



# **HIGH VOLTAGE DRIVERS**

DPB-3-8.6

DPB-3-8.6-AI

DPB-2.5-9.8

DPB-2.5-9.8-AI

Technical Description  
Rev. 2201

2022  
Lithuania



## CONTENTS

<b>CHAPTER 1</b>	<b>WARRANTY .....</b>	<b>1</b>
1.1.	WARRANTY STATEMENT .....	1
1.2.	SERVICE CONTACT INFORMATION .....	1
<b>CHAPTER 2</b>	<b>SPECIFICATIONS.....</b>	<b>2</b>
2.1.	GENERAL INFORMATION .....	2
2.1.1.	<i>Models</i> .....	2
2.1.2.	<i>Main Components</i> .....	2
2.2.	TECHNICAL SPECIFICATIONS .....	3
<b>CHAPTER 3</b>	<b>DEVICE LAYOUT .....</b>	<b>4</b>
<b>CHAPTER 4</b>	<b>SAFETY .....</b>	<b>7</b>
<b>CHAPTER 5</b>	<b>IMPORTANT NOTES .....</b>	<b>8</b>
<b>CHAPTER 6</b>	<b>QUICK START GUIDE .....</b>	<b>9</b>
6.1.	SET JUMPER #6 TO REQUIRED OPERATION MODE.....	9
6.2.	CONNECT WIRES TO THE POCKELS CELL .....	9
6.3.	GROUND THE POCKELS CELL DRIVER TOGETHER WITH THE GENERATOR AND HV SUPPLY .....	9
6.4.	SUPPLY VOLTAGE TO THE DRIVER FROM THE DC POWER SUPPLY .....	10
6.5.	SUPPLY VOLTAGE FROM THE HV SUPPLY.....	10
6.6.	PROVIDE SYNCHRONIZATION PULSES FROM THE GENERATOR.....	10

## LIST OF FIGURES

<b>FIGURE 1.</b> OUTLINE DRAWING AND DIMENSIONS OF THE DRIVER WITHOUT HV SUPPLY .....	4
<b>FIGURE 2.</b> OUTLINE DRAWING AND DIMENSIONS OF THE DRIVER WITH HV SUPPLY .....	4
<b>FIGURE 3.</b> OUTLINE DRAWING AND DIMENSIONS OF THE DRIVER COVER AND HV SUPPLY (-AI).....	5
<b>FIGURE 4.</b> VIEW OF THE DRIVER WITH HV SUPPLY (-AI) .....	5
<b>FIGURE 5.</b> VIEW OF THE DRIVER .....	6
<b>FIGURE 6.</b> DRIVER OPERATION CHART .....	8
<b>FIGURE 7.</b> CONTROL TIMING FOR ONE- AND TWO-PULSE CONTROLLED DRIVER .....	9
<b>FIGURE 8.</b> INPUT CIRCUIT OF DRIVER.....	11

## LIST OF TABLES

<b>TABLE 1.</b> MODELS .....	2
<b>TABLE 2.</b> MAIN COMPONENTS .....	2
<b>TABLE 3.</b> TECHNICAL SPECIFICATIONS.....	3
<b>TABLE 4.</b> PORTS SEEN IN TOP VIEW OF THE DRIVER .....	6

### 1.1. Warranty Statement

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The Pockels cell drivers are protected by a one-year warranty covering labor and parts. The warranty enters into validity since the shipment date. Any evidence of improper use or unauthorized repair attempts voids the warranty.

