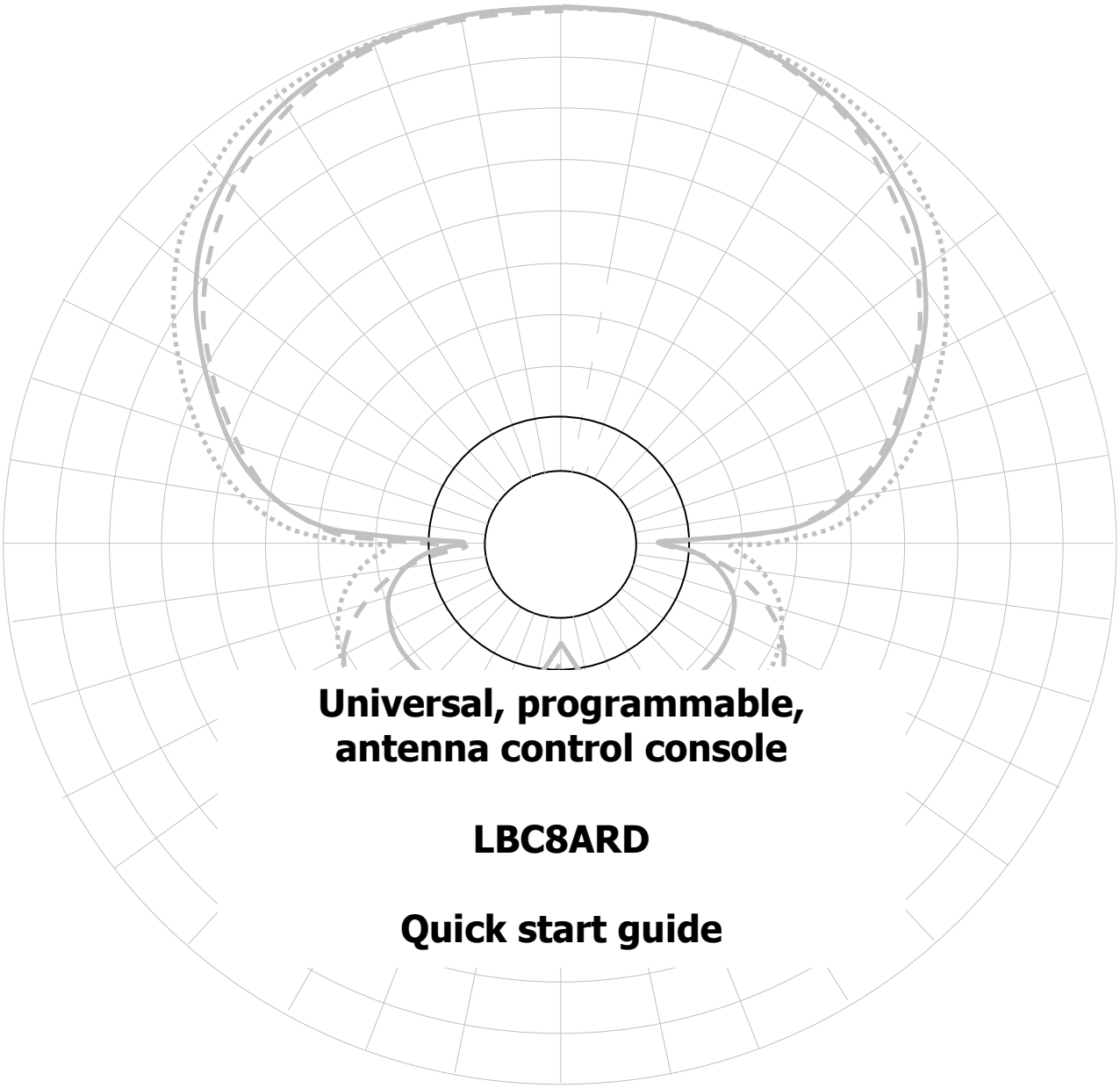
LOW BAND SYSTEMS



Universal, programmable, antenna control console

LBC8ARD

Quick start guide

SW v2.3a
HW v1.a
Manual v.1a

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Content:

I. Introduction

LowBandSystem`s Control Console LBC8ARD used to control receive (transmit) antenna switches and array`s controllers that uses a 12 to 30Vdc SINK or SOURCE.

Controller has many pre- programmed truth tables and can be programmed by end user as well.

Designed to control equipment of:

- **LowBandSystems** (any of the Beverage switch Systems, 4SQUARE RX, 8 Circle RX, K-98, distriution systems 8A2R, 8A4R, 4A4R, 4A2R etc.);
- **DX Engineering** (Four Square, Eight Circle, Beverage Antenna Systems, Transmit 4SQUARE system);
- **Hi-Z Antennas** (HiZ-2, HiZ-4, HiZ-8, HiZ4-8Pro, TriAngular systems);
- **Comtek** (ACB-4 Four Square systems);
- **YCCC** Vertical Receive antenna;
- **RemoteQTH** antennas and switches like K9AY loop;
- **Array Solution** 8 Direction Receiving Loops Antenna System, Shared Apex Loop Array;

REPLACES:

- **DX Engineering**: EC-8, EC-4BCD, CC-8A Control Consoles;
- Hi-Z Antennas: HIZ-SS4ELEMENT, CTRL-421, CTRL-821, SW-421, SW-422, SW-821, SW-822, and all the Controllers for 2-3-4-8 element systems;
- **COMTEK** ACB-4A Series Four-Square Control Consoles COM-ACB4A
- **DX Engineering** EC-DVA Directional Control Consoles DXE-EC-DVA
- **YCCC** Vertical Array Directional Switch Console kit
- **RemoteQTH** antennas and switches like K9AY loop;
- **Array Solution** 8 Direction AS-SAL-EXP - Shared Apex Loop Control Switch;

II. Key Features

USER programmable truth table, sink or source or both, 8 control lines.

Preprogrammed, 7 different control truth tables (programs) with different logics, for almost all know receive switches, combiners and other devices on a HAM market.

III. HARDWARE:

Control Console LBC8ARD is based on Arduino Micro.

- Input power: 13-30VDC, 0.5A maximum;
- Secondary power: 13-30VDC, 1A maximum;

