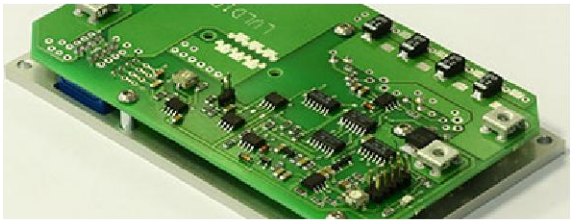
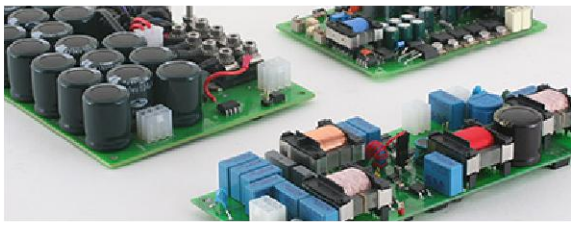
Capacitor Charging

- capacitor charging power supplies
- capacitor banks



Diode Driving

- laser diode drivers with AC input
- pulsed laser diode drivers with DC input
- thermocontrollers



Electrooptics

- electronics for pulse-picking applications
- Pockels cell driver boards
- bench-top Pockels cell drivers

Flashlamp Driving

- flashlamp drivers
- discharge circuits
- simmer boards

Contents

OEM-TECH GmbH » Hans-Knöll-Str. 6 » 07745 Jena, Germany » Tel. +49 3641 384859 » Fax +49 3641 384860 » E-mail: germany@oem-tech.de » www.oem-tech.de

Capacitor Charging Power Supplies

PCA-10, PCA-20, PCP-17, and PCP-35 capacitor charging power supplies are developed for application in pumping systems of flashlamp-pumped solid-state laser equipment.

The PCA-10 and PCA-20 are **medical** capacitor charging power supplies suitable for application in medical laser equipment. All the parameters meet the latest versions of the medical standards requirements: IEC 60601-1 for electrical safety, IEC 61000-3-2 for active power factor correction (PFC) and EN 55011 / CISPR 11 Class A safety requirements for EMI and leakage current. The PCA-10 and PCA-20 can be used in different kinds of medical devices without any additional filtration or protection measures.

The PCA-10 and PCA-20 have identical technical ideology, whereas the PCA-10 with the maximal output power of 1kW is the best solution for laser systems with medium power. The PCP-20 is basically a modern and effective AC/DC converter with the maximal output power of 2kW and wide range of available output voltages. The efficiency of the supply at maximum output voltage is over 85%.

The PCP-17 is intended as extremely compact and functional device for industrial and laboratory applications. It is basically a modern and effective AC/DC converter with the maximal output power of 1.75kW and wide range of available output voltages. However, relatively low power factor correction (PFC) value of 0.9 is insufficient for using the device in medical equipment. The supply is easy for embedding in laser systems. Two and more supplies may operate in parallel mode. The standard PCP-35 consists of two paired PCP-17 modules. The most of their characteristics are the same.

PCA-10
medical

PCA-20
medical

PCP-17

PCP-35

Capacitor Charging Power Supplies

		PCA-10 medical	PCA-20 medical	PCP-17	PCP-35
Input	Voltage	90 - 264VAC 50/60Hz	90 - 264VAC 50/60Hz	300VDC or 230VAC rectified	230VAC 50/60Hz
	Current	< 12A			
Output	Maximal output power	**1000W**	**2000W**	**1750W**	**3500W**
	Maxiaml output voltage	300/500/700/1000/1500V standard modifications up to 2000V on request			
	Modifications	partial discharge modification, complete discharge modification			
	Voltage stability	< 0.5%			
	Pulse to pulse stability	< 0.5%			
	Efficiency	more than 85%			
Safety	PFC coefficient	> 0.98 (active)	> 0.98 (active)	0.90 (partial)	0.90 (partial)
	Leakage current	< 200µA			
	Main safety standard	IEC 60601-1			
	Isolation	4000VAC (2x MOPP)			
	EMC	EN 55011 (Class A)			
	Protections	HV arc ground during operation Turn on with open circuit Turn on with short circuit Shut down on over-temperature over-voltage and open interlock			
Environment	Cooling	forced air (with built-in fan)			
	Operation temperature	+10°C to 40°C			
	Storage temperature	-20°C to +60°C			
	Humidity	90%, non-condensing			
Other	Size (L x W x H)	176x118x122mm	210x150x130mm	155x140x75mm	220x150x135mm
	Weight	1.9kg	2.8kg	1.3kg	2.8kg

