 <p>DAVE s.r.l.  <a href="http://www.dave.eu">www.dave.eu</a></p>	VERSION:	<b>1.0.0</b>
		DOCUMENT CODE:	<b>BEOV</b>
		NO. OF PAGES:	<b>23</b>

# Beryl

## *Overview*



**Printed in Italy**

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## History

<b>Version</b>	<b>Date</b>	<b>PCB version</b>	<b>Notes</b>
1.0.0	Aug 2008	CS104806B	First Release



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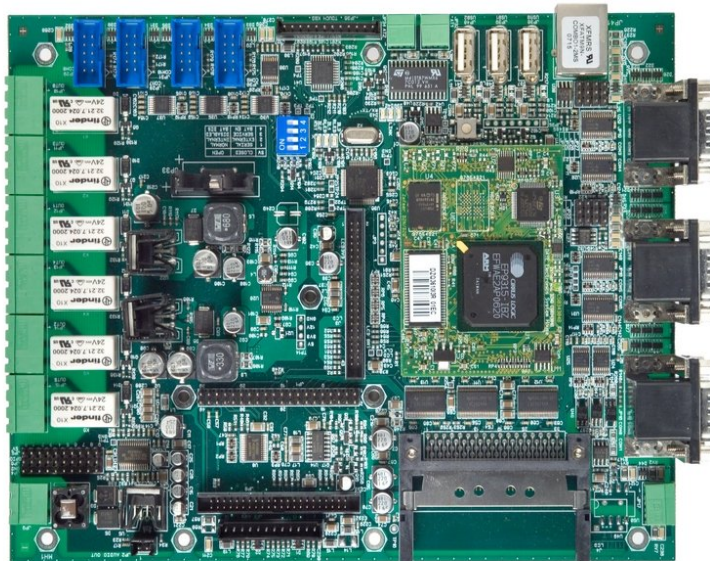


# 1 - Introduction

## 1.1 System description

Beryl system is composed by:

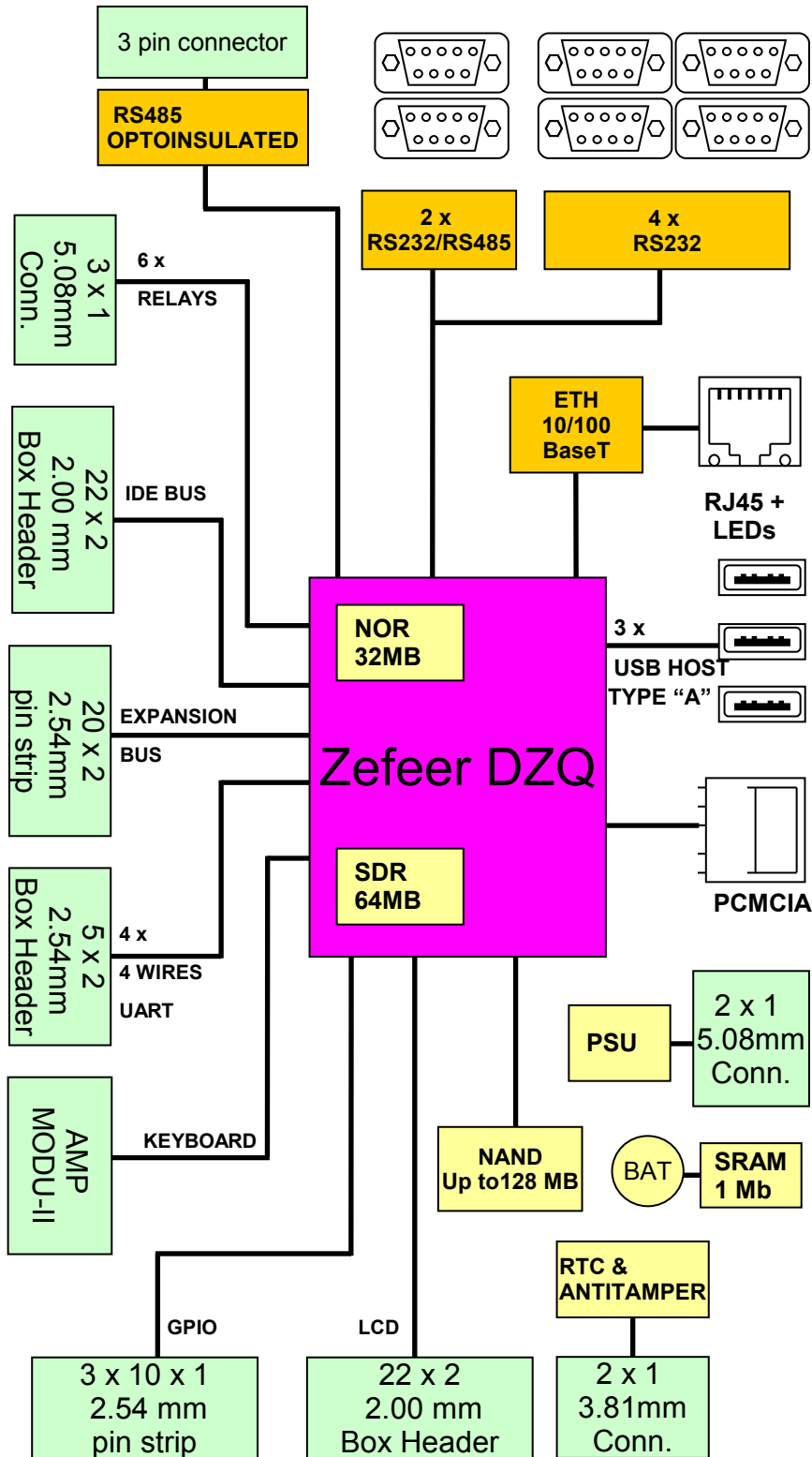
1. the host board that provides connectors to interface the system to the external world
2. processor module – Zefeer DZQ – that is plugged onto the host board.