### 1.2. Service Contact Information

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For service/warranty requests, please contact:

EKSMA OPTICS, UAB  
c/o EKSMA Optics, UAB  
Dvarcioniu st. 2B  
LT-10233 Vilnius, Lithuania

Phone: +370 5 272 99 00  
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E-mail: [info@eksmaoptics.com](mailto:info@eksmaoptics.com)  
Website: [www.eksmaoptics.com](http://www.eksmaoptics.com)

## 2.1. General Information

### 2.1.1. Models

**Table 1.** Models

<i><b>Model</b></i>	<i><b>Description</b></i>
<b>DPB-3-8.6</b>	3kHz repetition rate, 8.6kV output, open PCB
<b>DPB-3-8.6-AI</b>	3kHz repetition rate, 8.6kV output, with case and HV supply
<b>DPB-2.5-9.8</b>	2.5kHz repetition rate, 9.8kV output, open PCB
<b>DPB-2.5-9.8-AI</b>	2.5kHz repetition rate, 9.8kV output, with case and HV supply

### 2.1.2. Main Components

**Table 2.** Main components

<i><b>Component</b></i>	<i><b>Quantity</b></i>	<i><b>Notes</b></i>
High voltage (HV) driver <b>DPB-*-*</b>	1	-
DC power cable (l=1.5m)	1	-
BNC-SMB cables (l=1.5m)	2	-
HV power supply cable (l=1m)	1	Not supplied if <b>DPB-*-*</b> driver and HV power supply are ordered and screwed together.
Pair of cables for HV output to the Pockels cell (<10 cm)	1	-
Technical description	1	-

