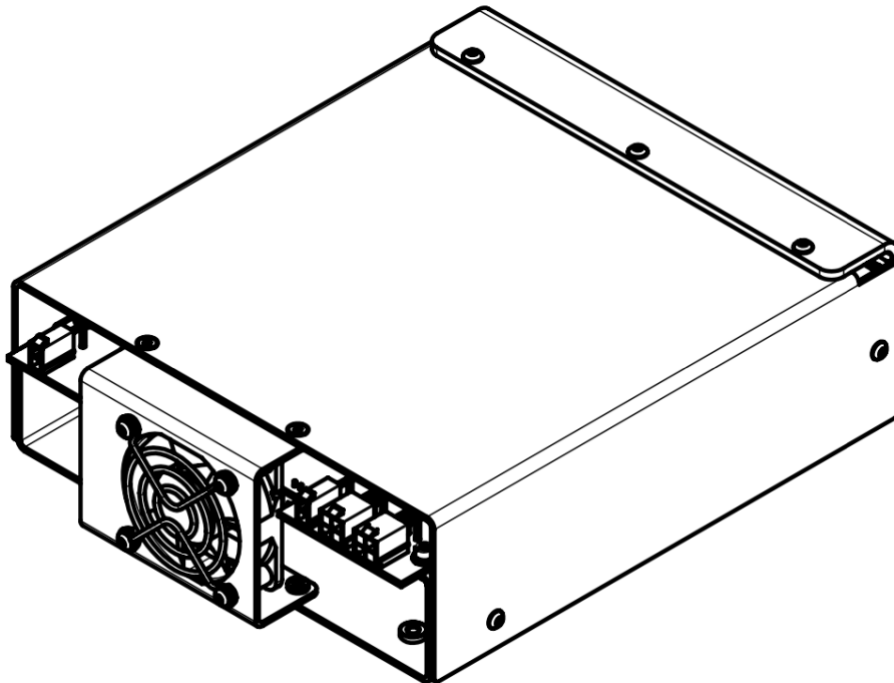


# **NBU-0808 discharge circuit**

## **User manual**



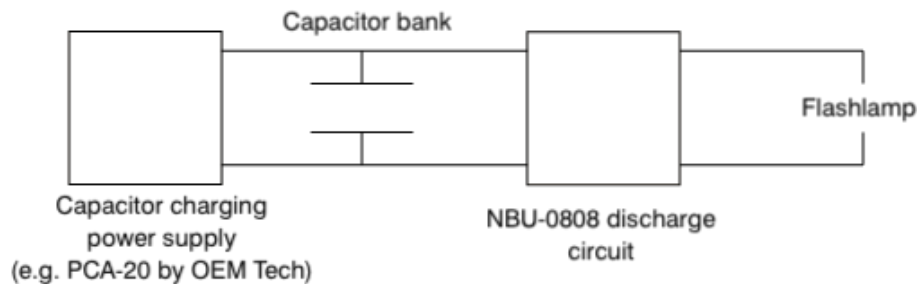
## Overview / Applications

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The NBU-0808 discharge circuit is designed for simplification of solid-state laser systems development. The module forms quasi-rectangular pulses on a flashlamp using energy stored in external capacitors bank. The module includes IGBT, its driver, protective circuits, simmer and trigger circuits and controls.

The module doesn't include embedded discharge resistors, although includes all the necessary circuits to control them. Discharge resistor assemblies of different size and resistance can be purchased as accessories by us.

Let us emphasize, NBU-0808 is not a stand-alone solution. For proper operation it requires capacitor charging power supply and capacitor bank as well as some minor parts and controls.



By default, NBU-0808 includes capabilities both for serial and external triggering (See *Triggering* section for details). Simplified as well as more complex modifications are available on request.

## Safety

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Important feature of NBU-0808 is a clear and visible separation between low voltage and high voltage parts. 24V power input and all interface circuits (SIM and PWF) are separated from high voltage circuits with 4mm creepages and solid insulation of 2500VAC test voltage (1 MOOP/MOPP).

