HADES RICH700

Temperature and Humidity Control

Documentation

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1   General informations

This documentation describes the EPICS IOC for humidity and temperature measurement at HADES RICH 700. EPICS is installed on a `Raspberry Pi model B+` in version 3.14.12.4. In addition the expansion `MSI` (vers. 1.6) and the module `SynAPPS` (vers. 5.7) are installed. SynAPPS uses just a few of the included modules due to the processor architecture of the Raspberry Pi. The readout of the temperature is done by `DS18B20` sensors connected to a HadCon2 which is connected to the Raspberry Pi via USB. The humidity sensor (`DHT22`) is directly connected to the GPIO Pins of the Raspberry Pi.

2   Temperature

The used temperature sensors are DS18B20[1] sensors from Dallas Instruments. They are connected via one wire. The HadCon2 has a one wire support. The HadCon2 has a `JOWIO1` Box Header which has 2 GND, 2 V_{cc} and 6 one wire pins. Each one wire pin can handle with several sensors, depending on the length of the cable. The connection is shown in Fig. 1. The used resistors are 3kΩ resistor. V_{cc} of the HadCon2 has 3,3 V.
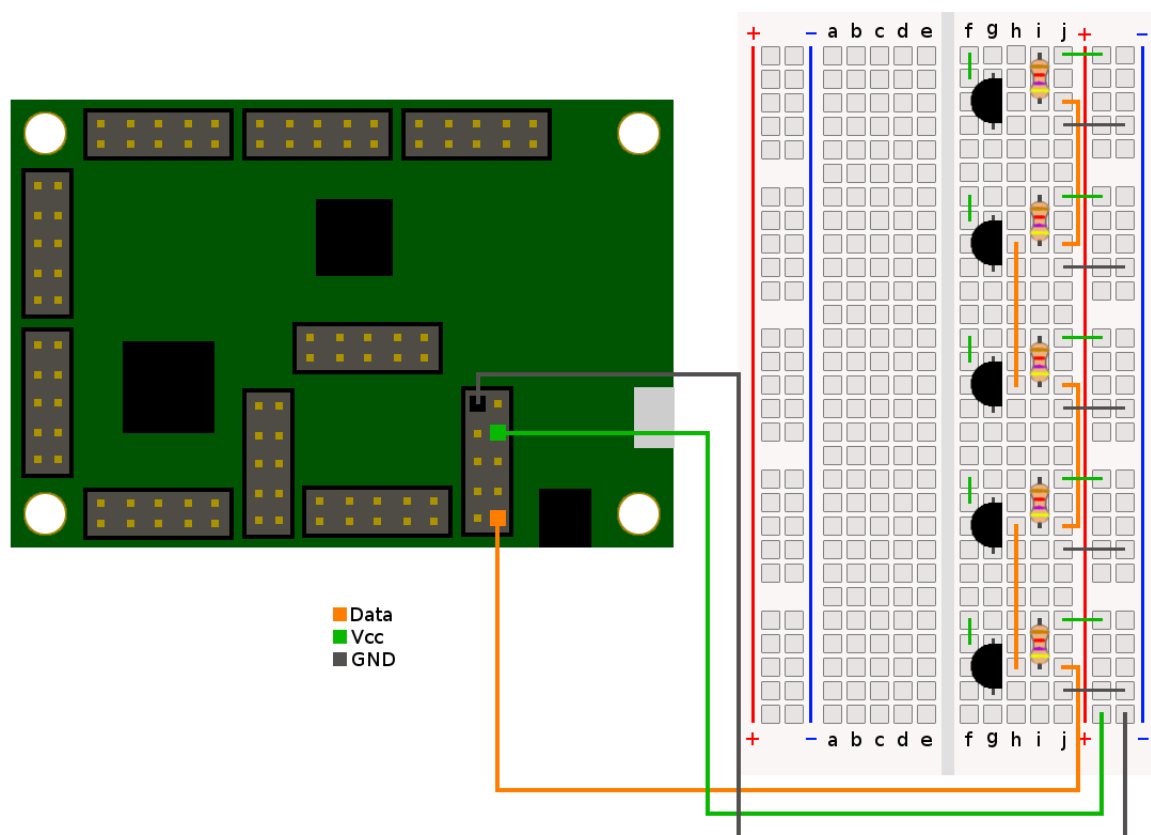

Figure 1: The DS18B20 temperature sensors connected with the HadCon2.

