



## ***Ultra compact 500W and 1000W single output power supplies***

- ***High Efficiency***
- ***Convection Cooled***
- ***Digital Communications***



Ultra-high efficiency 1U size



## FEATURES

- Single output: 24V or 48V
- EN60950 2<sup>nd</sup> Edition & EN60601-1 2<sup>nd</sup> and 3<sup>rd</sup> Edition
- Ultra high efficiency, >92%
- Low profile: 1U height (40mm)
- Convection Cooled 500W
- Fan Cooled 1000W (variable speed fan)
- 12V/300mA bias standby voltage provided
- Remote ON/OFF Signal
- Power Good Signal
- MIL810G
- 2 MOPP
- SEMI F47 Compliant
- Optional I<sup>2</sup>C PMBus™ Communications
- Optional OR-ing Function
- 5 Year Warranty
- Adjustable output voltage
- All models feature active power factor correction as standard
- Product Options: Conformal Coating, Low Leakage Current and Ruggedised

## APPLICATIONS INCLUDE

- Industrial
- Test & Measurement
- Medical

The Xsolo family of single output power supplies provides up to an incredible 1008W in an extremely compact package.

Available in two package types, the high efficiency Xsolo delivers an incredible **convection cooled 504W** in an open-frame U-channel form factor and up to **1008W in an enclosed, fan cooled chassis**.

The Xsolo platform comes with a host of features including: variable speed fan, 12V/300mA isolated bias supply, remote ON/OFF, output voltage control and parallel operation for higher power applications. Nominal output voltages are 24V and 48V with wide adjustment ranges and user defined set-points. Xsolo carries **dual safety certification, EN60950 2<sup>nd</sup> Edition** for Industrial Applications and **EN60601-1 2<sup>nd</sup> and 3<sup>rd</sup> Edition** for Medical Applications, meeting the stringent creepage and clearance requirements, 4KVAC isolation and <300uA leakage current. Xsolo is designed to meet **MIL810G** and is also compliant with **SEMI F47** for voltage dips and interruptions as well as being compliant with all relevant EMC emission and immunity standards.

Optional features include I<sup>2</sup>C digital communications and OR-ing Function for N+1 redundancy. The product can also be conformal coated and ruggedised for use in harsh environments. With convection cooled power capability of over 500W, the Xsolo is ideal for use in a wide range of applications: industrial, Hi-Rel MIL-COTS applications, as well as acoustically sensitive laboratory and medical environments.



## XS Models

	Model	Power (W)	Output Voltage	Output Current (A)	Medical Approval UL/EN60601-1 3rd edition	Industrial Approval UL/EN60950 2nd edition
XS	XS500-24	504	24	21.0	Yes	Yes
	XS1000-24	1008	24	42.0	Yes	Yes
	XS500-48	504	48	10.5	Yes	Yes
	XS1000-48	1008	48	21.0	Yes	Yes

	Model	Vnom (V)	Power (W)	Description	Set Point Adjust Range (V)	Dynamic Vtrim Range (V)	I <sub>max</sub> (A)	Remote Sense	Power Good
XS	XS500-24	24	504	Convection Cooled U-Channel	19-28	14-28	21.0	Yes	Yes
	XS1000-24	24	1008	Enclosed Fan Cooled	19-28	14-28	42.0	Yes	Yes
	XS500-48	48	504	Convection Cooled U-Channel	36-58	29-58	10.5	Yes	Yes
	XS1000-48	48	1008	Enclosed Fan Cooled	36-58	29-58	21.0	Yes	Yes

\*Full part numbering information including product options and ordering information on page 60.



