



Vaisala Thunderstorm Total Lightning Sensor LS8000



Total Lightning Sensor LS8000 combines VHF interferometry with LF magnetic direction finding and time-of-arrival technologies for the highest level of total lightning detection capabilities with calibrated lightning parameters. The LS8000 is a base sensor configuration in the Vaisala Thunderstorm Information System. The CG Enhanced Lightning Sensor LS7000 (inset) can be upgraded to the LS8000.

TOTAL CLOUD AND CLOUD-TO-GROUND LIGHTNING DETECTION

The LS8000 is one of two principal sensor configurations offered in the Vaisala Thunderstorm Information System. This sensor configuration integrates the two most effective lightning detection technologies:

- Very high frequency (VHF) interferometry
- Low frequency (LF) combined magnetic direction finding and time-of-arrival

VHF interferometry technology provides extremely high performance in detection of cloud lightning. LF combined magnetic direction finding and time-of-arrival technology offers the highest detection efficiency and most accurate location for cloud-to-ground lightning strokes.

These other modular sensor configurations can be upgraded to the Total Lightning Sensor LS8000:

- Cloud Enhanced Lightning Sensor LS7500
- Cloud Lightning Sensor LS7200
- CG Enhanced Lightning Sensor LS7000
- CG Lightning Sensor LS5000

APPLICATION FOCUS FOR NOWCASTING

The Total Lightning Sensor LS8000 is recommended for operations with responsibility for nowcasting, severe storm warning, and identification of hazardous convective weather:

- Air traffic management
- Airports
- Defense
- Hydrology
- Launch facilities
- Meteorology/Nowcasting

LS8000 Features and Benefits

- Total lightning detection for earlier and more accurate identification of hazardous thunderstorm phases
- Calibrated parameters for cloud-to-ground lightning: time, location, amplitude, polarity
- Minimum 90% network detection efficiency for cloud and cloud-to-ground lightning
- 500 meter median location accuracy for cloud-to-ground lightning strokes
- Modular sensor integrates with all other LS series lightning sensors
- Compatible with predecessors Vaisala SAFIR, Vaisala IMPACT, and Vaisala LPATS sensors

TECHNICAL INFORMATION

OPERATIONAL

Lightning Type	Total cloud discharges and cloud-to-ground (CG) flashes and strokes
Network Detection Efficiency	>90% for cloud and CG
Network Median Location Accuracy	1000m cloud discharge; 500m CG stroke
Nominal Baseline Between Sensors	20 to 180 km for VHF; 15 to 350 km for LF
VHF Band	110-118 MHz
LF Band	1kHz-350kHz
Performance Monitoring	Complete manual and automatic system calibration and self-test
Remote Configuration	Operational parameters are remotely configurable

SYNCHRONIZATION

Source	GPS receiver
Accuracy	100 nanoseconds to UTC

MOUNTING

Concrete ground pads for mast and guy wires
Non-ground mounting options available

POWER REQUIREMENTS

AC Power	90-250VAC; 45-65Hz
DC Power	24VDC

COMMUNICATION INTERFACES

Asynchronous RS-232
TCP/IP

DIMENSIONS

Height	Up to 17 meters
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ENVIRONMENTAL CONDITIONS

Temperature	-40°C to +55°C
Relative Humidity	0 to 99%
Wind Speed (VHF antenna)	0-200 km/h
Wind Speed (LF antenna)	0-240 km/h
Altitude	Up to 5500 meters
Hail (VHF antenna)	1.0 cm in diameter
Hail (LF antenna)	2.0 cm in diameter
Rain (VHF & LF antenna)	8 cm/h at wind speed 65 km/h

OPERATIONAL RELIABILITY

Mean time between failures (MTBF)	>30,000 hours
Mean time to repair (MTTR)	<2 hours

SUPPORT SERVICES

Training, technical support, and spare parts are available for maintaining optimal network and sensor performance. Contact your Vaisala Sales Representative for service agreement information.

