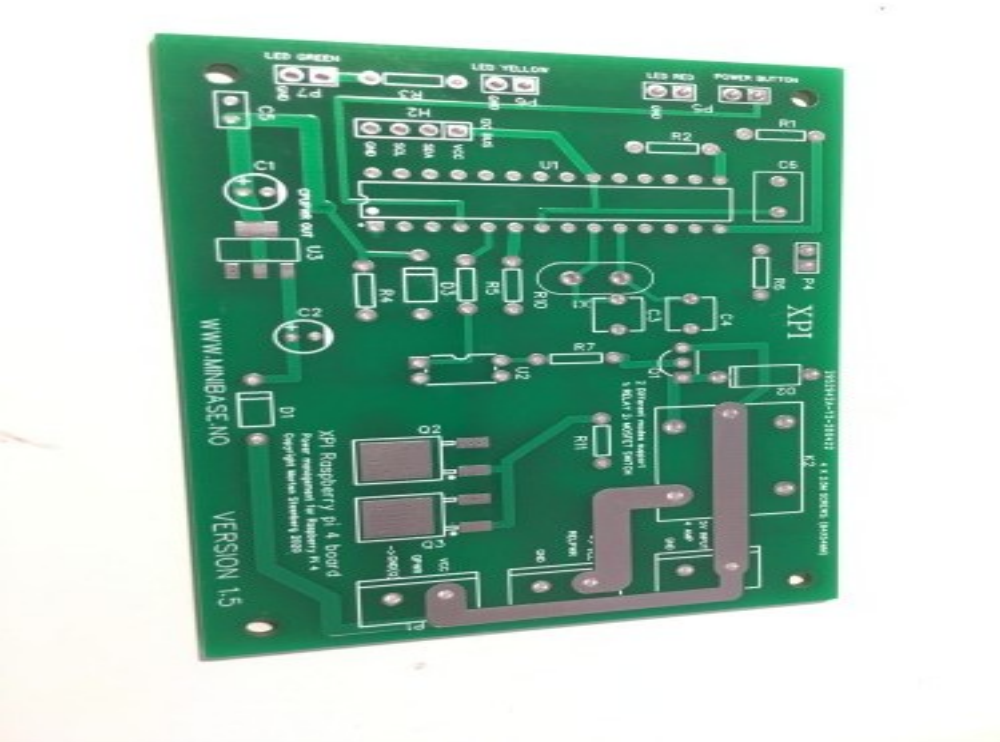
Documentaion for XPI Power Management Board



XPI

For raspberry PI 4B

Model : XPI Raspberry PI board. Power management for Raspberry PI 4 with 2 different modes to select.

XPI POWER BOARD					
BOARD REV.	BOARD DATE	DOC REV.	DOC DATE	COPYRIGHT	EMAIL
1.5	2020-4	1.0	2020-5	MORTEN STEENBERG	MORTEN@MINIBASE.NO

Preface

Raspberry Pi 4 is a powerful microcomputer that, in my opinion, is underestimated, especially in what it can be used to. There are countless opportunities for smart boxes for everything - without the expensive cost.

Price is very important. When this is so low, it gives developers the opportunity to experiment extensively, without spending hundreds of dollars for a couple of models.

The stability of the Raspberry Pi 4 along with Raspberry Pi OS is impeccable good against Windows and Mac Os - which I use beside at the same time for my other work with computing. The principle is simple: first power the control bord (XPI Powerboard) then the Raspberry Pi 4. The power control board can tell Raspberry Pi ho shutdown and power of the system, and the Raspberry Pi can "tell" the controller board that it will turn itself off. Simple in principle.