The software environment is directly derived from the Zefeer Embedded Linux Kit 1.5.0. It is assumed reader has already read references [1] and [2].



## 1.2 Block Diagram





## 2 - Hardware manual

### 2.1 Host board layout

The following picture shows host board layout and connectors identifiers.

Board size is 210 mm x 165 mm.

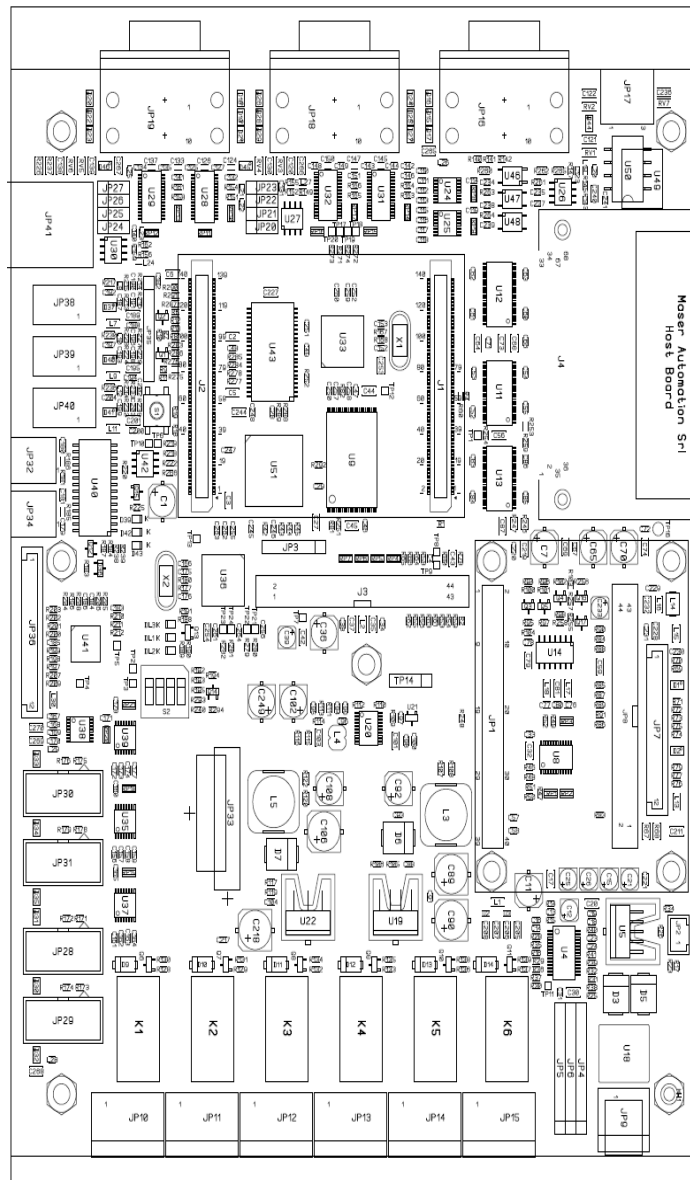
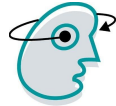


