110VAC Derating



XQA/XQB/XQC and XZA/XZB/XZC @ 220VAC Derating



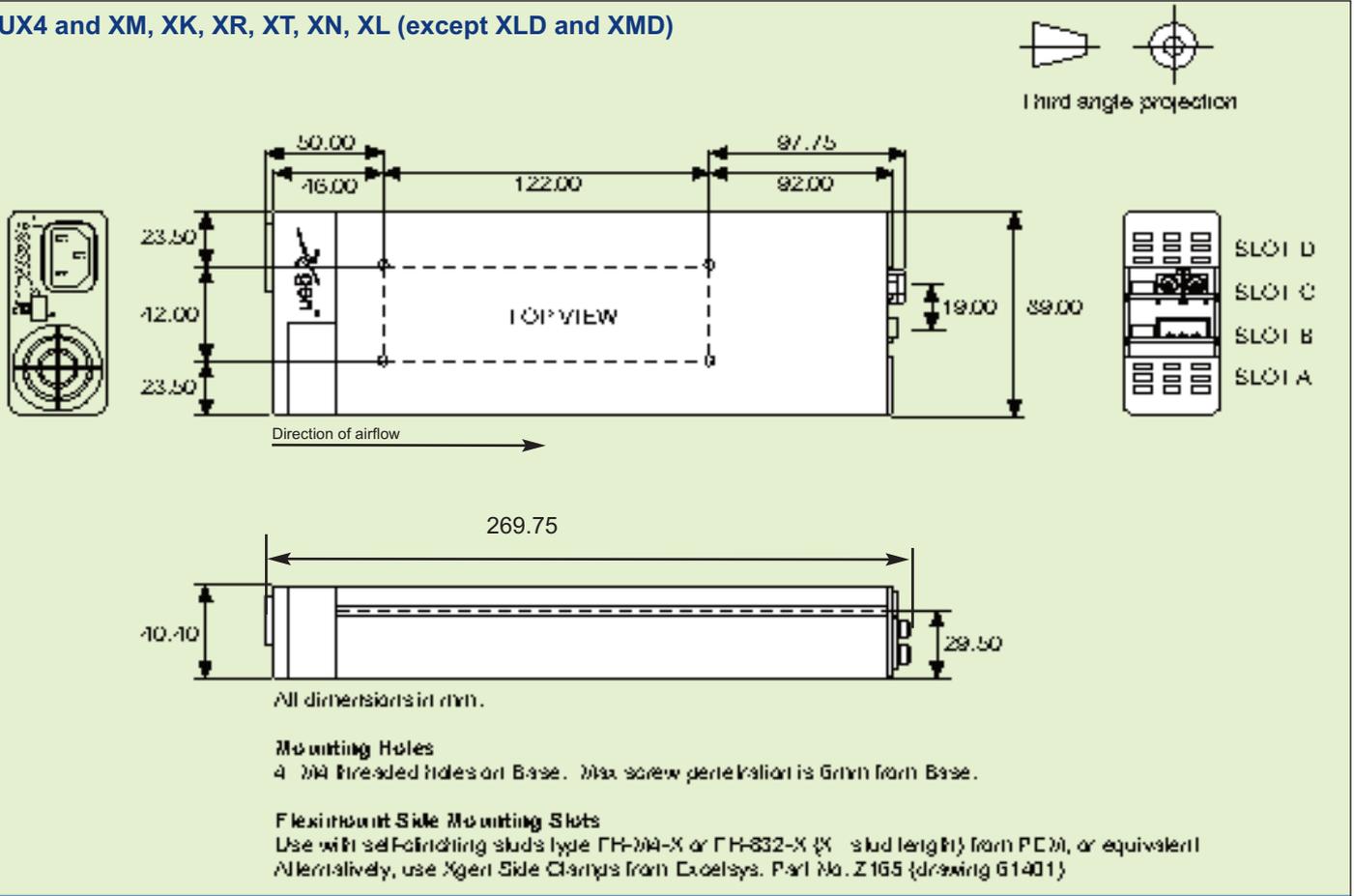
XQA/XQB/XQC and XZA/XZB/XZC @ 110VAC Derating

## Section 3.3

### Modular Power Supplies Mechanical Drawings

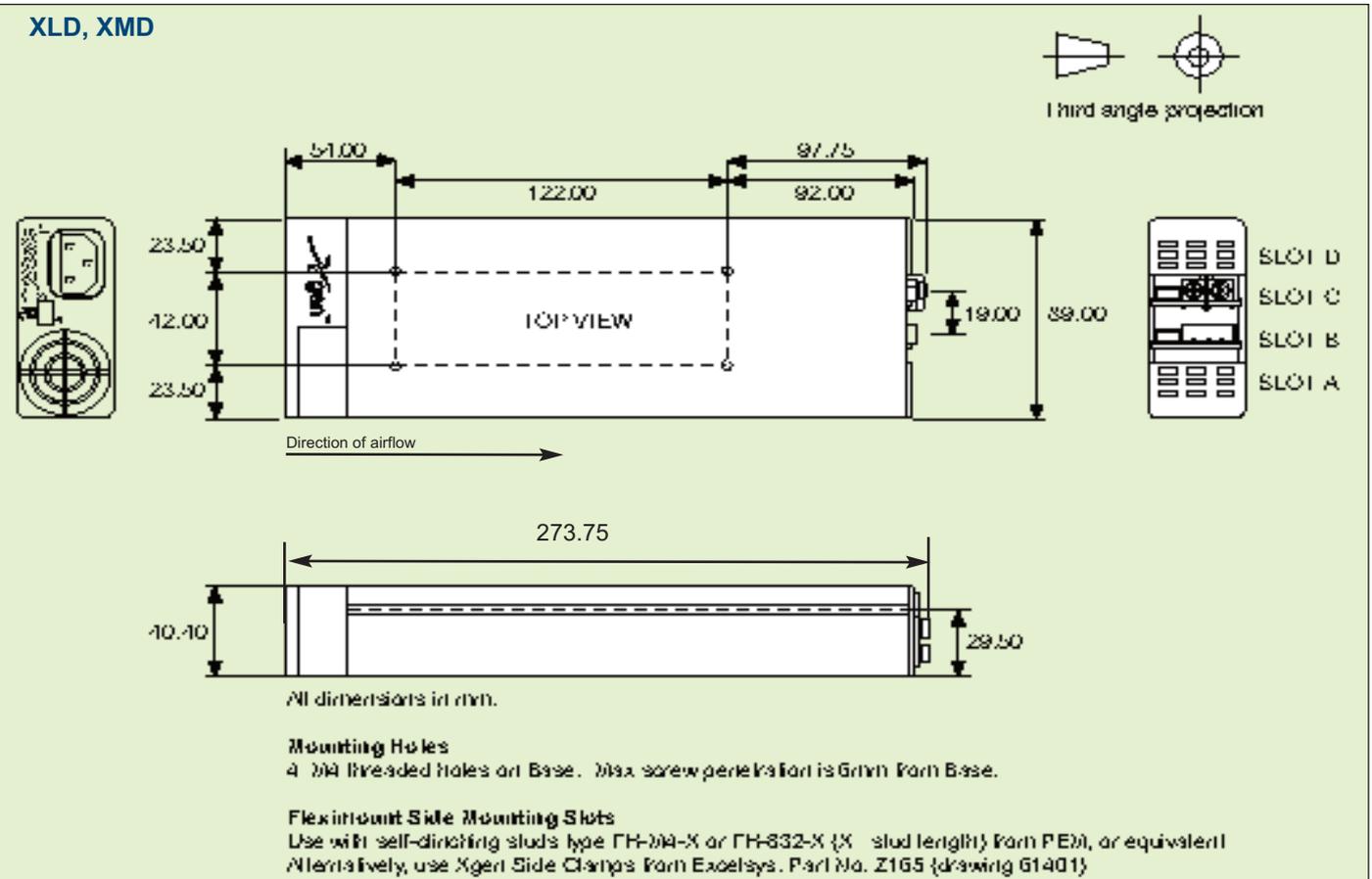
All 3D/CAD Drawings available at <http://www.excelsys.com/technical-support/3d-files-and-cad-drawings/>

#### UX4 and XM, XK, XR, XT, XN, XL (except XLD and XMD)



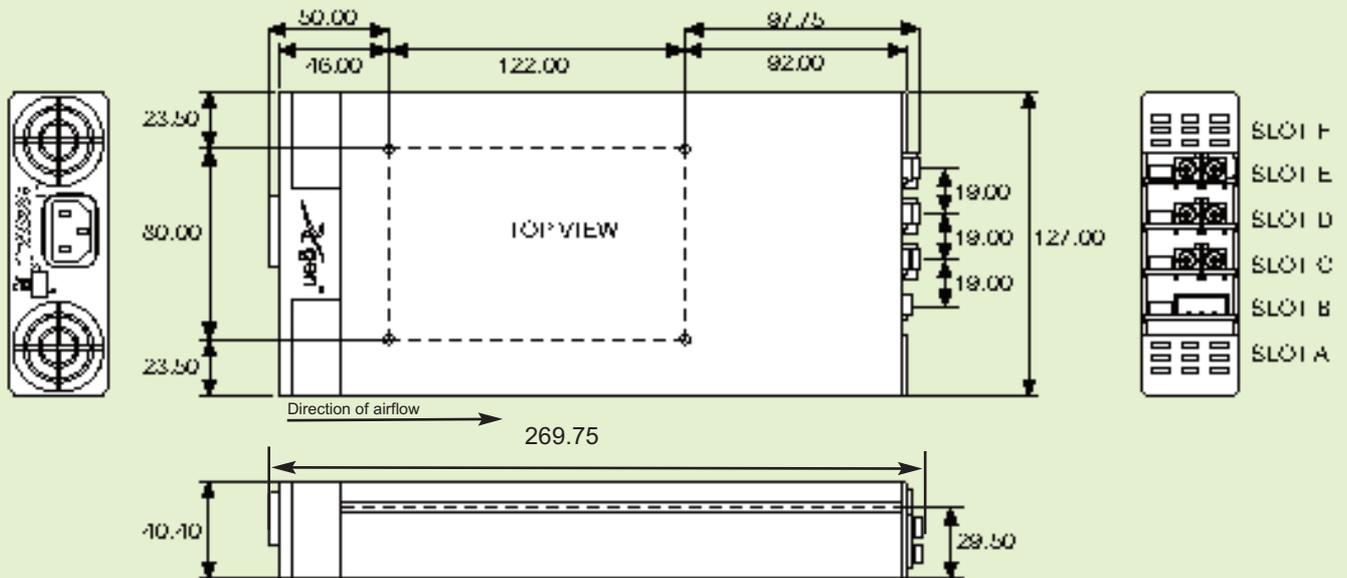
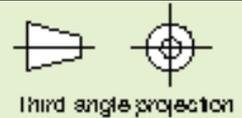
TOLERANCES unless otherwise stated, according to DIN 2768-1/-2 CLASS M ALL DIMENSIONS in mm. See <http://www.excelsys.com/technical-support/> for DIN table.

#### XLD, XMD



TOLERANCES unless otherwise stated, according to DIN 2768-1/-2 CLASS M ALL DIMENSIONS in mm. See <http://www.excelsys.com/technical-support/> for DIN table.