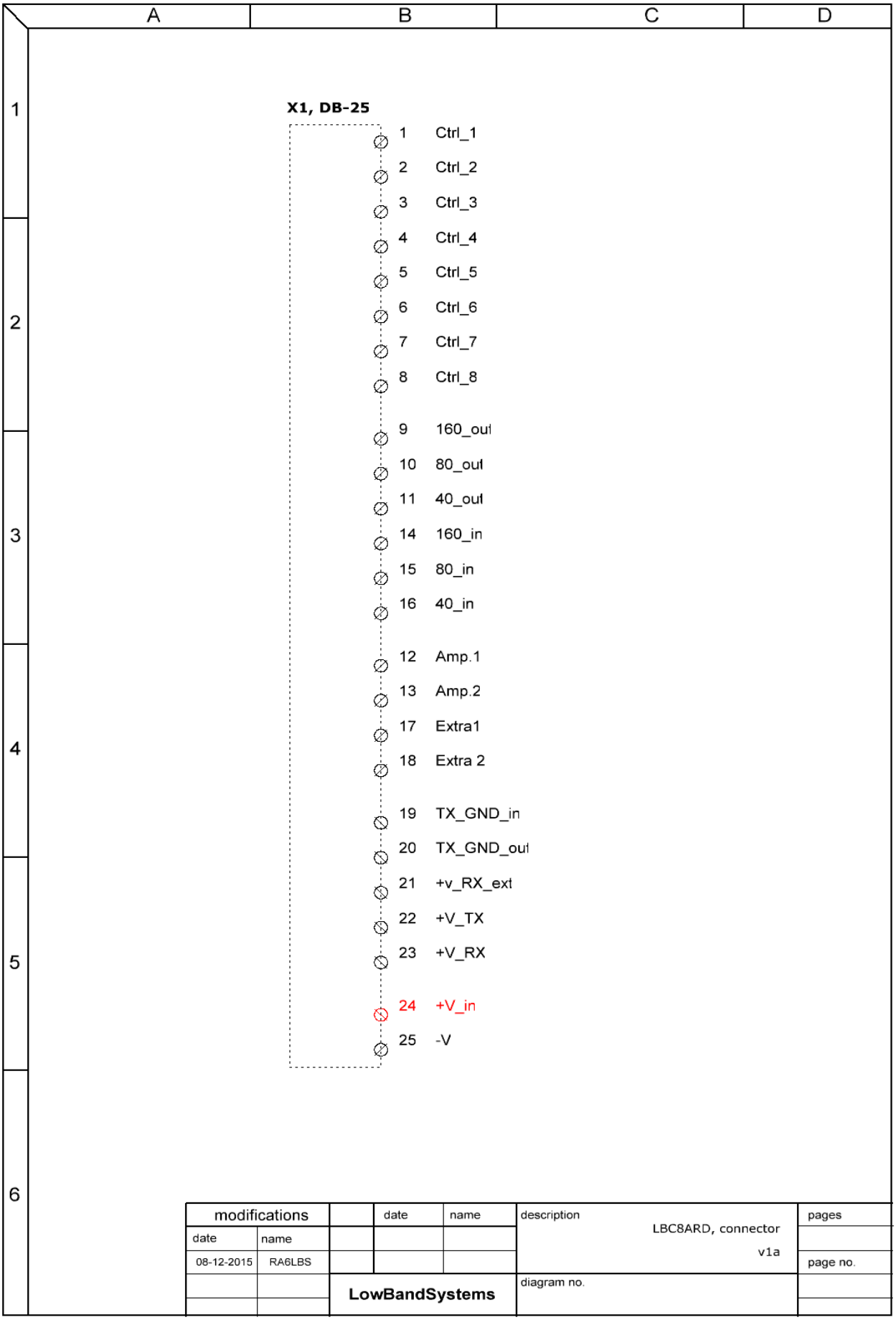
- Polyfused power lines, short circuits protected 0.5A + 0.7A;
- Connector: DB-25(m);
- 8 programmable relay outputs for direction control:

    - Sink or Source for all 8 lines;
    - Can be configured as Source for control 3 lines and Sink for 5 lines at the same time if you need;
    - Can control 3 lines for BCD switches and at the same time 5 more lines for other systems with different logic;

- Can use second, high voltage power supply for long runs of control cables to distant remote switches or other relays switches requiring other then +13Vdc control voltage;

- 3 band plus Auto manual selector for Receive BandPassFilters with Bypass option;
- 3 inputs (+13Vdc) for band decoder`s selected bands;
- 2 buttons for 2 external PreAmplifiers;
- 2 EXTRA buttons;
- RX chains (Remote Relay switch, BPFs, RX amps) is PROTECTED by switching OFF while transmit using TX_GND signal from transceiver;
- TX_GND_OUT signal to Power Amplifier, delayed 8 milliseconds, for safety reasons;
- TX_on and RX_on voltage signals for other gear on you station.

○ Output connector`s pins DB-25(m) description:



Pin	Name:	Description:
#1	Ctrl1	programmable, relay output #1;
#2	Ctrl2	programmable, relay output #2;
#3	Ctrl3	programmable, relay output #3;
#4	Ctrl4	programmable, relay output #4;
#5	Ctrl5	programmable, relay output #5;
#6	Ctrl6	programmable, relay output #6;
#7	Ctrl7	programmable, relay output #7;
#8	Ctrl8	programmable, relay output #8;
#9	160_out	output from band selector, band 160;
#10	80_out	output from band selector, band 180;
#11	40_out	output from band selector, band 40;
#12	Amp.1	output to PeAmp #1;
#13	Amp.2	output to PeAmp #2;
#14	160_in	input for station banddecoder, to switch BPF in Auto160;
#15	80_in	input for station banddecoder, to switch BPF in Auto80;
#16	40_in	input for station banddecoder, to switch BPF in Auto40;
#17	Extra.1	output from button Extra1;
#18	Extra.2	output from button Extra2, (only in F2 mode);
#19	TX_Gnd_in	input for TX_Gnd from transciever;
#20	TX_Gnd_out	delayed output TX_Gnd to Power Amplifier;
#21	+V_RX_ext	input for secondary (higher) voltage to controlled devices;
#22	+V_TX	output +V, on TX state of transceiver;
#23	+V_RX	output +V, on RX state of transceiver;
#24	+V_in	power to controller, +V, (+13-15B, 1A, polyfused);
#25	-V_in	Common for all the connections, should be bonded to station ground;

○ Notes on some controls:

- **Band selector:**
  - If you have a station BandDecoder, you can use its outputs to Auto Switch receive band pass filters in you receive chain.
  - 13VDC is expected at inputs #14-16;

- **Amp #1 and Amp #2 buttons:**
  - You can switch 2 separate Preamps (when band selector is in BAND position), Pin#12 and Pin#13 respectively;

- **Extra #1 and Extra #2 buttons:**
  - With this buttons you can control some extra devices at Pin#17 and Pin#18:

    - **Extra1** switches V_RX to Pin#17;

    - **Extra2**, has 2 different modes:
    - When connected to "Extra2" connector on a PCB, it switches V_RX to Pin#18.
    - When switched to "Extra3" connector on a PCB (default state), it switches and locks one only BCD code to control lines #1-#3 at Pins #1-#3. This feature is used when you need to control multiple receive systems from a single controller. The output BCD code is programmed in FIXED menu;

○ Notes on some inputs and outputs:

- **TX_GND input at pins #19 - #20**
  DO NOT FORGET TO USE THIS FEATURE!

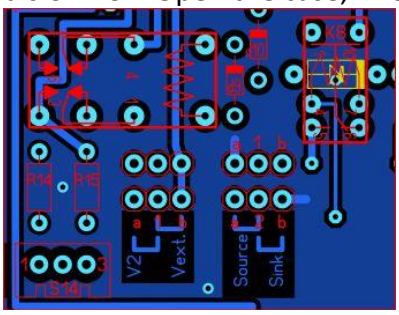
  - When TX_GND_in from transceiver exists (short on Pin#19 to Pin#25) , next sequence is taking place:
    - Switching **OFF** +V_RX and all the connected control lines;
    - Switching (delayed 8 msec.) **ON** +V_TX at Pin#22:
    - Switching (delayed 8 msec.) **ON** TX_GND_out at Pin#20 (short on Pin#20 to Pin#25);

    - ✓ When +V-RX disappears, all the remote relay switches, band pass filters, preamps is switched OFF. All the antenna`s inputs are terminated with 4W resistors inside the LowBandSystems equipment;
    - ✓ TX_Gnd_out can be used to switch on Power Amplifer t otransmit mode;
    - ✓ TX_Gnd_out can be used to switch on Detuning on a transmit matching units by LowBandSystems;

- **V_rx, V_tx outputs at pins #22-#23**
  - ✓ Depending on TX_Gnd input signal only one output is active. Polyfused, relayed output;