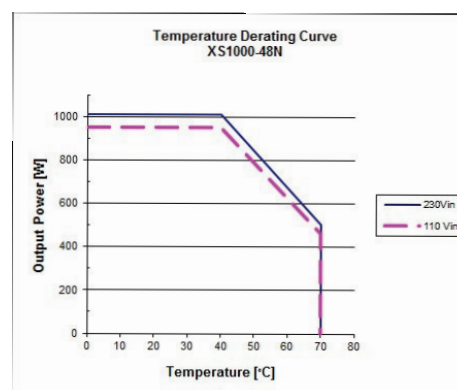
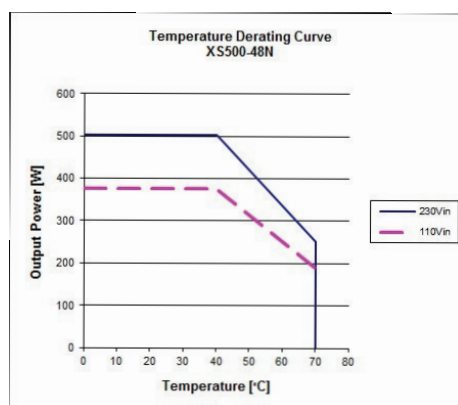
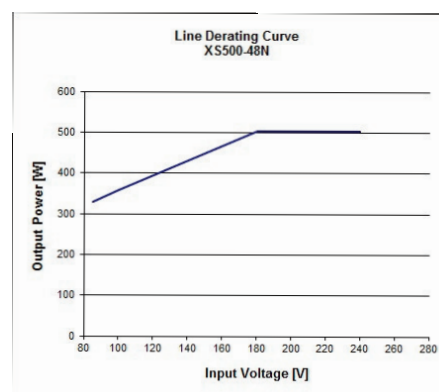
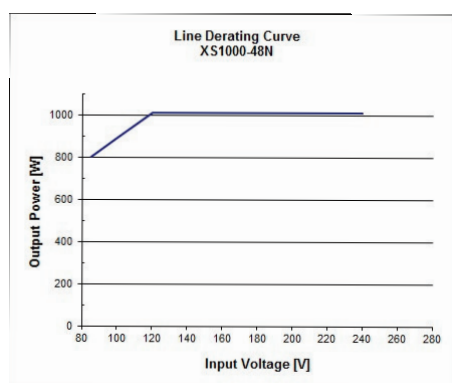
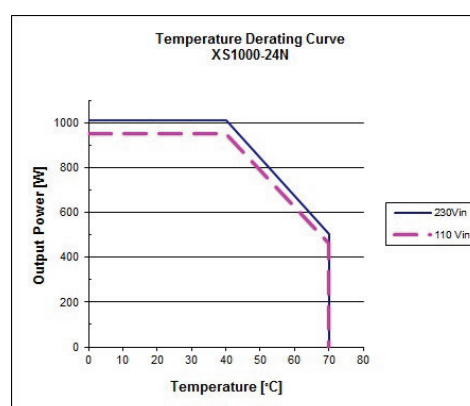
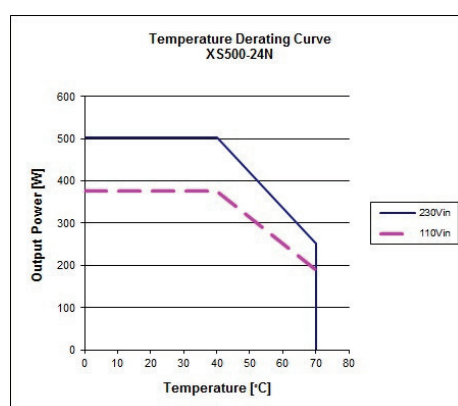
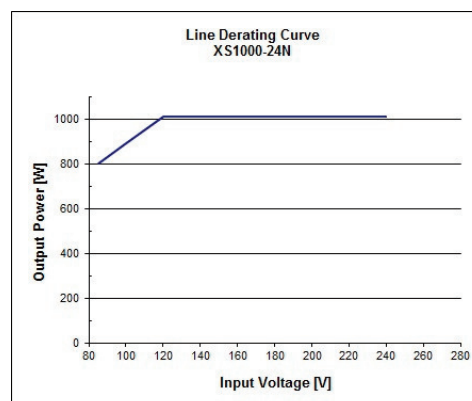
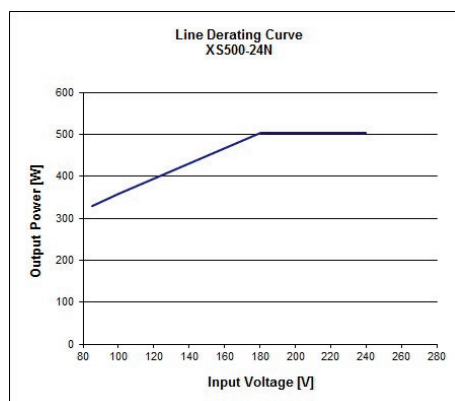
INPUT					
Parameter	Conditions/Description	Min	Nom	Max	Units
Input Voltage Range	Universal Input 47-440Hz	85 120		264 380	VAC VDC
Power Rating	XS500 XS1000		504 1008		W W
Input Current	XS500 XS1000		5 10		A A
Inrush Current	230VAC @ 25°C			25	A
Undervoltage Lockout	Shutdown	65		74	VAC
Fusing	XS500 250VAC XS1000 250VAC		F8A HRC F12A HRC		
OUTPUT					
Parameter	Conditions/Description	Min	Nom	Max	Units
Output Voltage Range	XS500/1000-24: Multi-turn potentiometer	19		28	VDC
	XS500/1000-24: Dynamic Vtrim range	14		28	VDC
	XS500/1000-48: Multi-turn potentiometer	36		58	VDC
	XS500/1000-48: Dynamic Vtrim range	29		58	VDC
Output Current Range	XS500-24			21	A
	XS1000-24			42	A
	XS500-48			10.5	A
	XS1000-48			21	A
Load & Cross Regulation	For 25% to 75% load change			±0.2	%
Transient Response	For 25% to 75% load change Voltage Deviation			2.5	%
	Settling Time			500	µs
Ripple and Noise	XS500/1000-24: 20MHz		240		mV pk-pk
	XS500/1000-48: 20MHz		480		mV pk-pk
Overvoltage Protection	XS500/1000-24: Latching	33	34	37	VDC
	XS500/1000-48: Latching	61	63	69	VDC
Overcurrent Protection	Straight line with hiccup activation at <30% of Vnom.	105	115	130	%
Line Regulation	For ±10% change from nominal line		±0.5		%
Remote Sense				0.5	VDC
Overshoot				2	%
Rise Time	Monotonic		3	5	ms
Turn-on Delay	From AC in		500	800	ms
	From Remote On/Off		10		ms
Hold-up Time	For nominal output voltages at full load.	17			ms
GENERAL					
Parameter	Conditions/Description	Min	Nom	Max	Units
Isolation Voltage	Input to Output	4000			VAC
	Input to Chassis	1500			VAC
	Output to Chassis	1500			VDC
Efficiency	230VAC, 1008W @ 24V/48V		>92		%
Safety Agency Approvals	EN60601-1 2nd and 3rd Edition, cTUVus 60601-1 EN60950 2nd Edition, cTUVus 60950				
Leakage Current	264VAC, 60Hz, 25°C			300	µA
	264VAC, 60Hz, 25°C (Option 4)			150	µA
Signals	See Page 3				
Bias Supply	Always on, current 300mA		12.0		VDC
Weight	XS500		1.1		Kg
	XS1000		1.3		Kg
MTBF	Telecordia SR-332, 40°C ground benign, parts count.			550,000	Hours
EMC					
Parameter	Standard		Level		Units
Emissions					
Conducted	EN55011, EN55022, FCC		Class B		
Radiated	EN55011, EN55022, FCC		Class B		
Harmonic Distortion	EN61000-3-2 Class A		Compliant		
Flicker & Fluctuation	EN61000-3-3		Compliant		
Immunity					
Electrostatic Discharge	EN61000-4-2		Level 2		
Radiated Immunity	EN61000-4-3		Level 3		
Fast Transients-Burst	EN61000-4-4		Level 4		
Input Line Surges	EN61000-4-5		Level 4		
Conducted Immunity	EN61000-4-6		Level 3		
Voltage Dips	EN61000-4-11, SEMI F47 Compliant. <sup>(1)</sup>		Compliant		
ENVIRONMENTAL					
Parameter	Conditions/Description	Min	Nom	Max	Units
Operating Temperature		-40		+70	°C
Storage Temperature		-40		+85	°C
Derating	See Page 4 for full temperature deratings				
Relative Humidity	Non-condensing	5		95	%RH
Shock and Vibration	Designed to meet MIL810G <sup>(2)</sup>		55		G
Altitude				3000	m

