



EEN-027 Multi-Mode Switching Power Supply

V (ENG) R1
2010-03-24

Introduction

This document explain one of the solutions ODEL S.p.A. is adopting to follow an environment sostenibility policy: the efficiency in power managent according to the newest guidelines.

Since 1951 Odel is involved in giving it's customer the best quality/price ratio. To achieve this goal Odel knows very well it's products because Odel is involved in the whole product life cycle, from developing, prototyping, manufacturing, and reviewing it.

Odel takes care of engineering and manufacturing of its high voltage generators from developing of electronics, power electronics and mechanical parts, also software engineering is internally done by Odel engineers.

This is the reason why Odel is proud to introduce in X-ray generators MULTI MODE SMART POWER CONTROL; this control modality lower the high voltage ripple also in low power output.

Low ripple is now achieved thanks to a smart control instead of using high frequency switching avoiding high loss due to high frequency power converters.

MULTI MODE SMART POWER CONTROL uses an adaptive power converter control way of switching due to the power required from the load; it changes from ZCS (high power) to ZCS PWM or BURST in function of output power.

This MULTI MODE SMART POWER CONTROL is used EFFECTIVENESS whith all applications that's asks for low high voltage ripple such as flat panel applications.

POWER IS NOTHING WITHOUT EFFECTIVENESS CONTROL.

High Frequency Generator and Power Efficiency

Modern tendencies on power supply realizations impose high efficiency in power management.

High Efficiency is realized by reducing the power dissipation, keeping output performances in a compliant interval on the whole power range.

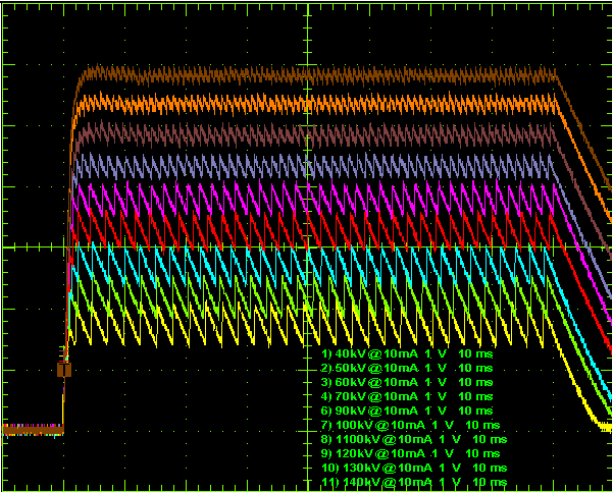
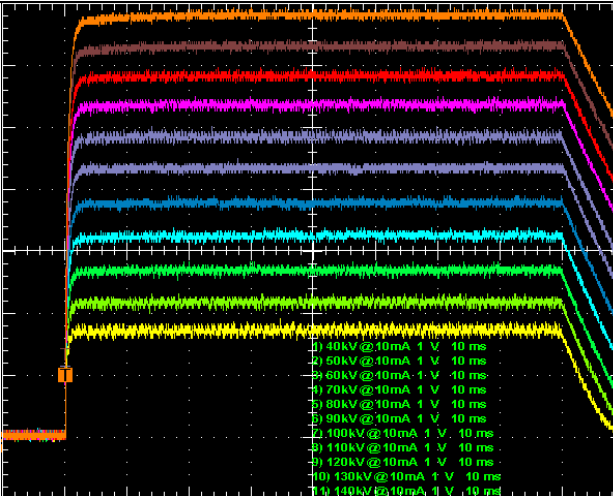
Reducing power dissipation means

- realize low loss magnetic circuit
- realize snubber-less power inverter
- reduce the switching frequency

ODEL S.p.A. generators are provided with a special embedded Digital Power Algorithm to realize a Multi-Mode Switching Converter in order to reduce the output ripple. This,

- compared to traditional 30kHz Generator will reduce the output ripple as in 100kHz technology
- compared to 100kHz Generator will reduce the heat produced in low power output, so no air ventilation or contactor to change the resonant period are need

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NOMEFILE	CLASSE	1
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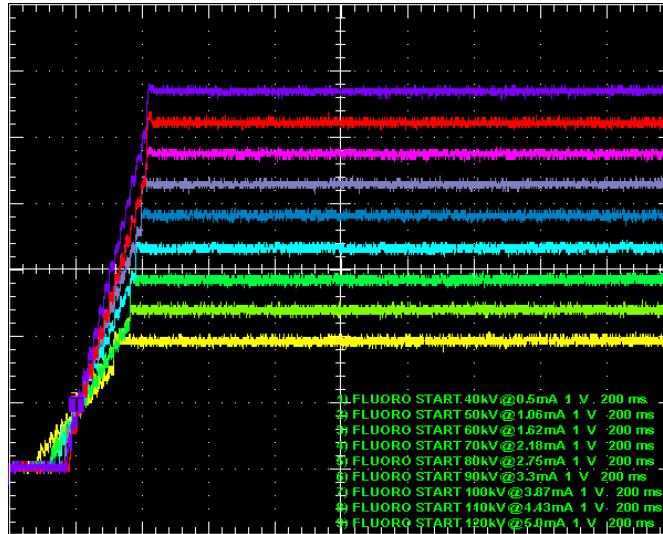
kV curves @10mA 80ms	
Non MMSPC Generator	MMSPC Generator
	