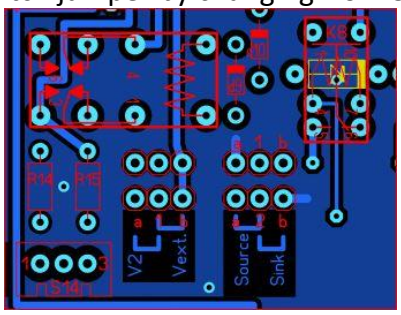
- **Secondary power supply input at pins #21:**

- ✓ If you need some other control voltage to remote equipment (not 13VDC), you can use this Pin#21 to supply it to all outputs by changing jumper from **V2** to **Vext.** terminals on PCB. Open the case, fine terminals:



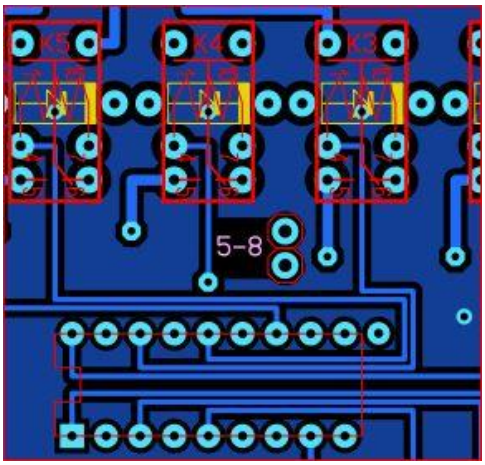
- **SINK control** *(default state)*:
  - Uses power applied to controller. Polyfused, 0.5A;

- **SOURCE control** *(jumper relocation is needed)*:
  - Max load is 30VDC, 2A on each relay.
    - You have to switch jumper by changing from Sink to Source:



- **SINK / SOURCE at the same time :**

  - ✓ If you need **Source, at Pin#1 - Pin#3**, and **SINK at Pin#4 - Pin#8,** remove jumper 5-8 on PCB:
    - Use “mirror truth table” to make switching, as you have to switch relays OFF to make SHORT on this pins.



IV. Software:

User can change:

1) Truth table on Pins #1 - #8. There are 7 preprogrammed ones and user can make its own truth table, program #8;
2) Directions of reverse reception to control matching units of LowBandSystems reversible Beverages system;
3) Fixed port designation (BCD control only) to be used with Extra2 button.

- **Reversible antenna management in sub program «REVERSE»:**

  Using reversible Beverage systems (RB2 from LowBandSystems), you have to inject DC voltage to switch to Reverse direction. This signal will appear at Pin #8.

  Switch OFF controller, push 45 degrees, Switch Power On, at the CW "REVERSE?" request push appropriate button for 4 direction sets.

  You will hear "E" confirmation or "?" if input is not correct.
  At the End of routine "R TU" will be send.

- **Fixed BCD code selection in sub program «FIXED» for Extra2 button:**

  Using LowBandSystems remote relay switch you can use multiple switches and arrays One of the neat features is to fix input ports of the relay switch while still controlling arrays at Pin#5-Pin#8).

  Switch OFF controller, push 90 degrees, Switch Power On, at the CW "FIXED?" request push appropriate button:

  - input #1 – 315 direction button
  - input #2 – 0 direction button
  - input #3 – 45 direction button
  - input #4 – 90 direction button
  - input #5 – 135 direction button
  - input #6 – 180 direction button
  - input #7 – 225 direction button
  - input #8 – 270 direction button

  You will hear "port number" confirmation and "R TU" if input is correct.

- **Truth tables description:**

Some of the different truth tables combined in a single sub program.
There are different switching techniques for different antenna systems and they are combined.

Feel free to find suitable for you or make your own.

Truth table #1

(Switch OFF controller, Push 0 degrees, Switch Power On, at the CW "MAP?" Request push 0 degrees, you will hear confirmation number)

- **Used to control:**
  - **Remote relay switches**

- **Control codes:**
  - **Plain 1 of 8 to Pin#1 – Pin#8**

Direction, degrees: \	Pin#1	Pin#2	Pin#3	Pin#4	Pin#5	Pin#6	Pin#7	Pin#8
315	1	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0
45	0	0	1	0	0	0	0	0
90	0	0	0	1	0	0	0	0
135	0	0	0	0	1	0	0	0
180	0	0	0	0	0	1	0	0
225	0	0	0	0	0	0	1	0
270	0	0	0	0	0	0	0	1

Truth table #2

(Switch OFF controller, push 0 degrees, Switch Power On, at the CW "MAP?" Request push 45 degrees, you will hear confirmation number)

- **Used to control:**
  - **remote relay switches LBSuper III, RS8BCD, 8A2R;**
  - **receive array 8Circle by LowBandSystems, BCD control;**
  - **receive array Hi-Z8A, Hi-Z Antennas;**

- **Control codes:**
  - **BCD 8_of_8, to Pin#1 – Pin#3**
  - **"Mirror code" for Hi-Z8A, to Pin# 4 – Pin# 8**

Direction, degrees \	Pin#1	Pin#2	Pin#3	Pin#4	Pin#5	Pin#6	Pin#7	Pin#8
315	0	0	0	1	1	1	0	0
0	1	0	0	0	1	1	1	1
45	0	1	0	1	0	1	1	1
90	1	1	0	1	1	0	1	1
135	0	0	1	1	1	1	0	1
180	1	0	1	0	1	1	1	0
225	0	1	1	1	0	1	1	0
270	1	1	1	1	1	0	1	0

Truth table #3

(*Switch OFF controller, push 0 degrees, Switch Power On, at the CW "MAP?" Request push 90 degrees, you will hear confirmation number)*

- **Used to control:**
  - **remote relay switches LBSuperIII, RS8BCD;**
  - **receive array Hi-Z8A, Hi-Z Antennas;**

- **Control codes:**
  - **BCD 4_of_8, to Pin# 1 – Pin# 2;**
  - **"Mirror code" for Hi-Z8A, to Pin# 4 – Pin# 8**

Direction, degrees \	Pin#1	Pin#2	Pin#3	Pin#4	Pin#5	Pin#6	Pin#7	Pin#8
315	0	0	-	1	1	1	0	0
0	1	0	-	0	1	1	1	1
45	0	1	-	1	0	1	1	1
90	1	1	-	1	1	0	1	1
135	0	0	-	1	1	1	0	1
180	1	0	-	0	1	1	1	0
225	0	1	-	1	0	1	1	0
270	1	1	-	1	1	0	1	0

Truth table #4

(Switch OFF controller, push 0 degrees, Switch Power On, at the CW "MAP?" Request push 135 degrees, you will hear confirmation number)

- **Used to control:**
  - **remote relay switches LBSuper III, RS8BCD;**
  - **remote relay switches LBSuper II;**
    - ✓ **Reversible Beverage systems RB2;**

- **Control codes:**
  - **BCD 4 of 8, (8 directions – 4 inputs of the relay switch), at Pin#1 – Pin#2, for LBSuper III, RS8BCD and BCD controlled switches;**
  - **LBSuper, (8 directions - 4 inputs of the relay switch), at Pin#4 – Pin# 7, for LBSuper II relay switch;**
  - **«Reverse direction» – extra signal to switch reversible beverages, at Pin#8** *(you have to program it);*

Direction, degrees \	Pin#1	Pin#2	Pin#3	Pin#4	Pin#5	Pin#6	Pin#7	Pin#8
315	0	0	-	1	0	0	0	0
0	1	0	-	0	1	0	0	0
45	0	1	-	0	0	1	0	0
90	1	1	-	0	0	0	1	0
135	0	0	-	1	0	0	0	0
180	1	0	-	0	1	0	0	0
225	0	1	-	0	0	1	0	0
270	1	1	-	0	0	0	1	0

