

3659 Noise Logger Technical Note

Estimating operating life

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The operating life of the 3659 noise logger is defined as the amount of time which it can operate unattended without user assistance. It is determined by two quantities, the battery capacity and the logging capacity. The lower of the two quantities will determine how often a unit must be visited.

OPERATING LIFE ON BATTERIES

The 3659 noise logger is powered by a combination of Li-ion batteries supplemented by a solar panel. Batteries keep the logger operating at night and during the day the solar panel both operates the unit and charges the batteries for the next night – providing there is sufficient solar radiation. Where solar radiation is not sufficient to operate and fully recharge the batteries, the batteries will slowly discharge until exhausted and the unit stop operating until sufficient solar radiation has charged the batteries or mains power is applied

The operating life is not straightforward to determine as it depends on the availability of sunlight which changes with season as well as with location. Given a particular location and time of year however, it is practical to estimate if the operating life will be sufficient and to determine when units should be replaced in the field to maintain logging. Operating life must also take into account the logging capacity of the unit.

The 3659 noise logger contains a 32Ahr battery. This is sufficient to operate the 3639-A for 5.9 days without the solar panel. The 3639-B has a higher current draw due to the 3G communications and will operate for 2.8 days on batteries without the solar panel. The more time the solar panel receives sunlight, the more power is available to operate and charge the batteries.

The chart and table below shows the number of days of autonomous operation for a given number of solar hours per day and the shaded area indicates continuous operation. It shows that above 5 solar hours/day the 3659-A will operate continuously. The 3659-B will operate continuously when there is more than 10 solar hours per day.

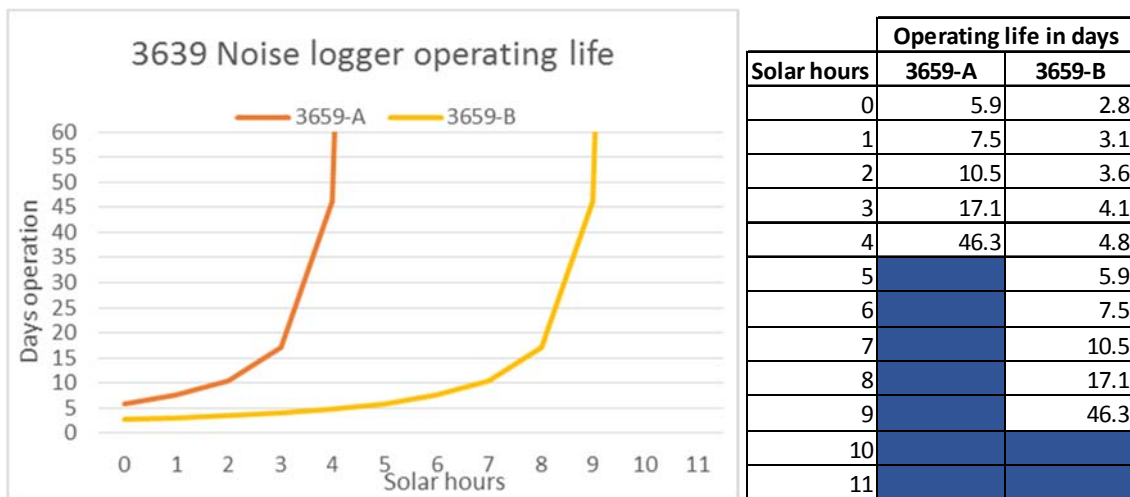


Chart / Table 1: Operating life vs solar hours (shaded = continuous operation)

Data on available solar hours is available from different sources for different regions in the appendices to this document.

To achieve these solar hours, the 3659 logger solar panel must be pointing South when used in the Northern Hemisphere or North when used in the Southern hemisphere, and located with an unobstructed view of the sun. From identifying the available daily sunshine hours in the charts in the appendices, users can use chart 1 to estimate the operating life of the unit.

EXAMPLE BATTERY LIFE ESTIMATION

Monitoring is to take place in Melbourne during February. Figure 1 indicates average sunshine hours as 7 per day. Chart 1 shows that a 3659-A will operate continuously and a 3659-B for just over 10 days. If the location is slightly shaded, these operating times should be adjusted.

LOGGING CAPACITY

The noise logger is delivered with a 8GB memory card. Operating life depends on the data being measured. When operating continuously, the logging capacity may be what determines the operating life of the logger.

