Electronic's Lab measuring panel
eLAB panel
NOT FINAL VERSION!

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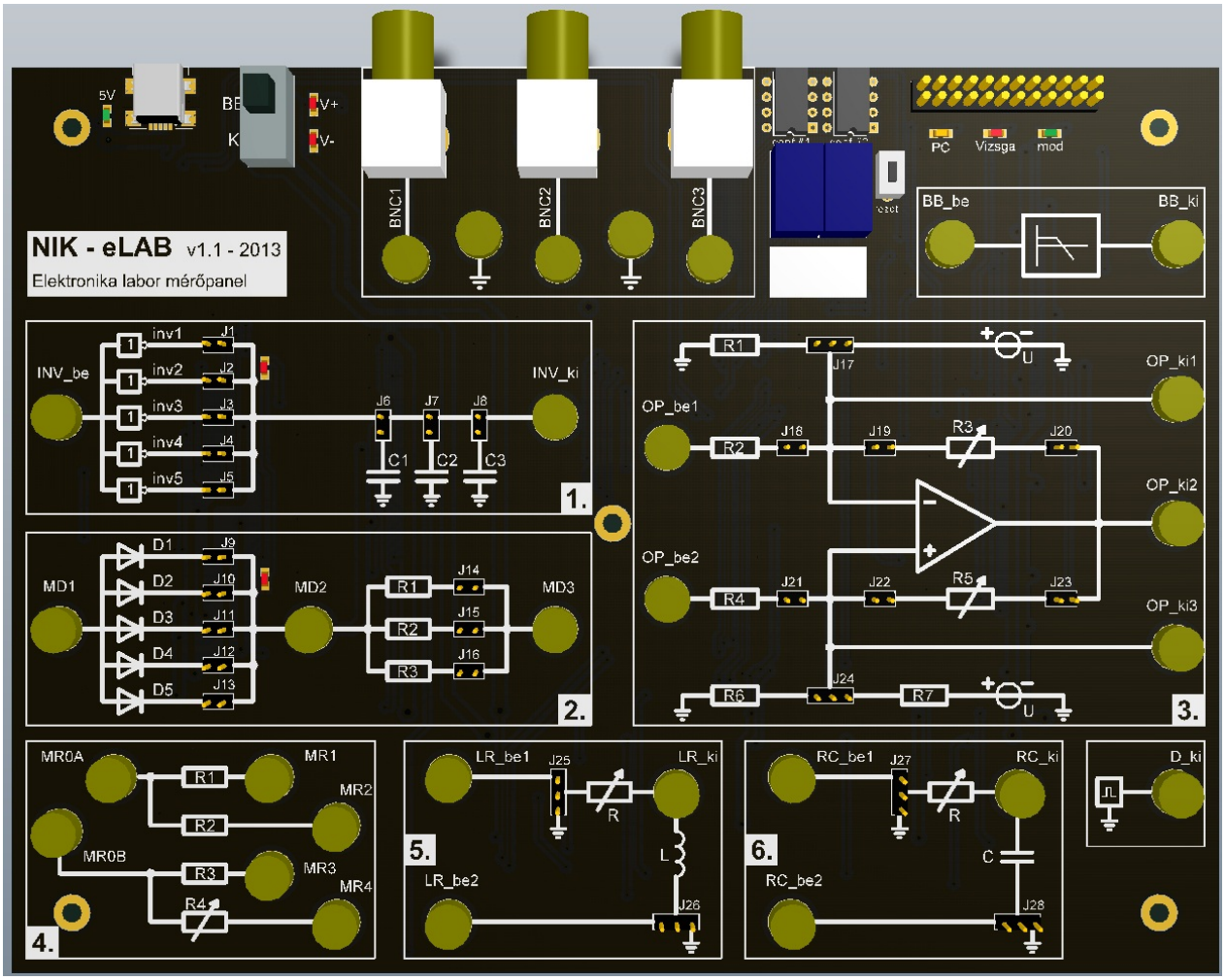
I. Introduction

