DATA Logger 3
Operating Manual

rev 1.0 September, 2021

kswichit.com/datalogger3

CONTENTS

INTRODUCTION

The operating manual describes how to use the Data Logger 3. The test will use built-in temperature sensor on channel 7. Kit includes the DC cable for USB power source. The power supply can be any USB power sources.

Steps for quick test will be described. The sensor jack section explains how to connect the external sensors.

SAFETY INFORMATION

- Ensure power off the device before connecting external sensors, Insert or Remove the SD card.
- Maximum input voltage range is -0.5V to +1.0VDC.
- Insert battery must be correct polarity placement.
- For long period recording, the external power source is recommended.

EXTERNAL POWER SOURCES

Kit includes the USB power cable (3.5x1.35 mm jack). The cable can connect to any USB power sources to provide power for the data logger.

The USB A type connector accepts +5V from any USB compatible power sources.

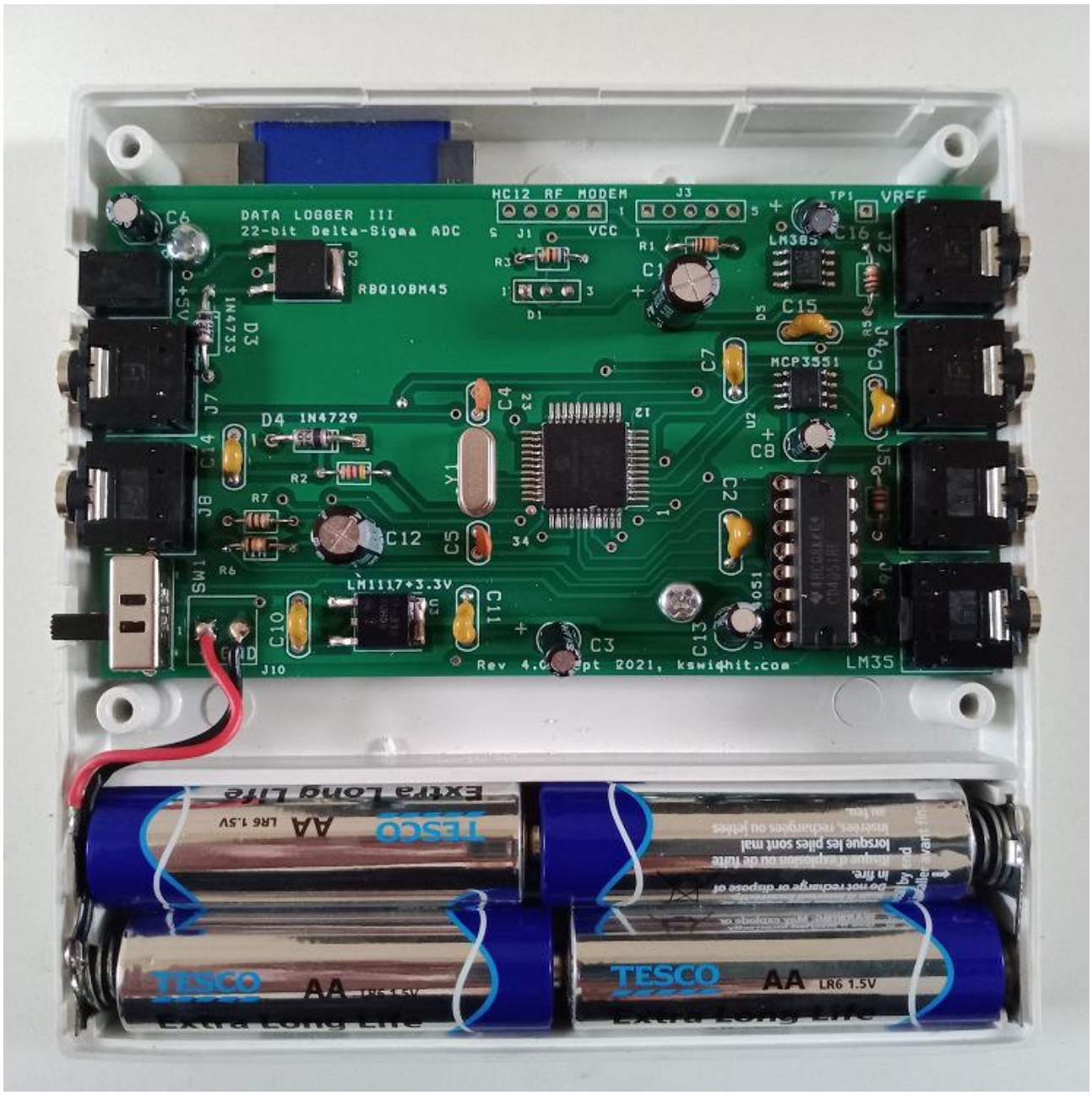
Example of USB power sources are USB AC adapter, power bank, or USB solar power.

