



# Scintillometers

## For the measurement of heat fluxes and evaporation at large scales

Heat fluxes and evaporation at the Earth's surface are of great importance to the fields of meteorology and hydrology. 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 (LAS) designed to provide continuous measurements of heat flux and turbulence statistics over long distances, for energy balance studies and evaporation monitoring. Thanks to the extended range, from 100 m up to 4.5 km, LAS measurements can be compared to the typical pixel sizes of satellite-based instruments, for ground validation.

The measurement technique is based on the scintillation phenomenon. Heat fluxes between the ground and the atmosphere cause variations in the refractive index of the air. The LAS detects these variations using a pulsed beam of infrared light which is emitted by the transmitter and

detected by the receiver. From the measurements the LAS MkII receiver can calculate and store the path-averaged structure parameter of the refractive index of air ( $C_n^2$ ).

When the accessory meteorological sensor kit is connected to the receiver it automatically recognizes the sensors and can calculate surface sensible heat flux (H). The LAS MkII can store more than a month of data. The raw data can also be exported to a PC where the supplied EVATION® software package can calculate ( $C_n^2$ ), (H) and other parameters and display them graphically in real time or historically.

For more advanced applications Kipp & Zonen offers the LAS MkII ET system to measure latent heat flux ( $L_vE$ ) and Evapotranspiration (ET). This is a turn-key system which provides all the instrumentation and software necessary to monitor  $C_n^2$ , H,  $L_vE$  and ET. Kipp & Zonen's ET system is specifically designed for Earth energy balance studies, water and crop management and for the ground-truth validation of satellite remote sensing measurements.

# LAS MkII Scintillometer



**LAS MkII** provides measurements of the path-averaged structure parameter of the refractive index of air  $C_n^2$  over path lengths from 250 m to 4.5 km, using the scintillometry technique. A pair of aperture restrictors is supplied to allow measurements down to 100 m. The durable design enables operation under almost any atmospheric condition and with very low maintenance. It also comes standard with a rugged transit case.

The internal digital processing unit automatically computes  $C_n^2$  and other relevant parameters. Results are stored in the internal non-volatile data memory. Using the built-in display and control keys, real time measurement data, configuration and installation parameters can be read directly from the display receiver.

The digital output of the receiver can be connected to a PC for remote real time display of data and instrument control. Our EVATION® software suite is included as standard to view real-time data numerically and graphically as well as to post-process advanced data. In addition analogue voltage outputs of  $C_n^2$  and signal strength are available at the receiver for connection to data loggers.

The transmitter, receiver, alignment telescopes, aperture restrictors and cables are supplied packed in a rugged, foam-lined aluminium case suitable for field-portable use.

The accessory meteorological sensor kit plugs into the receiver and provides live wind-speed, temperature and pressure data. This allows the LAS MkII to calculate and store the surface sensible heat flux (H) in real-time.

Other accessories include stands and power supplies.

Part number	Instrument
0371900	LAS MkII Large Aperture Scintillometer • Transit Case

Specifications	
Wavelength	850 nm
Scintillation bandwidth	0.2 to 400 Hz
$C_n^2$ range	$10^{-17}$ to $10^{-12} \text{ m}^{-2/3}$
Path length / aperture diameter	100 m to 1 km / 100 mm (restrictors included) 250 m to 4.5 km / 150 mm
Analogue outputs	0 to 2 V ( $C_n^2$ ) 0 to 2 V (signal strength)
Serial output	RS-232 or RS-422 (selectable)
Data processing	Internal processing of $C_n^2$ , $H_{\text{free}}$ (with meteorological sensor kit) and other parameters
Data logging	Integrated, minimum one month
Instrument control and data display	Built-in display and key-pad, or remotely via digital interface
External sensor connection	Wind speed, temperature and pressure kit
Supply voltage	9.6 to 18 VDC
Power consumption	6 W (heater off) / 54 W (maximum when heater on)
Pan and tilt adjustment	Built-in
Alignment telescopes	Included Adjusted to each transmitter and receiver
Windows™ compatible software	EVATION® instrument control and data analysis suite

