B4ce1x – full console MIDI encoder for B4 software organ
* user's guide *

1. Purpose of B4ce1x

- **B4ce1x** is designed to allow full control over all functions of famous **B4 software organ** simulator by *Native Instruments.*
- **B4ce1x** is capable to scan 4 contact scanmatrices, each of 8x8=64 scanpoints (totally up to 256), used for keyboard contacts, switches and selectors control, plus 48 potentiometers, used for continuous control.
- **B4ce1x** can be built-in into any keyboard console with/without full set of contacts/potentiometers turning it into full-capable MIDI instrument. Such console can be used for controlling **B4** as well as any standard MIDI synth/expander.

2. Preparing B4 software

Prior to using **B4ce1x** it is assumed that you have already installed **B4** software on your computer. You can download demo-version from

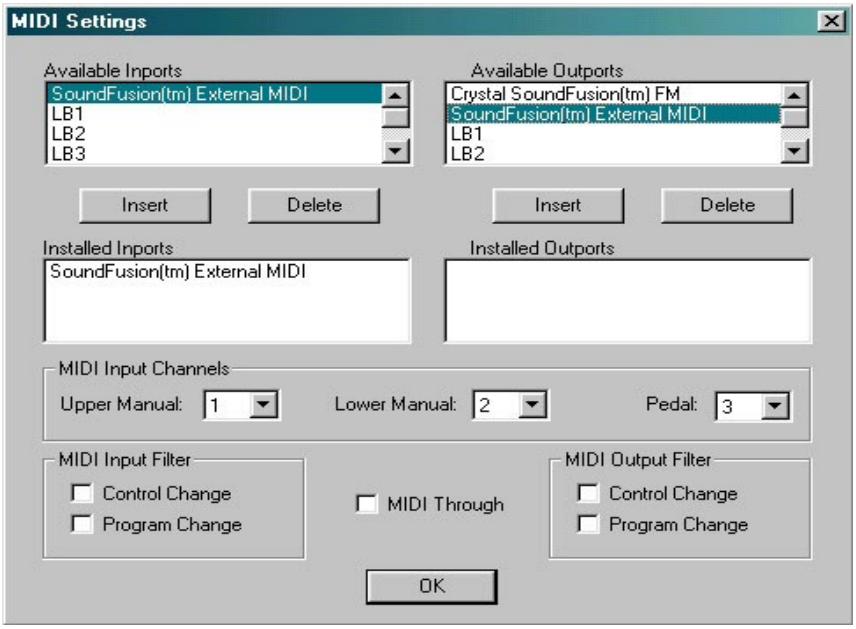


***Fig.1** MIDI settings of **B4** software*

www.native-instruments.com or purchase the full software package at their dealer. After this, you should set the **B4** MIDI communication in 2 steps:

- Set **B4** MIDI input (Inport) to receive from external MIDI devices;
- Set the MIDI input channels for each keyboard division.

Both steps can be be done by clicking on **B4** 'System' menu and selecting 'MIDI settings' item:

MIDI inport: External MIDI *(or what is similar on your system)*;
Upper keyboard: MIDI channel 1;
Lower keyboard: MIDI channel 2;
Pedalboard: MIDI channel 3.

Fig.1 shows an example of how MIDI settings should look after configuring. Note that the 'Available inports' and 'Available outports' lists can be different on your machine, depending on what hardware/software have you installed on it.

After setting **B4** MIDI communications this way, it will be able to receive messages from your **B4ce1x** controller unit.

2. Connecting the encoder

The wiring diagram for **B4ce1x** encoder unit is shown in ***Appendix A***. The scanmatrices #1,2,3 should be connected to key contacts of Upper/Lower/Pedal keyboard. Each of these keyboards can be up to 64 keys. Unused scanmatrices/contact inputs will be ignored by the unit. The functions of all scanpoints in scanmatrices 1-3 are listed in ***Table 1***.

Scanmatrix #4 should be connected to control switches/buttons. The functions of all scanpoints in scanmatrix #4 are listed in ***Table 2***.

Detailed wiring for both types of scanmatrices is shown in ***Appendix B***. Note that diodes are required for proper wiring of each scanmatrix. Recommended type of diodes is 1N4148 or similar. Contacts should be connected to the unit using ribbon cables with 2x10 pin cable headers (headers included on request).