BATTERY POWER SOURCES

The Data Logger can be operated with battery as well. The battery holder is for four cells AA size.

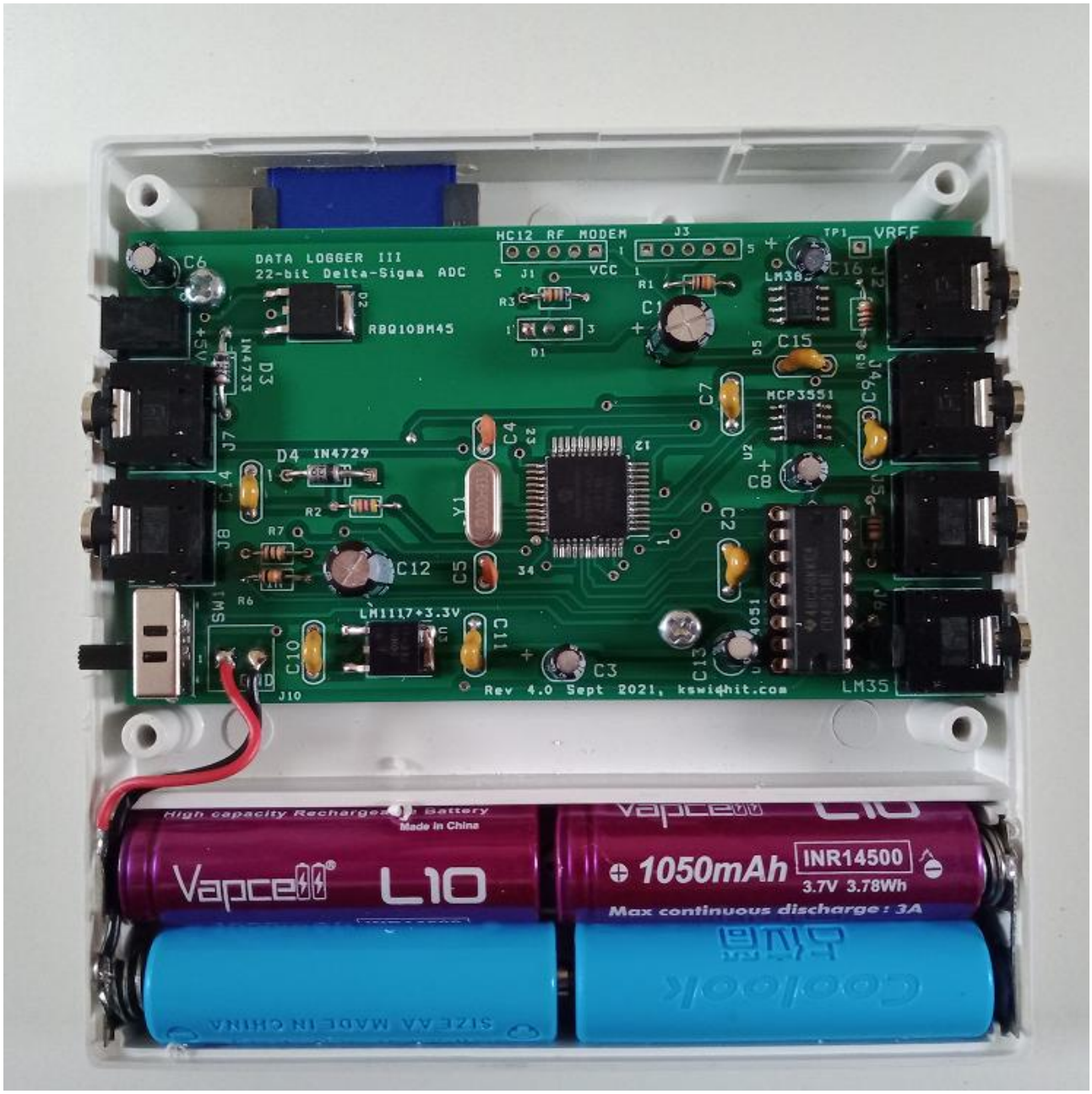
Three options for battery are:

Option 1: AA size dry cell, +1.5V x 4 (+6V).



+1.5V Dry cell AA size is suitable for class training.

Option 2: AA size rechargeable Li-ion battery, +3.7V x 2 (+7.4V)



The AA size (14500) rechargeable Lithium ion battery is best for mobile operation. No need external power.

The Li-ion battery can be recharged many times.

Since two cells series connected +7.4V is fine for the voltage regulator, we then need two dummy cells (wire connected internally) to complete the battery circuit.

Option 3: AA size Li-ion, +3.7V x 4 (+14.8V)

For sensors that need higher voltage, we can use Four Cells series connected +14.8V as well.

For battery use, Option 2 is recommended for many experiments.

If we have four Li-ion cells, while we are operating the data logger, we can charge the two cells.

Then we can replace the run out battery easily.

To extend period of battery use, we can add external power directly. For example, the USB solar panel can supply power on daytime. Battery will be used on nighttime.

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AA SIZE LITHIUM-ION BATTERY

The dimension of AA size Li-ion battery is called 14500.

Each cell provides +3.7V. The capacity of the commercial cells are available in wide range. Higher capacity, longer operating periods.

Students can study the discharge curve for a given Lithium-ion battery by analysis the data in Channel 8.

The Li-ion charger are also available in many brands. The sample one is LiitoKala, cheap and simple use.

QUICK TEST

For quick test, we will use external power source from USB port or cell phone USB adapter

Without any sensor connected to CH1 to CH6, we will test recording the built-in temperature sensor LM35 which is tied to channel 7.

Steps for quick test.

1. Ensure the power switch is turned off.

2. Insert the SD card, push until the card was locked.

3. Turn power switch ON.

4. The green LED indicates the SD card is found. The device will find set up file, auto.txt in the SD card. If no such file, then the device will create it.

5. The device will scan the analog signal and save the readings in Volts unit to the data file.

6. Interval between readings is 12 seconds.

7. Let the device operates for a while.

8. Turn power off when no LED indicating.

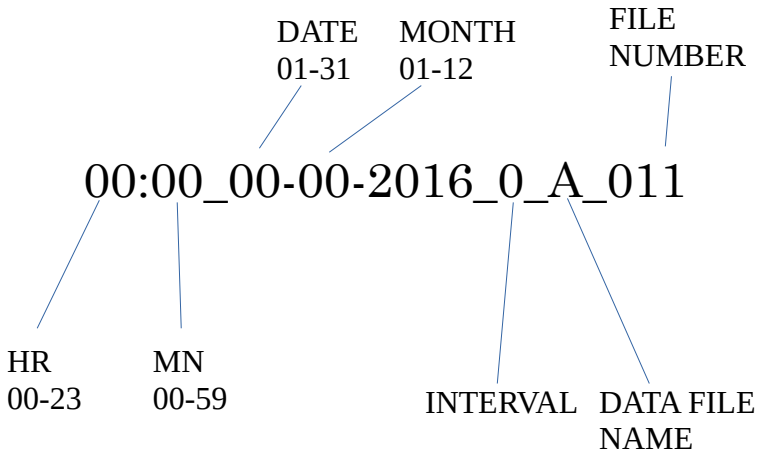
9. Push to remove SD card.