Fig. 1: Host board layout



## 2.2 Connectors

### 2.2.1 Power Connector – JP9

JP9 Power Supply Connector

<i>Pin #</i>	<i>Pin name and function</i>	<i>Note</i>
1	+24V +/-5%	
2	GND	

### 2.2.2 Ethernet – JP41

This is a standard RJ45 ethernet connector.

### 2.2.3 USB Ports – JP38,JP39,JP40

This is a standard HOST type-A connector. Total power consumption on all 3 USB host Port is limited to a maximum of 1.2A.

### 2.2.4 5V-tolerant digital GPIOs connectors – JP4, JP5, JP6

JP6 is a pin strip 10x1x2.54mm provides ten 5V-tolerant GPIO signals that can act as Input or Output. These pins are controlled by PCA9555 I/O expander that in turn is connected to the processor through I<sup>2</sup>C bus (address 0x24).

JP4 and JP5 are two connectors equal to JP6 and placed parallel to JP6. Pinout of JP4, JP5 and JP6 is reported below:

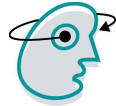
<i>Pin #</i>	<i>JP4</i>	<i>JP5</i>	<i>JP6</i>	<i>PCA9555 pin</i>	<i>Description</i>
1	GND	+5V	GPIO5V_0	I/O0.0	5V I/O Tolerant, internal resistor 10K pull-up to +5V
2	GND	+5V	GPIO5V_1	I/O0.1	5V I/O Tolerant, internal resistor 10K pull-up to +5V
3	GND	+5V	GPIO5V_2	I/O0.2	5V I/O Tolerant, internal resistor 10K pull-up to +5V
4	GND	+5V	GPIO5V_3	I/O0.3	5V I/O Tolerant, internal resistor 10K pull-up to +5V
5	GND	+5V	GPIO5V_4	I/O0.4	5V I/O Tolerant, internal resistor 10K pull-up to +5V
6	GND	+5V	GPIO5V_5	I/O0.5	5V I/O Tolerant, internal resistor 10K pull-up to +5V
7	GND	+5V	GPIO5V_6	I/O0.6	5V I/O Tolerant, internal resistor 10K pull-up to +5V
8	GND	+5V	GPIO5V_7	I/O0.7	5V I/O Tolerant, internal resistor 10K pull-up to +5V
9	GND	+5V	GPIO5V_8	I/O1.0	5V I/O Tolerant, internal resistor 10K pull-up to +5V



---

<b>Pin #</b>	<b>JP4</b>	<b>JP5</b>	<b>JP6</b>	<b>PCA9555 pin</b>	<b>Description</b>
10	GND	+5V	GPIO5V_9	I/O1.1	5V I/O Tolerant, internal resistor 10K pull-up to +5V

For more details about PCA9555, please refer to [http://www.nxp.com/acrobat/datasheets/PCA9555\\_6.pdf](http://www.nxp.com/acrobat/datasheets/PCA9555_6.pdf).



## 2.2.5 LCD connector – J3

<b>Pin #</b>	<b>Pin name and function</b>
1	12V_BACKLIGHT: +12V backlight inverter (MAX 1A)
2	12V_BACKLIGHT: +12V backlight inverter
3	GND
4	GND
5	+3.3V
6	GND
7	+3.3V
8	GND
9	+3.3V
10	GND
11	LCD_P0: LCD pixel bit 0
12	LCD_P1: LCD pixel bit 1
13	LCD_P2: LCD pixel bit 2
14	LCD_P3: LCD pixel bit 3
15	LCD_P4: LCD pixel bit 4
16	LCD_P5: LCD pixel bit 5
17	GND
18	GND
19	LCD_P6: LCD pixel bit 6
20	LCD_P7: LCD pixel bit 7
21	LCD_P8: LCD pixel bit 8
22	LCD_P9: LCD pixel bit 9
23	LCD_P10: LCD pixel bit 10
24	LCD_P11: LCD pixel bit 11
25	GND
26	GND
27	LCD_P12: LCD pixel bit 12
28	LCD_P13: LCD pixel bit 13
29	LCD_P14: LCD pixel bit 14
30	LCD_P15: LCD pixel bit 15
31	LCD_P16: LCD pixel bit 16
32	LCD_P17: LCD pixel bit 17
33	GND



