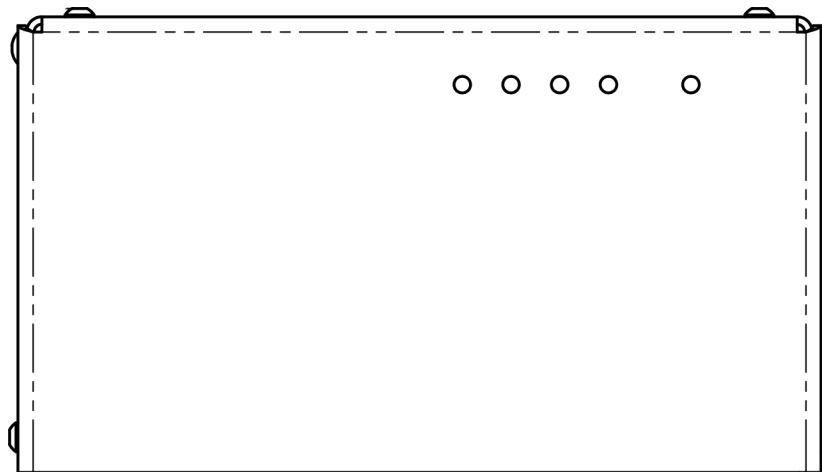


# **LSCB control board (4-channel version)**

## **User manual**



## Description

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LSCB is a controlling board designed to simplify the design and use of flashlamp drivers based on power modules by OEM Tech.

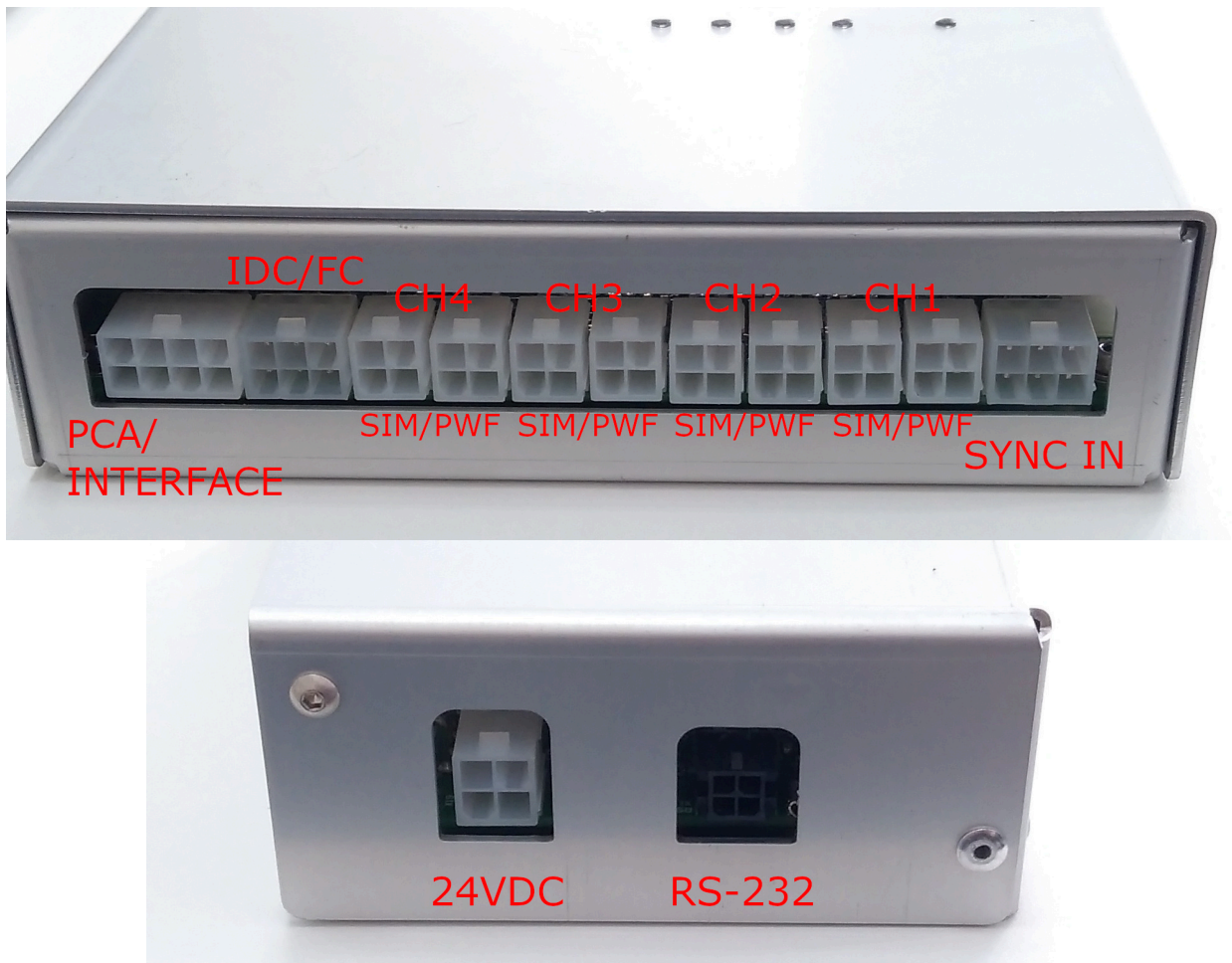
By default LSCB of 4-channel version supports the next capabilities:

- 1) One capacitor charger of PCA-series
- 2) Up to four NBU-1012 discharge circuits
- 3) Minor features like IDC, footswitch, synchro inputs and outputs

Base interface is RS-232 (RS-485 is available on request). Simple PC software is supplied together with the controller.

## Appearance

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## Connections, signals, signal descriptions

### PCA/INTERFACE: Molex 3930-1080

Capacitor charger of PCA-series to be connected here.

8	7	6	5
4	3	2	1

PIN (color)	DESIGNATION	DESCRIPTION
1 (black)	Interface Return	See user manual of PCA-series capacitor charger for the detailed signal description
2 (white)	Fault	
3 (blue)	Inhibit	
4	N/C	
5 (red)	+15VDC	<b>Important note: interface signals of PCA-series capacitor charger are galvanically isolated from other circuits of LSCB controller.</b>
6 (green)	Ready Indicator	
7 (yellow)	Voltage Program	
8 (violet)	Voltage Monitor	

### IDC/FS: Molex 3930-1060

Door interlock connector and/or footswitch or fingerswitch to be connected here.

6	5	4
3	2	1

PIN (color)	DESIGNATION	DESCRIPTION
1 (green)	IDC	Door-interlock connection. Should be pulled to the ground to allow the operations.
2 (blue)	Footswitch (Fingerswitch)	Footswitch (fingerswitch) connections. Once output is enables, should be pulled to the ground to enable flashes.
3, 5 (white)	Synchro Outputs	Synchro output signal coincided with pulse applied to the flashlamp. The same signal is paralleled to both synchro outputs. Other synchro output signals are available on request.
4, 6 (black)	GND	LSCB common ground.

### CH1 SIM: Molex 3930-1040

Discharge circuit of NBU-series (SIM connector) to be connected here.

4	3
2	1

PIN (color)	DESIGNATION	DESCRIPTION
1 (violet)	GND	

<b>2 (yellow)</b>	<b>Simmer Sensor</b>	See user manual of NBU-1012 discharge circuit for the detailed signal description
<b>3 (red)</b>	<b>Simmer Enable</b>	
<b>4 (black)</b>	<b>GND</b>	

### CH1 PWF: Molex 3930-1040

Discharge circuit of NBU-series (PWF connector) to be connected here.



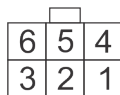
PIN (color)	DESIGNATION	DESCRIPTION
<b>1 (green)</b>	<b>Discharge</b>	See user manual of NBU-1012 discharge circuit for the detailed signal description
<b>2</b>	<b>N/C</b>	
<b>3 (orange)</b>	<b>Pulse</b>	
<b>4 (black)</b>	<b>GND</b>	

### CH2...CH4 SIM and CH2...CH4 PWF: Molex 3930-1040

Other discharge circuits of NBU-series to be connected here. Pin layout and signal description is identical to CH1 SIM/PWF connectors.

### SYNC IN: Molex 3930-1060

Synchronization inputs for operations in regimes with external synchronization of flashes.



PIN (color)	DESIGNATION	DESCRIPTION
<b>1 (red)</b>	<b>Synchro Input 1</b>	Incoming synchronization pulses should be applied to these pins if controller is run in external synchronization mode.
<b>2 (blue)</b>	<b>Synchro Input 2</b>	
<b>3 (green)</b>	<b>Synchro Input 3</b>	
<b>4 (orange)</b>	<b>Synchro Input 4</b>	Synchro Input 1 causes flashes in channel 1, Synchro Input 2 causes flashes in channel 2 and so on.
<b>5, 6 (black)</b>	<b>GND</b>	

### 24VDC: Molex 3930-1040

Power feeding LSCB controller to be provided here.



