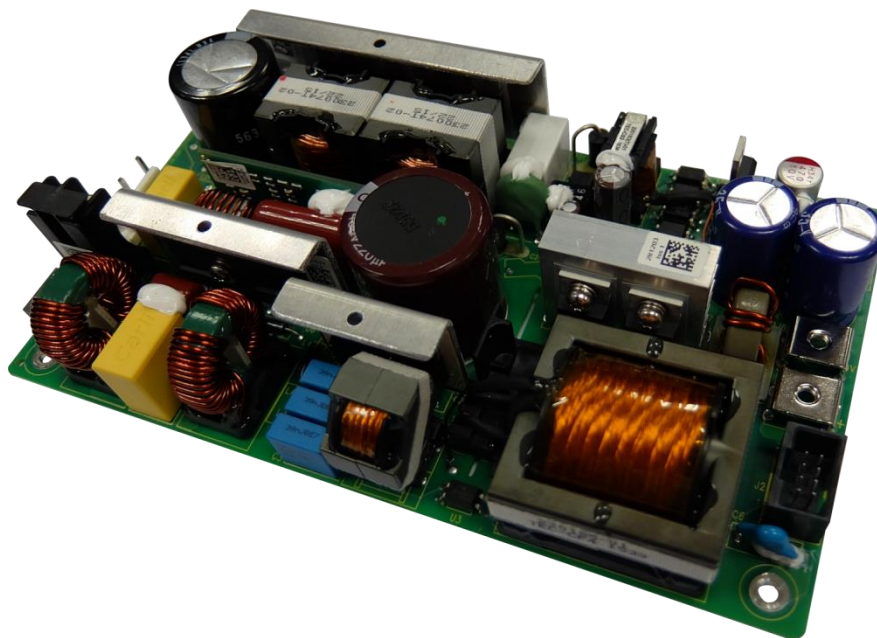


***XMS500***

**AC/DC Power Supply Series**

***APPLICATION NOTE***



## Contents

Contents .....	2
1. INPUT .....	3
AC INPUT LINE REQUIREMENTS .....	3
2. DC OUTPUT .....	3
OUTPUT VOLTAGE ADJUSTMENT .....	3
REMOTE SENSE .....	3
EFFICIENCY .....	4
NO LOAD OPERATION .....	5
CAPACITIVE LOAD OPERATION .....	5
SERIES CONNECTION .....	5
PARALLEL CONNECTION .....	5
OUTPUT CHARACTERISTICS .....	5
RIPPLE AND NOISE .....	5
TRANSIENT RESPONSE PERFORMANCE .....	6
POWER SUPPLY TIMING .....	7
SIGNALS .....	7
OVERSHOOT AT TURN ON/OFF .....	8
OUTPUT PROTECTION .....	8
COOLING REQUIREMENTS .....	9
3. RELIABILITY .....	10
4. ELECTROMAGNETIC COMPATIBILITY .....	11
INSTALLATION FOR OPTIMUM EMC PERFORMANCE .....	11
5. CONNECTIONS .....	12
(J1) AC Input Mating Connector Parts .....	12
(J1) Class I AC Input Connector Pin Definition .....	12
(J1) Class II AC Input Connector Pin Definition .....	12
(J2) Signal Output Mating Connector Parts .....	12
(J2) Signal Output Connector Pin Definition .....	12
(J3) Fan Output Mating Connector Parts .....	13
(J3) Fan Output Connector Pin Definition .....	13
6. MOUNTING .....	13
7. WEIGHT .....	13

## 1. INPUT

### **AC INPUT LINE REQUIREMENTS**

See datasheet for specification of input line requirements (including Input voltage range, Input frequency, Input harmonics, Input current and leakage current)

The power supply will automatically recover from AC power loss and capable of start-up with maximum loading at 90VAC.

Repetitive ON/OFF cycling of the AC input voltage will not damage the power supply or cause the input fuse to blow.

- **Input Fuses**  
Two internal fuses are fitted, one in each AC line. These fuses are not user serviceable. Fuses are rated F10AH; 250Vac.
- **Input Undervoltage**  
The power supply is protected against the application of an input voltage below the minimum specified so that it shall not cause damage to the power supply.

