Wireless Pulse Counter 3

Manual

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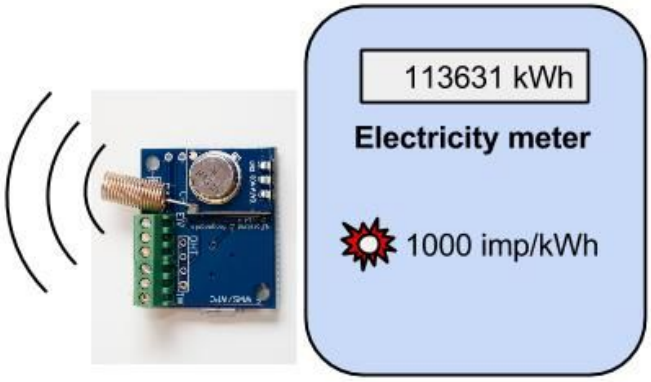
Overview

The Wireless Pulse Counter 3 (WPC3) is a device that can be used to measure Energy/Gas/Water consumption etc.
The WPC3 use the 433MHz frequency band to transmit pulse sensor readings over the air.

It is compatible with RFXtrx433(E), Tellstick DUO / NET and Tellstick Z-wave Lite v.2 transceivers and transmit using the RFXMeter protocol and Fineoffset protocol.
If more counter channels are needed, it is possible to add an external 1-wire counter so that 3 pulse sources in total can be monitored and transmitted by the WPC3.
It is also possible to add a Temperature/Humidity sensor module (DHT22) to measure Temperature and Humidity.



The WPC3 have 3 inputs.

- ❏ Pulse input: Blink detection, Rotating disk detection etc.
- ❏ 1-Wire® bus: The WPC3 support multiple 1-wire® devices
- ❏ Temperature and Humidity input: The WPC3 supports 1 temperature and humidity sensor (DHT22 or equivalent)

Changelog

Rev.2

- Added information about Reed Switch debounce circuit
- Minor updates/clarifications

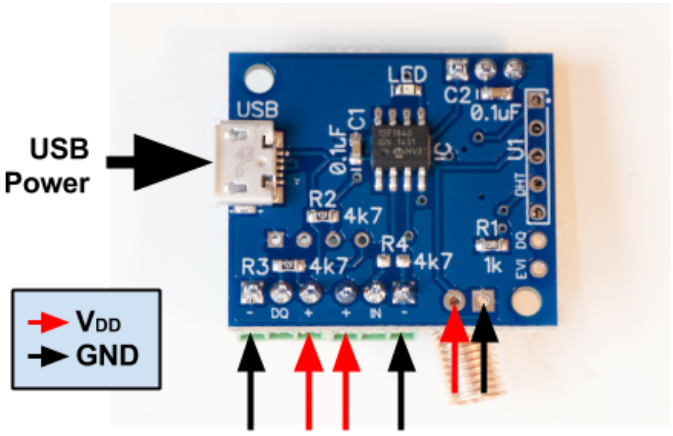
Rev.1

- First WPC3 revision.

Input details

Powering the WPC3

The WPC3 can be powered in several ways.



The most convenient way is through the micro USB port. An alternative way is to solder cables to the soldering points to the right of the screw terminals. A third option is to use any of the screw terminal points.
See the chapter Specification for details regarding voltage levels.

The Pulse Input port

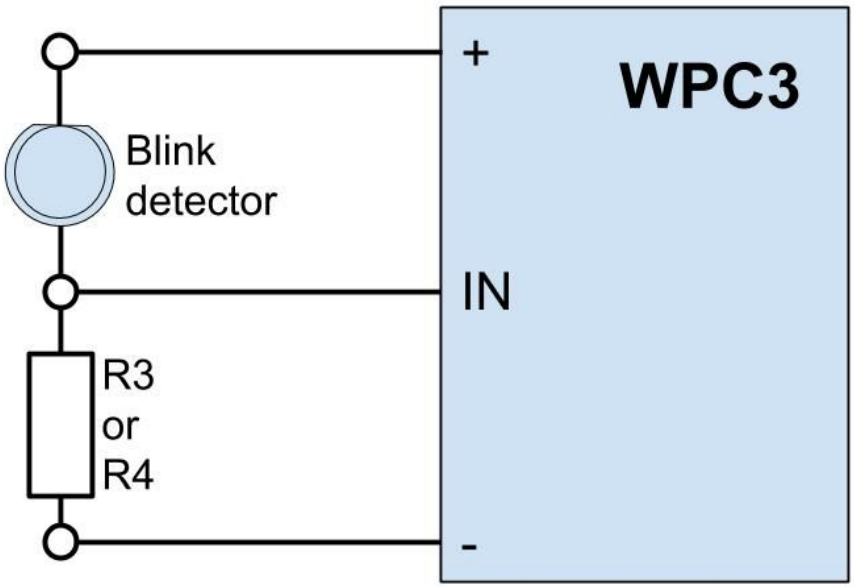
This is a general event input (marked IN on the PCB) that is used with a sensor that is capable of outputting some kind of on/off signal (0V to 5V), or capable of acting as a on/off switch[1].
The amount of detected pulses is transmitted to the transceiver.
The WPC3 counts +1 on every signal that goes from 0 to 5V (positive transition).