APPENDIX 1: SUNSHINE HOURS FOR AUSTRALIA

Data is available on the web [here¹](http://www.bom.gov.au/jsp/ncc/climate_averages/sunshine-hours/index.jsp?period=may-sep#maps) and in the graphics below showing average amount of solar hours for different times of year throughout Australia. More detailed data based on monthly averages is available at the quoted website.

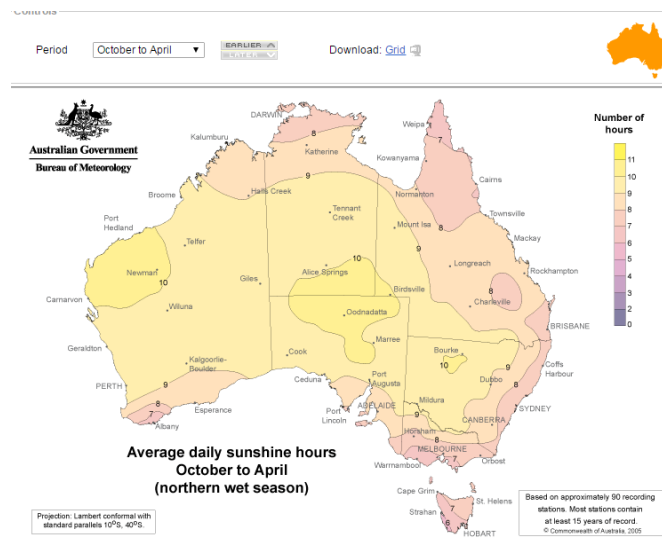


Figure 1: Solar hours, summer

¹ http://www.bom.gov.au/jsp/ncc/climate_averages/sunshine-hours/index.jsp?period=may-sep#maps

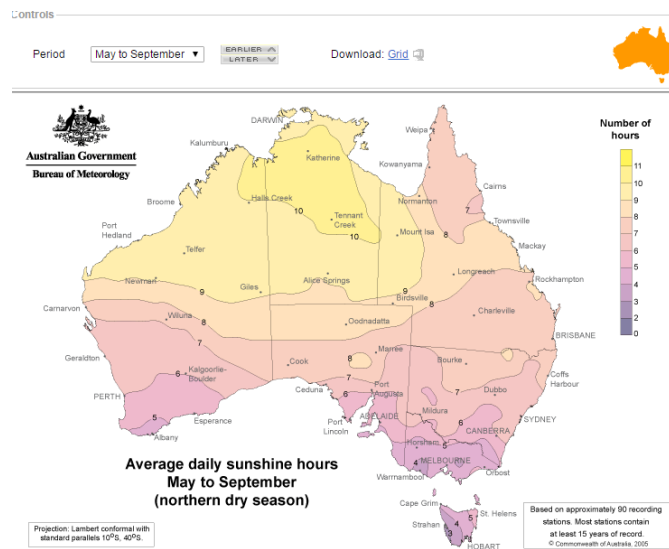


Figure 2: Solar hours, winter

APPENDIX 2: SUNSHINE HOURS FOR THE USA

Average sun hours per day across states in the US. Data sourced from <http://www.currentresults.com/Weather/US/average-state-sunshine-in-fall.php> and the US National Climatic Data Centre.

State	Place	Spring	Summer	Fall	Winter
Alabama	Birmingham	8.3	9.0	6.9	5.2
Alaska	Anchorage	8.0	8.1	4.0	2.8
Arizona	Tucson	12.0	11.9	9.9	8.5
Arkansas	Fort Smith	8.1	10.3	6.8	5.6
California	San Diego	8.8	9.4	8.1	7.8
Colorado	Grand Junction	9.4	11.6	8.2	6.4
Connecticut	Hartford	7.8	9.3	6.2	5.4
Florida	Tampa	9.8	8.8	7.3	6.6
Georgia	Macon	9.4	9.8	7.8	6.2
Idaho	Boise	9.5	12.3	7.3	4.1
Illinois	Peoria	7.6	10.0	6.3	4.7
Indiana	Indianapolis	7.3	9.5	6.1	4.2
Iowa	Des Moines	7.8	10.5	6.5	5.0
Kansas	Wichita	8.6	10.6	7.1	6.1
Kentucky	Louisville	7.5	9.5	6.4	4.5
Louisiana	New Orleans	8.3	8.7	7.1	5.2
Maine	Portland	7.4	9.0	6.3	5.3
Maryland	Baltimore	7.8	9.2	6.5	5.2

