



## Derived Quantities

LSI LASTEM data loggers have an internal library of formulas for calculating a series of environmental quantities. These quantities are obtained from measured parameters, entered by the operator and other calculated quantities.

Derived Quantities	Manual inputs by operator	Automatic inputs from measurements	E-LOG ALIEM	M-LOG (ELO009)
Absolute Humidity (VDI3786 Part 4)		<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Relative Humidity (%)</li> </ul>	X	X
Air changes "1997 Ashrae Fundamentals Handbook"- fluid flow	<ul style="list-style-type: none"> <li>Room volume (m<sup>3</sup>)</li> <li>Pipe dimensions (cm<sup>2</sup>)</li> <li>Pipe factor</li> </ul>	Air speed (m/s)	X	X
Air flow (mass, volume) "1997 Ashrae Fundamentals Handbook"- fluid flow	<ul style="list-style-type: none"> <li>Pipe dimension (cm<sup>2</sup>)</li> <li>Pipe factor</li> </ul>	<ul style="list-style-type: none"> <li>Air speed (m/s)</li> <li>Temperature (°C)</li> <li>Pressure (hPa) for mass air flow only (kg/hr)</li> </ul>	X	X
Air speed (using Pitot and darcy tubes)	Pitot or Darcy constant value	<ul style="list-style-type: none"> <li>Differential pressure (hPa)</li> <li>Absolute pressure (hPa)</li> <li>Air temperature (°C)</li> </ul>	X	X
Absolute Pressure (sea level)	Altitude	<ul style="list-style-type: none"> <li>Absolute pressure (hPa)</li> <li>Temperature (°C)</li> <li>Relative Humidity (%)</li> </ul>	X	X
Dew Point (ISO7726)		<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Relative Humidity (%)</li> </ul>	X	X
Heat index		<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Relative Humidity (%)</li> </ul>	X	X
Evaporation	Maximum water level (mm)	Water level (mm)	X	
Mean Radiant Temperature (ISO7726)		<ul style="list-style-type: none"> <li>Radiant Temperature (°C)</li> <li>Air temperature (°C)</li> <li>Air speed (m/s)</li> </ul>	X	X
Radiant temperature asymmetry (ISO7726)		<ul style="list-style-type: none"> <li>Radiant Temperature (°C)</li> <li>Air temperature (°C)</li> <li>Air speed (m/s)</li> </ul>	X	X
Operative Temperature (ISO7726)		<ul style="list-style-type: none"> <li>Radiant Temperature (°C)</li> <li>Air temperature (°C)</li> </ul>	X	X
Plane Radiant Temperature 1&2 (ISO7726)	Sensor orientation (cold/warm wall, cold/warm floor)	<ul style="list-style-type: none"> <li>Net radiation (W/m<sup>2</sup>)</li> <li>Sensor temperature (°C)</li> </ul>	X	X
Partial vapour pressure (ISO7726 : Table D.1 Humidity conver.equations)		<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Relative Humidity (%)</li> </ul>	X	X
Psychrometric Humidity (ISO7726)	<ul style="list-style-type: none"> <li>Psychrometric coefficient</li> <li>Standard pressure (if measurement of absolute pressure is not present)</li> </ul>	<ul style="list-style-type: none"> <li>Dry bulb temperature (°C)</li> <li>Wet bulb temperature (°C)</li> <li>Absolute pressure (hPa) (if present)</li> </ul>	X	X