Truth table #5

Switch OFF controller, push 0 degrees, Switch Power On, at the CW "MAP?" Request push 180 degrees, you will hear confirmation number

- **Used to control:**
  - **remote relay switches LBSuperIII, RS8BCD, LBSuperII;**
    - ✓ **Beverage systems RB, RB22;**
  - **Antenna K-98;**

- **Control codes:**

  - **BCD 8 of 8, (8 directions - 8 relay switch inputs), to Pin#1 – Pin#3, for LBSuperIII, RS8BCD;**
  - **BCD 4 of 8, (8 directions – 4 inputs of the relay switch), at Pin#1 – Pin#2, for LBSuper II, RS8BCD and other BCD controlled switches;**
  - **K-98, to Pin# 4 – Pin# 7, for antenna K-98;**
  - **«Reverse direction» – extra signal to switch reversible beverages, at Pin#8,** *(you have to program it);*

Direction, degrees \	Pin# 1	Pin# 2	Pin# 3	Pin# 4	Pin# 5	Pin# 6	Pin# 7	Pin# 8
315	0	0	0	0	1	0	1	0
0	1	0	0	0	0	0	1	0
45	0	1	0	1	0	0	1	0
90	1	1	0	0	0	1	1	0
135	0	0	1	0	1	0	0	0
180	1	0	1	0	0	0	0	0
225	0	1	1	1	0	0	0	0
270	1	1	1	0	0	1	0	0

Truth table #6

Switch OFF controller, push 0 degrees, Switch Power On, at the CW "MAP?" Request push 225 degrees, you will hear confirmation number:

- **Used to control:**
  - **remote relay switches LBSuperIII, RS8BCD;**
    - ✓ **Reversible Beverage systems RB2 requires switching;**
  - **Antenna K-98;**

- **Control codes:**

  - **BCD 4 of 8, (8 directions - 4 relay switch inputs), to Pin#1 – Pin#2, for LBSuperIII, RS8BCD;**
  - **K-98, to Pin# 4 – Pin# 7, for antenna K-98;**
  - **«Reverse direction» – extra signal to switch reversible beverages, at Pin#8,** *(you have to program it);*

Direction, degrees \	Pin#1	Pin#2	Pin#3	Pin#4	Pin#5	Pin#6	Pin#7	Pin#8
315	0	0	-	0	1	0	1	0
0	1	0	-	0	0	0	1	0
45	0	1	-	1	0	0	1	0
90	1	1	-	0	0	1	1	0
135	0	0	-	0	1	0	0	0
180	1	0	-	0	0	0	0	0
225	0	1	-	1	0	0	0	0
270	1	1	-	0	0	1	0	0

Truth table #7

Switch OFF controller, push 0 degrees, Switch Power On, at the CW "MAP?" Request push 270 degrees, you will hear confirmation number

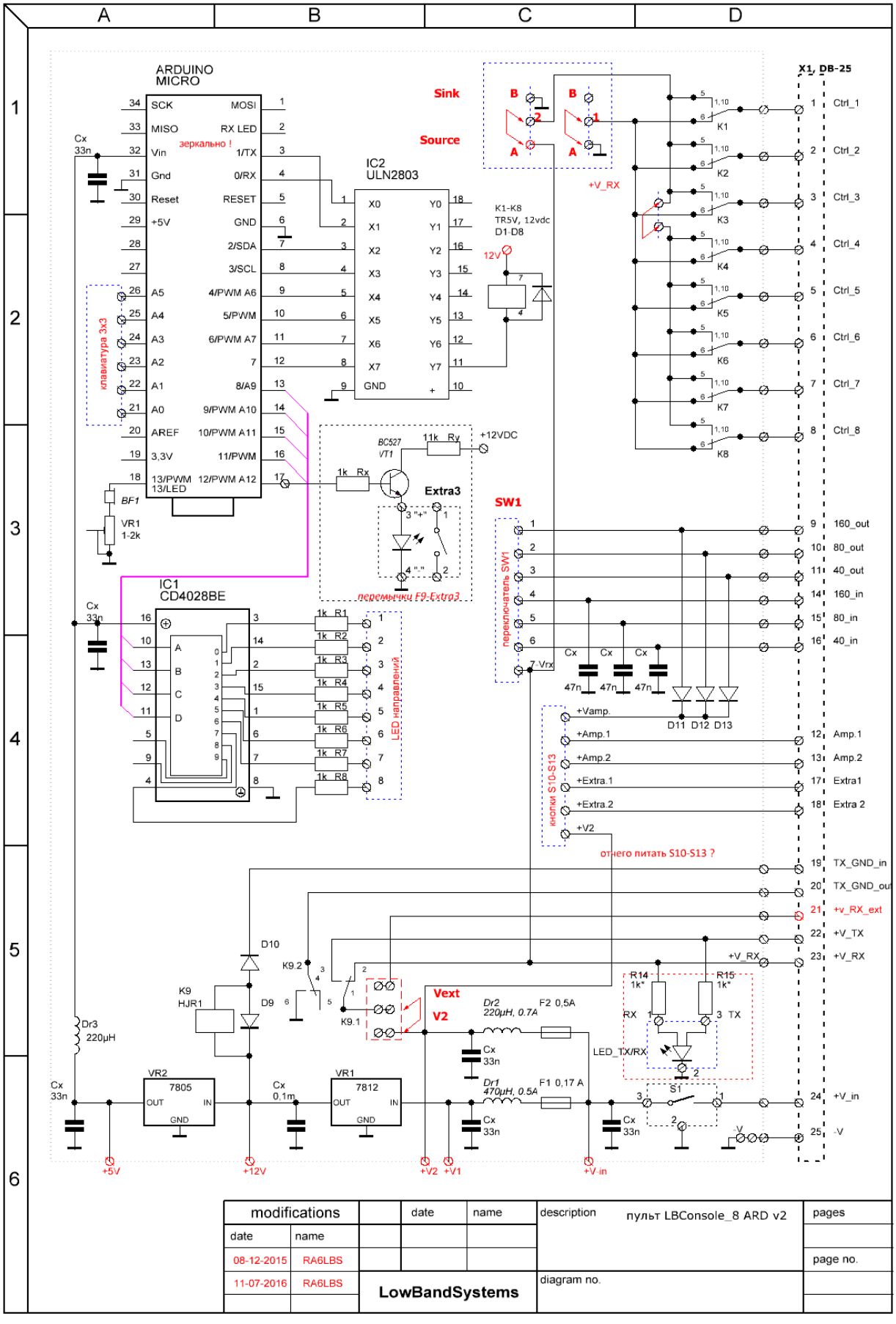
- **Used to control:**
  - **remote relay switches BCD, SINK configuration;**
  - **antenna system Hi-Z8A, Hi-Z Antennas, SINK control;**

