Development of Low power consumption data logger for earthquake observation

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(1) Summary of Development

Since an earthquake observation needs to be done at the places which have few factors causing ground noises, observation points are likely to be far places from cities and highways,which are inconvenient to go. So we need the low power consumption data logger which can continue observation by itself for a long time. In this study, we developed the low power data logger by using PIC.

Generally in development of the data logger, micro controllers such as Z80 are used as CPU which controls data logging. But we have already found out that we can reduce the power consumption by using PIC ,Peripheral Interface Controller, as CPU.

PIC has a simpler structure and consumes lower electric power than other micro controllers. It can do a few simple tasks and doesn't deal with many commands. But it has an enough ability to control data logging and available for development of the low power data logger.

PIC contains many useful functions to do almost everything needed for controlling appliances alone, for example, a program memory, I/O ports and A/D converter etc. So the low power data logger would be completed to some extent by attaching a few circuits needed to adjust the amplitude of the analogue signal before input and connect other devices.

But we contrived more to reduce the power consumption darastically. If PIC controls sampling the signal from seismometer, a waiting time for next sampling becomes relatively long for PIC because it can work much faster than sampling frequency, 100Hz in this study. During the waiting time, it can keep the sleep state in which it hardly consumes the power. But it isn't efficiency to make PIC recover from the sleep state to the usual state every sampling time.

So we decided to make a sequential circuit which controls sampling instead of PIC. Since PIC doesn't have to control sampling, it can keep the sleep state for a long time and hardly consumes the power. It just works for a short time to send all data from SRAM to a recording medium quickly and make all memory cells of SRAM empty every a few minutes. Since the sequential circuit is much simpler and should consume less power than PIC, we can make the very low power data logger if it can control sampling precisely.

It is also an advantage of this system that it is possible to continue observation during forwarding data from SRAM by using 2 SRAM.

(2)Result

We could confirm that the circuit was able to control 100Hz sampling. Now our system consumes about 20mW during sampling. It is less than 1/10 of the power that any other data loggers which have already been used practically consume. But we expect that we can reduce more power by taking measures against noises etc. Because the system wasn't made for practically use and it hasn't been elaborated yet.

We want to complete the data logger which consumes less than 10mW and could continue observation for more than 6 months with 4 batteries whose capacity are 8Ah.