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[1] Datasheet: https://datasheets.maximintegrated.com/en/ds/DS18B20.pdf

The EPICS IOC is based on a the HadCon2 IOC[2] from Peter Zumbruch. The communication is based on the OWTP protocol which access the DS18B20 support of the HadCon2. The `.db` file sends the message "OWTP" to the HadCon2. This happens every second. The answer of the HadCon2 is a bitstream from all connected sensors. Each bitstream includes the ROM-address, which identifies the temperature sensor, and the temperature as a hexadecimal number.

$$\text{OWTP} \quad <\text{ROM-Address}> \quad <\text{temperature}>$$

The protocol selects the temperature (the HEX number) and assigns it to the right process variable which scans as `I/O Intr`. The value of the process variable called `HADES:RICH:temp:$(ROM_ADDRESS)` is used as input for a `calc` record `HADES:RICH:temp:$(ROM_ADDRESS)_p16`. This PV calculates the corresponding degree Celsius temperature.

3   Humidity

The used humidity sensor is a DHT22 sensor. The communication of the sensor is based on one wire. Unfortunately the one wire communication is not based on the standard Dallas one wire protocol. Indeed there is a lot of open source software for a Raspberry Pi that supports the DHT22 sensor. The source code from *Adafruit* has the necessary C-library[3]. These librarys are included in a EPICS IOC (Apps→src→makefile). The included librarys can be used in the new developed device support. The new device support is called `DHT22oneWire` (DHT22onewire.C). The DHT22 has to be connected to Pin 7 (GPIO 4) of the Raspberry Pi. V_{cc} is connected to Pin 1 (3,3 V) and GND to Pin 6 (see Fig. 2). The resistor is a 10kΩ resistor. The DHT22 measures the temperature and the humidity. These measurements can be accessed via @`Humidity` or @`Temperature` in the INP field of the record. The DTYP field has to be set to `DHT22oneWire`.
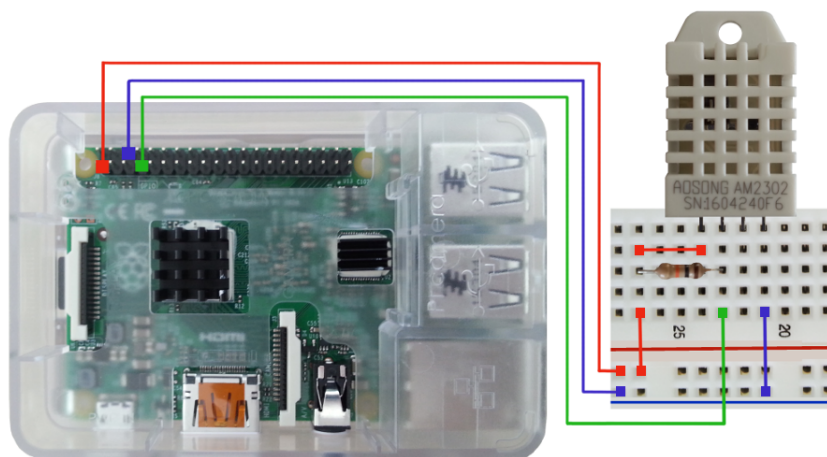

Figure 2: The DHT22 humidity sensor connected with the Raspberry Pi model B+.

[2]Download: https://github.com/zumbruch/HadCon2_AtmelRegisterIO_IOC
[3]Download: https://github.com/adafruit/Adafruit_Python_DHT