The typical turn on voltage is 82VAC, typical turn off voltage is 70VAC. (Full load, 25°C ambient)

## 2. DC OUTPUT

### **OUTPUT VOLTAGE ADJUSTMENT**

Consult technical sales for Voltage Adjustment (Factory Set)

Model	Nominal Output Voltage	Adjustment Range
XMS500-12	12V	11.6 to 13.2V
XMS500-24	24V	23.8 to 25.2V
XMS500-36	36V	36V
XMS500-48	48V	47.0 to 50.0V

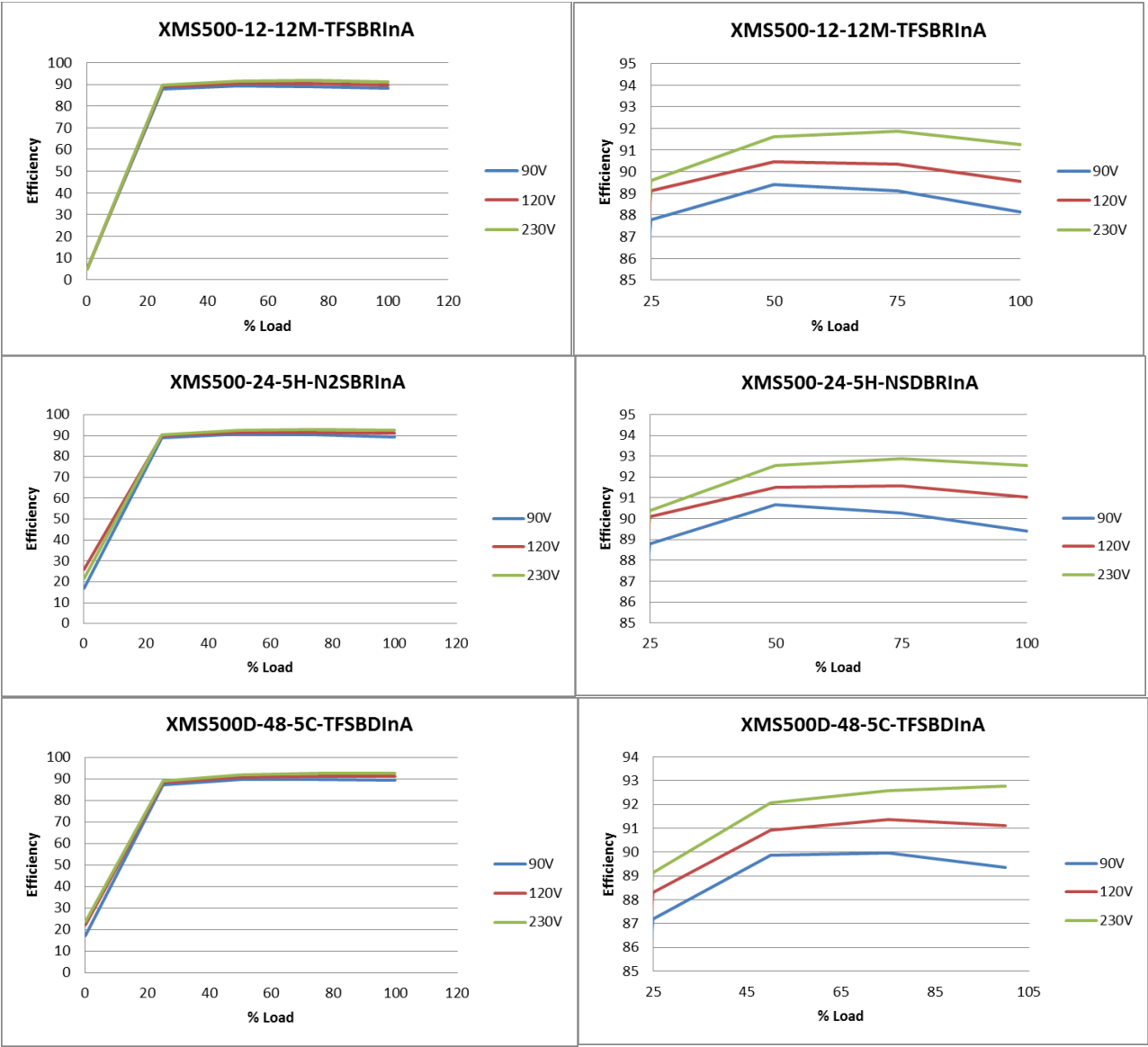
### **REMOTE SENSE**

No remote sense connection is available

**EFFICIENCY**

The following charts show the typical efficiency of the XMS500.

**XMS500**



## NO LOAD OPERATION

No minimum load is required for the power supply to operate within specification.

## CAPACITIVE LOAD OPERATION

The maximum capacitance that can be connected to the output is as follows:

Model Number	XMS500-12	XMS500-24	XMS500-36	XMS500-48
Maximum Capacitance ( $\mu\text{F}$ )	40,000	22,000	12,000	8,000

## SERIES CONNECTION

It is possible to connect multiple XMS500 power supplies in series. Do not exceed 150V for the total voltage of outputs connected in series.

