Mini Pearl Snap Logger Kit

This kit can be assembled in 15 minutes into a data logger which can record data every few minutes for many months. The logger is based on an Arduino Pro Mini microcontroller and a separate timer which turns the Arduino on and off so it logs data at a selected interval. Connections among the Pro Mini and four other electronic modules are made with DuPont wires and require no soldering.

Parts List

- Arduino Pro Mini compatible microcontroller (3.3v)
- Adafruit TPL5110 Low Power Timer
- MicroSD card board (3.3v)
- 1 GB microSD card
- Real time clock (DS3231) board (3.3v or 5v)
- CR2032 coin cell battery for RTC
- BMP280 sensor for barometric pressure and temperature
- Case for three AA batteries (has switch and leads)
- Custom 3D printed mounting plate with wires
- UART adapter to connect logger to a computer
- USB cable
- 23 DuPont wires

The included TPL5110 low power timer determines the logging interval and turns the Arduino on for only the few seconds required to collect data and write it to the microSD card. A sketch (program) to log pressure and temperature data from the BMP280 sensor is loaded onto the Arduino Pro Mini and is available here: http://kaptery.com/guides/. Many types of external sensors will work with the Mini Pearl Snap Logger including most on this page: http://kaptery.com/product/addon-sensors-etc. These sensors must operate at 3.3 volts. The logger is ready to accept two I2C sensors including the BMP280. The sketch must be modified to operate each different type of sensor. Install the free Arduino IDE from here: https://www.arduino.cc/en/Main/Software.

The assembled logger should operate on three AA batteries for several months and maybe a year. Extending the logging interval or disabling the LEDs on the components will extend the field duration.

You must supply

- three AA batteries (alkaline or rechargeable)
- small screwdriver (to adjust trimpot on timer to set logging interval)
- additional sensor (optional)
- weatherproof enclosure for field use
- Arduino IDE for modifying the sketch (program)
- modified sketch for additional sensor
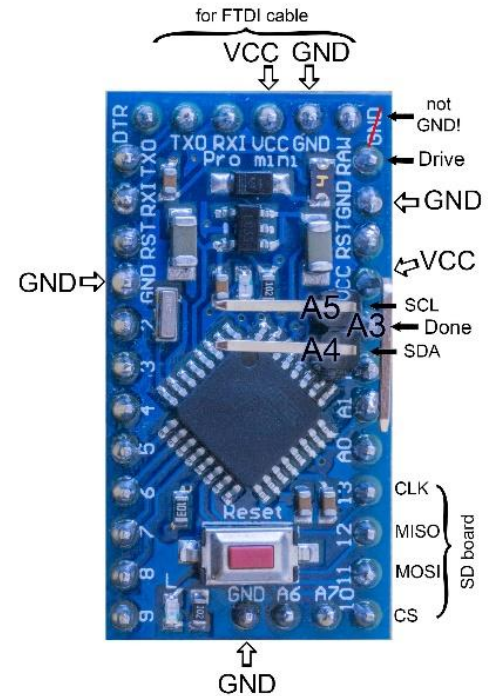
Assembly

The printed circuit boards in the kit have male headers (pins) soldered on. To connect the six parts, refer to the wiring diagram below and use DuPont wires which slide onto the pins. The red UART adapter does not need to be connected yet.

When making the connections, turn the power switch on the battery case to OFF or remove the batteries.

The Arduino Pro Mini will have 14 wires connected to it. Avoid the pins at the end of the board for the FTDI cable (see photo above). Three wires connect to ground (GND) and there are three GND pins available. Two wires connect to power (VCC) and the single available VCC has pins on both top and bottom of the board.
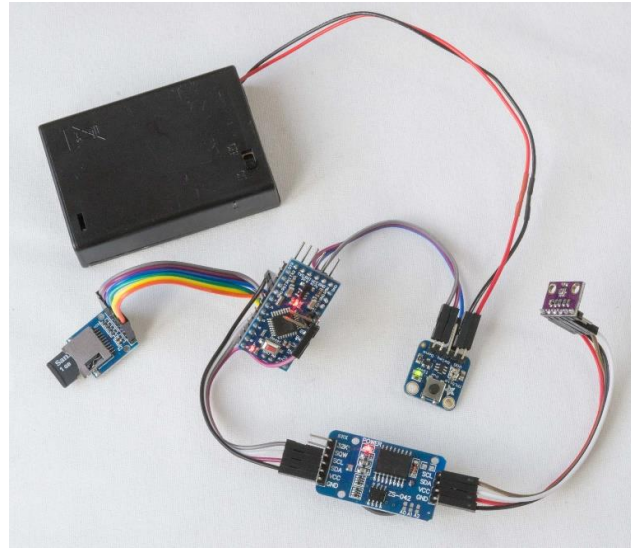
Check the connections—the boards can be damaged if power is supplied and the connections are not correct.

The battery leads connect to the TPL5110 timer (red to VDD, black to GND). **Do not connect a power source with more than 5.5 volts**. Three pins on the timer connect to the Arduino Pro Mini (DRIVE to RAW, GND to GND, DONE to A3).

