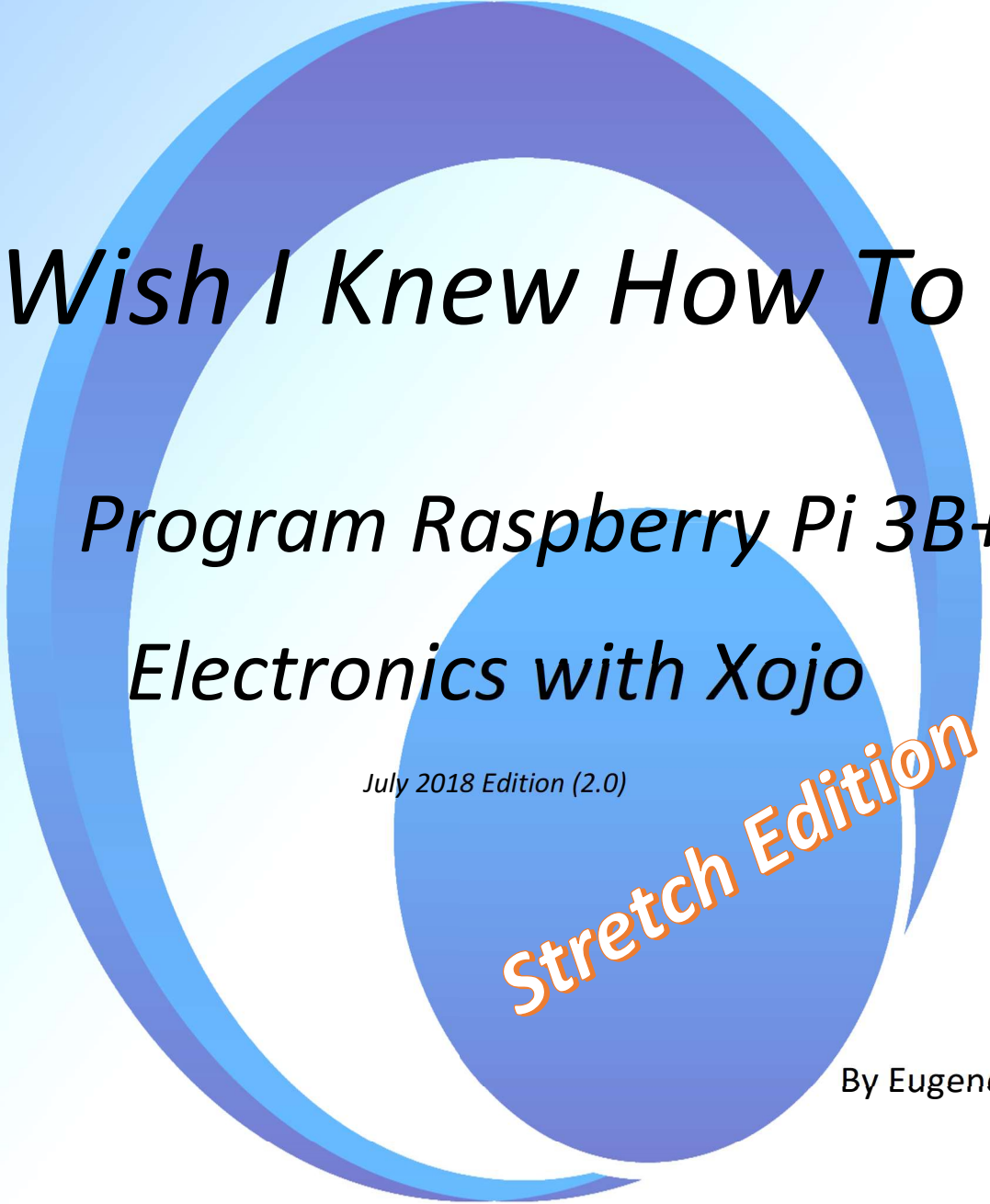




I Wish I Knew How To ...

*Program Raspberry Pi 3B+
Electronics with Xojo*

July 2018 Edition (2.0)

Stretch Edition

By Eugene Dakin

Table of Contents

Chapter 1 - Introduction to Raspberry Pi 3B+	12
Be Safe	12
Purchasing a Raspberry Pi 3 B+	12
Setting Up Raspberry Pi	16
Installing an OS	16
Starting Raspberry Pi for the first time	21
Update/upgrade Raspberry Pi 3 B+	21
GPIO Ribbon	23
GPIO Numbers	24
Electronic Playground 130	27
GPIO Module	28
QuickStart	28
Stretch Operating System	30
Chapter 2 – Linux Raspbian Commands/Programs	31
File System	31
Change TimeZone	35
Running a Program	35
Eject Thumb Drive	35
Paint Program (Pinta)	36
Run Pinta from Terminal	36
Create Run Icon on Desktop	36
Scrot (Screen Grab)	37
Graphical Text Editor (LeafPad)	38
Mounting Airport Extreme Drive	38
Boot Mount Airport Extreme Drive	39
Change Keyboard configuration	40
Stop (Kill) a running program	41
Get IP Address	41
Active Ports	42
Backup SD Card Image	42
Windows	42
OS X	43
Turn off ScreenSaver	44
Version of Pi	46
Restore Trash Can	48
Uninstall Program	49
Recover Disk Space	49
Remove Old Programs	49
Help Manual	49