## Cooling

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The module is cooled with a built-in fan.  
No external cooling is required.

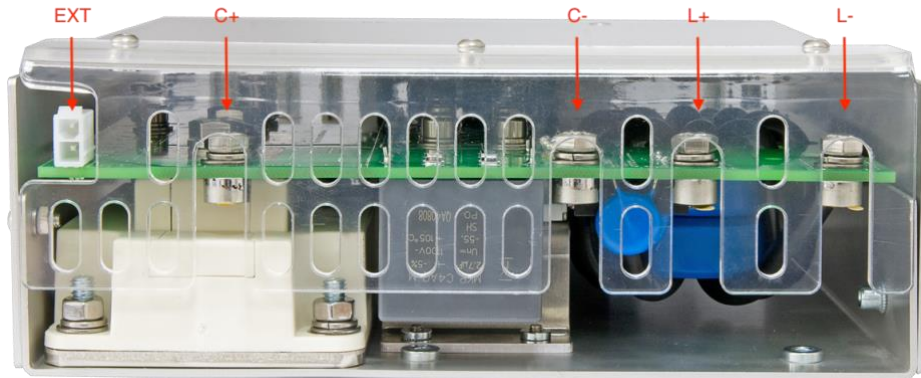
## Appearance

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## Connections, signals, signal descriptions

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### **CAPACITOR BANK CONNECTION:** Two M5 terminals

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C+ – to the capacitor bank positive  
C– – to the capacitor bank negative

### **FLASHLAMP CONNECTION:** Two M5 terminals

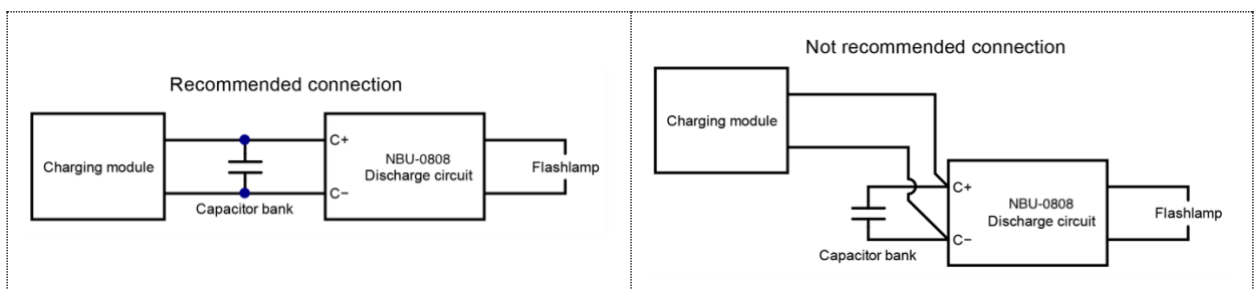
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L+ – to the flashlamp positive (i.e. to the flashlamp anode)  
L– – to the flashlamp negative (i.e. to the flashlamp cathode)

### **CAPACITOR CHARGER CONNECTION CONSIDERATIONS**

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**Note:** we recommend connecting capacitor charging power supply not to C+/C– terminals, but straight to the capacitor bank.



### **EXT (TO THE TRIGGER TRANSFORMER):** Molex 39-30-1020

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By default, NBU-0808 supports both serial and external methods of triggering. To use NBU-0808 for external triggering, a trigger transformer should be connected to the EXT connector. If EXT connector is left unconnected, NBU-0808 will automatically recognize this and apply pulses of serial triggering to L- flashlamp connection (see also *Triggering* section for details).

2  
1

PIN (color)	DESIGNATION	DESCRIPTION
1 (-)	GND	Trigger transformer connection.
2 (-)	TRIGGER	Once a trigger transformer is connected, trigger pulses will be automatically applied to the EXT connector instead of L- flashlamp connector. Trigger pulse parameters: <ul style="list-style-type: none"> <li>• 350V by default, other on request</li> <li>• ~20mJ by default, other on request</li> </ul>



**DR (TO DISCHARGE RESISTORS):** Molex 39-30-1020

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1

PIN (color)	DESIGNATION	DESCRIPTION
1 (-)	C+	Discharge resistors connection
2 (-)	RELAY	<ul style="list-style-type: none"> <li>• PIN1 is always under the same potential as C+</li> <li>• PIN2 is commutated by embedded relay and follows Discharge signal of PWF connector</li> </ul> Please do not exceed the peak and the average discharge current (500mA).