**UX6 and XC, XV, XQ, XZ, XB, XW, XH (except XCE and XVE)**



All dimensions in mm.

**Mounting Holes**

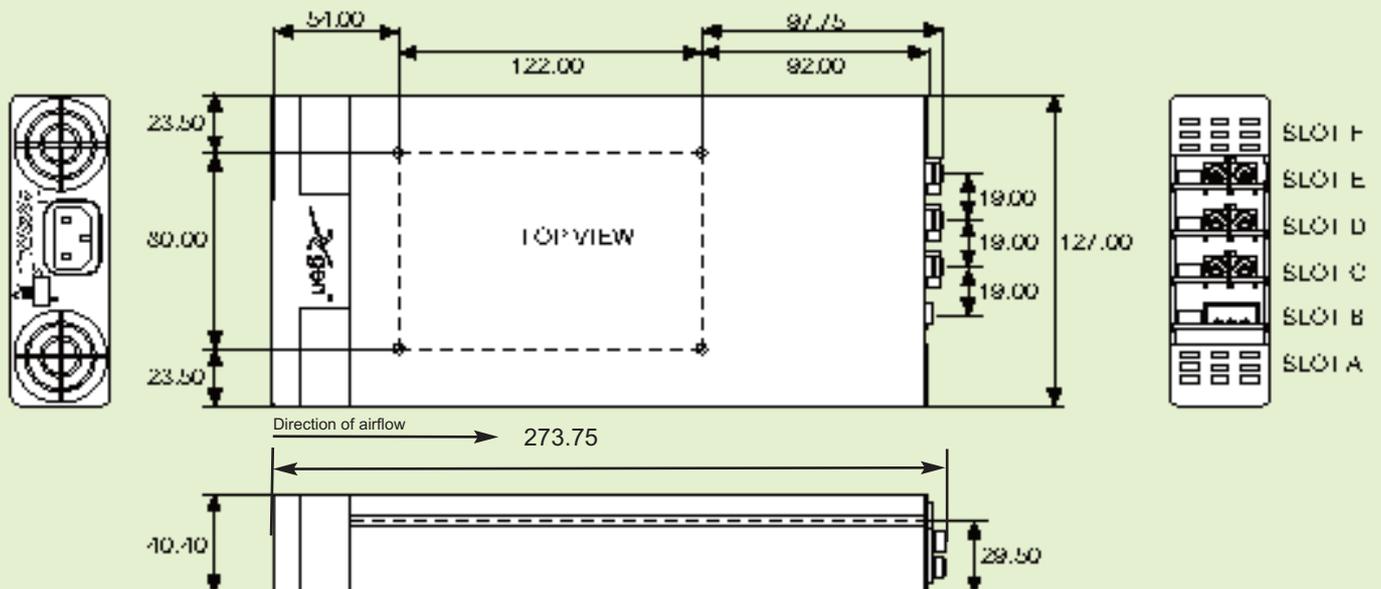
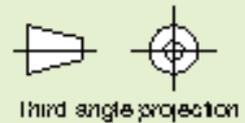
4 M4 Threaded Holes on Base. Max screw penetration is 6mm from Base.

**Fleximount Side Mounting Slots**

Use with self-clinching studs type FH-MA-X or FH-832-X (X = stud length) from PEM, or equivalent. Alternatively, use Xger Side Clamps from Excelsys. Part No. Z165 (drawing 61401)

TOLERANCES unless otherwise stated, according to DIN 2768-1/-2 CLASS M ALL DIMENSIONS in mm. See <http://www.excelsys.com/technical-support/> for DIN table.

**XCE, XVE & XF**



All dimensions in mm.

**Mounting Holes**

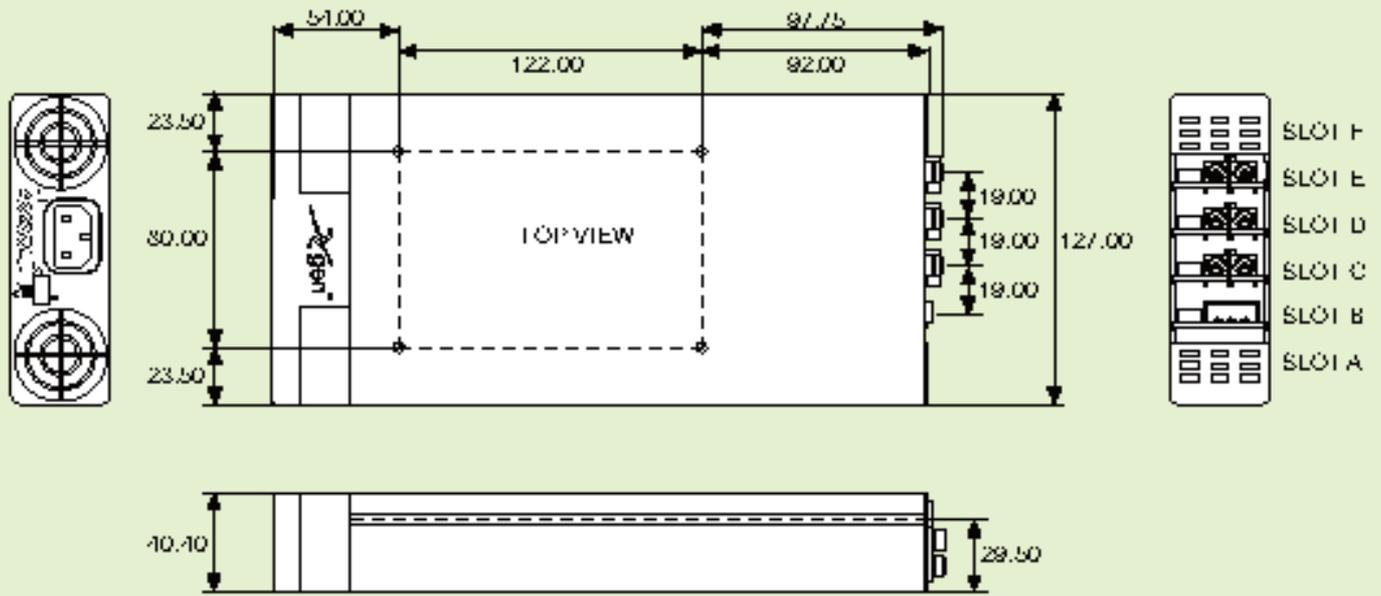
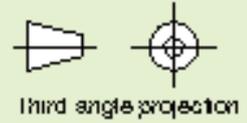
4 M4 Threaded Holes on Base. Max screw penetration is 6mm from Base.

**Fleximount Side Mounting Slots**

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TOLERANCES unless otherwise stated, according to DIN 2768-1/-2 CLASS M ALL DIMENSIONS in mm. See <http://www.excelsys.com/technical-support/> for DIN table.

**XCE, XVE**



All dimensions in mm.

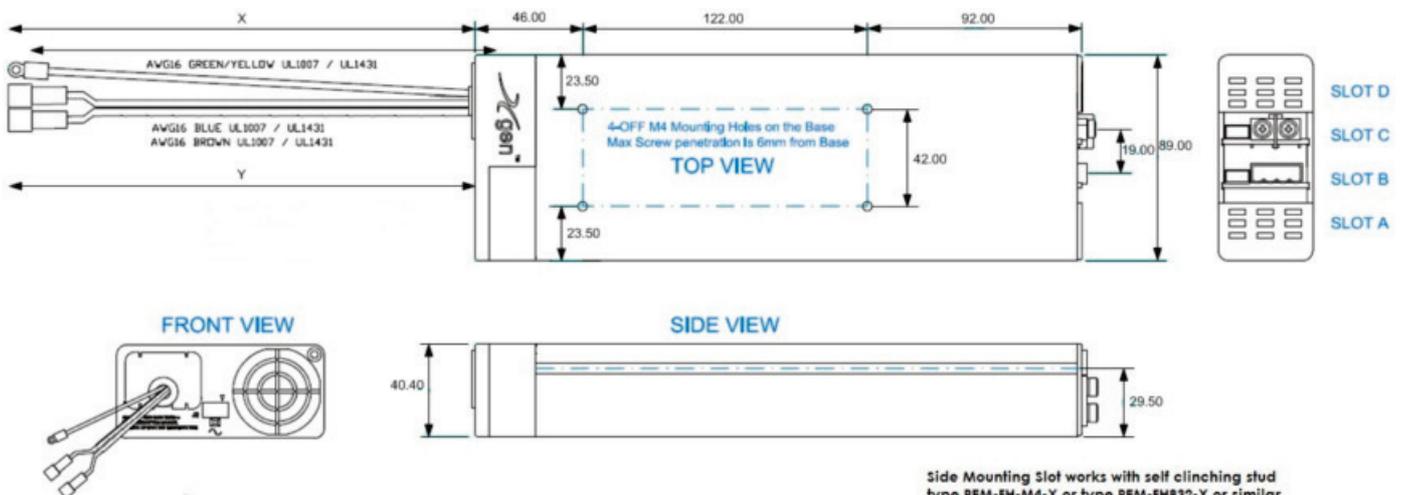
**Mounting Holes**

4 M4 threaded holes on Base. Max screw penetration is 6mm from Base.

**Fleximount Side Mounting Slots**

Use with self-clinching studs type PEM-FH-M4-X or PEM-FH32-X (X = stud length) from PEM, or equivalent. Alternatively, use Xger Side Clamps from Excelsys, Part No. Z165 (drawing 61401)

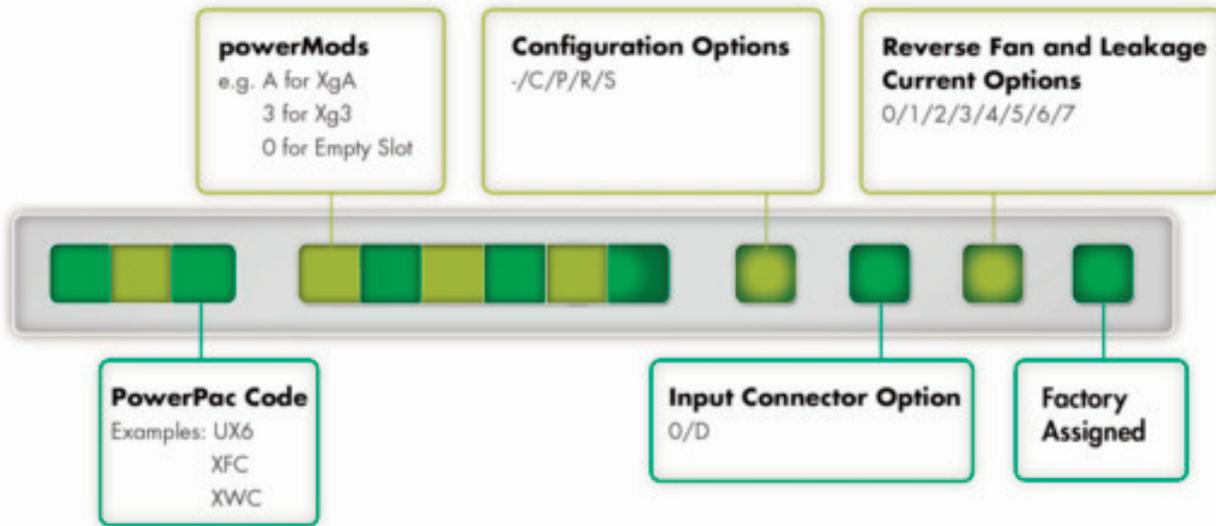
**4 slot Input Cable Version (Option D)**



Side Mounting Slot works with self clinching stud type PEM-FH-M4-X or type PEM-FH32-X or similar. X represents the length of the stud. Alternatively, the Side Mounting Slots may be used with Excelsys Side Clamps

Standard cable length 300 mm. Please contact factory for alternative lengths.