<b>Pin #</b>	<b>Pin name and function</b>
34	GND
35	LCD_SPCLK: LCD pixel clock
36	LCD_VSYNC: LCD VSYNC
37	LCD_BLANK: LCD BLANK
38	LCD_HSYNC: LCD HSYNC
39	GND
40	LCD_PWR: backlight inverter power on
41	RESERVED: do not use
42	RESERVED: do not use
43	RESERVED: do not use
44	LCD_BRT_ADJ: backlight inverter brightness control

### 2.2.6 Keyboard interface (no touch) – JP7

JP7 is an AMP MODU-II connector. Signals on JP7 are reported in the following table and comes out directly from keyboard matrix controller integrated on microprocessor of zefeer module with a series resistor of 22ohm placed near to the connector JP7.

<b>Pin #</b>	<b>Pin name</b>	<b>Description</b>
1	ROW0	Comes out from zefeer module, 22 ohm series resistor
2	ROW1	Comes out from zefeer module, 22 ohm series resistor
3	ROW2	Comes out from zefeer module, 22 ohm series resistor
4	ROW3	Comes out from zefeer module, 22 ohm series resistor
5	ROW4	Comes out from zefeer module, 22 ohm series resistor
6	COL0	Comes out from zefeer module, 22 ohm series resistor
7	COL1	Comes out from zefeer module, 22 ohm series resistor
8	COL2	Comes out from zefeer module, 22 ohm series resistor
9	COL3	Comes out from zefeer module, 22 ohm series resistor
10	COL4	Comes out from zefeer module, 22 ohm series resistor
11	GND	GND
12	Keyboard backlight: +12V (max 500mA)	Keyboard backlight: +12V (max 500mA)



## 2.2.7 Speaker – JP2

JP2 is a classic AMP- MODU II 2 poles connectors. Audio amplifier specs: 8ohm impedance, 4W max.

<i>Pin #</i>	<i>Pin name and function</i>
1	Speaker +
2	Speaker -

## 2.2.8 IDE connector – JP8 [box header 22x2x2.00mm] (\* changed with respect to rev.A)

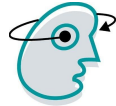
<i>Pin #</i>	<i>Pin name and function</i>
1	RSTn: RESET active low
2	GND
3	DIDE7: data bus 7
4	DIDE7: data bus 8
5	DIDE7: data bus 6
6	DIDE7: data bus 9
7	DIDE7: data bus 5
8	DIDE7: data bus 10
9	DIDE7: data bus 4
10	DIDE7: data bus 11
11	DIDE7: data bus 3
12	DIDE7: data bus 12
13	DIDE7: data bus 2
14	DIDE7: data bus 13
15	DIDE7: data bus 1
16	DIDE7: data bus 14
17	DIDE7: data bus 0
18	DIDE7: data bus 15
19	GND
20	NC: not connected



<b>Pin #</b>	<b>Pin name and function</b>
21	DMARQ: DMA request
22	GND
23	DIOWn: data write, active low
24	GND
25	DIORn: data read, active low
26	GND
27	IORDY: I/O ready
28	
29	DBeryKn: DMA acknowledge, active low
30	GND
31	DINTRQ: interrupt request
32	NC: not connected
33	AIDE1: IDE address 1
34	NC: not connected
35	AIDE0: IDE address 0
36	AIDE2: IDE address 2
37	IDECSn0: chip select 0, active low
38	IDECSn1: chip select 1, active low
39	DASPn
40	GND
41	5V for logic
42	5V for motors
43	GND
44	DO NOT USE

## 2.2.9 PCMCIA connector – J4

<b>Pin #</b>	<b>Pin name and function</b>
1	GND
2	CD3: data 3
3	CD4: data 4
4	CD5: data 5
5	CD6: data 6
6	CD7: data 7



