# **CONTROL SYSTEM FOR MAGNET POWER SUPPLIES FOR NOVOSIBIRSK FREE ELECTRON LASER**

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### The connection of control devices with power supplies



#### The control devices used:

**1. CANDAC16** - 16-channel DAC. Controls up to 16 low-current(3-17A) power supplies.

2. CANADC40 - 40-channel ADC. Measured output voltages form up to 16 low-current(3-17A) power supplies.

3. CDAC20 – 1-channel DAC and 5-channel ADC. Completely controls one high-current(300A-2500A) power supply.

Parameter	Candac16	Canadc40	Cdac20
DAC resolution	16 bits	-	21 bits
DAC accuracy	0.05%	-	0.005%
DAC channels	16	-	1
ADC resolution	-	23 bits	23 bits
ADC accuracy	-	0.03%	0.003%
ADC channels	-	40	5
Scale (input/output)	10 V	10 V	10 V
Qty of devices used in the 1 <sup>st</sup> FEL stage	10	10	3
Qty of devices used in the 2 <sup>nd</sup> FEL stage	24	24	7

Qty of devices used in 24 24 the 3<sup>rd</sup> FEL stage

#### The main operation modes:

1. Multi-channel mode. All ADC are continuously measuring all required channels and transmitting measured data to control PC. In this operation mode all power supplies are processed.

2. Single channel mode. One of ADC (CANADC40 or CDAC20) starting continuous measurement of channel, connected to output of interesting power supply. This operation mode is used to diagnosing of power supplies (detecting current ripples, studying time stability...)

## **CONTROL SOFTWARE**

**1.** The main window of application. The power supplies are represented as colored bars. The color of the bar and its content informs about state of current power supply. For modifying the current in power supply, the individual dialog window is opened.

MSC-21_03_03_mg	CONSTRANCE HIS 20MRM5 NO F	ESPONSE 20MRM6 NO RESPONSE	AMULZ NO RESPONSE
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DALUT NAME TOUS DA	Con mane tone mane have to	it CACUY Name Lout DACUY Name 1	COL JALL Hans Lout
The second secon	21RBM1 9.30 00 21R07 0.1	7 100 2080208 0.16 10 210581 2-0	
	21WPW2 8 54 02 21W09 0.1	CIMUS M	
The second s	21/0/2 9.54 02 21/00 0.5	21MQ8_Основная_обмотка	
	1802 0.27 04 4881 -0.1	DAC05 Channel02	0.07
Contraction of 05	1003 0 81	I(MAX) - 10 0 A (I(MAX) - 20.0 V	0.00
06 BORD 06	TMEMT - B	- 🗆 X	0.13
07	1MBM1 Основная обнотка	Read DAC	Graph Close 0.00
De la companya de la	THDHT_OCHOBALD_OOMOTEL		5 103
D.T. DMDTY MIN 107	DAC02 Channel00	R0 = 1.20 Obm	0.925 OK CENS
10 1218252 10	I(MAX) = 10.0 A U(MAX) = 20.0 V	Bout = -2 15 Ohm	
21 BRDT 12	Degauss Dead Da	al and and it is it is	Step I (A)
12 ENETY 12	Iveau DA	Graph Close	Set 0 0.0020 - 0.03
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NO EDITION IN	lout -6.1657 A R0 = 0.80 Of	Im -0.154 OK 14 20H02 y -0	.00 211 211 211 21 21 21 21 21 21 21 21 21
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00 19691 -0.17		3810 10.0020 +15 1	00 21905 8 0.59
01 IABAG -0,62		comora_k-ok	
01 20MBM1-2 7 04	03 204021 -0.	20МQ13_Обмотка_Коррекции_по_Х	-0.00
04 3M01 2,10	04 21601 2.1	DAC08 Channel09	-0.00
05 3802 2,05	65 318613 0.	I(MAX) = 3.0 A U(MAX) = 12.0 V	0.00
06 20801 1.03	06 21802 -1.5	Description	-0.00
07 20803 1.08	D7 21H014 -0.1	Read DAC	Graph Close 0.00
08 20Mo5 1.07	00 21H03 -0.7	lin -0.2200 A	-0.00
09 20MQ7_ 1.07	09 21M015 -1.5	lout =0.2201 A B0 = 2.50 Ohm	0.22 OK 0.00
10 20809 1.07	10 21804 0.3	Hout =0 5034 V Rout = 2.29 Ohm	Chan 1/42 0.00
11 20H011_ 1.07	11 21M016 2.1		Step I (A): 0.00
12 28MQ13_ 1.06	12 21805 1.6		Set 0 0.00060.00
13 20NQ15_ 1.08	13 218012 1.4		-0.32
14 20M017 -0.48	14 21M06 -3.5	15 14 20M018 y-0.04	14 UlCor3X -0.00
15 20MDM7-6 4.88	15-318011 -318	15 20M019_Y-0.00	15 01cor2X 0.00
Ready			

**2.** The mnemonic scheme of the microtron-recuperator. All elements of magnetic system are depict as colored rectangle. The element of different types (corrector, quadrupole, bending magnet) have different color and the size. Clicking by mouse cursor on the rectangle, individual dialog window, corresponding to power supply, controlling this element, is opened.



**3.** Diagnosing of power supply current ripples window. The application runs the cycle of single-channel measurements of all channels of all ADCs, measuring the output current of power supplies. Measured current waveform is processed - maximum deviation and rootmean-square deviation of current is calculated. Obtained values are represented in window as colored vertical bars.



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