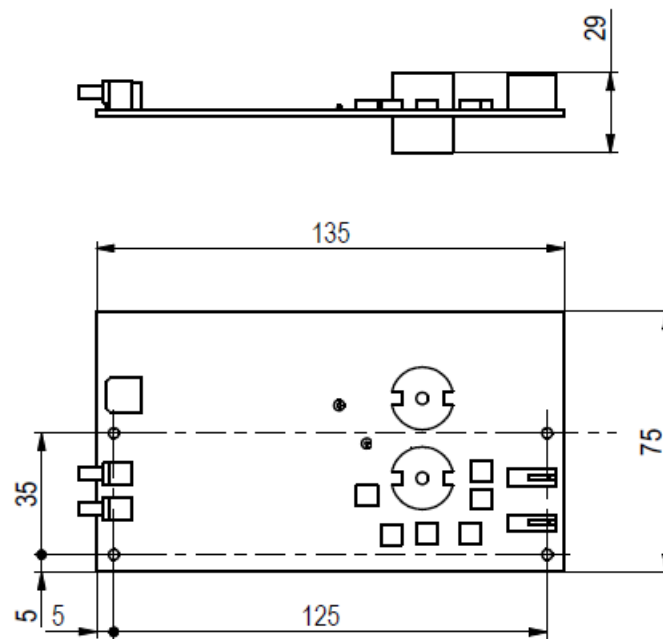
## 2.2. Technical Specifications

**Table 3.** Technical specifications

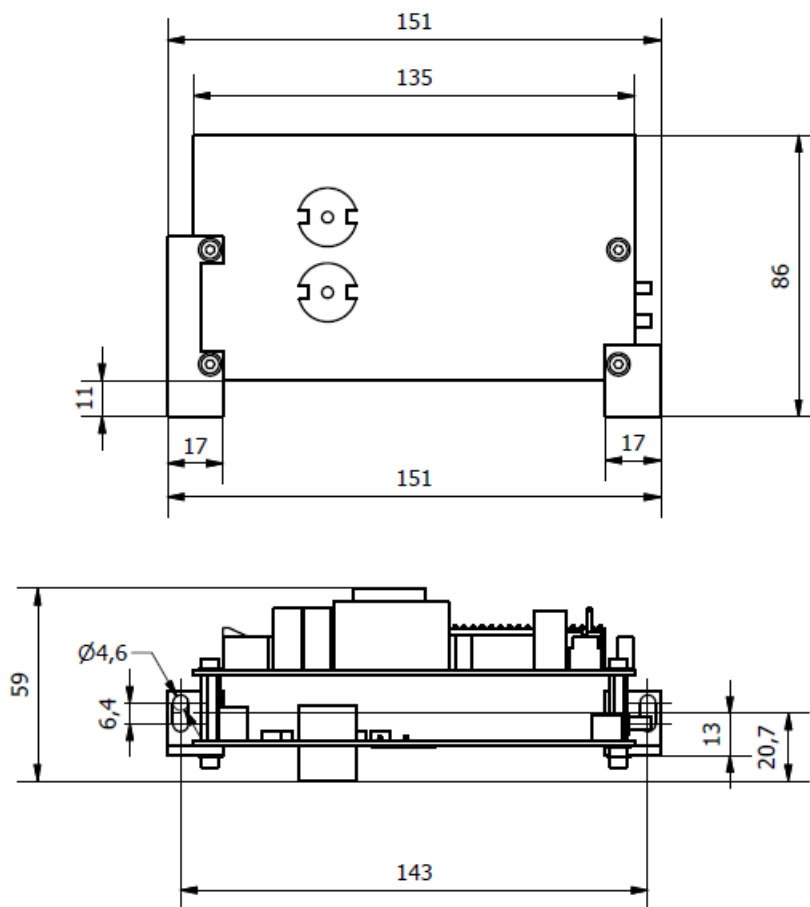
<i>Parameter</i>	<i>Value(s)</i>	
	<i>DPB-3-8.6(-Al)</i>	<i>DPB-2.5-9.8(-Al)</i>
Maximum output pulse amplitude (HV), <i>kV</i>	8.6 at 4.4 kV HV supply	9.8 at 5.0 kV HV supply
Minimum output pulse amplitude (HV), <i>kV</i> <sup>1</sup>	±2.7	
Maximum HV consumption (DPB load = 6 pF), <i>W</i>	5	
Polarity output	Bipolar	
External triggering input	1 or 2 pulses	
Maximum capacity load at maximal repetition rate and HV supply, <i>pF</i> <sup>2</sup>	12	
HV pulse rise/fall time, <i>ns</i> (HV load=6pF)	<10.5/9.5	<12/10.5
HV pulse duration, <i>ns</i>	35...2000	
Maximum HV repetition rate, <i>kHz</i>	3	2.5
HV pulse delay, <i>ns</i>	~30	
External triggering pulse amplitude @50Ω load, <i>V</i>	3.5...5	
External triggering pulse rise time, <i>ns</i>	<5	
External triggering pulse duration 2-input control mode, <i>ns</i>	>20	
External triggering pulse delay between IN1 and IN2 for 2 input control mode or IN1 pulse duration in 1- input control mode, <i>ns</i>	35...2000	
Low voltage DC requirements	23...25 V, 50 mA	
DC Connectors	Molex Micro-Fit 3.0	
Dimensions, <i>mm</i>	See figure(s) in CHAPTER 3 DEVICE LAYOUT 140×75×29 (without HV supply) 151×86×59 (with HV supply) 192×81×75 (-Al)	
Weight, <i>g</i>	130 (without HV supply) 260 (with HV supply) 560 (-Al)	

<sup>1</sup> Minimal voltage limit can be switched off, see CHAPTER 5 Specifications.

<sup>2</sup> Voltage or repetition rate derating is necessary if capacitance of your Pockels cell is higher. Contact Eksma Optics for details.