Capacitor Banks

Banks of aluminum electrolytic capacitors, consist of 20 or 28 small electrolytic capacitors with 470µF or 1000 µF each. They can be used instead of conventional large caps.

CB-350V-20mF

20 small SAMWHA 350V 1000µF capacitors connected in parallel

maximal voltage: 350V
nominal capacitance: 20000µF
rating: 2000 hours @ 85°C

dimensions: 210x150x60mm
weight: 3.0kg

CB-450V-14mF

28 small SAMWHA 450V 170µF capacitors connected in parallel

maximal voltage: 450V
nominal capacitance: 14000µF
rating: 2000 hours @ 85°C

dimensions: 210x150x60
weight: 3.0kg

CB-700V-5mF

20 small SAMWHA 350V 1000µF capacitors connected in series and in parallel

maximal voltage: 700V
nominal capacitance: 5000µF
rating: 2000 hours @ 85°C

dimensions: 210x150x60mm
weight: 3.0kg

CB-900V-3.5mF

28 small SAMWHA 450V 170µF capacitors connected in series and in parallel

maximal voltage: 900V
nominal capacitance: 3500µF
rating: 2000 hours @ 85°C

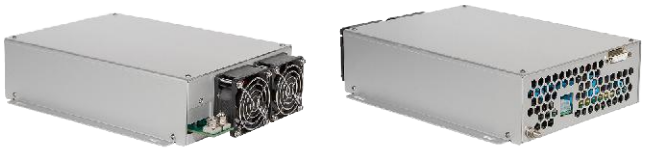
dimensions: 210x150x60mm
weight: 3.0kg

Laser Diode Drivers with AC Input

Laser Diode Drivers LDD for cw and pulsed lasers are intended for single laser diode driving as well as for driving of laser diode arrays. Input voltage, max. output power, max. output current, max. output voltage are selectable in wide ranges. The modules can be used also for medical applications. The maximal standatd available output power is 2kW, whereas there are standard laser diode drivers in serial production with 150W (LDD-150), 250W (LDD-250), 400W (LDD-400), 600W (LDD-600), 1kW (LDD-1000), and 1.5kW (LDD-1500).

LDD-150, LDD-250, LDD-400

LDD-600, LDD-1000, LDD-1500



Input	Voltage	90-254VAC, 50/60 Hz
	Current	3A ... 15A, depends on output power
Output	Maximal power (W_{max})	selectable in range 150W ... 2kW
	Maxiaml current (I_{max})	selectable in range: 5A … 75A (max. power 150W, LDD-150) or 10A ... 100A (power 250W ... 1.5kW, LDD-250 ... LDD-1500)
	Maximum voltage (U_{max})	is obtained automatically from formula W_{max} / I_{max}
	Rise/fall time	< 1ms (10% to 90% full current), < 500µs on request
	Current regulation accuracy	< 1% of I_{max}
	Current value error	< 1% of I_{max}
	Current overshoot	< 1% of I_{max}
	Efficiency	> 80%
Safety	PFC value	> 0.98 (active)
	Leakage current	< 150 µA
	Safety approval	IEC60950, IEC60601-1
	Case fault voltage	4000 VAC
	EMC approval	EN55011 (Class A)
Interface	Connector	15 Pin "D"-Sub Female
	Current program	analog, 0-10 V
	Current monitor	analog, 0-10 V
	Voltage monitor	analog, 0-10 V
Environment	Cooling	forced air (with built-in fan)
	Operating temperature	0°C to +40°C
	Storage temperature	-20°C to +60°C
	Humidity	90%, non-condensing
Other	Size (L x W x H)	250x180x70mm (150W ... 400W), 290x220x70mm (600W ... 1.5kW)
	Weight	1.8kg 2.9kg

Pulsed Diode Drivers with DC Input

The Pulsed Diode Drivers PDD-1000 is a series of high power pulsed diode drivers. The peak output power is up to 10kW (with user selectable maximal current and maximal voltage. The averaged output power is up to 1000W.

