WeatherDuino Logger
for
WeatherDuino Pro2 Plus

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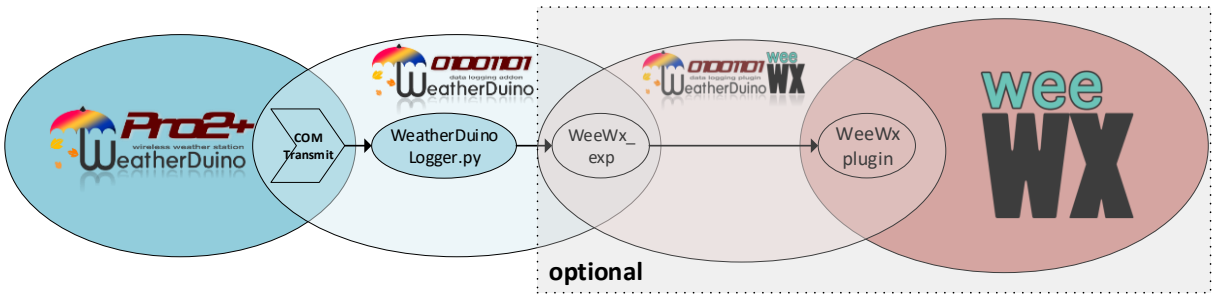
Get all the data captured by the WeatherDuino Pro2 Plus system and its modules to an additional serial interface with full precision for logging or further processing.

- The sampling rate is one sample per minute.
- Reports via E-Mail if data transmission stops.
- Data is exported in metric units.
- Validation of received data

This modification does not work on the compact receiver since it has no additional free UART interfaces.

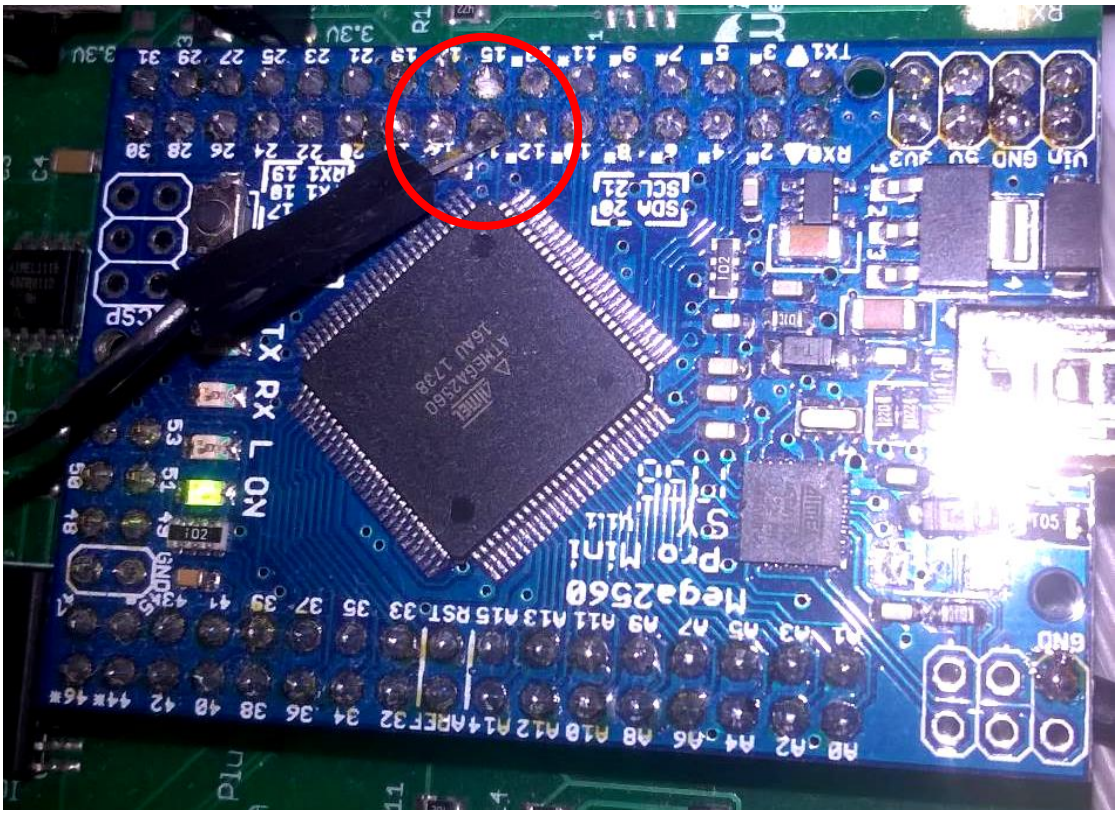
Since the data is written to the serial 3 interface of the meduino there is also a logging script written in python since it is platform independent.
This script logs all selected data to CSV. The script can also export selected signals to a text file. From there you can import additional weather data like the snow height into WeeWx weather software.
See: https://www.meteocercal.info/forum/Thread-WeeWx-extra-data-plugin