Each XMS500 should have a diode fitted across the output and rated for the output current of the XMS500.

The outputs connected in series are non-SELV (Safety Extra Low Voltage) if the total output voltage plus 30% of the highest maximum rated output voltage, exceeds 60V (the 30% addition allows for a single fault in any one individual channel).

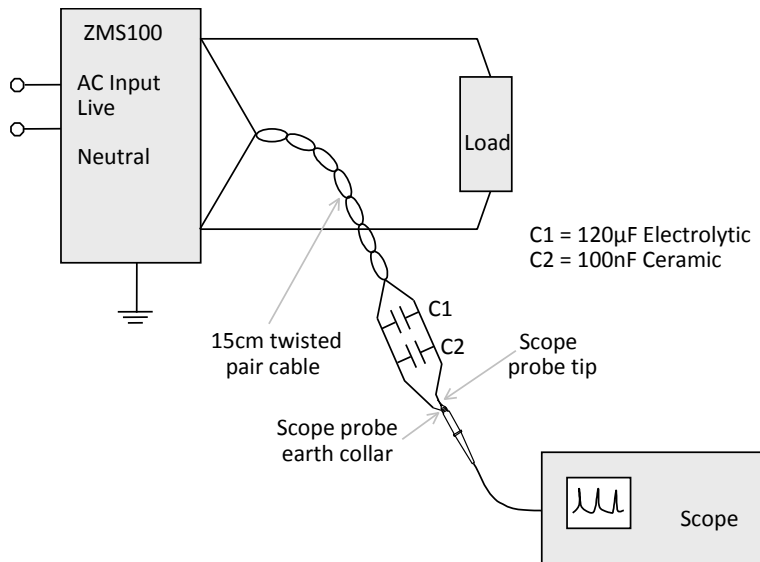
## PARALLEL CONNECTION

Outputs must not be connected in parallel as this may cause overheating and reduced field life.

## OUTPUT CHARACTERISTICS

### RIPPLE AND NOISE

Ripple and noise is defined as periodic or random signals over a frequency range of 10Hz to 20MHz. Measurements are to be made with a 20MHz bandwidth oscilloscope. Measurements are taken at the end of a 150mm length of a twisted pair of cables, terminated with a 100nF ceramic capacitor and a 120 $\mu\text{F}$  electrolytic capacitor. The earth wire of the oscilloscope probe should be as short as possible; winding a link wire around the earth collar of the probe is the preferred method.



Ripple and Noise Measurement

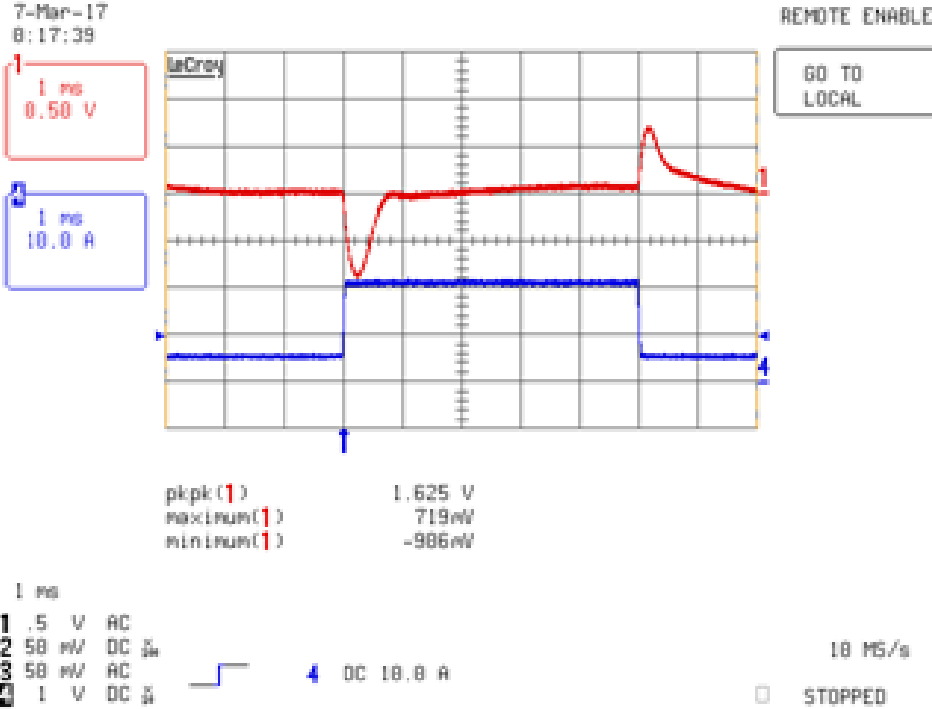
TRANSIENT RESPONSE PERFORMANCE

The transient response specification refers to a 25% - 100%, 100Hz repetition rate, 50% duty cycle at >=25°C ambient temperature