The XPI Power Management Board are developed by (C) Morten Steenberg in 2020. The idea was from an old simple similar circuit board with very poor current support and to small transistors to support the load (current). The most circuit I have seen is made for Raspberry Pi Zero – a long time ago...
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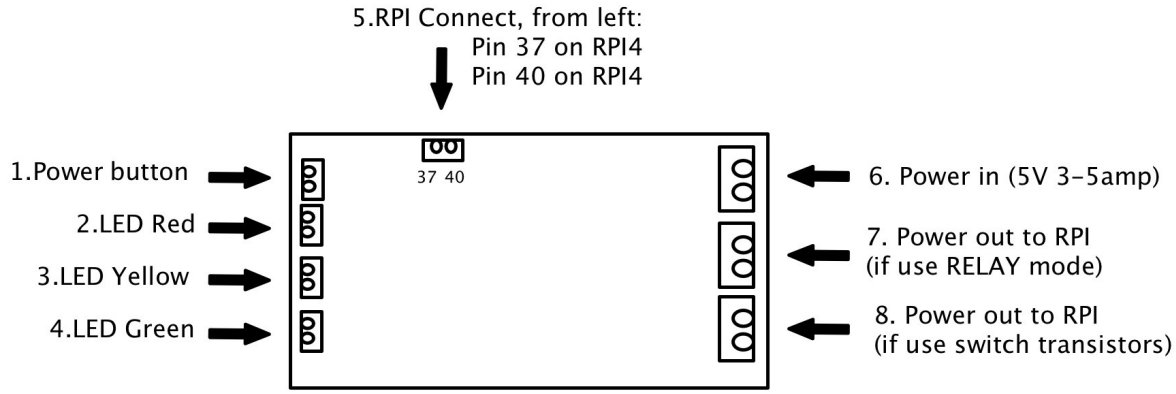
How to connect

XPI Power Management Board – pin configurations.



The PMB (Power Management Board for Raspberry PI 4) has 8 connections you can use.

1. Power button. This button is a 2-wire, this is an normal open circuit and when pushed, closed. This port/pin to the micro controller has an internal pull-up resistor already and only need a cable and a simple push button to operate. The micro controller detect when the button is pushed to ground. See schematic for more info.

2. Standard red led. This will light when the system is in standby mode. And only has power to the pmb and all power to the Raspberry PI is off.

3. Standard yellow led. This will light when the system is booting/starting/closeing and or is waiting for power off from a halt command in Raspberry Pi or the user has pushed the button (1) .

4. Standard green led. This light up when the system is up and running normal.

5. RPI Connect. This connector has 2 pins. Leftmost from this 2-pin connector (seeing from the led pins) goes to the Raspberry Pi's pin 37 and the second goes to the pin 40 on the Raspberry Pi. **Without this 2-wire cable to Raspberry Pi, this Power Management Board will not work**.

6. Power in. Supply 5V and 3 to 5 amp current.

7. Power out (relay output). If this circuit-board is used with relay, please support cable here to the USB-C on the Raspberry Pi 4.

8. Power out (transistor output). If this circuit-board is used with 2 x 4184 CMOS N-Channel switch transistors, please provide cable here til the USB-C connector on the Raspberry Pi 4.

This version of pmb also have support for 2-wire I2C connections for displays etc in the future. Future bios version will have support for other functions, like a simple "setup" specially what you what to do after a power loss has occured.