Continuous controls (Drawbars/potentiometers) should be wired to the unit the way shown in ***Appendix A.*** Potentiometers functions are listed in ***Table 3.*** The input that have nothing wired will be read by the unit as potentiometers left on Max position (full on). The wiring should be done using ribbon cables as short as possible, ending with 16-pin cable headers (included on request).

The rest of wiring consists of power supply wiring and MIDI wiring. The unit can be supplied by any AC/DC adapter capable to provide 100mA of current at 9-12V. There is on-board rectifier/regulator, therefore AC or DC of any polarity would work OK.

The unit has standard MIDI MIDI output. It can be connected to PC via MIDI/Game port or to any standard MIDI synth. Both connection ways are illustrated in ***Appendix A***. Cables for connencting the unit to PC or MIDI gear are not included in package.

3. Scanpoints/potentiometers assignment

Table 1. *Scanmatrices 1,2,3 scanpoints functions*

	Upper Keyboard (SM#1)		Lower Keyboard (SM#2)		Pedal Keyboard (SM#3)	
Scanpoint/ Key #	MIDI Note #	MIDI channel	MIDI Note #	MIDI channel	MIDI Note #	MIDI channel
1	36	1	36	2	36	3
2	37	1	37	2	37	3
3	38	1	38	2	38	3
4	39	1	39	2	39	3
5	40	1	40	2	40	3
6	41	1	41	2	41	3
7	42	1	42	2	42	3
8	43	1	43	2	43	3
9	44	1	44	2	44	3
10	45	1	45	2	45	3
11	46	1	46	2	46	3
12	47	1	47	2	47	3
13	48	1	48	2	48	3
14	49	1	49	2	49	3
15	50	1	50	2	50	3
16	51	1	51	2	51	3
17	52	1	52	2	52	3
18	53	1	53	2	53	3
19	54	1	54	2	54	3
20	55	1	55	2	55	3

21	56	1	56	2	56	3
22	57	1	57	2	57	3
23	58	1	58	2	58	3
24	59	1	59	2	59	3
25	60	1	60	2	60	3
26	61	1	61	2	61	3
27	62	1	62	2	62	3
28	63	1	63	2	63	3
29	64	1	64	2	64	3
30	65	1	65	2	65	3
31	66	1	66	2	66	3
32	67	1	67	2	67	3
33	68	1	68	2	68	3
34	69	1	69	2	69	3
35	70	1	70	2	70	3
36	71	1	71	2	71	3
37	72	1	72	2	72	3
38	73	1	73	2	73	3
39	74	1	74	2	74	3
40	75	1	75	2	75	3
41	76	1	76	2	76	3
42	77	1	77	2	77	3
43	78	1	78	2	78	3
44	79	1	79	2	79	3
45	80	1	80	2	80	3
46	81	1	81	2	81	3
47	82	1	82	2	82	3
48	83	1	83	2	83	3
49	84	1	84	2	84	3
50	85	1	85	2	85	3
51	86	1	86	2	86	3
52	87	1	87	2	87	3
53	88	1	88	2	88	3
54	89	1	89	2	89	3
55	90	1	90	2	90	3
56	91	1	91	2	91	3
57	92	1	92	2	92	3
58	93	1	93	2	93	3
59	94	1	94	2	94	3
60	95	1	95	2	95	3
61	96	1	96	2	96	3
62	97	1	97	2	97	3
63	98	1	98	2	98	3
64	99	1	99	2	99	3

Table 2. *Scanmatrix 4 scanpoints functions*

Scanpoint/ Control #	B4 Function	ON MIDI sequence (hex)	OFF MIDI sequence (hex)	Comments
1	Lower Vibrato	B0,1E,7F	B0,1E,00	Switch
2	Upper Vibrato	B0,1F,7F	B0,1F,00	Switch
3	Percussion	B0,42,7F	B0,42,00	Switch
4	Overdrive	B0,43,7F	B0,43,00	Switch
5	Rotator	B0,44,7F	B0,44,00	Switch
6	Velocity	B0,45,7F	B0,45,00	Switch
7	Lower-to-Pedal coupler	encoder's internal function	encoder's internal function	Switches.On activating/deactivating couplers no special MIDI message is transmitted, and only keyboards behaviour changes properly.
8	Upper-to-Pedal coupler	encoder's internal function	encoder's internal function	
9	VC, pos.V1	B0,49,7F,B0,4A,00	none	6-position (rotary) switch or 6 momentary buttons
10	VC, pos.C1	B0,49,00,B0,4A,00	none	
11	VC, pos.V2	B0,49,7F,B0,4A,40	none	
12	VC, pos.C2	B0,49,00,B0,4A,40	none	
13	VC, pos.V3	B0,49,7F,B0,4A,7F	none	
14	VC, pos.C3	B0,49,00,B0,4A,7F	none	
15	Rotator Speed	B0,01,7F	B0,01,00	Switch
16	Upper-to-Lower coupler	encoder's internal function	encoder's internal function	

