



# LAS MkII Scintillometer

For the Measurement of Heat Fluxes and Evaporation at Large Scales

Path averaged measurement of sensible heat fluxes  
Range 100 m to 4.5 km  
Stand-alone operation

Integrated data logger with GPS  
Digital data processing  
Real-time data display

## Introduction

Heat fluxes and evaporation at the Earth's surface are of great importance to the fields of meteorology and hydrology.

Sensible heat flux is the transfer of heat between the Earth's surface and the air above, due to a temperature difference between them. The direction of this flux can be seen by measuring temperature at two heights. Latent heat flux is the result of the evaporation of water or transpiration by vegetation. For this reason, this flux is often referred to as evapo-transpiration (ET). Both fluxes are major components of the Earth's surface energy budget.

Accurate continuous measurement of these parameters is often required for research projects and monitoring applications. Where the measurements need to be done on a field or landscape scale, or for validating satellite data, the traditional in-situ point measurement techniques are not sufficient.

The Kipp & Zonen LAS MkII is a large aperture scintillometer designed to provide continuous measurements of sensible heat flux and turbulence statistics ( $C_n^2$ ) over long distances, from 100 m up to 4.5 km, for energy balance studies and evaporation monitoring.

Thanks to the extended range, scintillometer measurements can be compared to the typical pixel sizes of satellite-based instruments for ground validation applications.

## Applications

Within the field of hydrology the energy balance plays an important role. For example, accurate measurements of the sensible heat flux and evapotranspiration are of great importance as inputs for hydrological models.

Scintillometer systems are used to make local measurements of the surface energy balance components, including evapo-transpiration. These measurements can then be used to 'ground-truth' energy flux estimates derived from satellite data, at field and regional scales.

In the field of (micro) meteorology the structure parameter of the refractive index of air ( $C_n^2$ ) is an important factor in determining the turbulent characteristics of the boundary layer.



## LAS MkII Large Aperture Scintillometer

The LAS MkII Scintillometer is Kipp & Zonen's solution for long term unattended monitoring of  $C_n^2$  and heat fluxes within the planetary boundary layer.

LAS MkII is easy to install and operate and requires virtually no maintenance. Data collection has never been more convenient thanks to analogue and digital outputs. Setup and data processing is made simple by the built-in key pad and display.

For the advanced monitoring of evapo-transpiration, sensible and soil heat fluxes as well as net radiation, we offer our LAS MkII ET system as a turn-key solution.

## Choice of Configuration

The system configuration depends on the parameters of interest for your application. The table below provides an overview of the required components for several types of measurements.

Parameter to measure	Equipment to use
$C_n^2$ Sensible heat flux ( $H$ and $H_{free}$ )*	<b>LAS MkII</b> <ul style="list-style-type: none"><li>• Transmitter &amp; Receiver</li><li>• 10 cm apertures for short paths</li></ul>
<i>*Using fixed values for meteorological parameters</i>	
$C_n^2$ Sensible heat flux ( $H$ and $H_{free}$ )*	<b>LAS MkII + optional meteorological sensor kit</b> <ul style="list-style-type: none"><li>• Transmitter &amp; Receiver</li><li>• 10 cm apertures for short paths</li><li>• Wind speed</li><li>• Temperature</li><li>• Pressure</li></ul>
<i>*Using measured data for meteorological parameters</i>	
$C_n^2$ Sensible heat flux ( $H$ and $H_{free}$ )* Latent heat flux ( $L_vE$ ) Evapo-transpiration (ET)	<b>LAS MkII ET system (with extended meteorological sensor kit)</b> <ul style="list-style-type: none"><li>• Transmitter &amp; Receiver</li><li>• 10 cm apertures for short paths</li><li>• Wind speed &amp; direction</li><li>• 2x Temperature</li><li>• Pressure</li><li>• Net radiometer</li><li>• 2x Soil heat flux</li><li>• Data acquisition system in IP65 enclosure</li></ul>
<i>*Using measured data for meteorological parameters</i>	

For the data acquisition system of the LAS MkII ET system additional options are available regarding power supply, telemetry, etc.