PIN (color)	DESIGNATION	DESCRIPTION
<b>1, 2 (red)</b>	<b>24VDC</b>	24VDC power to be applied here.
<b>3, 4 (black)</b>	<b>GND</b>	

## RS-232: Molex 43045-0400

Connection to the PC or to the master control boards.



PIN (color)	DESIGNATION	DESCRIPTION
1 (orange)	RX	to be connected to TX of the host
2 (blue)	TX	to be connected to RX of the host
3, 4 (black)	GND	

## LEDS:

There are several LEDs indicating state of LSCB controller

Power LED (blue):

- lits steadily while LSCB is powered

Simmer LED (yellow):

- starts blinking once simmer supply (one or several) is enabled
- lits steadily if all enabled flashlamps are simmered successfully

Charger LED (yellow):

- starts blinking once capacitor charger is enabled
- lits steadily if capacitor charger is enabled and capacitor bank is successfully charged up to ordered value (i.e. charger is ready, mR returns 1)

Pulse LED (green):

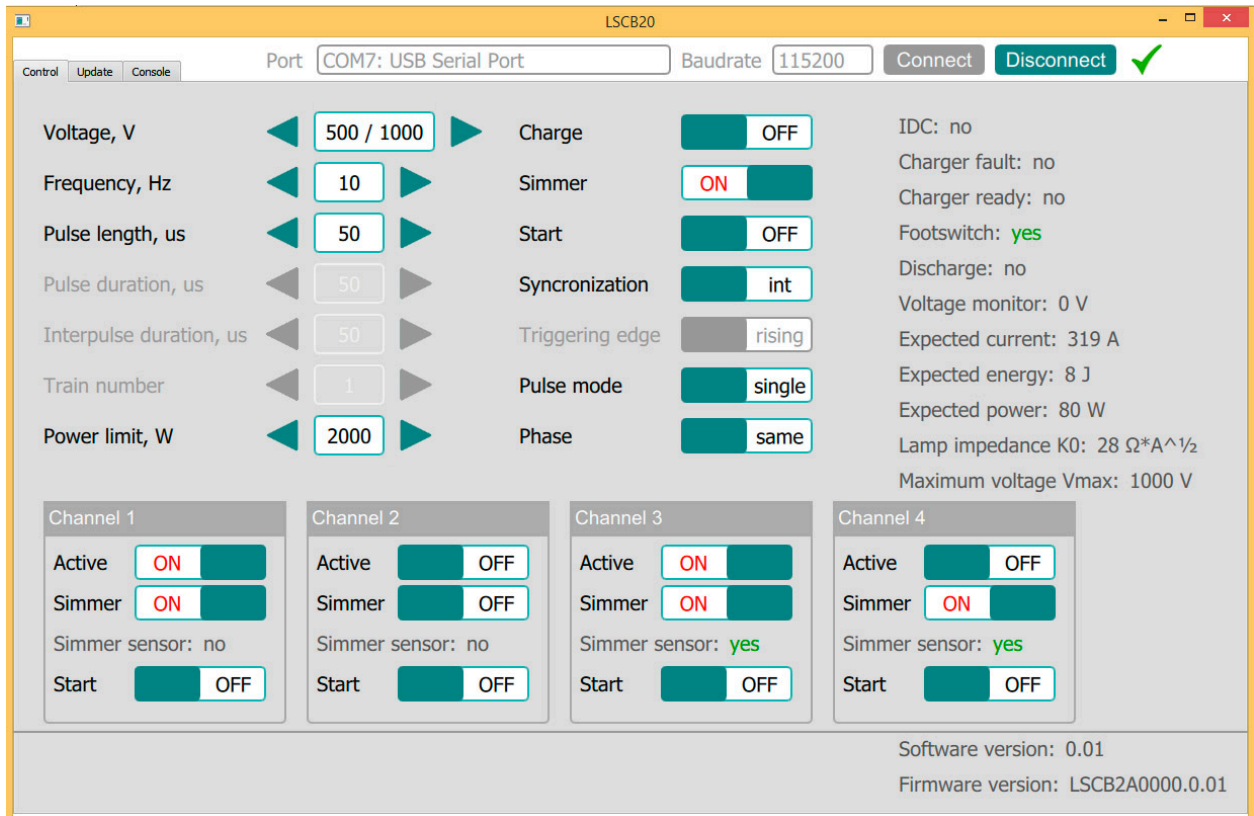
- lits steadily in run mode

Error LED (red):