## Section 3.4 Configuring your Modular Power Supply

The Xgen and UltiMod series of user configurable power supplies combine feature rich AC input front-ends (*powerPacs*) with slide-in DC output modules (*powerMods*). The plug and play architecture allows system designers to define and build 'instant' custom power solutions with industry leading 17W/in<sup>3</sup> power density and up to 92% efficiency.

**Configured units** may be specified and ordered using the part numbering system shown above.

### OPTION CODES EXPLAINED

#### CONFIGURATION OPTIONS

- "-" Standard. No additional configuration  
Nominal output voltages and no options
- "C" Conformal Coating
- "P" Preset. Voltage Adjustments, Series, Parallel Outputs
- "R" Extra Ruggedisation for Shock and Vibration
- "S" Conformal Coating and Extra Ruggedisation for Shock and Vibration

#### INPUT CONNECTOR CONFIGURATOR OPTIONS

- "0" Standard IEC Input Connector
- "D" Input Cable Option

#### REVERSE FAN AND LEAKAGE CURRENT OPTIONS

- "0" Standard Thermal Signals + Fan Fail Signal Included
- "1" Standard Thermal Signals + Fan Fail Signal Included (Xgen models only)
- "2" Reverse Fan (Includes "0")
- "3" Reverse Fan, Standard Thermal Signals + Fan Fail Signal Included (Xgen models only)
- "4" 150uA Leakage Current\*(medical models only, Includes"0")
- "5" 150uA Leakage Current\*, Standard Thermal Signals + Fan Fail Signal Included (Xgen models only)
- "6" 150uA\* + Reverse Fan (medical versions only, Includes"0")
- "7" 150uA Leakage Current\*, Reverse Fan, Standard Thermal Signals + Fan Fail Signal Included (Xgen models only)

### Specifying & Ordering Configured Power Supplies

Configured Units may be specified and ordered using the part numbering system shown opposite. At our configuration centre we will assemble the Power Supply as specified by you accounting for slot preferences and also for preferred settings (Voltage/Series/Parallel etc), and also incorporating any Options required.

Configuration example for UltiMod: part number UX4CGD0-D4 specifies the following product;

- UX4 powerPac – 600W (Medical & Industrial)
- Slot 1: XgC: 36V/5.6A powerMod
- Slot 2: XgG: 2.5V/40A powerMod
- Slot 3: XgD: 48V/4.2A powerMod
- Slot 4: empty
- Option D (input cable) & Option 4 (150uA Leakage current)

Configuration example for XF: part number XFC2DK4BHS01 specifies the following product;

- XFC501 powerPac - 1000W (includes options S & 1 as standard)
- Slot 1: Xg2C 5V/40A powerMod
- Slot 2: XgDC 48V/4.2A powerMod
- Slot 3: XgKC 24V/9.2A powerMod
- Slot 4: Xg4C 24V/10A powerMod
- Slot 5: XgBC 24V/8.3A powerMod
- Slot 6: XgHC 5V/36A powerMod

Configuration example for Xgen: part number XVD2345F0-D4 specifies the following product;

- XVD powerPac - 1200W (Medical)
- Slot 1: Xg2:5V/40A powerMod
- Slot 2: Xg3:12V/20A powerMod
- Slot 3: Xg4:24V/10A powerMod
- Slot 4: Xg5:48V/6A powerMod
- Slot 5: XgF:24V/3A, 24V/3A powerMod
- Slot 6: empty
- Option D (input cable) & Option 4 (150uA Leakage current)

\*UltiMod comes with Thermal and Fan Fail signals as standard

\*With 150uA Leakage Current (Option 4) some external filtering may in certain cases be needed to meet system level EMC specifications. Consult Excelsys for support.

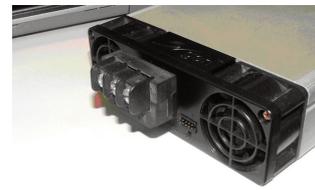
## Section 3.5 Accessories

### Input Cable (Option D)

Excelsys modular power supplies are also available with an input cable connection option allowing greater flexibility when mounting the power supply in the system. Individually insulated input cables are 300mm in length and come supplied with Faston connectors.

### IEC to Screw Terminal Adaptor

Some applications may require a screw terminal input rather than the standard IEC320 connector provided with Excelsys modular power supplies. For such applications, Excelsys can offer the XE1, the IEC to Screw terminal adaptor accessory plug. This is a press fit connector that plugs securely into the *powerPac* and provides the system integrator with screw terminals for mains connection (not available on XCE, XVE, XMD, XLD, XF).



### IEC to Faston Adaptor

For application that require Faston connectors on the AC input, Excelsys recommends IEC to Faston/Terminal Lugs Schurter P/N 4788.8000.



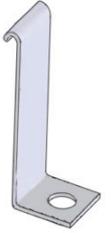
## Modular Power Supply Mounting Options

### 1. Base Plate Mounting

The unit can be mounted in the system via the mounting holes present on the UltiMod and Xgen base. See mechanical drawings for mounting hole positions. Use M3 mounting screws. Ensure that maximum screw penetration from base does not exceed 6mm.

### 2. Fleximount System A

Using the side mounting clips accessory shown, the clip can be positioned at the user defined position along the slide rail on the side of the UltiMod/Xgen. The clip is then mounted to the system base plate. Use M3 mounting screws to fix mounting clip to system base. Excelsys part number Z165.

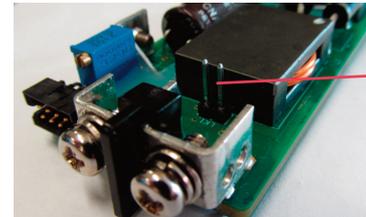


### 3. Fleximount System B

Using the slide rail on side of the UltiMod/Xgen, self-clenching studs can be placed at a user defined position. Excelsys recommends: PEM<FH-M4-X or FH-832-X or equivalent.

### LK1 for Current Share on powerMods XgA to XgD

To implement current share on powerMods XgA to XgD, The Excelsys LK1 connector must be inserted. Excelsys recommends the use of Harwin M7567-05 (Jumper Socket, Black 2.54mm 2 way connector). See picture below for details on where to inset LK1.



LK1 (Attach jumper here)

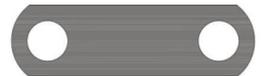
**Recommended Jumper for LK1: HARWIN M7567-05**  
(Jumper Socket, Black, 2.54mm, 2-way)

## XS1 & XP1 Bus Bars

### Parallel and Series Links

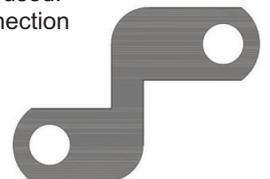
XP1 Parallel bus bar. When connecting *powerMods* in parallel for higher current outputs, the XP1 bus bar can be used. This can also be used to create common grounds between outputs.

Please follow the procedure for parallel connection of *powerMods* in Section 4.6



XS1 Series bus bar. When connecting *powerMods* in series for higher voltage outputs, the XS1 bus bar can be used. This can also be used to create common grounds between outputs. Please follow the procedure for series connection of *powerMods* in Section 4.6

Full mechanical details of all drawings available on request.



## Section 4.0 MODULAR POWER SUPPLIES

This Modular Power Supply Designers' Manual has been prepared by Excelsys experts to assist qualified engineers and technicians in understanding the correct system design practices necessary to achieve maximum versatility and performance from any of the UltiMod and Xgen range of Modular Configurable power supplies.



### Section 4.1 Overview of UltiMod and Xgen

The UltiMod and Xgen series allows users to instantly configure high efficiency, off-line power supplies. Although very small in size, the Excelsys range of modular power supplies provide up to 1340W of simultaneous output power.

A complete power supply is configured by selecting and inserting up to six DC output modules called *powerMods* into a *powerPac* to build a power supply. This offers the advantages of a custom supply, but is assembled from standard and modular building blocks continuing the Excelsys tradition of industry leading configurable power supplies.

Manufactured in world class power supply production facilities, the UltiMod and Xgen are completely user configurable. If output requirements change, i.e. more power or a different output voltage is needed, upgrading is easy: simply unlock a single screw and replace the slide-in *powerMod* assembly with the preferred alternative. Allowing additional flexibility, *powerMods* can be connected in parallel to increase output power, or in series for higher voltages (subject to staying within isolation ratings and giving due consideration to any SELV requirements).

A user-friendly interface on connector J3 of each *powerMod* provides control and output sequencing capability, in addition to useful status indicators.

The plug-together architecture facilitates 'instant' custom power solutions with industry leading 17W/in<sup>3</sup> power density and up to 92% conversion efficiency.

### Section 4.2 Installation Considerations

The UltiMod and Xgen series models may be mounted on any of three surfaces using standard M4 screws. The chassis comes with four mounting points on the base. Maximum allowable torque is 2Nm. The maximum penetration depth is 6mm. Additionally, the fleximount™ system on both side walls of the *powerPac* chassis facilitates flexible mounting.

When selecting a mounting location and orientation, the unit should be positioned so air flow is not restricted. Maintain a 50mm minimum clearance at both ends of the power supply and route all cables so airflow is not obstructed. The standard unit draws air in on the input side and exhausts air out the load side. If airflow ducting is used, avoid sharp turns that could create back pressure.

Avoid excessive bending of output power cables after they are connected to the *powerMods*. For high current outputs, use cable-ties to support heavy cables and minimise mechanical stress on output studs. Be careful not to short-out to neighboring output studs. *PowerMods* are supplied with spring washers on all output screws. These (or equivalents) should be used and thread locking compounds are not required. The maximum torque recommended on output connectors is 2Nm. Avoid applications in which the unit is exposed to excessive shock or vibration levels that exceed the specified levels. In such applications, a shock absorption mounting design is required.