State	Place	Spring	Summer	Fall	Winter
Massachusetts	Boston	7.9	9.6	6.5	5.3
Michigan	Lansing	7.6	9.9	5.3	3.8
Minnesota	Minneapolis	8.4	10.9	5.9	5.0
Mississippi	Jackson	8.3	9.5	7.1	5.2
Missouri	Springfield	7.9	10.0	6.8	5.2
Montana	Helena	8.3	11.1	6.4	4.1
Nebraska	Lincoln	8.0	10.4	6.8	5.5
Nevada	Reno	11.1	13.4	9.5	6.5
New Hampshire	Concord	7.7	9.2	5.8	5.2
New Jersey	Atlantic City	7.4	9.0	6.4	4.9
New Mexico	Albuquerque	10.2	11.2	8.9	7.6
New York	Syracuse	6.9	8.9	4.6	3.2
North Carolina	Greensboro	8.2	8.8	6.9	5.6
North Dakota	Bismarck	8.5	11.0	6.2	4.7
Ohio	Columbus	6.7	8.4	5.5	3.6
Oklahoma	Oklahoma City	9.0	11.2	7.7	6.3
Oregon	Portland	7.6	10.2	5.2	3.0
Pennsylvania	Harrisburg	8.0	9.8	6.3	5.0
Rhode Island	Providence	7.7	9.2	6.6	5.5
South Carolina	Columbia	8.9	9.2	7.4	5.9
South Dakota	Huron	8.8	11.4	7.0	5.6
Tennessee	Nashville	7.6	9.1	6.6	4.6
Texas	Dallas	8.0	10.4	7.3	5.9
Utah	Salt Lake City	9.3	12.2	7.8	4.5
Vermont	Burlington	7.2	9.2	5.0	4.1
Virginia	Richmond	8.7	9.9	7.2	5.7
Washington	Seattle	7.1	9.6	4.9	2.6
Wisconsin	Madison	7.3	9.6	5.5	4.5
Wyoming	Lander	9.1	11.2	7.5	6.3

APPENDIX 3: SUNSHINE HOURS FOR CANADA

Average sun hours per day for each month based on data from 1981 to 2010. Sourced from <http://www.currentresults.com/Weather/Canada/Cities/sunshine-average-january.php> and Environment Canada Canadian Climate Normals.

Place	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Abbotsford, British Columbia	2.2	3.5	4.3	7.0	6.7	7.1	8.9	8.5	6.7	4.0	2.2	2.1
Calgary, Alberta	3.9	5.2	5.7	8.3	8.0	9.0	10.1	9.2	6.9	5.6	4.0	3.7
Edmonton, Alberta	3.3	4.4	5.7	9.3	9.0	9.5	9.9	9.1	6.4	5.5	3.3	2.7
Guelph, Ontario	2.6	3.5	4.7	7.7	7.5	8.6	9.0	7.6	5.7	4.5	2.7	1.8
Halifax, Nova Scotia	3.5	4.5	4.6	6.4	6.2	7.4	7.6	7.3	6.0	5.1	3.6	3.4
Hamilton, Ontario	2.8	4.0	4.9	8.1	7.9	9.3	9.8	8.5	5.9	4.8	3.0	2.3
Kelowna, British Columbia	1.3	2.9	4.8	7.9	7.7	8.2	9.6	9.1	7.2	4.0	1.7	1.1
Kingston, Ontario	3.0	4.0	4.6	7.3	7.0	8.1	9.0	7.7	5.5	4.5	3.0	2.4
London, Ontario	2.1	3.2	4.0	7.3	7.1	8.1	8.5	7.0	5.5	4.2	2.2	1.7
Moncton, New Brunswick	3.7	4.4	4.5	6.9	6.7	7.8	8.3	7.8	5.8	4.8	3.2	3.3
Montréal, Quebec	3.3	4.6	5.3	7.6	7.4	8.0	8.7	7.9	6.1	4.6	2.8	2.7
Ottawa, Ontario	3.2	4.7	5.4	7.7	7.4	8.5	9.0	8.0	5.9	4.5	2.8	2.7
Peterborough, Ontario	2.8	4.1	4.6	7.3	7.0	8.9	9.5	8.0	5.7	4.3	2.6	2.2
Québec City, Quebec	3.2	4.3	4.9	7.0	6.8	7.8	8.1	7.5	5.4	3.9	2.6	2.6
Regina, Saskatchewan	3.1	4.8	5.0	8.7	8.5	9.3	10.5	9.3	6.6	5.3	3.3	2.7
Saskatoon, Saskatchewan	3.4	4.7	5.6	8.8	8.5	8.9	10.0	8.7	6.4	5.1	3.0	2.8
Sherbrooke, Quebec	2.8	4.4	4.9	6.7	6.5	6.2	6.4	5.7	3.0	2.0	1.7	1.9
St. Catharines - Niagara, Ontario	2.1	3.8	4.5	8.1	7.8	9.3	9.0	8.2	6.2	5.0	2.7	2.2
Saint John, New Brunswick	4.0	4.4	4.8	6.6	6.4	7.1	7.3	7.0	6.1	4.8	3.2	3.3
St. John's, Newfoundland	2.1	3.2	3.5	5.9	5.7	6.6	7.0	6.7	5.7	3.9	2.5	2.0