We suggest using NBU-0808 with discharge resistors of your choice. The resistance and the power rating of discharge resistors must be selected accordingly to your application. Real operating voltages, your capacitor bank capacitance and the required quick discharge time are the most important parameters affecting the choice. You are welcomed to contact us for the assistance.

**24VDC (TO 24VDC POWER SUPPLY): Molex 39-30-1020**



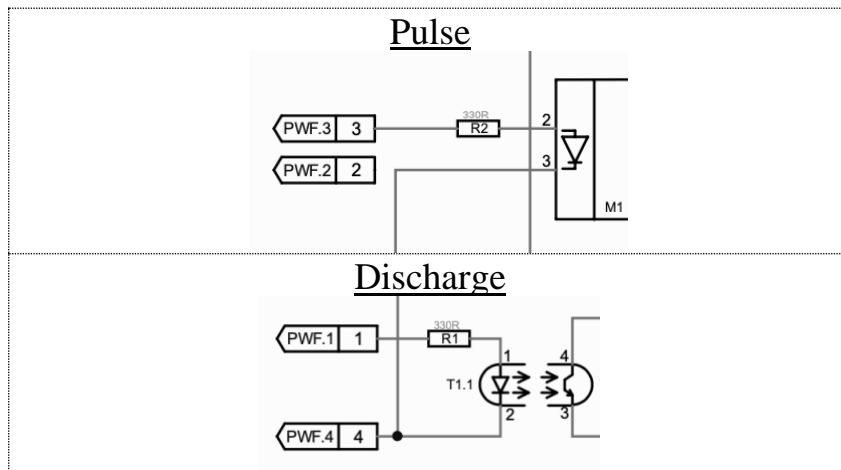
PIN (color)	DESIGNATION	DESCRIPTION
1 (-)	+24VDC	Supply power to the control circuits of NBU-0808 as well as to the integrated simmer supply module <ul style="list-style-type: none"> <li>• Voltage: 24VDC</li> <li>• Current: 5A max (up to 10A peak)</li> </ul>
2 (-)	+24VDC Return	Return of 24VDC power supply

**PWF (PULSE CONTROL): Molex 39-30-1040**



PIN (color)	DESIGNATION	DESCRIPTION
1 (-)	Discharge	While 0V voltage is applied to <i>PIN1</i> (or <i>PIN1</i> is unconnected), i.e. while <i>Discharge</i> is <i>ON</i> , capacitor battery continuously discharges on discharge resistors connected to DR connector of NBU-0808. Be careful, while <i>Discharge</i> is <i>ON</i> the capacitor charging is prohibited and capacitor charging power supply must be disabled. While +5V voltage is applied to <i>PIN5</i> ( <i>Discharge</i> is <i>OFF</i> ) module can be operated in the regular way.
2 (-)	Not Connected	–
3 (-)	Pulse	Duration of +5V TTL pulse at <i>PIN3</i> completely defines IGBT-key open state time and, as consequence, flashlamp pulse duration
4 (-)	Interface Return	Return of <i>Pulse</i> and <i>Discharge</i> signals