Here follows some examples of how to connect the WPC3 to measure different pulse sources.
The resistor names, values and color coding can be found in the Appendix.

Blinking LED

If you have an Electricity meter with a blinking LED, you connect the blink sensor between (+) and (IN) and resistor (R3 or R4) between (IN) and (-). **Blink sensor and Resistor is included**.
Use the (R4) 220k resistor for high sensitivity. This is the default resistor.
Use the (R3) 100k resistor lower sensitivity.

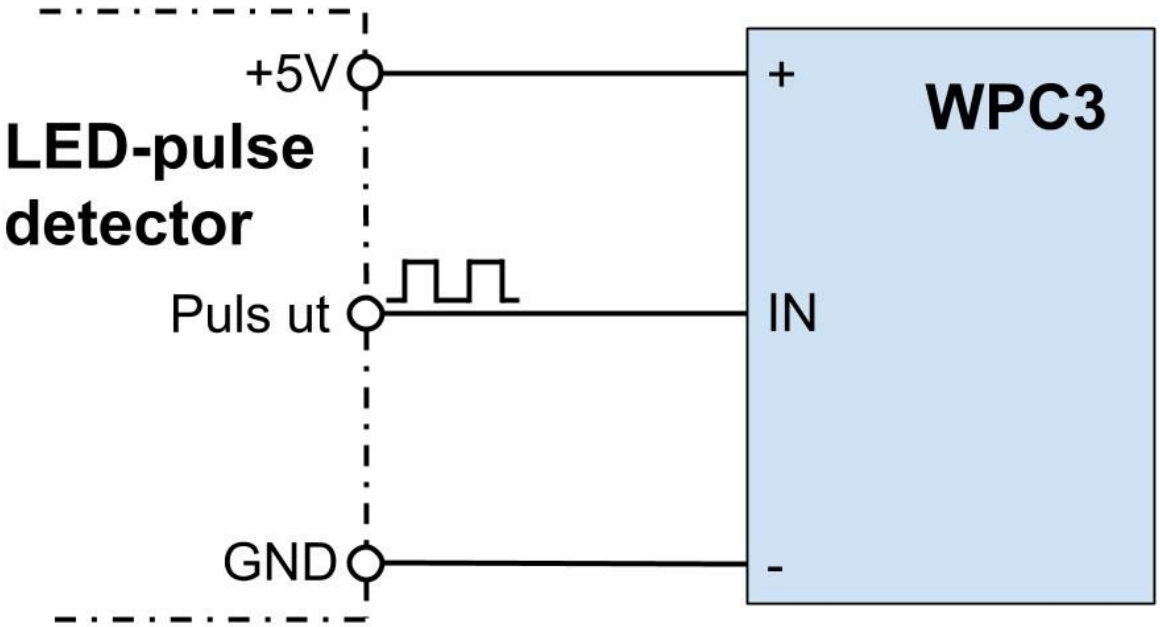
The Blink sensor need correct orientation to function and should be connected as in the picture below, with the leg close to the flat side of the detector connected to (+).



[1] Care have to be taken with mechanical switches since they bounce for a very short while (1-5ms) after state change. This will be seen as multiple pulse detections when expecting only one. There is no bounce dampening done by the WPC3.