Note 1. SEMI F47 compliant at input voltages >160VAC. Consult Excelsys for details.

Note 2. Consult Excelsys for HALT report (enhanced ruggedisation available as an option).

## Section 5.2

### Xsolo Derating Curves

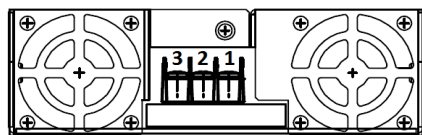
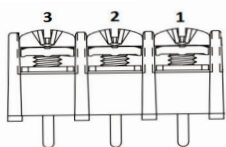


## Section 5.3

### Xsolo Connectors

#### Input Connector J7

Connector, Barrier Terminal Block, Vertical, 3 position, Pitch:0.375in  
Molex - 38720-7503



#### Output Signal Connector J5

Connector, Header 14POS 2MM Pitch T/H  
Molex - 87831-1420

#### J5 Mating Connectors

Locking Molex 51110-1451; Non Locking 51110-1450;  
Crimp Terminal: Molex p/n 50394

#### I<sup>2</sup>C Interface (Option)

The I<sup>2</sup>C PM Bus compatible interface can be used for monitoring the output voltage and current. It can also be used to manage real time data for the PSU.

For full details on PM Bus please contact sales@excelsys.com.

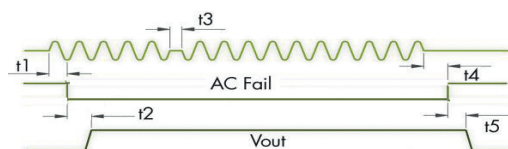
#### PMBus Connector:

PL1: Molex - 87833-0831

#### PL1 Mating Connector:

Locking Molex 51110-0860; Non Locking 51110-0850; Crimp Terminal: Molex p/n 50394

#### AC Fail Signal



$$80\text{ms} < t_1 < 700\text{ms}$$

$$10\text{ms} < t_2 < 100\text{ms}$$

$$t_3 = 10\text{ms}$$

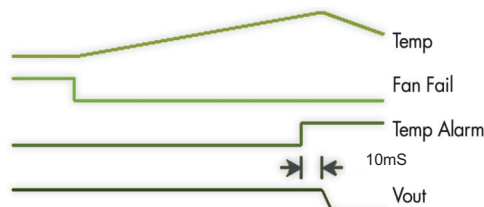
$$t_4 > 15\text{ms}$$

$$t_5 > 2\text{ms}$$

#### 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 10mS before loss of output regulation (at nominal voltage or 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.



#### Fan Fail

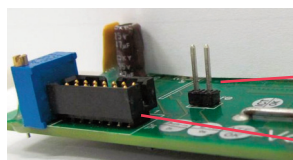
Open collector signal indicating that at least one of the fans has failed. This does not cause power supply shutdown. The power supply will continue to operate until 10ms after the temperature alarm signal is generated.

#### Paralleling Xsolo's

To achieve increased currents Xsolo products can be paralleled.

To connect in parallel the outputs must be trimmed to within 5mV of each other and then the current share header J20 must be added to each Xsolo product.

**Recommended Jumper for J20:** HARWIN M7567-05  
(Jumper Socket, Black, 2.54mm, 2-way)



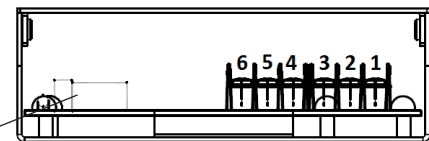
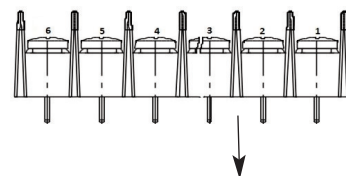
J20 (Attach jumper here)

Output Signal Connector J5

#### O/P Connector J10 and J12

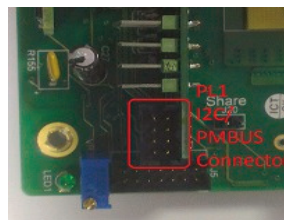
Connector, Barrier STRIP DL 3CIRC .325  
Tyco - 2-1437667-5