The PDD-1000 is especially designed for direct diode hair removal application. As a result the input voltage is DC (supposing the driver is powered from the buffer capacitor battery included in system). Such compositions allow also to use both flashlamp and diode applicators in the only system (e. g. capacitor charging power supply PCA-10 with PDD-1000).

Input	Power input voltage	300VDC by default (other on request)
	Power inpur current	up to 5A, typically
	Module input	+24VDC, 1A max
Output	Peak power (P_{peak})	10kW
	Maximal voltage (V_{max})	50V by default (up to 200V by request, V_{max}*I_{max}< P_{peak})
	Maximal current (I_{max})	200A by default (other on request, V_{max}*I_{max}< P_{peak})
	Pulse width	1ms - 100ms (other on request)
	Rise/fall time	<1ms (10-90% level)
	Average power	1kW
	Pulse repetition rate	limited with pulse energy and max. average power only
	Current accuracy	< 1% of I_{max}
	Current overshoot	< 1% of I_{max}
Safety	EMI	EN55011 since module is a DC/DC converter, other safety features must be realized in AC/DC converters used in system
Environment	Cooling	forced air (with built-in fan)
	Operating temperature	0°C to +40°C
	Storage temperature	-20°C to +60°C
	Humidity	90%, non-condensing
Other	Size (L x W x H)	256x199x81mm
	Weight	2.2kg

Thermocontrollers

The thermocontrollers TEC and TEC-BT are designed to control the temperature of the objects and to stabilize it at the certain level.

The TEC is a compact and powerful temperature controller. The target temperature is set with an analog input voltage. Voltage output is provided to monitor temperature of the object.

The TEC-BT is a standard temperature controller in bench-top plastic case. The target temperature is set either manually via front panel user interface or digitally via RS-232 machine interface. The actual object's temperature is measured and provided to the operator.

TEC

TEC-BT

		TEC	TEC-BT
Input	Voltage	+24VDC	110/230VAC, 50/60Hz max. 2.0A
Output	Voltage	-20V to +20V	-20V to +20V
	Current	up to 10A	up to 10A
	Power	up to 150W	up to 150W
	Feedback loop	10kOhm NTC termistor	10kOhm NTC termistor
	Output temperature range	+10°C to +40°C (other on request)	+10°C to +40°C (other on request)
	Temperature accuracy	0.1ºC	0.1ºC
	Cooling	forced air cooling is needed at >7A operations	forced air cooling with built-in fan
Other	Size (L x W x H)	130x80x30mm	225x200x60mm
	Weight	0.3kg	1.5kg

Electronics for Pulse-Picking Applications

HVSW-03 high voltage switch

High voltage high repetition rate Pockels cell driver:

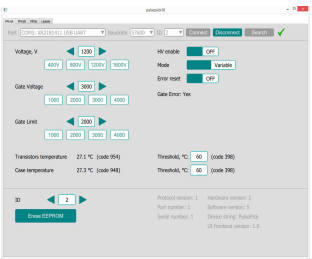
Output voltage: up to 2kV
Repetition rate: up to 1MHz@1.5kV
Risetime/falltime: 5...7ns (depends on load capacitance)
Embedded DC high voltage power supply
Conductive cooling through the bottom surface
Applications: pulse picking, pulse slicing, regenerative amplifier control

PP-CONTROL synchronization board

Precisely synchronizes up to two Pockels cell drivers to the seed oscillator optical pulse train:

1x optical synchro input
1x electrical synchro input
2x independent synchro outputs
up to 2000ns adjustable delay in each channel
+/- 250ps jitter
USB, RS-485 interfaces

PP-KIT developer kit

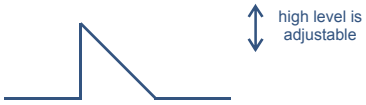


consists of:

PP-CONTROL synchronization board
1 or 2 HVSW-03 high voltage switches
PC software
Auxiliary power supplies, interconnective cables etc.