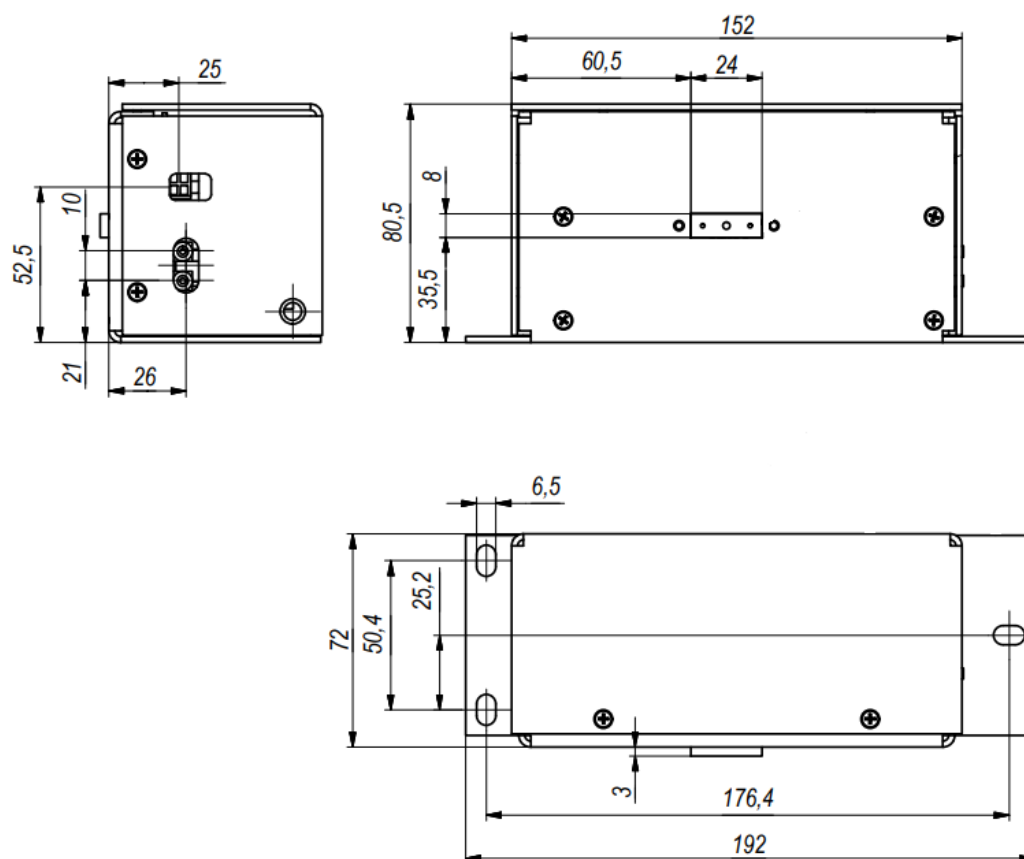


**Figure 1.** Outline drawing and dimensions of the driver without HV supply



**Figure 2.** Outline drawing and dimensions of the driver with HV supply

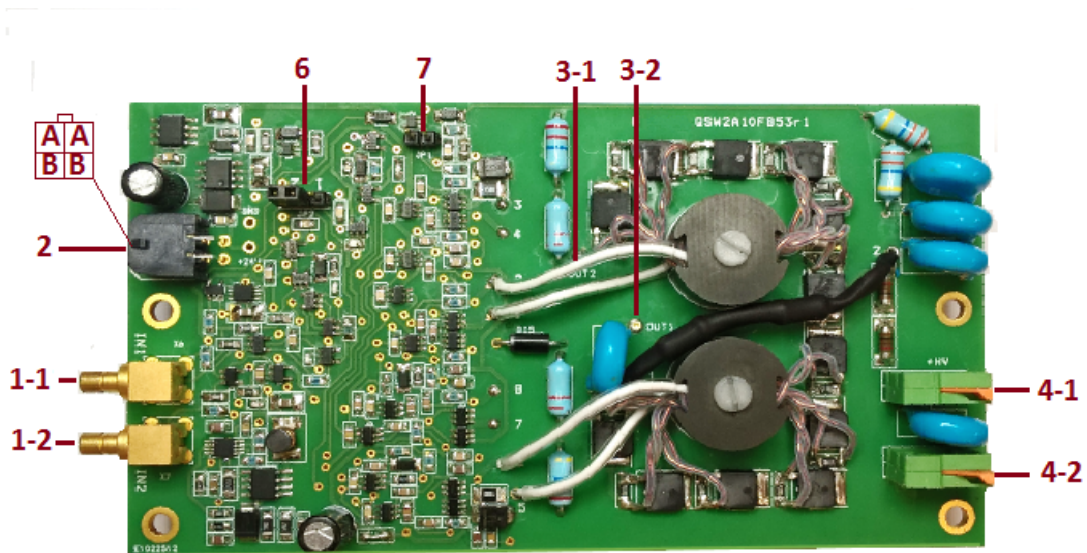




**Figure 3.** Outline drawing and dimensions of the driver cover and HV supply (-Al)



**Figure 4.** View of the driver with HV supply (-Al)



**Figure 5.** View of the driver

**Table 4.** Ports seen in top view of the driver

#	Port
1.1	X1(SYNC IN1) for HV opening, or SYNC IN in one impulse control mode
1.2	X2 (SYNC IN2) for HV closing
2	Connector Molex 4 (Microfit series) - interface for +DC (24 VDC) supply ("A" is +DC; "B" is GND)
3.1	HV pulse output pin <b>+OUT</b>
3.2	HV pulse output pin <b>-OUT</b>
4.1	Connector for +HV input from HV supply
4.2	Connector for GND input from HV supply
5	HV power supply tuning port( only for <b>-AI</b> drivers)
6	Jumper to toggle SYNC IN mode between one-and-two pulses control