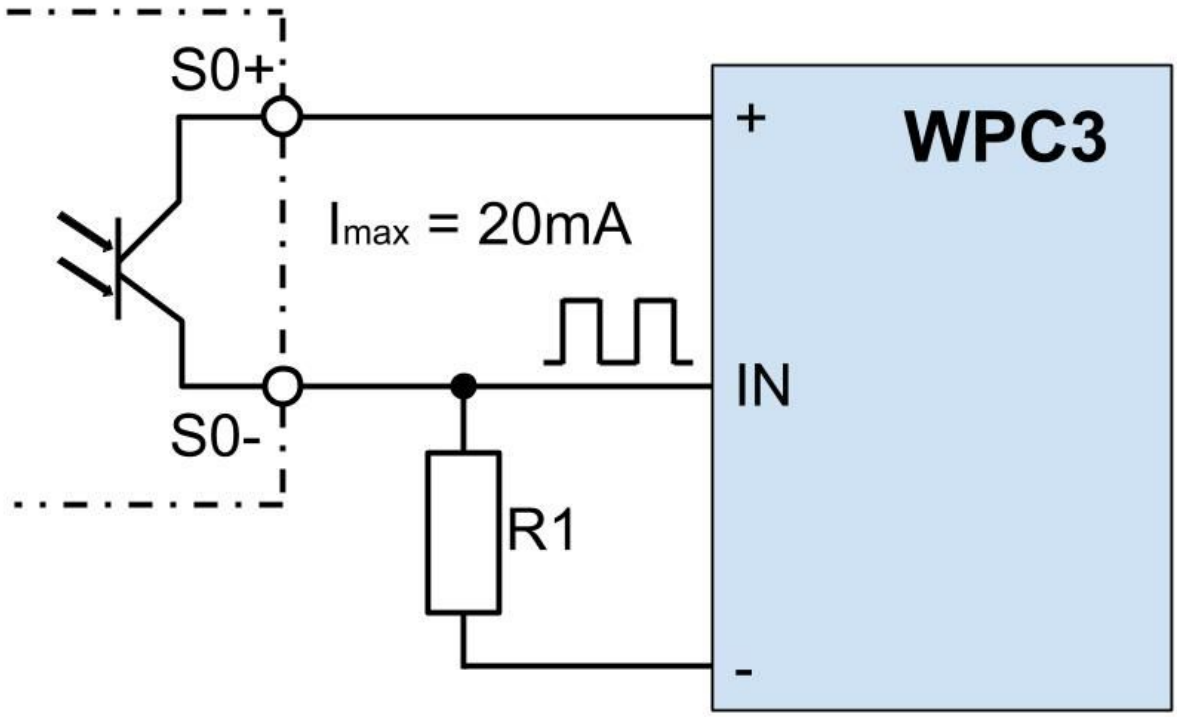
LED-Pulse detector from m.nu

If you have a LED-Pulse detector from m.nu, you can connect it to the WPC3.
See the connection guide here. Note! No resistor is needed when using this LED-Pulse detector.



S0 output

If you have an Electricity meter where the S0 output is accessible, it is the prefered connection over the blinking LED since the reading is electrical and not light based.
The resistor R1 is included (330Ohm). It limits the current to about 15mA.