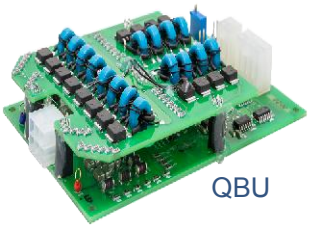
Pockels Cell Drivers

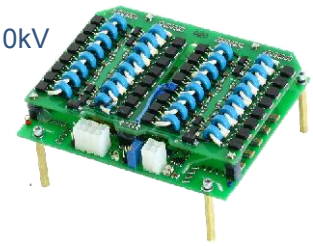
QBD and QBD-mini are a series of high repetition rate Pockels cell drivers allowing simple and reliable control of Q-switched lasers. The output voltages may be selected in range up to 6kV (QBD) and up to 4kV (QBD-mini). The drivers may be manufactured in two modifications: for pull-down scheme (normally on scheme) and for push-up scheme (normally off scheme). The high voltage level, the repetition rate, and the load capacitance depend on each other and can not achieve their maximal values simultaneously. A forced air cooling is required for operation with high repetition rates. The protection against overheating is necessary approx. at 72°C.

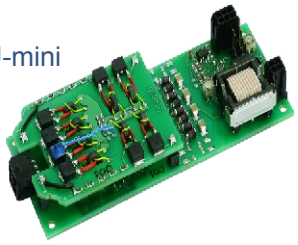
		QBD	QBD-mini
Input	Voltage, Current	+24VDC, 0.8A max	
Output	Working modes:	push-up (= normally off)	
	QBD-(mini-)UP		
		pull-down (= normally on)	
	QBD-(mini-)DN		
	Voltage, low level	fixed, 0V	
	Voltage, high level	regulated, up to 6kV	regulated, up to 4kV
	Repetition rate	up to 50kHz (CW) up to 100kHz (burst-mode)	up to 30kHz (CW) up to 50kHz (burst-mode)
	Rise time (fall time)	< 20ns	
	Recovery time	5-10µs (depends on load)	
	Jitter	10ns	
	Delay time	1µs	
	Load capacitance	up to 0.5nF	
Environment	Operation temperature	+10°C to +40°C (wider temperature range is available on request)	
	Storage temperature	-20°C to +60°C	
	Humidity	90%, non-condensing	
Other	Size (L x W x H)	110x80x25mm	90x50x20mm
	Weight	0.1kg	0.1kg

Pockels Cell Drivers

QBU, QBU-10kV, and QBU-mini are a series of high repetition rate Pockels cell drivers that repeat at their output an external driving TTL signal. As a result they may be used for q-switched lasers of push-up scheme, pull-down scheme as well as for mixed-type or other user-defined schemes. The output voltages may be selected in range up to 6kV (QBU) and up to 3.5kV (QBU-mini). The QBU-10kV is an extension of QBU-series up to 10kV operating voltage range. Due high output voltage it may be used with Pockels cells working under L/2 schemes. The high voltage level, the repetition rate, and the load capacitance depend on each other and can not achieve their maximal values simultaneously. A forced air cooling is required for operation with high repetition rates. The protection against overheating is necessary approx. at 72°C.