7	Protection jumper
8	Grounding screw (only for <b>-AI</b> drivers)

Equipment is designed to be safe under normal environmental conditions according to 1.4.1. 61010-1@IEC:2010 (Safety requirements for electrical equipment, control and laboratory use):

1. indoor use;
2. altitude up to 2000 m;
3. temperature 5°C to 35°C;
4. maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 35°C;
5. POLLUTION degree 1: no POLLUTION or only dry, non-conductive POLLUTION occurs.

**Warning:**

***The safety of the system incorporating driver and HV power supply is the responsibility of the assembler of the system.***

Operating the driver is allowed to persons acquainted with the operation manual and having permission to deal with voltages over 1000 V.

Do not remove unit covers while power cable is connected to the mains (if applicable).

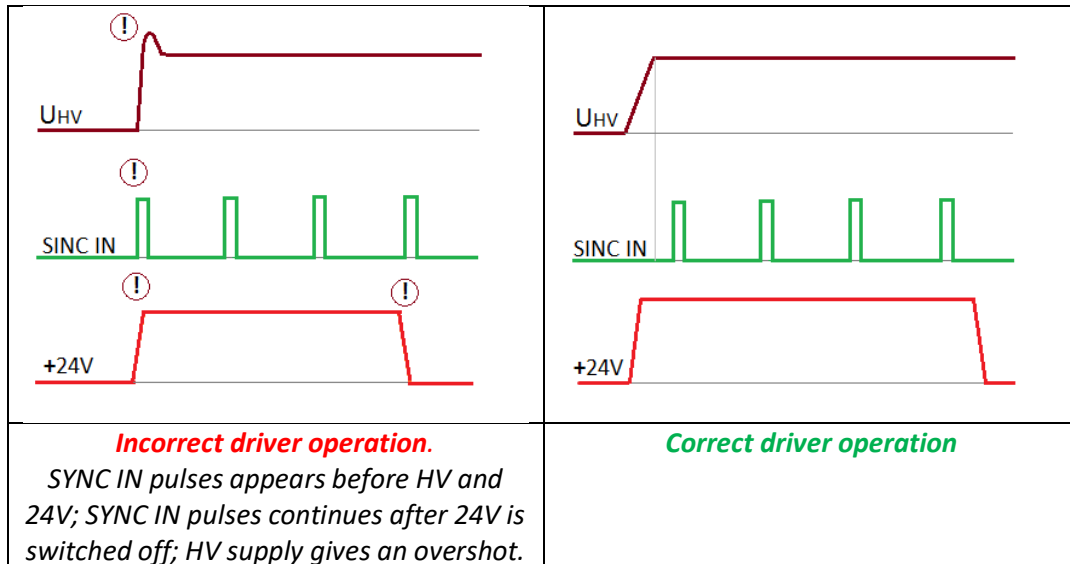
Do not touch any parts of the system when high voltage is applied, as it may cause injury or death.