17	Preset Bank #1	C0,xx,C1,yy	none	10 position (rotary) switch or 10 mometary buttons. Upon changing Preset bank, following MIDI sequence is transmitted (hex): C0,xx,C1,yy where: xx=Bank#+UpperPreset#; yy=Bank#+LowerPreset#
18	Preset Bank #2	C0,xx,C1,yy	none	
19	Preset Bank #3	C0,xx,C1,yy	none	
20	Preset Bank #4	C0,xx,C1,yy	none	
21	Preset Bank #5	C0,xx,C1,yy	none	
22	Preset Bank #6	C0,xx,C1,yy	none	
23	Preset Bank #7	C0,xx,C1,yy	none	
24	Preset Bank #8	C0,xx,C1,yy	none	
25	Preset Bank #9	C0,xx,C1,yy	none	
26	Preset Bank #10	C0,xx,C1,yy	none	
27-32	n.a.	none	none	not used
33	Upper Preset #1	C0,xx	none	12 positon switch. Upon changing Upper Preset, following MIDI sequence is transmitted(hex): C0,xx where: xx=Bank#+UpperPreset#
34	Upper Preset #2	C0,xx	none	
35	Upper Preset #3	C0,xx	none	
36	Upper Preset #4	C0,xx	none	
37	Upper Preset #5	C0,xx	none	
38	Upper Preset #6	C0,xx	none	
39	Upper Preset #7	C0,xx	none	
40	Upper Preset #8	C0,xx	none	
41	Upper Preset #9	C0,xx	none	
42	Upper Preset #10	C0,xx	none	
43	Upper Preset #11	C0,xx	none	
44	Upper Preset #12	C0,xx	none	
45-48	n.a.	none	none	not used
49	Lower Preset #1	C1,yy	none	12 position switch. Upon changing Lower Preset, following MIDI sequence is transmitted(hex): C1,yy where: yy=Bank#+LowerPreset#
50	Lower Preset #2	C1,yy	none	
51	Lower Preset #3	C1,yy	none	
52	Lower Preset #4	C1,yy	none	
53	Lower Preset #5	C1,yy	none	
54	Lower Preset #6	C1,yy	none	
55	Lower Preset #7	C1,yy	none	
56	Lower Preset #8	C1,yy	none	
57	Lower Preset #9	C1,yy	none	
58	Lower Preset #10	C1,yy	none	
59	Lower Preset #11	C1,yy	none	
60	Lower Preset #12	C1,yy	none	
61-64	n.a.	none	none	not used

Table 3. *Potentiometers functions*

Pot #	B4 control	MIDI CC #	MIDI channel	Type
1	Pedal Drawbar #1	33	1	Linear sliding potentiometer
2	Pedal Drawbar #2	34	1	Linear sliding potentiometer
3	Pedal Drawbar #3	35	1	Linear sliding potentiometer
4	Pedal Drawbar #4	36	1	Linear sliding potentiometer
5	Pedal Drawbar #5	37	1	Linear sliding potentiometer
6	Pedal Drawbar #6	38	1	Linear sliding potentiometer
7	Lower Drawbar #1	21	1	Linear sliding potentiometer
8	Lower Drawbar #2	22	1	Linear sliding potentiometer
9	Lower Drawbar #3	23	1	Linear sliding potentiometer
10	Lower Drawbar #4	24	1	Linear sliding potentiometer
11	Lower Drawbar #5	25	1	Linear sliding potentiometer
12	Lower Drawbar #6	26	1	Linear sliding potentiometer
13	Lower Drawbar #7	27	1	Linear sliding potentiometer
14	Lower Drawbar #8	28	1	Linear sliding potentiometer
15	Lower Drawbar #9	29	1	Linear sliding potentiometer
16	Upper Drawbar #1	12	1	Linear sliding potentiometer
17	Upper Drawbar #2	13	1	Linear sliding potentiometer
18	Upper Drawbar #3	14	1	Linear sliding potentiometer
19	Upper Drawbar #4	15	1	Linear sliding potentiometer
20	Upper Drawbar #5	16	1	Linear sliding potentiometer
21	Upper Drawbar #6	17	1	Linear sliding potentiometer
22	Upper Drawbar #7	18	1	Linear sliding potentiometer
23	Upper Drawbar #8	19	1	Linear sliding potentiometer
24	Upper Drawbar #9	20	1	Linear sliding potentiometer
25	Percussion Volume	70	1	Linear rotary potentiometer
26	Percussion Decay	71	1	Linear rotary potentiometer