QBU

QBU-10kV


QBU-mini


		QBU	QBU-10kV	QBU-mini
Input	Voltage, Current	+24VDC, 0.8A max	+24VDC, 1.6A max	+24VDC, 0.4A max
	Repetition of external low voltage TTL signal			
Output	Working modes:	push-up (= normally off)		
	QBU-(10kV-mini-)UP	 high level is adjustable		
		pull-down (= normally on)		
	QBU-(10kV-mini-)DN	 high level is adjustable		
	Voltage, low level	fixed, 0V		
	Pulse width	200ns ... DC		
	Voltage, high level	regulated, up to 6kV	regulated, up to 10kV	regulated, up to 3.5kV
	Repetition rate	up to 50kHz (CW) up to 100kHz (burst)	>5kHz at full load (10kV, 11pF)	up to 30kHz (CW) up to 50kHz (burst)
	Jitter	±10ns (common) ±1ns (LJ - low jitter)	±1.5ns	±2ns
	Delay time	1µs (common) 100ns (LJ - low jitter)	150ns	150ns
	Rise time (fall time)	approx. 10ns	<20ns / 25ns at load capacitance <11pF	approx. 10ns
Environment	Operation temperature	+10°C to +40°C (wider temperature range is available on request)		
	Storage temperature	-20°C to +60°C		
	Humidity	90%, non-condensing		
Other	Size (L x W x H)	130x80x25mm	132x105x50mm	140x50x20mm
	Weight	0.1kg	0.1kg	0.1kg

Bench-Top Pockels Cell Drivers

The bench-top Pockels cell drivers QBD-BT, QBU-BT, and QBU-BT-10kV are the completed devices based on Pockels cell driver boards QBD, QBU, and QBU-10kV correspondingly. The total load capacitance of Pockels cell and connective cable is assumed as 23 pF (this corresponds to pretty long 50 cm output cable bent in non-optimal way and higher than normal Pockels cell capacitance). The bench-top Pockels cell drivers have internal and external sinchronization modes. The internal synchonization is limited by the output values (voltage - repetition rate):

QBD-BT and QBU-BT	QBU-BT-10kV
0.40...0.79kV - 296kHz	4.00...4.99kV - 50kHz
0.80...1.19kV - 200kHz	5.00...5.99kV - 30kHz
1.20...1.39kV - 160kHz	6.00...6.99kV - 25kHz
1.40...1.59kV - 130kHz	7.00...7.99kV - 20kHz
1.60...1.79kV - 110kHz	8.00...8.99kV - 15kHz
1.80...1.99kV - 90kHz	9.00...9.99kV - 10kHz
2.00...2.49kV - 56kHz	10.00kV - 5kHz
2.50...2.99kV - 40kHz	
3.00...3.49kV - 31kHz	
3.50...3.99kV - 24kHz	
4.00...4.49kV - 18kHz	
4.50...4.99kV - 15kHz	
5.00...5.49kV - 12kHz	
5.50...5.99kV - 11kHz	
6.00kV - 9kHz	

Higher performance can be achieved in external synchronization mode. In burst mode (i.e. for short term operations) the performance increases at least twice and can achieve 100 kHz at low operating voltages and low load capacitances. Higher load capacitance decreases the performance.