- **Control codes:**

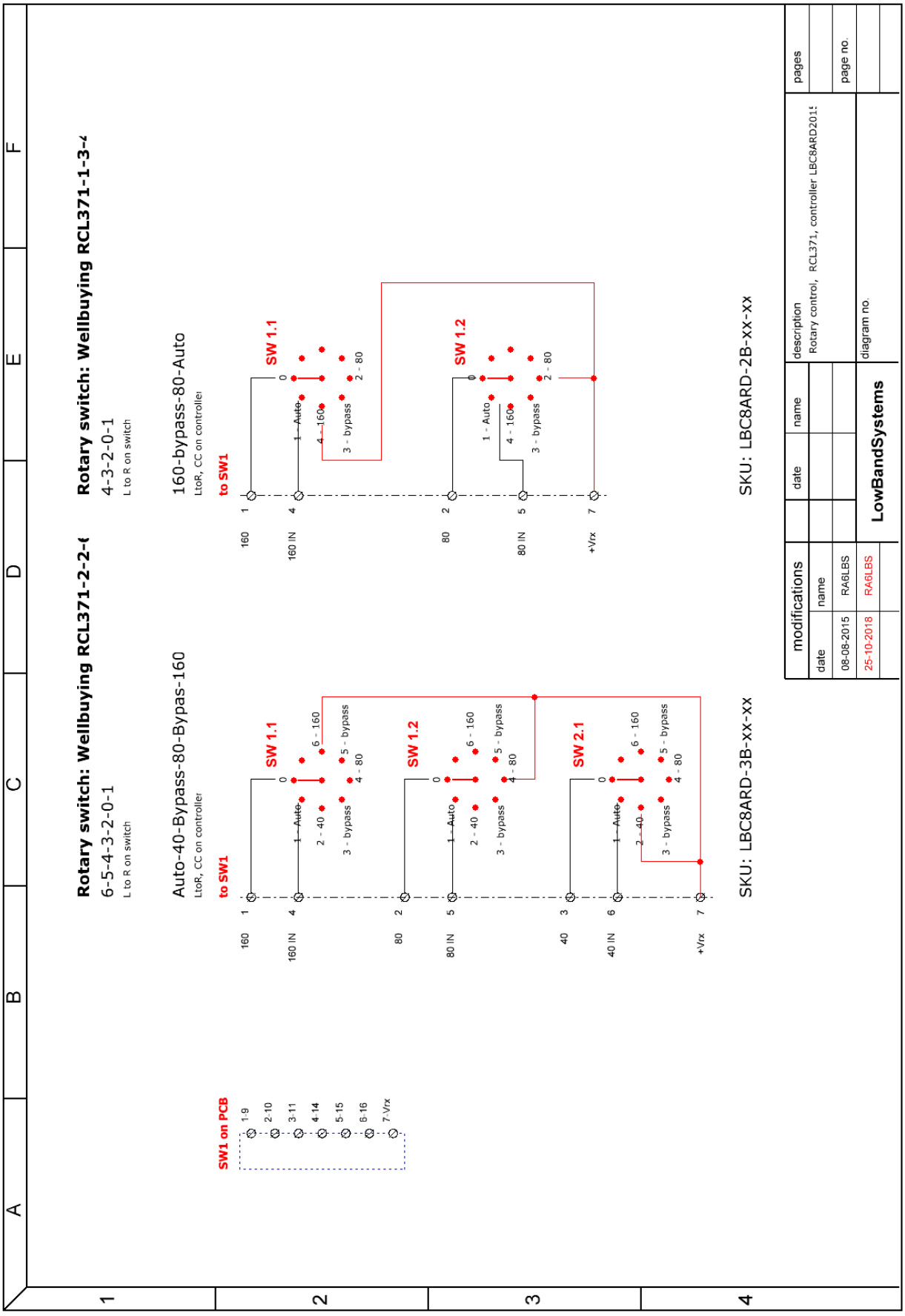
  - **BCD 8 of 8, (8 directions - 8 relay switch inputs), to Pin#1 – Pin#3, for SINK control *(jumpers Sink/Source should be rearranged)*;**
  - **K-98, to Pin# 4 – Pin# 7, for antenna K-98;**

Direction, degrees \	Pin#1	Pin#2	Pin#3	Pin#4	Pin#5	Pin#6	Pin#7	Pin#8
315	0	0	0	0	0	0	1	1
0	1	0	0	1	0	0	0	0
45	0	1	0	0	1	0	0	0
90	1	1	0	0	0	1	0	0
135	0	0	1	0	0	0	1	0
180	1	0	1	1	0	0	0	1
225	0	1	1	0	1	0	0	1
270	1	1	1	0	0	1	0	1