27	Percussion Harmonic	72	1	Linear rotary potentiometer
28	Vibrato Mix	73	1	Linear rotary potentiometer
29	Vibrato Depth	74	1	Linear rotary potentiometer
30	Keyclick Amount	75	1	Linear rotary potentiometer
31	Tube Amp Drive	76	1	Linear rotary potentiometer
32	Tube Amp Volume	7	1	Linear rotary potentiometer
33	Tube Amp Body	78	1	Linear rotary potentiometer
34	Tube Amp Bright	79	1	Linear rotary potentiometer
35	Treble Rotor Slow	81	1	Linear rotary potentiometer
36	Treble Rotor Fast	82	1	Linear rotary potentiometer
37	Treble Rotor Accel	83	1	Linear rotary potentiometer
38	Treble Rotor Tone	80	1	Linear rotary potentiometer
39	Bass Rotor Slow	91	1	Linear rotary potentiometer
40	Bass Rotor Fast	92	1	Linear rotary potentiometer
41	Bass Rotor Accel	93	1	Linear rotary potentiometer
42	Bass Rotor Tone	90	1	Linear rotary potentiometer
43	Mic Balance	8	1	Linear rotary potentiometer
44	Mic Pan	10	1	Linear rotary potentiometer
45	Mic Spread	9	1	Linear rotary potentiometer
46	Mic Distance	3	1	Linear rotary potentiometer
47	Swell	11	1	Linear rotary potentiometer
48	Controller #2 (not supported in B4)	2	1	Linear rotary potentiometer

