Protocol USB

Index

1. General Description

The USB connection is used for transfering matrix data between master host (PC) and slave PassiveMatrix board. Usb communication is implemented as a virtual Serial Port. The protocol uses two types of packets: a **request** and a **response**. The initiator of data exchange on the bus is always the host. It sends a request to the slave and waits for a response. For one request, the slave can send multiple responses, depending on the value of the **CommandID** field in the request.

General structure of requests and responses is described below.

Request frame structure (master to slave)

Index	Meaning	Value
0	Preamble byte 1	0xFF
1	Preamble byte 2	0xFF
2	Preamble byte 3	0xFF
3	Preamble byte 4	0xFF
4	Divider field	0x00
5	Data length low byte	Total length of useful data in Request frame. It is total length of "Command ID" field and following data bytes.
6	Data length high byte	-
7	Divider field	0x00
8	Command ID	Described in the "Commands" section
9+	Data byte	Depends on Command type

Answer frame structure (slave to master)

Index	Meaning	Value
0	Preamble byte 1	0xFF
1	Preamble byte 2	0xFF
2	Preamble byte 3	0xFF
3	Preamble byte 4	0xFF
4	Divider field	0x00
5	Data length low byte	Length of the all data bytes after length field
6	Data length high byte	-
7	Divider field	0x00
8	PackageID byte 0	Package identifier
9	PackageID byte 1	-
10	Divider field	0x00
11	PackageID byte 2	-
12	PackageID byte 3	-
13+	Data byte	Depends on Command type

The PackageID field is set to zero after a valid request is received. After each answer, its value increments.

2. Commands

2.1 Start

This command starts the matrix scan cycle.

Request frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero

5	0x0C	Data length low byte	Total length of useful data in Request frame. It is total length of "Command ID" field and following data bytes.
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x01	Command ID	
9	0x00	Shift X	
10	0x00	Shift Y	
11	0x60	Length X	
12	0x60	Length Y	
13	0x00	Number of samples	
14	0xUU	Update frequency low byte	The value specified in Hz
15	0xUU	Update frequency high byte	
16	0x00	Divider field	Must be zero
17	0xUU	ADC sample delay low byte	The value specified in us
18	0xUU	ADC sample delay high byte	

Example: ff ff ff ff 00 0C 00 00 01 00 00 01 01 01 00 00 00 00 00

First answer frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x1C	Data length low byte	Total length of useful data in answer frame. It is a total length of "Command ID" field and following data bytes.
6	0x00	Data length high byte	

7	0x00	Divider field	Must be zero
8	0xYY	Command ID	0x01 - started from PC; 0x03 - started from CAN
9	0x00	Shift X	
10	0x00	Shift Y	
11	0x60	Length X	
12	0x60	Length Y	
13	0xNN	Number of samples	
14	0xUU	Update frequency low byte	The value specified in Hz
15	0xUU	Update frequency high byte	
16	0x00	Divider field	Must be zero
17	0xUU	ADC sample delay low byte	The value specified in us
18	0xUU	ADC sample delay high byte	
19	0x00	Divider field	Must be zero
20	0x00	Reference voltage low byte	The value specified in 10mV
21	0x00	Reference voltage high byte	
22	0x00	Divider field	Must be zero
23	0xUT	Unixtime 0	Received from CAN
24	0xUT	Unixtime 1	Received from CAN
25	0x00	Divider field	Must be zero
26	0xUT	Unixtime 2	Received from CAN
27	0xUT	Unixtime 3	Received from CAN
28	0x00	Divider field	Must be zero
29	0xFV	Firmware version	Patch part
30	0xFV	Firmware version	Minor part
31	0x00	Divider field	Must be zero
32	0xFV	Firmware version	Major part
33	0xHV	Hardware version	

34	0x00	Request status. 0x00 - is true, otherwise is false.	

Second and following answer frames

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0xLL	Data length low byte	Total length of useful data in Answer frame. It is a total length of "Command ID" field and following data bytes.
6	0xLL	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x04	Command ID	
9	0x00	Divider field	Must be zero
10	0xNN	PackageID byte 0	
11	0xNN	PackageID byte 1	
12	0x00	Divider field	Must be zero
13	0xNN	PackageID byte 2	
14	0xNN	PackageID byte 3	
15	0x00	Divider field	Must be zero
16	0xTT	Timestamp byte 0	Number of milliseconds from the beginning of the measurement
17	0xTT	Timestamp byte 1	
18	0x00	Divider field	Must be zero

19	0xTT	Timestamp byte 2	
20	0xTT	Timestamp byte 3	
21	0x00	Divider field	Must be zero
22	0x00	Reserved	
23	0x00	Reserved	
24	0x00	Divider field	Must be zero
25	0x00	Reserved	
26	0x00	Reserved	
27+	0xYY	Data	

2.2 Stop

This command stops matrix scan cycle.