Place	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sudbury, Ontario	2.8	4.2	5.2	7.6	7.4	8.2	8.9	7.9	5.4	3.9	2.3	2.1
Thunder Bay, Ontario	3.5	4.5	5.2	8.6	8.4	8.7	8.6	8.3	5.5	4.0	2.9	2.9
Toronto, Ontario	2.8	4.0	5.2	7.6	7.4	8.7	9.0	7.9	6.5	5.0	3.0	2.5
Vancouver, British Columbia	1.9	3.3	4.4	7.4	7.2	7.6	9.4	8.9	7.1	3.9	2.0	1.8
Victoria, British Columbia	2.3	3.4	4.7	8.0	7.8	8.4	10.3	9.6	7.6	4.4	2.4	1.9
Winnipeg, Manitoba	3.7	4.8	5.9	9.5	9.2	9.2	9.9	9.1	6.3	4.7	3.1	3.2

APPENDIX 4: SUNSHINE HOURS FOR EUROPE

Average sun hours per day for each month based on 30 year averages. Sourced from

<http://www.currentresults.com/Weather/Europe/Cities/sunshine-annual-average.php>

Country	City	Winter			Spring			Summer			Autumn		
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Andorra	Andorra la Vella	3.5	3.8	4.7	5.5	5.6	5.8	6.3	6.6	6.9	6.1	5.1	3.8
Austria	Vienna	1.6	2.3	3.6	4.6	6.6	7.7	7.9	8.5	8.4	5.9	4.4	2.1
Belarus	Minsk	0.9	1.5	2.5	4.1	5.9	8.2	8.7	8.3	7.9	5.4	3.3	1.2
Belgium	Brussels	1.5	1.9	2.8	3.7	5.3	6.2	6.3	6.5	6.3	4.6	3.8	2.1
Bosnia & Herzegovina	Sarajevo	1.3	1.8	3.0	4.1	5.1	6.2	6.9	8.3	7.9	6.0	5.0	2.6
Bulgaria	Sofia	2.1	2.4	3.5	4.4	5.7	6.8	8.1	9.2	9.1	7.0	5.7	3.1
Croatia	Zagreb	1.6	1.8	3.5	4.6	5.6	7.4	7.8	8.9	8.6	6.1	4.1	2.0
Czech Republic	Prague	1.5	1.6	2.6	4.0	5.6	6.9	7.3	7.3	7.1	5.2	4.0	1.7
Denmark	Copenhagen	1.2	1.5	2.3	3.8	6.3	8.5	8.2	8.4	8.0	5.0	3.4	1.9
Estonia	Tallinn	0.6	0.8	2.0	3.9	6.2	9.3	9.7	9.5	8.0	4.8	3.0	1.0
Finland	Helsinki	0.8	1.2	2.6	4.2	6.5	8.9	8.9	9.4	7.3	4.6	2.8	1.2
France	Lille	1.6	2.1	2.5	3.9	5.7	6.3	6.9	6.8	6.7	4.9	3.8	2.0
France	Lyon	1.7	2.4	3.6	5.5	6.4	7.1	8.5	9.1	8.4	6.3	4.3	2.5
France	Marseille	4.4	4.7	6.2	7.7	8.1	9.5	11.1	11.9	10.9	8.4	6.2	4.9
France	Nice	4.5	5.1	6.1	7.0	7.5	8.6	10.2	11.2	10.5	7.8	6.2	4.8
France	Paris	1.6	2.0	2.8	4.2	5.5	6.3	6.7	6.8	7.1	5.4	3.9	2.2
Germany	Berlin	1.2	1.5	2.6	3.9	5.3	7.2	7.4	7.0	7.0	5.0	3.7	1.7
Germany	Cologne	1.4	1.5	2.8	3.5	5.2	6.2	6.2	6.3	6.1	4.6	3.7	1.9
Germany	Hamburg	1.1	1.4	2.4	3.4	5.4	7.0	7.4	6.7	6.9	4.5	3.4	1.7
Germany	Munich	1.6	2.0	3.0	4.1	5.2	6.4	7.0	7.6	7.1	5.6	4.3	2.2
Greece	Athens	4.1	4.2	4.9	5.9	7.7	9.4	11.2	11.7	11.3	8.9	6.9	4.9
Hungary	Budapest	1.6	1.7	3.0	4.3	6.0	7.5	8.4	9.0	8.5	6.3	5.0	2.1
Iceland	Reykjavík	0.4	0.9	1.9	3.6	4.7	6.2	5.4	5.5	5.2	4.0	2.8	1.3
Ireland	Dublin	1.7	1.9	2.7	3.5	5.3	6.2	5.8	5.3	5.3	4.2	3.4	2.3

Country	City	Winter			Spring			Summer			Autumn		
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Italy	Milan	1.9	1.9	3.4	4.9	5.9	6.8	8.1	9.2	8.4	6.0	4.3	2.1
Italy	Naples	3.4	3.7	4.4	5.1	6.3	7.9	9.3	10.1	9.8	7.5	6.3	4.1
Italy	Turin	3.5	3.6	4.2	5.1	6.0	6.3	7.3	8.4	7.4	5.4	4.8	3.4
Kosovo	Pristina	2.3	2.3	3.4	4.6	6.1	7.4	8.2	9.6	9.7	7.3	5.8	3.1
Latvia	Riga	0.8	1.0	2.3	4.1	6.1	8.5	9.6	8.5	7.7	5.0	3.1	1.3
Liechtenstein	Vaduz	1.7	2.3	3.3	4.0	4.8	5.4	5.7	6.3	5.9	4.7	3.9	2.2
Lithuania	Vilnius	0.8	1.2	2.5	3.8	5.5	7.8	7.7	7.1	7.2	4.5	3.1	1.1
Luxembourg	Luxembourg	1.4	1.4	2.9	3.8	5.5	6.6	7.0	7.5	6.9	5.1	3.6	1.8
Macedonia	Skopje	2.6	2.8	4.0	5.2	6.6	7.9	9.2	10.4	10.2	8.0	6.3	3.7
Malta	Valletta	5.0	5.1	6.1	7.2	8.2	9.7	10.9	11.8	11.3	8.4	7.3	5.9
Moldova	Chisinau	1.9	2.4	2.9	4.0	6.2	8.2	9.4	9.6	9.8	7.3	5.6	2.4
Monaco	Monaco	4.5	5.1	6.1	7.0	7.5	8.6	10.2	11.2	10.5	7.8	6.2	4.8
Montenegro	Podgorica	3.5	3.9	4.5	5.5	6.5	8.1	9.3	11.0	10.5	8.1	6.8	4.2
Netherlands	Amsterdam	1.6	2.0	3.1	4.1	6.1	7.2	6.9	7.0	6.6	4.5	3.6	2.0
Netherlands	Rotterdam	1.5	2.0	3.0	4.0	5.8	6.9	6.8	6.9	6.6	4.5	3.6	1.9
Norway	Oslo	1.1	1.3	2.7	4.1	5.9	7.1	8.3	7.9	7.2	4.6	2.9	1.6
Portugal	Lisbon	4.6	4.6	5.4	6.7	7.8	9.4	10.1	11.4	11.4	8.4	7.1	5.1
Romania	Bucharest	2.0	2.3	3.0	4.5	6.2	7.9	8.9	9.3	9.4	7.2	5.9	2.8
Russia	Kazan	1.1	1.6	3.2	4.8	6.8	9.1	9.8	9.4	8.5	5.2	2.8	1.3
Russia	Moscow	0.6	1.0	2.5	4.1	5.7	8.5	9.2	8.8	7.8	4.6	2.6	1.0
Russia	Nizhny & Novgorod	0.9	1.3	2.7	4.0	5.6	8.6	8.9	8.5	7.3	4.5	2.8	1.0
Russia	Rostov-on-Don	1.2	2.1	2.9	4.1	6.3	8.5	9.5	10.1	9.8	7.7	5.3	2.1
Russia	Saint Petersburg	0.4	0.7	1.9	4.0	6.0	8.4	9.2	8.6	7.1	4.2	2.3	0.9
Serbia	Belgrade	2.1	2.3	3.6	4.9	6.3	7.8	8.7	9.4	9.1	6.6	5.4	3.1
Slovenia	Ljubljana	1.2	1.5	3.0	4.1	5.4	6.8	7.4	8.4	7.7	5.3	3.9	1.8
Spain	Barcelona	4.5	4.8	5.8	6.5	7.3	7.9	8.7	10.0	9.4	7.1	6.0	4.7
Spain	Madrid	4.0	4.8	5.6	6.9	7.7	8.8	10.3	11.6	11.2	8.4	6.6	5.1
Sweden	Stockholm	1.1	1.3	2.6	4.4	6.2	8.9	9.7	8.4	7.4	5.0	3.3	1.7
Switzerland	Zurich	1.1	1.5	2.8	4.0	5.3	6.0	6.8	7.4	6.9	4.9	3.1	1.6

Country	City	Winter			Spring			Summer			Autumn		
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Turkey	Istanbul	2.3	2.3	2.6	4.6	5.3	7.2	9.6	9.2	8.9	6.9	4.7	3.2
Ukraine	Odessa	1.8	2.5	2.9	4.0	6.2	8.5	9.7	10.1	10.1	7.7	5.6	2.5
United Kingdom	Birmingham	1.2	1.5	2.4	3.2	4.7	5.8	5.5	5.9	5.6	4.0	3.3	1.8
United Kingdom	Glasgow	1.1	1.2	2.3	2.8	4.3	5.6	5.0	4.8	4.7	3.6	2.7	1.6
United Kingdom	London	1.5	1.5	2.3	3.3	4.9	5.5	5.7	5.7	6.2	4.3	3.5	1.9
United Kingdom	Manchester	1.5	1.7	2.6	3.2	4.9	6.1	5.8	5.8	5.5	4.2	3.3	1.9

APPENDIX 5: IRRADIATION HOURS GLOBALLY

A solar irradiance calculator by location is available from <http://solarelectricityhandbook.com/solar-irradiance.html>.

The irradiance calculator shows monthly figures of the average kWh per square metre per day for energy at the given location.

Multiply this irradiance figure by the wattage of unit's photovoltaic panel (18 W) to give you an average daily amount of energy you can expect to generate with your system, measured in Watt-hours.

- 3659-A (uses 66 W) needs 3,67 kWh/m²/day for continuous operation
- 3659-A (uses 138 W) needs 7,67 kWh/m²/day for continuous operation

Converting kWh/m²/day provided by the calculator to number of solar hours is done as given

kWh/m ² /day	Solar Hours	Operating Life (Days)	
		3639A	3639B
1	1,3	8.2	3.3
2	2,7	14.3	3.9
3	4,0	46.3	4.8
4	5,3		6.3
5	6,7		9.4
6	8,0		17.1
7	9,3		95.4
8	10,7		

APPENDIX 6: OPERATING LIFE 3659-A

For a Noise Logger 3659-A, the following operation durations (in days) can be expected in a location without shading from trees, buildings, etc. These durations are based on the solar irradiance calculator in Appendix 5.

Country	City	Jan	Apr	Jul	Oct
Brazil	Rio de Janeiro	Cont	150	42	Cont
Canada	Toronto Ontario	21	Cont	Cont	42
China	Beijing	160	Cont	Cont	Cont
Denmark	Copenhagen	13	250	Cont	21
Finland	Helsinki	12	Cont	Cont	17
France	Paris	15	160	Cont	24
Germany	Berlin	14	96	Cont	19
Greece	Athens	22	Cont	Cont	55
Ireland	Dublin	7	45	96	10
Japan	Tokyo	96	Cont	150	42
Spain	Madrid	29	Cont	Cont	75
Singapore	Singapore	Cont	Cont	250	Cont
United Kingdom	London	13	55	Cont	20
Australia	Melbourne	Cont	75	24	Cont
USA	Anchorage Alaska	12	Cont	Cont	20
USA	San Diego California	150	Cont	Cont	Cont