STANDARD WARRANTY

Vaisala warrants all products manufactured by Vaisala to be free from defects in workmanship or material for one year from the date of delivery. Contact your Vaisala Sales Representative for specific product service warranty details.



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Vaisala Thunderstorm CG Enhanced Lightning Sensor LS7000



CG Enhanced Lightning Sensor specializes in cloud-to-ground lightning sensing with excellent accuracy in location and lightning parameters using combined LF magnetic direction finding and time-of-arrival lightning sensing technology. LS7000 also detects survey-level (5-30%) cloud lightning. The LS7000 can be upgraded to the Total Lightning Sensor LS8000 (inset).

CLOUD-TO-GROUND LIGHTNING DETECTION ACCURACY

The LS7000 is one of two principal sensor configurations offered in the Vaisala Thunderstorm Information System. This sensor configuration employs low frequency (LF) combined magnetic direction finding and time-of-arrival technology which offers the highest detection efficiency and most accurate location for cloud-to-ground lightning strokes.

Modular sensor technology allows the LS7000 to be upgraded to the Total Lightning Sensor LS8000.

APPLICATION FOCUS ON LIGHTNING TRACKING

The CG Enhanced Lightning Sensor LS7000 is recommended for operations focused on tracking cloud-to-ground lightning threats to ground-based assets at risk:

- Electric power utilities
- Forestry
- Airports
- Meteorology/Climatology
- Telecommunications

LS7000 Features and Benefits

- Cloud-to-ground lightning detection for the most accurate lightning location and calibrated parameters
- Detects survey-level (5-30%) cloud lightning
- Calibrated parameters for cloud-to-ground lightning: time, location, amplitude, polarity
- Minimum 90% network detection efficiency cloud-to-ground lightning
- 500 meter median location accuracy for cloud-to-ground lightning strokes
- Can be upgraded to Total Lightning Sensor LS8000
- Modular sensor integrates with all other LS series lightning sensors
- Compatible with predecessors Vaisala SAFIR, Vaisala IMPACT, and Vaisala LPATS sensors

TECHNICAL INFORMATION

OPERATIONAL

Lightning Type	Cloud-to-ground (CG) flashes and strokes and survey-level cloud
Network Detection Efficiency	>90% for CG; 5-30% for cloud
Network Median Location Accuracy	500m CG stroke
Nominal Baseline Between Sensors	15 to 350 km
LF Band	1kHz-350kHz
Performance Monitoring	Complete manual and automatic system calibration and self-test
Remote Configuration	Operational parameters are remotely configurable

SYNCHRONIZATION

Source	GPS receiver
Accuracy	100 nanoseconds to UTC

DIMENSIONS

Height	2 meters
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MOUNTING

Concrete ground pad
Non-ground mounting options available

POWER REQUIREMENTS

AC Power	90-250VAC; 45-65Hz
DC Power	24VDC

COMMUNICATION INTERFACES

Asynchronous RS-232
TCP/IP

ENVIRONMENTAL CONDITIONS

Temperature	-40°C to +55°C
Relative Humidity	0 to 100% condensing
Wind Speed	0-240 km/h
Altitude	Up to 5500 meters
Hail	2.0 cm in diameter
Ice	8 cm
Rain	8 cm/h at wind speed 65 km/h

OPERATIONAL RELIABILITY

Mean time between failures (MTBF)	>30,000 hours
Mean time to repair (MTTR)	<2 hours

SUPPORT SERVICES

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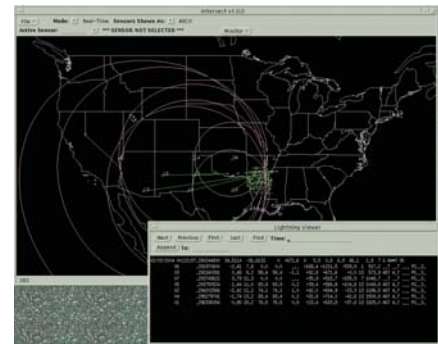


Vaisala Thunderstorm Central Processor CP8000/CP7000



Central Processors CP8000/CP7000 process real-time lightning data from various sensor configurations and monitor sensor status in the Vaisala Thunderstorm Information System. (left)

Monitor which sensors participated and which sensing technology was employed to calculate a lightning location. (below)



CENTRAL PROCESSING: HEART OF THE MODULAR SYSTEM

Vaisala's scientifically validated and patented lightning location and processing algorithms provide unmatched accuracy of lightning location and lightning parameters. The CP8000 and CP7000 are built on a stable, UNIX® platform that computes lightning solutions from the raw data from various sensor types, sends lightning solutions directly to appropriate real-time displays or to the archive processor for forensic applications, and monitors network performance.

CP8000 FOR TOTAL LIGHTNING PROCESSING

The CP8000 analyzes real-time lightning data from Total Lightning Sensor LS8000 and all other Vaisala VHF and LF sensor types, including LS7500, LS7200, LS7000, LS5000, SAFIR, IMPACT, and LPATS.

CP7000 FOR CLOUD-TO-GROUND LIGHTNING PROCESSING FOCUS

The CP7000 analyzes real-time lightning data from CG Enhanced Lightning Sensor LS7000, CG Lightning Sensor LS5000, and all other Vaisala LF network sensor types including IMPACT and LPATS sensors.

CP8000/CP7000 Features and Benefits

- Provides real-time output of data sets in various formats
- Provides simultaneous processing and reprocessing of data
- Continuously monitors remote sensor performance and communications status
- Archives, reprocesses, and replays raw sensor data and lightning solutions
- Configure, monitor, and run diagnostics from the CP console or from remote locations via dial-in or a TCP/IP telnet session
- Binary packet protocol for cost-effective low bandwidth, plus reliable and complete data transmission to remote displays
- Interfaces directly with other lightning networks using Vaisala technology
- Users can customize the real-time lightning output and transmit it across multiple standard computer networks, including intranets and the Internet

TECHNICAL INFORMATION

CP SERIES INTERFACE SUPPORT

CP8000 accepts data input from all Vaisala VHF and LF network lightning sensors: LS8000, LS7500, LS7200, LS7000, LS5000, SAFIR, IMPACT, and LPATS

CP7000 accepts data input from Vaisala network LF lightning sensors: LS7000, LS5000, IMPACT, and LPATS

Sends computed lightning information to Vaisala PDM, Vaisala LTrax®, third party lightning display software and most weather data provider software

Configurable number of sensors (3 to 512)

Interfaces with other Vaisala central processors

Remote sensor diagnostics, command, and control

Communication Interfaces

Asynchronous RS-232

TCP/IP

CP SERIES OPERATION AND STORAGE

Supports virtually unlimited user access to data

Removable high capacity recording media for a secure and flexible sensor data archive

Supports full simultaneous raw data reprocessing and real-time data output operation

ENVIRONMENTAL SPECIFICATIONS

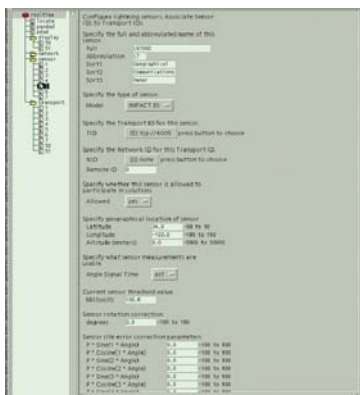
Operating temperature 0°C to 40°C

Non-operating temperature -40°C to 70°C

Relative humidity 5% to 95%, non-condensing

POWER REQUIREMENTS

100 to 240 VAC; 47 to 63 Hz; 0.4 kVA



Review individual sensor configuration and status.



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CP8000 LIGHTNING DISCHARGE AND STROKE PARAMETERS

Cloud discharges

Date and time with up to 100-microsecond resolution and full local time-zone support

Latitude and longitude

Position confidence ellipse

Number of sensors used in location solution

Cloud-to-ground strokes

Date and time with up to 100-nanosecond resolution and full local time-zone support

Latitude and longitude

Estimated peak current (kA)

Polarity

Flash multiplicity (number of return strokes)

Position confidence ellipse

Number of sensors used in location solution

Cloud-to-ground and cloud discharge classification with more than 98% certainty

CP7000 LIGHTNING STROKE PARAMETERS

Cloud-to-ground strokes

Date and time with up to 100 nanosecond resolution and full local time-zone support

Latitude and longitude

Estimated peak current (kA)

Polarity

Flash multiplicity (number of return strokes)

Position confidence ellipse

Cloud-to-ground and cloud discharge classification with more than 98% certainty

SUPPORT SERVICES

Training and after-sales support services are available for maintaining optimal network and processor performance. Contact your Vaisala Sales Representative for service agreement information.

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Vaisala Thunderstorm Archive Processor AP5000



Archive Processor AP5000 is a processing module in the Vaisala Thunderstorm Information System that specializes in archiving cloud and cloud-to-ground lightning data for forensic applications.

EASY, SECURED ACCESS TO REAL-TIME AND ARCHIVED LIGHTNING INFORMATION

Archive Processor AP5000 is the lightning data management processor module that receives and stores real-time lightning data from the Vaisala Thunderstorm Central Processor CP8000 or CP7000.

Vaisala Thunderstorm Information System operators use the AP5000 to archive their lightning data into Sybase®, a relational database manager. Users have easy and secured access to the archived data for use in their lightning display software and lightning analysis software. The AP5000 also provides secured access to real-time lightning data.

FLEXIBILITY FOR USERS

Multiple users can simultaneously access lightning information for use in their Vaisala FALLS® Fault Analysis and Lightning Location System and Vaisala Data Analysis Module DAM, or custom lightning application software. The standard data format allows users to import lightning data into their weather display software that is configured to accept external data.

AP5000 Features and Benefits

- Stores real-time lightning data from the Central Processor CP
- Provides long-term storage of stroke and flash data in a relational database, Sybase®, for post-storm and multi-year statistical analyses
- Distributes archived data to Vaisala FALLS® Fault Analysis and Lightning Location System and Vaisala Data Analysis Module DAM application software
- Supports multiple workstations and simultaneous queries
- Manages multiple user connections, including accounting and security control functions with the capability to add users
- Allows flexible and efficient manipulation of lightning data through a published set of industry standard Structured Query Language (SQL) function calls and procedures
- Provides standard and customized lightning data format outputs that can be integrated with weather display software configured to ingest external data

TECHNICAL INFORMATION

SUMMARY

The AP5000 resides on a single or multiprocessor Sun® server. A resident Sybase® relational database is provided with this module. All databases in the Sybase relational database management system, including lightning databases, are mirrored for increased reliability.

BASE SYSTEM

AP5000 module includes a Sun® server with the following:

256 MB RAM (minimum)
18 GB storage (minimum)
CD-ROM, floppy drive
21" 24-bit color monitor
18 GB mirrored storage (minimum)
8-port serial adapter (minimum)
Base Sybase® with 8 seat license
AP5000 software
User's Guide

It supports eight simultaneous dial-up users over serial lines. A maximum of 24 simultaneous users can be supported by adding an optional 16-port serial adapter.

DATA ACCESS/OUTPUT

Scalable number of simultaneous users
Supports simultaneous real-time and archived data access
Access to archived data based on date/time, latitude/longitude, and range/azimuth queries
Base configuration supports on-line storage for one billion strokes or flashes
Simultaneous flash or total lightning and stroke data access support

SYSTEM COMPATIBILITY

Communication Interfaces

Asynchronous RS-232
TCP/IP

AP5000 supports:

Archive lightning location data to Vaisala FALLS® and Vaisala DAM analysis software

Real-time data to Vaisala PDM, Vaisala LTrax® and other third-party software

ASCII-based, user-defined formats

Stored procedures and triggers

ODBC-compliant applications and other

Sybase® supported products

Vaisala FALLS® server software (may require additional hardware)

Custom interfaces for ORACLE™, INFORMIX™ and DB2™ available at additional cost

ENVIRONMENTAL SPECIFICATIONS

Operating temperature 0°C to 40°C

Non-operating temperature -40°C to 70°C

Relative humidity 5% to 95%, non-condensing

POWER REQUIREMENTS

100 to 240 VAC; 47 to 63 Hz; 0.4 kVA

Backup or secondary storage 8 mm tape

SUPPORT SERVICES

Training and after-sales support services are available for maintaining optimal network and processor performance. Contact your Vaisala Sales Representative for service agreement information.