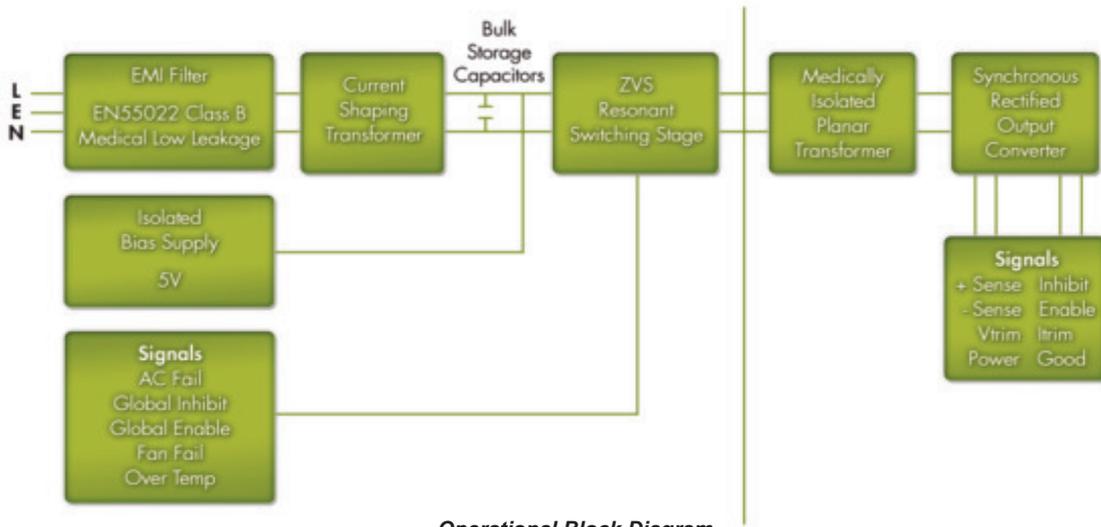
### Section 4.3 Mounting Considerations

- Always fill all output slots of the UltiMod or Xgen. If a slot is not filled with a *powerMod*, it should be filled with an Empty Slot Cover (part numbers XB1, XB2 or XB3). Empty Slot covers are plastic assemblies whose main function is to fill up an empty slot. Excessive airflow escape from an empty slot may degrade thermal performance and result in overheating and damage to the UltiMod unit. Refer to Section 4.11 for optimal positioning of *powerMods* to equalize airflow and prevent foreign objects from entering *powerPac*
- Do not unplug *powerMods* while input power is applied to the *powerPac*. The UltiMod and Xgen are not designed for hot-plug applications.
- Do not restrict airflow to the unit. The cooling fan draws air into the unit and forces it out at the output terminals.
- Always ensure that output screws are properly torqued to maximum 2Nm before applying power to the *powerPac*.
- Secure modules in *powerPac* chassis to a torque value of maximum 2Nm
- Positive and negative power cables should be arranged as a twisted pair to minimise inductance.
- Wait 4 minutes after shutting off power before inserting or removing *powerMods*.
- UltiMod and Xgen assemblies do not have user serviceable components. They must be returned to the factory for repairs. Contact Customer Service for a RMA number before returning the unit. Do not attempt to repair or modify the power supply in any manner other than the exchange of *powerMods* as described in this Designers' Manual.
- Use proper size wires to avoid overheating and excessive voltage drop.

### Section 4.4 Theory of Operation

The Xgen and UltiMod platforms are comprised of an appropriate *powerPac* and a selection of *powerMod* DC output modules selected to deliver the exact volts and amps requirements of the the system designer. See Operational Block Diagram.

The *powerPac* consists of a fan-cooled semi-enclosed chassis containing circuitry for an off-line single phase AC front end, EMI filter, cooling fan, customer interface and associated housekeeping circuits. Input AC mains voltage (L1/N, L2 and GND) is applied to an IEC320 type input connector and then through an EMI filter designed to meet EN 55022 Class B (for Industrial models).



Operational Block Diagram

For medical applications, the EMI filter also ensures the power supply meets the low earth leakage current requirements of EN60601-1 3rd Edition (Medical supplies only).

This stage is then followed by a high frequency switching input current shaping boost converter feeding the ZVS (Zero Voltage Switching) resonant switching stage. The ZVS stage supplies power to a variety of *powerMod* assemblies that provide the desired low voltage, regulated outputs. Conversion in the output assemblies is achieved by the most advanced high efficiency converters resulting in reduced size for magnetics and capacitors; excellent line and load regulation; wide adjustment range for output and low EMI/RFI emission.

At initial power-up, the outputs are disabled to eliminate inrush current and a low-power flyback converter operating with PWM current mode control converts the high voltage DC bus into regulated low voltage to power the internal housekeeping circuits and cooling fans. Once the bus potential is within operating parameters, the AC Fail signal is deactivated indicating that the input power is ok, and allows the installed *powerMod* outputs to come up. An auxiliary isolated bias supply of 5 VDC is provided for peripheral use on interface connector J2. In the case of medically approved supplies, this bias supply has medical isolation (4000VAC).

## Section 4.5

### Configuration (and Reconfiguration)

See Online Configuration tool:

[http://www.excelsys.com/xgen\\_configurator/configure.html](http://www.excelsys.com/xgen_configurator/configure.html)

*powerMods* may be easily added, replaced, or moved by sliding the assemblies in or out of the *powerPac* chassis.

Prior to removing or installing a *powerMod*, remove power from the *powerPac* and wait 4 minutes. Failure to do so can result in personal injury and/or damage to the supply. Take standard ESD precautions when handling *powerMods*.

Configuring the UltiMod and Xgen is as easy as 1,2,3!

1. Select the appropriate *powerMods* for your application.
2. Calculate your power requirements.
3. Select your appropriate *powerPac* for power and application from the wide range of *powerPacs*.

### Removing *powerMods*

*powerMods* may be removed by removing the screw on the top surface. Once this screw has been removed the *powerMod* will

slide out of the chassis. Once a *powerMod* has been removed, the empty slot MUST be filled with either another *powerMod* or an empty slot cover. If the slot is left empty, it will provide an air-flow escape and may cause inadvertent thermal shutdown of the unit to equalize airflow and prevent foreign objects from entering the *powerPac*.

### Installing *powerMods*

*powerMods* may be installed in empty slots by simply sliding in the new *powerMod*, pushing the *powerPac* 'home' until the mounting bracket lines up with the hole in the Top Panel, then securing the module with the M3 x 6 countersunk screw provided tighten to 2Nm max. Power and interface connections can be made after the *powerMod* has been installed.

*powerMods* may be paralleled for more power using bus bars (Paralleling Links) across the positive and negative output terminals. They can be series connected for applications requiring higher voltages.

## Section 4.6

### *powerMod* Operation

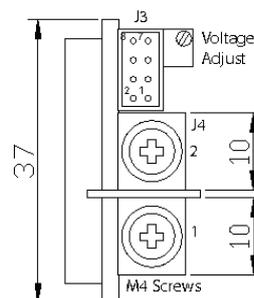
The UltiMod and Xgen series of products have been designed to allow maximum flexibility in meeting the unique requirements of system designers. The inherent flexibility resulting from modular concepts allows users to configure solutions with multiple outputs that can be individually controlled.

### Voltage Adjustment

The UltiMod and Xgen series outputs boast very wide adjustment ranges on the *powerMod*: Voltage setting and dynamic voltage adjustment can be achieved via the on board potentiometer and the J3 signals connector.

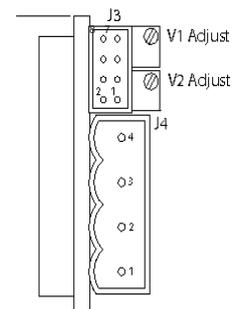
#### Type A: *powerMods*

XgA to XgE  
XgG to XgT  
Xg1 to Xg7



#### Type B: *powerMod*

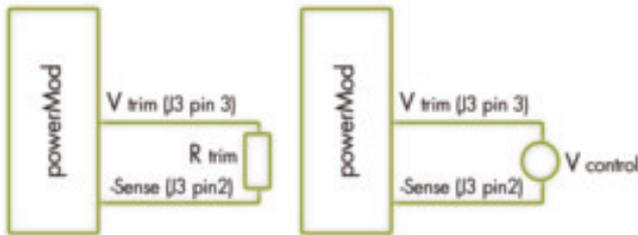
XgF/Xg8



## Designer Manual

Voltage adjustment may be achieved by

1. Front Panel potentiometer adjustment allowing users to set the output voltage to their required level.
2. Remote voltage adjustment using external resistor or potentiometer for modules XgG-XgT and Xg1-Xg5.
3. Remote voltage adjustment using an external voltage source for modules XgG-XgT and Xg1-Xg5.

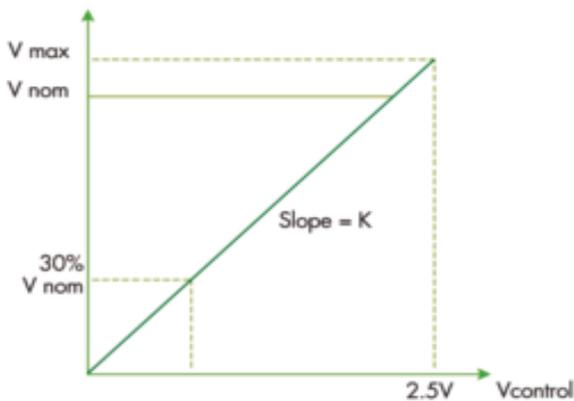


**Remote Output Voltage Adjustment of powerMods**

Excelsys have developed calculators that assist our customers in defining the external resistor values and external control voltages to allow users to set and control the output voltages. These are available to download from:

<http://www.excelsys.com/technical-support/>

Important: When using an external voltage source to set or adjust the output voltage, the control voltage must not exceed 2.5 VDC, and the slew rate of a dynamic control voltage must not exceed 2 V/ms.



**Remote Output Voltage Adjustment of powerMods**

Go to the support section of our website to download calculators and module specific K values:

<http://www.excelsys.com/technical-support/>

Modules XgM-XgQ can be dynamically trimmed to 1V. Contact Excelsys for applications support.

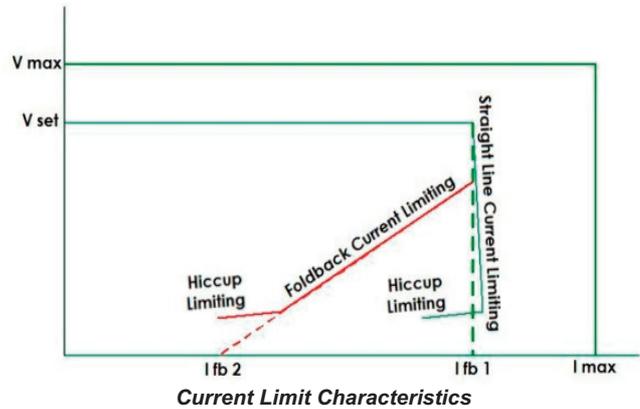
### Current Limit Adjustment

A number of over current protection methods can be implemented on the UltiMod and Xgen platforms. powerMods Xg1 to Xg5 and XgG to XgT can have the default Straight-Line current limit, a reduced user defined Straight-Line current or a user defined Foldback current limit. (See powerMod Summary Specifications table for the default Straight-Line current limit values)

The following simple external application circuits can be used to set user defined Foldback and Straight-Line current limit for reduced power or constant current applications.

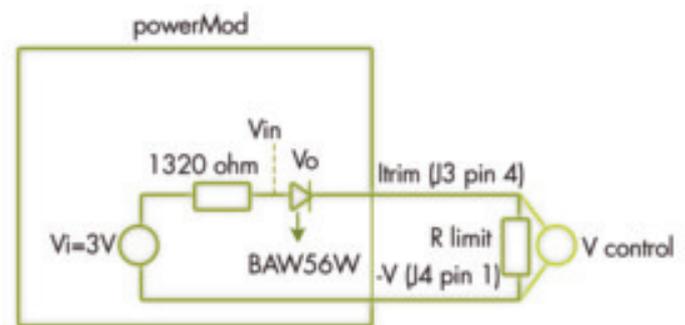
### Programming Current Limit

The current limit can be programmed to your requirements (in both Straight line and Foldback modes).



### Straight line Current Limit

The onset of current limit can be programmed using an external voltage source resistor/potentiometer. Connection between the Itrim pin (J3 pin4) and the -Vout (J4) terminal will set the current limit to the desired level.