Modes of operation

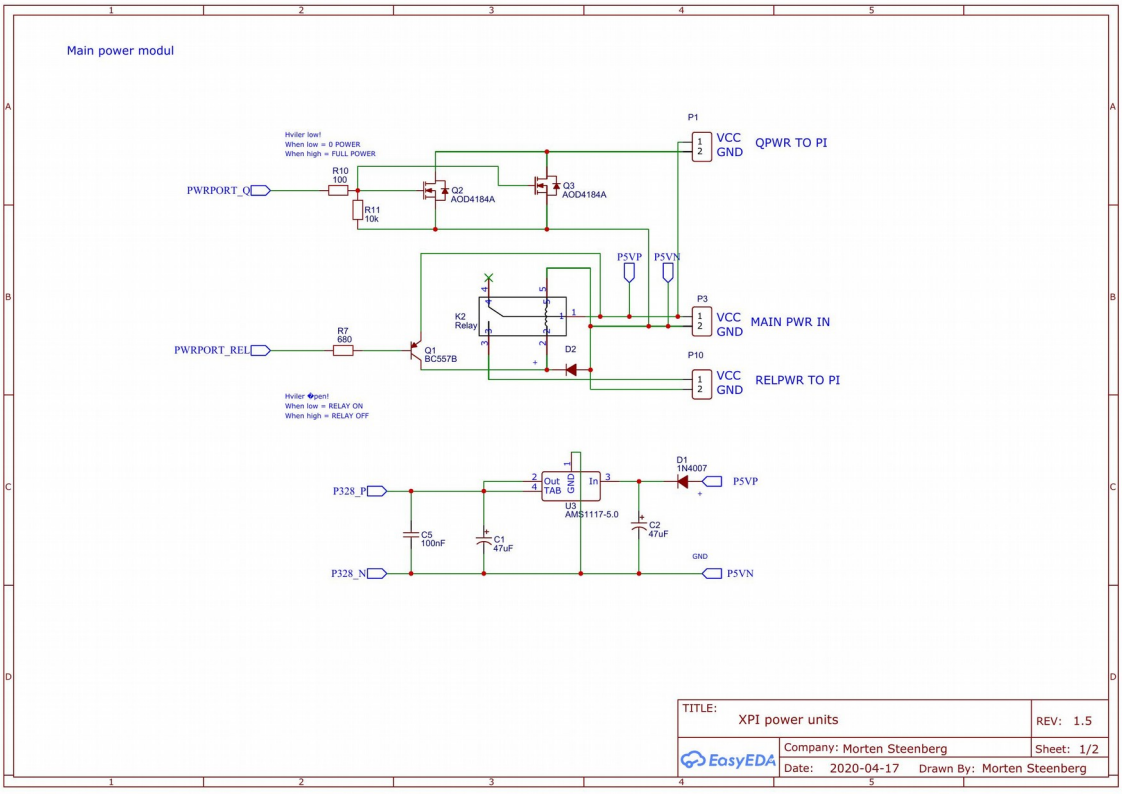
This circuit board support 2 modes of power delivery to Raspberry Pi 4. **Remember you cannot use both at the same time**. You shoud solder R?? if you want to use the pmb with relay or soldier R?? if you want to use the pbm with 2 x N-CHANNEL CMOS AOD4184 switch transistors instead.

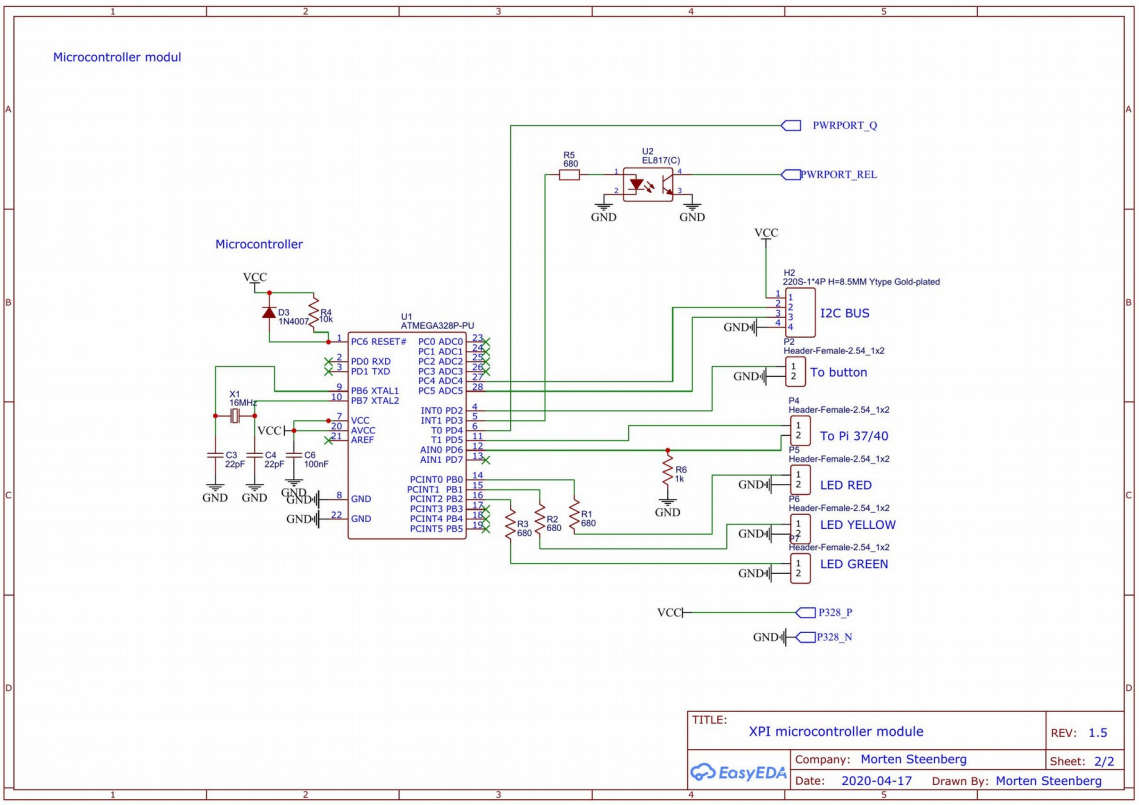
What is best, is you to decide. Take concern over temperatures and maximum current load when you select which mode to use for your Raspberry Pi 4. The pbm should handle up to maximum 5 amp continues current. It have been tested with a digital current load of 5 amp and 5 volt in 1 hour without any damages or critical temperatures found.