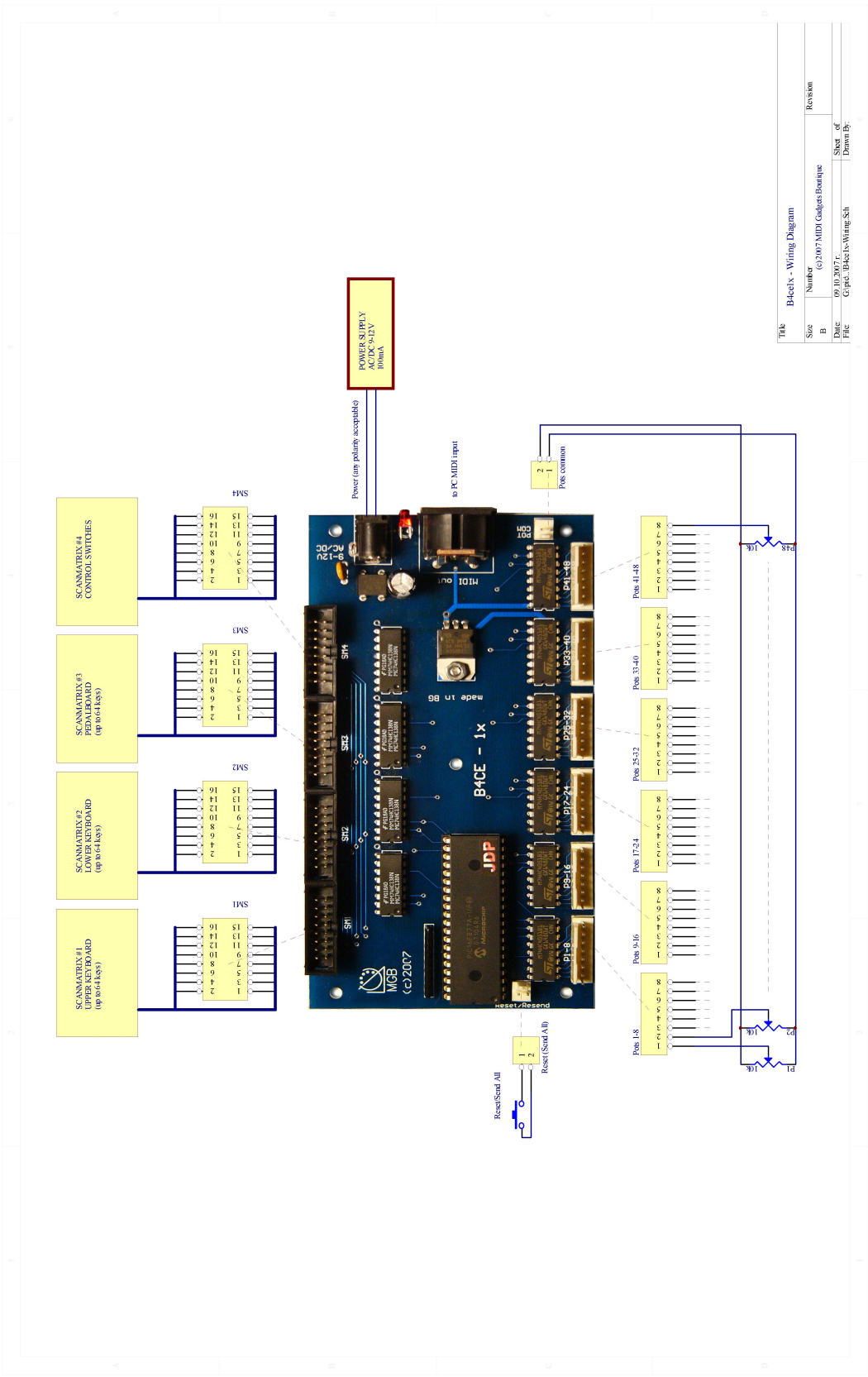
4. Technical specifications

- Scanned contacts: up to 256 (4x64);
- Scanned potentiometers: 48;
- Power supply voltage: 9-12 (AC/DC);
- Power supply current: typically 100mA (depends on potentiometers used);
- MIDI channel for Upper keyboard: 1;
- MIDI channel for lower keyboard: 2;
- MIDI channel for pedalboard: 3;
- MIDI channel for switch controls: 1&2;
- MIDI channel for continuous controls: 1;
- Scanrate for contacts: 300 times per second;
- Scanrate for potentiometers: 30 times per second;
- Size 16.5 x 10 cm (6.5 x 3.7");

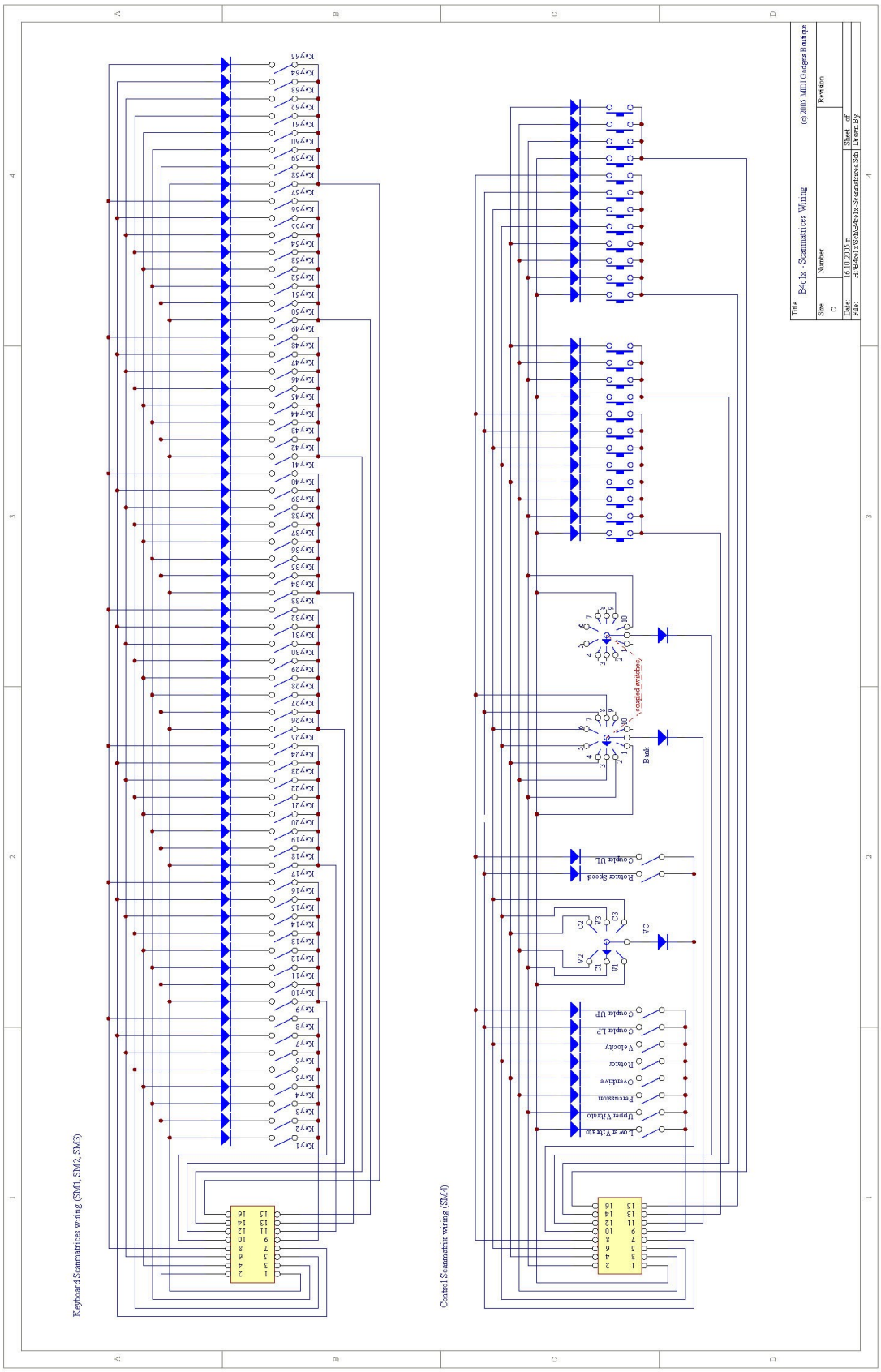
5. What is new in B4ce1x (compared to B4ce1)