Part number	Accessories
0371704	<b>Meteorological sensor kit</b> Wind speed, temperature and pressure sensors - pre-wired with cable and connector for LAS MkII receiver 2 m high mast for fixing in ground, with mountings for meteorological sensors
0371701	<b>CVP1 LAS MkII</b> Weatherproof heavy-duty AC-DC power supply unit for outdoor use For transmitter and receiver (one required for each) Wide AC input range, fully protected output 12 VDC at 3.5 A Operating temperature range -20 °C to +50 °C Pre-wired with 10 m output cable and connector for LAS MkII, 5 m AC power input cable with IEC female plug
0357703	<b>Adjustable Heavy-Duty Tripod Package</b> Aluminium folding tripod, adjusts up to 3 m height, includes base-frame for hard surfaces and fixing bolts for LAS MkII Two supplied, one each for transmitter and receiver, in a wood carrying case
0353710	<b>Tripod Floor Stand</b> For easy mounting and levelling of the LAS MkII, height 0.45 m Very stable and rugged As used with Kipp & Zonen Brewer and 2AP TrackerFor transmitter and receiver (one required for each)
0353750	<b>Height Extension Tube</b> Extends the tripod mounting height by 0.60 m to a total of 1.05 m
0357720	<b>Service and Factory Test</b> Excluding any replacement parts needed

# LAS MkII ET System



**LAS MkII ET System** is a complete solution for monitoring the energy balance within the boundary layer, including latent heat flux ( $L_vE$ ) and Evapotranspiration (ET). It is specifically designed for field scale observations of the path averaged energy fluxes using the scintillometry technique.

All the equipment of the ET system is selected and designed to offer easy installation and low maintenance operation. Our EVATION® software suite is included as standard to view real-time data numerically and graphically and to post-process advanced data. EVATION® reads the ET system measurement data but can also use files from other types of data acquisition systems.

The system features a LAS MKII scintillometer. The analogue outputs are connected to a COMBILOG data logger in a stainless steel weatherproof enclosure, which also houses the ambient pressure sensor. The data logger inputs have over voltage protection and there are mast mounting clamps for the enclosure. The COMBILOG requires 12 VDC power. A NR Lite2 net radiometer is also connected to the data logger.

Sensors for wind speed, wind direction, temperature at two heights and soil heat flux at two depths are also connected to the COMBILOG. A 4 m height telescopic mast has all the necessary mountings for the meteorological and net radiation sensors and includes guy wires and a lightning rod.

The COMBILOG can be ordered with an AC to 12 VDC power supply and backup battery fitted in the enclosure. A further option is a GSM modem for remote communication (a suitable SIM card and network access must be provided by the user). Software to configure the COMBILOG, manually download data and display it in real-time is included.

Part number	System
LAS MkII Evapo-Transpiration System comprises	
0371900	LAS MkII Large Aperture Scintillometer • Transit Case
3303094	Sensor Set LAS MKII ET System
0344920-003	NR Lite2 Net Radiometer • single-component • 15 m cable
0372900-100	COMBILOG in small IP65 enclosure (38 x 38 cm)
Options	
0372900-102	COMBILOG in small IP65 enclosure 12 V Power Supply • Backup Battery
0372900-112	COMBILOG in small IP65 enclosure GSM modem • Antenna • 12 V Power Supply • Backup Battery

Specifications	
Scintillometer	LAS MkII
Meteorological sensors and mast	Wind speed Wind direction Atmospheric pressure Ambient temperature at two heights Soil heat flux at two depths 4 m high telescopic mast with mountings for meteorological and net radiation sensors, lightning rod, guys and baseplate
Net radiation sensor	NR Lite2
Data acquisition	COMBILOG data logger system in weather-proof stainless steel enclosure with over-voltage protection, requires 12 VDC power
Windows™ compatible software	EVATION® instrument control and data analysis suite

Part number	Accessories
0371701	<b>CVP1 LAS MkII</b> Weatherproof heavy-duty AC-DC power supply unit for outdoor use For transmitter and receiver (one required for each) Wide AC input range, fully protected output 12 VDC at 3.5 A Operating temperature range -20 °C to +50 °C Pre-wired with 10 m output cable and connector for LAS MKII, 5 m AC power input cable with IEC female plug
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