\*Note maximum current per screw terminal is 20Am<sub>i</sub>



#### Connector Details

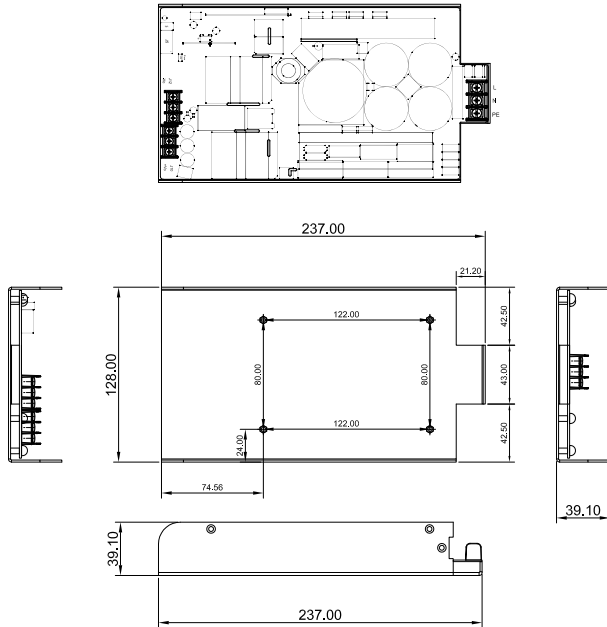
Pin	Input	Output	Signal	PMBus Connector
1	L	+Vo	EN-	Not Used
2	N	+Vo	EN+	SDA
3	E	+Vo	PG+	SCL
4		-Vo	PG-	Not Used
5		-Vo	12V	Not Used
6		-Vo	ACFail	Not Used
7			OTP	Not Used
8			Common	GND
9			Vtrim	
10			-Sns	
11			+Sns	
12			FanFail	
13			Itrim	
14			Common	



## Section 5.4

### Xsolo Mechanical Drawings

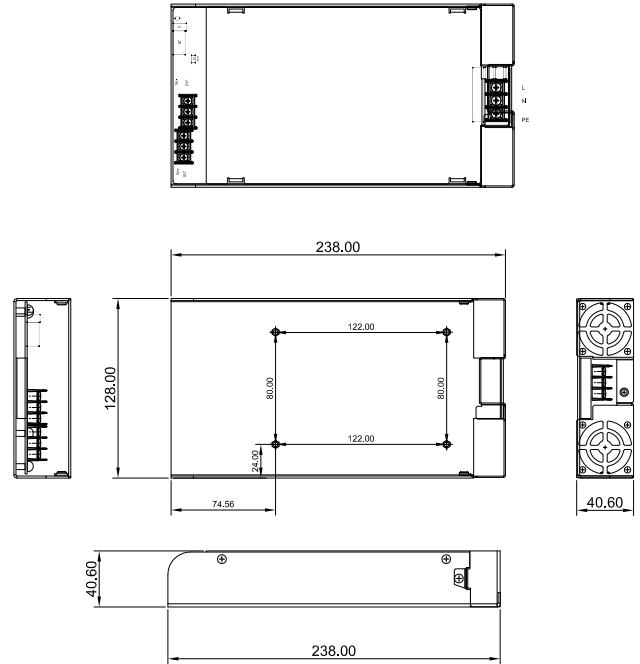
**XS500 Mechanical Specifications**  
(All dimensions in mm)