Request frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x02	Data length low byte	Total length of useful data in Answer frame. It is a total length of "Command ID" field and following data bytes.
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x02	Command ID	

Example: FF FF FF FF 00 02 00 00 02

Answer frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x03	Data length low byte	Length of the data bytes and "Command ID" field
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x02	Command ID	
9	0x00	Request status	0x00 - is true, otherwise is false.

2.3 Write working configuration

This command set parameters for matrix scan and save all to flash memory.

Request frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x12	Data length low byte	
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x08	Command ID	
9	0x00	Shift X	
10	0x00	Shift Y	
11	0x60	Length X	
12	0x60	Length Y	
13	0x00	Number of samples	
14	0xUU	Update frequency low byte	The value specified in Hz

15	0xUU	Update frequency high byte	
16	0x00	Divider field	Must be zero
17	0xUU	ADC sample delay low byte	The value specified in us
18	0xUU	ADC sample delay high byte	
19	0x00	Divider field	Must be zero
20	0xUU	Offset voltage low byte	The value specified in 0.1*V
21	0xUU	Offset voltage high byte	
22	0xUU	Reference voltage low byte	The value specified in 0.1*V
23	0xUU	Reference voltage high byte	
24	0xUU	Filter type	v3.0.0 and above

For example: ff ff ff ff 00 0C 00 00 08 00 00 01 01 01 00 00 00 00 00 00 00 00 00 00

Setting value for voltage f.e. '34' equals 3.4V

Filter types:

- 0 - No filtration;
- 1 - Moving average;
- 2 - Moving average cumulative;
- 3 - Moving average weighted;
- 4 - Median filter;
- 5 - Kalman filter.

Answer frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x02	Data length low byte	Length of the data bytes and "Command ID" field
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x08	Command ID	

2.4 Read working configuration

Request frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x02	Data length low byte	
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x09	Command ID	

For example: FF FF FF FF 00 02 00 00 09

Answer frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x12	Data length low byte	Length of the data bytes and "Command ID" field
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x09	Command ID	
9	0xXX	Shift X	
10	0xXX	Shift Y	
11	0xYY	Length X	
12	0xYY	Length Y	
13	0xNN	Number of samples	
14	0xUU	Update frequency low byte	The value specified in Hz

15	0xUU	Update frequency high byte	
16	0x00	Divider field	Must be zero
17	0xUU	ADC sample delay low byte	The value specified in us
18	0xUU	ADC sample delay high byte	
19	0x00	Divider field	Must be zero
20	0xUU	Offset voltage low byte	The value specified in 0.1*V
21	0xUU	Offset voltage high byte	
22	0xUU	Reference voltage low byte	The value specified in 0.1*V
23	0xUU	Reference voltage high byte	
24	0xUU	Filter type	v3.0.0 and above

2.5 Read firmware version

Request frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x02	Data length low byte	
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x0A	Command ID	

For example: FF FF FF FF 00 02 00 00 0A

Answer frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	

1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x07	Data length low byte	Length of the data bytes and "Command ID" field
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x0A	Command ID	
9	0xFV	Firmware version	Patch part
10	0xFV	Firmware version	Minor part
11	0x00	Divider field	Must be zero
12	0xFV	Firmware version	Major part
13	0xHV	Hardware version	

2.6 Start without parameters

This command starts matrix scan by using of working parameters that were set with "2.3 Write working configuration" command.

Request frame

Index	Value	Meaning	Note
0	0xFF	Preamble byte 1	
1	0xFF	Preamble byte 2	
2	0xFF	Preamble byte 3	
3	0xFF	Preamble byte 4	
4	0x00	Divider field	Must be zero
5	0x02	Data length low byte	
6	0x00	Data length high byte	
7	0x00	Divider field	Must be zero
8	0x0B	Command ID	

For example: FF FF FF FF 00 02 00 00 0B

All next frames are the same like for "Start" command with parameters. Take a look at "2.1 Start"