Hukseflux
Thermal Sensors

# Test report Hioki LR8515

## Hioki datalogger LR8515 used with Hukseflux heat flux + temperature sensors

*This note explains how to install Hukseflux FHF heat flux sensors with Hioki LR8515 datalogger. The latest FHF sensors have excellent compatibility with Hioki loggers. FHF sensors are very versatile: integrated temperature sensor, thermal spreaders to reduce thermal conductivity dependence, applicable over a temperature range from −70 to +120 °C. The combined measurement of heat flux and temperature offers you a full picture of the thermal behaviour of a system. Hioki heat flow loggers are high-speed, easy to use and compact. Often heat flux sensors are combined with thermocouples. The Hioki datalogger is easy and convenient in use. Hioki LR8515 can transmit data of one sensor wireless via Bluetooth.*

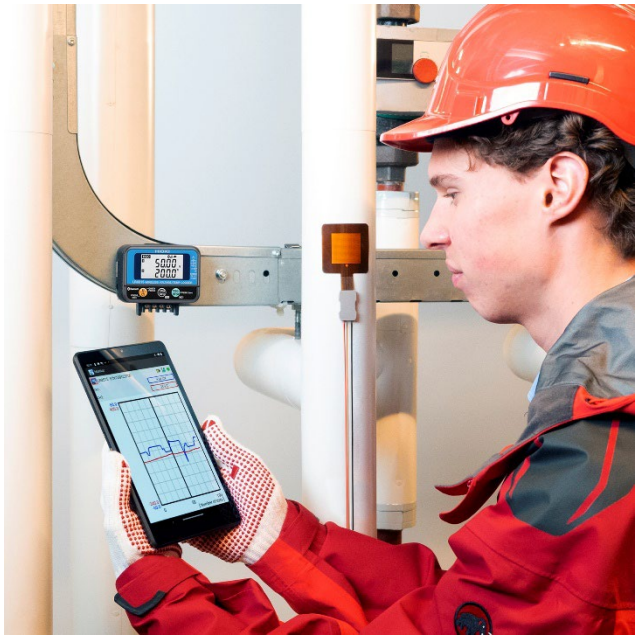

**Figure 1** *using Hioki LR8515 with Hukseflux FHF sensors is easy and convient*


**Figure 2** *Hioki LR8515 can transmit measurements of 1 sensor via Bluetooth*

## Introduction

Hukseflux offers a wide range of sensors for heat flux and temperature measurement. The thermopile heat flux sensor and thermocouple temperature sensor are both passive sensors; they do not require power.

## Conclusion of testing

FHF sensors such as FHF04 can be connected directly to the Hioki LR8515. The heat flux in $W/m^2$ is calculated by dividing the heat flux sensor's output, a small voltage, by its sensitivity. The sensitivity is provided with the sensor on its certificate.

## Specifications

Table 1 shows a summary of the most important specifications of the Hioki LR8515 used with Hukseflux FHF04. Contact Hukseflux for a final check of your proposed solution.

**Table 1** *most important specifications of Hioki LR8515 used with a Hukseflux FHF04 sensor*

| | LR8515 |
|---|---|
| no. of input channels | 2 |
| voltage | y (heat flux calculated in post-processing) |
| temperature | y |
| voltage measurement accuracy | 10 x $10^{-6}$ V |
| estimated heat flux resolution with FHF04 | 1 $W/m^2$ |
| temperature measurement accuracy | ±0.8 °C |
| wireless / Bluetooth | y |
| battery powered use | y |

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## Getting started

The following text helps you to instal the sensors to the datalogger and getting along. For more information see the sensor manual on our website or the Hioki user brochure. Visit also the Hukseflux YouTube channel for a quick introduction to heat flux or learning more about separation of radiation and convection.

## Before use

- use AA/LR6 Alkaline battery 2x for wireless use
- install Logger Utility and Wireless Logger Collector software on Windows PC
- or install Hioki datalogger app on an Android device

## Step 1

Suggested wire connection of FHF04:

- Ch 1 +: red (heat flux +)
- Ch 1 - : black (heat flux -)
- Ch 2 +: thermocouple (type T +)
- Ch 2 - : thermoucouple (type T -)

## Step 2

Specific your measurement:

- describe the purpose of the experiment;
- estimate the output range of heat flux sensor in [$\times 10^{-6}$ V] and verify if it matches LR8515 capabilities

## Step 3

Program your logger:

- connect the logger via Bluetooth to the Logger Utility software or smartphone app;
- set Ch 1 : voltage, 50 mV range;
- set Ch 2 : temperature type T, RJC internal;
- send the measurement conditions to the instrument

## Step 4

Start your measurement:

- press the start button for 2 sec;
- data from the two channels is displayed on the screen; please note the heat flux is dislplayed in millivolts.
- by pressing 'data info' the min/max and average values can be found;
- data can be downloaded via Bluetooth and anlyzed by the Wireless Logger Collector
- calculate the heat fux by dividing voltage by the sensor sensitivity

## Power supply

- the logger has a supplied AC adapter
- the logger has an internal battery pack, which can last for 2.5 hours at continuous use
- memory capacity for each channel is 500,000 data points

## Suggested use

Heat flux + temperature sensors and loggers are used to analyse the cause of temperature change. FHF04 is a sensor for general-purpose heat flux measurements, often applied as part of a larger test- or measuring system. Also, they are used to validate mathematical CFD simulations.

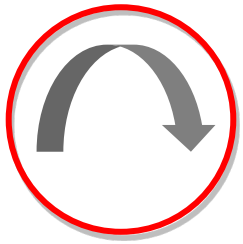
## About Hukseflux

Hukseflux is the leading expert in measurement of energy transfer. We design and manufacture sensors and measuring systems that support the energy transition. We take measurement to the next level. We are market leaders in solar radiation - and heat flux measurement. Main products are pyranometers and heat flux sensors. Hukseflux is ISO 9001 certified. Hukseflux products and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

Interested in this product?
E-mail us at: info@hukseflux.com

# FHF series outperforms competing models: how?

*FHF04 and FHF03 are Hukseflux' standard models for thin, flexible and versatile heat flux sensors. With its small footprint, FHF03 is the most economical one.*

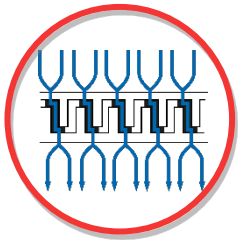


**Flexible**
FHF04 may be bent to a radius of 7.5 mm.
FHF03 may be bent to a radius of 50 mm.

**Large-area**
Larger is better: FHF04's sensitive area of 30 x 30 mm offers good averaging, leading to increased sensitivity. FHF04 has a thermal guard around the sensitive area. The guard can also be used for mounting the sensor without disturbing the sensitive area.

Sensitive area with thermal spreaders reducing thermal conductivity dependence

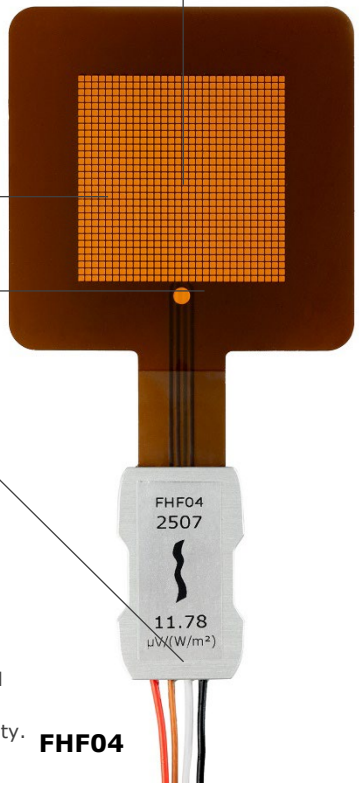
**Sensitivity independent of environment: Thermal spreader included**
Unlike many competing sensors, FHF series sensors have thermal spreaders, i.e. conductive layers covering the sensor. These layers help reduce the thermal conductivity dependence of the measurement. By employing spreaders, the sensitivity of FHF series becomes independent of its environment.



Corrosion-proof plastic cover protecting the thermal spreader

Thermocouple type T included

Durable waterproof wires with metal connection block, may be used as strain relief, temperature resistant up to 150 °C




**FHF04**

**FHF03**

Thermocouple type T included

Black and gold stickers matching FHF04 and FHF03 to measure radiative and convective heat flux separately

Durable waterproof shielded cable, temperature resistant up to 150 °C

**Stable: waterproof (IP67), corrosion-proof**
FHF series sensor connection is potted, and waterproof. Its protection class is IP67. Competing sensors often have wire connections with open contact to the environment. This is a large potential source of damage, as well as a starting point for measurement errors, corrosion, and sensor instability.

**Best paperwork**
Hukseflux has the paperwork covered; all FHF series sensors are provided with formally traceable calibration certificates. We calibrate in accordance with ASTM.