Do not operate the unit until it is **grounded** and the load is connected.

Do not use the unit if any defects have been detected.

**Please read these important notes before using the product!**

1. External triggering pulses to inputs **X1**(SYNC IN1) and **X2**(SYNC IN2) may be applied only if high voltage and DC power are provided and turned on. When turning off the driver, first turn off synchronization pulses, then turn off the power. Otherwise the driver may be damaged.



**Figure 6.** Driver operation chart

The DPB driver has protection against damage due above wrong SYNC IN timing. However, this protection blocks output if HV supply is set below 2.7 kV. If you still need to operate below this limit, the protection can be switched off by shortening pins of jumper **#7** (**Figure 7**). This case HV supply voltage and following amplitude of output pulses can be reduced down to 0 V. You should be absolutely sure that correct operation conditions as per **Figure 8** are fulfilled.

2. The output pulse is provided between OUT+ and OUT- connectors. Do not connect an oscilloscope or any other device to the OUT connector. The wire contact with the Pockels cell must be proper in order to avoid a discharge, which may damage the driver. Do not connect the driver without a capacitive load (4...10 pF) as this may damage to the driver.

3. The pulse shape (including fronts) can be measured indirectly. On your oscilloscope, select 1 V sensitivity and the 1 M $\Omega$  input. Use isolated 1:10 oscilloscope probe for measurement. Move the probe *slowly* and *carefully* toward the hot output wire. When the probe is ~10 mm away from the hot output wire, the pulse shape should appear in the oscilloscope (amplitude should be several volts). Do not place the probe too close to the hot output wire – a discharge may start and damage the driver. This measurement method is not suitable for measuring >500 ns pulses.

4. Do not attempt to measure the parameters of any parts of the driver's electronics using an oscilloscope, especially when the driver is running in pulsed mode. Attempts to measure parameters of certain parts of the driver's circuitry may lead to damage.

## 6.1. Set jumper #6 to required operation mode

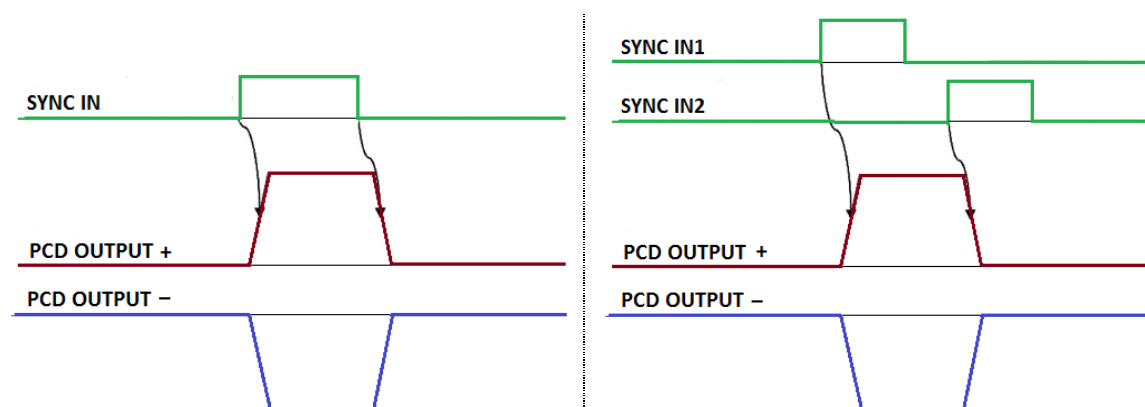
This step describes the commutation jumper marked “#6” in **Figure 9** / **Table 5**.

The DPB driver may be controlled by one or two SYNC IN signals (see **Figure 10**), depending on the jumper position:

- Jumper position **1**: one-pulse control mode  
SYNC IN1 rising edge turns HV to Pockels cell on, falling edge turns the voltage off.
- Jumper position **2**: two-pulse control mode  
SYNC IN1 rising edge turns voltage on, SYNC IN2 rising edge turns the voltage off.