**PWF CIRCUITS:**

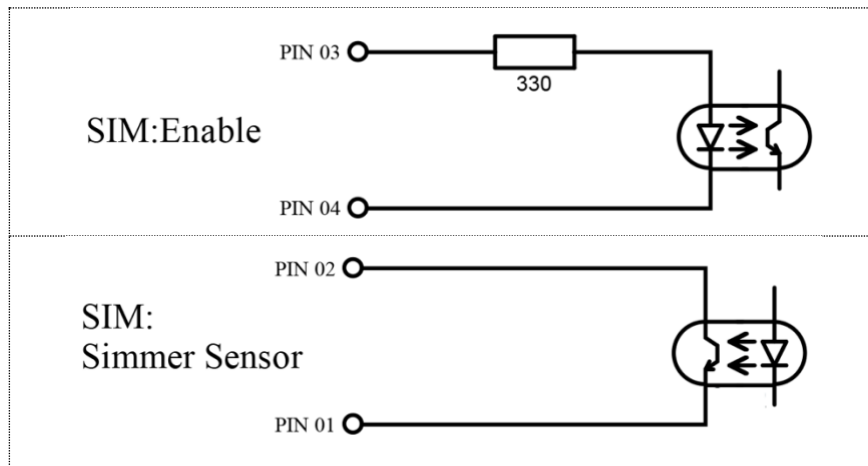


**SIM (SIMMER SUPPLY CONTROL): Molex 39-30-1040**



PIN (color)	DESIGNATION	DESCRIPTION
1 (-)	Sensor Return	Return of the <i>Simmer Sensor</i> signal
2 (-)	Simmer Sensor	<i>Simmer Sensor</i> circuit is closed while simmer current flows through flashlamp and is open while simmer current is absent
3 (-)	Enable	Once +5V voltage is applied to <i>PIN3</i> integrated simmer supply tries to strike and maintain low-current discharge (simmer) in the flashlamp. If flashlamp triggering is failed simmer supply module tries to trigger it again with a few Hertz repetition rate. After successful triggering the simmer supply can support up to 500mA flashlamp current (400mA is a preset by default). Simmer will be maintained until 0V is applied to <i>PIN3</i> .
4 (-)	Enable Return	Return <i>Simmer Enable</i> signal

**SIM CIRCUITS:**



**LED:**

There is the warning LED indicating that NBU-0808 circuits are under high voltage.

HV LED (**red**) – is ON when NBU-0808 circuits are under high voltage

## Safety

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**Warning!** This equipment produces high voltages that can be very dangerous. Don't be careless around this equipment.

- During operation all the protective covers of the equipment must be securely in place and all electrical connections must be properly attached
- NBU-0808 discharge circuit is designed to be installed inside a properly grounded metal. It is the user's responsibility to ensure that personnel are prevented from accidentally contacting the NBU-0808, especially C+/C- , DR and L+/L- connectors and cables. **Casual contact could be fatal!**
- After shutdown, do not handle the capacitance load until it has been discharged. Use an appropriate meter to check for complete discharge.
- Disconnect the module from the DC power source before making or changing electrical or mechanical connections.
- **Don't remove protective covers!** There are no user serviceable parts inside this equipment.



## Operations

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1. Connect capacitor charging power supply, +24V DC power supply, capacitor battery and flashlamp to NBU-0808 module
2. Set +5V voltage on *PIN1* of *PWF* to switch off capacitor bank discharging

**Warning!** By default capacitor discharging is on.

Be careful and always switch off capacitor discharging before turning on your capacitor charging module.

Otherwise, it may lead to failure of discharge resistors used in the system.

3. *Disable* simmer supply (*PIN3* of *SIM*)
4. Apply +24V DC power to the module
5. *Enable* your capacitor charging power supply (charging module). As soon as charging module starts operation, capacitors are charged
6. *Enable* simmer supply (set +5V on *PIN3* of *SIM*)
7. Wait a few seconds for *Simmer Sensor*. If it fails shut down your system
8. *Disable* your capacitor charging power supply before pulse

Note that PCP-series and PCA-series power supplies by OEM Tech are well-protected and it isn't obligatory to disable them. We recommend you do not disable PCP (PCA) at high on-off time ratio

9. Set +5V TTL pulse on *PIN3* of *PWF*. This pulse duration defines IGBT-key open state time and flashlamp pulse width.
10. *Enable* your power supply after pulse
11. Repeat #8-#10

To power down NBU-0808 and discharge capacitor battery

1. *Turn off* or *Disable* your capacitor charging power supply (important!)
2. *Disable* simmer supply
3. Set 0V on *PIN1* of *PWF* to switch on capacitor bank discharging. Wait for complete discharge of capacitors.