Dynamic Load Response

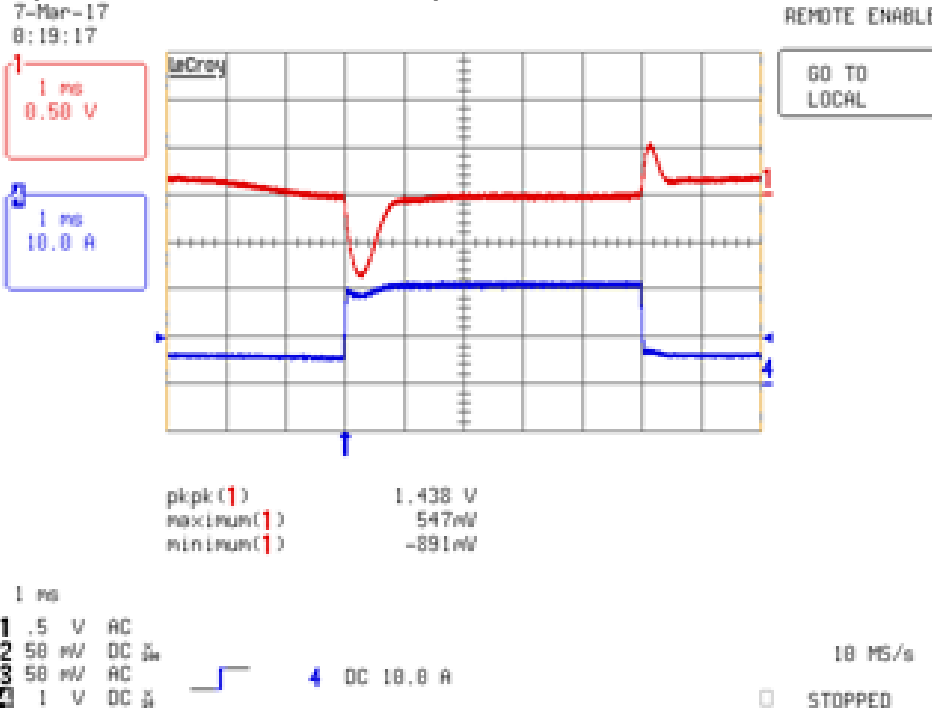
For a 75%, 25% - 100%, load change the output voltage will remain within 5% of the nominal output voltage. The output will recover to within 2% of the nominal output voltage in <= 1ms for a 25% - 100% load change.