Either of the two jumper positions must be selected when operating the driver. Do not leave the driver with no position set on the jumper.

Cables from generator must be of equal length for control by two synchronization pulses.



**Figure 11.** Control timing for one- and two-pulse controlled driver

## 6.2. Connect wires to the Pockels cell

The wires leading from outputs **OUT1** and **OUT2** to the Pockels cell must be about 0.24 mm<sup>2</sup> CSA. Both the wires must be as short as possible and equal length. The length of each wire must be not exceeding 100 mm. They should be located at least 5 mm away from any conductive material (including the operator’s fingers and instruments) – this is done to avoid any additional capacitive load. Otherwise, driver characteristics may degrade and/or the driver may get damaged.

## 6.3. Ground the Pockels cell driver together with the generator and HV supply

The driver output of several kilovolts (kV) with very fast edges is a powerful source of electromagnetic interference (EMI). Please ensure proper wiring and grounding to avoid problems caused by interference.

The best solution to minimize EMI is to mount the driver and the HV power supply on the metal body of the laser. The driver base plate must have very good contact with the ground wire of the HV power supply, such as the four mounting holes on the edges of the board. This is enough in

most cases, provided the driver is firmly attached to the metal laser body and the HV power supply is attached to the same body via all available mounting holes.

If the EMI level is still very high, attempt mounting ferrites on all power and control wires leading to the driver and power supply (except wires to the Pockels cell).

Please note that the aluminum case of the driver is not designed to provide effective EMI shielding. Essentially, correct wiring provides best results.

## 6.4. Supply voltage to the driver from the DC power supply

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For a safe start of the driver, the DC power supply must provide at least 0.6 A peak current when turning on. Although most DC power supplies are capable of providing this, it is recommended to double-check your supply as an insufficient peak current may damage the driver.

## 6.5. Supply voltage from the HV supply

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Set output voltage from HV supply.

If the HV power supply is manufactured by a third party, before supplying voltage, ensure there is no overvoltage while turning it on.

If driver is fixed together with HV power supply, connect CAN cable to HV tuning port **#5** in **Figure 12** or set HV voltage by potentiometer.

## 6.6. Provide synchronization pulses from the generator

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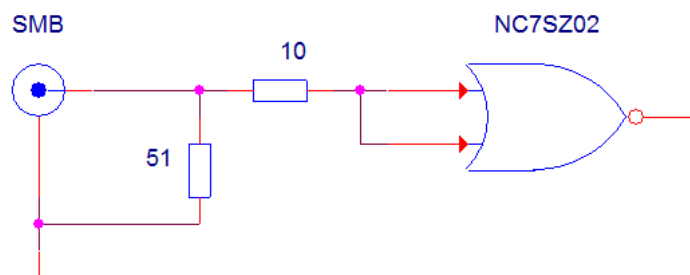
It is necessary to measure the generator output voltage with a  $50\Omega$  load before applying synchronization signals to the DPB driver. The signal voltage must be in the range of 4...5 V. Voltage lower than 4 V is not recommended due to growth of output pulse jitter; thus, make sure that the duration of SYNC IN1 pulse is longer than 30 ns in single-pulse driving, or delay between SYNC IN1 and SYNC IN2 is greater than 30 ns in two-pulse driving. A shorter duration or delay of the synchronization pulses may damage the driver.

After the generator output voltage is measured, remove the  $50\Omega$  load and provide synchronization pulses to the driver.

Note that the output pulse duration and delay depend of the control pulse signal level and HV pulse rise/fall time (edges of HV pulse); the duration may vary in the order of several nanoseconds (in positive and negative directions). It is not recommended to use control signals with edges longer than 20 ns. **Figure 13** presents the input circuit. Below 30 ns, driver output voltage starts decreasing. Output pulses shorter than 30 ns can damage the driver.

*Note:*

*After +DC voltage is applied, the first synchronization pulse is skipped.*



**Figure 14.** Input circuit of driver