Derived Quantities	Manual inputs by operator	Automatic inputs from measurements	E-LOG ALIEM	M-LOG (ELO009)
Specific Humidity (VDI3786 Part 4)		<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Relative Humidity (%)</li> <li>Absolute pressure (hPa)</li> </ul>	X	X
Sunshine Duration	Sunshine threshold	Direct radiation (W/m <sup>2</sup> )	X	X
TCH - Chill temperature (ISO TR11079)		<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Air speed (m/s)</li> </ul>	X	X
Wet bulb Temperature (ISO7726)		<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Relative Humidity (%)</li> <li>Absolute pressure (hPa)</li> </ul>	X	X
UV exposition		<ul style="list-style-type: none"> <li>UV-Aradiation (W/m<sup>2</sup>)</li> <li>UV-B radiation (W/m<sup>2</sup>)</li> </ul>	X	X
UV index		<ul style="list-style-type: none"> <li>UV-Aradiation (W/m<sup>2</sup>)</li> <li>UV-B radiation (W/m<sup>2</sup>)</li> </ul>	X	X
Wind Chill index (ISO TR 11079)		<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Air speed (m/s)</li> </ul>	X	X
WBGT index IN+OUT formulas (ISO7243)		<ul style="list-style-type: none"> <li>Outdoor air temperature (°C)</li> <li>Black globe temperature (°C)</li> <li>Wet temperature natural ventilation (°C)</li> </ul>	X	X
% dissatisfied by floor temperature (ISO7730)		Floor temperature (°C)	X	X
% dissatisfied by vertical temperature (ISO7730)		<ul style="list-style-type: none"> <li>Ankle air temperature @H.10 cm (°C)</li> <li>Air temperature @H.110 cm (°C)</li> </ul>	X	X
% dissatisfied by radiant asymmetry (ISO7730)	Sensor orientation (cold/warm wall, cold/warm floor)	<ul style="list-style-type: none"> <li>Net radiation (W/m<sup>2</sup>)</li> <li>Sensor temperature (°C)</li> </ul>	X	X
% dissatisfied by air draw (ISO7730)		<ul style="list-style-type: none"> <li>Turbulence index (TU using ESV306)</li> <li>Air temperature (°C)</li> <li>Air speed (m/s)</li> </ul>	X	X
Daylight factor (IESNA Lighting handbook)		<ul style="list-style-type: none"> <li>Indoor lighting (lx)</li> <li>Outdoor lightning (lx)</li> </ul>	X	X
Light intensity	Distance from luminous source	Lightning (lx)	X	X
Estimated Natural Decay of SARS-CoV-2 on surfaces (stainless steel and ABS plastic) under a range of temperatures and relative humidity (proposed by DHS and S&T, USA)	Decay factor K: <ul style="list-style-type: none"> <li>1 (50%)</li> <li>13,29 (99.99%)</li> <li>19,94 (99.9999%)</li> <li>26,58 (99.999999%)</li> </ul>	<ul style="list-style-type: none"> <li>Temperature (°C)</li> <li>Relative Humidity (%)</li> </ul>		X

Derived Quantities	Manual inputs by operator	Automatic inputs from measurements	E-LOG ALIEM	M-LOG (ELO009)
<b>Math formulas</b>				
Sum/Difference/ Multiplication/Division			X	X
Difference between two previous values			X	X
Integral/Mean/Elevation to power/Exponential/ Logarithm/ Base 10 logarithm/Square root			X	X
Mobile Maximum/Mobile Minimum/Mobile Average/ Mobile Total			X	X
<b>Vectorial calculations specific for anemometric quantities (WMO N°8, cap. 5.8)</b>				
Average direction (Prevailing)		Wind direction	X	X
Resulting average direction		<ul style="list-style-type: none"> <li>• Wind direction</li> <li>• Wind speed</li> </ul>	X	X
Resulting average speed		<ul style="list-style-type: none"> <li>• Wind direction</li> <li>• Wind speed</li> </ul>	X	X
Direction standard deviation		Wind direction	X	X
Calm wind percentage		Wind speed	X	X

## Alpha-Log

Derived Quantites	Manual inputs by operator	Automatic inputs from measurements
Dew point (ISO 7726)		<ul style="list-style-type: none"> <li>Air temperature (°C)</li> <li>Relative humidity (%)</li> </ul>
Psychrometric Humidity (ISO7726)	<ul style="list-style-type: none"> <li>Psychrometric coefficient</li> <li>Standard pressure (if measurement of absolute pressure is not present)</li> </ul>	<ul style="list-style-type: none"> <li>Dry bulb temperature (°C)</li> <li>Wet bulb temperature (°C)</li> <li>Absolute pressure (hPa)</li> </ul>
Sun position (height and azimuth) ("Astronomical Algorithms, Willmann-Bell, Inc., Richmond, VA" Book by Jean Meeus)	<ul style="list-style-type: none"> <li>Latitude</li> <li>Longitude</li> <li>Date/time</li> </ul>	
Diffuse solar radiation (WMO - Guide Nr. 8, Chapt. 8, eq. 8.2)		<ul style="list-style-type: none"> <li>Global solar radiation (W/m<sup>2</sup>)</li> <li>Direct solar radiation (W/m<sup>2</sup>)</li> <li>Sun elevation angle (deg) (calculated)</li> </ul>
Sunshine presence (WMO - Guide Nr. 8, Chapt. 8.1)		Direct solar radiation (W/m <sup>2</sup> )
Sunshine presence (Step Algorithm, "Updating and development of methods for worldwide accurate measurements of sunshine duration - Vuerich, Morel, Mevel, Oliiviéri")		<ul style="list-style-type: none"> <li>Global solar radiation (W/m<sup>2</sup>)</li> <li>Sun elevation angle (deg) (calculated)</li> </ul>
Sunshine presence (MeteoFrance Algorithm, "Updating and development of methods for worldwide accurate measurements of sunshine duration - Vuerich, Morel, Mevel, Oliiviéri")	<ul style="list-style-type: none"> <li>Coeff. A</li> <li>Coeff.B</li> </ul>	<ul style="list-style-type: none"> <li>Global solar radiation (W/m<sup>2</sup>)</li> <li>Sun elevation angle (deg) (calculated)</li> <li>Date/time</li> </ul>
Daily Evapo-transpiration (Penman- Montheith eq., "Crop evapotranspiration - Guidelines for computing crop water requirements - FAO Irrigation and drainage paper 56", Chapt. 2)	<ul style="list-style-type: none"> <li>Latitude</li> <li>Altitude (m)</li> <li>Height of the wind velocity measurement (m)</li> <li>Global solar radiation (W/m<sup>2</sup>) (instead of Net solar radiation if absent)</li> </ul>	<ul style="list-style-type: none"> <li>Air temperature (°C)</li> <li>Relative humidity (%)</li> <li>Wind velocity (m/s)</li> <li>Net solar radiation (W/m<sup>2</sup>) (if present)</li> </ul>
Barometric pressure (QNH, ref. ICAO) (Tab. 3.10 from "International Meteorological Tables – WMO No. 188 TP. 94 – 1966")	<ul style="list-style-type: none"> <li>Coeff. A</li> <li>Coeff. B</li> </ul>	Atmospheric Pressure (hPa)
Barometric pressure (QNH ref. ICAO) (ISA eq. 7, CIMO, "CIMO/ET-Stand-1/Doc. 10 (20.XI.2012)")	Altitude (m)	Atmospheric Pressure (hPa)
Barometric pressure (QNH ref. ICAO) (ICAO eq. 28/29, "CIMO/ET-Stand-1/Doc. 10 (20.XI.2012); ICAO documents 7488/9837")	Altitude (m)	Atmospheric Pressure (hPa)

## Alpha-Log

Derived Quantites	Manual inputs by operator	Automatic inputs from measurements
Cross Wind (ICAO doc. 8896, AN/893)	Runway angle respect to the North (°)	<ul style="list-style-type: none"> <li>Wind velocity (m/s)</li> <li>Wind direction (m/s)</li> </ul>
Head Wind (ICAO doc. 8896, AN/893)		
Tail wind (ICAO doc. 8896, AN/893)		
Stability cathegory Pasquill-Gifford (SRDT method, "Bowen, Dewart, Chen, 1983. Stability Class Determination: A Comparison for one site. Proceedings 6 <sup>th</sup> Symposium on Turbulence and Diffusion, American Meteorological Society")	Radiation threshold day/night (W/m <sup>2</sup> )	<ul style="list-style-type: none"> <li>Wind velocity (m/s)</li> <li>Solar radiation (W/m<sup>2</sup>)</li> <li>Lower air temperature (°C)</li> <li>Upper air temperature (°C)</li> </ul>
Gravimetric water content (VDI 3477 - Biological waste gas purification - Biofilters )	Density of the dry part (kg/m <sup>3</sup> )	<ul style="list-style-type: none"> <li>Volumetric water content (%)</li> </ul>

### Math formulas

Sum/Difference/Multiplication/Division		
Difference between two previous values		
Integral/Mean/Elevation to power/ Exponential/Logarithm/ Base 10 logarithm/Square root		
Mobile Maximum/Mobile Minimum/Mobile Average/Mobile Total		

### Vectorial calculations specific for anemometric quantities (WMO N°8, cap. 5.8)

Average direction (Prevailing)		Wind direction
Resulting average direction		<ul style="list-style-type: none"> <li>Wind direction</li> <li>Wind speed</li> </ul>
Resulting average speed		<ul style="list-style-type: none"> <li>Wind direction</li> <li>Wind speed</li> </ul>
Direction standard deviation		Wind direction
Calm wind percentage		Wind speed