XMS500-12 model



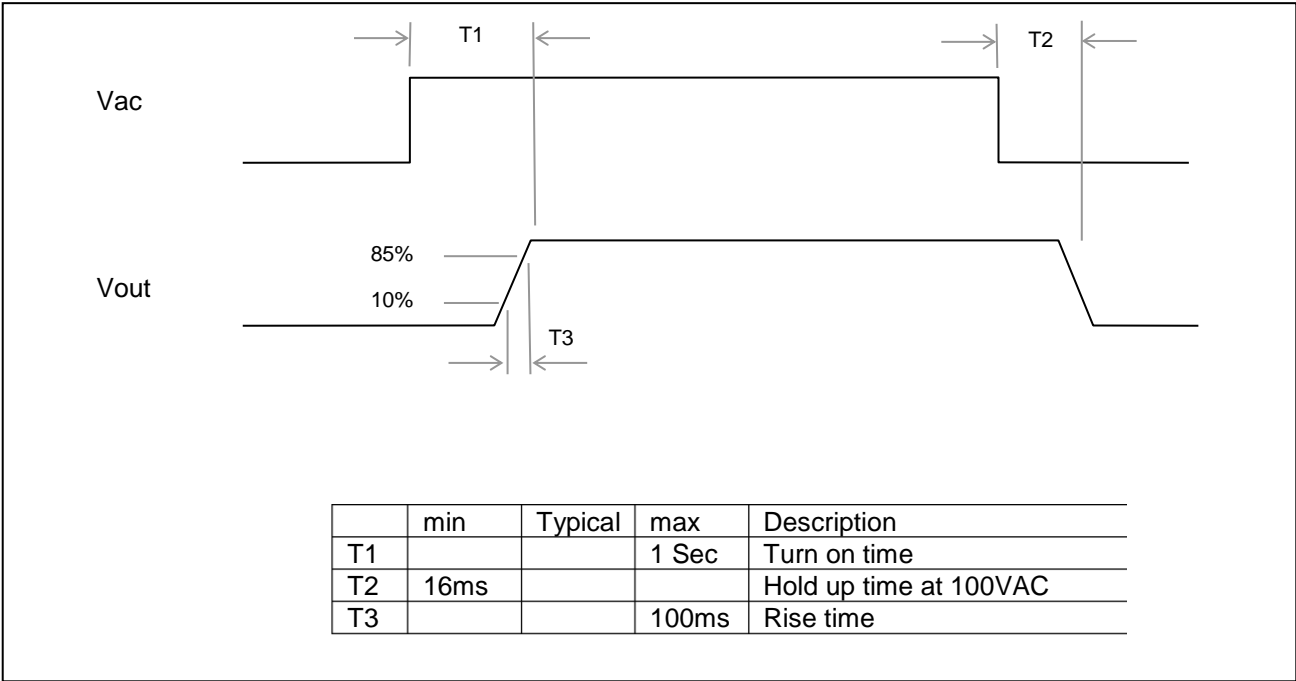
25% to 100% load change; 264Vac input

Capacitance added across the output will further can reduce over/undershoot as shown below



25% to 100% load change with 22,000uF capacitance; 264Vac Input

**POWER SUPPLY TIMING**



**Output timing diagram**

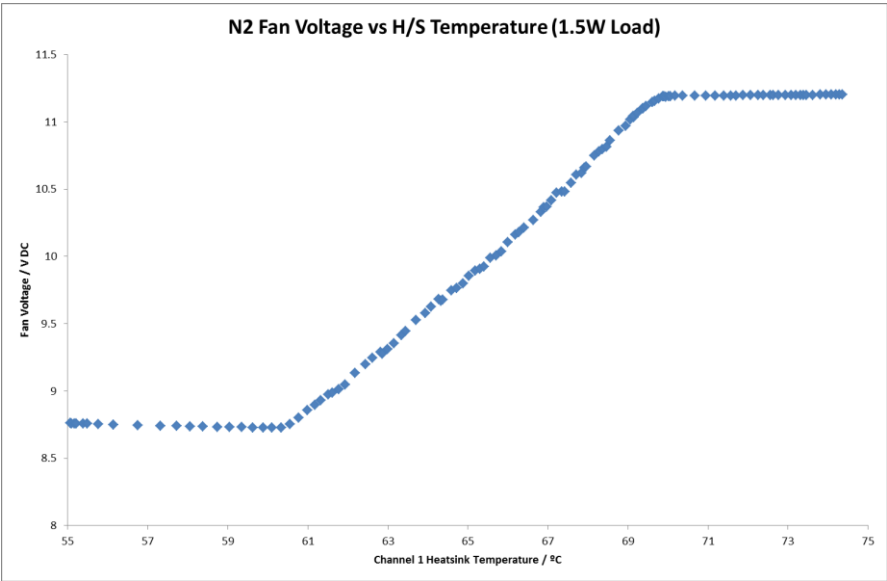
**SIGNALS**

**STANDBY SUPPLY**

Do not connect if Standby type “NN” (none) is fitted.  
 An output that is isolated from the main output channel. It is not affected by the remote on/off.  
 5V / 0.5A, 5V / 2A and 12V / 1A versions are available.

**FAN SUPPLY**

No connection available if Fan Supply type “N” is fitted  
 Fan Supply type “TF” is not user accessible. Top Fan provides fixed speed fan operation.  
 Fan Supply type “N2” provides a variable output with maximum 3W power. As temperature of PSU increases/decreases output voltage increases/decreases between range of 7V to 11.5V. Variation depends on load on Channel 1 and ambient temperature, temperature sensor mounted on top of channel 1 output heatsink.  
 Fan Supply type “N3” provides a fixed 12V output with maximum 3W power



## AC FAIL SIGNAL

Do not connect if AC Good type "N" (none) is fitted.

The AC fail signal is internally pulled up to the standby supply. When AC power is removed the AC Fail Signal will go to a logic high state, no advance timing of AC fail

## REMOTE ON/OFF

Control is fitted with an internal pull up resistor to Standby output.