10. The data file is CSV format. We can import it into the spreadsheet software easily.

SETUP FILE

The setup file, auto.txt is simple text file. We can modify it using any text file editor.

Time and date settings is for start recording.



The INTERVAL can be modified with number 0 to 6.

INTERVAL NUMBER	Sampling interval
0	12 secs
1	1 min *
2	3 mins
3	5 mins
4	10 mins
5	30 mins
6	60 mins

Note

- Internal number 0 is for sensor testing.
- * 1 min interval is the most use for many experiments.

SAMPLE DATA FILE

The record are saved as CSV file. Most of spreadsheet program can read it directly.

The example below was imported by Libre Office Calc

https://www.libreoffice.org/

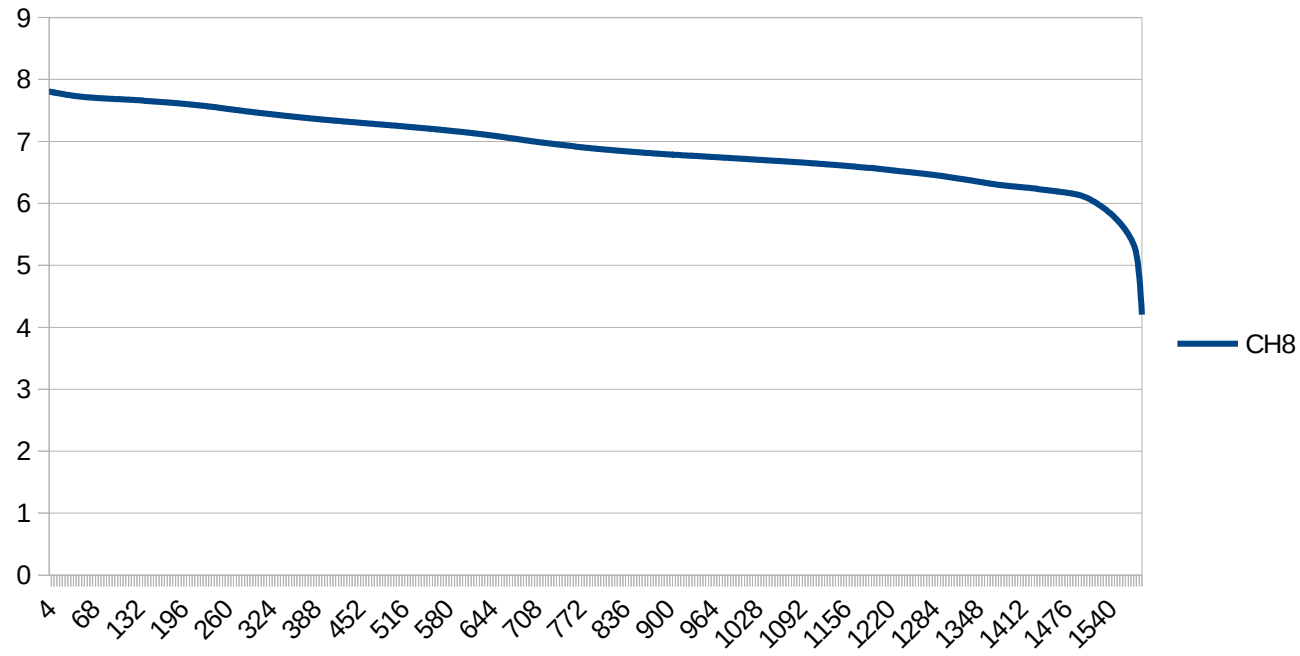
The data file when imported into spreadsheet, each data fields will be entered automatically.