To set the data logging interval, gently turn the trimpot (looks like a Phillips head screw, below the flower and "TPL5110"). If turned all the way clockwise, the interval is short (the LED stays lit). For testing, turn all the way clockwise and then back a little. Don't force the trimpot, it's a bit fragile.

Use wires to mount the assembled logger onto the 3D printed plate (see photo below). The square and triangular holes are not needed. The battery case is held underneath with elastic cord.

Using the Mini Pearl Snap Logger

When everything is connected and checked, insert a microSD card in the slot and put 3 AA batteries into the case (switched to OFF). Make sure none of the PCBs are touching each other (they can short each other and do damage). When the switch on the battery case is turned to ON, the LEDs on the boards should flash and then go off. When the LEDs are lit, the logger is writing data to the microSD card.

1. If no lights flash, turn the switch to OFF and check the connections. Then try again.
2. If the LEDs stay lit or flash rapidly, turn the switch to OFF and adjust the trimpot with a screwdriver by turning it a tiny bit counterclockwise. Turn ON again and watch the LEDs. Repeat until the flashing interval is several seconds for testing.

After the logger has completed several intervals, you can check if data has been saved to the microSD card.

1. Turn power to OFF.
2. Remove microSD card and view the files on a computer.
3. The file "datalogTPL.txt" can be opened in a text editor.
4. The file is comma separated, so if you change the extension to csv it will open in Excel and data will be separated into columns.

If data are present on the microSD card, the Mini Pearl Snap Logger is working. To change the logging interval, turn the trimpot (only when power is OFF), then power it up (make sure PCBs are not touching each other) and let the logger run. You can watch for the flashing LEDs or check the microSD card for data. Each data entry in the data file has a time stamp so you can see what the logging interval was.

Connect to your computer

If you want to modify the sketch (program) running on the Arduino Pro Mini or reset the time on the real-time clock, the Pro Mini must be connected to a computer with an FTDI module (e.g., TTL Level Serial Converter Cable) which is included. A jumper on the UART adapter should be on the 3.3v side. The module connects with six wires to the Arduino Pro Mini and a USB cable to the computer. Some boards differ, but the pin connections below are typical:

*Pins on the Arduino Pro Mini:*   **DTR TXO RXI VCC GND GND**

‖   ‖   ‖   ‖   ‖   ‖

Pins on the UART adapter: **DTR   RX   TX   VCC   CTS   GND**

Setting the real-time clock

There are instructions to set the clock in the sketch (download at http://kaptery.com/guides/) or follow these more detailed steps:

1. Open a copy of the sketch in the Arduino IDE.
2. Edit the sketch as described in the sketch by uncommenting one line (delete the "//").
3. The line to change is:
   // RTC.adjust(DateTime((__DATE__), (__TIME__)));
4. Load the edited sketch onto the Pro Mini using the UART adapter.
5. The sketch will start to run on the Pro Mini.
6. Start the serial monitor to watch the output on your computer monitor.
7. The time and date should be correct. Keep the Pro Mini running.
8. Edit the sketch so that line is once again commented out (preceded by "//").
9. Immediately load the sketch again onto the Pro Mini (before you power off the Pro Mini).
10. If the Pro Mini is restarted before step 8 and 9 are completed, the time will be wrong.
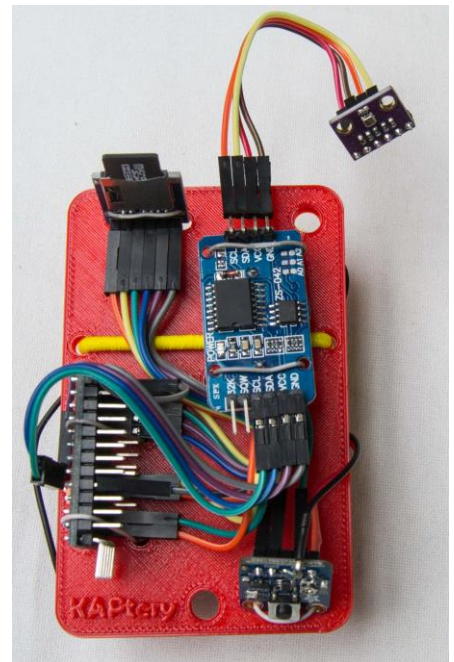
With the Pro Mini connected to your computer with the UART adapter, open the serial monitor and something like this should be displayed:

RTC OK 2018/01/22,19:55:24
BMP280 OK
SD OK

If all three lines are present and the time and date are correct, the logger is working correctly.

Wiring diagram: The pin locations might differ on the Arduino Pro Mini in your kit so refer to the names of the pins. Although the diagram shows only one connection to the Arduino for red (power) and black (ground) wires, the Arduino in the kit has three pins for power (VCC) and four pins for ground (GND), so connecting multiple DuPont wires is easy. For more information and technical support see: http://kaptery.com/product/mini-pearl-snap-logger-kit or research notes about the Mini Pearl Logger at Public Lab: https://publiclab.org/tag/mini-pearl-logger.