Hardware setup

First, the communication wire has to be soldered to pin 14 of the Meduino, carrying the UART3. We only need pin 14 (TX) since this will be a one-way communication.

Take care to get a proper ground connection; you can get this from one of the I2C connectors on the RX board.



Be aware that the output logic level is at 5V and hence not suitable for direct communication with a PC or a Raspberry Pi. You may use some level shifters to obtain a proper function.

The baud rate of the receiving device has to be set to 115200. Data bits 8, stop bit 1 and parity none.

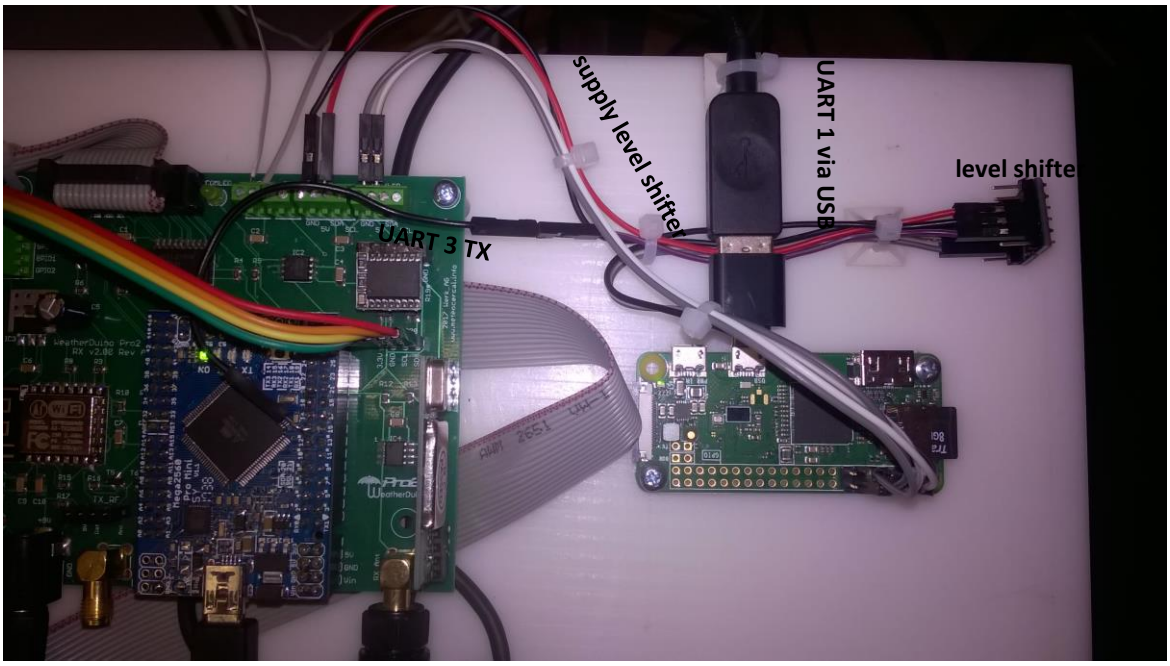
Additional setup for use with a Raspberry Pi (Zero W)

The provided logging script can be run with a Raspberry PI to log all the data. In this case you can use the Raspberry to run a weather software like WeeWx or Cumulus and additionally log all of your captured data in full precision or import some extra data into WeeWx.