The temperature sensor LM35 is saved in CH7 column.

The internal voltage monitor that supplied to the data logger is saved in CH8 column.

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	Sample	Date	Time	FracDay	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
3	0	17/9/22	20:13	17.842359	0.117223	0.184997	0.239705	0.284265	0.321024	0.350793	28.352781	7.804522
4	1	17/9/22	20:14	17.843053	0.117289	0.184912	0.239779	0.284388	0.321381	0.351574	28.493124	7.80216
5	2	17/9/22	20:15	17.84375	0.117149	0.184772	0.239479	0.284488	0.321301	0.351384	28.586585	7.80033
6	3	17/9/22	20:16	17.844444	0.117136	0.184798	0.239615	0.284352	0.321343	0.35158	28.655664	7.798618
7	4	17/9/22	20:17	17.845138	0.117127	0.184811	0.239653	0.284277	0.321088	0.351204	28.712701	7.796965
8	5	17/9/22	20:18	17.845832	0.117077	0.184827	0.239621	0.284336	0.321293	0.351322	28.76011	7.795075
9	6	17/9/22	20:19	17.846527	0.117049	0.184778	0.23957	0.284265	0.321051	0.350899	28.829723	7.793422
10	7	17/9/22	20:20	17.847221	0.117045	0.184622	0.239429	0.284214	0.321189	0.351273	28.914859	7.788167

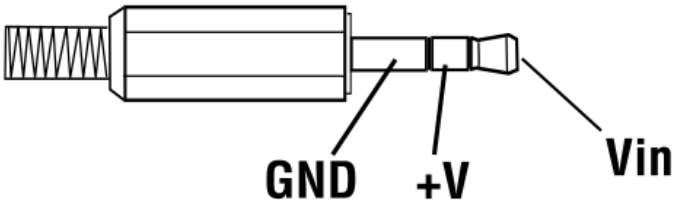
If we use Li-ion two cells, the data recording on CH8 will show the discharge curve.



EXTERNAL SENSORS

The Data Logger accepts 6-channel external sensors.

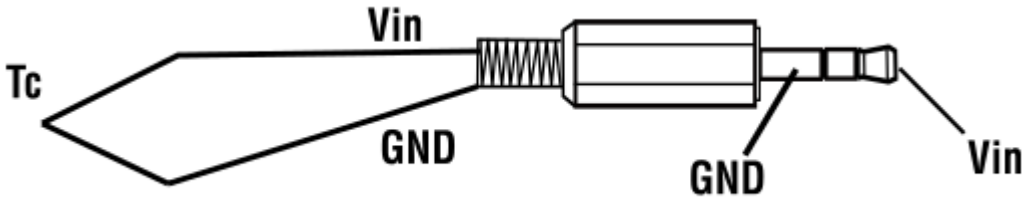
The input voltage is 0 to +1V range. The input jack is 3.5mm stereo jack.