<b>Pin #</b>	<b>Pin name and function</b>
7	MCELn
8	CA10: address 10
9	MCRDn
10	CA11: address 11
11	CA9: address 9
12	CA8: address 8
13	CA13: address 13
14	CA14: address 14
15	MCWRn
16	READY
17	AVCC
18	AVPP
19	CA16
20	CA15
21	CA12
22	CA7
23	CA6
24	CA5
25	CA4
26	CA3
27	CA2
28	CA1
29	CA0
30	CD0
31	CD1
32	CD2
33	WP
34	GND
35	GND
36	MCD1
37	CD11
38	CD12
39	CD13
40	CD14
41	CD15
42	MCEHn
43	VS1



<b>Pin #</b>	<b>Pin name and function</b>
44	IORDn
45	IOWRn
46	CA17
47	CA18
48	CA19
49	CA20
50	CA21
51	AVCC
52	AVPP
53	CA22
54	CA23
55	CA24
56	CA25
57	VS2
58	MCRESETn
59	MWAITn
60	NC
61	MCREGn
62	MCBVD2
63	MCBVD1
64	CD8
65	CD9
66	CD10
67	MCD2
68	GND

### **2.2.10 Relays K1, K2, K3, K4, K5, K6 – JP10, JP11, JP12, JP13, JP14, JP15**

Relays are named starting from K1 to K6 as silkscreen reported on top of the board. Each relay is driven by a GPIO (see section on page ) as shown in the following table.

<b>Relay</b>	<b>Connector name</b>	<b>Driving GPIO</b>
K1	JP10	I.0
K2	JP11	I.1
K3	JP12	I.2



<b>Relay</b>	<b>Connector name</b>	<b>Driving GPIO</b>
K4	JP13	I.3
K5	JP14	I.4
K6	JP15	I.5

The following table report pinout for each relays connectors (JP10-15):

<b>JPx Pin #</b>	<b>Pin name and function</b>
1	COM
2	NO
3	NC

The following table explains the logic to command relays.

<b>Driving GPIO value</b>	<b>Relay Status</b>
0 (LOW)	OPEN
1 (HIGH)	CLOSED



## 2.2.11 RS232 and RS485 Serial ports

The following table reports all Serial ports.

<b>Connector name</b>	<b>Conn type</b>	<b>Interface Type</b>	<b>Device</b>
JP16A (bottom)	DB9x2 male	RS232, DTE	/dev/ttyAM0
JP16B (top)	DB9x2 male	RS232, DTE	/dev/ttyAM1
JP17	Phoenix MC 1.5-G-3.81	RS485 <b>1kV isolated</b>	/dev/ttyAM2
JP19A (bottom)	DB9x2 male	RS232/485	/dev/ttyS0
JP19B (top)	DB9x2 male	RS232/485	/dev/ttyS1
JP18A (bottom)	DB9x2 male	RS232, DTE	/dev/ttyS2
JP18B (top)	DB9x2 male	RS232, DTE	/dev/ttyS3
JP28	Box header 5x2x2.54mm	RS232, DTE	/dev/ttyS4
JP29	Box header 5x2x2.54mm	RS232, DTE	/dev/ttyS5
JP30	Box header 5x2x2.54mm	RS232, DTE	/dev/ttyS6
JP31	Box header 5x2x2.54mm	RS232, DTE	/dev/ttyS7

## 2.2.12 JP16A – bottom – RS232 - COM0 - /dev/ttyAM0

<b>Pin #</b>	<b>Pin name and function</b>
1	NC: not connected
2	RX: receive data
3	TX: transmit data
4	DTR: data terminal ready
5	GND
6	DSR: data set ready (pin shared with RI. Use only one)
7	RTS: request to send
8	CTS: clear to send
9	NC: not connected



### 2.2.13 JP16B – top – RS232 - COM1 - /dev/ttyAM1

<i>Pin #</i>	<i>Pin name and function</i>
1	DCD: data carrier detect. Connected to DTR
2	RX: receive data
3	TX: transmit data
4	DTR: data terminal ready. Connected to DCD and DSR
5	GND
6	DSR: data set ready. Connected to DTR.
7	RTS: receive to send. Connected with CTS
8	CTS: clear to send. Connected with RTS
9	NC: not connected