**Mounting Holes**

4 M4 threaded PEMS on Base. Max Screw Penetration is 6mm from Base

**XS1000 Mechanical Specifications**  
(All dimensions in mm)



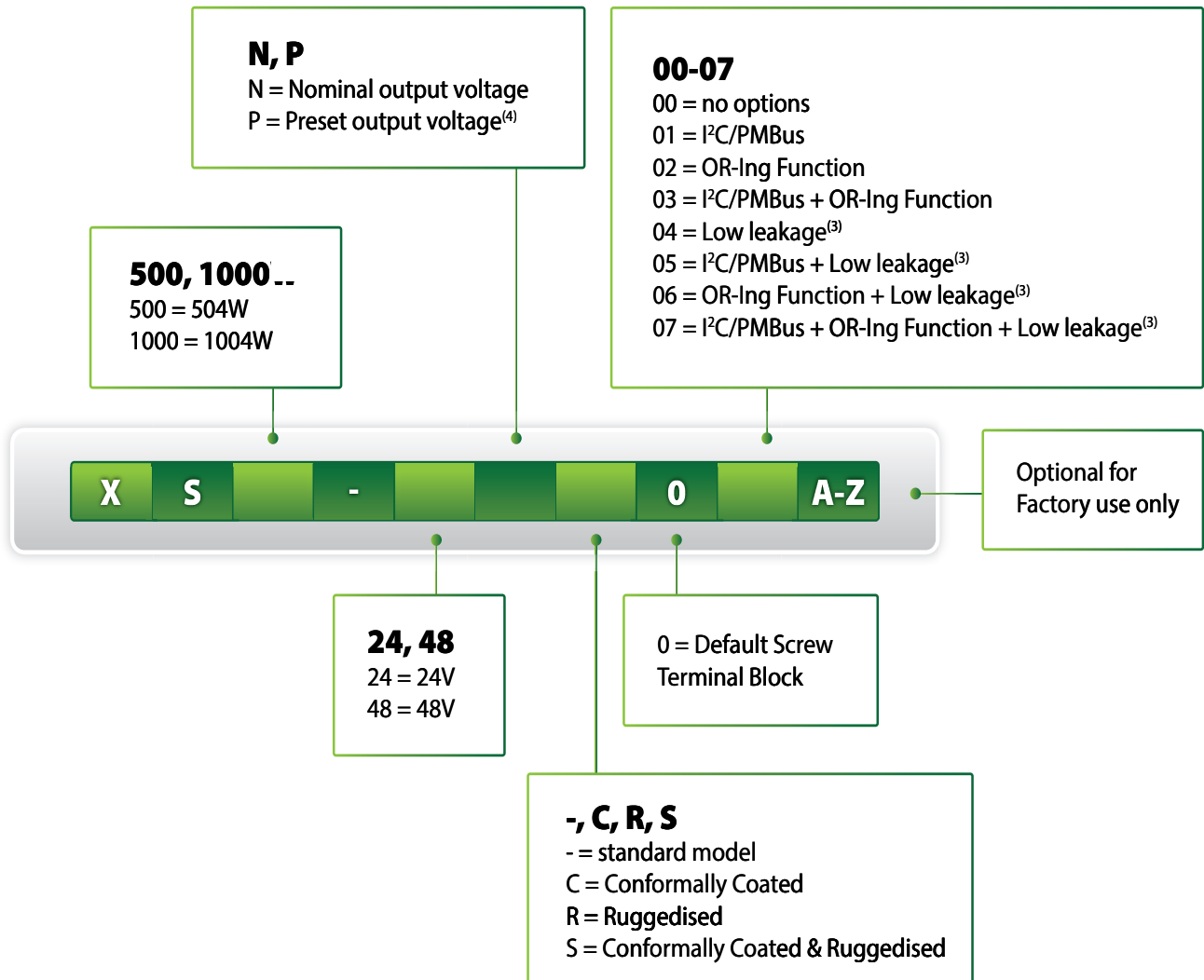
**Mounting Holes**

4 M4 threaded PEMS on Base. Max Screw Penetration is 6mm from Base

- Note 3. System design with low leakage capacitors requires particular attention to EMI. Please consult Excelsys for application details.  
 Note 4. Contact sales@excelsys.com for details including MOQs on alternative preset output voltages.  
 Note 5. The specifications contained herein are believed to be correct at time of publication and are subject to change without notice.  
 Note 6. All specifications at nominal input, full load, 25°C unless otherwise stated.  
 Note 7. Compliance with MIL-STD-461 (CE101 & CE102) achieved with the addition of an external line filter from LCR p/n F19374.

## Section 5.5

### Configuring your Xsolo



Example 1: XS1000-24N-000 = Xsolo 1000W, 24V output with no options

Example 2: XS1000-24N-003 = Xsolo 1000W, 24V output with I<sup>2</sup>C/PMBus and OR-Ing function.



Ultra-high efficiency 1U size



## Section 6.1 Overview of Xsolo

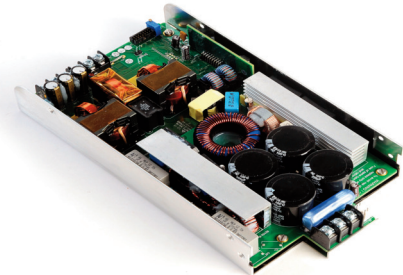
The Xsolo family of single output power supplies provides up to an incredible 1008W in an extremely compact package. Available in two package types, the high efficiency Xsolo delivers an incredible convection cooled 504W in an open-frame U-channel form factor and up to 1008W in an enclosed, fan cooled chassis.

The Xsolo platform comes with a host of features including: variable speed fan, 12V/300mA isolated bias supply, remote ON/OFF, output voltage control and parallel operation for higher power applications. Nominal output voltages are 24V and 48V with wide adjustment ranges and user defined set-points. Xsolo carries dual safety certification, EN60950 2nd Edition for Industrial Applications and EN60601-1 2nd and 3rd Edition for Medical Applications, meeting the stringent creepage and clearance requirements, 4KVAC isolation and <300uA leakage current. Xsolo is designed to meet MIL810G and is also compliant with SEMI F47 for voltage dips and interruptions as well as being compliant with all relevant EMC emission and immunity standards.

Optional features include I2C digital communications and OR-ing Function for N+1 redundancy. The product can also be conformal coated and ruggedised for use in harsh environments. With convection cooled power capability of over 500W, the Xsolo is ideal for use in a wide range of applications: industrial, Hi-Rel MIL-COTS applications, as well as acoustically sensitive laboratory and medical environments.

## Section 6.2 Xsolo Features

- EN60950 2nd Edition & EN60601-1 2nd and 3rd Edition
- MIL810G
- 2 MOPP
- SEMI F47 Compliant
- Ultra high efficiency, >92%
- Low profile: 1U height (40mm)
- Convection Cooled 500W/Fan Cooled 1000W (variable speed fan)
- 12V/300mA bias standby voltage provided
- Remote ON/OFF Signal, Power Good Signal
- 5 Year Warranty
- Adjustable output voltage
- Product Options: Conformal Coating, Low Leakage Current, Ruggedised, PMBus, & OR-ing function



## APPLICATIONS INCLUDE

- Industrial
- Test & Measurement
- Medical
- Hi-Rel/MIL-COTS
- Communication





## Section 6.3

### Installation Considerations

The Xsolo 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. Maintain a 50mm minimum clearance at both ends of the Xsolo power supply and route all cables so airflow is not obstructed. The XS1000 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. XS500 units are convection cooled.

Avoid excessive bending of output power cables after they are connected to the Xsolo 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.

Xsolo output 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 4Nm. 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 6.4:

### Xsolo Control and Signals (Analog)

#### Voltage Adjustment

The Xsolo has been designed with maximum user flexibility as a key objective. The output voltage can be adjusted over a wide range by a number of methods.

Voltage adjustment and setting may be achieved by:

1. Voltage Setting via the on board potentiometer.
2. Remote voltage programming.  
Vtrim is accessed by applying a control Voltage between J5 Pin 9 and Common (J5 Pin 8 or Pin 14) .

An Excel spreadsheet has been developed to help users define the output voltage and current limit control values. These are available to download from the support section of our website; <http://www.excelsys.com/technical-support/>

#### XS500-24 and XS1000-24

See graph below for Output voltage setting using an external voltage sources. Using an external Voltage source (Vcontrol), the output voltage of the XS1000-24 and XS500-24 may be adjusted over a wide range. The output voltage may be programmed by referring to the Voltage Programming Graph and applying the formula below to set the output voltage to the required level.

$$V_{\text{output}} = 12.59 \times V_{\text{control}}$$

**Important:** Vcontrol must not exceed 2.5V

Example.