Of course, you might may use any Raspberry Pi or another PC capable of running some python scripts, in this case check the corresponding pinout or the interfaces of your device and if necessary adapt the connection. It can also be necessary to adjust the name of the serial port in the python script.

Attention: Since the 5V linear regulator on the Meduino gets warm when the Raspberry Zero W is connected, I do not recommend suppling the Raspberry any longer via the WeatherDuino.

Be aware that the ground potentials of the Raspberry and the WeatherDuino have to be connected for a working communication.



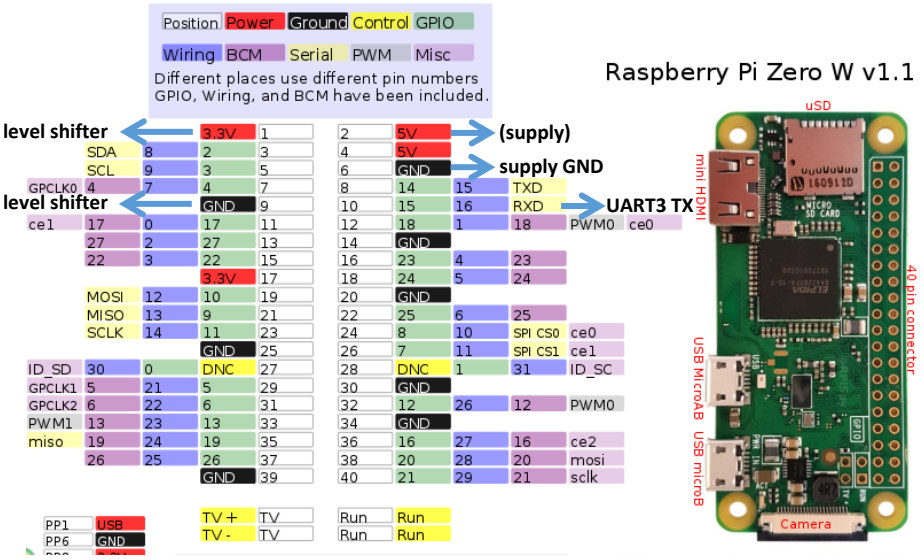


Image source: https://cdn.sparkfun.com/assets/learn_tutorials/6/7/6/PiZero_1.pdf by Sparkfun, retrieved on 27.08.2018

I used a bidirectional level shifter based on a BSS138, those can be found in almost any online shop. Since the level conversion has only to be unidirectional, a resistor divider or the usage of a zener diode would also be possible.

Software setup

The original WeatherDuino source code has to be modified as following in order to retrieve all the stored sensor data each minute.

This tutorial is valid for Pro 2 Plus v9.0 software. The principle using other versions is the same but signal names and line numbers may differ.

First init serial 3 on the Meduino:

In WeatherDuino_P2AT2560_RX9.0_[build].ino line 471 find:

```
//-------------------------------------------------------
//    Setup Things
//-------------------------------------------------------
void setup()
{
  Serial.begin(19200);
```

Change to:

```
//-------------------------------------------------------
//    Setup Things
//-------------------------------------------------------
void setup()
{
  Serial.begin(19200);
  Serial3.begin(115200);
```

Next, insert the sending routine in the 1-minute timer:

In Routines.ino line 348 find:

```
  float conv_factor = 1.0;
  #if (RAIN_DISPLAY_UNIT == 1)
    conv_factor = 0.03937;
  #endif
  Rain_LastHour = RainTips_LastHour * (COLLECTOR_TYPE[RAIN_SOURCE] / 1000.0) * conv_factor;
  //Serial.print("Rain Last Hour :"); Serial.println(Rain_LastHour);
  Rain_Last24Hours = RainTips_Last24Hours * (COLLECTOR_TYPE[RAIN_SOURCE] / 1000.0) *
conv_factor;
  //Serial.print("Rain last 24 hours :"); Serial.println(Rain_Last24Hours);
```

Change to:

```
  float conv_factor = 1.0;
  #if (RAIN_DISPLAY_UNIT == 1)
    conv_factor = 0.03937;
  #endif
  Rain_LastHour = RainTips_LastHour * (COLLECTOR_TYPE[RAIN_SOURCE] / 1000.0) * conv_factor;
  //Serial.print("Rain Last Hour :"); Serial.println(Rain_LastHour);
  Rain_Last24Hours = RainTips_Last24Hours * (COLLECTOR_TYPE[RAIN_SOURCE] / 1000.0) *
conv_factor;
  //Serial.print("Rain last 24 hours :"); Serial.println(Rain_Last24Hours);

    // --- Transmit raw data via Serial 3
    Com_Transmit();
```

Modify the receiving routine that wind values of each TX-Module are buffered:

In RX_TX.ino find line 142 – 162:

```
  if (TX_UnitID == WIND_SOURCE)
  {
   uint32_t gust;
   gust = RX_Data[2];
   if (gust <= 67000)                          // - First step Spike Removal - Process if Gust <= 241 Km/h
   {
    #if (WIND_SPIKECONTROL == 1)
     static uint32_t last_gust;
     uint16_t spike_limit;
     if     (last_gust < 11111 ) spike_limit = 8333;   // < 40 Km/h -> Spike Limit 30 Km/h
     else if (last_gust < 18055 ) spike_limit = 15277;  // < 65 Km/h -> Spike Limit 55 Km/h
     else spike_limit = 50000;                  // > 65 Km/h -> Spike Limit 180 Km/h
     if (gust > last_gust + spike_limit) gust = last_gust;
     last_gust = gust;
    #endif

    RX_WindPackets = RX_WindPackets + 1;

    TX_Unit[TX_UnitID].Wind_average   = RX_Data[1];
    TX_Unit[TX_UnitID].Wind_gust      = gust;
    TX_Unit[TX_UnitID].Wind_dir       = RX_Data[3];
```

Change to:

```
    uint32_t gust;
    gust = RX_Data[2];
    if (gust <= 67000)                          // - First step Spike Removal - Process if Gust <= 241 Km/h
    {
#if (WIND_SPIKECONTROL == 1)
     static uint32_t last_gust;
     uint16_t spike_limit;
     if     (last_gust < 11111 ) spike_limit = 8333;   // < 40 Km/h -> Spike Limit 30 Km/h
     else if (last_gust < 18055 ) spike_limit = 15277;  // < 65 Km/h -> Spike Limit 55 Km/h
     else spike_limit = 50000;                  // > 65 Km/h -> Spike Limit 180 Km/h
     if (gust > last_gust + spike_limit) gust = last_gust;
     last_gust = gust;
#endif

     TX_Unit[TX_UnitID].Wind_average   = RX_Data[1];
     TX_Unit[TX_UnitID].Wind_gust      = gust;
     TX_Unit[TX_UnitID].Wind_dir       = RX_Data[3];

     if (TX_UnitID == WIND_SOURCE)
     {
      RX_WindPackets = RX_WindPackets + 1;
```

Modify the receiving routine that rain values of each TX-Module are buffered:

In RX_TX.ino find line 217 – 226:

```
#if (RAIN_SOURCE != 3)
  if (TX_UnitID == RAIN_SOURCE)
   {
    COLLECTOR_TYPE[TX_UnitID]       = RX_Data[1];          // Collector tip value * 1000
    TX_Unit[TX_UnitID].Rainftipshour  = RX_Data[2];
    TX_Unit[TX_UnitID].TotalRain_tips = RX_Data[3];
    //Serial.print("TotalRain_tips :"); Serial.println(TX_Unit[TX_UnitID].TotalRain_tips);

    MainSensors_lastTimeRX[2] = now_millis;
    bitWrite(MainSensorsRX, 2, 1);
```

Change to:

```
#if (RAIN_SOURCE != 3)
    COLLECTOR_TYPE[TX_UnitID]       = RX_Data[1];          // Collector tip value * 1000
    TX_Unit[TX_UnitID].Rainftipshour  = RX_Data[2];
    TX_Unit[TX_UnitID].TotalRain_tips = RX_Data[3];
    //Serial.print("TotalRain_tips :"); Serial.println(TX_Unit[TX_UnitID].TotalRain_tips);

    if (TX_UnitID == RAIN_SOURCE)
    {
     MainSensors_lastTimeRX[2] = now_millis;
     bitWrite(MainSensorsRX, 2, 1);
```

Modify the receiving routine that the temperature and humidity values of the AQM are buffered:

In RX_TX.ino line 412 - 416 find:

```
case 12:
{
 AQ_Monitor.GAS_1 = RX_Data[3];  // GAS_1 from AQI Monitor
 AQ_Monitor.GAS_2 = RX_Data[4];  // GAS_1 from AQI Monitor
```

Change to:

```
case 12:
{
 AQ_Monitor.GAS_1 = RX_Data[3];  // GAS_1 from AQI Monitor
 AQ_Monitor.GAS_2 = RX_Data[4];  // GAS_1 from AQI Monitor
 AQ_Monitor.AQ_Temp = RX_Data[1]/10;  // Temp from AQI Monitor
 AQ_Monitor.AQ_Hum = RX_Data[2]/10;  // Humidity from AQI Monitor
```

to provide temperature and humidity data in your extra logging.

In data_structs.h line 50 - 51 find (Thanks Werk for leaving them):

```
//int16_t  AQ_Temp;
//uint16_t AQ_Hum;
```

Change to:

```
int16_t  AQ_Temp;
uint16_t AQ_Hum;
```

Finally copy the new provided file “COM_Transmit_v3.ino” into the project folder. This file contains the sending function that starts a data stream according to the enclosed pattern. The data layout can be found in the file “Transmission_Layout_[Version]”.

Logging script setup

The python script “Weatherduino_Logger_.py” can display and log all of the WeatherDuino Pro2 Plus data to a *.csv file. This data can be easily displayed with any csv viewer. Moreover, it can generate a dataset for import into WeeWx.

Installation steps

1. Get your WeatherDuinoPi hardware ready for logging. So activate the internal serial interface.

   ```
   sudo raspi-config
   ```

   At point 3 **Interfacing options → P6 Serial** do not enable the serial console (login shell) by pressing no and enable only the interface itself.

2. To prevent the serial console from blocking your serial port double check that everything is fine by checking the following file:

   ```
   sudo nano /boot/cmdline.txt
   ```

   Make sure that there is nothing written like:
   console=serial0,115200

3. Get all python libraries ready to work since python itself is already preinstalled. Therefore install the following stuff:

   ```
   sudo apt-get install idle
   sudo apt-get install python-pip
   sudo pip install pyserial
   sudo pip install pytz
   ```

4. When all preparations are done, you can copy the WeatherDuino logging script to your network share. You can get the script here. Change the path to your layout file and your logfile according to your needs.

5. Install a cronjob to get the logging script logging at startup of the system.

   ```
   crontab -e
   ```

   Insert the following line and change the path and script name if necessary:
   @reboot /usr/bin/python /home/pi/WeatherDuino/Weatherduino_Logger.py &

6. After a reboot the script should start up automatically and begin the logging.

The logging scripts works at the moment only with Python 2.7.