### 2.2.14 JP17 – 1KV isolated RS485 - /dev/ttyAM2

<i>Pin #</i>	<i>Pin name and function</i>
1	RS485 -
2	RS485 +
3	GND



### 2.2.15 JP19A/B – RS232/RS485

UART3: JP19A (bottom) [/dev/ttyS0]

UART4: JP19B (top) [/dev/ttyS1]

<b>Pin #</b>	<b>Pin name and function</b>	
	<b>RS232</b>	<b>RS485</b>
1	CD: carrier detect	Not used
2	RX: receive data	Data –
3	TX: transmit data	Data +
4	DTR: data terminal ready	Not used
5	GND	GND
6	DSR: data set ready	Not used
7	RTS: ready to send	Not used
8	CTS: clear to send	Not used
9	RI: ring indicator	Not used

To select RS232 or RS485 mode for UART3, jumpers JP20, JP21, JP22 and JP23 must be configured as shown in the following table.

To select RS232 or RS485 mode for UART4, jumpers JP24, JP25, JP26 and JP27 must be configured as shown in the following table.

<b>Jumper position</b>	<b>Function</b>
1-2	RS485
2-3	RS232

### 2.2.16 JP18A/B – RS232

UART5: JP18A (bottom) [/dev/ttyS2]

UART6: JP18B (top) [/dev/ttyS3]

<b>Pin #</b>	<b>Pin name and function</b>
1	CD: carrier detect
2	RX: receive data
3	TX: transmit data
4	DTR: data terminal ready
5	GND



<i>Pin #</i>	<i>Pin name and function</i>
6	DSR: data set ready
7	RTS: ready to send
8	CTS: clear to send
9	RI: ring indicator

### 2.2.17 JP28 – 31 – RS232 4-wires

<i>Pin #</i>	<i>Pin name and function</i>
1	(CD: carrier detect). This signal is not present <sup>1</sup>
2	RX: receive data
3	TX: transmit data
4	DTR: data terminal ready. This signal is not present <sup>2</sup>
5	GND
6	DSR: data set ready. This signal is not present <sup>3</sup>
7	RTS: ready to send
8	CTS: clear to send
9	NC: not connected
10	NC: not connected

### 2.2.18 JP32, JP34: Anti-tamper inputs

<i>Pin #</i>	<i>Pin name and function</i>
1	GND
2	Anti-tamper input

### 2.2.19 JP36: Touch keyboard

<sup>1</sup>This signal is not present. Pin 1,4,6 are connected together.

<sup>2</sup>This signal is not present. Pin 1,4,6 are connected together.

<sup>3</sup>This signal is not present. Pin 1,4,6 are connected together.



<b>Pin #</b>	<b>Pin name and function</b>
1	X0
2	X1
3	X2
4	X3
5	X4
6	X5
7	X6
8	X7
9	Y0
10	Y1
11	Y2
12	GND (filtered)

## 2.3 Switches and buttons

### 2.3.1 Reset – S1

When pressed, global system reset is performed.

### 2.3.2 Settings – S2

Settings are performed via dip switch S2 whose functions are described in Tab. 1.

<b>SW</b>	<b>Function</b>	<b>CLOSED</b>	<b>OPEN</b>	<b>DEFAULT</b>
1	<b>Serial Boot or Normal Boot for Zefeer Module</b>	SERIAL	NORMAL	OPEN
2	<b>External Boot or Internal Boot for Zefeer Module</b>	EXTERNAL	INTERNAL	CLOSED
3	<b>Service Mode (RFU)</b>	SERVICE	DISABLED	OPEN
4	<b>Battery Disconnection (during stockage)</b>	Connected	Disconnected	OPEN

Tab. 1: System settings



As shown above, SW 1 selects Serial Boot or Normal Boot option. SW 2 selects the boot from Internal BootROM (OFF) or from an external memory device. Default configuration sets NORMAL and EXTERNAL mode. SW3 is thought to start Beryl in a “SERVICE OPERATION“(This SW is connected to GPIO A.4 that can be read at Beryl bootstrapping). SW4 acts as battery disconnection to avoid battery discharge during stocking phase.



## 3 - Bibliography and useful links

- [1] Dave Srl, Zefeer Hardware Manual
- [2] DAVE Srl, ZELK Software Manual