Setting the output voltage to 20VDC via the Vtrim Pin

$$V_{\text{output}}/12.59 = V_{\text{control}}$$

$$20\text{V}/12.59 = 1.59\text{V}.$$

$$V_{\text{control}} = 1.59\text{V}$$

See Graph below for full range.

#### XS500-48 and XS1000-48

See graph below for Output voltage setting using an external voltage sources. Using an external Voltage source (Vcontrol), the output voltage of the XS1000-48 and XS500-48 may be adjusted over a wide range.

The output voltage may be programmed by referring to the Voltage Programming Graph and applying the formula below to set the output voltage to the required level.

$$V_{\text{output}} = 24.75 \times V_{\text{control}}$$

**Important:** Vcontrol must not exceed 2.5V

Example.

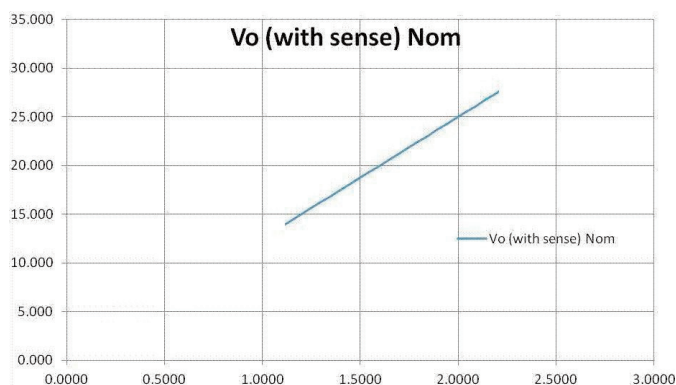
Setting the output voltage to 40VDC via the Vtrim Pin

$$V_{\text{output}}/24.75 = V_{\text{control}}$$

$$40\text{V}/24.75 = 1.62\text{V}.$$

$$V_{\text{control}} = 1.62\text{V}$$

See Graph below for full range.



#### Current Limit Adjustment

The Xsolo has been designed to allow users to adjust the onset of Current Limit. By applying a control voltage to the Itrim pin, J5 Pin 13, and the Common (J5 Pin 8 or Pin 14) the current limit of the XS500-24 and XS1000-24 can be adjusted from 0A to the max current limit rating.

#### Current Limit Adjustment on XS500-24

Current limit adjustment can be achieved by Remote voltage programming

Current limit can be adjusted from 0A to 23A via the Itrim pin on J5 connector Pin 13

$$I_{\text{output}} = 15.27 \times V_{\text{control}}$$

**Important:** Vcontrol should not exceed 1.5V for XS500-24

Example.

Setting the output current of the XS500-24 to 15A via the Itrim Pin

$$I_{\text{output}}/15.267 = V_{\text{control}}$$

$$15\text{A}/15.267 = 0.98\text{V}.$$

$$V_{\text{control}} = 0.98\text{VDC}$$

#### Current Limit Adjustment on XS1000-24

Current limit can be adjusted from 0A to 46A via the Itrim pin on J5 connector Pin 13

$$I_{\text{output}} = 15.267 \times V_{\text{control}}$$

**Important:** Vcontrol should not exceed 3.0V for XS1000-24

Example.

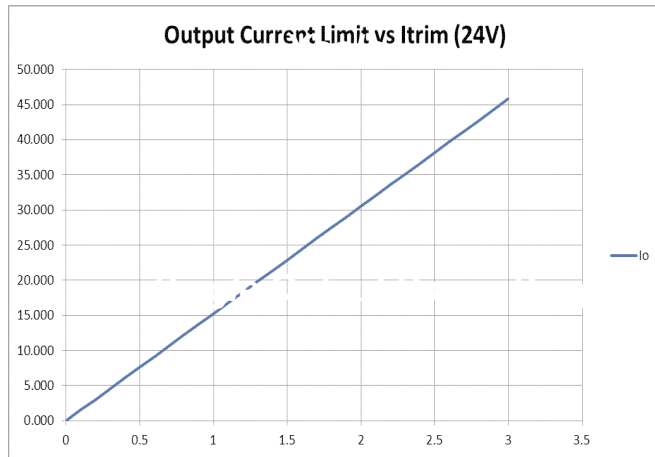
Setting the output current of the XS1000-24 to 30A via the Itrim Pin

$$I_{\text{output}}/15.267 = V_{\text{control}}$$

$$30\text{A}/15.267 = 1.96\text{VDC}.$$

$$V_{\text{control}} = 1.96\text{VDC}$$

See Graph for full range.



### Current Limit Adjustment on XS500-48

Current limit can be adjusted from 0A to 12A via the Itrim pin on J5 connector Pin 13

$$I_{\text{output}} = 8.06 \times V_{\text{control}}$$

**Important:**  $V_{\text{control}}$  should not exceed 1.5V for XS500-48

Example.

Setting the output current of the XS500-48 to 7.5A via the Itrim Pin

$$I_{\text{output}}/8.06 = V_{\text{control}}$$

$$7.5\text{A}/8.06 = 0.93\text{V}$$

$$V_{\text{control}} = 0.93\text{VDC}$$

### Current Limit Adjustment on XS1000-48

Current limit can be adjusted from 0A to 23 A via the Itrim pin on J5 connector Pin 13

$$I_{\text{output}} = 8.06 \times V_{\text{control}}$$

**Important:**  $V_{\text{control}}$  should not exceed 3.0V for XS1000-48

Example.