Reflection detector/Reflex detector

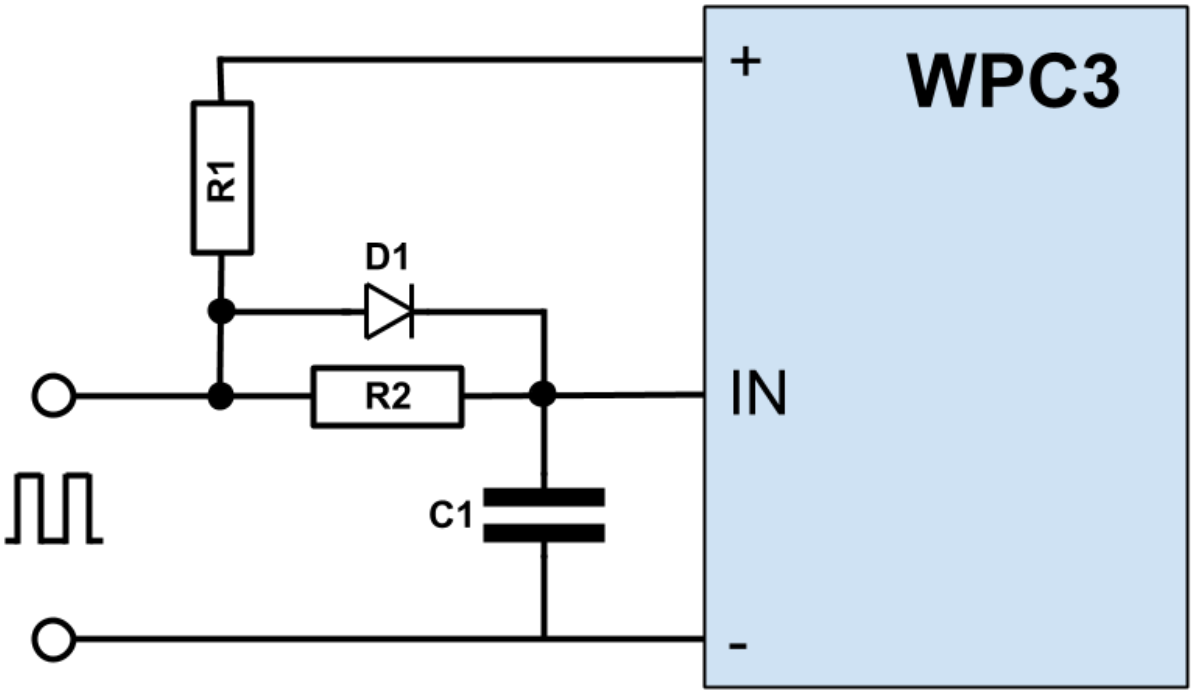
In some old Electricity meters or Gas meters there is a rotating disk with a small black marker on the circumference. This can be detected with a reflection detector that can be bought very cheap at ebay.com. I recommend the TCRT5000 based module.
Connect according to the table below. Note! No resistor is needed.

TCRT5000		WPC3
DO	⇔	(IN)
GND	⇔	(-)
Vcc	⇔	(+)

Reed switch

Some Water meters or Gas meters have a rotating magnet placed on a spinning disk. Disk rotation can be detected with a reed switch. Reed switches tend to be very bouncy, and care need to be taken so that one supposed pulse is not detected as several pulses.
It is recommended to use a debouncing circuit to avoid bounces.
Here the debouncing circuit is represented by R1, R2, D and C. The values of R1, R2 and C should be chosen so that the time constant is longer than the bounce time. Typically the bounce time for Reed Switches is around 2ms. The diode (D) can be of any small signal diode kind.
The following values is a good start.

R1,R2	33kOhm
C1	0.1uF
D1	1N4148



Temperature/Humidity sensor input

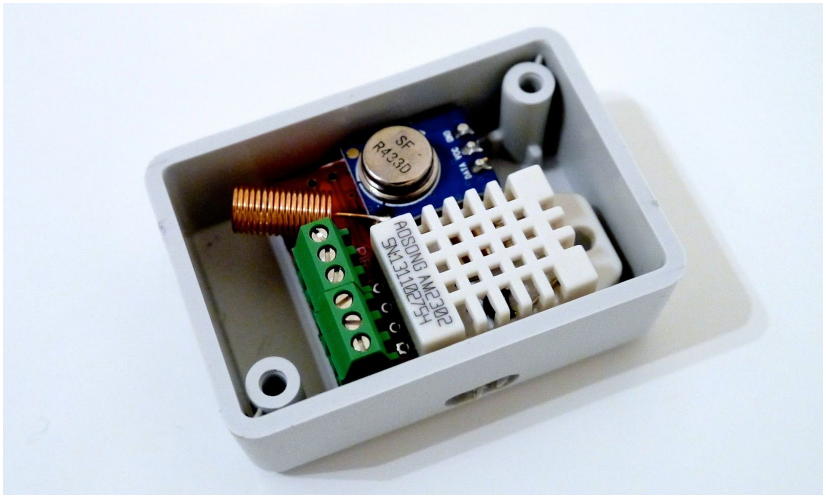
It is optional to add a temperature and humidity sensor to the WPC3. The WPC3 supports the DHT22 sensor.
The DHT22 sensor comes in different packages and have different names. AM2302 is a wired version of the DHT22. RHT03 is another name of the DHT22. This sensor can according to the specification, be connected with a cable up to 100m.

