Measurement the heat generated by electronic components

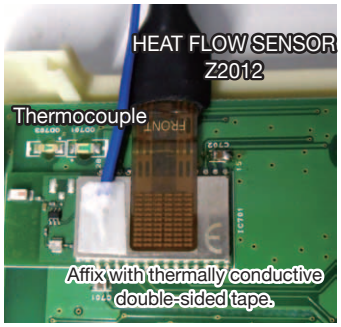
Identify patterns of heat generation and causes of increasing temperature with heat flow (heat flux) measurement

Increases in the speed and power level of electronic components are combining with shrinking package sizes to drive significant increases in heat generation density. Consequently, the heat design of electric circuits is becoming extremely important. Physically, temperature changes are always accompanied by the movement of heat. These movements of thermal energy can be measured using a heat flow logger and a heat flow sensor*. Since this approach allows you to measure the manner in which electronic components generate heat with a high degree of sensitivity, it is possible to assess heat generation during different operational regimes, for example to determine the amount of heat generated during different types of processing.

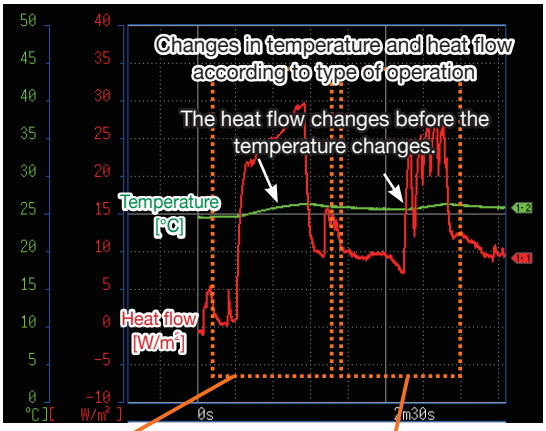
Individual heat flow sensors have different sensitivities, and it is difficult to configure scaling when using such sensors with a standard data logger. However, the Heat Flow Logger LR8432-20, which is specifically designed to measure heat flux, makes it easy to configure the sensitivity. In addition, the LR8432-20 eliminates troublesome wiring work thanks to its wireless capability, and it can meaure up to 105 channels. To further improve efficiency, the Hioki Z2012 (with a cable length of 1.5 m) and Z2015 (with a cable length of 5 m) flexible heat flow sensors have small sensor units that meaure approximately 10 mm × 10 mm, allowing them to be affixed to electronic components such as ICs.

* Sensors used to measure movements of thermal energy are known as heat flux sensors, heat flow sensors, or heat flow meters.

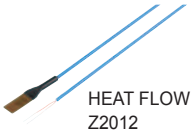
Example of measurement with the LR8432-20: Measuring the pattern of heat flow generation in a communications module



Heat flow sensors measure heat flow (W/m2), or movements of thermal energy, based on the difference in temperature between their top and bottom surfaces. Because heat flows are detected based on the difference in temperature between the top (ambient temperature) and bottom (component temperature) surfaces, heat generation can be measured with a higher degree of sensitivity than temperature. This data is useful when analyzing heat generation, for example in order to determine which type of processing or operation results in the most heat generation.
It is possible to determine whether heat is being generated (so that the component is becoming hotter) or absorbed (so that heat is flowing into the component from an external source) based on whether the heat flow is positive or negative. In addition, you can determine the amount of the heat (the amount of heat movement) based on the amplitude of the heat flow waveform.

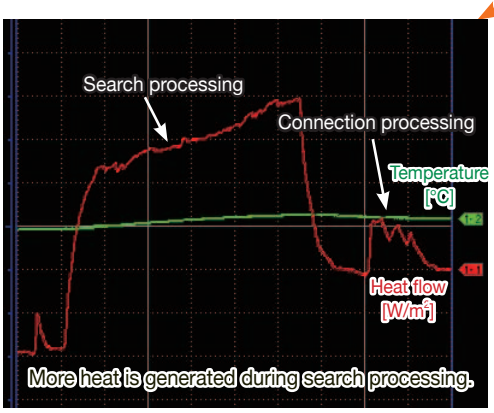


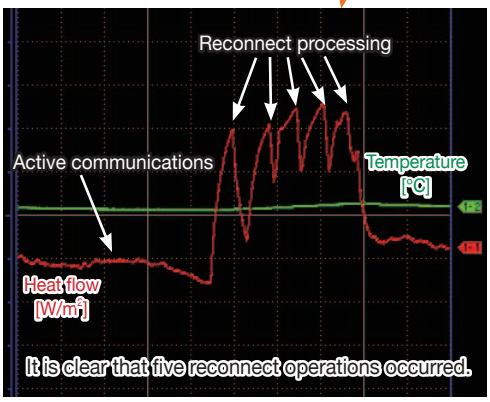
Temperature changes due to movements of thermal energy. Temperature can be predicted and controlled based on heat flows.



HEAT FLOW SENSOR
Z2012

HEAT FLOW LOGGER
LR8432-20





Products used

HEAT FLOW LOGGER LR8432-20	HEAT FLOW SENSOR Z2015
HEAT FLOW SENSOR Z2012	THERMALLY CONDUCTIVE TAPE Z5008

Information valid as of May 2016. Specifications are subject to change and revision without notice. HK022-E00 May 2016