In the Electronics Lab we use fot the measuring of the physical circuits the eLab panel. Every the circuits which are used on this course are on the panel. The system contains the following parts:

- eLAB board
- jumpers and cables, which are needed to the setting up of the circuits
- board management software to setting the changeable resistors and reference voltages



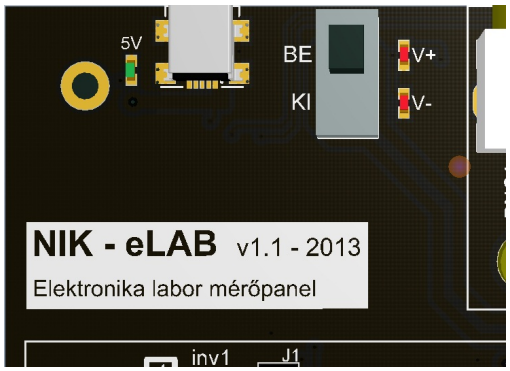
1. ábra. eLAB measuring panel

The measuring board is a PCB panel with $200mmx150mm$ dimensions. All of the needed basic circuits can be find on the board:

- digital circuits measurement
- diode measurement
- operational amplifiers examinasions
- resistor measurments
- RC, RL circuit investigations

The system is connected to the PC through an USB port which provides the programming and the power supply, too. White circuit diagram illustrates the connections between the different connectors, jumpers (

) and electrical components. Jumpers are used to set up the circuits. Unused jumpers must always be stored on the pins at the upper right corner.



2. ábra. Conector, power supply

I-A. Set-up

Make sure that the circuit is connected to the student PC through the USB cabel at the beginning of the measurements. When the eLab panel get power supply through the USB cabel the green LED with "5V" title lights up. In this case the control electronics and digital circuits are under voltage. $-5V$ and $+5V$ are produced on the panel to drive of the analog electronical elements (operational amplifiers, digital potentiometer, changeable reference voltage, etc.). Power switch is next to USB connector. If the switch is on, V+ and V- LEDs are illuminating.

I-B. Changeable resistors

The circuit is created by inside connections and components. The changeable inside resistors (

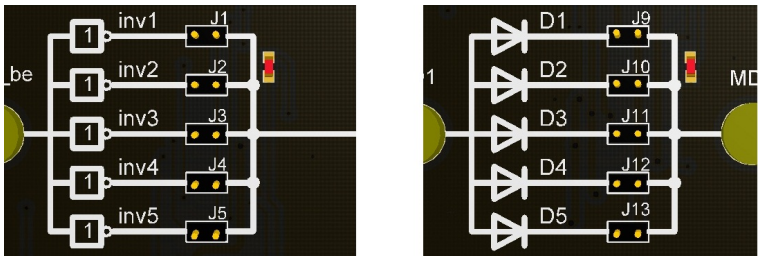
) are actually digital potmeters (type: AD5263).The values of these are changeable in the eLab software. The adjusted value are shown on the panel with 30% accuracy.

For example, if we set value of the $R4$ resistor to $30K\Omega$ in the software, then measure it, the value of $R4$ could be between $21K\Omega$ and $39K\Omega$. This difference comes from the manufacturing inaccuracies of the digital potmeters.

I-C. Circuit set-up

Always pay attention for the appropriate connection of the connectors, is an input or output and the maximum allowed voltage level when setting up the circuit. The placing of the jumpers be carefully to not short-circuited of the circuit and don't connect the input and the output.

In the inverter and diode measurements is possible that selection of the components with not just jumpers but also remotely in the software with relays which are placed on the board. When the selection is remote controlled then red LEDs are illuminating next to the selector jumpers (3. ábra). In this case MUST NOT placing jumpers to the (J1, J2, J3, J4, J5, J9, J10, J11, J12, J13) pins (see on the pic.) because it can connect several inverter outputs.