Supported sensors

- ❏ DHT22
- ❏ AM2302
- ❏ RHT03

Output

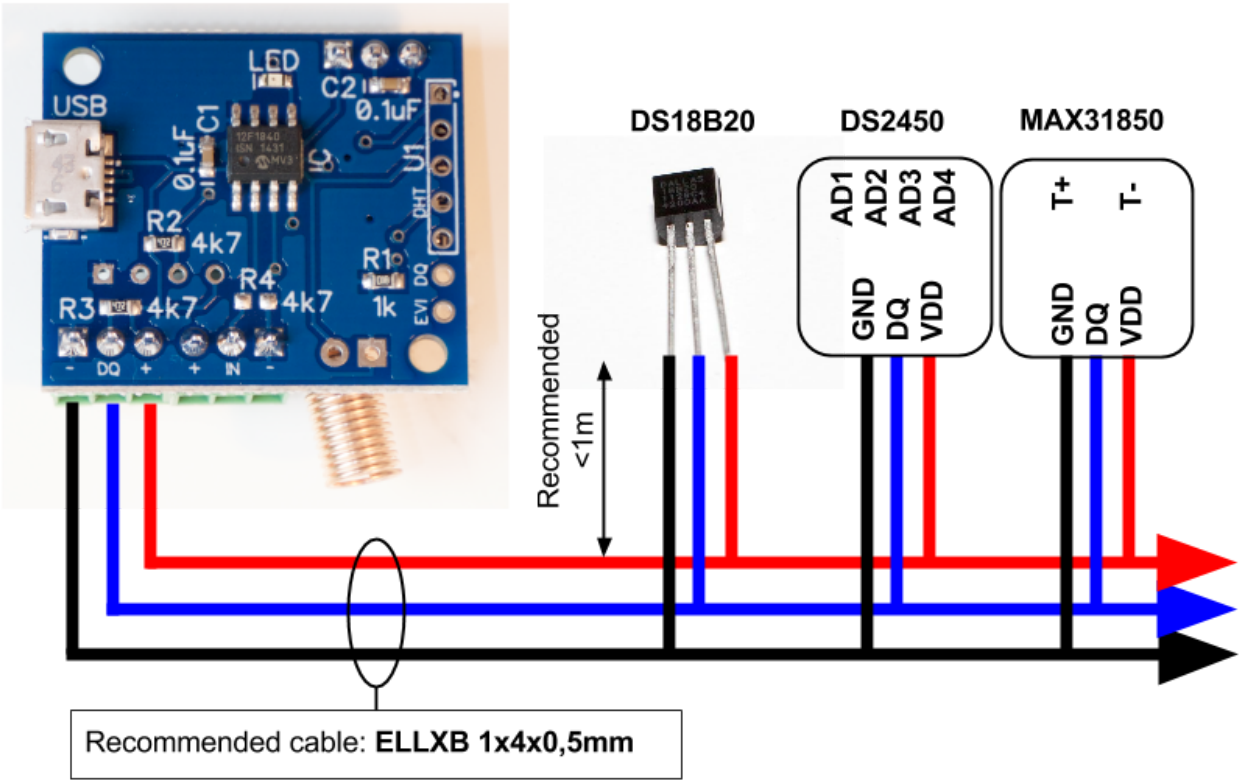
Detected as a Fineoffset temperature/humidity sensor. The Hideki-protocol need to be activated on the RFXtrx433(E) transceiver.



1-Wire device input

The WPC3 supports several 1-Wire® sensors. By for example, connecting an external Counter to the 1-wire® input you add additionally 2 counters to the WPC3.

NOTE! Parasite mode is not supported.



Supported 1-Wire® devices

- ❏ DS2423 - Dual counter
- ❏ DS1820, DS18B20, DS18S20, DS1822 - Temperature sensors
- ❏ MAX31850 - Thermocouple-to-Digital Converter
- ❏ DS2450 - Quad AD-Converter

If you find a sensor module that is based on any of the above 1-wire® devices, it is compatible with the WPC3.

Output

The WPC3 will send the counter data as an RFXMeter sensor from RFXCOM.com. The default RFXMeterID is random for channel A and +1 for Channel B.