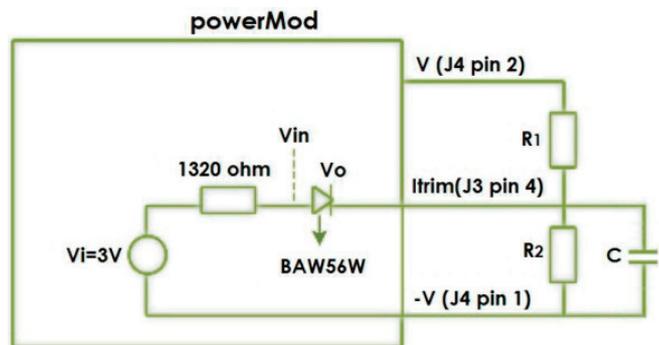
**Current Limit Programming**

Easy to use calculators have been developed to help users define the external resistor values and external control voltages to allow users to set and control the output current limit. These are available to download from <http://www.excelsys.com/technical-support/>

Important: when using an external voltage source for set/adjust the output current, the control voltage must not exceed 2.5VDC.

### Foldback current Limit Programming

Foldback Current Limit can be achieved using the circuit below



**Foldback Current Limit**

Calculators have been developed to help users define the external resistor values and to allow users to set and control the foldback current limit. These are available to download from the support section of our website;

<http://www.excelsys.com/technical-support/>

| Model             | Vnom (V) | Set Point Adjust Range (V) | Current Limit Foldback | Dynamic Vtrim Range (V) | I <sub>max</sub> (A) | Power (W) | OVP 1 Tracking % of Vset | Remote Sense (V) | Power Good |
|-------------------|----------|----------------------------|------------------------|-------------------------|----------------------|-----------|--------------------------|------------------|------------|
| XgA               | 12.0     | 10.8-15.6                  | -                      | -                       | 12.5                 | 150       | -                        | -                | -          |
| XgB               | 24.0     | 19.2-26.4                  | -                      | -                       | 8.3                  | 200       | -                        | -                | -          |
| XgC               | 36.0     | 28.8-39.6                  | -                      | -                       | 5.6                  | 200       | -                        | -                | -          |
| XgD               | 48.0     | 38.5-50.4                  | -                      | -                       | 4.2                  | 200       | -                        | -                | -          |
| XgE               | 24.0     | 5.0-28.0                   | No                     | -                       | 5.0                  | 120       | No                       | -                | Yes        |
| XgF <sub>V1</sub> | 24.0     | 5.0-28.0                   | No                     | -                       | 3.0                  | 72        | No                       | -                | Yes        |
| XgF <sub>V2</sub> | 24.0     | 5.0-28.0                   | No                     | -                       | 3.0                  | 72        | No                       | -                | Yes        |
| XgG               | 2.5      | 1.5-3.6                    | Yes                    | 1.15-3.6                | 40.0                 | 100       | 105-170%                 | 0.5              | Yes        |
| XgH               | 5.0      | 3.2-6.0                    | Yes                    | 1.5-6.0                 | 36.0                 | 180       | 105-170%                 | 0.5              | Yes        |
| XgJ               | 12.0     | 6.0-15.0                   | Yes                    | 4.0-15.0                | 18.3                 | 220       | 105-170%                 | 0.5              | Yes        |
| XgK               | 24.0     | 12.0-30.0                  | Yes                    | 8.0-30.0                | 9.2                  | 220       | 105-170%                 | 0.5              | Yes        |
| XgL               | 48.0     | 28.0-58.0                  | Yes                    | 8.0-58.0                | 5.0                  | 240       | 105-170%                 | 0.5              | Yes        |
| XgM               | 5.0      | 3.2-6.0                    | Yes                    | 1.0-6.0                 | 40.0                 | 200       | 105-170%                 | 0.5              | Yes        |
| XgN               | 12.0     | 6.0-15.0                   | Yes                    | 1.0-15.0                | 20.0                 | 240       | 105-170%                 | 0.5              | Yes        |
| XgP               | 24.0     | 12.0-30.0                  | Yes                    | 1.0-30.0                | 10.0                 | 240       | 105-170%                 | 0.5              | Yes        |
| XgQ               | 48.0     | 24.0-58.0                  | Yes                    | 1.0-58.0                | 6.0                  | 288       | 105-170%                 | 0.5              | Yes        |
| XgR               | 24.0     | 12.0-30.0                  | Yes                    | 8.0-30.0                | 10.0                 | 240       | 105-170%                 | -                | Yes        |
| XgT               | 48.0     | 28.0-58.0                  | Yes                    | 8.0-58.0                | 6.0                  | 288       | 105-170%                 | -                | Yes        |
| Xg1               | 2.5      | 1.5-3.6                    | Yes                    | 1.15-3.6                | 50.0                 | 125       | 105-170%                 | 0.5              | Yes        |
| Xg2               | 5.0      | 3.2-6.0                    | Yes                    | 1.5-6.0                 | 40.0                 | 200       | 105-170%                 | 0.5              | Yes        |
| Xg3               | 12.0     | 6.0-15.0                   | Yes                    | 4.0-15.0                | 20.0                 | 240       | 105-170%                 | 0.5              | Yes        |
| Xg4               | 24.0     | 12.0-30.0                  | Yes                    | 8.0-30.0                | 10.0                 | 240       | 105-170%                 | 0.5              | Yes        |
| Xg5               | 48.0     | 28.0-58.0                  | Yes                    | 8.0-58.0                | 6.0                  | 288       | 105-170%                 | 0.5              | Yes        |
| Xg7               | 24.0     | 5.0-30.0                   | No                     | -                       | 5.0                  | 120       | No                       | -                | Yes        |
| Xg8 <sub>V1</sub> | 24.0     | 5.0-28.0                   | No                     | -                       | 3.0                  | 72        | No                       | -                | Yes        |
| Xg8 <sub>V2</sub> | 24.0     | 5.0-28.0                   | No                     | -                       | 3.0                  | 72        | No                       | -                | Yes        |

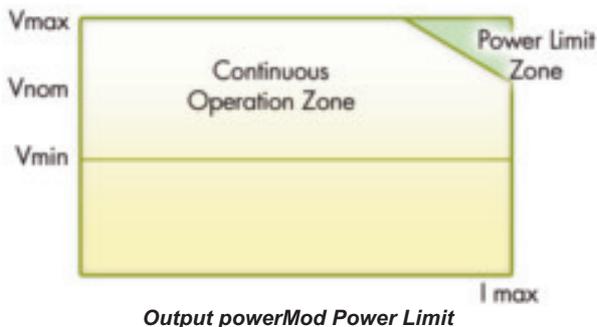
**PowerMod Summary Specifications**

**Over Voltage Protection (OVP)**

Over-voltage protection is implemented on each powerMod output. OVP level is fixed relative to V<sub>max</sub> (105-170%). OVP is latching and it may be reset by removing and reinstating AC power from the powerPac input.

**Power Limit**

Each powerMod has a number of levels of protection in order to ensure that UltiMod or Xgen is not damaged if used in overload conditions. Refer to Output powerMod Power Limit graph



When Vset is less than or equal to V<sub>nom</sub>, current limit is employed at the current limit set point. However if Vset is greater than V<sub>nom</sub>, the power limit is employed to ensure that the powerMods does not exceed its power rating. e.g. XgK is adjustable between 12V and 30V. I<sub>max</sub> is 9.2A. Power rating is 220W. At 24V the powerMod can deliver 9.2A continuously, i.e 220W. At 30V, the powerMod can still deliver 220W, however this equates to 7.33A continuous current.

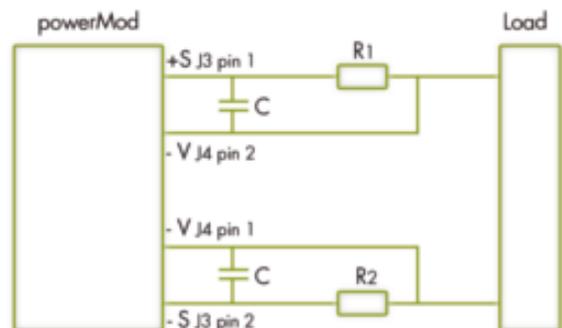
**Remote Sense (powerMods XgG-XgQ and Xg1-Xg5 only)**

To compensate for voltage drops in the output leads, use remote sensing. Remote sensing is available on XgG, XgQ and Xg1-Xg5 modules only.

Remote sensing may be implemented by connecting the Positive Sense pin (J3 pin1) to the positive side of the remote load and the Negative Sense pin (J3 pin2) to the negative side of the remote load. The maximum line drop, which can be compensated for by remote sensing, is 0.5V, subject to not exceeding the maximum module voltage at the output terminals.

Observe the following precautions when remote sensing:

1. Use separate twisted pairs for power and sense wiring.
2. Route the sensing leads to prevent pick up, which may appear as ripple on the output.
3. Never disconnect the output power rail with the sensing still connected to the load.



**Remote Sense of Output Voltage**

## Designer Manual

In certain applications where there is a high dynamic impedance along the power leads to the sensing point, remote sensing may cause system instability. This system problem can be overcome by using resistors in the sense leads (Positive sense lead:  $R1 = 100\text{ohm}$  , Negative sense lead:  $R2=10\text{ohm}$  ), together with local AC sensing, by using  $22\mu\text{F}$  capacitors between the remote sense pins and the output terminals. The resistance of the power cables must be so that the voltage drop across the cables is less than ( $R_{\text{cable}}$ )  $0.5\text{V}$  (to ensure remote sensing operates correctly).

$$R_{\text{cable}} < \frac{0.5}{I_{\text{out}}}$$

e.g. for an XgH,  $5\text{V}/36\text{A}$ . The  $R_{\text{cable}}$  must be less than  $13.9\text{mohms}$ .

### Measurement of Ripple & Noise

As with all switched mode power supplies, it is important to ensure that the correct method is used to measure ripple & noise. Care should be taken to ensure that a loop antenna is not formed by the tip and ground lead of the oscilloscope probe as this would lead to erroneous readings consisting mainly of pickup from remnant radiation in the vicinity of the output connectors. Excelsys recommends the use of an x1 probe with the ground sheath of the probe tip used for ground connection.

In some applications, further erroneous readings may result from CM currents. These can be reduced by looping a few turns of the scope lead through a suitable high permeability ferrite ring.

As most loads powered by a power supply will have at least small values of differential capacitors located near the load, Excelsys also recommends the use of small value of capacitance (approx  $1\mu\text{F}$ ) positioned at the point of measurement.

### Minimising System Noise

There are a number of causes of poor system noise performance. Some of the more common causes are listed below.

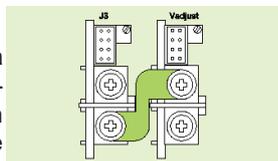
- Insufficient de-coupling on the PCB or load.
- Faulty wiring connection or poor cable terminations.
- Poor system earthing, system level grounding and shielding issues

There are some simple steps to eliminate, reduce or identify the causes of high frequency noise;

- Is the noise conducted or radiated? If changing the position of the power supply or screening improves performance, the noise is likely to be radiated. See Section 7.3 (EMC Characteristics).
- Twist all pairs of power and sense cables separately.
- Ground connections (zero Volt) should be made with the shortest possible wiring via a capacitor to the nearest point on the chassis. See Excelsys Application Note: AN1105 on website: <http://www.excelsys.com/wp-content/uploads/2011/09/ApplicationNoteAN1105-RippleandNoise1.pdf>

### Series Connection of powerMod outputs

It is possible to connect modules in series to increase output voltage. Outputs are rated SELV (Safety Extra Low Voltage), that is, that output voltages are guaranteed to be less than  $60\text{V}$ , if putting modules in series please take appropriate precautions.