**Warning!** If the capacitor bank capacitance is enormously high, this might lead to the overheating of the discharge resistors used in the system.

4. Remove +24V DC power from the module.

## Specifications

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### ELECTRICAL

<b>+24VDC:</b>	
Voltage	+24 V DC
Maximum current consumption	5 A max, up to 10 A peak
<b>PULSE PARAMETERS:</b>	
Max. voltage	800 V ( <i>up to 1000V on request</i> )
Max. discharge current (depends on flashlamp impedance K0)	1000 A for pulse width < 1 ms 500 A for pulse width > 1 ms ( <i>other on request</i> )
Max. average power	2000 W ( <i>other on request</i> )
Min. pulse width, max. pulse width	Accordingly to <i>PWF:Pulse</i> signal
Max. rep. rate	100 Hz ( <i>up to 200Hz on request</i> )
<b>RECOMMENDED WIRES:</b>	
For capacitor bank connections	FLEXI-2V or similar (>1000V rated voltage, >4mm <sup>2</sup> cross-section), short length (30cm recommended)
For flashlamp connections	For external triggering – FLEXI-2V or similar (>1000V rated voltage, >4mm <sup>2</sup> cross-section) For serial triggering additional insulation (e.g. with silicone tubing) or spacing (e.g. with spiral bundle hose) of L– wire is required
<b>SIMMER PARAMETERS</b>	
Simmer current	400 mA ( <i>200-500 mA on request</i> )
Max output voltage	300 V
Max output power	100 W
Open circuit voltage	1500 V
<b>FLASHLAMP TRIGGERING PARAMETERS</b>	
Trigger pulse width	~1 us
Restrike rate	A few Hertz (automatically adjusted)
<b>EXTERNAL:</b>	
Pulse energy / trigger voltage	~20mJ / 350V positive to the EXT connector ( <i>other on request</i> )

Trigger transformer	External transformer (purchased separately) Recommended p/n <i>ZS1324-24V LUL1(H)</i> by Excelitas Technologies (Digikey p/n <i>ZS1324- 24VLUL1(H)-ND</i> )
<b>SERIAL:</b>	
Pulse energy / trigger voltage	~160mJ / 10kV negative to L– ( <i>other on request</i> )
Trigger transformer	Integrated transformer
<b>Cooling</b>	Forced air cooling with built-in fan
<b>Protections</b>	
From overheating of internal components	
<b>Environment:</b>	
Operation temperature	0 ... +40 °C
Storage temperature	-20 ... +60 °C
Humidity	90%, non-condensing

### MECHANICAL

<b>Size (LxWxH)</b>	See dimensional drawing below
<b>Weight</b>	Approx. 2.0 kg (w/o cables)

### CABLE SET SUPPLIED WITH NBU-0808

<b>Cables</b>	Sold separately
<b>Trigger transformer for external triggering</b>	Sold separately



## **How to order? / Options**

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By default there is the only standard part number, namely NBU-0808.

On request the next options are available:

- Integrated current sensor
- High power / current / voltage IGBT with extended parameters
- Low power / current / voltage IGBT with reduced cost
- Digital RS-232 / RS-485 interface
- Modified cables and connectors
- Modified simmer and / or trigger parameters

## **Triggering. Serial triggering, external triggering, triggering basics**

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By default NBU-0808 supports both serial and external methods of triggering.

To use NBU-0808 for external triggering, a trigger transformer should be connected to the EXT connector.

Default parameters of external triggering are (other on request):

- 350V voltage (applied to EXT connector)
- ~20mJ energy
- Recommended transformer (sold separately) – 1:70 e.g. *ZS1324-24V LUL1(H)* by Excelitas Technologies (Digikey p/n *ZS1324-24VLUL1(H)-ND*)

If EXT connector is left unconnected, NBU-0808 automatically recognizes this and applies serial triggering to the flashlamp.

Default parameters of serial triggering are (other on request):

- 10kV voltage (applied to L-)
- ~160mJ energy