

Table of Contents

Introduction	7
1 • Requirements	9
1.1 • RPi	9
1.2 • SD Card	10
1.3 • Keyboard	11
1.4 • Mouse	11
1.5 • Display	11
1.6 • Internet Connection	13
1.7 • Power Supply	14
1.8 • Loudspeaker (or earphones)	14
1.9 • Breadboard	14
1.10 • Components	15
1.11 • Software Oscilloscope	16
2 • A Quick Tour Of The RPi	19
2.1 • LXterminal	20
2.2 • LXterminal – Scrot	20
2.3 • LXterminal – Nano	21
2.4 • Idle	22
2.5 • Debian Reference	22
2.6 • Epiphany	22
2.7 • Libre Office	23
2.8 • Leafpad	23
2.9 • Scratch	23
2.10 • Accessories – File Manager	24
2.11 • System Tools – Task Manager	25
3 • Installing the software	27
3.1 • RPi	27
3.1.1 • Keyboard	27
3.1.2 • Larger SD Card	28
3.1.3 • Changing The Memory Allocation (Memory Split)	28
3.1.4 • IP Address	29
3.2 • Windows PC (Optional)	31
3.2.1 • Disk Imager	31
3.2.2 • Python, wxPython and IdleX	32
3.2.3 • Putty (SSH)	33
3.2.4 • Xming (Xwindows)	34
3.2.5 • WinSCP	38
4 • Short Introductions To...	41
4.1 • Debian Linux	41
4.2 • Programming in Bash	47

4.3 • Programming in Python	51
4.4 • Programming in JavaScript.	74
5 • GPIO.	79
5.1 • Introduction	79
5.2 • LED	81
5.3 • Flashing LED	85
5.4 • Alternating Flashing LED	87
5.5 • Timer LED with Window	89
5.6 • Switch	93
5.7 • Time Switch	97
5.8 • Toggling Switch	98
5.9 • Switch State in a Window.	99
5.10 • A Button with Sound	102
5.11 • Pin Communications	104
6 • More Power	107
6.1 • TD62783 8-Channel High Source Driver	107
6.1.1 • Light (6 V, 65 mA).	108
6.1.2 • Motor (5 V, 145 mA)	109
6.2 • ULN2003 7 Open Darlington Arrays	110
6.2.1 • Fan (12 V, 150mA) and Light (6 V, 65 mA)	111
6.3 • IRF740 MOSFET	113
6.3.1 • Motor (5 V, 550 mA)	113
7 • PWM	117
7.1 • PWM LED with graph.	119
7.2 • Light with Gradually Increasing Brightness	122
7.3 • Motor with Variable Speed	125
8 • SPI	127
8.1 • Introduction to SPI	127
8.2 • MAX522 Digital to analog (DAC)	130
8.3 • DAC with opamp.	135
8.4 • More than two SPI devices	139
8.5 • MCP3008 Analog to Digital (ADC)	140
8.6 • MCP3008 pseudo-differential measurement.	145
9 • I²C	149
9.1 • Introduction to I ² C	149
9.2 • MCP23008 I/O extender	151
9.3 • More power for the extender	157
9.4 • TC74 digital thermometer	157

10 • Serial	165
10.1 • Introduction to RS232	165
10.1.1 • Serial loopback	166
10.2 Serial connection between RPi and Piccolino	167
10.2.1 • Serial echo	170
10.2.2 • Serial analog measurement (ADC)	171
10.3 • Bluetooth	178
11 • Web server (WiFi or wired)	181
11.1 • Introduction	181
11.2 • HTML server	181
11.3 • CGI	184
11.3.1 • Hello User	184
11.3.2 • Visitor counter in a file	188
11.3.3 • Passing variables from the browser to the server	189
11.3.4 • GPIO	192
11.3.5 • GPIO with JavaScript	198
11.3.6 • I ² C Fridge alarm with automatic web page	201
12 • Client server (WiFi or wired)	207
12.1 • Introduction	207
12.2 • TCP multiplication	207
12.3 • TCP LED control	212
12.4 • TCP DAC	214
12.5 • TCP sawtooth and square wave generator	215
12.6 • TCP Voltmeter with 8 channels	223
12.7 • UDP echo	227
12.8 • UDP light meter	230
13 • LEGO board	235
13.1 • Introduction	235
13.2 • Design	237
13.3 • Commands	241
13.4 • The Useless Box	243
Appendix	247
1 • Adjustable power supply	247
2 • GPIO header circuit	248
3 • Contents of the download package	250
4 • Parts list	251
Index	253