- Easy configuration and operation
- Low maintenance
- Real-time data display
- Analogue and digital output
- Direct PC connection
- Accurate time from GPS

**LAS MkII** large aperture scintillometer is designed to offer easy installation, configuration and operation, requiring only limited maintenance.

The LAS MkII can be installed and configured using its built-in display and key-pad without the need for any extra equipment. This prevents the inconvenience of carrying additional instruments to the site of installation.

The LAS MkII has a built-in data logger and digital outputs for direct PC connection. Real time measurements are shown on the display. The  $C_n^2$  data is also available as an analogue output to be recorded using virtually any type of data acquisition system. The internal clock is automatically synchronised with the included GPS antenna.

The EVATION® software included with the LAS MkII scintillometer is a fully featured configuration, monitoring and data processing program. The scintillometer can be controlled using EVATION® and it offers many data processing options and real time data display. This way you have all your results at the push of a button.

The processing parameters are customizable for more advanced or application specific processing options.

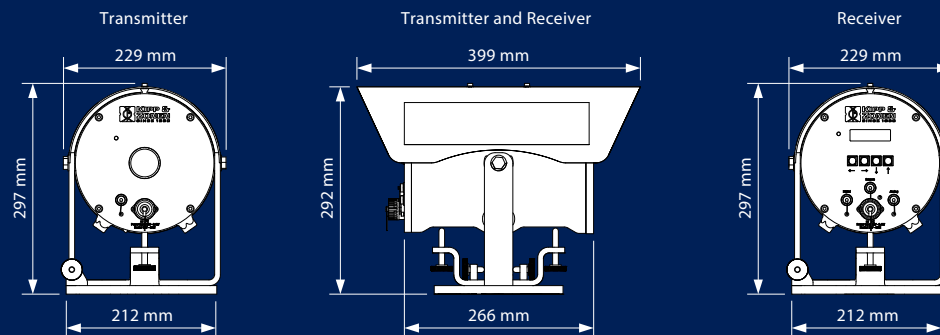
Data files from virtually any data logger can be read to process data from LAS MkII analogue or serial outputs recorded on an external data logger.



## Building a System

An optional meteorological sensor kit is available which includes wind speed, air temperature and barometric pressure and is connected directly to the scintillometer receiver. This provides a complete measurement solution in a single, easy to use, system.

The LAS MkII ET system comes complete with scintillometer, meteorological sensors, and data acquisition. The EVATION® software package for easy processing and display of data is included as standard. Depending on the installation requirements several options are available for remote communication and power supply. The system is fully pre-configured for simple installation.



## Specifications LAS MkII

Path length / Aperture diameter	100 m to 1 km (10 cm Aperture)
	250 m to 4.5 km (15 cm Aperture)
Wavelength	850 nm (40 nm FWHM)
Scintillation bandwidth	$10^{-17}$ to $10^{-11}$
Carrier frequency	6.5 to 7.5 kHz (50 % duty cycle)

## Features

Interface options	Digital RS-232/422
	Analog output 0 to 2.4 V
Instrument control and data display	Built-in display and key-pad or remote via digital interface
Pan and tilt adjustment	Integrated
Heating system	Programmable lens heater (receiver)
	Self-regulating lens heater (transmitter)
Data processing	Internal processing of $C_n^2$ , free sensible heat flux and other parameters
	Built-in data logger with GPS antenna for time and location
External sensor connection	GPS + optional sensor kit: wind speed, temperature and pressure
Software included	EVATION® (instrument control and data analysis)

## Operating requirements

Power requirements	12VDC / 6 W (heater off) / 54 W (maximum when heater on)
Operating temperature	-20 °C to +50 °C
Humidity range	0 to 100 % non-condensing
Environmental protection	IP65
Weight per transmitter/receiver	8.5 kg

## Options

Meteorological sensor kit	Includes wind speed, temperature and pressure sensor
	Fitted with 10 m cable and waterproof plug for direct connection to LAS MkII receiver

Note: The performance specifications quoted are worst-case and/or maximum values



Go to [www.kippzonen.com](http://www.kippzonen.com) for your local distributor

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Kipp & Zonen B.V. reserve the right to alter specifications of the equipment described in this documentation without prior notice



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