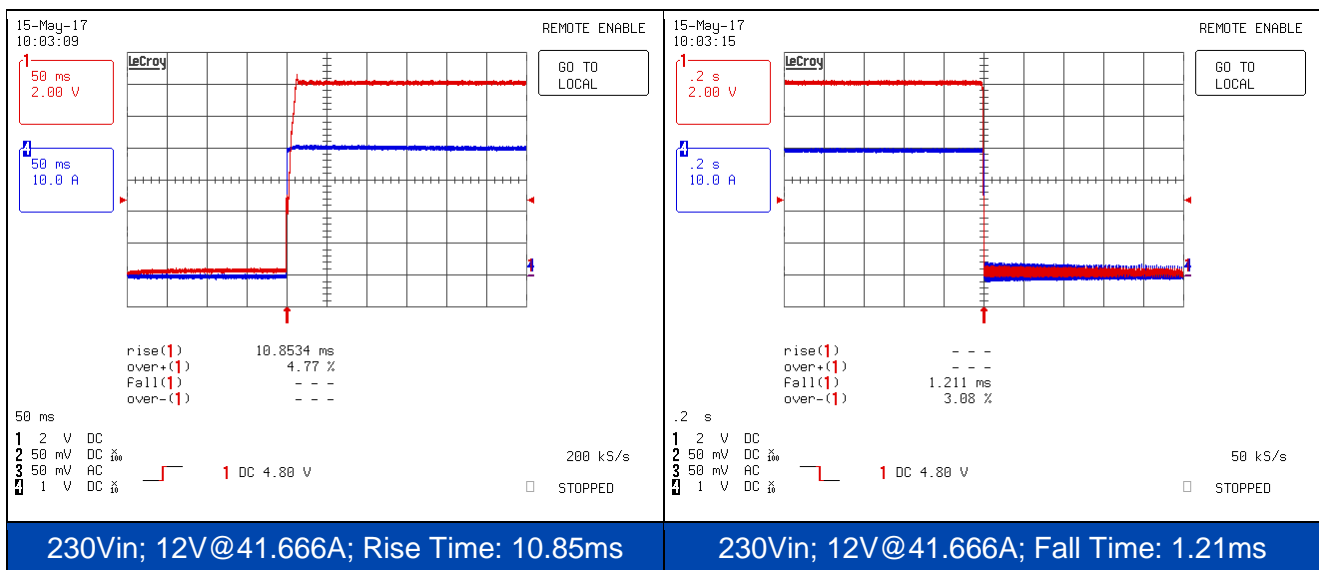
Enable option: Connect to Standby to enable Channel 1, open circuit or 0V to inhibit

Inhibit option: Connect to Standby to inhibit Channel 1, open circuit or 0V to enable

## OVERSHOOT AT TURN ON/OFF

The output voltage overshoot upon the application or removal of the input mains voltage shall be less than 5% (typically <1%) above the nominal voltage. No opposite polarity voltage is present at any time.

The typical turn on/off characteristics for the XMS500-12 unit is shown below.



## OUTPUT PROTECTION

### No Load Operation

The power supply will operate with no load on the output with no damage, hazardous condition or reduction in performance.

### Over current protection

If a load is applied which puts the power supply into over current then the power supply will enter a hiccup state. This will turn the output off for typically 1 second, then on for typically 50ms. This state will continue until the over load is removed.

### Short-Circuit Protection

A short circuit is defined as an impedance of <0.1 Ohms placed between the DC return and any output. A short circuit on the output will cause no damage to the power supply and will cause it to shutdown. The power supply will attempt to restart until the short-circuit is removed. After removal of the short circuit, the power supply will maintain normal operation.

### Over temperature protection

If the XMS500 is operated without adequate cooling it will result in an over temperature condition and the power supply will shutdown and latch off. To correct this, improve the cooling of the power supply, remove AC supply for 10 seconds and then reapply

### Over voltage protection

An overvoltage on the output will cause the power supply to shut-down. To restart, remove the ac supply for at least 10 seconds and then reapply.



## COOLING REQUIREMENTS

### Convection Cooling

XMS500 is suitable for use in certain convection applications. Its suitability depends on many factors including the load profile and ambient temperature. Please contact technical sales for assistance.

Above 50°C ambient, the output power (and output current) must be de-rated by 2.5%/°C up to 70°C.

### Fan Noise

The fan noise figures detailed below are for Top Fan type units. 12V and 48V units use a different fan from 24V units. The sound measurements were made in accordance with ISO 3744

#### 12V and 48V Channel 1 Top Fan Versions

Lp(B)	29.06	
L'p(ST)	30.97	
K1	4.49	
K2	1.19	
Lp	25.30 dB	Surface Time Averaged Sound Pressure level
Lw	33.28 dB	Sound Power level
V*Ir	1.45 dB	Apparent surface sound pressure level non-uniformity index

#### 24V Channel 1 Top Fan type

Lp(B)	28.05	
L'p(ST)	33.73	
K1	1.37	
K2	1.19	
Lp	31.17 dB	Surface Time Averaged Sound Pressure level
Lw	39.15 dB	Sound Power level
V*Ir	0.88 dB	Apparent surface sound pressure level non-uniformity index

