

# Development of Multichain Quartz Thermometer for temperature measurement in deep borehole.

# tsuneo yamauchi[1]

[1] RCSVDM

We have developed a method for thermometry of ground water in the borehole(multi chain quartz thermometer). In this system, the information about temperature is obtained from frequency variations of a crystal resonator due to temperature change. We installed the observation system composed with five thermometers for the observation of ground water temperature in the borehole at Singu, Wakayama Prefecture. The developed quartz thermometer has a sensitivity more than 1 mil degree, The diameter of the thermometer is 40 mm and the length is 500 mm.

The frequency of the specially made crystal resonator varies according to the change in measured temperature, and the frequency is measured by a counter, and the value of counter changes according to the variation of ground water temperature. We send the information of the temperature to the receiver unit, and we convert the information to the temperature change. Five thermometers share an electronic power line and a signal line of a data, then the electrical transmission time of each thermometer data have to accede to demand of the time schedule of the system. At present, each transmission time is delayed 10 minutes from prior one.

The sensitivity of the thermometer increase with the gate time of the frequency counter. If we count the frequency during an hour, we are able to obtain more than 0.1 mil degree. Therefore, we will be able to detect an abnormal variations of ground water, even if the change is slight. We are also able to detect precise geothermal gradient at Singu.