<p>Typical worst case of an IGBT based generator in resonant mode: The very high output ripple is due to high energy quantum transfer.</p>	<p style="text-align: center;">The same generator improved with MULTI MODE SMART POWER CONTROL</p> <p>The low output ripple is due to a proprietary Embedded Digital Power Algorithm which provides a Multi-Mode Switching Power supply capability</p>

Applying this digital power algorithm it is granted a very low output ripple compared to 3phases tradition generator, thyristors based medium frequency generator as well as classic 30kHz (Giant Transistors or IGBT based) generator, and no necessity to cool down the system using fans in continuous mode, as reported below:

CONTINUOUS MODE

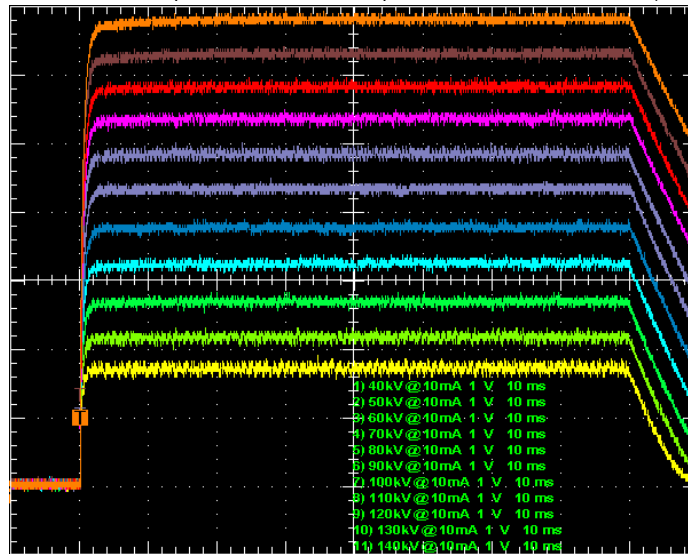
In Fluoroscopy output ripple lower than 2% for every load starting from 40kV @ 0.5mA till 120kV@5mA

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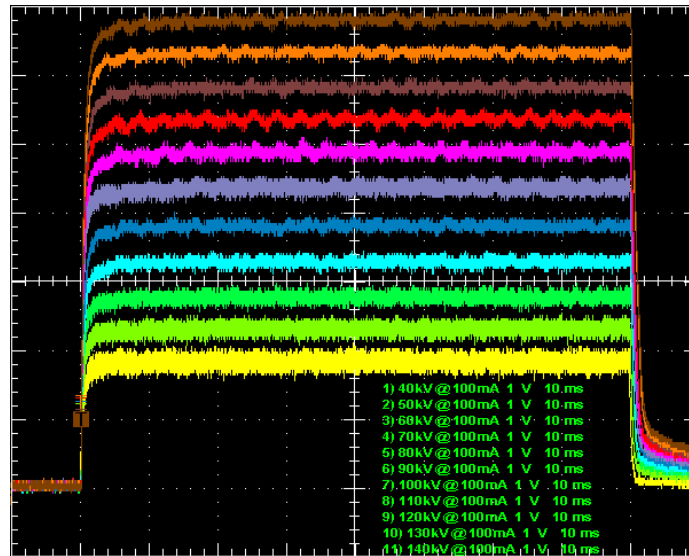
INTERMITTENT MODE

PULSED FLUOROSCOPY, RADIOGRAPHY, ANGIOGRAPHY, CINERADIOGRAPHY).



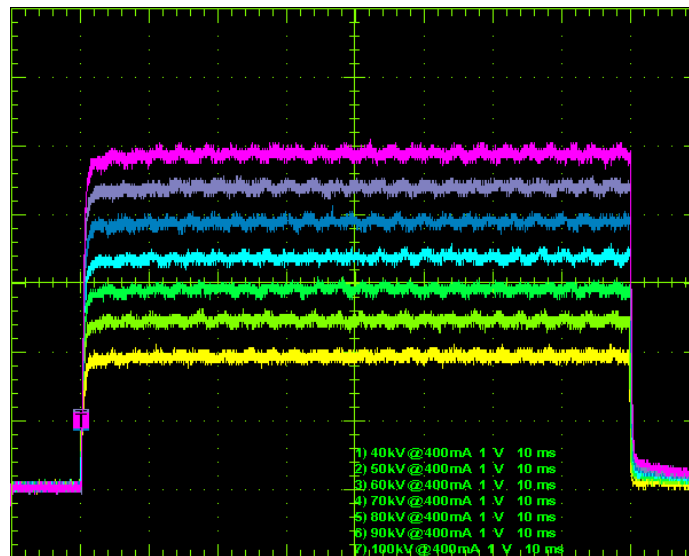
kV curves @10mA 80ms

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kV curves @100mA 80ms

Maximum ripple absolute output 3kV @ 110kV
 Maximum ripple percentage output = 3kV @ 110kV less than 3% (red track)



kV curves @400mA 80ms

Maximum ripple absolute output 3kV @ 100 kV
 Maximum ripple percentage output = 2kV @ 80kV = 5% (cyan track)

Notice

Generator used in Digital Radiography system from 2007 are equipped with MULTI MODE SMART POWER CONTROL

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