- PCB *redesigned;*
- Installed separate 16-pin cable headers for each scanmatrix, compatible with KeyMux64 key multiplexers;
- Potentiometer connectors changed to more convenient 8-pin row connectors placed on the side of the PCB(was 4-pin placed in two rows);
- Rotator control moved to Scanmatrix 4;
- Added one more Continuous Control (CC2 - suppolrted buy B4 software).

APPENDIX A. B4ce1x wiring diagram



APPENDIX B. B4ce1x scanmatrices wiring



APPENDIX C. B4 MIDI controllers

On-screen Control	MIDI Controller Number	Control kind
Upper Manual Drawbars (9)	12-20	a
Lower Manual Drawbars (9)	21-29 (or 12-20 on MIDI channel 2)	a
Pedal Drawbars (6)	33-38 (or 12-17 on MIDI channel 3)	a
Vibrato Lower	30 (or 31 on MIDI channel 2)	b
Vibrato Upper	31	b
Percussion On/Off	66	b
Overdrive On/Off	67	b
Rotary On/Off	68	b
Velocity Sensitivity	69	b
Expression Pedal	11 (expression)	a
Rotary Speaker Speed (Fast/Slow)	1 (mod wheel)	a
Percussion Volume	70	a
Percussion Decay	71	a
Percussion Harmonic	72	a
Vibrato Mix	73	a
Vibrato Depth	74	a
Keyclick Amount	75	a
Tube Amp Drive	76	a
Tube Amp Volume	7 (volume)	a
Tube Amp Body	78	a
Tube Amp Brightness	79	a
Rotary Speaker-Treble Tone	80	a
Rotary Speaker-Treble Horn Slow Speed	81	a
Rotary Speaker-Treble Horn Fast Speed	82	a
Rotary Speaker-Treble Horn Acceleration	83	a
Rotary Speaker-Bass Horn Tone	90	a
Rotary Speaker-Bass Horn Slow Speed	91	a
Rotary Speaker-Bass Horn Fast Speed	92	a
Rotary Speaker-Bass Horn Acceleration	93	a
Microphone Treble/Bass Balance	8	a
Microphone Pan	10	a
Microphone Spread	9	a
Microphone Distance (from speaker)	3	a

NOTES:

- this table is pre-printed as it is shown on **B4** User Manual. (pages 55-56) without changes.
- Controller types: a – continuous (analog), b – on/off

B4 drawbars mapping

Drawbar position	Drawbar value (hexadecimal)
0	00
1	0A
2	1E
3	2D
4	3C
5	4E
6	63
7	72
8	7F

B4 keyboard

Keyboard division	MIDI channel	Starting note	Keys in division
Upper keyboard	1	C3(36)	61
Lower keyboard	2	C3(36)	61
Pedal board	3	C3(36)	25

NOTE:

- these assignments were catched using Virtual Piano software to control **B4** keyboards