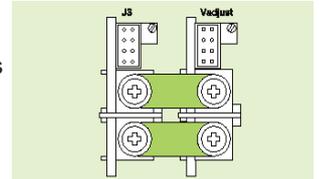
Series Links available.  
Part Number XS1

It is good practice to stack modules with similar output current limits, so that in case of short circuit the outputs collapse together.

If remote sensing is required, the exterior sense connections should connect to the load at point of use, and the interior connections to the local sense. Special links for series connection modules (part number XS1) to reduce wiring complexity can be specified and fitted by the installer or added at the factory.

### Parallel Connection for PowerMods

To achieve increased current capacity, simply parallel outputs using the standard parallel links. Excelsys 'wireless' sharing ensures that current hogging is not possible.



Parallel Links available to order.  
Part Number XP1

### To parallel connect outputs: XgG-XgQ and Xg1-Xg5

- Switch on IShare switch to ON.
- Connect Negative Parallel Link.
- Adjust output voltages of *powerMods* to within  $5\text{mV}$  of each other using differential techniques.
- Connect Positive Parallel Link.

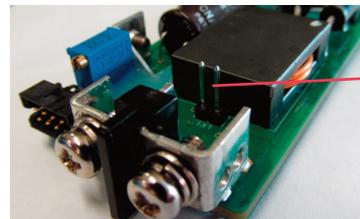


DIP Switch for Current Share & Inhibit/Enable for *powerMods* XgG to XgL and Xg1 to Xg5

### To parallel connect outputs: XgA-XgD

- Add jumper to current share header LK1 for *powerMods* XgA-XgD.
- Connect Negative Parallel Link.
- Adjust output voltages of *powerMods* to within  $5\text{mV}$  of each other using differential techniques.
- Connect Positive Parallel Link

### LK1 for Current Share on powerMods XgA to XgD



Recommended Jumper for LK1: HARWIN M7567-05  
(Jumper Socket, Black, 2.54mm, 2-way)

### powerMod Start-Up and Shutdown

*powerMods* are designed such that when input power is applied, all outputs rise to their set point voltage simultaneously. Likewise, when input power is removed all outputs commence to drop simultaneously and reach Zero potential simultaneously.

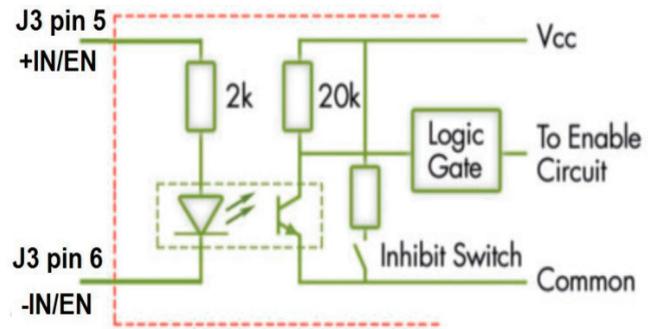
Outputs can be sequenced using the enable function in order to allow controlled start up if required. See plots for start-up and shutdown characteristics.



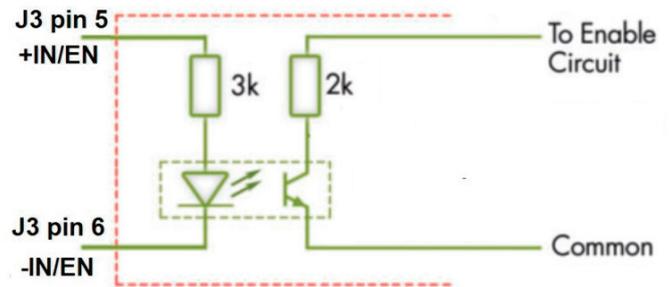
Output powerMod Start-Up



Output powerMod Shutdown



XgG-XgQ Remote Inhibit/Enable of Output Xg1-Xg5



XgA-XgD Remote Enable/Disable of Output

## Section 4.7

### PowerMod Signals

#### PowerMod Enable/Inhibit XgE-XgT and Xg1-Xg8

Each *powerMod* may be enabled/inhibited by means of an appropriate signal applied to an opto-isolated input (see figure alongside & table below)

#### XgG-XgT

Apply a signal to the opto-isolated input on J3 pin 5 (positive) and J3 pin 6 (negative), on *powerMods* XgG to XgL

#### Xg1-Xg5

Apply a signal to the opto-isolated input on J3 pin 5 (positive) and J3 pin 6 (negative), on *powerMods* Xg1 to Xg5

#### XgA-XgD

Inhibit is available by applying an appropriate signal to an opto-isolated input on J3 pin 5(positive) and J3 pin 6 (negative)

#### XgE and Xg7

Direct access to the output buck controller is given to the user via J3 pin 7 and J3 Pin 8. Reducing the voltage to less than 0.8V between J3 pin 7 and J3 pin 8 will inhibit the module.

#### XgF and Xg8

Direct access to the output buck controller is given to the user via J3 pin 3 and J3 Pin 4 for OP1 and J3 pin 7 and J3 pin 8 for OP2 Reducing the voltage to less than 0.8V between these pins will inhibit the corresponding module output.

When inhibited the output voltage of the *powerMod* will be fully inhibited to 0V. Turn-on delay from AC in and Global Enable is typically 2ms but is load dependant.

|                              | XgA to XgD | XgG to XgT | XgE/Xg7, XgF/Xg8 |
|------------------------------|------------|------------|------------------|
| Maximum signal input voltage | 17V        | 12V        | 0.8V             |
| Minimum signal input voltage | 4V         | 3V         | 0V               |
| Minimum current required is  | 1.7mA      | 1.7mA      |                  |

#### XgG-XgT and Xg1-Xg5

*PowerMods* can be configured to be normally ON or normally OFF the by appropriate setting of the DIP switch on the *powerMod*(default mode is normally ON as in figure below). The *powerMod* will deliver output voltage when mains is applied (and the powerPac is enabled). The *powerMod* requires an external 5V signal (between +IN/EN and -IN/EN) to disable the output pins. This may be reversed (normally OFF and requiring a signal to turn ON) by setting of the Inhibit dip switch to the OFF position



DIP Switch for Current Share & Inhibit/Enable for *powerMods* XgG to XgT

#### PowerMod Power Good Signal (XgE-XgQ and Xg1-Xg8)

Each *powerMod* contains an internal comparator which monitors the output voltage and determines whether this voltage is within normal operation limits. When the output voltage is within normal limits, the Power Good signal is activated (see below for signal descriptions).

#### For XgG-XgQ and Xg1-Xg5

The open collector of an opto-isolator is available on J3 pin 7 and the emmitter on J3 pin 8. (opto-transistor ON= Power-Good).

#### For XgE and Xg7

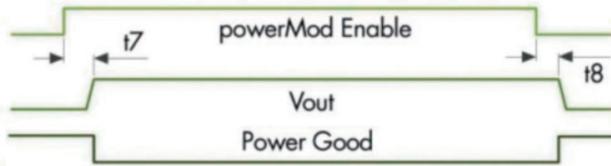
The open collector of an opto-isolator is available on J3 pin 6 and the emmitter on J3 pin 5. (opto-transistor ON= Power-Good).

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### For XgF and Xg8

The open collector of an opto-isolator is available on J3 pin 6 and J3 pin 5 for OP1 and J3 Pin 2 and J3 Pin 1 for OP2 (opto-transistor ON= Power Good).

Maximum collector current is 2mA.  
Maximum Collector voltage is 30V.  
 $t7 < 30\text{ms}$   
 $t8 < 30\text{ms}$



**Output powerMod Signals**

(In this figure the Power Good open collector has been pulled up to a 5V signal with a 4k resistor).

### powerMod LED Indicator

The LED indicator on each *powerMod* module gives a visual indication of the information contained in the Power Good signal above.

## Section 4.8

### powerPac Operation

The *powerPac* provides the front end input power to the *powerMods*. This is available in two package sizes and a number of power ratings. See Section 4.11, Power Ratings for more detail.

### Bias Voltage

A SELV isolated bias (always on) voltage of 5V nominal @ 500mA (250mA on XF, XCE and XVE models) is provided on J2 pin 2 relative to J2 pin 1 (common) and may be used for miscellaneous control functions. For medical applications, this bias supply voltage has 4000VAC isolation.

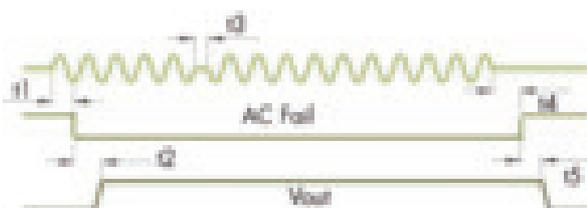
## Section 4.9

### powerPac (Global) Signals

#### AC Fail

AC Mains Fail signal is implemented by an open collector of an opto-isolator with a maximum sink current of 4mA. During normal operation the transistor is ON. When the input voltage is lost or goes below 80Vac, the opto-transistor is turned OFF at least 5mS before loss of output regulation (at nominal *powerMod* voltage or below)

In this figure the AC Fail open collector has been pulled up to a 5V signal with a 4k resistor.



**Mains AC Fail Signal**

$$80 \text{ ms} < t1 < 600 \text{ ms}$$

$$80 \text{ ms} < t2 < 100 \text{ ms}$$

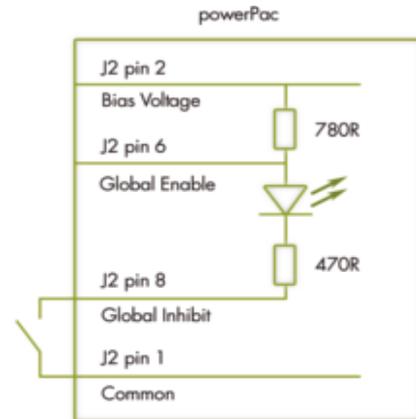
$$t3 = 10 \text{ ms}$$

$$t4 > 10 \text{ ms}$$

$$t5 > 2 \text{ ms}$$

### Global Inhibit

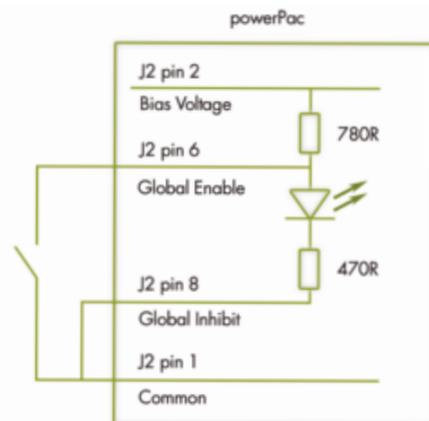
A global inhibit function may be implemented via simple contact closure as shown. This function inhibits ALL *powerMod* outputs except the auxiliary bias voltage. Global inhibit also shuts down the *powerPac* fans. When current flows through the internal opto-isolator the *powerPac* is turned off.