Configuration

In the upper part of the logging script you can make some settings for debugging, logging and mail notifications.

Be sure the path to the “Signal_Description.csv” file is correct. I had some trouble with relative paths, so I suggest to use an absolute path pointing to that file.

The main settings concerning signal preparation and logging are made in the “Signal_Description” csv file. The column separator must be ‘;’.

Line 1	Groups the origin where the data was collected at the WeatherDuino
Line 2	Names the signals referring to the names in the WeatherDuino software
Line 3	Space to give an alias name to be written in the log file. This overwrites the Names given in line 2
Line 4	By writing a '1' in the field, logging is enabled for the corresponding signal
Line 5	Names the signal for WeeWx export. This name overwrites the signal names given in line 2 and maybe overwritten in line 3
Line 6	By writing a '1' in the field, WeeWx export is enabled for the corresponding signal
Line 7	Names the unit group for WeeWx
Line 8	Type of the used unit needed for correct augmenting in WeeWx
Line 9	Defines the variable type, as it is defined in the WeatherDuino software. This is needed for encoding the serial data string.
Line 10	The factor to divide the integer value coming from the WeatherDuino to get a decimal
Line 11	The unit of the signal to be plotted in the header of the csv log file

You should only change line 3 - 6 unless you know what you are doing.

Since WeeWx does not like signal names with a space ' ' in it I suggest not to use spaces in any of the names in the file. Better use underscores '_' instead.

Be careful that the description file is saved with UTF-8 coding.

If you use the WeeWx plugin the fields in Line 7 and 8 may only contain variable groups and types that are defined in WeeWx by default (see customization guide) or the the first section of the WeeWx_Logger_plugin (see install guide).

To make the script working properly it should run all the time since it captures the serial data sent by the WeatherDuino, decodes it and logs is or stores it in the export file for WeeWx.

Data validation

The script can validate data received from the WeatherDuino RX module by enabling the setting EnableValidyCheck in the header of the logging script. This might be important after updates and reboot cycles of the RX module because it starts sending the data, when valid data for the main sensors has arrived but does not check the additional sensors. With this setting you might lose some datasets (depending on how long it takes for the RX to get a correct system status package from the TX it should only be 1-2 datasets), but you will not have wrong data in the logfile.

Integration of additional data

The layout file can be extended after the termination signal of the WeatherDuino with additional input signals (see Figure 1). These variables have to be variable type 'import' and the data has to be written in a vector called extra data in the corresponding section of the logging script. This can be found around line 466 in the python code. **Please take care that the function retrieving the import data terminates within 10 seconds** (probably is already useless or dead when it takes that long…).

In case of the shown example the list extraData must contain three items with the corresponding signal values for Input1, Input2 and Input3 at the end.

		ByteSum	CRC	END			
	WiFi_H3	ByteSum	CRC_8	Termination	Input1	Input2	Input3
)	0	0	0	0	1	1	1
p	group_percent						
	int16_t	uint16_t	uint8_t	uint16_t	import	import	import
)	10	1	1	1	1	1	1
	% r.H.						

Figure 1: Extension of layout file

Integration of calculation data

Like the 'import' signals you can add some extra signals of type 'calc' to the layout file. You can do the necessary calculations in the script around line 523. An automatic formula parser might be added in future.

Automatic start of logging script

In case of using a linux machine I suggest using a cron job to start the script.

In a terminal window type *crontab –e*
Add the following command at the bottom of the file and exit saving it:
@reboot /usr/bin/python /home/pi/WeatherDuino/WeatherDuino_Logger.py &
You have to adjust the paths that it fits your requirements.
I suggest using absolute paths, since my cron job did not work correctly when using relative path.
After a reboot, the script should run properly in the background. You can check the log file and the error log if there is actual data.