Setting the output current of the XS1000-48 to 15A via the Itrim Pin

$$I_{\text{output}}/8.06 = V_{\text{control}}$$

$$15\text{A}/8.06 = 1.86\text{VDC}$$

$$V_{\text{control}} = 1.86\text{VDC}$$

See Graph for full range.

### Remote ON/OFF

The Xsolo may be inhibited by means of an appropriate signal applied to an opto-isolated input (diode of an opto-isolator) on pins J5 connector Pin 2 (positive) and Pin 1 (negative). The delay from Inhibit to output turning OFF is typically <1ms.

Maximum current source allowed is 6.5mA.

Maximum applied voltage allowed is 13V.

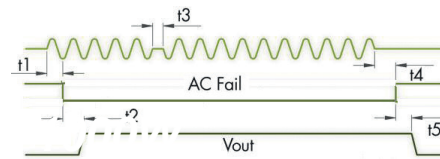
### Fan Fail

Fan Fail is an Open collector signal indicating that at least one of the Xsolo 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 Fan Fail signal is accessed via J5 connector Pin 12. There is an on-board series current limit resistor of 2k connecting Pin 12 to the collector of an NPN transistor opto-coupler output. The emitter is connected to J5 Pin 8 – or Pin 14 (Common). When a fan-fail condition is detected the transistor turns off.

Maximum current source allowed is 6.5mA.

Maximum applied voltage allowed is 13V.

### AC Mains Fail



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

$$10\text{ms} < t2 < 20\text{ms}$$

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

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

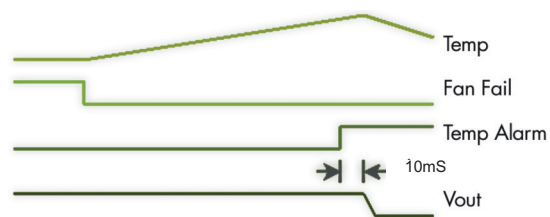
$$t5 > 2\text{ms}$$

AC Mains Fail signal is implemented by an Opto-isolated signal with a maximum sink current of 6.5mA. 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 2mS before loss of output regulation (at nominal voltage or below).

AC Mains fail signal is accessed through J5 connector Pin 6. There is an on-board series current limit resistor of 2kohm connecting Pin 6 to the collector of an NPN transistor opto-coupler output. The emitter is connected to J5 Pin 8 or Pin 14 (Common). The output voltage waveform above assumes a pull-up resistor or direct connection to a maximum voltage of +13V. Maximum current source allowed is 6.5mA. Maximum applied voltage allowed is 13V.

### Over-Temperature Protection (OTP)

This is an opto-isolated open collector transistor 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. The OTP signal is accessed via J5 connector Pin 7. The signal is normally low and switches to high when an OTP event occurs.



The Fan Fail and Temp Alarm signal waveforms in the diagram assume connection via a pull-up resistor to the 12 V bias source or an external voltage.

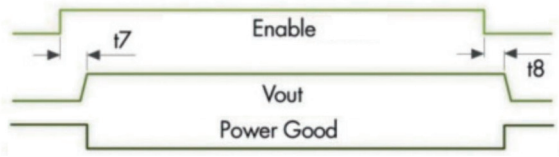
### Remote Sense

Remote sensing can be used to compensate for voltage drops in the output loads.

Remote sensing may be implemented by connecting the Positive Sense pin (J5 pin11) to the positive side of the remote load and the Negative Sense pin (J5 pin 10) 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.

### Power Good Signal

The Xsolo 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 PowerGood signal is activated. The signal is implemented by an open collector op an opto-isolator which is available on J5 Pin 3 and the emitter on J5 Pin 4 (transistor ON = Power Good).



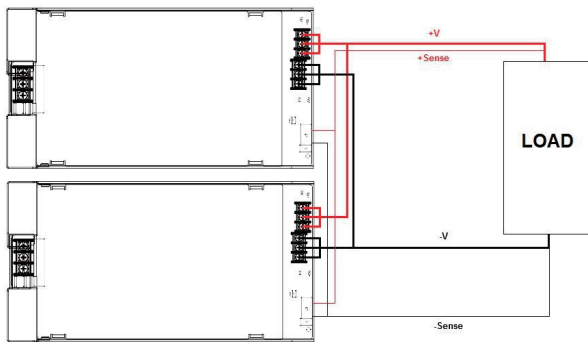
## Section 6.5

### Parallel Connection and N+1 Redundant operation

#### How to Connect in Parallel

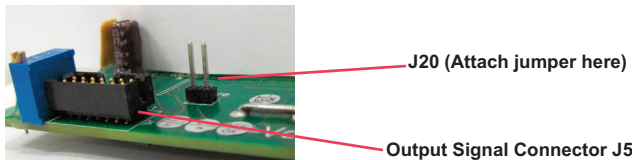
To achieve increased current capacity, 2 or more Xsolo power supplies may be connected in parallel.

To connect in parallel the current share header J20 must be added to each Xsolo product, all -Vo pins must be connected together and then the outputs must be trimmed to within 5mV of each other using the on-board potentiometer.



For optimal current sharing with OR-ing fet option a 10% min load is recommended. If paralleling 3 or more Xsolos consult Excelsys for applications support.