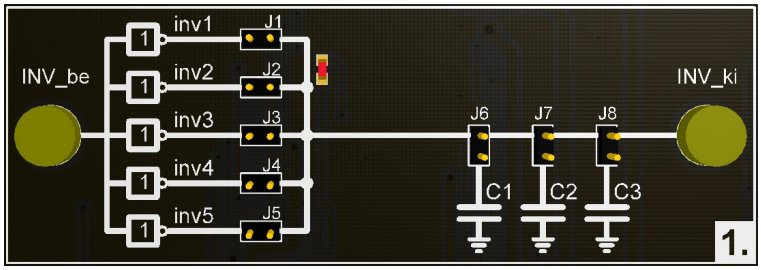


3. ábra. Inverter, diode selecting

II. Basic circuits

II-A. Digital circuit measurements

The digital circuits measuring have been created on the modul with number 1. During the measuring five different types of digital circuits measuring is possible beside seven different values of active loadings.



4. ábra. Panel

Maximum 1 jumper must be connected to the connectors J1, J2, J3, J4, J5 to select an inverter to measuring. If the red LED is illuminating next to the jumper pins that indicates that any pin connection (jumper using) is not allowed! With J6, J7, J8 connectors can select the value of the loading capacity. Here more than one capacity is selectable, then the summarized capacity is shown on the gates.

The following table shows the properties of the circuit's measuring points (2mm banana sockets).

Identifier	Direction	Voltage range	Comment
INV_in	input	$0V...5V$	
INV_out	output		connecting to signal source or ground point is PROHIBITED

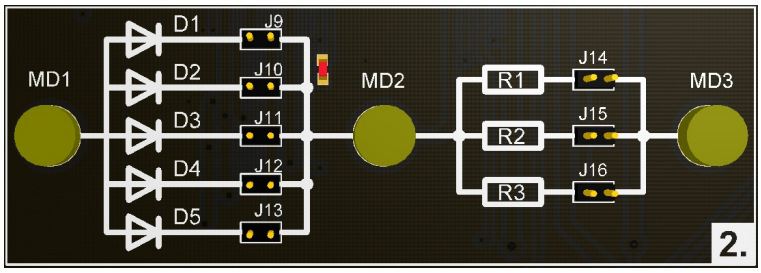
The following tables contains and summarizes all components and values in the circuit.

Identifier	Type	Comment
inv1	7407	buffer with open-collector
inv2	CD74ACT04E	inverter
inv3	SN74LS04N	inverter
inv4	SN74HC14N	Schmitt trigger inverter
inv5	CD4001BE	inverter formed from NOR gate

Identifier	Capacity value	accuracy
C1	$10pF$	10%
C2	$100pF$	10%
C3	$1nF$	10%

II-B. Diode measurements

The diode measuring is possible on panel with number 2. During the measurements five different diode measuring is available and beside them seven different operating points can be chosen.



5. ábra. Dióda measurements

Maximum 1 jumper must be connected to the connectors J9, J10, J11, J12, J13 to select a diode to measuring. If the red LED is illuminating next to the jumper pins that indicates that any pin connection (jumper using) is not allowed! With J14, J15, J16 connectors can select the operating point selector resistors value. Here more than one resistor is selectable, then the summarized resistance has to be considered while calculating. Do not connect the MD2 and MD3 point to each other!

The following table shows the properties of the circuit's measuring points (2mm banana sockets).

