Oscilloscope / logic analyzer control via SPI bus

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Contents

Scope settings

The setting string contains two bytes.

The first byte specifies which setting to change and the second byte specifies the setting.

Volt/Div setting

Byte #1: 0x91

Byte #2	Setting with 8 voltage divisions	Full scale
0x01	5V/div	40V
0x02	2V/div	16V
0x03	1V/div	8V
0x04	0.5V/div	4V
0x05	0.2V/div	1.6V
0x06	0.1V/div	0.8V

Coupling setting

Byte #1: 0x92

Byte #2	Setting
0x01	AC coupling
0x02	DC coupling

Time/Div setting

Byte #1: 0x93

Byte #2	Setting with 16 time divisions	Sample rate
0x01	200ms/div	250S/s
0x02	100ms/div	500S/s
0x03	50ms/div	1kS/s
0x04	20ms/div	2.5kS/s
0x05	10ms/div	5kS/s
0x06	5ms/div	10kS/s
0x07	2ms/div	25kS/s
0x08	1ms/div	50kS/s
0x09	0.5ms/div	100kS/s
0x0A	0.2ms/div	250kS/s
0x0B	0.1ms/div	500kS/s
0x0C	50µs/div	1MS/s

Trigger setting

Byte #1: 0x94

Byte #2	Setting
0x01	Trigger On
0x02	Trigger Off
0x03	Trigger edge Rising
0x04	Trigger edge Falling

Y-position setting

Byte #1: 0x95

Byte #2	Setting
0x00	Max position
0xFF	Min position
0x7F	Middle position

Trigger level setting

Byte #1: 0x96

Byte #2	Setting
0x01	Low
0xFE	High
0x7F	Middle

Reading the data

To reset the system and to start the data acquisition, send byte 0x81 to the SPI port. Then check if the data acquisition is complete:

1. Wait 20ms.
2. Send byte **0x82** to the SPI port
3. Read the response from the SPI port.

   *If the response is **0x02**, the data acquisition is complete.*

   *If the response is **0x00**, the data acquisition is not yet complete.*

   In this case repeat the sequence 1-3 above.

After getting response **0x02**, the acquired data can be read. Send 801 times **0x01** to the SPI port and read the response. You'll get 800 values containing the oscilloscope data.

Then send 801 times **0x02** to the SPI port and read the response. You'll now get 800 values containing the logic analyzer data for the eight first channels.

Then send 801 times **0x03** to the SPI port and read the response. You'll now get 800 values containing the logic analyzer data for the channels 9 and 10. Bit #0 is channel 9 data and bit #1 is channel 10 data.

In the logic analyzer data each bit corresponds the input channel state:

bit value 0 = input state low

bit value 1 = input state high

SPI interface settings

Clock Polarity (CPOL) = 1
Clock Phase (CPHA) = 0
SPI chip select = enabled, active low
SPI clock speed = 500 kHz max. SPI bits per word = 8
Bit order = MSB first

The SPI port needs to be enabled in Raspbian before it can be used. Edit the modules blacklist file by typing:
sudo nano /etc/modprobe.d/raspi-blacklist.conf
Add a '#' character to this line so it is commented out:
#blacklist spi-bcm2708

Exit and save the file.
Enter "sudo reboot" to restart the pi and now the SPI pins will be available to use.

Test the SPI port is working by typing:
ls /dev/spidev*

You should see the following:
/dev/spidev0.0 /dev/spidev0.1

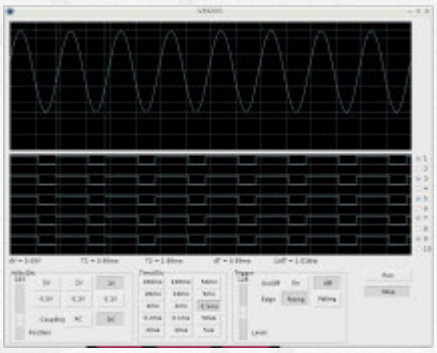
NOTE:

Oscilloscope and Logic Analyzer Shield for Raspberry Pi

VM205

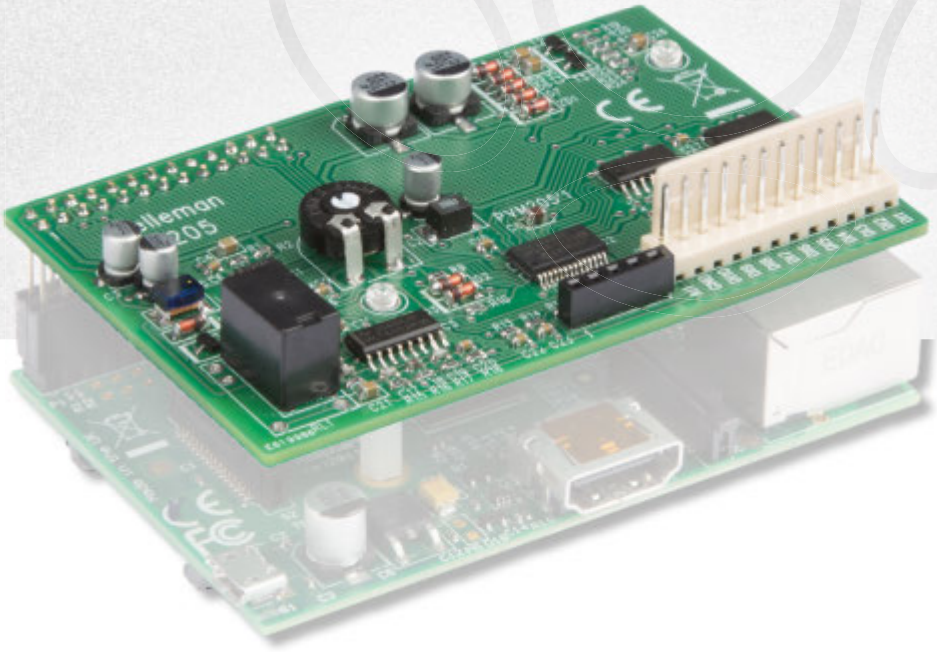
Oscilloscope:

- maximum sample rate : 1MS/s
- input amplifier bandwidth : 200kHz (-3dB)
- measurements can be performed up to: 100kHz
- input impedance : 100kohm // 20pF
- maximum input voltage: 30Vp (AC + DC)
- input coupling: AC+DC
- AD resolution: 8 bit
- record length: 800 samples
- run modes: Run, Single
- trigger level adjustable: in 254 steps
- timebase range: in 15 steps 5µs to 200ms/division
- input sensitivity range : in 6 steps, 100mV/division to 5V/division
- input sensitivity: 3mV display resolution
- time and Voltage markers readout
- frequency readout (through markers)



Logic analyzer:

- number of channels: 10
- record length: 10x800 samples
- maximum sample rate: 1MS/s
- max. input voltage: 5VDC



You own a RaspberryPi? Add this shield and you also own a digital storage oscilloscope!
All standard oscilloscope features are available and the application source code is supplied, so you can develop your own application. As a bonus, you also get a 10-channel logic analyzer, a great tool to monitor digital signals.

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