- lits steadily if one of connected devices reports about failure



## Software description



**Voltage** – sets the desired output voltage (V)

**Frequency** – sets the desired repetition rate of flashes (Hz)

**Pulse length** – in **Single pulse mode** – sets the desired pulse width (us)

**Pulse duration** – in **Pulse train mode** – sets the duration of individual pulselets (us)

**Interpulse duration** – in **Pulse train mode** – sets the interval between the individual pulselets (us)

**Train number** – in **Pulse train mode** – sets the number of pulselets in each train

**Charge** – turns capacitor charging module on and off

**Power limit** – sets the maximal power allowed per channel (calculated, W)

**Simmer** – turns simmer supplies of all **active** NBU-1012 on and off

**Start** – enables and disables flashes in all **active** channels

**Synchronization** – select synchronization mode – **Internal synchronization** / **External synchronization**

In **Internal synchronization mode** flashes are defined by LSCB

In **External synchronization mode** flashes are defined by external signals applied to SYNC IN connector of LSCB

**Triggering edge** – in **External synchronization mode** defines the triggering edge of synchronization signal – either rising edge or falling edge

**Pulse mode** – switches LSCB between **Single pulse mode** and **Pulse train mode**

**Phase** – switches LSCB between synchronic and shifted operations of Channel 1...4

**Channel 1 Active ... Channel 4 Active** – makes the corresponding channel active or inactive

**Channel 1 Simmer ... Channel 4 Simmer** – starts/stops simmer supply in Channel 1 ... Channel 4 respectively

**Channel 1 Start ... Channel 4 Start** – starts/stops flashes in Channel 1 ... Channel 4 correspondingly

**IDC** – status of Door Interlock (IDC signal of IDC/FS connector) – flashes are prohibited if IDC loop is open

**Charger fault** – internal fault status of the capacitor charging power supply (Fault signal of PCA)

**Charger ready** – Ready signal of PCA

**Footswitch** – footswitch status (FS signal of IDC/FS connector)

**Discharge** – status of discharge resistors (Discharge signal of NBU-1012)

**Voltage monitor** – the actual voltage on the capacitor bank (Voltage monitor of PCA)

**Expected current** – the calculated current through the flashlamp (calculations are based on Voltage and Flashlamp impedance K0 values)

**Expected energy** – the calculated flash energy (calculations are based on Voltage, Flashlamp impedance K0 and Pulse length values)

**Expected power** – the calculated power through flashlamp (calculations are based on Voltage, Flashlamp impedance K0, Pulse length and Frequency values)

**Lamp impedance K0** – value from flashlamp d/s

**Maximal voltage Vmax** – maximal voltage of the particular capacitor charger (value taken from PCA label)



## RS-232 protocol description

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RS-232 connection parameters: 38400 bps, 8 data bit, 1 stop bit, no parity

Command format is: {command} {data (optionally)} {end-of-line}

- Command is 1 to 3 character long (see list below)
- Data is ASCII-string, command and data must be separated with space (space symbol)
- End-of-line symbols are \n or \r\n

List of available commands:

- v – sets the desired output voltage (in volts, example «v 300»)
- p – sets the desired pulse width (in us, example «p 250») – in single pulse mode of operations only
- f – sets the desired pulse repetition rate (in hertz, example «f 0.5»)
- V, P, F – return the corresponding set points
  
- b – sets “single pulse” or “train of pulses” mode of operations («b 0» – single pulse, «b 1» – train of pulses); in train of pulses mode parameter p is ignored, parameter f defines the repetition rate of pulse trains
- n – sets number of pulses in pulse train mode («n 3»)
- on – sets pulse duration in pulse train mode (in us, example «on 1000»)
- off – sets interpulse interval in pulse train mode (in us, example «off 1000»)
- B, N, ON, OFF – return the corresponding set points
  
- x – sets the synchronization mode («x 0» – internal, «x 1» – external)
- t – sets triggering edge in external synchronization mode («t 0» – rising, «t 1» – falling)
- X, T – return the corresponding set points
  