Azonosító	Irány	Feszültségtartomány	Megjegyzés
MD1		$-20V...+20V$	jelforás bemenet, vagy föld pont
MD2	kimenet	-	mérőpont
MD3		$-20V...20V$	jelforás bemenet, vagy föld pont

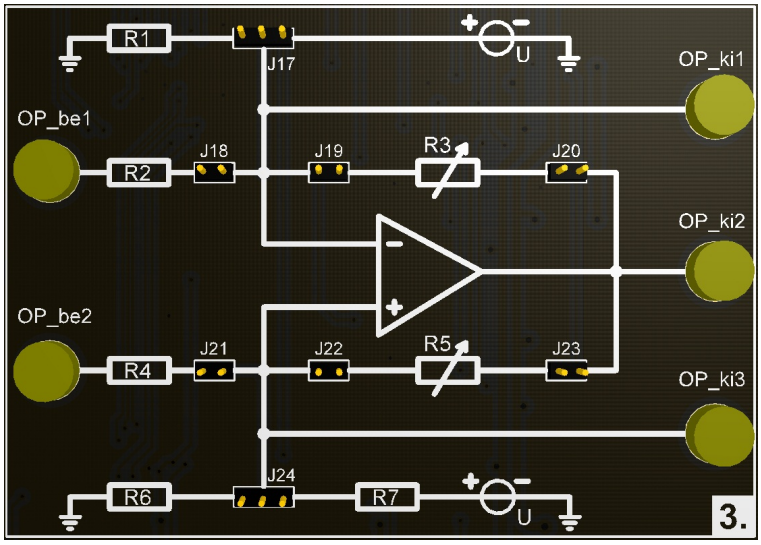
The following tables contains and summarizes all components and values in the circuit.

Identifier	Resistor value	accuracy	power
R1	500Ω	1%	$0,5W$
R2	$1K\Omega$	1%	$0,5W$
R3	$5K\Omega$	1%	$0,5W$

Identifier	Type
D1	B340-13-F
D2	S3K-E3/57T
D3	1SMA4739
D4	1SMA5914BT3G
D5	green LED

II-C. Examination of operational amplifiers

The operational amplifier measuring is possible on panel 3.



6. ábra. Panel

The following circuits can setting up with J17, J18, J19, J20, J21, J22, J23, J24 jumpers:

- Inverting circuit
- Non-inverting circuit
- Inverting comparator
- Non-inverting comparator
- Inverting comparator with hysteresis
- Non-inverting comparator with hysteresis

The following tables contains and summarizes all components and values in the circuit and show the measuring points properties.

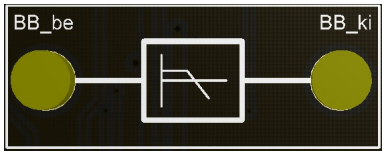
Identifier	Direction	Voltage range	Comment
OP_be1	input	-5V +5V	
OP_be2	input	-5V +5V	
OP_ki1	output/measuring point	-5V +5V	Do not connect signal source, voltage supply, ground with this point!
OP_ki2	output/measuring point	-5V +5V	Do not connect signal source, voltage supply, ground with this point!
OP_ki3	output/measuring point	-5V +5V	Do not connect signal source, voltage supply, ground with this point!

The following tables contains and summarizes all components and values in the circuit.

Identifier	Value	accuracy	Power	Comment
R1	$20K\Omega$	1%	$0,25W$	
R2	$20K\Omega$	1%	$0,25W$	
R3	$3K\Omega...200K\Omega$	30%	$0,25W$	changeable resistor
R4	$4,7K\Omega$	1%	$0,25W$	
R5	$3K\Omega...200K\Omega$	30%	$0,25W$	changeable resistor
R6	$20K\Omega$	1%	$0,25W$	
R7	$4,7K\Omega$	1%	$0,25W$	
U	$-5V... + 5V$			changeable reference voltage

II-D. Measuring of transfer characteristics

The transfer characteristics measuring circuit is established in the upper right corner of the eLAB panel. During the lab course the bode characteristics of an active bandpass filter will be measured.



7. ábra. Transfer characteristics measurement

The following tables contains and summarizes all components and values in the circuit and show the measuring points properties.

Identifier	Direction	Voltage range	Comment
BB_be	input	-5V ... +5V	
BB_ki	output	-	Do not connect signal source, voltage supply, ground with this point!