Specification

Voltage:	Min 2.3V - Max 5.5V (Sensor dependent. See Table 1) **5V will always work. i.e. USB standard.**
Input connectors:	Micro USB, Screw terminals, soldering pads for (DHT22)
Frequency:	433 MHz, OOK
Protocols:	Improved **Fineoffset** including CRC-protected data and **RFXCOM**
Supported transceivers:	RFXtrx433(E), Tellstick DUO / NET and Tellstick Z-wave Lite v.2
RF power:	13 dBmW@2.4V, 15 dBmW@3V, 20 dBmW@5V *20 dBmW is equal to 100 mW*

Sensor	Min Voltage	Max Voltage
DHT22 / AM2302 / RHT03	3.3V	5.5V
DS2423	2.8V	5.5V

Table 1

Example1. WPC3 + DS2423

Minimum voltage for WPC3 is 2.3, but minimum voltage for the DS2423 is 2.8V. Thus the Voltage need to be at least 2.8Volts. The maximum Voltage is limited to 5.5V for both WPC3 and the DS2423.

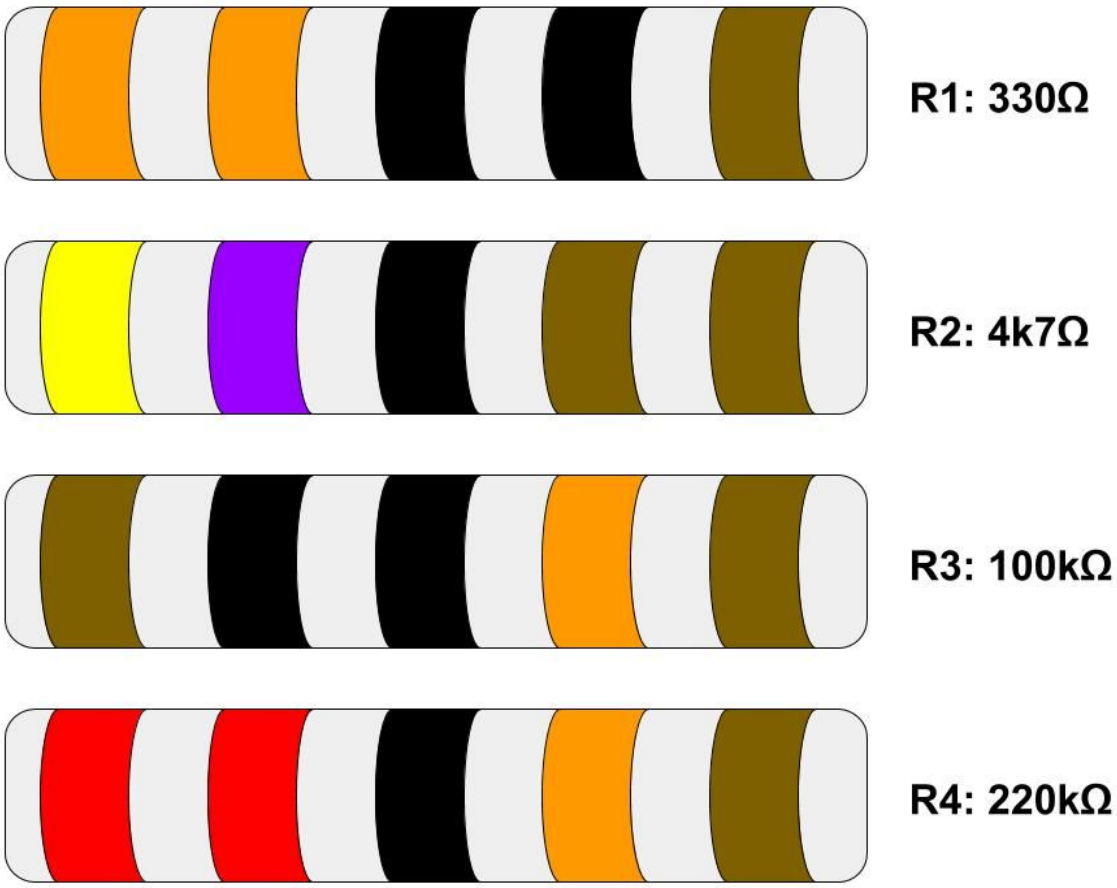
Example2. WPC3 + DHT22 + S0 input.

Minimum voltage is decided by the DHT22 since it has the highest minimum voltage 3.3V. The Maximum Voltage is limited to 5.5V for both WPC3 and DHT22.

Add-on

Plastic box from Hammond manufacturing$_{TM}$ (Part.no.1551GBK) is a perfect fit for the WPC3.

Appendix

Resistor color mapping

There are three resistors included. There are different resistor values depending on what type of pulses that will be counted.
R1 is for S0 connection
R2 is for mechanical switch connection
R3,R4 is for blinking LED detector