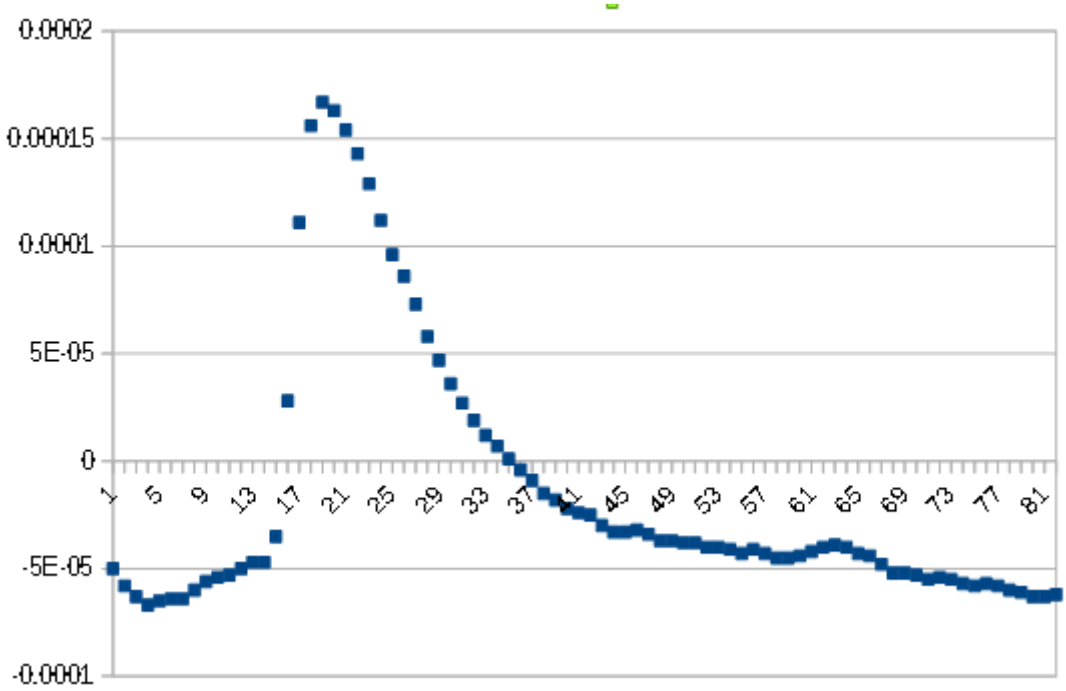
Any type of sensors must be conditioned to provide 0 to +1V range.

For electromotive sources with small output voltage, for example thermocouple type K,

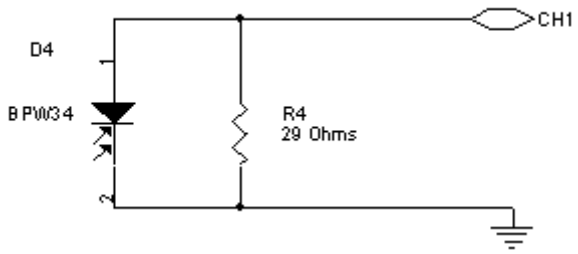
it can connect to the 3.5mm jack with Vin and GND pin directly.



The graph below uses thermocouple type K with 40μV Seebeck voltage as the sensor. No amplifier is needed.

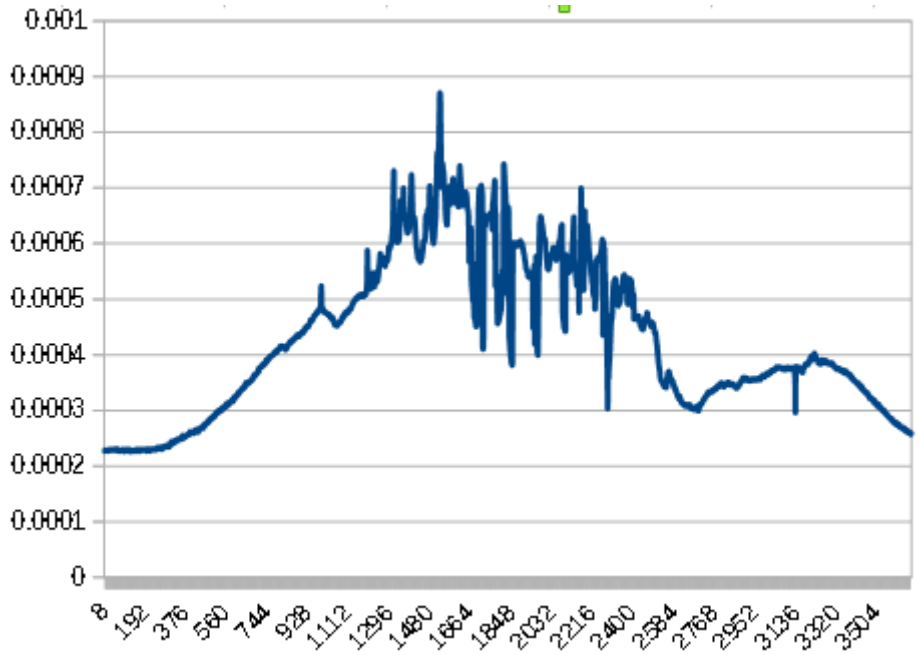


Another example of electromotive source is small silicon photo-diode, BPW34. The photo-generation current can be detected with a small resistance load.