QBU-BT

QBD-BT and QBU-BT

QBD-BT

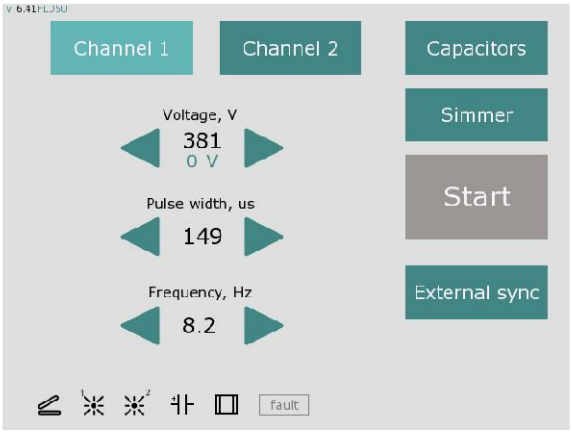
QBU-BT-10kV

Bench-Top Pockels Cell Drivers

		QBD-BT	QBU-BT	QBU-BT-10kV
Input	Voltage	110/230VAC, 50-60Hz		
	Current	< 1A		
	Repetition of external low voltage TTL signal	-		
Output	Working modes:			
	QBD-BT-UP QBU-BT-(10kV)	push-up (=normally off) 	push-up (=normally off) 	
	QBD-BT-DN QBU-BT-(10kV)	pull-down (=normally on) 	pull-down (=normally on) 	
	Voltage, low level	fixed, 0V		
	Sinchronization	internal / external		
	Pulse width	-	1µs-1s internal sinchronization 200ns ... DC external sinchronization	
	Voltage, high level	regulated, up to 6kV	regulated, up to 6kV	regulated, up to 10kV
	Repetition rate	up to 50kHz (CW) up to 100kHz (burst)	up to 50kHz (CW) up to 100kHz (burst)	>5kHz at full load (10kV, 11pF)
	Jitter	±1ns	±1ns / ±10ns	±2ns
	Delay time	100ns	100ns / 1µs	150ns
	Load capacitance	up to 0.5nF	-	-
	Recovery time	5-10µs (load dependent)	-	-
	Rise time (fall time)	<20ns	<20ns	<20ns / 25ns at load capacitance <11pF
Environment	Operation temperature	+10°C to +40°C (wider temperature range is available on request)		
	Storage temperature	-20°C to +60°C		
	Humidity	90%, non-condensing		
Other	Size (L x W x H)	225x200x60mm	225x200x60mm	300x220x80mm
	Weight	2.0kg	2.0kg	2.0kg

Flashlamp Drivers

FLD-4U is a series of flashlamp drivers (syn. laser power supplies) for pulsed flashlamp pumped solid-state lasers such as Nd:YAG, Er:YAG, Alexandrite etc. FLD-4U drivers are all-in-one solutions and include all the neccessary subsystems: capacitor bank, capacitor charging power supply, simmer supply and discharge circuit (discharge circuits). They can be equipped with up to two output channels and up to two flashlamps connected in series. In that way each FLD-4U is able to drive up to four flashlamps. The parameters of the FLD-4U can be adjusted via front panel user interface and RS-232 machine interface.



Input	Voltage	230VAC (110/230VAC on request)
Output	Number of driven flashlamps	1 or 2 (outputs aren't independent and can work with identical parameters only)
	Output type	pulsed, variable pulse width partial discharge, quasi-rectangular pulse shape
	Max. output voltage	450/700/900V (other on request)
	Max. output power	1.75/2.0/3.5kW
	Pulse width	0.1-20ms (other on request)
	Repetition rate	1-50Hz (other on request)

Flashlamp Drivers

Design	Protections	overvoltage, overheating, flashlamp breakdown, interlock etc
	Cooling	forced air (built-in fans)
	Simmer supply	SBZ-2008 or SBZ-3008
	Triggering	serial or parallel
	Capacitor charger	PCP-17, PCA-20 or two PCP-17 connected in parallel
	Embedded capacitor bank	28000µF / 450V, or 10000µF / 700V, or 7000µF / 900V (others on request)
	Embedded capacitor bank	extension slot
	Interfaces	- 7" display, touch panel - RS-232 (full control) - 1x synchro input - 2x synchro outputs - 1x power input - 1x or 2x flashlamp outputs - 1x capacitor bank extension slot - 1x footswitch/fingerswitch connector - 1x interlock-door connector
Environment	Operation temperature	0°C to +40°C
	Storage temperature	-20°C to +60°C
	Humidity	90%, non-condensing
Environment	Size (W x D x H)	500x380x172mm
	Weight	10-12kg (in dependence on configuration)

Discharge Circuits

NBU-1012 is a series of discharge circuits. There are OEM devices for simplification of solid-state laser systems development. The modules form flashlamp pulses of quasi-rectangular shape using the energy stored in an external capacitors bank. The special feature of the NBU-1012 is the built-in simmer supply supplemented with a circuit for serial or external flashlamp triggering. Ignition circuits are also embedded into the module. The NBU-1012 is intended for capacitor charging / pulse discharging applications such as pulsed laser systems. By default the NBU-1012 is supplied in modification for serial triggering. Modification for external triggering is available on request. The module is cooled with embedded fan, no external cooling is required. The discharge circuit should be protected against simultaneous capacitor battery charging and discharging, too short pulses (50µs by default, other by request), and too long pulses (10ms by default, other by request).