V. Schematic diagrams:

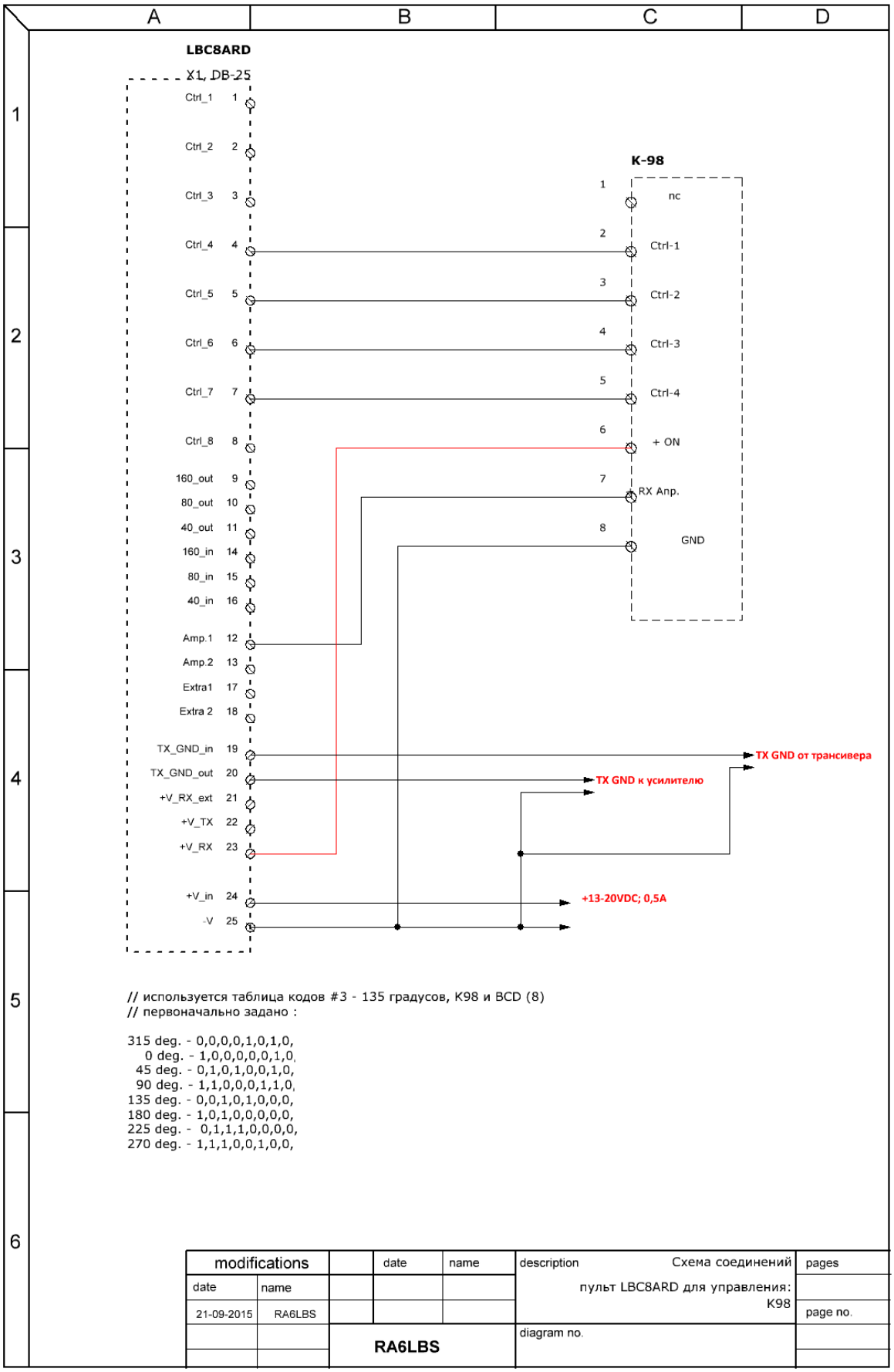


VI. Rotary switches:

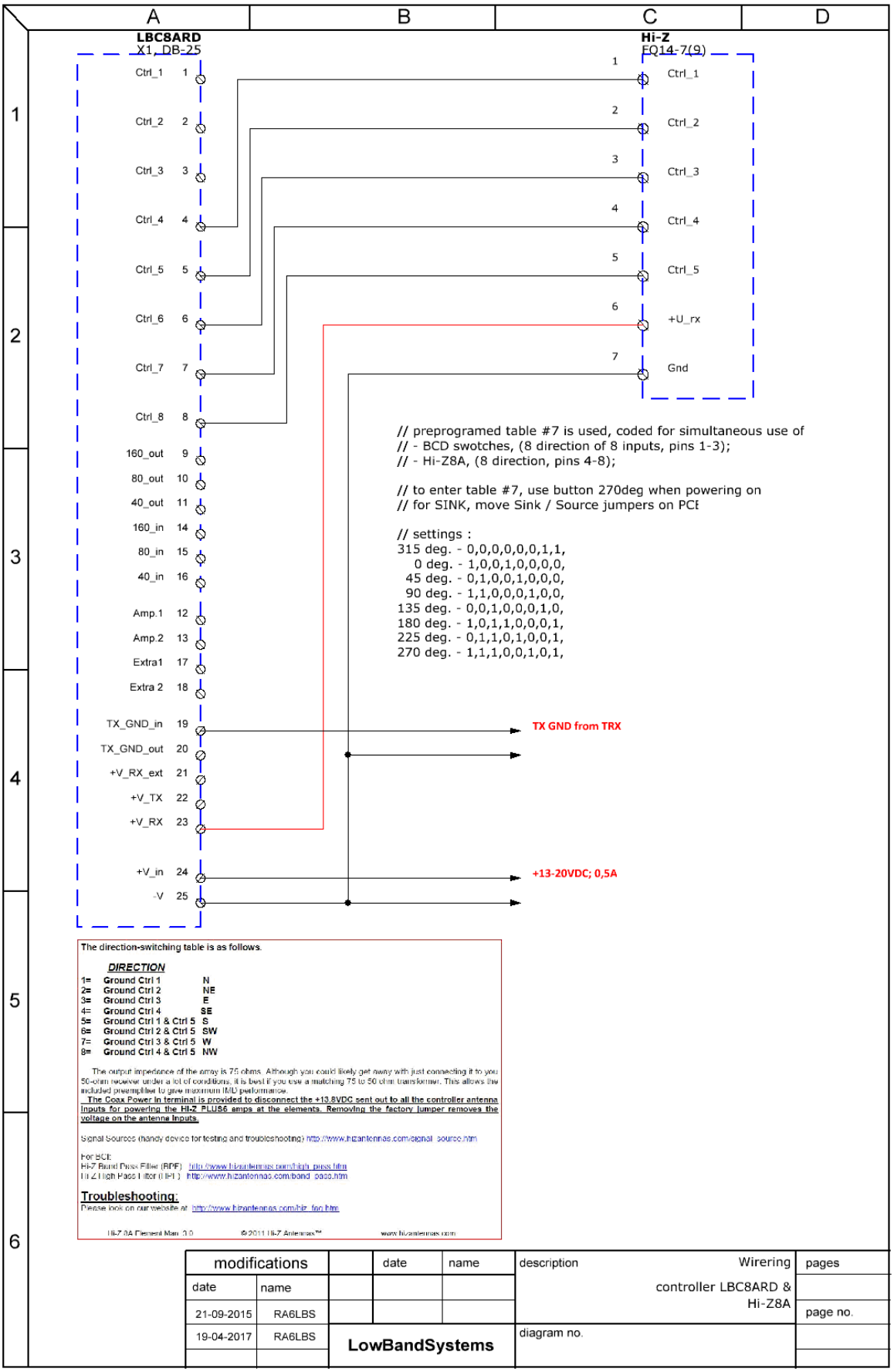


Connection diagrams examples:

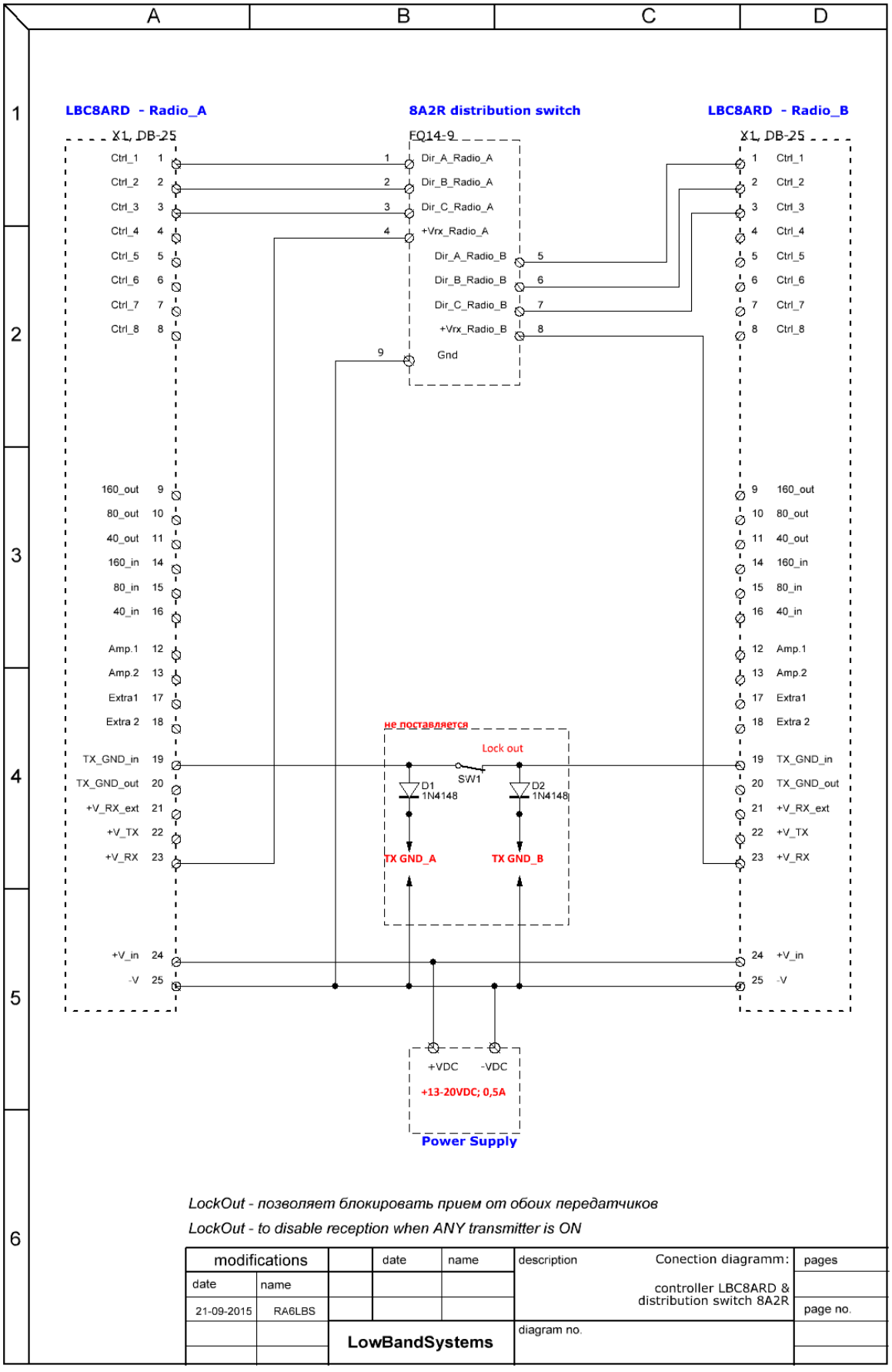
LBC8ARD & antenna K–98



LBC8ARD & antenna Hi - Z8A



LBC8ARD & distribution switch 8A2R:



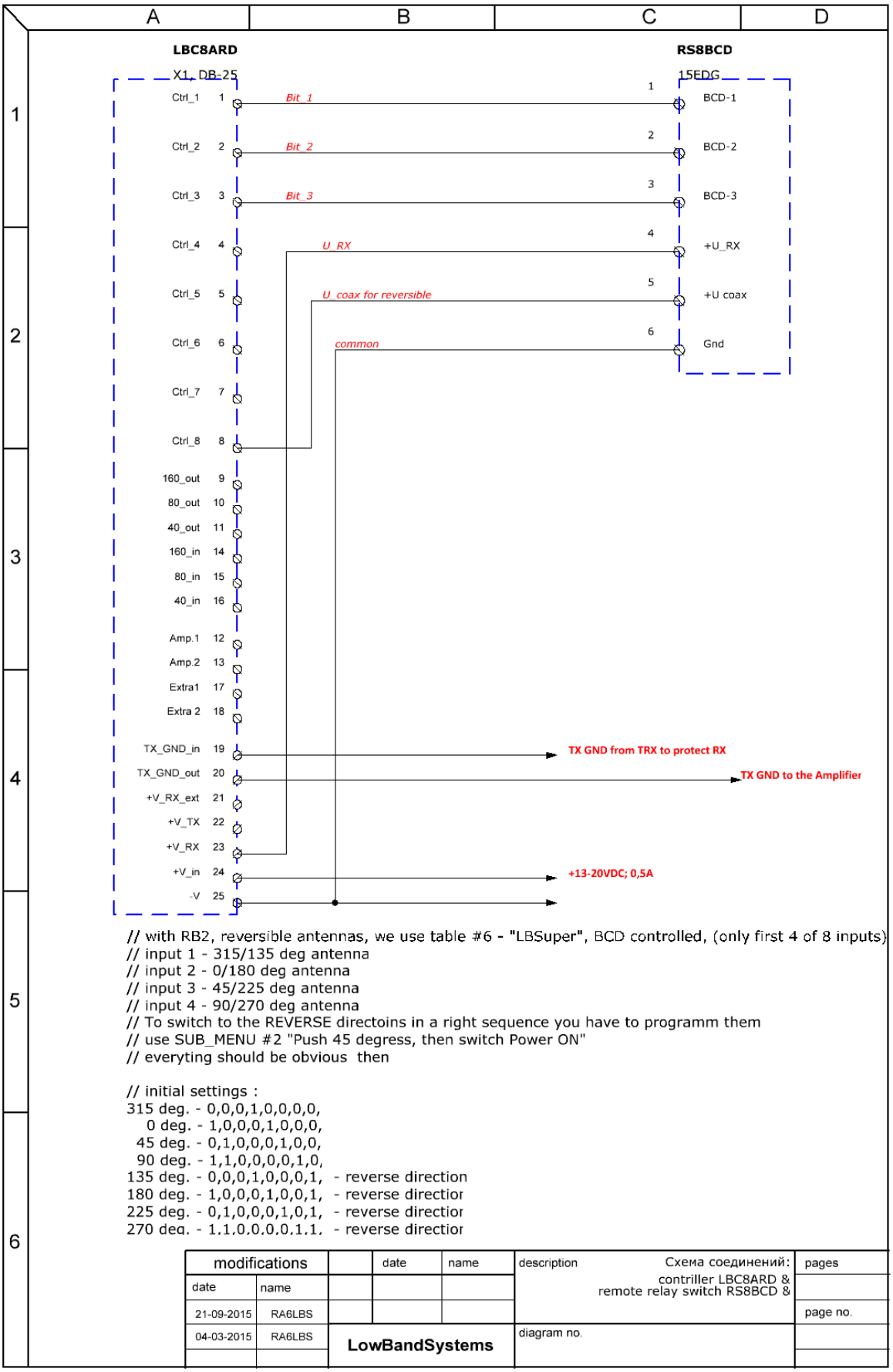
LockOut - позволяет блокировать прием от обоих передатчиков

LockOut - to disable reception when ANY transmitter is ON

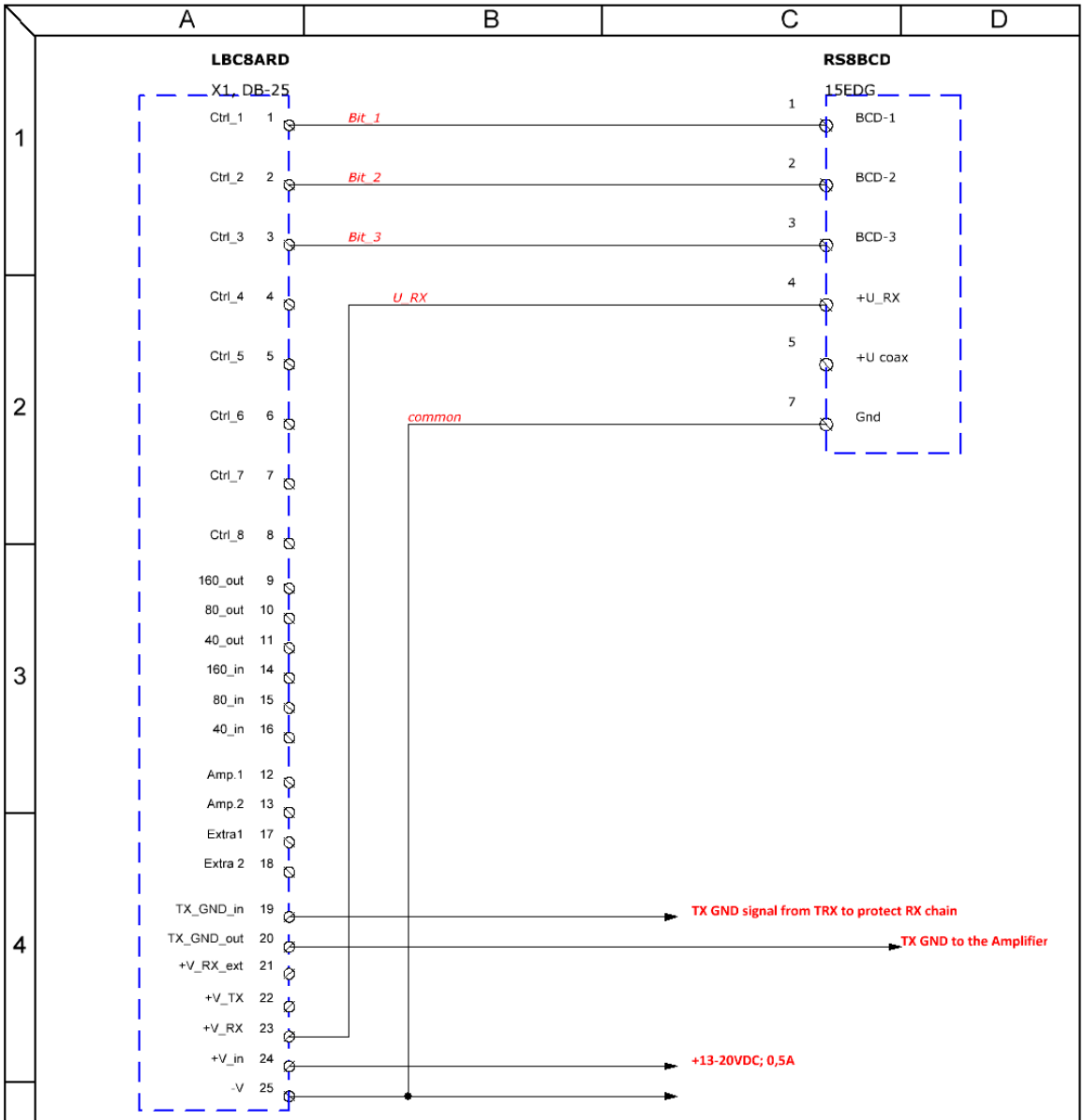
modifications			date	name	description	Conection diagramm:	pages
date	name					controller LBC8ARD & distribution switch 8A2R	
21-09-2015	RA6LBS						page no.
		LowBandSystems			diagram no.		

