Introduction

The RF transmitter add-on board can be used with the R-PI to control up to 4 simple Energenie radio controlled sockets independently using a small software program. We have written a simple program in Python to allow us to switch the sockets on and off with a single keyboard press.

The add-on board connects to the row of pins called the GPIO which can be controlled as either input or output lines under your software control.

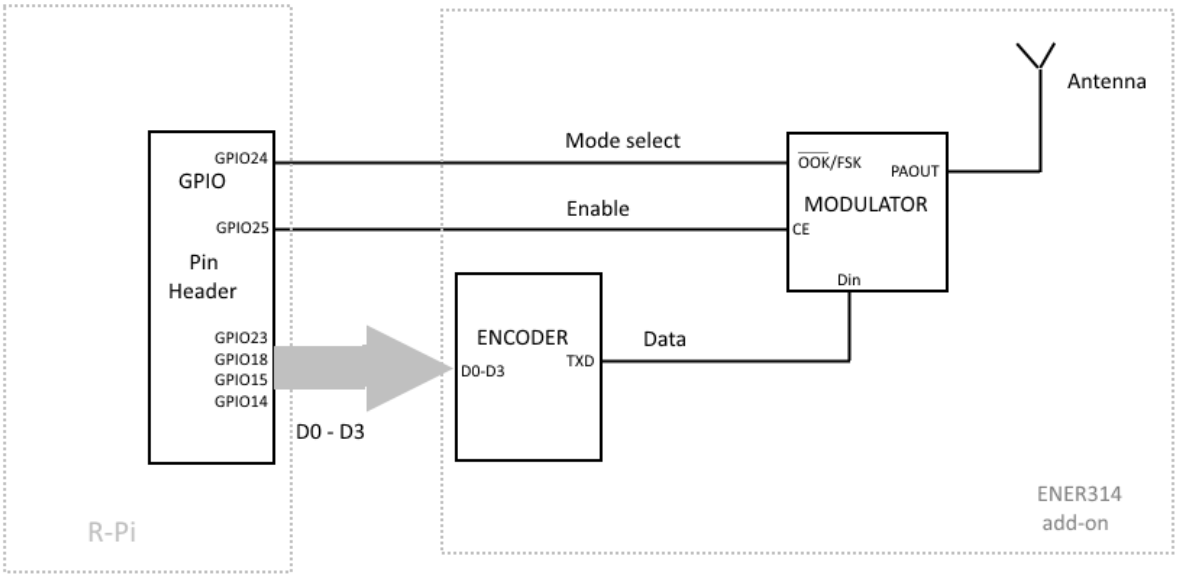
Installing the board

Fig. 1: R-Pi with piggy back RF-transmitter board

Install the board on to the row of pins as show in the picture and connect your Raspberry-Pi as normal to a monitor, mouse, keyboard and USB power supply.

Note: The RF transmitter add-on board must be connected securely first before powering on the R-Pi. Connecting after the R-Pi is on may result in the device freezing.

How it is controlled by Software



The pin header connects to the add-on board as follows to allow you to control the GPIO lines as outputs to drive the radio frequency transmitter.

GPIO Pin Header Rev 2.0
view from top

	3V3	1	2	5V	
	GPIO2	3	4	5v	
	GPIO3	5	6	Ground	
	GPIO4	7	8	GPIO14	
	Ground	9	10	GPIO15	
Encoder signal D0	GPIO17	11	12	GPIO18	
Encoder signal D3	GPIO27	13	14	Ground	
Encoder signal D1	GPIO22	15	16	GPIO23	Encoder signal D2
	3V3	17	18	GPIO24	MODSEL mode select signal (OOK/FSK)
	GPIO10	19	20	Ground	
	GPIO9	21	22	GPIO25	CE modulator enable (Output ON/OFF)
	GPIO11	23	24	GPIO8	
	Ground	25	26	GPIO7	

Your software will use the outputs on the GPIO connector to drive the add-on board. At the end of this document is some sample code written in Python to switch the Energenie sockets on and off.

Each board transmits a frame of information using On-Off-Keying (OOK) which is a basic form of Amplitude Shift Keying (ASK). This frame includes source address (20 bits) and control data (4 bits). See Appendix 1. The source address is randomly selected (so unique for that board), pre-programmed and cannot be changed. The socket will accept commands frames that have the source address that it learns during the learning process described later.

Here are the pairs of codes using D0-D3 signals that can be sent to control sockets.

D3	D2	D1	D0	Meaning	D3	D2	D1	D0	Meaning
1	0	1	1	All on	0	0	1	1	All off
1	1	1	1	socket 1 on	0	1	1	1	socket 1 off
1	1	1	0	socket 2 on	0	1	1	0	socket 2 off
1	1	0	1	socket 3 on	0	1	0	1	socket 3 off
1	1	0	0	socket 4 on	0	1	0	0	socket 4 off

The pcb can therefore control a maximum of 4 Energenie radio sockets independently. However, more that one socket may be controlled by the same control code.

There are two parts to the transmitter. The encoder and the modulator.

1) The encoder will accept 4 input signal levels programmed onto 4 of the GPIO lines (D0-D3) as shown above. It will then serialise them on a single line to the modulator part.
2) The modulator transmits the serialised signal. It needs to be programmed in Amplitude-Shift Keying (ASK) mode for the sockets using a GPIO signal. It also needs to be enabled by a separate GPIO signal.

Firstly, we need to install a Python module, RPi.GPIO, to enable software control of the GPIO pins for the Raspberry Pi. Open an LXterminal from the desktop and type the following lines:

```
sudo apt-get install python-rpi.gpio
```

Now, open a text editor such as Leafpad and type the python code listed at the end called ENER002.py into a new file under home/pi (or, more easily, download it from the energenie4u.co.uk website and copy using a USB flash drive). This program will allow us to send coded commands to the sockets to program them and then switch them on and off when the return key on the keyboard is hit.

Controlling the sockets

Launch your program by typing the following command at the prompt in the LXterminal window:

```
sudo python ENER002.py
```

Then insert a radio controlled socket into a mains wall socket which is switched on.
The socket must then be programmed to learn a control code from the transmitter. To do this the socket must be in learning mode indicated by the lamp on the front of the socket housing flashing slowly. If it is not doing this, press and hold the green button on the from of the housing (while the lamp is off), for 5 seconds or more and then release it when the lamp starts to flash at 1 second intervals. Then send a signal to it from you program by hitting the return key. Acceptance will be indicated by a

brief quick flashing of the lamp on the housing which will then extinguish. Program first one socket then the other in this way, otherwise they will react to the same signal.

You can then toggle the socket on and off by hitting the return key. You can also switch it manually on and off by briefly pressing the button on the front housing.

You can always reset the socket programming by perfoming a factory reset.
The socket memory can be fully erased by a factory reset:
1. Turn the socket OFF
2. Press and hold the Green button on the socket until the LED light flashes quickly - the Red LED light will flash at 1 second intervals first then flash quickly indicating a full reset.

To increase the range of the transmitter you may wish to add an extra antenna to the circuit board. You can do this by soldering a piece of ordinary copper wire 13.5cm long into the hole marked ANT1 on the circuit board.

IMPORTANT: *If using more than one socket, they will need to be inserted into separate mains wall sockets with a physical separation of at least 2 metres to ensure they don't interfere with each other. Do not put into a single extension lead.*

Controlling the extension lead

The RF transmitter add-on board is also compatible with our 4 way radio controlled extension lead, product code ENER010. You can visit our website to purchase:
https://energenie4u.co.uk/index.php/catalogue/product/ENER010

Here is the program ENER002.py

```
#import the required modules
import RPi.GPIO as GPIO
import time

# set the pins numbering mode
GPIO.setmode(GPIO.BOARD)

# Select the GPIO pins used for the encoder K0-K3 data inputs
GPIO.setup(11, GPIO.OUT)
GPIO.setup(15, GPIO.OUT)
GPIO.setup(16, GPIO.OUT)
GPIO.setup(13, GPIO.OUT)

# Select the signal used to select ASK/FSK
GPIO.setup(18, GPIO.OUT)

# Select the signal used to enable/disable the modulator
GPIO.setup(22, GPIO.OUT)

# Disable the modulator by setting CE pin lo
GPIO.output (22, False)

# Set the modulator to ASK for On Off Keying
# by setting MODSEL pin lo
GPIO.output (18, False)
```

```
# Initialise K0-K3 inputs of the encoder to 0000
GPIO.output (11, False)
GPIO.output (15, False)
GPIO.output (16, False)
GPIO.output (13, False)

# The On/Off code pairs correspond to the hand controller codes.
# True = '1', False ='0'

print "To clear the socket programming, press the green button"
print "for 5 seconds or more until the red light flashes slowly"
print "The socket is now in its learning mode and listening for"
print "a control code to be sent. It will accept the following"
print "code pairs"
print "0011 and 1011 all ON and OFF"
print "1111 and 0111 socket 1"
print "1110 and 0110 socket 2"
print "1101 and 0101 socket 3"
print "1100 and 0100 socket 4"
print "Hit CTL C for a clean exit"

try:
      # We will just loop round switching the unit on and off
      while True:
            raw_input('hit return key to send socket 1 ON code')
            # Set K0-K3
            print "sending code 1111 socket 1 on"
            GPIO.output (11, True)
            GPIO.output (15, True)
            GPIO.output (16, True)
            GPIO.output (13, True)
            # let it settle, encoder requires this
            time.sleep(0.1)
            # Enable the modulator
            GPIO.output (22, True)
            # keep enabled for a period
            time.sleep(0.25)
            # Disable the modulator
            GPIO.output (22, False)

            raw_input('hit return key to send socket 1 OFF code')
            # Set K0-K3
            print "sending code 0111 Socket 1 off"
            GPIO.output (11, True)
            GPIO.output (15, True)
            GPIO.output (16, True)
            GPIO.output (13, False)
            # let it settle, encoder requires this
            time.sleep(0.1)
            # Enable the modulator
            GPIO.output (22, True)
            # keep enabled for a period
            time.sleep(0.25)
            # Disable the modulator
            GPIO.output (22, False)

            raw_input('hit return key to send ALL ON code')
            # Set K0-K3
            print "sending code 1011 ALL on"
            GPIO.output (11, True)
            GPIO.output (15, True)
            GPIO.output (16, False)
            GPIO.output (13, True)
            # let it settle, encoder requires this
```

```
                time.sleep(0.1)
                # Enable the modulator
                GPIO.output (22, True)
                # keep enabled for a period
                time.sleep(0.25)
                # Disable the modulator
                GPIO.output (22, False)

                raw_input('hit return key to send ALL OFF code')
                # Set K0-K3
                print "sending code 0011 All off"
                GPIO.output (11, True)
                GPIO.output (15, True)
                GPIO.output (16, False)
                GPIO.output (13, False)
                # let it settle, encoder requires this
                time.sleep(0.1)
                # Enable the modulator
                GPIO.output (22, True)
                # keep enabled for a period
                time.sleep(0.25)
                # Disable the modulator
                GPIO.output (22, False)

# Clean up the GPIOs for next time
except KeyboardInterrupt:
      GPIO.cleanup()
```

Appendix 1 – Tx Frame format