**3. RELIABILITY**

Calculated according to Telcordia SR332 Issue 2, Method I, Case 3, Ground Benign Controlled, at 510W, 230Vac and 35°C

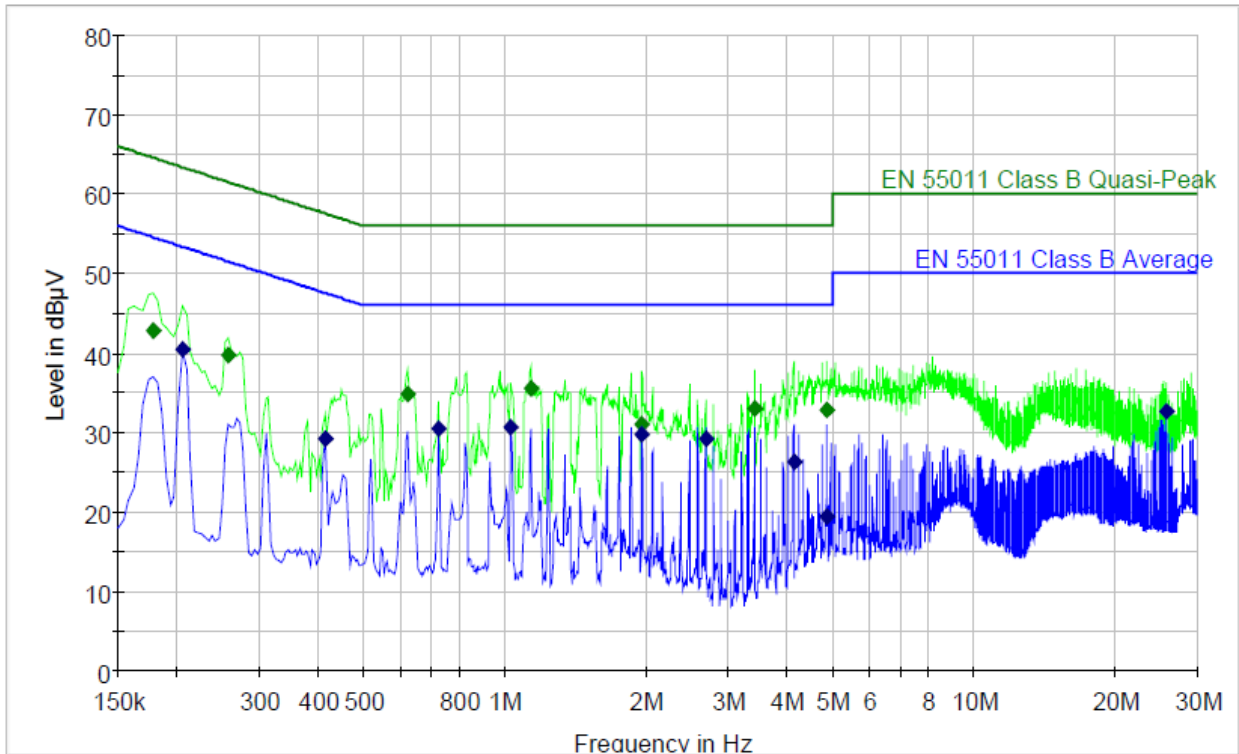
510W forced air cooled – 476,339 hours

Electrolytic Capacitor Lifetime

<b>U-Chassis variant - Wind tunnel – Ducted - Electrolytic capacitor lifetime (Hours)</b>				
		Main output voltage variant		
Ref	Description	12V	24V	48V
C4	Main Output Capacitor	520049 / 520049	595800 / 893700	763557 /
C15	Main Output Capacitor	557684 / 557684	657759 / 986639	766363
C9	Boost Capacitor	602001 / -		
C13	Boost Capacitor	376028 / 378380		
		Auxiliary output voltage variant		
		5H	5C	12M
C17	AUX_SEC Decoupling Cap	215959 / 215959	139604 / -	NF
C19	Aux Output Capacitor	112315 / 70635	184103 / -	596087 / 198696
C20	Aux Output Capacitor	129714 / 88788	261864 / -	683712 / 227904
C16	VCC Decoupling Capacitor	66023 / -	65535 / -	65850 / -
C5	+V Decoupling Capacitor	240948 / 240652	235582 / 235003	234525 / 233891
<b>Top Fan variant - Thermal chamber - Electrolytic capacitor lifetime (Hours)</b>				
		Main output voltage variant		
Ref	Description	12V	24V	48V
C4	Main Output Capacitor	387890 / 387890	534737 / 802105	565974 / 454120
C15	Main Output Capacitor	474842 / 474842	604842 / 907264	636441 / 511296
C9	Boost Capacitor	382581 / -		
C13	Boost Capacitor	437669 / 440407		
		Auxiliary output voltage variant		
		5H	5C	12M
C17	AUX_SEC Decoupling Cap	216709 / 216709	140088 / -	NF
C19	Aux Output Capacitor	111771 / 70293	183212 / -	593201 / 197734
C20	Aux Output Capacitor	107574 / 73634	217169 / -	567015 / 189005
C16	VCC Decoupling Capacitor	135009 / -	134010 / -	134654 / -
C5	+V Decoupling Capacitor	245160 / 244859	239700 / 239110	238625 / 237979