LBC8ARD & remote relay switch RS8BCD:

1) For reversible beverages



2) For 8 single direction antennas:



Truth table #2

(Switch OFF controller, push 0 degrees, Switch Power On, at the CW "MAP?'
Request push 45 degrees, you will hear confirmation number)

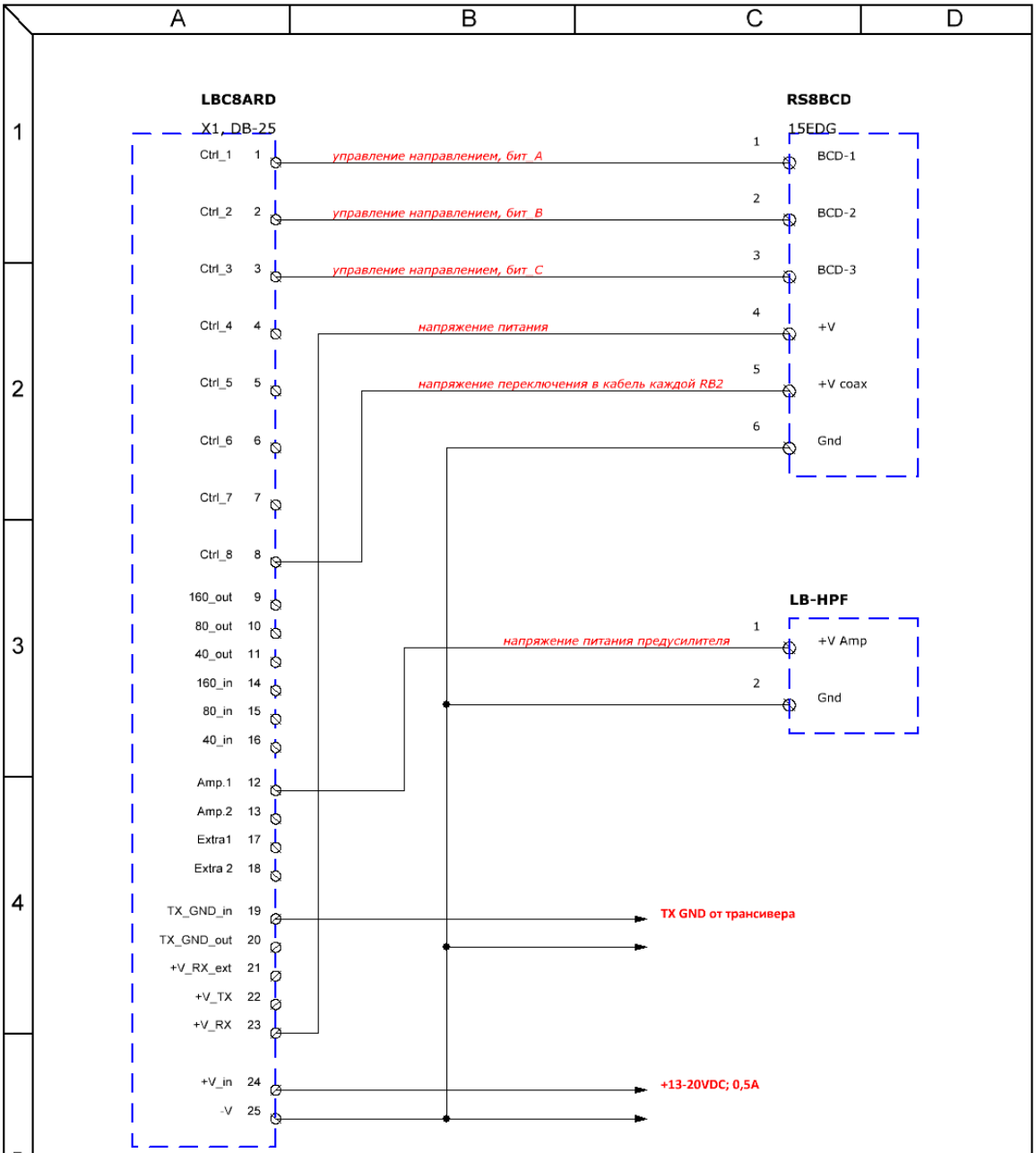
Used to control:
remote relay switches LBSuperIII, RS8BCD, 8A2R
receive array 8Circle by LowBandSystems, BCD control;
receive array Hi-Z8A, Hi-Z Antennas;

Control codes:
BCD 8_of_8, to Pin#1 - Pin#3
"Mirror code" for Hi-Z8A, to Pin# 4 - Pin# 8

Pin#1/Pin#2/Pin#3/Pin#4/Pin#5/Pin#6/Pin#7/Pin#8
Direction, degrees
315 00011100
0 10001111
45 01010111
90 11011011
135 00111101
180 10101110
225 01110110
270 11111010

modifications			date	name	description	Схема соединений:	pages
date	name					contriller LBC8ARD & remote relay switch RS8BCD &	
21-09-2015	RA6LBS						page no.
25-10-2018	RA6LBS	LowBandSystems			diagram no.		

LBC8ARD – remote relay switch RS8BCD and preamp LB-HPF:



// для RB2 используется таблица кодов #3 (90 градусов), LBSuper, коды BCD (4 из 8) и LBSuper 1xN,
// 8ой выход - обратное направление, программируется в меню "45 градусов + Power ON"

// первоначально задано :
315 deg. - 0,0,0,1,0,0,0,0,
0 deg. - 1,0,0,0,1,0,0,0,
45 deg. - 0,1,0,0,0,1,0,0,
90 deg. - 1,1,0,0,0,0,1,0,
135 deg. - 0,0,0,1,0,0,0,1,
180 deg. - 1,0,0,0,1,0,0,1,
225 deg. - 0,1,0,0,0,1,0,1,
270 deg. - 1,1,0,0,0,0,1,1,

// для RB используется таблица кодов #2 (45 градусов), коды BCD (8 из 8)

modifications			date	name	description	Схема соединений:	pages
date	name					пульт LBC8ARD & коммутатор RS8BCD & предусилитель LB-HPF	
21-09-2015	RA6LBS						page no.
		RA6LBS			diagram no.		

LBC8ARD – remote relay switch LBSuper III: