

**Vaisala Total
Lightning Processor™,
TLP100™ and TLP200™
Series on Linux®**



VAISALA

Vaisala Total Lightning Processor™ TLP100 and TLP200 Series



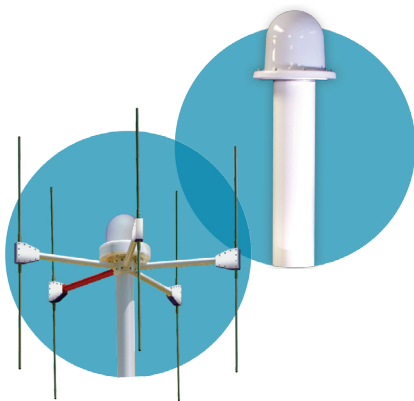
The TLP100 Series processes data from Vaisala's low frequency LS7002 Advanced Total Lightning sensors and provides detection efficiency of greater than 90% for Cloud-to-Ground (CG) and greater than 50% for Cloud (IC) lightning flashes. IC pulses are geolocated in three dimensions.

The TLP200 Series processes data from Vaisala's TLS200 (combined low frequency and very high frequency) sensors and provides lightning location solutions for greater than 90% of both CG and IC lightning flashes.

Advanced Lightning Geolocation with Flexible Features

The revolutionary technology in Vaisala's Total Lightning Processor™ is designed with multiple performance levels to meet the needs of a wide range of applications. This allows users the flexibility to choose the features most suited for their application. Licenses are available for the following TLP™ features:

- System and sensor performance monitoring
- Network performance mapping
- Dynamic detection efficiency (DE) and location accuracy (LA) projections
- Advanced lightning type classification, "burst" processing, and waveform parameters.



TLP100/TLP200 Features and Benefits

- **Continuously monitors remote sensor performance and communication status:**
Allows sensor owners to validate that the sensor is operational and functioning to specification(s).
- **Includes Vaisala's patented location algorithm with propagation correction service:**
Yields median location accuracy as good as 150 meters.
- **User-friendly, web-based Network Control Center with graphical tools for sensor and network quality assessment:**
Provides tools to perform comprehensive analysis of sensor and network performance using a variety of reported parameters.
- **Dynamically monitors network location accuracy and detection efficiency:**
Gives accurate picture of network performance at any given time.
- **Includes Zabbix monitoring tools:**
Allows for customized ping services to notify operators of unfavorable network operating conditions resulting in improved overall network performance.
- **Improved archive management tools:**
Allows for configurable file size * .iso image bins that can be burned to CDs/DVDs.
- **New advanced waveform features Vaisala's newest sensor technology**
- **Vaisala patented algorithm for geolocating multiple pulses in lightning generated pulse-bursts**
- **Geolocation of cloud lightning in three dimensions (3-D)**
- **Logistic regression based enhanced lightning classification using multiple waveform parameters**
- **New flash algorithm providing grouping of cloud pulses and cloud-to-ground strokes belonging to the same flash**

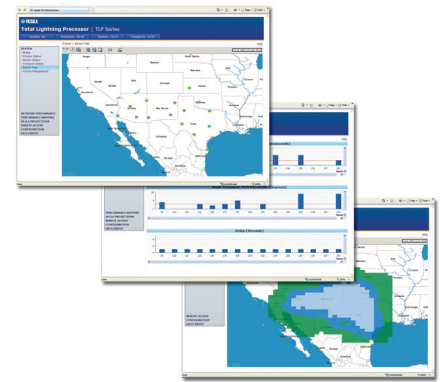
These features provide more efficient network operations, stabilized performance, and deliver advanced information about the geolocated lightning events.

The TLP™ combines Vaisala's latest patented 3-D location algorithm with terrain and propagation correction services, significantly improving the network median location accuracy to 250 meters or better in the interior of the network. With Vaisala's

newest sensor technology, a location accuracy approaching 150 meters can be achieved.

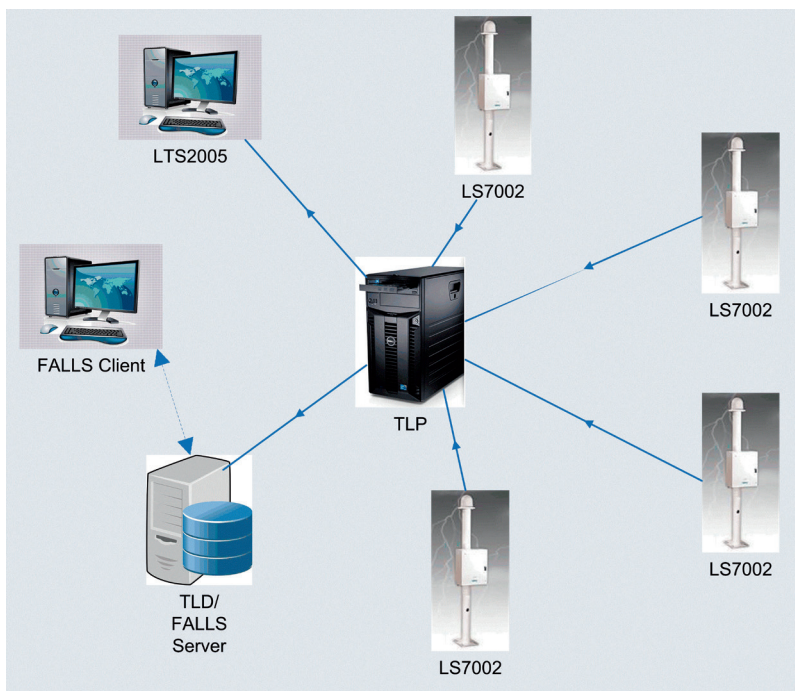
User-Friendly, Web-based Operation

The TLP™ is available on a Linux® operating system for added flexibility and lower ownership costs. The TLP™ employs a web-based interface with excellent network monitoring tools.



Vaisala Total Lightning Processor™ TLP100/200 Series — License Levels

PART NUMBER	BASE + LF	System & Network Performance	Network Performance Mapping	DE/LA Projections	Premium ("Burst" Processing, Enhanced Classification, Advanced Waveform Parameters)
TLP111	✓	✓			
TLP121	✓	✓	✓		
TLP131	✓	✓	✓	✓	
TLP141	✓	✓	✓	✓	✓
PART NUMBER	BASE + LF + VHF	System & Network Performance	Network Performance Mapping	DE/LA Projections	
TLP211	✓	✓			
TLP221	✓	✓	✓		
TLP231	✓	✓	✓	✓	
TLP241	✓	✓	✓	✓	



A typical Vaisala LF precision lightning detection network configuration uses TLP100. Vaisala LF + VHF networks require TLP200. Each network consists of four or more sensors (depending upon desired coverage area). Each sensor sends back data from detected lightning-generated electromagnetic signals to the TLP in real-time. The TLP uses this data from multiple sensors along with a geolocation algorithm to find the optimum location solution for each lightning event. In addition, a variety of parameters and associated characteristics are reported for each solution. Lightning data from the TLP can be sent to different applications for display, storage, and analysis.

Technical Data

Fully Supported Sensors

TLP100™ Series	LS7001, LS7002
TLP200™ Series	TLS200

Compatible but Unsupported Sensors

TLP100™ Series	IMPACT, IMPACT-ES, IMPACT-ESP, LS7000
TLP200™ Series	LS8000

Capacity up to 512 Sensors

Up to 512 for LF only, 256 for LF + VHF data

Supported Communication Interface

TCP/IP

Supported Web Browser Interface

Mozilla Firefox 10 for Red Hat Enterprise® (RHEL) 6
Internet Explorer 10 (in compatibility mode) and
Mozilla Firefox 22 for Windows 7

Certified Hardware

Option of Desktop or Rack Mount Server*

Certified Hardware Requirements

8 GB of RAM
2.5 Ghz Quad Core Intel Core i7 series or better CPU
2 (1)TB SATA II disk, RAID 1
2 x NIC ports compatible with RHEL 6 (1 Gbps each)
4 USB 2.0 ports
1280x1024 certified video adapter and monitor
DVD+RW Burner
Graphics card with hardware accelerated drivers compatible with RHEL 6 (512MB RAM, PCI Express Interface). ATI Radeon HD 4350 GPU (recommended)
RHEL 6, 64 bit edition

Environmental Specifications*

The hardware must be in a climate-controlled environment. The environmental specifications are equal to the HW specifications by default. The following specifications are subject to change without notice based on hardware availability.*

Operating Temperature	10 °C to 35 °C (50 °F to 95 °F)
Storage Temperature	-40 °C to 65 °C (-40 °F to 149 °F)
Operating Relative Humidity	20 % to 80 % non-condensing (non-condensing twmax=29C)
Storage Relative Humidity	5 % to 95 % non-condensing (twmax=38C)
Operating Altitude	-16 to 3,048 m (-50 ft to 10,000 ft)
Storage Altitude	-16 m to 10,600 m (-50 ft to 35,000 ft)

Lightning Parameters^a

Date and Time to 100 nanosecond resolution
Latitude, Longitude and Altitude
Number of sensors used in location solution
Position confidence (chi-square)
Degrees of freedom when optimizing the solution
Semi-major axis of the 50% positional confidence ellipse (km)
Semi-minor axis of the 50% positional confidence ellipse (km)
Eccentricity of the positional confidence ellipse
Enable threshold crossing-to-peak risetime (microseconds)
Peak-to-zero time (microseconds)
Maximum rate-of-rise (kA/microsecond)
Polarity
CG flash multiplicity (number of CG strokes per flash)
Number of IC pulses in a flash
10-to-90 risetime (premium license only)
50-to-90% risetime (premium license only)
Maximum rate-of-rise of current (premium license only)
Bipolarity (premium license only)
Peak-to-peak times (premium license only)
Associated events before/after (premium license only)
Waveform time before/after (premium license only)

^a Not all parameters are applicable to all lightning types or license levels

Graphical Tools

Over 50 graphs and tables for detailed network quality analysis
Individual sensor status and quality analysis
Time Deviation, 95th percentile
Angle Deviation, 95th percentile
Detection Efficiency Map
Location Accuracy Map
Region Status Map

Performance Mapping Tools

Sensor Map	Avg. Positive Signal
Lightning Counts	Avg. Negative Signal
% Positive	Avg. Error Ellipse SMA
% Optimized	Avg. Chi-Square Value
% Cloud	Avg. Sensor Count
Lightning Density	Avg. Positive Peak Current
	Avg. Negative Peak Current



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