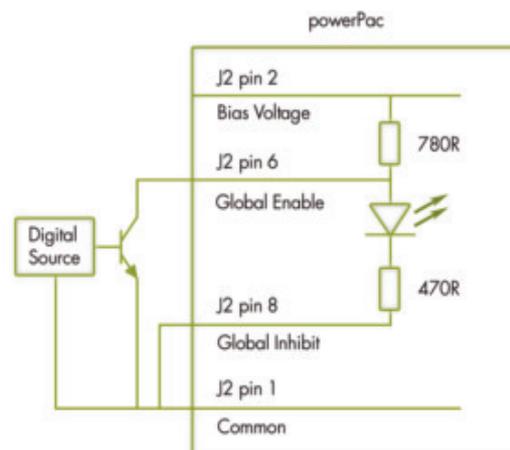
**Global Inhibit Using Bias Supply Voltage**

### Global Enable

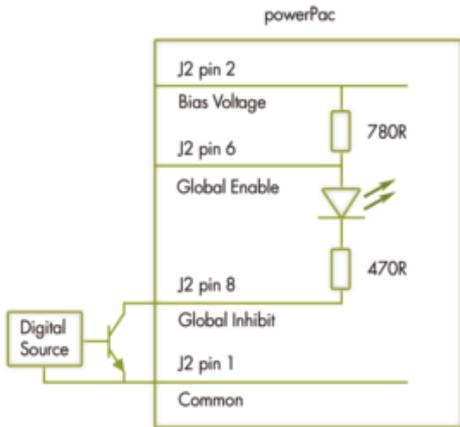
A global enable function may be implemented via simple contact closure as shown in the diagram. Ensure that J2 pin 8 and J2 pin 1 are connected prior to contact closure, this mode by-passes the opto-isolator. This function enables ALL *powerMod* outputs and the *powerPac* fans when the switch is closed.



**Global Enable Using Bias Supply Voltage**



**Global Enable Using an External Signal**

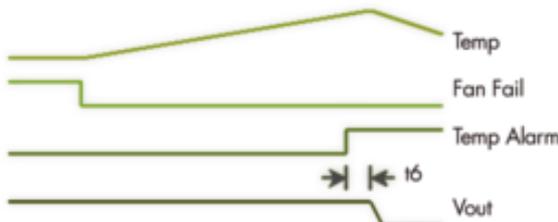


Global Inhibit Using an External Signal

## Section 4.10 powerPac Options

### Temperature Alarm

Open collector signal indicating that excessive temperature has been reached due to fan failure or operation beyond ratings. This signal is activated at least 10ms prior to system shutdown. (In this figure the Fan Fail and temperature alarms open collector have been pulled up to a 5V signal with a 4k resistor).



Over-temperature and Fan Fail

### Fan Fail

Open collector signal indicating that at least one of the powerPac fans has failed. This does not cause power supply shutdown. The power supply will continue to operate until 10ms after the temperature alarm signal is generated. The signal is low during normal fan operation, going open on failure.

### Reverse Fan (Option 02)

UltiMod and Xgen are available with reverse air flow direction. This is ideal to expel air from the system and works particularly well with the internal fan cooling built into the overall system. Contact factory for details (standard airflow is from input connections to output connections).

### Ultra Low Leakage Current (Option 04)

The UltiMod and Xgen is available with the option of Ultra Low Earth Leakage Current of  $<150\mu\text{A}$ . This is ideal for Medical applications using two power supplies or containing additional parts that contribute to the system Earth Leakage Current, ensuring system Earth Leakage current does not exceed levels defined in EN60601-1 and UL60601-1 2nd and 3rd Editions. Consult Excelsys for possible filter recommendations which may be needed to meet system level EMC specifications.

### Conformal Coating (Option C)

UltiMod and Xgen is available with conformal coating for harsh environments and MIL-COTs applications. It is IP50 rated against dust and protected against vertical falling drops of water and non condensing moisture, e.g. UX6ABDDL0C0 is a conformal coated 1000W configured UltiMod. Conformal coating material is Humiseal 1A33: (polyurethane based and military qualified)

### Ruggedised (Option R)

UltiMod and Xgen are available with extra ruggedisation as standard for applications that are subject to extremes in shock and vibration. These parts have been tested on 3 axes, for a total of 300hours at 1.67g's rms and have been tested versus MIL-STD 810G., e.g. UX6ABDDL0R00 is a ruggedised 1000W configured UltiMod.

### Conformal Coated and Ruggedised Option (Option S)

UX6ABDDL0S00 is a ruggedised and conformal coated 1000W configured UltiMod.

### Input Cable Option (Option D)

Excelsys modular power supplies are also available with an input cable connection option allowing greater flexibility when mounting the power supply in the system. Individually insulated input cables are 300mm in length and come supplied with Faston connectors.

## Section 4.11 Power Ratings

When specifying an UltiMod or Xgen power supply in an application it is necessary to ensure that powerPacs and powerMods are operating within their power output capabilities, taking into account the Temperature Derating and Input Voltage Derating. The maximum permissible output power that may be drawn from any powerMod is given in the powerMod specification table in Section 4.6. Refer to derating Curves on Individual Datasheets for Line and Temperature derating for UltiMod and Xgen.

Refer to derating Curves on individual datasheets or on page 45 and 46 for Line and Temperature deratings for UltiMod and Xgen.

### PowerMod Positioning

PowerMod performance can vary depending on slot position. Please use our online configurator to determine the optimal configuration for your system. This is particularly important when paralleling modules. Visit our configurator here [http://www.excelsys.com/xgen\\_configurator/configure.html](http://www.excelsys.com/xgen_configurator/configure.html)

## Section 4.12 Acoustic Noise

UltiMod and Xgen power supplies can be used in a wide variety of applications. Certain applications are more sensitive to acoustic noise than others. The table below sets out the measured acoustic noise of the various versions of UltiMod and Xgen. All acoustic noise measurements have been conducted in an anechoic chamber at a distance of 1m.

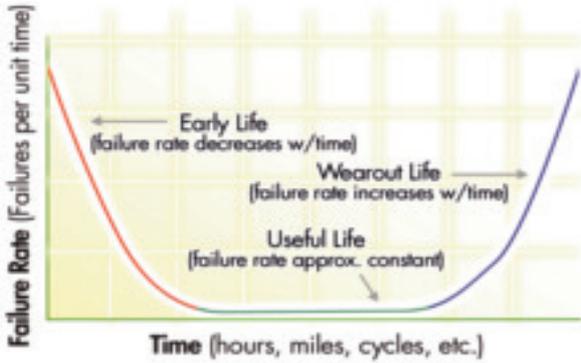
Acoustic Noise measurements of powerPacs

| 4-Slot powerPac     | [dBA] | amb [dBA] |
|---------------------|-------|-----------|
| XL, XM              | 45.8  | 27.4      |
| UX4, XK, XR         | 39.8  | 27.5      |
| Ultra Quiet, XT, XN | 37.3  | 27.3      |
| XLD, XMD            | 52.8  | 27.3      |
| 6-Slot powerPac     | [dBA] | amb [dBA] |
| XC, XV, XH          | 49.5  | 27.3      |
| UX6, XQ, XZ,        | 42.7  | 27.5      |
| Ultra Quiet, XB, XW | 38.3  | 27.4      |
| XCE, XVE, XF        | 56.5  | 27.3      |

# Section 7 Reliability, Safety, EMI and Technical Resources

## Section 7.1

### Reliability



The 'bath-tub' curve shows how the failure rate of a power supply develops over time. It is made up of three separate stages. Immediately after production, some units fail due to defective components or production errors. To ensure that these early failures do not happen while in the possession of the user, Excelsys carries out a burn-in on each unit, designed to ensure that all these early failures are detected at Excelsys. After this period, the power supplies fail very rarely, and the failure rate during this period is fairly constant. The reciprocal of this failure rate is the MTBF (Mean Time Between Failures).

At some time, as the unit approaches its end of life, the first signs of wear appear and failures become more frequent. Generally 'lifetime' is defined as that time where the failure rate increases to five times the statistical rate from the flat portion of the curve.

In summary, the MTBF is a measurement of how many devices fail in a period of time (i.e. a measure of reliability), before signs of wear set in. On the other hand, the lifetime is the time after which the units fail due to wear appearing.

The MTBF may be calculated mathematically as follows:

MTBF = Total x t / Failure , where  
 Total is the total number of power supplies operated simultaneously.  
 Failure is the number of failures.  
 t is the observation period.

MTBF may be established in two ways, by actual statistics on the hours of operation of a large population of units, or by calculation from a known standard such as Telecordia SR-332 and MIL-HDBK-217 and its revisions.

#### Determining MTBF by Calculation

MTBF, when calculated in accordance with Telecordia, MIL-HDBK-217 and other reliability tables involves the summation of the failure rates of each individual component at its operating temperature. The failure rate of each component is determined by multiplying a base failure rate for that component by its operating stress level.

The result is FPMH, the failure rate per million operating hours for that component.

Then FPMH for an assembly is simply the sum of the individual component FPMH.

$$\text{Total FPMH} = \text{FPMH}_1 + \text{FPMH}_2 + \dots + \text{FPMH}_n$$

$$\text{MTBF (hours)} = \frac{1,000,000}{\text{FPMH}}$$

In this manner, MTBF can be calculated at any temperature.

powerMod 0.958 failures per million hours  
 4slot powerPac 0.92 failures per million hours  
 6slot powerPac 0.946 failures per million hours

The figures for the powerPac excludes fans.

Example:

What is the MTBF of UX4DD00  
 UX4 FPMH = 0.92  
 XgD FPMH = 0.286  
 Total FPMH = 1.49  
 MTBF = 670,000 hours at 40°C

#### Xsolo MTBF

Xsolo has an MTBF of 550,000 hours at 40°C and full load based on the Telecordia SR-332 (fans excluded).

#### MTBF and Temperature

Reliability and MTBF are highly dependent on operating temperature. The figures above are given at 40°C. For each 10°C decrease, the MTBF increases by a factor of approximately 2. Conversely, however, for each 10°C increase, the MTBF reduces by a similar factor. Therefore, when comparing manufacturer's quoted MTBF figures, look at the temperature information provided. Contact Excelsys for detailed analysis of MTBF for your specific application conditions.

## Section 7.2

### Safety Approvals

UltiMod and Xsolo carry **dual safety certification, UL/EN60950 2nd Edition** for Industrial Applications and **UL/EN60601-1 2nd and 3rd Edition** for Medical Applications, meeting the stringent creepage and clearance requirements, 4KVAC isolation and <300uA leakage current. The Xgen series also carries full safety approvals. Refer to individual Xgen Datasheets for the relevant safety approvals carried by each model.

UltiMod, Xsolo and Xgen are designed to meet **MIL810G** and are also compliant with **SEMI F47** for voltage dips and interruptions as well as being compliant with all relevant EMC emission and immunity standards (Eee individual datasheets for details).

#### Safety Approvals

##### Low Voltage Directive (LVD) 2006/95/EC

The LVD applies to equipment with an AC input voltage of between 50V and 1000V or a DC input voltage between 75V and 1500V. The XSolo series is CE marked to show compliance with the LVD. The relevant European standard for UltiMod, Xsolo and Xgen models is EN60950 (Information technology). The 2nd Edition of this standard is now published and all relevant Excelsys power supplies are certified to the latest edition as well as the 1st Edition.

The relevant European standard for UltiMod, Xsolo and Xgen models is EN60601-1 (Medical Devices Directive). The 3rd Edition of this standard is published and all Excelsys medically approved power supplies are certified to this latest edition as well as the 2nd Edition. With appropriate packaging, the UltiMod, Xsolo and Xgen models can also meet the requirements of EN61010-1 for industrial scientific measuring equipment and process control.

UltiMod, Xsolo and Xgen models are certified to comply with the requirements of IEC950, EN60950, UL60950 (1st and 2nd Editions), and CSA 22.2 no. 234 and IEC1010, when correctly installed in a limited access environment.

The UltiMod, Xsolo and Xgen series are certified to comply with the requirements of IEC601-1, EN60601-1, UL60601-1 (2nd and 3rd Editions) and CSA601-1, for non-patient connect applications.

PowerMods are capable of providing hazardous energy levels (>240 VA). Equipment manufacturers must provide adequate protection to service personnel.

### Environmental Parameters

The UltiMod, Xsolo and Xgen series are designed for the following parameters

Material Group IIIb, Pollution Degree 2

Installation Category 2

Class I

Indoor use (installed, accessible to Service Engineers only).

Altitude: -155 metres to +3000 metres from sea level.

Humidity: 5 to 95% non-condensing.

Operating temperature -20°C to 70°C

Derate to 70°C. See *powerPac* Derating for details.

### Approval Limitations

#### Use in North America

When these products are used on 180 to 253 Volts AC mains with no neutral, connect the two live wires to L (live) and N (neutral) terminals on the input connector.

### Standard

Creepage Distances XL, XC, XK, XQ, XT, XB, XH models

Primary mains circuits to earth: 2.5mm spacing

Primary mains circuits to secondary: 5mm spacing

Dielectric strength XL, XC, XK, XQ, XT, XB, XH models

Primary mains circuits to chassis: 1500VAC

Primary mains circuits to secondary: 3000VAC

### Medical

Creepage Distances UltiMod, Xsolo, XM, XV, XR, XZ, XN, XW models

Primary mains circuits to earth: 4mm spacing

Primary mains circuits to secondary: 8mm spacing

Dielectric strength UltiMod, Xsolo, XM, XV, XR, XZ, XN, XW models

Primary mains circuits to chassis: 1500VAC

Primary mains circuits to secondary: 4000VAC

The primary to secondary test is not possible with modules fitted to the unit, as damage to the EMI capacitors will occur.

### Output Isolation

Xsolo : Output to Chassis isolation is 1500VAC.

UltiMod, Xgen: Output to Output Isolation is 500VDC  
Output to Chassis Isolation is 500VDC

## Section 7.3

### EMC Characteristics

#### EMC Directive 2004/108/EC

Component Power Supplies such as the UltiMod, Xsolo and Xgen series are not covered by the EMC directive. It is not possible for any power supply manufacturer to guarantee conformity of the final product to the EMC directive, since performance is critically dependent on the final system configuration. System compliance with the EMC directive is facilitated by Excelsys products compliance with several of the requirements as outlined in the following paragraphs. Although the UltiMod, Xsolo and Xgen series meet these requirements, the CE mark does not cover this area.

### EMISSIONS

#### Power Factor (Harmonic) Correction

The UltiMod, Xsolo and Xgen series incorporates active power factor correction and therefore meets the requirements of EN61000-3-2. Power factor: 0.98.

#### EN61000-3-3 Flicker & Voltage Fluctuation Limits

UltiMod, Xsolo and Xgen power supplies meet the requirements of the limits on voltage fluctuations and flicker in low voltage supply systems.

#### EN55022 Class B Conducted Emissions

For system compliance to EN55022, Level B, additional filtering may be required, for technical support, contact our Applications Engineering team.

### IMMUNITY

The UltiMod, Xsolo and Xgen series has been designed to meet, and tested to, the immunity specifications outlined below:

#### EN61000-4-2 Electrostatic Discharge Immunity

8kV Air discharge applied to Enclosure

6kV Contact with Enclosure

#### EN61000-4-3 Radiated Electromagnetic Field

10Volts/metre 80MHz to 2.5GHz applied to Enclosure

#### EN61000-4-4 Fast Transients-Burst Immunity

+/-2kV

#### EN61000-4-5 Input Surge Immunity

Xsolo:

+/-4kV Common Mode 1.2/50 S (Voltage); 8/20uS (Current)

+/-2kV Differential Mode 1.2/50 S (Voltage) 8/20 S (Current)

UltiMod and Xgen:

+/-2kV Common Mode 1.2/50 S (Voltage); 8/20uS (Current)

+/-1kV Differential Mode 1.2/50 S (Voltage) 8/20 S (Current)

#### EN61000-4-6 Conducted Immunity

10 V/m 150KHz to 80MHz

#### EN61000-4-11 Voltage Dips

0% 1s Criteria B

40% 100ms Criteria B

70% 10ms Criteria A

Further details on all tests are available from Excelsys.

### Guidelines for Optimum EMC Performance

All Excelsys products are designed to comply with European Normative limits (EN) for conducted and radiated emissions and Immunity, when correctly installed in a system. However, power supply compliance with these limits is not a guarantee of system compliance and system EMC performance can be impacted by a number of items.

Cabling arrangements and PCB tracking layouts are the greatest contributing factors to system EMC performance. All cables and PCB tracks should be treated as radiation sources and antenna. Every effort should be made to minimise current carrying loops that can radiate, and to minimise loops that could have noise currents induced into them.

- Keep all cable lengths as short as possible.
- Minimise the area of power carrying loops to minimise radiation, by using twisted pairs of power cables with the maximum twist possible.
- Run PCB power tracks back to back.
- Minimise noise current induced in signal carrying lines, by twisted pairs for sense cables with the maximum twist possible.
- Do not combine power and sense cables in the same harness
- Ensure good system grounding. System Earth should be a "starpoint". Input earth of the equipment should be directed to the "starpoint" as soon as possible. The power supply earth should be connected directly t

\*Radiated emissions are extremely applications dependent - with steps outlined above, it may still be possible in a system to generate some high frequency conducted noise through the power & load cables. These may be broadcasted and picked up by an antenna during a radiated test. For issues with resolving these issues we would encourage you to talk to our applications engineering team who have extensive knowledge in this field and can make some recommendations on attenuating specific frequencies should these occur during your system testing

## **EMI for XF**

The XF series of Hi-Rel/MIL-COTS Modular power supplies have been designed for use in harsh environments including military applications. Please contact Excelsys for information relating to MIL461F, CE101 and CE102 EMI characterisation. Contact our applications team for support on external filter recommendations.

# TECHNICAL RESOURCES



## CONSULT AN ENGINEER

Our experienced applications engineering team is ready to provide design consultancy support including product recommendations to deliver optimal systems performance, and most importantly reduced time to market. We are committed to providing you with the highest performing, most reliable power solution ensuring the lowest total cost of ownership for you.

To contact one of our team please e-mail [support@excelsys.com](mailto:support@excelsys.com) or telephone:

**North America and Canada:** +1 972 771 4544

**Europe and Asia:** +353 21 4354716

## ONLINE RESOURCES



Our website [www.excelsys.com](http://www.excelsys.com) hosts a wide range of easily accessible resources to support your power supply decision making. This includes:

- **Application Notes:** Supporting system designers in the integration of the Excelsys power supplies into their system.
- **Safety and Environmental Certification:** All our power supplies carry full international safety agency approvals including UL and EN for information technology and medical power supplies. To ease the system safety approvals we have provided our UL and CB certificates and we have also included our declarations of conformity. All Excelsys power supplies are REACH and RoHS compliant. Visit our Safety and Environmental section online where you can download our UL and CB safety certifications, and declarations of conformity to simplify system compliance.
- **EMI Characterisation:** Excelsys power supplies are component power supplies and as such are not subject to the EMC directive for EMI, however in order to ease system integration, Excelsys Technologies has carried out extensive EMI characterization of our products against the relevant standards.
- **HALT (Highly Accelerated Life Testing):** Poor reliability, low MTBF, frequent field returns, high in-warranty costs and customer dissatisfaction are often the result of design and/or process weaknesses, even if a product has successfully

passed qualification tests and burn-in. Excelsys Technologies subjects all our products to the HALT (Highly Accelerated Life Testing) process to uncover design and/or process weaknesses. During the HALT process, the product is subjected to progressively higher stress levels brought on by thermal dwells, vibration, rapid temperature transitions and combined environments.

- **White Papers:** Excelsys team of experienced power supply designers have an extensive knowledge of power supplies, technology and the challenges facing system designers. In conjunction with the UltiMod, Xsolo and Xgen Designers' Manual, and Application Notes, we also prepare White Papers on topics that are relevant to system designers.
- **Designers' Manual:** Excelsys has created Designers' Manual for our UltiMod, Xsolo and Xgen series of power supplies. These have been prepared to assist engineers and technicians in understanding correct design practices necessary to achieve the maximum versatility and performance from any of the UltiMod products. Whatever your application, be it industrial electronics, medical equipment, automation equipment etc., these Designers' Manuals provide the system designer with easy to implement integration instructions. The various Designers' Manuals can be downloaded from the Excelsys website.
- **Datasheets:** All Excelsys product datasheets are available to download online.
- **3D files and CAD drawings:** 3D CAD files in a number of formats (STEP, DXF and DWG formats) are available to download from our website. These files can easily imported by system designers to simplify the mechanical engineering design of systems. Download 3D files & CAD drawings from <http://www.excelsys.com/technical-support/3d-files-and-cad-drawings/>.
- **Online Configurator:** Whatever your power supply needs, Excelsys has a solution for you. Design your power supply using our Online Configurator. Simply input your volts and amps, and the configurator will generate a power supply solution to meet your exact power requirement. Visit the Excelsys Online Configurator at [http://www.excelsys.com/xgen\\_configurator/configure.html](http://www.excelsys.com/xgen_configurator/configure.html)
- **Online Calculators:** Excelsys have developed a range of online calculators to assist system developers in utilising the wide feature set of our products. Voltage adjustment and control, Current limit adjustment and weight calculators are available online and to download. These are available to download <http://www.excelsys.com/technical-support/>

The specifications contained herein are believed to be correct at time of publication and are subject to change without notice.



Excelsys supports customers and distributors worldwide. With experienced Applications Teams based in the US and in Europe, this allows Excelsys to offer immediate support and service to our customers.

Whatever your application, our dedicated team is ready to assist you in defining and implementation of the optimum power supply solution. Check out our *"Contact Us"* page on our website [www.excelsys.com](http://www.excelsys.com) and speak with your local Excelsys distributor.

Excelsys Technologies Ltd.  
27 Eastgate Drive  
Eastgate Business Park  
Little Island  
Co. Cork  
Ireland

t: +353 21 4354716  
f: +353 21 4354864  
e: [sales@excelsys.com](mailto:sales@excelsys.com)

Excelsys Technologies  
80 Bricketts Mill Road,  
Hampstead,  
New Hampshire  
03841  
USA

t: +1 972 771 4544  
f: +1 972 421 1805  
e: [salesusa@excelsys.com](mailto:salesusa@excelsys.com)