This kit includes all the parts to build a data logger based on an Arduino Pro Mini microcontroller. Connections among the Pro Mini and three other electronic modules must be soldered using the included wires. An Adafruit TPL5110 Low Power Timer controls the Arduino and minimizes power consumption.

Parts List

- Arduino Pro Mini compatible microcontroller (3.3v)
- Adafruit TPL5110 Low Power Timer
- 1% resistor to set a logging interval of about 10 minutes
- MicroSD card board (3.3v)
- 1 GB microSD card
- Real-time clock (DS3231) board (3.3v/5v)
- CR2032 coin cell battery for RTC
- Case for three AA batteries (has switch and leads)
- Some loose headers (optional)
- A bunch of 24AWG stranded wire of different colors

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 temperature data from the real-time clock is available here: http://kaptery.com/guides/. Many types of external sensors will work with the Mini Pearl Pro Logger including the 3.3v sensors on this page: http://kaptery.com/product/addon-sensors-etc. 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

- soldering iron
- solder
- wire cutter/stripper
- heat shrink tubing (optional)
- connectors (optional)
- small screwdriver for trimpot (optional)

- sensors
- cables for sensors
- FDTI converter for programming
- Arduino IDE for loading sketches
- weatherproof enclosure for field use
- 3 AA batteries alkaline or rechargeable

The Arduino Pro Mini does not have a USB port, so programming the Arduino requires an FTDI module (e.g., TTL Level Serial Converter Cable) which is not included in the kit. See details here: https://www.arduino.cc/en/Guide/ArduinoProMini.

Assembly

The Arduino Pro Mini has no headers (pins) soldered on but some of the components do. Refer to the wiring diagram below and solder wires to connect the four blue PCBs.

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). Three wires connect to ground (GND) and there are three GND pins available. Two wires connect to power (VCC) so both must connect to a single VCC pin.

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 (less than a second). For testing, turn it all the way clockwise and then back a little. Don't force the trimpot, it's a bit fragile.

The logging interval can also be set by soldering a resistor onto the timer between GND and DELAY. A 1% resistor of about 60kΩ is included to set the interval to about 10 minutes. The jumper "Trim Enable" must be cut to use a resistor. Before using the resistor, set the interval with the trimpot for testing.

Using the Mini Pearl Pro 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 have 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 Pro 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 not included. A jumper on the FTDI converter should be on 3.3v. 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 FTDI converter:　　**DTR RX TX VCC CTS GND**

Setting the real-time clock

There are instructions in the sketch to set the clock (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 an FTDI converter.
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.
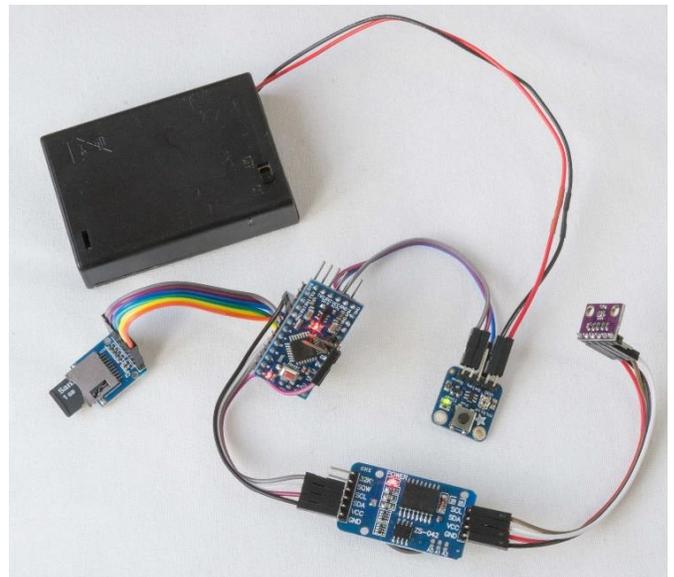
With the Pro Mini connected to your computer with the FTDI converter, open the serial monitor and something like this should be displayed:

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

If both 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 black (ground) wires, the Arduino in the kit has three pins for ground (GND). For more information, clearer images, and technical support see: http://kaptery.com/product mini-pearl-pro-logger-kit or research notes about the Mini Pearl Logger at Public Lab: https://publiclab.org/tag/mini-pearl-logger.