**Recommended Jumper for J20:** HARWIN M7567-05 (Jumper Socket, Black, 2.54mm, 2-way)



#### How to implement N+1 Redundancy

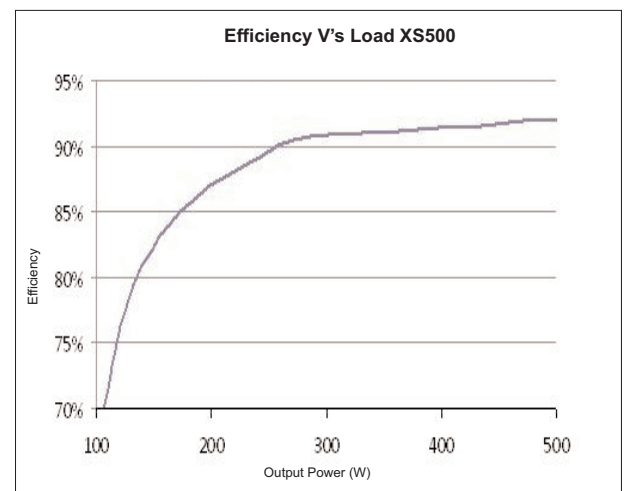
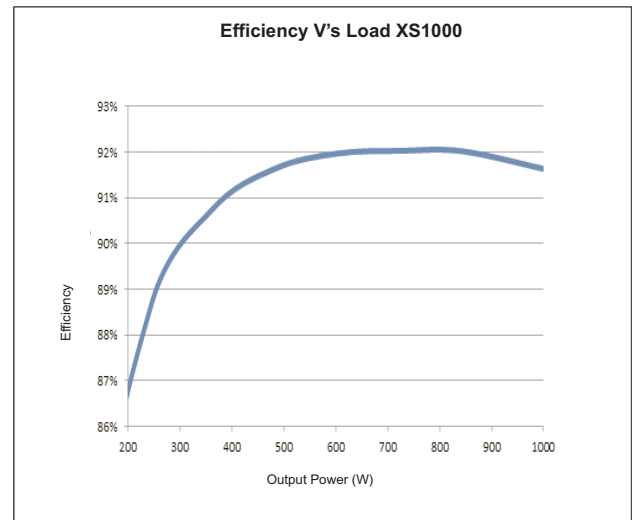
Xsolo can be utilised in systems that require N+1 redundant operation. The OR-ing option (Option 02) must be selected. Then simply connect the required number of Xsolo power supplies in parallel using the procedure for Parallel Connection of Xsolo.

## Section 6.6

### Options

#### Environmental Conformal Coating (Option C)

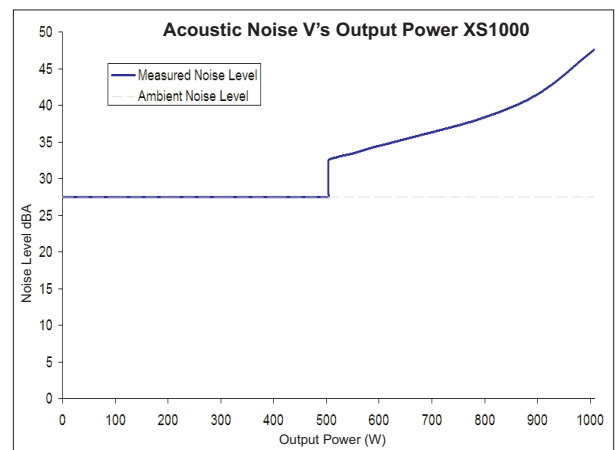
Xsolo is available with conformal coating for harsh environments and MIL-COTs applications. It is IP50 rated against dust and protected against vertical falling drops of water and non condensing moisture.



### Acoustic Noise

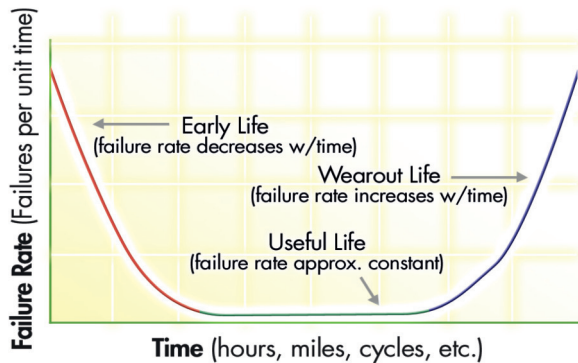
The XS500 provides up to 504W with no fan cooling and is therefore a silent power supply. The XS1000 has an integral temperature controlled fan that only operates if and when the output load and internal component temperatures require. Please refer to the Acoustic Noise vs Output Power XS1000 graph below.

At loads below 500W the fan is not required and the XS1000 is silent.



### 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:

$MTBF = \text{Total} \times t / \text{Failure}$ , 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.

Total FPMH = FPMH1 + FPMH2 + ..... + FPMHn

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

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 40degC 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.

### 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 Xg2, Xg3, Xg4 and Xg5 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 +2000 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 1500VDC.

UltiMod, Xgen: Output to Output chassis 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

Under appropriate test conditions, the UltiMod, Xsolo and Xgen series meets the requirements of EN55022 Class B, without the need for external filtering.

### 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. See performance levels attained above. However, power supply compliance with these limits is not a guarantee of system compliance. System EMC performance can be impacted by a number and combination items. Design consideration such as PCB layout and tracking, cabling arrangements and orientation of the power supply amongst others all directly contribute to the EMC performance of a system.

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

- a. Keep all cable lengths as short as possible.
- b. Minimise the area of power carrying loops to minimise radiation, by using twisted pairs of power cables with the maximum twist possible.
- c. Run PCB power tracks back to back.
- d. Minimise noise current induced in signal carrying lines, by twisted pairs for sense cables with the maximum twist possible.
- e. Do not combine power and sense cables in the same harness
- f. Ensure good system grounding. System Earth should be a “star-point”. Input earth of the equipment should be directed to the “star-point” as soon as possible. The power supply earth should be connected directly to the “starpoint”. All other earths should go to the ‘starpoint’.

#### **EMI for XF**

The XF series of Hi-Rel/MIL-COTS Modular power supplies have been designed for used in harsh environments including military applications. Please contact Excelsys for information realting to MIL461F, CE101 and CE102 EMI characterisation.

## 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 are available 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/>