Input	Voltage	+24VDC
	Current	4A max
Output	Voltage	up to 1000V
	Discharge current	up to 1000A for pulse width < 1ms up to 500A for pulse width > 1ms
	Flashlamp pulse width	up to 100 ms (on request)
	Average power	up to 3000W
	Min. pulse width	50µs (other on request)
	Max. pulse width	10ms (other on request)
	Repetition rate	up to 50Hz (up to 20Hz on request)
Recommended wires	For capacitor bank connections	LIFY 4 sq. mm (min)
	For flashlamp connections	LIFY 4 sq. mm (min)
Simmer parameters	Voltage	up to 200V (300V on request)
	Open circuit voltage	about 1500V
	Current	300...800mA (500mA by default)
	Power	up to 70W (100W on request)
Triggering parameters	Voltage	about 10kV negative pulse (serial flashlamp triggering) about 1kV negative pulse (parallel flashlamp triggering)
	Pulse width	about 1µs
	Restrike rate	1-30Hz (automatically adjusted)
Environment	Operation temperature	-20°C to +45°C
	Storage temperature	-40°C to +85°C
	Humidity	90%, non-condensing
Other	Size (L x W x H)	210x203x58mm
	Weight	3.0kg

Simmer Boards

Simmer supply is the device that strikes and maintains low-current discharge in the flashlamp in order to increase its lifetime and operation stability. SBZ-2008 and SBZ-3008 simmer supplies are powered by +24VDC source, whereas SCA-2008 and SCA-3008 simmer supplies are powerded by 230VAC. Simmer supplies include all the circuits necessary not only for maintaining of low-current discharge, but also for simmer ignition as well: the gas discharger for production of high voltage and high energy triggering pulse as well as the auxiliary 1400V open-circuit voltage supply. Ignition transformer is not included in simmer supplies and sold separately. Simmer current can be adjusted from 300mA up to 800mA with on-board potentiometer. In case of current interruption automatic restrikes with approximately 3Hz repetition rate start until the restoring of discharge. The simmer supply can be used in laser systems with serial or external triggering without any changes.

SBZ-2008

SCA-2008

SBZ-3008
SCA-3008

		SBZ-2008	SBZ-3008	SCA-2008	SCA-3008
Input	Voltage	24VDC	24VDC	230VAC 50/60Hz	230VAC 50/60Hz
	Max. input current	3.5A	5A	0.4A	0.5A
	Fuse			1A	1A
Output	Voltage (set automatically)	up to 200V	up to 300V	up to 200V	up to 300V
	Maximal output power	70W	100W	70W	100W
	Open circuit voltage	1400V (1500V on request)			
	Current	300-800 mA (500mA by default)			
	Efficiency	about 85%			
Flashlamp triggering	Voltage	1kV (other on request)			
	Pulse energy	approx. 150mJ			
	Restrike rate	approx. 3Hz			
Environment	Operation temperature	-20°C to +45°C			
	Storage temperature	-40°C to +85°C			
	Humidity	90%, non-condensing			
Other	Protections	short-circuit protection at the output open-circuit protection			
	Cooling	convective	built-in fan	convective	built-in fan
	Size (L x W x H)	152x68x38mm	178x81x57mm	152x68x38mm	178x81x57mm
	Weight	<0.2kg	<0.5kg	<0.2kg	<0.5kg

LASERELEKTRONIK OEM Tech Laser Electronics

OEM-TECH GmbH

Hans-Knöll-Str. 6, 07745 Jena, Germany
Tel. +49 3641 384859
Fax +49 3641 384860
germany@oem-tech.de, www.oem-tech.de