Kernel Version	50
Distro Version	50
Reboot	50
XscreenSaver	50
Update Pi Firmware.....	50
Upgrade Operating System	51
Cleanup old Packages.....	52
Installed Packages (Programs)	52
Is a Package installed.....	52
Purge Program.....	52
Remote Access – VNC Server	53
 Chapter 3 - Xojo Programs.....	 56
Hello World Desktop	56
Hello World Web (Standalone)	58
Hello World Wide Web (CGI) (Not supported)	61
Play Sound	64
Pi Configuration	64
Play Sound File	65
 Chapter 4 – Electronics Review	 67
Volts.....	67
Amperage (Current)	67
Resistor.....	68
Watt.....	70
Energy.....	70
Diode	70
LED.....	71
Calculating an LED resistor value	73
No LED's in Parallel	74
Button.....	75
Capacitor	75
Transistor.....	76
NPN Transistor.....	77
PNP Transistor	77
nMOSFET	78
pMOSFET	79
Making a Plan (Schematics)	79
Transformer.....	80
 Chapter 5 – Physical Computing	 82
Pi Specs.....	82
Light Simple Circuit.....	83

Setup Pi and Xojo	86
Install Wiring Pi.....	86
Confirm wiringPi Installation	87
Xojo GPIO Module	89
LED On and Off	89
Basic Button Input.....	95
Floating Input Gate.....	99
Pull-Up Resistor	100
Pull-Down Resistor	104
Transistor NPN Switch	109
Transistor PNP Switch	114
Photocell (Cds)	119
Potentiometer	122
pMOSFET Switch	123
nMOSFET Switch	126
 Chapter 6.....	 131
DC Motor On/Off.....	131
PWM Dim LED	136
Voltage Control.....	138
LED Dim.....	139
Control Motor Speed.....	143
Voltage Divider	147
LED 7-Segment	151
Servo.....	157
Calculating Servo Settings	162
Photocell Switch	165
Internal Power H-Bridge.....	169
External Power H-Bridge	174
Dual Power H-Bridges (L293D)	181
 Chapter 7 – Logic Gates	 189
NAND Gate (Switch)	189
Simulated Alarm System	190
Pressure Alarms.....	196
PNP NOR Gate	200
AND Gate (Switch).....	206
OR Gate (Switch)	211
And Gate (IC)	215
OR Gate (IC)	221
NAND Gate (IC).....	225
NOR Gate (IC)	230
Inverter (IC)	235

Chapter 8 - Capacitors	240
Light Intensity.....	240
Ticking Sound	246
Resistor Rotation Position	250
Chapter 9 - 1-Wire Digital Thermometer.....	256
Configuration of Raspberry Pi	257
Wiring	257
Config File	259
Create Xojo Program	261
Chapter 10 – Infrared Motion Detection.....	265
Chapter 11 - Camera	270
Camera Specifications	270
Installation.....	270
Enable Camera	271
Modules.....	273
Take Pictures Program	274
Take Videos Program	278
Convert h264 to mp4	282
Pi Noir Camera V2	283
Chapter 12 - LCD Display.....	284
16x2 LCD Display	284
Static Text.....	286
Dynamic Text.....	291
Extra LCD Characters.....	296
Custom LCD Character Glyph	301
Chapter 13 – Ultrasonic Range Finder	308
Range Finder Data	308
How the Signal Works	309
Depth Range HC-SR04	312
LV-Maxsonar MB1010.....	318
Chapter 14 – Piezo	326
Create Sound	327
Change Tone.....	331
Reverse Pressure Sensor	336
Chapter 15 – Fire Detection.....	341
Flame Detection	341

Chapter 16 - Power	347
Input Pins.....	347
USB Hubs	348
Battery Power Bank.....	348
Chapter 17 - Long Range RF Link	349
Send On/Off.....	352
Receive On/Off	357
Chapter 18 – RGB LED	364
Single Colours	365
RGB LED SoftPWM.....	369
Chapter 19 – Interrupt – 555 Timer.....	374
AStable Multivibrator	376
Chapter 20 – SPI.....	382
Analogue to Digital Converter (ADC)	383
MAX31855 and Thermocouple	391
Chapter 21 – I2C.....	401
Enable I2C (Raspberry Pi 3 B+)	402
I2C BaudRate	403
MCP9808 I2C Temperature Sensor	405
2 x MCP9808 Temp Sensors.....	411
MCP4725 – Digital to Analogue Converter	417
MPL3115A2 Barometric Sensor	425
Chapter 22 – Infrared.....	437
Test IR Sensor	438
Read IR Remote Control.....	439
Chapter 23 – MCP23017 GPIO Expansion	450
LED Digital Output Expansion.....	453
Digital Input Expansion.....	459
Chapter 24 – Stepper Motor	465
Stepper Motor Sequencing	468
Full Step DRV8833	469
Half Step DRV8833	481
Wave Drive DRV8833	493
Two Phase Stepper Motor-Half Step 5.0-volt L293D	504
Full Step TB6612.....	509

Chapter 25 – DOF Sensor	520
LSM9DS0 – 9 DOF	520
Accelerometer ADXL377	538
Chapter 26 - LED Displays	545
8x8 Matrix LED - Simple	545
8x8 Matrix LED – Dynamic.....	555
16x8 Matrix LED – Simple.....	563
16x8 Matrix LED – Dynamic.....	572
Numerical 7-Segment LED.....	580
Alpha Numeric LED.....	588
Appendix A – New Format Cheat Sheet	597
Appendix B – Parts List.....	598
Appendix C – OSEPP LCD Character Codes	600
Appendix D – Error Solutions.....	601
Index.....	602

Xojo GPIO Module

The Xojo GPIO module needs to be included in your project. The latest version of the GPIO module is included in the sample programs which are in the folder: “Example Projects -> Platform-Specific -> RaspberryPi”. For your convenience, the version which came with Xojo 2018 r1.1 is in the Chapter 5 folder and is called “GPIO.xojo_binary_code”. If you have a newer version of Xojo, then open up the example Xojo program and copy-and-paste the latest version into your program.

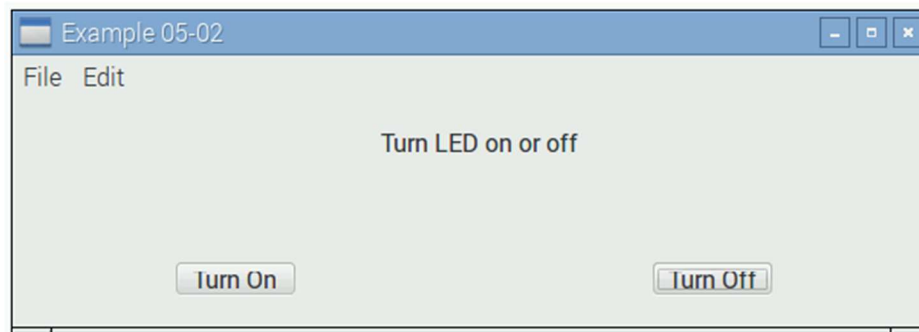
In the example ‘LED On and Off’, I have dragged-and-dropped the “GPIO.xojo_binary_code” module into Example 5-2.

Now that the supporting programs have been installed (Wiring Pi and GPIO Module), the next step is to build the Xojo programs!

LED On and Off

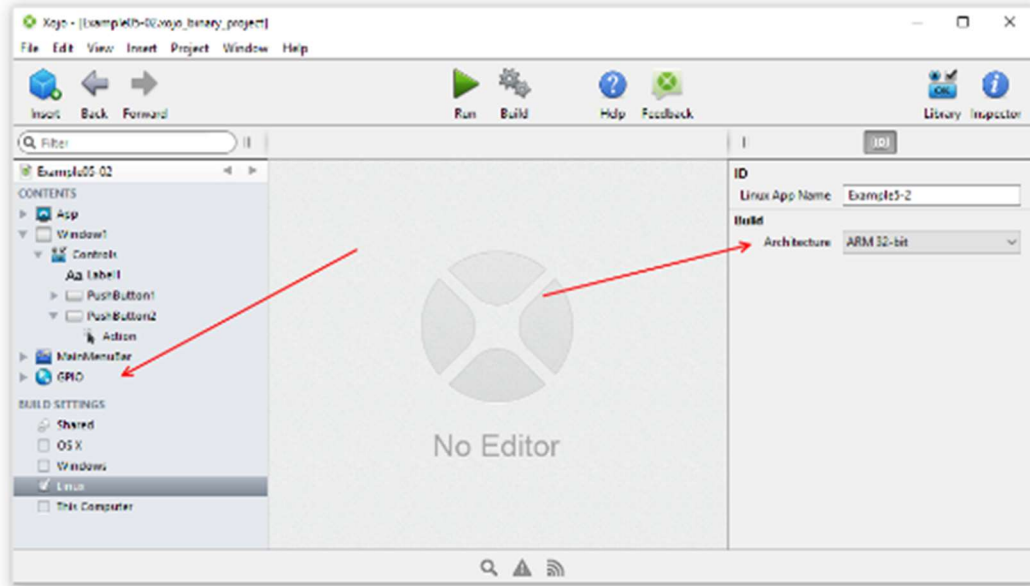
This example shows how to turn the LED light on and off by using the Xojo program. Make sure that wiringPi (installing Wiring Pi) and the GPIO module (XOJO GPIO Module) have been installed/added before building this program (see section on Setup Pi and Xojo).

This example will be a desktop program which will have two buttons, one to turn on the LED and the other to turn the LED off. Start Xojo and create an empty desktop program. Add one label and two pushbuttons and the layout should be similar to the below screen grab.



The button on the left side will Turn-On the LED light and the pushbutton on the right side will Turn-Off the LED light.

Figure 38. GPIO and ARM 32-bit Architecture



The next step is to add the GPIO module by either copying from a new example from the directory “Example Projects -> Platform-Specific -> RaspberryPi” or by copying from the Chapter 5 folder and pasting into the Xojo IDE for Example 5-2.

Code 6. Example 5-2: Window1 Open Event

```
//Setup the GPIO
GPIO.SetupGPIO
```

SetupGPIO can only be called **once** when the program is running, and it is preferably placed in the Window1 Open event.

Add an action event for the pushbutton with the text ‘Turn On’ and add the following code:

Code 7. Example 5-2: Turn On

```
Const LEDPinNumber = 4 ' "#4" on the pinout

' Set the pin to accept output
GPIO.PinMode(LEDPinNumber, GPIO.OUTPUT)

' Turn the pin on (light the LED)
GPIO.DigitalWrite(LEDPinNumber, GPIO.ON)
```

This code sets up the GPIO with a declare in the SetupGPIO method. In our example the power (+ side) for the LED will be at pin number 4, and a constant is made. The pin to have changes is the pin number (#4) and the pin is set to change the output. The pin can either accept an instruction (example: input from a switch) or set a voltage (turn output power on or off), and in this case the PinMode sets the pin to change its output.

Code 8. pinMode Method⁹

```
void pinMode(int pin, int mode)
```

Pins can be set to either input, output or PWM_OUTPUT. Only pin #1 supports PWM output. Other pins can be modified by code to resemble PWM output.

The last line of code is to change the digital value to turn the pin on (GPIO.ON = 1) or turn power off to the pin (GPIO.OFF = 0).

Code 9. digitalWrite Method¹⁰

```
void digitalWrite(int pin, int value)
```

This sets the value of the pin to either on (1) or off (0).

⁹ Gordons Projects: Projects, Fun and Games from Gordon @ Drogon: Functions (API), <https://projects.drogon.net/raspberry-pi/wiringpi/functions/>, Last accessed 2 June 2018.

¹⁰ Gordons Projects: Projects, Fun and Games from Gordon @ Drogon: Functions (API), <https://projects.drogon.net/raspberry-pi/wiringpi/functions/>, Last accessed 2 June 2018.

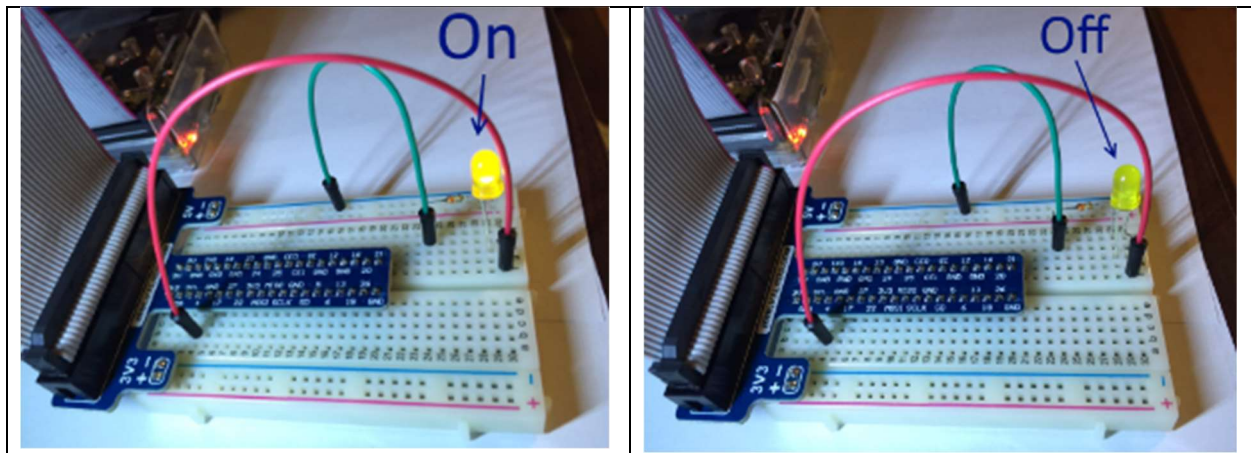
Code is similar to turn off the LED light, and the following code is added to the pushbutton with the text 'Turn Off':

Code 10. Example 5-2: Turn Off

```
Const LEDPinNumber = 4 ' "#4" on the pinout  
  
' Set the pin to accept output  
GPIO.PinMode(LEDPinNumber, GPIO.OUTPUT)  
  
' Turn the pin off (LED turns off)  
GPIO.DigitalWrite(LEDPinNumber, GPIO.OFF)
```

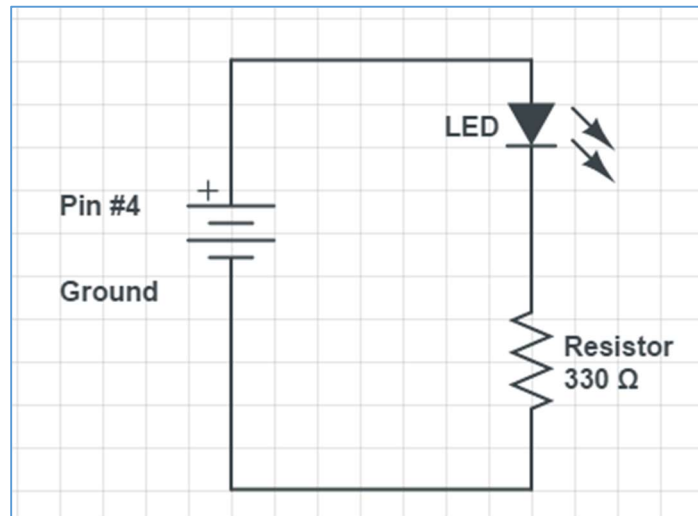
The GPIO is setup, the pin number constant is created, the pin is set to change its output (power on or off), and pin #4 is turned off (GPIO.OFF).

Figure 39. Pi LED On and Off



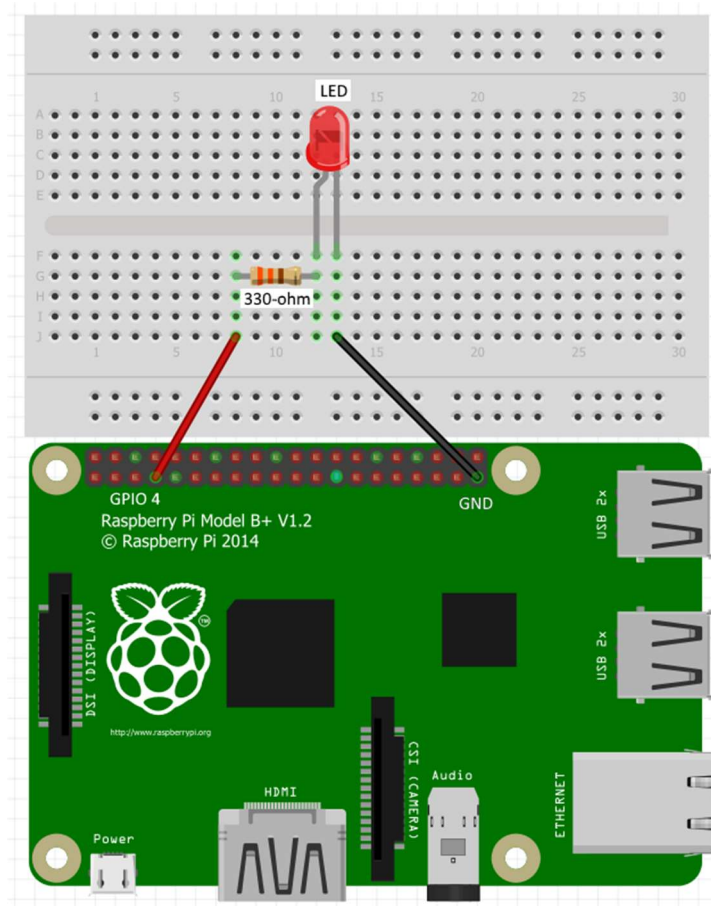
When the Xojo program 'Turn On' pushbutton is pressed then the LED light turns on. When the pushbutton with the text 'Turn Off' is pressed then the LED turns off.

The schematic for this circuit is shown below:

Figure 40. Example 5-2: Schematic

Power is supplied with Pin #4 which has a wire that goes to the LED. Make sure that the 'long' wire on the LED is on the positive side (Pin #4). Next, the resistor is added (a resistance above 220 ohms is preferred) and it does not matter which direction the resistor is in the circuit. The other side of the resistor is connected to a ground (it doesn't matter which negative (-) it is connected).

Figure 41. Example 5-2: Breadboard Layout



This example shows how to make a Xojo program which can turn on and off an LED light.

Index

- ./, 58
- μF , 75
- 12-bits, 418
- 555 timer, 374
- 74HC00, 225, 230, 235
- 74HC08AP, 216
- 74HC32, 221, 225, 230, 236
- 8x8 Matrix LED
 - Blinking, 552
 - Brightness, 550
 - Display, 550
 - LED Pairs, 553, 565
 - Oscillator, 551
 - Rows, 550
- AC, 67
- Active Ports, 42
- Activity LED, 16
- ADC, 382, 383
- Address Select Pins, 406
- AddressOf, 379
- Alternating Current, 67
- amixer, 64
- Ampere, 67
- amp-second, 75
- Analog to Digital, 382
- Analogue To Digital Converter, 383
- Analogue-to-Digital Converter, 241
- AND Gate, 206
- AND Gate (IC), 215
- AND Truth Table, 217
- AStable, 376
- autoclean, 52
- autoremove, 49
- avconv, 282
- Backdrop, 276
- Backup SD Card, 42
- base-emitter current, 77
- Battery Power, 348
- BaudRate, 403
- Blank Screen, 44
- Boot Mount, 39
- Breadboard, 14, 23

Breadboard wiring, 25

Breakout Board, 23

Button, 75

Buttons, 14

Calculate Resistor, 73

Camera, 270

Camera Module, 15

capacitance, 75

Capacitor, 75, 240

Card image, 42

Case, 448

cat, 46, 50

Cds, 119, 165

Centre Tap, 80

Change Keyboard Layout, 41

Change Locale, 40

cifs, 38, 40

clean, 49

Cleanup, 334

Clock Cycle, 137

collector-emitter current, 77

Colour of Resistors, 68

Convert analog to digital, 382

Convert h264 to mp4, 282

coulomb, 75

Coulomb, 68

CPU, 16

Current, 67

DC, 67

DeleteAllRows, 276

digitalWrite, 91

DigitalWrite, 91

Direct Current, 67

directory

- /etc, 39

DisableBackgroundTasks, 445

Display, 16

Distro Version, 50

dpkg --get-selections, 52

dpkg --get-selections | grep wiringpi, 52

DrawPicture, 276

dump, 39, 40

Duty Cycle, 137

Dynamic Text, 291

EDGE_BOTH, 378

EDGE_FALLING, 378, 379

EDGE_RISING, 378

EDGE_SETUP, 378

EHZ, 437

Electronic Colour Code, 68

Electronic Playground 130, 27

Elevation, 425

en_US UTF-8 UTF-8, 40

Enable SPI, 382, 402

Energy, 70

English (US), 41

Ethernet Controller, 16

Ethernet Port, 15

Exahertz, 437

Example

03-01 Hello World Desktop, 56

03-02 Hello World Web App, 58

03-04 Play mp3 File, 65

05-01 Light Simple Circuit, 83

05-02 Light Turn On, 91

05-03 Check Switch, 97

05-04 Pull-Up Resistor, 103

05-05 Pull-Down Resistor, 108

05-06 Transistor NPN Switch, 113

05-07 Transistor PNP Switch, 118

05-08 pMOSFET Switch, 126

05-09 nMOSFET Switch, 130

06-01 Motor Turn On, 134

06-02 Dim LED, 141

06-03 Change Motor Speed, 146

06-04 Voltage Divider, 150

06-05 7-Segment LED, 154

06-06 Move Servo, 161

06-07 Servo Pulse Calculator, 164

06-08 Read Photocell, 168

06-09 Internal Motor Direction, 172

06-10 External Motor Direction, 178

06-11 L293D H-Bridges, 186

07-01 Simulated Alarm, 194

07-02 Pressure Alarm, 199

07-03 NOR Status, 204

07-04 AND Gate, 210

07-05 OR Gate, 214

07-06 IC AND Gate, 219

07-07 IC OR Gate, 223

07-08 IC NAND Gate, 229

07-09 IC NOR Gate, 234

07-10 IC Inverter Gate, 238

08-01 Light Intensity, 243

08-02 Ticking, 248

08-03 Measure Position, 253

09-01 Measure Position, 261

10-01 Infrared Sensor, 268

11-01 Open Picture, 276

11-01 Take a picture, 275

11-02 Play a Video, 280

11-02 Take a Video, 279

12-01 LCD Static Text, 289

12-02 LCD Dynamic Text, 294

12-03 LCD Unique Characters, 299

12-04 Create Glyph, 305

13-01 Ultrasonic Distance, 315

13-02 Read Sonar Voltage, 322

14-01 Piezo Sound, 330

14-02 Play Piezo Tune, 334

14-03 Piezo Pressure Release, 339

15-01 Fire Detection, 345

17-01 Remote LED Control, 355

17-02 Receiver Display, 361

18-01 Show LED Colours, 367

18-02 LED Colours SoftPwm, 373

19-01 Count 555-timer interrupts, 380

20-01 ADC Read Voltage, 387

20-02 Read MAX31855, 396

20-02 Read Thermocouple, 396

21-01 I2C Read Temperature, 408

21-02 I2C Read Two Temperatures, 414

- 21-03 I2C Set Analogue Voltage, 421
- 21-04 Altitude, Temperature, and Pressure, 433
- 22-01 Decode IR Remote, 445
- 23-01 MCP23017 Turn on LED, 456
- 23-02 MCP23017 Read Digital Input, 462
- 24-01 DRV8833 Full-Step Stepper Motor Drive, 477
- 24-02 DRV8833 Half-Step Stepper Motor Drive, 489
- 24-03 DRV8833 Wave-Step Stepper Motor Drive, 500
- 24-04 L293D Half Step L293D Stepper, 507
- 24-05 TB6612 Full-Step Stepper Motor Drive, 516
- 25-01 LSM9DS0 9-DOF, 526
- 25-02 ADXL377 G-Force, 543
- 26-01 Single Simple 8x8 Matrix LED, 550
- 26-02 8x8 Matrix LED Animation, 559
- 26-03 Single Simple 16x8 Matrix LED, 568
- 26-04 16x8 Matrix LED Animation, 576
- 26-05 7-Segment 4-digit LED, 586
- 26-06 Alpha numeric LED, 593
- Execute, 275
- Exists, 276
- Expansion I/O Pins, 453
- Farad, 75
- File System Check, 39, 40
- File System Table, 39
- FillColor, 154
- Fire Detection, 341
- Firmware update, 50
- Flame Detection, 341
- flip-flop, 377
- floating, 99
- Floating Input Gate, 99
- FolderItem.PathTypeShell, 276
- forward voltage, 72
- fsck, 39, 40
- fstab, 39
- Gates, 189
- General Purpose Input-Output, 16
- GHz, 437
- gigahertz, 437
- Glyph, 301
- GND, 406
- GPIO, 16
 - Cleanup, 334
 - DigitalWrite, 91
 - LCD, 289
 - OFF, 92
 - ON, 91
 - OUTPUT, 91
 - PUD_DOWN, 379
 - SetupGPIO, 90
 - SoftPwmCreate, 372
 - SoftPwmWrite, 373
 - SoftToneCreate, 334
 - SoftToneWrite, 334
 - WiringPiISR, 379
- GPIO Module, 28
- GPIO Numbers, 24

GPIO Ribbon, 23

Graphical Text Editor, 38

h264, 282

h264 to mp4, 282

HARD PWM LED, 136

H-Bridge, 169

HDMI Cable, 14

HDMI Port, 16

Heat Sinks, 14

Help, 49

Help Manual, 49

Hertz, 137

Hostname, 41

Hz, 137

I2C, 401, 402, 426

I2C BaudRate, 403

IC, 191

illuminance, 120

Infrared, 437

Infrared Detection, 341

Infrared Sensor, 265

Input Pin Power, 347

Input Threshold Voltage, 99

Integrated Circuit, 191

Interface Bus, 382

interference, 99

Inter-Integrated-Circuit, 401

Internal Power H-Bridge, 169

Internationalisation Options, 40

Interrupt, 374

Interrupt Handler, 374

Interrupt Service Routine, 374

InteruptModule, 379

Inverter Truth Table, 237

IP Address, 41

IR Sensor Test, 438

IRL530, 126

ISR, 374

Joule, 70

Jumper Wire, 14

Kernel Version, 50

keyboard configuration, 40

Keyboard Layout, 41

Kill program, 41

kilojoule, 70

kilometer, 437

kilowatt hour, 70

kLine1, 299

kLine2, 300

km, 437

kWh, 70

LCD, 289

LCD Characters, 296

LCD Clear, 289

LCD Display, 284

LCD Home, 289

LCD SetMessage, 290

LCD Static Text, 286

LCDGlyph, 305

LeafPad, 38

Least Significant Bits, 418

LED, 14, 71

LED Parallel, 74

LED RGB, 364

LetterCode, 306

libav, 282

Light Emitting Diode, 71

Light Intensity, 240

Linux

apt-get, 38

CAT, 31

CD, 31

CHMOD, 31

CHOWN, 32

CP, 32

CURL, 32

DF, 32

dist-upgrade, 22

DPKG, 32

GREP, 32

hostname, 42

HOSTNAME, 32

IFCONFIG, 32

kill, 41

leafpad, 39

LS, 33

LS -a, 33

LS -l, 33

MAN, 33

MKDIR, 33

mount, 38

MV, 33

netstat, 42

PING, 33

ps, 41

ps -ef|grep Example, 41

PWD, 33

RM, 34

RMDIR, 34

startx, 23

SUDO, 34

sudo apt-get dist upgrade, 22

sudo apt-get install pinta, 36

sudo apt-get update, 21

sudo apt-get upgrade, 22

sudo dpkg-reconfigure tzdata, 35

sudo startx, 23

TOUCH, 34

update, 37, 38

upgrade, 22

WHICH, 34

Linux raspi-config, 40

Listbox, 276

Logic Gate, 99

Logic Gates, 189

login, 21

Low Power Device, 349

LPD, 349

LSB, 418

Lux, 121

man, 49

Master, 401

MAX31855, 391

MCP23017, 453

DEFVALA, 452

DEFVALB, 452

GPINTENA, 452

GPINTENB, 452

GPIOA, 452

GPIOB, 452

GPPUA, 452

GPPUB, 452

INTCAPA, 452

INTCAPB, 452

INTCONA, 452

INTCONB, 452

INTFA, 452

INTFB, 452

IOCON, 452

IODIRA, 452

IODIRB, 452

IPOLA, 452

IPOLB, 452

OLATA, 452

OLATB, 452

MCP3008, 382

MCP4725 DAC, 417

MCP9808 I2C Temp Sensor, 405

megajoule, 70

Micro SD, 16

Micro USB Cable, 13

microfarad, 75

MicroSD Card, 13

MidB, 423

millimeter, 437

mm, 437

ModeMultiple, 142

ModeOff, 142

Module GPIO, 28

MOSFET n-channel, 78

MOSFET p-channel, 79

Most Significant Bits, 418

Motion Detection, 265

Mount, 38

Mount Airport Extreme, 38

mp4, 282

MPL3115A2, 425

MSB, 418

Multivibrator, 376

NAND, 189

NAND Gate (IC), 225, 230, 235

NAND Truth Table, 189, 228

nanometer, 437

NativePath, 277

n-channel, 78

netstat, 42

nm, 437

nMOSFET, 78

nMOSFET Switch, 126

NOR Gate, 200

NOR Truth Table, 232

Not And, 189

NPN Transistor, 109

-o, 38

OFF, 92

ohms, 68

ON, 91

Open Picture, 276

Operating System Upgrade, 51

OR Gate, 211

OR Gate (IC), 221

OR Truth Table, 222

os-release, 50

OUTPUT, 91

Paint (Pinta), 36

Parallel LED, 74

pass, 39, 40

Passive Infrared Sensor, 265

password, 21

PathTypeShell, 276

p-channel, 79

Petahertz, 437

Photocell, 119, 165

PHz, 437

pi, 21

Pi Version, 46

Picture, 276

Picture Open, 276

Pictures, 274

Piezo, 326

Pin Numbers, 24

pinMode, 91

Pinta, 36

pMOSFET, 79

- pMOSFET Switch, 123
- PNP NOR Gate, 200
- PNP Transistor, 77, 114
- Polling, 374
- port netstat, 42
- Pot, 122
- Potentiometer, 122, 250
- Power, 347
- Power Bank, 348
- Power In, 16
- Power Input Pins, 347
- Power LED, 16
- Power Supply, 13
- Power USB Hubs, 348
- Pressure Alarm, 196
- Program Running, 41
- Program Uninstall, 49
- PUD_DOWN, 379
- pull-up resistor, 102
- Pulse Width Modulation, 136
- purge, 52
- Purge program, 52
- PWM, 136
- PWM Dim LED, 136
- PWM_MODE_MS, 160
- PwmSetClock, 160
- PwmWrite, 141
- QuickStart, 28
- Quit program, 41
- Radio Frequency, 349
- Range Finder, 308
- raspberrypi, 21
- Raspistill
 - d, 276
 - e, 276
 - fp, 276
 - h, 275
 - k, 276
 - l, 275
 - o, 275
 - q, 275
 - r, 275
 - s, 276
 - t, 275
 - th, 276
 - tl, 276
 - v, 275
 - w, 275
 - x, 276
- Raspivid
 - , 280, 281
 - b, 280
 - cs, 280
 - d, 280
 - e, 280
 - fps, 280

-h, 280
-k, 280
-o, 280
-pf, 280
-t, 280
-td, 280
-v, 280
-w, 280
reboot, 50

Recover Disk Space, 49

RegisterCustomGlyph, 306

Remote Access, 53

remove, 49

Remove old programs, 49

remove program, 49

Repeated-Start, 426

Resistance, 68

Resistor, 68

Resistor Calculation, 73

Resistor Colour, 68

Resistor formula, 73

Resistor Rotation Position, 250

Resistor-Capacitor Circuit, 242

Resistors, 14

Restore SD Card, 42

Restore Trash Can, 48

RF, 349

RGB, 154

RGB LED, 364, 365

Ribbon, 23

Ribbon Cable, 14

Round, 422

Run program, 58

Run program from Terminal, 36

Running Programs, 41

Schematics, 79

SCL, 406

Screen Grab (scrot), 37

Screen Power Mode, 44

Screen Saver, 44

Screen Shot (scrot), 37

screensaver remove, 44, 50

ScrollDisplayLeft, 295

ScrollDisplayRight, 295

Scrot, 37

SD card image, 42

SDA, 406, 412

sec, 38, 40

Select-Case, 448

selections, 52

SendByte, 299

SensorInterrupt, 379

Serial Clock Line, 406

Serial Data Line, 406

Serial Peripheral Interface, 382, 391

SetLine, 306

SetMessage, 290

SetupGPIO, 90

Shell, 275

ShiftLeft, 560

ShiftRight, 560

Simulated Alarm System, 190

Slave, 401

SoftPWM, 369

SoftPWM LED, 369

SoftPwmCreate, 372

SoftPwmWrite, 373

SoftToneCreate, 334

SoftToneWrite, 334

Sound, 64

Sound Jack, 15

space, 31

SPI, 382

SPI Bus, 391

SPI Enable, 382, 402

Split, 448

StackOverflowChecking, 445

startx, 23

static, 141

Step Response, 250

Stop program, 41

sudo, 23

sudo ./, 58

sudo apt-get autoclean, 52

sudo apt-get dist-upgrade, 51

sudo apt-get purge wiringpi, 52

sudo rpi-update, 50

sudo startx, 23

-t, 38

terahertz, 437

Thermocouple, 391

Threshold Voltage, 99

Threshold Voltage Range, 99

THz, 437

time zone, 35

Timer, 97

timer 555, 374

TIP30C, 123

Transformer, 80

Transformer Windings, 81

Transistor, 76, 109, 114

Transistor NPN, 77

Transistor NPN Switch, 109

Transistor PNP Switch, 114

Trash Can, 48

Truth Table NAND, 189

type, 39

UInt16, 422

UInt8, 422

Ultrasonic Range Finder, 308

uname, 50

Uninstall program, 49

Update, 21

Upgrade, 21

Upgrade Operating System, 51

USB Controller, 16

USB Hub Power, 348

USB Ports, 15

Val, 423, 448

variable resistor, 122

Vdd, 406

Version, 46

Version of Pi, 46

Videos, 278

VNC Server, 53

VNC Viewer, 53

voltage drop, 72

Volts, 67

Watt, 70

WhatIsMyElevation, 425

Windings, 81

Windows 10 IoT, 13

wiring breadboard, 25

WiringPi, 86, 402

WiringPiISR, 378, 379

xScreenSaver, 44

The 'I Wish I Knew' series contains technical data and advice that makes sense and contains practical and numerous examples with explanations to allow you to ease into the steep programming curve. You can create interactive Raspberry Pi applications today!

This book "I Wish I Knew How to ... Program Raspberry Pi 3 B+ Electronics with Xojo" shows how to interact electronics with the real-world. Book examples have been tested with the Raspian Stretch Desktop Operating System with Xojo version 2018 r1.1. Xojo Raspberry Pi licenses are now free!

This intermediate book is written as a guide and reference to Xojo programmers who want to program the Raspberry Pi with a heavy focus on electronics. It is recommended that you have a basic desire to want to learn how to work with electronics and perform a little electronic math before using this book. Each chapter and example build on previous examples which begins with easier concepts to produce more complete examples near the end of the book. These examples require that there be a licensed version of Xojo to build the programs for Raspberry Pi – the demo version does not build programs and the registered free version does build programs.

There are 26 chapters and contains over 600 pages with more than 70 example programs.

Examples include topics such as moving a servo, 7-segment LED, Button Input, Various LED displays, precision stepper motors, Infrared Motion Detection, and more. Many screenshots have been added to show the results of the code with an index to help find topics quickly.

This is one of many books that can be purchased at XojoLibrary.com where many great Xojo resources are available.

Happy programming!

Eugene

Eugene Dakin MBA, Ph.D., P.Chem., is an author of Xojo and Real Studio reference materials and has many years of experience in the programming industry. Another great reference book is *I Wish I Knew How To ... Program Win32 Declares for Windows*.

ISBN: 978-1-927924-21-1