- a – sets the mask of active channels (bit0 corresponds to channel 1, bit3 corresponds to channel 4, «a 0» – no active channels; «a 1» – only channel 1 is active; «a 2» – only channel 2 is active; «a 15» – all four channels are active and so on).  
*Note: any use of the command forcedly sets “s”, “s1”... “s2”, “r”, “r1”... “r2” to 0*
- A – returns the mask of active channels
  
- s1...s4 – turns the simmer supply in channel 1...4 on and off («s1 1» – on, «s1 0» – off)  
*Note: the command is ignored if channel isn't set active with “a” command*
- s – turns the simmer supply in all active channels on and off («s 1» – on, «s 0» – off)  
*Note: “s1” ... “s4” follow “s” automatically (once the corresponding channels are set active with “a” command)*
- c – turns the capacitor charging module on and off («c 1» – on, «c 0» – off)
- r1...r4 – enables / disables the output in channel 1...4 («r1 1» – enables)  
*Note: the command is ignored if channel isn't set active with “a” command*
- r – enables / disables the output in all active channels («r 1» – enables)  
*Note: “r1” ... “r4” follow “r” automatically (once the corresponding channels are set active with “a” command)*
- S1...S4, S, C, R1...R4, R – returns the corresponding set point

- h – sets maximal power limit (in watts, example «h 1000»)
  - H – returns the corresponding set point
  - !k0 – sets flashlamp impedance used for calculations (in VA<sup>-1/2</sup>, example «!k0 28»)
  - !K0 – returns the corresponding set point
  - !i – sets maximal current limit (in amps, example «!i 1000»)
  - !I – returns the corresponding set point
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- mV – voltage monitor (volts)
  - mF – returns fault state (0 – no fault, 1 – fault)
  - mJ – returns fault code
  - mR – returns ready state (status of the capacitor charging module, 0 – not ready, 1 – ready)
  - mI – returns IDC state (0 – open, 1 – closed)
  - mW – returns footswitch state (“0” – footswitch is released, “1” – footswitch is stepped)
  - mS1...mS4 – returns simmer sensor state in channel 1..4 (0 – off, 1 – on)
  - mS – command returns the mask of simmer sensors (bit0 corresponds to channel 1, bit3 corresponds to channel 4)
  - mD – returns state of embedded discharging resistors (0 – no discharge, 1 – discharging)
  - mP – returns expected power (in watts)
  - mC – returns expected current (in amperes)
  - mE – returns expected pulse or pulse train energy (in joules)
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- g – sets phase shift between channels («g 0» – phase shift is 0 degrees i.e. all channels are run simultaneously; «g 90» – phase shift between sequential channels is 90 degrees)  
*Note: if phase shift is set to 90 degrees, this means the pulses in channel N+1 are delayed relatively to the pulses in channel N for 1/(4\*f) second **independently on whether these channels are active on not***
  - G – returns the corresponding set point
- 
- vm – sets V<sub>MAX</sub>, i.e. the maximal voltage of the capacitor charger; correct setting of V<sub>MAX</sub> is necessary to match the output signal of LSCB programming the voltage with the corresponding input signal of the capacitor charger unit  
*Note: set V<sub>MAX</sub> accordingly to the p/n of the capacitor charger used*
  - VM – returns the corresponding set point
- 
- !b – sets the baudrate of interface (possible values - 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400; example “!b 2400”)
  - !c – enables/disables control sums in protocol (disabled by default; contact factory for instructions if you want to enable control sums in protocol)

## Presets

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Parameter	Minimum (*)	Maximum (*)	Increment (*)	Default value (**)
Baudrate	2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400			38400
Output voltage, V	100	V <sub>MAX</sub>	1	200
Pulse width, us	100	1500	1	200
Rep. rate, Hz	1	50	0.1	1
V <sub>MAX</sub> , V	100	1000	1	1000
K0, VA <sup>-1/2</sup>	5	50	0.1	20
Power limit, W	100	2000	1	2000

(\*) Other values are available on request  
(\*\*) Might be set in accordance with your application (if known)

## Operations

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1. Before starting the operations please check if the states of the following commands match your application and re-set their values if necessary:

Parameter	Comment
a	active and non-active channels
b	single pulse mode or pulse train mode
g	channels are synphase or in counter-phase
x	internal or external synchronization
t	external synchronization trigger edge
vm	V <sub>MAX</sub> of the capacitor charger
!k0	impedance of your flashlamp
h	output power limitation

2. Set main parameters – v, p (on, off, n), f
3. Enable capacitor charger – c
4. Trigger flashlamp/flashlamps – s (s1...s4)
5. Enable flashes – r (r1...r4)