Firmware

This circuit use an pre-programmed AtMega328 Micro-controller, programmed in C++. The source is not available for public. This use an Interrupt in the code to control the push button, no extra library is used.

Schematics


Main power modul
P1
VCC
GND
QPWR TO PI
Hviler low!
When low = 0 POWER
When high = FULL POWER
R10
100
PWRPORT_Q
Q2
AOD4184A
Q3
AOD4184A
R11
10k
P5VP
P5VN
P3
VCC
GND
MAIN PWR IN
K2
Relay
R7
680
PWRPORT_REL
Q1
BC557B
D2
P10
VCC
GND
RELPWR TO PI
Hviler open!
When low = RELAY ON
When high = RELAY OFF
D1
1N4007
P5VP
P328_P
Out
TAB
GND
In
U3
AMS1117-5.0
C5
100nF
C1
47uF
C2
47uF
GND
P328_N
P5VN
TITLE:
XPI power units
REV: 1.5
EasyEDA
Company: Morten Steenberg
Sheet: 1/2
Date: 2020-04-17
Drawn By: Morten Steenberg


Microcontroller modul
PWRPORT_Q
PWRPORT_REL
R5
680
U2
EL817(C)
GND
GND
Microcontroller
VCC
H2
220S-1*4P H=8.5MM Ytype Gold-plated
I2C BUS
D3
1N4007
R4
10k
U1
ATMEGA328P-PU
PC6 RESET#
PD0 RXD
PD1 TXD
PB6 XTAL1
PB7 XTAL2
X1
16MHz
C3
22pF
C4
22pF
C6
100nF
VCC
AVCC
AREF
GND
P2
Header-Female-2.54_1x2
To button
P4
Header-Female-2.54_1x2
To Pi 37/40
P5
Header-Female-2.54_1x2
LED RED
P6
Header-Female-2.54_1x2
LED YELLOW
Header-Female-2.54_1x2
LED GREEN
R6
1k
R1
680
R2
680
R3
680
P328_P
P328_N
TITLE:
XPI microcontroller module
REV: 1.5
EasyEDA
Company: Morten Steenberg
Sheet: 2/2
Date: 2020-04-17
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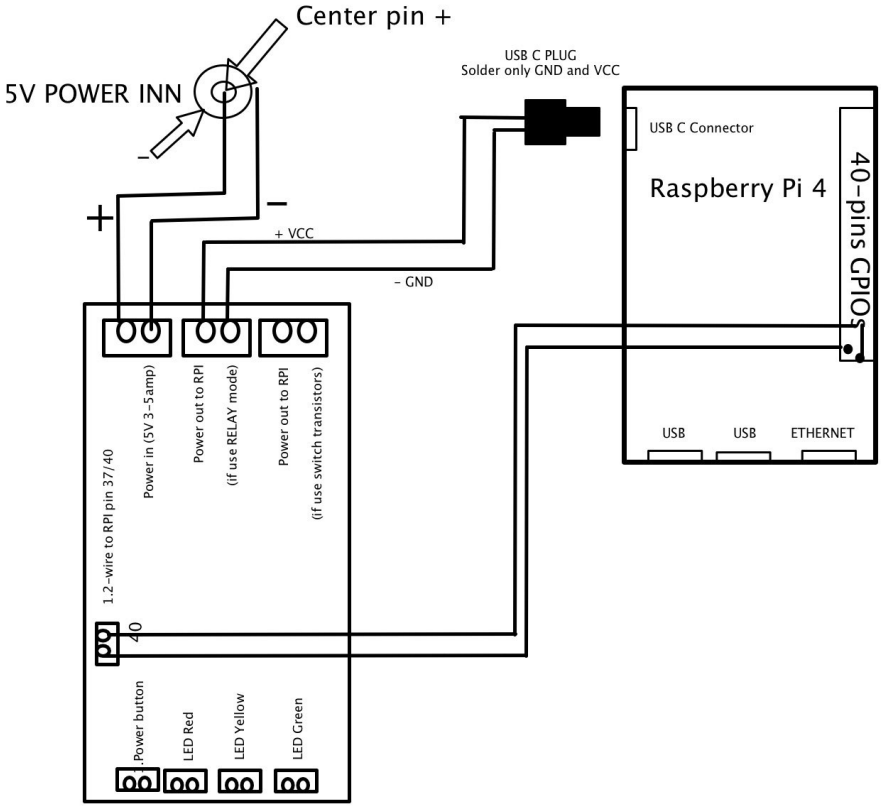
Sample setup



EASY Configuration with PMB and RASPBERRY PI 4.
This configuration use RELPWR (You have soldered RELAY). If you solder only (and NOT relay) CMOS SWITCH TRANSISTOR(S) USE TERMINAL QPWR ONLY!

Software configuration of XPI and Raspberry Pi 4

To support this pmb you need to type in 2 lines of code in the config.txt file on Raspberry Pi. If you do not know what this is, can I tell you this is the real configuration file for your Raspberry Pi. Be aware of what you do – don't change other things, if you don't know what you do! You find documentation on raspberrypi.org on config.txt things!

From the rot folder on Raspberry Pi you find a folder with the name *boot*, here you have a file named *config.txt*. There are many ways to edit this file, most prefer nano editor. I like the idle editor (install it via sudo apt install idle). So run *sudo idle /boot/config.txt. Or change idle with nano.*.

Add thees 2 lines to the bottom of the config.txt file:
dtoverlay=gpio-shutdown,gpio_pin=21,active_low=0,gpio_pull=off
dtoverlay=gpio-poweroff,gpio_pin=20
Finish with control+s to save the file!

Remember "pin" in config file is not the physical pin on Raspberry Pi, this is GPIO pins. On the physical Raspberry Pi the 2-wire cable to pmd shall go to physical pin 37 and 40 on the Raspberry Pi 4.

XPI

Components list

REL 1.5

Part number	Shortname	Type	Value/name
1	K2	Relay	5V (10A/250V)
2	D1	Diode	1N4007
3	D2	Diode	1N4148
4	D3	Diode	1N4007
5	R1	Resistor	680
6	R2	Resistor	680
7	R3	Resistor	680
8	R4	Resistor	10K
9	R5	Resistor	680
10	R6	Resistor	1K
11	R7	Resistor	680
12	R8	NOT IN USE	*
13	R9	NOT IN USE	*
14	R10	Resistor	100
15	R11	Resistor	10K
16	U1	Microcontroller	ATMEGTA328P-PU
17	U2	Optocopler	EL817(C)
18	U3	Voltage regulator 5V	AMS1117-5.0
19	Q1	Transistor	BC557B
20	Q2	Transistor	AOD4184A
21	Q3	Transistor	AOD4184A
22	X1	Crystal	16MHZ
23	C1	Capacitor electrolyt	47µf 16 volt
24	C2	Capacitor electrolyt	47µf 16 volt
25	C3	Capacitor ceramic	22 pf
26	C4	Capacitor ceramic	22 pf
27	C5	Capacitor polyester	100 nf
28	C6	Capacitor polyester	100 nf
29	LED1	Lightning diode	5MM GREEN
30	LED2	Lightning diode	5MM RED
31	LED3	Lightning diode	5 MM YELLOW
32	SWITCH	Standard low power push switch button	

NOTE!

Resistors R8 and R9 not in use!

You don’t need to use K2 if you use Q2 and/or Q3.

You don’t need to use Q2 and/or Q3 if you use K2.