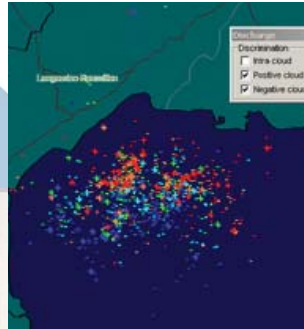
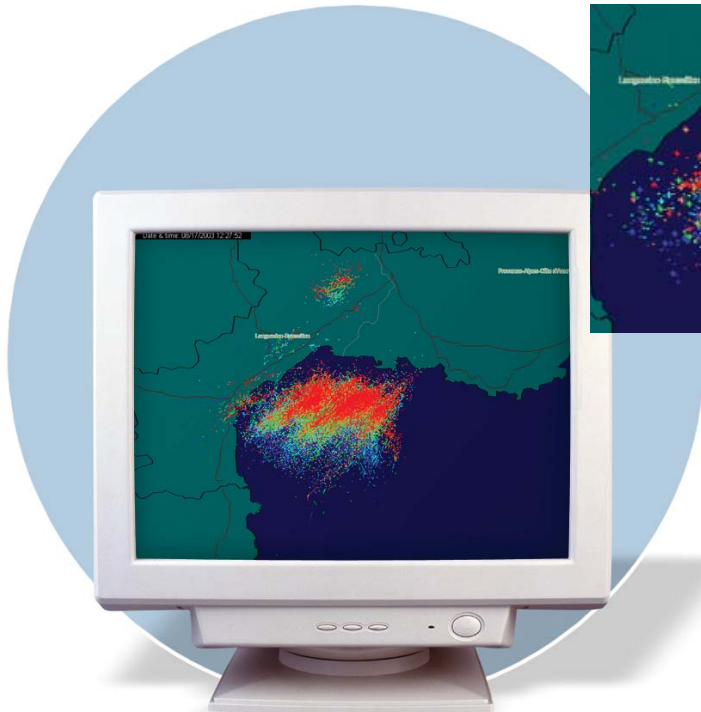


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Vaisala Thunderstorm Processing and Display Module PDM



Vaisala Processing and Display Module PDM displays real-time total cloud lightning and cloud-to-ground lightning in easy-to-use formats for monitoring thunderstorm cell development, assessing severity, and forecasting storm path and intensity.

The total cloud and cloud-to-ground lightning map (main image) and cloud-to-ground lightning map (inset) displays lightning mapped in color-coded time sequence with lightning type identified.

APPLICATION SOFTWARE FOR NOWCASTING AND SEVERE STORM WARNING

Processing and Display Module PDM is Windows®-based, real-time lightning display software module in the Vaisala Thunderstorm Information System. PDM provides comprehensive total lightning maps, statistics, and specialized nowcasting of thunderstorm cell evolution and intensity to issue more accurate advance warnings.