## 4. ELECTROMAGNETIC COMPATIBILITY

Typical Conducted Emissions result for the XMS500-24-5H at 510W output:



### INSTALLATION FOR OPTIMUM EMC PERFORMANCE

#### Mounting

All equipment should ideally be mounted inside an earthed metal box. Alternatively an earthed metal plate can be used to mount the power supply and load. All four mounting holes (one in each corner) on the XMS500 should be utilized for best electrical and mechanical performance, with 6mm (minimum height) metal stand offs.

The XMS500 can be ordered as a Class II power supply (without a ground connection). Perforated Frame option available for Class II PSU mounted in plastic enclosure (consult technical sales for details)

#### Cables

All cables (both AC input and DC output) should be run as close as possible to the earthed metal box/plane. AC input cable should be a twisted group laid as flat to the earthed metal box/plane as possible.

All output cables should be routed as far away from the input cables as possible. If the input and output cables must be run close to each other screen one (or ideally both).

The positive and negative supply cables should be twisted together. All cable run loops should be kept as small as possible (this should be implemented in the system PCB design also).

#### Connecting between boxes

If cables must be connected between equipment boxes, then at the closest possible point to the port where the cables exit the 1st enclosure connect 100nF decoupling Y caps (between the output and earth). Note that these capacitors must be rated at the working voltage. Ideally these capacitors should be between all signal cables which have to connect between boxes although this may not be practical if fast switching [digital] signals are involved (if this is the case then smaller value Y capacitors should be used).

## Earth star point

Where the AC supply enters the equipment, this should be taken to a 'star point' chassis mounted earth point (Note for compliance with EN60950-1 requires the main protective earth to have its own dedicated spring washer and nut) as close as possible to the mains inlet. All other earth points should be taken back to this point only.

## ESD

Where signal or control ports are connected to a user accessible panel (for example PSU inhibit to a switch, AC Good to an indicator circuit), these ports must be protected from electrostatic discharges. This can be done by selecting suitable panel controls or by fitting ESD suppression devices to the connections on the panel.

## Switching frequency

The XMS500 has a variable switching frequency ranging from 64kHz to 150kHz, depending upon the input voltage, output voltage and output load.

## 5. CONNECTIONS

### (J1) AC Input Mating Connector Parts

PSU Class	Molex Part Numbers		Crimps Required
	Housing	Crimp	
I	09-50-8051	08-70-1030	2
II	09-50-1031	08-70-1030	3

### (J1) Class I AC Input Connector Pin Definition

Pin	Function
J1-1	Live
J1-2	No connection
J1-3	Neutral
J1-4	No connection
J1-5	Earth

### (J1) Class II AC Input Connector Pin Definition

Pin	Function
J1-1	Live
J1-2	No connection
J1-3	Neutral

### (J2) Signal Output Mating Connector Parts

Molex Part Numbers		Crimps Required
Housing	Crimp	
90142-0008	901190109	6*

\*Depending on configuration. e.g. where no standby is configured , no crimps are required

### (J2) Signal Output Connector Pin Definition

Pin	Function
J2-1	+ Vout Standby
J2-2	- Vout (0V)
J2-3	+ Vout Standby
J2-4	- Vout (0V)
J2-5	Remote ON/OFF
J2-6	AC Fail
J2-7	Temperature Sense**
J2-8	Temperature Sense**

\*\* Custom option only

**(J3) Fan Output Mating Connector Parts**

Molex Part Numbers		Crimps Required
Housing	Crimp	
51191-0200	50802-9001	2

**(J3) Fan Output Connector Pin Definition**

Pin	Function
J2-1	- Vout (0V)
J2-2	+ Vout Fan

**6. MOUNTING**

Please refer to handbook for allowable orientations.

Mount using all four corner holes for Class I models.

**7. WEIGHT**

XMS500 Top Fan models weigh approximately 860 grams

XMS500 U chassis models weigh approximately 730 grams

XMS500 Open Frame models weigh approximately 570 grams

XMS500 Perforated Frame models weigh approximately 695 grams