The voltage developed on the load can tie to the input of the data logger directly, no need amplification.

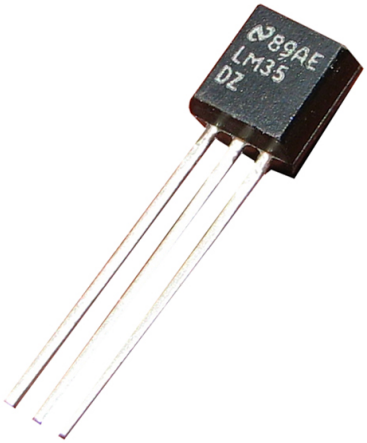
The sample graph below shows recording the insolation. The signal on Y-axis is Volts unit.



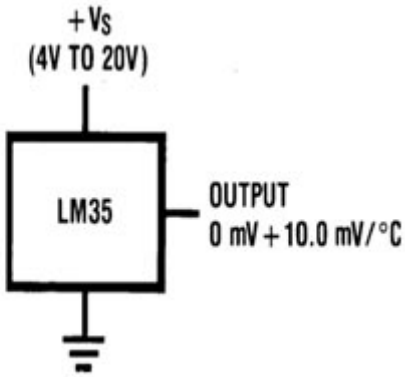
For external sensors that need power supply, +V pin provides power supply. The available voltage depends the source being used.

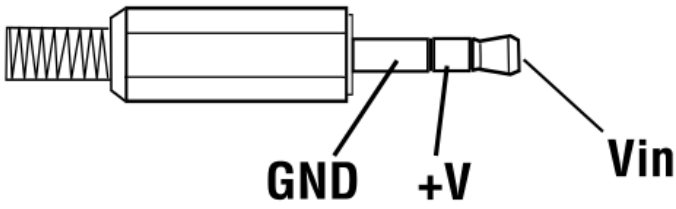
Data Logger power source	Voltage level at +V pin
USB power source	+4V
Battery AA size +1.5V x 4 cells	+6V
Li-ion Battery AA size +3.7 x 2 cells	+7.4V
Li-ion Battery AA size +3.7 x 4 cells	+14.8V

Example of the external sensor is the National Semiconductor precision temperature sensor LM35. The output is 10.0mV/ºC.



The LM35 will need power supply, +Vs from 4V to 20V. We can use +V pin from 3.5mm Jack directly.





STATUS LED

The status LED shows the device functioning and internal status.

LED Blinking	Status
RED blinking at power on	No SD card or card is not FAT32
Green_____Green__Green__Green___	SD card found, begins scanning
Green__Green__Green___Red___	Scanning and save the record to SD card
RED blinking after scanning	Low battery

TROUBLESHOOTING

PROBLEM	CAUSE	ACTION
No power LED with +5V USB power when turn on	1. USB plug is not provide +5V 2. broken cable	1. Find the USB plug with +5V, try with PC USB port 2. find new cable
RED LED alert blinking	1. no memory card 2. dead card 3. card is not FAT32	1. Insert memory card 2. Try new memory card 3. Format it with FAT32
No records file	1. dead card 2. Card is not FAT32 format	1. try new memory card 2. Format the card with FAT32
Strange Date and time shown in the record	1. wrong settings for data and time in auto.txt	1. correct data and time settings in auto.txt
Device stop running, no LED indicator	1. battery is run out	1. renew battery or use external +5V USB power
Date and time shown in the record is not correct	1. date and time must be set beforehand	1. set date and time for new recording
Some channel can not use	The analog selector chip may dead, caused by the over input voltage.	Replace the new chip, CD4051

NOTE