TOTAL LIGHTNING APPLICATIONS

PDM is ideal for operations with responsibility for nowcasting, severe storm warning, and identification of hazardous convective weather:

- Air traffic management
- Airports
- Defense
- Hydrology
- Launch facilities
- Meteorology

CLOUD-TO-GROUND LIGHTNING APPLICATION FOCUS

PDM is also recommended for use by operations whose primary concern is identifying cloud-to-ground lightning threats to ground-based assets:

- Electric Power
- Forestry
- Telecommunications

PDM Features and Benefits

- Total cloud and cloud-to-ground lightning mapping with individually identified cloud discharges and cloud-to-ground lightning strokes
- Real-time lightning density calculation and map
- Real-time thunderstorm cell tracking maps and analysis
- Forecasted location and intensity for each individual cell
- Automatic warning messages with estimated time of arrival and storm severity can be issued
- Map background layer options
- Pan, zoom, and predefined zoom
- Display center, grid, and color scale
- Distance and direction measurement tools
- Statistical histogram of lightning

TECHNICAL INFORMATION

SYSTEM CONFIGURATION

Operating System

Windows® 2000 and XP

Communications Interfaces

TCP/IP

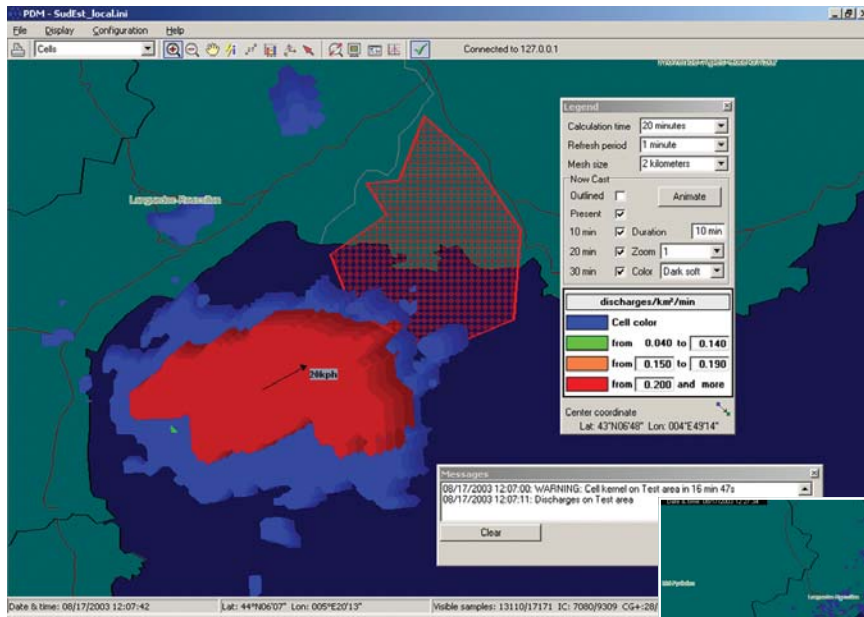
Contact your Vaisala Sales Representative for recommended system configurations along with turnkey installations that include workstations, printers, communications and data services.

LIGHTNING DATA SOURCE

Lightning data from any lightning detection network using Vaisala Thunderstorm Central Processor CP8000 or CP7000 and preceding central processors LP (IMPACT) and CPS (SAFIR).

SUPPORT SERVICES

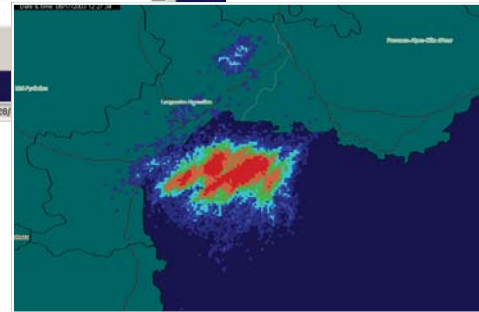
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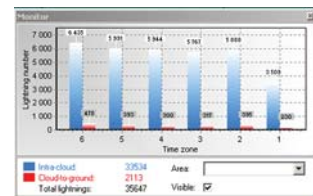
The forecasted location and intensity for each cell is displayed for continuous assessment. Warning parameters can be set for receiving automatic warning messages for vulnerable sites in the storm's path.



Point and click on individual cloud-to-ground lightning strokes to display detailed stroke parameters.



Storm intensity can be measured by mapping the density of lightning discharges. Total lightning density best identifies the most active and hazardous convective areas in a thunderstorm.



PDM displays flash rates for user-selected areas.



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